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

Consultation Document

March 2023

Annex 3: Rapid review of the potential impacts of released common pheasant and red-legged partridge on species and habitats listed under section 7 of the Environment (Wales) Act 2016

Summary

This rapid review considered potential impacts of released game on species and habitats listed under section 7 of the Environment (Wales) Act 2016. The review examined the evidence presented by three contemporary reviews published in 2020 and a review of evidence submitted to NRW's call for evidence, alongside expert judgement to identify potential impact pathways from the release of gamebirds and associated management on species and habitats listed under section 7. Impacts were assessed at a local, patch or landscape scale. The review then considered whether reliance on the protected sites network alone would provide sufficient protection from any impacts identified, and whether any impacts identified might be managed through the adoption of the Guidelines for Sustainable Gamebird Releasing issued by the Game and Wildlife Conservation Trust (hereafter referred to as the 'GWCT guidelines').

Overall negative impacts were associated with the gamebirds themselves, typically at a local to patch level. However, some impacts (such as disease risk) were considered to have potential landscape scale effects. Management activities associated with the release of gamebirds (e.g. the retention, creation, and management of habitats) were typically considered to be positive at a landscape level.

Representation within the protected sites network alone, was often considered insufficient to minimise potential risks from released gamebirds to species and habitats listed under section 7. However, it was considered that, in principle, impacts could be minimised through the adoption of the GWCT guidelines, particularly in relation to limits on stocking densities and the avoidance of releases in potentially ecologically sensitive habitats. The GWCT guidelines are based on extensive research and have been developed to minimise the severity and longevity of impacts at an around release sites and to maximise the potential for environmental benefits from associated management.

Background

Natural Resources Wales (NRW) have been asked to consider the evidence relating to the environmental impact of gamebird release in Wales and to advise Welsh Government and the Ministers about the manner in which gamebirds (common pheasant and red-legged partridge) should be added to Schedule 9 of the Wildlife and Countryside Act 1981, and to develop and implement any licensing approach that may be required.

In considering the approach needed, NRW needs to consider its duties (and the Ministers' duties) under the Environment (Wales) Act 2016. Specifically, sections 6 and 7 of the Act.

Section 6 makes it clear that we must seek to maintain and enhance biodiversity and in so-doing must "*have regard to*" the section 7 lists. Section 7 lists comprise habitats and species "*of principal importance for the purpose of maintaining and enhancing biodiversity*". In this context "*have regard*" means to give proper weight to them in the exercise of our functions. Under section 7(3) of the Act, the Welsh Ministers must "*take all reasonable steps to maintain and enhance the living organisms and types of habitat included in any list published under this section*".

The species listed under section 7 can be found here:

Biodiversity and resilience of ecosystems duty (section 6): list of living organisms

The habitats listed under section 7 can be found here:

Biodiversity and resilience of ecosystems duty (section 6): list of habitats

Why we carried out this assessment

NRW will be consulting on a proposed new approach to licencing the release of gamebirds in Wales. The project is considering a proposal that would see releases away from sensitive protected sites, at densities within widely accepted good practice thresholds (in particular maximum densities of birds), permitted under a general licence. Any releases within sensitive SSSI or European Sites, or within 500m of their boundaries, would only be permitted under specific licences. Releases at any location which did not comply with the terms and conditions of the proposed general licence would also require a specific licence.

This assessment was carried out to evaluate whether such an approach might provide a reasonable and proportionate level of protection for species and habitats listed under section 7 and whether the terms and conditions being considered for a proposed general licence would be likely to be effective at managing any potential impacts.

Approach

In 2020, three contemporary reviews examining the effects of gamebird release on ecological (and other) receptors were published. These were Madden & Sage (2020), Mason et al. (2020), and Sage et al. (2020). These reviews, hereafter referred to as the "2020 reviews", formed the starting point of the review in Wales.

In 2022, NRW published a call for evidence and invited submissions of additional evidence that had not been considered by the 2020 reviews. In addition, NRW has commissioned two evidence reports. Firstly, an assessment of the evidence relating to scale and location of gamebird releases and shooting in Wales (Madden 2023a) and secondly an assessment of all the available evidence in order to assess the likely environmental effects of gamebird releases in Wales (Madden 2023b). Madden (2023b) provides a comparison of approaches to the 2020 reviews, including the identification of the some of the main potential impact pathways. It then examined any new evidence, including that submitted in response to the NRW call for evidence.

As well as considering the findings of all these reviews, advice was sought from NRW species and habitat specialists.

- Specialists were asked to consider whether there were any likely impact pathways and any likely effects (both positive and negative) on species and habitats listed under section 7, from the release of gamebirds and associated management.

- Specialists were then asked to advise whether the species or habitats are confined to protected areas and hence would be satisfactorily protected by any specific measures proposed to protect those areas

- Finally, they were asked for their view on whether any negative effects might be mitigated by adherence the GWCT guidelines.

The scale at which an effect might operate was broadly categorized (after Sage et al. 2020) as; local (part of a woodland or field, or the release pen), patch (the whole of a woodland or field) or landscape. Potential effects (positive and negative) associated directly with released gamebirds and indirectly with associated management practises were both assessed. The type and extent of these management practices will vary from shoot to shoot.

