Provision of brood-rearing cover on agricultural land to increase survival of wild ring-necked pheasant *Phasianus colchicus* broods at Seefeld Estate, Lower Austria, Austria

Roger A.H. Draycott[1*], Thomas H. Bliss[2], John P. Carroll[2] & Karl Pock[3]

[1] *Game & Wildlife Conservation Trust, Fordingbridge, Hampshire SP6 1EF, UK*
[2] *Warnell School of Forestry & Natural Resources, University of Georgia, GA31411, USA*
[3] *Gutsverwaltung Hardegg, Seefeld-Kadolz, A2062, Austria*

*Corresponding author e-mail: rdraycott@gct.org.uk

SUMMARY

Wild ringed-necked pheasants *Phasianus colchicus* have declined throughout their naturalized European range as a result of habitat loss and a reduction in food resources on farmland. To ameliorate the reduction in chick food availability on arable farmland, 'brood-rearing' seed mixtures (to provide insect-rich foraging areas) were sown on rotational set-aside on a large commercial farming estate in Lower Austria during 2001-2003. The use of these areas by wild pheasant broods and their effect on brood survival was determined by radio-telemetry. Areas of planted brood-rearing cover were positively selected by pheasant broods and survival rates were highest amongst broods which incorporated these brood rearing areas into their home ranges.

BACKGROUND

Wild (naturalized) ringed-necked pheasants *Phasianus colchicus* have declined significantly throughout Europe in recent decades (Tapper 1999, Campbell *et al.* 1997). The main factors responsible for these declines are related to agricultural intensification. Several changes in farming practice have taken place, which are widely regarded as being detrimental to wild gamebirds. These include the introduction and subsequent widespread use of insecticides and herbicides that can directly and indirectly reduce the abundance of insect food items for gamebird chicks (Campbell *et al.* 1997, Potts 1991, Rands 1986). Previous studies of European wild gamebirds associated with agriculture suggest that the abundance of weedy areas, grasslands and insects are inversely related to home range size, and positively correlated with chick survival of pheasants (Hill 1985), red-legged partridges *Alectoris rufa* (Green 1984) and grey partridges *Perdix perdix* (Green 1984). The most crucial time for pheasant chicks is the first 14 days after hatching, when they are dependent on invertebrates for growth and survival (Hill 1985). In order to increase the quantity of insect-rich foraging areas for wild pheasants on an estate in Lower Austria, seed mixtures were sown on rotational set-aside land (to provide brood-rearing cover). The success of these planted areas in increasing survival of chicks was assessed using radio-tracking data from hen pheasants with broods.

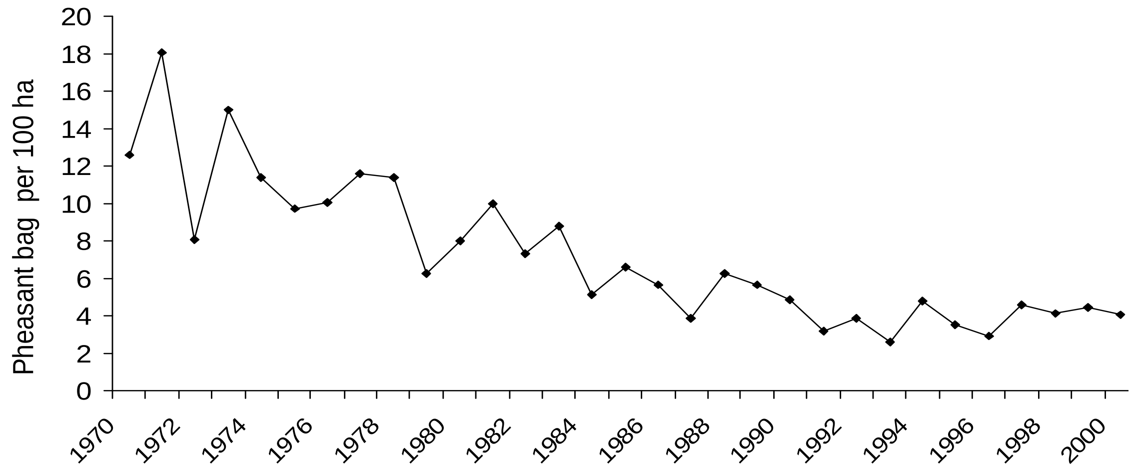

Figure 1. Declining shooting bags of wild pheasants as an indication of population declines in Lower Austria, 1970-2000.

