GROUSE NEWS

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IUCN/SSC-WPA Galliformes Specialist Group

Galliformes Specialist Group

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From the Editor

The first Grouse Symposium was held at Culloden House in Inverness in Scotland in 1978. It started with a small group of scientists. The list of participants only counted just above 40 mainly from Europe. The second symposium was held in Edinburgh, Scotland and the third in York, England before it moved to other European countries. In 1996 the 7th international symposium was the first arranged outside Europe in Fort Collins, Colorado, USA. Tim Lovel did a great job to organise this first symposium.

In the future I hope it will be possible to increase contributions to GN from outside Europe. The aim is to have a more even distribution of contributions throughout the grouse area, and also species of grouse. The majority of contributions are still from Europe although this issue has many contributions from America. We would like to increase materials from the east and US/Canada. To reach this goal we need you to write about your research or other things of interest to grouse people worldwide. We welcome articles, reports from projects, planned projects, conservation news, abstracts from papers (if permitted by the journal) and also other things you think may be of interest to grouse people.

In this issue you will find information on capercaillie in Scotland and a report on diet of rock ptarmigan in Scotland. Further, articles on sage-grouse and Attwater's prairie chicken in USA are found. Also information on two new project is reported, one on the effect of wind parks and grouse in Europe and one about protection of lowland capercaillie populations in Poland. A new book on use of pointing dogs in research is reported.

The 31st IUGB Congress will take place in Brussels from 27th until 29th August 2013 in Belgium. The overall theme selected for the 2013 IUGB Congress is "Diversity in Wildlife Management – Objectives & Tools".

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From the Chair

Time for re-formation of the Galliformes Specialist Group (GSG) has come again. SSC/IUCN request to formally renew Specialist Group membership every four years; the new quadrennium 2013-2016 has started this year. In this process, it is the task of SG Chairs to invite new and re-appoint old members on behalf of the Species Survival Commission (SSC) of the International Union for Nature Conservation (IUCN). As Co-Chairs of the Galliformes SG, Peter Garson and I will soon send out invitation and re-appointment letters to you by email (please make sure that we do have your up-to-date coordinates). All those who confirm that they wish to become or remain, respectively, a GSG member will be added to a revised GSG membership file that will then be adopted by IUCN/SSC. As you know, in 2008 the Grouse Group (formerly IUCN/SSC Grouse Specialist Group) has become part of the larger IUCN/SSC Galliformes SG. Members of the Grouse Group are also members of the Galliformes Specialist Group (GSG), and all Specialist group members will automatically also become members of the SSC, the largest of the six volunteer commissions of IUCN, and have to agree to share SSC´s goals. The combined skills and insights represented by SSC's broad membership of scientists, field biologists and other professionals uniquely position the SSC to identify and promote actions necessary to stem the loss of the world's biological diversity. The more competent members we have, the stronger is the position of the GSG in grouse conservation. If you are interested in GSG membership and should not receive an email invitation from Peter and me within the next few weeks, please let me know. Any experienced (normally defined as post-doc level and beyond) person involved professionally in the study, conservation, and sustainable management of grouse is welcome as a GSG member.

Finally, I would like to advertise a new project into the effects of wind parks on grouse. Currently, renewable energy development is an issue in many countries, and wind turbines are being erected in (mostly uphill) grouse habitats throughout much of Europe. While the GSG, as part of SSC and IUCN, certainly welcomes renewable energy, there are major concerns in areas where grouse are red-listed. In the planning stage of new wind parks, environmental impact statements are legally required, and threatened species and their conservation status are an issue. However, we lack scientifically robust evidence of the impacts of the building, operating, and maintenance of wind parks on grouse. A group of colleagues from central Europe (so far, Austria, Germany, Switzerland) is therefore starting a major cooperative project into effects of wind parks on black grouse and capercaillie, using a before-after approach. Please see the report on page 19 and contact coordinator Joy Coppes if you are interested in cooperation. We are particularly looking for windparks currently under planning that could be used as study cases.

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RESEARCH REPORTS

Greater Sage-Grouse Breeding Habitats: Landscape-based comparisons

J. W. Connelly, A. Moser and D. Kemner

Introduction

By 2005, 8 petitions to list the greater sage-grouse (*Centrocercus urophasianus*) under the Endangered Species Act (ESA) were submitted to the United States Fish and Wildlife Service (USFWS). Despite these petitions and documented declines of sage-grouse populations, the USFWS found that greater sage-grouse did not warrant listing under the ESA. However the U.S. District Court (Idaho, USA) found that this decision was arbitrary and capricious; the USFWS was instructed to reconsider the decision. In 2010 the USFWS found that listing of greater sage-grouse under the ESA was warranted because of habitat loss and lack of regulatory mechanisms but listing action was precluded because of higher priorities.

Numerous studies have identified habitat loss and fragmentation as primary reasons for sage-grouse population declines. Loss of breeding habitat has been especially severe in some areas. However, before conservation efforts can be successful seasonal habitats must be understood and defined. Previous work has suggested that sage-grouse nest relatively close to leks and use these areas for rearing chicks until chicks are several weeks old (Wallestad 1975, Braun et al. 1977, Connelly et al. 2000). Many of these studies were based on comparatively small samples (e.g. < 50 radio-marked hens per year) conducted in discrete areas over relatively short time frames (2-3 years).

While developing a statewide conservation strategy for sage-grouse in Idaho, USA we compiled all available data on movements of sage-grouse from leks to nest sites. These data were collected over a wide geographic area of southern Idaho and spanned a period from the early 1990s to 2012. The purpose of this paper is to provide a preliminary definition of breeding habitat based on this large dataset, evaluate characteristics of breeding habitats throughout the state, and compare the extent of these breeding habitats to breeding habitats based on smaller geographic areas and shorter time frames reported in the literature.

Study Area

Lek to nest data were acquired from populations distributed throughout southern Idaho ranging in elevation from 1,600-2,400 m in a variety of sagebrush (*Artemisia* spp.)-dominated habitat types. At least 12 habitat types (Hironaka et al. 1983) are present throughout southern Idaho and at least 1 habitat type was present within each of the study areas supporting sage-grouse populations.

Sampling areas varied considerably, and included large stands of big (*A. tridentata*), little (*A. arbuscula*), black (*A. nova*), three-tip (*A. tripartita*), and mixed sagebrush types, as well as grasslands, and burned areas. Non-native grasses such as cheatgrass (*Bromus tectorum*) and crested wheatgrass (*Agropyron christatum*) were common on many sites. Because there was considerable spatial variation in habitat types among sites, these areas were representative of the variety of conditions on southern Idaho rangelands. The study areas were comprised of many different land ownership and management entities including private land, Forest Service, U.S. Fish and Wildlife, Bureau of Land Management, and state-owned land.

Methods

We divided sage-grouse habitat in Idaho into four individual Conservation Areas ("CA"): two north (Mountain Valleys, Desert) and two south (Southern, West Owyhee) of the Snake River. Wildfire, infrastructure, and invasive species pose threats for sage-grouse in all CAs. Additionally, sage-grouse habitats in the Mountain Valley CA tend to be more naturally fragmented than those of the other CAs.

We used the Idaho Department of Fish and Game (IDFG) sage-grouse telemetry database, dating back to the early 1990's, to investigate distances between leks and nests. Within this database, we selected hens that were captured during the breeding season (March 1-June 30). We then identified individual nest locations for all radio-collared female grouse but removed duplicate telemetry locations for each nest, so there was only 1 location for each nest. We also removed second nest attempts and nests recorded in subsequent years for a hen after her initial capture because we did not know what lek the hen may have visited following her initial nest attempt. Next, we ensured that each nesting hen had a corresponding capture location recorded. We assumed that the lek closest to the point of capture represented the lek where the hen was bred.

For each nest, we used Geospatial Modeling Environment© Version 0.7.2.0 (GME; Beyer 2012) to calculate the distance from capture lek to nest. We divided distances into 1-km categories (i.e., 0-1 km,

1.1-2 km, etc.) and summed the number of nests in each 1-km category. These data were used to calculate cumulative density curves. We also separated nests by the four Conservations Areas to investigate potential geographic variation within the state.

Results

Statewide, 302 nests qualified for the analysis (Desert, n = 34; Mountain Valleys, n = 143; Southern, n = 85; West Owyhee, n = 39). Throughout Idaho, 105 nests (35%) occurred within 2 km of the capture lek and 140 (46%) occurred within 3 km (Figure 1). However, 103 nests (34%) occurred > 7 km from capture leks (Figure 1). A cumulative density histogram indicates that throughout the state < 50% of nests were within 3km of capture leks but 80% of nests were within 10 km of the capture lek (Figure 2).

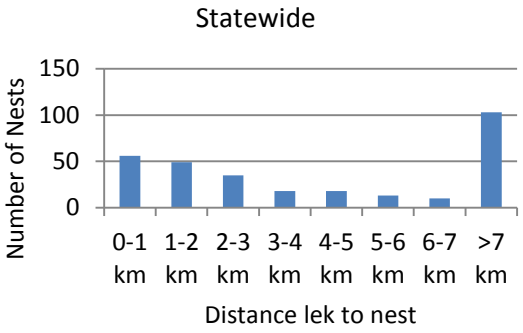

Figure 1. Number of nests within distance categories for Idaho.

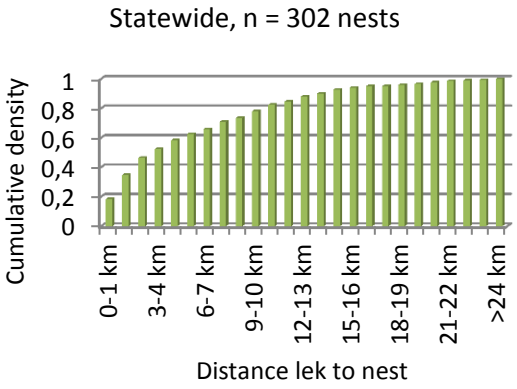

Figure 2. Cumulative density of sage-grouse nests within distance categories for Idaho.

Desert Conservation Area

Although we had relatively few nests in the Desert CA, the pattern of the cumulative density histogram for this CA (Figure 3) was similar to that of the statewide histogram (Figure 2). Within the Desert CA, roughly 50% of nests were within 3 km of capture leks but 82% were within 8 km (Figure 3). In this CA, no radio-marked hen nested >12 km from her capture lek.

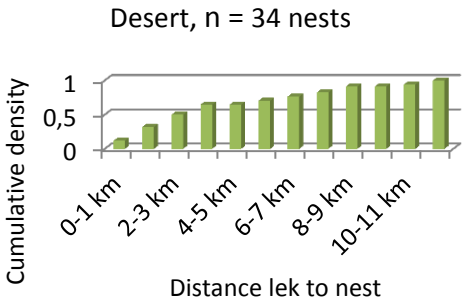

Figure 3. Cumulative density of sage-grouse nests within distance categories for the Desert

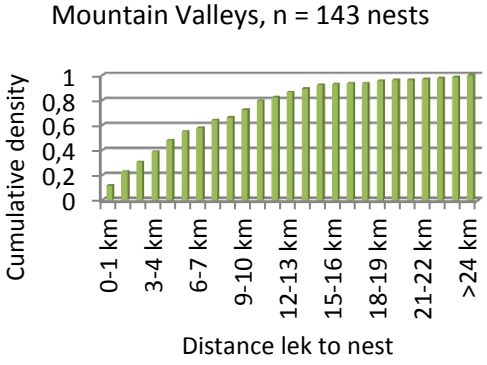

Figure 4. Cumulative density of sage-grouse nests within distance categories for the Mountain Valley Conservation Area.

