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Appendix 1

Woodland management for pheasants			
Woodland planting and retention for pheasants			
Firbank (1999)	Report	Random squares	+ve
320 1-km^2 grid squares in England classified as managed for game or not based on site visits. Game squares had more and larger woods although the differences were small. In a sub-sample of 12 game squares they found a significant increase in woodland since the 1960s (none had less), and no mean increase in 12 non-game squares (3 had less).			
Short (1994)	Report	Voluntary questionnaire survey	+ve
Of 261 farms, 61% of holdings that released pheasants planted new small woodlands (1 – 5 ha) compared to 21% of non-release sites; 31% of the release sites had more than 5% woodland cover compared to 14% of the non-release sites.			
Vegetation and breeding birds in lowland woodland interiors			
Short (1994)	Report	Voluntary questionnaire survey	+ve
58%, 36% and 41% of holdings that released pheasants managed rides, coppiced trees and planted shrubs. Equivalent figures for non-release holdings were 8%, 5% and 10%.			
Draycott et al. (2008a)	Peer review	Selected and random sites	+ve
The interior of 159 lowland woods were surveyed in southern and eastern England for vegetation structure, composition and songbird abundance. Half had release pens or pheasant feeders and surveys were undertaken away from release points. Woods managed for pheasants had a more open canopy structure than unmanaged woods, more ground cover (63% compared to 48%) and more quadrats contained herbs (80% and 60%). No differences were detected in abundance or diversity of woodland interior shrubs (but see next section). There were between 22% and 32% more songbirds in pheasant woods than control woods. Each 4-ha survey plot contained on average 2.0 warbler territories in the game woods and 1.3 territories in the control woods.			
Davey (2008)	PhD thesis	Selected sites	ntl
Game management variables and the abundance of songbirds in 20 woods with release pens were compared taking account of bird detectability. The abundance of six species was positively related to the density of feed hoppers. No relationships between songbird abundances and the density of pheasants in the woodlands were found. Bird abundance between 40 woods with release pens and 40 non-game woods from the RSPB/BTO Repeat Woodland Bird Survey dataset (Amar et al. 2006) were compared. Of 20 bird species considered, none showed a difference in abundance between wood types.			
Sage (2018a)	Report	Selected sites	+ve
In 26 conifer woodlands on four estates in the Exmoor region, the lower and upper tree canopy managed for game was about 25% more open than in non-game conifer woods. There was 30% more bracken *Pteridium* spp. in game woods and a tendency towards more bramble *Rubus fruticosus* and grasses. The abundance of herbaceous vegetation was not found to differ. On average 18 birds (mainly passerines) were encountered per survey transect in the game conifer woods, and 10 in the non-game woods.			

Shrubs, butterflies and bees at wood edges			
Hoodless and Draycott (2005)	Article	Selected and random sites	+ve
Most of the woods in the sample by Draycott et al. (2008a) were used in a study of habitat, butterfly and bee abundance in the woodland edge zone (20 m into the wood). Edge zones of pheasant woods had a more sloping profile, 1.3x greater shrub cover and fewer overhanging trees than non-game woods in East Anglia, but not in Hampshire. Game woods in East Anglia also had 2.5x more flowering shrubs and 1.7x greater shrub density, 2.2x more butterflies and 1.5x more species. No relationship between game management and numbers of bumblebees were found in either region.			
Woodland rides in game woods			
Capstick et al. (2019a)	Peer review	Random sites	+ve
Using the same sample of woods described in Draycott et al. (2008a), rides were not longer but were 20% wider in game woods (10.5 m), occupied a higher proportion of woodland area (13%) than non-game woods (8%), were more likely to have an open canopy, and experienced more disturbance by vehicles but less foot or horse path erosion. There was 55% less bare ground in rides in game woods, 27% more ruderals, 53% more species of fertile soil and similar numbers of ancient woodland indicator species. There were 41% more shrub species in rides in game woods in the southern region. Butterfly abundance and diversity was not significantly different in rides between game and non-game woods.			
Songbird use of pheasant woods in winter			
Hoodless et al. (2006)	Article	Selected and random sites	+ve
Birds were counted along 1-km transects in 70 semi-natural oak and ash woods in central southern England in winter, half of which had pheasant release pens and game feeding. Vegetation cover was measured. Bird numbers in November-December were 1.5x higher in release woods. There were 13.0 species per game wood compared to 10.4 species in non-game woods. Game woods contained higher numbers of finches, tits and woodpigeons *Columba palumbus* than non-game woods. Thrush and woodpecker numbers were not detectably different. Bird numbers increased as canopy cover decreased; average canopy cover was lower in game woods than non-game woods (37% and 45%). The paper suggested that thinning or skylighting in the game-managed woods may have benefited birds and that feeding in pheasant woods in winter may also be a component.			
Small mammals in pheasant woods			
Davey (2008)	PhD thesis	Selected sites	+ve
Data were collected from a grid of 160 baited small mammal traps at between 8 and 16 releasing woods (so no non-releasing controls) in south-west England. 2100 mammals were caught, six rodents and three shrews. Habitat variables explained most variance in numbers caught but game management also had an effect on two species. Numbers of bank voles *Myodes glareolus* and wood mice *Apodemus sylvaticus* caught were higher at sites where feed hoppers were used all year. The distribution of wood mice was positively related to feed hoppers and to release pens in autumn. In Spring bank voles were more common near pens and wood mice less common. The study concluded that game management tended to be positive for woodland small mammals. The study found no			

