NATURAL ENGLAND

Guidance on evaluating the ecological consequences of badger culling on European Sites

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Contents

Introduction

1. This guidance is concerned with assessments of the ecological effects of badger culling on European Sites where this is carried out in accordance with Government policy on licensing the killing of badgers to prevent the spread of bovine tuberculosis in cattle (bTB)[1]. This guidance is also relevant to sites which are designated solely as SSSIs.

2. The guidance provides advice on two key potential ecological effects:

    a. Disturbance of wildlife; and

    b. Predation and trophic cascades.

3. This guidance supplements Natural England's suite of Habitats Regulations Guidance Notes (HRGNs) and should be used in conjunction with the relevant HRGNs and the Natural England Habitats Regulations Assessment (HRA) template 'Help Notes'[2] when undertaking assessments that relate to licences for badger culling.

Sources of information

4. The primary source of information on the ecological effects of badger culling is provided by a research project on '*The Ecological Consequences of Removing Badgers from an Ecosystem*' (Defra, 2007) undertaken as part of the Randomised Badger Culling Trial. This research and other relevant publications are summarised in Fera (2011).

5. The guidance takes account of the evidence presented in Defra (2007), Fera (2011), more recent published research and the expert knowledge and practical experience of relevant Natural England specialists.

Please note that this is a 'live' internal guidance document designed for use by Natural England staff. Please make sure you are using the latest version.

[1] Latest guidance: Guidance to Natural England. Licences to kill or take badgers for the purpose of preventing the spread of bovine TB under section 10(2)(a) of the Protection of Badgers Act 1992 (May 2018)

[2] Natural England Habitats Regulations Assessment (HRA) template - Help Notes for NE staff (June 2018)

How to approach the assessment

6. It is recommended that a coordinated assessment is carried out for all protected areas potentially affected by activities associated with each individual culling licence application.

7. In this section of the guidance there is advice on:

    a. Selecting the appropriate geographical area to assess;

    b. Identifying relevant potential effects; and

    c. Considering potential in-combination effects resulting from other activities.

Defining the geographical area over which to assess potential effects

8. The first stage of an assessment is to identify the European Sites and SSSIs that are relevant to the licence application.

9. All European Sites and SSSIs wholly or partially within the boundary of a cull area should be considered when assessing the risk of potential effects of culling. Such European Sites should be subject to a HRA in accordance with the Habitats Regulations 2017. In addition, European Sites that are close enough to a cull area to potentially be impacted directly or indirectly by culling activities, or which are functionally linked to the cull area or the wider area impacted by the activity should also be considered for a HRA.

10. To help identify which European Sites should be considered for a HRA we identify a 'zone of influence'. The 'zone of influence' for a plan or project can be described as the area over which ecological features may be at risk of significant effects as a result of the proposed project and its associated activities (CIEEM, 2016). This zone may extend beyond the application site, for example where there are ecological or hydrological links beyond the site boundaries. A plan or project's likely zone of influence is a consideration made by Natural England officers when providing formal advice or making decisions on behalf of Natural England.

11. As a licence to cull badgers to control bTB is a 'plan or project' the same consideration needs to be applied when assessing whether a bTB licence application has the potential to affect European Sites (or other protected sites).

12. In the case of licences to cull badgers, a zone of influence extending 20 km from the proposed cull area boundary is recommended. This distance is precautionary and is considered more than sufficient to cover the risk or the possibility that mobile features (or a proportion of a population) for which a site may be designated use a cull area at some point or otherwise are exposed to the effects of licensed operations. It will ensure that there is an evidence-led approach to the selection of protected sites for an initial assessment of risk by way of the *SSSI vulnerability matrix*.

13. The selection of a 20 km zone of influence takes account of the Maximum Foraging Distances (MFDs) of key mobile species for which European Sites and SSSIs have been notified. MFDs are set by Natural England's species specialists, drawing on their own expertise and evidence in published literature. The same MFDs are used in Natural England's 'Impact Risk Zone' tool[3], a mapping tool routinely used by local planning authorities to assess planning applications for the likely risk of impacts on SSSIs. The MFDs allow applications that are unlikely to pose risks to SSSIs to be separated from those that require more detailed assessment.[4]

14. The MFDs used to inform the zone of influence take account of the possibility of mobile features leaving a site boundary and using 'Functionally Linked Land' that lies within or close to the application areas. *Functionally linked land* refers to land lying beyond the boundary of a protected site, which is nevertheless used frequently by a designated feature associated with the site. Such areas typically provide habitat for foraging or other ecological functions essential to the maintenance of the designated population. Functionally linked land may extend up to the maximum foraging distance for the designated species. However, the number of animals foraging will tend to decrease with increasing distance from a protected site and thus the importance of the land to the maintenance of the designated population will also decrease[5].

15. Given the precautionary approach to the size of the zone of influence, Natural England considers it highly unlikely that any notified feature of a European or other protected site lying beyond this 20 km zone could be significantly affected by the activities directly or indirectly related to bTB badger licensing. European and other protected sites located more than 20 km from a cull area boundary do not, therefore, need further assessment in respect to any Habitats Regulations Assessment.

Identifying potentially relevant effects

16. To be of relevance to an assessment an effect needs to be:

    a. of a sufficient magnitude to potentially undermine the conservation objectives of the European Site,

    b. a consequence that is directly or indirectly related to badger culling, and

    c. credible.

17. Assessments need to identify instances where environmental changes linked to activities conducted under badger control licences could have a negative effect on a qualifying feature of a European Site. The effect does – however – need to be judged of sufficient magnitude or severity to adversely affect the population of the feature linked to a site. For example, if badger culling leads to an increase in fox abundance,

[3] For advice on using IRZs see: http://neintranettechnical/content/technical/topics/wiki.asp?PG=4187
[4] Relevant MFDs are summarised in Annex A.
[5] HRGN 9 - Applying the Habitats Regulations to land and sea 'functionally-linked' to European Sites: http://neintranettechnical/content/technical/topics/document_details.asp?DC=24516

even if that will increase predation or disturbance by foxes of a species that is a feature of a protected site, this is a concern for the purpose of a HRA only if this is likely to adversely affect the population to an extent that could undermine the conservation objectives of the European Site.

18. Foxes are a predator of ground-nesting bird species like the stone-curlew. The HRA process is not seeking to interfere with a natural predator-prey relationship such as this, even if predation is judged to be harmful to the stone-curlew population. The HRA is concerned only with identifying and preventing negative impacts resulting – directly or indirectly - from the proposed licensed activity. In this scenario, if there was expected to be a significant net increase in predation of curlew resulting from badger culling, then that would be a matter of concern.

19. To be relevant to a HRA an effect also needs to be credible, and not simply a hypothetical risk.

20. This guidance includes advice identifying species that may potentially be affected by badger culling based on available evidence and expert judgement. An assessor is entitled to rely on this guidance in making their assessment. Assessors may also take account of their own expert knowledge and experience of a site or species. Where this leads to a decision that differs from the guidance then the reasoning should be documented.

Considering in-combination effects from other activities

21. The assessment needs to take account of other activities that could potentially affect European Sites, including badger culling carried out in other cull areas. The 20 km maximum distance zone described above should be used to identify sites potentially affected by badger culling carried out in more than one cull area.

22. Guidance on considering in-combination effects is provided in '*HRGN 6 - Interpretation of Key Principles associated with the Habitats Regulations (UPDATED - JUNE 2018*)'[6].

6 http://neintranettechnical/content/technical/topics/document_details.asp?DC=15121&SRH=hrgn+6+interpretation+key+principles+associated+habitats+regulations+updated+june+2018

Disturbance of wildlife

Wild birds

How does disturbance affect birds?

23. To assess the potential disturbance risk presented to birds by culling activities it is necessary to first understand how birds can be affected by disturbance and how they perceive disturbance as a threat.

24. Disturbance resulting from human activities can affect birds in several ways, ranging from physiological changes such as the release of stress hormones, changes in behaviour such as an increased occurrence of a 'heads-up' posture and greater vigilance, moving away from the source of disturbance and complete abandonment of heavily disturbed locations. Physiological changes resulting from stress can potentially reduce individual fitness and thus survival. Increased vigilance will decrease food intake rates which, again, can reduce individual fitness of birds with consequences for their survival and/or breeding productivity. Frequent significant disturbance which results in displacement from some areas effectively reduces habitat extent for foraging, roosting or breeding. Complete flight away from an area will also reduce foraging or roosting time and increase energy expenditure. Displacement might also result in birds settling on alternative, less optimal areas for food or rest, with further potential consequences for individual fitness and survival.

25. The effects of disturbance depend on a wide range of factors, including the time of year, bird numbers and their activity. Non-breeding waterbirds are more vulnerable as they usually occur in flocks while foraging and roosting, which tend to be more sensitive to disturbance. They are also often under particular pressure to seek sufficient food and shelter during migration or when subject to harsh winter weather conditions. Breeding birds are also more vulnerable to disturbance. The flushing of nesting birds can result in the loss of productivity due to exposure of eggs or chicks to adverse weather conditions and predators, or reduced provisioning of chicks dependent on adults for food.