Mountain Valley CA
The Mountain Valley CA had a relatively large number of nests, but only 31% were within 3 km of the capture lek while 80% were within 10 km (Figure 4). The cumulative density histogram for this CA also appeared very similar to both the statewide and Desert CAs. However, about 7% of the hens in these habitats moved >15 km from capture lek to nest; thus this CA appeared to have larger overall breeding habitats than those of grouse in the Desert CA.

Southern CA
Although 63% of radio-marked hens in the Southern CA nested ≤ 3 km of their capture lek (Figure 5), relatively few nested between 3 and 12 km. Thus, this distribution differed somewhat from the Mountain Valley CA because the cumulative density did not encompass 80% of nests until a distance of 12 km of their capture lek was reached. Nevertheless, similar to the Mountain Valley CA, about 5% of hens in the Southern CA nested > 18 km from their capture lek.

West Owyhee CA
The pattern of the density histogram (Figure 6) for this CA followed that of the Southern CA with relatively few hens nesting between 3 and 12 km. Although 62% of nests were within 3 km of capture leks, 80% of nests were within an area just under 10 km distance from capture leks. Within this CA about 5% of nests were ≥15 km from capture leks.

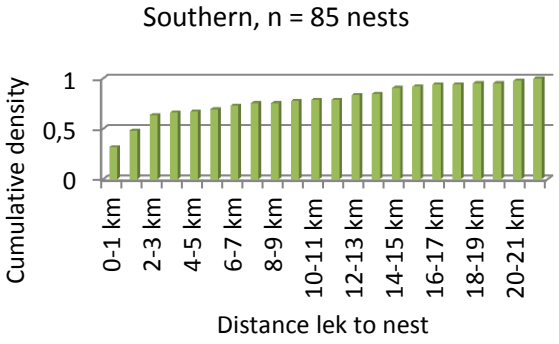

Figure 5. Cumulative density of sage-grouse nests within distance categories for the Southern Conservation Area.

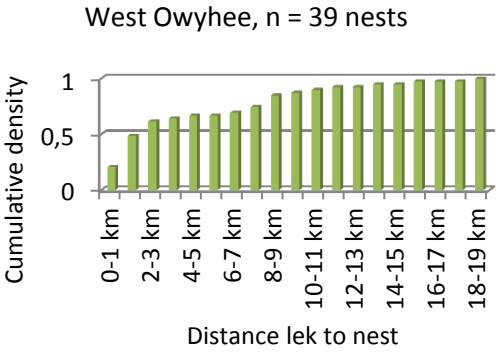

Figure 6. Cumulative density of sage-grouse nests within distance categories for the West Owyhee Conservation Area.

Discussion
Clearly breeding habitats for greater sage-grouse cannot be defined by simply applying a 3 km radius to existing leks. Our preliminary statewide analysis indicates that throughout their range in Idaho, many sage-grouse nest much farther from their capture lek than was previously thought. The general assertion that nests are usually located near leks (Wallestad 1975, Crawford et al. 2004) may result in misguided management actions. Although recent work has shown that females nest further from leks than previously suspected, many of these findings still indicate lek to nest distances of about 5 km (Connelly et al. 2011). Our preliminary findings suggest that these lek to nest distances may vary spatially over large landscapes.

Landscape structure influences the ability of an animal to move across a landscape (Knick and Hanser 2011). Within Idaho, preliminary analysis of cumulative density histograms suggested patterns were generally similar among CAs, indicating that roughly 80% of nests occur within 8-12 km of capture leks. However, breeding habitats north and south of the Snake River may differ somewhat. Conservation Areas north of the river had 31-50% of leks within 3 km of capture leks while those south of the river had >60% of leks within 3km of capture leks. Additionally, a relatively large proportion of grouse nested between 3 and 10-12 km from leks in the CAs north of the Snake River. In contrast, a smaller proportion of grouse nested between 3 and 10-12 km from leks in the CAs south of the Snake River. These differences may be due to landscape characteristics with grouse using the more naturally fragmented habitats north of the river adapting to this fragmentation by using a larger portion of the landscape for

breeding habitat than grouse south of the river. This notion is further supported by examining differences in distribution of lek to nest distances between the two CAs north of the Snake River. In that area the Mountain Valley CA is more naturally fragmented than the Desert CA. Only 31% of the sage-grouse nests in the Mountain Valley CA were within 3 km of capture leks while 50% of nests within the Desert CA were within 3 km of capture leks. Similarly, female sage-grouse nesting in fragmented habitats of Washington, USA moved almost twice as far to nest as female sage-grouse nesting in relatively intact habitats of southern Idaho (Wakkinen et al. 1992, Fischer 1994, Schroeder et al. 1999).

Greater sage-grouse have been described as a landscape species (Knick and Connelly 2011), underscoring the need to conserve large portions of the sagebrush habitat to meet the necessary seasonal needs of this grouse. It appears that adequately protecting and managing breeding habitats requires a landscape approach. Connelly et al. (2000) suggested that protecting areas within 3.2 km of occupied leks would be sufficient for non-migratory populations of sage-grouse while it may be necessary to protect habitats within 18 km of leks for migratory populations. Our preliminary results suggest that landscape structure may also influence the size of breeding habitats. Most greater sage-grouse populations that we have studied in Idaho appear to be migratory. However, it is unlikely that the cumulative density histograms we developed for Idaho would represent populations throughout the species' range. Thus we recommend others examine similar databases for their respective states and provinces to better define sage-grouse breeding habitats in those areas.

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Capercaillie monitoring on the national forest estate in Scotland: 2002 to 2012

Kenny Kortland and Andrew Peace

The national forest estate (NFE) in Scotland comprises over 650,000ha of land that is in public ownership. It is managed by Forestry Commission Scotland (FCS) on behalf of the Scottish Government. Capercaillie (*Tetrao urogallus*) is found in parts of the NFE and it is a priority species for FCS. An action plan has been written that outlines the conservation work being carried out for this species, including monitoring.

Capercaillie monitoring on the NFE is done by counting all known occupied leks and as many of the defunct leks as possible each year. Additional areas are also surveyed based on reports of birds having been sighted. Searches for leks started in 1999 and most leks, including a consistent sample of twenty-seven leks, have been counted each year since 2002. In addition to lek counts, brood counts using highly-trained pointer dogs have been carried out on a selection of NFE sites since 2002. The objective of this monitoring work is to detect population changes and to try to detect responses to management and other environmental changes.

Capercaillie lek counts

From 2001 to 2011, the number of capercaillie cocks on leks on the NFE increased from 31 to 63, then decreased to 51 in 2012 (Figure 1). The observed increase was in part due to increased survey effort. However, in the main it was due to events at two forests called Glenmore and Inshriach (Photo 1), which

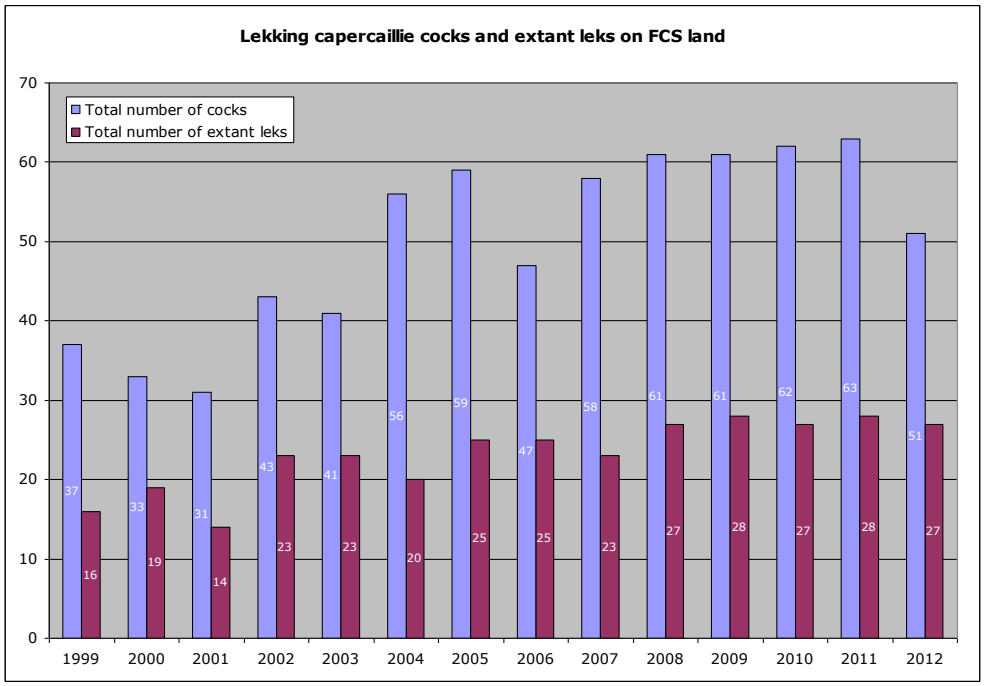

Figure 1. Number of capercaillie cocks and known extant leks on FCS land from 1999 to 2012.

are located in a region called Badenoch & Strathspey. In these two sites, the populations of capercaillie have increased, both in number (Figure 2) and in range. Glenmore and Inshriach are about 3km apart – but are linked by continuous forest – and comprise mainly Scots pine plantation with a total area of about 7000ha. Capercaillie have spread southwards through Inshriach over the last few years – following a near-twenty-year absence – and are now even colonising neighbouring woodlands further to the south; from where the species have been absent for decades.

Photo 1. Cock capercaillie in Scots pine (Pinus sylvestris) plantation habitat in Inshriach forest, Badenoch & Strathspey, Scotland. This site was visited by Grouse Specialist Group members during the visit to Scotland in 2003. (Photo. K Kortland.)

However, if lek data from Glenmore and Inshriach are removed, the number of capercaillie at NFE leks has declined from 44 in 2008 to 17 in 2012 (Figure 3). Eight NFE leks have gone extinct in this period. These counts are somewhat confounded by small variations in annual effort. However, a similar trend is seen in a sub-set of twenty-seven leks that are counted with consistent effort each year (Figure 4). In addition, the national trend mirrors closely the situation shown in Figures 3 and 4 (T Poole *pers comm.*). So, there is very strong evidence that there are real and significant declines happening across the range, apart from within the Badenoch & Strathspey region.

In 2002 on the national forest estate, twenty-seven leks were located and counted and twenty-three were extant, with a total of forty-three males. Only 13% (3/23) of the extant leks and 14% (6/43) of the males were in Glenmore and Inshriach in 2002. In 2012, fifty leks were counted and twenty-seven were extant, with a total of fifty-one males. However, 56% (15/27) of the extant leks and 67% (34/51) of the males were now in the Glenmore and Inshriach.

