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COUNTRYSIDE BIRD SURVEY: STATUS AND TRENDS OF COMMON AND WIDESPREAD BREEDING BIRDS 1998-2016

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An Roinn Cultúir, Oidhreachta agus Gaeltachta
Department of Culture, Heritage and the Gaeltacht

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Front cover, small photographs from top row:

Coastal heath, Howth Head, Co. Dublin, Maurice Eakin; **Red Squirrel** *Sciurus vulgaris*, Eddie Dunne, NPWS Image Library; **Marsh Fritillary** *Euphydryas aurinia*, Brian Nelson; **Puffin** *Fratercula arctica*, Mike Brown, NPWS Image Library; **Long Range and Upper Lake**, Killarney National Park, NPWS Image Library; **Limestone pavement**, Bricklieve Mountains, Co. Sligo, Andy Bleasdale; **Meadow Saffron** *Colchicum autumnale*, Lorcan Scott; **Barn Owl** *Tyto alba*, Mike Brown, NPWS Image Library; **A deep water fly trap anemone** *Phelliactis* sp., Yvonne Leahy; **Violet Crystalwort** *Riccia huebeneriana*, Robert Thompson

Main photograph:

Yellowhammer *Emberiza citrinella,* Dick Coombes

Countryside Bird Survey: Status and trends of Common and Widespread Breeding Birds 1998-2016

Version 1.1

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Executive Summary

The Countryside Bird Survey (CBS) is an annual survey that tracks the breeding populations of Ireland's common and widespread birds. This on-going survey is underpinned by the efforts of around 200 field surveyors, mostly volunteers, making it one of Ireland's best examples of a citizen science project which tracks ecological changes in our environment. The volunteers' survey effort is supplemented to a significant degree by both BirdWatch Ireland and National Parks and Wildlife Service staff.

The survey, which started in 1998, aims to measure changes in bird numbers in a random selection of approximately 300 1 km square sample plots surveyed from year to year. This level of sustained coverage ensures that all common and widespread breeding species are surveyed across a wide range of habitats and geographical locations. CBS is funded by the National Parks and Wildlife Service and coordinated by the CBS Office based at BirdWatch Ireland.

The collection, analyses and reporting of robust data are an integral part of sound conservation management. CBS data was the primary evidence base that informed Ireland's reporting obligations under Article 12 of the Birds Directive for over 50 of Ireland's breeding bird species for the period 2013 – 2018. On a more frequent basis CBS species trend data is used to produce a Common Bird Index and Farmland Bird Index for Ireland and through the Pan-European Common Bird Monitoring Scheme, these data contribute to similar indices at the European scale.

The majority of terrestrial birds that breed in the Irish countryside are present all year, but the CBS also monitors those migrants (including warblers and hirundines) that arrive in spring from sub-Saharan wintering grounds to breed in Ireland.

It should be noted, that some bird species that were once more common and widespread across the Irish countryside are not included here. Such species include Lapwing, Curlew and Grey Partridge, which have become too restricted in their distribution and are too scarce for CBS models to provide accurate monitoring data. This current report provides an update on the population estimates and trends of common and widespread breeding birds in Ireland for the period 1998-2016 using data primarily from CBS, but also from the most recent Bird Atlas (2007-2011). Detailed accounts are provided for 51 bird species considered adequately covered by CBS. Updated population estimates are provided for each species, in addition to the 10-year (2006-2016) and 18-year (1998-2016) trends in abundance.

Over the 18-year period since CBS began, population trend analyses indicate that 47% of species are increasing, 27% of species are stable and approximately 26% of our common and widespread birds are in decline. The most pronounced of these declines are those of Grey Wagtail, Stock Dove, Swift, Greenfinch and Kestrel. However, some bird species' populations have increased during this period particularly Blackcap, Goldfinch, Redpoll, Collared Dove and Chiffchaff.

This report also looks at the long-term (i.e. since 1970 approximately) changes in the distributions of our common and widespread birds. For example, species' trends in breeding distributions since the early 1970s indicate that 38 of the 51 species examined exhibited stable and or increasing distributions, while 13 species have shown declines; the largest declines were observed for Stock Dove, Yellowhammer and Swift.

The report concludes with an assessment of the current pressures and threats facing Ireland's common and widespread breeding birds. Relevant to the current Article 12 reporting period of 2013 – 2018, only one high level pressure and threat was identified and relates to the *Trichomonas gallinae* parasite linked to the severe decline in Greenfinch numbers since it was first recorded in Ireland over 10 years ago. Additional pressures and threats determined to be at the moderate scale, were identified in relation to: agriculture and forestry, which include *inter alia* changes to grazing and grassland management and the use of pesticides; development (e.g. loss of traditional nesting habitats of Swift), and climate change.

Acknowledgements

The Irish Countryside Bird Survey (CBS) is coordinated by BirdWatch Ireland and funded by the National Parks and Wildlife Service (Department of Culture, Heritage and the Gaeltacht). The CBS Steering Group is comprised of Dick Coombes (National Coordinator), Lesley Lewis and Brian Burke of BirdWatch Ireland, David Tierney and Sinéad Cummins of the National Parks and Wildlife Service, John O'Halloran of University College Cork, and Niall Ryan (Department of Agriculture, Food and the Marine).

This report is the product of tens of thousands of hours work by a large number of committed field surveyors across the country, comprised primarily of volunteers, as well as professional conservation staff of the National Parks and Wildlife Service and BirdWatch Ireland. The success of CBS is therefore owed to the hard work, passion, and time they devote to monitoring Ireland's birds in their allotted CBS squares. This publication is therefore dedicated to every bird surveyor, both current and past, that has contributed to the Countryside Bird Survey. Each valued field surveyor is listed in Appendix 1.

1 Introduction

1.1 Background to surveying countryside birds in Ireland

The distribution of terrestrial breeding birds in Ireland was first described in a breeding bird atlas carried out between 1968 and 1972 (Sharrock, 1976). A second breeding bird atlas survey carried out between 1988 and 1991 (Gibbons *et al.*, 1993) showed that significant changes had occurred over the intervening 20-year period. These distributional changes had implications for changes in population levels (Crowe *et al.*, 2017). The declines in distribution of several farmland bird species coincided with a period of increased agricultural intensification. Similar declines occurred throughout Europe over the same period and were attributed to agricultural intensification which was brought about by increased demand for agricultural productivity following the Second World War (Krebs *et al.*, 1999, Donald *et al.*, 2001). While the first two breeding bird atlases, and a third one carried out between 2007 and 2011 (Balmer *et al.*, 2013), flagged changes in the status of some species over time, they focused mainly on distribution. Abundance was recorded in the second and third atlases, providing indications of population changes over that twenty-year period. However, the atlases were carried out at 20 year intervals and clearly, there was a need for a long-term monitoring programme to track changes of terrestrial breeding birds on an annual basis.

1.2 Background to the Countryside Bird Survey (CBS)

After several years of preparatory discussions by personnel from the National Parks and Wildlife Service, BirdWatch Ireland, The Heritage Council and University College Cork, agreement was reached that a robust monitoring scheme of terrestrial bird species should be put in place in the Republic of Ireland. In 1998, the Countryside Bird Survey (CBS) was initiated, employing the same survey methods devised for the Breeding Bird Survey (BBS) in Britain and Northern Ireland, which was launched in 1994 (Gregory *et al.*, 1996). The BBS was designed to replace the Common Bird Census (CBC), which had been running since 1966 in the UK.

The primary objective of the Countryside Bird Survey is to monitor breeding populations of common and widespread species in the Republic of Ireland (Crowe *et al.*, 2010). The CBS is funded by the National Parks and Wildlife Service and coordinated by the CBS Office based at BirdWatch Ireland. CBS is an annual survey that is underpinned by the efforts of around 200, mostly volunteer, observers each year. The survey aims to measure changes in bird numbers in a random selection of 1 km sample plots surveyed from year to year. CBS has been undertaken during all years since 1998 with the exception of 2001, when Foot-and-Mouth restrictions prevented survey work.

1.3 Species covered by CBS

The large number of sample plots surveyed in CBS (over 300 annually) ensures that all common and widespread breeding species are surveyed across a wide range of habitats and geographical locations. The majority of terrestrial birds that breed in the Irish countryside are present all year, but a number of species – including warblers, swifts and hirundines – are summer visitors, arriving in spring from sub-Saharan wintering grounds. Within CBS, 49 bird species are considered to be adequately covered (and therefore can be said to be reliably monitored), comprising 37 residents and 12 summer migrants. Amongst the residents, the main groups comprise five corvids, three doves, two raptors, three pipits and wagtails, four tits, three thrushes, seven finches and two buntings. The remaining species are Pheasant *Phasianus colchicus*, Skylark *Alauda arvensis*, Starling *Sturnus vulgaris*, Wren *Troglodytes troglodytes*, Dunnock *Prunella modularis*, Robin *Erithacus rubecula*, Stonechat *Saxicola torquatus* and Goldcrest *Regulus regulus*. In addition, Treecreeper *Certhia familiaris* and Spotted Flycatcher *Muscicapa*

striata are included within analyses, and within this report, but because they occur in less than 30 squares per year are considered less adequately monitored than the aforementioned 49 bird species.

A high proportion of 1 km squares surveyed in CBS are entirely or at least partly within farmland habitats. Species which can be broadly termed 'farmland birds' are of particular interest in terms of monitoring, as some have been shown to be adversely affected by some changes in agricultural practices. The severe decline in Yellowhammer *Emberiza citrinella* since the first Breeding Bird Atlas of 1968-72 is considered to be related directly to the general shift from arable farming to pastoral farming in many parts of the country. It is therefore important that CBS continues to track further changes of this and other seed-eaters such as Eurasian Skylark *Alauda arvensis*, which is currently showing a decline in numbers.

The summer visitors covered by CBS are Cuckoo *Cuculus canorus*, Swift *Apus apus*, three hirundine species, Wheatear *Oenanthe oenanthe* and six warblers. All are insectivores and all winter in sub-Saharan Africa (though some of the Blackcap *Sylvia atricapilla* population winters in the Mediterranean Basin). Summer migrant numbers are prone to annual fluctuations, which in some cases are related to detrimental environmental conditions on the wintering grounds. Some migrants, such as Whitethroat *Sylvia communis* and Sand Martin *Riparia riparia*, which winter in the arid zones of the Sahel region, south of the Sahara Desert, can suffer losses in years of severe drought there. Others such as Sedge Warbler *Acrocephalus schoenobaenus* and Grasshopper Warbler *Locustella naevia*, may be affected by extreme wet season rainfall in their West African wintering area. Declines will be picked up in CBS in the breeding seasons immediately following winters when such conditions prevail.

Species not adequately covered by CBS methods (even though some may be recorded during the survey) include all waders (including Woodcock *Scolopax rusticola*), owls, some raptors, Dipper *Cinclus cinclus*, Kingfisher *Alcedo atthis* and all non-terrestrial species. These species require different methodologies, often more species-specific.

1.4 How CBS data are used

To date, the information gathered and analyses of these data have served to provide information on the status of our common and widespread bird species which are published in regular reports (e.g. Crowe & Coombes, 2005; Crowe *et al.*, 2011; Crowe *et al.*, 2017), and have facilitated trend analyses that are undertaken on a regular basis on more than 50 common and widespread breeding birds (e.g. Crowe *et al.*, 2010). More recently the analyses of data from CBS and the Bird Atlas (2007-2011) (Balmer *et al.*, 2013) have been used to generate population estimates for common and widespread breeding birds in Ireland (Crowe *et al.*, 2014). In addition, CBS data have also been used in a wider, pan-European context, aimed at determining the status of birds throughout Europe as a whole (Pan-European Common Bird Monitoring Scheme (PECBMS) (http://www.ebcc.info/pan-european-common-bird-monitoring-scheme-pecbms/) (e.g. PECBMS, 2019), while data from a selection of farmland species feed into the European Farmland Bird Index. Every five years, CBS trends are also used to inform the update of the list of Birds of Conservation Concern in Ireland accordingly i.e. to help determine which species qualify for red-listing (Colhoun & Cummins, 2013).

This current report aims to provide an update on the population estimates and trends of common and widespread breeding birds in Ireland for the period 1998-2016 using data from both CBS and the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). Importantly, these data inform Article 12 reporting under the EU Birds Directive, supporting assessments of bird species trends, pressures and threats and conservation efforts at national and European scales.

2 Methods

2.1 Data collection

2.1.1 CBS survey design

The Countryside Bird Survey (CBS) is based on a random approach stratified by region, and the survey design and field methodology closely follows that of the UK Breeding Bird Survey (BBS) which is undertaken in Britain and Northern Ireland (Risely *et al.*, 2010). Survey work is undertaken by a combination of volunteers and professional staff of the National Parks & Wildlife Service and BirdWatch Ireland. Roughly 450 field workers have contributed to date.

The Republic of Ireland was divided into eight regions, based on the administrative divisions of the National Parks and Wildlife Service at that time (Figure 1). These regions varied in size, and each contained between three and four counties. Grid squares of 10 km by 10 km (based on the Irish National Grid) were randomly selected within each region for coverage. Those squares with less than 50% land, for example coastal areas or lake shores, were excluded, leaving some 700 possible survey squares. For each 10 km square selected, the 1 km square at the extreme south-west corner is then surveyed. In total, 401 1 km squares have been surveyed between 1998 and 2016 (Crowe *et al.*, 2017). The survey aims to achieve coverage of the same 1 km squares every year, ideally by the same observer, although there is some turnover of survey participants. Within each square, the ideal survey route comprises two parallel transects, each 1 km in length, about 500 m apart, and about 250 m from the edge of the square. However, for practical reasons there is sometimes deviation from the ideal route (Crowe *et al.*, 2010).

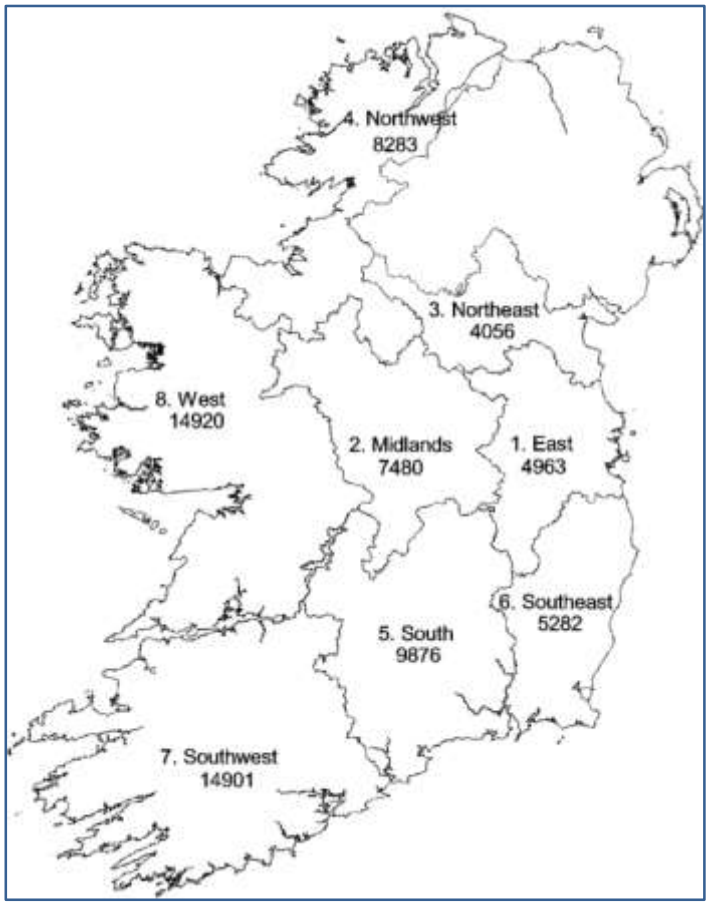

Figure 1 The eight Countryside Bird Survey regions which formed the basis for the stratified random sampling. The area (km^2) of each region is indicated.

2.1.2 Field survey methods

CBS is an annual survey carried out exclusively during the breeding season. Bird counts are undertaken during two visits. The first visit is in the early part of the breeding season (April to mid-May) and the second at least four weeks later (from mid-May to the end of June). This reflects the abundance of residents and early migrants which tend to be more easily detected during the first visit, and later migrants which are more abundant during the second visit (Crowe *et al.*, 2010). During each survey visit, observers are asked to begin their counts between 06:00 and 07:00 hours to coincide with maximum bird activity, but to avoid dawn, when concentrated song activity is highest. Observers are also encouraged to record only the adult birds they see or hear as they walk along their transect routes. Bird counts in heavy rain, poor visibility, or strong winds are discouraged (Bibby *et al.*, 1992). Habitat data are recorded using codes from an established hierarchical system common to a range of bird surveys in the UK (Crick, 1992).

2.1.3 Bird Atlas 2007-2011

The most recent bird atlas for Britain and Ireland began in November 2007 and aimed to achieve coverage of all 10 km squares on both islands during both winter and summer. In Ireland, the Irish National Grid formed the basis for identifying the sampling units. Two methods were used (Balmer *et al.*, 2013). The simpler 'roving records' aimed to gather details on presence or absence of a species in each 10 km square. The second 'Timed Tetrad Visit' (or TTV) method was used to provide an indication of relative abundance. The TTV survey method was considerably more labour intensive as it required the observer to devote time to surveying a minimum of eight tetrads (2 × 2 km squares) within their allocated 10 km square. Observers were required to spend at least one hour in each tetrad and to focus their survey effort within the major habitats present in that tetrad. It was deemed from the outset that the coverage of all 10 km squares in Ireland for TTVs would be unachievable. Therefore, a chequerboard approach was applied, where efforts were instead focussed on ensuring TTV coverage of every alternate 10 km square within the chequerboard. The atlas relied on the inputs of more than 40,000 observers across Britain and Ireland, with almost 2,000 in Ireland. Full details of the survey methods and coverage are presented in Balmer *et al.* (2013).

2.2 Data analyses and interpretation

2.2.1 Trends in abundance

The total numbers of adult birds of each species detected in each 1 km square were calculated for each year. The maximum of the two counts (from early and late visits) was used as the annual measure of relative abundance for each species. Annual population indices were then calculated using the freeware program TRIM (Trends & Indices for Monitoring Data), a program used for the analysis of time series of counts with missing observations (Pannekoek & van Strien, 1996). Using loglinear models, counts were modelled as a function of square (site) and year effects, with interpolated estimates for site-year combinations with missing data. The stratified sampling design results in unequal representation of regions across Ireland, so annual counts were weighted by the inverse of the proportion of the area of each region that is surveyed that year.

Population change is shown in the form of indices, where the result from the first season (1998) is constrained to a value of 100, and results for all other years are expressed relative to this baseline. The mean annual change was then calculated as the slope of the line of best fit through the annual indices and was extrapolated across the time series 1998-2016 to generate modelled values assuming a linear fit.

A 10-year trend (2006-2016) was calculated as the percentage change between the modelled value in the final year (2016) and the modelled value in 2006. Similarly, an 18-year trend (1998-2016) was calculated

as the percentage change between the modelled value in the final year (2016) and the modelled value in 1998. Confidence limits were calculated as the mean annual change +/- 1.96 (standard error). These upper and lower confidence limits were treated in a similar fashion to the mean annual change as described above to generate the confidence limits around the trends calculated. The criteria used to distinguish whether a trend was 'stable', 'increasing' or 'decreasing' trends followed Article 12 Explanatory Notes and Guidelines for reporting under the Birds Directive (DG Environment, 2017).

Population trends were calculated for species occurring in an average of 30 or more squares over the duration of the survey; precision below this threshold considered to be low (Joys *et al.*, 2003). The exception to this is the inclusion of trends for Treecreeper and Spotted Flycatcher that both occur in less than 30 squares on average, and for which the trends are considered approximate.

Colonial-nesting species (e.g. waders and gulls) are inadequately monitored using CBS methodology (Joys *et al.*, 2003), and were omitted from analyses with the exception of Sand Martin, which is included but with some degree of caution assigned. Trends for certain species that can occur with clumped distributions (e.g. Rook *Corvus frugilegus*, Starling or species with a high proportion of zero counts such as Sparrowhawk *Accipiter nisus*, Kestrel *Falco tinnunculus,* Grey Wagtail *Motacilla cinerea* and Wheatear) were calculated, but are assigned some degree of caution (Crowe *et al.*, 2010).

2.2.2 Population estimates

Robust population estimates for common breeding birds in Ireland were last produced in 2014. Crowe *et al.* (2014) used data from CBS, and the UK's Breeding Bird Survey (BBS) in Northern Ireland, to calculate densities i.e. the total number of individuals of common and widespread species using distance sampling analyses. Data from the Bird Atlas (2007-2011) (Balmer *et al.*, 2013) were then used to quantify species distribution and to generate an indication of proportional occurrence within survey squares. The total number of each species was then estimated for each 10 km square by multiplying proportional occupancy by the total area of the 10 km square within each CBS region, and by the mean regional density generated from CBS. For further details please refer to Crowe *et al.* (2014).

The calculation of updated population estimates using the aforementioned method (as described in Crowe *et al.* 2014) is obviously precluded by the absence of more recent atlas data. Therefore, updated population estimates were generated by extrapolating the former 2014 estimates, by the mean annual change generated by CBS. The upper and lower confidence limits were calculated in a similar fashion to generate the confidence limits around each new population estimate.

2.2.3 Trends in breeding distribution

Trends in breeding distribution were calculated for three time periods, as described below.

10-year trend (2006-2016): This trend, based on CBS data, was calculated as the change in the frequency of occurrence of a species in CBS 1 km squares. A series of years that are 12 years apart were examined for each species; i.e. the two 3-year periods 2002-2004 and 2014-2016. The number of 1 km squares that each species was recorded in was then calculated for each of the two time periods. The trend was calculated as the percentage change between the two time periods as follows:

$$\text{Change} = ((I_y - I_x) / I_x) \times 100$$

where I_y is the value for the recent time period and I_x is the value for the earlier time period

25-year trend (1991-2016): The number of relevant occupied (i.e. confirmed, probable and possible) 10 km squares from the Bird Atlas (2007-2011) for each species (Balmer *et al.*, 2013) was first updated by using the percentage change figure generated by the 10-year distribution trend discussed above. For

example, where a species was considered to have increased in distribution by 1.6% during the recent 10-year period, the abundance of occupied squares generated by Balmer *et al.* (2013) was simply extrapolated by 1.6%. The 25-year breeding distribution trend was then calculated as the difference between the updated abundance of 10 km squares from the Bird Atlas (2007-2011), with those from the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993).

44-year trend (1972-2016): The 44-year trend was calculated by comparing the updated abundance of 10 km squares from the Bird Atlas (2007-2011) (Balmer *et al.*, 2013) (as above), with those from the Bird Atlas (1968-1972) (Sharrock, 1976).

2.2.4 Pressures and threats

Analysis of the IUCN Red List shows that there has been a steady and continuing deterioration in the status of the world's birds since the first comprehensive assessment in 1988, and at least 40% of bird species worldwide are in decline. The reasons behind these declines are many and varied but agricultural changes and expansion, overexploitation, pollution, disturbance, habitat loss and modification are all thought to be driving declines worldwide, while climate change may prove to be the most serious threat of all (Birdlife International, 2018).

In relation to birds, pressures and threats can be defined as the principal factors responsible for causing individual species to decline, suppress their numbers, or restrict their ranges (DG Environment, 2017). Regular assessments of the pressures and threats facing birds are therefore fundamental to understanding not only why the numbers and distribution of our breeding birds may be changing, but also to identify and inform conservation management measures at various spatial scales (site, region, national, flyway). This report therefore provides the results of a thorough assessment of the current pressures and threats facing Ireland's breeding birds. The assessment relates to the time period as per reporting under Article 12 of the Bird's Directive, in that pressures relate to the six-year period 2013-2018, while future threats relate to two reporting periods (i.e. within 12 years following the end of the current period).

The assessment was undertaken for all bird species included within this report. The term 'pressure' is used to describe issues negatively affecting bird populations now and in the recent past, while the term 'threat' describes those issues likely to affect bird populations negatively in the coming years. Pressures and threats were ranked as High (H), Medium (M) or Low (L) based on the following:

- High importance/impact: Important direct or immediate influence and/or acting over large areas (a pressure is the major cause or one of the major causes, if acting in combination with other pressures, of significant decline of species population, distribution area or deterioration of habitat quality; or pressure acting over large areas preventing the species population of depleted species to expand);

- Medium importance/impact: Medium direct or immediate influence, mainly indirect influence and/or acting over moderate part of the area/acting only regionally (other pressure not directly or immediately causing significant declines);

- Low importance/impact: identified as a pressure or threat but not deemed to be of High or Medium importance.

3 Species accounts

This report provides individual species accounts for all common and widespread breeding birds in the Republic of Ireland.

The taxonomy and scientific nomenclature used in this report follow that used for Article 12 reporting under the EU Bird's Directive. Common names follow normal usage in Ireland, but the common names used in the *List of birds of the European Union* (hereafter 'EU Bird List') are given where different in each species account. The EU Bird List incorporates the taxonomic and nomenclatural changes proposed in del Hoyo & Collar (2014) and del Hoyo & Collar (2016).

The following section provides details on the layout of species accounts and interpretation of data.

3.1 Layout of species accounts

Common Name / Scientific Name / Irish Name

Resident/Summer migrant

Breeding population:	**Population estimate (2011-2016)[a]:**	217,252
	min – max population estimate[b]:	145,092 – 294,597
	10-year trend (2006-2016)[c]:	+2.4
	18-year trend (1998-2016)[d]:	+4.4
Breeding distribution change (%):	**10-year trend (2006-2016)[e]:**	+9
	25-year trend (1991-2016)[f]:	-39
	44-year trend (1972-2016)[g]:	-62

[a] Updated population estimate (2011-2016). Refer to Section 2.2.2.

[b] The upper and lower confidence limits around the population estimate. Refer to Section 2.2.2.

[c] The 10-year population trend (2006-2016). Refer to Section 2.2.1.

[d] The 18-year population trend (1998-2016). Refer to Section 2.2.1.

[e] The 10-year trend (2006-2016) in breeding distribution is the change in the frequency of occurrence of a species in CBS 1 km squares over this time period. Refer to Section 2.2.3 for analytical methods.

[f] The 25-year trend in breeding distribution is the change in the frequency of occurrence of a species from the Bird Atlas (2007-2011) (Balmer *et al.*, 2013) with those from the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993) (Republic of Ireland data only). Refer to Section 2.2.3 for more details on analytical methods used.

[g] The 44-year trend in breeding distribution is the change in the frequency of occurrence of a species from the Bird Atlas (2007-2011) (Balmer *et al.*, 2013) with those from the Bird Atlas (1968-1972) (Sharrock,1976) (Republic of Ireland data only. Refer to Section 2.2.3 for more details on analytical methods used.

Species accounts are provided for bird species recorded in 30 1 km squares or more, per year on average, during CBS between 1998 and 2016 with the exception of:

- Spotted Flycatcher *Muscicapa striata* and Treecreeper *Certhia familiaris* occur, on average, in less than 30 CBS 1 km squares per year but are included within this report. However some caution is assigned to the population estimates and trend data presented.

- The population size and distribution of Mallard *Anas platyrhynchos*, Grey Heron *Ardea cinerea* and Moorhen *Gallinula gallinula* are not best surveyed by CBS methods and these species are not included in this report.

- Snipe *Gallinago gallinago*, Lesser Black-backed Gull *Larus fuscus* and Herring Gull *Larus argentatus* were recorded in more than 30 squares during the relevant time period but were not included in data analyses or summaries as they are considered inadequately monitored by CBS.

- Feral Pigeon/Rock Dove *Columba livia* is not included within this report.

For the aforementioned excluded species, summary data (where available) are presented in Appendix 2 but trend data should be interpreted with necessary caution.

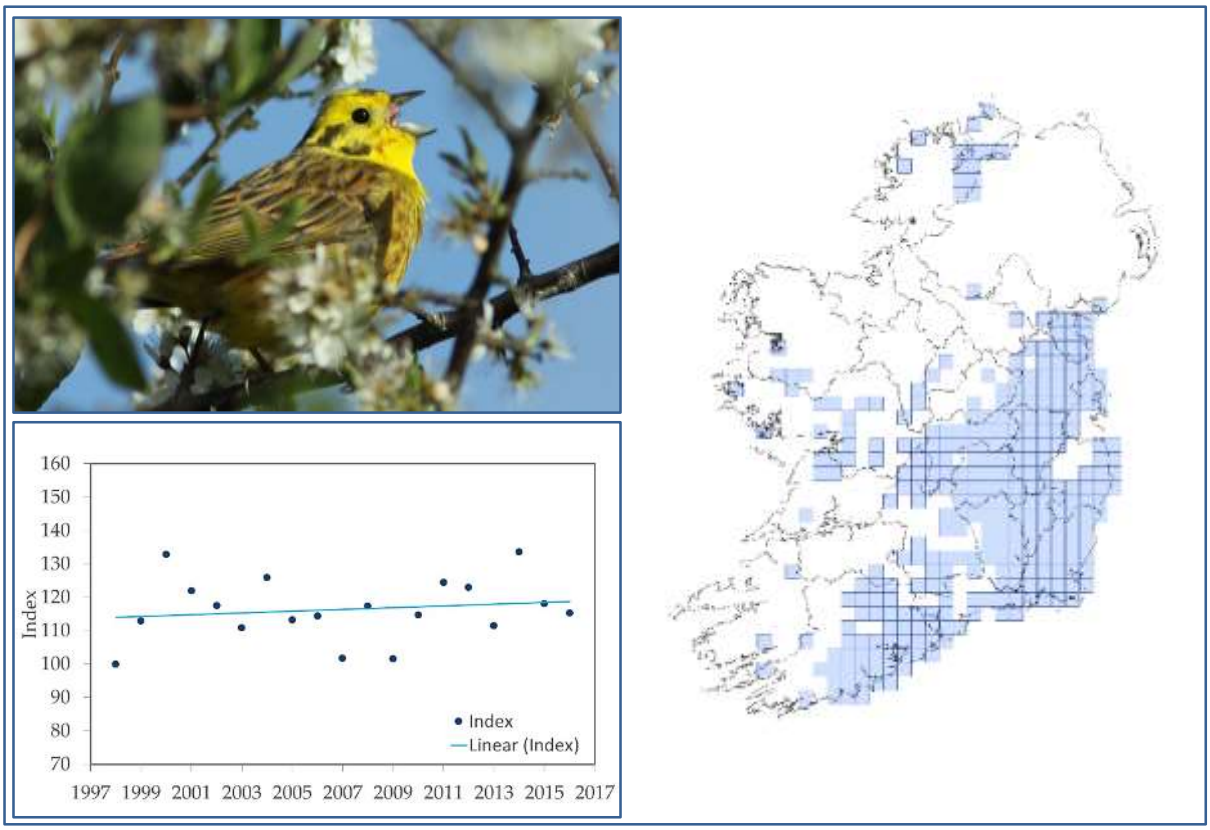

Figure 2 Sample distribution map and graphed population 18-year trend for Yellowhammer. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

3.1.1 Notes on interpretation

- Species accounts refer to previous published data, with the three previous breeding bird atlases referred to as:

  - Bird Atlas (1968-1972) (Sharrock, 1976);

  - Bird Atlas (1988-1991) (Gibbons *et al*., 1993);

  - Bird Atlas (2007-2011) (Balmer *et al*., 2013).

- Breeding distribution change figures (25- and 44-year trends), as explained above, are calculated with data for the Republic of Ireland only. However, when referring to atlas data generally in the text of species accounts, data for Ireland refer to all-Ireland, while Britain relates to Scotland, England and Wales, as well as the Channel Islands and the Isle of Man (Balmer *et al.*, 2013).
- Reported trends based on the Breeding Bird Survey (BBS) in the UK (e.g. Harris *et al.*, 2018) relate to the UK as a whole, including Northern Ireland.

3.2 Pheasant *Phasianus colchicus* Piasún

Resident

Breeding population:	**Population estimate (2011-2016):**	309,248
	min – max population estimate:	242,961 – 384,900
	10-year trend (2006-2016):	+17.1
	18-year trend (1998-2016):	+32.8
Breeding distribution change (%):	**10-year trend (2006-2016):**	+6
	25-year trend (1991-2016):	+15.5
	44-year trend (1972-2016):	+15.1

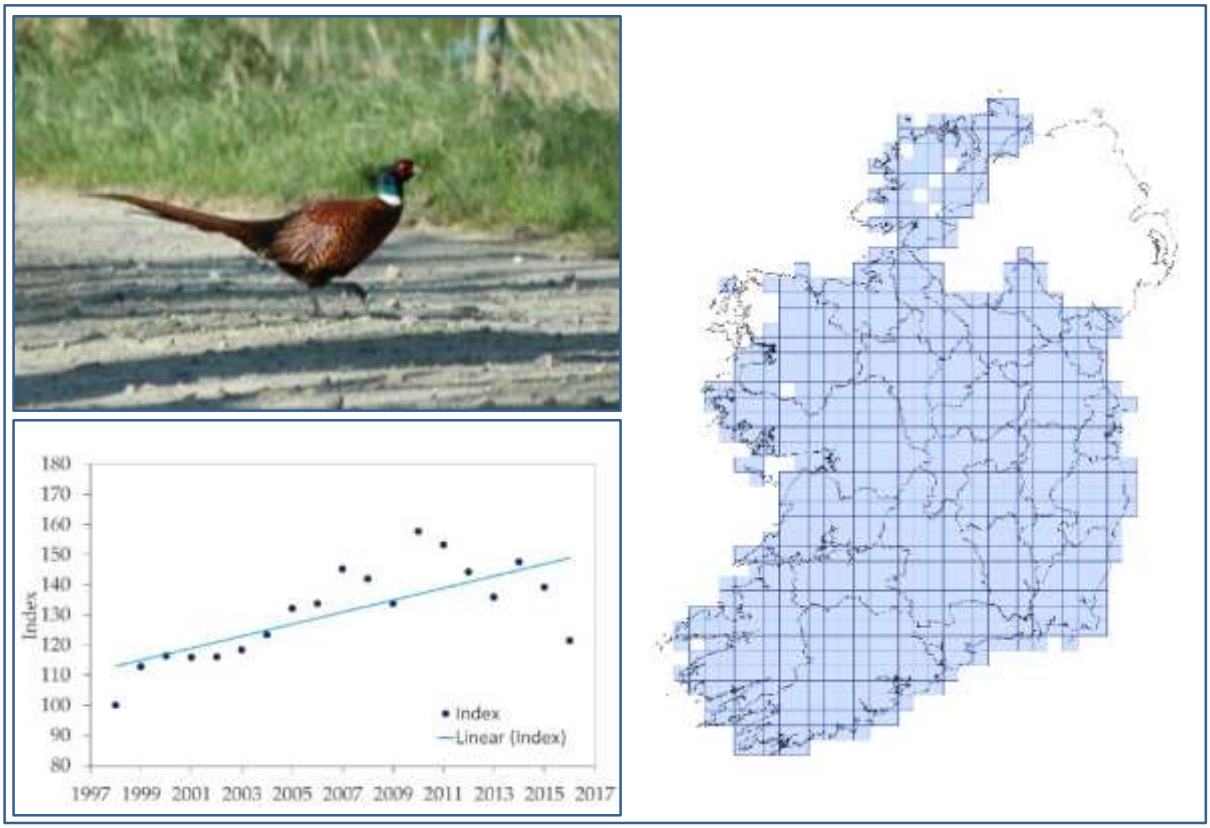

Figure 3 Distribution map and graphed population 18-year trend for Pheasant. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer et al., 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Pheasant (Common Pheasant on the EU Bird List) is a non-native species from Asia, first introduced in the 16th century (Lever, 2005). Two races have been introduced to Ireland, but the race from China, with a white neck ring, has dominated. As a game bird, the Pheasant is raised in captivity and released into woodland to be shot soon afterwards. Many birds therefore disperse far from their release sites and can be found in woodland, farmland, large gardens and parks, where they become 'wild'. Although, traditionally considered as a woodland species, Pheasant is a species of woodland edge and agricultural

farmland. Woodland is typically used during winter with the birds moving out into farmland during spring and summer (Robertson *et al.*, 1993).

The Pheasant is widespread across Ireland and was recorded in 91% of Irish 10 km squares during the breeding season for the Bird Atlas (2007-2011), absent only from a few west coast squares (Balmer *et al.*, 2013). On average, Pheasant was recorded in 241 CBS 1 km squares each year. Numbers have increased by nearly 33% over the lifetime of CBS (1998-2016) and have similarly increased over the course of the UK's Breeding Bird Survey (BBS) (Harris *et al.*, 2018) as well as in Europe (1980-2016) (PECBMS, 2019). Increases are generally attributed to a rise in the number of captive-reared birds released for shooting (Balmer *et al.*, 2013). Breeding distribution has been stable over the recent 10-year period, while increases are evident over the 18- and 44-year trend periods.

3.3 Sparrowhawk *Accipiter nisus* Spióróg

Resident

Breeding population:	**Population estimate (2011-2016):**	11,859
	min – max population estimate:	8,746 – 14,252
	10-year trend (2006-2016):	-6.4
	18-year trend (1998-2016):	-11.2
Breeding distribution change (%):	**10-year trend (2006-2016):**	+17.0
	25-year trend (1991-2016):	+42.6
	44-year trend (1972-2016):	+14.6

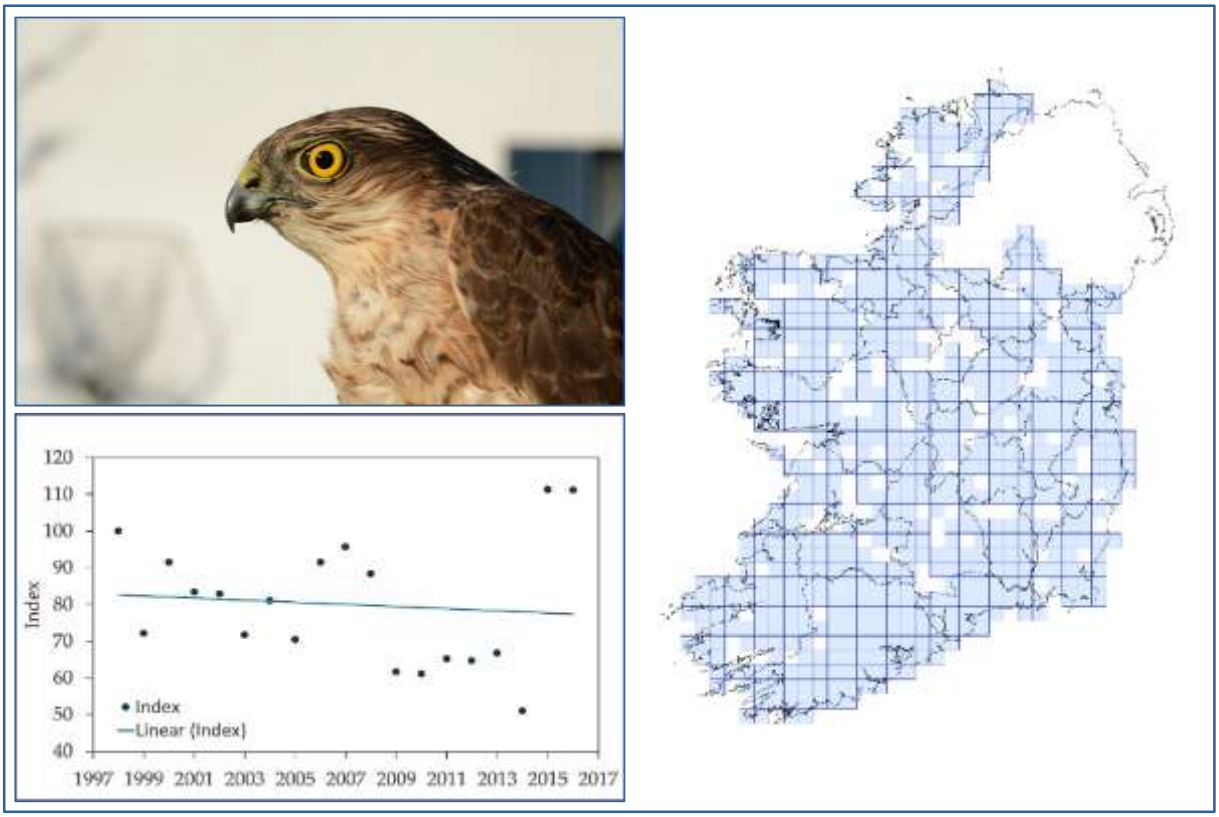

Figure 4 Distribution map and graphed population 18-year trend for Sparrowhawk. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Sparowhawk (Eurasian Sparrowhawk on the EU Bird List) is typically considered a woodland bird, although in reality is common and widespread across any habitat with sufficient cover and small bird prey to hunt. According to Sharrock (1976) in the Bird Atlas (1968-1972) "Few places in Britain and Ireland are unsuitable for the species".

The difficulties in detecting species with large home ranges, as well as those with a secretive nature, mean that the estimates and trends produced for Sparrowhawk should be taken as indicative rather than robust. On average, the species is recorded in 30 CBS 1 km squares per year and therefore just

meeting the threshold at which trend estimates can be made. Over the 18 years of CBS, Sparrowhawk has decreased in abundance by 11.2%, but appears to be largely stable in Ireland in recent years. However, more targeted nest recording work at local or regional levels would greatly enhance our knowledge of the status of the species. In the UK, BBS trends indicate a decline in Sparrowhawk over 21 years (-19%) and 10 years (-22%) (Harris *et al.*, 2018). The population appears to be stable across Europe as a whole (PECBMS, 2019).

Despite the apparent decline in long-term abundance, the trend in breeding distribution shows an increase over the periods examined.

Causes for the putative decline in the abundance of Sparrowhawk in Ireland since CBS began, are poorly understood. As with other raptors, secondary rodenticide poisoning is a known threat (e.g. Walker *et al.*, 2015). Under the RAPTOR scheme (Recording and Addressing Persecution and Threats to Our Raptors) one incident (classed as the occurrence of a non-habitat related anthropogenic impact on a bird of prey or the use of poison leading to wildlife injury or death) involved a Sparrowhawk in 2018 (O'Donoghue, 2018).

3.4 Kestrel *Falco tinnunculus* Pocaire gaoithe

Resident

Breeding population:	**Population estimate (2011-2016):**	13,500
	min – max population estimate:	9,918 – 17,393
	10-year trend (2006-2016):	-28.2
	18-year trend (1998-2016):	-44.9
Breeding distribution change (%):	**10-year trend (2006-2016):**	-31.0
	25-year trend (1991-2016):	-22.1
	44-year trend (1972-2016):	-34.5

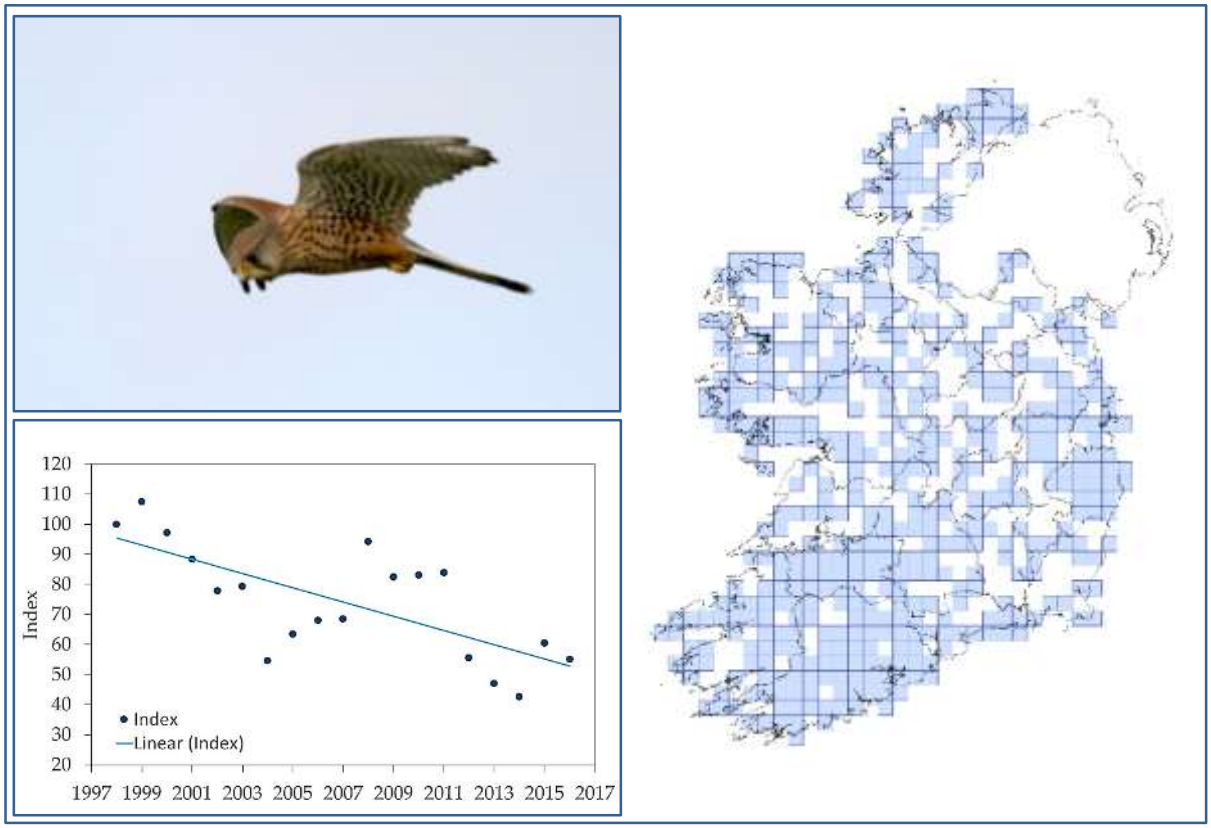

Figure 5 Distribution map and graphed population 18-year trend for Kestrel. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Shay Connolly).

The Kestrel (Common Kestrel on the EU Bird List) is the most widely distributed raptor in Ireland, present in 88% of 10 km squares during the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). Based on CBS results there are around 13,500 individuals in the Republic of Ireland (2011-2016). However the CBS methodology is not suitable to produce a robust estimate of Kestrel numbers in Ireland due to detectability issues for species with large home ranges and that occur in low densities (Crowe *et al.*,

2014), as well as the secretive nature of nesting pairs and the fact that the species can be particularly inconspicuous early in the day when CBS counts are carried out (Clements, 2008).

The CBS results for Kestrel do provide an indication of the direction and scale of the trend for the species, however. The recent population estimate represented a decrease of 3,000 individuals from the previous five-year period (2006-2010; Crowe *et al.*, 2014) and between 1998 and 2016, Kestrel declined by almost 45%, one of the largest declines for any species in the survey. The breeding distribution, as recorded by CBS (2006-2016), has fallen by 31% (present in 37 squares on average per year). Similar decreases are reflected by the 25- and 44-year trends in breeding distribution.

