NRW's proposed approach to regulating the release of gamebirds (common pheasant and red-legged partridge) in Wales

Consultation Document

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Annex 2: Assessment of evidence relating to gamebird survival rates and patterns of dispersal

Release and restocking regimes of non-native gamebirds (common pheasant *Phasianus colchicus* and red-legged partridge *Alectoris rufa*), normally using captive-bred birds, are the most commonly used game management approaches in the UK. Madden (2023) estimated between 0.8-2.3 million gamebirds are released annually in Wales, across 171-431 shoots, with a median release of 1,000 birds. This represents up to ~4% of non-native gamebirds reported as being held for release in the UK. Most environmental effects of gamebird release may be associated with the abundance of birds (Madden and Sage, 2020, Mason *et al.,* 2020, Sage *et al.,* 2020). The proximity and scale of released birds (e.g. density of birds per ha of release pen) combined with the dispersal of the birds, their survival rates and any human interventions will all contribute to gamebird density temporally and spatially and the associated level of ecological impact.

In extended areas of dense pheasant release, dispersal from one shoot may supplement stocks on neighbouring shoots, and therefore, dispersal itself may be inconsequential to the overall release/shot ratio. However, where shooting estates are not contiguous, dispersing birds likely leave managed areas and so enter areas without supplementary food, managed habitats or predator control where they are more likely to have low survival rates.

This note presents a rapid assessment of the scientific evidence of released gamebird survival and dispersal. It does not test whether released gamebirds restock wild populations, nor does it determine the ecological impact of released birds.

Survival of released gamebirds

Based on a relatively large sample (>200 shoots), Tapper (1999) and Aebischer (2003) suggest an average shooting return of 40% (this is the proportion of birds shot, at the end of the shooting period, from the total number of birds released). The available evidence, which mostly relates to England, indicates that both post-released pheasants and red-legged partridges show poor survival rates following release, with only around 15% surviving past the end of the shooting season and into February (Turner, 2007; Hesford, 2012 (in Sage *et al*., 2021)). Turner (2007) suggested 70% of radio-tagged released pheasants survived just prior to shooting in the release area. Most published research suggest between 30-40% of birds released are shot (Turner, 2007; Robertson *et al*., 2017; Madden and Sage, 2020). High post release losses and relatively high levels of predation are common to all

studies. Poor survival of post-released pheasant and red-legged partridge releases have two serious consequences: i) the economic value of released gamebird is markedly decreased and ii) the meso-predator communities consume a relatively high proportion of released gamebirds prior to and after shooting (Turner, 2007).

Increasing the number of released birds may not necessarily result in a proportional increase in the number of shot birds, in fact one study concluded the proportion of pheasants that were shot was significantly reduced as stocking density of the pen increased (Turner, 2007). Factors such as predator pressure, habitat quality, habitat management, stocking density, conditions of the birds at the time of release and the timing of release may all play a contributory role in determining the survival of released gamebirds.

Movements of released gamebirds

Understanding the survival and movements of released gamebirds is useful to the assessment of ecological impact on sensitive habitats and species. Pheasant are reasonably sedentary with wild birds normally remaining within 5km of natal sites (Gatti *et al*., 1989). Very few published studies have looked at dispersal patterns of released gamebirds in the UK. Those that have, document movements either as a home range (home ranges are routinely used in ecological studies to define the area occupied by the individual of a species in its normal activities of food provisioning, courtship and breeding) or as dispersal distance from release locations. Most such studies report either the mean maximum range (the average of the maximum distance moved by each bird that was successfully tracked between release site and the end of the study period) (Turner, 2007) or mean dispersal (e.g., Sage *et al.,* 2001) (Table 1). In addition, there are a few studies where small numbers of released pheasant or red-legged partridge have been radio-tagged and movements reported in Europe (Alonso *et al*., 2005; Duarte *et al*., 2011; Sage *et al*., 2021). However, in most if not all of these studies the game management regime and habitats differ from those of shooting estates in the UK and are not considered comparable.

Published studies suggest dispersal distance can be influenced by game management practices, habitat quality and seasonal movements with dispersal movements greater in females than males (Sage *et al.,* 2001; Turner, 2007).