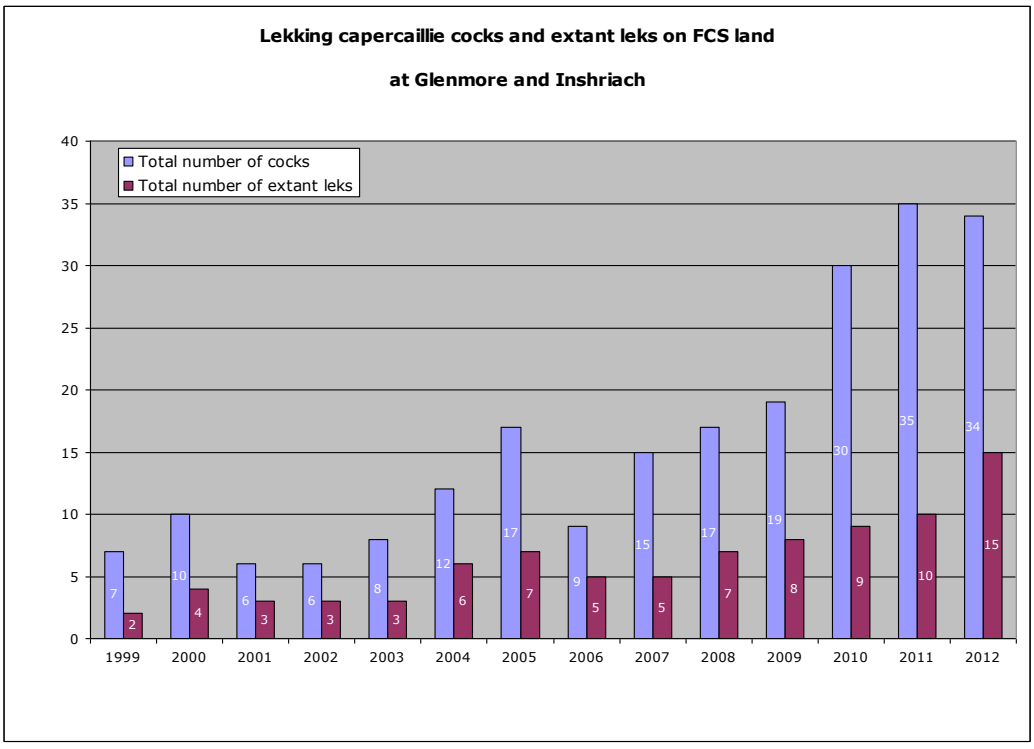

Figure 2. Number of capercaillie cocks and extant leks at Glenmore and Inshriach between 1999 and 2012. Note that leks include males displaying alone.

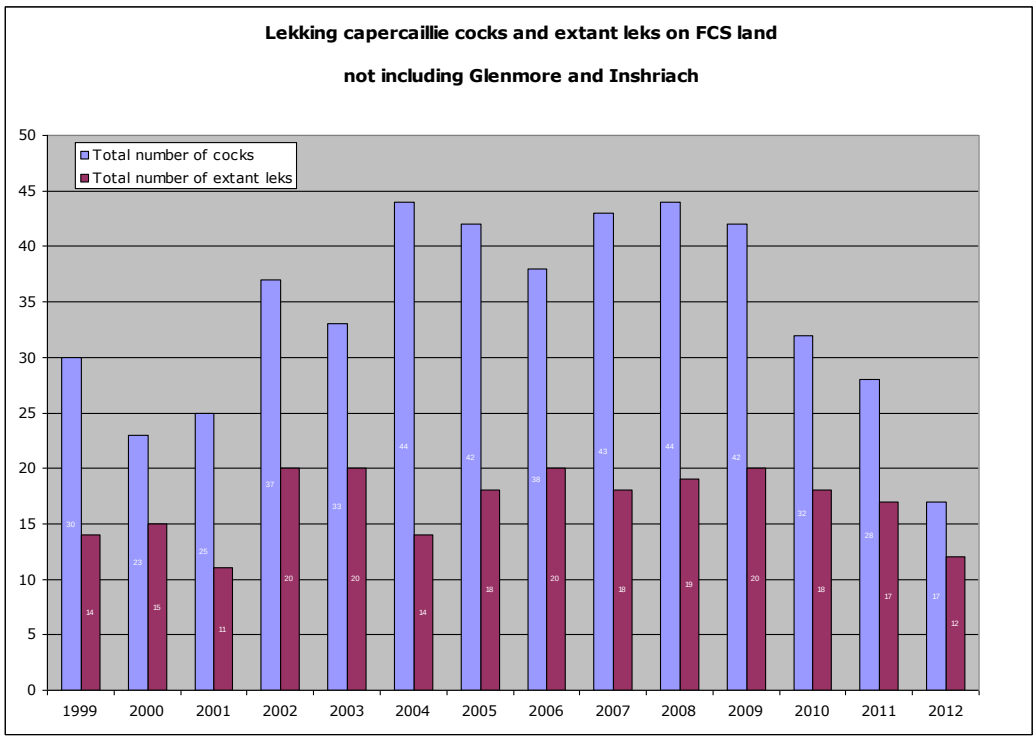

Figure 3. Number of capercaillie cocks on FCS land from 1999 to 2012 excluding Glenmore and Inshriach.

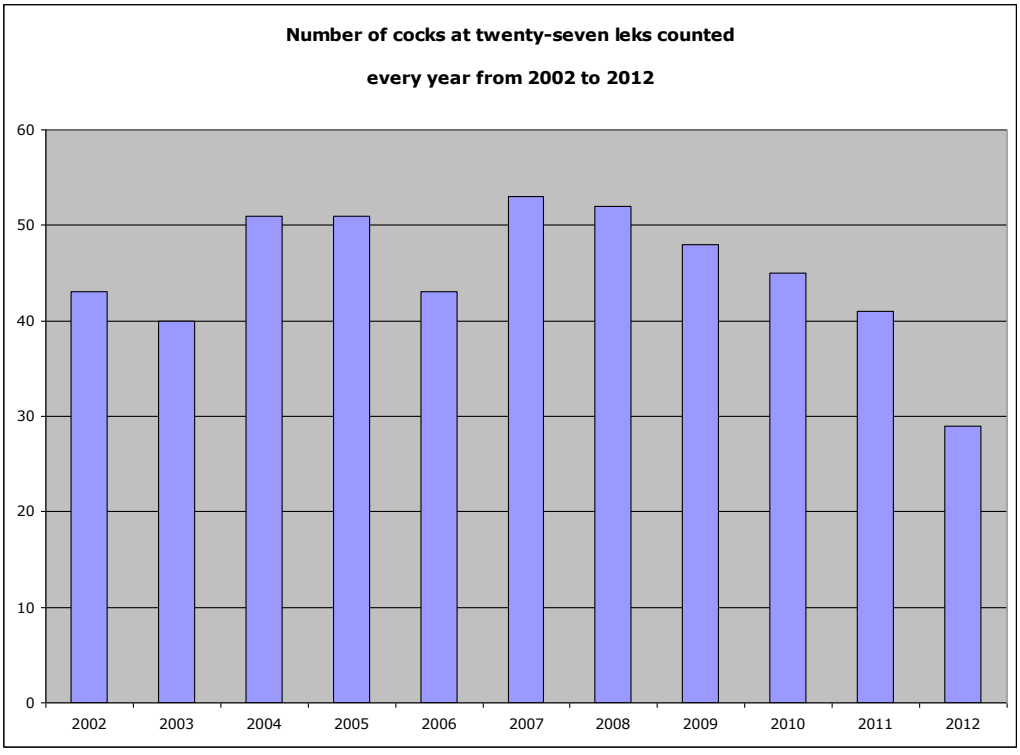

Figure 4. Number of capercaillie cocks on the same twenty-seven leks counted with consistent effort between 2002 and 2012.

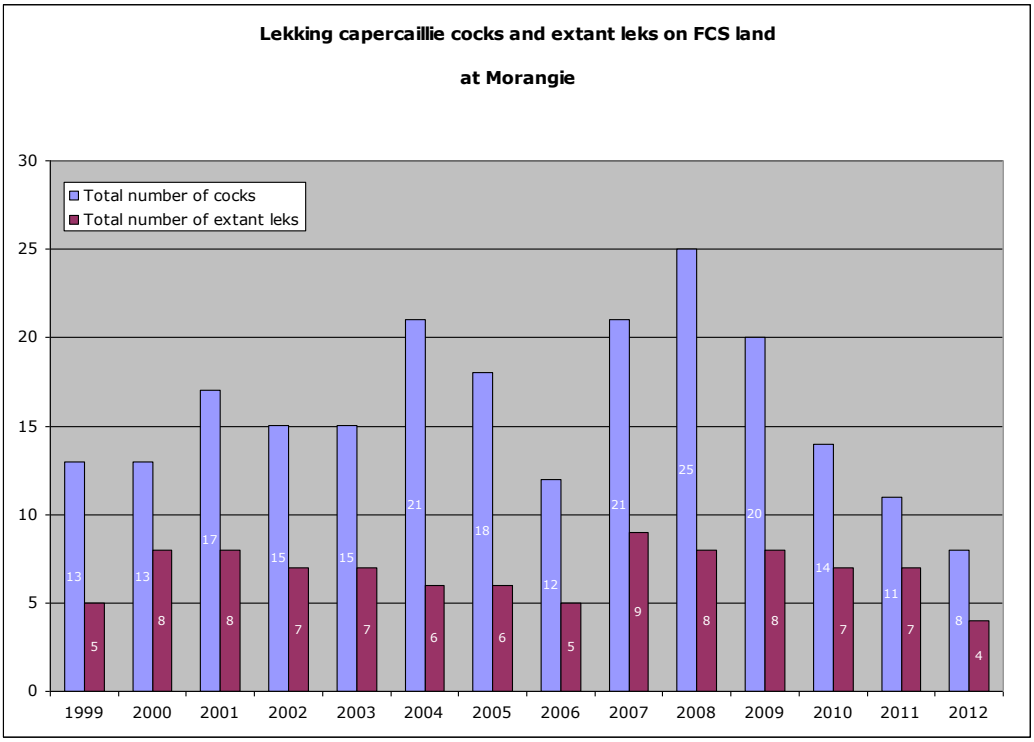

Figure 5. Number of capercaillie cocks and extant leks at Morangie between 1999 and 2012.

The situation at a forest called Morangie (Figures 5 and 10) is typical and extinction at this site now seems very possible despite significant investment in capercaillie conservation at the site by FCS. Since 1999, capercaillies have disappeared (i.e. no known leks) from nine NFE forests: Black Isle, Elchies, Ferness, Hill of Wangie, Monaughty, Bunzeach, Allean, Errochty and Glen Affric; although occasional hen records are still received for some of these blocks.

Capercaillie brood counts

Between 2002 and 2012, seventy-one brood counts were carried out across eight sites. A few of these sites had counts in all years and a few had counts only in some of the years. These counts located 303 cocks, 325 hens, 119 broods, and 271 chicks. The mean number of chicks per hen for all counts was 0.83 (se = 0.11).