According to Balmer *et al.* (2013) the breeding relative abundance shows declines in the midlands and west and increases in the south-west. In Britain, changes in its breeding distribution over time are broadly similar to changes in Ireland, though their relative abundance is down significantly in Scotland and Wales, with localised declines compared to increases in relative abundance in England.

Causes for the decline of Kestrel in Ireland in recent years are likely centred around prey availability, agricultural changes and reduced feeding opportunities (Wilson-Parr & O'Brien, 2019), as well secondary rodenticide poisoning. Under the RAPTOR scheme one incident (classed as the occurrence of a non-habitat related anthropogenic impact on a bird of prey or the use of poisoned leading to wildlife injury or death) involved a Kestrel in 2018 (O'Donoghue, 2018).

3.5 Stock Dove *Columba oenas* Colm gorm

Resident

Breeding population:	**Population estimate (2011-2016):**	27,486
	min – max population estimate:	14,934 – 43,039
	10-year trend (2006-2016):	-38.6
	18-year trend (1998-2016):	-58.4
Breeding distribution change (%):	**10-year trend (2006-2016):**	-30.0
	25-year trend (1991-2016):	-45.0
	44-year trend (1972-2016):	-61.3

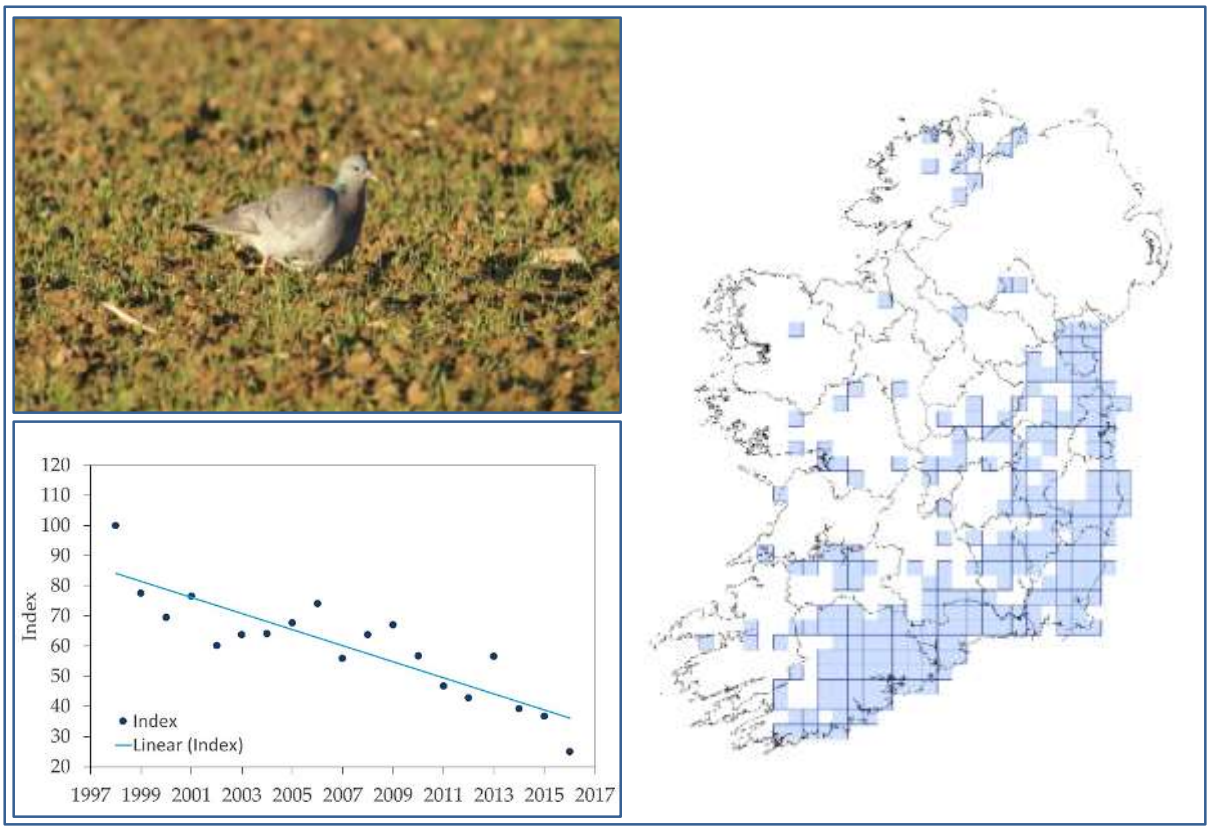

Figure 6 Distribution map and graphed population 18-year trend for Stock Dove. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

Stock Dove first colonised Ireland in the late 1800s, starting in counties Louth and Down in 1877 and soon after spreading to counties Antrim, Armagh, Wicklow and Carlow, before expanding westwards and eventually covering most of the country by the 1950s (Sharrock, 1976). It is a species associated with arable farmland and open woodland in this part of their range. At European level, both in the long-term and over the 10 years to 2016, Stock Dove underwent a moderate increase (PECBMS, 2019). In the UK,

Stock Dove has undergone significant increases of 22%, 25% and 11% over 21 years, 10 years and one year of BBS respectively (Harris *et al.*, 2018). Its breeding distribution in the UK was stable over the 40- and 20-year periods examined and although its relative abundance has decreased in Scotland and northern and western parts of England, this has been more or less offset by increases in breeding abundance in the south and east (Balmer *et al.*, 2013). At European level, Stock Dove has sustained a moderate increasing trend in both the long-term and the recent 10-year period (2007-2016; PECBMS, 2019).

The situation in Ireland is quite the opposite, however. Stock Dove has declined by 58.4% throughout the lifetime of CBS, and its population is estimated at less than 30,000 individuals. This is the second largest decline of any species in CBS, behind only the dramatic decline in Grey Wagtail numbers likely due to cold-weather impacts from the successive winters of 2009/10 and 2010/11.

Stock Dove is recorded in 30 CBS 1 km squares on average each year, with a decline in breeding distribution of 30% over the 10-year period 2006 to 2016. Steeper losses in breeding distribution are evident over the 25- and 44-year period. The pattern of distribution change, echoed by loss of breeding abundance, clearly shows a contraction from the west, with Stock Dove becoming increasingly restricted to the south and east coasts. The pattern and scale of decline is thought to be due to the loss of mixed farming in the west and midlands, meaning that Stock Dove is confined to the arable farming areas in counties in the east and south (Balmer *et al.*, 2013).

3.6 Woodpigeon *Columba palumbus* Colm coille

Resident

Breeding population:	**Population estimate (2011-2016):**	2,573,909
	min – max population estimate:	2,064,510 – 3,123,195
	10-year trend (2006-2016):	+19.3
	18-year trend (1998-2016):	+37.4
Breeding distribution change (%):	**10-year trend (2006-2016):**	+1.0
	25-year trend (1991-2016):	+2.9
	44-year trend (1972-2016):	+1.6

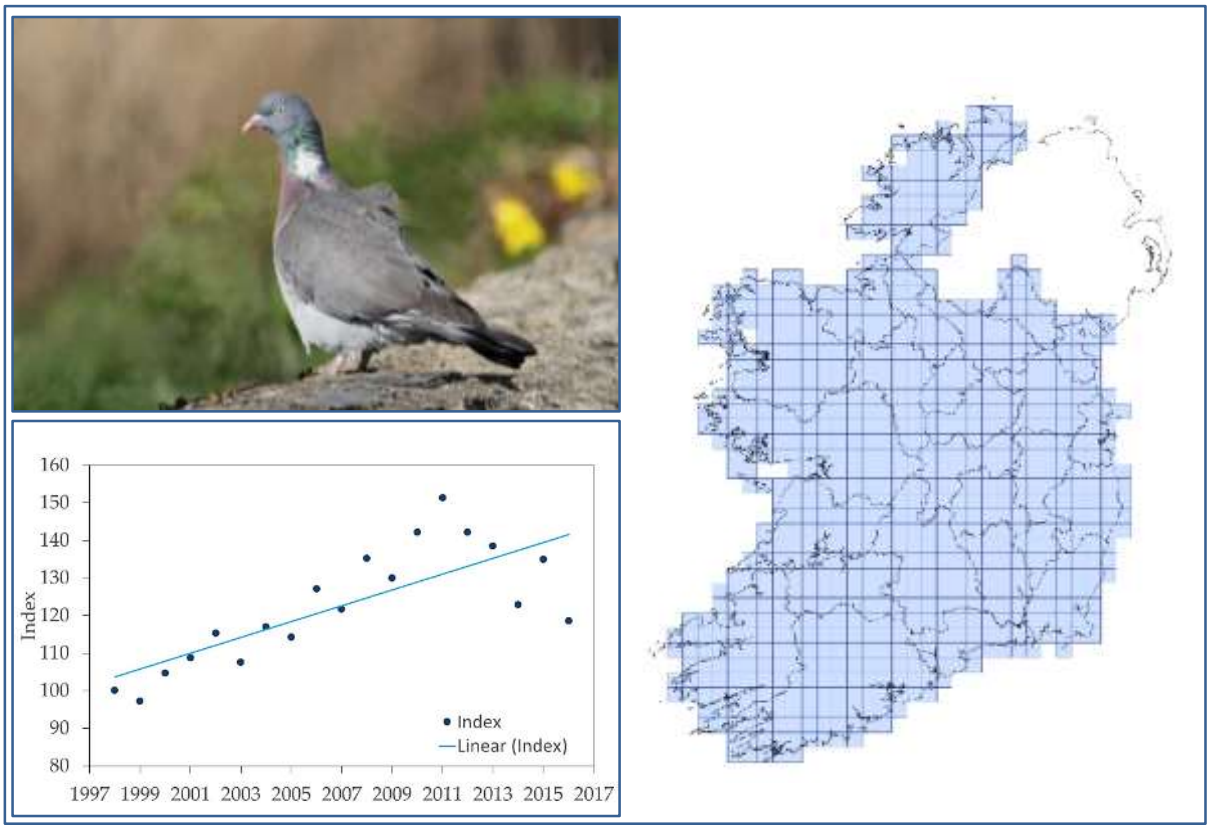

Figure 7 Distribution map and graphed population 18-year trend for Woodpigeon. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Woodpigeon (Common Woodpigeon on the EU Bird List) is a widespread breeding species throughout Europe and western parts of Asia. Formerly a bird of deciduous woodland, Woodpigeon is now found in any habitat with sufficient vegetation for nesting, including hedgerows, tall heather and garden shrubs. As a result, it was recorded as breeding in 95% of 10 km squares covering the island of Ireland in the Bird Atlas (2007-2011) (Balmer *et al.*, 2013) with highest densities in the south-east where

arable crops are prevalent, and lowest densities in the west where there are wide expanses of open habitats such as blanket and raised bog and coastal grasslands, as well as significant areas of enclosed forestry.

Woodpigeon has increased by 37.4% during CBS (1998-2016), with a current population estimate of >2,500,000 individuals, making Woodpigeon the seventh most numerous CBS species. It is recorded in 271 CBS 1 km squares on average per year, making it the fifth most frequently encountered species. Woodpigeon has increased by 33% in 21 years of BBS in the UK, with more stable trends in the shorter-term (+3% in 10 years, 0% in one year; Harris *et al.*, 2018). It has undergone a moderate increase at European level, both in the long-term and in the most recent 10-year period examined (2007-2016; PECBMS, 2019).

In the Republic of Ireland, the breeding distribution of Woodpigeon has been stable over all time periods assessed, but its relative abundance has increased in the north-west (Sligo, Leitrim and Donegal) and along much of the west coast (Balmer *et al.*, 2013).

Agricultural changes such as a shift towards autumn-sown cereals and the growth in oilseed rape cultivation are likely to have greatly increased overwinter survival of Woodpigeon, thus facilitating a population increase (Inglis *et al.*, 1997). In addition, suburban populations of Woodpigeon in some areas have been found to have higher breeding success than their rural counterparts (Slater, 2001), which may be another factor fuelling continued population increase at a local or regional level. As with many very common species, it has been the focus of very little targeted research in Ireland and the UK and we therefore have a limited understanding of its ecology and demography and how these might be linked to its continued increase.

3.7 Collared Dove *Streptopelia decaocto* Fearán baicdhubh

Resident

Breeding population:	**Population estimate (2011-2016):**	260,939
	min – max population estimate:	156,394 – 384,944
	10-year trend (2006-2016):	+56.0
	18-year trend (1998-2016):	+122.8
Breeding distribution change (%):	**10-year trend (2006-2016):**	+41.0
	25-year trend (1991-2016):	+128.8
	44-year trend (1972-2016):	+113.9

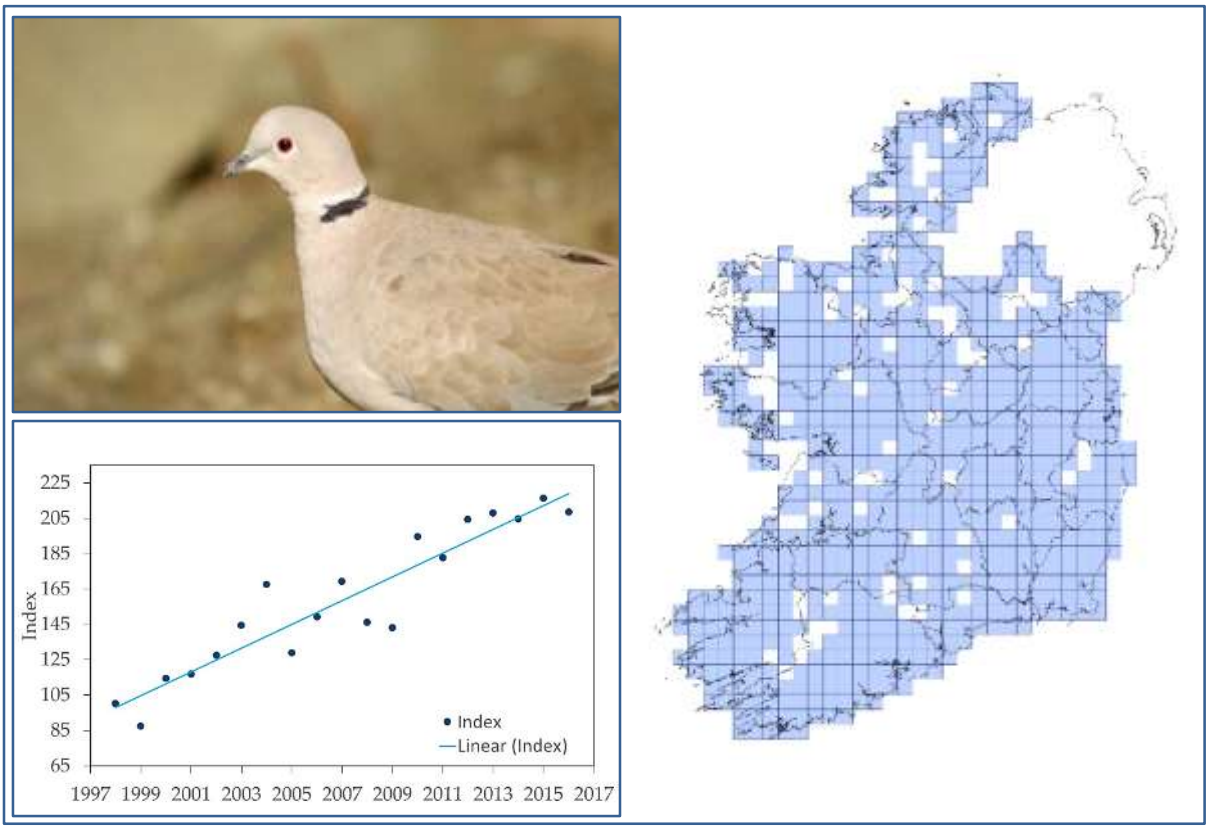

Figure 8 Distribution map and graphed population 18-year trend for Collared Dove. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

Until around 1930, the Collared Dove (also referred to as Eurasian Collared-dove) was restricted in Europe to Turkey and parts of the Balkans (Sharrock, 1976), but the species subsequently underwent a dramatic and rapid expansion across the continent that saw it reach Ireland in 1959 (Hudson, 1965). Its increase in range and numbers on reaching Ireland and Britain was similarly dramatic as it exploited an ecological niche not filled by other species here (Sharrock, 1976). In the Bird Atlas (2007-2011),

Collared Dove was recorded breeding in 84% of the 10 km squares in Ireland, absent only from remote treeless areas of our uplands or lowland bogs (Balmer *et al.*, 2013).

On average Collared Dove is recorded in 65 CBS 1 km squares per year, although in recent years it has been >75 squares. It has increased in abundance by 122.8% over the lifetime of CBS (1998-2016), with a similarly impressive increase in breeding distribution over 10-, 25-, and 44-year trend periods. These are some of the largest increases seen for any breeding species in Ireland, with the exception of Common Buzzard and the three reintroduced raptor species (Red Kite *Milvus milvus*, White-tailed Eagle *Haliaeetus albicillia* and Golden Eagle *Aquila chrysaetus*).

Trends in Britain, as seen in the Bird Atlas (2007-2011), have been similarly positive, albeit at a slower rate of recent growth (Balmer *et al.*, 2013). Results from BBS suggest the population is levelling off, with only a 2% increase over 23 years and a 21% decline over 10 years (1995-2016; Harris *et al.*, 2018).

Collared Dove has not been the focus of much study so the likely reasons for this recent downturn in the UK are not well understood. Pigeon and dove species, including Collared Dove, are the main hosts of the *Trichomonas gallinae* parasite (Marx *et al.*, 2017), which has spread to finch populations in Britain and further afield since 2006 (Lawson *et al.*, 2012). The increased prevalence of pathogenic lineages of *T. gallinae* amongst wild bird communities and the recent downturn in Collared Dove numbers may therefore warrant some scrutiny. At European level Collared Dove has undergone moderate increases since 1980 and 2007 (PECBMS, 2019).

3.8 Cuckoo *Cuculus canorus* Cuach

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	11,808
	min – max population estimate:	7,148 – 17,823
	10-year trend (2006-2016):	+10.0
	18-year trend (1998-2016):	+18.8
Breeding distribution change (%):	**10-year trend (2006-2016):**	-2.0
	25-year trend (1991-2016):	-0.7
	44-year trend (1972-2016):	-27.1

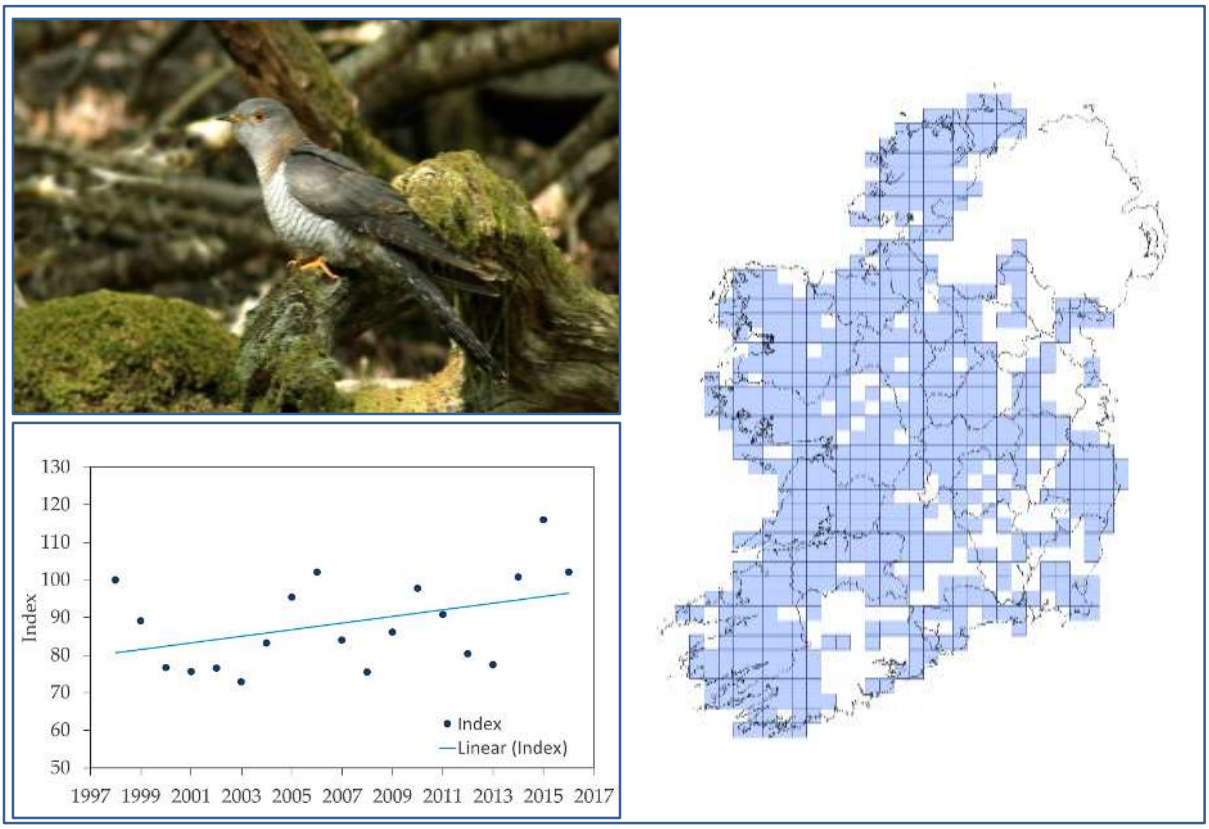

Figure 9 Distribution map and graphed population 18-year trend for Cuckoo. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The distinctive song of the Cuckoo (Common Cuckoo on the EU Bird List) makes it one of the easiest breeding birds to monitor. It is a summer visitor, arriving in April and most adults will have departed by late July or early August. In Ireland, it is found in all counties but only patchily in Co Cork, the south-east and north-east. It occurs in a range of habitats including farmland and woodland, but the highest

densities are found in upland and marginal habitats. There are less gaps in Britain, where the species is widespread. It is also widespread on the continent, occurring in all European countries.

On average, Cuckoo has been recorded in 74 CBS 1 km squares per year. Perhaps surprisingly, in light of at least anecdotal evidence that Cuckoo is declining, the CBS shows a positive population trend of nearly 19% since the survey began in 1998. However, there was a 27% contraction in breeding distribution in the 44 years between the first Bird Atlas (1968-1972) (Sharrock, 1976) and the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013). However, the 10- and 25- year trends in breeding distribution are stable.

In the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), Cuckoo was recorded in 68% of 10 km squares in Ireland and the breeding relative abundance change since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993) shows a mix of declines and increases in various regions within the country. Population trends in the UK show declines throughout England and Wales and increases in Scotland (Harris *et al.*, 2018). Thus, Cuckoo shows a population shift northwards and westwards similar to a number of other migrants which winter in Africa's humid regions. There was a moderate decline in Europe since 1980 (PECBMS, 2019). Falling moth numbers in Britain is considered to be a likely factor in the decline of Cuckoo there (Fox *et al.*, 2006) and perhaps something similar has been at play in Ireland, contributing to the contraction in breeding distribution recorded during the past 44 years.

3.9 Swift *Apus apus* Gabhlán gaoithe

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	51,728
	min – max population estimate:	19,154 – 97,976
	10-year trend (2006-2016):	-38.0
	18-year trend (1998-2016):	-57.7
Breeding distribution change (%):	**10-year trend (2006-2016):**	-34.0
	25-year trend (1991-2016):	-43.8
	44-year trend (1972-2016):	-52.8

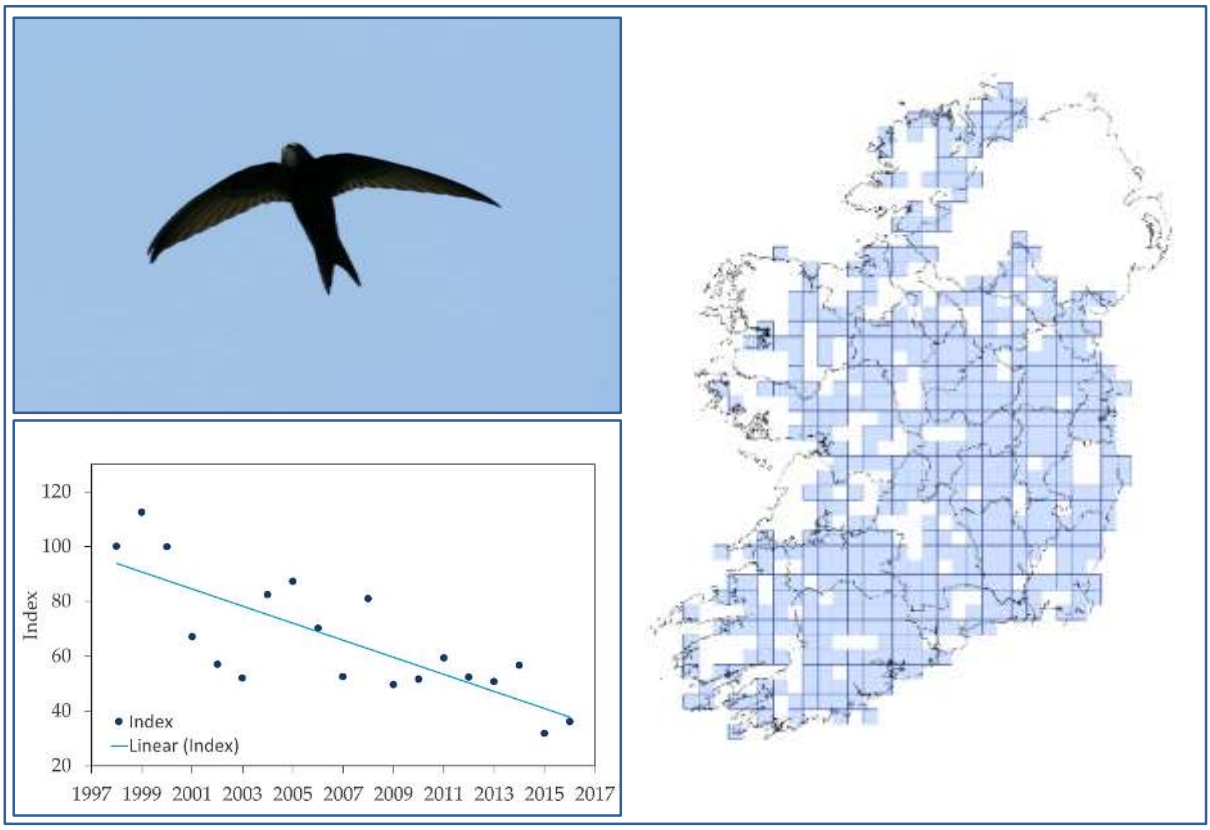

Figure 10 Distribution map and graphed population 18-year trend for Swift. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Swift (Common Swift on the EU Bird List) is one of the latest arrivals to Ireland each summer and stays for one of the shortest lengths of time. It arrives in early May and departs at the end of July or early August (Whelan *et al.*, 2018). In Ireland, it has quite a patchy distribution across the country, with some notable gaps, especially in upland areas and it is absent from many more exposed parts of western coastal regions from Kerry to Donegal. In Britain, it is more widely distributed, with the main gaps in parts of Scotland (Balmer *et al.*, 2013). The European range of Swift extends to all countries, only absent

from the extreme north of Scandinavia. While the Swift will forage over almost any habitat, it is most common in the built environment in urban or suburban areas where nest sites in buildings are available.

The Swift has declined in abundance by nearly 58% since the start of the CBS survey. The recent population estimate of 51,728 (2011-2016) is a decline of 17,000 since 2010 (Crowe *et al.*, 2014). The Swift is recorded in 37 CBS 1 km squares per year on average, while in the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), the Swift is recorded in 63% of 10 km squares in Ireland.

The 44-year breeding distribution change between the first and latest breeding bird atlases was -52.8%; the highest losses recorded in the western half of the country and in Cavan, Monaghan and Leitrim (Gibbons *et al.*, 1993; Sharrock, 1976). Since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993), relative abundance has shown declines over most of the country, with the exception of some patchy gains in southern, south-eastern and north-eastern regions. Range loss in Britain is less obvious, mainly confined to parts of northern England and Scotland, however the relative abundance density is much higher throughout England compared to Ireland. Negative trends were also shown in the BBS in the UK of -53% from 1995-2016 and - 39% from 2006-2016 (Harris *et al.*, 2018). The European trend is stable since 1980 (PECBMS, 2019).

The Swift exhibits strong fidelity to its nest site and a likely reason for the steady decline in numbers is the loss of many traditional nest cavities in buildings which have been renovated or demolished (Whelan *et al.*, 2018). The Swift is slow to take up new sites and modern buildings provide few suitable cavities. Also, as a long-distance migrant, it may succumb to pressures on migration or in on its sub-Saharan wintering areas where environmental changes may have occurred.

3.10 Magpie *Pica pica* Snag breac

Resident

Breeding population:	**Population estimate (2011-2016):**	563,536
	min – max population estimate:	448,300 – 694,814
	10-year trend (2006-2016):	-10.2
	18-year trend (1998-2016):	-17.6
Breeding distribution change (%):	**10-year trend (2006-2016):**	+2.0
	25-year trend (1991-2016):	+4.5
	44-year trend (1972-2016):	+5.4

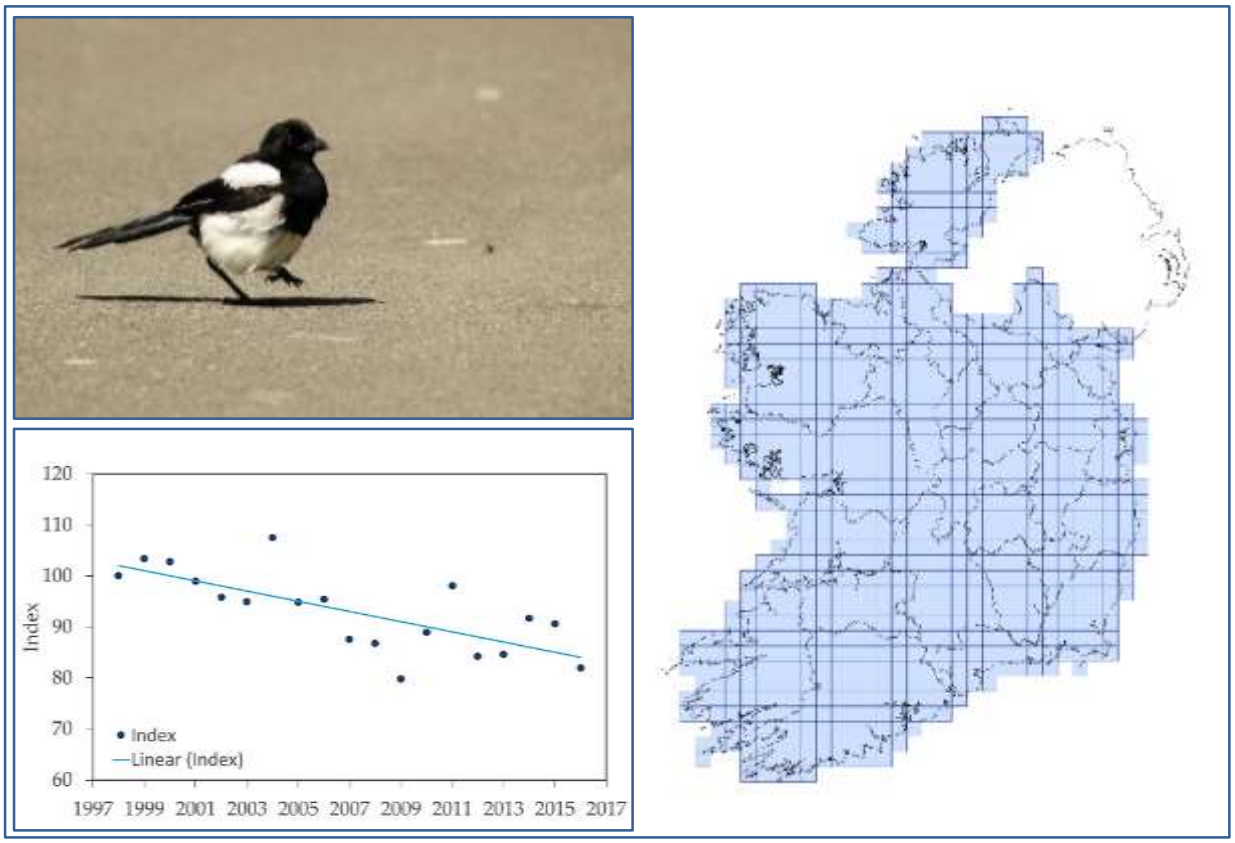

Figure 11 Distribution map and graphed population 18-year trend for Magpie. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

Magpie (Eurasian Magpie on the EU Bird List) is resident throughout Ireland, occupying almost all habitats to some extent, although in much lower densities in upland areas. It is also widespread and common across Britain, with the exception of the Scottish uplands and islands (Balmer *et al.*, 2013) and its global range covers most of the Palearctic. The species was first recorded in Ireland (Wexford) in 1676 and colonised the country over subsequent decades.

In the 18 years of CBS, Magpie has decreased in population abundance by -17.6%, with nearly 40,000 fewer individuals than estimated between 2006-1010 (Crowe *et al.*, 2014). It is present in 253 CBS 1 km

squares on average, the eighth most commonly encountered species. Despite the declining population trends for both 10- and 18-year periods, the breeding distribution trend is stable across all periods assessed.

Magpie was widespread during the Bird Atlas (2007-2011) (Balmer *et al.*, 2013) and recorded in 96% of Irish 10 km squares and with a higher relative abundance here than in most of Britain. Its trend in the UK has been stable both since BBS began and in the shorter-term (Harris *et al.*, 2018) and it has been stable at European level over the last 10 years, although it has undergone a moderate decline since 1980 (PECBMS, 2019).

The seemingly contrasting abundance and distribution trends may be at least partly accounted for by the differing temporal and spatial scales presented, as well as a possible shift in local distribution to nest and feed in more urban areas (which feature in a minority of CBS squares). Very high densities of breeding Magpies have been recorded in Dublin city since the early 1980s (Kavanagh, 1987) and this is undoubtedly not unique to Dublin. A study in France, examining Magpie colonisation and extinction at a landscape level, found that the Magpie populations were slowly shifting towards large urban areas and disappearing from the wider countryside (Chiron *et al.*, 2008). In Poland, Magpie populations were found to be increasing three times faster in urban areas than rural settings, as they took advantage of milder temperatures, anthropogenic food sources and an abundance of available nest sites (Jerzak, 2001). Breeding success of urban Magpies has been found to be higher than rural pairs in many areas (e.g. Jerzak, 2001; Antonov & Atanasova, 2003), and crows are often implicated as one of the main causes of nest failure in rural areas (e.g. Jerzak, 2001; Antonov & Atanasova, 2003; Eden, 1985; Baeyens, 1981), with urban Magpies benefitting from their absence in more urbanised areas.

3.11 Jackdaw *Corvus monedula* Cág

Resident

Breeding population:	**Population estimate (2011-2016):**	2,564,415
	min – max population estimate:	1,808,972 – 3,409,595
	10-year trend (2006-2016):	+19.2
	18-year trend (1998-2016):	+37.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+5.0
	25-year trend (1991-2016):	+6.2
	44-year trend (1972-2016):	+4.0

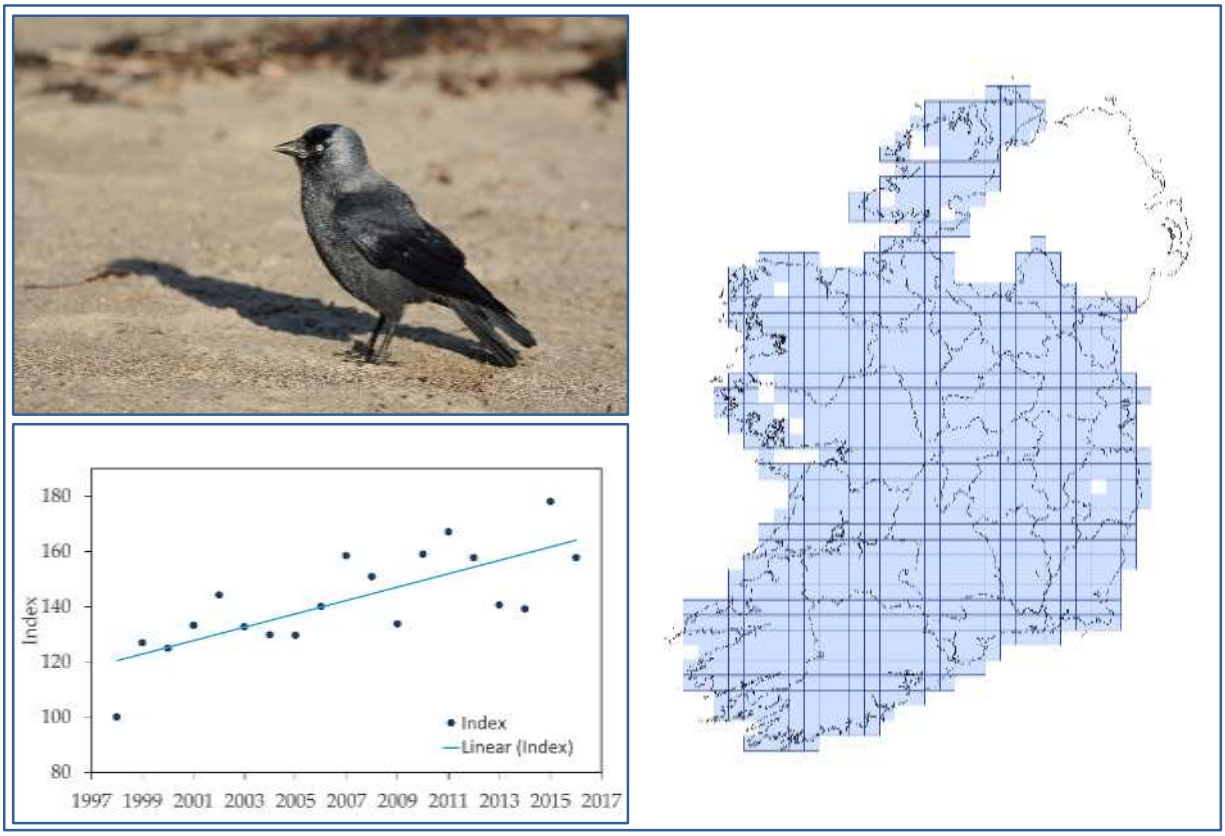

Figure 12 Distribution map and graphed population 18-year trend for Jackdaw. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Jackdaw (Eurasian Jackdaw on the EU Bird List) is widespread and abundant across Ireland, with the only gaps in its distribution being in the mountains of Connemara, Mayo, the north-west and Donegal (Balmer *et al.*, 2013). It is absent from much of north-west Scotland, but otherwise prevalent across almost all of Britain bar the areas of particularly high ground. The range of the Jackdaw covers Europe (except northerly parts of Scandinavia), North Africa and as far east as Central Asia.

Over the last 18 years, Jackdaw has shown a significant increase in abundance of over 37%. Its breeding population stands at over 2.5 million individuals (2011-16), up from >2.3 million over the preceding 5-year period (Crowe *et al.*, 2014). The trend shows considerable fluctuation, but overall shows a significant positive trend. The noted increase in Jackdaw abundance in Ireland is mirrored in the UK (particularly England), but with significant increases of 55% and 24% over 21- and 10-years of BBS, respectively (Harris *et al.*, 2018). At a European level numbers are considered stable (PECBMS, 2019).

Jackdaw is the 15th most commonly recorded species in CBS, present in 227 1 km squares on average each year. It was recorded in 95% of Irish 10 km squares visited during the breeding season for the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The breeding distribution trend has been stable across all periods assessed, with a 4% increase over 44 years.

Jackdaw is performing well in Ireland, presumably due to the overall suitability of our predominantly pastoral landscape for both feeding and nesting, and similar increases have been noted on farmland in the UK (Gregory & Marchant, 1996). The short-term fluctuations in its CBS status are likely to be a product of detectability, with large aggregations likely to be recorded in years and locations where favourable weather conditions have allowed silage to be been cut within the survey period.

3.12 Rook *Corvus frugilegus* Rúcach

Resident

Breeding population:	**Population estimate (2011-2016):**	3,476,836
	min – max population estimate:	2,275,226 – 4,836,806
	10-year trend (2006-2016):	+4.2
	18-year trend (1998-2016):	+7.6
Breeding distribution change (%):	**10-year trend (2006-2016):**	+1.0
	25-year trend (1991-2016):	+0.6
	44-year trend (1972-2016):	-1.4

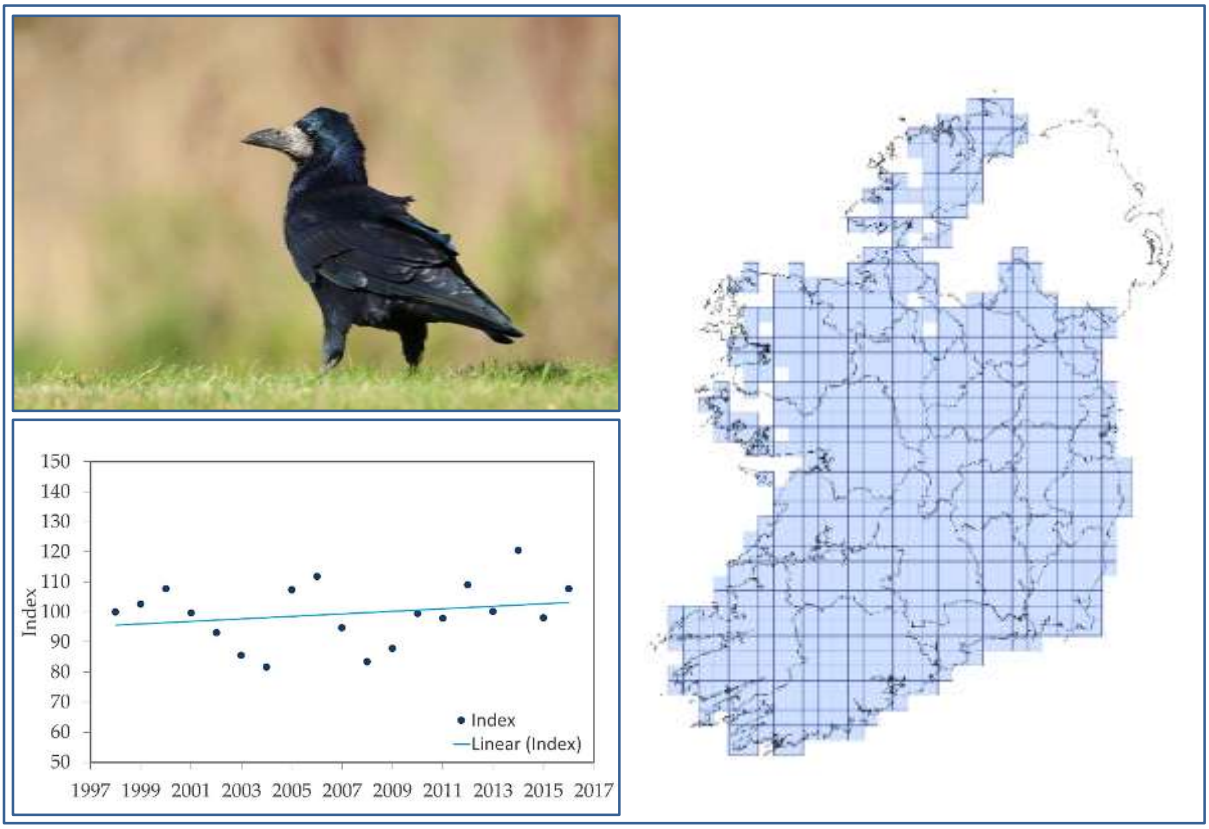

Figure 13 Distribution map and graphed population 18-year trend for Rook. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The distribution of the Rook is similar to the Jackdaw in Ireland - widespread across the countryside, with the exception of upland parts of the west and north-west, where trees are scarce (Balmer *et al.*, 2013). In the UK, it is similarly prevalent, with notable absences on higher ground and in the Greater London area (Balmer *et al.*, 2013). It is found across most of Europe. The Rook, perhaps the most social of corvids, is a colonial species and forages year-round around the colony. Both the amount of foraging habitat and its interaction with the number of competitors from surrounding colonies are important predictors of colony size (Griffinn & Thomas, 2000).

Rook has shown a broadly stable population trend over the 18 years of CBS, with some considerable fluctuation but a net increase of 7.6% to date. The current population estimate is at almost 3.5 million individuals (up from 3.4 million 2006-10; Crowe *et al.*, 2014), making it our most numerous corvid species. It is recorded in 246 CBS 1 km squares on average each year (9th highest species), with little change in that number over the years. The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013) found Rooks in 90% of 10 km squares during the breeding season, with some very minor losses and gains in upland and coastal areas. Overall the breeding distribution trend has been stable across all periods assessed.

As with Jackdaw, Hooded Crow and Magpie, the relative abundance of Rook in Ireland is considerably higher than that in Britain. Since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993) there have been very slight fluctuations in breeding relative abundance, with gains in Cork but no clear pattern of change elsewhere (Balmer *et al.*, 2013). Conversely in the UK, it has shown a significant negative BBS trend (-21% 1995-2016, -16% 2006-16; Harris *et al.*, 2018), with the Bird Atlas (2007-2011) (Balmer *et al.*, 2013) showing decreased relative abundance over much of Britain but a cluster of increases in 10 km squares in eastern England. Rook has undergone a moderate increase across Europe between 1980 and 2016, although a more recent moderate decrease from 2007 to 2016 is evident (PECBMS, 2019).

At national level, the long-term stability of our Rook population in terms of both abundance and distribution is likely attributable to its generalist and colonial nature, with suitable hedgerows and stands of trees for nesting common features of open lowland countryside across Ireland. At a finer spatial scale, changing patterns of abundance are probably a result of changes in land use, particularly grassland management, as well as colonisation of suburban and urban areas (Balmer *et al.*, 2013; McGhie, 2000). A recent survey in Kildare estimated 22,883 breeding pairs across approximately 720 rookeries in the county (Tierney *et al.*, 2017). Almost 70% of rookeries were in broadleaved trees, with 21% in mixed broadleaf/conifer stands and the remaining 9% in pure conifers. Improved grassland was the dominant surrounding primary land-use (61%), with built land (39%) the most common secondary habitat. Cultivated land, too, was important (primary habitat around 26% of rookeries). Given the importance of broadleaf trees and open countryside, the rapid expansion of forestry in the north-west may be expected to reduce the availability of nesting sites and feeding opportunities at a local level.

