

Index of Abundance for Scottish Terrestrial Breeding Birds, 1994 to 2018

An Official Statistics Publication for Scotland

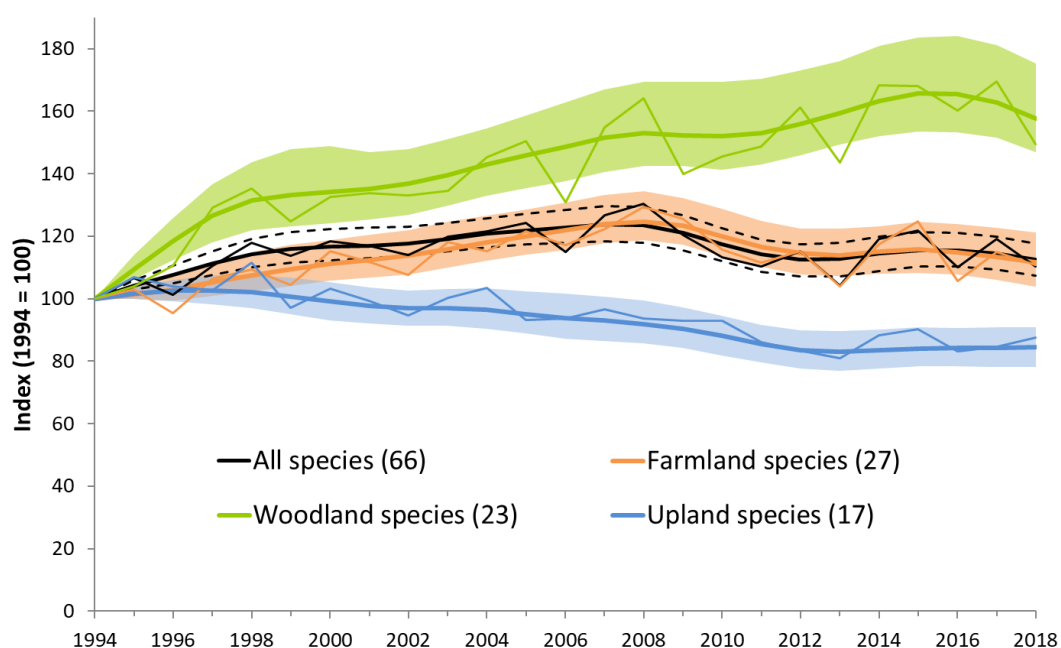
Scotland's terrestrial breeding birds occupy a wide range of habitats including urban areas and wetlands, but most species are associated with one or more of the dominant landscapes of farmland, upland and woodland. Some are found in one particular habitat, for example goldcrest is a typical woodland 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.

Figure 1. Index of Abundance for Scottish Terrestrial Breeding Birds, 1994 to 2018

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 2018:

- Of the 66 bird species, 35 increased, 24 declined, and 7 were stable (i.e. within 5% of 1994 value);
- The all-species (smoothed) index increased steadily up to the mid-2000s, but has subsequently declined to fluctuate between 12% and 17% above the 1994 index value since 2010. It is currently 12% higher than in 1994;
- The smoothed woodland bird index increased significantly, by 58%;
- The smoothed farmland bird index increased steadily up to the late-2000s, peaking at 25% above the 1994 index value. It is currently 12% higher than in 1994;
- The smoothed upland bird index decreased significantly by 15%;
- The unsmoothed data show that, between 2017 and 2018 (the short-term change), the all-species index decreased by 7%, and the woodland bird index decreased by 12%. The farmland and upland bird indices were stable, i.e. have not changed more than 5% since last reported.

All species change (2017 – 18)	Decreased
All species change (1994 – 18)	Increased

Commentary

Since 1994 the smoothed all-species index steadily increased, peaking in 2007 then becoming more variable after this time. In 2018 it was 12% above the baseline and 9% below the peak in 2007. Between 2017 and 2018 the all-species and woodland indicators decreased, whilst the upland and farmland indicators were stable. The decline since 2017 probably has multiple causes but there is evidence that the harsh winter of 2017-18 was a factor.

In this commentary, 'long-term' refers to the period from 1994 to 2018 while 'short-term' refers to changes between 2017 and 2018. Longer-term changes since the 1970s, analogous to those reported for the UK (e.g. DEFRA, 2018; Harris *et al.*, 2019) 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 have generally been 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. Recent increases in BBS coverage in Scotland should allow some of these additional species to be subsequently added to the indicators.