26. These effects mean that disturbance can in principle result in habitat deterioration from a bird's perspective, with a consequent reduction in the capacity of a habitat to support its bird populations. This is particularly relevant to assessments of effects on SSSIs, SPAs and Ramsar Sites which are designated for their aggregations or assemblages of breeding or non-breeding birds. A significant decline in habitat suitability and consequent effects on bird distribution and/or numbers can reduce the capacity of such sites to support birds, which can adversely affect site integrity as defined by the Habitat Regulations.

How do we assess the likelihood of significant disturbance?

27. Not all disturbance is significant and the risk of a harmful effect depends not only on the timing, frequency, duration, proximity and nature of an activity but also on bird

sensitivity, which varies with species, time of year, flock size and availability of alternative habitats, and, importantly, the birds' prior exposure to similar activities.

28. The likelihood of significant disturbance depends as much on the receptor birds' perception of threat as it does on the nature of the disturbing activity. Birds generally show a greater response to unpredictable, sporadic and sudden activities and are more likely to become accustomed to more predictable and regular activities (a process often referred to as 'habituation'). For example, birds can generally tolerate people walking along a footpath but are more likely to move away if people stray from the linear route.

29. In the case of shooting, in some cases birds can apparently habituate to the noise of shots where there is no visual stimulus (and sometimes this also occurs where there is association with human presence), although there are exceptions (Draulans, 1987; Smit & Visser 1993, Baxter & Allan, 2008)[7]. Importantly, it should be noted that although habituation might reduce the likelihood of more significant and potentially harmful effects such as flight and movement to other locations, subtle effects such as increased vigilance and reduced foraging rates might still occur.

Badger culling: a description of key activities

30. Badger culling operations involve either shooting free-ranging badgers or shooting cage-trapped badgers.

Shooting free-ranging badgers ('controlled shooting')

31. Shooting of badgers is conducted covertly at night by teams of two people (a shooter and a spotter) using a moderated (i.e. muffled) centrefire rifle with the aid of night vision and/or thermal imaging equipment (and, on rare occasions, spot-lamps). Moderators suppress the report (noise) of the rifle when it is fired, thereby reducing noise in the environment. Moderators also make it extremely difficult for animals to determine the location of the potential danger. Badgers are usually shot in areas of open habitat because of the requirements for a safe back-stop, and to take shots away from badger setts and areas of dense cover. This reduces the likelihood of disturbance to other wildlife that may reside in trees, hedges or areas of dense cover at night.

32. Controlled shooting is permitted between 1 June and 31 January but the majority is conducted between the end of August and the end of October because of the opportunity constraints imposed by farming calendars and other seasonal factors.

33. It can be assumed for assessment purposes that controlled shooting activities will not take place in the following habitats because (i) badgers are unlikely to use such areas

[7] Species where habituation to shooting was reported in these studies include: gulls, corvids, cormorant, oystercatcher and curlew. There was evidence of a decline in diversity of feeding shorebirds suggesting some species are, however, less tolerant.

for foraging and/or for sett-building purposes, and/or (ii) it would be unsafe to use a centrefire rifle in these habitats:

- coastal foreshore (i.e. below the high-water mark)
- sea cliffs
- watercourses
- wetlands, marshes, water meadows or reed-beds
- coniferous plantations
- moorland
- heathland
- mountains
- quarries
- residential areas

34. The proximity of these habitat to areas where controlled shooting may take place should, however, be considered. For example, controlled shooting will not take place along a coastal foreshore, but could do so on land immediately adjoining it. Disturbance from firearm report to, for example, wading bird assemblages or nesting birds in the foreshore area, does need to be considered. A buffer zone where shooting is not permitted to protect sensitive species in adjoining habitat can be recommended to avoid any risk of disturbance.

35. Direct impacts of controlled shooting through misidentification of the target species (e.g. mistaking an otter for a badger) are extremely unlikely and can be discounted.

36. The discharge of rifles during culling operations is infrequent. In the first year of culling[8] there is an approximately:

    a. 1 in 24 chance of a shot being taken in any 1 km square on any night of the cull (rising to a 1 in 13 chance on any day if shots to dispatch cage-trapped badgers are included), and

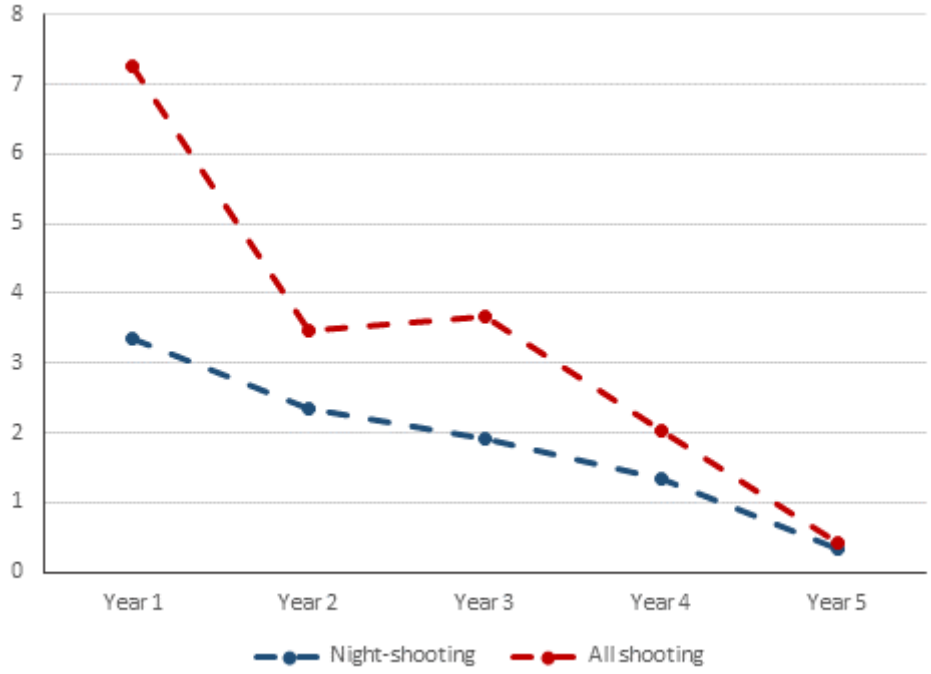
    b. 3.8 shooting teams active per night per 100 km^2.

37. These figures represent the highest levels of disturbance in the four years of culling because the amount of activity will diminish in each subsequent year. The levels of activity in the Supplementary Cull areas will be far lower, as illustrated in Figure 1.

[8] Using published data for 2017 (Cull Areas 11-21): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/670225/badger-control-monitoring-summary-2017-annexa2.pdf

Figure 1: Number of shots each night and day of a cull

This figure shows the average number of shots taken each night (blue line) and each day (red line) per 100 km^2 during a cull period. The daily 'all shooting' value is the combined total for night-shooting and dispatching cage-trapped badgers during day-light hours. Averages are based on data for Areas 1 – 21 (at conclusion of 2017 culls). The duration of the culling period in Year 5 (the first year of a Supplementary Cull) is about three times the duration of an Intensive Cull.



Shooting cage-trapped badgers

38. Badgers are encouraged into live-capture cage traps using a suitable bait. Once trapped, they are humanely dispatched using a 12-bore shotgun (during day-time). Cage-traps are constructed of heavy duty weldmesh, have dimensions of 1 m (L) x 0.35 m (H) x 0.35 m (W) and weigh approximately 12 kg. They are usually deployed close to field signs of badger activity (e.g. runs, latrines, foraging areas, setts (rarely)) and take advantage of cover (e.g. hedgerows and overgrown areas) to provide protection for trapped animals against exposure to inclement weather (hot or cold). All traps need to be 'bedded in' to stabilise them and to ensure that the weldmesh floor is covered. This can be achieved by either loosening the soil under the footprint of the trap with a spade and 'rubbing' the trap back and forward until the floor is covered or placing the trap on the ground and covering the floor with soil obtained from nearby.

39. Cage-trapping and dispatch is permitted between 1 June and 30 November, but the majority will be carried out between the end of August and the end of October because of the opportunity constraints imposed by farming calendars and other seasonal factors.

40. It can be assumed for assessment purposes that cage-trapping activities will not take place in the following habitats because (i) badgers are unlikely to use such areas for foraging and/or sett-building purposes, and/or (ii) it would not be practicable or appropriate (e.g. because of animal welfare concerns) to deploy cage traps in these areas:

    - coastal foreshore (i.e. below the high-water mark)
    - sea cliffs
    - watercourses
    - wetlands, marshes, water meadows or reed-beds
    - moorland
    - heathland
    - mountains
    - quarries
    - residential areas

41. The principal risk associated with cage-trapping is its potential to cause physical damage from 'bedding in' traps (see above). This can result in physical damage to plants or the substrate where a trap is located. The 'footprint' of an individual trap is 0.35 m^2, and the area of ground significantly impacted by installing a single trap is not expected to exceed approximately 1 m^2.

Potential disturbance effects of badger culling on birds

42. The potentially disturbing activities resulting from badger culling include vehicle and personnel movements during the day and personnel movements and shooting at night. Indirect disturbance to birds from the shotgun report dispatching badgers in cage traps during daytime is expected to be negligible.