Specialists were guided that shoots not adhering to widely accepted good practice thresholds (in particular maximum densities of birds) would require a specific licence. Impacts were therefore considered in relation to a shoot adhering to GWCT guidelines. The main findings of Madden (2023a) were also highlighted, particularly in reference to the profile of numbers of gamebirds released per shoot in Wales.

Summary of Results

It is important to note that some impact pathways highlighted were supported by a limited number of scientific studies or mainly anecdotal evidence. Under-recording of many taxa, particularly fungi, lichens, bryophytes, and many invertebrates, limits our ability to make assessments of effects particularly at population levels, as does the lack of available, reliable information relating to the distribution and scale of release of gamebirds in Wales (Madden 2023a).

Impact on freshwater and marine species and habitats

Impacts on freshwater and migratory fish, stonewort, aquatic invertebrates, and marine species and habitats were considered likely to be low. Whilst released game could feasibly have a negative impact on freshwater species and habitats through direct effects on water quality; it is likely that such issues would be highly localised and not necessarily discernible from wider issues around water quality. It is noted, however, that the GWCT guidelines do not include reference to buffer distances to water courses.

Section 7 Species

Mammals (Table 1)

The potential for some minor negative impacts was identified for bat, otter, and water vole from gamebirds themselves (although for otter and water vole see comments above in relation to freshwater impacts).

There was the potential for local to patch level impacts on dormouse and harvest mouse through predation. Determining the extent of this is difficult due to gaps in evidence on gamebird diets, but predation pressure would likely be density dependent. Davey 2008 (in 2020 reviews) found no evidence that gamebirds themselves had population level impacts on small mammals.

Disease transmission was considered by all three of the 2020 reviews and by the specialists consulted, as being a potential negative effect. Gamebirds could act as vectors for disease, particularly for species likely to be attracted to supplementary feeding stations. Disease risk represented a landscape level effect. Hedgehog and brown hare were identified in the reviews as having been recorded occasionally at gamebird feeding stations. The impact of this, in relation to disease transmission, is uncertain.

The use of rodenticides to control rats at supplementary feeding sites also represent an impact pathway with potential for (secondary) poisoning (Mason et al. 2020). Specialists agreed that rodenticides could impact section 7 species that may be expected to use feeding stations (hedgehog) or potentially those that prey on rats (pine marten and polecat). These effects might represent up to a landscape scale but were felt to be an uncommon event. The use of rodenticides is covered by existing legislation.

The 2020 reviews also consider illegal killing of predators as a potential negative landscape scale effect. In terms of mammals listed under section 7, this is only likely to apply to pine marten, polecat, and otter. Killing of these species is already regulated under existing legislation.

The 2020 reviews point to evidence of increases in grey squirrel populations in woods managed for gamebirds. This was assessed as a patch to landscape impact for red squirrel due to potential increases in competition for resources and disease spread. Specialists felt that this potential could be offset through effective lethal control of grey squirrel.

Negative impacts from release were often considered to be density dependent. Adherence to GWCT guidelines on release densities, avoiding releasing in favourable woodlands (for

dormouse), and limiting the percentage of available area of woodland used for release pens were all suggested by specialists as potential solutions. Some concerns were raised over gaps in the evidence base and likely levels of compliance.

While most species of mammal listed under section 7 do occur within protected sites, the majority of populations occur outside of the protected sites network.

Adherence to the GWCT guidelines was considered to have the potential to reduce impacts on mammal species listed under section 7; particularly adherence to recommended release densities.

The potential for positive effects at a landscape scale were noted where game management led to retention, management, and creation of woodland and hedgerows. Additionally, increases in some woodland small mammal species could provide a source of prey for pine marten and present a positive effect in this regard.

Birds (Table 2)
There are currently 51 bird species listed under section 7. Turtle dove, red-backed shrike, aquatic warbler, wood lark and corncrake are now considered extinct or rare migrants in Wales (Johnstone et al. 2023). No likely direct or indirect impacts from released gamebirds were identified for bittern, seabirds (except herring gull and possibly black-headed gull), twite, ring ouzel, grasshopper warbler, cuckoo, hawfinch, lesser spotted woodpecker, or nightjar. Lead shot is not in scope for this project and therefore this was not considered here.

Disease and parasite transmission was identified by the 2020 reviews as being a potential negative effect. The specialists consulted agreed with this assessment, particularly in relation to Highly Pathogenic Avian Influenza (HPAI) but only for species closely related to gamebirds (i.e. grouse species and grey partridge) or where they were likely to come into close contact (e.g. granivorous farmland bird species). HPAI risk was considered for those species plus chough, wader, and wildfowl species.

Other potential negative effects identified included resource competition (mainly grouse species and grey partridge, and possibly tree sparrow) but limited evidence was present in the 2020 reviews for this. Illegal persecution was identified as a negative landscape scale effect by the 2020 reviews. Overshooting of grey partridge may also be a negative impact but the specialists noted that the grey partridge is likely to continue to persist in Wales as a result of the management activity of shoots.

The 2020 reviews suggest that the judgements as to whether effects of gamebird releases and their associated management are positive or negative can be open to interpretation. For instance, supplementary feeding can benefit granivorous farmland birds but also promote increases in small mammals that may then predate the nests of those bird species. The specialists agreed with this but were of the view that, for most bird species, associated management practices were generally likely to have positive effects.