evidence that pheasants predated small mammals. Wood mice and bank voles are relatively robust common species found in a range of habitats.

Impact of released pheasants on lowland woodland habitats			
Ground flora effects in woodland-based pheasant release pens			
Sage et al. (2005a)	Peer review	Selected sites	-ve
Compared ground flora using quadrats inside and next to pheasant release pens with distant control quadrats in the same Ancient Semi Natural Woodlands (ASNW) at 43 sites. Mean stocking density was 2200 birds per hectare of pen. The recommended density is 700-1000 per hectare (Sage 2007 and Code of Good Shooting Practice). Release pens had 2x more bare ground than control areas, reduced vegetation cover below 50 cm, 20% lower average species diversity, lower percentage cover of shade-tolerant winter-green perennials (6.4% compared to 25%). Annual species and some perennials of fertile ground were present in more pens than in control areas especially where stocking density increased beyond 1000 pheasants per hectare of pen. Perennials characteristic of shady habitats decreased as stocking densities went over 1000 birds per ha (for winter-green perennials there was no threshold stocking density). This work provides a basis for the recommendation that release pens should be stocked at 1000 birds per ha or less (Code of Good Shooting Practice).			
Sage (2018a)	Report	Selected sites	-ve
Ground floras were compared inside and outside release pens/woods at seven game estates in the Exmoor region. The study did not look at pen stocking densities but the sample included pens on several very large shoots. There was no difference in overall plant diversity between plot types. There was more bare ground (40% compared with 10%) and lower cover of herbaceous plants (15% compared with 30%) and ferns (10 % and 20%) inside release pens than outside. Fern diversity was twice as high outside as inside the pens. The impacts that were measured were confined to the pen i.e. did not extend to other parts of the release woods.			
Capstick et al. (2019b)	Peer review	Selected sites	-ve
A study of ground floras in abandoned or disused pheasant release pens (some 14+ years) undertaken over three years in 65 ASNWs with paired control areas in the same woodland. There were 15% more species of high fertility in the abandoned pens than in controls and 50% fewer winter-green perennials. Overall vegetative percentage cover had recovered and there were no longer differences in the proportions of grasses, annual herbs or species of disturbed ground. The sensitive ground flora community showed signs of recovery in pens disused for 14+years but this was less marked where >1000 pheasants per hectare had been released. The study suggests pen relocation should not be undertaken on conservation grounds unless particularly important sites are involved.			
Soil effects in woodland-based pheasant release pens			
Sage et al. (2005a)	Peer review	Selected sites	-ve
In a sub-sample of five release pens from the sample described above, soil potassium was 2.5 x and phosphate 65% higher in pens than in control areas; pH and magnesium levels			