Productivity was generally low at most sites in most years. The same pattern was evident on most private sector sites. Of the seventy-one counts, productivity was above the estimated population maintenance level of 0.62 chicks per hen (assuming zero mortality through fence collisions; Moss *et al* 2000) on twenty-four occasions. However, due to low numbers of hens (< 10), the statistical power was probably only high enough in seven counts to have a good degree of confidence that the figure was representative of what was actually happening on the site in that year. A sample of ten hens is required because the running mean of the chicks-per-hen ratio tends to plateau only beyond a sample of ten (R. Moss *pers. comm.*). Obtaining a sample of ten hens is becoming increasingly difficult and was only achieved in thirteen of the counts between 2002 and 2012. The seven counts with more than ten hens, and where productivity was above 0.62 chicks per hen, were at two sites (Glenmore and Morangie) where the fence threat has been largely nullified, so the assumption about fence mortality is reasonable.

Detailed analyses of the brood count data were undertaken to look for patterns and trends and to try to detect differences between sites; in particular, to investigate whether high productivity at Glenmore and Inshriach could explain the observed population increase at these sites. The analyses focussed on three components of site productivity:

a) The percentage of hens producing broods,
b) The average number of chicks per brood,
c) The average number of chicks per hen.

Data were restricted to combinations of site and year where there was at least one hen. There were enough data for seven sites to fit models. For these sites a series of generalised linear mixed models were fitted to estimate site effects, and these models took into account the unbalanced nature of the dataset (sites assessed at different times between 2002 and 2012, sometimes no hens present). Site effects

were estimated by least square means, which allows "balanced" means to be estimated as if all eleven years of the study had been recorded at each site.

Models for component a) were fitted using binomial errors and logit link functions; for component b) Poisson errors, log link functions and a log offsets of brood numbers; and for component c) Poisson errors, log link functions and a log offset for the number of hens. As noted above, hen numbers per site are generally low. This, in addition to the assessment year imbalance, has a fairly large effect on the precision of site effects and the ability to identify significant site differences of interest.

a) Figure 6 shows that for all sites apart from Wallace Hill, less than 50% of the detected hens had broods. Two sites in particular, Morangie and Pannanich, appear to have had fewer hens with broods. However, a wide range of productivity rates were observed between sites and between years, which resulted in large standard errors and consequently no significant site differences were recorded. However, this analysis does indicate strongly that there are particular problems at Morangie and Pannanich. There was no indication that Glenmore and Inshriach were significantly better than other sites.

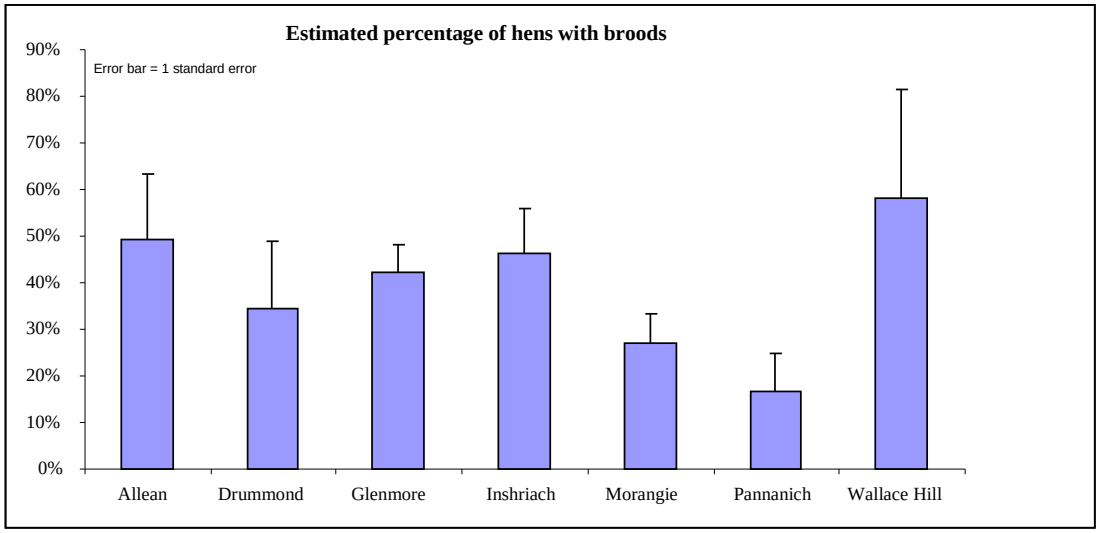

Figure 6. The estimated percentage of hens producing broods between 2002 and 2012.

Estimated yearly effects are highlighted in Figure 7. An average year effect has the value zero, so the X axis represents an index against which the individual years are plotted. Interestingly, a fluctuating pattern of productivity is apparent with a four-year cycle between "good" and "poorer" years.

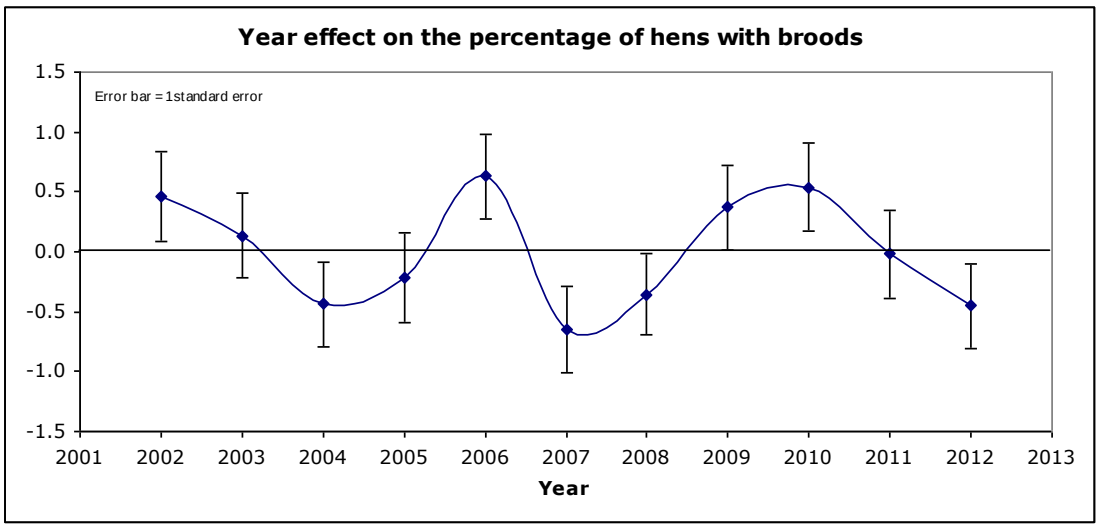

Figure 7. Year effect on the percentage of hens with broods on seven sites between 2002 and 2012 (Average year effect = 0)

b) As shown in Figure 8, brood size was roughly similar across the seven sites with no observed significant differences and little year-to-year variability. However, the data indicate once again that Pannanich seems to perform comparatively poorly.

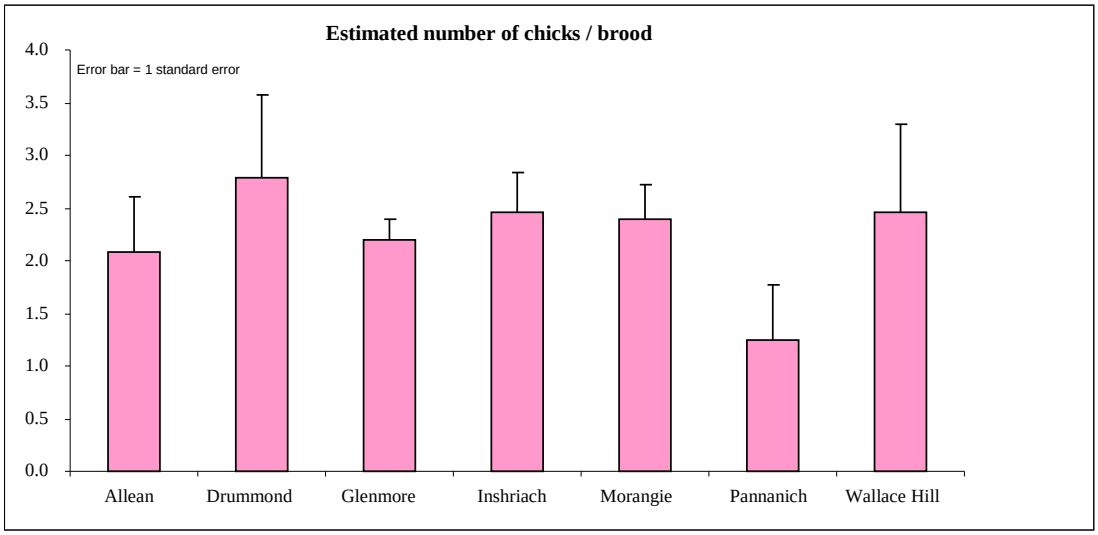

Figure 8. Estimated number of chicks per brood at seven sites between 2002 and 2012

c) Combining the two sets of information above, namely proportion of hens with broods and the numbers of chicks per brood generates the productivity statistic, number of chicks per hen. Figure 9 shows the results for seven sites. Estimated numbers show possible differences across sites but large standard errors have resulted in no significant differences being identified. However, once again, there are strong indications that Morangie and Pannanich are sites where capercaillie breeding success is comparatively low. There is no indication that productivity has been significantly higher at Glenmore and Inshriach between 2002 and 2012.

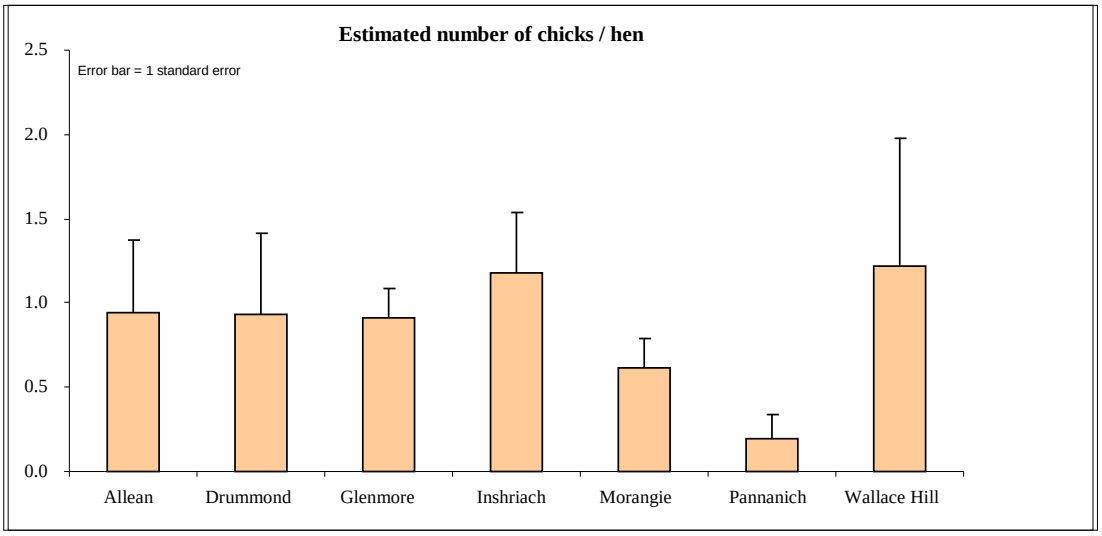

Figure 9. Estimated number of chicks per hen at seven sites between 2002 and 2012

The areas covered during brood counts at each site have been reasonably consistent through the years, both in terms of the part of the forest surveyed and the total area surveyed. This means that it is possible to assess changes in the densities of hens. This is biased towards hens with broods as hens

without broods tend to hide in thick cover (*pers obs*) and are therefore more difficult to detect. However, over the course of several years it is reasonable to infer trends in hen densities. Figure 10 shows data for four sites for which there are data for all years between 2002 and 2012 (apart from Pannanich in 2002). Worryingly, since 2007 there has been an obvious decline in hen density to very low levels at three of the sites; with no hens found at both Pannanich and Allean in 2010 and 2011. The declines at Morangie and Pannanich are particularly worrying because they are regarded as key national sites for this species. Even at Glenmore, hen densities decreased between 2008 and 2011, but the density remains quite high and the largest sample of hens (n=22) since counts began in 2002 was detected there in 2012.