Advice from specialists was that management activities such as retention, creation, and management of habitat were considered to be positive for some section 7 species; particularly farmland bird species than utilise hedgerows, field margins, and cover crops. It was considered that the retention, creation, and management of woodland (particularly

increased structure) could potentially have benefits for some woodland species, but this was highly dependent on woodland type and management.

Overall, specialists felt that a reliance solely on the protected sites network was insufficient to minimise risks from released gamebirds to native birds listed under section 7. They felt that that adherence to the GWCT guidelines was likely to be an effective way to minimise negative impacts from released gamebirds. Some effects were considered density dependent and adherence to recommended release densities was particularly important, especially to minimise disease risk.

Invertebrates (Table 3)

Assessing impacts on invertebrates is challenging as there are 188 species listed under section 7 and there are many evidence gaps.

The 2020 reviews generally agreed that the impacts of released gamebirds on invertebrates was likely to be negative, at a local to patch scale but that the evidence shows mixed effects on this group. Some studies showed local changes in invertebrate abundance and changes in community composition in habitats with or without releasing and/or before or after releasing. Predation of ground-active invertebrates has the potential to alter community structure, particularly close to release sites, and this is likely to be density dependent.

Direct predation by gamebirds is a potential impact pathway for all invertebrates listed under section 7 (with the exception of aquatic species). The few studies that have investigated the diet of released gamebirds show that typically the invertebrate component of diet of released birds can vary from around 5% to as high as 54%. However, here is likely to be seasonal trend with a much lower invertebrate component in winter (<15%). Released adult gamebirds in winter rely on a diet mainly of grain. Chicks of gamebirds also consume more invertebrate prey that adults. It is also logical to assume that the most abundant invertebrate species in an area will likely comprise the majority of those eaten; although species with lower mobility or with larval stages during late summer or autumn (when birds are released) are likely to be most susceptible to predation. As gamebirds also eat vegetation, there is a potential impact pathway via reduction in availability of important food plants for some species; again, this is likely to be density dependent.

Both these impacts were assessed as occurring at a local to patch level and likely to affect widespread species listed under section 7. Of the 41 species that were considered to have very local or restricted distributions, 39 are mainly or entirely found within the protected sites network and may therefore be largely addressed through approaches specifically for releases in protected sites and their buffers.

Specialists considered that adherence to the GWCT guidelines might reduce or minimise some impacts. The 2020 reviews identify a density dependent element to the impacts of gamebirds on invertebrates. Avoiding releases in habitats of conservation importance and adherence to recommended release densities may therefore reduce potential impacts on this group. Impacts may also be reduced through timing releases to coincide with periods with lower invertebrate activity, as noted in the GWCT guidelines. The 2020 reviews highlight that habitat retention, creation and management associated with gamebird

release can increase abundance of invertebrates which would be likely to include some invertebrate species listed under section 7.

Vascular plants (Table 4)

15 species of vascular plant listed under section 7 were identified as being likely to be impacted by released gamebirds. These comprised 6 woodland edge species and 9 arable plant species.

Impacts were assessed as negative and occurring at a local to patch level via herbivory and physical action by birds. There was agreement that impacts are likely to be density dependent. Specialist felt that adherence to the GWCT guidelines with regard to densities was likely to be important for both woodland and arable species, although it was noted that no specific densities for release of red-legged partridge were included.

Although all 15 species of plant occur within protected sites, specialists did not feel that they were likely to be sufficiently protected through approaches that focussed on releases within or close to protected sites.

Adherence to the GWCT guidelines was considered likely to mitigate most impacts, particularly in relation to recommended release density, avoiding sensitive locations, and the proportion of woodland used as release pens. However, some specialists consulted felt that release should ideally be avoided in woodland classified as Ancient Semi Natural Woodland.

Retention and management of woodland were considered to be potential positive landscape level effects. Similarly, game cover crops can provide suitable habitat for arable plants of interest, but this can be dependent on how and where they are established, and how they are managed. Specialists welcomed the advice in the GWCT Guidelines that release pens should not be placed on or close to near particularly sensitive locations with notable flora or fauna but felt that ensuring shoots had access to good data on these locations was important.

Reptiles and amphibians (Table 5)

All the 2020 reviews agreed that the impact of gamebirds on this group was negative. Predation was considered an impact pathway for all 8 species of reptiles and amphibians listed under section 7 and was considered to be likely at a local to landscape scale.

The core range of great crested newts in Wales overlaps with areas where there are particular concentrations of pheasant releases (Haysom et al. 2018, Madden 2023a). The majority of effects are likely to be at the level of patch but potential for landscape level effects exists for species with restricted or patchy distributions. Welsh level effects for sand lizard and natterjack toad are possible due to their limited range in Wales. However, we have very limited information on the distribution of reptiles and amphibians for most of Wales. Impacts are likely to be dependent on release density of pheasants. The potential for positive effects through the retention, creation, and maintenance of suitable habitats was recognised.

Natterjack toad and sand lizard populations in Wales occur wholly within the protected sites network (but not necessarily as notified features). The specialist view was that reliance on the protected sites network would be insufficient for other more widespread species.