ACTION

Study site: We studied wild pheasants in Austria, where, in common with many other countries in Europe, they have declined significantly over the last 30-40 years (Fig. 1). Seefeld Estate (a 2,400 ha arable farming estate) is situated in the region of Lower Austria, close to the Austrian/Czech border approximately 100 km north of Vienna. During 2001-2003 the land use comprised 1,000 ha winter cereals, 100 ha spring cereals, 200 ha sugar beet and potatoes, 300 ha maize, 130 ha oilseed rape, 200 ha rotational set-aside, 70 ha long-term grassland set- aside, 250 ha woodland, 100 ha wetland areas and 50 ha shelterbelt/hedgerow.

Seefeld (elevation 190 m above sea level) has a mid-continental climate with a temperature range of 6 to 37˚ C in summer and -25 to 5˚ C in winter. Average annual rainfall is 480 mm, with 160 mm falling in May and June. Yields of all crops have increased considerably on the estate since the 1960's (e.g. winter wheat in the 1960's yielded 3 tons/ha, compared with 5 tons/ha in the 1990's) due primarily to agricultural intensification and a switch to winter (as opposed to spring) sown crops; such changes are implicated in general declines of many farmland birds.

Brood rearing cover: In an attempt to provide insect-rich foraging areas for wild pheasant and grey partridge chicks, rotational set-aside was sown with seed mixtures of narrow (grasses) and broad-leaved (forbs) species to provide brood-rearing cover. In total, 142 ha of rotational set-aside were planted with seed mixes in 80 different locations around the estate. Plots varied in size from 0.5 ha to 3 ha. A variety of different mixtures were sown, but always included a combination of three or more of the following: oilseed rape *Brassica napus*, lucerne *Medicago sativa*, sunflowers *Helianthus annuus*, wild flowers, cereals and grasses. The mixtures were sown at the edges of fields or in areas of the farm that were difficult to manage with large machinery. Seed mixes were sown at a low seed rate (10kg/ha), the idea being to prevent the cover becoming too dense. The structure of brood rearing cover is important, as gamebird broods prefer a combination of an overhead canopy for concealment from predators and an open structure at the base to allow freedom of movement so that chicks can forage efficiently.

Narrow strips were cut through the cover every 20 m or so to provide open 'drying out' areas for broods and to provide diversity in the sward structure (Fig. 2). These strips were cut early in the growing season (April) and maintained at a short height through the breeding season. They were cut in curved rather than straight lines to help reduce the risk of raptor strikes. The remaining cover was not cut until after the breeding season to prevent broods being destroyed by machinery. No herbicides or insecticides were used on these brood rearing areas.

Figure 2. Strip cut through rotational set-aside planted with brood rearing cover to provide drying out areas for broods, Seefeld Estate.

Monitoring: Pheasant hens were captured from 1 March - 10 April during 2001 - 2003 using maize-baited walk-in funnel traps. Hens were fitted with necklace radio collars (Holohil® model RI-2B) and located 2-3 times a week (Fig. 3). Nests, when located, were monitored three times a week. Once nests of tagged hens hatched, broods were located twice daily from a distance of around 15-30 m for the first 21 days to determine exact habitat use and home range size. A brood was considered lost during the rearing period if a brood 'caution' or 'gathering' call were not heard during consecutive observations, or if the hen died.

Figure 3. Radio-tracking wild pheasants in brood-rearing cover planted on rotational set-aside land, Seefeld Estate.