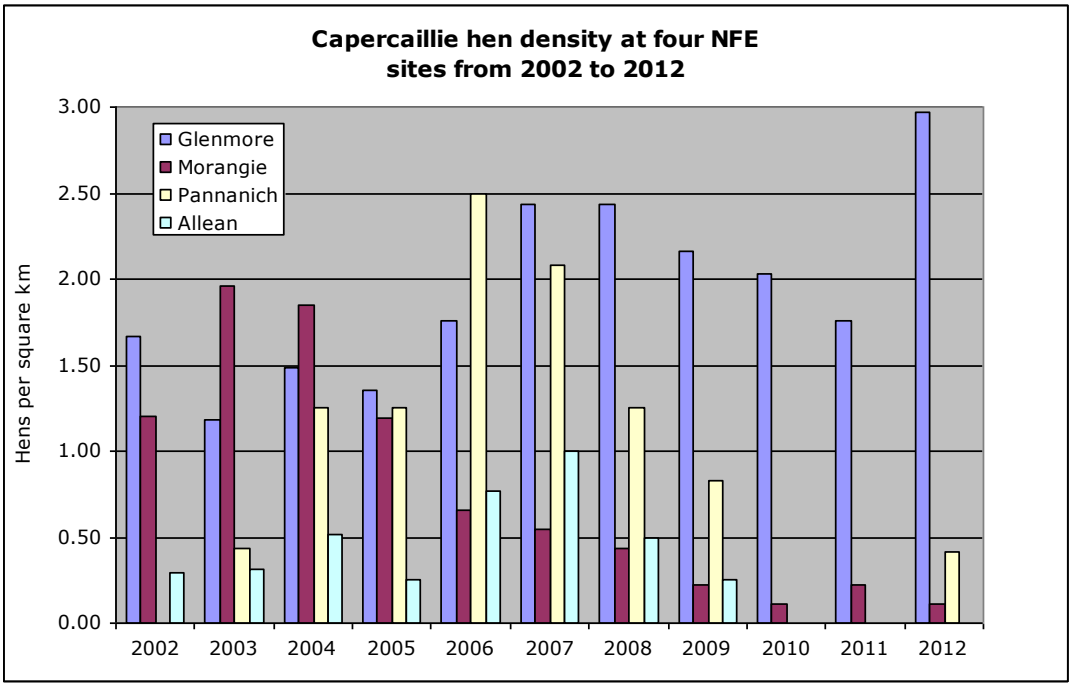

Figure 10. Capercaillie hen density at Glenmore, Morangie, Pannanich and Allean from 2002 to 2012. All sites were counted using dogs in each year, apart from Pannanich in 2002.

Conclusions from capercaillie monitoring

The national capercaillie population appears to be declining across the majority of its range in Scotland, and an increasing proportion of the population is now found in Badenoch & Strathspey. This pattern is reflected in the NFE data presented here. The decline is apparently due to consistently poor productivity. The reasons for this level of productivity are probably a combination of predation, habitat fragmentation and unsuitable weather in spring and summer. The interaction of these factors is important at the site level. Research indicates that landscape and management factors are influential in the demise of capercaillie at individual sites in Scotland (Kortland 2008). For example, capercaillie are apparently more likely to disappear from forest blocks that are set in agricultural landscapes, which have high densities of generalist predators and few gamekeepers. The Black Isle and Monaughty forest blocks mentioned above are two good examples of this situation. The implication is that irrespective of how well FCS manages forests for capercaillie, populations may decline on the NFE because of factors that are prevalent in the wider landscape. Hence it is important that management for capercaillie is carried out in a coordinated way that necessarily involves numerous ownerships.

At Glenmore and Inshriach the situation is much more positive and is probably a result of the combination of specific management for capercaillie, the (inadvertently) beneficial silvicultural activities, and the landscape context. All fences have been removed, forest restructuring is creating good habitat, and predator control is practised in the wider landscape; so generalist predator densities are probably lower than in other parts of the capercaillie range. Although the above analyses do not indicate that productivity has been significantly better at Glenmore and Inshriach compared to other NFE sites between 2002 and 2012, productivity in recent years at these two sites has been relatively good. It has been consistently better than the national average, for example. In 2012, 55% of the 29 capercaillie chicks located on all brood counts, including privately-owned sites, were in these two forests. Ongoing

and proposed studies of capercaillie in these forests aims to understand what is going on at these two sites and findings from this work could be crucial for this species in Scotland.

Long-term monitoring data, such as those presented above, are invaluable for land managers such as FCS, who have limited budgets for action. But such data allow funds to be targeted with maximum effectiveness. For example, the above analyses indicate that there are particular problems with low productivity and declining populations at Morangie and Pannanich, and these sites are now priorities for action. Unfortunately, monitoring is expensive and it can be difficult to obtain funding. However, monitoring data allow ecologists to understand what the real problems are and can allow them to identify which conservations actions should NOT be funded. This can, on the face of it, save an organisation a lot of money and make monitoring seem like a wise investment.

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Diet of Scottish rock ptarmigan

Adam Watson

Summary

Blaeberry (*Vaccinium myrtillus*) was the predominant food of rock ptarmigan (*Lagopus muta*) in Scotland at all seasons. There was some evidence that hens in April took more of it than cocks, but this did not hold for September–January or February, and male crops in May held preponderant blaeberry.

Introduction

Data below form the largest set of observations on the diet of rock ptarmigan (*Lagopus muta*) in Scotland based on 153 crops at all seasons. The bird's diet has been little studied. Watson (1964) made the first quantitative assessment of 90 crops, mainly from birds that he shot in January–June 1952 on the Cairngorms massif. Heather (*Calluna vulgaris*), crowberry (*Empetrum hermaphroditum*) and blaeberry (*Vaccinium myrtillus*) were the three main species, with heather the chief one in winter at lower altitudes, especially during snowy periods when many ptarmigan descended to the upper heather-dominated moorland.

Later I collected crops from some birds killed by predators and ski-lift wires. This allowed Moss & Watson (1984) to compare the diets of rock ptarmigan in April–June on the infertile granite bedrock and soils of Derry Cairngorm with diets on the relatively more base-rich bedrock and more fertile soils on the Cairnwell hills. Crops at Derry Cairngorm held less blaeberry than at the Cairnwell hills, in line with blaeberry's lesser abundance at Derry Cairngorm.

Since then, Rae (1994) assessed diets of cocks, hens, and young on the Cairnwell, by counting recognisable remains in their faeces in relation to his collection of known species. In spring, hens took more blaeberry than cocks, a plant known (Moss & Watson 1984) as more nutritious than heather or crowberry.

In my collections for the present paper, some rock ptarmigan had been killed by red fox (*Vulpes vulpes*), golden eagle (*Aquila chrysaetos*) and peregrine falcon (*Falco peregrinus*) on hills in the Cairngorms massif and the Cairnwell hills, and some had flown into lift wires at Glenshee Ski Area and Cairngorm Ski Area. Also I inspected crops of birds shot by Balmoral Estate on the granitic Lochnagar and by Invercauld Estate on the Cairnwell hills and the nearby Glas Maol and Carn an Tuirc, only 1–2 km from my ptarmigan study areas at the Cairnwell and Meall Odhar.

Materials and methods

Table 1 lists locations and numbers of birds. In the laboratory I separated items in each crop according to plant species and usually identified all fragments. Minute particles too small to be identified by the naked eye came to far less than 1% of crop contents. Separated contents were oven-dried and weighed (Watson 1964). In a few crops stained with blood from shooting, I washed the contents first.

Results

Table 1 shows the preponderance of blaeberry at all seasons. All shot birds came from autumn days when hills were snow-free, and birds from winter days when most of the typical alpine land used by ptarmigan was snow-free. Because heather is not dominant on alpine land and does not occur on upper alpine land, its availability was lower than when Watson (1964) found it predominating in the crops of ptarmigan that he shot during periods of deep snow when rock ptarmigan moved downhill to the upper heather moorland. A few birds came from altitudes above the limit of heather, and for instance the crop of a young cock killed by a fox at 1100 m on Cairn Gorm contained nothing but leaves of least willow (*Salix herbacea*). Feeding is often opportunistic, e.g. the birds that I watched pecking on Derry Cairngorm in November 1964 (Table 1, M). They foraged on a ridge with crowberry and creeping azalea, too exposed for heather and lacking enough snow-lie for blaeberry.

Table 1. Crop contents of 153 Scottish ptarmigan, showing within each column the total weight and the proportion (%) of items according to species, most data to nearest whole number for ease of reading, column M from observations on six ptarmigan feeding at 1100 m at Derry Cairngorm on 10 November 1964 with a total of 1008 pecks, watched at <5 m range.

	A	B	C	D	E	F	G	Hc	Hh	Ic	Ih	Jc	Jh	K	L	M
n	10	30	17	23	6	40	2	4	5	2	2	2	2	4	4	6
Wt in g	8	47	59	20	22	86	80	47	88	10	86	3	1	31	24	-
Vacc myr leaf	24	76	77	53	33	70	95	47	45	44	94	81	33	85	15	23
Vacc myr berry	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Vvi leaf	9	5	4	4	4	3	2	1	4	2	2	3	0	6	0	0
Vvi berry	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vacc ulig leaf	1	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0
Empetrum leaf	38	6	5	42	45	18	1	12	36	30	1	9	67	4	7	74
Empetrum berry	4	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0
Calluna vulgaris	9	8	11	<1	13	5	1	35	14	22	1	3	0	5	0	0
Galium saxatile	4	4	3	1	5	3	0	T	0	2	<1	3	0	0	0	0
Salix herbacea	2	0	0	0	1	0	0	<1	0	0	0	0	0	0	76	0
Grass leaf, seed	<1	T	T	T	0	0	T	0	T	0	0	0	0	T	0	2
Cerastium sp	0	<1	<1	0	0	0	0	0	0	0	1	0	0	0	0	0
Rumex sp	0	<1	T	0	0	0	0	0	0	0	0	0	0	0	0	0
Polygonum	0	T	T	0	0	0	0	0	0	0	0	0	0	0	0	0
Polytrichum	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
Saxifraga aizoid	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	0	0
Cladonia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0
Loiseleuria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Euphrasia sp	0	0	T	0	0	0	0	0	0	0	0	0	0	0	0	0