In principle, it was felt that adherence to the GWCT guidelines could reduce some impacts on reptiles and amphibians listed under section 7. The guidelines recommend avoiding placing release pens directly onto or close to sensitive locations such as those with reptile populations and delaying timing of release to try to avoid conflicts with these species.

Lichens/Bryophytes/Fungi (Table 6)

Enrichment of soil and air by aggregations of fed gamebirds is likely to create concentrations of ammonia which is damaging to many lichens and bryophytes. The effects are therefore likely to be seen at a local to patch level. The 2020 reviews describe the impacts of gamebird releases as being typically negative for lichens and bryophyte communities that are sensitive to nitrogen, although the affects seem to be limited to the release pen and release wood. Specialists highlighted NRW Evidence Report 295 (Bosanquet 2018) which details how the presence of pheasant release pens caused detectable impacts in a lichen-rich woodland at Allt-y-gest SSSI.

The specialist view was that almost all of the really lichen-rich woodland examples are within SSSI, but there are many other lichen-rich Ancient Semi Natural Woodlands (ASNW) that are not designated as SSSI. Lichen-rich ASNW was previously constrained by industrial pollution and improvements in air-quality mean that many such communities are recovering.

Specialists felt that adherence to GWCT guidelines might reduce some impacts. However, they considered that even releases within recommended stocking densities may still have a negative effect on this group.

Section 7 Habitats

On the whole gamebird releases were thought mainly to affect habitats listed under section 7 broadly as “Broadleaved, mixed and yew woodland”, “Boundary and linear features”, and “Arable and Horticultural”, and the various grassland habitats. The potential effects (positive and negative) of released gamebirds on these habitats could, in principle, apply to all terrestrial habitats listed under section 7 if where gamebirds are released within them.

Impacts on freshwater habitats (“Rivers and streams” and “Standing open waters and canals”), were considered to likely be highly localised and not necessarily discernible from wider issues around water quality. It is noted, however, that the GWCT guidelines do not include recommended buffer distances between release pens and water courses.

Impacts on these habitats were expected to be mainly from direct impacts from the birds themselves on species components of these habitats (see above). Herbivory of vegetation/ground flora, mechanical actions from the birds themselves, and the impacts from droppings on soil and air were considered to be density dependent and local to patch level in scale. The retention, creation, and management of these (main) habitats were considered to be beneficial at a patch to landscape scale. It was noted that the evidence from the 2020 reviews points towards hedgerows, woodland, and arable strips often being more prevalent on land managed for shooting.

It was considered that, while these habitats are represented within the protected sites network, the majority of the resource is found outside of the protected sites network. Reliance on the protected sites network would therefore be insufficient to minimise negative impacts.

Overall, adherence to the GWCT guidelines was considered likely to have the potential to minimise impacts (especially where retention, creation, and management of these habitats was also evident). Adherence to recommended stocking densities, quantity of woodland used for release, and avoidance of releases in or close to ecologically sensitive habitats were considered key to minimising impacts from gamebird releases. Specialists felt that guidance and/or conditions should be used to avoid game cover crops being established inappropriately on arable section 7 habitats.

Conclusions

Overall, positive impacts were considered to come from the management activities associated with the release of gamebirds. Activities linked to the retention, creation and management of habitat were considered positive at a landscape scale overall for most species and some habitats listed under section 7.

Overall, negative impacts tend to be associated with the gamebirds themselves and were typically evident at a local to patch level. However, several were considered to be landscape scale effects; particularly those relating to disease, predation of reptiles (particularly sand lizard), and illegal persecution of predators. Specialists generally felt that more common and widespread species would likely be less vulnerable than less common more range restricted species, and effects were likely dependent on the extent of associated habitat retention/creation and management.

With a few exceptions (e.g. some fungi communities, some bird species, and some range restricted invertebrates) none of the specialists felt that the protected sites network alone was sufficient to manage the potential negative effects from released gamebirds on species and habitats listed under section 7.

The 2020 reviews generally agreed that negative impacts tended to be density dependent, with greater and longer lasting effects evident when release densities exceeded 700-1000 birds per hectare. This view was broadly supported by specialists. Adherence to recommended stocking densities was considered important for minimising impacts on species and habitats listed under section 7. Similarly, avoiding releasing gamebirds in or near ecologically sensitive sites (e.g. section 7 woodland or grassland), and restricting the amount of available woodland habitat used for release pens were also considered key to

reducing impacts. While it was noted that the overall number of birds released is an important factor in determining impacts, adoption of the GWCT guidelines would in principle minimise impacts on species and habitats listed under section 7.

The specialists sometimes raised the concern that some species (and habitats) listed under section 7 cold be found within the protected sites network but not always as a notified feature of the site. For example, the Dyfi SSSI, Morfa Harlech SSSI, and Morfa Harlech a Morfa Dyffryn SAC all hold important reptile populations, including reintroduced populations of sand lizard, but they are not notified features. We are aware that releases of gamebirds currently occur close to these sites. However, it was observed that, if the proposed new approach led to releases within protected sites being licenced under section 16 of the 1981 Act rather than relying section 28E consenting, the current restrictions on conditioning only for the benefit of notified site features would no longer apply.

Several specialists felt that providing good information about the location of important species and habitats would help shoot managers make informed decisions about where they locate gamebird releases and where they undertake associated management. For example, NRW already has a GIS layer with those woodlands with N-sensitive lichen and bryophyte assemblages which could be made available through online guidance. Therefore, signposting to existing resources or developing new resources as part of a new licensing approach could be of benefit.