43. Birds will move away from people, especially when on foot and accompanied by dogs. They are often less disturbed by vehicles. Birds are also less likely to be disturbed from areas if they are already familiar with predictable forms of disturbance, such a regular vehicle movements along a track.

44. Culling in the vicinity of larger aggregations of birds, such as breeding seabirds or non-breeding waterbirds, is more likely to cause significant disturbance because greater numbers of birds are affected, with consequently greater risks of adverse effects. Flocks of birds roosting at night are more vulnerable to disturbance. Many waterbird species also forage at night, particularly in conditions of good visibility and under a full moon, and are thus potentially at risk of being disturbed. Disturbance could be significant if it displaces large numbers of birds from breeding colonies or important roosting or foraging areas.

45. Some waterbirds (e.g. ducks and swans) roost on open water and are consequentially often less vulnerable to disturbance from activities on land. Similarly, grazing waterbirds generally retreat to adjacent areas of open water when disturbed rather than abandon an area entirely.

46. Foraging waterbirds on intertidal habitats and functionally linked farmland are normally more dispersed than roosting birds, but significant aggregations, if they were to occur, could be vulnerable to disturbance. Birds using farmland are more likely to be habituated to the presence of vehicles and personnel, and the use of firearms and crop-scarers, so are likely to be less vulnerable than those exclusively using intertidal areas.

47. Disturbance of dispersed breeding birds, either on the nest or (in the case of stone-curlews) foraging at night, is generally less likely to be significant at the population level as such birds are usually at a low density and thus the proportion of individuals affected by a disturbing event should normally be quite low. However, in the case of particularly scarce breeding birds, significant disturbance of a small number of individuals could be harmful.

48. Disturbance of non-breeding birds (other than waterbirds) on land is unlikely to be significant in cases where birds are widely dispersed across extensive habitats. As with waterbirds, disturbance can be more significant if it affects areas used by flocks of birds or proportionately high numbers of population in a designated site, such as hen harriers and merlins at a key roosting location. Again, scarce species are potentially more likely to be adversely affected by localised disturbance than more abundant and widespread species.

Avoiding or minimising disturbance effects

49. There are a range of measures that can help to avoid or minimise the potential disturbance effects of badger culling activities. Many of these measures are consistent with the requirements for badger culling.

    a. Personnel should remain in vehicles as much as possible and, during shooting, keep concealed and quiet. Walking and driving over areas used by breeding birds should be kept to a minimum;

    b. To reduce disturbance while shooting at night, contractors should use night vision / thermal imaging equipment (rather than spotlights) and use rifles with a sound moderator;

    c. Shooting and other potentially disturbing activities should not be conducted during the main bird breeding season (late March to July for the majority of species);

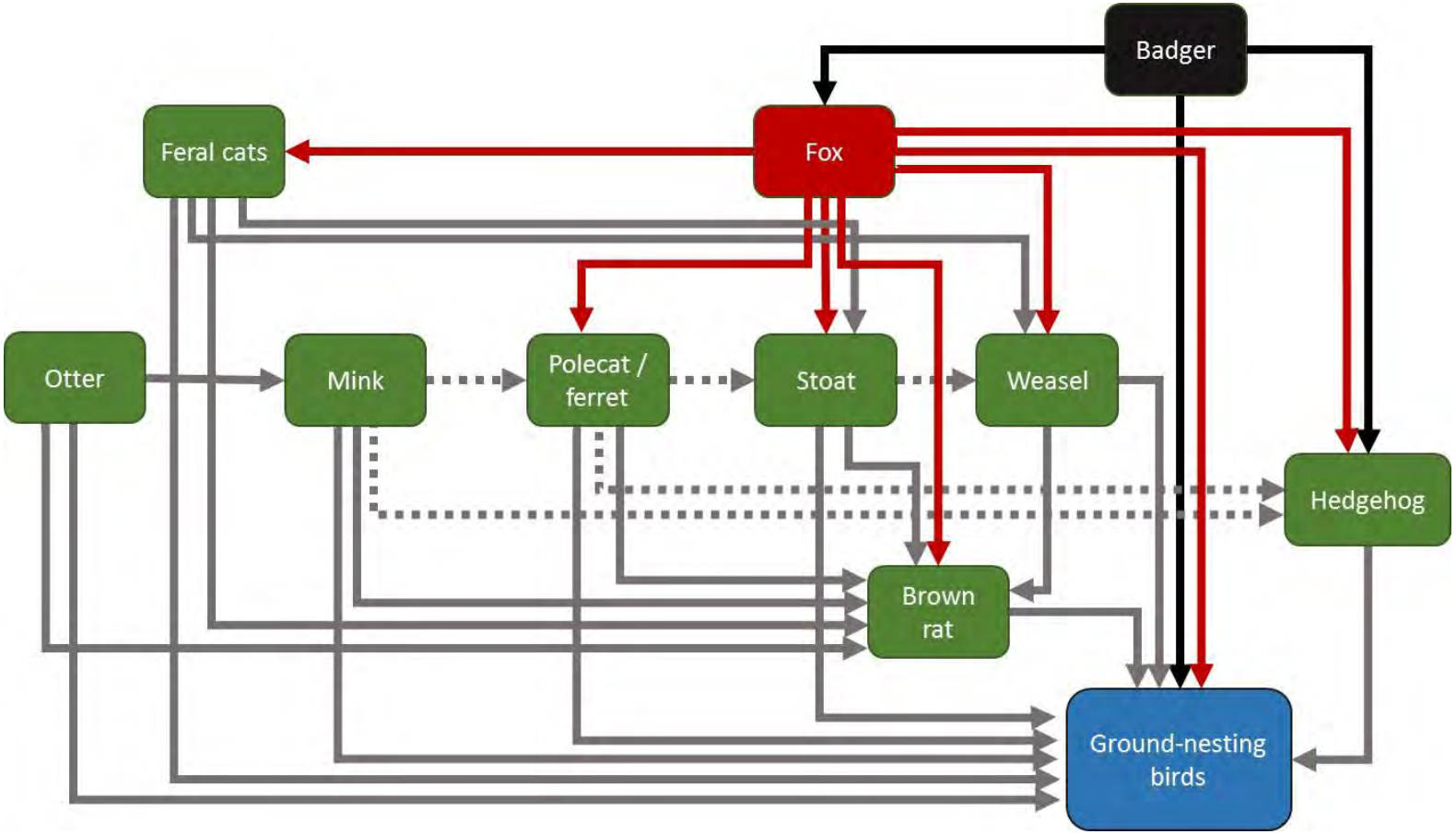
    d. On intertidal areas, disturbance of roosting and foraging birds should be reduced by employing a buffer distance of at least 200 metres and/or avoiding disturbing

activities during the period around high tide. Shooting should be avoided during November to February when peak numbers of many species are present.

e. Shooting should be avoided near areas of reed-bed or heath used regularly by roosting birds of prey.

Figure 2: Predatory or competitive interactions between terrestrial mammalian predators

The species typically implicated in the predation of ground-nesting birds in present-day lowland rural landscapes in England (based on a review of published research and Natural England expert opinion)



Key:

- Lines indicate a relationship
- Arrows point towards the species expected to be negatively affected (in the majority of interactions)
- Dotted lines indicate uncertainty in current understanding of relationship
- Not all these species will necessarily be present at a particular site

Predation and trophic cascades

50. This section provides general advice on the ecological effects of reducing badger population density in cull areas on species associated with European Sites.

51. In this guidance the term 'predation' refers to the actual hunting and killing of prey as well as effects on the behaviour of prey as a response to predation risk (e.g. avoidance behaviours, changes in activity patterns and ranging behaviour).

52. These ecological effects may be relevant to European Sites located within cull areas, to sites located adjacent to cull areas and to more distant sites that are notified for mobile species that use habitats within or adjacent to cull areas.

Historic and recent changes in badger populations

Trends in badger population

53. The badger has expanded its range and increased its population in England in recent decades. It is estimated that between 1985 and 2010 there was an increase of 103% (83–123%) in the number of badger social groups (Judge *et al*, 2014). The most recent estimate of average social group size is 6.7 badgers (Judge *et al*, 2017). The badger typically occurs at higher densities in the British Isles than elsewhere in Europe (Kowalczyk *et al*, 2000)[9] so the doubling in the number of social groups of Britain's largest terrestrial carnivore in about 25 years is itself an ecological change of considerable significance.

54. The Judge *et al* 2014 & 2017 sources provide estimates of sett and badger density by Land Class Group that can be used to estimate badger abundance in a specific area.

Effect of licensed culling on badger populations

55. Licensed culling aims to reduce the badger population within a cull area by at least 70%, but allows a reduction of up to 95%. The duration of the licence is 4 years. This period of suppressed population may be extended for a longer period under a 'Supplementary Badger Control' licence.

56. The average number of badgers removed in the first year of culling is 3.3 km^{-2} (range: 1.8-7.2 km^{-2}; data for Areas 1 – 21) while an average of 6.8 badgers km^{-2} are removed in total over the first 4 years of culling (the 'Intensive Cull' period)[10]. Approximately 0.5 badgers km^{-2} are removed during each year of Supplementary Badger Control[11].