3.13 Hooded Crow *Corvus corone cornix* Caróg liath

Resident

Breeding population:	**Population estimate (2011-2016):**	523,293
	min – max population estimate:	398,476 – 659,352
	10-year trend (2006-2016):	+21.5
	18-year trend (1998-2016):	+42.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+8.0
	25-year trend (1991-2016):	+11.5
	44-year trend (1972-2016):	+9.5

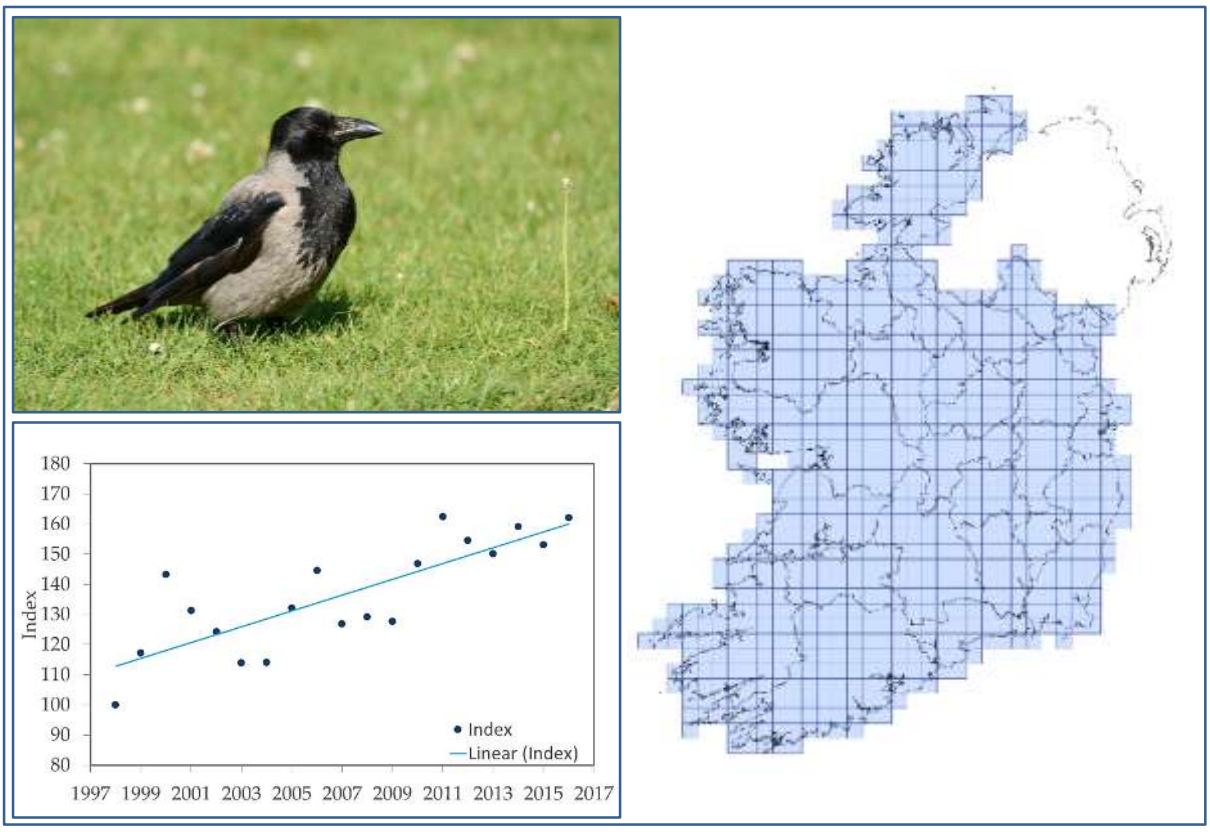

Figure 14 Distribution map and graphed population 18-year trend for Hooded Crow. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Hooded Crow is found throughout Ireland and north-west Scotland, as well as northern, eastern and south-eastern Europe and into parts of the Middle East. It is resident in Ireland, and associated with open countryside habitats (bog, farmland) although it exists at such high densities here that Hooded Crow are encountered in all habitats. In south-east Scotland, the rest of Britain, and most of central and western Europe Hooded Crow is replaced by the Carrion Crow, with the two considered to be separate subspecies, though there is evidence to suggest they should be considered full species (Parkin *et al.*, 2003).

Hooded Crow has shown an increasing trend of over 40% since CBS began in the late 1990s. The recent population estimate of >520,000 (2011-16) represents an increase of almost 60,000 individuals since 2010 (Crowe *et al.*, 2014). Relative abundance showed increases over much of the country since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993). Elsewhere, Hooded Crow has showed positive trends in the UK (14% from 1995-2016, 17% from 2006-2016; Harris *et al.*, 2018). Its relative abundance is considerably higher throughout Ireland than in its Scottish home range (Balmer *et al.*, 2013).

On average, Hooded Crow is recorded in 242 CBS 1 km squares per year (11th highest ranking species), and the 10-year CBS trend in breeding distribution is stable (+8%). The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), recorded the species in 98% of 10 km squares in Ireland during the breeding season. Based on bird atlas comparisons, the trend in breeding distribution has increased by 11.5% and 9.5% respectively, over the past 25- and 44 years.

The reasons for the positive trend for Hooded Crow throughout CBS are likely attributable to its adaptable nature and generalist ecology (Sullivan *et al.*, 2016). The hedgerow network across much of the Irish landscape, together with the increased availability of forest edge through commercial forestry (Smedshaug *et al.*, 2002), provide an abundance of suitable nest sites, and Irish farmland and suburban/urban areas allow for ample feeding opportunities. The recent ban on indiscriminate poisoning (S.I. 481/2010 – European Communities (Birds and Natural Habitats) (*Restrictions on use of Poisoned Bait*) Regulations 2010), which was likely carried out in the past to remove Hooded Crow from areas with lambs or sheep, is also likely to have benefited Hooded Crow in more recent years, as it did other scavenging species (Burke *et al.*, 2014).

3.14 Raven *Corvus corax* Fiach dubh

Resident

Breeding population:	**Population estimate (2011-2016):**	55,878
	min – max population estimate:	36,350 – 76,409
	10-year trend (2006-2016):	-7.3
	18-year trend (1998-2016):	-12.7
Breeding distribution change (%):	**10-year trend (2006-2016):**	+11.0
	25-year trend (1991-2016):	+42.0
	44-year trend (1972-2016):	+119.1

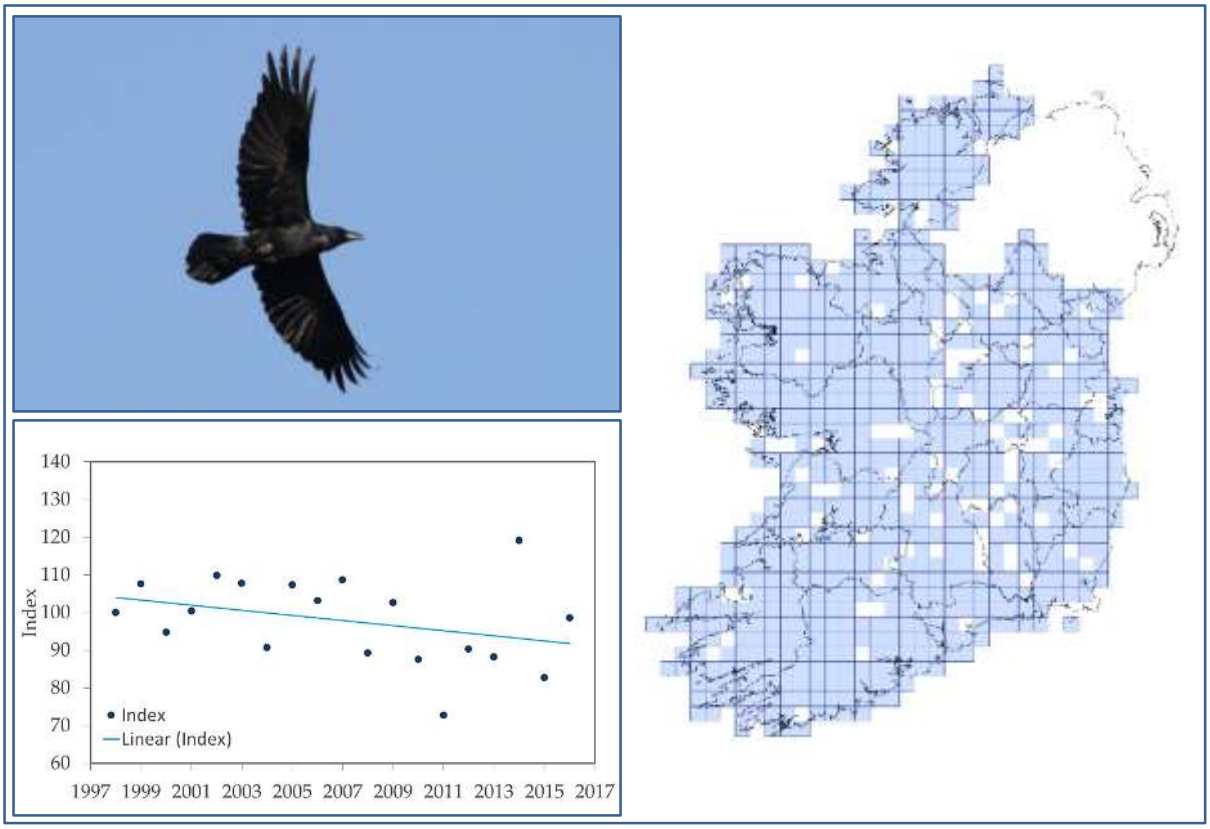

Figure 15 Distribution map and graphed population 18-year trend for Raven. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer et al., 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Raven (Common Raven on the EU Bird List) is the most widely distributed corvid species across the world. A few decades ago it was considered a bird of remote coastal and upland habitats, nesting on cliffs and feeding in the surrounding moorland habitats (Sharrock, 1976), but now it is found in all habitats across the island of Ireland (Balmer *et al.*, 2013).

The Raven has decreased in number by 12.7% since CBS began in 1998. Between 2011 and 2016 its numbers were estimated at 55,878 individuals, down slightly from 58,460 in the previous period (2006-

10; Crowe *et al*., 2014) but overall considered stable for the shorter 10-year CBS period (2006-2016). It is recorded in 70 CBS 1 km squares on average each season. The negative 18-year population trend in CBS is surprising given the fact that its breeding distribution has increased significantly over 25- and 44-year periods, and by 11% during the shorter 10-year CBS period (2006-2016). Consistent with these breeding season trends was a 48% increase in its winter distribution in Ireland since the 1981-1984 period (Lack, 1986).

In the UK, Raven has increased in abundance by 36% between 1995 and 2016, with stable trends across shorter time periods (-4% 2006-16, -7% 2016-17; Harris *et al*., 2018). Its breeding and wintering distribution, and relative abundance changes in Britain have been positive on the scale of the Irish trends (Balmer *et al.*, 2013). At European level it has undergone a moderate increase since 1980 but has remained stable in the shorter-term (2007-2016; PECBMS, 2019).

The overall declining 18-year CBS trend for Raven, and considerable year-to-year variation in the index, are possibly a result of detectability issues during the CBS season, with the early breeding season of the species and large home-range likely contributing factors. The significant increases in Raven distribution in Ireland and further afield in recent years, as illustrated by the Bird Atlas (2007-2011) (Balmer *et al*., 2013), have been attributed to reductions in (legal and illegal) control and excessive stocking of sheep providing an abundance of carrion (McGreal, 2007). More Ravens are now utilising trees for nesting, something which was rare in the past but has been facilitated more recently by increasingly favourable agricultural land management providing sufficient feeding opportunities (McGreal, 2007). Future population trends are likely to be dictated by food availability (Gibbons *et al.*, 1993).

3.15 Goldcrest *Regulus regulus* Cíorbhuí

Resident

Breeding population:	**Population estimate (2011-2016):**	601,806
	min – max population estimate:	436,715 – 805,617
	10-year trend (2006-2016):	-2.6
	18-year trend (1998-2016):	-4.6
Breeding distribution change (%):	**10-year trend (2006-2016):**	+15.0
	25-year trend (1991-2016):	+24.2
	44-year trend (1972-2016):	+15.6

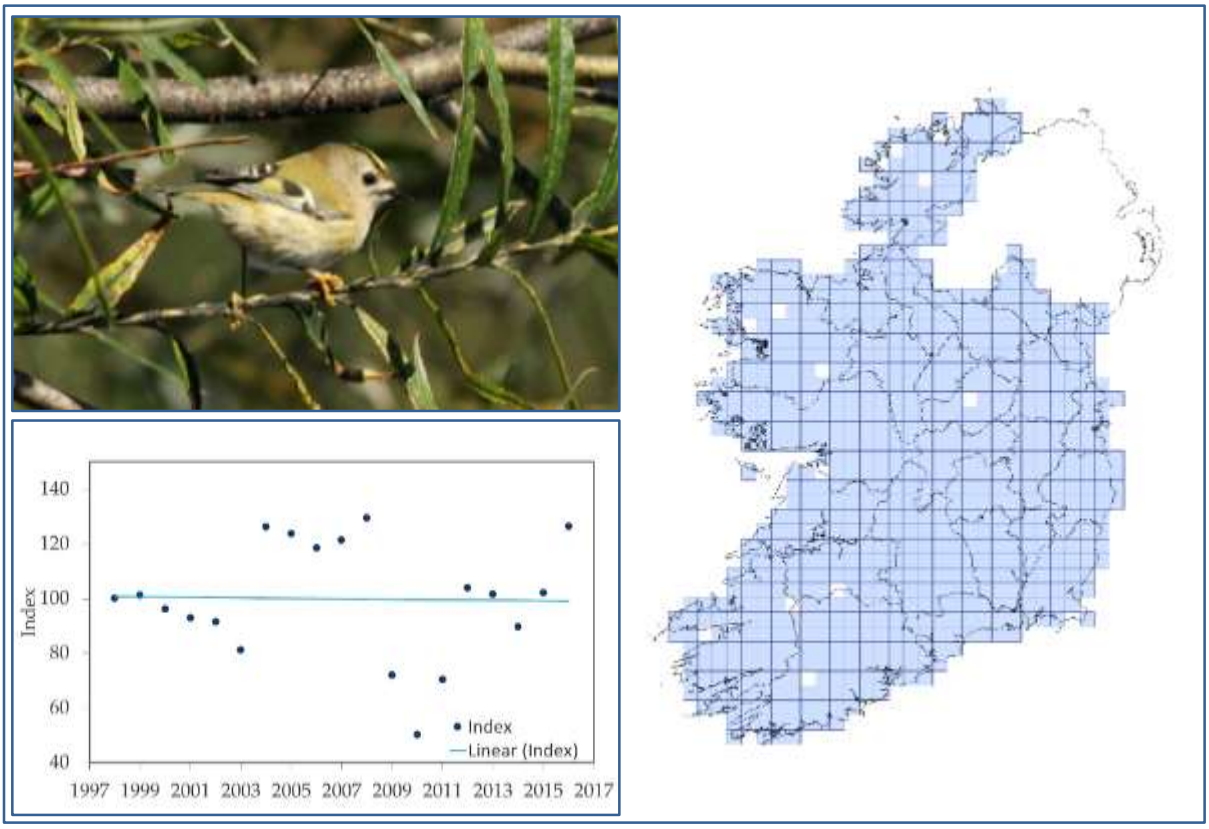

Figure 16 Distribution map and graphed population 18-year trend for Goldcrest. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Goldcrest is Ireland's smallest bird. It is resident in Ireland, Britain and most of northern Europe and is a summer visitor to northern Scandinavia. In southern Europe, it is mostly a winter visitor. Its favoured habitat is coniferous woodland, although it can also occur in broad-leaved woodland and farmland hedgerows, but at much lower densities.

Goldcrest populations are prone to major fluctuations, usually associated with adverse weather conditions. Being small-bodied, the species is very vulnerable to adverse weather conditions and can

sustain heavy losses in cold winters. Numbers are usually quick to recover, however, as evidenced in Britain when the population crashed in the severe winter of 1962/63, but then recovered steadily thereafter and by 1972 the Common Bird Census showed that Goldecrest had increased ten-fold since the crash (Sharrock, 1976).

The recent Goldcrest population estimate of 602,000 (2011-2016) is 9,300 lower than the 2010 estimate (Crowe *et al.*, 2014). In Ireland, in the two breeding seasons following the severe winters of 2008/09 and 2009/10, the CBS recorded very low numbers. However, a fairly rapid recovery was noted in the years following 2010. The population trend throughout CBS has fluctuated widely but is considered stable over both 10- and 18-year periods. In the UK, Goldcrest showed a positive trend of 20% from 1995-2016, but a 9% decline in the 10-year period 2006-2016 (Harris *et al.*, 2018), a further indication of the short-term fluctuations found in this species. Goldcrest has shown a moderate decline in Europe since 1980 (PECBMS, 2019).

In the latest Bird Atlas (2007-2011) (Balmer *et al.*, 2013), Goldcrest was recorded in 90% of 10 km squares in Ireland. The average number of CBS 1 km squares in which Goldcrest is recorded per year is 154, which shows a short-term (2006-2016) distribution increase of 15%. Similarly the long-term (44-year) breeding distribution change shows an increase (+15.6) between the first breeding bird atlas (1968-1972) and the most recent atlas (2007-2011).

Goldcrest thrives in coniferous woodland and the increase in commercial conifer plantations (DAFM, 2018) has likely benefited it. However, the fluctuations in numbers between years, likely due to changeable weather conditions makes it difficult to get a clear picture of how the species is faring in the long-term.

3.16 Blue Tit *Cyanistes caeruleus* Meantán gorm

Resident

Breeding population:	**Population estimate (2011-2016):**	1,942,762
	min – max population estimate:	1,566,124 – 2,368,360
	10-year trend (2006-2016):	+7.0
	18-year trend (1998-2016):	+13.0
Breeding distribution change (%):	**10-year trend (2006-2016):**	+6.0
	25-year trend (1991-2016):	+10.4
	44-year trend (1972-2016):	+7.7

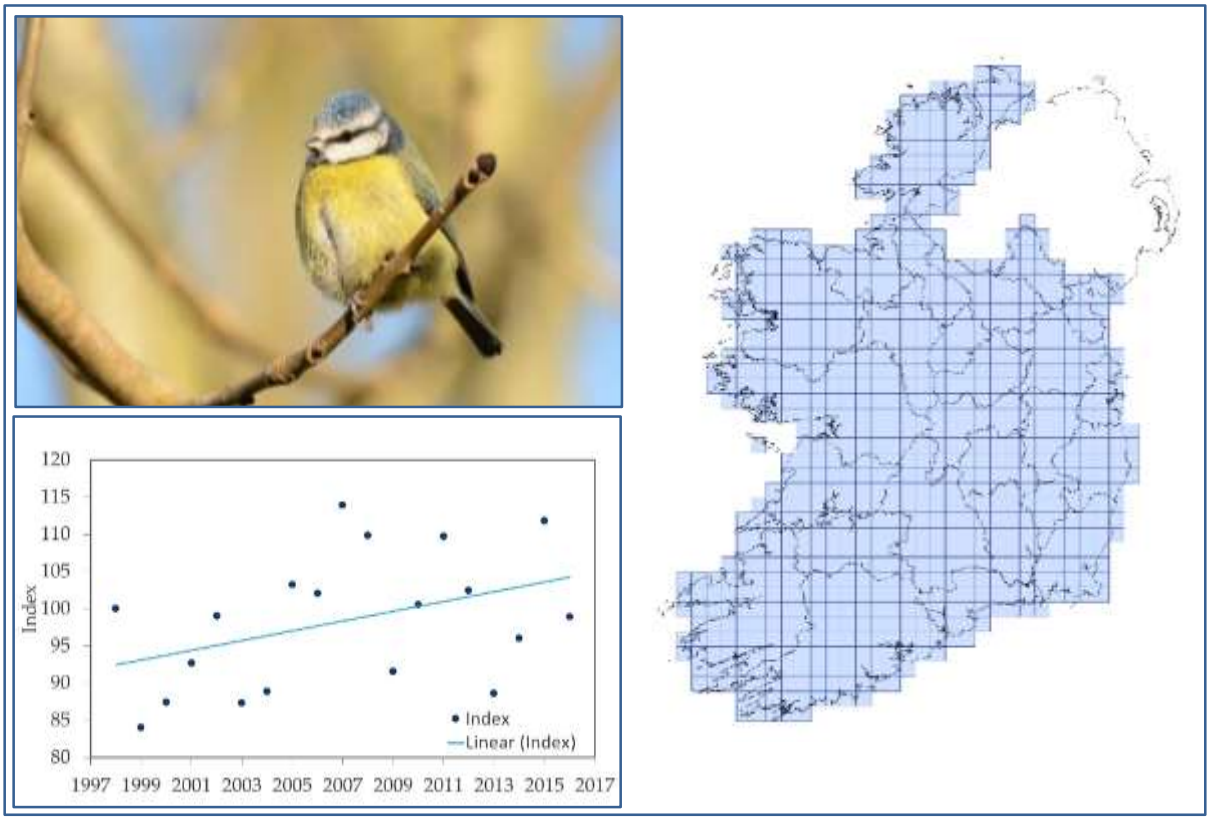

Figure 17 Distribution map and graphed population 18-year trend for Blue Tit. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Blue Tit (Eurasian Blue Tit on the EU Bird List) is the most common and abundant tit species in Ireland (Crowe *et al.*, 2014). In northern continental Europe, the Blue Tit is a partial migrant, but in Ireland the species is resident and largely sedentary. The Blue Tit is typically a bird of broadleaved woodland, with oak widely regarded to be the optimal breeding habitat (Perrins, 1979), however this hole-nesting passerine has adapted to a variety of other woody habitats such as parkland, gardens and scrub. Food provisioning and the availability of nest boxes may have led to higher abundances in

suburban areas. Recorded in just under 98% of gardens, Blue Tit was the third most widespread species in the 2016/17 Garden Bird Survey (Burke, 2017).

Blue Tit has increased by 13% over the lifetime of CBS, with a recent breeding population estimate of 1,942,762 individuals. The European trend is for moderate increase (PECBMS, 2019) while the species has undergone a small decline (-3%) in the UK over a 21-year period (1995-2016) (Harris *et al.*, 2018).

With a widespread distribution, Blue Tit was recorded in 243 1 km squares on average during CBS (80%), and in 95% of Irish 10 km squares during the breeding season for the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). Its breeding distribution is considered broadly stable based on CBS data (2006-2016), with an increase noted for the 25-year trend and a stable long-term trend for the 44-year period.

Temperate hole-nesting woodland passerines, including Blue Tit, have become well-used model systems for understanding trophic mismatch, specifically examining the effects of spring temperature on trophic interactions and fitness (e.g. Visser *et al.* 1998, Charmantier *et al.* 2008).

3.17 Great Tit *Parus major* Meantán mó

Resident

Breeding population:	**Population estimate (2011-2016):**	1,288,058
	min – max population estimate:	1,031,988 – 1,583,637
	10-year trend (2006-2016):	+32.8
	18-year trend (1998-2016):	+66.7
Breeding distribution change (%):	**10-year trend (2006-2016):**	+14.0
	25-year trend (1991-2016):	+25.0
	44-year trend (1972-2016):	+21.0

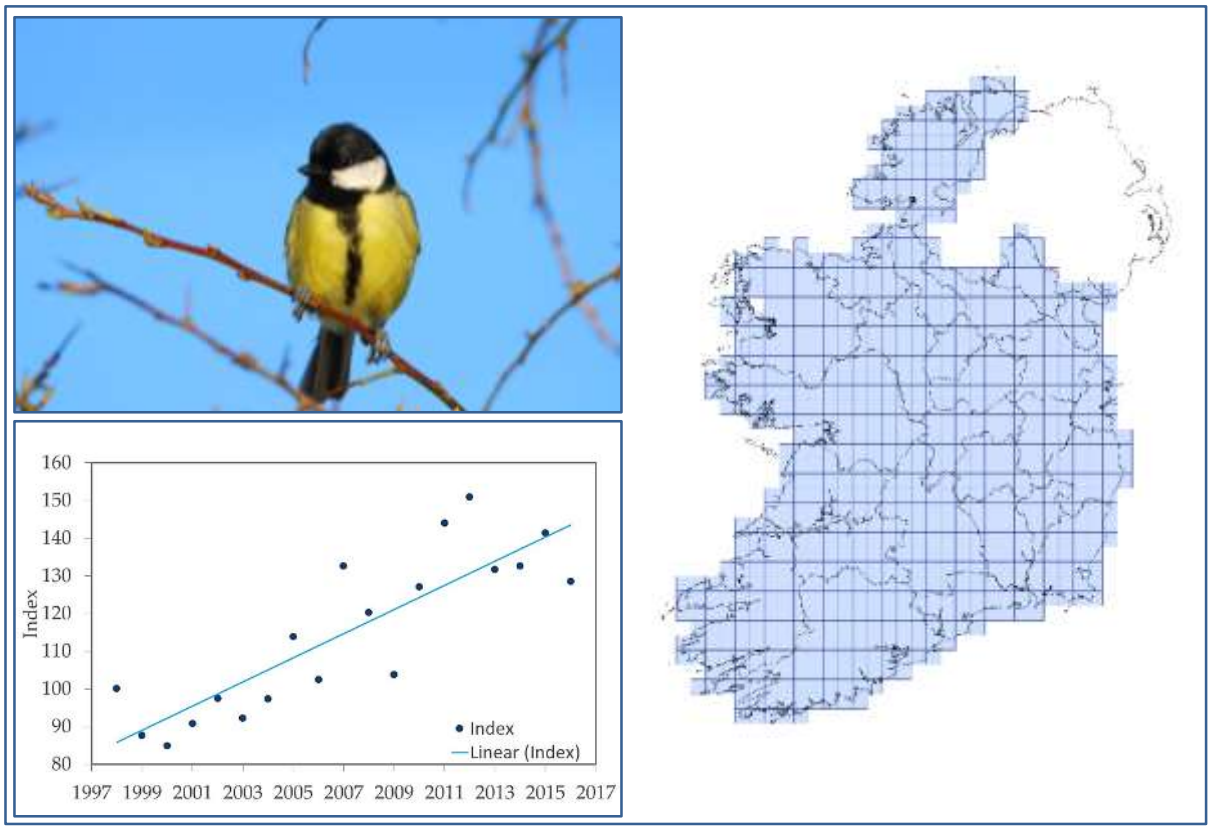

Figure 18 Distribution map and graphed population 18-year trend for Great Tit. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Great Tit is the second most common and abundant tit species in Ireland (Crowe *et al.*, 2014). Although broadleaved woodland, especially Oak, is the favoured breeding habitat, the Great Tit can be found year-round in most woodland, scrub and garden habitats (Wernham *et al.*, 2002) where food provisioning and the availability of nest boxes may have led to higher abundances in suburban areas. Recorded in 94% of gardens, Great Tit was the fifth most widespread species in the 2016/17 Garden Bird Survey (Burke, 2017).

Great Tit has increased in number by nearly 67% throughout CBS. This is consistent with a moderate increase across Europe over both the long-term (1980-2016) and recent 10-year period (2006-2016). In the UK, its population has increased by 30% (1995-2016) in the long-term, with more recent trend periods (10- and 1-year) showing declines of 9% and 7% respectively (Harris *et al.*, 2018).

Great Tit was recorded in 223 1 km squares on average during CBS (73%), and in 94% of 10 km squares in Ireland during the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). Its breeding distribution has increased by 14% based on CBS data (2006-2016), with the 25- and 44-year trends based on atlas data also showing an increase.

Tit species make excellent study species for ecological research as they readily take to nest boxes, breed at high densities, do not travel far from where they are born, and cope well with being monitored by scientists (e.g. *wythamtits.com*). Climate-induced ecological mismatch between animals and their food supply is one such study that has focused upon tit species. For example, asynchrony found between peak caterpillar biomass and peak nestling demand of species such as Great and Blue Tits increases in earlier (warm) springs, which means that these birds need to breed earlier to avoid being mismatched. Given projections of continued spring warming, it is predicted that temperate forest birds will become increasingly mismatched with peak caterpillar timing (Burgess *et al.*, 2018). Population consequences are likely to be observed, however, research in northern Europe has so far suggested that Great Tits are maintaining their population numbers, despite a reduction in fitness (defined as the ability to produce viable offspring) possibly due to less competition between the offspring (Reed *et al.*, 2013).

3.18 Coal Tit *Periparus ater* Meantán dubh

Resident

Breeding population:	**Population estimate (2011-2016):**	836,424
	min – max population estimate:	612,205 – 1,088,460
	10-year trend (2006-2016):	+15.8
	18-year trend (1998-2016):	+30.3
Breeding distribution change (%):	**10-year trend (2006-2016):**	+8.0
	25-year trend (1991-2016):	+17.3
	44-year trend (1972-2016):	+18.1

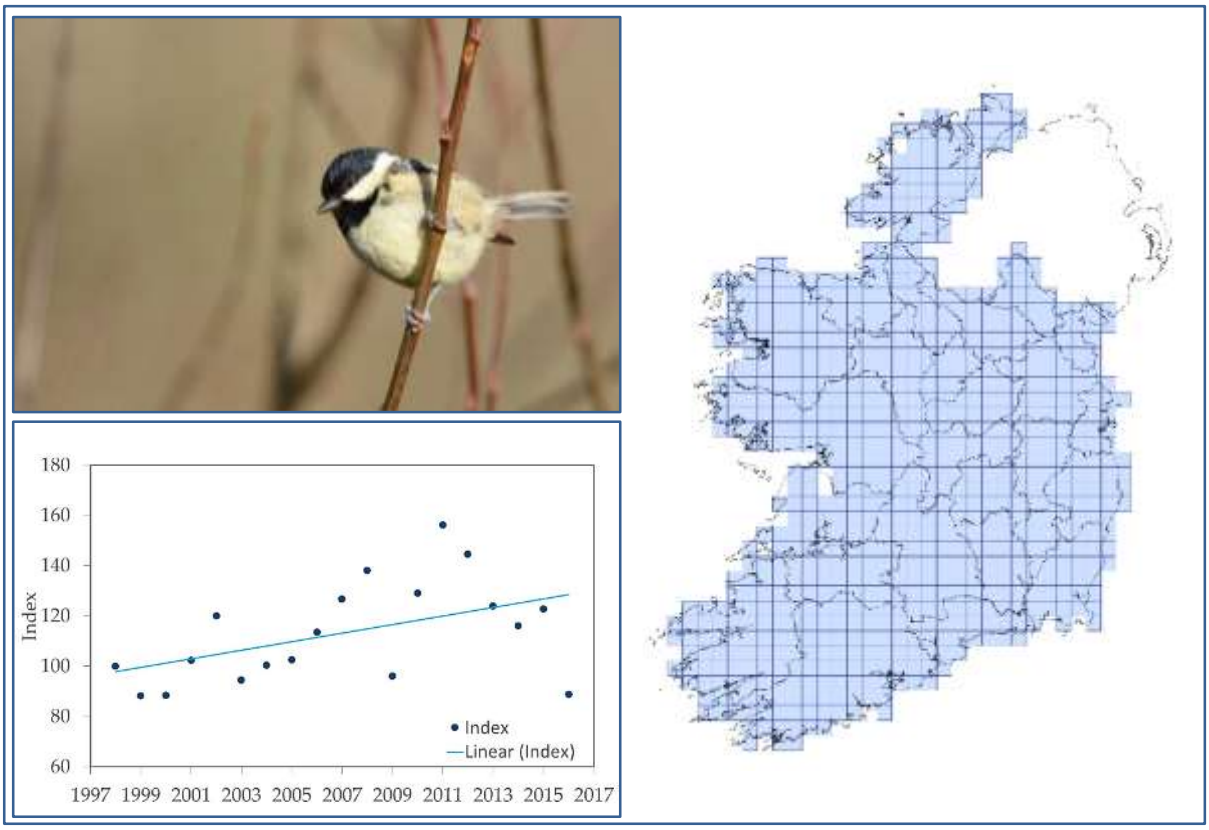

Figure 19 Distribution map and graphed population 18-year trend for Coal Tit. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

Coal Tit is a woodland specialist most associated with coniferous woodland during the breeding season. Ireland hosts both the nominate race *ater*, and the Irish *hibernicus* subspecies which are largely sedentary. Coal Tit is also a common visitor to gardens during winter. Recorded in 87% of gardens, it was the seventh most widespread species in the 2016/17 Garden Bird Survey (Burke, 2017).

Coal Tit has increased in number by 30% throughout CBS and the current population estimate stands at 836,424 individuals. This increasing trend contrasts to a moderate decline across Europe over the

long-term (1980-2016) and declines over a 10- and 21-year period in the UK based on BBS data (Harris *et al.*, 2018).

Coal Tit was recorded in 179 1 km squares on average during CBS (59%), and in 91% of Irish 10 km squares during the breeding season for the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The species has increased by 8% in breeding distribution during CBS (considered stable), while changes based on comparisons of atlas data also show increases over the 25-and 44-year period assessed.

3.19 Skylark *Alauda arvensis* Fuiseog

Resident

Breeding population:	**Population estimate (2011-2016):**	301,800
	min – max population estimate:	204,138 – 402,724
	10-year trend (2006-2016):	-10.7
	18-year trend (1998-2016):	-18.4
Breeding distribution change (%):	**10-year trend (2006-2016):**	-12.0
	25-year trend (1991-2016):	-18.2
	44-year trend (1972-2016):	-23.8

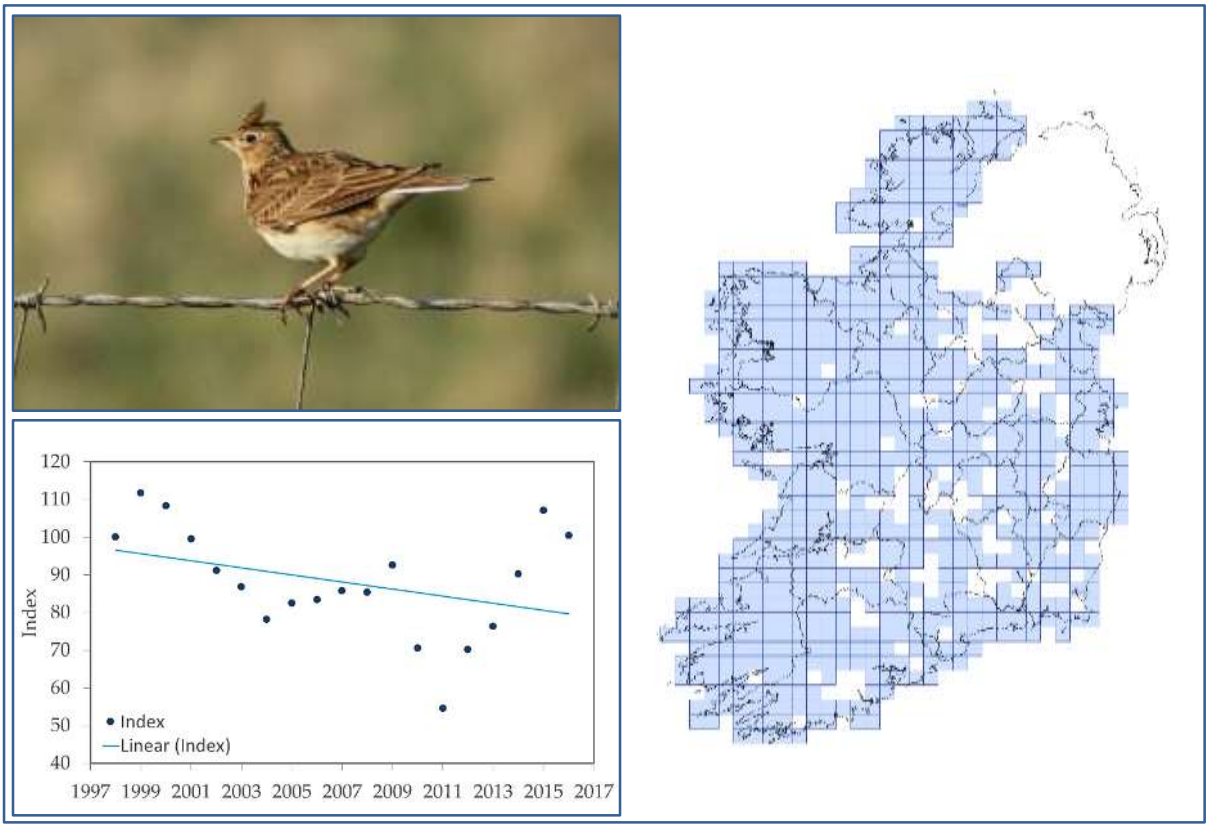

Figure 20 Distribution map and graphed population 18-year trend for Skylark. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Skylark (Eurasian Skylark on the EU Bird List) is resident in Ireland, but rather sparsely distributed in some regions, especially away from coastal areas. It is also resident in Britain and across the western half of Europe but is a summer migrant to eastern Europe and Scandinavia.

Skylark is associated with open countryside habitats, including upland and lowland bog, coastal dune systems and farmland, although it is largely absent from intensive lowland pasture. A study in 2012 used data from CBS and the Farmland Bird Project (FBP) to determine large-scale (national) distribution and habitat selection, in addition to smaller-scale (farm- and field level) habitat use. Significant regional

differences were found in breeding densities, with the highest relative abundances in the north-west and west. Dry grassland/grass moor habitats supported the highest densities of breeding Skylarks which were significantly higher than in improved grassland or tillage. At a farm-level, Skylark numbers were positively related to wetland habitats but negatively associated with trees in field boundaries, dense ground vegetation and overall density of farm boundaries. At the field-scale, larger fields and unimproved grasslands were preferred (Copland *et al.*, 2012).

Skylark has declined in number by >18% since CBS began in 1998. The recent population estimate of >301,000 (2011-2016) represents a decline of over 21,000 since 2010 (Crowe *et al.*, 2014). In the UK, BBS trends show a negative trend of -20% over the 21-year period (1995-2016) (Harris *et al.*, 2018) while in Europe, there was a moderate decline since 1980 (PECBMS, 2019).

On average, Skylark is recorded in 124 CBS 1 km squares per year. In the first Bird Atlas (1968-1972) (Sharrock, 1976), Skylark was found to be the most widely distributed bird in Britain and Ireland, recorded in more 10 km squares than any other species. The latest Bird Atlas (2007-2011) (Balmer *et al.*, 2013), showed that Skylark, although still widespread on these islands, has contracted in range, mostly in Ireland. Skylark was found in 85% of 10 km squares in the breeding season, with most of the losses in the midlands, south and east. Consequently, its breeding distribution has declined by 23.8% and 18.2% over the 44- and 25-year trend periods based on atlas data, while a 12% decline in breeding distribution is evident for the CBS 10-year period (2006-2016).

The reason for the declining population and distribution in Ireland is likely to be attributable to agricultural intensification, such as silage making and grazing (Copland *et al.*, 2012). However, Skylarks appear to depend upon relatively open grassland swards, and a cessation of grazing activity is also likely to lead to a decline in Skylark breeding densities (Copland *et al.*, 2012). Cereal grain forms a major part of the its diet (Green, 1978) and in some regions Skylark has traditionally had a certain dependency on the availability of spilt grain and weed seeds in winter stubble. In areas where cereals are no longer grown or indeed where autumn sowing has replaced spring sowing, this food source is no longer available in winter. In the UK, the reduction of the breeding Skylark population to about half its former level in the early 1980s, as recorded in the long-term CBC/BBS trend from 1966-2013 (Woodward *et al.*, 2018), was considered to be the result of the switch from spring to autumn cereal sowing, as well as the use of more efficient herbicides, reducing the availability of weed seeds. Additionally, it was found that autumn sowing resulted in the vegetation being too tall and dense for Skylark to nest in later in the season.

3.20 Sand Martin *Riparia riparia* Gabhlán gainimh

Summer Migrant

Breeding population:	**Population estimate (2011-2016):**	460,223
	min – max population estimate:	128,198 – 990,514
	10-year trend (2006-2016):	-17.7
	18-year trend (1998-2016):	-29.6
Breeding distribution change (%):	**10-year trend (2006-2016):**	+26.0
	25-year trend (1991-2016):	+74.3
	44-year trend (1972-2016):	+19.4

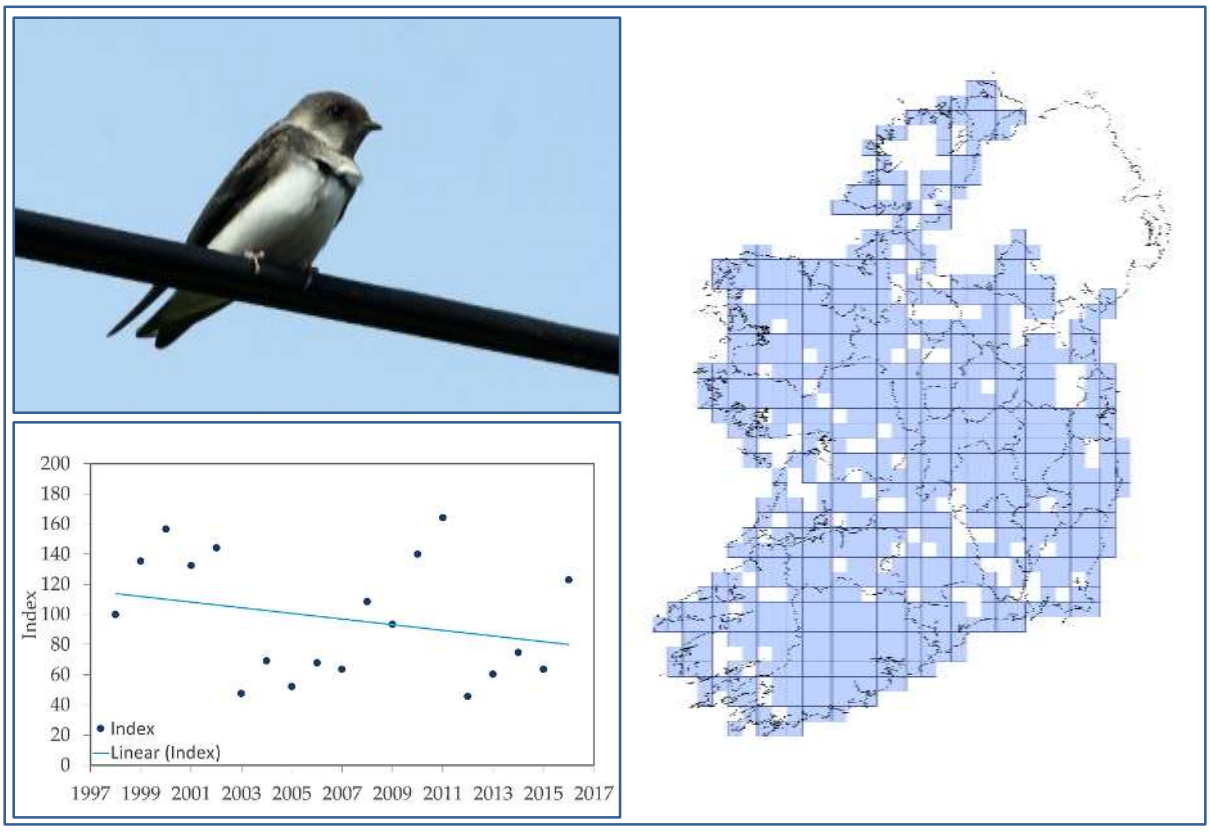

Figure 21 Distribution map and graphed population 18-year trend for Sand Martin. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Sand Martin is a summer visitor to Ireland and aside from a few gaps, it is found throughout the country. It is also widespread in Britain and in Europe in summer. Patterns of arrival in spring have shown that amongst aerial insectivores Sand Martin is amongst the first to arrive from its wintering grounds, in the Sahel region of sub-Saharan Africa. Sand Martin is highly gregarious, breeding, feeding and roosting communally (Mead & Harrison, 1979).

The Sand Martin usually nests in sandy or mud cliffs, quarries, river banks and cutaway peat banks. In some urban areas it nests along rivers using drainage pipes and can also be attracted to use nest boxes

shaped like tunnels, but normally requires fairly soft strata in which to excavate burrows (Morgan, 1979). Sand Martin forages for aerial insects over a range of habitats, but particularly over lakes and rivers.

Sand Martin has shown a decline in numbers of nearly 30% since CBS began in 1998 (18-year trend), while a downwards trend is still evident over the 10-year period 2006-2016. The recent population estimate of >460,000 (2011-2016) represents a decline of 57,000 birds since 2010 (Crowe *et al.*, 2014). This contrasts to the UK BBS population trend (1995-2016) which is +48% (Harris *et al.*, 2018).

The variance between recent Irish and UK population trends is notable. As a colonial species, numbers of Sand Martin can vary dramatically at different locations and results could potentially get skewed, especially considering the low number of 1 km squares that record the species in CBS (33 on average). It is therefore probable that the sample size is too small to derive a reliable trend through CBS. Also, the CBS index has shown major fluctuations in some years (Figure 21), with very low numbers being recorded in 2003 and 2012 and contrasting peak numbers in 2000 and 2010. Overall it is advisable to treat the CBS population trends with some caution. This species can also be prone to quite extreme fluctuations in numbers. For example, severe droughts in the Sahel region of Africa in 1968-69 and 1983-84 were considered to have had a major impact on wintering Sand Martins at that time (Vickery *et al.*, 2014).

In the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), Sand Martin was recorded in 78 10 km squares in Ireland during the breeding season. During CBS, Sand Martins are recorded, on average, in 33 1 km squares per year. Contrary to the CBS population trend, the species has increased in breeding distribution over the recent 10-year period of CBS (2006-2016) (+26%), while the longer-term breeding atlas comparisons also show increases in distribution.

Sand Martin is one example of an Afro-Palearctic migratory bird that has suffered substantial declines across its range over the past 30 years (Hagemeijer & Blair, 1997). Potential drivers are diverse. The largest pressures facing the species includes the degradation and/or loss of suitable breeding habitats (e.g. sand banks through natural erosion/development), habitat degradation and changing climatic conditions, particularly drought in the Sahel zone appear to be the most important factors (Vickery *et al.*, 2014).

