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Consultation to the Birds Directive Article 3 Birds of Conservation Concern and Delivery Mechanisms

Authors

Ian G. Henderson, David Noble, Rachel Taylor & Veronica Mendez

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The British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU
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SUMMARY

1. This report was commissioned by Natural England and Natural Resources Wales to support the provision of ministerial guidance on the implementation of duties relating to Article 3 of the Birds Directive in England and Wales. The report condenses information from the literature, workshops, advice from stakeholders, to identify the mechanisms currently available to public bodies wishing to implement Article 3. All species are categorised by their association with one or more of seven landscapes (lowland farmland, woodland, lowland heathland, urban, uplands, wetlands, coastal & marine). Information on population changes causes of declines and relevant conservation measures are included in the assessment.

2. *Lowland Farmland*: Since the early 1990s, a concerted programme of research sought to identify both the causes of decline and appropriate remedial measures for long-term declining farmland breeding bird populations. For farmland birds, evidence is strongly dominated by the over-riding effects of management practice causing declines through negative effects on habitats and food. On farmland, breeding Redshank and Snipe largely disappeared by 1990, along with swathes of lowland wet grassland. For other species, areas of seed-rich habitat also declined on a vast scale as crop selection favoured winter-sown crops. National population trends for several geographically widespread farmland-associated species (Kestrel, Grey partridge, Lapwing, Turtle Dove, Skylark, Starling, Whinchat, Linnet, Corn Bunting, Yellowhammer and Yellow Wagtail) show little evidence of population recovery and continuing declines in abundance and range in the west of Britain especially suggest that a lack of suitable habitat for foraging and breeding remains an especially acute problem in grassland systems. Predation may also exacerbate recovery for some ground nesting species. However, Natural England and a range of conservation bodies have developed 'Farmland Bird Packages' for arable and mixed farming systems through the agri-environment scheme (AES) route. Recent farm and landscape-scale monitoring work suggests that some species are responding to some measures delivered in these packages, when delivered at the correct scale.

3. *Uplands*: Strongly declining upland bird species include waders plus Cuckoo, Ring Ouzel, Tree Pipit, Twite, and amber listed species, Whinchat and Golden Plover. High fertiliser inputs, drainage and silage production have increased the capacity of grassland to carry livestock but habitat simplification has altered vegetation structures, food supplies and predation risk, causing long-term declines in breeding populations of ground-nesting species. On higher unenclosed land, an important assemblage of birds is associated with complex upland dwarf shrub heath with bogs and birch mosaics and flushes, but these mosaics are easily damaged by drainage, inappropriate burning or heavy grazing. In England and Wales there have been considerable losses of heather moorland in recent times, to agricultural land improvements, heavy grazing by sheep and afforestation. But the effects of inappropriate burning and of grazing on natural vegetation complexity are likely to be at least as important to the wider bird community as heather loss *per se.* The conservation mechanisms in place for upland bird populations in England and Wales include protected areas, agri-environment schemes (AES) and direct management (including halting persecution, predator control, diversionary feeding and species-specific provision of key resources for nesting pairs or for chicks). These schemes have the potential to maintain and enhance sustainable populations of designated bird species if complex interactions between habitat quality and predation pressure can be taken into account.

4. *Woodland*: The woodland bird index has shown a 28% 40-year decline with strong declines both residents and migrants species, such as Lesser Spotted Woodpecker, Wood Warbler, Spotted Flycatcher, Willow Tit, Marsh Tit and Hawfinch. Reduced levels of active management (especially coppicing) and changes in grazing/browsing pressure (especially by deer) may be important, however, for many woodland birds the factors that currently limit populations are not fully understood. The incidence of disease is affecting several native tree species (Elm, Ash, Oak; and Red-band needle blight now threatening Scots Pine) and appears to be increasing, with uncertain effects on the attendant fauna. UK Forestry Standard provides the foundation of the Government's approach to ensure conformance with international legislation such as the Birds Directive (administered by the Forestry Commission and Natural Resources Wales). Woodland management and its increase in cover are expected to contribute to priority habitat creation for 2020, for more, bigger and less fragmented areas for wildlife, but a conflict is that low productivity areas targeted for planting by landowners currently may be of greatest biodiversity value (e.g. Welsh ffridd).

5. *Lowland heathlands*: Characteristic bird species of lowland heathlands include Stone Curlew, Nightjar, Cuckoo, Woodlark, Dartford Warbler, Grasshopper Warbler, Tree Pipit, Linnet and Yellowhammer (and Hen Harrier in winter), all of which are red-listed species of conservation concern due to vulnerable national populations (e.g. Dartford Warbler) or have strongly declining national populations (e.g. Tree Pipit and Yellowhammer) Heathlands were recognised as an important habitat at a European level by the EU Habitats Directive in 1992. In England, Lowland Heath is a biodiversity priority habitat with a Habitat Action Plan (HAP) for restoration and re-creation, with a target set of restoring 58000 hectares and recreating a further 6000 hectares by 2020 (Defra 2011). In Wales, lowland heathland is also a country-level priority habitat, with actions and targets set for their improvement and expansion. The condition of heathland habitats is still a major concern in England and Wales but restoration can be controversial involving felling or changes in management practice, and possible restrictions of access too, as disturbance or erosion by walkers and dogs can be a serious problem for habitats and wildlife.

6. *Wetlands*: There is abundant evidence of extensive post-war losses of wetlands to agricultural improvement and industrial development. Breeding Curlew, Lapwing, Snipe, Redshank and Yellow Wagtail showed a marked decline since 1975 as did birds of reedbeds. Reedbed species are beginning to recover to restoration management, but despite the implementation of agri-environment schemes, the abundance of wet meadows species continues to decline. Also on open waters, Little Grebe, Great Crested Grebe and Dipper have all declined. In winter, generally, wildfowl numbers have increased since 1975, probably due to improved protection of wetlands, internationally, better hunting regulation and milder winters. A proliferation of inland water bodies in the UK (gravel pits) has provided further breeding habitat for some species. The '50-year Wetland Vision' project for England (Wetland Vision, 2008) was produced by the Environment Agency, English Heritage, Natural England and NGOs. This initiative encourages a large-scale approach to the creation of wetland mosaics. The 'Wetlands for Wales' project has also restored or created wetlands across Wales. The Environment Agency has developed a Water Resources Strategy for England and Wales, directed towards the sustainable management of water resources, with Defra having announced extra funding in 2011 to help deliver WFD objectives.

7. *Coastal & Marine*: Many saltmarsh species are facing considerable population declines, in particular Lapwing, Redshank, Snipe and Curlew. Declines are likely to be driven by a loss of breeding habitat in terms of quantity and quality of coastal saltmarsh and wet grasslands due to changes in agricultural practices and grazing regimes. Some sea ducks, such as Velvet Scoter and Eider that feed on shellfish, demonstrate long-term declines. The populations of a range of other wintering species such as Black-Tailed Godwit Brent Goose and Barnacle Goose continue to rise, and a number of habitat management schemes and protection have led to the recovery and increases of some of the coastal/marine species, such as geese. With one exception (Black Guillemot), all regularly occurring seabird and sea duck species are proposed to be protected as designated features of Special Protection Areas (SPAs) in the UK. However, these will only protect a proportion of the population with significant numbers occurring outside SPAs. The SPA network in the UK is fairly comprehensive for the protection of coastal/near shore areas that support significant numbers of birds (Stroud *et al.* 2001) but less good for marine areas that are further offshore, and work is being done to identify and protect these areas (marine SPAs are currently being considered by JNCC). The UK is important for many wintering species, with many sites supporting more than 1% of the international population of wildfowl or waders. All such sites are designated as SPAs for their wintering populations.

8. *Urban*: The urban environment is occupied by large numbers of many more generalist species but there has been a decline amongst urban 'specialists' such as Swift, House Sparrow and House Martin, as well as Starling. However, Herring Gull and Lesser Black-backed Gull have adapted well to urban areas, switching their natural habitats for artificial ones and nesting on the rooftops of buildings. Limited measures exist that provide protection for urban birds and currently, some research is needed to understand the causes of population changes in urban environments. The most appropriate delivery mechanism involves 'Planning Policies & Control' and 'Species Licensing and Legal changes'. The urban environment does differ from the other landscape categories in being less clearly defined or perhaps being perceived differently in terms of what it can deliver towards the Birds Directive. But Government recognition of the social as well as wildlife value of the urban environment is implicit within its flagship policy for Nature Improvement Areas (NIAs) via 'The Natural Choice, to incorporate green space, create ecological networks, cleaning-up polluted urban rivers for reasons of health, quality of life, aesthetics and wildlife. The multi-functional benefits of urban planning are recognised in the Core Planning Principles that promote benefits for wildlife, recreation, flood risk and pollution mitigation, carbon storage and food production.

INTRODUCTION

This report was commissioned by Natural England and Natural Resources Wales to support the provision of ministerial guidance on the implementation of duties relating to Article 3 of the Birds Directive in England and Wales. The report condenses information from the literature, workshops, advice from stakeholders (both as professionals and/or practitioners); to identify issue facing priority birds species and the mechanisms currently available to public bodies wishing to implement Article 3. Articles 3 and 4(4) (second sentence) of the Directive are designed to ensure Member States *'preserve, maintain or re-establish a sufficient diversity and area of habitats for wild birds and to ensure that outside those areas which are specifically designated as important bird habitats, efforts are taken to avoid pollution or deterioration of habitats.'*

The bird species included are all those covered by the Birds Directive, that were classified as Red or Amber listed species of Conservation Concern in the UK, Channel island and Isle of Man (Eaton et al. 2009), or as Priority Species under the Natural Environment and Rural Communities Act 2006 in England (S41) or in Wales (S42). Such species are included on the basis that they have vulnerable or declining populations or that they are of international importance within Europe. The list includes some of the most widespread (albeit declining) species in the UK.

All species are categorised by their association with one or more of seven different landscapes (lowland farmland, woodland, lowland heathland, urban, uplands, coastal and marine). Information on population changes causes of declines and relevant conservation measures for all species associated with a particular landscape are included in the assessment. For each landscape category, the report summarises current evidence of population trends, known or suspected drivers of changes in abundance, and conservation actions that are or could be implemented. In the tables (Appendix A), these are summarised for each species associated with the landscape whereas the chapters provide a synthesis across species and focus on general drivers and conservation actions that pertain to Article 3. As well as summarising mechanisms for delivery, gaps in knowledge are also identified, to help guide interpretation of the available evidence.

At an early stage in the process, the issue of what constitutes a 'sufficient diversity and area of habitats for wild birds' was raised by consulted stakeholders. There is no clear guidance from the EU on this subject, leaving Member States to interpret this independently. Given that most UK legislation related to bird conservation refers to reversing declines and that most species in S41 or S42 have small, declining or vulnerable populations in England and/or Wales, 'sufficient diversity and area of habitats' has been conservatively interpreted as that necessary to reverse declines. Under this interpretation, the goal is to improve the status of focal species by making population trends stable or increasing, it avoids the use of targets based on areas of occupancy or population size. However, it was suggested by some consulted stakeholders that appropriate targets should be developed and would ideally be linked to local Biodiversity Action Plans. There should also be linkage to 2020 biodiversity targets (and Aichi; Rode *et al.* 2012) where appropriate.

It was noted that there was no clear guidance on the geographic scale at which these aims should operate, within the UK as a whole or its constituent countries, and how these applied to regional and local authorities. It would have been useful to know how this issue was being handled in other EU Member States, and whether the four countries in the UK were going to confer and show consistency in their approach. For some species, notably migrant waders and wildfowl, research and conservation measures are coordinated at the international scale through flyway management plans, and this approach might be appropriate for other groups.

It has also been apparent early in the literature search stage that clear evidence on the main causes of declines was lacking for many species, and moreover may change over time and differ between regions. Although outside the scope of this review, this highlights the need for further studies to understand the reasons for population declines, further research and tests of the effectiveness of conservation measures, and the role of potentially over-riding factors such as climate change. Because the remit of this review was to identify actions that could be taken by competent bodies in England and Wales to implement this article of the Birds Directive, we focus on causes of decline operating in the UK and/or under the control of the UK government. Nevertheless, all factors implicated in declines are included for context, as they could impinge on the effectiveness of conservation measures implemented.

The report takes the form of seven chapters, one for each landscape. The text in Section A is supported by a corresponding species summary spreadsheet in Appendix A-G. Each chapter was written in consultation with Natural England, Natural Resources Wales and Welsh Government. The chapters were also circulated more widely to garner the opinion of a group of experts and conservation practitioners associated with the Welsh workshops.

SECTION A. CAUSES OF DECLINES AND CONSERVATION ACTIONS

1. LOWLAND FARMLAND

1.1 Definition

'Lowland Farmland' refers to arable and grass fields, hedgerows and other non-farmed habitats (e.g. ditches) within agricultural land below 300m, and is the UK's predominant form of land use. Lowland wet grassland is covered under 'freshwater wetlands' and farm woodlands under 'woodlands'.

1.2 Species' Trends and Drivers: The Nature of Declines and Role of "Area And Diversity of Habitat"

Trends: The majority of species associated with lowland farmland have shown marked declines since the mid-1970s (and this is the main reason for their inclusion on priority lists of species of conservation concern). Since the early 1990s, a concerted programme of research sought to identify both the causes of decline and appropriate remedial measures. The research concluded overwhelmingly that the main driver of the declines was multi-faceted agricultural intensification (Wilson *et al.* 2009), of which key elements were:

- The switch from spring to autumn-sowing of cereal crops has led to a reduced availability of overwinter non-cropped habitats and the loss of in-field breeding habitat.
- Increased mechanisation has led to larger fields, more efficient harvesting, storage & drainage and has contributed to the loss or degradation of boundaries.
- Increased use of agrochemicals has reduced invertebrate and weed-seed resources.
- Grassland re-seeding, fertilisation, mowing regimes, drainage and high livestock densities, have reduced accessible invertebrate and weed-seed resources.
- Specialisation and simplification of crop rotations has led to a general loss of heterogeneity, and mixed farmland with arable and grass in close juxtaposition (leading to fewer options for breeding and foraging birds and a truncated breeding season).
- Reduced productivity for some ground nesting species such as Lapwing and Curlew.

Resources and breeding habitat: A large body of government and privately funded research has demonstrated that many farmland-dependent bird populations have become limited by depleted post-breeding and winter in-field resources (invertebrates and seeds, including late winter/early spring, Siriwardena *et al*. 1998, 2000, 2007). Overall, the effects of intensification in both arable and pastoral systems has been to reduce the quality of habitats in winter and summer leading to reduced recruitment into the breeding populations in what have become botanically and structurally simplified systems (Benton *et al.* 2002, Benton *et al*. 2003, Sutherland 2004, Whittingham *et al.* 2007, Vickery & Arlettaz 2012). As a consequence, populations of some farmland bird species declined by as much as over 90% (Tree Sparrow 91%, Corn Bunting 90%, Grey Partridge 91%, Skylark 58% and Lapwing 56%, Eaton *et al*. 2012).

For farmland, evidence is strongly dominated by the over-riding effects of management practice causing declines through negative effects on habitats and food (Chamberlain *et al*. 2000, Fuller 2000, Donald *et al*. 2001, Robinson & Sutherland 2002, Newton 2004). Negative elements of management practice include many facets, including simplified crop rotations, increased herbicide and inorganic fertilizer use and more-intensive grassland management (Potts 1980, Rands 1985, Fuller *et al*. 1995, Wilson *et al*. 1997, Siriwardena *et al*. 1998, Chamberlain *et al*. 2001, Vickery *et al.* 2001, Newton 2004, Boatman *et al*. 2007, Durant *et al.* 2008). The widespread switch from spring to autumn sowing of cereals that occurred in the 1970s was responsible for reducing the availability of overwinter stubbles during winter, partly mitigated by et-aside between the early 1990s and 2007.

The general reduction in stubbles resulted in a major loss of food for seed-eating birds, and breeding habitat too (Henderson & Evans 2000, Gillings *et al* 2012). Crop management was also shown to truncate the breeding season of in-field species due to rapid crop growth (e.g., Wilson *et al*. 1997, Gilroy *et al.* 2010, Perkins *et al.* 2012) or mechanical management (O'Brien *et al* 2006), so effectively reducing annual productivity. On enclosed grassland there is strong evidence that habitat quality for birds has been affected by increased use of fertilisers, higher levels of drainage, a switch from hay to silage cropping and earlier and more frequent cutting dates plus higher stocking levels (Vickery *et al*. 2001, Pinches *et al.* 2013). These actions affect the sward quality for breeding a foraging and can lead to earlier and more frequent cutting dates and higher stocking levels causing increase egg and chick mortality and reduced nesting opportunities (Durant *et al.* 2008). Documented consequences for birds included large reductions in the numbers of breeding waders (Lapwing, Redshank, Curlew and Snipe) in some areas (Baines 1988, 1989, Pinches *et al*. 2013). In Lapwings, in-field management and predation is known to severely reduce breeding productivity (e.g. Galbraith 1988, Shrubb 1990, Hotker 1991, Hudson *et al.* 1994, Siriwardena *et al.* 2000a, Taylor & Grant 2004, Wilson *et al.* 2005, Milsom 2005, Fuller & Ausden 2008, Smart *et al.* 2013). In other species there is further good evidence that the timing and the frequency of mowing contributes directly to declines in grassland species, such as Whinchat, Corncrake and Yellow Wagtail (Gruebler *et al* 1997, Green *et al*. 1997, Court *et al* 2001, Gilroy *et al.* (2008).

Habitat options, area and scale: While habitat quality is critical, the availability of appropriate remedial measures and the proportional scale of their provision both within and between farms affect the carrying capacity of farmland for birds (Gillings *et al.* 2005, Siriwardena 2010, Kleijn *et al.* 2011, Aebischer & Ewald 2012, Henderson *et al*. 2012, and Baker *et al.* 2012). In terms of habitat extent, there is historical evidence that changes in the farmland mosaic have involved vast scales of removal of semi-natural and uncropped habitats, including hedgerows, woodland, downland and wet grassland (Peterken & Allison 1989), causing gross losses of habitat in both quality and area. Declines in many once common species such as Quail, Corncrake and Cirl Bunting were largely unquantified (Fuller 2000, Newton 2004) but the effects on birds of a resurgence in farmland improvement schemes during the late 1970s and 1980s was monitored (Fuller *et al* 1995, Fuller *et al* 1997). Breeding Redshank and Snipe for example, largely disappeared by 1990, along with swathes of lowland wet grassland (Wilson *et al.* 2004). For other species, areas of seed-rich habitat also declined on a vast scale as crop selection favoured winter-sown crops (Robinson & Sutherland 2002). This decline was correlated with a strong decline in seed-eating bird species especially (Chamberlain & Fuller 2001).

1.3 Delivery Challenges: Actions that can Reverse Declines and Mechanisms Available

1.3.1 Mechanisms in place

Measures to improve habitat and resource provision for birds were enhanced in England with the introduction of Environmental Stewardship (ES) in 2005. By including both a 'broad and shallow' element, Entry Level Stewardship (ELS), designed for large scale uptake amongst farmers, as well as a more targeted scheme, Higher Level Stewardship (HLS), ES had potential to reverse the decline in farmland birds at a national scale provided that the measures were appropriately targeted, were of sufficient quality and were deployed at the appropriate scale (Vickery *et al.* 2004a). Natural England developed a revised targeting framework for HLS, to take account of rapidly declining range-restricted birds (Phillips *et al.* 2010). At the time of writing, Environmental Stewardship was being replaced by a new scheme, under a former banner of the 'Countryside Stewardship' but retaining some of the more targeted elements of ES, especially higher tier (HLS) options. As with ES, a large range of options to provide food (bird seed options) or habitats (fallow or boundary options) will be made available to applicants. In Wales a new scheme, Glastir, is replacing the existing schemes

including Tir Gofal and Tir Cynnal. Glastir will include a whole farm Entry Component providing general broad and shallow environmental actions and Advanced components which will address specific environmental issues in key geographical areas. Glastir pays for the delivery of specific environmental goods and services aimed at combating climate change, improving water management, maintaining and enhancing biodiversity. Glastir will cover Cross Compliance (compulsory requirements) and offer management options best suited to individual farms.

1.3.2 Limitations to mechanisms and remedial measures

There is evidence that targeted and persistent intervention can lead to regional recoveries of some range restricted species, for example Cirl Bunting (Stanbury *et al.* 2010). For geographically widespread breeding species, measures to improve habitat and resource provision were enhanced in England with the introduction of Environmental Stewardship (ES) in 2005. This scheme had potential to reverse the decline in farmland birds at a national scale, provided that the measures were appropriately targeted, were of sufficient quality and were deployed at the appropriate scale. There is some evidence of positive response by some species' populations to some of these measures (Vickery *et al*. 2004a, Baker *et al.* 2012). However, national population trends for several geographically widespread farmland-associated species (Kestrel, Grey partridge, Lapwing, Turtle Dove, Skylark, Starling, Whinchat, Linnet, Corn Bunting, Yellowhammer and Yellow Wagtail) show little evidence of population recovery (Risely *et al.* 2012). Continuing declines in abundance and range in the west of Britain especially (Balmer *et al.* 2013), for species such as Kestrel, Curlew, Lapwing, Turtle Dove, Yellow Wagtail and Starling suggest that a lack of suitable habitat for foraging and breeding remains an especially acute problem in grassland systems. Though climate change and pollution could be having an impact, the general consensus from both research (e.g., Butler *et al.* 2010, Davey *et al.* 2010a&b, Siriwardena 2010, Aebischer & Ewald 2012, Henderson *et al*. 2012, Baker *et al.* 2012) and practitioners is that it is the insufficient scale at which some measures (especially 'in-field' options) are deployed that is limiting success. To address this, Natural England and a range of conservation bodies have developed 'Farmland Bird Packages' for arable and mixed farming systems (e.g. Stoate *et al*. 2012). These establish a minimum quantity requirement for the delivery of measures to provide nesting habitat, invertebrate chick food and adult seed food within an individual ES agreement. Evidence suggests that to reverse the decline in farmland birds (at least in arable/mixed farming landscapes), we need to broadly apply the ELS package to 90% of arable land and the HLS package to the remaining 10% to cover a current shortfall in ES of c. 80,000 ha. Recent farm and landscape-scale ES monitoring work suggests that some birds are responding to the measures delivered in these packages when delivered at the correct scale (Baker *et al.* 2012).

The UK government's *Biodiversity 2020: A strategy for England wildlife and ecosystem services* (Defra 2011), includes a number of 'Outcomes' and 'Priority actions' that should facilitate the delivery of this short-fall in suitable lowland farmland habitat for birds by the year 2020. Three complementary approaches will be followed to address this: increasing the scale of ES options providing winter-seed, especially the extended winter stubbles option, increasing the quality of current options and introducing a supplementary feeding option into ELS and HLS. It is anticipated that some 65,000 ha of the new priority habitat created under Outcome 1 of *Biodiversity* 2020 will be allocated to 'arable field margins' (i.e. wild bird seed mixtures, fallow plots, conservation headlands, nectar mixtures and flower-rich margins).

In grassland systems, there is still a need to identify the diversity and area of measures required for improving bird status in areas dominated by improved grassland, with, in England, the introduction of two new grassland options into ES low input grass fields and grass silage allowed to seed). Further R&D work is on-going, targeting the development of the intensive grassland package by 2015, but

more trialling of options for intensive grass fields and the development of intensive grassland bird packages are needed. Dedicated grassland packages must create food (invertebrates and seeds), improved in-field habitat structure (e.g., heterogeneous sward structures) and modify grassland management methods (e.g., grazing and mowing regimes) on a larger geographic scale, with higher rates of farmer-uptake.

In Wales, Glastir has the potential to deliver both farm-scale and landscape scale environmental benefits. The 'Glastir Entry' is the initial requirement to access more specialised support. Once a farm has an Entry contract, they may enter the selection pool for an Advanced contract. The eligibility to join Entry is dependent on the applicant committing to undertake work and management to meet a points threshold. The threshold score is based on the farm size and payments, requiring larger farms to undertake more commitments to enter the scheme. Eligible activities are collated into a selection of options, each carrying points allocations. To promote the optimal options within appropriate areas, a Regional Package is available where the points allocation has been increased by 10% should the applicant choose option packages best suited to meet the main objectives of that region. The system prioritises those farms that have the greatest potential to deliver the desired outcomes (objectives) of the Welsh Government, based on an attributed map layer, provided by partner organisations. The targeting of resources at specific geographical areas through Advanced, as well as the provision of the general positive landscape management of Glastir Entry, aims to improve the provisions for farmland birds. The key to the success of these schemes is in uptake and spatial targeting. Although for the advanced schemes there has been effective use of existing data to target options, and deployment in some areas of specialised officers to provide advice, the incentives have to be economically viable to farmers to ensure uptake, and this is not always the case in changing market conditions.

1.4 Case Studies

Cirl Buntings: Cirl buntings have increased from 118 pairs in 1989 to over 860 pairs in 2009 (Stanbury *et al.* 2010*)*. Most of this recovery is attributed to the deployment of AES agreements, this being the best example of AES packages reversing the decline of a threatened species (Davies *et al.* 2011). The most beneficial options for this species were spring barley winter stubbles and wide grass margins of arable fields. There are now over 200 Cirl Bunting 10-year agreements (Countryside Stewardship/HLS) which directly cover around 50% of the total Cirl Bunting population, with 90% of the population lying within 1km of an agreement. The relatively contained area of south Devon has meant that concentrated effort in deployment and management has been possible, which may be difficult to replicate at larger geographic scales. However, the cirl bunting project shows that when appropriate prescriptions are deployed with sufficient focus, at an appropriate scale (with management advice provided to farmers) then recovery packages can work.

Individual farm projects: Several individual farm projects have demonstrated increasing breeding populations of farmland-dependent species. Published examples include Hillesden (success with field and boundary management: Hinsley *et al*. 2010), Colworth Farm (successes with mixed rotations (within 1km$_2$): Henderson *et al*. 2009) and Hope Farm/Loddington (success with 'farm packages': Stoate *et al*. 2012). In one project of 24 farms, higher densities of breeding birds were associated with proportional rates of un-cropped land per farm >5% (Farm4bio, Henderson *et al*. 2012). Individual-farm scale projects may be subject to levels of management advice and manipulation that is difficult to replicate across the wider farming community. Nevertheless, the successes suggest that appropriate deployment of AES prescriptions and crop management regimes can raise the carrying capacity of viable farmland for birds.