[9] This review of published literature for the Palearctic region found that sett densities in the British Isles averaged 14.9 km^{-2} compared to 1.7 km^{-2} in continental Eurasia.

[10] The average lower and upper estimates of pre-cull densities of badgers in Areas 1 – 21 were 5.2 – 7.3 km^{-2}. Badger densities are reduced by approximately 60% as a result of the Year 1 cull.

[11] The 4 year figure includes cull areas that have completed a different number of years culling. Only Areas 1 and 2 have completed all 4 years. The Supplementary Culling estimate is based in a single year's culling in Areas 1 and 2.

57. The net effect of population increases since the late 1980s and licensed culling will be to reduce a badger population in a cull area to very roughly 60% of its size in the 1980s.

What this might mean for other species

The theoretical effects of predator removal

58. Changes in the abundance of a predatory species may have effects on the abundance of its competitors and prey species, and these effects can in some circumstances 'cascade' through the trophic ('feeding') levels of a food web. Where a top ('apex') predator is removed this can lead to increased abundance of medium-sized predators ('meso-predators') as the downward regulator pressure on these species is lessened, which can in turn lead to changes in the abundance of smaller predators and the prey of these predators. This is sometimes referred to as the 'carnivore release effect' or the 'meso-predator release effect'[12].

59. The 'release' of meso-predator populations from the regulating effects of apex predators can negatively impact populations of their prey and can also reduce overall diversity of ecosystems (Pugh et al, 2009, Carroll, 2016). Meso-predators that replace apex predators may not be ecologically equivalent to the absent top predator(s). Top predators tend to have restricted and largely carnivorous diets, whereas meso-predators often feed over a range of trophic levels and are in some cases omnivorous. This allows meso-predators to exploit prey resources more thoroughly than top predators and may explain why a change in apex predator abundance often has a disproportionate effect on meso-predator abundance (up to four-fold; Ritchie & Johnson, 2009). The result can be a similarly disproportionate effect on competitors and prey (Prugh et al, 2009; Ritchie & Johnson, 2009).

60. There is no simplistic or easily predicted outcome that follows from the removal of a predator in an ecosystem – particularly one that has already been subject to ecological disruption. It can have both positive and negative outcomes for different species in the same ecosystem. This is unsurprising. The relationships that exist between the species forming 'food webs' in most ecosystems are complex (Prugh et al, 2009). This is illustrated by the complex inter-relationships between mammalian predators implicated in predation of ground-nesting birds in lowland England shown in Figure 2. This is itself a simplification as it excludes the diverse array of avian predators that also predate ground-nesting birds (and some of the predatory mammals). This point is important in the context of a HRA as our interest is the effect of badger removal on specific species of conservation interest.

61. Finally, it is not only the loss of top predators that can disrupt the stability and diversity of ecosystems. Species that exert disproportionate effects on ecosystems (termed 'keystone species') are not exclusively predators and not all predators are keystone species. For example, the wolf was likely to have been a keystone species in

[12] For more background on 'meso-predator release effects' see reviews by Prugh et al 2009 and Ritchie & Johnson 2009

Mesolithic Britain, but in modern-day agricultural landscapes the European rabbit (an exotic species introduced by people to Britain) is one of the most important keystone species – a fact that was dramatically illustrated by changes to predator and plant communities following the introduction of the myxomatosis pathogen in the 1950s (Sumption and Flowerdew, 1985).

Badgers as a predator

62. The badger is an omnivore that feeds across numerous trophic levels, and while it largely subsists off soil invertebrates, badgers will also prey upon ground nesting birds, hedgehogs and other vertebrates.

63. While the badger is now the UK's largest terrestrial predator it evolved as a meso-predator in ecosystems with larger predators like the wolf and lynx. The loss of these large carnivores resulted in the badger occupying the niche of apex mammalian predator for many terrestrial ecosystems in modern-day rural England (see Figure 2).

64. The absence of predators and the more recent introduction of protective legislation in the 1970s (which ended most human control) released the badger population from the regulating effects of predation (and control) and allowed it to achieve high densities; regulated to a large degree by 'bottom-up' density-dependent effects related to resource availability. Typical densities of badgers in the UK's agriculturally dominated landscapes now far exceed densities reported for surviving woodland ecosystems in Europe that are comparable to those that would have characterised much of Britain in the Mesolithic period[13].

65. This means there are two 'meso-predator release' effects that we need to consider:

    a. the release which occurred as a result of the cessation of predation/control on badgers, and

    b. the release that could occur if badgers are themselves removed.

66. We are concerned first and foremost with the latter effect when we assess the ecological implications of badger culling on features of European Sites; however, it is also important to be mindful of the consequences of increases in badger populations – particularly the recent significant increases.

Approach to assessment

67. Because the effect of predator removal varies between species it is important to identify exactly which species are relevant to an assessment. Typically, the relevant species will be those that are notified features of the European Site. It is also important to consider potential indirect effects mediated through impacts on other species that are important to the notified species (e.g. effects on its prey, predators or competitors,

[13] 3.29 badgers km^{-2} average England and Wales (Judge et al, 2017) compared to 0.1-0.2 badgers km^{-2} in temperate woodland in Eastern Europe (see Kowalczyk et al, 2000, 2008)

or on species that provide important habitat). Theoretical effects that are linked to badger removal by multiple intermediate 'steps' do, however, need to be credible to justify inclusion in any assessment.

68. The following sections summarise current understanding of the effects of badger culling on other predators and birds. Detailed advice on specific bird species is given in Annex 2 and the associated EXCEL Worksheet '*Bird species and associations between badger culling and related activities - guidance on avoidance, mitigation and monitoring of birds'*.

Fox

Trends in population

69. After several decades of increase (Harris et al, 1995; Aebischer *et al* 2011), the fox population appears to have stabilised by the mid-1990s and then, at least according to one long-term survey, it underwent a decline of 34% (95% CI = 44%-23%) between 1996 and 2014 (see Mathews *et al*, 2018).

Effect of badger culling on fox populations within cull areas

70. Removing badgers can lead to an increase in fox abundance, at least where culling is sufficiently intense. This effect was observed in three cull areas during the Randomised Badger Culling Trial where badger abundance was significantly reduced (≥ 64%) but not in a fourth cull area where the culling was less effective (≤ 39%; Trewby *et al*, 2008). Fox densities increased by between 1.6 – 2.3 foxes / km^2. This is equivalent to approximately one extra fox for every 1.5 – 2.1 badgers / km^2 removed (Trewby et al, 2008).

71. The increase in fox populations observed during the Randomised Badger Culling Trial was sustained while badger populations were culled. What happened after culling ceased was not investigated, but logically, fox populations are expected to decline as badger densities recover. Where a Supplementary Control licence is issued in time to allow the maintenance of a reduced badger population, no new or additional effect on the fox population is anticipated.

72. The increase in fox abundance following badger culling is evidence that badgers can limit fox populations. The mechanism by which they do this is unknown. The two species share food sources and may compete for the same breeding sites (dens/setts). As the badger is dominant in interactions with foxes (Macdonald *et al*, 2004), it has been suggested that when badgers are removed the reduction in competition potentially leads to increased fox survival and immigration, or increased cub production and survival (Trewby *et al*, 2008). The regulatory effect that badgers exert on fox populations provides a possible cause, or contributing factor, leading to the stabilisation and apparent decline in the fox population nationally since the 1990s (see above).

73. Although fox populations can potentially increase in response to badger culling, this may not happen and increases, where they do occur, may be short-lived. This could occur because of the regulating effects of human control on fox populations foxes. Fox control can reduce fox populations at a local scale (Reynolds, 1995) and regionally (Heydon & Reynolds, 2000). Furthermore, in the time since the Randomised Badger Culling Trial was conducted the efficacy of control has benefited from significant advances in night vision and thermal imaging technology and its availability to game keepers and others involved in fox control. It is, therefore, important to consider the prevalence of fox control in an area when evaluating the likely response of fox populations to reduced competition from badgers. In areas where game shooting is prevalent foxes are more likely to be regulated by human control than by competition with badgers and culling badgers may lead to only negligible or short-term effects on fox numbers.

Effect of badger culling on fox populations outside cull areas

74. There have been no studies investigating the effects of badger culling on fox populations outside cull areas. It is unlikely, however, that significant numbers of foxes would disperse out of culling areas and into neighbouring areas. The relationship between badgers and foxes is believed to be one of aggression and competitive exclusion, not predation (Trewby *et al*, 2008). The removal of badgers within cull areas allows foxes to opportunistically exploit additional resources and increase in abundance, thus making cull areas more 'attractive' to resident foxes and also to foxes in neighbouring areas. The persistence of high badger densities outside of the culling areas, along with the presence of resident territorial foxes, would – in contrast - be expected to discourage dispersal and settlement by new arrivals. There may in fact be a net movement of foxes into, and not out of, the cull areas because of the increased opportunities provided by the removal of badgers.