Woodland Birds

Over the long-term woodland bird species increased more than the other groupings. 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. Great tit, bullfinch lesser redpoll and tree pipit have also increased by more than 50%. Cuckoo, which have increased in Scotland by 49%, are declining on the southern edge of their UK range, whilst increasing in Scotland. A recent study by Denerley *et al.* (2018), showed that the core distribution of cuckoos has shifted from south to north within the UK linked to changes with their main food – macro-moths such as garden tiger - climate change and lowland agricultural management. Regional differences in UK cuckoo population trajectories may also be linked to differences in migratory routes (Hewson *et al.*, 2016). Blackcap have shown a more rapid increase in Scotland than in the rest of the UK, which suggests that climatic warming may be allowing this species to extend its range northwards (Hewson *et al.*, 2007). Between 1998 and 2019 woodland cover in Scotland increased by 12% from 1.28 to 1.43 million hectares (Forestry Commission, 2019).

The biggest long-term decrease (-51%) 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 a five-year trend for spotted flycatcher and both a five-year and ten-year trend for jay. It should therefore be possible to include 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 spotted flycatcher, pied flycatcher and redstart in decline while nuthatch and jay (both resident species) have increased.

In contrast to the increasing long-term trend of this group, the woodland indicator declined significantly, by 12% between 2017 and 2018. The largest short-term decreases (more than 30%) were for wren, bullfinch, and goldcrest whilst a number of other resident species such as robin, treecreeper, great spotted woodpecker and lesser redpoll experienced less marked declines of around -20%. Harsh winter weather, such as that experienced late in the 2017-18 winter (the *Beast from the East* in February and March), is known to affect over winter survival for many of our resident birds. Morrison *et al.* (2016) showed that wrens in the north typically have 5% more body mass in the colder north east Scotland compared to the warmer south-west, though even with this adaptation colder temperatures and snow in early spring 2018 still resulted in declines. Interestingly, resident species such as great tit, blue tit and coal tit seemed unaffected, potentially benefitting from garden feeding or food caching. Most woodland migrants also experienced a bad year, with numbers of relatively early-arriving species such as chiffchaff, willow warbler and tree pipit down by -16% or more in 2018. This could be attributed to mortality in early 2018, poor conditions on their wintering grounds, or the negative impact of the unusually warm and dry summer of 2017, known to influence species such as willow warbler (Calladine *et al.*, 2019). Only cuckoo bucked the trend, increasing by 15% or more in all habitats.

Farmland Birds

Overall there has been a long-term increase among the species trends which contribute to the farmland bird indicator. The greatest long-term increases have been for goldfinch (+331%) and great tit (+147%), both of which are more than twice as abundant as in 1994. Corncrake, magpie, whitethroat, reed bunting, buzzard and jackdaw populations on farmland have also increased between 50-100%. There have been some substantial long-term decreases in other farmland birds, however, including declines of more than 50% for

greenfinch, kestrel, and lapwing, and between 25-50% declines in oystercatcher, rook and pied wagtail. 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 in Scotland. 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 kestrel, jackdaw, woodpigeon and carrion crow increased between 10% and 14% between 2017 and 2018. Greenfinches on farmland showed at least temporary signs of recovery (9% increase) since last year's severe decline but numbers are markedly down due to the effects of the disease trichomoniasis (Lawson *et al.*, 2018). Pied wagtail had the largest decrease (-33%) and another two (dunnock and whitethroat) had decreases of more than -20% on farmland since the last update. Species such as reed bunting and yellowhammer, which are largely dependent on winter seed availability, seem to be less affected by the colder weather in early 2018.

Upland Birds

Seventeen species contribute to the upland bird indicator, and of these nine are in significant long-term decline. Five species (dotterel, curlew, black grouse, hooded crow and common sandpiper) have declined by more than 50%. 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). Raven and cuckoo populations have increased the most, by more than 130% since 1994 but four other species (red grouse, snipe, golden eagle and skylark) are also increasing. 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 change, 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 raven (+60%) and cuckoo (+44%), contributing to their longer-term increases across Scotland. Golden plover, skylark and wheatear also experienced short-term population increases of more than 10%, whereas common sandpiper and hooded crow declined by more than 25% and 10% respectively since the last report. Many waders had arrived on territory when the cold weather in early spring 2018 arrived, but there was little detected impact on subsequent breeding numbers. Changes in numbers of golden plover 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).

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. The long-term decline of swifts may be related to the reduced availability of suitable nesting sites on buildings (Woodward *et al.*, 2018), though a reduction in availability of flying insects may

also play a role (Hallmann *et al.*, 2017). In contrast there have been long-term increases for house sparrow, stonechat, and house martin, although the latter two species, and grey wagtail, showed significant declines between 2017 and 2018. Grey Herons are known to be strongly affected by cold winters (North, 1979; Marquiss, 1989) and breeding numbers fell markedly, by 34% since the last update.

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 2018 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 2020.

