

Index of Abundance for Scottish Terrestrial Breeding Birds, 1994 to 2017

An Official Statistics Publication for Scotland

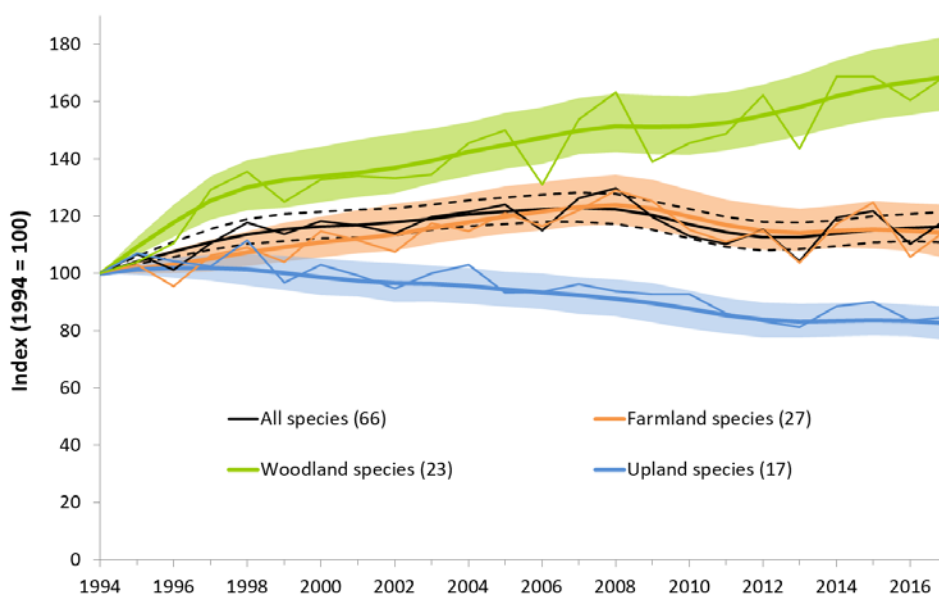
Scotland's terrestrial breeding birds occupy a wide range of habitats including urban areas and wetlands, but most species are associated with one or more of the dominant landscapes of farmland, upland and woodland. Some are found in one particular habitat, for example goldcrest is a typical woodland bird. Others use a wider range of habitats, such as meadow pipit which can be found in farmland and upland, or song thrush which uses both woodland and farmland. Bird populations can respond relatively quickly to drivers such as changes in habitat extent or condition through changes in breeding success, survival or dispersal. Since birds are well surveyed through volunteer-based and professional surveys, and many are widespread and abundant, they are often used as indicators of environmental change.

Evidence

In Scotland, annual monitoring of terrestrial breeding birds is achieved primarily through the Breeding Bird Survey (BBS). Randomly located 1km survey squares are visited by volunteers twice in each breeding season (April to July). These squares are intended to be representative of Scotland's habitats including farmland, woodland and upland. Ten of the 66 species are assessed using targeted surveys, as they are either too scarce for reliable abundance estimation by the BBS or are better monitored by specialised surveys.

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Thick and thin lines are smoothed and unsmoothed trends, respectively. Dashed lines (for all species trend) and shaded areas (for habitat specific trends) illustrate 95% confidence intervals.



Assessment

Since the start of the time series in 1994 to the most recent estimate in 2017:

- Of the 66 bird species, 40 increased, 24 declined, and 2 were stable.
- The all-species (smoothed) index increased steadily up to the mid-2000s, subsequently fluctuating between 12% and 23% above the 1994 index value. It is currently 16% higher than in 1994.
- The smoothed woodland bird index increased significantly, by 69%;
- The smoothed farmland bird index increased steadily up to the late-2000s, peaking at 23% above the 1994 index value. It is currently 14% higher than in 1994;
- The smoothed upland bird index decreased significantly by 17%;
- The unsmoothed data show that, between 2016 and 2017 (the short-term change), the all-species index increased by 8%, the farmland bird index increased by 9% and the woodland bird index increased by 5%. The upland bird index was stable.

All species change (2016 – 17)	Increased
All species change (1994 – 17)	Increased

Commentary

Since 1994 the smoothed all-species index steadily increased, peaking in 2007 then becoming more variable after this time. In 2017 it was 16% above the baseline and 8% below the 2007 figure. Between 2016 and 2017 the all-species, farmland and woodland indicators all increased significantly. No significant change was detected in the upland indicator.