The South West Farmland Bird Initiative: The South West Farmland Bird Initiative (SWFBI) is a five year partnership project (running from October 2008-March 2013) that has been set up to specifically help reverse the decline of farmland birds across Wessex. The initiative is targeting nationally important farmland bird hotspots across Gloucestershire, Wiltshire and Dorset as defined by the distribution of the six rarer, most declining farmland birds, often called the 'Arable Six': Grey Partridge, Lapwing, Turtle Dove, Yellow Wagtail, Tree Sparrow, Corn Bunting. Across these three counties, four sister projects have worked together under the umbrella of the initiative. Each is led by a different partner organisation, with a dedicated project officer giving practical advice to farmers on how they can best use the Environmental Stewardship (ES) scheme to help farmland birds and the plants and animals associated with the arable landscape. The development of an evidence based **Farmland Bird package** within ES has been central to the success of the approach. The package focuses on those in-field options that deliver the maximum benefit for farmland birds with a 'fixed list' approach. When deployed together, the options provide the critical resources that farmland birds need to survive and breed successfully i.e. over-winter seed food, spring/summer invertebrate food and places to nest in-field. The mix of ES options was formulated using the best research, evidence and experience from RSPB, GWCT, BTO and Natural England. (eg., Stoate *et al.* 2012).

1.5. Conclusions

Since the early 1990s, a concerted programme of research sought to identify both the causes of decline and appropriate remedial measures for long-term declining farmland breeding bird populations. For farmland birds, evidence is strongly dominated by the over-riding effects of management practice causing declines through negative effects on habitats and food. On farmland, breeding Redshank and Snipe largely disappeared by 1990, along with swathes of lowland wet grassland. For other species, areas of seed-rich habitat also declined on a vast scale as crop selection favoured winter-sown crops. National population trends for several geographically widespread farmland-associated species (Kestrel, Grey partridge, Lapwing, Turtle Dove, Skylark, Starling, Whinchat, Linnet, Corn Bunting, Yellowhammer and Yellow Wagtail) show little evidence of population recovery and continuing declines in abundance and range in the west of Britain especially suggest that a lack of suitable habitat for foraging and breeding remains an especially acute problem in grassland systems. Predation may also exacerbate recovery for some ground nesting species. However, Natural England and a range of conservation bodies have developed 'Farmland Bird Packages' for arable and mixed farming systems through the agri-environment scheme (AES) route. Recent farm and landscape-scale monitoring work suggests that some species are responding to some measures delivered in these packages, when delivered at the correct scale.

2. UPLANDS

2.1 Definition

Upland habitats include the many 'open' habitats found above the 250 – 400m upper limit of agricultural enclosure, and include rocky habitats such as screes, ledges and mountain habitats, with characteristic vegetation types including heaths, bogs and rough grasslands. These open habitats have important functional connections with other habitats such as native woodlands and freshwaters, and cover approximately 5% of the land surface in England and 12% in Wales of the land surface (UK National Assessment 2012). Upland habitats are found in mid and North Wales, the North York moors, Pennines, Lake and Peak Districts (and to a lesser extent Exmoor) and much of North and West Scotland. UK upland priority habitats include blanket bogs, inland rock and scree habitat, mountain heaths and willow scrub, calcareous grasslands, flushes, fens and swamps, upland heathland and limestone pavements.

2.2. Species' Trends and Drivers

Strongly declining upland bird species include red listed species: Cuckoo, Ring Ouzel, Tree Pipit, Skylark, Linnet, Redpoll and Twite, amber listed species: Wheatear and Whinchat (Eaton *et al.* 2009, 2012, Appendix B). Among waders, Golden Plover (amber), Dunlin, Curlew and Lapwing (all three are red listed) are also in decline (Eaton *et al.* 2012). The Peregrine is relatively stable but populations of Hen Harrier and Kestrel are regionally declining or at a critically low levels (e.g. Hen Harrier in England). Merlin (amber) shows indications of a recent doubling of population following a long-term decline (Rebecca & Bainbridge 1998), but has been in shallow decline (13%) since the previous survey in 1993–94, with decline most noticeable in England (Holling & RBBP 2010). This recent UK increase may be associated with an increased use of forest edge as a nesting habitat (Little *et al.* 1995). Among game birds, Red Grouse fluctuate strongly (although these cycles may be buffered locally where medicated grit is routinely used to control parasite burdens) but are probably in long term decline driven by loss of heather moorland (Bonn *et al.* 2009). Black Grouse has a restricted and vulnerable population in England and Wales. Buzzard and Raven are increasing their range eastwards across the UK (Balmer *et al* 2013).

The main causes of the longer-term reductions in numbers of the declining species have been dominated by intensive land-use, causing a depletion of the extent of some habitats and deteriorating habitat complexity and condition, due to the following causes (Thompson *et al* 1995, Ratcliffe 2009, Pearce-Higgins *et al*. 2009, Pearce-Higgins *et al*. 2012):

- Habitat loss and fragmentation caused by overgrazing, agriculture and forestry (Crowle & McCormack 2009).
- Decreases in prey abundance (e.g., crane flies) due to intensive upland management: grazing or sylviculture drainage and drying (Carroll *et al.* 2011).
- Recreational disturbance wind farm development and erosion, Inappropriate management (over-grazing, under-grazing, burning), or scrub and bracken encroachment and structural change (Crowle & McCormack 2009).
- Drainage/drying/abstraction affecting bogs, wet heathland & attendant insect populations.
- Nutrient enrichment from atmospheric deposition (air pollution, Bonn *et al.* 2009) and overgrazing, and especially grassland improvement management for grazing and silage on enclosed marginal upland farmland (Pinches *et al*. 2013).
- Exacerbating effects of predation on productivity and population recovery (Fletcher *et al.* 2010, Douglas *et al*. 2014).
- In the past pesticides have caused declines that have improved under legislation (Ratcliffe 2009).

The primary cause of the decline in breeding waders is thought to be habitat change and degradation, including the drainage of wetlands, farmland conversion, sward management and grazing and the planting of conifer forests on marginal farmland (Wilson *et al.* 2004, Eglington *et al*. 2008). There is increasing evidence showing predation is a proximate driver of declines, in the uplands, or at least may exacerbate recovery (Fletcher *et al.* 2010, Douglas *et al*. 2013, Smart *et al.* 2013). Climate change, and in particular increased rainfall at certain times of year, may also be putting pressure on populations (Hulme 2005, Calladine & Bray 2012). However, for several decades, high fertiliser inputs, drainage and silage production have increased the capacity of grassland to carry livestock (Fuller & Gough 1999) and have resulted in large long-term reductions in breeding populations of Lapwing, Redshank, Curlew, Snipe in Wales and northern England (Baines 1988, 1989). Many passerines (Skylark, Meadow Pipit, Yellow Wagtail, Whinchat and Twite) have similarly declined as breeding birds of upland grasslands (Fuller *et al*. 2002, Henderson *et al*. 2004). Habitat simplification has altered vegetation structures, food supplies and predation risk (Fuller & Gough 1999).

In England and Wales There have been considerable losses of heather moorland in recent times, associated with agricultural land improvements, heavy grazing by sheep and afforestation (Avery & Leslie 1990). Overall, 27% of heather moorland is estimated to have been lost in England and Wales between 1947 and 1980. It has also been estimated that 440,000 ha of land in the uplands in England and Wales have less than 25% cover of heather (Fuller 2012, chapter 8). But heather moorland is mainly beneficial to Red Grouse, and to a lesser extent Merlin, Hen Harrier and Golden Plover and Stonechat too (Pearce-Higgins & Grant 2006). Heather moorland is itself an historical consequence of intensive upland management for grouse (Crowle & McCormack 2009), albeit with significant local economic value. Grouse moor management itself is associated with heather dominated moorland habitats on mineral or peat soils and blanket bogs. Grouse moor management focuses on providing habitat and food through grazing and heather burning, reducing predator pressure, and reducing parasites and disease and may have helped to limit losses of dwarf shrub dominated habitats to afforestation and conversion to grassland (Grant *et al*. 2012). Burning will supress natural succession to woodland and encourage new heather growth, but under some conditions can have negative implications for water quality, peat erosion and damage to Sphagnum mosses and blanket bogs (Shepherd *et al.* 2013). Many species depended on other aspects of habitat such as upland dwarf heath, bogs and birch mosaics, flushes, fens and swamps. The latter are important nesting habitats for Curlew, Snipe and Redshank (Pearce-Higgins *et al*. 2009) but may be easily damaged by drainage or inappropriate burning. These actions may lead to simplified swards of tough unpalatable grasses (Crowle & McCormack 2009, Fuller 2012, chapter 8). As an upland priority habitat, dwarf shrub heath in 'favourable condition' is typically dominated by heather, bilberry, crowberry, bell heather and, in the south and west, western gorse and in places juniper. An important assemblage of birds is associated with complex upland dwarf shrub heath, including Red Grouse, Black Grouse, Merlin and Hen Harrier (Pearce-Higgins *et al*. 2009). Meadow Pipits are also most abundant at intermediate levels of heather and grass (Pearce-Higgins & Grant 2006) and various waders will utilise a heather matrix (Pearce-Higgins *et al*. 2009). Since the 1950s, conifer plantations, acid grasslands and 'improved' hill pastures have replaced many of these more natural upland habitats (Fuller & Ausden 2008, Shepherd *et al.* 2013). The effects of inappropriate burning and of grazing on natural vegetation complexity (structure and composition and sward dampness) are likely to be at least as important to the wider bird community as heather loss *per se* (Pearce-Higgins *et al*. 2009, Graves *et al.* 2013), affecting both sward quality and food (Pearce-Higgin *et al* 2010).

Notwithstanding the local economic value of managed grouse moors (Fletcher *et al.* 2014), there is evidence that Mountain Hare densities may be higher on grouse moors, and some wader populations too, such as Curlew (Douglas *et al.* 2014). However, hares may be culled to reduce the transmission of louping ill to grouse via ticks (Laurenson *et al*. 2003). Meanwhile, Hen Harriers in particular can reduce grouse shooting bags, and have been subject to much illegal persecution (Thompson *et al.* 2009). Thus, there remain conflicts between conservation (such as bird of prey conservation), sport management, farm management, public access and important ecosystem services for carbon storage and water quality that need to be addressed urgently, through dialogue, research and new initiatives. For example, finding a solution to the harrier-grouse conflict would bring considerable benefits to the management of the UK's heather moorlands and have broad implications for the conservation of predators (Redpath & Thirgood 2009).

For a number of migrant species (such as Ring Ouzel and Whinchat), survival outside the breeding season may well be a key limiting factor in breeding population recovery (Ockenden *et al.* 2010, Henderson *et al.* 2012). For Ring Ouzel, in southeast Scotland, studies suggest that the population change could be linked to higher natural mortality outside the breeding season (Beale *et al.* 2006) with low survival between breeding seasons being a major national cause of decline (Sim *et al.* 2010).

In the uplands, although populations of moorland birds have declined from loss of habitat due to afforestation (Bonn *et al.* 2009), upland forests can provide important habitat for some species such as Merlin, Short-eared Owl, Willow Warbler and Whinchat, particularly in the first 10-15 years before the canopy closes (Avery & Leslie 1990, Gillings *et al.* 2000, Calladine *et al.* 2013). The spread of young forest aided the re-colonisation of mainland Scotland by hen harriers from the Northern Isles in the 1940s, and many other species have colonised the new forests and that some of these species are nationally scarce, for example Black Grouse and Goshawk (Avery & Leslie (1990). Middle-aged plantations, with a dense, dark canopy support relatively few species, but as the plantation matures, other species, such as Crossbill, can colonise, but as plantations have matured and the area of new planting has fallen, declines in Tree Pipit and Lesser Redpoll have occurred (Fuller 2012).

2.3. Delivery Challenges: Actions that can Reverse Declines and Mechanisms Available

2.3.1 Mechanisms in place

The conservation mechanisms in place for upland bird populations can be largely categorised as protected areas, such as nature reserves and special protection areas (SPAs), agri-environment schemes (AES) and direct management (including halting persecution, predator control, diversionary feeding and species-specific provision of key resources for nesting pairs or for chicks). On SPAs, bird populations (such as Hen Harrier, Merlin Golden Plover and Curlew) must be maintained as a legal condition of SPA designation and so issues affecting bird populations such as grazing, over-burning or other forms of intensive management (e.g., drainage or quarrying) are at least partly addressed through management agreements, including payments for positive heather management.

In addition, in England, on upland farmland, AES fall under the new Countryside Stewardship Scheme (upland options) as higher and lower tier schemes incorporating different levels of management stringency for subscribed farmers to adhere too. The Welsh uplands form a major part of the Protected Landscapes of Wales that comprise approximately 45% of the Welsh uplands. The major land use support mechanism in Wales is Glastir, which includes prescriptions (including higher tier 'advanced' options for permanent pasture and open country grazing management) and support

for heather management and restoration, *Molinia* control, grip blocking and re-wetting of marshy habitats, and specific bird-focused management practices (grassland management for feeding Chough, feeding and breeding Merlin, Curlew, Lapwing, Golden Plover and Ring Ouzel). Future policy may also seek to support those farming systems that are considered to be Higher Nature Value and/or are delivering more in terms of environmental goods and services.

These schemes have the potential to maintain and enhance sustainable populations of designated bird species as assessed through bird population monitoring. There is some evidence that appropriately managed AES for the uplands can deliver measurable population benefits to breeding wader populations if complex interactions with predation pressure and context are taken into account (Smart *et al.* 2013).

2.3.2 Limitations to mechanisms and remedial measures

Although appropriate land management practices aimed at improving upland bird populations have the potential for significant benefits, it may be necessary to implement other conservation actions simultaneously in order to see positive results. Generally, uptake of prescriptions (e.g. Glastir or ELS/HLS), and recognition of the value of upland mosaics and large scale strategic planning of their implementation are key considerations for policy. In general, partnership schemes involving a number of key stakeholders and including major landowners have proved most successful in developing appropriate management for species such as Black Grouse, because they provide a process for ensuring suitable land use policies in the habitat matrix (e.g. winter heather management of dry heaths for Black Grouse, and clear-felling and forest re-spacing in adjoining forested areas). Another good example is the Important Upland Bird Area (IUBA) framework (Jones 2007) aimed at integrating the delivery of site features on a number of upland SSSIs in Wales. However, these partnerships are dependent on continued funding as well as staff resources within the relevant organisations.

There are some new initiatives aiming to restore native forest vegetation and habitat networks, especially in Scotland (Humphrey *et al.* 2003), to encourage natural regeneration of woodland within the uplands, to improve diversity and more closely resemble natural woodland/bog/heather mosaics. It is unclear as to whether similar initiatives of naturalisation are being considered for upland areas of England or Wales (for the sake of wildlife conservation).

2.4 Case Studies

The **Welsh Black Grouse Recovery Project (RSPB, WG, FC-Wales, and CCW)** was set up in 1999 to halt the species' decline. It surpassed the 2015 Biodiversity Action Plan target of 270 lekking males in 2011, four years earlier than expected, although more recent data indicate some subsequent declines, and ongoing range retraction remains a cause for concern. During the 1990s, the Black Grouse population in Wales was declining towards extinction, with numbers of lekking males reaching a low of 126 in 1997. The long-term decline of these birds, seen across Europe, was mainly due to wide-scale habitat and land-use changes. Black Grouse require a habitat mosaic to survive, including a combination of unimproved farmland, moorland, blanket bog and open forest to allow them to feed, display, seek refuge and breed successfully. The Clwydian Range and Llantysilio Mountains have seen an increase in heathland management for the benefit of agriculture as well as black grouse. Rotational heather cutting in traditional landscape patterns has restored the upland heath, grassland and bog mosaic, and the species is further supported through game conservation and game keeping on private land areas. The observed Welsh population trend is largely due to an increase on these areas. See *www.rspb.org.uk/whatwedo/projects/details/223483-wales-black-grouse-recovery-project.*

Twite recovery project (RSPB / NE): The Twite is a species of bird which is extremely vulnerable. It used to breed in 12 counties in England but it now only breeds in the South Pennines. In the past 14 years numbers have dropped by 90% and there are now only about 100 breeding pairs left. A key issue that has been identified as possibly affecting Twite numbers is the reduced availability of seed, especially later in the breeding season. Typically, Twite raise a second brood of chicks in early August, this is not happening in the South Pennines, possibly because there is not enough seed to feed the young. Reduced availability of suitable nesting habitat, which is primarily mature heather or bracken, which has 2 years growth or more is also a problem for Twite as are accidental and deliberate moorland fires. Accidental fires often occur through discarded cigarettes, campfires that have not been properly extinguished, or sometimes as a result of managed moorland burning that has become out of control. The aims of the ongoing recovery project, which began in 2010, are to:

- Halt the current decline in Twite numbers and range and in the medium term to increase the population breeding at existing colonies and to establish breeding at new and/or former sites.
- Increase the proportion of the population having second broods (currently very low), resulting in increased breeding productivity.
- Develop a management plan for each extant Twite colony and proactively target habitat intervention within a 2.5 - 4 km radius of the colony.
- Secure the future of the designated breeding sites by bringing the non-designated feeding sites into long-term conservation management agreements.

Since 2010, the Twite Recovery Project has re-seeded a total of 128.87ha with food sources specifically for Twite (e.g. Dandelion, Common sorrel, Autumn Hawkbit as well as Yellow Rattle and locally harvested seed mixes). 36 landowners/farmers have signed up to government-funded schemes to help increase food supplies for Twite so far, with more in the process of coming on board. Where possible, fields are shut up early to encourage dandelions for early foraging. There is widespread promotion of hay meadow late cutting date (cut once after 15th July – ideally mid to late August) to ensure that seed is available for second broods of Twite in July/August. The project continues to work closely with the community to raise awareness of the plight of the Twite and organises training and events for volunteers who help with the Project. See *http://www.rspb.org.uk/whatwedo/projects/details/222974-england-twite-recovery-project*.

2.5. Conclusions

Strongly declining upland bird species include waders plus Cuckoo, Ring Ouzel, Tree Pipit, Twite, and amber listed species, Whinchat and Golden Plover. High fertiliser inputs, drainage and silage production have increased the capacity of grassland to carry livestock but habitat simplification has altered vegetation structures, food supplies and predation risk, causing long-term declines in breeding populations of ground-nesting species. On higher unenclosed land, an important assemblage of birds is associated with complex upland dwarf shrub heath with bogs and birch mosaics and flushes, but these mosaics are easily damaged by drainage, inappropriate burning or heavy grazing. In England and Wales there have been considerable losses of heather moorland in recent times, to agricultural land improvements, heavy grazing by sheep and afforestation. But the effects of inappropriate burning and of grazing on natural vegetation complexity are likely to be at least as important to the wider bird community as heather loss *per se.* The conservation mechanisms in place for upland bird populations in England and Wales include protected areas, agri-environment schemes (AES) and direct management (including halting persecution, predator control, diversionary feeding and species-specific provision of key resources for nesting pairs or for chicks). These schemes have the potential to maintain and enhance sustainable populations of designated bird species if complex interactions between habitat quality and predation pressure can be taken into account.

3. WOODLAND

3.1 Definition

All forms of broadleaved and conifer woodland are included, also lowland wood-pastures and parklands, wet woodland (alder, birch and willows), oak, ash or beech dominated woodland, pine forest and upland oak or ash woods.

3.2. Species' Trends and Drivers

Where known, species-specific effects on populations are summarised in the table (Appendix C) for 23 priority species and long-term decline in some UK woodland birds is a major conservation issue in the UK. The woodland bird index for the UK (represented by 38 constituent species) shows a 28% decline between the base level in 1970 and 2013 (Defra: Wild bird populations in the UK 2007-2013), and for England the decline is 21% across the same period. However, since 2000, the woodland bird index for the UK has been broadly stable. The Repeat Woodland Bird Survey (RWBS) investigated changes in breeding bird populations and habitat in more than 400 broadleaved and mixed woods between the 1980s and 2000s (Hewson *et al.* 2007). Nine of 34 species covered in their study showed significant national declines and three other species showed population declines of a smaller magnitude though there were increases too. Overall, specialist residents and long distance migrants have declined the most, and several species are now Red or Amber listed in Birds of Conservation Concern 3 (Eaton *et al.* 2009, 2012).

Among the priority species, there has also been range recovery in Nightjars and Woodlarks, (slower for Woodlark in Wales) following effective conservation action in forests. Overall, continuing UK-level declines are recognised for migrant species (Turtle Dove, Spotted and Pied Flycatcher, Wood Warbler, Tree Pipit and Nightingale) and for resident species (Woodcock, Lesser Spotted Woodpecker, Willow Tit, Marsh Tit, Starling, Mistle Thrush, Lesser Redpoll, Hawfinch and Bullfinch, Eaton *et al.* 2009, 2012, Risely *et al.* 2012). Range shifts are recognised in other species too, perhaps indicative of climate mediated effects (Tree Pipit, Lesser Redpoll, Song Thrush Willow Tit, Spotted Flycatcher, Willow Warbler, Balmer *et al*. 2013: Atlas 2007-2011). There have also been encouraging local increases in Hawfinches in parts of Wales, though against the UK trend (Balmer *et al.* 2013: Atlas 2007-2011).

In summary, causes of recent declines affecting woodland birds may include (Fuller *et al* 2005, 2007):

- Scrub and woodland degradation (decline in management and deer browsing breaks in continuity of dead wood habitat, reduction in habitat complexity and the loss of specialised habitats),
- Loss of deadwood (Amar *et al.* 2010).
- Changes in invertebrate biomass (Fuller 2012, Chapter 14).
- Loss of veteran trees through disease, physiological stress, and drought, felling for safety reasons, development.
- Prolonged drought and climate change.
- For the migrant birds, factors operating outside of the breeding season may be relevant (e.g., Ockenden & Hewson 2012).

Reviews of the evidence for known and likely causes of decline for each declining species in the woodland indicator for England (Fuller *et al.* 2005, 2007, Eglington & Noble 2009, Charman *et al*. 2009), suggested that two main processes are likely to be involved: (1) reduced levels of active management (especially coppicing) and (2) changes in grazing/browsing pressure, especially by deer.

However, for many woodland birds, the ecological and demographic factors that currently limit populations are simply not fully understood. Nest records and ring-recovery rates suggest that, in some species, reproductive success may be stable or may even have increased (Starling, Wood Warbler, Woodlark, Spotted Flycatcher, Pied Flycatcher). In others, annual survival rates have declined, implying that limiting effects of the environment outside the breeding season may be driving trends (Baillie *et al*. 2012.). Among woodland birds, this mechanism has been demonstrated only in Song Thrushes, where low food availability in drier habitats contributed to low winter survival and declining trends (Peach *et al*. 2004a&b).

In terms of habitats, loss of structural diversity has effects on breeding bird densities ((Fuller 2012 Chapter 2), see also Marsh Tit (Broughton 2012) and Willow Tit (Lewis *et al.* 2009)), and one source, deer browsing (Holt *et al.* 2010, 2011, 2013, Newson *et al*. 2011), is a widespread problem in parts of England, and an increasing problem in Wales. Also affected are important transitional mosaics of scrub, woodland edge that are now slowly gaining conservation prominence as legitimate bird habitats (Fuller 2012, Chapter 5). Habitat availability may limit some species, such as Nightjars and Woodlarks (Dolman & Morrison 2012) and Tree Pipits in similar habitats have continued to decline, especially in the east of Britain (Balmer *et al.* 2013). The standing dead-wood component of woodland and forest is a recognised important feature for many species (Humphrey *et al.* 2003, Amar *et al.* 2010, Fuller 2012) not least Lesser Spotted Woodpecker, Wryneck, Starling, Marsh Tit, Willow Tit, Pied Flycatcher, Redstart, Spotted Flycatcher for foraging and/or nest sites. In the Netherlands, climate-driven, mismatches between birds and seasonal peaks in food availability are implicated in declining populations in Pied Flycatchers (Both *et al.* 2006, 2010).

For several woodland species the precise, current, population constraints are still not fully understood (in particular Cuckoo, Spotted Flycatcher, Tree Pipit, Bullfinch, Hawfinch and Redpoll), though research is on-going for Cuckoo, Lesser Spotted Woodpecker, Wood Warbler, Willow and Marsh Tits).

The incidence of disease is affecting several native tree species (Elm, Ash, Oak, and Red-band needle blight now threatening Scots Pine) and appears to be increasing, with uncertain effects on the attendant fauna.

3.3 Delivery Challenges: Actions that can Reverse Declines and Mechanisms Available

UK Forestry Standard (Forestry Commission 2011) serves as the basis for the regulatory systems for forestry exercised by the Forestry Commission, Forest Service in Northern Ireland, and Natural Resources Wales and, as such, it is mandatory. It provides the foundation of the Government's approach to ensure that woodland management in the UK conforms to Government policies and to a number of international agreements on the protection of the world's forests and the environment. The UKFS therefore ensures that international agreements and conventions, for example the Birds Directive, are robustly applied in the UK.

The UKFS provides the benchmark for assessing all forestry applications, (felling licences, forest plans and grant applications) in the UK. The guidance for these regulations will be embedded within the regulatory and incentive systems of the UKFS. Conditions within the UKFS apply to all woodland, irrespective of who owns or manages it.

A range of legislation, including the Forestry Acts, means that permission is required for tree felling and other forestry activities. Compliance with the Birds Directive can be made a more specific part of the procedure through which felling licences, assessing applications for grants under the Woodland Grant Scheme, and assessing Forest Design Plans are discharged under UKFS. As part of these

procedures, FC consults the statutory nature conservation bodies over approvals. Applications are also available for public comment, which offers further opportunity for scrutiny and amendment.
The Forestry Commission is the competent authority and responsible for administering the Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999 (in Wales now administered by Natural Resources Wales) and the Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999. EIA for forestry covers the following projects: deforestation and afforestation, roads/tracks and quarries. The regulations stipulate an area threshold for each of the projects, above which an EIA is required. Much lower thresholds are given for projects that lie within sensitive areas and for many sensitive areas no threshold is used – all projects are subject to an EIA. Currently, when deciding whether or not to grant consent under the Regulations, the FC or Natural Resources Wales must take into account a number of environmental factors including "human beings, fauna and flora" (Schedule 4 to the Regulations), including effects on wild birds.