In one study, the dispersal patterns of released pheasants at six large, spatially independent sites over three years were studied (Turner, 2007). In this study 486 pheasants were tagged, released and radio-tracked for six months, although only three months of data was only analysed from date of release (August) to prior to shooting (October). The mean maximum distance for all tagged birds was 913m ±82m, with females dispersing greater distances than males (Table 1). The frequency and dispersal distance of released pheasants demonstrates that movement from release areas occurs prior to the start of gamebird shooting. This finding suggests a proportion of released birds may stray away from driven beats (pheasants are shot on the traditional formal "driven shoot" principles, whereby guest or paying guns have birds driven over them by beaters, and on smaller "rough shoots" by other methods) and may not contribute to the shooting bag. Turner (2007) also experimentally manipulated stocking densities and suggests stocking density in a release pen did not influence movement of females in terms of distance moved,

but males released from pens with high stocking densities had larger home ranges around the pen.

Other studies of gamebird movement did not measure the relationship between dispersal distances and density of birds released for males or females prior to the shooting season. It is fair to assume that stochastic processes (e.g. fluctuations in the availability of natural food sources, nest and roost sites) and different regimes of game management may result in inter annual variations in movements of released pheasants.

Spring dispersal distances were reported for 24 radio-tagged game-breed released pheasants and determined the mean distance from release pen to catching-up (normally early February) of 266 ±41m and from release pen to April of 512 ±66m (Sage *et al.,* 2001). Other studies are referenced in Madden and Sage, 2020.

Table 1 Published studies of dispersal distances of pheasant and red-legged partridge in the UK.

Source	Dispersal distance	Commentary
Sage *et al*., 2001	Game-farm breed: release pen (August) to: February 266 ±41m, April 512 ±66m. Wild breed: release pen (August) to February 381 ±59m, April 738±131m.	Pheasant: 50 birds from one location were radio-tagged bird (two strains were tagged: 25 tagged birds were from game-farm bred and 25 tagged birds were from wild bred birds). Mean dispersal distance measured from August (release date from pens) to the following February, March, April and nest location. Study undertaken in England, 1992.
Turner 2007	Mean maximum distance for both sexes 913 ±82m Mean maximum distance for males 783 ±91m. Mean maximum distance for females 1053 ±136m.	Pheasant: 486 birds from six study sites were radio-tagged. Birds were radio tracked for six months but dispersal distances were only analysed using data for three months, from the point of release to prior to the start of shooting. The mean maximum distance moved by each tagged bird was determined from the release pen (August) to the start of the shooting season (October). Study undertaken in England, 2001-2003.
Beardsworth *et al*., 2021	Almost all radio-tagged birds remained within 500m prior to the start of the shooting season.	Pheasant: 50 birds from one location were radio-tagged bird (25 males, 25 females). Birds were tracked from 22nd August to 30th September. Females moved further than males.

Hesford 2012	The mean dispersal distance from release pen was 408m.	Red-legged partridge: 274 birds were tagged at six large sites over a three-year period. Birds were tracked for 5 months following release to the end of the shooting season. 68% of tagged birds stayed within 500m of the release location, 32% of birds dispersed >500m but less than 1km and 5% dispersed more than 1km. Study undertaken in England.

Neither Sage *et al.* (2001) nor Turner (2007) provide Kernel Density Estimations (KDEs) for tagged birds or determine the proportion of birds that predominantly occupied different distance bands (i.e. 0-50m, 51-100m and so on) from the release pen to prior to the shooting season. However, we can determine that as the distance from the release pen increases, the corresponding area of available land increases significantly and we can therefore assume the density of birds may reduce rapidly.

Hypothetical example

In a simplistic approach, we determine the numbers of released pheasants likely to be found in different radii from the release pen. Our approach was to determine different densities of released birds, ranging from the median number of 1,000 birds released/shoot in Wales (Madden, 2023) up to 10,000 birds. We applied three simplistic rules:

i) 16% of released birds will survive from release to the end of shooting season (e.g. from 1,000 released birds 160 will survive to February) (Turner, 2007).

ii) We assume all birds are evenly distributed in a radius of 1,000m from the point of release until after the shooting period (February).

iii) Game management techniques (such as placement of feeders or cover crops) were applied close to release pens to reduce movements after release.

A circle with a 300m radius from a release pen would cover 28.8ha, at 500m the area increases to 78.5ha, at 750m it increases to 176.7ha and at 1,000m it would be 314.2ha. If we assume that a release of 1,000 birds was evenly distributed within these areas, with 84% mortality, we may expect to find a density at the end of the shooting season of 5.7 birds/ha within 300m, 3.2 birds/ha within 400m, 2 birds/ha within 500m, 0.9 birds/ha within 750m and 0.51 birds/ha at 1km (Table 2). Of course, 1000 birds would be a small shoot, though Madden (2023a) suggested this was the median shoot size in Wales. The total number released by a shoot may be significantly higher and even if recommended stocking densities are adhered to the ranges of released pheasants is likely to overlap with the potential for cumulative densities in some areas.