Assessment Tables

Table 1: Section 7 Mammals. Potential impact pathways based on those identified in reviews by Madden & Sage (2020), Mason et al. (2020), Sage et al. (2020), and with reference to Madden (2023a) and (2023b)

Species/Taxa	Impact pathways	Likely Effect	Potential Mitigation/solution	Covered by protected sites
Bats (8 species)	Potential reduction of insect prey in and around release pens. Habitat retention, creation, and management	Negative local. Unlikely to negatively affect favourable conservation status at a local/Welsh level Positive, Patch to landscape	Guidance to maximise benefits of habitat management/creation for bats	Yes

Water vole	Potential to create and maintain habitats in certain areas.	Potentially positive patch to landscape where applicable.	Guidance to maximise benefits of suitable habitat to water vole.	Found within protected sites network but extent likely insufficient to cover range
Otter	Potential to create and maintain habitats in certain areas.	Potentially positive patch to landscape where applicable.	Guidance to maximise benefits of suitable habitat to water vole.	Found within protected sites network but extent likely insufficient to cover range
Dormouse	Pheasant are known to consume small mammals. Dormice hibernate at ground level within woods/hedges. However, Dormouse not specifically mentioned in diet of pheasant in the 2020 reviews.	Local to patch, (possibly landscape but difficult to assess given paucity of dietary studies). Davey 2008 (in 2020 reviews) found no evidence that the birds themselves had population impacts on small mammals.	Scale of predation unknown. Likely to be density dependent – adherence to recommended stocking densities. GWCT guidelines advises restriction on available amount of woodland (<1/3, and this includes areas of scrub and hedgerow). Pheasants tend not to use interior of large blocks of woodland. Avoiding releases in high quality or	Found within protected sites network but extent likely insufficient to cover range

			known dormouse habitat and/or with a buffer.	
	Retention, creation, management of woodland and hedgerows on land managed for released game could provide benefits	Positive patch to landscape.	Guidance to maximise benefits of habitat management/creation for dormouse on shoots.	
Red Squirrel	Grey Squirrel populations can be higher in woodland managed for gamebirds	Negative patch to landscape – increased competition for resources and disease spread.	Requirement (e.g. via licence condition) to control grey squirrels in or near areas with Red Squirrel interest	Found within protected sites network but extent likely insufficient to cover range
	Potential (indirect) positive – habitat retention, creation, and management.	Positive patch to landscape.	Guidance to maximise benefits of habitat management/creation for dormouse on shoots.	

Hedgehogs	Hedgehogs were listed (see Sage et al. 2020 , Mason et al. 2020) as occasionally visiting supplementary feeding sites. Poorer quality feed may lead to poor nutrition and poor health if species consuming grain, but unlikely to be doing so. Feeding sites could contribute to disease transmission as could birds themselves.	Negative local to landscape. Likely low due to occasional use of supplementary feeding sites recorded.	Guidance on maximising biosecurity and reduce disease transmission at feeding sites.	Mainly found outside of protected sites network.
	Potential for secondary poisoning from rodenticides (used at feeding sites).	Negative local to patch. But in context of occasional use	Proper use of rodenticides is already covered in legislation.	
	Resource competition	Negative local to patch.	Likely to be density dependent – adherence to recommended stocking densities	
	Retention, creation, management of woodland on land managed for released game could provide benefits.	Positive local to landscape.	Guidance to maximise benefits of habitat management/creation for hedgehogs on shoots.	

Polecat	Potential for secondary poisoning from rodenticides. Rats form small part (c.15%) of diet (Sainsbury *et al.* 2020) Retention, creation, management of woodland on land managed for released game could provide benefits.	Negative patch to landscape. Likely minor due low occurrence of diet in the rat of polecats Positive local to landscape.	Proper use of rodenticides is already covered in existing legislation.	Mainly found outside of protected sites network.
Brown Hare	Hedgehogs were listed (see Sage et al. 2020 , Mason et al. 2020) as occasionally visiting supplementary feeding sites. Poorer quality feed may lead to poor nutrition and poor health if species consuming grain, but unlikely to be doing so. Feeding sites could contribute to disease transmission as could birds themselves. Retention, creation, management of woodland on land managed for released game could provide benefits	Negative patch to landscape. Likely low due to occasional use of supplementary feeding sites recorded. Positive patch to landscape.	Guidance/requirement on maximising biosecurity and reduce disease transmission at feeding sites. Guidance to maximise benefits of habitat management/creation for brown hare on shoots.	Mainly found outside of protected sites network.

Table 2: Bird species listed under Section 7. Potential impact pathways based on those identified in reviews by Madden & Sage (2020), Mason et al. (2020), Sage et al. (2020), and with reference to Madden (2023a) and (2023b)

Species/Taxa	Impact pathways	Likely Effects	Potential Mitigation/solution	Covered by protected sites
Turtle dove, red-backed shrike, aquatic warbler, corncrake, and woodlark.	Scoped out	None	These species are now considered extinct or rare migrants in Wales (Johnstone *et al.* 2023).	N/A
Seabirds	Scoped out for Balearic shearwater, common scoter, roseate tern	None	No overlap in habitat (in breeding or non-breeding seasons) between these species and released gamebirds	N/A
	Disease/parasite transmission – Highly Pathogenic Avian Influenza (HPAI).	Negative landscape	Reporting suspected cases of Highly Pathogenic Avian Influenza in gamebirds to Defra and APHA for testing. Where appropriate and carcass removal and disposal. Existing legislation/processes such as biosecurity measures (e.g.	Protected sites network not sufficient.