were not detectably different in this small sample.			
Capstick et al. (2019b)	Peer review	Selected sites	-ve
Used the same sample of 65 disused pheasant release pens as above. In average-aged pens phosphate and potassium remained 75% and 35% higher. Soil chemistry showed some recovery in pens abandoned for 14+ years, less so where >1000 per hectare had been released.			
Woodland ground invertebrates in pheasant release pens			
Pressland (2009)	PhD	Selected sites	ntl
Studied 17 matched woodland pairs in SW England, with and without pheasant releasing. Ground invertebrates were sampled using pitfall traps inside (near pen), outside (in grass field) and wood-edge before (May/June) and after (September) release. Fewer insects were caught outside the wood before releasing occurred. No difference in insect numbers were found in wood-edge plots with or without releasing and before or after releasing, and between any plot type after release. Some insect groups were caught more frequently with releasing and some without and these variations were not easily explained. Faecal analysis indicated that pheasants sometimes ate invertebrates especially in the spring when more insects were available and pheasants much less common. Caterpillar biomass along woodland tracks was not strongly linked to pheasant density.			
Neumann et al. (2015)	Peer review	Selected sites	-ve
Compared invertebrate samples from 10 pitfall traps at 37 sites in the central area of the release pen with woodland pitfalls around 300 m away. Vegetation measures were taken. Mean release density in pens was 1500 birds per hectare. There were more disturbance-tolerant annuals and perennials inside the pens and less leaf litter. No difference in overall invertebrate abundance between the two plot types. Carabid and staphylinid species richness was the same. Release pens had a different community of ground beetles with fewer large woodland carabid beetles and more beetles characteristic of arable and grass fields. There were also more detritivores such as snails in the release pens that released more than 1000 birds per ha.			
Hall (2020)	PhD	Selected sites	-ve
Pitfall-trapped invertebrates inside (and next to) and away from release pens at different times. Prior to release, pen interior invertebrate biomass was lower, while slug counts were higher, than away from pens. After release invertebrate biomass and numbers were sometimes lower inside pens.			
Direct impacts on butterflies			
(Clarke & Robertson 1993)	Peer review	Selected sites	ntl
A correlative study suggested that UK 10 km^2 squares with pheasants were less likely to have fritillary (and other) butterflies because of predation by pheasants of caterpillars (Corke 1989). Warren (1989) described how the ecology of fritillaries meant that they were at a low risk of predation, and that Corke's correlations were probably not causal. Twenty colonies of third-instar larvae of the fritillaries *Boloria euphrosyne* and *B. selene* were established on violets (*viola spp*.) near a pheasant pen. 95% of larvae were recovered live after 9 days. In 50 woods in southern England that had fritillary colonies recorded in a 1970 survey, a resurvey showed that the proportion with colonies had declined by a third,			

but that the decline was the same in woods with and without pheasant releasing.			
Woodland bryophytes and lichens on trees			
Sage (2018a, 2018b)	Report	Selected sites	-ve
Bryophytes and lichens were compared on trees inside and outside release pens/woods at seven game estates in the Exmoor region. The study did not look at pen stocking densities but the sample included several very large shoots. The abundance and diversity of bryophytes and lichens on trees overall was not different between plots. Moss diversity was 25% lower in game woods (in and outside pens) compared to other woods. Lichen diversity was not detectably different. Liverwort diversity was reduced by 30-50%. For moss and lichen abundance there was no detectable difference. Liverwort species were 50% less diverse on trees in pheasant woods. Species affected included *I. myosuroides* and *F. tamarisci*, which are sensitive to atmospheric nitrogen enrichment and used as indicators of this in woodlands (Mitchell et al. 2004).			

Management for released gamebirds on farmland habitats			
Hedgerows and other edge habitats on farmland			
Firbank (1999)	Report	Random squares	+ve
320 1-km^2 grid squares in England classified as managed for game or not based on site visits. There were more hedges, more complete hedgerow networks and greater connectivity between hedges and woods on released game areas than on non-game areas. Common farmland / hedgerow birds and butterflies were 10% more abundant on game areas per unit area of habitat than on non-game areas.			
Songbirds using game crops planted on farmland			
Sage et al. (2005b)	Peer Review	Selected sites	+ve
30 winter game crop plots contained more than 10 songbirds per ha in most months between October and January, while adjacent arable field plots contained less than one. Kale *Brassica oleracea* spp. and quinoa *Chenopodium quinoa* game crops had more birds than cereal-based game crops. Of 26 bird species recorded, 10 have declined. Songbird numbers in game crops declined in the second half of the winter (January to March) but remained much higher than in the arable fields throughout.			
Parish and Sotherton (2004)	Peer review	Selected sites	+ve
In Eastern Scotland, found a similar magnitude of difference in songbird abundance when comparing birds in 20 kale and cereal game-crop plots with 20 nearby stubbles and conventional arable fields. There were 50% more species in game crops compared to set aside and 90% more compared to conventional crops.			
Stoate et al. (2003)	Peer review	Selected sites	+ve
Found that kale and quinoa were the best crops for wintering birds including tree sparrow *Passer montanus*, bullfinch *Pyrrhula pyrrhula*, reed bunting *Emberiza schoeniclus*, yellowhammer *E. citronella* and grey partridge.			