Vacc myr leaf is *Vaccinium myrtillus* leaf and includes leafless green stalks in winter, Vvi is *Vaccinium vitis-idaea*, Vacc ulig is *Vaccinium uliginosum*, Empetrum is *Empetrum hermaphroditum* with a little *Empetrum nigrum*, Polygonum is *Polygonum viviparum*, Polytrichum is *Polytrichum* sp. capsules, Saxifraga aizoid is *Saxifraga aizoides*, Loiseleuria is creeping azalea (*Loiseleuria procumbens*), <1 is 0.1–0.9, T is <0.1

A shot October 1953 by Balmoral Estate on Lochnagar
B shot 3 November 1967 by Invercauld Estate on Glas Maol
C shot October 1964 by Balmoral Estate on Lochnagar

D shot 11 November 1965 by Invercauld Estate on Carn an Tuirc
E shot 10 November 1964 by Mar Estate on Derry Cairngorm
F shot October 1964 by Invercauld Estate on Cairnwell hills
G cocks killed 16 May 1985 by ski wires on Cairnwell hills
Hc cocks killed September–January 1984–94 by ski wires and predators Cairnwell hills
Hh hens as Hc
Ic cocks killed April 1964 by ski wires, car and predators Cairnwell hills
Ih hens as Ic

I had crops from only two cocks and two hens from the Cairnwell hills in April (Ic and Ih in Table 1), to check Rae's finding that hens on the Cairnwell in spring take more blaeberry than cocks. My results are suggestive, the hens taking twice the proportion of blaeberry compared with the cocks, and the cocks far more crowberry and heather than the hens. One hen's crop contained nothing but 1.09 g of freshly-growing leaves, 81% of them *Cerastium sp* and 19% *Galium saxatile*. This confirmed my casual observations of hens seen eating such new leaves in April at the roadside below the Cairnwell as well as those of *Rumex sp* and occasionally *Alchemilla alpina*. All of these start growth before the heath species. That hens in spring select heavily for new growth along roadsides and elsewhere is well known also for red grouse (*Lagopus lagopus scoticus*), black grouse (*Tetrao tetrix*) and capercaillie (*Tetrao urogallus*) in Scotland, and is a feature in grouse species generally (Watson & Moss 2008).

This sexual difference in my rock ptarmigan from the Cairnwell hills in April was apparently short-lived. In September–January (Hc and Hh), the proportion of blaeberry taken by both sexes was about equal, and in February (Jc and Jh) the cocks took more blaeberry than hens, and hens more crowberry than cocks. Also, the only two crops that I had from May in the Cairnwell hills (both cocks) had an overwhelming proportion of blaeberry, 95%. By May, blaeberry there showed abundant growth of new shoots and leaves, whereas in April the hens that chose it had to spend much time selecting the small proportion of shoots which had started growth.

Discussion

A revealing variant was the emerging foliage of cloudberry (*Rubus chamaemorus*). This species appears to be the only one on alpine land, subalpine land and moorland to postpone the start of growth until late May and early June, weeks after the other plant species have begun to grow. The emerging leaves are a preferred food for adult rock ptarmigan and red grouse in early summer. In the late 1960s and early 1970s on the Cairnwell hills, I watched both species eating the leaves. In two adults of each species that had died from hitting cars or ski-wires in June, the crop contents consisted wholly or largely of these new leaves. The fresh leaves have a lettuce-like appearance, light green in colour, thin, delicate to the touch of fingers, and each up to about 10 mm in diameter. This differed markedly from the later, large, leathery, dark green, full-grown leaves, which I have never seen adults eating. I presume that newly emerging leaves have higher nutrient content and less fibre than later full-grown leaves.

Counting pecks at close range would offer a useful method when rock ptarmigan are confiding and can be watched undisturbed at close range without binoculars.

Acknowledgements

I thank estate staff for telling me about shot birds and helping me to take crops, and staff at ski centres for collecting some birds that flew into wires.

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New European research project: Grouse and Wind power

Joy Coppes

Current energy policy has led to a fast increase in the number of wind turbines across Europe. This combined with technological advancements is causing increased pressure to construct wind turbines in grouse habitats all over Europe. In the Black Forest, south western Germany and in the Austrian Alps this pressure and the lack of knowledge on this topic has led to the negative effects of the turbines on grouse species being questioned. Therefore it was decided that this topic should be intensively studied in the near future to support knowledge based management of this currently "hot-topic". With partners from Germany, Switzerland and Austria (for institutions see below) a concept was created to study the effects of wind turbines on grouse, with an emphasis on capercaillie, on a European scale. Most studies focusing on the effects of wind turbines on birds are small case studies, making it difficult to use the results on a wider scale. We want to study the effects on grouse of a broad geographical scale using the same methods. It is crucial for this project that the same methods are used in different study areas so results can be compared and management can be adequately supported. This study will take place from 2013 to 2017. To properly study this complicated matter, Before-After-Control-Impact studies using a variety of methods are planned, also establishing Europe wide monitoring standards and study methods when wind turbines are constructed in grouse habitats are a priority. In 2012 research and monitoring methods have been developed and tested also the first pre-construction data has been collected on a wind park which will be completed during early 2013 in Austria. For 2013 pre-and post-construction data collection is planned in several areas in Germany, Austria and Finland.

Combined with this research, we are setting up an openly accessible online platform to facilitate knowledge exchange on this topic. This website will have information on where wind turbine have been, or will be constructed in grouse habitats but also on studies or monitoring results. The main goal of this platform is combining and sharing knowledge to get a European view on the scale of wind turbines affecting grouse habitats.

We are still interested in using the study methods in other areas in Europe, so please feel free to contact us if you would like to collaborate in this project. If you know of wind turbines located in grouse habitats or of plans to construct new turbines, please inform us, this contributes to the online platform as well as it might be interesting new study areas. If you have any questions or would like more information on this research project, do not hesitate to contact me.

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Assumption and conditions of the Project LIFE11 NAT/PL/428 "Active protection of lowland populations of Capercaillie in the Bory Dolnośląskie Forest and Augustowska Primeval Forest"

Kobielski, J., Merta, D., Zawadzka, D., Krzywiński, A., Myszczyński, G., Wilczyński, T., Rzońca, Z. and Zawadzki, J.

History of the project

Capercaillie *Tetrao urogallus* is one of the most endangered bird species in Poland and in Europe. At the beginning of the 20th century, within the present national borders of Poland, about 2500 capercaillie lived in Poland. Since the 1970s, a dramatic decline in the numbers of this species has begun, with the average rate of extinction at 500 individuals/10 years (Głowaciński and Profus 1992). At present, the total population numbers of capercaillie in Poland is estimated at ca. 380-500 birds (Żurek and Armatys 2011), living in four isolated populations: Western Carpathians, Solska Primeval Forest, Augustowska Primeval Forest, and the Bory Dolnośląskie Forest (Figure 1). In mid-20th century, the number of capercaillie in the

Bory Dolnośląskie Forest amounted to ca. 360 individuals, at the end of the 1970s – ca. 200-270 individuals (Głowaciński and Profus 1992), whereas in 2006 – it was slightly more than ten birds (Merta et al. 2008). In 2009, a capercaillie restitution programme began in the Ruszów Forest District in Bory Dolnośląskie Forest. In 2009-2012, within the framework of the project, 78 birds obtained from breeding facility were released into the area (Merta et al. 2011a). In the Augustowska Primeval Forest, where over 100 individuals lived in the mid-1990s, the annual rate of population decrease during the last 15 years was more than 3%. In 2011, the size of population was estimated at 30-40 birds, including 16 cocks. Over the same period, the number of active display grounds dropped from 12 to 7-8 (Zawadzki and Zawadzka 2012). The decline in population numbers in both areas had a strong reducing impact on genetic diversity and resulted in greater isolation of display grounds and particular stations of this species. In Augustowska Forest, the comparison of habitat conditions using HSI index showed that the most important difference between stand covering active and abandoned leks were share of undergrowth (Brzeziecki et al. 2012). In Poland, capercaillie is a protected species and its leks are preserved by creation of protection zones. It is also entered into the Polish Red Book of Animals as 'critically endangered' species (CR category), and into the Annex I of the Birds Directive and therefore considered when special areas for bird protection are established under the Natura 2000 network. It is a qualifying species for the Augustowska Primeval Forest PLB200002, and for the Bory Dolnośląskie Forest PLB020005. In order to protect and preserve both these disappearing refugees of capercaillie, an application was submitted in 2011 to the Fund Life+ for a project entitled "Active protection of lowland populations of capercaillie in the Bory Dolnośląskie Forest and Augustowska Primeval Forest" (Zawadzka et al. 2011). In August 2012, the European Commission approved the project for financing in 2012-2018 (LIFE11 NAT/PL/428). The project budget amounts to € 5 312 000 and the financing institutions are: the European Commission, the National Fund for Environmental Protection and Water Management, and the State Forests National Holding.

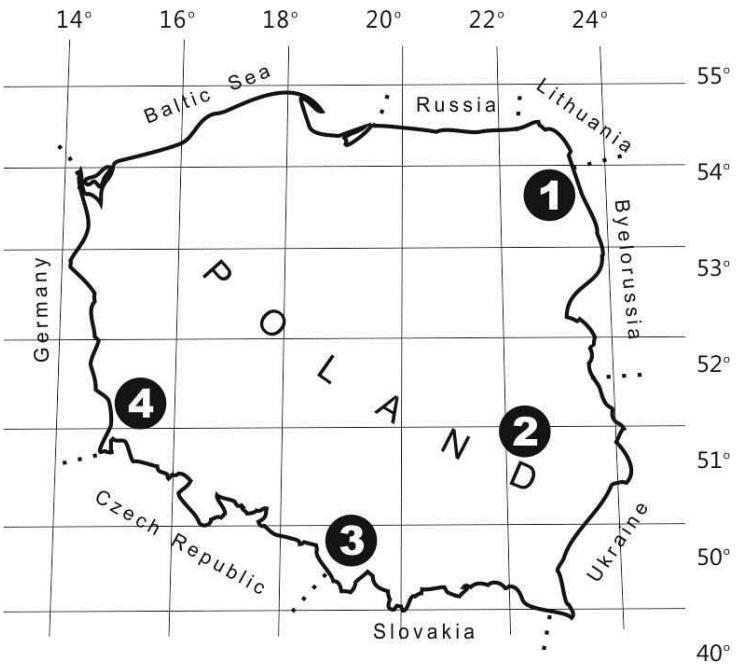

Figure 1. Distribution of capercaillie population in Poland. 1. Augustowska Primeval Forest, 2. Solska Forest, 3. West Carpathians, 4. Bory Dolnośląskie Forest.