75. Even if a net dispersal of foxes from cull areas into neighbouring areas occurs, the effects of this can be expected:

    a. to diminish with increasing distance from the cull area as the proportion of foxes dispersing declines sharply with increasing distance (a study in Bristol showed that the number that dispersed more than 3km was low; Harris & Trewhella, 1988); and

    b. to be influenced by significant environmental barriers, such as rivers and major roads, which to varying degrees can be expected to slow or limit dispersal. Rivers are a physical barrier while the mortality associated with roads will also limit dispersal (approximately 100,000 foxes are killed on roads each year (Garland, 2001) which represents about 25% of annual productivity[14]).[15]

[14] Based on the UK productivity estimate of 425,000 in Harris et al, 1995.
[15] There is limited published science on the effects of barriers on fox dispersal. However, litter mates tend to disperse in the same general direction suggesting a possible effect of some environmental factor(s) on dispersal direction (Harris & Trewhella, 1988).

76. For the purposes of assessing potential risks to species predated by foxes, and taking a precautionary approach to this risk, we judge it highly unlikely that an increased fox population arising from badger culling could materially increase the predation risk posed by foxes to the population of any prey species >2 km from the edge of a cull area[16] (as stated above, the use of functionally linked land within or neighbouring the cull area by species based outside of the cull area requires separate consideration).

Site-based measures to counter effects of increases in fox population

77. There are measures that can be employed to reduce fox predation impacts. In cases where there is a credible threat posed by badger culling and it is judged prudent to prevent or minimise potential increases in foxes, or reduce exposure of vulnerable species to fox predation, the following measures are available. The appropriate choice will depend on the specific circumstances (e.g. the vulnerable species, type of habitat, severity of threat, practicalities and cost).

    a. **Habitat management**: For lowland wet grassland sites important for breeding waders there is some evidence that habitat manipulation might help to reduce fox predation. Creating very wet conditions within fields supporting breeding birds, including areas of standing water, can deter foxes. At the same time, allowing taller vegetation to develop on the margins of fields and along tracks and other non-productive land can encourage higher densities of small mammals, which provide an alternative food source for foxes.

       Habitat management measures are likely to be most effective when used in combination with predator-proof fencing. These measures will often not be available to a licensee and alternative options should also be considered.

    b. **Anti-predator fencing**. These are generally suitable for small, discrete areas, e.g. to protect individual fields or enclosures around nesting sites. There are various designs for such fencing, but permanent electric fencing is the most effective way to deter foxes. Temporary electric fencing, which is more suitable for agricultural land, can also be reasonably effective if properly maintained. For seabird colonies, 24 hour wardening has also proven to be beneficial by ensuring that the fencing remains effective and by helping to keep foxes away from the colony.

    c. **Fox control**. Lethal fox control is lawful using permitted methods. Shooting and live capture trapping (followed by humane dispatch) are the recommended approaches. Snaring is lawful and in some circumstances is more effective than

[16] This is consistent with what is described as a 'conservative' approach recommended in the Ecological Impact Assessment for the proposed Intensive Action Pilot Area (for badger culling) in Wales (Cresswell and Hounsome, 2009).

other methods. Where snaring is used we expect operators to comply with the Code of Good Practice and use snares that comply with the Code[17].

d. **Localised restrictions on badger control.** Maintaining an un-culled badger population on and surrounding a site with a particularly sensitive species present could be employed as a technique to reduce risks associated with a potential increase in fox abundance following badger culling. This is a possible option where foxes specifically, rather than badgers or other predators, are judged to pose a critical predation threat. The recommended buffer size for such sites is [*to be confirmed*[18]] km.

Hedgehog

Trends in population

78. The hedgehog population has declined in recent decades, although by how much is uncertain. The most recent, comprehensive assessment suggests a national decline of about 73% since the national estimate published in the 1990s (see Mathews *et al*, 2018 for further details). The species has a 'vulnerable' IUCN Red List classification.

79. Hedgehog distribution patterns are inversely linked with the presence, and abundance, of badgers (see Mathews *et al*, 2018).

Effect of badger culling on hedgehog populations

80. The badger is a competitor and predator of the hedgehog. Unsurprisingly, therefore, badger culling has been shown to result in increases in hedgehog density. In preferred habitats (amenity grassland fields)[19] densities increased by approximately 100% compared to cull areas (Trewby *et al*, 2014).

Effect of badger culling on hedgehog populations outside cull areas

81. For the purposes of assessing potential risks to species predated by hedgehogs, a 500m buffer around the boundary of a cull area is recommended on a precautionary basis[20].

Site-based measures to counter effects of increases in hedgehog population

82. Although the hedgehog is a predator, and in some circumstances this species can have a detrimental effect on ground-nesting bird populations (e.g. on islands; Jackson

[17] Code of Good Practice on then use of snares for fox control in England: https://www.gwct.org.uk/media/708982/Snaring-Best-Practice-Booklet-LOW-RES.pdf
[18] *Until guidance is available please seek advice from a relevant specialist*
[19] There were too few observations of badgers to allow statistical analysis of effects in pastoral fields.
[20] A hedgehog home range is typically between: 10 and 50 ha (Morris, 1988)

& Green, 2000), lethal control[21] is not advised because of the declining conservation status of this species.

83. If it is necessary to take action to manage hedgehog predation (for example, where hedgehogs are significantly impacting a colony of ground-nesting sea birds), then the recommended approach (if it is appropriate) is to use exclusion fencing.

84. In some circumstances it may be necessary to remove hedgehogs from within a fenced exclusion area. If the method to be employed involves use of traps, nets or illuminating devices (e.g. spot-lamps or torches) or any other prohibited method, then a licence will be required (see footnote below on 'prohibited methods').

Predation risk to birds on protected sites

85. The badger, fox and hedgehog exist sympatrically (in the same or overlapping geographic areas) across most of England (see Mathews *et al*, 2018 for further details) and all are predators of birds, although the extent to which birds form part of their respective diets and the species they predate vary. We therefore need to consider both the potential for direct and indirect effects of culling on bird populations.

86. In addition, there are other mammal species that predate birds whose abundance may be directly or indirectly affected by badger culling – through competition or predation. Figure 2 illustrates the intra-guild relationships between terrestrial mammal species potentially implicated in bird predation in lowland England.

Birds most at risk from predation by terrestrial mammals

87. Badgers, foxes and hedgehogs are all generalist avian predators that forage opportunistically. However, there will be differences in the vulnerability of different species of bird to predation by each and, typically, birds will form a larger component of the diet of foxes than the other two species[22].

88. Badgers and hedgehogs typically predate eggs and nestlings of species nesting on the ground; foxes are agile predators which are also capable of predating adult birds on the nest, as well as adult and juvenile birds feeding, foraging or roosting on or close to the ground.

89. The bird species which terrestrial mammalian predators are potentially capable of exerting a significant impact on are, in most cases, ground-nesting[23]. This is because nests located on the ground are particularly vulnerable to predation by terrestrial

[21] Lethal control of the hedgehog is lawful. However, the hedgehog is listed on Schedule 6 of the Wildlife and Countryside Act 1981 (as amended) so certain methods of control – listed in section 11 of the Act - are prohibited without a licence.

[22] The contribution of birds to the diet of predators will vary between sites and seasonally, as well as between species. Example estimates from published studies: badger: 8% (Hounsome & Delahay 2005); fox: 8%, 11% & 25%, respectively (Doncaster *et al* 1990; Baker *et al*, 2006; Reynolds & Tapper, 1995)

[23] This assessment is supported by reviews of published studies in Fera 2011 and Roos *et al*, 2018

mammals and, to some extent, because of the increased vulnerability of adult birds caring for that nest.

a. Ground-nesting birds most vulnerable to mammalian predation include waders such as stone-curlew, golden plover, lapwing, redshank and curlew, as well as ground-nesting seabirds such as terns and gulls.

b. There is also a potential risk to other ground-nesting species such as game-birds, ground-nesting birds of prey, nightjars and some songbirds such as larks and pipits.

90. Available evidence shows that ground-nesting waders and some seabirds can be significantly affected by mammalian predation (e.g. Roos *et al*, 2018). A high level of nest predation and chick predation, along with other factors such as habitat loss and deterioration, is considered responsible for the recent population declines of some species.

91. Birds which do not nest on the ground do not share this specific vulnerability during the breeding season. Generally speaking, adult and fledged juvenile birds are not likely to be predated by foxes unless sick or injured[24]. Birds which forage and roost on land at night might be more vulnerable (for example waterbirds foraging on farmland, waders roosting on saltmarsh and raptors roosting in reedbeds and heathland) but there is no evidence that such predation is sufficiently frequent to result in significant levels of mortality.

92. Nocturnally active birds have excellent hearing and eyesight so will normally avoid mammalian predators. Many waterbirds (ducks, geese and swans), and other birds such a hen harriers, roost in inaccessible areas, often on wet ground (or on water in the case of many waterbirds) and/or in tall vegetation, so it is unlikely that foxes would actively target them. In any event, foxes are opportunistic predators and are highly unlikely to focus on elusive, active and wary prey species which are widely dispersed over often difficult terrain.

93. A recent review of avian predation (by both mammalian and avian predators) concluded that species whose populations are potentially limited by predation tend to be, in addition to ground-nesting: single-brooded, long-lived and begin breeding later in life (Roos *et al*, 2018). These are all factors to consider in assessing the vulnerability of a bird population to predation.