A number of government-backed schemes and policy changes facilitated by the Forestry Commission have led to a 13% increase in woodland cover by 2011/12 (e.g. Woodland Bird, Woodland Improvement Grant). The UK government's white paper *UK Low Carbon Transition Plan* (2009) estimated that planting 10,000 hectares of new woodland every year over the next 15 years could help to increase our woodland cover by about 1%. The UK Woodland Assurance Standard (UKWAS) is a voluntary independent certification standard recognised by the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification Programmes (PEFC). Nevertheless, there are still problems with the lack of take up of appropriate management options, partly due to private ownership of land, and the issue that many of the low productivity areas targeted for planting by landowners are of greatest biodiversity value (e.g. Welsh ffridd). Woodland management and its increase in cover are expected to contribute to priority habitat creation for 2020, for more, bigger and less fragmented areas for wildlife.

FC and Defra are currently funding a four year research project, led by BTO. This project is addressing habitat quality for declining woodland birds and whether populations can be increased through the adoption of particular silvicultural practices and management treatments designed to improve woodland structure, a reduction in deer browsing pressure, or combinations of both. Outcomes from this research will be used to inform woodland management for bird populations, and will be embedded in the UK Forest Standards.

3.4 Case studies

East Midlands Woodland Bird Project: Woodland bird populations have been in steady decline since the 1970s with 33 species decreasing by 20% in the last 25 years. Together with the RSPB, Natural England and other key conservation bodies, the East Midlands Woodland Birds Project is aiming to reverse this decline by providing financial support to landowners and managers to improve woodland habitat for birds and wider biodiversity. The grants, offered through the English Woodland Grant Scheme (EWGS), are specifically aimed at woodland creation and management that will help woodland birds across the region. EWGS grants of £1.9 million have been match funded by an estimated £4.7million from the private sector to secure sustainable woodland management and support rural economies. Whilst declining woodland birds are the focus and being used to promote and measure the success of this targeted funding, the key objective of bringing woodland back into active sustainable management at a broad, multiple ownership, landscape scale is being realised, providing a range of benefits for biodiversity, the low carbon economy, recreation and timber quality. Restructuring of woodlands is expected to produce 108,000 green tonnes of timber over the next five years, this timber (mostly destined for wood fuel) is estimated to have a value of at least £2.7 million at roadside before utilisation (www.forestry.gov.uk: Forestry Commission, England).

3.5 Conclusions

The woodland bird index has shown a 28% 40-year decline with strong declines both residents and migrants species, such as Lesser Spotted Woodpecker, Wood Warbler, Spotted Flycatcher, Willow Tit, Marsh Tit and Hawfinch. Reduced levels of active management (especially coppicing) and changes in grazing/browsing pressure (especially by deer) may be important, however, for many woodland birds the factors that currently limit populations are not fully understood (in some cases research is ongoing). The incidence of disease is affecting several native tree species (Elm, Ash, Oak, and Red-band needle blight now threatening Scots Pine) and appears to be increasing, with uncertain effects on the attendant fauna. UK Forestry Standard provides the foundation of the Government's approach to ensure conformance with international legislation such as the Birds Directive (administered by the Forestry Commission and Natural Resources Wales). Woodland management and its increase in cover are expected to contribute to priority habitat creation for 2020, for more, bigger and less fragmented areas for wildlife, but a conflict is that low productivity areas targeted for planting by landowners currently may be of greatest biodiversity value (e.g. Welsh ffridd).

4. LOWLAND HEATHLAND

4.1 Definition

Lowland heathland occurs on acidic, dry sandy or wet peaty soils, and is characterised by the presence of a range of dwarf-shrubs, including heather and gorse, below 300m. It may merge with wet flows and mire. Much of the habitat occurs in coastal counties of England and Wales (Suffolk, Somerset, the Gower, Pembrokeshire, the Llyn Peninsula, and Anglesey) but also inland, such as Thames basin, Breckland, the Midlands, Lincolnshire and Yorkshire.

4.2 Species' Trends and Drivers

In the England and Wales, lowland heathland is a priority for nature conservation as a rare and threatened habitat www.ukreate.defra.gov.uk/PDFs/Leaflets/Lowlandheath.pdf). Although none, bar Dartford Warbler, are heathland specialist species (Appendix D), characteristic bird species of lowland heathlands include Stone Curlew, Nightjar, Cuckoo, Woodlark, Dartford Warbler, Grasshopper Warbler, Tree Pipit, Linnet and Yellowhammer (and Hen Harrier in winter), all of which are red-listed species of conservation concern due to vulnerable populations (e.g. Dartford Warbler) or have strongly declining national populations (e.g. Tree Pipit and Yellowhammer, Eaton *et al*. 2012). Additional species that use open grass-heath or wet heathland, and are declining nationally include Grey Partridge, Curlew, Lapwing, Stone Curlew and Kestrel. The main causes of the historical decline in these species on heathland have been the depletion of the extent of the habitat (lowland heathland has declined in area by as much as 80% during the last two centuries) and deteriorating habitat condition, due to the following causes (www.jncc.defra.gov.uk):

- Habitat loss and fragmentation caused by housing development, agriculture and forestry.
- Habitat degradation causing loss of invertebrates and possibly other taxa (e.g. small mammals).
- Recreational disturbance and erosion or burning, especially close to built-up areas.
- Inappropriate management (over-grazing, burning), or scrub and bracken encroachment.
- Drainage/drying/abstraction affecting wet heathland and attendant insect populations.
- Disease, (fungal *Phytophthora*) causing dieback of bilberry/blaeberry plants.
- Nutrient enrichment from dog faeces, an increasing problem near built-up areas.
- Pollution: air pollution leading to dry deposition of ammonia. Wet heathland may be threatened by nutrient-enriched water, which encourages rank vegetation to spread.

In recent years, species such as Nightjar and Woodlark have shown significant signs of recovery following conservation intervention (Conway *et al* 2007, 2009) through regional heathland re-creation and restoration programmes to improve the extent and condition of the habitat. Overall, managing the heterogeneous quality of the heathland for (a) invertebrates (including large insects, such as moths, crickets, beetles and dragonflies) and (b) structural complexity (Dolman & Morrison 2012) may also be important for several key bird species, such as Woodlark (Dolman & Morrison 2012). Virtually all of the breeding species of lowland heathland are dependent on viable populations of invertebrates being present. Meanwhile, several species (Nightjar, Cuckoo, Dartford Warbler, Red-backed Shrike (potentially), Stonechat, Linnet & Yellowhammer and also Nightingale) have some reliance on structured or transitional habitats (including scrub) in juxtaposition with bare or physically disturbed ground (Fuller 2012). Meanwhile Stone Curlew, Skylark, Woodlark, Wheatear and Tree Pipits all nest and forage over the open grass/bare ground interface and Choughs too on the grassier components of Welsh coastal heathlands. In addition, Nightjars, larks, pipits & chats are all ground nesters. This makes them particularly vulnerable to changes in management and to accidental disturbance, such as by ranging dogs (e.g., Liley & Clarke 2003, Mallord *et al.* 2007).

4.3 Delivery Challenges: Actions that can Reverse Declines and Mechanisms Available

4.3.1 Mechanisms in place

Heathlands were recognised as an important habitat at a European level by the EU Habitats Directive in 1992. In England, Lowland Heath is a biodiversity priority habitat with a Habitat Action Plan (HAP) for restoration and re-creation, with a target set of restoring 58000 hectares and recreating a further 6000 hectares by 2020 (Defra 2011). A key vehicle for management delivery to date in England has been Environmental Stewardship Higher Level Scheme, with specific options available for heathland restoration, creation and maintenance. There are many separate heathland projects in place for example across the New Forest, Cannock Chase, Sherwood, Forest of Dean, North Yorkshire, and East Anglia (www.forestry.gov.uk/forestry/ 'A snapshot of local heathland restoration across England'). Many of the sites have designated SSSI/ASSIs, SAC or SPA status. Each of these projects plans to restore and/or recreate habitat and several have already recorded successes with bird species such as Nightjar and Woodlark or Stonechat (Balmer *et al.* 2013). Also critical to most of these projects has been the Tomorrows Heathland Heritage project partly supported by the Heritage Lottery Fund (www.hlf.org.uk/looking-funding/our-grant-programmes/tomorrows-heathland-heritage). Some details are provided in the case study accounts given below.

In Wales, lowland heathland is also a country-level priority habitat, with actions and targets set for their improvement and expansion. Natural Resources Wales and its partner organisations, such as the RSPB, National Trust, the Wildlife Trusts, National Parks, and local authorities, are taking forward much of the work to achieve these national targets. Added to this, around 13% of lowland heathland is included within SSSIs, Special Areas of Conservation and Special Protection Areas, which are important for lowland or maritime heath, and the bird species (primarily Chough) that they support. There are also codes of practice for English and Welsh Heather and Grass Burning. Other delivery mechanisms included Tir Gofal and its replacement scheme, Glastir. The Gower Commons Initiative and Pembrokeshire's Living Heathlands project are two examples of partnership working to deliver heathland restoration.

4.3.2 Limitations to mechanisms and remedial measures

As above, the restoration of 58000 hectares of lowland heathland, and recreation of a further 6000 hectares is planned for 2020 (Defra 2011). The condition of a third of the SSSIs in England assessed by Common Standards Monitoring is considered to be 'unfavourable' and showing no signs of recovery, but government has a targeted for 95% of SSSi sites (by area) to be in condition by 2020 (Natural England 2008). Since 2006-07 the condition of some coastal habitats has improved. But while habitat loss has slowed with protection and restoration programmes in place, habitat degradation and resilience (e.g. Mitchell *et al.* 2000) and dog fouling are still significant problems. For at least two projects, Dorset Heaths and Thames Basin Heaths, plans are in place to mitigate disturbance and recreational pressures by creating new green spaces to provide dog walkers with alternatives with easier access than the heathland sites.

Air pollution is a continuing problem and can critically alter the acidity and overall nutrient status of sites. Assessments indicate that critical air pollution loads for acidity and nutrient nitrogen are being exceeded on many lowland heaths, with dry deposition of ammonia very high in most parts of England and Wales (www.jncc.defra.gov.uk). Research in the Netherlands and the UK has demonstrated effects of Nitrogen deposition on the composition of heathland (De Graaf *et al* 1998, Kleijn *et al*. 2008, Southon *et al*. 2013). Excess soil Nitrogen can lead to a dominance of grasses (*Deschampsia flexuosa* and *Molinea caerulea*) at the expense of heather (Aerts & Heil, 1993). There

is legislation in place to reduce nitrogenous pollutants but work at Thursley Common in Surrey indicates that recovery will be a slow process, with the effects persisting for many years after additions cease (eg Barker *et al*. 2004, www.ukreate.defra.gov.uk/Lowlandheath.pdf).

The condition of heathland habitats is still a major concern in Wales too, facing difficulties in appropriate stock management and landowner acceptance of the need for a change in practice.
Heathland restoration itself can be a controversial exercise for locals where this means the destruction of existing habitats (especially tree-felling) or the construction of fences for livestock which then restrict movement and access to land. Nevertheless, trials have demonstrated some success in pH reduction and vegetation re-establishment, but requiring close management (Pywell *et al.* 2011).

4.4 Case Studies

The Dorset Heathland Project: (wwww.rspb.org.uk/whatwedo/dorset-heathland-project) is considered successful, though not without controversy over felling activities and other sensitivities. In 1989, there were about 5,600 ha of open heathland left in Dorset, together with a further 1,600 ha affected by the invasion of scrub and bracken. The initial target for the project was to increase the area of good heathland by 10 per cent over a 10-year period. This target was reached and regular monitoring has shown an expansion in ranges of monitored birds, invertebrates and plants. For birds, both nightjars and woodlarks have increased not only nationally, but also in local range extent and large-scale breeding density in Dorset amongst other areas of south-west England (Conway *et al*. 2007, 2009).

The Tomorrow's Heathland Heritage programme (THH) was one of the first major habitat restoration schemes supported by the Heritage Lottery Fund (HLF). The programme ran from 1997 to 2010 (www.hlf.org.uk/looking-funding/our-grant-programmes/tomorrows-heathland-heritage). Natural England, initially as English Nature, led the programme, with delivery of the habitat provided by local partnerships. The involvement of over 140 partner organisations ensured that technical expertise and local knowledge was shared, effectively pooling resources to maximise the chances of successful habitat creation or restoration. Around 2,500 hectares of lowland heath has been re-created and over 46,000 hectares has been restored from a degraded state. Improving the extent and quality of this habitat has benefitted bird species such as Nightjar, Dartford Warbler and woodlark alongside other wildlife (and people). Projects have been located all across the UK, from East Anglia to Northern Ireland and Scotland to the Isles of Scilly and have been valued in terms of cost, at around £26 million, with the Heritage Lottery Fund providing £14 million. Some examples are given below. In the Breckland area in the east of England, the Forestry Commission with other partners have restored more than 300 hectares of heathland, set within a mosaic of plantation, clear fell and open heathland. Further north in the Sherwood Forest area in Nottinghamshire, the Forestry Commission has worked with partners including local authorities, the wildlife trust and local landowners to re-create 200 hectares of heathland, set alongside other habitats such as acid grassland and birch-oak woodland.

'Suitable Alternative Natural Green Space' (SANGs) is the name given to green space that is of a quality and type suitable to be used as mitigation within the Thames Basin Heaths Planning Zone. Its role is to provide alternative green space to divert visitors from visiting the Thames Basin Heaths Special Protection Area (SPA). SANGs are intended to provide mitigation for the potential impact of residential development on the SPA by preventing an increase in visitor pressure on the SPA. This is an innovative solution benefitting both birds and people, and could be applied to other similar situations**.** An example of where this has worked well in practice with the development industry can be found near Fleet in Hampshire. Berkeley Homes put in a planning application for 300 houses at

their site at Hitches Lane, Fleet. The development site was within the five km zone of influence around the Thames Basin Heaths SPA. Evidence when the SPA was designated in 2005 showed that the majority of visitors to the SPA came from within a five kilometre linear distance, hence the requirement for avoidance and mitigation measures here. The development itself only required around five hectares of SANG to avoid and mitigate any likely significant effects, however the developer came forward with a proposal for a new thirty-five hectare Country Park. The land was previously agricultural land, but the developer produced an exciting proposal that adhered to all of the SANGs Guidelines. These include a circular walk of at least 2.3 km, and a semi-natural feel similar to what you would experience at the SPA. This meant that when the planning application was submitted, Hart District Council, as competent authority, was able to grant the planning permission. Construction of housing and SANG was able to begin. The SANG is currently open to the residents of the completed houses, and will be accessible to all very shortly. The developer is actually using the presence of the SANG, now called Edenbrook Country Park, to advertise the properties. The remaining capacity of the SANG is being used to unlock windfall development throughout Hart, which ordinarily on its own wouldn't be able to provide SANG. The developers make a financial contribution towards the management of the SANG, in return for the relevant amount of capacity they need to deliver the development (www.thesangsproject.co.uk).

4.5 Conclusions

Characteristic bird species of lowland heathlands include Stone Curlew, Nightjar, Cuckoo, Woodlark, Dartford Warbler, Grasshopper Warbler, Tree Pipit, Linnet and Yellowhammer (and Hen Harrier in winter), all of which are red-listed species of conservation concern due to vulnerable national populations (e.g. Dartford Warbler) or have strongly declining national populations (e.g. Tree Pipit and Yellowhammer) Heathlands were recognised as an important habitat at a European level by the EU Habitats Directive in 1992. In England, Lowland Heath is a biodiversity priority habitat with a Habitat Action Plan (HAP) for restoration and re-creation, with a target set of restoring 58000 hectares and recreating a further 6000 hectares by 2020 (Defra 2011). In Wales, lowland heathland is also a country-level priority habitat, with actions and targets set for their improvement and expansion. The condition of heathland habitats is still a major concern in England and Wales but restoration can be controversial involving felling or changes in management practice, and possible restrictions of access too, as disturbance or erosion by walkers and dogs can be a serious problem for habitats and wildlife.

5 FRESHWATER WETLANDS

5.1 Definition

Freshwater wetlands include a wide variety of aquatic habitats in lowland and upland landscapes including swamps, marshes, bogs, floodplains and fen. Wetlands are lands that have a natural supply of water due to geological or ecological factors and are covered or soaked for at least a part of the year. This section also includes linear waterways (rivers, streams and ditches) in lowland and upland environments.

5.2 Species' Trends and Drivers

A representation of freshwater species (Appendix E) is the freshwater wetland indicator of 26 species, which has remained broadly stable in the UK since 1975 (Defra 2014). However, for sub-habitats (fast-flowing waters, slow/standing water, reed beds and wet meadows) there are contrasting trends. Birds of 'slow flowing and standing water' (e.g. Mallard and Tufted Duck,) showed the most positive trend, almost doubling since 1975, whilst birds of 'reed bed' (e.g. Reed Bunting) declined from 1975 through to the 1990s but have since recovered slowly, possibly due to effective reed bed management. Conversely, birds of 'wet meadows' (e.g. Curlew, Lapwing, Snipe, Redshank and Yellow Wagtail) showed a marked decline since 1975. The index for 'fast flowing water birds' (e.g. Dipper, Grey Wagtail) has fluctuated in number but with an overall decrease by 28 per cent compared to 1975.

The wintering waterbird indicator (waders and wildfowl) increased steadily from the 1975-76 baseline to peak numbers in the mid-1990s. Since then, there has been a downward trend of 2%, but overall abundance remains above the 1975-76 baseline (Defra 2014). European White-fronted Geese, Pochard, Shelduck, Redshank and Ringed Plover show marked declines over the last decade (Shelduck and Redshank are at their lowest point for over 30 years), and numbers of Little Grebes and Great Crested Grebes have declined too. In contrast, numbers of wintering Avocet, Gadwall, Whooper Swan and Pink-footed Goose have increased dramatically (Austin *et al.* 2014), and there are generally increasing population (and range) trends for piscivorous species such as herons and egrets (Balmer *et al.*, 2013).

The declines in breeding freshwater wetland birds have several potential causes, including (Eglington *et al.* 2008, Fuller & Ausden 2008):

- Habitat loss and degradation due to drainage for urban development and arable conversion and general agricultural intensification.
- Changes in food availability due to point source and diffuse sources of pollution especially pesticides (resulting in reduction of insect prey) and nitrogen/phosphate (eutrophication).
- Acid deposition affecting water quality in rivers, with negative effects on species such as Dipper.
- Changes in climatic conditions in wintering grounds outside UK and carry-over effects for breeding recruitment in UK.
- Historical persecution of birds of prey such as Osprey and Marsh Harrier.
- Hunting pressure, as quarry species in the UK and as migrants outside the UK (legally and illegally).
- Nest and chick predation by avian and mammal predators.
- Recreational disturbance (Gill 2012). There is evidence that recreational disturbance (e.g. walkers, boat traffic) and species, such as terns, grebes and ducks, may avoid areas of high disturbance (Beale & Monaghan 2004a & b).

Wetland habitats cover expansive habitats, such as upland bog and mire (see above) and lowland wet grasslands (with links to farmland reclamation and management, above) as well as complex fen, reed, pond and water course mosaics. There is abundant evidence of extensive post-war losses to reedbed, fen, mire and lowland wet grassland to agricultural improvement and reclamation schemes and to industrial development, across the UK (eg., Green 1998, Wakeham-Dawson & Smith 2000, Vickery *et al.* 2001, Robinson & Sutherland 2002, Shrubb 2003, Eglington *et al.* 2008). Lowland wet grassland only survived at relatively small scales, with compounded breeding failure due to nest destruction and trampling and increase susceptibility to nest predation (eg., Ausden *et al.* 2009, Ausden & Bolton 2012, Baillie *et al* 2013). In addition to outright loss, the management of lowland grassland quality in Britain was transformed through drainage, high fertilizer inputs and re-seeding, to optimise yields for grazing or silage (Chamberlain *et al*. 2000, Fuller 2000, Vickery *et al.* 2001). The lowering of water tables alone adversely affects breeding wader populations (Green & Robins 1993, Vickery *et al*. 1997, Ausden, Sutherland & James 2001), and combined with intensive sward management, has played an important role in the decline of other grassland species too, including Corncrake (Green 1984), Whinchat and Yellow Wagtail (Bradbury & Bradter 2004, Fuller & Ausden 2008, Henderson *et al.* 2014). Generally, wintering wildfowl and allied species increased considerably from 1975/76 to 1996/97, likely driven by the improved protection of wetlands internationally (affecting migratory species), better hunting regulation and milder winters and changes in agricultural practices. In the last 20 years, some fen or reed specialists, such as Bittern and Breaded Tit, though still rare or localised, have begun to recover due to strong levels of habitat intervention and restoration, and a careful accumulation of ecological and demographic knowledge (for Bittern: Wotton *et al.* 2009, Gilbert *et al.* 2010). At the same time, a proliferation of inland water bodies, created originally for mineral extraction or water supply, has provided further new breeding habitat for species such as Great-crested Grebe, Tufted Duck, Gadwall, Common Tern, Oystercatcher and Little Ringed Plover (Fox & Salmon 1989). However, there are now strong declines in some species, notably Redshank and Shelduck but also Great Crested and Little Grebe (Austin *et al.* 2014) that are of concern.

Wetlands have also been subject to variations in habitat quality caused by a lowered water table, increased nutrient loads (eutrophication) due to diffuse pollution from agricultural run-off and sustained discharges of sewage effluent (Perrow *et al*. 1999, Neal *et al* 2010), potentially affecting food for birds (Allen *et al*. 2004). For Dippers, the acidification of upland streams, through acid deposition and afforestation (Buckton & Ormerod 1997) reduces breeding densities and productivity (Ormerod *et al.* 1991, Vickery 1991, 1992). There was no similar effect on more generalist species, such as Common Sandpiper *Actitis hypoleucos* or Grey Wagtail *Motacilla cinerea*, that are less reliant on aquatic invertebrates (Ormerod & Tyler 1991, Vickery 1991, Buckton & Omerod 1997).

Climate change effects on breeding habitats (Rehfisch *et al.* 2004) and fluctuations in winter conditions may also be important in determining apparent distribution (Gilbert *et al.* 2010). Increasingly milder winter conditions may contribute positively to the increases in wintering populations or geographic shifts in the population, as appears to be evident for some heron species and Reed Warbler (Balmer *et al.* 2013). In fact in the UK, breeding range expansion is evident across a range of phylogenies among wetland species (eg., Little Egret, Coot, Avocet, Little Ringer Plover, Reed Warbler, Cetti's Warbler in the last 40 years, Balmer *et al.* 2013). A warmer climate in the UK is expected to affect bird populations by changing properties of food availability, and with it (directly or indirectly), bird survival and/or productivity (Pearce-Higgins & Green 2014). In aquatic systems, especially at high latitudes, warming may increase primary production, especially of shallow or ephemeral waters, with consequences for food web characteristics. Mild winters are also associated with lower mortality in Mute Swans, followed by high reproductive output (Delany *et al.* 1992) and may have contributed to an increase in the breeding population of that species.

In the non-breeding season, there have been strong changes in the migration patterns of some wetland bird populations –especially waders such as Ruff (Verkuil *et al.* 2012), attributed to climate change. Range shifts above demonstrate a clear need for large scale strategic planning to accommodate future population flux, through protected habitat networks and to maintain accurate knowledge of bird movements over very large (national and international) spatial scales. This is especially important for wetland species since the majority are highly mobile. Currently, flyway characteristics are well monitored at least, for many waders and wildfowl (Austin *et al.* 2014).

5.3. Delivery Challenges: Actions that can Reverse Declines and Mechanisms Available

5.3.1 Mechanisms in place

Several initiatives have been established to manage, protect and enhance wetlands across the UK. UK and local Biodiversity Action Plans have established targets for the conservation of wetland habitats (particularly those which are priority habitats) and species. Agri-environment schemes have provided financial support to farmers to manage wetlands, to return arable land to grassland and raise water levels to improve habitat quality for many species. In 2008, the '50-year Wetland Vision' project for England (Wetland Vision, 2008) was produced by the Environment Agency, English Heritage, Natural England, the RSPB, and The Wildlife Trusts, with the Wildfowl & Wetlands Trust and National Parks supporting the steering group. This initiative has identified ambitious targets and encourages a large-scale approach to the creation of wetland mosaics over the next 50 years, taking into account coastal change predictions. This project complements Regional Plans, strategies and local projects. A number of different schemes are supported through the project. Natural England funding in 2008-09 supported creation or restoration of 690 ha wetland and during 2009-11, a further £4 million funding supported schemes within and outside the priority landscape areas. The 'Wetlands for Wales' project, a partnership between the Heritage Lottery Fund, Welsh government agencies and the RSPB, has already been successful in restoring and creating wetlands across Wales, including 250 hectares along the Dyfi estuary, where numbers of waders have been increased.

National and local organisations, often working with conservation agencies, have also made significant contributions to the restoration and management of wetlands to provide suitable habitat for endangered species, such as the Bittern (eg., Gilbert *et al* 2010). The Bittern's historic decline and its current rarity qualify it for red-listing in the UK Birds of Conservation Concern and it is also on the UK BAP list. Much effort has been put into the restoration and creation of new reed beds for Bitterns, which also provides habitat that supports other birds (e.g. reed bunting, bearded tit) and wetland species (e.g. water voles). However, changing the water levels during spring and summer to provide suitable conditions for breeding Bittern and halt reed bed succession can reduce the availability of suitable nesting areas for Bearded Tits (Wilson 2005). The RSPB has been placing nest boxes in reed beds to provide additional potential nest sites for Bearded Tit across the reserves. This highlights the need to understand the ecology of species within habitats, as managing habitat for one species can be disadvantageous for others.

The current agri-environment scheme in England is Environmental Stewardship (ES), although many agreements from previous schemes, Environmentally Sensitive Areas (ESAs) and original Countryside Stewardship Scheme (CSS) still remain in place. However, a freshwater wetland strand of ELS (except lowland grassland) does not exist. In Wales from 2012, the existing agri-environment schemes under the Rural Development Plan (Tir Mynydd, Tir Cynnal, Tir Gofal and the Organic Farming Schemes) were replaced by one scheme, Glastir, part of the Rural Development Plan for Wales 2007-2013, which has the potential to 'help' wetland habitat in future.