Structure, objectives and tasks of the project

The main beneficiary of the project is the Ruszów Forest District (of the Wrocław Regional State Forest Directorate), and the co-beneficiary is the Głęboki Bród Forest District (of the Białystok Regional State Forest Directorate). The project envisages cooperation with experts in the field ecology, genetic and breeding of capercaillie. The project is implemented within five forest districts of the Bory Dolnośląskie Forest, covering a combined area of 83 896 hectares, and four forest districts of the Augustowska Primeval Forest, covering a combined area of 71 370 hectares. It is also assumed to be a continuation of the capercaillie restitution programme which was initiated in 2009 in Ruszów Forest District, as well as replenishing the near-extinct population in the Augustowska Primeval Forest. A detailed analysis of causes for the decline of capercaillie in the studied areas has been performed, and the measures planned aim at either elimination or alleviation of the identified threats. The following issues have been considered the most important: (1) critically low population number, adverse genetic status, isolation of both populations of capercaillie – in the Bory Dolnośląskie Forest and the Augustowska Primeval Forest, (2) alteration of living habitat of the species, (3) excessive impact of predators, and (4) intensifying

anthropogenic impact. All planned activities comply with the provision of the Polish National Plan for the Protection of capercaillie and the recommendations of the IUCN Re-introduction Group. The overarching objective of the project is to restore vestigial lowland populations of capercaillie in the areas of the Bory Dolnośląskie and the Augustowska Primeval Forest by implementing the following measures:

The restoration of capercaillie populations in the Bory Dolnośląskie and Augustowska Primeval Forest and preservation of their genetic pools in the Augustowska Primeval Forest

In order to restore the capercaillie population numbers in both areas where the project will be implemented, a total number of 220-285 birds obtained from Polish breeding farms (Breeding Centre of Forest Grouse in Wildlife Park in Kadzidłowo, State Forests Capercaillie Breeding Centres in Wisła and Leżajsk) will be released. The birds obtained from Kadzidłowo will be bred by the method called "born to be free" developed by Dr. A. Krzywiński (Krzywiński and Kobus 2009). The breeding centre in Kadzidłowo has its stock of capercaillie from a Byelorussian line enriched by genes of wild males from the Polish population of Lublin province (Puszcza Solska Forest), and from Augustowska Primeval Forest population obtained by mating breeding females by wild which prevents inbreeding and the adaptation to life in captivity. The protection of the local genetic pool from the Augustowska Primeval Forest population of capercaillie is planned by perfecting the method applied earlier in black grouse *Tetrao tetrix* (Krzywiński et al. 2012) which involves capturing males from the wild, which after short stay in captivity will be released at the points of capture.

In the Bory Dolnośląskie Forest, capercaillie will be released near the longest active display ground in the Ruszów Forest District, while in the Augustowska Primeval Forest - at the abandoned latest display grounds in order to shorten the distance among still active leks, and near those which are still active. Prior to release, the birds will undergo comprehensive veterinary examination, and material for genetic studies will be collected from each individual. The adaptation of released birds will be carried out in special adaptation areas where the capercaillie will be protected from predators (with pieces of brightly coloured cloths on ropes, adaptation aviaries, electric fence), and their food will be supplemented by natural items. Also planned is translocation of 60-80 wild birds of *Tetrao urogallus major* subspecies from Belarus as well as setting up a breeding facility of capercaillie in the Głęboki Bród Forest District, using the "born to be free" breeding method.

Monitoring of capercaillie populations

The activities planned in the project include telemetric monitoring of ca. 50% of capercaillie released, using VHF and GPS transmitters with activity and mortality sensors. The data obtained from telemetric measurements will allow the determination of: (1) the survival rates of the released capercaillie, and possible reasons of their death; (2) home ranges and habitats preferences and the seasonal changes in these parameters; (3) the ranges and extents of possible migrations. This will enable to evaluate the effectiveness of the program and correct orientation of protection measures related to the quality of habitats. Feather samples will be collected from all birds released in order to establish their individual genetic profiles. The genetic analysis will also be completed for all capercaillie feathers found in the study area in order to determine the population numbers of wild-living birds, and whether the birds released had entered reproduction. The monitoring of capercaillie populations will also be performed by twice repeated censuses on courting trees and during displays, and by analyzing information from observations charts.

Reducing and monitoring the population numbers of mammalian predators

The projects envisage the reduction of population numbers of predatory mammals (red fox *Vulpes vulpes*, racoon-dog *Nyctereutes procyonoides*, pine marten *Martes martes*, badger *Meles meles*, American mink *Neovison vison*, and raccoon *Procyon lotor*) by shooting and capturing in live-traps. The inventories of burrows and checks of the numbers of occupied burrows will also be performed as well as hunts with the use of hunting dogs. All this will result in reaching the target level of population density of predators at ca. 2 individuals/1000 hectares, recommended for the areas where restitution of small game animals and forest grouse is conducted.

Improving and monitoring the living habitat of capercaillie

The following measures are planned in the project: (1) improving water regime via the construction of small-scale retention projects i.e. gates and small ponds in the Bory Dolnośląskie Forest; (2) removing excessive tree undergrowth and forest bottom vegetation in order to restore optimum structure of habitat; (3) improving available food supply and shelter for capercaillie through mowing of tall, low-production bilberry patches; (4) marking fences around timber plantations and removing old fencing in order to limit the mortality among birds colliding with them in flight; (5) covering selected sections of forest roads

made of dangerous sharp aggregates by gravel (proper source of gastrolithes) in order to reduce mortality of birds caused by wounds in their digestive tracts; (6) removing neophytic plants and planting bog whortleberry in order to restore natural structure and species composition of the habitat in the Bory Dolnośląskie Forest. Monitoring of habitat quality is also planned.

Reducing anthropogenic impact

Under this task, gate-type barriers and information boards will be installed on forest roads near active leks and places where birds are released. Because in the Bory Dolnośląskie, the cycling tourism is the most pursued type of recreation during the season most critical for capercaillie population (April-September), provisions are made to construct hiking/cycling path with full infrastructure, in order to channel tourist traffic away from Capercaillie sanctuaries.

Environmental education and promotion of the project

For the purpose of raising the level of environmental awareness and developing social acceptance for the protection measures in the program, the following activities are envisaged: (1) seminars marking the inauguration of the project, (2) series of training sessions for various age groups of local residents which should win their support for protection measures, (3) issuing information/promotion-related tables and publications on the biology and ecology of capercaillie as well as on the project, (4) producing a 20-minute documentary about the species and the project, (5) disseminating the outcomes of the project via presentations at national and international conferences, and (6) creating and maintaining a project website. The project will conclude with an international conference on the protection and restitution of capercaillie population, with view of its demonstrative character, also by publishing a compendium summing up all results and experience gathered during the implementation of the project.

Conclusions

Implementing the project involving two distant and isolated populations of capercaillie will allow assessment of the effectiveness of measures undertaken for the purpose of protection and strengthening the existing but greatly endangered population in the Augustowska Primeval Forest. It will also constitute a continuation of earlier, four-year long programme aimed to restore a vestigial capercaillie population in the Bory Dolnośląskie Forest. The project will be implemented chiefly in areas managed by the State Forest and is a challenging task in carrying an effective protection of endangered species in commercial forests. The implementation of the project will ensure protection and increase the numbers in two of three Polish lowland populations of capercaillie which can result in an overall increase in the numbers of this species in Poland by 25-30%. The telemetric measurements used should provide data on survival rates and reproductive success of birds bred by different methods and those translocated, and – as a consequence – to evaluate their suitability in the species restitution programmes. The telemetric monitoring will also provide data pertaining to the detailed reasons for the mortality of released birds. It is the first time ever, that in the Augustowska Primeval Forest, the birds bred by 'born to be free' method will be released. The results obtained with this method in 2009-2012 in the Bory Dolnośląskie Forest area have been very promising because of the high survival of birds (Merta et al. 2011b). Under the framework of this programme, the experiments on the enriching the genetic pool of bred birds by genetic material from populations living in the wild will be continued. The effectiveness of various methods of monitoring and limiting the numbers of mammalian predators as well as results of measures undertaken to improve the quality of habitats will be verified. Another effect of the programme will be the increased ecological awareness and knowledge of capercaillie as well as of the Natura 2000 network among local communities. The experience gained during the implementation of the project can then be used in the conservation of remaining capercaillie and black grouse populations as well as in the protection of forest grouse in other Member States of the European Union.

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Energy development and conservation of sympatric wildlife: New approaches to meet growing challenges

William C. Dunn

CHAPTER ABSTRACTS:

Chapter 1. Climatic Heterogeneity and the Implications for Conservation of the Imperiled Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*)

William C. Dunn and Bruce T. Milne

A geographic range is a heterogeneous matrix in which the natural capability to support the resident species at any given location may vary from detrimental to optimal. Given this, the first step in recovery of imperiled species should be determining where optimal environments exist. We used MaxEnt species distribution modeling to distinguish climatic characteristics associated with persistent leks from those at random locations as a means of characterizing the niche and predicting the potential distribution of the imperiled Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*). Annual, brood period, and winter precipitation were most important in characterizing the niche across the geographic range, but maximum temperature during nesting was a key characteristic in the southern part of the range. Only 26% of LPC habitat across the geographic range had climate similar to locations of persistent leks. The largest proportions of climatically-similar habitat were in east-central New Mexico and western Kansas and Oklahoma. Lesser Prairie-Chickens appear constrained on the western edge of their range by abiotic factors, namely aridity, unfavorable temperatures, and a lack of sandy soil that supports preferred vegetation. Conversely, they appear constrained on the eastern edge by biotic factors, namely a change in habitat that favors dominance by Greater Prairie Chickens (*Tympanuchus cupido*). Maintaining populations in western Kansas and Oklahoma as well as east-central New Mexico will be key to conserving this species. Aridity, unfavorable temperatures, and a paucity of habitat make eastern Colorado and southeastern New Mexico challenging areas for LPC persistence.

Chapter 2. Modeling the Dynamics of Landscapes Occupied by Energy Development and Wildlife

William C. Dunn and Bruce T. Milne

Worldwide energy demand is increasing at an unprecedented rate. One result is significant loss of wildlife habitat. We developed a spatially-explicit patch model to determine the effect energy development on patch occupancy by sympatric wildlife. We used data from 80 years of oil and gas (O&G) extraction in southeastern New Mexico and counts of sympatric Lesser Prairie Chickens (LPC) (*Tympanuchus pallidicinctus*) to explore the dynamics of energy-wildlife relationships. If unprotected from energy development, all patches occupied by LPC went extinct, but time of persistence was inversely related to rate of O&G development. If patches initially occupied by LPC were protected from development, LPC persisted beyond the 100 year modeling period. However, the effectiveness this measure does have limitations. As rates of development increased, the number of years in which patches occupied by LPC were connected across the landscape decreased. The increased isolation was reflected in lower proportions of occupied patches at the end than at the beginning of the modeling period. The reason is that there are fewer avenues for recolonization, so protected cells become increasingly isolated and, in turn, remain empty.

Chapter 3. Spatial renormalization as a multiscale approach to determining the security of landscapes

William C. Dunn, Bruce T. Milne and Melanie E. Moses

One critical aspect concerning organismal fitness is how landscape connectivity affects security. Commonly used connectivity indices measure landscapes at the scale of the patch and provide a discrete categorization of security: patches have value, but the matrix between patches does not. In reality, security at any given location will vary based on proximity and availability of habitat and the scale at which an organism perceives its surroundings. We developed a security index based on majority rule renormalization, a technique in which fine-scale patterns of landscapes are measured at a cellular level and translated to broader-scales through aggregation of cells. To measure security, simulated landscapes,

lattices of equal-sized cells randomly classified as habitat (value = 1) or non-habitat (value = 0), were sampled with non-overlapping 2 x2 cell windows. All cells within the window were reclassified to the same numerical value as the majority of cells. In the next iteration, each window was considered a cell and measurement of the landscape was repeated. The sum of values derived from all iterations was the Security Index (*SI*) for each cell.