Henderson et al. (2004)	Peer review	Selected sites	+ve
At 192 farmland sites 12 times as many birds per ha of winter bird/game crops were found compared to conventional crops. Kale was the best overall for the 18 species of bird recorded. Kale and quinoa retained seed better as the winter progressed and larger plots of 1 ha or more also retained seeds for longer.			
Sage (2018a)	Report	One landscape	+ve
In a predominantly grassland landscape, game crops were the only or dominant seed bearing crop. In hedgerows near to game crops, twice as many breeding resident songbirds were recorded in the spring compared to hedgerows further away. The density of migrants was not different suggesting that the winter game crops held resident species locally and this caused the effect rather than hedge quality factors.			
(Parish & Sotherton 2008)	Peer review	Selected sites	+ve
Another study in Eastern Scotland found that game-crop plots in grassland landscapes had more birds in winter than similar game crops in arable areas.			
Supplementary feeding of gamebirds			
Sanchez-Garcia et al. (2015)	Peer review	Selected sites	+ve
Used trail cameras on 260 spiral dispenser drum feeders at three sites with modest pheasant releases. They found that gamebirds accounted for 30% of photos taken, wood pigeon *Columba palumbus* accounted for 17%, blackbird *Turdus Merula* and dunnock *Prunella modularis* 5% each, yellowhammer *Emberiza citrinella* 4% and 33 bird species in total including other declining species. 14 mammal species were also recorded using the feeders. The commonest were brown rat *Rattus norvegicus* (17%) and mice (10%) plus deer, brown hare *Lepus europaeus*, rabbit *Oryctolagus cuniculus*, grey squirrel, stoat *Mustela erminea* and hedgehog *Erinaceus europaeus*. Overall, the feeders were used slightly less than half the time by gamebirds and songbirds and slightly more than half the time by non-target birds and mammals.			
Estrada et al. (2015)	Peer Review	Selected sites	+ve
Steppe-bird abundance was assessed at 54 red-legged partridge hunting estates in Spain with varying levels of game-management over several years. Information about game management was collected using questionnaires to game managers. Birds were counted from fixed points and the amount of different land uses in each point was estimated during surveys. The study showed that the abundance of granivorous species, especially sandgrouse *Pterocles Namaqua,* increased significantly with the density of feeders.			
Siriwardena et al. (2007, 2008)	Peer review	Selected sites	+ve
A study of farmland birds and seed provided on the ground experimentally at 110 sites in England over two years. Peak use of supplementary food was in January or February depending on species. Declines for yellowhammer, robin *Erithacus rubecula* and dunnock were less steep on fed sites and several other species appeared to increase. Most birds benefited if the food resources were more than 1 km apart (Siriwardena et al. 2006).			