The Water Framework Directive (WFD) was designed to improve and integrate the way water bodies are managed throughout Europe. In the UK, it came into force in 2000, and much of the implementation work is undertaken by competent authorities, administered at the scale of river basin districts with a six-year planning cycle. The WFD was designated to enhance the status and prevent deterioration of aquatic ecosystems and associated wetlands, promote the sustainable use of water and reduce water pollution. In 2009, the Environment Agency published the River Basin Management Plans for England and Wales. In 2011, Defra announced extra funding designated for helping deliver WFD objectives over four years, and allocated £18M of this funding for a number of projects including the Catchment Restoration Fund for England (to support partnerships to reduce diffuse pollution, restore natural features and reduce the impact of man-made features in water courses) and Partnership Projects in Wales. Measures within the WFD are concerned with the management and restoration of aquatic and riparian habitats, creation and restoration of backwater habitats, management and use of large wood, re-meandering straightened rivers, and managing bank instability and erosion.

5.3.2 Limitations to mechanisms and remedial measures

Although improvement in the creation and restoration of wetland habitats has been achieved across the UK, most current management plans do not incorporate practices to make wetlands more robust in the face of climate change. The integrity of wetland habitats is prone to be affected by changes in rainfall and groundwater level, different river flow regimes, increased temperature and summer evaporation. However, the Environment Agency has developed a new Water Resources Strategy for England and Wales, directed towards the sustainable management of water resources. In Wales, this will now be taken forward through Natural Resources Wales.

Despite the implementation of agri-environment schemes and improvement of habitat conditions, the abundance of some species continues to decline (e.g. Snipe). This suggests that other aspects of habitat quality, such as prey abundance, might be driving the declines (Smart *et al.* 2008). Thus, appropriate management for invertebrate prey abundance should be incorporated into land management.

Localised predation may also limit the recovery of species on sites with good habitat management, particularly for ground-nesting species. Effort has been concentrated on creating the habitat conditions preferred by target breeding species, but the impact of this on other aspects of the food web is not well understood. Changes in habitat structure can also influence the distribution and abundance of other species and potentially increase the pressure of predation on nests and chicks. RSPB is currently undertaking research to understand predation effects on nesting waders in relation to habitat manipulation.

There are currently declines in some species in winter that are not understood, and require further research and closer attention. In particular, declining populations of coastal and estuarine species (Turnstone, Ringed Plover, Redshank and Shelduck) are of concern plus several inland and coastal diving duck species (Austin *et al*. 2014).

5.4 Case Studies

Bittern conservation action: The total European population of Bitterns was estimated to be 2500-2700 pairs in 1976. There was a 30-50% decline after the 1978/79 winter. In the UK, the bittern is listed as a former UK Biodiversity Action Plan (BAP) species for its historic decline and its current rarity. It is rare and threatened status led to its listing in UK and EU legislation, in particular under Annex 1 of the EU Birds Directive. Breeding pairs are almost entirely confined to lowland marshes in Norfolk, Suffolk and Lancashire. The RSPB and Natural England have been responsible, through the Action for Birds in England programme, for monitoring bitterns in the UK annually since 1990. The main factors causing bittern declines have been the loss of reed quantity and quality. The quantity of the reed bed around the UK has been declining since 1950s, with 50 % loss in the Norfolk and Suffolk Broads between 1946 and 1977. For this reason, Bitterns and reed beds are given high priority for action within Biodiversity: The UK Steering Group Report, which includes action plans for both. The UK BAP has the objective to create eight new landscape-scale wetlands by 2020. A series of reed bed-habitat restoration and creation projects was also initiated and promoted by RSPB, Natural England, the Wildlife Trusts and several other organizations, often in partnership and often with EU-LIFE funding. To date, numbers have responded well, though work continues to refine our knowledge and to identify the benefits to other wildlife of management aimed at further increasing Bittern numbers and productivity (eg., Gilbert *et al*. 2010).

The Fens for the Future Partnership works within the Fens Natural Area across the 'inland fens' of Lincolnshire, Cambridgeshire and Norfolk, excluding the coastal areas. There is a geographical and ecological link (via the River Nene) to the Nene Valley Nature Improvement Area (NIA). This is an ambitious and integrated project to create and restore a landscape-scale ecological network of multi-functional wetland habitats, set within a matrix of sustainable agriculture. The overall aims do not include those specifically relating to the provision of wild bird habitat. Rather, the approach is one of supporting and enabling wildlife (including birds) via improving the connectivity and the network of habitats within the landscape between enlarged and enhanced core target areas, thus increasing resilience and adaptation for species in the face of climate change. Partnership working is pivotal to the success of this approach. The Steering Group members include academic institutions, statutory agencies, non-governmental organisations, local authorities, wildlife charities, drainage boards and landowner representatives. The Partners pool and share expertise, evidence and technical resources. This reduces the likelihood of a piecemeal approach to wetland habitat restoration and creation and has the potential to strengthen funding bids. Sitting under this strategic approach, there are specific projects that provide wild bird habitat for the benefit of groups of birds or individual species, alongside other wildlife (and people). Examples include the Great Fen Project and Lakenheath Fen RSPB reserve, the former is discussed in more detail below. More information can be found at: http://www.lincsfenlands.org.uk/index.php?page=BiodiversityFensFuture

The Great Fen Project is a partnership 50 year vision which promotes and is delivering a landscape-scale multi-functional 3,700ha wetland mosaic located around two remaining fragments of lowland fen habitats that are found at the National Nature Reserves, Woodwalton Fen and Holme Fen in Cambridgeshire. Much of the land undergoing restoration was or continues to be under an arable farming regime. However, this land is gradually changing under a variety of management techniques, dependent on the hydrology, topography, water resource needs, availability and landowner consultation. In some areas, lowland wet grassland is being created that has attracted breeding lapwing and wintering waterbirds. In other parts, drier hay meadows are attracting hunting kestrels and owls. Reed bed construction is underway, providing suitable habitat for birds such as marsh harrier and bearded tit. Pockets of woodland and scrub will provide further diversity of bird (and other wildlife) habitat. Crucial to the success of habitat creation and ongoing management is the monitoring activity. Breeding bird surveys and wintering bird surveys are undertaken by a group of

volunteers and partners. The results show how wild bird communities (and other wildlife) are changing as the habitats develop and will be an invaluable evidence source upon which to base future land management activity. More information can be found at: http://www.greatfen.org.uk/.

5.5 Conclusions

There is abundant evidence of extensive post-war losses of wetlands to agricultural improvement and industrial development. Breeding Curlew, Lapwing, Snipe, Redshank and Yellow Wagtail showed a marked decline since 1975 as did birds of reedbeds. Reedbed species are beginning to recover to restoration management, but despite the implementation of agri-environment schemes, the abundance of wet meadows species continues to decline. Also on open waters, Little Grebe, Great Crested Grebe and Dipper have all declined. In winter, generally, wildfowl numbers have increased since 1975, probably due to improved protection of wetlands, internationally, better hunting regulation and milder winters. A proliferation of inland water bodies in the UK (gravel pits) has provided further breeding habitat for some species. The '50-year Wetland Vision' project for England (Wetland Vision, 2008) was produced by the Environment Agency, English Heritage, Natural England and NGOs. This initiative encourages a large-scale approach to the creation of wetland mosaics. The 'Wetlands for Wales' project has also restored or created wetlands across Wales. The Environment Agency has developed a Water Resources Strategy for England and Wales, directed towards the sustainable management of water resources, with Defra having announced extra funding in 2011 to help deliver WFD objectives.

6 MARINE AND COASTAL

6.1 Definition

The coastal/marine category includes maritime cliffs and slopes, coastal sand dunes, machair and coastal vegetated shingle, saltmarsh (sometimes sheep-grazed), mudflats, all inshore and offshore reefs, sediments, sea grass and mollusc beds on which bird species may depend for food.

6.2 Species' Trends and Drivers

The large and diverse area of coastal and marine habitats characteristic of the UK supports breeding populations of many different bird species, including internationally important numbers of breeding seabirds. For example, rocky coastline, with cliffs, islets and offshore islands support important numbers of breeding seabirds, whereas saltmarsh and estuarine habitat is extremely important for waders (e.g. Redshank), wildfowl (e.g. Shelduck), colony-nesting species (e.g. Common and Little Tern) and passerines (e.g. Reed Bunting) (Fuller 2012).

Trends in breeding populations for species are included in the tables in Appendix F (Marine & Coastal and with some species under Freshwater Wetlands). However, for some of these species (e.g. Teal, Pintail or Mallard), it is basically only the wintering population that occurs in coastal habitats, and for these species it is the wintering population trend that is most relevant. During the 20th century, many seabird species showed large increases in population size. For some, these increases were linked to growing human fisheries, due to increases in food discarded by commercial fishing and/or through high fishing pressure on large predatory fish leading to increases in the availability of smaller fish that normally are the main prey of seabirds. In some instances, the increases could be attributed to a decline in persecution at the start of the 1900s. However, the current situation for some seabird species has reversed, and regional declines have become apparent. Seabird breeding success in some parts of the UK has been very low and the total number of seabirds breeding in the UK is estimated to have declined by around 7.5% between 2000 and 2011 (MCCIP 2013). Breeding success and over-winter survival has been lowered by reduction of prey availability due to overexploitation and environmentally driven changes (e.g. reduction in sand eel abundance and changes in plankton communities caused by changes in sea temperature). Recent population decline has been observed in Lesser Black-backed Gull (partly compensated by increased range and exploitation of urban habitat) Surface feeders (Kittiwake and terns) have fared less well then diving species such as Gannet and auks (Defra 2014).

Many saltmarsh species are also facing considerable population declines, in particular Lapwing, Redshank, Snipe and Curlew. Declines are likely to be driven by a loss of breeding habitat in terms of quantity and quality of coastal saltmarsh and wet grasslands (the latter covered under the 'Freshwater' habitat, Newton 2004, Wilson *et al.,* 2004, Fuller & Ausden, 2008).

Other factors have been identified as drivers of population change in species breeding in coastal/marine habitats, including (www.jncc.defra.gov.uk):

- Habitat loss and degradation of coastal saltmarshes due to changes in agricultural practices (particularly drainage and the intensification of farming) and grazing regimes (resulting in changes to vegetation structure).
- Threats from marine pollution (oil or chemicals)
- Changes in food availability linked to environmental/oceanographic changes and overexploitation by fisheries.
- Loss of nesting habitat due to human disturbance, farming operations, trampling of nests and chicks.

- Intensified predation on remaining breeding sites e.g., by American Mink and Brown Rat as well as by corvids, gulls & Foxes.
- Coastal development and coastal erosion as a consequence of sea level rise.

Coastal habitats, in particular estuaries, provide resources and shelter for a great diversity of bird species during the non-breeding season. Estuaries support a wide range of many species of waders and wildfowl. It is particularly important for species such as Shelduck, Teal, Wigeon, Bar-tailed godwit, Dunlin and Knot. Large numbers of Lesser Black-backed, Herring, Common and Black-headed Gulls also are common in estuaries in winter (Burton *et al*., 2003). The seeds of saltmarsh plants provide key resources for seed-eating species such as Twite (Brown and Atkinson, 1996).

The population trends of wintering waders vary amongst species. Some species (e.g. Ringed Plover, Dunlin) have been suffering long-term declines (Holt *et al.,* 2012), whereas others have experienced declines more recently (e.g. Curlew and Redshank). Similarly, some sea ducks, dabbling and diving ducks (e.g. Velvet Scoter, Eider, Mallard and Pochard), demonstrate long-term declines. Wintering gulls show mixed fortunes, with Common and Lesser Black-backed Gulls both showing signs of decline, whilst numbers of Black-headed, Herring and Great Black-backed Gull appear to be relatively stable, and an increase in Mediterranean Gull is evident across coastal sites in Britain (sites covered by WeBS). The populations of a range of other wintering species such as Avocet and Black-Tailed Godwit, Whooper Swan, Barnacle Goose and Little Egret continue to rise (Eaton *et al*. 2012).

Wintering populations face different pressures to breeding populations. The declines in wintering coastal/marine birds have several potential causes, including (Gill 2012, Davy *et al.* 2009, Austin *et al.* 2014):

- Habitat loss resulting from land claim, dredging, human development (e.g. renewable energy developments, ports and marinas) and sea level rise (Gill 2012).
- Grazing has a marked effect on the structure and composition of saltmarsh vegetation by reducing the height of the vegetation and the diversity of plant and invertebrate species. Less intense grazing produces a tussocky structure which favours breeding waders.
- Human disturbance from recreational disturbance (e.g. water sports, wildfowlers, dog walkers) or from boat/plane/road traffic (Gill 2012).
- Changes in food availability linked to overexploitation by fisheries (e.g. shellfish, discards), the amount of organic nutrients discharged into coastal waters (discharges can increase food availability), and changes in agricultural practices (improvement of foraging opportunities for some goose species), Stillman *et al*. 2001, Atkinson *et al*. 2004 .
- Climate change: changes in temperature, the timing and extent of precipitation and the frequency and severity of extreme weather events can positively or negatively influence habitats such as saltmarsh, or bird populations (Norris *et al.* 1998). Low juvenile and adult survival rates can result from extremely cold weather conditions. Changes in climate and severe weather events are also implicated in recent easterly re-distributions observed in many wintering species' ranges (Austin & Rehfisch, 2005).
- Restrictions on hunting (Gill 2012).

6.3. Delivery Challenges: Actions that can Reverse Declines and Mechanisms Available

A number of species and habitat management schemes have led to the recovery and increases of some of the coastal/marine species. With one exception (Black Guillemot), all regularly occurring seabird and sea duck species are proposed to be protected as designated features of Special Protection Areas in the UK. However, these will only protect a proportion of the population with significant numbers occurring outside SPAs. The SPA network in the UK is fairly comprehensive for

the protection of coastal/near shore areas that support significant numbers of birds (Stroud *et al.* 2001) but less good for marine areas that are further offshore – though work is being done to identify and protect these areas (marine SPAs (or in some cases Marine Conservation Zones - MCZs) are currently being considered by the government). Local and regional coastal/marine initiatives, particularly on SSSIs promote the management of important breeding sites to provide and protect nesting habitat, reduce human disturbance and control predation (Burges & Hirons 1992, Morrison & Gurney 2007). Eradication projects (e.g. for brown rats) have been implemented on some islands (e.g. Puffin Island / Ynys Seiriol, North Wales) with the successful result of some seabird species recolonizing the island. Sand Eel shortages, linked to oceanographic changes and fisheries (Frederiksen *et al.,* 2004) have also been associated with the declines in seabird breeding populations. In 2000, following advice from the International Council for the Exploration of the Sea (ICES) Advisory Committee on the Marine Environment, summer fishing for sand eel was banned around the east of Scotland and north-east England (Wright *et al.,* 2002), with reopening dependant on Kittiwake breeding success, which has shown some signs of improvement since the ban, whilst that of Common Guillemots and Razorbills in the same area has declined.

The UK is very important for many wintering species, with many sites supporting more than 1% of the international population. Thus, all such sites are designated as SPAs for their wintering populations. However, conflict can occur, for example between shellfisheries and waders such as Oystercatcher and Knot. Human overexploitation of shellfish stocks can lead to increased mortality, reduced body condition, breeding success and juvenile settlement in the birds (Atkinson *et al*. 2003, 2005). In the Wash, one of the most important sites in the UK for waterbird conservation, fishing restrictions have been put in place by the Eastern Sea Fisheries Joint Committee, and the farmed mussel cultures have been encouraged to allow wild mussel beds to recover, maintain a steady income for fisherman, and provide suitable feeding grounds for bird species (Atkinson *et al.,* 2010) – see Case Study.

6.3.1 Limitations to mechanisms and remedial measures

Coastal development projects (e.g. tidal barrages) reducing bird habitat have historically compensated by providing habitat at neighbouring sites. However, birds can have difficulty in settling in these new areas and can exhibit reduced winter survival and body conditions (Burton et al., 2006).

The feeding range of many seabird and sea duck species remains unknown. More research on this area is required, though the use of tracking devices on gulls for example (by satellite or GPS), are now helping to elucidate seasonal and inter-seasonal details on bird movements (Thaxter *et al* 2012). A network of Marine Protected Areas is required to improve their feeding conditions and influence breeding success and survival. Also, MPAs to protect species from over-fishing shellfish may not be effective if over-fishing continues occurring in adjacent areas (Burges & Hirons 1992, Harris & Wanless 1997, Verhulst et al. 2004). The UK currently has 107 SPAs with marine components, but only three of these are entirely marine: Carmarthen Bay (for its non-breeding aggregations of common scoter), the Outer Thames Estuary and Liverpool Bay (for their non-breeding aggregation of red-throated diver and common scoter in Liverpool bay). Work is currently undertaken by JNCC and nature conservation agencies to identify further SPAs with marine components. Different types of marine SPAs are currently being considered to cover different aspects of the marine environment: marine extensions to existing seabirds breeding colonies SPA (extension of existing boundaries into the marine environment to protect maintenance areas and feeding grounds), inshore aggregations of non-breeding waterbirds (feeding and moulting areas and migration staging posts for divers, grebes and sea duck) and offshore aggregations of seabirds (protection of important seabirds concentrations in the open sea).

6.4 Case Studies

Mussel fishery – the Wash: During winter, Oystercatchers are heavily reliant on cockles (*Cerastoderma edule*) and mussels (*Mytilus edulis*), both commercially important shellfish species. This has led to conflicts between fishery managers and nature conservation interests in Britain and the Netherlands (Ens, 2002), because dredging for shellfish can significantly reduce food supplies for many species of waterbird. In The Wash, one of the most important estuaries in UK supporting waterbirds, the cockle and mussel stock collapsed in 1992. Atkinson *et al.* (2003) provided evidence that the decline in Oystercatchers and other bivalve-feeders in the early 1990s in the Wash was largely caused by overfishing of the mussel beds. The low recruitment of mussel spat in the 5 years prior to 1992 and the high rate of exploitation of the fishable stock led to the collapse in the adult stock. When cockle stocks were low in the 1991-1992 winter mass Oystercatcher mortality was observed, which was repeated to a lesser extent in the later three or four winters. In normal circumstances (when there is no overfishing) mussel populations act as a buffer against Oystercatcher mortality in years of low cockle abundance. As a consequence of collapse of the mussel stock, fishing restrictions were put in place by the Eastern Sea Fisheries Joint Committee (The Wash Fishery Order 1992) and the wild mussel fishery closed in 1994. Since then, there has been a recovery of the wild mussel beds and the farmed mussel stock also increased. This increase in mussel culture meant that fishermen managed beds to maintain a steady income, but this also provided nature conservation benefits when wild mussel stocks were low reducing pressure on the wild beds. Thus, changes in policy and the shift in fishing from wild beds to small, intensively farmed ones, allowed wild mussel beds and birds to recover.

The Wallasea Island Wild Coast Project: Prior to being enclosed by the current sea walls, **Wallasea 'Island'** was made up of five separate saltmarsh islands - each with dwellings and managed as separate grazing enterprises. These areas of saltmarsh were progressively enclosed by sea defences, eventually developing the current island shape. Some small-scale arable areas were present periodically but the area was largely managed with sheep as Essex coastal grazing marsh until the drainage/conversion to arable took place from the 1930s. The Wallasea Island Wild Coast Project will transform this island back into an intertidal coastal marshland. The Project will strive to create a rich area, not only for wildlife, but for people too – the benefits of which will be felt throughout the local community and much further afield. It will also help with flood alleviation in the area. After careful consultation and examination, a managed realignment option was deemed the most appropriate, providing the low land level could be raised. In early 2008 Crossrail - a British project to build major new railway connections under central London approached the project. Crossrail were seeking a beneficiary to reuse the clean spoil from their tunnelling. Managed realignment is an intertidal habitat creation technique, using breaches (holes) in the sea wall to allow the sea in to recreate intertidal habitats - the resultant habitats are dependent on the height of the land being flooded. The material from the Crossrail partnership will consist of clay, chalk and gravel and will help transform the site into nearly 1,500 acres of tidal wildlife habitat. The new habitats created through this project will support an array of nationally and internationally important bird populations, as well as a host of other wildlife. This new, wild coast will enable visitors to experience a rich, wonderful environment full of biodiversity.

6.5 Conclusions

Many saltmarsh species are facing considerable population declines, in particular Lapwing, Redshank, Snipe and Curlew. Declines are likely to be driven by a loss of breeding habitat in terms of quantity and quality of coastal saltmarsh and wet grasslands due to changes in agricultural practices and grazing regimes. Some sea ducks, such as Velvet Scoter and Eider that feed on shellfish, demonstrate long-term declines. The populations of a range of other wintering species such as Black-Tailed Godwit Brent Goose and Barnacle Goose continue to rise, and a number of habitat management schemes and protection have led to the recovery and increases of some of the coastal/marine species, such as geese. With one exception (Black Guillemot), all regularly occurring seabird and sea duck species are proposed to be protected as designated features of Special Protection Areas (SPAs) in the UK. However, these will only protect a proportion of the population with significant numbers occurring outside SPAs. The SPA network in the UK is fairly comprehensive for the protection of coastal/near shore areas that support significant numbers of birds (Stroud *et al.* 2001) but less good for marine areas that are further offshore, and work is being done to identify and protect these areas (marine SPAs are currently being considered by JNCC). The UK is important for many wintering species, with many sites supporting more than 1% of the international population of wildfowl or waders. All such sites are designated as SPAs for their wintering populations.

7. URBAN HABITATS

7.1 Definition

The urban environment encompasses a wide range of habitat types from city centre streets to public parks, gardens, brown-field and green areas, which provide a variety of nesting, roosting and feeding opportunities for many bird species, though none of these are priority habitats.

7.2 Species' Trends and Drivers

Very few bird species are considered specialists of the highly anthropogenic urban environment, but this habitat is occupied by large numbers of many more generalist species (Appendix G). The now discontinued urban bird indicator, calculated for 27 breeding bird species that are typical of towns and gardens, but also other landscapes increased by 9% between 1994 and 2007, with most of the increases occurring before 2000 (Defra Statistical Release 2012). However, this increase masks a decline amongst urban 'specialists' such as Swift (-50%), House Sparrow (-38%), and House Martin (-35%) as well as other species (e.g. Mistle Thrush (-42%), Starling (-35%) and Song Thrush (-20%). In Appendix A-G, we report population trends and drivers for eleven red or amber listed species with substantial urban populations, including two increasingly inland-breeding gull species. Herring Gull and Lesser Black-backed Gull have adapted well to urban areas, switching their natural habitats for artificial ones and nesting on the rooftops of buildings and foraging from landfill sites. Potential causes of declines in terrestrial urban birds include:

- Habitat loss: particularly the loss of suitable nesting habitat in old buildings due to building improvements or replacement by new buildings affecting birds dependent on holes and cavities for nesting such as house sparrow, swift and starling. Also the loss of feeding, breeding and roosting habitat due to the encroachment of urban expansion into parks and green areas (Traltos *et al.* 2007).
- Less food available due to cleaner tidier urban environment and in gardens/parks the use of herbicides and pesticides potentially reducing invertebrate prey, or non-native plants being less productive for invertebrates as bird food (Chamberlain *et al.* 2007, Chamberlain et al. 2009, Shaw *et al*. 2011).
- Predation, particularly by cats, and possibly squirrels for species nesting in accessible locations or species that spend a lot of their time in suburban gardens (e.g. Starling and House Sparrow) (Thomas *et al.* 2012).
- Pollution and disease: the spread of avian botulism amongst some species (e.g. Herring Gull) and other diseases related to the digestive system, causing difficulties to the bird in swallowing (e.g. sparrows). Some of these diseases, *Trichomonosis*, Avian pox and *Colibacillosis*, may be spread more easily in areas with a high concentration of birds (e.g. around bird feeders) and have become more prevalent in recent years (Lawson *et al*. 2012a, 2012b).
- Possible deleterious effects of supplied fatty foods depressing breeding performance in some urban species (Harrison *et al* 2010, Plummer *et a*. 2013).

The Countryside Surveys 2000 and 2007 reported that "*Built-up and Gardens* Broad Habitat" and transport features totalled about 2.3 million ha in 1998 (and did not increase by 2007), almost 10% of the total land surface of Great Britain with economic and demographic pressures likely to remain present for the foreseeable future. Housing developments built on farmland and semi-natural habitats have potentially direct and indirect impacts on wildlife and on wildlife "amenities", such as river corridors, heathlands, woodlands and coastal strips (e.g. Liley & Clarke 2003, Woodfield & Langston 2004). At the same time, there is recognition that mature housing environments may support relatively high populations of some bird species (e.g. Song Thrush – Mason 2000) or bird

communities (Tratalos *et al.* 2007), in some cases exceeding population densities observed in poorer landscapes such as intensive open farmland (e.g. O'Connell et al. 1998). For birds, the long-term benefits of suburban "succession" (shrub maturation) may be under-estimated. Furthermore, there is evidence that relatively high biodiversity within urban areas is perceived positively by humans and therefore measures to improve urban biodiversity are also likely to improve the quality of life of the human population (Fuller *et al*. 2007). However, very much less attention has been given to quantifying net levels of change in urban bird biodiversity or change caused by expansion into rural areas (Henderson *et al.* 2007). This lack of information prevents objective assessments of risk.

7.3. Delivery Challenges Actions that can Reverse Declines and Mechanisms Available

National and international legislation provides the legal basis for the protection of urban birds, and includes the Birds Directive (2009/147/EC) and Habitats Directive (92/43/EEC). Many of the species listed in the table and their nests are fully protected under the Wildlife and Countryside Act, 1981. Limited measures exist that provide protection for urban birds and currently, some research is needed to understand the causes of population changes in urban environments. The UK and local Biodiversity Action Plans had already established targets for the provision and protection of nest sites (e.g. House Sparrow) but for most urban species, the most appropriate delivery mechanism involves 'Planning Policies & Control' and 'Species Licensing and Legal changes'. For birds, this should ensure that home-owners, Local Authorities, developers and others consider the needs of species through building and green space design. However, a lack of knowledge of the remedial measures needed for most species in the urban environment may hinder delivery. Once research into factors limiting abundance and distribution in urban-suburban landscapes is complete, and mitigation measures have been identified it may be possible to implement these on sufficient scale.

Urban bird monitoring used by Defra, via the BTO, includes the Garden Bird Watch and Garden Bird Feeding Survey (funded by membership) but also the national monitoring scheme the Breeding Bird Survey (BTO/RSPB /JNCC BBS) which includes an urban element. Also, a number of on-going surveys are carried out for different species by the BTO, RSPB and local Wildlife Trusts to investigate in more detail the ecology and demography of this group of species.