	Herring gull (possible but considered unlikely for black-headed gull)		housing orders) and avian influenza prevention zones (AIPZ)	
Heron species	No impacts envisage for Bittern	N/A	N/A	N/A
Wader and wildfowl species (non-breeding)	Disease/parasite transmission – particularly HPAI Gamebirds as reservoirs/vectors of disease/parasites	Negative Landscape	Major estuaries in Wales are mostly designated sites, and majority of these species will use these sites. However, section 7 wader and waterfowl species are not necessarily species or assemblage features of these sites. Species can and do occur out with the protected sites network. Reporting suspected cases of Highly Pathogenic Avian Influenza in gamebirds to Defra and APHA for testing. Where appropriate and carcass removal and disposal. Existing legislation/processes such as biosecurity measures (e.g. housing orders) and avian influenza prevention zones (AIPZ)	Protected sites network not sufficient.

Upland species (Black and red grouse, hen harrier, ring ouzel, breeding golden plover, including breeding curlew)	No impact pathways envisaged for ring ouzel, grasshopper warbler or cuckoo Black and red grouse, hen harrier, breeding golden plover: Disease/parasite transmission - particularly HPAI. Gamebirds as reservoirs/vectors of disease/parasites	N/A Negative Landscape	N/A Populations found mainly or entirely within the protected sites network within Wales for hen harrier, and black and red grouse. Impacts could therefore potentially be dealt with via licences relating to protected sites and buffer zones. Golden plover found within protected sites network but not as feature. Avoid releases near breeding sites. Reporting suspected cases of Highly Pathogenic Avian Influenza in gamebirds to Defra and APHA for testing. Where appropriate and carcass removal and disposal. Existing legislation/processes such as biosecurity measures (e.g.	N/A Protected sites network probably sufficient for all bar Golden plover

			housing orders) and avian influenza prevention zones (AIPZ)	
	Displacement and/or resource competition (Black and Red grouse)	Negative patch to Landscape	Populations found mainly or entirely within the protected sites network Impacts could therefore potentially be dealt with via licences relating to protected sites and buffer zones.	
	Illegal persecution (hen harrier)	Negative landscape. Species not usually associated with gamebird releases	Already covered by existing legislation.	
	Carcass availability on generalist predators (particularly breeding curlew)	Negative to landscape, where leads to increase of generalist predators	Possibly density dependent. Avoiding releases near roads to reduce carrion availability. Predator control during breeding season.	
	Predator control	Positive landscape		
Upland/Coastal	No impacts envisaged for twite.	N/A	N/A	N/A

	Chough: Disease/parasite transmission - particularly HPAI. Gamebirds as reservoirs/vectors of disease/parasites Potential for resource competition (minor?)	Negative patch to Landscape	Populations found mainly or entirely within the protected sites network within Wales for hen harrier, and black and red grouse. Impacts could therefore potentially be dealt with via licences relating to protected sites and buffer zones. Reporting suspected cases of Highly Pathogenic Avian Influenza in gamebirds to Defra and APHA for testing. Where appropriate and carcass removal and disposal. Existing legislation/processes such as biosecurity measures (e.g. housing orders) and avian influenza prevention zones (AIPZ).	Protected sites network probably sufficient to minimise risk for chough
Farmland species	Granivorous farmland bird species, including grey partridge: Disease/parasite transmission. Feeding sites could contribute to	Negative patch to landscape	Guidance relating to best practice for supplementary feeding (e.g. relocating	Protected sites network

	disease transmission as could birds themselves. HPAI risk		feeders). Disease/parasites risk likely density dependent. Reporting suspected cases of Highly Pathogenic Avian Influenza in gamebirds to Defra and APHA for testing. Where appropriate and carcass removal and disposal. Existing legislation/processes such as biosecurity measures (e.g. housing orders) and avian influenza prevention zones (AIPZ)	would be insufficient.
	Herbivory of hedgerows by gamebirds. Suggestion that yellowhammers nest predation lower on sites without pheasants compared to with potentially due to changes in hedgerow structure	Negative local to patch	Likely to be density dependent; stocking density important. Potentially off set through retention, creation, and management of these and other habitats.	
	Resource competition – tree sparrow (see Mason et al. 2020) and grey partridge.	Negative patch to landscape	Likely to be density dependent. Potentially offset through supplementary feeding, cover crops etc.	
	Overshooting (unintentional shooting) (Grey Partridge)	Negative patch to landscape	Linked to density of red-legged partridge. Currently no guidance on stocking densities for red-legged partridge.	