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

References

- Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. & Fuller, R.J. 2013. *Bird Atlas 2007-11: the breeding and wintering birds of Britain and Ireland*. Thetford, BTO Books.
- Bell, M.V. & Calladine, J. 2017. The Decline of a Population of Farmland Breeding Waders: a twenty-five year case study. *Bird Study*, 64, 264-273.
- Buchanan, G.M., Pearce-Higgins, J.W., Douglas, D.J.T. & Grant, M.C. 2017. Quantifying the importance of multi-scale management and environmental variables on moorland bird abundance. *Ibis*, 159, 744-756.
- Calladine, J., Jarrett, D. & Wilson, M. 2019. Breeding bird assemblages supported by developing upland shrub woodland are influenced by micro-climate and habitat structure. *Bird Study*, 66, 178-186.
- Davies, J., Arthur, D. & White S. 2014. Effects of variation in breeding habitat on Ring Ouzel *Turdus torquatus* productivity and chick condition. *Bird Study*, 61, 162-170.
- Department for Environment, Food and Rural Affairs, 2018. Wild bird populations in the UK, 1970 to 2017: Annual statistical release. Defra National Statistics, London.
<https://www.gov.uk/government/statistics/wild-bird-populations-in-the-uk>
- Denerley, C., Redpath, S.M., van der Wal, R. *et al.* 2018. Breeding ground correlates of the distribution and decline of the Common Cuckoo *Cuculus canorus* at two spatial scales. *Ibis*, 161, 346-358.
- Donald, P.F., Green, R.E. & Heath, M.F. 2001. Agricultural intensification and the collapse of Europe's farmland bird populations. *Proceedings of the Royal Society B: Biological Sciences*, 268, 25-29.
- Douglas, D.J.T., Bellamy, P.E., Stephen, L.S. *et al.* 2014. Upland land use predicts population decline in a globally near-threatened wader. *Journal of Applied Ecology*, 51, 194-203.
- Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. & Gregory, R. 2015. Birds of Conservation Concern: the population status of birds in the UK, Channel Islands and Isle of Man. *British Birds*, 108, 708-746.
- Fewster, R.M., Buckland, S.T., Siriwardena, G.M., Baillie, S.R. & Wilson, J.D. 2000. Analysis of population trends for farmland birds using generalized additive models. *Ecology*, 81, 1970-1984.
- Forestry Commission, 2019. Forestry Statistics 2019. Forest Research, Edinburgh.
- Franks, S.E., Douglas, D.J.T., Gillings, S. & Pearce-Higgins, J.W. 2017. Environmental correlates of breeding abundance and population change of Eurasian Curlew *Numenius arquata* in Britain. *Bird Study*, 64, 393-409 <https://doi.org/10.1080/00063657.2017.1359233>
- Hallmann, C. A., Sorg, M., Jongejans, E., Siepel, H., Hofland, N., Schwan, H. *et al.* 2017. More than 75 percent decline over 27 years in total flying insect biomass in protected areas. *PLoS ONE*, 12(10): e0185809. <https://doi.org/10.1371/journal.pone.0185809>

Harris, S.J., Massimino, D., Eaton, M.A., Gillings, S., Noble, D.G., Balmer, D.E., Pearce-Higgins, J.W. & Woodcock, P. 2019. The Breeding Bird Survey 2018. BTO Research Report 717. British Trust for Ornithology, Thetford.

Henderson, I., Calladine, J., Massimino, D., Taylor, J. & Gillings, S. 2014. Evidence for contrasting causes of population change in two closely related, sympatric breeding species the Whinchat *Saxicola rubetra* and Stonechat *Saxicola torquata* in Britain. *Bird Study*, 61, 553-565.

Hewson, C.M., Amar, A., Lindsell, J.A., Thewlis, R.M., Butler, S., Smith, K. & Fuller, R.J. 2007. Recent changes in bird populations in British broadleaved woodland. *Ibis*, 149 (suppl. 2), 14–28.

Hewson, C.M., Thorup, K., Pearce-Higgins, J.W. & Atkinson, P.W. 2016. Population decline is linked to migration route in the Common Cuckoo, a long-distance nocturnally-migrating bird. *Nature Communications*, 7, 12296. <https://doi.org/10.1038/ncomms12296>

Lawson, B., Robinson, R.A., Toms, M.P. *et al.* 2018. Health hazards to wild birds and risk factors associated with anthropogenic food provisioning. *Philosophical Transactions of the Royal Society B*, 373. <http://doi.org/10.1098/rstb.2017.0091>

Marquiss, M. 1989. Grey Herons *Ardea cinerea* breeding in Scotland: numbers distribution and census techniques. *Bird Study*, 36, 181-191.