The urban environment does differ from the other landscape categories in being less clearly defined or perhaps being perceived differently in terms of what it can deliver towards the Birds Directive. It does not benefit from large scale or national strategic planning in the way FC forest design planning or farmland agri-environment planning does, and relies on local initiatives to integrate planning policy and stakeholder interests. The urban environment frequently supports existing habitat of significant wildlife value – such as woodland, riparian or wetland that play a central role in urban green space design and strategically planned green infrastructure of urban areas to connect habitats (Natural England 2009). Government recognition of the social as well as wildlife value of the urban environment is implicit within its new flagship policy for Nature Improvement Areas (NIAs) via 'The Natural Choice'(Defra 2011b), which sets out aims to improve the quality of the natural environment across England, to halt the decline in habitats and species, and strengthen the connection between people and nature. This is a commitment by Government to support the natural environment, to function more effectively through joined-up action at local and national levels and to create ecological networks which are resilient to changing pressures. It includes an urban NIA: "Birmingham and the Black Country Living Landscape". In this instance, the NIA will create heathland on brownfield sites and 40 hectares of new native woodland.

Also the National Planning Policy Framework (March 2012) includes as one of its *'dimensions of sustainable development'* an 'environmental role' which contributes to protecting and enhancing our natural, built and historic environment, and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate

change (including moving to a low carbon economy). As regards pollution, urban diffuse pollution in rivers and waterways severely damages ecosystems in rivers, streams and ponds. Currently, many water body failures are due to urban and other non-agricultural diffuse pollution. Cleaning-up polluted urban rivers is considered to have significant benefits for health, quality of life, aesthetics and wildlife. Thus, the multi-functional benefits of urban planning are recognised in the Core Planning Principles that promote multiple use benefits from urban land, such as for wildlife, recreation, flood risk and pollution mitigation, carbon storage and food production. Here, pursuing sustainable development involves seeking positive improvements in stemming the net loss of bio-diversity. Further policy guidelines recommend:

- A requirement for local authorities to consider all pillars of sustainable development – economic, social and environmental – in planning and decision making
- An emphasis on gains for biodiversity through the planning system
- Encouragement for local authorities to plan for the development of ecologically coherent networks
- Reduce habitat fragmentation as one of the most significant drivers of biodiversity loss across all ecosystems. This process, by which habitats are transformed into smaller and more isolated fragments, has intensified over the last 20 years primarily as a result of on-going urban expansion.

One significant limitation is that the built habitat is difficult to protect through the existing system of site designations (e.g. Site of Special Scientific Interest/ Local Wildlife Sites) because the criteria for site selection currently used are unlikely to rate buildings and the built environment as being of importance.

7.4 Case Studies

City wildlife projects: Actions to improve the urban environment for wildlife have largely been a matter driven by local government authorities to act through city wildlife projects. One of the longest serving and perhaps the best example of this process is provided by the progress and vision for urban wildlife by Leicester City, originally via the City of Leicester Biodiversity Action Plan 2010-2020. Leicester has made a significant commitment to promoting biodiversity in the city by being one of 21 pioneering cities around the world that are currently participating in the urban biodiversity project: Local Action for Biodiversity, to protect and enhance sites of nature conservation value in the city, to identify new sites and to encourage participation. Leicester City now publishes reports on the state of biodiversity, as a public record. The purpose is to conserve a range of habitats contributing to the regional and national biodiversity whilst providing an attractive and sustainable natural environment in which to live, work, learn and enjoy. Leicester City works with many partners to help protect and conserve wildlife and to incorporate nature conservation into all aspects of development and education. Specifically, Leicester City Council aims to increase the area of woodland cover via the 10,000 tree project, to plant trees around Leicester on public and private land. Meanwhile, monitoring and recording of wildlife will help identify whether targets are being achieved and where further attention needs to be focussed to safeguard the habitats and wildlife associated with them.

Urban greenspace planning: More than half of the land within towns and cities is not built on, and much of this space includes aspects of the natural environment. However many existing urban green spaces are not designed or managed to optimise their full potential for people or wildlife. The RSPB's London House Sparrow Project and the London Parks and Greenspace Forum's Small Parks and Squares report both demonstrate that simple changes to greenspace management can improve conditions for birds in urban areas and the attractiveness of the space for people. Monitoring 25 habitat treatment plots in 19 London parks, the house sparrow project concluded that relaxing of grass cutting regimes provides increased invertebrate food for wild birds and reduces park

maintenance costs. Wild bird seed mixes of native and non-native species were the most used treatment by house sparrows, particularly in the spring and summer months when foraging for invertebrate chick food, and proved to be the preferred treatment of park users (Weir 2012). In addition to food provision, the habitat structure of urban greenspace is an important determinant of an area's value for biodiversity. The work of the London Parks and Greenspace Forum concludes that the best-managed green spaces for people, with a rich, well vegetated and well-maintained landscape, are also the most likely to be good for birds. Providing different layers of vegetation, dead wood and retaining ivy-clad trees were all important management requirements. Sites with a shrubby understory that was of medium to tall height supported a greater species diversity including Blackcap, Wren, Dunnock and other species associated with woodlands and woodland edge habitat (Sibley *et al.* 2004).

The Black Redstart: This species is a rare breeding bird on the north-western edge of its range in England, with a population of around 40-50 breeding pairs present each year. It is afforded special protection under Schedule 1 of the Wildlife & Countryside Act (1981) and is an amber-listed Bird of Conservation Concern. It has some rather specific and unusual habitat requirements, being found predominantly in urban areas in England. These mimic the bird's natural preference for dry, rocky or stony habitats in areas of central and southern Europe where it is a common and widespread species. It is often found in derelict industrial areas in England making it vulnerable to disturbance and nest destruction during regeneration projects. London is a major stronghold for this species. In parts of London where it breeds regularly the bird has now become a flagship species for local landowners and businesses. Information leaflets and online guidance (e.g. www.blackredstarts.org.uk/) has been produced to raise awareness of the species, its habitat requirements and legal obligations that must be adhered to in order to protect breeding birds and their habitat. Bespoke habitat for black redstarts has been created in the main breeding areas in London, often as part of mitigation for new development projects, with the London Wildlife Trust and other conservation bodies working closely with developers and the local planning authority. Given the limitations of space available, as part of redevelopment projects in London some new habitat has been created on the roofs of new buildings. Patches of stonecrops have been provided together with areas with a mixed aggregate base, which can be colonised naturally by ruderal plants and associated invertebrates. These 'green roofs' also have an amenity value and provide habitat for a range of urban wildlife in addition to the black redstart. This work was pioneered at Deptford Creek and the approach has now been adopted in several different areas in London as well as in other cities in England.

7.5 Conclusions

The urban environment is occupied by large numbers of many more generalist species but there has been a decline amongst urban 'specialists' such as Swift, House Sparrow and House Martin, as well as Starling. However, Herring Gull and Lesser Black-backed Gull have adapted well to urban areas, switching their natural habitats for artificial ones and nesting on the rooftops of buildings. Limited measures exist that provide protection for urban birds and currently, some research is needed to understand the causes of population changes in urban environments. The most appropriate delivery mechanism involves 'Planning Policies & Control' and 'Species Licensing and Legal changes'. The urban environment does differ from the other landscape categories in being less clearly defined or perhaps being perceived differently in terms of what it can deliver towards the Birds Directive. But Government recognition of the social as well as wildlife value of the urban environment is implicit within its flagship policy for Nature Improvement Areas (NIAs) via 'The Natural Choice, to incorporate green space, create ecological networks, cleaning-up polluted urban rivers for reasons of health, quality of life, aesthetics and wildlife. The multi-functional benefits of urban planning are recognised in the Core Planning Principles that promote benefits for wildlife, recreation, flood risk and pollution mitigation, carbon storage and food production.

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APPENDIX A. A SUMMARY OF EVIDENCE FOR DECLINES AND DELIVERY MECHANISMS

Lowland farmland: A summary of population trends, limiting factors where known and delivery mechanisms available, for current Birds of Conservation Concern and priority species associated with this habitat. Sources include BTO Bird Facts (Robinson 2005; www.bto.org/birdfacts) and Bird Trends (Baillie et al 2014). Population estimates via Musgrove et al 2013 (B=breeding pairs/territories; W =winter individuals). Population trends are via State of the UK's birds 2011 (Eaton et al 2012), BBS 2011 (Risely et al 2012) and the National Atlas 2007-2011 (Balmer et al. 2013; BTO).

Species	BoCC status red/amber & Section 41, 42 priority species		UK Popl. Best est. 2012	Long-term popl. trend % 1970-2009 ('-' denotes a declining trend; no symbol denotes a positive trend)	Regional variation ('-' denotes a declining trend)	Probable, current demographic limitations	Causes of trend within the UK relevant to lowland farmland	Delivery mechanism in place?	Mechanism limitations?	Evidence or main source	Relevant subjects identified in Article 12
Summer habitat or resources probably limiting, limiting effects largely or partly understood											
Grey Part-ridge	r	S41,S42	43,000 (B)	-91	Now an arable specialist. Rarer still in western grassland systems.	Post-nesting effects on survival and population retention.	Impoverished insect & seed resources in later summer and winter. AES winter seed can reduce popl. decline.	AES options for arable systems Glastir in Wales.	Invertebrate chick food critical but difficult to manage appropriately in the wider countryside. Prescription uptake maybe biased towards boundary options less beneficial to this species than in-field options? AES funding is critical and locally numbers can be increased where food & nesting habitat are provided and pesticide use restricted, but usually with predator control.	Well studied. Recently: Aebischer & Ewald 2012; Sotherton *et al.*2014). Baker et al 2012	
Kestrel	a	S41,S42	46,000 (B)	-44	Engl: -13% Scot: -58% Wales: -50% (1994-2006; BBS)	Integrated analyses suggest that changes in first-year and, particularly, adult survival are the primary contributors to population change.	Nest success appears good. Impoverished small mammal populations could be limiting productivity or survival?	AES field margins? Glastir in Wales	More research is needed to establish links between potential ecological factors, especially food, land-use and Kestrel population change. Lack of scale of uptake of appropriate ES measures on arable land. Prescription uptake is biased towards boundary and margin options, which may be less beneficial to this species than in-field options. The level of funding behind AES is critical No extensively managed grassland AES options for summer or winter or options for mixed farming.	RSPB Leech & Barimore 2008 Robinson *et al.* 2014.	

Crane	a		52 (W) 9-14 (B)	Recovery		Population recovery	Probably became extinct because of over-exploitation (last breeding in England in 1542). Natural re-colonisation and re-introduction.	Wetland management and protection. Re-introduction.	Not yet known whether habitat availability, predation, human disturbance and collision risk will constrain population growth. No AES for encouraging mixed rotations or seasonal flooded farmland?	WWT, RSPB www.thegreatcraneproject.org.uk	
Stone-curlew	a		350 (B)	Recovering from historical decline	E Anglia and S Downs/Wiltshire	Safe breeding habitat on free-draining soils, farmland.	Bespoke habitat provision and monitored nesting.	AES plots and protection from farm field operations.	Limitations to site and nest protection and disturbance management	Well studied; eg., Green et al. 2000; RSPB	
Corn crake	r	S41,S42	1,200 (B)	Apparent slow increase	Wales -100% since 1981	Breeding (UK) (Over-winter survival?)	Lack of breeding habitat and management: Early & late cover & delayed mowing needed.	AES (regional) And the SPA network Glastir in Wales	No appropriate measures for wet grasslands on a larger geographic scale? Numbers have recovered following targeted habitat management, but most of their previous range is still unoccupied.	Well studied; eg., Green et al. 1997; Green & Gibson 2000 RSPB	Abandonment of pastoral systems, lack of grazing. Agriculture intensification
Lapwing	r	S41,S42	140,000 (B)	-48	England -14% Wales -77%	Low survival during the 1980s, and habitat loss; Productivity now very low too.	There is a good evidence for a lack of breeding habitat due to agricultural intensification of the lowlands (wet grassland, arable land and the loss of mixed farming). Lower densities on arable-only or grass-only farmland and high predation or nest losses.	Glastir in Wales AES?	Bigger areas of habitat are needed, that are resilient to climate change & predation. Low uptake of fallow AES options. Local predation may exacerbate low levels of recovery. No appropriate AES measures for grassland breeding habitat and inverts.	Large literature: 'Action for Birds In England' (AfBiE) wader project. Devereux et al 2004; Bolton et al 2007; Bodey et al. 2011; Smart et al 2013.	Agriculture / modification of cultivation practices / agricultural intensification .
Curlew	a	S41,S42	68,000 (B)	-60	Engl: -41% Scot: -53% Wales: -49%	Breeding habitat. Post-breeding survival poorly understood; productivity now low too.	Most serious declines associated with grassland management, lack of suitable breeding habitat leading to restricted populations and low productivity.	AES Glastir in Wales	Localised predation may exacerbate recovery (Tharme et al 2001). However, on land use practice in upland and lowlands may reduce the extent of suitable habitat. Still,, the level of funding behind AES is critical. Appropriate measures in AES are needed for grassland breeding habitats, to control grazing, create wet ground, and control field operations.	Fletcher et al 2010. AfBiE project: is aimed at 'Determining the causes of curlew declines'. O'Brien et al 2011, Douglas et al 2014.	Natural system modifications / human induced changes in hydraulic conditions, Agricultural practices. Natural biotic and abiotic processes.

Turtle Dove	r	S41,S42	14,000 (B)	-91	Large range contraction from west. Low densities in the east.	Breeding conditions? Disease? Decline in over-winter survival?	Lack of 'arable' weeds and weed seeds (early and mid-summer) and thus a truncated breeding season.	AES - summer fallows Glastir in Wales	Lack of scale of uptake of appropriate ES measures for weed seed provision in summer. No appropriate AES measures for weed seed provision in grassland systems or to encourage mixed farming.	Browne & Aebischer 2005; Browne et al 2005; Dunn & Morris 2012 Stockdale et al 2014. RSPB	
Yellow Wagtail	r	S41,S42	15,000 (B)	-72	Losses from grassland and mixed farming west & south; now also from the s-e England	Breeding conditions? (Over-winter survival?)	Suitable breeding habitat includes mixed rotations (beans, potatoes). Original damp grassland pop. now very low.	AES? Glastir in Wales	Limited uptake of in-field ES measures (skylark plots) or encouragement for mixed rotations. No appropriate extensive grassland management in AES for damp soil inverts.	Gilroy et al 2010 Mortimer et al 2007; Ockenden et al. 2012	
Skylark	r	S41,S42	1,500,000 (B)	-58	Engl: -23% Scot: 5% Wales: -20% (BBS since 1995)	Winter survival. Productivity (fewer 2nd broods), breeding conditions	Limited winter resources Low productivity in cereal monocultures. Positive population response to ES grassland management.	AES: winter food, summer fallows and skylark plots; Grassland margins Glastir in Wales	Lack of scale of uptake of appropriate ES measures on arable land. Prescription uptake is biased towards boundary and margin options, which may be less beneficial to this species than in-field options. The level of funding behind AES is critical. No appropriate extensive grassland management in AES for soil-dwelling inverts	Morris et al 2004 Gillings et al 2005 Donald et al 2002 Mortimer et al 2007 Henderson et al 2012 Baker et al 2012.	
Song Thrush	r	S41,S42	1,200,000 (B)	-54 (13% increase since 1995)	Wales: 31% (BBS, since 1995)	Decreased juvenile/post-breeding survival.	Probably limited by the availability of winter molluscs and insect resources, which are associated with damp or moist/humid soil conditions.	AES – especially shady brassica-based winter bird crops? Glastir in Wales	Need uptake of relevant prescriptions - to support appropriate management for damp soils wet features & dense woody vegetation nearby. No appropriate grassland management in AES for soil-dwelling inverts.	Peach et al 2004 a & b	
Starling	r	S41,S42	1,900,000 (B)	-80	Engl: -51% Scot: -29% Wales: -63% (BBS since 1995)	Probably post-breeding survival. Causes not fully understood.	Availability of in-field invertebrate resources, stubbles and grassland (sward structure) in summer and winter. Uncertain link between productivity and food availability on farmland.	AES Glastir in Wales	No AES measures for mixed farming. No appropriate grassland management in AES for soil-dwelling inverts. (cf., lapwing, song thrush)	Robinson *et al*. 2005b, 2006; Crick et al. 2002. Whittingham et al., 2004. Devereux et al 2004.	

Tree Sparrow	r	S41,S42	200,00 (B)	-91	Strong losses in s -w UK and the Pennines. Gains in n-east England, n-e Scotland and NI	First-winter survival. Possible loss of resources due to drained and drier farmland; loss of mixed farming?	Availability of winter and spring seed resources are limiting factors: species is showing good signs of recovery where nest boxes + year-round supplementary food provided.	AES Glastir in Wales	Lack of uptake of relevant prescriptions within AES or mixed farming. There are no dedicated AES prescriptions for grassland systems	Field et al 2008 Perkins et al 2007; Freeman et al 2007; Robinson et al 2014.	
Linnet	r	S41,S42	430,000 (B)	-55 (BBS)	Engl: -32% Scot: 10% Wales: -31% (BBS since 1995)	Nest failure, possibly post-breeding survival.	Good availability of summer and winter seed resources (small seeds) can reduce productivity and possibly survival. Scale of availability of foraging habitat per farm may be important.	AES Glastir in Wales	Future of AES uncertain. Prescription uptake is biased towards boundary and margin options, which are less beneficial to this species than in-field options. Thus, the level of funding behind AES is critical. No dedicated AES for pastoral land seeds	JNCC, RSPB Siriwardena et al 2001; Moorecroft et al. 2006; Henderson et al 2012 Baker et al 2012.	
Yellow-hammer	r	S41,S42	710,00 (B)	-55	Engl: -23% Scot: -9% Wales: -54% (BBS since 1995)	Post-breeding survival	Good availability of winter seed resources can significantly reduce popl. decline. Grain substitution for poor insect resources can depress body condition.	AES. Glastir in Wales	Lack of uptake and scale and timing of availability. No AES for scrub/grassland mosaics. No AES grassland option for invert. prey or late winter seed.	Buckingham et al 2010 Baker et al 2012 Henderson et al 2012 Siriwardena et al 2010 Douglas et al 2012	
Corn Bunting	r	S41,S42	11,000 (B)	-90	Widespread decline. Rare in Wales, -100% since 1981.	Post-breeding survival	Availability of winter seed resources: -There is some evidence of population response to AES margins.	AES arable options available for winter food. Glastir in Wales	Lack of prescriptions for summer food/nesting? Lack of uptake of appropriate grassland AES options and scale of availability.	Perkins et al 2011 Baker et al 2012 Current NE/RSPB AfBiE project	
Reed Bunting	a	S41,S42	250,000 (B)	-36 (apparent recovery suggested for the last 5 years)		Winter food availability and survival.	Enhanced winter seed availability (via ES) has significantly reduced the pop decline, also positive effects detected via HLS.	AES options.	No grassland AES options for the provision of inverts & seed. Probably would benefit from wet marginal features on farmland.	Gruar et al 2006; Siriwardena et al 2008 Buckingham et al 2011 Baker et al 2012.	
Limiting factors relating to farmland poorly understood											

Cuckoo	r	S41,S42	16,000 (B)	-62	Engl: -63% Scot: -2% Wales: -20% (BBS since 1995)	Poor breeding conditions? (Poor over-winter survival)?	Summer breeding conditions (e.g. availability of caterpillars)? Decline not clearly related to host species densities or trends.	Under-studied species though there is on-going research	No AES for scrub/grassland mosaics.	BTO, RSPB, Aberdeen Univ.	
Wood lark	a	S41,S42	3,100 (B)	Recovering	Recovering range but local decline in the Brecks.	Breeds in fallows in S-west. Possible winter food effect here & elsewhere?	Unknown limitations to winter survival on farmland (e.g. availability of stubbles).	SSSIs and SPAs, FC and RSPB management. AES stubbles/ fallows option	Low-intensity agri. systems needed within the historic range of the woodlark; mixed rotations or mixed farming.	UEA, FC, BTO, RSPB – Wright et al. 2007, 2009; Mallord et al 2007a,b; Dolman & Morrison 2012	Forest and Plantation management & use. Human intrusions and disturbances.
Dunnock	a	S41,S42	2,500,000 (B)	-30	Engl: 24% Scot: 56% Wales: 38% (BBS since 1995)	Not well understood in the farmland context.	Bare ground next to breeding habitats? So evidence of eg shady brassica strips being preferred to dense grass.	AES – especially winter bird crops, non-cereals (e.g. kale.).	No AES for scrub/grassland mosaics	Henderson et al 2009. But under-studied on farmland.	
Bullfinch	a	S41,S42	220,000 (B)	-41	Engl: -6% Scot: 25% Wales: -18% (BBS since 1995)	Poorly understood; changes in survival may be important.	Current lack of reliable demographic data; though over winter survival; mechanism not really understood (food and/or predation).		No AES for scrub?	Siriwardena et al 2001. Proffitt et al 2004, Marquis 2007 Robinson et al 2014	
House Sparrow	r	S41,S42	5,300,000 (B)	-64	Recent declines in abundance in the west of GB	Evidence for changes in survival rates due to lack of food resources, on farmland. Evidence for productivity driver currently weak.	Winter seed resources; Persists near livestock or mixed horticultural crops.	AES winter bird crops?	No options to encourage mixed farming.	Hole et al 2002. Robinson *et al*. 2005a. Robinson et al 2014. Newson et al 2010.	
Mainly winter visitors to lowland farmland											
Hen Harrier	r	S41,S42	630 (B)	(probable increase or stable)	Breeding: virtually extinct in England. Welsh population is recovering.	Breeding success (mainly persecution). Winter habitat availability	Persecution aside, over grazing can reduce breeding habitat suitability. Winter open farmland with good bird and mammal populations in stubbles, grassland, ditches and margins.	Adult and nest protection AES for margins and ditches, stubbles.	Protection enforcement. Breeding habitat unlikely to be limiting. No AES extensively managed grassland options for winter.	Sim et al. 2007; Redpath & Thirgood 2009; Redpath et al 2000 (a, b); Thompson et al 2009; Whitfield et al 2008;	Agriculture / grazing / Hunting / trapping, poisoning, poaching

										Elston et al 2014	
Golden Plover	a	S41,S42	40,000 (B) 420,000 (W)	-13 (B: 1995-2010)	(B) Scot: -21% (B) Wales: sharp decline of -83% since 1982.	Breeding habitat quality on marginal pastoral land and uplands. Possible contribution is low quality winter foraging habitat on farmland?	Cultivated fields and organic-rich pastures; mixed rotations.	AES for fallows/stubbles	No AES for mixed rotations or mixed farming.	Gillings et al. 2007 Pearce-Higgins et al 2010.	Agri-systems
Bewick's Swan	a	S41,S42	7,000 (W)	-24		Low breeding success	Global population decline. Habitat loss and quality. Illegal shooting. Lead poisoning. Collisions with man-made structures	Monitoring programme. International Single Species action plan	Increased use of agricultural areas in southeast England may result in some conflict with agricultural interests	WWT, AEWA	Hunting trapping, poisoning, poaching.
Greenland w-front	a	S41,S42	13,000 (W)	Decline since 1990	+1% Wales since 1988	Poor reproductive success abroad.	Natural bogland habitats maybe limiting, but in recent years intensively managed grassland have been used.	Goose management schemes were initiated in 1992/93 by SNH		Fox *et al*. 1999 WWT	
Brent Goose	a r	S41,S42	120,000 (W)	Approx.200% increase but UK decline in the dark-bellied race of -6%)	Wales (+306 since 1978 dark-bellied)		After depleting *Zostera*, *Enteromorpha* & saltmarsh food they switch to grassland and crops, and can come into conflict with farming in E. Anglia	Nature reserve management to provide alternative feeding to farmland. AES options available but rarely implemented.		WWT	

APPENDIX A. A SUMMARY OF EVIDENCE FOR DECLINES AND DELIVERY MECHANISMS

B. Uplands: A summary of population trends, limiting factors where known and delivery mechanisms available, for current Birds of Conservation Concern and priority species associated with this habitat. Sources include BTO Bird Facts (Robinson 2005; www.bto.org/birdfacts) and Bird Trends (Baillie et al 2014). Population estimates via Musgrove et al 2013 (B=breeding pairs/territories; W =winter individuals). Population trends are via State of the UK's birds 2011 (Eaton et al 2012), BBS 2011 (Risely et al. 2012) and the National Atlas 2007-2011; Balmer et al. 2013.