Analytical methods: Brood survival (the proportion of broods in which at least one chick survived to fledging) was calculated using the Kaplan-Meier method (Kaplan & Meier 1958). To determine habitat use and preference we analysed habitat data using compositional analysis following the methods of Aebischer (1993). Brood survival was modelled in relation to a number of non-habitat and landscape variables. These are listed in Table 1. To determine best fit models and the effect of each covariate on brood survival, Akaike's Information Criteria for small sample size (AICc) was used (Anderson *et al*. 2000). Slope (β), standard error (SE) and 95% confidence interval (CI) were calculated by model averaging for each covariate. If the CI for a covariate included zero we considered it to have no influence on survival.

CONSEQUENCES

Habitat use: Home range size for successful broods (n=28) was 11.1 ha. No difference was found in home range between years ($F_{2,25} = 1.99$, $P = 0.16$), or in relation to the age of the hen ($F_{1,26} = 0.02$, $P = 0.90$). Habitat analysis showed that habitat use by broods was not random. At the estate level, broods used more agricultural land than would be expected by chance (Wilk's $\lambda = 0.59$, $F_{3,30} = 6.92$, $P = 0.001$). Within individual home ranges, planted brood-rearing crops were positively selected by broods (Wilk's $\lambda = 0.44$, $F_{3,30} = 12.66$, $P < 0.0001$) (Fig. 4).

Brood survival: Survival of broods for the first 21 days was estimated at 74% in 2001, 92% in 2002 and 66% in 2003. Over the 3 years, seven complete broods were lost between 2–17 days after hatching with average loss occurring 11 days after hatch. Predation by fox (n = 4) and other mammalian predators (n = 1) were responsible for the loss of five (72%) broods; the other two (28%) were considered lost to exposure and during harvesting operations. None of the non-habitat variables had a significant effect on brood survival. Planted brood-rearing cover was the only habitat variable which significantly influenced survival. Broods utilising this cover had 100% survival. Although not significant, woodland and long-term grassland set-aside appeared to have a negative impact upon brood survival, whereas data suggested wetlands were positively correlated with survival (Table 1).

Conclusions and management recommendations: Within pheasant brood home ranges, broods preferred rotational set-aside planted with seed mixes with (presumably) a fairly insect-rich accessible sward structure. Broods that incorporated brood rearing covers in their home ranges had 100% survival. When brood-rearing cover is managed correctly it has low stem density and contains little ground debris, which allows for easier movement. Brood-rearing cover also attracts a wider variety of insects than found in crops, which is important for chick survival (Hill 1985). We advocate provision of insect-rich foraging areas to benefit wild gamebirds. Many other farmland birds that feed their young on invertebrates will likely benefit from these foraging areas too. Options to plant seed mixes that encourage insects to provide foraging areas for birds should be incorporated into agri-environmental schemes; particularly as the opportunity to use set-aside land has now been lost due to a change in European Union Agricultural Policy. These results highlight the value and potential of growing wildlife seed mixtures on set-aside land for farmland wildlife. Permanent set-aside, although probably valuable for nesting, was not suitable for foraging broods due to the thickness of the sward. We also observed that woodland was negatively associated with brood survival, probably owing to a higher numbers of predators in woodland. Therefore, we recommend that brood-rearing covers are placed away from woodland edges.

ACKNOWLEDGEMENTS

We would like to thank Count Maximilian Hardegg, owner of Seefeld Estate for his financial support, enthusiasm for wild pheasants and generous hospitality. We also thank Brandon Anderson for assistance in the field.