	Carcass availability on generalist predators (particularly breeding lapwing).	Negative to landscape, where leads to increase of generalist predators.	Possibly density dependent. Avoiding releases near roads to reduce carrion availability. Predator control during breeding season.	
	Use of supplementary feeding sites	Positive patch to landscape		
	Secondary poisoning (Kestrel) via rodenticide use at feeding sites	Negative patch to landscape	Proper use of rodenticide is already covered by existing legislation.	
	Retention, creation, and management of habitats (e.g. hedgerows, cover crops, arable strips)	Positive patch to landscape. Breeding habitats benefit for all bar house sparrow, starling, kestrel, unclear for skylark. Potential increase prey abundance for kestrel)		

	Predator control – ground nesting birds	Positive landscape		
Woodland Species (including species associated with scrub)	No impact pathways envisaged for hawfinch, lesser spotted woodpecker, and nightjar Retention, creation, and management of habitats of woodland likely to benefit some species although this will depend on woodland type and management.	N/A Neutral to Positive (patch to landscape).	N/A Management geared towards specific species/species groups.	

Table 3: Section 7 Invertebrates. Potential impact pathways based on those identified in reviews by Madden & Sage (2020), Mason et al. (2020), Sage et al. (2020), and with reference to Madden (2023a) and (2023b)

Species/Taxa	Impact pathways	Likely Effects	Potential Mitigation/solution	Covered by protected sites
All invertebrates	Predation of by gamebirds Reduction in availability of food plants via herbivory	Negative local to patch. Possibly landscape if range restricted Negative local to patch. Possibly landscape if range restricted	Impact likely density dependent. Adherence to stocking densities important. Avoiding releases in or near ecologically sensitive habitats. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some invertebrates.	Varies by species. Of the 41 species that were considered to have very local or restricted distributions 39 are mainly or entirely found within the Protected Sites network.

	Retention, management, and creation of range of habitats	Potentially positive local to landscape, providing management is toward promoting the conservation interest.	Guidance on habitat management. Ensuring information relating to	

Table 4: Section 7 Vascular Plants. Potential impact pathways based on those identified in reviews by Madden & Sage (2020), Mason et al. (2020), Sage et al. (2020), and with reference to Madden (2023a) and (2023b)

Species/Taxa	Impact pathways	Likely effects	Potential Mitigation/solution	Covered by protected sites
Woodland plants considered vulnerable to released gamebirds: Campanula patula Cephalanthera longifolia Hypopitys monotropa Melittis melissophyllum Sorbus eminens s.s. Sorbus minima	Herbivory and mechanical action by birds themselves Increase in more ruderal species forcing out more threatened / rarer species	Negative (direct) local to patch. Negative (direct) local to patch.	Mitigation through existing GWCT guidance, and/or the provision of additional, more detailed guidance to retain species in woodland. Impact likely density dependent. Adherence to stocking densities important. Adherence to guidance on the amount of woodland that should be included in release pens and not moving pens Adherence to stocking densities important Avoid releasing in Ancient Semi Natural Woodland. Guidance on woodland management that will promote section 7 woodland plants	May occur within protected sites network but widespread. Reliance solely on protected sites network therefore insufficient

	Retention and management of existing woodlands	Potentially positive (indirect) Local to landscape, providing management is toward promoting the conservation interest of the woodland rather than for releasing (potentially negative local to landscape).		
Arable plants considered vulnerable to released gamebirds: Centaurea cyanus Fumaria purpurea Galeopsis segetum Galeopsis speciosa Ranunculus arvensis Scandix pecten-veneris Scleranthus annuus Silene gallica Valerianella rimosa	Herbivory and mechanical action by birds themselves	Negative (direct) local to patch. Potential for (indirect) local to	Consideration of locations of populations of these species and maybe other threatened arable plants is required – achievable via e.g. distribution maps based on current records. Impact likely density dependent. GWCT guidance does not provide densities for red-legged partridge; development of recommended density for this species needed. Guidance on how best to manage arable margins and establish and manage game	May occur within protected sites network but widespread. Reliance solely on protected sites network therefore insufficient.

	Retention of arable margins, planting of cover crops	landscape depending on management	cover crops for the benefit of these species.	

Table 5: Section 7 Reptiles and Amphibians. Potential impact pathways based on those identified in reviews by Madden & Sage (2020), Mason et al. (2020), Sage et al. (2020), and with reference to Madden (2023a) and (2023b)

Species/Taxa	Impact pathways	Likely effects	Potential Mitigation/solution	Covered by protected sites
Sand Lizard	Predation by released gamebirds	Negative local to landscape. Very limited distribution in Wales	As per GWCT guidelines, avoid releases within or close to important/sensitive locations e.g. those with important reptile or amphibian populations. Releases currently occurring at near important locations for reptiles. Impact likely to be density dependent. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some taxa e.g. reptiles. Timing of releases to avoid sensitive life stages (e.g. hatching or emergence from ponds) would be beneficial.	Occurs within protected site network but not as a feature. Reliance solely on protected sites network therefore insufficient.