Species	BoCC status red/amber & Section 41 & 42 priority species		UK Popl. Best est. 2012	Long-term popl. trend % 1970-2009 ('-' denotes a declining trend; no symbol denotes a positive trend)	Regional variation ('-' denotes a declining trend)	Probable, current demographic limitations	Causes of trend within the UK relevant to uplands	Delivery mechanism in place?	Mechanism limitations?	Evidence or main source	Relevant subjects identified in Article 12
Hen-harrier	r	S41, S42	630 (B)	- (probable increase)	Breeding: virtually extinct in England. Welsh population is recovering.	Breeding success (mainly persecution). Winter habitat availability	Persecution aside, over grazing can reduce breeding habitat suitability. Winter open farmland with good bird and mammal populations in stubbles, grassland, ditches and margins.	Adult and nest protection AES for margins and ditches, stubbles.	Protection enforcement. Breeding habitat unlikely to be limiting. No AES extensively managed grassland options for winter.	Sim et al. 2007; Redpath & Thirgood 2009; Redpath et al 2000 (a, b); Thompson et al 2009; Whitfield et al 2008; Elston et al 2014	Agriculture / grazing / Hunting / trapping, poisoning, poaching
Merlin	a		1,291 (B)	Probable increase but variable	Declines in Eastern England	Historic poor breeding due to OC pesticides	Pesticide legislation. Increased use of forest edge as nesting habitat. But afforestation and overgrazing exacerbate population recovery.		Land use policies for uplands need provision for birds to ensure key feeding & nesting requirements are met; moorland extent and management.	Rebecca 2011. RSPB	Natural system modifications / Other ecosystem modifications / reduction of prey availability
Peregrine Falcon	a		1,500 (B)	Recovering but recent trend is down, -26% (1995-2010)	Decline evident in North Wales, parts of SW England and possibly NW	Historic poor breeding due to OC pesticides. Low breeding productivity.	Pesticide legislation. Illegal persecution More recently food	Provision of nesting ledges Continuous vigilance to keep in check the	Land use policies for uplands need provision for birds to ensure key feeding & nesting requirements are met; prey abundance	Crick & Ratcliffe 1995; Redpath & Thirgood 1999; Banks et	Human intrusions and disturbances. Biological resource use other than agriculture & forestry. Hunting

					England.		availability may be relevant to declines in the uplands.	illegal persecution by gamekeepers and pigeon fanciers; egg collectors and falconers.	especially.	al 2010. European Peregrine Falcon Working Group	and collection of wild animals/ trapping, poisoning, poaching
Black Grouse	r	S41,S42	5,100 lekking males (B)	Strong decline	Vulnerable across breeding range	Habitat loss, overgrazing, afforestation: loss and structural change in ericaceous moorland.	Poor habitat structure reduces juvenile survival (raptor predation) and breeding success.	Habitat management, site protection	Lack of integrated Forestry & agricultural plans, with suitable habitat in close proximity. HLS delivery mechanism not delivering due to lack of resources. But regional projects are testing management measures. (eg., North Pennines and Welsh Black Grouse Recovery Projects)	Well studied : eg., Baines. & Hudson 1995; Baines et al. 2002; Calladine et al 2002; Pearce-Higgins et al. 2007b; Warren et al. 2003; 2013; White 2012	
Red Grouse	a	S42	230,000 (B)	+5	Engl: -10% Scot: -2% Wales: no trend available (BBS)	Habitat loss, disease and predation.	Loss of heather moorland and an increasing incidence of viral disease.	Private site management	Ensure that landowners, managers and the agri-environment schemes promote management of moorland in relation to grazing, burning and harvesting.	GWCT Warren & Baines 2007. Pearce-Higgins et al 2013	
Golden Plover	a	S41,S42	40,000 (B) 420,000 (W)	-13 (B: 1995-2010)	(B) Scot: -21% (B) Wales: sharp decline of -83% since 1982.	Loss of breeding habitat (extent & quality).	Upland bog degradation, drainage, burning, grazing (over- and under-grazing)	Site management (bog and wetland management) AES?	On SPAs and via Glastir; include heather restoration, *Molinia* control, and re-wetting of marshy habitats (to restore water tables and tipulid populations) .	Pearce-Higgins 20010, 2011; Pearce-Higgins et al 2005, 2006, 2010; Carrol et al. 2011.	Intensive mowing, intensive grazing
Dunlin (race *alpina*)	r		8,600-10,600 (B) 350,000 (W)	(B) uncertain trend? -49 (W)	Stronghold Scottish uplands, Pennines and N England	Breeding habitat and winter survival via wetland foraging conditions all may contribute but reasons for decline not understood	Breeding habitat loss through afforestation. Agricultural intensification. Egg predation by introduced Hedgehogs, disturbance; climate? Uncertain relationships with winter habitat condition?	AES?	Land use practice in uplands may needed to increase the extent of suitable habitat bog matrix (ie grazing burning and drainage and afforestation management).	Beale et al. 2006; Pearce-Higgins et al 2007a; Balmer et al 2013	Natural System modifications; reduction or loss of specific habitat features.

Lapwing	r	S41,S42	140,000 (B)	-48	Engl: -14% Wales: -77% (BBS 1987-1998)	Breeding habitat and food	Lack of breeding habitat due to agricultural intensification of the lowlands (wet grassland, arable land and the loss of mixed farming). Lower densities on arable-only or grass-only farmland; nest predation.	Glastir (Wales) options for grassland management	Bigger areas of habitat are needed, that are resilient to climate change & predation. Low uptake of fallow AES options. Local predation may exacerbate the low levels of recovery.	Large literature: 'Action for Birds In England' (AfBiE) wader project. Devereux et al 2004; Smart et al 2013.	Agriculture / modification of cultivation practices / agricultural intensification.
Curlew	a	S41,S42	68,000 (B)	-60	Engl: -41% Scot: -53% Wales: -49% (BBS)	Breeding habitat. Post-breeding survival poorly understood.	Uplands habitat suitability. Agricultural intensification (e.g. drainage and reseeding). Nest predation. Most serious declines associated with grassland management.	Site protection and disturbance management	No appropriate measures in AES for grassland breeding habitat or inverts. Localised predation may exacerbate recovery (Tharme et al 2001). However, land use practice in upland and lowlands may reduce the extent of suitable habitat. Still, the level of funding behind AES is critical. Appropriate measures in AES are needed for grassland breeding habitats, to control grazing, create wet ground, and control field operations.	Action for Birds In England' (AfBiE) wader project. O'Brien et al 2011, Douglas et al 2014. Fletcher et al. 2010; Smart et al 2013.	Agriculture / modification of agricultural practices. Natural biotic and abiotic processes) / Interspecific faunal relations / predation
Common Gull	a		710,000 (W) 49,000 (B)	(B) 36 (with recent declines)	(B) Engl: few pairs (B) Wales: no longer breeds (B) Scotl: 26	Breeding success	predation by mink	Control of predation	Mink trapping effort increased in 1990s but may have decreased since	JNCC; Craik 2010.	
Ring Ouzel	r	S42	6,200-7,500 (B)	Decline		Low first-year, and possibly adult, survival.	Possible factors: reduced food supplies, changes in grazing regimes, agricultural improvement, habitat loss in wintering areas.		Seems mainly a wintering problem though heather cover and quality may be important for breeding sites, thus heather management, low grazing may be required actions .	Sim et al 2007, 2010, 2011; Green et al. 2012	
Wheatear	a		240,000 (B)	Variable but declining across	England: 7 Scotland: 3 Wales: -15	Breeding habitat suitability or over-winter	Possible factors: losses of suitable grassland quality climate effects or over	Site protection. Provision of artificial	Difficult species, slightly uncertain monitoring	Balmer et al. 2013.	

				Europe and strong range loss in Britain	(since 1995, BBS)	survival? Productivity appears to have increased (though range has changed!)	winter/passage conditions?	nesting sites.	accuracy of breeding populations due to many late passage birds in spring appearing to breed but not necessarily staying to do so. UK wide range shift may suggest climate influence on breeding habitat suitability perhaps interacting with management – requiring closer attention.		
Whinchat	a		47,000 (B)	-57	Large decline in across Britain, especially in lowland England.	Loss of breeding habitat & low over-winter survival suspected.	Loss of grassy marginal farmland habitats to grazing or grassland improvement management (inputs and mowing); altitudinal sqeezing.	Site protection & grassland management. Via Glastir in Wales?	Shear extent of suitable habitat for nesting and food.	Pearce-Higgins & Grant 2006; Calladine & Bray 2012; Ockenden et al 2012, Balmer et al. 2013 Henderson et al 2014	
Tree Pipit	r	S41,S42	88,000 (B)	-13	Wales: -26% England: -50% Scotland: 51% (BBS)	Survival? Low breeding success?	Overgrazing and agricultural abandonment of marginal habitats?	FC policy on planation management. Glastir in Wales?	Full details of key demographic and ecological drivers still lacking	Fuller et al. 2006 Ockenden et al 2012, 2013. Balmer et al 2013;	
Chough	a	S42	450 (B)	Recovery	Restricted population in western GB	Probably winter food availability for breeding recruitment?	Persecution, interference and agricultural intensification	Creation of artificial nests and foraging habitat. AES	No dedicated AES for low intensity livestock farming or extensively managed grassland options	RSPB, Johnstone et al., 2007	Modification of cultivation practices. Abandonment of pastoral systems, lack of grazing.

Twite	r	S41, S42	10,000 (B)	Long-term and recent declines	Most Twite breed in north-west Scotland. Also in the south Pennines	Late summer productivity, (Over-winter survival?)	Summer and winter grassland seed resources; Reduced availability of seed, especially later in the breeding season.	UK action to ensure a recovery programme. Grassland and especially heather management (eg., grazing and burning controls) via Glastir in Wales; AES and Recovery project in South Pennines where promotion of hay late cutting will ensure seed (eg dandelions) is available in July/August. Also help ensure winter seed food supply	Very small Welsh population, geographically limited. Improved monitoring required.	Langston et al. 2006; Wilkinson & Wilson 2010; RSPB/NE studies in Sth Pennines.	
Lesser Redpoll	r	S41, S42	27,000 P (B)	3	Engl: -28% Scot: 2% Wales: NA (BBS).	Both survival and productivity? Mechanism for decline not fully understood.	Seems to respond to extent of birch availability? Increased in gardens in winter feeding Nyger seed.	Glastir in Wales? Forest support policies & habitat action plans?	General lack of knowledge of limiting factors or reasons for decline – upland and lowlands. Limited monitoring in uplands.	Fuller et al 2005; Siriwardena, et al 1998; Smart et al 2007; Eglington & Noble 2009	

APPENDIX A. A SUMMARY OF EVIDENCE FOR DECLINES AND DELIVERY MECHANISMS

C. Lowland woodland: A summary of population trends, limiting factors where known and delivery mechanisms available, for current Birds of Conservation Concern and priority species associated with this habitat. Sources include BTO Bird Facts (Robinson 2005; www.bto.org/birdfacts) and Bird Trends (Baillie et al 2014). Population estimates via Musgrove et al 2013 (B=breeding pairs/territories; W =winter individuals). Population trends are via State of the UK's birds 2011 (Eaton et al 2012), BBS 2011 (Risely et al 2012) and the National Atlas 2007-2011: Balmer et al. 2013.

Species	BoCC status red/amber & Section 41, 42 priority species		UK Popl. Best est. 2012	Long-term popl. trend % 1970-2009 ('-' denotes a declining trend; no symbol denotes a positive trend)	Regional variation	Probable, current demographic limitations	Causes of trend within the UK relevant to lowland farmland	Delivery mechanism in place?	Mechanism limitations?	Evidence or source	Relevant subjects identified in Article 12
Black Grouse	r	S41, S42	5,100 lekking males (B) *also in upland	Decline	Vulnerable across breeding range	Habitat & productivity; knowledge gaps of precise mechanisms.	Lack of suitably managed moist woodland/grassland mosaics? Timing of forestry rotation; deer and sheep fencing; habitat extent.	Original BAP recovery strategy, by GWCT in 2012. Woodland Grant Scheme and HLF Agri-environment schemes and forestry scheme prescriptions exist. Thus, regional projects are testing management measures. (eg., North Pennines and Welsh Black Grouse Recovery Projects)	Lack of integrated Forestry & agricultural plans, with suitable habitat in close proximity. HLS delivery mechanism not delivering due to lack of resources?	Well studied : eg., Baines. & Hudson 1995; Baines et al. 2002; Calladine et al 2002; Pearce-Higgins et al. 2007b; Warren et al. 2003; 2013; White 2012 White et al. 2013	
Woodcock	a		81,000 M (B) 1,400,000 (W); Dedicated survey: 55,000 males (2013) 78,000 males (2003)	-88 (CBC) -29 in ten years	Vulnerable across breeding range	? Demographic limiting factors not understood. E.g. winter survival; chick mortality, or habitat suitability?	Possible causes: Recreational disturbance, the drying out of natural woodlands, woodland coverage, overgrazing by deer, declining woodland management, and the maturation of new plantations?	SSSI and SPA network and FC management; England Woodland Grant Scheme (EWGS); Glastir in Wales.	Ensure needs of woodland birds are incorporated into forest policy; protection against drying/abstraction.	Ongoing GCWT work and survey work. BTO/GWCT Woodock Survey	

Turtle Dove	r	S41, S42	14,000 (B)	-91	Large range contraction from west. Low densities in the east.	Breeding conditions? Disease? Decline in over-winter survival?	Lack of 'arable' weeds and weed seeds (early and mid-summer) and thus a truncated breeding season.	Farmland AES summer fallows England Woodland Grant Scheme (EWGS); Glastir in Wales?	Lack of scale of uptake of appropriate ES measures for weed seed provision in summer. Prescriptions still under review and research also underway. Uses 'open structure' forest (i.e, rotational)?	Browne & Aebischer 2005; Browne et al 2005; Dunn & Morris 2012 Stockdale et al 2014. RSPB/NE and 'Action for Birds'	
Starling	r	S41, S42	1,900,000 (B)	-80	Engl: -51% Scot: -29% Wales: -63% (BBS)	Drivers? Winter food? Nest sites may be limiting in woods/forest.	Mature standing dead wood is important for nest sites, near invertebrate-rich soils (farmland). On adjacent land, availability of in-field invertebrate resources, stubbles and grassland (sward structure) in summer and winter. Uncertain link between productivity and food availability on farmland?	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Adequate protection of standing dead wood needed (nest sites)? Adjacent to woodland, no AES measures for mixed farming. No appropriate grassland management in AES for soil-dwelling inverts	Robinson *et al*. 2005b, 2006; Crick et al. 2002. Whittingham et al., 2004. Devereux et al 2004. RSPB – on-going	
Nightjar	r	S41, S42	4,600 males (B)	34 (recovering)	n-Wales, nw England and Scotland: decline & range contractions since 1992	Climate and degraded or disturbed habitat.	Currently, habitat availability. Habitat loss; Human disturbance is problematic in places.	SPA and SSSI network; SANGS approach for the Thames Basin Heaths SPA to reduce disturbance. Glastir in Wales?	Lack of suitable forest habitat (open and young tree-age classes) contributes to local declines; loss of 0-10 years tree age groups).	Conway et al 2007 Langston et al 2007 Dolman & Morrison 2012	Forest and Plantation management & use. Human intrusions
Lesser spotted Woodpecker	r	S41, S42	1500 (B)	-71	SE decline, some small gains in Midlands/ Wales.	? No reliable demographic data; Poor chick survival due to starvation?	Availability of extensively managed oak-dominated wood-landscapes.? Habitat fragmentation? Full detailed ecological vs demographic studies still lacking. Food shortages for chicks highly implicated, with some evidence of phonological mismatch.	England Woodland Grant Scheme (EWGS); Glastir in Wales	Ensure needs of woodland birds are incorporated into forest policies. Need adequate protection of mature and standing dead wood (nest sites and food)?	Charman et al 2010, 2012 Smith & Charman 2012, Rossmanith et al 2007; RSPB Eglington & Noble 2009	

							Drying conditions on prey availability in southern woodlands should be investigated?			Balmer et al 2013	
Cuckoo	r	S41, S42	16,000 (B)	-62	Engl: -63% Scot: -2% Wales: -20% (BBS)	Poor breeding conditions(food scrub availability? (Over-winter survival)?	Caterpillar abundance and climate modified effects on prey? Decline not clearly related to host species densities or trends.	Research phase. Key factors not really known. Drivers of population change between hosts or habitats. Glastir in Wales and eg ffridd.	Is scrub adequately covered by schemes? Under-studied.	Newson et al 2009 Douglas et al 2010 Denerley 2014	
Red-backed Shrike & Wryneck	r	S41, S42	Occasional (B)	Now all but 'extinct' as a breeding species			Increase potential by provision of low-input, structurally diverse ground for populations of large insects (RBS) or ants (WRY);	Management of statutory and important non-statutory sites (e.g. nature reserves).	Deadwood and over-mature trees in forests for Wryneck (also nestboxes?)	RSPB JNCC	
Marsh Tit	r	S41, S42	41,000 (B)	-68		Habitat quality implied but no demographic info. available or winter ecology info.	Availability of extensively managed mature deciduous woodland and understorey?	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Full detailed ecological vs demographic studies still lacking (but ongoing). Ensure needs of woodland birds are incorporated into forest policies, support measures and HAPs	CEH Broughton 2010; Broughton et al. 2011, 2012	
Wood Warbler	r	S41, S42	6,500 (B)	-65	Marginal increases in n-w Scotland only	Demographic drivers unknown.	Possible climate-mediated range shift, drying of habitat and/or deer? Correlative studies so far uninformative but research on demographics is on-going. Structure?	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Full detailed ecological vs demographic studies still lacking. Ensure needs of woodland birds are incorporated into forest policies measures	Autecology on-going: Mallord et al per comm. (RSPB)	
Spotted Flycatcher	r	S41, S42	36,000 (B)	-88	General decline, especially the s-east. Some gains in n-w Scotland.	Over-winter survival?. Range change implies drying of habitats but demographic drivers are unknown.	Studies so far uninformative as to drivers (eg survival vs productivity, access to large flying insects vs climate/habitat mediation.	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Full detailed ecological vs demographic studies still lacking. Ensure woodland birds are incorporated into forest policies, support measures	RSPB, on-going	

Redstart	a		100,000 (B)	42	Recovery since 1990s	Productivity has increased, though no data on winter survival is available.	Open mature woodlands with standing deadwood or nest sites; climate change?	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Adequate protection of mature and standing dead wood (nest sites)?	BTO monitoring and nest records	
Pied Flycatcher	a	S41, S42	18,000 (B)	-50	Recent declines though small gains in n-west and Wales, eg. Pembrokeshire	Over-winter survival implicated as main limiting factor.		England Woodland Grant Scheme (EWGS); Glastir in Wales?	Adequate protection of mature and standing dead wood (nest sites)?	BTO monitoring and nest records (Both et al 2010)	
Woodlark	a	S41, S42	3,100 (B)	Recovering	Recovering range but local decline in the Brecks.	Breeding habitat.	Breeding habitat in forest important.	SSSIs and SPAs, FC and NE management programmes. Glastir in Wales?	Lack of suitable forest habitat contributes to local declines (ie. 0-15 years tree age groups).	Wright et al. 2007. Mallord et al 2007a,b, Conway et al 2009.	Forest and Plantation management & use. Human intrusions.
Tree Pipit	r	S41, S42	88,000 (B)	-13	Engl: -50% Scot: 51% Wales: -26% (BBS)	Over-winter survival? Productivity implicated but not yet assessed against survival	Studies uninformative as to key drivers (survival vs productivity, drying of habitats, climate/habitat). Trends contrast with Woodlark in similar habitat so predation unlikely and easterly decline suggests drying of habitat?	SPA and SSSI network; FC policy on planation management. Glastir in Wales?	Lack of suitable forest habitat (open and young tree-age classes? Full detailed ecological vs drivers still lacking; lack of knowledge of remedial measures.	Burton 2007, 2009 Ockenden et al 2012, 2013. Balmer et al 2013	
Willow Tit	r	S41, S42	3,400 (B)	-93	Abandonment of s-e England	Habitat quality implied as strongest likely cause of decline, but there is a lack of knowledge of limiting factors or reasons for decline.	Decline implies loss of habitat quality; i.e., extensively managed shrubby moist woodland, (drying of habitats & impacts from deer?); lack of heterogeneous age structure?	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Detailed ecological vs demographic studies still lacking. Ensure needs of woodland birds are incorporated into policy; protection against drying of habitats/abstraction.	Formal testing of causes still required: Lewis et al 2009a,b; Eglington & Noble 2009	
Song Thrush	r	S41, S42	1,200,000 T (B)	-49	Engl: 22% Scot: 20% Wales: 31% (BBS, since 1995)	Survival exacerbated by drying of habitats, drainage and	Probably limited by the lack of winter molluscs and insects, associated with moist soils. Prefers thicket and understorey, including in	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Ensure appropriate design and funding of schemes, the creation of wet features, damp soils and dense woody vegetation	Peach et al. 2004a,b RSPB	

						pesticides, and reduced in cold winters. Woodland structure & wetness?	forestry.		nearby.	Robinson et al. 2007 Eglington & Noble 2009 Newson et al. 2009	
Nightingale	a	S41, S42	6,700 (B)	-52	Retreating from north-western fringe (i.e. Midlands)	Over-winter survival and carry-over effects?	Understory and scrubby, thicket habitats important; may be effected by e.g. deer browsing or lack of coppicing.	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Is scrub adequately covered by schemes?	Holt *et al.* 2010, 2012a,b; Newson et al. 2014 Eglington & Noble 2009	
Dunnock	a	S41, S42	2,500,000 (B)	-30	Engl: 24% Scot: 56% Wales: 38% (BBs, since 1995)	Survival rates level but immature survival low and nesting output low.	Lack of knowledge of demog. limiting factors. Canopy closure and deer browsing pressure may be relevant. No info. on food resources.	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Full detailed ecological vs demographic and ecological studies still lacking.	Fuller *et al.* 2005 Siriwardena et al 1998a BTO bird trends	
Bullfinch	a	S41, S42	220,000 (B)	-47	Engl: -6% Scot: 25% Wales: -18% (BBS)	Poorly understood; winter survival or productivity?	Current lack of reliable demographic data; though over winter survival has been implied; mechanism not really understood (food and/or predation). Scrub, management & browsing may contribute?	England Woodland Grant Scheme (EWGS). Glastir in Wales?	Lack of precise knowledge of limiting factors or reasons for decline.	Siriwardena et al 2001. Proffitt et al 2004, Marquis 2007 Robinson et al 2014; Eglington & Noble 2009	
Hawfinch	r	S41, S42	4,000 (B)	>50%	National decline but partial increase in n-w Wales and Herefordshire (+/-)	Poorly understood; could relate to winter survival?	Total lack of knowledge of limiting factors or reasons for decline; no reliably balanced demographic data available. Habitat fragmentation?	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Lack of knowledge of limiting factors or reasons for decline. Ensure needs of woodland birds are incorporated into, forest policies, support measures.	RSPB. Langston et al. (2002) Eglington & Noble 2009; Balmer et al. 2013	

Lesser Redpoll	r	S41, S42	27,000 P (B)	3	Engl: -28% Scot: 2% Wales: NA (BBS)	Both survival and productivity.	Maturation of woodland and a reduction in birch seed food supplies may be a problem but little research in support. Often winters on farmland.	England Woodland Grant Scheme (EWGS); Glastir in Wales?	Lack of precise knowledge of limiting factors or reasons for decline.	Siriwardena et al 1998a. Smart et al 2007 Eglington & Noble 2009	

APPENDIX A. A SUMMARY OF EVIDENCE FOR DECLINES AND DELIVERY MECHANISMS

D. Lowland heathland: A summary of population trends, limiting factors where known and delivery mechanisms available, for current Birds of Conservation Concern and priority species associated with this habitat. Sources include BTO Bird Facts (Robinson 2005; www.bto.org/birdfacts) and Bird Trends (Baillie et al 2014). Population estimates via Musgrove et al 2013 (B=breeding pairs/territories; W =winter individuals). Population trends are via State of the UK's birds 2011 (Eaton et al 2012), BBS 2011 (Risely et al 2012) and the National Atlas 2007-2011 (Balmer et al. 2013).

Species	BoCC status red/amber & Section 41, 42 priority species		UK Popl. Best est. 2012	Long-term popl. trend % 1970-2009 ('-' denotes a declining trend; no symbol denotes a positive trend)	Regional variation ('-' denotes a declining trend)	Probable, current demographic limitations	Causes of trend within the UK relevant to lowland heathland	Delivery mechanism in place?	Mechanism limitations?	Evidence or main source	Relevant subjects identified in Article 12
Kestrel	a	S41,S42	46,000 (B)	-44	Engl: -13% Wales: -50% (1994-2006; BBS)	Integrated analyses suggest that changes in first-year and, particularly, adult survival are the primary contributors to population change?	Nest success appears good. Impoverished small mammal populations could be limiting productivity or survival?	For heathlands, site protection and grassland management, via Glastir or local heathland?	More research is needed to establish links between potential ecological factors, especially food, land-use and Kestrel population change Habitat loss. No extensively managed grassland AES options or management for small mammals.	RSPB Leech & Barimore 2008 Robinson *et al.* 2014	
Stone-curlew	a		350 (B)	Recovering	E Anglia and S Downs	Safe breeding habitat on free-draining soils, farmland.	Bespoke habitat provision and monitored nesting.	On heathland, site protection regarding disturbance management.	Threats to habitat loss and habitat quality, maybe also disturbance	Well studied; eg., Green et al. 2000; RSPB	
Cuckoo	r	S41, S42	16,000	-62	Engl: -63% Scot: -2% Wales: -32% (BBS since 1995)	Poor breeding conditions; (Poor over-winter survival)?	Summer breeding conditions (e.g. availability of caterpillars)? Decline not clearly related to host species densities or trends.	Heathland sites protection, management for scrub/shrub heather insects, and protection for wet mires.	Under-studied species though there is on-going research	BTO, RSPB, Denerley 2014 .	
Nightjar	r	S41,S42	4,300	34%	Recovering, though slower in n-w Britain	Breeding habitat availability.	Restoration of breeding habitat availability, including heathland.	SSSIs and SPAs, FC, NE, RSPB and local management &	Threats to heathland by development & disturbance.	RSPB as regards heathland	

								restoration programmes; SPA - heathland recreation (Brecklands) and open space programme for forest population.		Conway et al 2007. Langston et al. 2007 Dolman & Morrison 2012	
Woodlark	a	S41,S42	3,100 (B)	Recovering	Recovering range but local decline in the Brecklands.	Extent of breeding habitat, bare open habitat and some young scrub (trees)	Breeding on open heathland may have light scrub but also large bare areas or low swards.	SSSIs and SPAs, FC, NE, RSPB and local management & restoration programmes and disturbance management. SPA - heathland recreation (Brecklands) and open space programme for forest population.	Habitat loss in area. Threats to heathland by development & disturbance; Changes to forest age structure	Wright et al. 2007, 2009; Mallord et al 2007a,b; Dolman & Morrison 2012	
Chough	a	S41,S42	450 (B)	Recovery	Restricted population (+48% Wales 1992-2002)	Probably winter food availability for breeding recruitment?	Heathland: needs close grazed swards, ideally organically rich for soil inverts.	Heathland: site protection & grassland management. Via Glastir?	Persecution, interference and agricultural intensification.	RSPB Johnstone et al., 2007	
Grasshopper Warbler	r	S41,S42	16,000 (B)	Shallow recovery (59% since 1995)	-80% Wales (1981-2006)	Over-winter survival?	Tall extensive grassland or rank vegetation often wet in winter; **e.g. heathland mire.** Tolerates scrub.	Heathland: site protection & wet-grassland/mire management. Glastir in Wales?	Habitat loss, including water table decline and over grazing.	RSPB	
Wheatear	a		240,000 (B)	Variable but declining across Europe and strong range loss in Britain	England: 7 Scotland: 3 Wales: -15 (since 1995, BBS)	Breeding habitat suitability or over-winter survival? Productivity appears to have increased (though range has changed!)	Becoming rare on heathland, needs close grazed swards (rabbits?) ; perhaps drying soils important in southern England?	Heathland: site protection & grassland management. Via Glastir in Wales?	Extent of suitable habitat for nesting and food? Difficult species, slightly uncertain monitoring accuracy of breeding populations due to many late passage birds in spring appearing to breed but not necessarily staying to do so. UK wide range shift may suggest climate influence on breeding habitat suitability perhaps interacting with management –	Not specifically heathland: Balmer et al. 2013.	