Impacts of released gamebirds on open habitats

Impacts of released pheasants on hedgerows			
Sage et al. (2009)	Peer review	Selected sites	-ve
Hedge and hedgebank structure, ground flora and songbirds using hedgerows were measured along transects leading away from release points at 100+ game estates in southern and eastern England over two years, to see if pheasants were altering these habitats. Within 100 m of release pens, there was twice as much bare ground and reduced ground flora structure on hedge-banks and/or inside hedges. Shrub structure up to 1 m above the ground was reduced close to release pens containing more than 1500 birds. In arable areas, the diversity of perennial weed species inside hedgerows was about 25% greater where 1500+ birds were released nearby. In grassland areas the diversity of desirable perennial plants was greater inside hedges where fewer than 1500 birds were released. Alongside game crops, the study found fewer annual and perennial plants within hedgerows (but not on hedge banks) where more than 1500 birds were released. There were a third fewer songbirds in hedgerows near to release sites that released 1500+ birds than hedgerows further away.			
Draycott et al. (2012)	Peer Review?	Selected sites	ntl
In a similar study of hedgerows close to woodland only, hedgerow structure was similar on game and non-game sites and woody species richness and woody cover was not depleted in hedges adjoining woodlands with pheasant release pens.			
Gamebirds and grassland invertebrates			
Callegari (2006a)	PhD	Selected sites	ntl
Possible impacts on invertebrates of high-density releasing onto arable ground alongside sensitive chalk grassland habitats at six sites in central southern England, three with releasing and three without (see also Callegari 2006b). Released partridges (and some pheasants) that strayed onto the grassland spent a considerable amount of time feeding there in September following initial dispersal, which then declined into the winter. Invertebrate fragments in faecal samples peaked at 54% of pheasant and 44% of partridge samples in September, reducing to very small percentages by January. Flies, ants and weevils were common on the sites and in the pheasant and partridge samples. Invertebrates were sampled in the spring in and outside gamebird exclosures (and insect inclosures) set up before gamebird releases in the previous autumn at all sites. Of nine invertebrate groups considered, only Diptera species saw a reduction in spring emergence (not abundance) outside the exclosures. Although the gamebirds were eating some invertebrates on the grassland, mainly following release in autumn, they did not appear to impact spring invertebrate densities.			
Callegari (2014)	Peer review	Selected sites	nlt
At the same sensitive grassland sites as Callegari (2006a) similar gamebird exclosures over horseshoe vetch *Hippocrepis comosa*, the food plant of the Adonis blue *Polyommatus bellargus* butterfly were deployed. No difference was found in the numbers of emerging butterflies between plot types. Low productivity in the Adonis Blue at the site may have compromised the study's ability to detect an effect.			
Direct impact on reptiles			
Dimond et al. (2013)	Report	One site	ntl

In 2012, using DNA Identification techniques, no reptile fragments were found in a sample of 50 pheasant droppings collected from a grassland / heathland area that contained released pheasants and reptiles. It is possible that the techniques were unable to identify reptile DNA even if present. Note, this study does not provide clear findings however there are no other studies.			
Berthon (2014)	MSc thesis	Selected sites	ntl
Juvenile penned pheasants preferentially pecked at reptile shaped plastic objects compared to similar plastic objects in non-reptile shapes. Adult pheasants did not show a preference. Berthon also recorded no reptiles under refugia set out in a sample of pheasant releasing woods at three sites in the New Forest area but did record a small number of grass snakes *Natrix natrix* and slow worms *Anguis fragilis* in refugia in three non-release woods.			
Red-legged partridge releasing and over-shooting wild partridges			
Watson et al. (2007)	Peer Review	Selected sites	-ve
Quantified shooting on winter mortality of wild grey partridge on a large study area in Sussex where pheasants and partridges are released and greys are off the quarry list. Despite this, 86 of 243 (35%) grey partridges present in the autumn were shot in 1999/2000. On two farms with large partridge releases around two-thirds of grey partridges present were shot.			
Aebischer & Ewald (2010)	Peer review	Single site	ntl
In a GWCT grey partridge recovery demonstration project, both grey and red-legged partridges responded to a programme of wild game management. Using warning alert measures designed to minimise shooting of greys, while a sustainable surplus of red-legged partridges were shot, losses of <5% of the autumn grey partridge stocks were achieved.			

Indirect impacts of releasing - shared parasites, diseases and genes			
Endo parasites of pheasants and partridges			
Tompkins et al. (2000, 2001)	Peer review	Laboratory study	-ve
Released pheasants are largely unaffected by *H. gallinarum* but may act as a reservoir for them, allowing the parasites to be picked up by other birds. Eight grey partridges that were experimentally infected with *H. gallinarum* lost weight and condition compared with six controls. The findings from this small sample of birds were used to support a model that suggested that pheasants carrying *H. gallinarum* could compete and ultimately exclude grey partridges via the parasite alone (Tompkins et al. 2002).			
Sage et al. (2002)	Peer review	Laboratory study	ntl
Tompkins' results of an impact of *H. gallinarum* on the weight and condition of grey partridge were not repeatable in a study using 26 experimentally infected partridges and 26 uninfected ones.			
Villanúa et al. (2008)	Peer Review	Selected sites	-ve
The helminth community in around 100 shot red-legged partridges was investigated at two estates in Spain that released partridges and in a control area nearby without releasing.			