Adder	Predation by released game birds	Negative local to Patch. Possibly landscape in some areas - widespread but patchy distribution	As per GWCT guidelines, avoid releases within or close to important/sensitive locations e.g. those with important reptile or amphibian populations. Releases currently occurring at near important locations for reptiles. Impact likely to be density dependent. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some taxa e.g. reptiles. Timing of releases to avoid sensitive life stages (e.g. hatching or emergence from ponds) would be beneficial.	Occurs within the protected sites network but majority of population outside of this. Reliance solely on protected sites network therefore insufficient.
	Retention, creation, and maintenance of suitable habitats	Potential for local to landscape depending on management		

Grass snake	Predation by released game birds Retention, creation, and maintenance of suitable habitats	Negative local to Patch. Potential for local to landscape	As per GWCT guidelines, avoid releases within or close to important/sensitive locations e.g. those with important reptile or amphibian populations. Releases currently occurring at near important locations for reptiles. Impact likely to be density dependent. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some taxa e.g. reptiles. Timing of releases to avoid sensitive life stages (e.g. hatching or emergence from ponds) would be beneficial.	Occurs within the protected sites network but majority of population outside of this. Reliance solely on protected sites network therefore insufficient.
Slow worm	Predation by released game birds	Negative local to Patch. Possibly landscape in some areas - widespread	As per GWCT guidelines, avoid releases within or close to important/sensitive locations e.g. those with important reptile or amphibian	Occurs within the protected sites network but majority of population

	Retention, creation, and maintenance of suitable habitats	but patchy distribution Potential for local to landscape	populations. Releases currently occurring at near important locations for reptiles. Impact likely to be density dependent. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some taxa e.g. reptiles. Timing of releases to avoid sensitive life stages (e.g. hatching or emergence from ponds) would be beneficial.	outside of this. Reliance solely on protected sites network therefore insufficient.
Common Lizard	Predation by released game birds	Negative local to Patch.	As per GWCT guidelines, avoid releases within or close to important/sensitive locations e.g. those with important reptile or amphibian populations. Releases currently occurring at near important locations for reptiles.	Occurs within the protected sites network but majority of population outside of this. Reliance solely on protected sites network therefore insufficient.

	Retention, creation, and maintenance of suitable habitats	Potential for local to landscape	Impact likely to be density dependent. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some taxa e.g. reptiles. Timing of releases to avoid sensitive life stages (e.g. hatching or emergence from ponds) would be beneficial.	
Common Toad	Predation by released game birds	Negative local to Patch. Widespread but patchy distribution	As per GWCT guidelines, avoid releases within or close to important/sensitive locations e.g. those with important reptile or amphibian populations. Releases currently occurring at near important locations for reptiles. Impact likely to be density dependent. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some taxa e.g. reptiles. Timing of releases to avoid	Occurs within the protected sites network but majority of population outside of this. Reliance solely on protected sites network therefore insufficient.

	Retention, creation, and maintenance of suitable habitats	Potential for local to landscape	sensitive life stages (e.g. hatching or emergence from ponds) would be beneficial.	
Natterjack Toad	Predation by released gamebirds	Negative local to landscape. Very limited distribution in Wales	As per GWCT guidelines, avoid releases within or close to important/sensitive locations e.g. those with important reptile or amphibian populations. Releases currently occurring at near important locations for reptiles. Impact likely to be density dependent. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some taxa e.g. reptiles. Timing of releases to avoid sensitive life stages (e.g. hatching or emergence from ponds) would be beneficial.	Yes but not necessarily a feature in all instances. Reliance solely on protected sites network therefore insufficient.

Great Crested Newt	Predation by released game birds Retention, creation, and maintenance of suitable habitats	If occurs negative local to Patch. Core range in Wales overlaps with main areas of release of gamebirds in Wales (Haysom et al. 2018, Madden 2023a). Potential for local to landscape	As per GWCT guidelines, avoid releases within or close to important/sensitive locations e.g. those with important reptile or amphibian populations. Releases currently occurring at near important locations for reptiles. Impact likely to be density dependent. GWCT guidelines advises adjusting timing of release to avoid sensitive periods for some taxa e.g. reptiles. Timing of releases to avoid sensitive life stages (e.g. hatching or emergence from ponds) would be beneficial.	Occurs within the protected sites network but majority of population outside of this. Reliance solely on protected sites network therefore insufficient.

Table 6: Lichens, Bryophytes, and Fungi. Potential impact pathways based on those identified in reviews by Madden & Sage (2020), Mason et al. (2020), Sage et al. (2020), and with reference to Madden (2023a) and (2023b)

Species/Taxa	Impact pathways	Likely effects	Potential Mitigation/solution	Covered by protected sites
Lichens and Bryophytes	Impacts through enrichment of the soil or atmosphere with nitrogen. Some evidence that	Negative local to patch.	Mitigation through existing voluntary guidance may be insufficient as releases are known to take place in sensitive woodlands. Impacts could be controlled through regulation. Avoidance of releasing in any section 7 woodland with Nitrogen sensitive communities of lichens and bryophytes Guidance on woodland management for lichens and bryophytes.	May occur within or are features of protected sites network but many localised. Under recorded group

	Retention and management of existing woodlands	Potentially positive Local to landscape, providing management is toward promoting the conservation interest of the woodland rather than for releasing (potentially negative local to landscape).		
Fungi	No studies were found, or presented by the 2020 reviews, examining the impacts of released game of Fungi species. Reduction in and immediately around release seems logical. Retention and management of existing woodlands and grassland	Potential for negative local to perhaps patch. Potential for local to landscape depending on management	Impacts unknown so not possible to assess. Guidance on how best manage woodlands and grasslands for the benefit of fungi	May occur within or be features of protected sites network but many localised. Under recorded group

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