3.21 Swallow *Hirundo rustica* Fáinleog

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	4,936,488
	min – max population estimate:	4,056,663 – 5,904,001
	10-year trend (2006-2016):	-0.8
	18-year trend (1998-2016):	-1.4
Breeding distribution change (%):	**10-year trend (2006-2016):**	+3.0
	25-year trend (1991-2016):	+5.3
	44-year trend (1972-2016):	+4.3

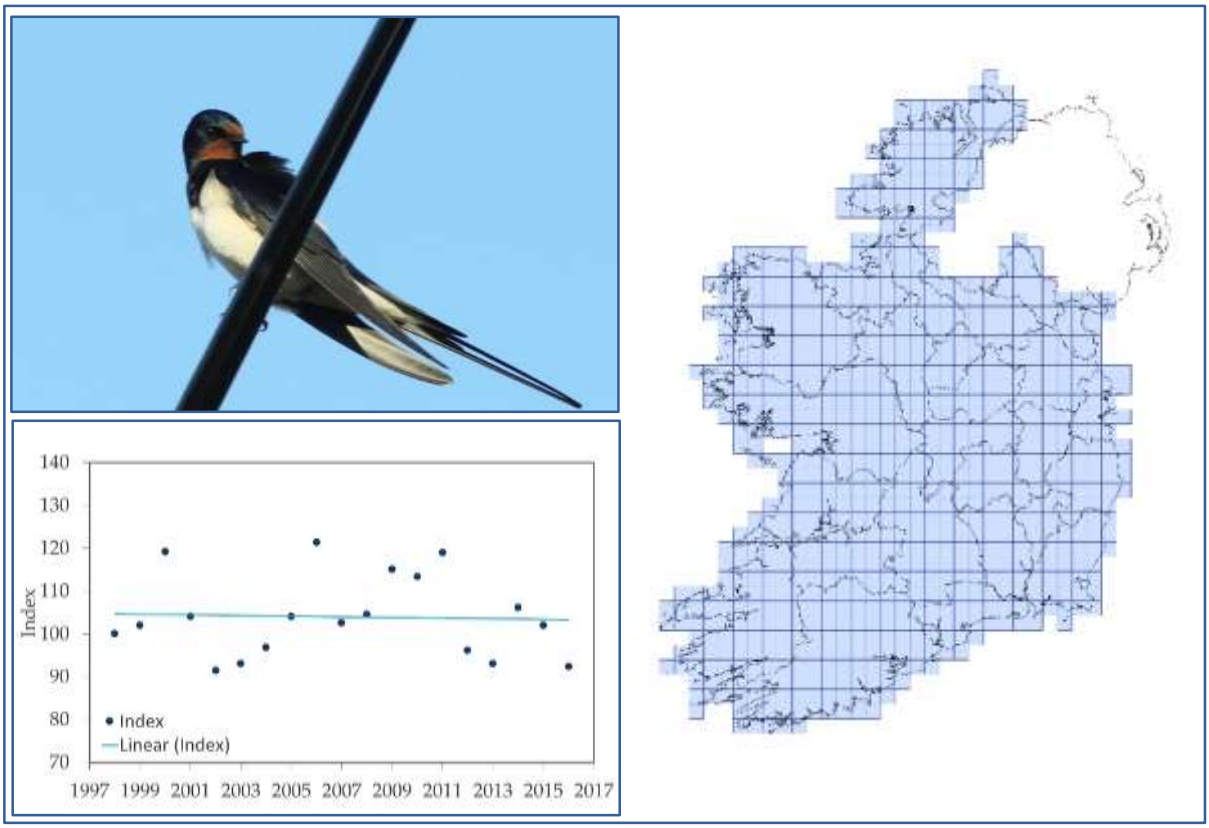

Figure 22 Distribution map and graphed population 18-year trend for Swallow. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Swallow (Barn Swallow on the EU Bird List) is a summer visitor to Ireland, the bulk of birds arriving from African wintering grounds in April and departing in September. It migrates mostly by day-stopping frequently *en route* to refuel and will spend several days building fat stores before crossing major land/sea barriers such as the Sahara Desert (Coiffait *et al.*, 2011). The Swallow is widespread in Ireland throughout the summer and in the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013) it was recorded in 98% of 10 km squares in Ireland and in 94% of squares in the UK (the only substantial gaps

being on offshore islands and upland regions of Scotland). Thus, the Swallow has the most extensive distribution of any summer migrant in Britain and Ireland. It is similarly distributed throughout all European countries with the exception of Iceland where it is considered a rare breeder (Pétursson & Kolbeinsson, 2016). It is a gregarious species and can nest colonially and occur in a range of habitats but most commonly near water sources and in farmland, which can offer an abundance of aerial insects and nesting opportunities, particularly in farm barns and outhouses. Prior to migration, the Swallow often roosts in large flocks in reedbeds and some crops and is strongly associated with the presence of cattle and horses and taller hedgerows, in arable areas in particular (Henderson *et al.*, 2007).

Since CBS began in 1998, numbers of Swallows have been relatively stable, with a marginal declining trend of -1.4%. The CBS population trend graph shows great fluctuations in the index in some years, but over time these extremes have smoothed out, resulting in a relatively stable trend over the 18 year-period. The 21-year UK trend in BBS (1995-2016) shows a 12% increase, while the 10-year trend (2006-2016) shows a 16% decline, perhaps reflecting a similar pattern of fluctuating abundance in some years, as noted in Ireland (Harris *et al.*, 2018).

Swallow is recorded in 271 CBS 1 km squares on average each year. The breeding distribution over the 10-year CBS period (2006-2016) has shown a marginal 3% increase (stable), while longer-term comparisons of bird atlas data are also considered broadly stable with small increases in breeding distribution; +5.3 and +4.3% respectively over 25- and 44-years.

In Ireland, the main habitat used by the Swallow is lowland farmland, and especially farmland with grazing livestock. Lower densities are found in arable areas. The general shift in Ireland away from arable to pasture may well be benefiting the species which depends on a ready supply of aerial insects.

3.22 House Martin *Delichon urbicum* Gabhlán binne

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	606,043
	min – max population estimate:	349,050 – 945,726
	10-year trend (2006-2016):	+22.3
	18-year trend (1998-2016):	+43.6
Breeding distribution change (%):	**10-year trend (2006-2016):**	+26.0
	25-year trend (1991-2016):	+49.0
	44-year trend (1972-2016):	+32.5

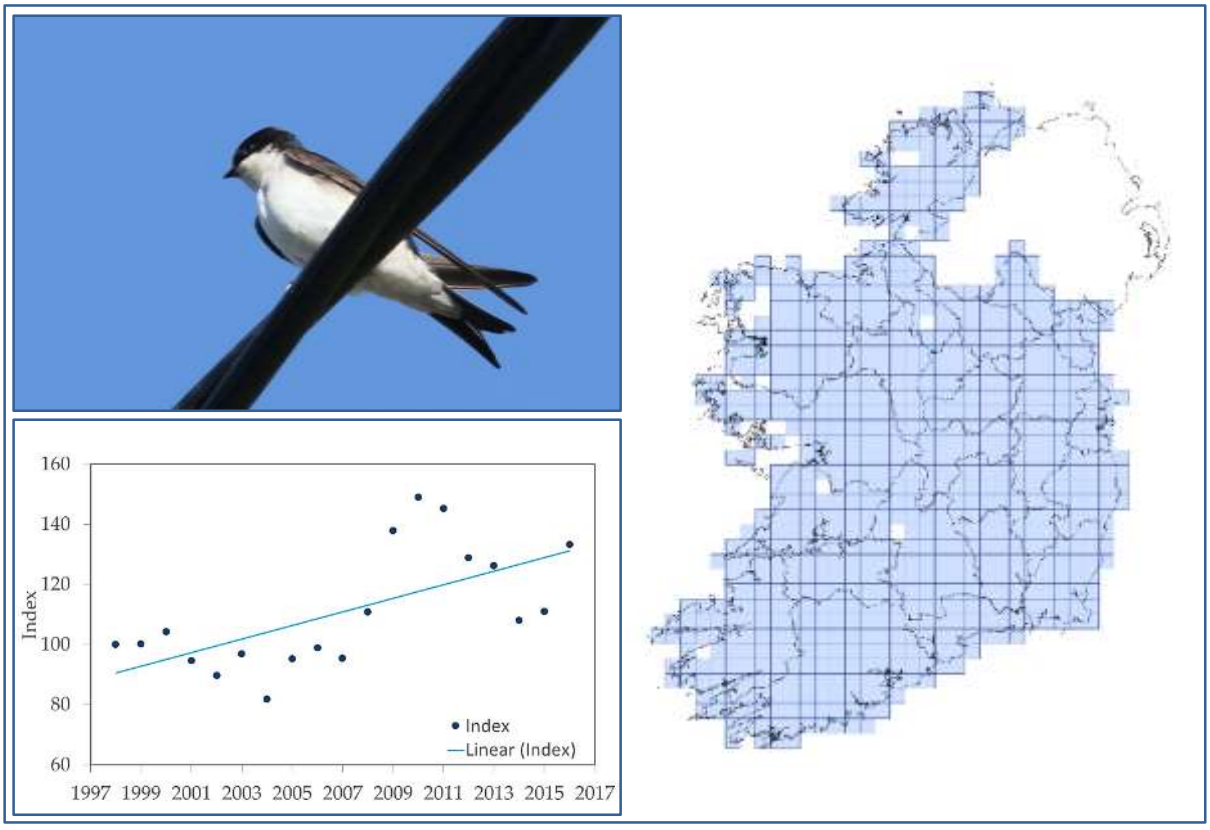

Figure 23 Distribution map and graphed population 18-year trend for House Martin. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The House Martin (Northern House Martin on the EU Bird List) is a summer visitor to Ireland and is found throughout the country (in 91% of 10 km squares in the Bird Atlas 2007-2011) (Balmer *et al.*, 2013), absent only from a few exposed parts of the west and northwest coasts. It is widespread in Britain too, except for the highest parts of the Scottish Highlands and parts of some offshore islands. It is also widespread throughout all European countries. Although House Martin has a close association with humans (most build their nests on buildings), densities are considered low in large urban centres such as Dublin and Belfast.

House Martin has increased in abundance over the 18 years since the start of CBS in 1998 (43.6%), while an increase is also evident over the recent 10-year period. The latest population estimate of >606,000 (2011-2016) represented an increase of almost 70,000 birds since 2010 (Crowe *et al.*, 2014). The European population has been stable since 1980 (PECBMS, 2019). These trends contrast with the UK, where the 21-year BBS trend (1995-2016) is a 12% decline in numbers.

The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), showed substantial increases in relative abundance across all of Ireland and declines in most of England, especially in the south-east, since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993). Increases were also found in Scotland, thus showing a shift in abundance across a line running south-west to north-east across Britain and Ireland, with increases above the line and declines below it. This pattern has been found with a number of other summer migrants including Barn Swallow and Willow Warbler.

House Martin is recorded in 94 CBS 1 km squares per year on average. In line with population increases, the trends in breeding distribution are positive over all time periods assessed, most notably a 49% increase over the past 25 years.

3.23 Long-tailed Tit *Aegithalos caudatus* Meantán earrfhada

Resident

Breeding population:	**Population estimate (2011-2016):**	101,834
	min – max population estimate:	61,476 – 152,497
	10-year trend (2006-2016):	-1.2
	18-year trend (1998-2016):	-2.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+14.0
	25-year trend (1991-2016):	+57.2
	44-year trend (1972-2016):	+18.5

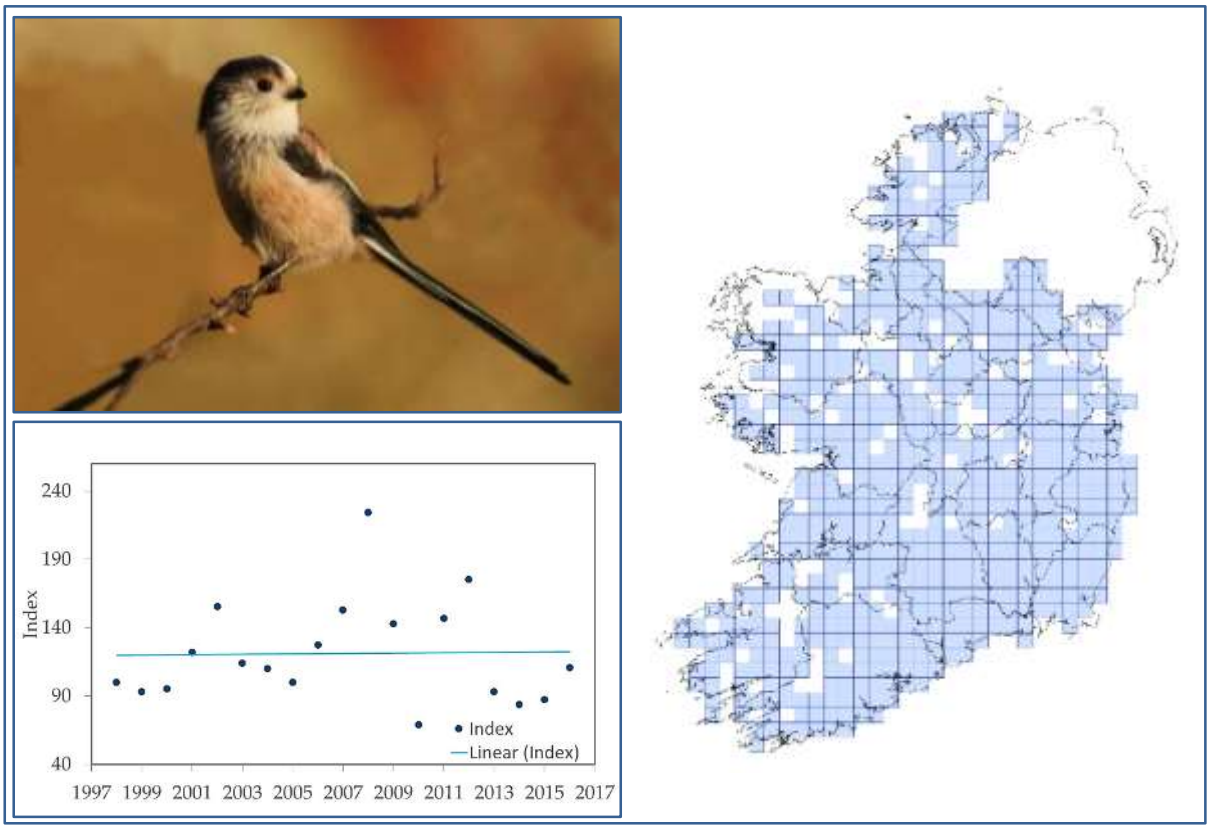

Figure 24 Distribution map and graphed population 18-year trend for Long-tailed Tit. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

Long-tailed Tit is a resident breeding bird of broadleaved and mixed woodland. The race *rosaceus* found in Ireland and Britain is a member of the western European *europaeus* group and is distinct from the white-headed nominate race which is found in northern Europe and Asia (Wernham *et al.*, 2002). The species is sedentary over much of its range.

Long-tailed Tit has exhibited a broadly stable trend throughout CBS. That said, numbers have fluctuated widely and the species is known to be susceptible to the effects of cold winters (Balmer *et al.*, 2013). The

species also has a stable trend across Europe (PECBMS, 2019) while in the UK there has been progressive increase in Long-tailed Tit abundance since the early 1980s (Woodward *et al.*, 2018).

Long-tailed Tit is widespread across Ireland and occurred in 75% of Irish 10 km squares during the breeding season for Bird Atlas (2007-2011) (Balmer *et al.*, 2013). During CBS however, Long-tailed Tit has been recorded in 52 1 km squares on average each year which is relatively low and this may affect the robustness of reported population trends. Breeding distribution trends, however, have shown increases over all periods assessed.

Long-tailed Tit is a reasonably common visitor to gardens during winter and was recorded in 40% of gardens during the 2016/17 Garden Bird Survey (Burke, 2017).

Reasons for increasing numbers in the UK have been linked to increased use of gardens, while research has shown that breeding season weather has strong impacts on the recruitment of Long-tailed Tit fledglings. Recruitment was also found to be strongly density dependent, which may help buffer populations from the effects of weather at other times of year (Gullett *et al.*, 2015).

3.24 Chiffchaff *Phylloscopus collybita* Tiuf-teaf

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	345,748
	min – max population estimate:	253,840 – 451,110
	10-year trend (2006-2016):	+51.0
	18-year trend (1998-2016):	+110.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+28.0
	25-year trend (1991-2016):	+38.9
	44-year trend (1972-2016):	+27.7

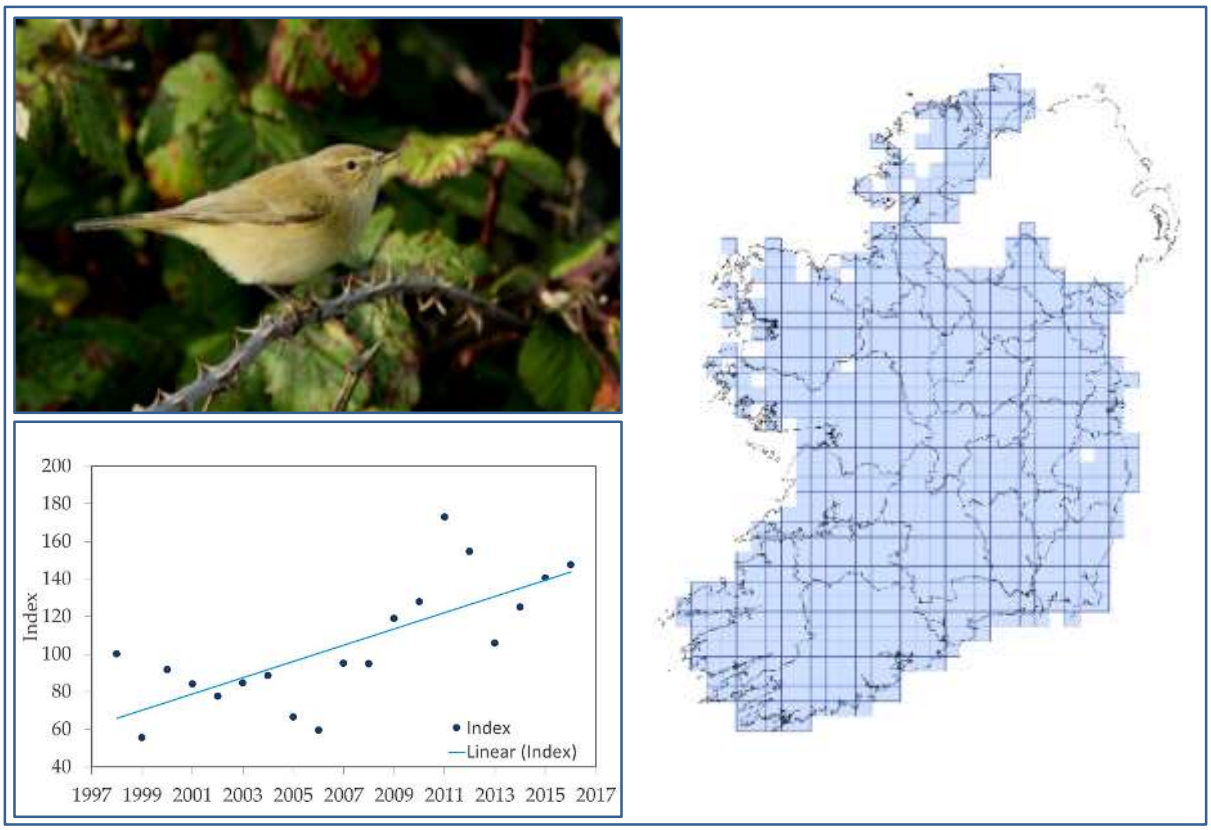

Figure 25 Distribution map and graphed population 18-year trend for Chiffchaff. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Chiffchaff (Common Chiffchaff on the EU Bird List) is a bird of open woodland, requiring tall trees as song-posts and rough undergrowth for nesting (Sharrock, 1976). The species is widespread across Europe and was recorded in 88% of Irish 10 km squares in the recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013). Chiffchaff is recorded in 138 CBS 1 km squares on average each year, although that average has been exceeded each year since 2008.

As well as showing increases in breeding distribution over the lifetime of CBS, the Chiffchaff also made considerable gains in the 25- and 44-year comparisons between breeding atlases (Gibbons *et al.*, 1993

and Sharrock, 1976, respectively). The breeding population trend shows a similar positive trend, with a short-term increase of 51.0% (2006-2016) and an increase of 110.1% since CBS began (1998-2016). The Bird Atlas (2007-2011) (Balmer *et al.*, 2013) found the relative abundance of breeding Chiffchaff to be mostly increasing in Ireland, with a few minor decreases and with the most significant gains in southern half of the country.

In the UK, Chiffchaff has increased significantly throughout the lifetime of BBS, by 125% since 1995, 66% since 2006 and 21% since 2011 (Harris *et al.*, 2018). The Bird Atlas (2007-2011) shows increased distribution in much of north-east Scotland and gains in abundance throughout much of England and Wales (Balmer *et al.*, 2013). Chiffchaff is also doing well at European level, having undergone a moderate increase over the long-term (since 1980) and in the 10 years to 2016 (PECBMS, 2019). Increases in numbers of Chiffchaff in Ireland, the UK and Europe, are likely to be linked to better overwinter survival (Johnston *et al.*, 2016) as well as earlier arrival dates allowing for earlier egg laying (Crick & Sparks, 1999; Newson *et al.*, 2016).

3.25 Willow Warbler *Phylloscopus trochilus* Ceolaire sailí

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	1,721,483
	min – max population estimate:	1,329,439 – 2,160,953
	10-year trend (2006-2016):	+44.9
	18-year trend (1998-2016):	+95.0
Breeding distribution change (%):	**10-year trend (2006-2016):**	+18.0
	25-year trend (1991-2016):	+23.4
	44-year trend (1972-2016):	+21.1

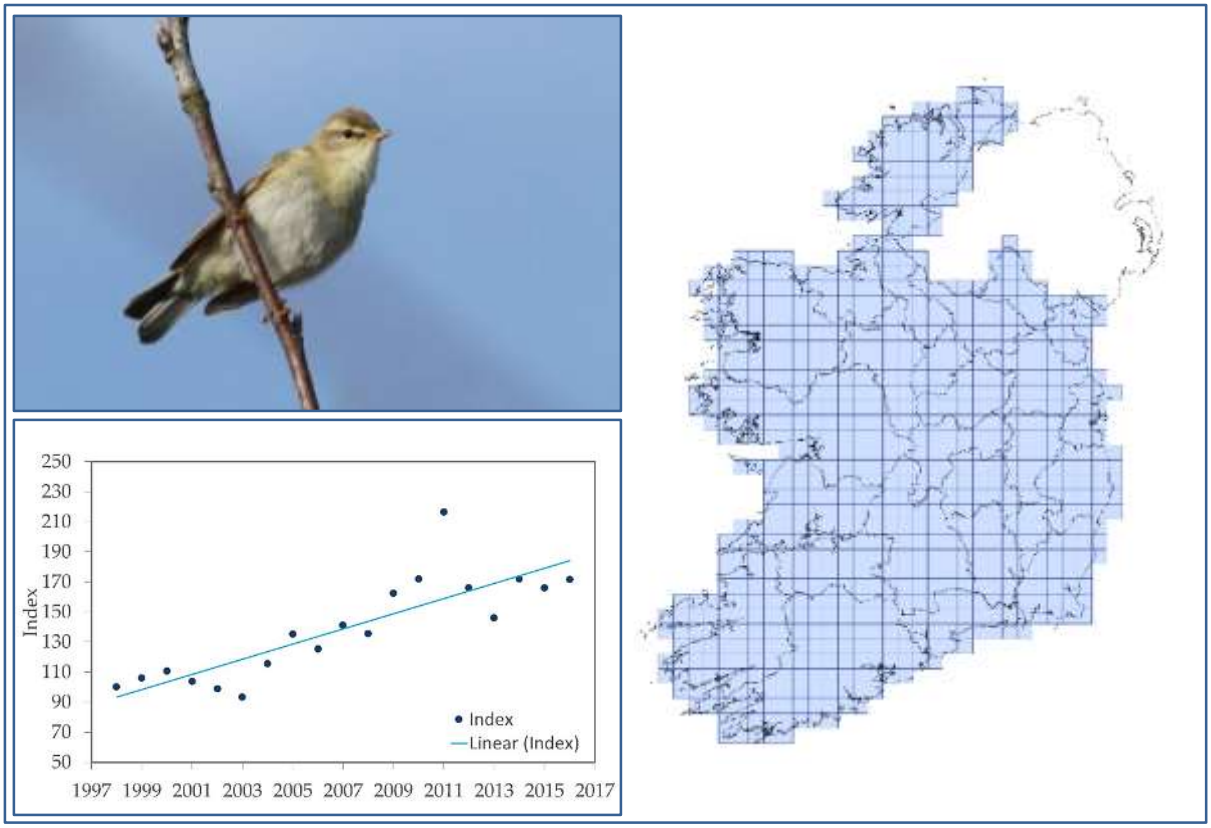

Figure 26 Distribution map and graphed population 18-year trend for Willow Warbler. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Willow Warbler is the most numerous warbler species in Europe, which accounts for less than half of its global breeding range (BirdLife International, 2004). With an estimated population of 1.7 million individuals it is also Ireland's most numerous warbler species, and our second most numerous summer migrant behind Swallow. This recent estimate is an increase of almost 350,000 birds since the 2006-10 period (Crowe *et al.*, 2014) and Willow Warbler has increased by 95% since CBS began in 1998. Results since BBS began in the UK show a decline of 9%, although shorter-term trends show a more complex picture (+6% in 10 years, +1% in 1 year; Harris *et al.*, 2018) which is likely a result of contrasting trends

in different parts of its UK range. The Willow Warbler has undergone a moderate decline in Europe both in the long-term and over the 10 years to 2016 (PECBMS, 2019).

The Willow Warbler nests on the ground amongst low-lying vegetation and is therefore common in open woodlands, scrub, upland and lowland bog and farmland hedgerows. It occurs in 223 CBS 1 km squares on average each year (+18% for the period 2006-2016) and was recorded in 95% of 10 km squares on the island of Ireland during the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). Breeding distribution trends based on atlas data also show increases over the 25-year (+23.4) and 44-year periods (+21.1).

The relative abundance of breeding Willow Warbler in Ireland was considerably higher than in much of Britain during the recent Bird Atlas. Although its abundance over most of Ireland and Scotland has increased since 1988-91, numbers have fallen over much of England – a pattern shared with several other long-distance migrants including House Martin and Cuckoo (Balmer *et al.*, 2013). The reason for the contrasting trends between Ireland and Scotland (north-west) and England and parts of Wales (south-east) have been attributed to differences in productivity (Morrison *et al.*, 2016), with conditions in the former likely to be more conducive to provisioning chicks and avoiding predation than in the more intensively-farmed latter region. In both the north-west and south-east of Britain, the timing of breeding attempts has moved forward in recent years, now occurring six and four days earlier (respectively) than it did more than 30 years ago (Morrison *et al.*, 2015).

3.26 Blackcap *Sylvia atricapilla* Caipín dubh

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	586,216
	min – max population estimate:	366,335 – 855,733
	10-year trend (2006-2016):	+396.5
	18-year trend (1998-2016):	+1,689.3
Breeding distribution change (%):	**10-year trend (2006-2016):**	+129.0
	25-year trend (1991-2016):	+514.5
	44-year trend (1972-2016):	+738.2

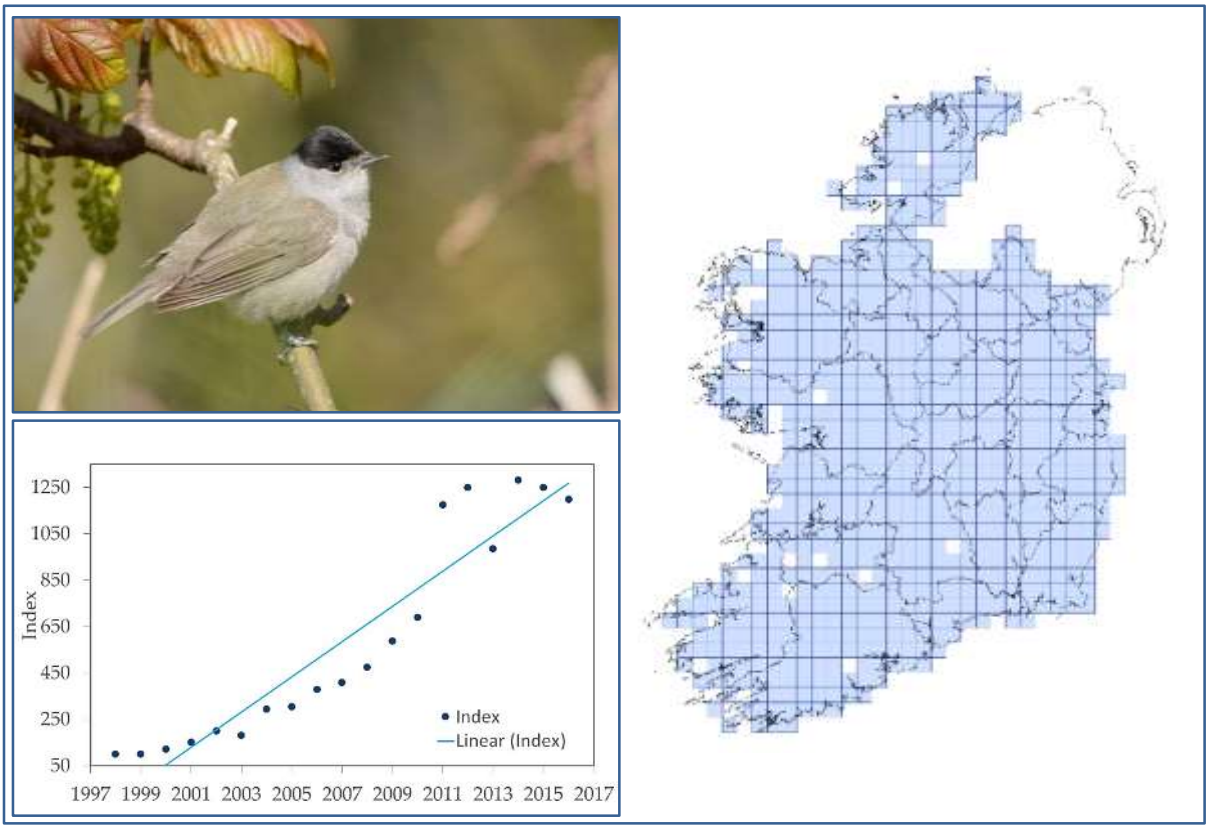

Figure 27 Distribution map and graphed population 18-year trend for Blackcap. The breeding distribution map is based on the Bird Atlas (2007-11) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

In the nineteenth century, the Blackcap (Eurasian Blackcap on the EU Bird List) was known to breed in 24 counties on the island of Ireland. However, by the mid-1960s, the Blackcap was believed to be confined to just five counties, its stronghold in Co. Wicklow. Today, the Blackcap is widespread throughout the country, with just a few gaps in distribution along exposed west coast areas. While there is a sizeable wintering population in Ireland, mainly in eastern and southern counties, these birds are believed to migrate from Central Europe in autumn and depart in spring. The Blackcap that breeds in Ireland, winters in the Mediterranean Basin and arrives as a summer visitor in spring. It is widespread

in Britain too, but absent from stretches of the Scottish uplands and Scottish islands. In Europe, it is resident in Iberia, France, Italy and Greece and a summer visitor to the rest of the continent. Its preferred habitat is shady woodland and scrub but it can occur in even small clumps of shrubs, trees and gardens.

Since the start of CBS in 1998, Blackcap has increased by an astounding 1,689%. The recent population estimate of >586,000 (2011-2016) represents an increase of more than 363,000 individuals since 2010 (Crowe *et al.*, 2014). On average, Blackcap is recorded in 116 CBS 1 km squares per year, and the breeding distribution has increased by 129% between 2006 and 2016. Trends in distribution based on atlas data also show large increases, and Blackcap was recorded in 88% of 10 km squares in Ireland during the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013).

In line with striking gains in the distribution of Blackcap, relative abundance showed significant increases across the country since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993). In the UK, the BBS population trend (1995-2016) was +143% (Harris *et al.*, 2018). Interestingly, in Europe only a moderate increase has been recorded since 1980 (PECBMS, 2019). As there has been no clear change in its habitat in the last few decades, it is likely that climate change is the main reason for the on-going increases in both abundance and range of Blackcap across Ireland, Britain and Europe.

3.27 Whitethroat *Sylvia communis* Gilphíb

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	97,099
	min – max population estimate:	63,356 – 131,478
	10-year trend (2006-2016):	+22.0
	18-year trend (1998-2016):	+43.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+36.0
	25-year trend (1991-2016):	+68.3
	44-year trend (1972-2016):	+23.7

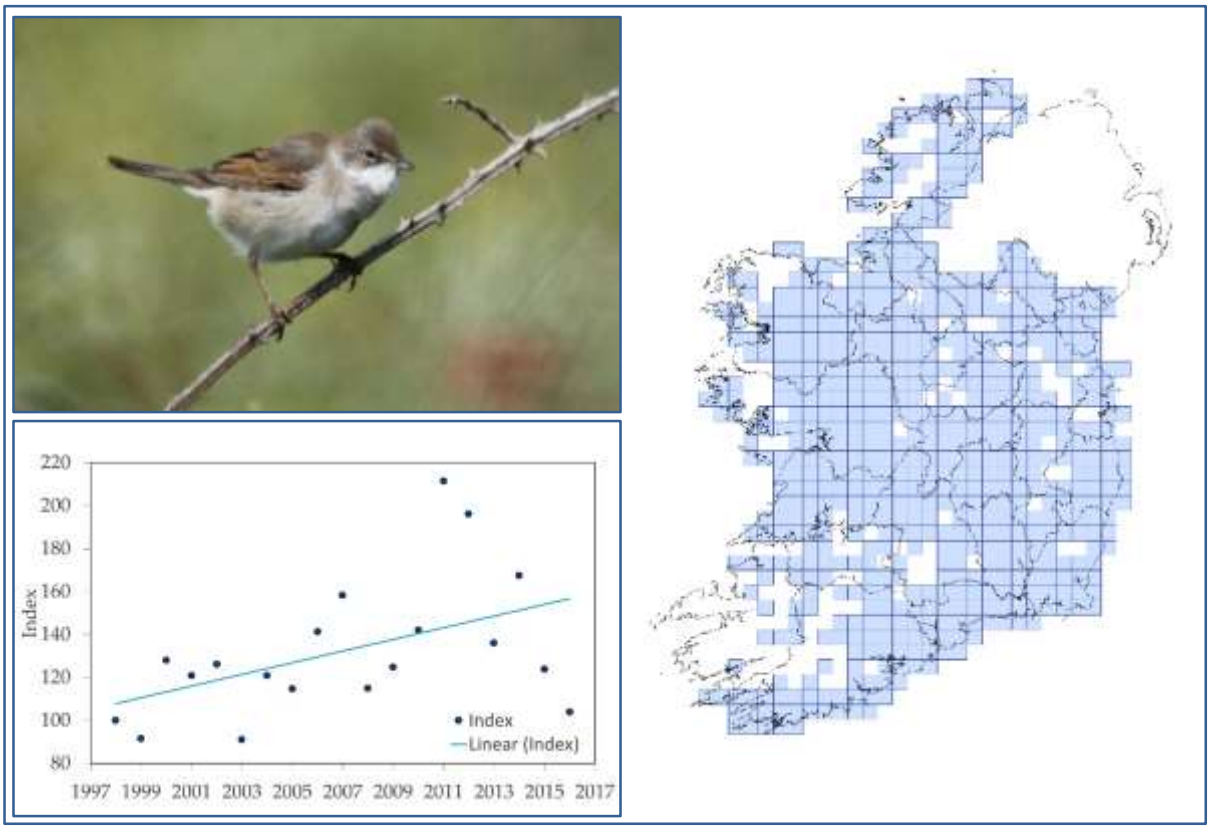

Figure 28 Distribution map and graphed population 18-year trend for Whitethroat. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Whitethroat (Common Whitethroat on the EU Bird List) is a summer visitor to Ireland, where it is widely distributed but absent from large tracts of Kerry, north Cork, Galway and Mayo. In the UK, it is also widespread but with gaps at higher altitudes and on the north coast and islands of Scotland. It is widespread throughout Europe except northern Scandinavia. Whitethroat is a bird of open country, where low scrub, bramble and hawthorn thickets predominate. It also frequents farmland hedgerows, woodland edge habitats and young conifer plantations. In the UK, it is one of seven species considered hedgerow specialists (Fuller, 1995).

Whitethroat has shown an increasing trend of 43.1% since CBS began in 1998. However, the numbers arriving in Ireland each summer are prone to considerable fluctuation – higher numbers were recorded in 2007, 2011 and 2014, with lower numbers in 2003, 2008 and 2013. The recent population estimate of 97,100 (2011-2016) represents an increase of almost 11,000 individuals since 2010 (Crowe *et al.*, 2014).

In the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), relative abundance showed more increases than decreases in the western half of the country, and a mix of increases and decreases in the eastern half, since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993). UK BBS data show positive trends of 12% over ten years (2006-2016) and 27% over 23 years (1995-2016) (Harris *et al.*, 2018).

On average, Whitethroat is recorded in 67 CBS 1 km squares per year, and the breeding distribution trend based on CBS data (2006-2016) is a 35% increase. The 25- and 44-year distribution trends based on atlas data also show substantial gains.

Fluctuations in Whitethroat numbers are thought to relate to the species' overwinter survival. A 75% crash in the population in Britain in the spring of 1969 was considered to have been the result of severe drought in the wintering quarters in the Sahel region, to the south of the Sahara (Winstanley *et al.*, 1974). Sharp declines were repeated in 1984 and 1991. The Whitethroat appears to be able to recover well from such setbacks in intervening years.

3.28 Grasshopper Warbler *Locustella naevia* Ceolaire casarnaí

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	22,382
	min – max population estimate:	13,740 – 33,361
	10-year trend (2006-2016):	+9.8
	18-year trend (1998-2016):	+18.3
Breeding distribution change (%):	**10-year trend (2006-2016):**	0.0
	25-year trend (1991-2016):	+74.6
	44-year trend (1972-2016):	+2.4

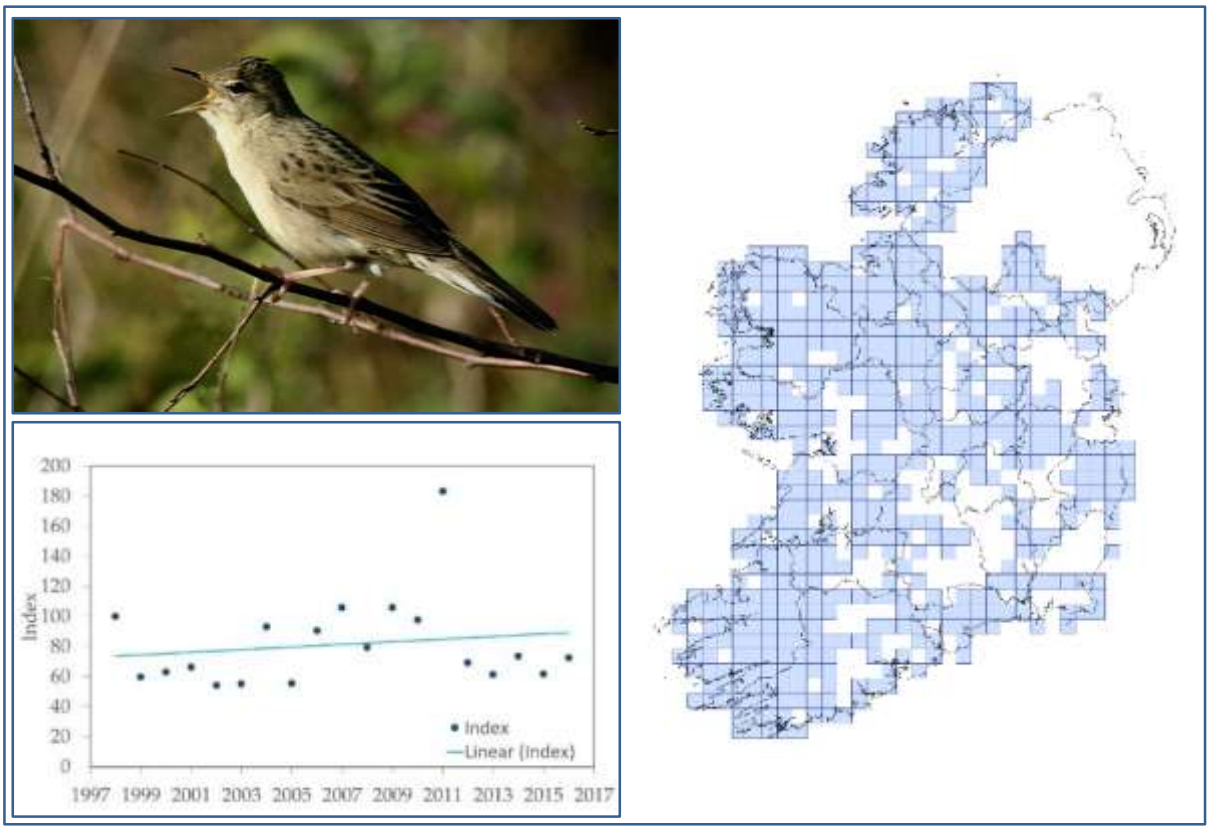

Figure 29 Distribution map and graphed population 18-year trend for Grasshopper-warbler. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Grasshopper Warbler (Common Grasshopper-warbler on the EU Bird List) is a summer visitor, found in all counties in Ireland, but it is rather thinly dispersed in some eastern and southern regions. In Britain it also has a patchy distribution with some large gaps and on the continent, its range stretches eastwards from the north of Spain across northern/central Europe, including southern Scandinavia. It is a secretive bird, more often heard than seen and mainly associated with marginal habitats, where

dense tangled low vegetation such as bramble mix with sedges and reeds and, increasingly, in young conifer plantations.

The 10-year population trend is considered broadly stable (with minimum and maximum estimates either side of zero) and the 18-year population trend since CBS began in 1998 is +18%. The most recent population estimate (2011-2016) of 22,400, represents an increase of over 1,000 individuals since 2010 (Crowe *et al.*, 2014). In contrast, the UK BBS population trend (1995-2016) was -7% (Harris *et al.*, 2018), while the European trend shows a moderate decline since 1980 (PECBMS, 2019).

The average number of CBS 1 km squares in which the species is recorded is 38. This low figure reflects the relatively low number of CBS survey squares in western regions, where Grasshopper Warbler has its stronghold and occurs in highest densities. The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), recorded Grasshopper Warbler in 70% of 10 km squares in Ireland during the breeding season. There were losses and gains in occupancy of 10 km squares across the country since the first Bird Atlas (1968-1972) (Sharrock, 1976), with most losses in eastern regions. The overall breeding distribution change across 44-years is +2.4% (stable), while the trend over 25-years is for considerable gains.

Relative abundance in the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013) showed substantial increases in the north-west, west and south-west of the country and declines in scattered pockets in the midlands, east and south. The highest densities were found in the western half of Ireland, similar to densities found in Wales and south-west Scotland. The rest of Britain showed relatively low densities, following declines, particularly in England, since the Bird Atlas (1988-91) (Gibbons *et al.*, 1993).

Grasshopper Warbler is associated with wet habitats, but it appears to have adapted to drier habitats in recent decades, early stage conifer plantations being particularly favoured. This may explain the species' steady increase in Ireland, as afforestation continues to spread across the country. Equally, it is thought that canopy closure through woodland succession and maturing of forestry plantations may be the reason for declines in much of Britain (Balmer *et al.*, 2013).

3.29 Sedge Warbler *Acrocephalus schoenobaenus* Ceolaire cíbe

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	115,726
	min – max population estimate:	77,542 – 158,627
	10-year trend (2006-2016):	+6.6
	18-year trend (1998-2016):	+12.2
Breeding distribution change (%):	**10-year trend (2006-2016):**	-2.0
	25-year trend (1991-2016):	+23.8
	44-year trend (1972-2016):	-2.9

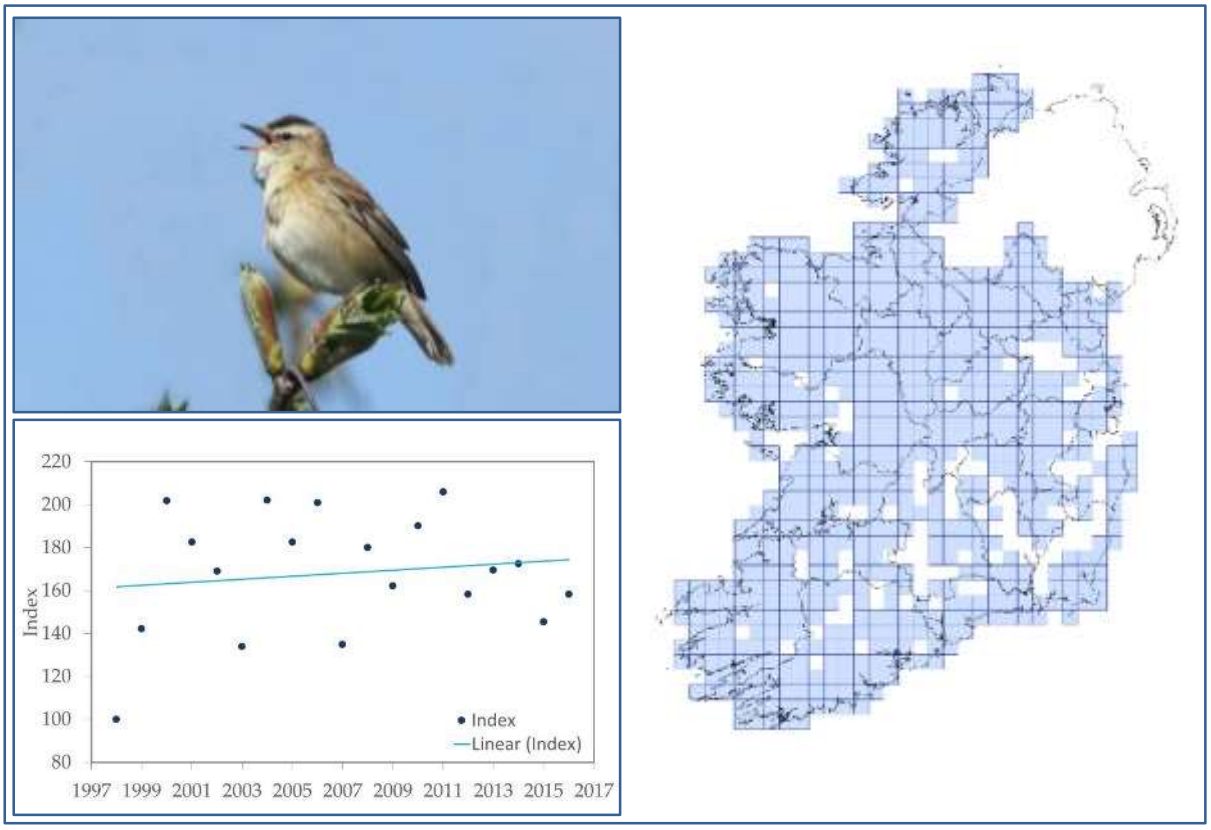

Figure 30 Distribution map and graphed population 18-year trend for Sedge Warbler. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

Sedge Warbler is a summer visitor to Ireland, and it occurs throughout the country and is similarly widespread in Britain, but with gaps in upland regions. The European range extends more or less across the northern half of the continent. Sedge Warbler is mainly associated with wet habitats, particularly reedbeds, marshes and the vegetated sides of rivers, canals and lakes. It can be found in drier habitats including patches of brambles, scrub and even young conifers.