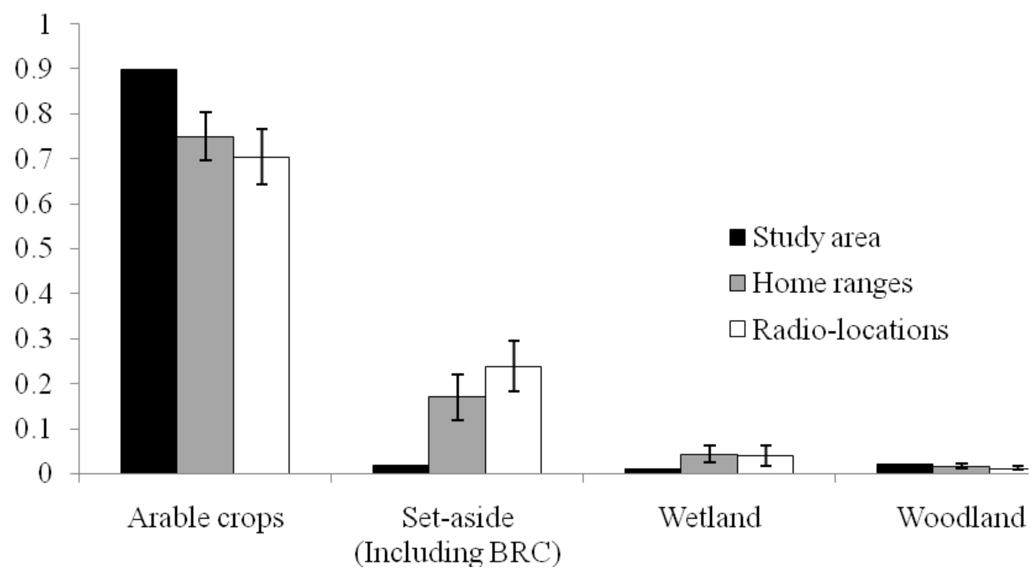

Figure 4. Relative habitat use of wild pheasant broods. Habitat proportions within the study area, within home ranges (±SE) and radiolocations (±SE).

Table 1. The influence of non-habitat and habitat covariates upon 21 day survival of radio-tagged pheasant broods at Seefeld Estate during 2001 - 2003. Inclusion of zero within the 95% CI suggests there is no significant slope.

	AICc	Delta AICc	Slope	95% CI	
Pheasant hen covariates					
Condition index	80.25	0.00	0.19	-0.31	0.68
Age	80.29	0.04	0.38	-1.22	1.99
Habitat covariates					
Brood rearing cover on rotational set-aside (%)	74.52	0.00	609.04	472.28	745.79
Wetland (%)	75.74	1.22	36.58	-9.70	82.85
Edge (m/ha)	75.99	1.48	-0.35	-0.93	0.24
Nest location	78.49	3.97	-1.22	-2.92	0.48
Woodland (%)	78.78	4.26	-14.59	-32.92	3.75
Arable fields (%)	80.56	6.04	-1.13	-5.27	3.01
Permanent set aside (%)	80.80	6.29	-0.22	-3.60	3.17

REFERENCES

Aebischer N.J., Robertson P.A. & Kenward R.E. (1993) Compositional analysis of habitat use from animal radio-tracking data. *Ecology*, **74**, 1313-1325.

Anderson D.R., Link W.A., Johnson D.H.& Burnham K.P. (2000) Suggestions for presenting the results of data analyses. *Journal of Wildlife Management*, **65**, 373-378.

Campbell L.H., Avery M.I., Donald P., Evans A.D., Green R.E. & Wilson J.D. (1997) *A review of the indirect effects of pesticides on birds.* JNCC Report No.227, Joint Nature Conservation Committee, Peterborough, UK.

Hill D.A. (1985) The feeding ecology and survival of pheasant chicks on arable farmland. *Journal of Applied Ecology*, **22**, 645-654.

Green R.E. (1984) The feeding ecology and survival of partridge chicks (*Alectoris rufa* and *Perdix perdix*) on arable farmland in East Anglia. *Journal of Applied Ecology*, **21**, 817-830.

Kaplan, E.L. & Meier, P. (1958) Nonparametric estimation from incomplete observations. *Journal of American Statistical Association*, **53**, 457-481.

Potts G.R. (1991) *The environmental and ecological importance of cereal fields*, in: Fairbank L.G., Carter N., Darbyshire J.F. & Potts G.R. (eds). *The ecology of temperate cereal fields*. Blackwell Scientific Publications, Oxford, UK, pp. 3-21.

Rands M.R.W. (1986) The survival of gamebird (Galliformes) chicks in relation to pesticide use on cereals. *Ibis*, **128**, 57-74.

Tapper S.C., (1999) *A question of balance: game animals and their role in the British Countryside.* The Game Conservancy Trust, UK.