In this commentary, 'long-term' refers to the period from 1994 to 2017 while 'short-term' refers to changes between 2016 and 2017. Longer-term changes since the 1970s, analogous to those reported for the UK (e.g. DEFRA 2018; Harris *et al.* 2018) are not available for Scotland due to low monitoring coverage prior to the start of the BBS in 1994. The main drivers of population change are often unclear, but information is provided, where available, which may help to explain some of the likely causes. Breeding bird populations in Scotland are, as elsewhere, affected by conditions in all parts of their range, in the non-breeding as well as the breeding season. For example, a summer migrant to Scotland may be affected by conditions in Scotland, along its migration route, and/or on its wintering grounds. Long-term and short-term changes for individual species are assessed using unsmoothed trends. Due to annual variability in the individual species trends, populations are considered to have increased or decreased only when the change is at least 5%. Individual species trends are shown in Table 1.

A further 46 terrestrial species regularly breed in Scotland but are too scarce to be monitored by the BBS effectively and are not covered by species-specific surveys. Among these species are several woodland, farmland and upland specialists of current conservation concern (Eaton *et al.* 2015) such as wood warbler, spotted flycatcher and whinchat.

Woodland Birds

Over the long-term woodland birds have increased more than those in other groups. All but four of the twenty-three species included in the woodland indicator have increased since 1994. The biggest increases, of over 300%, are for chiffchaff, great spotted woodpecker and blackcap. Most woodpecker species have been increasing across their ranges in Europe, a change thought to be associated with forest expansion and/or increased connectivity (Gil-Tena *et al.* 2013). Blackcap have shown a more rapid increase in Scotland indicated by BBS which suggests that climatic warming may be allowing this species to extend its range northwards (Hewson *et al.* 2007). Between 1995 and 2015 woodland cover in Scotland increased by 12% from 1.28 to 1.43 million hectares (Forestry Commission 2015). A further nine species have increased in abundance by over 50% (bullfinch, wren, lesser redpoll, tree pipit, willow warbler, song thrush, great tit, treecreeper, and goldcrest). The biggest long-term decrease is for capercaillie. There were no declines of greater than 10% for any other woodland bird populations. Some woodland species, such as pied and spotted flycatcher, redstart, wood warbler and nuthatch, are currently not encountered often enough in the BBS squares to contribute to the woodland indicator. However, due to increasing numbers of BBS squares, we are now able to calculate five or ten year trends for species such as spotted flycatcher and jay. It should therefore be possible to include some of these species in the indicator in the future. The 2007-11 Bird Atlas (Balmer *et al.* 2013) showed that fortunes for these species are mixed, with trans-Saharan migrants such as pied flycatcher, spotted flycatcher and redstart in decline while nuthatch and jay (both resident species) have increased.

In line with the increasing long-term trend of this group, the woodland indicator increased significantly, by 5% between 2016 and 2017. The largest short-term decreases (more than 10%) were for mistle thrush and siskin. Short-term increases of more than 10% were experienced by lesser redpoll, bullfinch, chiffchaff, goldcrest, tree pipit, willow warbler, song thrush and great spotted woodpecker. The increase for bullfinch followed last year's decline, but three successive years of increases before that, and in 2017 it was 163% more abundant than in 1994. Some inter-annual variation is inevitable, particularly for short-lived species, so this needs to be viewed in the context of longer-term change.

Interpretation of short-term changes can sometimes be aided by looking at information collected by other types of bird monitoring. In addition to the Breeding Bird Survey, some volunteers contribute to other BTO monitoring schemes, for example bird ringing at 'Constant Effort Sites' (CES) and the Nest Record Scheme (NRS). The CES scheme monitors the abundance, breeding success and survival of 24 common breeding songbirds. Changes in the total number of adults caught provides a measure of changing population size, whilst the ratio of juveniles to adults captured provides an index of breeding success. Recaptures of adult birds ringed in previous years are used to estimate annual survival rates. The NRS is the main source of information on breeding productivity of most UK birds. CES and NRS data suggest that 2016 was another poor breeding season, although patterns vary between regions

(Walker and Barimore 2018). Although there were some exceptions, overwinter survival between 2016 and 2017 was lower than average, particularly for woodland migrants such as garden warbler and common residents such as wren, robin, dunnock and chaffinch.

Farmland Birds

Overall there has been a long-term increase among the species which contribute to the farmland bird indicator. The greatest long-term increases have been for goldfinch, whitethroat, and great tit, all of which are more than twice as abundant as in 1994. Song thrush, magpie and corncrake have also increased by more than 50%. There have been some substantial long-term decreases in other farmland birds, however, including declines of more than 50% for kestrel, greenfinch and lapwing. Some farmland species such as grey partridge, corn bunting and tree sparrow do not contribute to this indicator because of insufficient coverage by the BBS. The 2007-11 Bird Atlas (Balmer *et al.* 2013) suggests long-term declines for the former two species and substantial increases for the latter. Long-term changes in farmland birds have been driven by a range of factors including agricultural intensification, reduced heterogeneity of crop types at the within-farm scale and moves away from spring-sown crops (Donald *et al.* 2001, Bell and Calladine 2017).