There were more parasite species at a higher prevalence and intensity for all helminths found on the release areas. The authors suggest that the release of farm-reared red-legged partridges poses a risk of exposing to wild bird populations to certain parasites normally only found in the rearing system. They also suggest that the establishment of the introduced parasites is limited and may not persist without continued releasing.			
(Gethings et al. (2016a,b)	Peer review	Selected sites	-ve
Syngamus trachea or gapeworm is a particular problem for pheasant and partridge releases and many game managers treat birds for infections via their food or drink when released. Following treatment, birds will usually re-infect themselves because the parasite eggs can survive on/in the soil from one season to the next around feed points in and around released pens. A strong negative association between worm number and body condition in pheasants and carrion crows *Corvus corone* was shown. It is not known whether birds in poor condition are more likely to acquire these worms or whether the worms reduce condition.			
Holand et al. (2015)	Peer review	One population	-ve
Looked at egg production and other parameters in a breeding house sparrow population. They found that mothers with high faecal egg counts of *S. trachea* (gapeworm) produced fewer eggs compared with uninfected birds.			
Millan et al. (2004)	Peer review	Selected sites	ntl
Looked at a sample of partridges in nine areas of Spain with released partridges and seven areas with only wild ones and found a total of 16 different helminth species, mainly nematodes. However only one of these occurred in both the reared and wild samples.			
Pheasants, ticks and *Borrelia*			
Kurtenbach et al. (1998)	Peer review	One site plus lab. experiment	-ve
Small mammals have been identified as the likely key vectors (i.e. a host that can get the bacteria from one tick and then pass it to another) of *Borrelia* in woodlands (Perez et al. 2016). Pheasants were infected in the laboratory with ticks collected from a focus area with Lyme Borreliosis. The results show that pheasants can be infected experimentally with *B. burgdorferi*, that they can pass the spirochetes back to ticks and that their infectivity may persist up to three months. This identifies pheasants as another potential vector of *Borrelia*.			
Diseases of gamebirds and wildlife			
Pennycott et al. (2005)	Peer Review	Voluntary sample	-ve
In recent years respiratory disease, in particular the pathogen *Mycoplasma gallisepticum* (MG) (Welchman et al. 2002) has become increasingly important in reared gamebirds before and after release. In a sample of primarily dead wild birds, MG was detected in rooks *Corvus frugilegus,* house sparrow, blackbird and several other species. It is widely recognized in song birds in North America. There is opportunity for transmission of MG from released gamebirds to certain wild birds in the UK and *vice versa* if they come into close contact when feeding.			
Díaz-Sánchez et al. (2012b)	Peer review	Selected sites	-ve

Intestinal disease is commonly associated with bacterial infections, eg *Salmonella* and *Escherichia coli.* Both of these are associated with younger birds in the rearing system and therefore unlikely to spread to wild birds as a result of release. Díaz-Sánchez et al. (2012b) showed a significantly higher prevalence of avian pathogenic *E. coli* (APEC) in released red-legged partridges (45-60%) in Spain compared to wild populations (6%). The prevalence of *Campylobacter* sp. (23%) did not differ significantly between these three husbandry groups, and *Salmonella* sp. was only detected at one of the farms studied (0.9%, 5 out of 544). These results suggest that farm-reared and restocked partridges can act as carriers of these enteropathogens and a potential risk of transmission to natural populations.			
Díaz-Sánchez et al. (2012a)	Peer review	Selected sites	-ve
Antibiotics have been widely used in gamebird rearing and some bacteria may have developed resistance. *E. coli* isolated from a small percentage of wild partridges was resistant to three selected antibiotics. The authors suggested that releasing treated birds was a potential means of disseminating antibiotic resistant bacterial strains among wild birds. However resistant bacterial strains are also likely to spread to wild birds from all farmed livestock, and the reverse can occur as well.			
Bertran et al. (2014)	Peer review	Literature review	ntl
Gamebirds are susceptible to the notifiable diseases avian influenza and Newcastle disease, although pheasants and partridges are less susceptible to clinical effects than poultry. Although there is the potential for gamebirds to spread these diseases to wildlife, including after release, in practical terms the likelihood of this in the UK is reduced once an outbreak has been confirmed because they are subject to a stamping-out policy.			
Red-legged partridge and chukar hybridisation			
Casas et al. (2012)	Peer Review	One region	ntl
In the 1960s game farmers rearing the red-legged partridge in the UK and elsewhere in Europe began importing the chukar partridge *Alectoris chukar* (from further East), which they crossed with *A. rufa* to produce a more productive bird for rear and release (see also Blanco-Aguiar et al. 2008 and others). However it was soon recognized that after release into the wild, these hybrid birds survived reasonably well and were breeding with genetically pure wild *A. rufa* throughout its natural range and where it had been introduced. This has resulted in the virtual loss of the native *A. rufa* genome (Barbenera et al. 2010), or at least one of its three subspecies *A. r. rufa* (see Madge & McGowan 2002) including no pure *A. rufa* in the UK Barbenera et al. (2015).			