94. The review found that in only 15% of the studies examined was there evidence that predators had a limiting effect on avian prey species. Predation effects on avian populations is, therefore, likely to be the exception, not the rule. The review concluded that there is little evidence that predation limits the numbers of pigeons, raptors, owls, woodpeckers and passerines, even in landscapes with abundant and increasing

[24] There are potential exceptions, including some game birds (e.g. common pheasant and red-legged partridge). These have a higher vulnerability to fox predation where captive reared and released than native, wild-born birds. These are not species of conservation concern.

populations of generalist mammalian and avian predators. However, the results did show that predation can limit the abundance of ground-nesting species, such as waders, gamebirds, and seabirds[25].

Badger culling and bird populations

Findings from studies of predation

95. A comprehensive review of predator control studies in the UK found that removing a single species usually has no detectable effect on avian prey species (Roos *et al*, 2018). The authors suggest that the lack of a detectable effect when only a single species is removed is probably due to a compensatory increase in predation by the remaining predatory species. This effect has also been reported in comparable ecosystems elsewhere (e.g. USA: Ellis-Felege *et al*, 2012).

96. Removing multiple predator species simultaneously is more likely to lead to a detectable increase in prey numbers (Roos *et al*, 2018). Where multiple predators are removed (e.g. Tapper *et al*, 1996; Fletcher *et al*, 2010) there is little scope for the remaining predators to increase their predation sufficiently over a short period to regulate populations of prey species to the same degree – resulting in observed increases in avian prey populations.

97. These observations are relevant for two reasons:

    a. Firstly, it suggests that badger culling is unlikely to result in any detectable change in the overall level of avian predation and thus may not impact individual bird populations; and

    b. Secondly, it seems likely that long-term upward trends in the abundance of several mammalian terrestrial predators – particularly amongst the largest species, including: badger**, fox, otter**, mink, polecat*, and stoat - may have increased net predation pressure on ground-nesting birds. It seems unlikely that this would have been compensated for by declines in the abundance of feral cat and the smaller mammalian predators: the hedgehog* and weasel[26].

(** fully protected & * partially protected species)

Findings from studies of badger removal

98. The only study to experimentally investigate the effects of badger culling on bird populations found that skylark and meadow pipit populations remained constant in cull areas but declined in non-cull experimental control areas[27]. Artificial nests deployed to

[25] The species most often identified as limiting bird populations were the fox and non-native mammals (mink and hedgehog on islands). There were, however, no studies included in the review that examined the effects of badgers in isolation; the sole study considering badgers alongside other species found a negative effect on bird populations.

[26] For population trends: see reviews by Roos et al. 2018 and Matthews et al, 2018

[27] Both species have been recorded in the diet of badgers

investigate rates of predation also tended to have higher survival rates in areas where badgers were culled compared to no-cull control areas (Fera 2011). While the study had its limitations, the available evidence from a scenario where the fox population increased by 57% whilst the badger population declined by 69% found no measurable decrease in the populations of ground-nesting birds or increase in the predation of nests.

99. A review of Breeding Bird Survey (BBS) data by the British Trust for Ornithology (Kettel & Siriwardena, 2018) examined population growth rates of 70 bird species inside and outside badger cull areas to identify associations between badger removal and bird numbers. The study did not investigate the causation of changes, so the significant associations identified should only be considered relevant to a HRA if there is an ecologically plausible mechanism for the association[28].

100. The findings of the review were mixed, with some species showing positive effects on population growth in cull areas, and others showing negative effects, but with only weak, overall effects at the guild level. Most species appeared to be unaffected by culling and there was no clear pattern for species more likely to be sensitive to badger (or other terrestrial mammal) predation to be more responsive.

101. All bird guilds considered, including ground-nesting species, showed some evidence of a balance in favour of positive associations with culling. However, some individual species did exhibit a significant negative association.

102. Overall, the authors concluded that associations with unmeasured and uncontrolled features of land-use and land management are probably a better explanation of the observed patterns than changes in badger abundance. This conclusion is broadly consistent with the general observation (discussed above) that the removal of a single predator usually does not result in detectable changes in bird populations.

<u>Bird species potentially affected by culling – a summary of the evidence</u>

103. Evidence from reviews of predator removal and the evidence specifically relevant to badger culling indicates that badger culling is very unlikely to result in a significant negative effect on bird populations considered collectively, in or neighbouring cull areas and there may even be an overall positive net effect on bird abundance[29].

104. There is a theoretical possibility that a small number of species - including medium-sized waders (lapwing and oyster-catcher) that commonly nest in farmland - may be adversely affected by culling (potentially due to increases in fox predation). As stated above, the evidence does not demonstrate that an adverse effect on such species is caused by badger culling and the observed association may relate to other factors.

[28] The study acknowledges that due to the number of statistical tests conducted there is a high likelihood of Type 1 errors occurring (i.e. a false positive results). This is more relevant to the results for individual species than it is to the overall (e.g. guild-level) analysis.

[29] If badger culling takes place in areas where there is widespread control of other predatory mammals (including foxes, mink, stoats, weasels) and birds (corvids) then net predation may be depressed sufficiently to allow increases in bird populations.

However, adopting a highly precautionary approach to this potential effect, it may be prudent to consider either:

a. mitigation measures (listed above) to reduce predation risk if these – or ecologically similar – species are notified as features of a European Site; or

b. monitoring population(s) of the potentially vulnerable species. If monitoring indicates there is increased predation then mitigation measures should be employed. Monitoring can also be used to evaluate the effectiveness of mitigation measures.

105. Appendix 2 lists bird species where there is evidence available that suggests there is a potential positive or negative association with badger culling. This information can be used to inform HRA risk assessments for these species, and potentially for other species that are ecologically similar. Please note that a causal link between badger culling and changes in bird populations has not be proven for any species so these potential effects and the related advice represent a highly precautionary approach.

Other species

106. *Additional sections on other species: including SAC species likely to be present in cull areas (e.g. bats, amphibians, invertebrates and plants) and on lagomorphs will be included in this guidance in due course. In the interim, if advice on these species is required please contact a relevant specialist in Specialist Services and Programmes Team (Chief Scientists Directorate)*.

Annex A: Maximum foraging distances to use for selecting protected sites for initial risk assessment

This guidance on Maximum Foraging Distances (MFDs) is taken from Natural England's Impact Risk Zone ('IRZ') Bird Guidance Summary[30].

- **Sites[31] notified for breeding bird assemblages (excluding ground-nesting heathland species, stone-curlew, marsh harrier & nightjar)**
    - Use MFD of 500m.
    - Some breeding SSSI birds of prey (peregrine, merlin, hen harrier & honey buzzard) can also forage up to 4km.
- **Sites notified for wintering birds (except wintering waders and grazing wildfowl, wigeon and geese)**
    - Use MFD of 500m
    - Home ranges of dabbling ducks such as teal, mallard and gadwall could extend beyond site boundaries at coastal sites, but less likely to do so at inland water bodies. Where functional habitat of dabbling ducks does extend beyond site boundaries then this is likely to be accommodated by presence of wigeon, geese or waders. Wintering marsh harrier and hen harrier can forage 10s of km and are likely to make significant use of farmland habitat beyond semi-natural areas encompassed by site boundaries. Owing to the extensive presence of farmland within 10s of km and low densities of birds, the standard distance of 500m relating to all wintering birds is deemed acceptable.
- **Sites notified for wintering waders (except golden plover and lapwing), brent goose & wigeon**
    - Use MFD of 2km.
    - Breeding marsh harrier can also forage up to 4km and are likely to make significant use of farmland habitat beyond semi-natural areas encompassed by site boundaries. Owing to extensive presence of farmland and low densities of birds, a reduced distance of 2km is deemed generally acceptable.
- **Sites notified for ground-nesting heathland species (breeding nightjar & stone curlew)**
    - Use MFD of 2km
    - Many sites (e.g. Thames Basin Heaths SPA/ Dorset Heaths SPA) with such sensitive features have issues of recreational disturbance. Buffers need to take into account travel to sites from proposed residential developments. For some Heathland SSSIs/SPAs most of the suitable habitat is designated, areas surrounding the sites are largely built up and the extent of functionally connected land will be limited. Such sites may need to be considered on a site by site basis.

[30] Available at: http://neintranettechnical/content/technical/topics/document_details.asp?DC=21689
[31] Including European Sites and SSSIs

Nightjar - up to 4km foraging distance for nightjars but unlikely to be >2km beyond site boundary.