Of the 27 species which contribute to the farmland indicator four showed short-term increases of more than 20% between 2016 and 2017 (reed bunting, linnets, goldfinch and especially kestrel, the latter by more than 100%). Three species (greenfinch, rook and swallow) showed marked short-term declines on farmland. Although swallows nationally had good over-winter survival between 2016 and 2017, the 2016 breeding season was not particularly good (Walker and Barimore 2017). Greenfinch showed a marked decline (-28%), mirroring declines all across Europe as a result of the disease trichomoniasis (Lawson *et al.* 2018).

The kestrel population showed a short-term increase (104%) reducing the level of long-term population decline to 68% lower than in 1994. This recent increase is difficult to explain given the relatively low productivity of kestrels in 2016 (Challis *et al.* 2018) but 2017 was a good breeding season for kestrels and adults foraging for larger broods may have been more detectable. Bird populations fluctuate from year to year for many reasons and the long-term decline for kestrel remains cause for concern. Its cause could be related to changes in prey availability (for example declines in farmland passerines, small mammals and macro-invertebrates) and competition with larger avian predators (Hoy *et al.* 2017).

Upland Birds

Seventeen species contribute to the upland bird indicator, and of these ten are in significant long-term decline. These include curlew and dotterel which have declined by 62% and 60% respectively. Research is underway to identify factors impacting on the curlew population, with evidence suggesting interacting effects of land use change and predation (Douglas *et al.* 2014, Franks *et al.* 2017). Cuckoo, raven and red grouse populations have increased the most, all having increased in abundance by more than 50% since 1994. Some other species breeding in the uplands such as whinchat and ring ouzel do not currently contribute to the indicator because of insufficient coverage by the BBS. Both of these species are in long-term decline (Balmer *et al.* 2013, Henderson *et al.* 2014, Wotton *et al.* 2016) potentially impacted by reduced heterogeneity in structure and composition of moorlands and upland pastures (Murray *et al.* 2016, Davies *et al.* 2014). Long term changes in upland bird populations have been driven by a number of factors including climate, forest expansion, changes in grazing and other site based management such as predator control (Buchanan *et al.* 2017).

The largest short-term increases were for red grouse, golden plover, common sandpiper and hooded crow. Golden plover numbers increased between 2016 and 2017. Changes in numbers have been linked to climate change, in part due to impacts on the abundance of craneflies during the breeding season (Pearce-Higgins *et al.* 2005, 2010). Red grouse numbers also increased. Weather conditions during the 2016 breeding season were better than those compared to 2015. Red grouse populations can fluctuate considerably in response to weather conditions (Fletcher *et al.* 2013). Snipe, common sandpiper and skylark also experienced short-term population increases of more than 10%, whereas wheatear, cuckoo, hooded crow and raven declined by more than 10% since the last report.

Birds not specific to any of the habitats

Eight bird species are not included in the habitat-specific trends, either because they do not show a strong association with any of the habitats reported, or because insufficient data were available to calculate a habitat-specific trend. Long-term trends remain as previously reported for most of these species, most notable being the continued decline of swift and an emerging decline in collared dove. In contrast there have been long-term increases for house sparrow, stonechat, grey wagtail and house martin. The long-term decline of swifts may be related to the reduced availability of suitable nesting sites on buildings (Baillie *et al.* 2014), though a reduction in availability of flying insects may also play a role (Hallmann *et al.* 2017).

Source data and updates

Data for 56 of the 66 species come from the Breeding Bird Survey (BBS) run by British Trust for Ornithology (BTO) on behalf of a partnership that also includes the Joint Nature Conservation Committee (JNCC) and Royal Society for the Protection of Birds (RSPB) (view map of BBS sites [in this report](#)).

The data for BBS consist of annual counts made over a period of years at a series of sites. Generalised Linear Models were used to generate trends. To prevent short-term population variability and sampling error having an undue influence, trends were smoothed and long-term trends assessed using techniques recommended by Fewster *et al.* (2000). The smoothed indices were used to assess the significance of long-term changes and the unsmoothed indices were used to assess the significance of short-term changes.

Details of the methods used to calculate the indices are available from <http://www.bto.org/birdtrends2010/methodology.htm>.