There is great variation in the annual index but Sedge Warbler has shown an increasing trend in numbers of over 12% since CBS began in 1998. The recent population estimate of >115,726 (2011-2016)

represents an increase of some 4,300 individuals since 2010 (Crowe *et al.*, 2014). The UK BBS population trend from 1995-2016 was -10% (Harris *et al.*, 2018) and the European trend has been stable since 1980 (PECBMS, 2019).

On average, Sedge Warbler is recorded in 66 CBS 1 km squares per year. In the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), Sedge Warbler was recorded in 84% of 10 km squares across Ireland. Considered stable given a marginal decline in its breeding distribution over the 10-year period with an increase of nearly 24% in range over 25-years. Across 44-years, its breeding distribution has been stable.

Sedge Warbler undergoes a long-haul migration from northwest Europe to sub-Saharan Africa by feeding extensively on superabundant food supplies, specifically reed aphids (e.g. *Hyalopterus pruni*), unlike the Reed Warbler which stops and refuels two or three times in order to complete the same journey (Bayly, 2007). Fluctuations in Sedge Warbler numbers in Ireland may relate to wet-season rainfall quantities in their West African wintering grounds. Analyses of independent survival estimates of Sedge Warbler show that it is limited by competition for resources on its wintering grounds (Baillie & Peach, 1992). A population crash in the UK, which occurred in 1984/85, is thought to have been the result of extreme rainfall amounts in the Sahel region (Peach *et al.*, 1991).

3.30 Treecreeper *Certhia familiaris* Snag

Resident

Breeding population:	**Population estimate (2011-2016):**	77,344
	min – max population estimate:	30,944 – 122,463
	10-year trend (2006-2016):	+17.8
	18-year trend (1998-2016):	+34.3
Breeding distribution change (%):	**10-year trend (2006-2016):**	+21.0
	25-year trend (1991-2016):	+48.2
	44-year trend (1972-2016):	+14.1

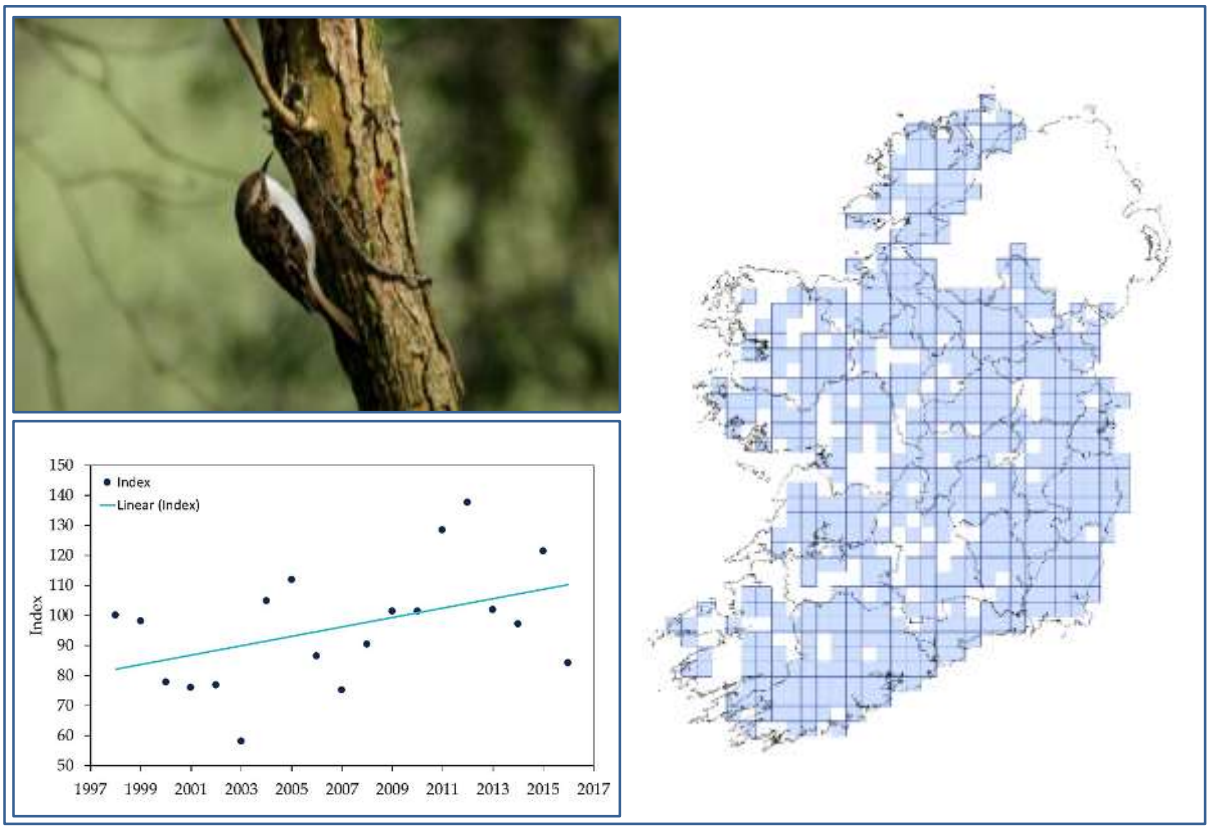

Figure 31 Distribution map and graphed population 18-year trend for Treecreeper. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo Dick Coombes).

The Treecreeper is distributed throughout most of Ireland, with some large gaps in Kerry, Clare, Galway and Mayo. As it has a high dependency on trees, woodland is its main habitat. However, it can occur along hedgerows which contain some mature trees and in parks and gardens. Mature conifer plantations, especially those featuring standing deadwood, also provide suitable habitat. The Treecreeper is widespread in Britain, with the exception of the higher mountainous regions of Scotland and its offshore islands. It is resident in Ireland and Britain and throughout its range, which extends across eastern and northern Europe, with isolated populations in the French Alps and Pyrenees.

The CBS showed a positive trend of nearly 18% for the 10-year period (2006-2016) and 34% over the 18-years (1998-2016). The latest population estimate is >77,300 (2011-2016) (Crowe *et al.*, 2014). The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), showed a mix of gains and losses in distribution, with an overall gain of 14% (1972-2016). Relative abundance change since the Bird Atlas (1988-1991) showed the greatest increases for Treecreeper in the Sligo, Leitrim, Roscommon region and south west Cork with declines scattered throughout the rest of the country. In Britain, there has been a small 5% loss in its overall distribution since 1972.

In the UK, the BBS recorded population increases of 4% in the UK over 10-years (2006-2016) and 7% over 23-years (1995-2016) (Harris *et al.*, 2018). Across Europe, the Treecreeper has undergone a moderate decline in numbers since 1980 (PECBMS, 2019).

On average, Treecreeper is recorded in 23 CBS squares each year. As this falls below the 30-square threshold normally applied to produce population trends in CBS, the above CBS trends should be treated as approximate. There has been little research carried out on Treecreeper in Ireland and Britain. The population gains in both regions may possibly be explained by the amount of forestry currently maturing, providing additional suitable habitat.

3.31 Wren *Troglodytes troglodytes* Dreoilín

Resident

Breeding population:	**Population estimate (2011-2016):**	5,552,467
	min – max population estimate:	4,711,623 – 6,412,250
	10-year trend (2006-2016):	+6.2
	18-year trend (1998-2016):	+11.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+2.0
	25-year trend (1991-2016):	+4.1
	44-year trend (1972-2016):	+3.1

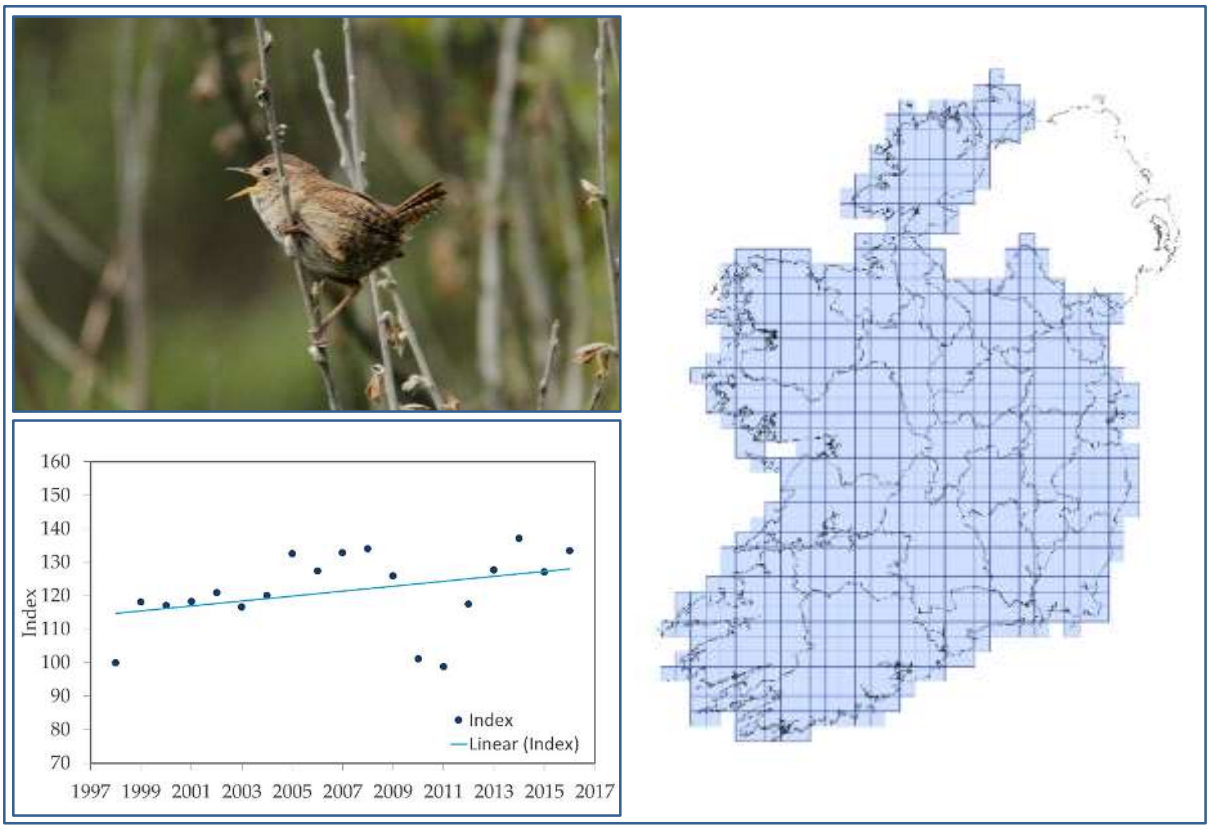

Figure 32 Distribution map and graphed population 18-year trend for Wren. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Wren (Northern Wren on the EU Bird List) is the most widespread bird species in Ireland, occurring on average in 293 1 km CBS squares, and 98% of Irish 1 km squares during the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). Wren is amongst the top recorded species in Irish gardens, occurring in 82% of gardens during the winter of 2016/17 (Burke, 2017). It occupies a wide range of habitats and overall densities are higher in Ireland than in Britain (Balmer *et al.*, 2013).

The species has shown a moderate increase in numbers of 11.1% throughout CBS (1998-2016). The main driver of changes in Wren populations is considered to be extreme cold weather events (e.g. Robinson

et al., 2007) and the trend graph for Wren clearly shows a drop in overall numbers in the breeding seasons following the winters of 2009/10 and 2010/11, likely attributed to the extreme cold weather events during those winters. The UK BBS trends reveal increases over a 10- and 21-year period (Harris *et al.*, 2018) while the trend over a longer timeframe, albeit showing peaks and troughs likely due to cold winters, is also increasing (Woodward *et al.*, 2018). The European trends for Wren, both for 10-year and across the long-term (1980-2016) are for moderate increases.

The trend in breeding distribution, across all time periods is modest (stable), which is understandably low given its ubiquity throughout the CBS and bird atlas surveys.

3.32 Starling *Sturnus vulgaris* Druid

Resident

Breeding population:	**Population estimate (2011-2016):**	2,066,904
	min – max population estimate:	1,437,631 – 2,803,162
	10-year trend (2006-2016):	-4.0
	18-year trend (1998-2016):	-7.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+10.0
	25-year trend (1991-2016):	+14.1
	44-year trend (1972-2016):	+10.8

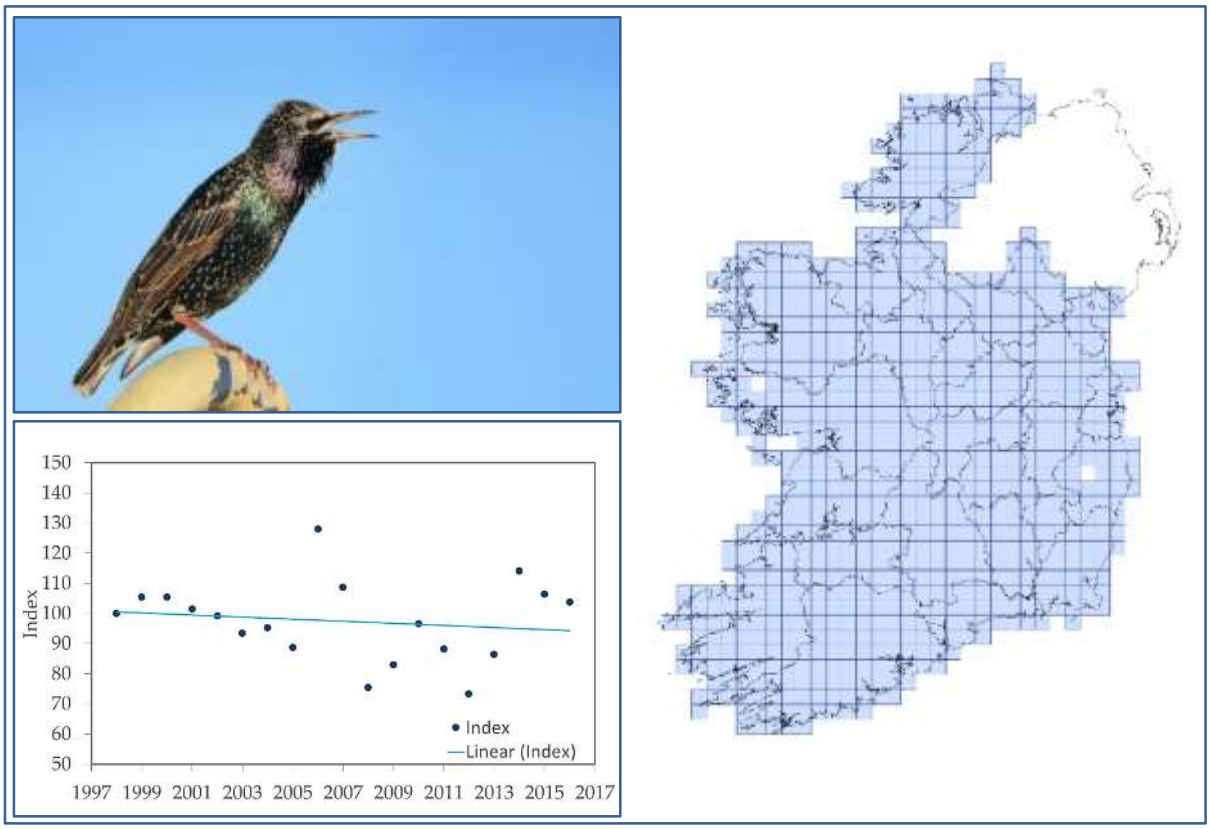

Figure 33 Distribution map and graphed population 18-year trend for Starling. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Starling (Common Starling on the EU Bird List) is a common and widespread resident bird species throughout Ireland and Britain. The resident population is supplemented by continental birds in winter. In Europe, it is resident from France to Denmark and throughout most of southern Europe. It is a summer visitor to eastern Europe and Scandinavia and a winter visitor to Iberia. Starling is a familiar bird, found in a broad range of habitats, including urban and suburban environments as well as farmland.

The Starling has shown a relatively stable trend (slight decline of -7.1%) during CBS (1998-2016). The recent population estimate of 2,066,904 (2011-2016) represents a decrease of almost 52,000 since 2010 (Crowe *et al.*, 2014). The UK BBS trends are -51% (1995-2016) and -30% (2006-2016) (Harris *et al.*, 2018), representing something of a crash in the population over quite a short time period. The European trend is showing a moderate decline since 1980 (PECBMS, 2019).

Starling is recorded in 220 1 km squares on average each year. The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), recorded Starling occurring in 97% of 10 km squares in Ireland. Starling was not always so widespread or common in Ireland. In the mid-nineteenth century, it was primarily a winter visitor and only bred in relatively small numbers, absent from or very scarce in west Cork, Kerry, Wexford and Waterford (Ussher & Warren, 1900). The breeding distribution of Starling has increased by 10.8% since 1972 (44-year trend), with similar increases over 10- and 25-years. The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), showed relative abundance increases over much of the country since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993), especially in southern counties, the midlands and Donegal. In contrast, the UK relative abundance change map shows declines throughout England and Wales and parts of Scotland since 1988-1991.

The reasons for the contrasting trends in Ireland and Britain may relate to food availability. The Starling largely forages in fields, especially pasture, where cranefly larvae (Diptera, Tipulidae) are a mainstay in the bird's diet (Whitehead *et al.*, 1995). Intensive improvement of grassland for the beef and dairy industry in Ireland has produced high soil fertility, conducive for crane fly larvae. As a result, the Starling may be benefiting from such agricultural intensification (Vickery *et al.*, 2001).

3.33 Blackbird *Turdus merula* Lon Dubh

Resident

Breeding population:	**Population estimate (2011-2016):**	4,613,945
	min – max population estimate:	3,960,070 – 5,316,172
	10-year trend (2006-2016):	+9.8
	18-year trend (1998-2016):	+18.3
Breeding distribution change (%):	**10-year trend (2006-2016):**	+1.0
	25-year trend (1991-2016):	+2.3
	44-year trend (1972-2016):	+1.1

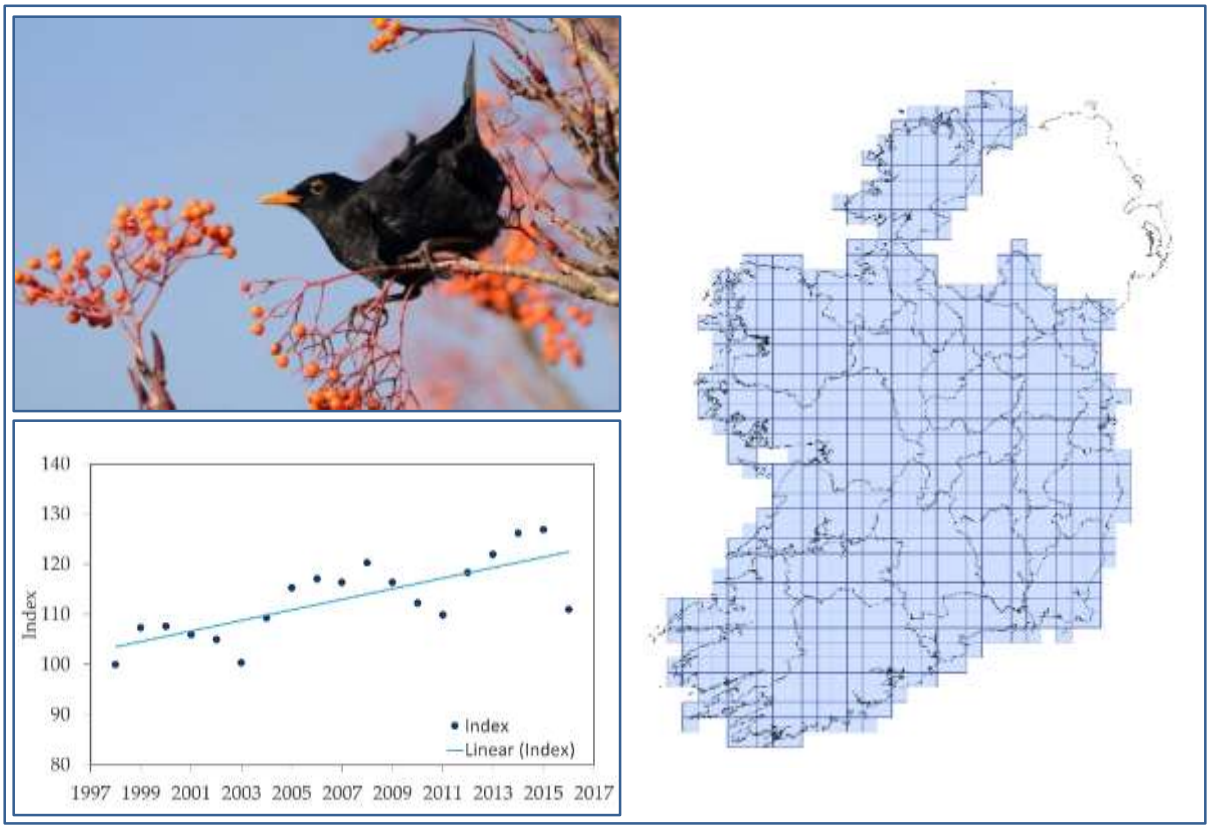

Figure 34 Distribution map and graphed population 18-year trend for Blackbird. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Blackbird (Eurasian Blackbird on the EU Bird List) breeds across most of Europe, which constitutes >50% of the species' global range (Birdlife International, 2004). The Blackbird is resident in Ireland, with a largely sedentary breeding population joined by birds from countries to the north-east (British, Scandinavian and Baltic countries) in the winter (Wernham *et al.*, 2002). It is an example of a species that would have historically been associated with woodland edge, but in the last couple of centuries has very successfully adapted to farmland hedgerows, moorland edge and suburban and urban habitats

(Sharrock, 1976). As a result, Blackbird was recorded in 97% of Irish 10 km squares during the Bird Atlas (2007-2011), absent only from some open coastline and offshore islands (Balmer *et al.*, 2013).

Blackbird has increased by 18.3% over the lifetime of CBS, with a recent breeding population estimate of 4,613,945 individuals making it Ireland's third most numerous breeding species (behind Wren and Swallow). In the UK, Blackbird has increased by 24% since 1995, with stable trends in the shorter-term (Harris *et al.*, 2018).

On average Blackbird is recorded in 284 CBS 1 km squares each year, behind only Wren and very slightly behind Robin. Its breeding distribution trend in CBS (2006-2016) is stable (+1%), which is understandably given their ubiquity throughout the survey. In the 25- and 44-year periods between the current Bird Atlas (2007-2011) (Balmer *et al.*, 2013) and the previous two atlases, their breeding distribution has also remained stable.

The reason for the largely positive trend for Blackbird in Ireland is likely down to a combination of the overall suitability of the Irish agricultural landscape (i.e. pasture, hedgerows) for nesting and feeding, suitably damp summers influencing food availability during the breeding season and breeding productivity as a result, as well as winter temperature and food availability influencing overwinter survival (Robinson *et al.*, 2010a). In Britain, annual population growth rates were found to be higher in the west than the east, the former having a damper climate and more pasture-based landscape (similar to Ireland) than the latter (Robinson *et al.*, 2010a).

3.34 Song Thrush *Turdus philomelos* Smólach ceoil

Resident

Breeding population:	**Population estimate (2011-2016):**	853,569
	min – max population estimate:	687,965 – 1,028,321
	10-year trend (2006-2016):	-3.9
	18-year trend (1998-2016):	-7.0
Breeding distribution change (%):	**10-year trend (2006-2016):**	+5.0
	25-year trend (1991-2016):	+8.5
	44-year trend (1972-2016):	+5.4

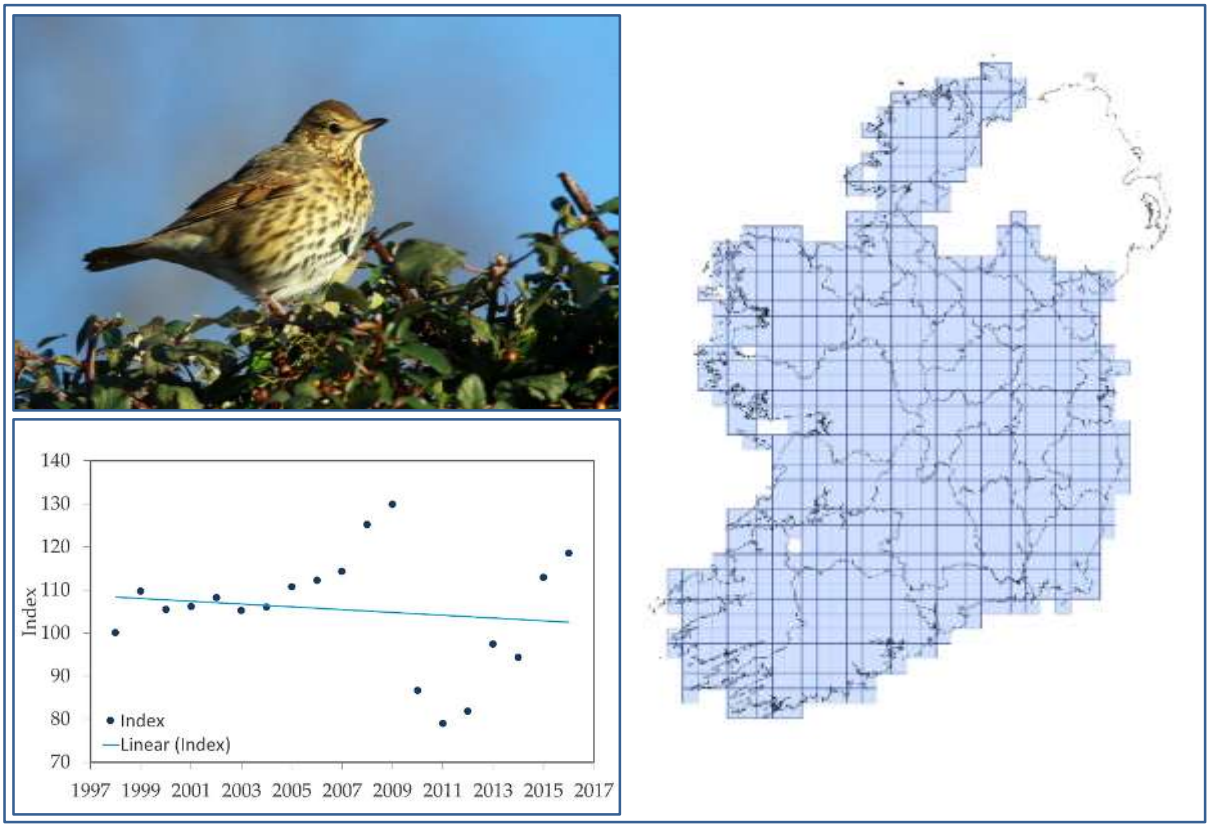

Figure 35 Distribution map and graphed population 18-year trend for Song Thrush. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Song Thrush has a breeding distribution covering 95% of 10 km squares across the island (Balmer *et al.*, 2013). The species would have historically been more closely tied to coniferous and broadleaved forests, but now happily occupies farmland hedgerows, scrub habitats, suburban gardens and urban parks and anywhere else with a combination of open ground and bushes or trees (Cramp, 1985).

Song Thrush has declined by 7% in number throughout CBS (1998-2016) (but considered broadly stable in the shorter-term), owing largely to significant declines following harsh winters preceding the 2010

and 2011 breeding seasons. The breeding population is estimated at 853,569 individuals (2011-16), down 2% (>20,000 individuals) since the 2006-10 period (Crowe *et al.*, 2014). The BBS trends for Song Thrush in the UK is a significant increase of 32% over the 23 years of the survey, with similar positivity over 10 years (6%) and in the shorter-term (Harris *et al.*, 2018). Its population has increased (moderate) across Europe in the long-term and the ten years to 2016 (PECBMS, 2019).

Song Thrush is recorded in 259 CBS 1 km squares on average each year and has increased in breeding distribution by 5% over the course of the survey. The 25- and 44-year trends in distribution show small increases (8.5% and 5.4% respectively) suggesting stability overall. When comparing the two most recent bird atlases, breeding relative abundance increased significantly over much of the southern half of the country, the midlands and the north-west, with stability in the west and some scattered losses in Clare and elsewhere.

Overall, the Song Thrush is a species that fares well in most years across the Irish countryside, but which is prone to notable population declines following harsh (very cold or dry) winters which result in the mortality of many first-year birds (Thomson *et al.*, 1997). Land drainage and pesticides are also among the likely candidates contributing to declines at various spatial scales (Robinson *et al.*, 2004).

3.35 Mistle Thrush *Turdus viscivorus* Liatráisc

Resident

Breeding population:	**Population estimate (2011-2016):**	185,200
	min – max population estimate:	135,797 – 239,181
	10-year trend (2006-2016):	-9.8
	18-year trend (1998-2016):	-17.0
Breeding distribution change (%):	**10-year trend (2006-2016):**	0.0
	25-year trend (1991-2016):	+4.9
	44-year trend (1972-2016):	-7.3

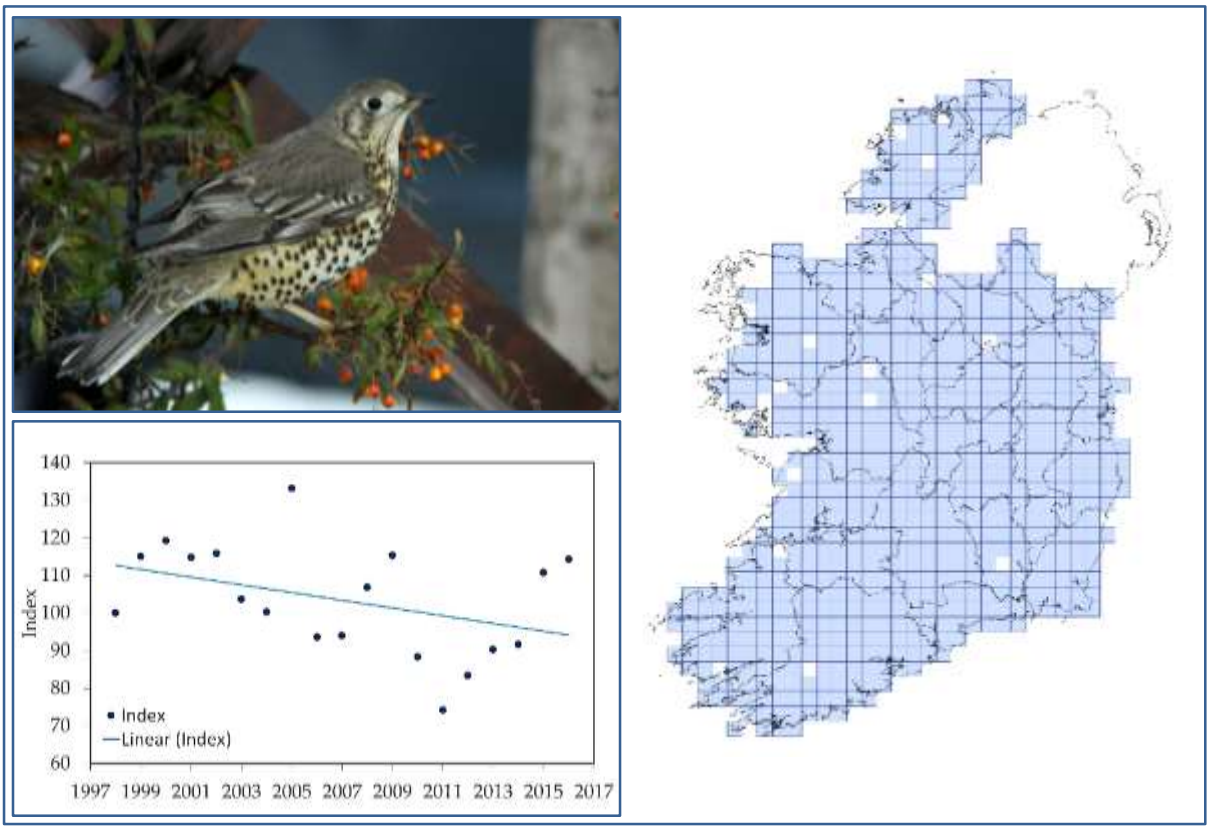

Figure 36 Distribution map and graphed population 18-year trend for Mistle Thrush. The breeding distribution map is based on the Bird Atlas (2007-11) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Mistle Thrush was first recorded in Ireland in 1800, with breeding evidence recorded in all counties by the middle of the 19th century (Sharrock, 1976). Like the other *Turdus* species in Ireland, it has expanded its range in the last 200 years by occupying 'new' habitats including much lowland farmland and suburban/urban recreational grasslands. As with Song Thrush and Blackbird, the ecological requirements of the Mistle Thrush include open ground to feed on invertebrates, sufficient shelter and nesting space in vegetation, with berry-laden trees and shrubs readily taken to in the autumn (Cramp,

1985). The majority of the Irish-breeding population is sedentary, with a small influx of birds from more north-easterly regions in the winter (Wernham *et al.*, 2002).

Mistle Thrush has declined by 17% in number throughout CBS (1998-2016), while the 10-year trend (2006-2016) is also one of decline. The BBS trend shows declines of 24% and 20% since 1995 and 2006, but a recent increase of 8% between 2011 and 2016 (Harris *et al.*, 2018). At a broader European scale, Mistle Thrush has remained stable since 1980 but has shown a moderate increase since 2017 (PECBMS, 2019).

On average, Mistle Thrush is present in 134 CBS 1 km squares each year. Breeding evidence was recorded in 88% of Irish 10 km squares during the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). During CBS (2006-2016), the breeding distribution has remained stable, with the trends based on atlas comparisons over the 25-and 44-year periods (+4.9 and -7.3 respectively), also considered stable.

The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013) showed that breeding relative abundance had increased considerably across most of Munster, Leinster and Ulster over the 20 years since the previous breeding atlas, with counties in Connacht as well as County Clare showing notable declines. In Britain, breeding relative abundance decreased over the majority of England and Scotland, with increases along the English east coast and in much of Wales. Reduced survival of juveniles, during the post-fledging and overwintering periods, has been implicated as a likely cause of the downward population trajectory of Mistle Thrush (Siriwardena *et al.*, 2008). The changes in breeding relative abundance between Mistle Thrush and Song Thrush are broadly similar over much of Ireland, with both species increasing almost everywhere except Clare and Connacht, where the Song Thrush was largely stable, but Mistle Thrush had declined. Given the similarities, it may be the case that similar environmental (weather) and habitat-related (agricultural change and land-management) issues may be impacting both species (Thomson *et al.*, 1997; Robinson *et al.*, 2004). Given that Mistle Thrush can occur in much lower numbers than Song Thrush, it is more likely the former would undergo the more dramatic changes in abundance.

3.36 Spotted Flycatcher *Muscicapa striata* Cuilire liath

Summer visitor

Breeding population:	**Population estimate (2011-2016):**	34,197
	min – max population estimate:	20,968 – 48,740
	10-year trend (2006-2016):	-15.4
	18-year trend (1998-2016):	-26.0
Breeding distribution change (%):	**10-year trend (2006-2016):**	-5.0
	25-year trend (1991-2016):	-5.8
	44-year trend (1972-2016):	-25.0

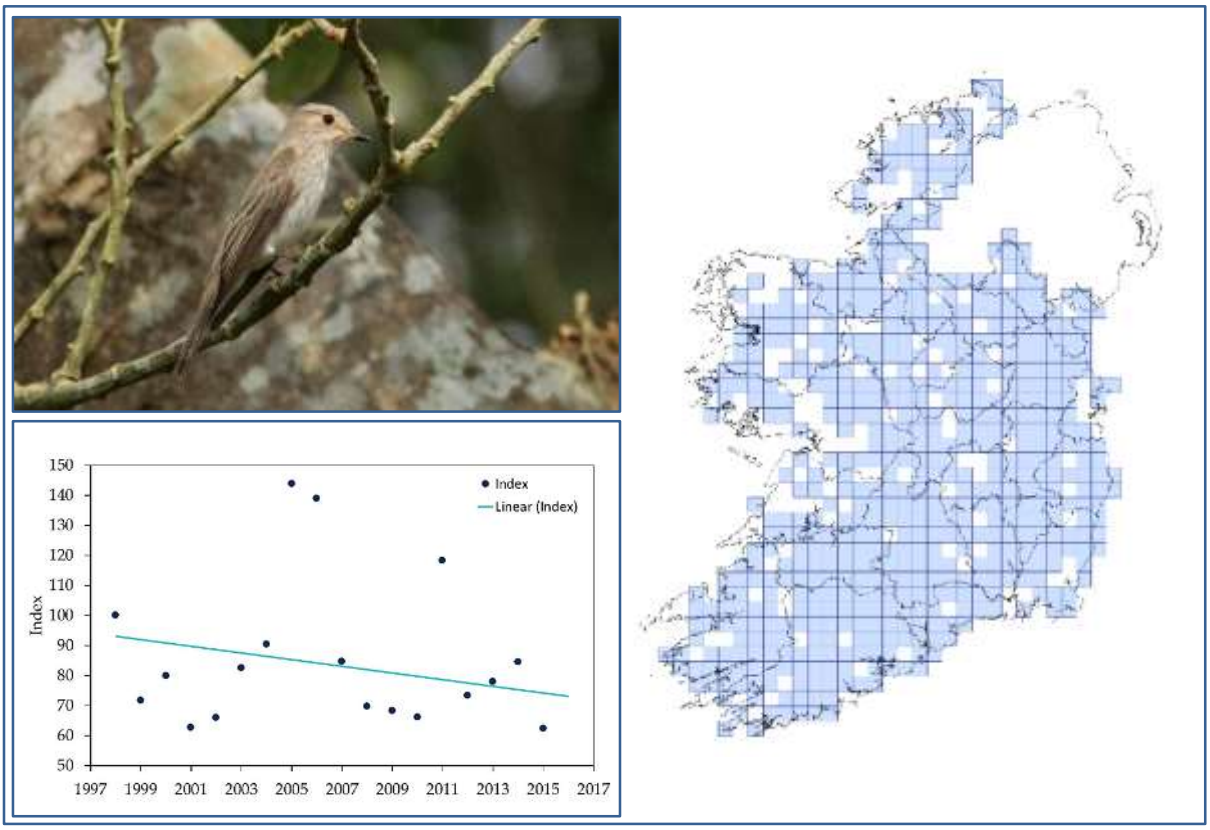

Figure 37 Distribution map and graphed population 18-year trend for Spotted Flycatcher. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Spotted Flycatcher is one of the later-arriving summer visitors to Ireland, the bulk of numbers typically making landfall in late April / early May. It is found throughout the country, with a few gaps in the more treeless regions and especially in parts of the west and north-west. In Britain, it is similarly widespread, but absent from large urban areas and most Scottish islands. The European range of Spotted Flycatcher extends throughout all countries on the continent. It is associated with woodland habitats (mainly deciduous), but also farmland, parks and gardens with large trees. It often nests close

to human habitation, utilising the cover provided by creepers and climbers growing against the walls of farmhouses and sheds.

The population estimate for the period 2011-2016 is 34,197 individuals. The 10-year CBS trend (2006-2016) shows a decline of over 15%, while a decline of 26% is evident over 18-years (1998-2016). On average, Spotted Flycatcher is recorded in 27 CBS squares per year but as this falls below the 30-square threshold normally applied to produce population trends in CBS, the above trends should be treated as approximate. The UK BBS population trend showed a decline of 6% over 10-years (2006-2016) and a decline of 39% over 23-years (1995-2016) (Harris *et al.*, 2018). The European trend has shown a moderate decline since 1980 (PECBMS, 2019).

In the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), Spotted Flycatcher was recorded in 70% of 10 km squares across Ireland. However, there have been considerable losses in distribution across the country amounting to 25% over 44-years (1972-2016), the heaviest losses being in western and north-western counties. Britain experienced a 10% loss in distribution in the same period. The recent Bird Atlas (2007-2011) also revealed a mix of declines and increases in relative abundance across Ireland since 1988-91, the strongest declines being centred in the east midlands.

There has been a long-term population decline of Spotted Flycatcher in both Britain and Ireland. British studies suggest that productivity per nesting attempt has declined, mainly due to avian predators (Stoate & Szczur, 2006) with Eurasian Jay identified as one of the main predators (Stevens *et al.*, 2008). Grey squirrel *Sciurus carolinensis* may also be having an effect on woodland bird populations (Newson *et al.*, 2010) including Spotted Flycatcher. It is not known if these predators are affecting the Spotted Flycatcher population in Ireland. A number of other migrant species, which winter in the same humid zone of West Africa as Spotted Flycatcher, have been undergoing similar severe declines and it is thought there may be a common factor at play, impacting on these wintering populations (Ockendon *et al.*, 2012).

3.37 Robin *Erithacus rubecula* Spideog

Resident

Breeding population:	**Population estimate (2011-2016):**	4,517,711
	min – max population estimate:	3,903,840 – 5,198,776
	10-year trend (2006-2016):	-8.6
	18-year trend (1998-2016):	-15.0
Breeding distribution change (%):	**10-year trend (2006-2016):**	+1.0
	25-year trend (1991-2016):	+3.1
	44-year trend (1972-2016):	+1.6

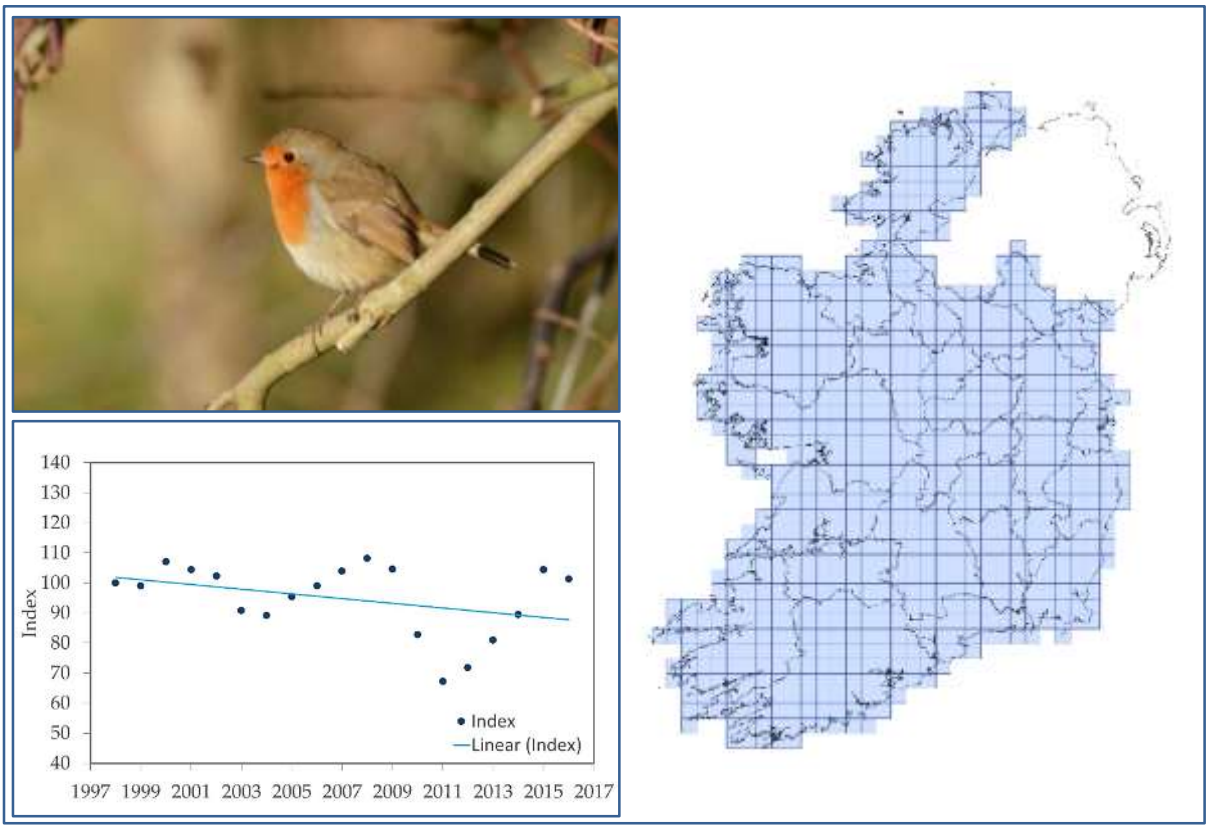

Figure 38 Distribution map and graphed population 18-year trend for Robin. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

Despite being a resident breeding species, most populations of Robin (European Robin on the EU Bird List) are partially migratory during autumn and winter, with females more likely to migrate than males, and immatures more likely to migrate than adults (Wernham *et al.*, 2002).

The Robin breeds in a wide variety of habitats from woodland and scrub to parks and gardens. It readily takes up nest boxes and is Ireland's top-ranking winter garden bird; occurring in 99.5% of gardens during the 2016/17 Garden Bird Survey (Burke, 2017).

Over the 18 years of CBS, Robin has declined by 19% in abundance. A decline is also evident over the shorter 10-year trend period. As with Wren, the trend graph clearly shows a drop in numbers following the winters of 2009/10 and 2010/11, likely attributed to the extreme cold weather events during those winters. In the UK, increases have been evident over the 10- and 21-year periods (Harris *et al.*, 2018), and the Robin has increased in numbers markedly since the mid-1980s, according to both Common Bird Census and BBS data and Constant Effort Sites (CES) ringing data (Walker *et al.*, 2015). The UK data also show that marked and significant annual fluctuations occur in numbers, perhaps in response to winter weather (Woodward *et al.*, 2018). Across Europe, Robin has exhibited a moderate increase in numbers over the long-term (1980-2016) and is stable across the recent ten-year period (PECBMS, 2019).

The Robin is the most widespread species after Wren based on CBS, occurring on average in 284 1 km squares each year. The Bird Atlas (2007-2011) (Balmer *et al.*, 2013) recorded Robin in 97% of squares. The trends in breeding distribution for Robin across all time periods are stable.