Releasing and predators			
The effect of predator control			
Porteus et al. (2019)	Peer review	Selected sites	+ve
It has been demonstrated that fox control by gamekeepers can reduce foxes locally (eg Reynolds et al. 1993, Tapper et al. 1996). Fox population dynamics in relation to culling effort were modelled at 22 estates the majority of which (it was not clear exactly how			

many) released. All 22 estates successfully suppressed the fox population, reducing on average pre-breeding (late winter) density to about half (range 20 – 90%) of estimated carrying capacity. At most sites immigration was rapid so effort was needed to maintain a reduction into the spring and summer. Five regionally-disparate estates for which data on both gamebird releasing and foxes was available (Porteus 2015) suggested that the effectiveness of fox control declined as the size of the release went up.			
Heydon et al. (2000)	Peer review	Selected sites	ntl
Used spotlight transect counts to compare fox abundance in East Anglia, where wild gamebird management is relatively common, with two other UK regions (see also Heydon and Reynolds 2000). In the East Midlands, where there is relatively little interest in wild gamebirds yet still some fox-culling activity, there was no regional reduction in the fox population level below that predicted based on landscape. In East Anglia, fox density was substantially below prediction. This suggests that culling in the East Midlands region was less effective than in East Anglia (but not that the releases caused an increase in foxes).			
Sage et al. (2018c)	Peer review	Selected sites	+ve
Combined the results of seven spring and summer pheasant radio-tracking studies. Two sites that had high-level predator control and released pheasants had improved survival of adult birds during the spring compared to four which released and had low-level control. Draycott et al. (2008b) documented improved nest survival in the two release sites with high-level predator control. We include this study in the synthesis on the basis that released pheasants act as a surrogate for other ground nesting birds in this context.			
Cabodevilla et al. (2020)	Peer review	Lanscape	+ve
Studied changes in abundance of little bustard *Tetrax tetrax* in a Spanish province that contained numerous partridge releases. Over a 15-year period little bustard declined by 60 % across the landscape. However the only areas where there was no decline were the larger releasing shoots. The authors speculated that this was due to predator control and habitat management on those shoots.			
White et al. (2014)	Peer review	Selected sites	ntl
An analysis of 11 years of nest data from six songbird species on three lowland farms enabled a comparison of the effect of systematic mammal and corvid reduction and sporadic corvid reduction on nest success in songbirds. There was a positive effect of systematic predator reduction on five of the six species. Sporadic corvid reduction had a positive effect on one (nestling blackbird). Systematic predator control is usually undertaken on wild game estates while sporadic corvid control is more likely on release-based shoots.			
The impact of releases on predators			
Robertson (1986)	PhD	Selected site	-ve
Intensively studied a large pheasant release pen in Ireland. He searched for fox droppings fortnightly throughout 1984 and found four times as many within 200 m of the release pen in August and September (poults were placed in pens on 4th August) than before, and that these droppings contained more pheasant fragments.			
Kenward et al. (1981)	Peer review	Selected sites	-ve
Radio-tagged 43 goshawks in the vicinity of a large released pheasant shooting estate in			