Trends for common sandpiper and dipper are derived from the BTO Waterways Bird Survey and the Waterways Breeding Bird Survey. Grey heron trends are derived from the Heronries Census. Trends for seven species (golden eagle, hen harrier, peregrine, dotterel, corncrake, black grouse and capercaillie) are estimated from single-species surveys carried out periodically, during the period 1994 to 2017 as part of the SCARABBS (Statutory Conservation Agency/RSPB Annual Breeding Bird Scheme) programme. A further 46 terrestrial species regularly breed in Scotland (being found in at least 100 10km squares in Bird Atlas 2007-11), but insufficient data are available through current monitoring schemes to permit their inclusion in these indicators.

In Scotland, the production of multi-species indicators is limited to a start date in 1994 as this is when BBS was first implemented, and achieved broad-scale representative coverage of many terrestrial species in Scotland. Changes reported through these indicators therefore exclude any changes that occurred prior to 1994, which based on UK data show marked declines in many farmland and woodland species.

Results for the UK are available from <https://www.gov.uk/government/statistics/wild-bird-populations-in-the-uk>

The index will be next updated in November 2019.

Official Statistics are produced by professionally independent statistical staff in accordance with the Code of Practice for Official Statistics.

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Table 1. Percentage changes in abundance for the Scottish Terrestrial Breeding Birds, 1994-2017 and 2016-2017, species listed in order of overall change 1994 to 2017.

Summarised trends for individual species and their habitat associations from 1994 to 2017, and the most recent year of change. A blank entry denotes that the species did not show a strong association to that habitat, or that insufficient data were available to calculate a habitat-specific trend. Species in grey text are those whose trends are only available from periodic surveys.

Species name	All-habitats		Woodland		Farmland		Upland	
	1994-2017	16-17	1994-2017	16-17	1994-2017	16-17	1994-2017	16-17
Chiffchaff	1007	21	1007	21				
Great Spotted Woodpecker	638	12	638	12				
Blackcap	361	2	339	8				
House Martin	260	33						
Goldfinch	255	22			428	24		
Bullfinch	163	49	163	49				
Whitethroat	133	-2			133	-2		
Stonechat	115	64						
Wren	104	6	104	6				
Magpie	101	21			90	7		
Lesser Redpoll	100	54	100	54				
Reed Bunting	88	45			88	45		
Corncrake	86	-16			86	-16		
Tree Pipit	85	12	85	12				
Goldcrest	79	15	79	15				
Great Tit	65	-3	63	-1	145	13		
Treecreeper	63	-2	63	-2				
Raven	59	-12					59	-12
Willow Warbler	57	13	57	13				
Willow/Red Grouse	57	63					57	63
Song Thrush	53	16	58	13	71	13		
Cuckoo	49	-8	30	1			58	-23
House Sparrow	49	18						
Siskin	43	-14	43	-14				
Snipe	39	14					39	14
Buzzard	38	4	17	9	53	5		
Dunnock	33	3	43	-6	14	3		
Jackdaw	33	12			36	17		
Grey Wagtail	32	66						
Yellowhammer	32	0			32	0		
Blackbird	23	7	12	6	49	15		
Robin	22	-6	29	-9				
Golden Eagle	22	1					22	1
Sedge Warbler	16	11			16	11		
Mistle Thrush	16	-24	16	-24				
Blue Tit	14	2	-4	-9	44	16		
Pied Wagtail	9	10			9	10		

Linnet	9	25			9	25		
Grey Heron	8	14						
Woodpigeon	1	5			2	10		
Hen Harrier	0	-2					0	-2
Mallard	-6	-9						
Carrion Crow	-6	5			-5	-2		
Coal Tit	-8	0	-8	0				
Skylark	-10	10			-11	9	-2	14
Meadow Pipit	-10	-3					-10	-3
Chaffinch	-10	-7	-4	1	-3	0		
Starling	-11	10			16	19		
Swallow	-12	-10			-12	-10		
Golden Plover	-14	50					-14	50
Collared Dove	-14	-20						
Dipper	-15	-4					-15	-4
Peregrine	-18	-1					-18	-1
Common Sandpiper	-32	12					-32	12
Wheatear	-33	-32					-33	-32
Rook	-35	-22			-35	-22		
Oystercatcher	-37	14			-37	14		
Hooded Crow	-47	-13					-47	-13
Capercaillie	-50	-2	-50	-2				
Black Grouse	-55	-3					-55	-3
Lapwing	-57	14			-57	14		
Curlew	-60	4					-60	4
Swift	-61	32						
Dotterel	-62	-5					-62	-5
Greenfinch	-67	-13			-70	-28		
Kestrel	-68	104			-68	104		