3.38 Stonechat *Saxicola torquatus* Caislín cloch

Resident

Breeding population:	**Population estimate (2011-2016):**	93,088
	min – max population estimate:	61,168 – 136,685
	10-year trend (2006-2016):	-24.0
	18-year trend (1998-2016):	-39.0
Breeding distribution change (%):	**10-year trend (2006-2016):**	-10.0
	25-year trend (1991-2016):	+17.5
	44-year trend (1972-2016):	-16.5

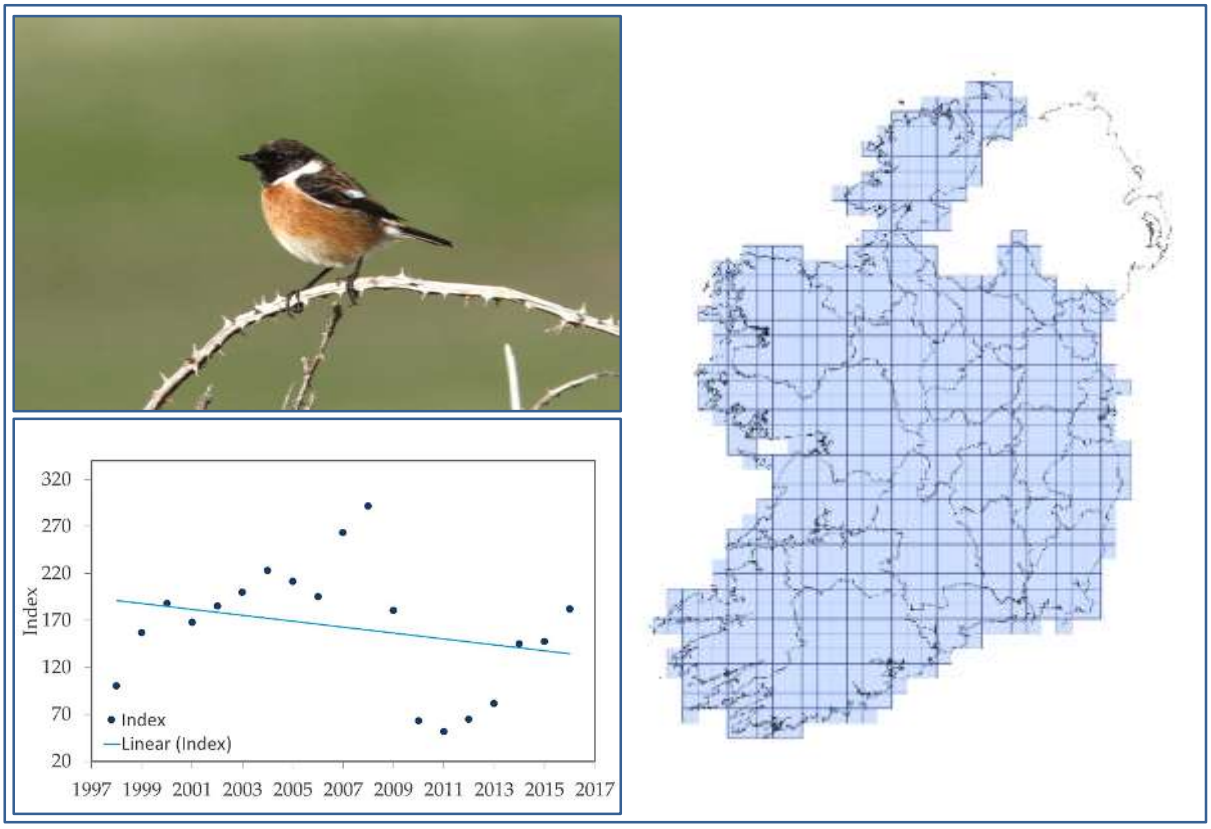

Figure 39 Distribution map and graphed population 18-year trend for Stonechat. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Stonechat (Common Stonechat on the EU Bird List) is found throughout most of Ireland, although there are large gaps in some regions away from the coast, especially in the eastern half of the country. In the UK, it is widely distributed in Scotland, Wales and northern England. The Stonechat is resident in Ireland and is associated with open countryside habitats often with scattered low vegetation and short to medium height perches (Urquhart & Bowley, 2002). Its preferred habitats includes low growing scrub where Gorse (*Ulex europaeus*) predominates (Cummins & O'Halloran, 2003), farmland with suitable hedgerows, coastal habitats including dune systems and peatland habitats with a mix of

heather-stands of young and older ages. The Stonechat will also utilise young conifer plantations, at least until the trees are approximately ten years old.

The 18-year CBS trend shows a decline in numbers of 39%. The recent population estimate of 93,088 individuals (2011-2016) represents a decrease of almost 16,700 individuals since 2010 (Crowe *et al.*, 2014). In the UK, the BBS trend from 1995-2016 was +92%, but the 10-year trend from 2006-2016 was -35% (Harris *et al.*, 2018). The European population has been stable since 1980 (PECBMS, 2019).

The average number of CBS 1 km squares in which Stonechat is recorded per year is 64. In the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), Stonechat was recorded in 74% of Irish 10 km squares during the breeding season. However, its distribution as mapped is known to have decreased during the atlas survey due to the exceptionally cold winter of 2009/10 (Balmer *et al.*, 2013), the coldest in almost 50 years in Ireland followed by a further extreme cold spell at the end of 2010 with the lowest ever recorded December air temperature of -17.5^{0}C in Ireland (Met Eireann Report, 2017). With a diet of invertebrate prey (Cummins & O'Halloran, 2002) (and largely ground invertebrates in winter), prolonged cold-weather events are considered to have negative impact on its survival (e.g. Madden & Lovatt, 2016).

The breeding distribution trends show variability over the time scales. During CBS (2006-2016), the breeding distribution declined by 10% and comments from CBS fieldworkers suggest that the squares where the Stonechat had disappeared after the cold winters were mainly at inland locations – populations in coastal regions being largely unaffected. The 25-year trend, comparing distribution in the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013) with the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993) shows an increase of 17.5%, while the 44-year trend is showing a decline (-16.5%).

The Stonechat is extremely susceptible to cold weather (Lack, 1986; Urquhart & Bowley, 2002). Very heavy losses of Stonechats were recorded in Ireland in the cold winter of 1916-17 and again in early 1945, after which, reportedly, hardly any survived in some areas. However, by the early 1950s, numbers had recovered to former levels (Kennedy *et al.*, 1954). For the first ten years of CBS (from 1998 to 2008), Stonechats steadily increased. The species is multi-brooded in Ireland (Cummins & O'Halloran, 2003) and can recover from population crashes caused by severe cold spells.

3.39 Wheatear	*Oenanthe oenanthe*	Clochrán

Summer migrant

Breeding population:	**Population estimate (2011-2016):**	43,635
	min – max population estimate:	18,605 – 75,471
	10-year trend (2006-2016):	+0.4
	18-year trend (1998-2016):	+0.7
Breeding distribution change (%):	**10-year trend (2006-2016):**	+1.0
	25-year trend (1991-2016):	-6.6
	44-year trend (1972-2016):	-28.0

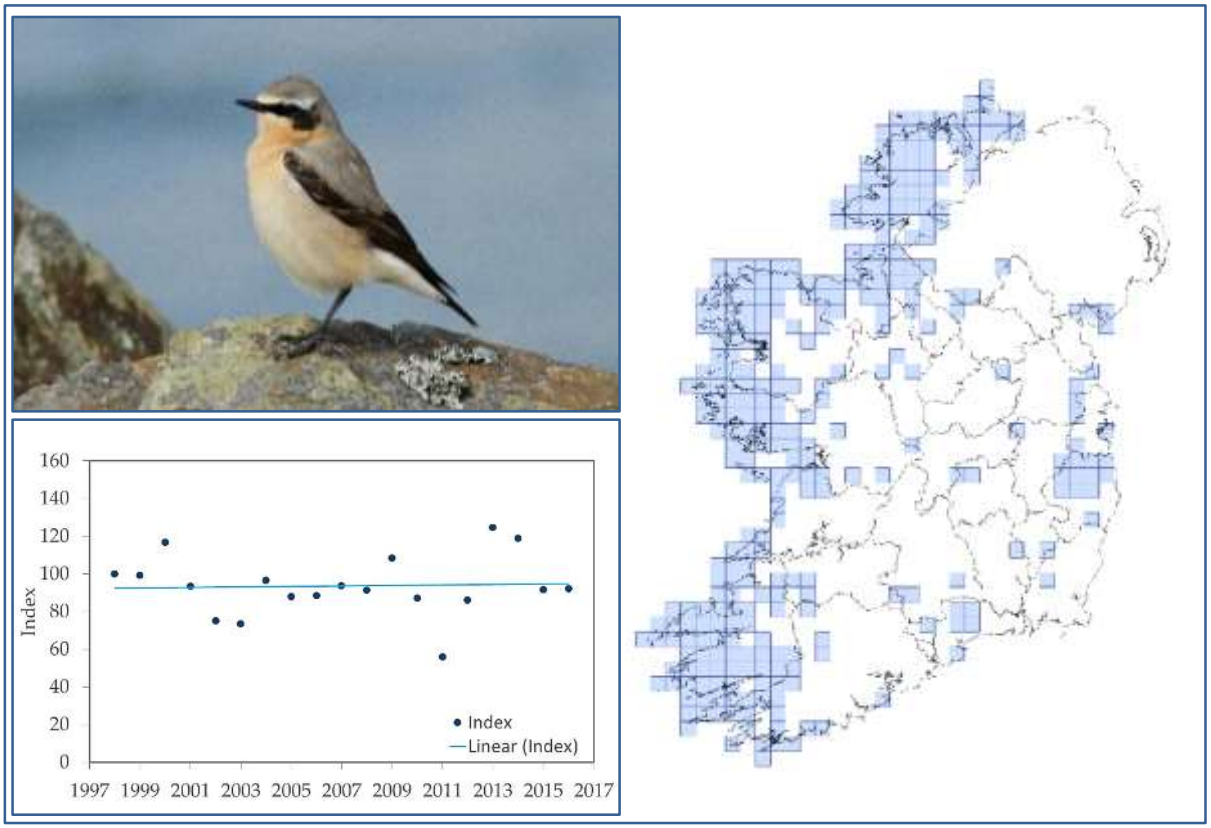

Figure 40 Distribution map and graphed population 18-year trend for Wheatear. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Wheatear (Northern Wheatear on the EU Bird List) is a summer visitor to Ireland. It is mainly confined to upland areas and coastal regions of the west and north and is absent from most lowland areas away from the coast. In Britain, it is found throughout Scotland and Wales and absent from most of England except for upland regions in the north of the country. Its range on the continent covers all European countries.

Wheatear has exhibited a stable trend since the start of CBS in 1998, and over the shorter 10-year time period 2006-2016. However, within the 18-year period, there have been considerable fluctuations in numbers in some years, particularly in 2010 and 2011, when severe declines were found, followed by a strong recovery in 2012 and 2013. The recent population estimate of 43,635 (2011-2016) shows an increase of just 100 birds since 2010 (Crowe *et al.*, 2014), reflecting the stable CBS trend. In the UK, Wheatear has shown negative population trends of -26% from 1995-2016 and -17% from 2006-2016 (Harris *et al.*, 2018). The European trend showed a moderate decline since 1980 (PECBMS, 2019).

On average, Wheatear is recorded in 31 CBS 1 km squares per year. In the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), it was recorded in 41% of 10 km squares on the island of Ireland during the breeding season. Between 2006 and 2016, the breeding distribution, based on CBS, has been stable. The 25-year trend, comparing distribution in the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013) with the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993) shows a small decline of 6.6% (stable), while the 44-year trend is a greater decline (-28.8%) in distribution.

Balmer *et al.* (2013) showed relative abundance increases and declines in more or less equal measure in Ireland since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993) – the increases being mainly in the coastal regions of the south-west and the north-west and declines in the west (Galway and Mayo). The highest densities were found in the coastal parts of Donegal, Mayo, Galway and Kerry.

While the Wheatear population has been relatively stable for the last 20 years, its breeding distribution contraction over 25- and 44- years suggests a decline in overall population in that period. The reason for this downward trend is unclear. Wheatear is an insectivorous, ground-foraging species mainly found in habitats consisting of bare ground or short field layers (Cramp, 1988). Encroachment by tall grass is therefore likely to diminish habitat suitability for the Wheatear, with management of grasslands through mowing and grazing influencing the abundance and accessibility of invertebrates with Wheatear preferring shorter swards (van Oosten *et al.*, 2014). Declines in Wheatear populations are thought to be linked to the loss of short vegetation and bare ground in semi-natural and low-intensity habitats, with agricultural intensification (Artl *et al.*, 2008) and associated changes in food availability affecting overall breeding productivity (Seward *et al.*, 2014).

3.40 Dunnock *Prunella modularis* Dunnóg

Resident

Breeding population:	**Population estimate (2011-2016):**	1,630,331
	min – max population estimate:	1,294,124 – 1,966,732
	10-year trend (2006-2016):	+13.7
	18-year trend (1998-2016):	+26.0
Breeding distribution change (%):	**10-year trend (2006-2016):**	+7.0
	25-year trend (1991-2016):	+10.7
	44-year trend (1972-2016):	+7.5

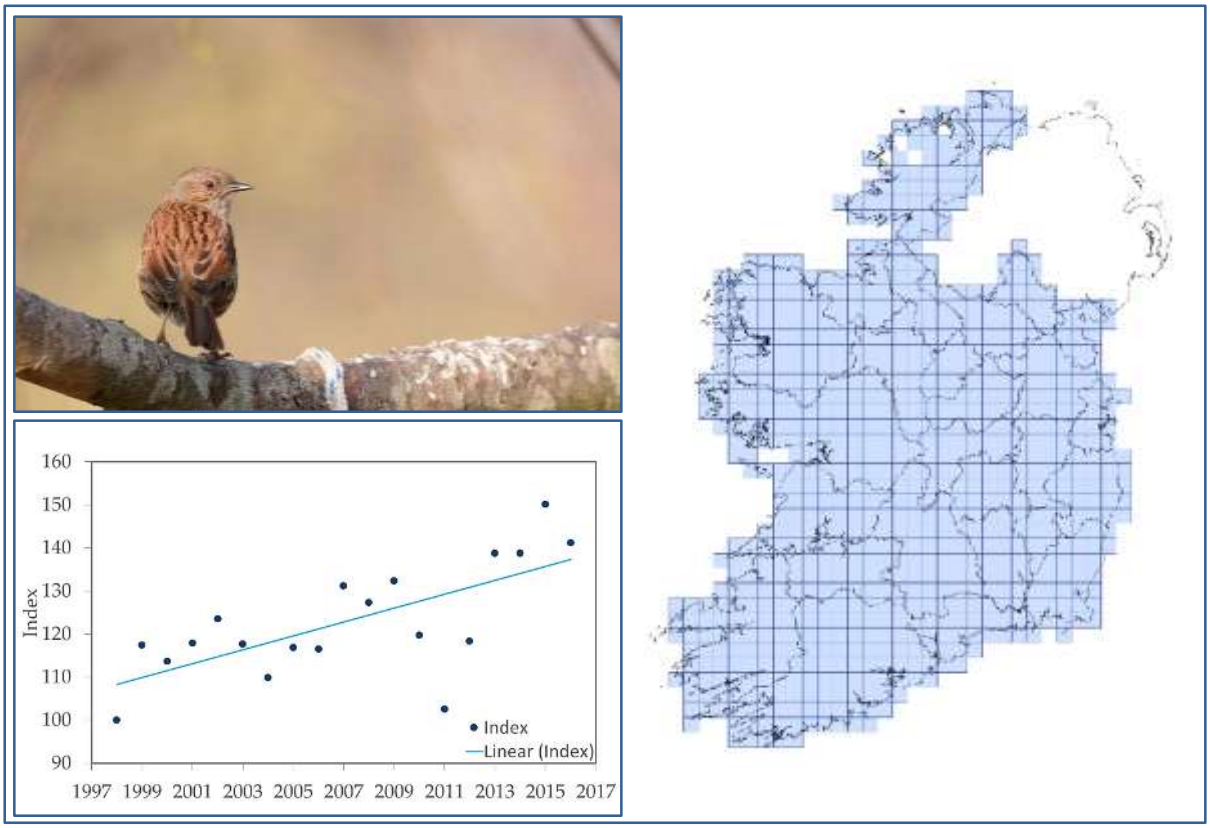

Figure 41 Distribution map and graphed population 18-year trend for Dunnock. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Dunnock is a bird of semi-sheltered habitats including woodlands, hedgerows and gardens. It breeds across Europe and is the most widespread member of the Accentor family, the rest of which are mountainous species. Dunnock was recorded breeding in 96% of 10 km squares on the island of Ireland in the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), absent only from the most remote offshore islands and treeless stretches of upland Donegal.

Numbers of Dunnock have increased by 26% since CBS began and the current population estimate is >1,630,000 individuals. The successive cold winters of 2009/10 and 2010/11 (Met Eireann, 2017) had a

notable impact, but by 2013 Dunnock had recouped its losses. In the UK, the population has increased by 23% since 1995, with stable trends in the shorter-term (Harris *et al.*, 2018). At European level, Dunnock has undergone a moderate decline in the long-term (since 1980) but has remained stable in the last 10 years (2007-16; PECBMS, 2019).

Dunnock is recorded in 229 CBS 1 km squares on average each year. Its breeding distribution during CBS (2006-2016) has increased by 7% (stable). The atlas distribution trends over 25-and 44-year periods are also positive. The relative abundance of Dunnock has increased over most of the country since the Bird Atlas (1988-1991) (Gibbons *et al.*, 1993). Breeding relative abundance in the eastern half of Ireland is higher than in the west and northwest, and similarly Dunnock is more abundant over most of Ireland than in Britain (in particular Scotland and Northern England). Its distribution in Britain has remained stable through successive breeding bird atlases (Balmer *et al.* 2013), with some notable increases in relative abundance in areas of lower density.

The Dunnock is undoubtedly doing well in Ireland in recent decades, well-suited to the hedgerow network across the Irish landscape, and quite at home in woodland edge and suburban parks and gardens too. In Britain, shrub density has been found to be an important factor to explain Dunnock breeding density (Fuller & Henderson, 1992) and declines in woodland habitats have been linked to loss of understorey vegetation due to browsing pressure from deer (Holt *et al.*, 2011).

3.41 House Sparrow *Passer domesticus* Gealbhan binne

Resident

Breeding population:	**Population estimate (2011-2016):**	2,266,646
	min – max population estimate:	1,590,360 – 3,055,829
	10-year trend (2006-2016):	+39.6
	18-year trend (1998-2016):	+82.2
Breeding distribution change (%):	**10-year trend (2006-2016):**	+28.0
	25-year trend (1991-2016):	+38.6
	44-year trend (1972-2016):	+28.2

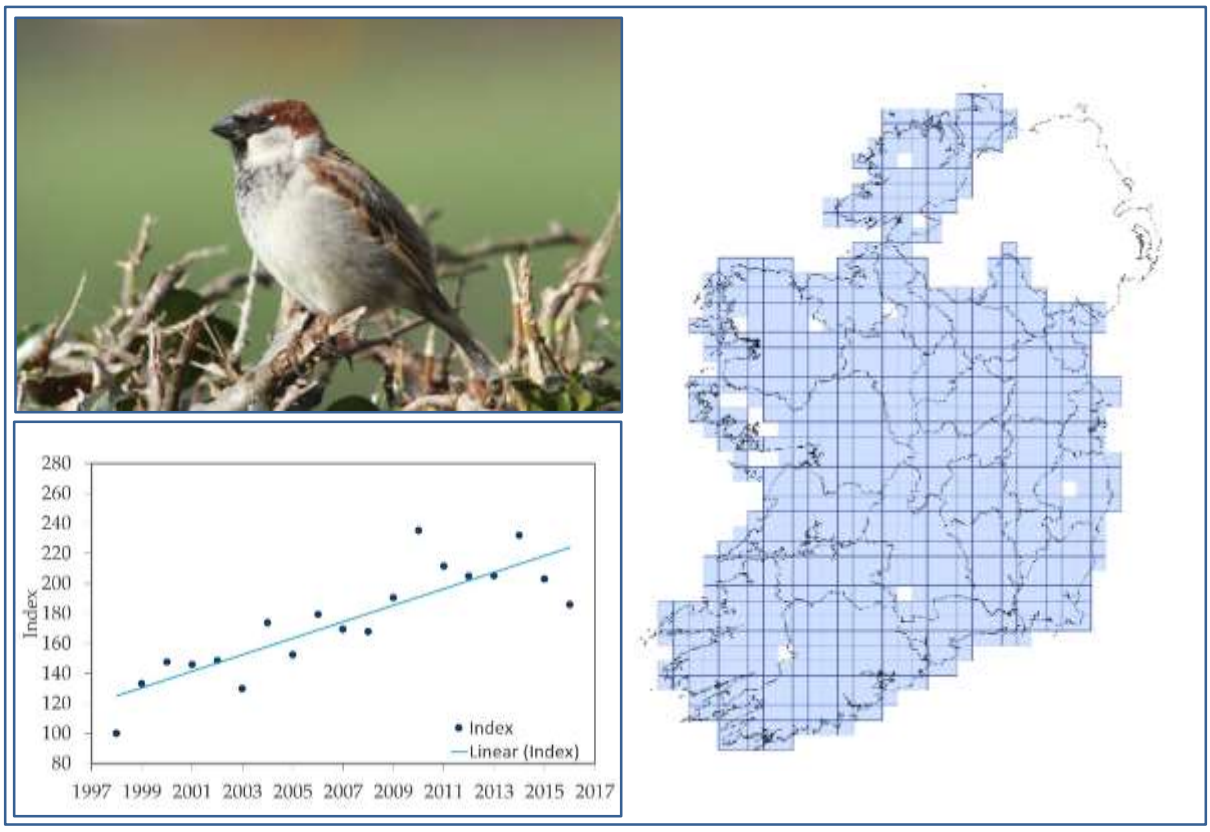

Figure 42 Distribution map and graphed population 18-year trend for House Sparrow. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The House Sparrow is one of the most widely distributed birds in the world, being native to most of Europe, Asia and North Africa, and having been introduced to North and South America, southern parts of Africa and Australasia. It is abundant across Ireland, breeding in 95% of 10 km squares (Balmer *et al.*, 2013). The House Sparrow is granivorous, benefitting from winter stubbles, and has been shown to be positively associated with the availability of farmyards (e.g. De Laet & Summers-Smith, 2007). Highest densities are on the eastern half of the island which has a greater percentage of arable farming including (spring and winter-sown) wheat, barley and oats (CSO, 2012).

The 18-year CBS trend shows a major increase in numbers of 82.2% between 1998 and 2016. The BBS trend in the UK has been stable but edging towards decline, with a 6% decrease over 23 years (not statistically significant), a 1% increase over 10 years, but a statistically significant drop of 3% in the five years to 2016 (Harris *et al.*, 2018). House Sparrow has undergone a moderate decline at European level over the long-term (since 1980) as well as in the shorter-term (2007-16; PECBMS, 2019).

House Sparrow is recorded in 150 CBS 1 km squares on average per year. The 10-year trend in breeding distribution is for 11% increase, while the 25- and 44-year trends are also positive. By comparison, its breeding abundance increased in Wales and parts of Scotland during the Bird Atlas (2007-2011) but decreased over almost all of England and elsewhere in Scotland (Balmer *et al.*, 2013).

The reasons for the significant increases in House Sparrow in Ireland over the last 20 years including the population dynamics of urban and rural House Sparrow populations have not received any research focus. Based on causes of decline elsewhere, reasons for the increases in House Sparrow observed here are likely to include high productivity (Morrison *et al.*, 2014) and overwinter survival rates (Hole *et al.*, 2002; Siriwardena *et al.*, 2008), both of which are probably driven by a good food supply (Peach *et al.*, 2008; Cleasby *et al.*, 2010; Seress *et al.*, 2012).

3.42 Grey Wagtail *Motacilla cinerea* Glasóg liath

Resident

Breeding population:	**Population estimate (2011-2016):**	50,768
	min – max population estimate:	36,949 – 66,035
	10-year trend (2006-2016):	-46.5
	18-year trend (1998-2016):	-67.6
Breeding distribution change (%):	**10-year trend (2006-2016):**	-39.0
	25-year trend (1991-2016):	-42.2
	44-year trend (1972-2016):	-48.0

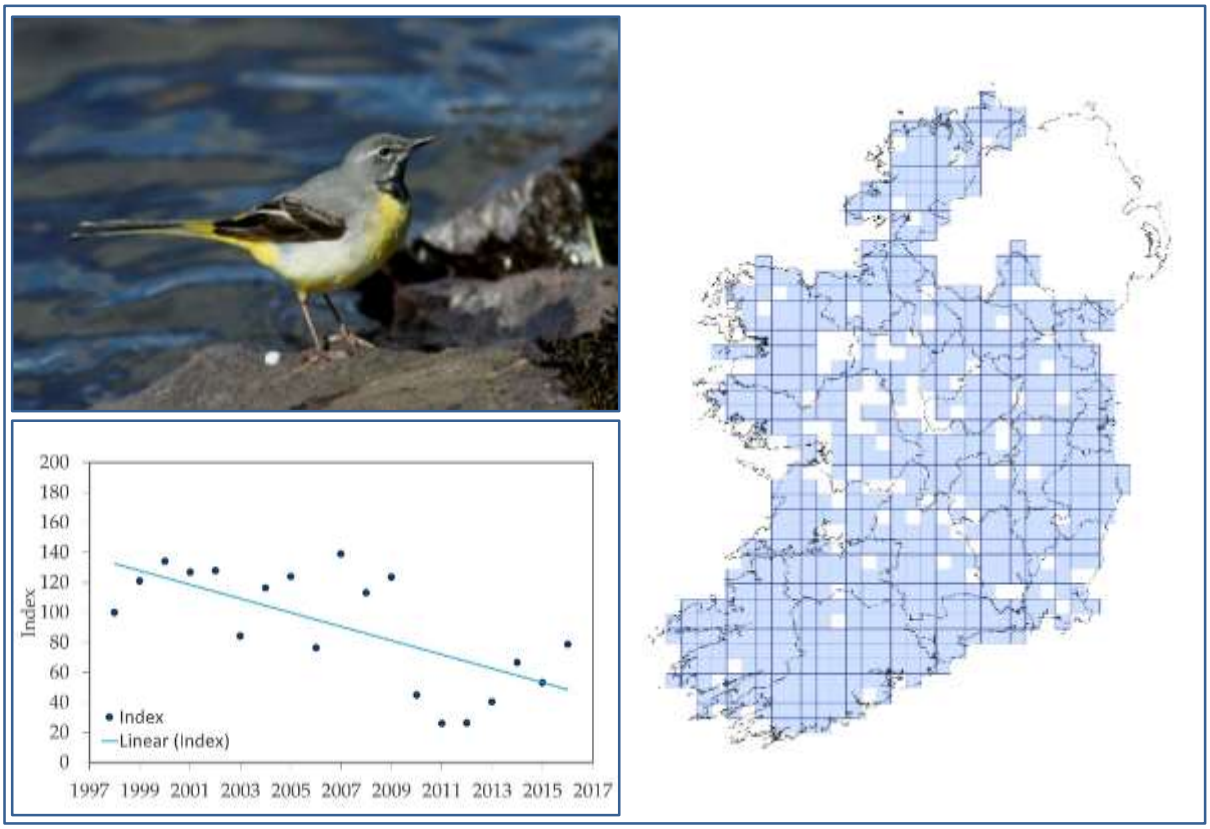

Figure 43 Distribution map and graphed population 18-year trend for Grey Wagtail. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Grey Wagtail is found along fast-flowing, rocky streams and rivers in both upland and lowland habitats in and around waterbodies with a strong selection for riparian shingle (Ormerod & Tyler, 1991). Feeding on ground and aerial invertebrates, the population is prone to significant losses when prolonged periods of sub-zero temperatures limit availability of terrestrial and aquatic insects.

On average Grey Wagtail is recorded in 37 CBS 1 km squares each year, ranging from 55 in 2000 to only 7 in 2011. Grey Wagtail was present in 76% of Irish 10 km squares during the breeding season in the Bird Atlas (2007-2011) (Balmer *et al.*, 2013), down 42.2% and 48% over 25- and 44-year periods

respectively. The losses reported by Balmer *et al.* (2013), and the large gaps in range across much of Connacht and parts of Leinster, were attributed to significant losses of birds following the severe cold weather spells of the winters of 2009/10 and 2010/11 (Met Eireann, 2017). Similarly, the breeding relative abundance of Grey Wagtail fell during the Bird Atlas (2007-2011) across most of the country. Breeding relative abundance in Ireland remains higher across the island of Ireland compared with much of Britain, however, with the south-east, north-west and parts of the east coast around Wicklow supporting particularly high densities of Grey Wagtail.

The CBS Grey Wagtail population index value fell from 123.4 to 25.9 after the aforementioned cold winters and has still not recovered to the levels of the summer of 2009 or before (78.6 in 2016). For the period 1998-2016, Grey Wagtail has undergone a decrease of 67.6% in its population size. Before its population crashed, it showed a significant amount of year-to-year variation, which was likely a result of varying detectability. Some caution is advised when interpreting current CBS trends for this species, with a more targeted survey of suitable waterbodies likely to yield a more accurate population estimate.

In the UK, the BBS trends for Grey Wagtail are stable over 23-years (1% increase) but a 25% loss over 10-years (2006-2016), with signs of significant recovery in the short term (28% in five years; Harris *et al.*, 2014). Smiddy & O'Halloran (1998) found that the Grey Wagtail in Ireland starts to breed earlier, lays smaller clutches and produces fewer young than other European populations. This research partly explains the slow recovery of the Irish population following the successive cold winters of 2009/10 and 2010/11 which negatively impacted adult survival and likely subsequent breeding productivity. At European level, recent analysis of trends has found its population to be stable (PECBMS, 2019).

3.43 Pied Wagtail *Motacilla alba* Glasóg shráide

Resident

Breeding population:	**Population estimate (2011-2016):**	501,741
	min – max population estimate:	372,511 – 642,673
	10-year trend (2006-2016):	+23.1
	18-year trend (1998-2016):	+45.4
Breeding distribution change (%):	**10-year trend (2006-2016):**	+25.0
	25-year trend (1991-2016):	+27.4
	44-year trend (1972-2016):	+24.3

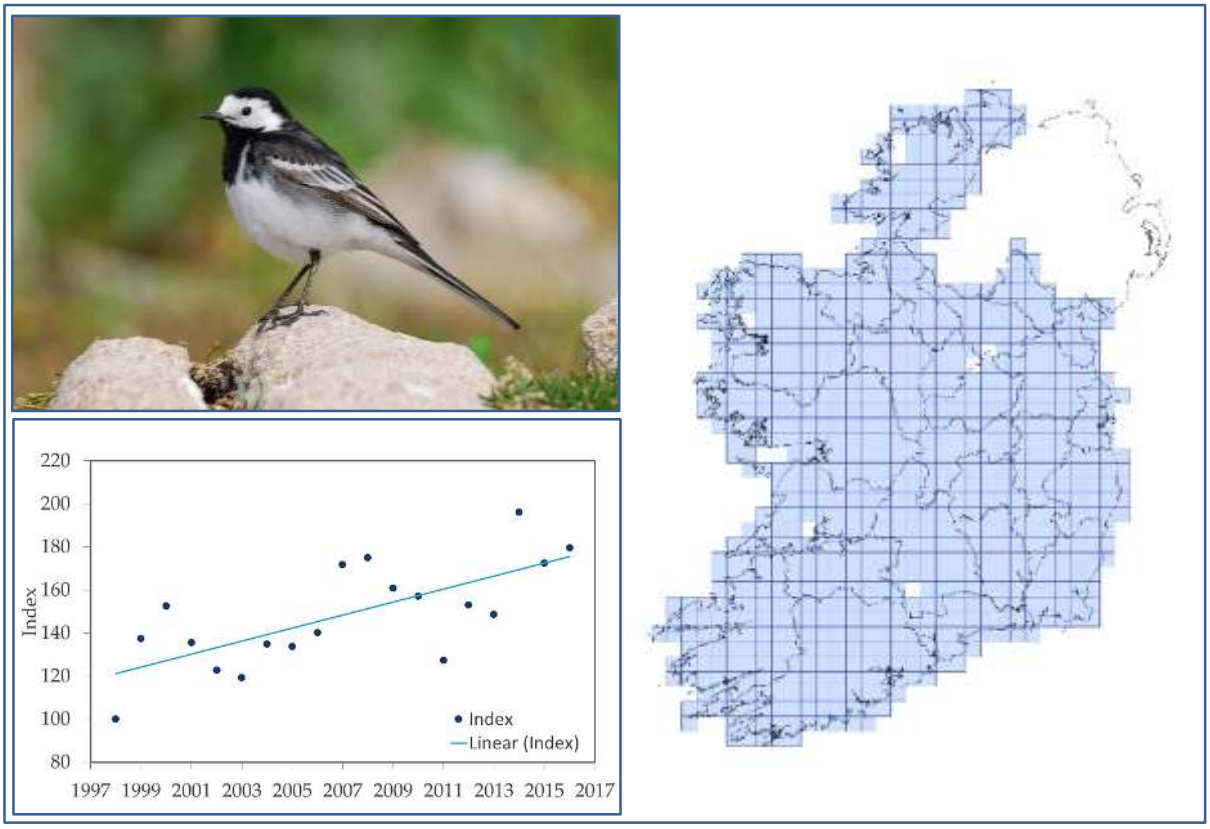

Figure 44 Distribution map and graphed population 18-year trend for Pied Wagtail. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The nominate subspecies of White Wagtail (*Motacilla alba alba*) is found across Europe, but the 'pied' subspecies (*M. a. yarrellii*) breeds in Ireland and Britain. It was one of the most widespread breeding species in Ireland in the recent Bird Atlas (2007-2011), recorded in 97% of 10 km squares (Balmer *et al.*, 2013). It occurs in most habitats, although in much lower densities in upland and heavily afforested areas. This variation in abundance across habitats and regions largely explains why Pied Wagtail is recorded in 'just' 166 CBS 1 km squares on average each year despite its national ubiquity. In addition,

Pied Wagtail is common in urban and suburban areas, as well as along roadsides and in other man-made habitats, all of which are under-sampled by CBS.

The Pied Wagtail population has increased by 45.4% between 1998 and 2016. In the UK, BBS indicates the population is much more stable, with minimal change over 23-years (1995-2016) and 10-years (2006-2016; Harris *et al.*, 2018). A 15% increase since 2011 in the UK is likely recovery of the population after the negative effects of consecutive cold winters on insectivorous birds. After a similar decline in Ireland, also due to consecutive cold winters (2009/2010 and 2010/2011), the population of Grey Wagtail had recovered to pre-crash levels by 2014.

Coupled to the population increases, the breeding distribution trends are also increasing, across 10-, 25-, and 44-year periods.

Despite limited research on Pied Wagtail in Ireland or Britain in recent decades, indications are that the species is thriving across a broad range of habitats, with occasional prolonged cold winter events affecting numbers but with any losses usually recovered within a couple of years.

3.44 Meadow Pipit *Anthus pratensis* Riabhóg mhóna

Resident

Breeding population:	**Population estimate (2011-2016):**	1,351,995
	min – max population estimate:	1,007,407 – 1,726,880
	10-year trend (2006-2016):	-12.4
	18-year trend (1998-2016):	-21.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	-5.0
	25-year trend (1991-2016):	-1.9
	44-year trend (1972-2016):	-8.1

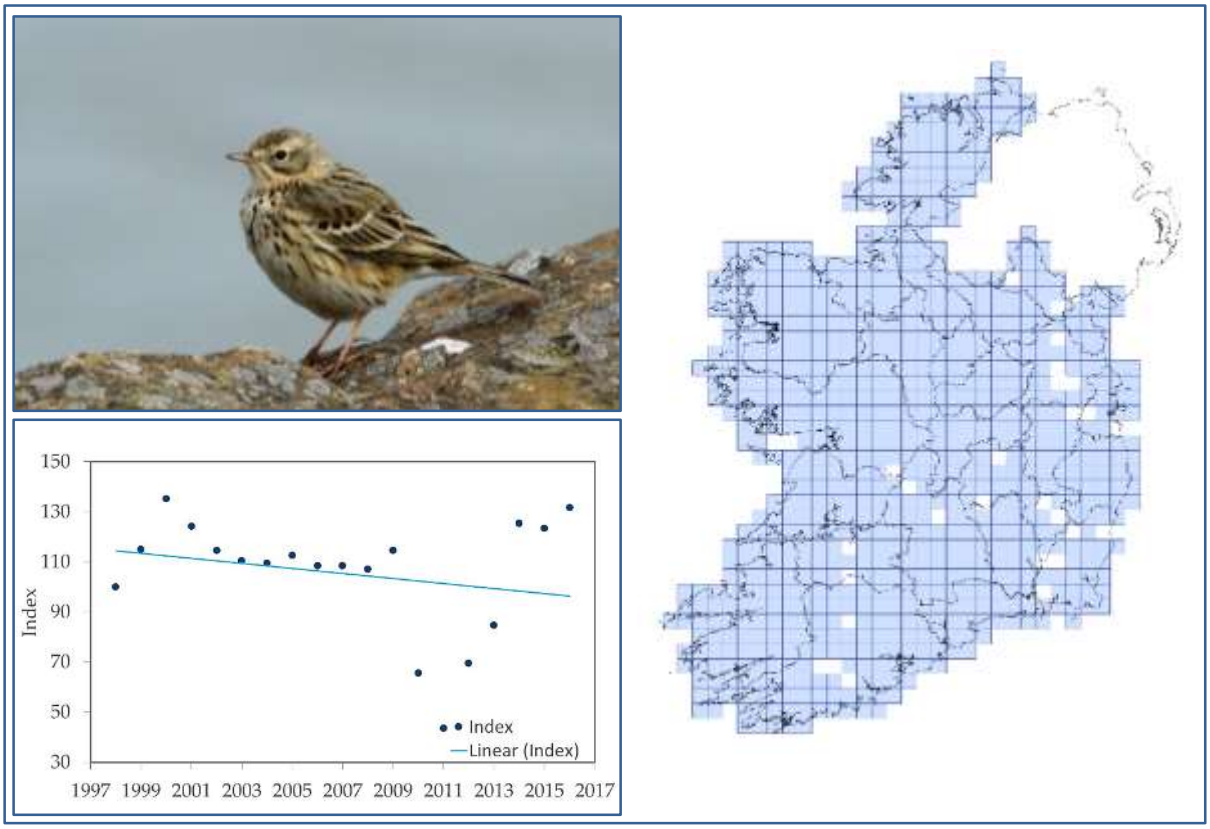

Figure 45 Distribution map and graphed population 18-year trend for Meadow Pipit. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Meadow Pipit is the most common pipit species in Europe (Cramp, 1985). Resident in Ireland, it is insectivorous and associated with open countryside such as rough grasslands and both lowland and upland bogs and grass moors. In the most recent Bird Atlas (2007-2011) it was recorded as breeding in 96% of 10 km squares on the island of Ireland (Balmer *et al.*, 2013). The breeding Meadow Pipit population in the Republic of Ireland was estimated at >1,350,000 individuals between 2011 and 2016.

CBS population trends indicate a 21.1% decline since 1998 for Meadow Pipit. The current breeding population represents a loss of around 110,000 individuals since the 2006-10 period (Crowe *et al.*, 2014). Much of this most recent decline can be attributed to the consecutive cold winters in 2009/10 and 2010/11 which caused a huge fall in numbers with more recent indications of some recovery. In the UK, the population has declined by 7% overall since 1995, but with more recent signs of recovery, up 7% since 2006 and 17% since 2011 respectively (Harris *et al.*, 2018). Comparisons between the CBS and BBS datasets, which compare different time periods, should be made with caution, however. Since 1980, Meadow Pipit has declined (moderate) across Europe, although in the more recent 10-year period examined (2007-16) the European population remained stable (PECBMS, 2019).

Over the 18 years to 2016, Meadow Pipit has been recorded in 177 CBS 1 km squares on average each year. The trend in the 10-year breeding distribution (2006-2016) is considered stable (-5%). The 25- and 44-year distribution trends are also considered broadly stable despite noted CBS population trends. The most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013) showed relative abundance during the breeding season had increased in some regions (notably Wicklow, Wexford and the north midlands), but decreased in Clare, much of Connacht and parts of the north-east, over the 20 years examined (Balmer *et al.*, 2013). In Britain, the relative abundance changes are very similar to those in Ireland, with a scattering of decreases but very few increases.

Studies in Britain have found that livestock grazing influences the abundance of breeding Meadow Pipit, with low-intensity mixed-species grazing (i.e. sheep and cattle) producing the necessary heterogeneity in vegetation to maximise invertebrate prey availability and therefore positively influence Meadow Pipit numbers (Evans *et al.*, 2006; Vandenberghe *et al.*, 2009). It is not clear to what extent changes in habitat availability/quality, as well as occasional high winter mortality, are responsible for the regional changes and trends in abundance of Meadow Pipit observed across Ireland in the Bird Atlas (2007-2011) (Balmer *et al.* 2013) or the CBS trend over the last two decades. In Ireland it appears that local losses may have been buffered by gains in other areas, and certainly the biggest driver for population change during the period assessed has been severe prolonged cold weather impacts although the most recent 10-year trend (2006-2016) would suggest that the population is in recovery, albeit still at a lower level than when CBS began.

3.45 Chaffinch *Fringilla coelebs* Rí rua

Resident

Breeding population:	**Population estimate (2011-2016):**	3,690,474
	min – max population estimate:	3,096,430 – 4,332,284
	10-year trend (2006-2016):	+20.6
	18-year trend (1998-2016):	+40.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+3.0
	25-year trend (1991-2016):	+4.3
	44-year trend (1972-2016):	+3.0

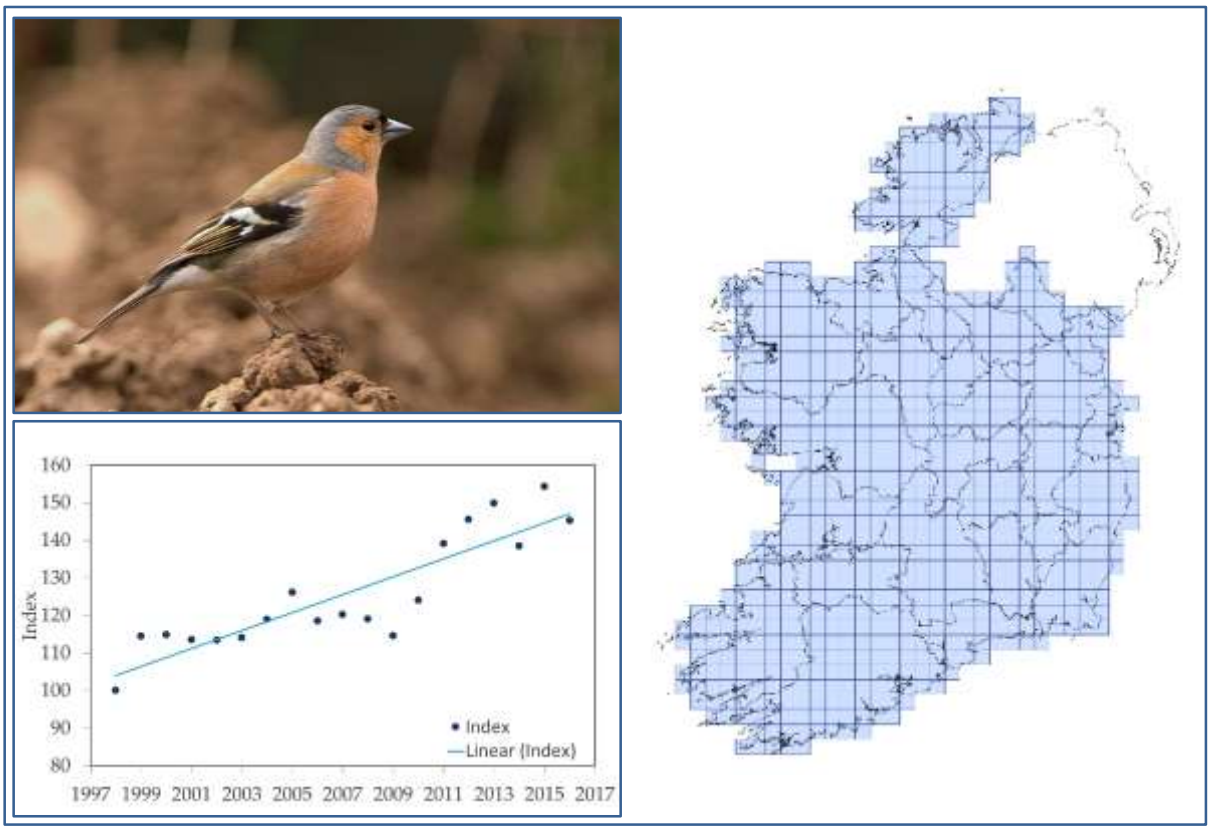

Figure 46 Distribution map and graphed population 18-year trend for Chaffinch. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Clive Timmons).

The Chaffinch (Common Chaffinch on the EU Bird List) is one of Ireland's commonest breeding bird species (Crowe *et al.*, 2017) and is resident in Ireland, with a largely sedentary breeding population joined by birds from countries to the north-east, largely Scandinavia, Finland and north-west Russia, during winter (Wernham *et al.*, 2002). Chaffinch occupies a variety of habitats, including woodland, scrub, farmland, parks and gardens (Cramp & Perrins, 1994), but is generally found in or near woodland (Hagemeijer & Blair, 1997) with lower densities in urban areas and open farmland (Balmer *et al.*, 2013). A widespread distribution means that Chaffinch was recorded in 94% of Irish 10 km squares during the

breeding season for the most recent Bird Atlas (2007-2011) (Balmer *et al.*, 2013), and its distribution has increased in western counties where it is now only absent only from a few coastal squares.

Chaffinch has increased by 40.1% over the lifetime of CBS, with a recent breeding population estimate of 3,690,474 individuals making it Ireland's fifth most numerous breeding species. The species is considered stable across Europe (PECBMS, 2019) but in contrast is exhibiting declines across both the short- and long-term in the UK (Harris *et al.*, 2018), at least partially attributed to an outbreak of finch trichomonosis, caused by the protozoal parasite *Trichomonas gallinae* (Lawson *et al.*, 2012).

On average, the Chaffinch was recorded in 278 CBS 1 km squares each year, below Wren, Robin and Blackbird in ranking. Its distribution trend in CBS (2006-2016) is considered stable (at +3%). Changes in its short-term and long-term breeding distribution based on bird atlas data show similar stable trends.