Using simulated landscapes, we classified cells as habitat in densities of p = 0.1 to 0.9 and calculated *SI*. We also introduced different-sized disturbances and measured changes in *SI*. Values of *SI* were highest in the interior of patches and lowest in the matrix. Security increased relatively continuously with habitat density at small scales, but a marked transition from low to high *SI* at p = 0.5 was evident at large scales. When landscapes were disturbed, the amount of change in *SI* was positively associated with size of disturbance, scale, and habitat density. Our results were consistent with empirical observations concerning the value of landscapes in providing security. We discuss how this technique may be applied to corridor conservation, habitat restoration, and wildlife translocations.

Dunn, W. C. 2012. Energy development and conservation of sympatric wildlife: New approaches to meet growing challenges. Ph. D. Dissertation. University of New Mexico. 151pp.

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Attwater's prairie-chicken brood survival – the invertebrate and red imported fire ant connection

Michael E. Morrow, Rebecca E. Chester, Bastiaan M. Drees and John E. Toepfer

The Attwater's prairie-chicken (APC) (*Tympanuchus cupido attwateri*) is endemic to prairies along the Texas and Louisiana gulf coast (Bendire 1894). Historically occurring in numbers that may have approached 1 million individuals on 6 million acres of habitat (Lehmann 1968), fewer than 110 have existed in the wild since 1995 despite intensive management intervention (USFWS 2010). Recovery actions undertaken during the last 20 years have included habitat restoration, captive breeding and release, and a number of research projects focused on identifying factors limiting recovery progress (USFWS 2010). Post-release survival for captive reared birds returned to wild habitats has ranged from 8–43%, and averaged 17% annually. While lower than the approximately 50% annual survival reported for wild prairie-chickens, it is substantially higher than attempts with other pen-reared galliform species (Toepfer 1988, Pratt 2010, USFWS 2010, Rymesova et al. 2012).

Estimates are that >66,000 acres of habitat exist in suitable condition for APC occupation (USFWS 2010). Even given a low carrying capacity estimate of 1 bird/50 acres (Lehmann 1941), this amount of habitat should support more than the number of APC currently found there. The APC Recovery Plan identified poor survival of chicks in the wild as "…the single-most important factor limiting significant progress toward recovery" (USFWS 2010:40). Observations at the Attwater Prairie Chicken National Wildlife Refuge (APCNWR) in 2003 documented via radio telemetry a total loss of 8 broods <12 days post-hatch. Several dead or dying chicks were found with brood hens at night roosts, indicating that predation was not the sole cause of chick mortality (USFWS 2010). Necropsy of these chicks attributed cause of death to inanition and dehydration.

Invertebrates are an important food source for young prairie-chickens (e.g., Lehmann 1941, Jones 1963, Rumble et al. 1988, Savory 1989, Hagen et al. 2005). Savory (1989) noted that invertebrate food comprised >90% of the diet of prairie-chickens <5–8 weeks old. Comparisons of insect abundance in APC brood habitat with that from an increasing Minnesota greater prairie-chicken (GPC) (*T. c. pinnatus*) population found that while insect biomass did not differ between the areas, APC brood habitat supported <30% of insect numbers (i.e., >70% lower) compared to GPC brood habitat (P < 0.001) (Pratt et al. 2003). In an attempt to confirm the importance of invertebrates as a limiting factor for APC during the first 2 weeks post-hatch, broods (wild radioed hens and chicks) were confined on APCNWR at the nest site immediately post-hatch and provided locally collected insects *ad libitum*. From 2004–2012, 83% of 547 chicks treated in this manner survived the critical 2-week period, and were subsequently released back to wild habitats. A number of these chicks survived to adulthood (Morrow, APCNWR, unpublished data).

Red imported fire ants (RIFA) (*Solenopsis invicta*) were accidentally introduced to the United States at the port of Mobile, Alabama (Allen et al. 1995) circa 1930. Today this species occupies almost the entire southeastern United States (Porter and Savignano 1990). RIFA arrived in occupied APC range

circa 1970 (Allen et al. 1995, http://www.extension.org/pages/14911/texas-quarantine-map). The disruptive impacts of RIFA on native invertebrate communities are well documented (e.g., Porter and Savignano 1990, Allen et al. 2001, Wojcik et al. 2001). Porter and Savignano (1990) found that species richness of non-ant arthropods was 30% lower in sites infested by RIFA, and numbers of individuals were 75% lower.

We investigated (1) the relationship between invertebrate abundance and APC brood survival, and (2) the effects of RIFA on invertebrate communities over a broad area at multiple large-scale treatment sites during the APC's early brooding season (May–mid-June). Additionally, we collected information on hen source (captivity or wild-reared) and age to evaluate impacts of the captive-rearing environment on the ability of hens to successfully rear young.

Brood survival data were collected from 44 broods from 2009–2012. Of these, 21 (48%) were successful (i.e., still had chicks at 2 weeks post-hatch). To evaluate the influence of invertebrate abundance with respect to APC brood survival, invertebrates were collected by sweep-netting once daily at APC brood sites during the first 2 weeks after hatch. Brood sites were determined by triangulating radioed hens, and invertebrate samples were collected 1–2 days later to minimize potential disturbance to the brood. At 2 weeks post-hatch, the radioed hen was observed at dawn (before leaving the night roost while still brooding their chicks) to determine if any chicks were alive. A brood was considered successful if at least 1 chick was observed. No attempt was made to obtain a total count of chicks present. The influence of hen characteristics on brood survival was evaluated by comparing brood success with hen age (second year (SY) versus after second year (ASY)), hen source (captive or wild), and for hens released from captivity, time since release.

To assess the impact of RIFA on APC brood habitat quality as indicated by invertebrate abundance, we used an impact-reference design with 5 sets of replicates in space and 3 replicates in time during each of 2 years. The 440–725-acre treated areas received an application of Extinguish® Plus brand fire ant bait to reduce RIFA abundance. Extinguish® Plus was applied at the recommended label rate of 1.5 lbs/acre by helicopter during early November 2010 and again in late September 2011 during weather conditions appropriate for application. Invertebrate samples were collected from control and treated areas beginning the last week in April following treatment and continued for 3 consecutive bi-weekly periods through early-June each year.

Overall, median invertebrate numbers were 2.1 times higher ($P < 0.001$) at successful brood sites compared to unsuccessful sites (128 versus 60, respectively). No other attributes of hens (age, released from captivity or wild-hatched, years since release for captive-reared hens, or previous nesting experience or success with fledging chicks) hypothesized to affect brood success were significant ($P > 0.52$). Median total invertebrates/sample was 1.4 times higher ($P < 0.05$) for treated sites compared to untreated controls. Median dry weight of invertebrates/sample was 1.6 times higher ($P < 0.05$) for treated sites compared to untreated controls.

Data collected in this study clearly demonstrate that availability of invertebrates during the first 2 weeks post-hatch is a major factor limiting survival of young APCs. This study also clearly demonstrated that the invasive RIFA has significantly reduced invertebrate abundance within historic and extant APC habitats. APC populations consistently declined during the 25-year period following invasion of APC habitat by RIFA circa 1970. Therefore, it is likely that the introduction of RIFA played a significant role in the APC's plunge toward the precipice of extinction, and has frustrated recovery efforts in recent years.

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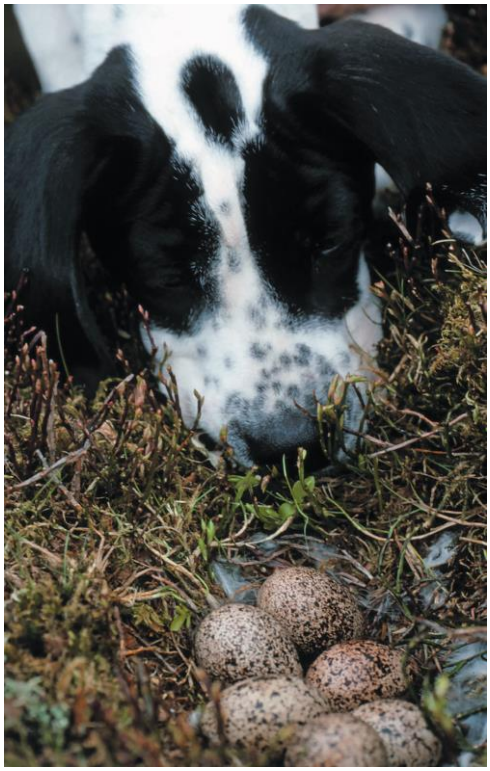
NEW BOOKS

Points, sets and man.

In this book, the author looks back at 56 years' of personal experiences with his own pointers and setters, and those of members of the research team that he came later to lead. They studied the population biology, territorial behaviour, habitats and environment of red grouse and ptarmigan in Scotland. The joint achievements of men and dogs elicited a fresh understanding of populations and behaviour of animals in general, drawing international attention and recognition to the human workers. It is time to sing for recognition of the dogs, because the human achievements would have been immeasurably less had the faithful dogs not joined them to form a crucial inspirational partnership. The author tells of that partnership, its development and fruition. The book is mainly the author's personal account, describing how the human workers gradually gained insight and experience that made the partnership ever more effective. Because the author's dogs lived with him and his family, and the others in the team who had dogs usually kept them at home, part of the book tells of these relationships. Personal anecdotes and humorous events enliven the text. The author knew some other workers who used dogs to aid their research on wild animals, and visited them in Canada, USA, Ireland and Norway. Also he was in close touch with other colleagues who used dogs for wildlife research in France, England, Sweden and northern Italy. A valuable international aspect to the book has been contributed by a few of these colleagues. 124 photographs illustrate the text, showing dogs and men in fieldwork together and apart, as well as portraits of both. Hunters, shooters, researchers and dog enthusiasts in general will enjoy and appreciate this book. The book has 246 pages, published by Paragon Publishing and printed in England, USA and Australia.



Adam Watson 2012. Points, sets and man. Pointers and setters, stars of research on grouse, ptarmigan and other game. ISBN 978-1-78222-076-3. £14.99, US$24.99, C$24.99, €15.99, A$29.99.

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SNIPPETS

The 31st IUGB Congress in Brussels 2013

The main IUGB events are its international Congresses, organised every two years. The next IUGB Congress will take place in Brussels from 27th until 29th August 2013 and the website for on-line registration as well as submission of presentations of papers or posters is now accessible under www.iugb2013.be where all relevant information, including the provisional Programme, can be found.

The overall theme selected for the 2013 IUGB Congress is "*Diversity in Wildlife Management – Objectives & Tools*". All over the world, people – professionals as well as volunteers, including many hunters – are indeed conserving and managing game and other wildlife species, as well as their habitats, for a wide range of reasons or stakes and using sometimes very different tools and techniques. The IUGB Congress seeks to address this diversity in order to let participants learn and benefit as much as possible from each other's experiences and knowledge through the different papers and posters presented and the views related to them. Presentations will be made on the following five Congress topics:

1. Interactions Wildlife-Wildlife
2. Impacts Humans → Wildlife
3. Impacts Wildlife → Humans
4. Interactions Humans-Humans
5. Tools for management and research

For additional information, contact the Congress Secretariat at: iugb2013@momentum-pco.be.