- **Sites notified for wintering lapwing and golden plover**
    - Use MFD of 15-20km
    - Golden plover can forage up to 15km from a roost site within a protected site. Lapwing can also forage similar distances. Both species use lowland farmland in winter and it is usually difficult to distinguish between designated populations and those present within the wider environment. Developments affecting functionally linked land more than 10km from the site are unlikely to impact significantly on designated populations.
- **Sites notified for wintering white-fronted goose, greylag goose, Bewick's swan, whooper swan & wintering bean goose**
    - Use MFD of 10km
- **Sites notified for wintering pink-footed goose, barnacle goose**
    - Use MFD of 15-20km
- **Sites notified for bats**
    - Use MFD of 5km
    - Lesser horseshoe bats can travel 3-5km between summer roosts and are fairly site-faithful. They can travel at least 4km to feeding sites. The Barbastelle bat, on the other hand, can switch tree roosts every few days in summer and may roost in other suitable woodlands in the area – up to several kilometres away. Changes in land use which could affect bat commuting routes to and from their feeding areas and other roost sites. Depending on species this could range from 500m to 5km.
- **Sites notified for otter**
    - No MFD has been set for otter
    - Although a number of SSSIs and SACs have been notified for their resident otter population, this animal is wide-ranging and closely associated with waterways and associated riparian habitats. Chanin (2003) considered that the evidence suggested otters are not impeded by human disturbance and there is increasing evidence that otters readily habituate to many forms of human disturbance.
- **Sites notified for great crested newt**
    - Use MFD of 500m
    - A minimum buffer of 500m was set for all SSSIs that support great crested newts as 500m is widely accepted as a rule of thumb for the distance newts will travel from their breeding ponds.

Annex 2: Bird species and associations between badger culling and related activities

This table can be used to inform initial screening when assessing potential effects upon bird features of protected sites in England. It also indicates potential effects on breeding or non-breeding bird species' populations at site or wider landscape scales. 'Non-breeding' includes both passage and wintering populations.

These effects are categorised as either direct consequences of licensed badger culling and related activities, such as human disturbance and damage through vehicle use, shooting etc.; or as indirect consequences, such as through meso-predator release, an ecological process described above.

The 'effects' indicated are potential or hypothetical effects identified on the basis of evidence and / or expert opinion that are judged to be plausible. It is important to note that a precautionary approach has been adopted as there is no proven causal link between licensed badger cull related activities and changes to the populations of any bird species.

In the case of **bird assemblages** the potential risks are assessed on a precautionary basis and all breeding bird assemblages associated with a different habitat types are combined for initial screening purposes.

The categories of 'effect' used in the table are explained below. The threshold for assessing a response as 'no effect' (i.e. the 'none' category) is where approximately 1% or less of a bird population would likely be affected within any given area (e.g. a site for bird features, or a cull area of non-notified species). The assessment considers the cumulative effect of culling taking place over a number of years (as is expected with a licence of 4 or more year's duration).

Where possible, the table was populated with information derived from relevant research and publications, but where this was unavailable expert opinion was used, drawing on relatable research and applying the precautionary principle without incorporating mitigation measures intended to supress negative effects.

How to use this Annex table:

- Find the species or species assemblage in the table below. Species are listed alphabetically by common English name and assemblages are listed at the end of the table.
- Check the breeding and/or non-breeding season 'potential effect' relevant to the screening process;
- The 'potential effect' column will be populated with advice on what you do next; which will one of the following:
    - '**none**' or 'positive' (indicated in grey-coloured cell): in this case we are satisfied there will be either no effect or a positive effect associated with culling activities and therefore further consideration of this species in the assessment is unnecessary. It can be 'screened out'.
    - '**negative**' (indicated in an **orange**-coloured cell): in these cases the assessment should follow to the next level of associated guidance, which is provided in '*Guidance on threats and mitigation for bird features relating to bTB Badger licensing*'. [add link to guidance].
    - **'?'**: indicates insufficient relatable research. Where the cell is in **orange** a precautionary approach is applied and this potential risk should be considered at the next stage; where the cell is in grey, it can be 'screened out'.

- **'not in England'** = species does not occur in England or insignificant numbers of individuals occur and no further assessment is required. It can be 'screened out'.
- '**non-native**' = feral populations; some species have both feral and wild populations that occur in England; if in grey-colour no further assessment is required. It can be 'screened out'.

Key to 'Comments' column:

Numbers and abbreviations in the 'Comments' column indicate the source of information and evidence relied upon. Each number relates to a particular published study (listed below). "e/o" denotes the use of expert opinion to assign the risk status.

A number in **bold** in the table below indicates an association between culling and bird populations that is statistically significant ($P<0.05$); a number in brackets '()' indicates that research has concluded an *apparent* effect exists but statistically is most likely attributable to chance ($P>0.95$) and the effect is unlikely to be real. For some species, studies may report contradictory effects. In these cases expert opinion was used to assign the species to the most likely response. The code '(e/o interp. 1)' is where expert opinion has interpreted results from relevant research of a similar species with similar ecology.

Numerical key to references:

1. Esther Kettel & Gavin M. Siriwardena (2018) Comparisons of breeding bird population and abundance trends within and outside two specified areas located in SW England. Unpublished. BTO.

2. Food and Environment Research Agency (January 2011). Evaluation of the Potential Consequences for Wildlife of a Badger Control Policy in England

3. M. Ruddock & D.P. Whitfield (2007) A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage. http://www.anev.org/wp-content/uploads/2012/06/AREVIE1.pdf

Species: English & scientific	**Season:** breeding or non-breeding	**Source:** indirect or direct	**Potential effect**	**Comments**
Aquatic Warbler *Acrocephalus paludicola*	Breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Arctic Tern *Sterna paradisaea*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Avocet *Recurvirostra avosetta*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Barnacle Goose *Branta leucopsis*	Breeding	Indirect e.g. predation	non-native	
		Direct e.g. disturbance	non-native	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Bar-tailed Godwit *Limosa lapponica*	Breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	e/o	e/o
		Direct e.g. disturbance	negative	e/o
Bean Goose spp. *Anser fabalis* and *A. serrirostris*	Breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Bearded Tit *Panurus biarmicus*	Breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Bewick's Swan *Cygnus columbianus*	Breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	Breeding	Indirect e.g. predation	negative	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Bittern *Botaurus stellaris*		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
Blackbird *Turdus merula*	Breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Blackcap *Sylvia atricapilla*	Breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Black-headed Gull *Chroicocephalus ridibundus*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Black-necked Grebe *Podiceps nigricollis*	Breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Black-tailed Godwit *Limosa limosa*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Black-throated Diver *Gavia arctica*	Breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Blue Tit *Cyanistes caeruleus*	Breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Brent Goose (all ssp.) *Branta bernicla* ssp.	Breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Bullfinch *Pyrrhula pyrrhula*	Breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Buzzard *Buteo buteo*	Breeding	Indirect e.g. predation	none	1 (e/o)
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Carrion Crow *Corvus corone*	Breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Cetti's Warbler *Cettia cetti*	Breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
	Breeding	Indirect e.g. predation	none	1

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Chaffinch *Fringilla coelebs*		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Chiffchaff *Phylloscopus collybita*	Breeding	Indirect e.g. predation	none/positive	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Chough *Pyrrhocorax pyrrhocorax*	Breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Cirl Bunting *Emberiza cirlus*	Breeding	Indirect e.g. predation	positive	(e/o interp. 1)
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Coal Tit *Periparus ater*	Breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	None	e/o
Collared Dove *Streptopelia decaocto*	Breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Common Gull *Larus canus*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	negative	e/o
Common Sandpiper *Actitis hypoleucos*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Common Scoter *Melanitta nigra*	Breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Common Tern *Sterna hirundo*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Coot *Fulica atra*	Breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Cormorant *Phalacrocorax carbo*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Corn Crake *Crex crex*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	Breeding	Indirect e.g. predation	negative	1

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Cuckoo *Cuculus canorus*		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Curlew *Numenius arquata*	Breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Dartford Warbler *Sylvia undata*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Dipper *Cinclus cinclus*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	none	e/o
Dunlin *Calidris alpina*	Breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Dunnock *Prunella modularis*	breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Eider *Somateria mollissima*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Fieldfare *Turdus pilaris*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Fulmar *Fulmarus glacialis*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Gadwall *Mareca strepera*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Gannet *Morus bassanus*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Garden Warbler *Sylvia borin*	breeding	Indirect e.g. predation	none	(1, e/o)
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Garganey *Spatula querquedula*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	breeding	Indirect e.g. predation	none / positive	1 (e/o)

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Goldcrest *Regulus regulus*		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Golden Plover *Pluvialis apricaria*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Goldeneye *Bucephala clangula*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Goldfinch *Carduelis carduelis*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Goosander *Mergus merganser*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Goshawk *Accipiter gentilis*	breeding	Indirect e.g. predation	positive	1 (e/o)
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	positive	1 (e/o)
		Direct e.g. disturbance	negative	e/o
Grasshopper Warbler *Locustella naevia*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Great black-backed Gull *Larus marina*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Great crested Grebe *Podiceps cristatus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Great Northern Diver *Gavia immer*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Great S. Woodpecker *Dendrocopos major*	breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Great Tit *Parus major*	breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Green Sandpiper *Tringa ochropus*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	breeding	Indirect e.g. predation	positive	1