3.46 Greenfinch *Chloris chloris* Glasán darach

Resident

Breeding population:	**Population estimate (2011-2016):**	536,730
	min – max population estimate:	402,596 – 680,185
	10-year trend (2006-2016):	-34.8
	18-year trend (1998-2016):	-53.7
Breeding distribution change (%):	**10-year trend (2006-2016):**	-10.0
	25-year trend (1991-2016):	+3.6
	44-year trend (1972-2016):	-9.4

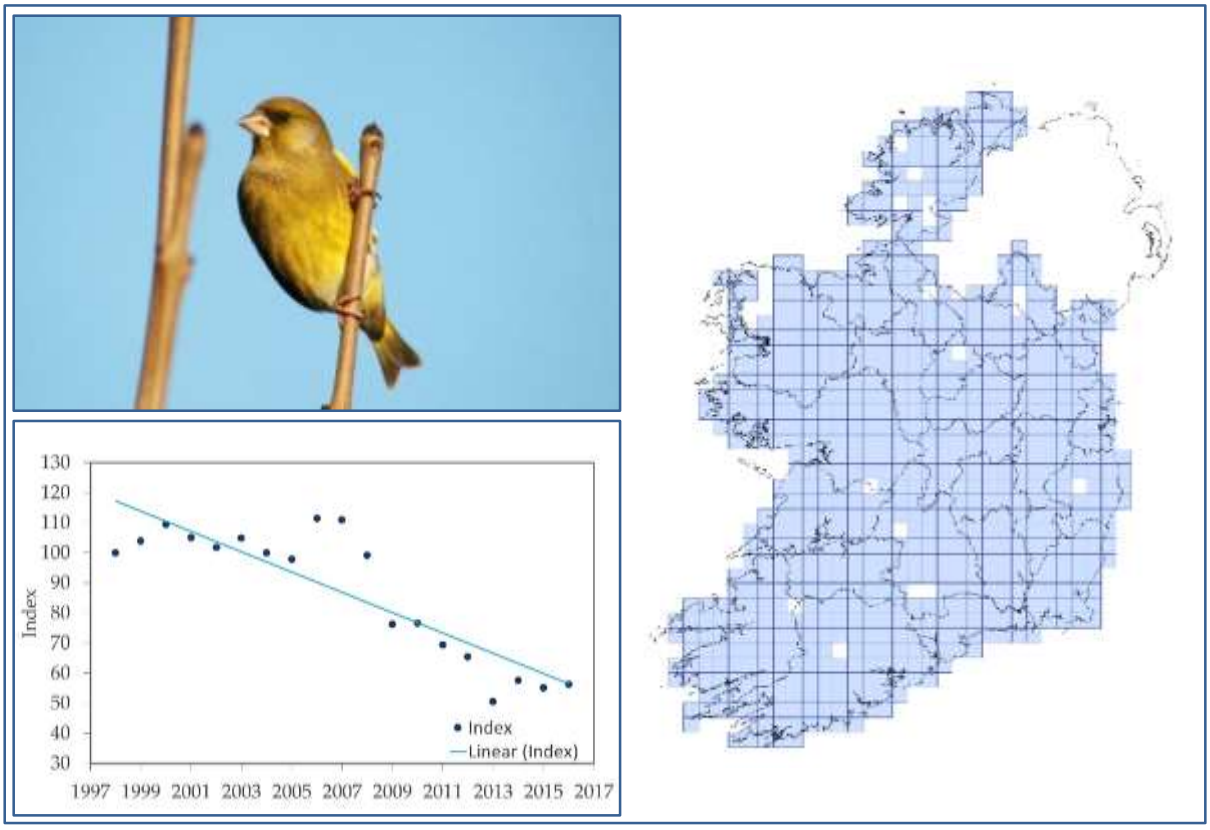

Figure 47 Distribution map and graphed population 18-year trend for Greenfinch. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Brian Burke).

The Greenfinch (European Greenfinch on the EU Bird List) is considered resident, although seasonal movements are known, with populations bolstered during winter by birds from continental Europe (Wernham *et al.*, 2002). The species nests semi-colonially within mature woodland and shrubs and is a familiar bird of parks and gardens (Balmer *et al.*, 2013).

The Greenfinch has undergone an almost sustained decline throughout CBS with a population decline of just over 50% during the period 1998-2016. In Ireland these declines have been largely attributed to

outbreaks of finch trichomonosis, caused by the protozoal parasite *Trichomonas gallinae (*Lawson *et al.*, 2012). Incidences of the disease increased from 2007 and although other finch species are susceptible, the Greenfinch has been most affected with noticeable losses in some areas for several years (CBS Office, pers. obs.). There is also an increased risk predation for Greenfinches feeding in gardens, with cat-related mortality one of the leading causes of death reported by observers (Pavisse *et al.*, 2019).

In the UK, Greenfinch abundance fluctuated up to the mid-1990s, then underwent a period of increase before sharply falling due to the widespread and severe outbreak of trichomonosis that began in 2005 (Robinson *et al.*, 2010b). The European trend, however, has been broadly stable since 1980 (PECBMS, 2019).

On average the Greenfinch was recorded in 165 CBS 1 km squares each year and its distribution trend in CBS (10-year) has declined by 10% while the 44-year trend is close to 10% decline (considered stable). The 25-year trend is also considered stable (shows small gains).

Trichomonosis has resulted in levels of mortality and declines unprecedented in British and Irish wild bird populations (Robinson *et al.*, 2010b). For example, results of the Garden Bird Survey of 2016/17 found that finches, in particular Greenfinch, was at its lowest level since the winter of 2004/05 (Burke, 2017). While recent GBS data suggests improving numbers, with increasing numbers visiting Irish gardens during the winter of 2018/19 (Garden Bird Survey, unpublished data), there is uncertainty regarding whether and/or when there will be another outbreak of the disease and what the consequences will be for the Greenfinch population.

3.47 Goldfinch *Carduelis carduelis* Lasair choille

Resident

Breeding population:	**Population estimate (2011-2016):**	1,107,425
	min – max population estimate:	808,467 – 1,449,700
	10-year trend (2006-2016):	+89.0
	18-year trend (1998-2016):	+214.4
Breeding distribution change (%):	**10-year trend (2006-2016):**	+27.0
	25-year trend (1991-2016):	+61.7
	44-year trend (1972-2016):	+31.9

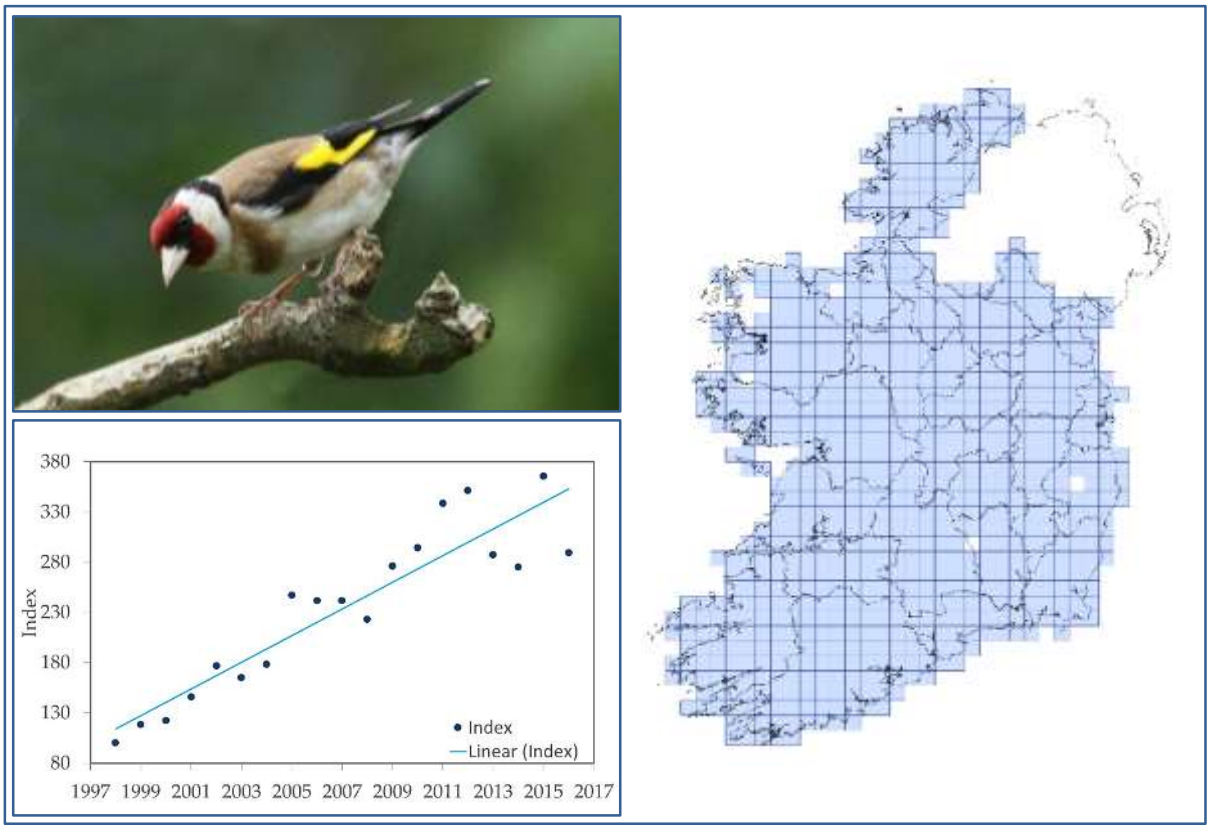

Figure 48 Distribution map and graphed population 18-year trend for Goldfinch. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Goldfinch (European Goldfinch on the EU Bird List) is a partial migrant across its native range (Wernham *et al.*, 2002). While considered resident in Ireland, with many birds remaining close to breeding areas during winter, ring-recoveries suggest that some birds undertake predominantly southern or south-eastern movements to Britain and the Continent during winter (Wernham *et al.*, 2002).

Numbers of Goldfinch have increased throughout CBS, consistent with a moderate increase across Europe (PECBMS, 2019) and both the short- and long-term positive BBS trends in the UK (Harris *et al.*,

2018; Woodward *et al.*, 2018). In the UK, population increases have been attributed to the Goldfinch exploiting a range of habitats, including gardens where bird food is often provided (Siriwardena *et al.*, 1999) and while the same pattern is not as evident in Ireland (Burke, 2017) it is likely to depend on winter weather amongst other factors. One theory is that the Goldfinch has benefited from declines in the Greenfinch as a result of finch trichomonosis, with Goldfinch gaining better access to feeders and tables in gardens (Woodward *et al.*, 2018) which subsequently aids its survival and annual breeding productivity.

On average, Goldfinch was recorded in 146 1 km squares during CBS, and the breeding distribution has increased by 27% over 10-years. Distributional increases are also evident over the 25- and 44-year trend periods.

3.48 Linnet *Linaria cannabina* Gleoiseach

Resident

Breeding population:	**Population estimate (2011-2016):**	459,892
	min – max population estimate:	312,245 – 630,786
	10-year trend (2006-2016):	+3.1
	18-year trend (1998-2016):	+5.7
Breeding distribution change (%):	**10-year trend (2006-2016):**	+6.0
	25-year trend (1991-2016):	+27.9
	44-year trend (1972-2016):	+3.6

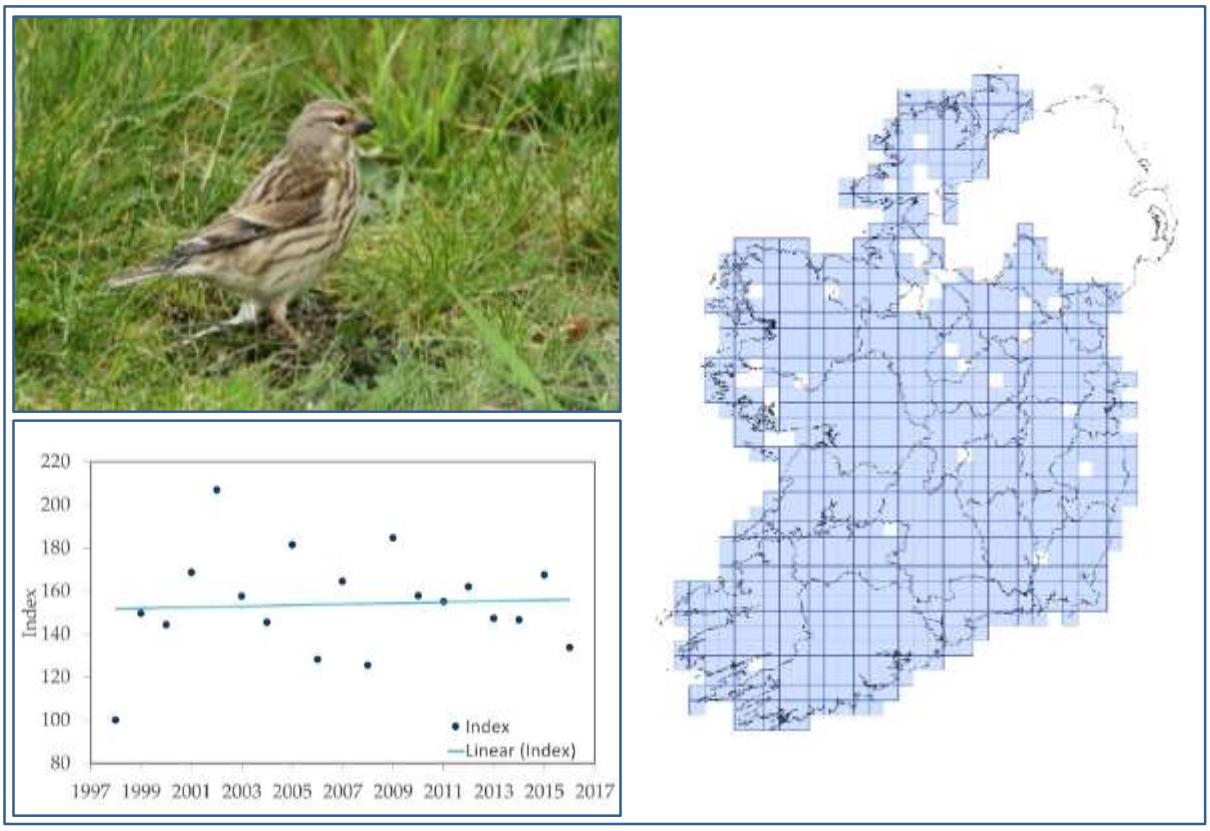

Figure 49 Distribution map and graphed population 18-year trend for Linnet. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Linnet (Common Linnet on the EU Bird List) is widely distributed throughout Ireland and most of Britain, with the exception of the higher mountainous regions of Scotland and some of its offshore islands. It is resident in Ireland, Britain and most of Europe except for the northeast of Europe, southern Norway and Sweden, where it is considered a summer migrant. It can be found foraging and nesting in hedges, bushes and shrubs, especially gorse in heath, bog, farmland and dune systems. Young conifer plantations can provide suitable nesting sites and in coastal areas, sea buckthorn and sueda may be used. Several breeding pairs often form loose colonies (Drachmann & Broberg, 2002).

With a stable 10-year CBS population trend, the 18-year trend (since the start of the survey in 1998) shows a 5.7% increase in its breeding population. The most recent population estimate of 459,892 (2011-2016) is an increase of 9,000 since 2010 (Crowe *et al.*, 2014). Although the 40-year change in the Linnet distribution in the UK is stable at +1% (Balmer *et al.* 2013), the BBS recorded a decline in abundance in the UK of -18% from 1995-2016 (Harris *et al.*, 2018). Across Europe, Linnet has undergone a moderate decline in numbers since 1980 (PECBMS, 2019).

The average number of CBS 1 km squares recording Linnet is 126 per year and this number was considered stable between 2006 and 2016 (+6%). The 25-year trend in breeding distribution (1991-2016) reveals an increase of nearly 30%, but with the distribution considered broadly stable since 1972 (+4%).

The Linnet's diet consists almost exclusively of weed seeds, obtained on the ground or directly from seed heads. As it inhabits mainly quite marginal land, the species does not seem to be affected by major changes in farming practices. Indeed, farm abandonment may well benefit Linnet as it will opportunistically move into rough ground lying fallow or untended, where weeds proliferate.

3.49 Redpoll *Acanthis flammea* Deargéadan

Resident

Breeding population:	**Population estimate (2011-2016):**	358,973
	min – max population estimate:	201,351 – 533,242
	10-year trend (2006-2016):	+64.9
	18-year trend (1998-2016):	+146.1
Breeding distribution change (%):	**10-year trend (2006-2016):**	+39.0
	25-year trend (1991-2016):	+116.7
	44-year trend (1972-2016):	+33.9

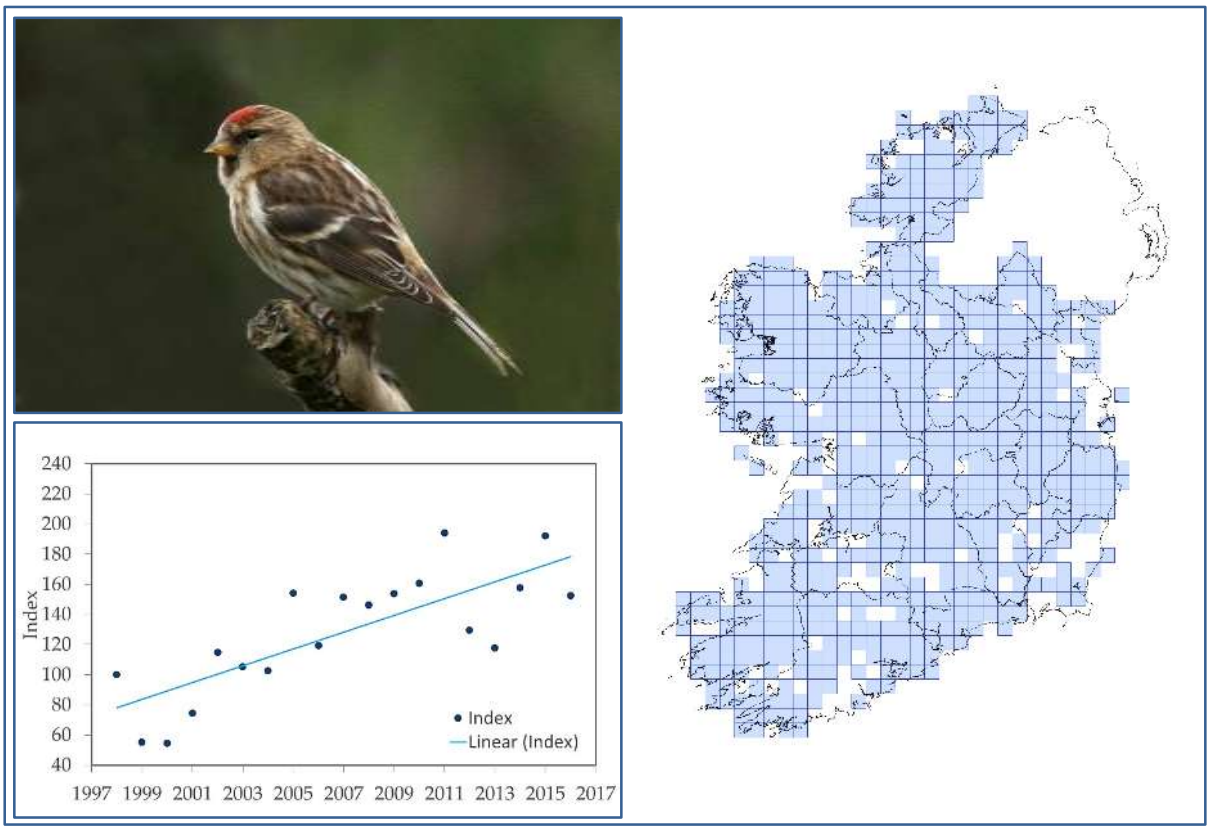

Figure 50 Distribution map and graphed population 18-year trend for Redpoll. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The nominate subspecies *A. f. flammea*, generally called the Common or Mealy Redpoll, is found across northern parts of Eurasia and North America. The Lesser Redpoll (*A. f. cabaret*), which is considered a subspecies of Common Redpoll by some taxonomic authorities, breeds in Ireland, Britain and parts of west and central Europe. The information in this account therefore refers to Redpoll (also referred to as Lesser Redpoll).

Considered a woodland specialist, Redpoll breeds in scrub woodland and conifer plantations, and feeds on a variety of tree seeds, such as willow (*Salix* spp.), birch (*Betula* spo.), Alder (*Alnus glutinosa*) and

larch (*Larix* spp.). Redpoll also forages on grass and weed seeds from stubbles and has taken to winter feeding on peanut feeders in gardens, occurring in 27% of gardens during the 2016/17 Garden Bird Survey (Burke, 2017).

The Redpoll has increased throughout CBS with a 146.1% population increase over 18-years, and a 64.9% increase over 10-years. Similarly in the UK, 10-year (2006-2016) and 21-year (1995-2016) BBS trends are showing increases, although the 10-year trend for Northern Ireland is one of decline. However, the long-term UK dataset, dating back to the late 1960s, shows a dramatic decline despite the more recent modest increases (Woodward *et al.*, 2018). The European combined trend for *cabaret* and *flammea* is of a moderate decline since 1980 (PECBMS, 2019).

On average Redpoll was recorded in 61 CBS 1 km squares each year. Its breeding distribution through CBS (2006-2016) has increased by 39%. Large increases are also evident over the 25- and 44-year trend periods.

Reasons for the contrasting Irish and UK trends are unclear. Afforestation in Ireland is progressing at one of the fastest rates in Europe. Along with ambitious targets to increase forest cover to 18% by 2046, an annual increase in afforestation of 15,000 ha (DAFM, 2014) may be resulting in increased habitat for some of our woodland specialists, particularly when any surrounding native shrub layer is included (Wilson *et al.*, 2006). However, Redpoll, which traditionally breeds in young, open forests (Fuller, 1995) is eliminated from older forest stages and its presence in young plantations may be more dependent on the original habitat and vegetation of a site prior to afforestation than on features attributable to forestry (Wilson *et al.*, 2006).

3.50 Bullfinch *Pyrrhula pyrrhula* Corcrán coille

Resident

Breeding population:	**Population estimate (2011-2016):**	648,630
	min – max population estimate:	422,103 – 700,663
	10-year trend (2006-2016):	+40.9
	18-year trend (1998-2016):	+85.4
Breeding distribution change (%):	**10-year trend (2006-2016):**	+6.0
	25-year trend (1991-2016):	+16.5
	44-year trend (1972-2016):	+10.3

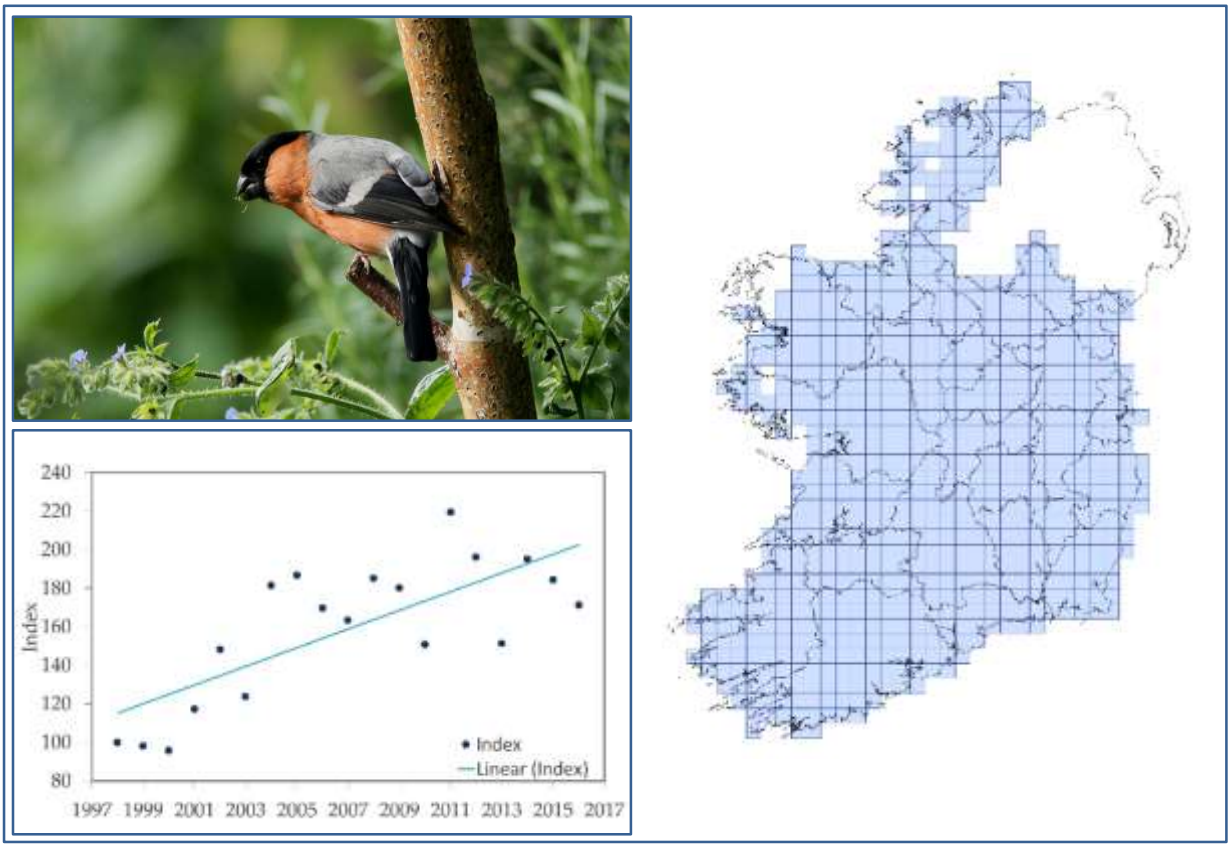

Figure 51 Distribution map and graphed population 18-year trend for Bullfinch. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Bullfinch (Eurasian Bullfinch on the EU Bird List) is resident in Ireland and largely sedentary, remaining reasonably close to where it breeds (Wernham *et al.*, 2002). Densities are highest in lowland deciduous and coniferous woodland (Balmer *et al.*, 2013) although Bullfinch is not considered to be true woodland specialist as it is also associated with farmland, gardens and scrub (Gregory & Baillie, 1998). It has a varied diet which includes seeds, insects, grains, berries and tree buds.

Bullfinch has increased in numbers throughout CBS (+85.4% over 18-years). This contrasts to a moderate decline in Europe over the long-term, although a moderate increase is apparent over the recent ten-year period (PECBMS, 2019). In the UK, Bullfinch numbers declined steeply during the period 1977-1982 (Balmer *et al.*, 2013) but an upturn was evident from 2000. Despite positive ten- and 21-year BBS trends (Harris *et al.*, 2018), the UK population is still significantly lower than in 1967 (Woodward *et al.*, 2018). In Northern Ireland, there has been an increase of 29% in the Bullfinch population over the ten-year period 2006-2016.

On average, the Bullfinch was recorded in 139 1 km CBS squares and its short-term breeding distribution (2006-2017) is considered stable (+6%) with increases in the 25- and 44-year distribution trend periods (Sharrock *et al.*, 1976; Balmer *et al.* 2013).

Declines in the Bullfinch population in the UK have been attributed to agricultural intensification, a reduction in the structural and floristic diversity of woodland, and habitat losses outside of woodland (e.g. hedgerow removal) leading to lower food availability and nesting cover (Fuller *et al.*, 2005). The observed difference in BBS and CBS trends is probably due to less expansive agricultural intensification in Ireland. In addition, afforestation in Ireland is progressing at one of the fastest rates in Europe, with ambitious targets to increase forest cover to 18% by 2046, with an annual increase in afforestation of 15,000 ha (DAFM, 2014) may be resulting in increased habitat for some of our woodland specialists, especially if incorporating a native surrounding shrub layer (Wilson *et al.* 2006).

3.51 Yellowhammer *Emberiza citrinella* Buíóg

Resident

Breeding population:	**Population estimate (2011-2016):**	217,252
	min – max population estimate:	145,092 – 294,597
	10-year trend (2006-2016):	+2.4
	18-year trend (1998-2016):	+4.4
Breeding distribution change (%):	**10-year trend (2006-2016):**	+9.0
	25-year trend (1991-2016):	-33.4
	44-year trend (1972-2016):	-58.1

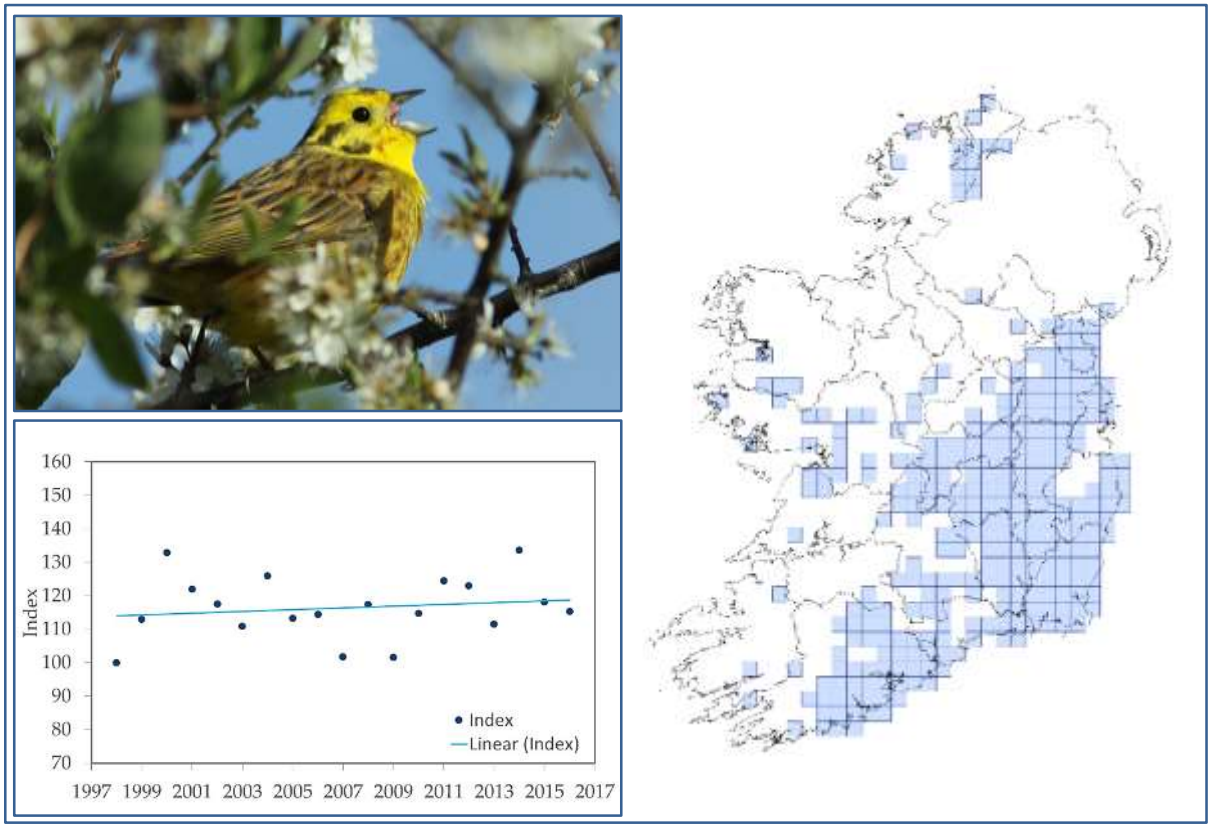

Figure 52 Distribution map and graphed population 18-year trend for Yellowhammer. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Yellowhammer is resident in Ireland, Britain and most of Europe its range extending north to southern Scandinavia and south to the Mediterranean (Cramp & Perrins, 1994). It is a summer visitor to parts of Norway, Sweden and Finland and winter visitor to the northern half of Spain and countries bordering the Black Sea and Caspian Sea.

Since CBS began in 1998, Yellowhammer numbers have been relatively stable (+ 4.4%). The 2011-2016 population estimate of 217,252 shows an increase of 3,000 since 2010 (Crowe *et al.*, 2014). This contrasts to the UK where BBS trends show declines over 21- and 10-year periods (Harris *et al.*, 2018).

The mean annual number of CBS 1 km squares in which Yellowhammer was recorded is 76. Few range changes of any passerine in Ireland have been as striking or severe as Yellowhammer. The Bird Atlas (1968-1972) (Sharrock, 1976) showed the species to be widely distributed across Ireland, with just a handful of gaps in the north midlands and the south. Today, its breeding distribution is largely restricted to eastern and southern counties (Balmer *et al.*, 2013), the stronghold of cereal farming (CSO, 2012). The 44-year distribution trend (1972-2016) is a 58.1% decline. The Yellowhammer is currently Red Listed (Colhoun & Cummins, 2013) based on this significant range decline (Balmer *et al.*, 2013) since the first breeding bird atlas (Sharrock *et al.*, 1976). The 25-year trend, based on a comparison between the current Bird Atlas (2007-2011) (Balmer *et al.*, 2013) and its predecessor i.e. Bird Atlas (1988-1991) (Gibbons *et al.*, 1993) is also a decline (-33.4%), while the 10-year CBS distribution trend is considered stable (+ 9%).

Yellowhammer has a close association with cereal farming (Kyrkos *et al.*, 1998) and winter stubbles (Whittingham *et al.*, 2005) and its high dependency on a ready supply of cereal and weed seeds for food, can leave the Yellowhammer vulnerable when farming practices change, e.g. from arable crops to livestock grazing. The steady contraction of the Yellowhammer's range to eastern and southern counties mirrors the loss of cereal growing in western and northern parts of the country. The provision of wild bird cover (Stoate *et al.*, 2004) and the creation of uncultivated margins around intensive arable or pasture fields are considered beneficial to Yellowhammer (Stevens & Bradbury, 2006).

3.52 Reed Bunting *Emberiza schoeniclus* Gealóg ghiolcaí

Resident

Breeding population:	**Population estimate (2011-2016):**	191,922
	min – max population estimate:	136,453 – 256,297
	10-year trend (2006-2016):	+10.9
	18-year trend (1998-2016):	+20.5
Breeding distribution change (%):	**10-year trend (2006-2016):**	+13.0
	25-year trend (1991-2016):	+27.1
	44-year trend (1972-2016):	+9.4

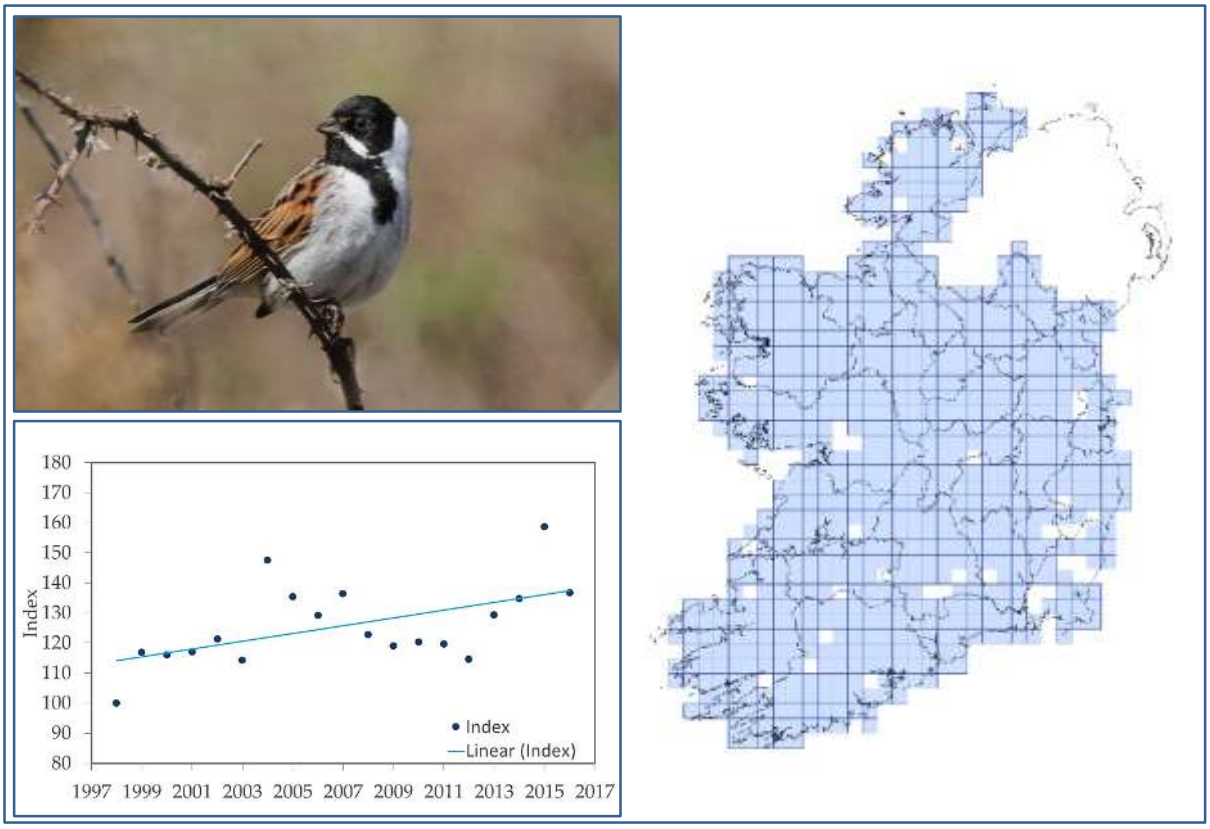

Figure 53 Distribution map and graphed population 18-year trend for Reed Bunting. The breeding distribution map is based on the Bird Atlas (2007-2011) (Balmer *et al.*, 2013). The population trend uses data from CBS 1998-2016 (Photo: Dick Coombes).

The Reed Bunting occurs throughout Ireland and Britain, absent only in some of the islands and higher altitude regions of Scotland (Balmer *et al.*, 2013). It is resident in Ireland, Britain and across a band of European countries from France to northern Germany and patchily in central Europe across to the Caspian Sea. In Scandinavia and northeast Europe, it is a summer visitor, and a winter visitor to the Iberian Peninsula and countries bordering the northern coasts of the Mediterranean. Its main breeding habitat is in wetland areas, particularly *Phragmites* reedbeds, but also in hedgerows, scrub and even

young conifer plantations. In winter, it disperses more widely, especially into arable farmland where spilt grain in stubble and weed seeds provide feeding opportunities.

Over the 18 years of the CBS, Reed Bunting has shown an increasing trend of 20.5%. The population estimate of 192,922 (2011-2016) was an increase of 12,000 birds since 2010 (Crowe *et al.*, 2014). In Europe, a moderate decline has been shown since 1980 (PECBMS, 2019).

The mean number of CBS 1 km squares in which Reed Bunting was recorded was 90 per year. Breeding distribution trends are for increase in the short (10-year) and medium term (25-year) and stable in the longer-term (44-year). An expansion of the species' distribution, from formerly almost exclusively wet habitats to include drier ones, was noted to be taking place in Britain from the 1960s onwards (Sharrock, 1976). This may also possibly be the case in Ireland and that the trend for adapting to drier habitats, which can include hedgerows and scrub, may be continuing. In light of the general reduction of wetland habitats in recent decades, it seems likely, and may explain the positive distributional trends across all periods assessed.

4 Pressures and threats facing Ireland's breeding bird populations

The Countryside Bird Survey (CBS), is a citizen science-based survey, which has been running since the late 1990s as a way to monitor upwards of 50 of the most common and widespread breeding birds in the Irish landscape. It provides a useful health-check each year of how countryside birds are faring by carrying out repeat visits to pre-assigned 1 km squares each breeding season (through early and late season counts) and using information collected to quantify rates of change (i.e. trends) in species abundance.

Some of the most well understood and significant issues facing regularly occurring and widespread terrestrial breeding birds in Ireland include changes in land-use (e.g. agriculture, forestry), urbanisation and development, climate change and impacts of plant and animal pathogens. These are discussed in this section. The term 'pressure' is used to describe issues negatively affecting farmland bird populations currently and in the recent past, and the term 'threat' describes those issues likely to affect countryside bird populations negatively in the coming years. It is important to note that the current assessment relates to the time period as per reporting under Article 12 of the Bird's Directive (DG Environment, 2017), in that pressures relate to the six-year period 2013-2018, while future threats relate to the future two reporting periods (i.e. within 12 years following the end of the current period).

The pressures and threats are discussed in order of their significance (high, medium or low), although a wider and more general discussion is also provided under each heading. Pressures and threats are grouped as follows: (1) Climate change; (2) Agriculture and forestry; (3) Urbanisation and development; (4) Pathogens and (5) 'Others'. The final category 'others' is a discussion on other known potential pressures or threats facing regular and widespread terrestrial breeding birds in Ireland, but where the risks are either considered to be currently low, or where detailed information and data are lacking. Note, the list is not exhaustive, as there are likely many current and future threats which have not yet been identified.

4.1 Climate change

4.1.1 Introduction

Changing weather patterns as a result of climate change is one of the most significant threats facing breeding birds of the Irish countryside (Radchuk *et al.*, 2019). As temperature, precipitation and the frequency and duration of extreme weather events change, these changes may have direct and indirect impacts on resident and migrant breeding bird populations through changes in the phenology of birds, particularly the timing of migration and of nesting (Crick *et al.*, 2004). Climate change may alter the availability of food sources and nesting habitats, creating a temporal or spatial mismatch that has knock-on effects for bird reproduction, distribution and abundance (Pearce-Higgins *et al.*, 2014).

4.1.2 Climate change in Ireland

By the middle of this century, Ireland is projected to have significantly lower mean annual precipitation levels, particularly during the summer (Nolan *et al.*, 2017). The frequency of heavy precipitation events is projected to increase during the autumn and winter months however, as are the number of extended dry periods during summer and autumn (Nolan *et al.*, 2017). Changes in temperature and precipitation at different times of the year may result in changes to food availability (Robinson *et al.*, 2007) and habitat distribution (Berry *et al.*, 2002) and energy expenditure for both resident and migratory bird populations that will likely have population-level impacts at varying temporal and spatial scales. Pearce-Higgins *et al.* (2015) identified hot, dry summer weather as having a negative impact (via desiccation of larval stages of invertebrates with a time lag) on some bird populations' e.g. upland birds. The effect was

greatest in species that rely on subsurface invertebrates (e.g. worms, fly larvae) as well as habitat specialists, with knock-on negative effects for the 'species specialization index' of bird communities in a given area.

Salewski *et al.* (2013) found that severity of winter weather was associated with survival of some resident and partial-migrant species (the Blackbird and the Dunnock respectively), with higher apparent survival in warmer winters and those with fewer days of snow cover. Similarly, Gullett *et al.* (2015) found that survival in Long-tailed Tits was strongly linked to interannual variability in weather. Cool and wet conditions in spring reduced annual survival, as did cold autumn weather.

In Ireland, periods of prolonged cold winter and spring weather (e.g. winters 2010/11 and 2011/12) negatively affect the numbers of resident species including Goldcrest, Grey Wagtail, Long-tailed Tit, Meadow Pipit, Mistle Thrush, Song Thrush, Robin, Skylark, Stonechat and Treecreeper (CBS survey data). In spring 2018, a cold weather frontal system known as the 'Beast from the East', brought freezing temperatures and heavy snow cover to many parts of the country (Met Eireann Archive March 2018, unpublished data). This cold-weather front is considered to have adversely affected many resident insectivores. Despite predictions for increased average temperatures in Ireland in the future (e.g. Murphy *et al.*, 2019), any increase in relatively short-term severe winter weather conditions including heavy rainfall or snow, particularly when coupled with sub-zero temperatures, will cause high mortality in these species (Dobinson & Richards, 1964; Cawthorne & Marchant, 1980) which can impact subsequent recovery in the short and medium-term.

4.1.3 Climate change outside Ireland

There is increasing evidence that weather patterns in Africa are important in determining breeding population trends of Afro-Palearctic migrants (Ockendon *et al.*, 2014), some of which breed in Ireland. The Sahel region of Africa is a crucial stop-off location on autumn southerly migration and spring northerly migration, where birds refuel after and before crossing the Sahara Desert (respectively).

Rainfall in the Sahel is linked to vegetation growth and insect availability. Johnston *et al.* (2016) found a significant positive relationship between rainfall in the Sahel and survival and annual population change in seven Afro-Palearctic migrant warbler species. Salewski *et al.* (2013) found that winter precipitation in the Sahel was positively correlated to the survival of adult Willow Warblers while Robinson *et al.* (2008) concluded that breeding Swallow numbers in Britain were correlated with rainfall in the western Sahel.

Population dynamics of Sand Martin populations in parts of Europe have also been linked to drought conditions in parts of the Sahel during the wintering period (Szép, 1995). The strength of this relationship appears to have varied somewhat over the years and is possibly only evident during the more extreme drought conditions when precipitation levels fail to reach a certain minimum threshold (Robinson *et al.*, 2008; Masoero *et al.*, 2016). Still, the threat remains that the frequency of such droughts in the future will impact the overwinter survival and long-term breeding success of these summer migrant birds as a result.

From an Irish perspective, many of our summer migrants winter in the Sahel region of Africa including Common Whitethroat and Sedge Warbler. Predictions of future precipitation in the Sahel region of Africa under climate change conditions are not consistent (Haarsma *et al.*, 2005; Dai, 2003), but the possibility remains that decreased precipitation will negatively impact overwinter survival and therefore numbers returning to Ireland to breed. In the western Mediterranean, weather conditions before and during key migration times may also influence survival (Salewski *et al.*, 2013). Droughts and decreases in precipitation due to climate change in countries outside Ireland, are therefore considered to present a medium-level threat to Blackcap, Sedge Warbler, Whitethroat, Willow Warbler and Sand Martin, and a low-level threat to Cuckoo and Swallow.

4.2 Agriculture and forestry

Agricultural land covers over 70% of Ireland's total land area, with grassland accounting for around 86% of that total and cropland the remaining 14% (CSO, 2016). Forestry accounts for a further 10.6% of total land area (CSO, 2016) and Ireland is projected to increase forest cover by 15,000ha annually to reach targets of 18% forest cover by 2046 (DAFM, 2014). Therefore, how agricultural land and forestry is managed has a far-reaching influence on the status and trends of our countryside bird populations. Such intensification in recent decades (particularly since the 1970s) has been implicated in far-reaching changes to the Irish landscape with the drivers of farming intensification and afforestation associated (either directly or indirectly) with declines in abundance and range of many countryside bird populations (Colhoun & Cummins, 2013) through changes in suitable habitat extent and quality. Government policy e.g. 'Food Wise 2025' will significantly increase agri-food exports in the coming years which will necessitate more intensive agricultural activity at various spatial scales. While Food Wise 2025 plans highlight the need for sustainability, there are concerns that such a significant and rapid increase in agricultural outputs will come at a cost to birds and other biodiversity.

4.2.1 Management of arable land, conversion to grassland

Winter food availability is often the limiting factor for the over-winter survival of granivorous bird species (Robinson & Sutherland, 2002). Loss of arable land and mixed farming to grassland or other agricultural land uses over the last 50 years has reduced the extent of suitable habitat and associated food availability for species such as Yellowhammer and Stock Dove, with large declines recorded in the ranges of both species (Balmer *et al.*, 2013). More recently, the switch to autumn-sowing of arable crops has reduced the availability of winter stubble, with likely knock-on effects for winter survival of these birds. A lot of granivorous passerines select winter stubble fields as a foraging habitat and show preference for areas of bare ground within fields (Moorcroft *et al.*, 2002; Wilson *et al.*, 2005), but conversion to autumn-sown cereals means there is little or no bare ground or seeds available. Denser cropping and the absence of bare patches or heterogeneity in terms of sward or crop height during the year reduces the suitability of agricultural land for Yellowhammer. Studies of Yellowhammer foraging behaviour during the breeding season have consistently found adult birds preferentially selecting locations within cereal fields and field margins which have shorter and sparser vegetation, and even in autumn, foraging Yellowhammer prefer to use structurally heterogeneous swards (Perkins *et al.*, 2000; Wilson *et al.*, 2005).