Sweden. He found that goshawks were the main cause of over-winter mortality of pheasants. Goshawks on the release site were at a higher density, had smaller ranges and were heavier than goshawks elsewhere.			
Kenward et al. (2001)	Peer review	Selected sites	ntl
Since the 1970s the buzzard has increased in parallel with the increase in UK pheasant releasing and some buzzards are sometimes interested in pheasant release pens (see also Parrott 2015; Swan 2017). Reductions in persecution, the banning of certain pesticides and the size of the rabbit population have been suggested as the most likely drivers of the increase (Parkin & Knox 2010) but it is possible that pheasant releasing has also contributed.			
Swan (2017)	PhD	Selected sites	-ve
Found that buzzards nested at greater density in areas with more pheasants and rabbits. However, only rabbits were caught in proportion to their abundance and only rabbit provisioning rate was associated with buzzard productivity.			
Pringle et al. (2019)	Peer review	Data review	-ve
Identified a series of positive and some negative associations between pheasants/partridges and buzzards/some corvids using spatial datasets from the Bird Atlas 2007-2011 (Balmer et al. 2013) and from APHA poultry register data (www.gov.uk/guidance/poultry-registration), which identifies an unknown proportion of gamebird rearing and releasing facilities in Britain (Madden & Sage 2020). Some of the model relationships suggest straightforward responses by the predators to the presence of gamebirds while others suggest different factors are involved. Potential habitat factors were not always fully accounted for, relationships were frequently not linear or explained little variation in the data but were significant at $P<0.05$ because of large sample sizes. The paper suggests further work to explore these relationships.			
Beja et al. (2009)	Peer review	Selected sites	-ve
Measured foxes on 12 game estates and 12 otherwise similar non-game areas in Portugal. Most of the game estates released partridges. The survey method involved only one diurnal transect survey at each site in spring but they reported that foxes were more common on the game estates even though many of the sites targeted them for culling.			
Porteus (2015)	PhD	Selected sites	-ve
Found that estimated immigration rates for basic landscape type correlated with the mean density of pheasants released in each landscape (e.g. there were 15 times as many released pheasants and four times as many foxes on arable than upland). Foxes might be responding to the releases, but equally landscapes suitable for foxes are also suitable for releasing. He also estimated fox immigration rates (foxes per km^2 per week), and the carrying capacities of foxes at five sites appeared to be positively related to the number of gamebirds released, the gamebird bag and the number of gamebirds not shot. With only five sites these relationships were not statistically significant.			
Releasing and illegal killing of raptors			
Kenward et al. (2001)	Peer review	Selected sites	-ve
Documented predatory behaviour of 40 radio-tagged buzzards living close to pheasant release pens in southern England. 4.3 % of poults were killed by buzzards and another			

5.2% by other predators. Few buzzards associated regularly with pens and only 20% of releases lost more than two pheasants. Buzzard predation was found to be associated with pens with little shrub cover, more ground cover and large numbers of pheasants suggesting that losses can be ameliorated by habitat management. This paper is the main source of evidence of buzzards being killed in association with pheasant release pens - of 136 radio-tagged buzzards in his studies between 1991 and 1995, 38 birds died of which 12 were shot or poisoned, 'mostly' near pheasant release pens.			
Marquiss and Newton (1982)	Book	Voluntary data	-ve
In their comprehensive look at goshawk in Britain 40 years ago, two sets of relevant data are reported. Of 101 nestling goshawks ringed in Britain between 1975 and 1980, 14 were recovered, eight of which had been shot, trapped or poisoned, but there was no information on whether this was associated with releasing gamebirds. Of 49 goshawks (ringed or not) recorded as killed by man between 1971 and 1980, eight were shot or pole-trapped at or near pheasant release sites.			
Beja et al. (2009)	Peer review	Selected sites	-ve
Measured raptors on 12 game estates and 12 similar areas in Portugal. Most (it was not stated how many) game estates released partridges. They reported only kestrel as being less common on game estates. Within game estates, the overall abundance of raptors varied inversely with gamekeeper density except for buzzard, which increased.			
RSPB (2019 and previous)	Website	Reports	-ve
This website provides annual reports on bird crime including the killing of raptors by game managers in the UK. While it is focused mainly on upland or other wild game management activities, occasionally there are reports of raptor killing in association with releasing, indicating that this activity continues at some level today.			

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