									requiring closer attention.		
Whinchat	a		47,000 (B)	-57 since 1995	Large decline in across Britain, especially in lowland England.	Loss of breeding habitat & low over-winter survival suspected.	Now rare on heathland; needs tall insect-rich grass not necessarily bracken or heather.	Heathland: site protection & grassland management. Via Glastir in Wales?	Extent of suitable habitat for nesting and food.	Not specifically heathland: Balmer et al. 2013. Pearce- Higgins & Grant 2006; Calladine & Bray 2012; Ockenden et al 2012, 2013. Henderson et al 2014	
Red-backed Shrike	r	S41, S42	Occasional (B)	Both, all but 'extinct' as a breeding species		Ants; crickets and beetles; also lizards. (Over-winter survival)	Availability of extensively managed grassland/scrub mosaics for ants (Wyr) and large insects (RBS).	Site protection and management for insects, perhaps low intensity cattle grazing.	RBS: Management for scrub/low input grass mosaics. Wyr: Extensive forest mosaic management	Part of AfBiE project. RSPB Eaton et al 2009	
Dartford Warbler	a		3,200	Increase		Gorse-heath & climate	On heathland, availability of gorse-scrub.	Site protection and management	Habitat loss in area and quality.	RSPB Wotton et al. 2009.	
Tree Pipit	r	S41,S42	88,000	Strong decline	Especially e and c England. -11% Wales 1995-2007	Survival? Low breeding success? Extent of appropriate breeding habitat?	Extent of open habitat/heathland with light scrub. Trend unlike woodlark implying winter constraints or preference for different woodland mosaic structure?	Heathland: site protection & management tolerance of scrub mosaics. Glastir in Wales?	Habitat loss in area and structure - on heathland and woodland/forest	Not specifically heathland: Burton 2007 Ockenden et al 2012, 2013. Balmer et al 2013;	

Linnet	r	S41,S42	430,000 (B)	-55	Engl: -32% Wales: -25% (BBS since 1995 - 2007) Declining in abundance in s and e UK	Post-breeding survival Climate?	Good availability of winter seed resources (small seeds) can reduce popl. decline and scale of availability of foraging habitat per farm may be important. On heathland, availability of scrub/grassland mosaic with bare ground and weed-seeds is probably important.	Heathland: site protection & management tolerance of scrub mosaics. Glastir in Wales?	Heathland: habitat loss in area and structure.	Not specifically heathland: JNCC, RSPB Siriwardena et al 2001; Moorecroft et al. 2006; Henderson et al 2012 Baker et al 2012.	
Yellow-hammer	r	S41,S42	710,00 (B)	-55	Engl: -23% Scot: -9% Wales: -39% (BBS since 1995-2007)	Post-breeding survival.	On heathland, availability of scrub/grassland mosaic with bare ground.	Heathland: site protection & management tolerance of scrub mosaics. Glastir in Wales?	Habitat loss in area and structure.	Not specifically heathland: Buckingham et al 2010 Baker et al 2012 Henderson et al 2012 Siriwardena et al 2010 Douglas et al 2012	

APPENDIX A. A SUMMARY OF EVIDENCE FOR DECLINES AND DELIVERY MECHANISMS

E. Freshwater wetlands: A summary of population trends, limiting factors where known and delivery mechanisms available, for current Birds of Conservation Concern and priority species associated with this habitat. Sources include BTO Bird Facts (Robinson 2005; www.bto.org/birdfacts) and Bird Trends (Baillie et al 2014). Population estimates via Musgrove et al 2013 (B=breeding pairs/territories; W =winter individuals). Population trends are via State of the UK's birds 2011, 2014 (Eaton et al 2012, SUK 2014 = State of the UKs Birds 2014); WeBs report (Austin et al 2014), BBS 2011 (Risely et al 2012), the National Atlas 2007-2011 (Balmer et al. 2013) and JNCC for seabirds; also AEWA (Agreement on the Conservation of African-Eurasian Migratory Waterbirds).

Species	BoCC status red/amber & Section 41, 42 priority species	UK Popl. Best est. 2012	Long-term popl. trend % ('-' denotes a declining trend; no symbol denotes a positive trend)	Regional variation ('-' denotes a declining trend)	Probable, current demographic limitations	Causes of trend within the UK relevant to lowland farmland	Delivery mechanism in place?	Mechanism limitations?	Evidence or source	Relevant subjects identified in Article 12
Greylag Goose	a	230,000 (W) 46,000 (B)	514		Breeding success. Overwinter survival	Hunting regulation. Improved wintering foraging and nesting opportunities.	SSIs,NNR, goose management scheme.	Feeding areas (especially farmland) are not significantly represented within the protected sites network	WWT, JNCC State of the UKs Birds 2014	Biological resource use other than agriculture & forestry / hunting & collection of wild animals
Shelduck	a	61,000 (W) 15,000 (B)	(W) -13	(W) Engl: 30 (W) Wales: 82 (W) Scotl: 46		Shift in wintering distribution. Habitat loss as a result of tidal barrage schemes. Over-exploitation of shellfishery.	Site management to provide and protect nesting habitat. SPAs (winter and breeding sites)		Burges & Hirons 1992 See legend	Climate change/changes in biotic conditions. Human intrusions and disturbances / other human intrusions and disturbances
			(B) 2 since 1995	(B) Engl: 85		Breeding range expansion.				

Wigeon	a		450,000 (W) 300-500 (B)	(W) 35	(W) Engl: 129 (W) Wales: 60 (W) Scotl: 30	Winter recruitment	(W) Possible shift in winter distribution and/or increases in overall population abundance (B) Possible factors: acidification of favoured waters, fluctuations of insect food availability, loss of nesting habitat.	Multi-species SPAs and other reserves; wetland management and protection SPAs		See legend	Climate change / changes in biotic conditions / decline or extinction of species. Natural System modifications / human induced changes in hydraulic conditions / Altered water quality due anthropogenic changes in salinity
				(B) ?	Breeding Wigeon is dispersed at low densities.						
Gadwall	a		25,000 (W) 690-1,730 (B)	(W) 260	(W) Engl: 2000 (W) Wal: 2667 (W) Scot: 400	Winter recruitment	Population expansion	Multi-species SPAs and other reserves; wetland management and protection. SPAs		See legend	
				(B) increasing		Breeding success	Habitat availability				
Garganey	a		14-93 (B)	74	Species not well monitored		Possible factors: habitat degradation, nest loss, human disturbance			See legend	
Teal	a		220,000 (W) 1,600-2,800 (B)	(W) 76	ENgl: 194 Wales; 98 Scotl: 61	Winter recruitment	Increase of habitat availability. Overall population increases.	Multi-species SPAs and other reserves; wetland management and protection SPAs		See legend	

Mallard	a		710,000 (W) 61,000-146,000 (B)	(W) -37 (B) 18 since 1995	(W) Engl: -26 (W) Wales: -21 (W) Scotl: -56 (B) Engl: 31 (B) Wales: -12 (B) Scotl: -17	Wintering recruitment and survival	(W) decrease in continental immigration and overwinter loss (duckling mortality) (B) probable increase in domesticated birds and ongoing large-scale releases for shooting	Site management to provide and protect nesting habitat. SPAs (winter and breeding sites)	Wintering population still declining.	Burges & Hirons 1992; See legend	Climate change / changes in biotic conditions / decline or extinction of species
Pintail	a		29,000 (W) 9-33 (B)	(W) -33	(W) Engl: 25 (W) Wales: 197 (W) Scotl: 64	Winter recruitment. Habitat quality.	Possible decrease in overall population size or shift in core wintering range. Habitat loss	Multi-species SPAs and other reserves; wetland management and protection SPAs; Species Management Plan		See legend	
Shoveler	a		18,000 (W) 310-1,020 (B)	(W) 62	(W) Engl: 2 (W) Wales: 10 (W) Scotl: 0	Winter recruitment	Redistribution in response to climate change	Breeding and non-breeding SPAs		See legend	Natural system modifications/other ecosystem modifications.
Pochard	a		48,000 (W) 350-630 (B)	(B) 281 (W) -55	(W) Engl: -21 (W) Wales: -37 (W) Scotl: -75	Wintering recruitment and survival	Possible shift in winter distribution. High levels of eutrophication. Reduction of food availability.	Multi-species SPAs and other reserves; wetland management and protection SPAs		See legend	
Tufted Duck	a		120,000 (W) 16,000-19,000 (B)	(W) 18	(W) Engl: 98 (W) Wales: 57 (W) Scotl: -5		(W) response to climate change	Multi-species SPAs and other reserves; wetland management and protection		See legend	Climate change / changes in biotic conditions / decline or extinction of species

				(B) 64 (BBS) 104 (WBS)	(W) Engl: 35 (BBS)	Breeding habitat and food	(B) Spread of zebra mussel	SPAs			
Little Grebe	a		17,000 (W) 3,900-7,800 (B)	(B) -53 (WBS) -37 (BBS)		Unknown	unknown	Wetland restoration? Wetland management and protection.	Wetland management and protection	See legend	
Black-necked Grebe	a		130 (W) 32-51 (B)	(W) 50 (B) 54	(W) Engl: 85 (W) Scot: -98		unknown	Wetland restoration? Wetland management and protection	Lack of wetland management and protection	See legend	
Little Egret	a		4,500 (W) 660-740 (B)	(W) 529 (B) large increase	(W) Engl: 512 (W) Wal: 1512 (W) Scot: -100	Post-breeding dispersal. Over-winter survival	Expansion of nesting and wintering range attributable to milder winter conditions.	Wetland restoration? Wetland management and protection		See legend	
Bittern	r		120 (B)	(B) 567		Habitat provision	Habitat provision. Expansion of nesting and wintering range possibly also attributable to milder winter conditions.	Reedbed restoration and management and protection.	Reedbed quantity and quality	See legend RSPB eg., Gilbert el al 2010.	
Spoonbill	a		20 (W) 2 (B)	(W) ? (B) very rare breeding bird in the UK		Climate?	Habitat loss and degradation, so restoration UK and abroad may have helped but possible climate warming too.	Species of European concern International Single Species Action Plan		AEWA	

Marsh Harrier	a		320-380 (B)	Recovering 988 (B)		Population recovery, protection, survival.	Historical persecution. Habitat loss. Warmer climate	Wetland management, protection (some moderating attitudes).	AES for wet features, ditches and ponds?	RSPB; See legend	Agricultural intensification. Natural system modifications/ human induced changes in hydraulic conditions.
Osprey	a		200-250 (B)	Recovering 426 (B)	Mainly breeds in Scotland	Population recovery	Historical persecution. Pesticides. Entanglements with fishing lines.	Habitat and nest protection. Bans on pesticide usage. Co-operation with anglers and landowners.		RSPB; See legend	Threats and pressures from outside the Member State
Corncrake	r	S41,S42	1,200 (B)	163	Wales - 100% since 1981	Breeding (UK) (Over-winter survival?)	Lack of breeding habitat and management: Early & late cover & delayed mowing needed.	AES (regional) and SPA network. Glastir in Wales	No appropriate measures for wet grasslands on a larger geographic scale? Numbers have recovered following targeted habitat management, but most of their previous range is still unoccupied.	Well studied; eg., Green et al 1997 Green & Gibson 2000 RSPB, JNCC	Abandonment of pastoral systems, lack of grazing. Agriculture intensification
Spotted Crake	a		28-80 males (B)	172	Species not well monitored and under recorded			Wetland SPA network?	Effective monitoring and information.	Gilbert 2002; Francis & Stroud 2006; Stroud et al. 2012; RBBP	
Crane	a		52 (W) 9-14 (B)	Recovery		Population recovery	Probably became extinct because of over-exploitation (last breeding in England in 1542). Natural re-colonisation and re-introduction.	Wetland management and protection. Re-introduction.	Not yet known whether habitat availability, predation, human disturbance and collision risk will constrain population growth. No AES for encouraging mixed rotations or seasonal flooded farmland?	WWT, RSPB Stanbury et al 2011 See legend	

Oystercatcher	a		340,000 (W) 110,000 (B)	(W) -10 (B) -14	(W) Engl: 11 (W) Wales: 8 (W) Scotl: -6 (B) Engl: 50 (B) Wales: ? (B) Scotl: -24	Breeding success	(W) Over-exploitation of shellfishery. Habitat degradation (B) Nest failure due to habitat quality	Site management to provide and protect nesting and wintering habitat. Gull control.	MPAs to protect the species from shellfish over-fishing may not be effective if over-fishing continues occurring in adjacent areas.	Burges & Hirons 1992; Harris & Wanless 1997; Verhulst et al. 2004.	Biological resource use other than agriculture & forestry / Fishing and harvesting aquatic resources
Avocet	a		7,500 (W) 1,500 (B)	(W) 4700 (B) 504	(W) Engl: 9300 (W) Wales: 3450	Breeding success and survival	Reduced human disturbance and appropriate habitat management at breeding sites; climate amelioration; site protection abroad and UK .	Site management to provide and protect nesting habitat. SPAs (winter and breeding sites)		Burges & Hirons 1992	
Ringed Plover	a	S42	36,000 (W) 5,400 (B)	(W) -52 (B) -37	(W) Engl: -35 (W) Wales: -60 (W) Scotl: -5	Low immigration Higher nest failure rates	(W) Shifts in wintering distribution. (B) Predation and human disturbance	SPAs (winter and breeding sites). Site management to provide and protect nesting habitat.	Low immigration from mainland Europe? Human usage of beach areas. Higher nest failure rates	Burges & Hirons 1992; Leech & Barimore 2008; Austin et al. 2014	
Golden Plover	a	S42	420,000 (W) 40,000 (B)	(W) 153 but recent declines (-32) (B) -4	(W) Engl: 167 (W) Wales: -65 (W) Scotl: -71	Breeding success	(W) Possible shift in winter distribution. (B) Changes in breeding phenology of golden plover and its prey associated with	multi-species SPAs and other reserves; wetland management and protection SPAs , Species management plan	See lowland farmland	Gillings et al 2006.	Climate change / changes in biotic conditions / decline or extinction of species

							warmer springs				
Snipe	a		80,000 (B) 1,100,000 (W)	(B) -62 (1982-2002) (W) uncertain		Reduced breeding success. Over-winter survival?	Habitat loss due to drainage. Habitat quality. Food availability in breeding season	Habitat management for environmentally sensitive areas AES	Soil conditions have improved but prey abundance is likely to be limiting	Smart et al. 2008	Climate change / changes in biotic conditions / decline or extinction of species
Curlew	a	S41,S42	150,000 (W) 68,000 (B)	(W) 3 (B) -60	(W) Engl: 1 (W) Wales: 9 (W) Scotl: 25 (B) Engl: -41 (B) Wales: -49 (B) Scotla: -53 (BBS)	Breeding habitat and success; Post-breeding survival is poorly understood.	(W) Possible shift in winter distribution. (B) Habitat loss due to drainage. Most serious declines associated with grassland management.	SPAs. Glastir in Wales	Localised predation may exacerbate recovery (Tharme et al 2001). However, on land use practice in upland and lowlands may reduce the extent of suitable habitat. Still,, the level of funding behind AES is critical. Appropriate measures in AES are needed for grassland breeding habitats, to control grazing, create wet ground, and control field operations.	Fletcher et al 2010. AfBiE project: is aimed at 'Determining the causes of curlew declines'. O'Brien et al 2011, Douglas et al 2014.	Natural system modifications / human induced changes in hydraulic conditions, Agricultural practices. Natural biotic and abiotic processes
Redshank	a		25,000 (B) 130,000 (W)	(B) -69 (WBS) -35 (BBS) (W) -16	(B) Engl: -24 (BBS) (W) Engl: 14 (W) Wales: -9 (W) Scotl: -48	Low breeding success -low hatching success and poor chick survival; Lack of breeding habitat.	(B) Drainage of farmland. Grazing pressure. Tidal flooding. (W) shift in wintering distribution.	AES. Species management plan. SPAs (winter and breeding sites).	Lack of breeding habitat, Localised predation	O'Brien & Wilson 2011; Burges & Hirons 1992	

Lapwing	r	S41,S42	140,000 (B) 620,000 (W)	(B) -48 (W) 30	(B) Engl: -14 (B) Wales: -77 (W) Engl: 69 (W) Wales: -19 (W) Scot: -78	Lack of breeding habitat, Low productivity	Lack of breeding habitat due to agricultural intensification of the lowlands (wet grassland, arable land and the loss of mixed farming). Lower densities on arable-only or grass-only farmland Wintering numbers vary in response to temperature.	Glastir in Wales AES SPAs	Bigger areas of habitat are needed, that are resilient to climate change & predation. Low uptake of fallow AES options. Local predation may exacerbate the low levels of recovery. No appropriate AES? measures for grassland breeding habitat and inverts. Lack of mixed farmland; See lowland farmland.	'Large literature: 'Action for Birds In England' (AfBiE) wader project. Devereux et al 2004; Bolton et al 2007; Bodey et al. 2011; Smart et al 2013)	Agriculture / modification of cultivation practices / agricultural intensification. Climate change / changes in biotic conditions / decline or extinction of species
Ruff	r		0-11 females (B) 820 (W)	(B) -62 (W) 11, but declining since 2000s	(W) Engl: 6 (W) Wales: 100	Lack of breeding habitat; demographics – European range shift.	(B) Not clear. Possible factors: habitat quality or natural demographic fluctuations on the edge of the species' range. (W) Unknown	Multi-species SPAs and other reserves; wetland management and protection	Lack of wetland (grassland/meadow) habitat management and protection	JNCC	Agriculture / modification of cultivation practices / agricultural intensification. Natural system modifications/human induced changes in hydraulic conditions.
Black-tailed Godwit	r	S41 (limosa subsp)	54-66 (B) - *limosa* subsp 44,000 (W) - *islandica* subsp	23 (B) relatively stable since 80s (W) 500	(W) Engl: 471 (W) Wales: 212 (W) Scotl: 307	Low breeding success *limosa* sbsp High breeding success icelandic sbbsp	(B) habitat loss/degradation (W) High productivity in Icelandic breeding grounds and expansion of wintering habitat (*islandica* subsp)	International Single Species Action Plan Wetland management and protection Multi-species SPAs and other reserves	Lack of wetland meadow management and protection	AEWA International Single Species Action Plan Gill 2012; Gill et al. 2007	
Black-headed Gull	a	S42	2,200,000 (W) 140,000 (B)	(B) 32 (W) recent declines		Breeding success-variation in productivity	Predation by mammals	SPAs and creation and management of nesting habitat		JNCC Mitchell et al 2004 Austin et al 2014.	

Common Tern	a		12,000 (B)	-9	Engl: 1 Wales: 31, but steep decrease since 2007 Scot: -29	Low breeding success	Predation by mink and foxes. Food availability. Habitat change (e.g. coastal developments)	Management of breeding sites:, habitat creation maintenance.		JNCC	Natural biotic and abiotic processes Interspecific faunal relations / predation.
Black tern	a		? Unconfirmed potential breeding pairs								
Kingfisher	a		3,800 - 6,400 (B)	Fluctuating. Probable decline in Wales			Pollution and poor water quality. River bankside management? Human disturbance.		no UK Action Plan		
Sand Martin	a		49,000 - 174,000 nests (B)	ongoing decrease since late 1990s		Over-winter Sahel (rainfall) conditions and carry-over for breeding recruitment?	Drought in their wintering grounds in Africa	Creation of artificial nesting banks and man-made burrows		Gulickxs et al 2007; Robinson et all. 2007; Norman & Peach 2013	
House Martin	a		510,000 (B)	3 (B)			Wetland condition or extent? Climatic conditions? Loss of suitable nest sites?	Artificial nest. Nest protection.	difficult to monitor	RSPB Robinson et al. 2007; Balmer et al. 2013	
Grasshopper Warbler	r	S41,S42	16,000 (B)	Shallow recovery	Engl: -21	Breeding conditions (UK)? Over-winter survival?	Unknown. Possible factors: Decrease in amount of suitable breeding habitat. Changes in wintering conditions (Africa)	site protection & wet-grassland/mire management. Glastir in Wales?	Lack of understanding in habitat requirement and the relative importance of habitat type and condition in breeding and wintering grounds		

Savi's Warbler	r	S41	1-3 (B)	Decline with tentative recolonisation in SE England from the 1960s (-74)		Edge of its range	Possible factors: Habitat loss and impoverishment due to drainage and abandonment of traditional uses for reedbeds.	Wetland habitat creation, restoration and management		RSPB and Natural England; RBBP	
Aquatic Warbler	r	S41,S42	Passage migrant	population decline in all its range; -68%		Low breeding success	Habitat loss and impoverishment due to drainage and fen management abandonment abroad	Designation and management of key passage sites as SSSIs. Global conservation initiatives.	Lack of understanding in ecological requirement when passing through Britain	JNCC	Natural system modifications/ reduction or loss of specific habitat features
Marsh Warbler	r	S41	2-8 (B)	-77		?		Breeding sites designated as SSSIs, protected and managed.	Human interference	JNCC RBBP	
Yellow Wagtail	r	S41,S42	15,000 (B)	-72	Huge range contraction from the grassland and mixed farming west and south; more recently from s-e England	Breeding conditions? (over-winter survival?)	Agricultural intensification	AES? Glastir in Wales	Limited uptake of infield ES measures (Skylark plots), and no AES encouragement for mixed rotations? No appropriate extensive grassland management ? Overwinter conditions.	Gilroy et al 2012; Mortimer et al 2007; Ockenden et al 2012	
Grey Wagtail	a		38,000 (B)	-35 (WBS)		Breeding success?	Vulnerable to severe winters		Pollution and poor water quality?		
Bearded Tit	a		630 (B)	34		High cold weather mortality	Wetland habitat provision and nest box provision . Expansion of nesting and wintering range possibly also	Reedbed restoration and management and protection.	Reedbed quantity and quality	RSPB.	

							attributable to milder winter conditions.				
Reed Bunting	a	S41,S42	250,000 (B	-36 (BBS, since 1995)	Wales: -30% (BBS) (UK 24% recovery since 1995)	Breeding success. First-year survival. Winter food.	Draining of wetlands and grazing marshes and the intensification of agriculture. Enhanced winter seed availability (via ES) has reduced the decline. Also positive effects detected via HLS.	AES options. Acquisition and management of reedbeds, wet grassland and other wetland areas.	No AES grassland options for the provision of inverts & seed. Probably would benefit from wet marginal features on farmland	Siriwardena et al 2008; Buckingham et al 2011; Baker et al 2012	
Largely winter only											
Bewick's Swan	a	S41	(W) 7,000	-32% -47 (1985/86)		Low breeding success	Global population decline. Habitat loss and quality. Illegal shooting. Lead poisoning. Collisions with man-made structures	Monitoring programme. International Single Species action plan	Increased use of agricultural areas in southeast England may result in some conflict with agricultural interests	WWT, AEWA SUK 2014	Hunting and collection of wild animals (terrestrial) / Taking and removal of animals (terrestrial) / trapping, poisoning, poaching.
Whooper Swan	a		15,000 (W)	267	Engl: 1314 Wales: -83 Scotl: 46	Breeding success	Increasing breeding population in Iceland.	Species protected throughout its range.	Illegal shooting along migration	WWT SUK 2014	Hunting and collection of wild animals (terrestrial) / Taking and removal of animals (terrestrial) / trapping, poisoning, poaching

Pink-footed Goose	a		360,000 (W)	241 113 (since 1985/86)	Engl: 172 Scotl: 140	Breeding success. Winter survival.	Increase of foraging habitat.	Goose Management Scheme, targeted nature reserve management, Establishment of roosting refuges.	Feeding areas (especially farmland) are not significantly represented within the protected sites network	Fox et al. 2005; WWT SUK 2014	Agriculture / modification of cultivation practices
Greenland White-fronted Goose	r		21,000 (W)	15 -41 recent 10yrs		Productivity	Climate change	Goose Management Scheme, targeted nature reserve management, Establishment of roosting refuges	Protection and management of all key wintering sites.	WWT SUK 2014	
Taiga Bean Goose	r		450 (W)			?	Agricultural management?	AEWA International Single Species Action Plan. SPA network?		AEWA JNCC	
Barnacle Goose	a		94,000 (W) 1,000 (Escaped Breeder)	Both races strong increase	Mainly winters in Scotland	Survival	Changes in agricultural practices lead to improvement of foraging opportunities. Restrictions on hunting.	Feral/resident populations establishing in England		WWT SUK 2014	No threats or pressures
Smew	a		180 (W)	393 but with recent declines	Engl: 407 Wales: NA Scotl: 232	Shift in winter distribution	Response to climate change	No SPAs selected for this species.		JNCC	
Jack Snipe	a		110,000 (W)	Species poorly monitored. Population trends unknown.			Threats: Loss and degradation of wetland habitat, wetland drainage for	May occur on Sites of Importance for Nature Conservation r SSSIs.	There are no known concentrations for this species to designate as SPA. There is a need to improve knowledge and monitoring of the		

							agricultural intensification, hunting, peat extraction		species.		

APPENDIX A. A SUMMARY OF EVIDENCE FOR DECLINES AND DELIVERY MECHANISMS

F. Marine and Coastal: A summary of population trends, limiting factors where known and delivery mechanisms available, for current Birds of Conservation Concern and priority species associated with this habitat. Sources include BTO Bird Facts (Robinson 2005; www.bto.org/birdfacts) and Bird Trends (Baillie et al 2014). Population estimates via Musgrove et al 2013 (B=breeding pairs/territories; W =winter individuals). Population trends are via State of the UK's birds 2011 (Eaton et al 2012), BBS 2011 (Risely et al 2012), the National Atlas 2007-2011 (Balmer et al. 2013) and JNCC for seabirds.