The conversion to autumn-sown arable crops is likely to represent a medium-level threat to Stock Dove, a farmland specialist that continues to decline in both range (Balmer *et al.* 2013) and abundance (CBS trend data). Other species likely to be affected include Linnet, Yellowhammer and Reed Bunting, but to a lesser extent. In addition to the removal of a winter food supply, the timing of vegetation growth and maturation of autumn-sown crops also reduces the availability of suitable nesting habitat for ground-nesting birds such as Skylark, though probably only represents a low-level threat to the Irish population at present given their preference for grassland habitats (Copland *et al.*, 2012).

Changes to agricultural land that have 'simplified' the landscape in terms of habitat, as part of a drive towards greater intensification, has also had an indirect effect on raptors such as Kestrel through the loss of suitable hunting habitat, the loss of habitat connectivity through hedgerow removal, and reduced prey base (small birds and mammals) (Butet *et al.*, 2010).

4.2.2 Pesticides

Intensification of agriculture including more efficient crop harvesting and weed control, means that there is less food available for birds in the winter months (e.g. Chamberlain *et al.*, 2000). Use of herbicides reduces plant diversity and weeds within the crop and along crop edges, thereby eliminating a source of seeds for birds which are particularly valuable when other food sources have been depleted late in the winter. Moorcroft *et al.* (2002) found that, when foraging in stubble fields in winter, the Linnet selects

areas that are both richer in preferred weed seeds, but also with greater areas of bare ground than randomly selected locations in the same fields (via Wilson *et al.*, 2005).

In 2016, 3,135 tonnes of pesticides (active ingredient) were used on Irish agricultural land (via Pesticides Registration and Control Division of the Dept. of Agriculture). Pesticides, directly and indirectly, reduce the diversity and quantity of food available to farmland birds including insect abundance and seed/weed abundance, both prey groups being so important in supporting overwinter survival of farmland birds (Whispear & Davies, 2005).

The use of herbicides and insecticides on agricultural land, as well as recreational land, constitutes a low-level pressure and threat for many birds in the wider countryside by removing sources of food that can be important to help secure breeding success and overwinter survival at key times during the year.

4.2.3 Changes to grazing and grassland management

Up until the later part of the 20th century, grassland birds such as Meadow Pipit and Skylark were ubiquitous in the Irish agricultural landscape (Holloway, 1996), where extensive farming and rotational farming practices created a heterogeneous field structure that provided an abundance of suitable nest sites, invertebrate prey and seeds and grains from stubble and weeds. More recently, intensive grazing and taking multiple cuts for silage throughout the summer are making Ireland's grassland habitats less and less suitable for these grassland bird species (Copland *et al.*, 2012). Such agricultural practices represent a widespread medium-level threat to grassland birds given the recent lifting of milk quotas and plans for Ireland to "…realise its full potential in terms of output, export earnings…" (DAFM, 2015). Earlier and more frequent silage cuts (up to three or even four in a growing season), are likely to lead to more losses of nests, eggs and chicks for ground-nesting birds. Reseeding of grasslands, and other semi-natural habitats, as part of intensive grassland management also reduces the diversity of vegetation and sward structure and availability of seeds for species such as Linnet and Yellowhammer to feed on (Moorcroft *et al.*, 2002; Ostyn, 2016) and is considered a low-level pressure and threat.

Conversely, agricultural abandonment of grassland has a similar impact on species such as Meadow Pipit and Skylark by resulting in a sward too tall and dense to utilise effectively for foraging and nesting. For species such as Starling, that feed on subsurface invertebrates (e.g. worms, diptera larvae), the cessation of grazing and mowing similarly deprives them of feeding opportunities. This results in lower foraging success and increased energy expenditure, with potential knock-on effects for breeding success and overwinter/first-year survival rates (Devereux *et al.*, 2004; Wilson *et al.*, 2005). The current scale and rate of agricultural abandonment in Ireland at present means that it constitutes only a low pressure and future threat for these species.

4.2.4 Afforestation and forestry management

In 1990, forested land covered 6.8% of Ireland's total land area, but the figure for 2014 was up to 10.6% and continues to increase (CSO, 2016). Ireland is projected to increase forest cover by 15,000ha annually to reach targets of 18% forest cover by 2046 (DAFM, 2014). The conversion of open, agricultural and semi-natural habitats to forest plantations constitutes a major ecological change that can be expected to have a profound influence on the populations of many bird species in Ireland (O'Halloran *et al.*, 1998). The impact of a new conifer plantation on bird communities can be variable depending largely on the land use and management prior to afforestation (Wilson *et al.*, 2012). For instance, Graham *et al.* (2015) found that the density of bird species of conservation concern increased in response to the planting of intensively managed grassland sites (i.e. improved agricultural grassland) but decreased when forestry was planted on peatlands and less intensively managed grasslands.

Where forestry replaces extensively managed grassland it results in the direct and permanent loss of habitat for species such as Skylark and Meadow Pipit, and reduced feeding opportunities for Starlings. The establishment of forestry also facilitates increased densities of mammalian predators and avian

mesopredators (i.e. mid-ranking predators in the middle of the trophic level) which can lead to increases in predation for ground-nesting birds.

The practice of removing dead and dying trees as part of forestry/silviculture management, can reduce nesting and feeding opportunities for species such as Treecreeper (Soderstrom, 2009) and Great Spotted Woodpecker (Pasinelli, 2007). There is no evidence that this is adversely affecting populations to date, but it may represent a low-level threat in the coming years depending on how forests and woodlands are managed (i.e. for commercial reasons or reasons of perceived tidiness or safety).

4.2.5 Upland and peatland management

Illegal closed-season burning of agricultural lands, particularly upland and lowland bog and scrub areas, has been well-documented in Ireland in recent years (e.g. DAFM, 2016). Such activity results in direct losses of early nests in such areas as well as losses in extent of suitable bird nesting and feeding habitats for several years. 'Food Wise 2025' plans to significantly increase agri-food exports in Ireland in the coming years leading to more intensive agricultural activity at various spatial scales. Although Food Wise 2025 highlights the need for sustainability, there are concerns that such a significant and rapid increase in agricultural outputs will come at a cost to birds and biodiversity. Burning as a 'grassland management tool' for agriculture in Ireland, particularly of scrub habitats, is likely to continue in the foreseeable future in a bid by landowners to avail of more grazing lands, to meet production targets and to increase the area included under the Single Farm Payment schemes (DAFM 2019). The CBS species most affected by upland burning, particularly uncontrolled burning, include Skylark, Meadow Pipit, Stonechat, Reed Bunting and Linnet. Given that these are widespread and relatively numerous species, burning for agriculture is currently considered a low-level pressure and threat, although there may be more noticeable effects at local level depending on the extent and frequency of burning and habitat removal. Mechanical extraction of peat, at an industrial and/or individual/private scale, is similarly damaging to species such as Skylark, Meadow Pipit and Skylark, and constitutes direct loss in extent of nesting and feeding habitat.

4.2.6 Management of small landscape features

As grasslands and crops are managed with increased intensity to maximise their agricultural and economic output, countryside birds are increasingly reliant on small landscape features such as hedgerows, stone walls, rushes, open ditches, springs, marshes etc. for nesting and feeding. Removal or reduction of such features reduces habitat diversity at a local scale and is likely to reduce feeding opportunities for many species, as well as nesting opportunities for some species too. 'Food Wise 2025' plans to significantly increase agri-food exports in the coming years will necessitate more intense agricultural activity at various spatial scales. While Food Wise 2025 plans highlight the need for sustainability in terms of growth in the agri-food sector, there are concerns that such a significant and rapid increase in agricultural outputs will come at a cost to birds and other biodiversity.

Removal of hedgerows which act as important wildlife corridors, results in the loss of available nesting habitat for many countryside bird species, as well as an importance source of food and shelter throughout the year. Under Good Agricultural and Environmental Condition (GAEC) DAFM regulations, hedgerows, trees in a line and drains/ditches, are designated as landscape features to be retained and maintained. The Environmental Impact Assessment (Agriculture) Regulations (S.I. No. 407 of 2011 as amended), set down clear requirements in respect of screening and approval including the removal of hedgerows. Where hedgerow removal takes place, replacement with a similar length (or longer) of new hedgerow should be in situ prior to removal of the old hedgerow, although this new hedgerow generally takes several years to acquire the structural complexity and biodiversity of an older/mature hedgerow. Similarly, poor management of hedgerows that reduces their structural diversity (e.g. cut too short, too narrow, removal of uncropped margins) all drastically reduce the quality of hedgerow habitat. The Wildlife Act 1976 (Section 40 and amendments) prohibits cutting hedgerows during the breeding season (1st March to 31st August), with some exemptions, e.g. for

hedgerows facing roads. Cutting and management of hedgerows during the breeding season carries a number of risks including the destruction of eggs, chicks and nests, nest abandonment, increased predation and higher breeding failure. Potential damage is not limited to the cutting or removal of trees as some species nest on or close to the ground in scrub and ditch vegetation. Such vegetation in uncropped margins also provides an accessible prey resource for birds of prey including Kestrel. The loss of such features at field level reduces their connectivity at landscape level, not only impacting farmland birds directly but also inhibiting movement of small mammals which in turn reduces the available prey-base for Kestrel and other raptor species (Butet *et al.*, 2010). The thousands of kilometres of hedgerows and related features are a hugely important habitat in the context of Irish farmland. The removal and destruction of these landscape features while unlikely to occur at a sufficient spatial scale to cause population level impacts for the majority of the widespread breeding countryside birds. However, such activities are currently considered a medium-level threat to declining species such as Kestrel, and a low-level threat to other countryside bird species, but that assessment may change in the future. Species likely to be affected include Blackbird, Chaffinch, Collared Dove, Dunnock, Goldfinch, Greenfinch, Linnet, Long-tailed Tit, Mistle Thrush, Robin, Song Thrush, Tree Sparrow, Whitethroat, Woodpigeon, Wren and Yellowhammer.

The drainage of marsh and wet features in agricultural habitat, for either agricultural use or for settlements (McLaughlin & Mineau, 1995) also continues to be an issue that affects many species including Reed Bunting and Sedge Warbler.

4.3 Urbanisation and development

4.3.1 Modification of settlements in urban areas

Some species, such as House Martin and Swift are almost completely reliant on man-made structures for nest sites. Modern building techniques, renovation and thermal insulation of occupied buildings, and repair and pointing of brickwork on historic structures, are removing suitable nest-cavity sites for Swift across the country (Balmer *et al.*, 2013; Schaub *et al.*, 2016; Whelan *et al.*, 2018). Swifts are very site-faithful and in some towns and villages will be reliant on one or two buildings for nesting, so the removal of these nest sites can force them to desert an area completely. Such modifications to housing and settlements are therefore considered a medium-level pressure and threat on Swift populations in Ireland.

4.3.2 Energy production and related infrastructure

Climate change poses a serious threat to global biodiversity. In response to a progressively more catastrophic breakdown in climatic norms, governments around the world are aiming to rapidly decarbonise their economies in the coming decades. Most countries, including Ireland, have signalled an intent to move away from fossil fuel sources of energy and to exploit renewable energy sources. Potential sources of renewable energy include wave and tidal energy, although these are in their infancy in Ireland, with offshore wind farms likely to grow considerably in the coming years. Terrestrial wind farms are already well established in Ireland, however. Wind generation provided 85% of Ireland's renewable energy and almost one quarter (24.8%) of electricity generated in 2017 (SEAI, 2018), making it the second largest source of electricity after natural gas. Over 500 MW of wind generation was installed in Ireland in 2017 (SEAI, 2018), an increase of 27%, bringing the total number of operating turbines here to 1,909 and with a capacity of 3.4GW (IEA Wind, 2018). A further 678MW of wind energy capacity had been approved beyond 2017 (IEA Wind, 2018) and the Sustainable Energy Authority of Ireland's 'Wind Energy Roadmap' (SEAI, 2011) outlined the potential for Ireland to achieve deployment of between 11GW and 16GW of onshore wind by 2050, representing a significant abatement opportunity as well as economic opportunities in job creation and export potential. The Government of Ireland's (2018) 'Draft National Energy & Climate Plan (NECP) 2021-2030' proposes future scenarios for renewable energy development in Ireland, all of which would see our wind energy capacity increase

significantly. The environmental necessity of reducing carbon emissions and tackling climate change at a national and international level are evident, but it is important that renewable energy developments are truly sustainable when it comes to potential impacts on local biodiversity and habitats.

Potential impacts of onshore windfarms on breeding birds include direct collision mortality and/or displacement and habitat loss (i.e. indirect impacts) but can be minimised or reduced by avoiding sites with sensitive habitats and key populations of vulnerable species. Pearce-Higgins *et al.* (2009) found that Buzzard showed reduced flight activity and avoided an area of 500 m around turbines. Snipe too showed significant avoidance of turbines and were found in significantly lower densities within 400 m of turbines in upland habitats (Pearce-Higgins *et al.*, 2009). Previous research has shown that Skylark shows sex- and age-biased mortality in collision with wind turbines, with a male bias related to the characteristic male song flight (Morinha *et al.*, 2014; Kelly *et al.*, 2018).

Recent research by Fernández-Bellon *et al.* (2018) on Irish windfarms found that large wind farms held lower densities of open-habitat species such as Meadow Pipit, Skylark and Wheatear. This effect is possibly down to differences in habitat quality, land-use or habitat management, or possibly the susceptibility of different species to disturbances from either human activity or the movement of the turbine blades themselves. The study also highlights the need to further understand the interactions between land-use change and upland ecology, particularly in the context of potential impacts of continued growth in wind-energy development and potential cumulative impacts with afforestation, agricultural intensification and climate change (Fernández-Bellon *et al.*, 2018).

The common terrestrial breeding birds considered here are sufficiently widespread that windfarm development is likely to represent only a low-level threat in the coming years.

4.4 Plant and animal pathogens and pests

Finch trichomonosis was first reported in Ireland in 2007 (Lawson *et al.*, 2012), following from initial reports in Britain in 2005, and rapidly became epidemic (Robinson *et al.*, 2010b). The protozoan parasite *Trichomonas gallinae* infects the upper alimentary tract of the bird, causing necrotic ingluvitis and eventually preventing the bird from feeding, resulting in death (Robinson *et al.*, 2010b). It can be spread through direct contact between birds (e.g. courtship, feeding) and indirectly via water sources and shared food (Robinson *et al.*, 2010b). Greenfinch numbers have declined rapidly since finch trichomonosis took hold in the Irish population and this pathogen is considered a high-level pressure and threat for this species. It is considered a low-level pressure and threat for Chaffinch in Ireland, as infection and mortality have been recorded over the same time period, although this has not had observable population-level effects on the species here.

4.5 Others

Under the Wildlife Act, 1976, all wild birds and their nests and eggs, other than wild birds of the species mentioned in the Third Schedule to this Act, are protected under Irish Law. There are a number of specific derogations (please refer to Irish Statute Book for details).

4.5.1 Hunting, shooting and incidental killing

The E.U. Birds Directive (Amended 2009/147/EC) allows member states to make derogations for the control of certain wild birds (Third Schedule) that would otherwise be protected, where they are causing damage to crops, livestock or fauna or represent a threat to public health or safety (including air safety) (see: '*Declaration under regulations 1(1)(A) of the European communities (Wildlife Act 1976)(Amendment) Regulations 1986 (S.I. No. 254 of 1986*'). Bird species that feature on the Third Schedule include: Hooded Crow, Magpie, Rook, Jackdaw, Woodpigeon, Feral Pigeon and Collared Dove. The reason for control varies between species, as does the period covered by the declaration and the permitted methods of control. For example, Hooded Crows can be controlled to prevent serious damage to livestock, protection of fauna (notably the nests and young of game birds) and where there is a threat to public health or risk of spreading animal diseases. Collared Dove, on the other hand, can only be controlled to prevent serious damage to arable crops (including cereals, legumes, brassicas) or where there is a threat to public health through contamination of food storage. Hooded Crow can be controlled by shooting with rifle or shotgun, or with the aid of cage traps (subject to conditions), whereas Collared Dove can be shot with rifle or shotgun or controlled through the use of non-meat-based poison or anaesthetic bait (under license with prescribed conditions via NPWS). The species mentioned above are widespread and numerous, but no data is collated on the numbers controlled under derogation each year and this therefore represents a direct pressure on each respective population, of unknown scale and impact. Based on current CBS population trends for those species listed on the Third Schedule, the assumption is this pressure i.e. deliberate control, is acting at a local-level and not likely to be significant in the national context.

4.5.2 Illegal shooting, killing and poisoning

The illegal shooting, poisoning and otherwise killing of birds of prey is considered to be a current pressure acting on populations in Ireland. As with most illegal activity, the full extent of its reach in Ireland is not known. However, the RAPTOR protocol (O'Donoghue, 2018), which commenced in 2011, documents all known incidents on an annual basis and maintains a national database of same to provide intelligence for an informed approach to address the impact of anthropogenic issues on birds of prey through education, law enforcement and forward planning. The motives behind such practices are broad and include perceived threats to livestock, such as sheep, by species including Raven and Buzzard and threats to captive-bred birds, including Pheasant and racing pigeon, by species such as Buzzard and Sparrowhawk.

The RAPTOR protocol also records numerous incidents of raptors being poisoned with banned substances including carbofuran. O'Donoghue (2018) highlights that the frequency with which this lethal poison is used and its widespread use across Ireland in wildlife crime is of significant concern. Indiscriminate use of highly toxic poisons has also resulted in the death of Starlings, corvid species and pigeons. Buzzard is by far the most commonly recorded species for which poisoning and illegal killing has been recorded over the period 2007 to 2018. Buzzard, Kestrel, Sparrowhawk and other raptor and owl species are also illegally shot (O'Donoghue, 2018). The known incidents recorded through the RAPTOR protocol are likely to be only a fraction of the true number of incidents that occur in total each year (O'Donoghue, 2018). Overall, the population-level impact of illegal killing (shooting, poisoning) on Buzzard, Kestrel, Sparrowhawk and Raven is believed to be low based on evidence available, but it is quite likely that many more incidents go unreported/undiscovered.

The use of second generation anti-coagulant rodenticides is also responsible for the incidental killing of Buzzard and Kestrel, as well as other raptor and owl species and rodenticides have been detected in 60% of all incidents recorded during the period of the RAPTOR protocol. A study in Scotland found unexpectedly high levels of rodenticide exposure in Sparrowhawk, considering rodents comprise a very minor part of its diet compared to many other birds of prey (Hughes *et al.*, 2013).

5 Report conclusions

The Countryside Bird Survey (CBS) commenced in 1998 and this report marks an important milestone, with 20 years of data now collected through a nationwide network of volunteers and surveyors including professional conservation staff of the National Parks & Wildlife Service, coordinated by BirdWatch Ireland. CBS charts the history of changes in common terrestrial bird communities in Ireland captured through annual monitoring of over 300 1 km squares documenting trends for 51 species that are associated with a variety of habitats including woodland, scrubland, farmland, heathland and bogs as well as around human sites in urban, suburban and rural areas. Each species has its own unique requirements from feeding preferences to nesting ecology and each employs different life history strategies ranging from highly sedentary behaviour throughout the year (i.e. resident in Ireland all year) to undertaking sub-Saharan migrations outside the breeding season.

Taking the most recent 10-year period, countryside bird populations in Ireland are largely faring quite well with 38 species stable or increasing in population size. However, over the same 10-year period, 13 species are declining with several species exhibiting large and worrying declines. As some regularly occurring countryside birds are resident year-round and relatively small in terms of body-size, they can be more susceptible to mortality from inclement weather, both during and outside of the breeding season for example. It is clear from the population indices of many of our resident species, that the prolonged cold weather spells experienced during the winters of 2009/10 and 2010/11 caused many species to sustain heavy losses: Goldcrest, Grey Wagtail, Wren, Robin, Meadow Pipit and Stonechat. Multi-brooded species are capable of recovering relatively quickly from such population crashes, although in the case of Grey Wagtail and Stonechat, their annual indices are still below levels observed prior to 2009/10.

There is also a growing body of evidence that changing weather patterns as a result of climate change is not only a significant threat but is already exerting an influence upon the breeding birds of the Irish countryside. Amongst summer migrants, Swift and Sand Martin are both exhibiting significant declines in the short-term (2006-2016) and the availability of suitable undisturbed breeding habitats in Ireland is likely a limiting factor. As both species are Afro-Palearctic migrants, changes in the levels of rainfall on their wintering grounds in Africa (e.g. more frequent droughts and knock-on effects on the growth of vegetation and insect abundance) caused by climate change, could lead to declines in their over-winter survival, with fewer returning to Ireland to breed. So far, negative trends have not been observed for Swallow, House Martin or warblers such as Sedge Warbler and Willow Warbler, but these latter two species as well as Swallow and Chiffchaff, are known to have advanced their egg laying dates to maximise productivity (Morrison *et al.*, 2015). Climate change driven shifts in breeding range are also being exhibited by some summer migrants. Blackcaps, Willow Warbler and Chiffchaff are known to be shifting their distribution northwards. There is also evidence that some species may not be responding rapidly enough (Devictor *et al.*, 2012) and together with a potential lack of availability and distribution of suitable habitat and/or changes in species interactions could restrict the ability of some species to track suitable climate (Hayhow *et al.*, 2017). Monitoring through CBS and other periodic surveys such as the Bird Atlas, ensures evidence is available to support national and EU-wide assessments of how these bird populations are faring and such surveys play a pivotal role in supporting national and international bird conservation efforts.

The Greenfinch has suffered one of the largest declines which is largely attributed to outbreaks of finch trichomonosis, caused by the protozoal parasite *Trichomonas gallinae* causing levels of mortality and declines unprecedented in British and Irish wild bird populations (Robinson *et al.*, 2010b). However, the Goldfinch may have benefited from the population declines of the Greenfinch, potentially with more availability of feeders and bird tables in gardens in recent years (Woodward *et al.*, 2018) and due to the lack of competition with Greenfinch, which subsequently may have aided annual survival and annual breeding productivity for this species.

Changes in agricultural practices has been highlighted as one of the threats to both Irish habitats and species (e.g. Wall *et al.*, 2016) and declines in farmland bird populations has accompanied farming intensification (e.g. Fuller *et al.*, 1995; Chamberlain *et al.* 2000). Overall, the intensification of agriculture including the conversion of mixed farming to intensive grassland management for the dairy/beef industry, weed control, use of fertilizers and pesticides/herbicides as well as increased stocking densities has led to indirect effects on the abundance and availability of invertebrate prey. The effects of changing land management vary widely according to type, timing and intensity but in general, the abundance and diversity of invertebrates declines with reductions in sward diversity and habitat structural complexity (Vickery *et al.*, 2001; Benton *et al.*, 2002). The decline in aerial and ground insects has likely had a big impact on bird populations (e.g. Møller, 2019).

Ireland's substantial network of hedgerows supports a rich biodiversity ranging from small rodents, badgers and hedgehogs to birds, invertebrates and fruits. These vegetated field boundaries, which in today's Ireland, largely define the borders of grass fields grazed by livestock, act as a substitute for scrub and woodland in otherwise relatively monoculture landscapes. They provide important habitat for a range of bird species both for nesting and feeding. Hedgerows, especially older ones, contain a diverse variety of plants which in turn produce a diversity of berries, seeds and nuts, many of which are a direct food source for birds. Hedgerows also support a diverse range and abundance of invertebrates – an important source of food for many bird species, including those normally granivorous species (finches and buntings) which need a ready supply of invertebrates to feed developing young during the breeding season. The complete removal of hedgerows or the cutting back of the foliage and branches during the breeding period, depletes the availability of these foods and can directly destroy nests of many species within the hedgerows. The Yellowhammer, a red-listed species which has declined and contracted in range significantly in the last fifty years, and whose nesting behaviour extends well into August, would be particularly vulnerable to ill-timed hedgerow management activities. Therefore the conservation of Ireland's hedgerows and their management, underpinned by appropriate legislation and agri-environment schemes is integral to the conservation of many of Ireland's countryside bird populations.

The practice of burning heather in upland areas to encourage new growth for sheep grazing, can have an impact on ground nesting birds such as Meadow Pipit, Skylark and Stonechat, especially if carried out during or close to the breeding season. Also, in cases where large areas are left bare through burning (rather than a patchwork of "islands" of vegetation being left unburnt), whole hillsides may be devoid of nesting habitat for several years. Despite legislation i.e. Wildlife Act (Section 40 of the Wildlife Act 1976, as amended by Section 46 of the Wildlife (Amendment) Act 2000) prohibiting burning of vegetation on land between March 1st and August 31st, illegal burning is still carried out during the main nesting period for upland birds, with little research carried out in Ireland to assess its impact on ground nesting passerines.

Commercial afforestation has traditionally comprised of mainly non-native coniferous tree species such as Sitka spruce and Lodgepole pine in Ireland. Although the spread of such afforestation has been beneficial to a handful of bird species, including Goldcrest, Siskin and Redpoll, it has resulted in the loss of tracts of other habitats, particularly grasslands and peatlands, which in turn has likely to have contributed to the recorded declines in Meadow Pipit and Skylark breeding populations.

In Ireland, turbary and mechanical cutting have resulted in a 47% loss of peatland habitats. As well as turf cutting peatland habitat has been lost to forestry, overgrazing and agricultural reclamation, all reflected by the decline in birds associated with peatland habitats (Malone & O'Connell, 2009).

Declines recorded in two aerial feeders – namely Sand Martin and Swift – may be related to the aforementioned decline in the abundance of airborne insects. However, the downward trend in Swift numbers over recent decades may at least partly be attributed to the loss of available nest sites, particularly cavities in old buildings which have undergone renovation or demolition. The high fidelity of Swift to previously used nest sites means that the Swift is slow to colonise new ones, when existing sites are destroyed. Appropriately positioned nest boxes, with playback devices broadcasting Swift calls

installed close by, have been successful in starting new colonies or expanding existing ones in several locations across the country. The general public's interest in erecting Swift nest boxes is growing and this development may help slow down or reverse the species' decline in time. BirdWatch Ireland have been gathering information on Swift numbers and their distribution through citizen science projects since 2014. Documenting nest sites has been useful in identifying important large colonies, where recommendations for their preservation can be made, while projects that empower local communities to take ownership and responsibility of their local Swift populations has had great success to date.

Birds are key indicators of the health of our environment. However, it is clear that there are significant pressures and threats facing Ireland's common and widespread bird populations and many challenges lie ahead not least climate change. Having a robust method to track our common and widespread breeding bird species is needed now more than ever. CBS is well placed to continue to provide the necessary evidence base to inform the conservation of Ireland's countryside bird species.

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Appendix 1

List of CBS participants 1998 – 2017 (with sincere apologies for any inadvertent omissions).

Joe Adamson, Peter Anderson, Eugene Archer, Tina Aughney, Craig Ayres, Tony Baldock, Enda Bannon, Marie Bartlett, Penny Bartlett, Colin Barton, H. Baumann, Myrna Beardsworth, Michael Bell, Jenny Benito, Bernadette Bergin, Dominic Berridge, Simon Berrow, Eddie Berry, Tony Berry, Sinead Biggane, Brendan Black, David Bluck, Helen Boland, Hans Bomhoff, Richard Bono, Heather Bothwell, Neil Bourke, Fintan Bracken, Fran Brady, Marion Brady, Dermot Breen, Sean Breen, John Breen, Martin Brennan, Niall Brennan, Derek Brennan, Bro Angelo, Thomas Broe, Anthony Brogan, Leo Brogan, Maurice Bryan, Noel Bugler, Patsy Burke, Eileen Burke, Paul Burke-Kennedy, Tim Burkitt, Roger Bushell, Marian Bushell, Andrew Butler, Jim Byrne, Paul Byrne, Brian Caffrey, Sue Callaghan, Greg Campbell, Richard Cannon, Susan Carmody, Bruce Carrick, John Carroll, Terry Carruthers, Alison Carter, Edward Carty, Helen Carty, Catherine Casey, Stephen Casey, Ciaran Casey, May Cashman, Noel Cassidy, Caomhe Cawley, Pat Christie, Simon Clark, Damian Clarke, Amanda Clarke, Tom Clear, Conor Clenaghan, Gerry Clerkin, Cameron Clotworthy, Michael Cobley, David Cole, Kyran Colgan, Kendrew Colhoun, Bríd Colhoun, Kevin Collins, Jane Coman, Padraig Comerford, Declan Coney, Elerina Conneelly, Naoimh Conneely, Patrick Conneely, Eoin Connelly, Caroline Connolly, Alan Connolly, Maurice Connolly, Paddy Connors, Jimmy Conroy, Dick Coombes, Alison Cooper, Alex Copland, Ilse Corkery, William Cormacan, Sean Corry, Paudie Cosgrove, Joe Costelloe, John Coveney, Donal Coveney, Phil Cox, Peter Craven, Michael Creegan, Peter Crisp, John Cromie, Jerry Cronin, Ciaran Cronin, Christine Croton, Olivia Crowe, Miriam Crowley, Sekeeta Crowley, Seamus Cuddy, Teresa Culhane, Seamus Culhane, Denis Cullen, Majella Cullen, Tony Culley, Maura Culligan, Sinéad Cummins, Kieran Cunnane, Breda Curran, Donna Curtin, Ignatius Cusack, John Cusack, Barry Dalby, Gregory Daly, Clive Darling, John Davis, Mike Davis, Michael Davis, Mark Davis, Claire Deasy, John Deasy, Hugh Delaney, Eamonn Delaney, Pat Dempsey, Edward Denniston, John Mark Dick, Ethna Diver, Terry Doherty, Anita Donaghy, Joe Doolan, Eamonn Doran, Paul Dowding, Pascal Dower, Margaret Doweth, Frank Doyle, Hazel Doyle, Susan Doyle, Pauline Doyle, Gene Draper, Nick Duff, Richard Duff, Brian Duffy, Dave Duggan, Graham Duncan, Teresa Dunne, Rosaline Dunphy, Pat Durkin, Mary Durkin, Tommy Durkin, Jamie Durrant, Kieran Dwane, Bridget Dwyer, Richard Dwyer, Maurice Eakin, Martin Egan, Pat Egan, Siobhan Egan, Ciaran Egan, Jamie Ellis, John Emmett, Liam English, Martin Enright, Seamus Enright, Norman Evans, Dave Fabby, Finbar Fagan, Peter Fagan, Liz Fahey, Patrick Fanning, Frances Farrell, Fiona Farrell, Shane Farrell, Rory Feeney, Seamus Feeney, Caitriona Fenton, John Fingleton, Catherine Fingleton, Des Finnamore, Triona Finnen, Cathy Fisher, Therese Fitzgerald, Mary Fitzgerald, Billy Fitzpatrick, Tom Flanagan, Noel Flanagan, Pat Flemming, Leonard Floyd, Ciara Flynn, Maeve Flynn, Orla Flynn, Billy Flynn, Owen Foley, Marie Foley, Pat Foley, Ciaran Foley, Joe Foley, Aidan Foley, Sarah Jane Fortune, Denise Foulkes, Jim Fox, John Fox, Eddie Foyle, Stephen Franck, Kathryn Freeman, Patricia Fuentes, Janice Fuller, Debbie Gaffney, Tara Gallagher, Joanne Gallagher, Colin Gallagher, Paul Galvin, Rory Gardner, Emmet Gavin, Emer Giddy, Girion Girion, Emma Glanville, Adrian Glasgow, Andrew Glenn-Craigie, Michael Glynn, Pauline Goggin, Ruairi Goodwin, Ruairi Goodwin, Tim Gordon, Jo Gordon, T. Gordon, Jackie Gorman, Brian Gormley, Brian Gormley, Kieran Grace, Patrick Graham, Nick Gray, Elena Green, Jim Greene, Roger Greene, Tim Griffin, Michael Gunn, John Guthrie, Josephine Guthrie, Thomas Gyorffy, D. Haisley, Lesley Hambrook, Billy Hamilton, John Hand, Hugh Hanley, Josephine Hanley, Vincent Hanlon, Cathryn Hannon, Gordon Hardwicke, Michael Harkin, Niall Harmey, Yvonne Harrington, Seamus Hassett, Niall Hatch, Don Healy, Michele Healy, Clare Heardman, Stephen Heery, Luke Heffernan, John Hehir, Joe Henry, Fergal Henry, Paul Higgins, Gerry Higgins, John Higgins, Iain Hill, Gary Hill, Kathleen Hinde, Mike Hirst, Dan Hogan, Sean Hogan, Mick Hogan, Staphanie Holstead, Chris Honan, Joe Hopkins, Chris Houlihan, Mairin Hughes, Jackie Hunt, Geoff Hunt, Trevor Hunter, Caroline Hurley, Trish Hyde, John Hynes, Robert Imbush, Brendan Ingoldsby, Justin Ivory, Gearoid Jackson, Margaret Jackson, Jack James, Graham Johnston, Stefan Jones, James Kapalo, Padraig Kavanagh, Joe Kavanagh, Laura Kavanagh, Tom Kealy, Paula Kearney, Paul Keating, Elaine Keegan, Karen Keegan, Padraig Keirns, Niamh Kellaghan, Katherine Kelleher, Joe & Annette Kelly, Aidan G. Kelly, Sean Kelly, Kilian Kelly, Caroline Kelly, John Kennedy, Henry Kenny, Fridolin Kerr, Antoin Kiely, Michael Killeen, James Kilroy, Austin Kinsella, Ken Kinsella, Nancy Klein, Peter Kysela, Andrew Lambe, Olivia Lardner, Jim Lawlor, Niall Leahy, Ruth-Ann Leak, Suzanne Ledwith, Larry Lenehan, Noel Lenehan, Joe Lennon, Lesley Lewis, Michael Lewis, Ita Logan, John Lovatt, John Lusby, Rob Lynch, Annette Lynch, Aine Lynch, Tom Lynch, Liam Lysaght, Carmel Mackey, Kay Macklin, Coilin MacLochlainn, Emer Magee, Rosie

Magee, John Maher, Mary Mahony, Seamus Mallon, Colm Malone, Declan Manley, Ruth Mann, Wendy Martin, Breffni Martin, Paddy Martin, Angela Mason, Albert Mason, Seamus Masterson, John Matthews, John McAdam, Louise McAlavery, Kate McAney, Deirdre McAvinchey, Brigid McCabe, Nicholas McCabe, Peter McCarron, Flor McCarthy, Kathleen McCormick, Mark McCorry, Larry McDaid, Lee McDaid, Michael McDonagh, Cathy S McDonald, Rosemarie McDonald, Caroline McDonald, Sinead McDonnell, Seamus McDonough, Paul McFadden, Ger McGann, John McGillicuddy, Seamus McGinty, Bernie McGrath, Eoin McGreal, Brendan McGuigan, Congella McGuire, Becky McIndoe, Barbara McInerney, David McKay, Andrew McKeever, Rodney McKenna, Elizabeth McKenna, John McKenna, Hugh McLindon, Barry McMahon, Frank McMahon, Jim McNally, Brian McNamara, David McNamara, Roger McNaughton, Josephine McNern, Peter McQuillan, Berna McQuillan, Anna McWilliam, John Meade, Stephen Meaney, Tony Mee, Allan Mee, Oscar Merne, Cian Merne, Brian Meskell, Eamon Meskill, Robbie Miller, Les Milne, John Milroy, Nicholas Mitchell, Richard Moles, Sandra Molloy, Martin Moloney, Daniel Moloney, Jason Monaghan, Jim Moore, Mark Moore, Des Moore, Peadar Morgan, Tim Morgan, Megan Morris, Doreen Morrison, Bea Moya, Pat Mulhern, Michael Murphy, Declan Murphy, Pat Murphy, Brendan Murphy, Caroline Murphy, Kevin Murphy, Jacintha Murphy, Sandra Murphy, Pat Murphy, Evelyn Murray, Tony Murray, Georgia Murray, Gerard Murray, Mieke Muyllaert, Tony Nagle, Rev David Nesbitt, Daniel Neville, Willie Newe, Aine Ni Shuilleabhain, Róisín Nigfhloinn, Des Nolan, Jane Nolan, Albert Nolan, Jim Noonan, Maura Noonan, Michael Noonan, Gabriel Noonan, Mark Norris, Kevin Nunan, Laura Nuttall, John O'Boyle, Seamus O'Brien, Margaret O'Brien, Irene O'Brien, Philip O'Carroll, Séamus Ó'Ciarduáin, Michael O'Clery, Micheal O'Coileain, Dan O'Connell, Sr Mary O'Connell, Laurence O'Connell, Kevin O'Connell, Peadar O'Connell, Jack O'Connell, Michael O'Connell, Brendan O'Connor, Brian O'Connor, Charlie O'Connor, Fergal O'Connor, Kate-Marie O'Connor, Daire O'Criodain, Aonghus O'Donaill, Padraig O'Donnell, Mick O'Donnell, Declan O'Donnell, Ger O'Donnell, John O'Donnell, Tim O'Donoghue, Seamus O'Donoghue, Padraigin O'Donoghue, Barry O'Donoghue, Susan O'Donohoe, Joan O'Faherty, Sean O'Farrell, John O'Flaherty, Eanna O'Flynn, Neil O'Gorman, Maree O'Gorman, Rosemary O'Gorman, Richard O'Gorman, Olivia O'Gorman, John O'Halloran, Donna O'Halloran, William O'Halloran, Tim O'Hara, Jane O'Hara, Michael O'Keefe, Daniel O'Keefe, Jean O'Keefe, Ciaran O'Keeffe, Denis O'Mahony, Ciara O'Mahony, Dermot O'Mahony, Elaine O'Malley, Nuala O'Malley, Stephen O'Malley, Niall O'Muiri, Charlie O'Neill, Michelle O'Neill, Claire O'Nolan, Ger O'Regan, Michelle O'Regan, Niall O'Reilly, Stephen O'Shea, Christian Osthoff, Oran O'Sullivan, Paddy O'Sullivan, Michael O'Sullivan, Michael O'Sullivan, Dennis O'Sullivan, John Palmer, John Parkin, Jordan Patton, James Pembroke, Chris Peppiatt, Ben Phalan, Peter Phillips, George Phipps, Daphne Pochin Mould, Claire Pollock, Brian Porter, Gerry Power, Andrew Power, Frank Prendergast, Paula Prendergast, Robin Price, Bob Price-Adams, Vanessa Price-Adams, Aileen Prole, Paul Proudfoot, Michael Purser, Pat Pykett, Paddy Quinn, John Quinn, Jessica Quinn, Noel Raftery, Christopher Ramsey, Ted Rearden, Mark Reed, David Rees, Moya Reid, Michael Reilly, Peadar Reynolds, Mary Riordan, A. Robb, Tony Roche, Marie Rochford, Tim Roderick, Ger Rogan, Brendan Rooney, Hugh Rothwell, Stuart Roy, Denis Ryan, Michael Ryan, Pearse Ryan, Donal Scannell, Franz Scholand, Sol Schvartzman, Lorcan Scott, James Scully, Eoin Scully, Catherine Seale, Joe Shannon, Neil Sharkey, Bob Sharpe, Jim Sheehan, Hugh Shepherd, Ralph Sheppard, Paddy Sheridan, Caroline Shiel, Mark Shorten, Pat Smiddy, Sean Smith, Moray Souter, Andrew Speer, Sarah Stapleton, Robert Steed, Ray Stephens, Michael Stinson, Jane Stokes, Bob Strickland, Philip Strickland, Wendy Stringer, Neil Stronach, Denis Strong, Clodagh Studdert, Dave Suddaby, Eva Sweeney, Eugene Sweeney, Eoin Sweetman, Mary Talbot, Malcolm Tanner, Tom Tarpey, Rebecca Teesdale, Marianne Ten Cate-Whilde, Kate Thompson, Roy Thompson, Niall Tierney, David Tierney, David Toohey, Peter Towe, Yvonne Traynor, Maura Turner, Frank Turpin, Aine Ui Dhubhshlaine, Julie Vangendt, Pat Vaughan, Bart Venneman, Yvette von Cramon, Brendan Wall, Marita Wall, Eugene Wallace, Paul Walsh, Alyn Walsh, Cathy Walsh, David Walsh, Philip Walton, Graham Webb, Andrea Webb, Gill Weyman, Bill Wheel, Rob Wheeldon, Gerry Wheeler, Ricky Whelan, Janet Whelehan, Tristam Whyte, Gareth Williams, Ray Wills, Chris Wilson, Faith Wilson, Fran Wolstenholme, Will Woodrow, Jerry Wray, Michael Wright, Mick Wright, Piotr Wrobel.

Appendix 2

Summary data for species recorded in 30 squares or more during CBS 1998 – 2016. This shows the mean number of squares that each species was recorded in (proportion in brackets), the mean annual change (%) in numbers, and the population trends over the time periods 2006-2016 and 1998-2016. Significant mean annual change values are represented by ** highly significance ($p<0.01$) and * moderate significance ($p<0.05$).

Species	Scientific name	Mean number squares (%)	Mean Annual Change (%)	Trend 06-16 (%)	Trend 98-16 (%)
Mallard	*Anas platyrhynchos*	89 (29.2)	1.32**	14.0	26.7
Pheasant	*Phasianus colchicus*	241 (79.4)	1.59**	17.1	32.8
Grey Heron	*Ardea cinerea*	60 (19.8)	-2.23**	-20.2	-33.4
Sparrowhawk	*Accipiter nisus*	30 (10)	-0.66	-6.4	-11.2
Kestrel	*Falco tinnunculus*	37 (12.2)	-3.26**	-28.2	-44.9
Moorhen	*Gallinula chloropus*	36 (11.9)	-0.2	-2.0	-3.5
Feral Pigeon	*Columba livia*	37 (12)	1.99*	21.8	42.6
Stock Dove	*Columba oenas*	30 (10)	-4.76**	-38.6	-58.4
Woodpigeon	*Columba palumbus*	271 (89.4)	1.78**	19.3	37.4
Collared Dove	*Streptopelia decaocto*	65 (21.5)	4.55**	56.0	122.8
Cuckoo	*Cuculus canorus*	74 (24.4)	0.96*	10.0	18.8
Swift	*Apus apus*	37 (12.2)	-4.67**	-38.0	-57.7
Magpie	*Pica pica*	253 (83.5)	-1.07**	-10.2	-17.6
Jackdaw	*Corvus monedula*	227 (74.7)	1.77**	19.2	37.1
Rook	*Corvus frugilegus*	246 (81.2)	0.41	4.2	7.6
Hooded Crow	*Corvus corone cornix*	242 (79.9)	1.97**	21.5	42.1
Raven	*Corvus corax*	70 (22.8)	-0.75	-7.3	-12.7
Goldcrest	*Regulus regulus*	154 (50.6)	-0.26	-2.6	-4.6
Blue Tit	*Cyanistes caeruleus*	243 (80)	0.68**	7.0	13.0
Great Tit	*Parus major*	223 (73.4)	2.88**	32.8	66.7
Coal Tit	*Periparus ater*	179 (59.1)	1.48**	15.8	30.3
Skylark	*Alauda arvensis*	124 (40.8)	-1.12**	-10.7	-18.4
Sand Martin	*Riparia riparia*	33 (10.9)	-1.93	-17.7	-29.6
Swallow	*Hirundo rustica*	271 (89.4)	-0.08	-0.8	-1.4
House Martin	*Delichon urbicum*	94 (31)	2.03**	22.3	43.6
Long-tailed Tit	*Aegithalos caudatus*	52 (17.2)	-0.12	-1.2	-2.1
Chiffchaff	*Phylloscopus collybita*	138 (45.6)	4.21**	51.0	110.1
Willow Warbler	*Phylloscopus trochilus*	223 (73.6)	3.78**	44.9	95.0
Blackcap	*Sylvia atricapilla*	116 (38)	17.38**	396.5	1689.3
Whitethroat	*Sylvia communis*	67 (22.1)	2.01**	22.0	43.1
Grasshopper Warbler	*Locustella naevia*	38 (12.6)	0.94	9.8	18.3
Sedge Warbler	*Acrocephalus schoenobaenus*	66 (21.9)	0.64	6.6	12.2
Treecreeper	*Certhia familiaris*	23 (8)	1.65	17.8	34.3
Wren	*Troglodytes troglodytes*	293 (96.5)	0.6**	6.2	11.4
Starling	*Sturnus vulgaris*	220 (72.5)	-0.41	-4.0	-7.1

Species	Scientific name	Mean number squares (%)	Mean Annual Change (%)	Trend 06-16 (%)	Trend 98-16 (%)
Blackbird	*Turdus merula*	284 (93.6)	0.94**	9.8	18.3
Song Thrush	*Turdus philomelos*	259 (85.3)	-0.4	-3.9	-7.0
Mistle Thrush	*Turdus viscivorus*	134 (44.3)	-1.03**	-9.8	-17.0
Spotted Flycatcher	*Muscicapa striata*	27 (9)	-1.66	-15.4	-26.0
Robin	*Erithacus rubecula*	284 (93.6)	-0.9**	-8.6	-15.0
Stonechat	*Saxicola torquatus*	64 (20.9)	-2.71**	-24.0	-39.0
Wheatear	*Oenanthe oenanthe*	31 (10.1)	0.04	0.4	0.7
Dunnock	*Prunella modularis*	229 (75.6)	1.29**	13.7	26.0
House Sparrow	*Passer domesticus*	150 (49.5)	3.39**	39.6	82.2
Grey Wagtail	*Motacilla cinerea*	37 (12.1)	-6.07**	-46.5	-67.6
Pied Wagtail	*Motacilla alba*	156 (51.3)	2.1**	23.1	45.4
Meadow Pipit	*Anthus pratensis*	177 (58.3)	-1.31**	-12.4	-21.1
Chaffinch	*Fringilla coelebs*	279 (92)	1.89**	20.6	40.1
Greenfinch	*Chloris chloris*	165 (54.4)	-4.19**	-34.8	-53.7
Goldfinch	*Carduelis carduelis*	146 (48.2)	6.57**	89.0	214.4
Linnet	*Linaria cannabina*	126 (41.5)	0.31	3.1	5.7
Redpoll	*Acanthis flammea*	61 (20.1)	5.13**	64.9	146.1
Bullfinch	*Pyrrhula pyrrhula*	139 (45.8)	3.49**	40.9	85.4
Yellowhammer	*Emberiza citrinella*	76 (25.2)	0.24	2.4	4.4
Reed Bunting	*Emberiza schoeniclus*	90 (29.6)	1.04*	10.9	20.5