It is highly unlikely that released birds will immediately range to their full extent immediately after release. Birds may be expected to gradually range further from the release pen as birds mature and their confidence and ability to fend for themselves increases; and as over time the level of husbandry reduces at the pen. This assumption is supported by Tuner (2007) who found departure from the release pens of radio-tagged pheasants occurred 30 days (mean number of days) after release. Applying these assumptions and accounting for the high mortality rate from release to the end of the shooting season it is expected the total number of birds surviving to disperse into that area will decrease. Sage *et al*. (2021) suggest that by the end of the shooting season and into spring, when accounting for mortality from shooting and other causes, the density of pheasants from a shoot of a 1,000 bird release, if evenly distributed, would be c.1 bird per ha within 500m of the release pen and around 0.3 birds per ha within 1km. Our simple calculations (see Table 2) compare favourably with those of Sage *et al*. (2021).

Table 2. Density of released pheasant (birds/ha) that are expected to survive to February (end of shooting season) at different radii from the release pen and different numbers of released birds (range 1,000 to 10,000 birds).

Number of pheasants released	Number of birds/ha per radii from release pen				
	300m	400m	500m	750m	1000m
1,000	5.7	3.2	2.0	0.9	0.5
2,000	11.3	6.4	4.1	1.8	1.0
3,000	17.0	9.5	6.1	2.7	1.5
4,000	22.6	12.7	8.1	3.6	2.0
5,000	28.3	15.9	10.2	4.5	2.5
10,000	56.6	31.8	20.4	9.1	5.1

The assumption that the density of birds is evenly distributed throughout their range is unlikely to reflect reality. Turner (2007) explored the role of habitat quality in dispersal and survival of radio-tagged pheasants following release and found that tracked pheasants dispersed into more favourable habitats, which in order of preference were; cover crops, field edges, woodland edges, woodland interiors and open habitats. It may therefore be possible, to some extent, to predict the pattern of dispersal from specific release sites by looking at the surrounding habitat types and topography. In addition, there is an economic incentive to minimise movements beyond the boundaries of the releasing shoot. However, it is fair to assume that

constant harassment during the shooting season in the form of disturbance by beaters and dogs may cause pheasants to disperse from release areas.

The movement and dispersal of birds from release sites and the how released birds utilise and occupy available habitats is important to understand ecological impacts.

Conclusions

From this assessment, the following conclusions are drawn:

- Where pheasants are released at high densities, competition for food, water, roosting and nesting sites, may stimulate dispersal for some individuals.

- Published scientific studies on dispersal of reared pheasants from release sites in the UK is limited, thus there is high scientific uncertainty. However, there is consistent evidence in the form of two tracking studies to indicate that the majority of birds do not generally disperse further than 500m from their point of release. Though none of these studies determined the density of birds (e.g. mean the number of birds/ha) at different radii from the release sites.

- Though gamebird dispersal seems to be limited to less than 500m from the release site, there are no actual studies that determine the effects of gamebirds at or beyond 500m from the release site, including effects on generalist predator populations, foraging behaviour, disease spread, competition for food, and eutrophication. This represents an evidence gap not evidence of no impact.

- Direct or indirect human interventions have the potential to influence dispersal of released non-native gamebirds. The assumption is birds are less likely to roam far if their needs are catered for close to the release site and the release densities do not exceed the capacity of the habitat.

- Applying a range of rules and assumptions to a median shoot size in Wales of 1,000 birds, at a radius of 500m from the release site, the density of birds was predicted to be 2 birds/hectare. However, there were several assumptions i) all birds were evenly distributed within a radius of 500m (an area of 75.5ha), ii) no other shoots were in close proximity, therefore ruling out that dispersal from one shoot supplements densities of birds on another shoot, and iii) game management techniques (such as placement of feeders or cover crops) were applied close to release pens to reduce movements after release. In most cases it will be in the interests of the shoot to ensure birds do not stray, particularly where they may disperse out of the estate. However, we cannot rule out the possibility that birds may move into sensitive sites.

- Current evidence indicates that whilst we may expect to see high densities at, or very close to, release pens, those densities will tend to rapidly decrease as distance from the release pen increases, and over time.

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