Species	BoCC status red/amber & Section 41, 42 priority species		UK Popl. Best est. 2012	Long-term popl. trend % 1985/86-2011/12/13 ('-' denotes a declining trend; no symbol denotes a positive trend)	Regional variation ('-' denotes a declining trend)	Probable, current demographic limitations	Causes of trend within the UK relevant to lowland farmland	Delivery mechanism in place?	Mechanism limitations?	Evidence or source	Relevant subjects identified in Article 12
Eider	a		63,000 (W) 27,000 (B)	(W) decline 11% (last 10 yrs)		Over-winter survival/habitat?	Decrease in food availability (shell-fishing). Climate change. Thiamine deficiency.	SPAs, Marine Act, M(SPAs)	Conflict with mussel farmers	JNCC Austin et al. 2014	Climate change / changes in biotic conditions / decline or extinction of species
Gannet	a		220,000 (B)	39 (since 1986)	Engl: 405 (1 colony) Wales: 12 (1 colony) Scot: 43	High adult survival and breeding success	Not constrained by type of food and can travel great distances from nest (no food shortage).	Marine Act, M(SPAs)	Pollution and degradation of marine environment and offshore re-newables.	JNCC WWT Consulting 2012	
Manx Shearwater	a		200,000-300,000 (B)	? Uncertain trend? Moderate decline?	Scotland and Wales holds over 90% of UK population	Productivity? Food availability?		SPAs; Marine Act, M(SPAs)	Rats and other introduced predators to islands. Potentially offshore wind farms. Pollution and degradation of marine environment; food supply. Disease.	JNCC Mitchell et al. 2004	
European Storm petrel	a		26,000 (B)	?		Productivity?		SPAs; Marine Act, M(SPAs)	Rats and other introduced predators to islands.	JNCC Mitchell et al. 2004	
Northern Fulmar	a		500,000 (B)	-3 (since 1986)	Engl: 5 Wales: 27 Scotl: -4	Food availability	Declines in food discarded by commercial fishing and sandeels abundance. Changes in plankton community due to changes in sea temperature. Accidental death by long-	(M)SPAs. EU Action Plan Consultation for reducing incidental catches of seabirds in fishing gears. Proposals for	Incidental catches of seabirds in fishing gears.	JNCC Mitchell et al. 2004	Climate change / changes in biotic conditions / Fishing and harvesting aquatic resources / Professional passive fishing

							lining fleet .	Marne Conservation Zones (MCZs).			
Shag	a		27,000 (B) 110,000 (W)	(B) -27 (W) stable (but poorly monitored)	(B) Engl: 11 (B) Wales: 16 (B) Scotl: -32	Adult survival. Breeding success	High mortality due to increased onshore gales. Decrease sandeel abundance. Predation of eggs and chicks by invasive mammalian predators.	SPAs and (M)SPAs; Proposed MCZs?	Vulnerability to sandeel population depletion.	JNCC Birdlife. Mitchell et al. 2004; Wanless et al. 2004; Furness & Tasker 2000.	Climate change / changes in biotic conditions / decline or extinction of species
Dunlin	r		350,000 (W) 8,600-10,600 (B) *also in upland	(W) -23	Engl: -46 Wales: -65 Scotl: -59	Breeding habitat (not coastal). Wintering habitat.	Shift in wintering distribution. Habitat loss. Human disturbance.	SPAs		Austin et al. 2014	Climate change/ changes in biotic conditions. Human intrusions and disturbance
Oystercatcher	a		340,000 (W) 110,000 (B)	(W) -14 (B) -8	(W) Engl: 11 (W) Wales: 8 (W) Scotl: -6 (B) Engl: 50 (B) Wales: ? (B) Scotl: -24	Breeding success	(W) Over-exploitation of shellfishery. Habitat degradation (B) Nest failure due to habitat quality	Site management to provide and protect nesting and wintering habitat. Gull control.	Localised predation. MPAs to protect the species from shellfish over-fishing may not be effective if over-fishing continues occurring in adjacent areas.	Harris & Wanless 1997; Verhulst et al. 2004. Austin et al. 2014.	Biological resource use other than agriculture & forestry / Fishing and harvesting aquatic resources

Ringed Plover	a	S42	36,000 (W) 5,400 (B)	(W) -52 (B) -37	(W) Engl: -35 (W) Wales: -60	Nest survival and productivity.	(W) Shifts in wintering distribution. (B) Predation and human disturbance?	SPAs (winter and breeding sites) Site management to provide and protect nesting habitat.	Localised predation. Human usage of beach areas.	JNCC; Liley & Sutherland 2007 Conway et al. 2008. Austin et al. 2014.	
Guillemot	a		950,000 (B)	50	Engl: 51 Wales: 45 Scotl 24 but declines since 2000	Current low productivity could lead to future population declines	No evidence for the increases in population. Low productivity may be associated with low food availability.	SPAs and marine SPAs		JNCC Harris et al. 2000 Wanless et al. 2004; Furness & Tasker 2000.	
Black Guillemot	a		19,000 (B)	3	Engl: -50 (1 colony) Wales: 8 (1 colony)			Existence of a small number of SSSI.	Black Guillemot is very difficult to survey.	JNCC	
Puffin	a		580,000 (B)	19 but possible recent declines	Engl: 105 with recent declines Wales: increasing (Skomer population)	low productivity	Food shortage. Climate. Predation	SPAs. Tracking work to identify wintering grounds. Prevention of ground predators.	Vulnerability at sea to marine pollution, entanglement in fishing gear, loss of food (sandeels and small pelagic fish).	RSPB JNCC Harris et al. 2000 Wanless et al. 2004; Furness & Tasker 2000.	Climate change / changes in biotic conditions / decline or extinction of species
Razorbill	a		130,000 (B)	87	Engl: 10 Wales: 33	Current low productivity can lead to future population	No evidence for the increases in population. Low productivity may be associated with low food availability.	SPAs	Death by entanglement in fishing nets at sea	JNCC; Harris et al. 2000 Wanless et al. 2004;	Climate change / changes in biotic conditions / Fishing and harvesting aquatic resources /

						declines				Furness & Tasker 2000.	Professional passive fishing
Roseate tern	r	S41,S42	86 (B)	-83 (since 1986)	Engl: 6 Wales: -99 Scotl: -22	Immature survival rates	Predation, nesting habitat loss and disturbance at the colonies. Mortality in winter grounds.	Provision of protection with nest boxes. Education programmes in Africa.	More nest boxes and habitat management needed in other colonies	RSPB	Biological resource use other than agriculture & forestry. Trapping, poisoning, poaching
Sandwich tern	a		12,000 (B)	overall increase since 1986 but fluctuates dramatically between years	Engl: slight decline since 2002 Wales: increases (1 colony) Scotl: -53	Low breeding success	Predation by mammals and gulls. Disturbance. Tidal inundation of nests.	SPAs and control of predators (mainly foxes)	The use of electric fences to exclude foxes are not always successful.	JNCC	Biological resource use other than agriculture & forestry / Hunting trapping, poisoning, poaching
Common Tern	a		12,000 (B)	-9	Engl: 1 Wales: 31, but steep decrease since 2007 Scot: -29	Low breeding success	Predation by mink and foxes. Food availability. Habitat change (e.g. coastal developments)	Management of breeding sites: control of predation, habitat creation and maintenance and reduction of disturbance.		JNCC	Natural biotic and abiotic processes
Arctic tern	r		53,000 (B)	-31	Engl: -21 Wales: 133 Scotl: -34	low breeding success	Low food availability (linked to oceanographic changes and fisheries). Predation by mink, hedgehog. Coastal development and disturbance.	Mink eradication programme and other control measures		JNCC	Climate change / changes in biotic conditions. Oceanographic changes.
Little tern	a		1,900 (B)	-23 but partial recovery since 2005	Engl: -27 Wales: 36 (1 colony) Scotl: -11	low breeding success	Predation. Bad weather conditions. Low food availability. Human disturbance.	Site management to provide and protect nesting habitat	Working, but local predation and human disturbance still affecting colonies (excluding tourists from beach is very difficult and politically contentious).	RSPB, Burges & Hirons 1992; Ratcliffe et al. 2008	
Mediterranean Gull	a		1,800 (W) 600-630 (B)	(W) 2750	(W) Engl: 2800 (W) Wal: 1217 (W) Scotl: -67	Breeding success	Expansion in population size and range	They benefit from multi-species SPAs of importance for a		JNCC	

				(B) 11,000	(B) Engl: 10,700 (B) Wal: recent colonist (B) Scot: don't breed			range of other breeding seabirds.			
Black-headed Gull	a	S42	2,200,000 (W) 140,000 (B)	(W) -26 (not well monitored) (B) 36 (since 2000)	(W) Engl: -16 (W) Wales: -33 (W) Scotl: -60 (B) Engl: 6 (B) Wales: not well monitored (B) Scotl: -28	Breeding success-variation in productivity	predation by mammals	SPAs and creation and management of nesting habitat		JNCC	
Lesser Black-backed Gull	a		130,000 (W) 110,000 (B)	(W) 42 (B) 40, but with recent declines	(W) Engl: 45 (W) Wales: -51 (W) Scotl: -3 (B) Engl: 98 (but decreasing since 2002) (B) Wales: slow decline since 1993 (B) Scotl: 10	Adult survival rate	Decrease in food availability.	SPAs	Most plans have concentrated on managing its population, to minimise its adverse effect on other seabirds. However, the population is declining and numbers should be carefully monitored	Birdlife JNCC Balmer et al. 2013	Biological resource use other than agriculture and forestry/fishing and harvesting aquatic resources. Natural and abiotic processes.
Great Black-backed Gull	a		77,000 (W) 17,000 (B)	(W) 42 but recent decline (B) -14 since 2000	(W) Engl: 45 (W) Wales: -51 (W) Scotl: -3 (B) Wales: 47 (B) Scotl: -60		Unknown	SPAs?	Most management plans have centred on controlling its numbers to conserve other seabirds. Causes of populations change not understood.	JNCC Good, T.P. (1998); Mitchell 2004. Balmer et al. 2013	
Herring Gull	r	S41,S42	140,000 (B)	(B) -13	33% decline since 2000	Breeding and wintering food and habitat quality.	Factors: botulism?, disease, but probably mainly low food availability due to less fish discard.	Increasing in urban areas, nesting on roof tops.	No non-breeding SPAs (M()SPAs.	JNCC Mitchell et al. 2004. Balmer et al. 2013; Rock 2005 Austin et al. 2014	Natural and abiotic processes / introduction of disease (microbial pathogens). Invasive, other problematic species and genes / invasive non-native species.

Kittiwake	a		380,000 (B)	-44 since 1986	England and Wales: stable although fluctuating Scot: -50 since 1999	Breeding success and adult survival	Decreases in abundance of sandeel. Presence of sandeel fisheries	Reduction in sandeel fisheries	Not implemented a network of Marine Protected Areas as yet; vulnerability to sandeel decline.	Harris & Wanless 1997 Harris et al 2000; Wanless et al. 2004; Frederiksen et al. 2004; JNCC; Mitchell et al. 2004	
Chough	a	S42	450 (B)	Recovery	Restricted population in western GB	Probably winter food availability and carry-over for breeding recruitment?	Persecution Agricultural intensification	Creation of artificial cliff nest sites and foraging habitat/ AES. Climbing restrictions to reduce disturbance.	No dedicated AES for low intensity livestock farming or extensively managed grassland options	RSPB Cymru, Johnstone et al., 2007	Agriculture / modification of cultivation practices. Agriculture / abandonment of pastoral systems, lack of grazing
Twite	r	S41, S42	10,000 (B) *also in upland	Long-term and recent declines	Most Twite breed in north-west Scotland. Also in the south Pennines	Late summer productivity, (Over-winter survival?)	Summer and winter grassland seed resources; Reduced availability of seed, especially later in the breeding season.	UK action to ensure a recovery programme. Grassland and especially heather management (eg., grazing and burning controls) via Glastir in Wales; AES and Recovery project in South Pennines where promotion of hay late cutting will ensure seed (eg dandelions) is available in July/August. Also help ensure winter seed food supply	Very small Welsh population, geographically limited. Improved monitoring required. Conservation work directed at breeding population rather than coastal wintering sites	Langston et al. 2006; Wilkinson & Wilson 2010; RSPB/NE studies in Sth Pennines.	
Largely winter only species in England and Wales											

Balearic Shearwater	r	S41,S42		Declining in Europe and small population		Adult survival	Unclear, but possible reduction of prey availability (pelagic fish); marine pollution?	Legally protected across its main distribution range; European species action plan. Development of marine SPAs	Marine pollution, oil spills. The designation of protected sites at sea may be far from sufficient.	Birdlife JNCC	
Scaup	r	S41,S42	12,000 (W)	-42	Engl: -88 Wales: -60 Scotl: -74	Winter survival	Reduction of food availability due to sewage regulation at some sites.	SPAs (only 1 site supports more than 1% of the international population)	Network of marine SPAs in the marine environment needed; impacts of wind-turbines needs investigating.	Natural England; JNCC	
Common Scoter	r	S41,S42	52(B)	Long-term decline		Breeding success? Overwinter survival?	Degradation and loss of feeding opportunities due to harvest of clam beds and other marine benthos. Oil pollution.	Not a breeding species in Wales or England. But marine moult and wintering concentrations elsewhere; (M)SPA designations?	Oil spills and other marine pollutants; commercial exploitation of marine benthic organisms and shellfish. Monitoring knowledge, wind-farm interactions, movements and winter ecology.	Birdlife. JNCC	
Velvet Scoter	a		2,500 (W)	232, but with recent declines	Engl: -48 Scotl: 580	Breeding success? Overwinter survival?	Degradation and loss of feeding opportunities due to harvest of clam beds and other marine benthos. Oil pollution.	Not a breeding species but marine moult and wintering concentrations (M)SPA designations? (M)SPAs. Sea Fishery (Wildlife Conservation) Act 1992. National guidelines for the management of oil spills in coastal waters.	Oil spills and other marine pollutants; commercial exploitation of marine benthic organisms and shellfish. Poor understanding of causes of mortality in wintering birds (e.g.drowning in fishing nets).	Birdlife. JNCC.	Pollution / Marine water pollution / oil spills in the sea. Biological resource use other than agriculture & forestry / Marine and Freshwater Aquaculture / bottom culture
Brent Goose	a		120,000 (W) (3 subspecies)								
		S41,S42	Dark-bellied Brent Goose	390 but with recent	Engl: 292 Wales: 2600	Breeding success	Population growth related to the increased use of	Improved protection in	As species concentrate in few areas, wider countryside conservation	Vickery et al. 1994; RSPB,	

			(bernicla)	stabilisation	Scotl: -73		inland habitats for foraging. Reduced mortality.	wintering and staging areas grazing and provision of alternative feeding areas such as high-quality grasslands.	measures are not ideally suited.	WWT	
			Canadian light-bellied Brent Goose (hrota)	Increasing	winters mostly in Ireland	Breeding success	Population growth related to the increased use of inland habitats for foraging. Reduced mortality	Improved protection in wintering and staging areas within the species range		JNCC; WWT	
			Svalbard light-bellied Brent Goose (hrota)	Increasing	winters mostly in Lindisfarne	Breeding success	Population growth related to the increased use of inland habitats for foraging. Reduced mortality	Improved protection in wintering and staging areas within the species range		JNCC Birdlife; WWT	
Black-throated Diver	a		560 (W) 220 (B)	(W) 31	Engl: 100 Wales: NA Scotl: 17 Decline in Europe	Breeding success? Overwinter survival?	Degradation and loss of feeding opportunities due to harvest of clam beds and other marine benthos. Oil pollution.	Not a breeding species in Wales or England. But marine moult and wintering concentrations elsewhere; (M)SPA designations?	Oil spills and other marine pollutants; commercial exploitation of marine benthic organisms and shellfish. Monitoring knowledge, wind-farm interactions, movements and winter ecology.	JNCC Birdlife	
Red-throated Diver	a		17,000 (W) 1300 (B)	(W) 98 (B) increase	(W) Engl: 61 (W) Wales: 966 (W) Scotl: 79	Breeding success? Overwinter survival?	Degradation and loss of feeding opportunities due to harvest of clam beds and other marine benthos. Oil pollution.	Not a breeding species in Wales or England. But marine moult and wintering concentrations elsewhere; (M)SPA designations?	Oil spills and other marine pollutants; commercial exploitation of marine benthic organisms and shellfish. Monitoring knowledge, wind-farm interactions, movements and winter ecology.	JNCC Birdlife	
Slavonian Grebe	a		1,100 (W) 30 (B)	(W) 20	Engl: -9 Wales: 2 Scotl: 32		Shift of distribution or overall population decline	Not a breeding species in Wales or England. But marine wintering elsewhere; (M)SPA designations?	Oil spills and other marine pollutants; commercial exploitation of marine benthic organisms and shellfish.	JNCC Birdlife	
Grey Plover	a		43,000 (W)	36 but steady	Engl: 212	Shift in winter	Response to climate change.	SPAs	Monitoring knowledge, wind-farm	Austin et al.	

				decline since mid 1990s	Wales: -49 Scotl: 140	distribution. Breeding success.	Reduction of shooting pressure.		interactions, movements and winter ecology.	2014	Climate change/changes in biotic conditions
Knot	a		330,000 (W)	-4	Engl: 7 Wales: -50 Scotl: -13	Over-winter survival? Wintering re-distribution	Over-exploitation of shellfishery stock. Increase of nutrient inputs. Response to climate change. Human disturbance.	Eastern Sea Fisheries Joint Committee: fishing restrictions. SPAs.	Impacts of small but intensively farmed mussel beds on subtidal areas have not been assessed yet.	Atkinson et al. 2010 Maclean et al. 2008; Austin et al. 2014	Biological resource use other than agriculture & forestry / Fishing and harvesting aquatic resources. Climate change / Changes in abiotic conditions
Bar-tailed Godwit	a	S42	41,000 (W)	-12	Engl: 18 Wales: -79 Scotl: -7	Wintering re-distribution	Response to climate change	SPAs	Monitoring knowledge, wind-farm interactions, movements and winter ecology.	Austin et al. 2014	Climate change / changes in biotic conditions / decline or extinction of species
Spotted Redshank	a		98 (W)	?				Multi-species SPAs	Difficult to locate internationally significant concentrations that occur on a predictable basis.	JNCC	
Turnstone	a		51,000 (W)	-40	Engl: 13 Wales: -63 Scotl: 10		Not apparent but it is vulnerable to habitat loss as a result of rising sea level and changes to invertebrate communities	SPAs	Monitoring knowledge, wind-farm interactions, movements and winter ecology.	Austin et al. 2014	Natural system modifications / Othe ecosystem modifications
Purple Sandpiper	a		13,000 (W)	-56	Engl: -17 Wales: 655 Scotl: 36	Possible shift in winter distribution	Response to climate change	SPAs	Monitoring knowledge, wind-farm interactions, movements and winter ecology.	JNCC. Local species action plan (e.g. Durham)	Climate change/changes in biotic conditions
Whooper Swan	a		15,000 (W) *also in freshwater wetlands	69	Engl: 1314 Wales: -83 Scotl: 46	Breeding success	Increasing breeding population in Iceland.	Species protected throughout its range.	Illegal shooting along migration	WWT	Hunting and removal / trapping, poisoning, poaching

Pink-footed Goose	a		360,000 (W) *also in freshwater wetlands	113	Engl: 172 Wales: NA Scotl: 140	Breeding success. Winter survival.	Increase of foraging habitat.	Goose Management Scheme, targeted nature reserve management, changes in availability of agricultural foraging resource. Establishment of roosting refuges.	Feeding areas (especially farmland) are not significantly represented within the protected sites network	Fox et al. 2005; WWT	Agriculture / modification of cultivation practices
Smew	a		180 (W) *also in freshwater wetlands	393 but with recent declines	Engl: 407 Wales: NA Scotl: 232	Shift in winter distribution	Response to climate change	no SPAs selected for this species.	Monitoring knowledge, wind-farm interactions, movements and winter ecology.	JNCC	
Little gull	a		400-800 (W)	?		Shift in winter distribution		Proposed marine (M)SPAs.	Monitoring knowledge, wind-farm interactions, movements and winter ecology.	NE Technical Information NoteTIN133	
Yellow-legged Gull	a		1,100 (W)	Increasing? - lack of WeBS coverage		Shift in winter distribution		Proposed marine (M)SPAs?	Monitoring knowledge, wind-farm interactions, movements and winter ecology. Threats from oil pollution.	Birdlife RBBP	

APPENDIX A. A SUMMARY OF EVIDENCE FOR DECLINES AND DELIVERY MECHANISMS

G. Urban: A summary of population trends, limiting factors where known and delivery mechanisms available, for current Birds of Conservation Concern and priority species associated with this habitat. Sources include BTO Bird Facts (Robinson 2005; www.bto.org/birdfacts) and Bird Trends (Baillie et al 2014). Population estimates via Musgrove et al 2013 (B=breeding pairs/territories; W =winter individuals). Population trends are via State of the UK's birds 2011 (Eaton et al 2012), BBS 2011 (Risely et al 2012) and the National Atlas 2007-2011 (Balmer et al. 2013).

Species	BoCC status red/amber & Section 41, 42 priority species		UK Popl. Best est. 2012	Long-term popl. trend % 1970-2009 ('-' denotes a declining trend; no symbol denotes a positive trend)	Regional variation ('-' denotes a declining trend)	Probable, current demographic limitations	Causes of trend within the UK relevant to lowland farmland	Delivery mechanism in place?	Mechanism limitations?	Evidence or source	Relevant subjects identified in Article 12
Herring Gull	r	S41,S42	740,000 (W) 140,000 (B)	(B) -33 since 2000, but nests on buildings in urban areas are increasing	(B) roof nesters increasing	Not well understood in the urban context;	(W) breeding population decline. Increase use of urban habitat. (B) abundant food supply in urban areas. Safe, predator-free nesting sites on rooftops	Most plans have concentrated on managing its increasing breeding urban population, to minimise its adverse effect on buildings, and public health or safety. However, numbers should be carefully monitored as overall population is declining.		JNCC, Raven & Coulson 1997	Natural and abiotic processes / introduction of disease (microbial pathogens)/predation.
Lesser Black-backed Gull	a		130,000 (W) 110,000 (B)	(W) 42	(W) Engl: 45 (W) Wales: -51 (W) Scotl: -3	Adult survival rate	Changes in food availability?	Most plans have concentrated on managing its increasing breeding urban population, to minimise its adverse effect on buildings, and public health or safety. However, numbers should be carefully monitored as overall population is declining.		Birdlife JNCC Balmer et al. 2013	Biological resource use other than agriculture and forestry. Fishing and harvesting of aquatic resources.
Swift	a		87,000 (B)	-31	Engl: -32 Wales: -27 Scot: -50 (BBS)	Not well understood; food availability and survival suspected as an African migrant; also nest	Unknown. Possible causes: loss of nesting sites and reduction of food availability.		Modern building design and refurbishment of old buildings. More research needed	RSPB, BTO	

						site loss in UK?					
House Martin	a		510,000 (B)	-4	Engl: -15 Wales: -2 Scotl: 114 (BBS)	Not well understood; rainfall in Africa suspected as affecting survival.	Climatic conditions, Loss of suitable nest sites, but largely unknown in the urban environment	Artificial nests. Nest protection.	Difficult to monitor population trends.	RSPB; Robinson et al. 2008. BTO: New population survey in 2015; Balmer et al. 2013	
Dunnock	a	S41,S42	2,500,000 (B)	-29 (24)	Engl: 15 Scot: 61 Wales: 35 (ie.,recovering since 1995: BBS	Survival rates level but immature survival low and nesting output low. Not well understood in the urban context	Lack of knowledge of demographic. limiting factors. Unknown in the urban environment. Possible causes: predation and/or a reduction of food availability.	Not developed for the urban environment.	Full detailed ecological vs demographic and ecological studies still lacking.	Fuller *et al.* 2005. Siriwardena et al 1998a. BTO bird trends	
Black Redstart	a		19-44 (B) 400 (W)	No population trends available		Not well understood	Unknown in the urban environment	Bespoke habitat for Black Redstarts has been created in the main breeding areas in London, often as part of mitigation for new development projects, with the London Wildlife Trust and other conservation bodies working closely with developers and the local planning authority		London Wildlife Trust	
Song Thrush	r	S41	1,200,000 T (B)	-49	Engl: 22 Wales: 20 Scot: 31 (BBS trends since 1995)	Survival exacerbated by drying of habitats, drainage and pesticides, and reduced in cold winters. Woodland structure & wetness?	Unknown drivers or trends in the urban environment. Possible causes: predation and/or a reduction of food availability.	Not developed for the urban environment	Ensure appropriate design and funding of greenspaces, the creation of wet features, damp soils and dense woody vegetation nearby; lowered input insecticides and molluscicides around urban areas? Urban research required for this species.	Peach et al. 2004a,b RSPB Robinson et al. 2007. Eglington & Noble 2009. Newson et al. 2009	
Starling	r	S41,S42	1,900,000 (B)	-78	Engl: -51 Wales: -63 Scotl: -29 (BBS)	Drivers? Winter food? Nest sites may be limiting in woods/forest? Nesting attempts in urban and suburban areas	Mature standing dead wood is important for nest sites, near invertebrate-rich soils (farmland). On adjacent land, availability of in-field invertebrate resources, stubbles and	Not developed for the urban environment.	Adequate protection of standing dead wood needed (nest sites)? Lawn and grassland management to promote tipulid (cranefly) abundance? Perhaps further ecological	Robinson *et al.* 2005b, 2006; Crick et al. 2002. Whittingham e t al., 2004.	

						produce fewer young than rural areas, due to lower clutch sizes and hatching success.	grassland (sward structure) in summer and winter. Uncertain link between productivity and food availability on farmland? Causes in urban: unknown, but possible that the availability of soil invertebrates has either declined or become less available during dry summers. Nest site availability in these habitats is unknown.		research needed generally and in the urban context, to determine limiting factors.	Newton 2004; Devereux et al 2004. Ryymer et al. 2012 RSPB – on-going	
House Sparrow	r	S41,S42	5,300,000 (B)	-66	Recent declines in abundance in the west of GB	Decreased juvenile survival? Evidence for changes in survival rates due to lack of food resources, on farmland at least. Decrease in breeding performance possible? However invertebrate food supply and breeding performance may be linked positively.	Tidying; reduction in the availability of habitat and food in towns and the loss of suitable nesting sites. Winter seed resources? Often persists near allotments.	Not developed for the urban environment. Evidence that mealworm food supply improves breeding performance.	Perhaps further ecological research needed generally and in the urban context, to determine limiting factors.	Crick et al. 2002; Hole et al 2002. Robinson *et al.* 2005a. Robinson et al 2014. Newson et al 2010. Shaw et al 2011. Morrison et al. 2014; Peach et al. 2014. RSPB, on-going	