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Green Woodpecker *Picus viridis*		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Greenfinch Chlo*ris chloris*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Greenshank *Tringa nebularia*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Grey Heron *Ardea cinerea*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Grey Partridge *Perdix perdix*	breeding	Indirect e.g. predation	negative (or none)	e/o, (1)
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Grey Plover *Pluvialis squatarola*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Greylag Goose *Anser anser*	breeding	Indirect e.g. predation	non-native	
		Direct e.g. disturbance	non-native	
	non-breeding	Indirect e.g. predation	?	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	negative	e/o
Guillemot *Uria aalge*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Hen Harrier *Circus cyaneus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
Herring Gull *Larus argentatus*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Hobby *Falco subbuteo*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Honey-Buzzard *Pernis apivorus*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
House Sparrow *Passer domesticus*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
House Martin *Delichon urbicum*		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Jackdaw *Corvus monedula*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Jack Snipe *Lymnocryptes minimus*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Jay *Garrulus glandarius*	breeding	Indirect e.g. predation	none	(e/o interp. 1)
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Kestrel *Falco tinnunculus*	breeding	Indirect e.g. predation	positive	1, e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Kingfisher *Alcedo atthis*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Kittiwake *Rissa tridactyla*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	-
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Knot *Calidris canutus*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Lapwing *Vanellus vanellus*	breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Leach's Petrel *Oceanodroma leucorhoa*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Lesser Black-backed Gull *Larus fuscus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Lesser Redpoll *Acanthis cabaret*	breeding	Indirect e.g. predation	none	e/o (1)
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Lesser Whitethroat *Sylvia curruca*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
	breeding	Indirect e.g. predation	negative	1

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Linnet *Linaria cannabina*		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
Little Egret *Egretta garzetta*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Little Grebe *Tachybaptus ruficollis*	breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
Little Gull *Hydrocoloeus minutus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
Little Owl *Athene noctua*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	positive	e/o
		Direct e.g. disturbance	negative	e/o
Little Tern *Sternula albifrons*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	?	e/o
Long-tailed Tit *Aegithalos caudatus*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Magpie *Pica pica*	breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Mallard *Sternula albifrons*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Manx Shearwater *Puffinus puffinus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	**none**	e/o
		Direct e.g. disturbance	**none**	e/o
Marsh Harrier *Circus aeruginosus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Marsh Tit *Poecile palustris*	breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Meadow Pipit *Anthus pratensis*	breeding	Indirect e.g. predation	positive	1,2
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	breeding	Indirect e.g. predation	negative	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Mediterranean Gull *Ichthyaetus melanocephalus*		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Merlin *Falco columbarius*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Mistle Thrush *Turdus viscivorus*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Moorhen *Gallinula chloropus*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Montagu's Harrier *Circus pygargus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
Mute swan *Cygnus olor*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Nightjar *Caprimulgus europaeus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Nightingale *Luscinia megarhynchos*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Nuthatch *Sitta europaea*	breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Oystercatcher *Haematopus ostralegus*	breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Peregrine *Falco peregrinus*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	3
	non-breeding	Indirect e.g. predation	positive	e/o
		Direct e.g. disturbance	none	e/o
Pheasant *Phasianus colchicus*	breeding	Indirect e.g. predation	non-native	
		Direct e.g. disturbance	non-native	
	non-breeding	Indirect e.g. predation	non-native	
		Direct e.g. disturbance	non-native	
Pied Wagtail *Motacilla alba*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	breeding	Indirect e.g. predation	not in England	

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Pink-footed Goose *Anser brachyrhynchus*		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Pintail *Anas acuta*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Pochard *Aythya ferina*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Puffin *Fratercula arctica*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Purple Sandpiper *Calidris maritima*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Quail *Coturnix coturnix*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	?	e/o
Raven *Corvus corax*	breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	negative	e/o
Razorbill *Alca torda*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Red Kite *Milvus milvus*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	3
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Red-breasted Merganser *Mergus serrator*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Red-legged Partridge *Alectoris rufa*	breeding	Indirect e.g. predation	non-native	
		Direct e.g. disturbance	non-native	
	non-breeding	Indirect e.g. predation	non-native	
		Direct e.g. disturbance	non-native	non-native
Redshank *Tringa totanus*	breeding non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
		Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Redstart *Phoenicurus phoenicurus*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	breeding	Indirect e.g. predation	not in England	

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Red-throated Diver *Gavia stellata*		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Redwing *Turdus Iliacus*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Reed Warbler *Acrocephalus scirpaceus*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Ringed Plover *Charadrius hiaticula*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Robin *Erithacus rubecula*	breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Rook *Corvus frugilegus*	breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Ruff *Philomachus pugnax*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	negative	e/o
Sand Martin *Riparia riparia*	Breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Scaup *Aythya marila*	Breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Sedge Warbler *Acrocephalus schoenobaenus*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
Sanderling *Calidris alba*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	not in England
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Sandwich Tern *Sterna sandvicensis*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
Shag *Phalacrocorax aristotelis*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	breeding	Indirect e.g. predation	negative	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Shelduck *Tadorna tadorna*		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Short-eared Owl *Asio flammeus*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
Shoveler *Spatula clypeata*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Siskin *Spinus spinus*	breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Skylark *Alauda arvensis*	breeding	Indirect e.g. predation	positive	1, 2
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Slavonian Grebe *Podiceps auritus*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Snipe *Gallinago gallinago*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	negative	e/o
Song Thrush *Turdus philomelos*	breeding	Indirect e.g. predation	none	1,
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Sparrowhawk *Accipiter nisus*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	positive	e/o
		Direct e.g. disturbance	none	e/o
Spoonbill *Platalea leucorodia*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Spotted Flycatcher *Muscicapa striata*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Starling *Sturnus vulgaris*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Stock Dove *Columba oenas*	breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	breeding	Indirect e.g. predation	negative	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Stone-Curlew *Burhinus oedicnemus*		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
Storm Petrel *Hydrobates pelagicus*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Swallow *Hirundo rustica*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Tawny Owl *Strix aluco*	breeding	Indirect e.g. predation	positive	(e/o interp. 1)
		Direct e.g. disturbance	e/o	e/o
	non-breeding	Indirect e.g. predation	positive	e/o
		Direct e.g. disturbance	e/o	e/o
Teal *Anas crecca*	breeding	Indirect e.g. predation	e/o	e/o
		Direct e.g. disturbance	e/o	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	e/o	e/o
Tree Pipit *Anthus trivialis*	breeding	Indirect e.g. predation	positive	**1**
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Tree Sparrow *Passer montanus*	breeding	Indirect e.g. predation	negative	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Treecreeper *Certhia familiaris*	breeding	Indirect e.g. predation	none	1 (e/o)
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Tufted Duck *Aythya fuligula*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Turnstone *Arenaria interpres*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Turtle Dove *Streptopelia turtur*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Velvet Scoter *Melanitta fusca*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Wheatear *Oenanthe oenanthe*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
	breeding	Indirect e.g. predation	not in England	

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Whimbrel *Numenius phaeopus*		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
White-fronted Goose *Anser albifrons*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Whitethroat *Sylvia communis*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Whooper Swan *Cygnus cygnus*	breeding	Indirect e.g. predation	not in England	
		Direct e.g. disturbance	not in England	
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Wigeon *Mareca penelope*	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
Willow Tit *Poecile montanus*	breeding	Indirect e.g. predation	negative (or positive)	1, e/o
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
Willow Warbler *Phylloscopus trochilus*	breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
		Direct e.g. disturbance	none	e/o
Woodlark *Lullula arborea*	breeding	Indirect e.g. predation	positive	(1) e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Wood Warbler *Phylloscopus sibilatrix*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Woodpigeon *Columba palumbus*	breeding	Indirect e.g. predation	none (or negative)	1, e/o
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Wren *Troglodytes troglodytes*	breeding	Indirect e.g. predation	none	1
		Direct e.g. disturbance	none	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	none	e/o
Yellow-legged Gull *Larus michahellis*	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	?	e/o
Yellow Wagtail *Motacilla flava*	breeding	Indirect e.g. predation	positive	1
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	?	e/o
	breeding	Indirect e.g. predation	positive	1

Species: English & scientific	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Yellowhammer *Emberiza citrinella*		Direct e.g. disturbance	?	e/o
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	not applicable	
		Direct e.g. disturbance	not applicable	

Species Assemblages	Season: breeding or non-breeding	Source: indirect or direct	Potential effect	Comments
Variety of breeding bird species (70)	breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	not applicable	
		Direct e.g. disturbance	not applicable	
Variety of wintering bird species (90)	breeding	Indirect e.g. predation	not applicable	
		Direct e.g. disturbance	not applicable	
	non-breeding	Indirect e.g. predation	negative	e/o
		Direct e.g. disturbance	negative	e/o
>20,000 non-breeding waterbirds	breeding	Indirect e.g. predation	not applicable	
		Direct e.g. disturbance	not applicable	
	non-breeding	Indirect e.g. predation	?	e/o
		Direct e.g. disturbance	negative	e/o
Raptor assemblage	breeding	Indirect e.g. predation	none	e/o
		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	not applicable	
		Direct e.g. disturbance	not applicable	
	breeding	Indirect e.g. predation	negative	e/o

Species: English & scientific	**Season:** breeding or non-breeding	**Source:** indirect or direct	**Potential effect**	**Comments**
***Any** habitat type breeding bird assemblage*		Direct e.g. disturbance	negative	e/o
	non-breeding	Indirect e.g. predation	not applicable	
		Direct e.g. disturbance	not applicable	

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