Morrison, C.A., Robinson, R.A and Pearce-Higgins, J.W. 2016. Winter wren populations show adaptation to local climate. *Royal Society Open Science*, 3. <https://doi.org/10.1098/rsos.160250>

Murray, C., Minderman, J., Allison, J. & Calladine, J. 2016. Vegetation structure influences foraging decisions in a declining grassland bird: the importance of fine scale habitat and grazing regime. *Bird Study*, 63, 223-232.

North, P.M. 1979. Relating Grey Heron survival rates to winter weather conditions. *Bird Study*, 26, 23-28.

Pearce-Higgins, J.W., Yalden, D.W. & Whittingham, M.J. 2005. Warmer springs advance the breeding phenology of golden plovers *Pluvialis apricaria* and their prey (Tipulidae). *Oecologia*, 143, 470-476.

Pearce-Higgins, J.W., Dennis, P., Whittingham, M.J. & Yalden, D.W. 2010. Impacts of climate on prey abundance account for fluctuations in a population of a northern wader at the southern edge of its range. *Global Change Biology*, 16, 12-23. <https://doi.org/10.1111/j.1365-2486.2009.01883.x>

Woodward, I.D., Massimino, D., Hammond, M.J., Harris, S.J., Leech, D.I., Noble, D.G., Walker, R.H., Barimore, C., Dadam, D., Eglinton, S.M., Marchant, J.H., Sullivan, M.J.P., Baillie, S.R. & Robinson, R.A. 2018. BirdTrends 2018: trends in numbers, breeding success and survival for UK breeding birds. Research Report 708. British Trust for Ornithology, Thetford. <https://www.bto.org/our-science/publications/birdtrends/2018>

Wotton, S.R., Stanbury, A.J., Douse, A., Eaton, M.A. 2016. The status of the Ring Ouzel *Turdus torquatus* in the UK in 2012. *Bird Study*, 63, 155-164.

Table 1. Percentage changes in abundance for the Scottish Terrestrial Breeding Birds, 1994-2018 and 2017-2018, species listed in order of overall change 1994 to 2018.

Summarised trends for individual species and their habitat associations from 1994 to 2018, 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 name	All-habitats		Woodland		Farmland		Upland	
	1994-2018	2017-2018	1994-2018	2017-2018	1994-2018	2017-2018	1994-2018	2017-2018
Chiffchaff	763	-23	763	-23				
Great Spotted Woodpecker	516	-21	516	-21				
Blackcap	341	-6	350	-2				
Goldfinch	260	2			331	-17		
House Martin	161	-27						
Raven	158	60					158	60
Cuckoo	97	30	49	15			132	44
Corncrake	96	3			96	3		
Magpie	87	-6			89	1		
Whitethroat	85	-22			85	-22		
Reed Bunting	80	-5			80	-5		
Great Tit	73	6	77	9	147	4		
Bullfinch	64	-37	64	-37				
Lesser Redpoll	62	-18	62	-18				
Buzzard	51	9	17	-1	61	7		
Tree Pipit	50	-16	50	-16				
House Sparrow	50	6						
Jackdaw	50	14			51	12		
Willow/Red Grouse	45	-5					45	-5
Snipe	43	3					43	3
Treecreeper	35	-19	35	-19				
Willow Warbler	30	-17	30	-17				
Yellowhammer	27	-3			27	-3		
Blue Tit	27	9	16	16	28	-12		
Sedge Warbler	26	7			26	7		
Golden Eagle	24	1					24	1
Stonechat	23	-42						
Wren	22	-40	22	-40				
Song Thrush	21	-18	42	-7	44	-12		
Goldcrest	18	-33	18	-33				
Siskin	18	-17	18	-17				
Dunnock	16	-14	26	-9	-12	-23		
Mistle Thrush	16	3	16	3				
Blackbird	15	-6	9	-2	29	-12		
Woodpigeon	13	12			11	12		
Mallard	3	7						
Carrion Crow	3	10			2	10		

Golden Plover	3	20					3	20
Skylark	2	11			-7	6	16	16
Hen Harrier	-2	-2					-2	-2
Grey Wagtail	-3	-25						
Coal Tit	-4	0	-4	0				
Swallow	-6	4			-6	4		
Collared Dove	-6	7						
Robin	-8	-24	2	-19				
Linnet	-9	-17			-9	-17		
Chaffinch	-9	1	-7	-2	-3	1		
Meadow Pipit	-13	-6					-13	-6
Peregrine	-18	-1					-18	-1
Dipper	-20	-7					-20	-7
Starling	-22	-12			-1	-15		
Wheatear	-25	13					-25	13
Pied Wagtail	-28	-33			-28	-33		
Rook	-32	4			-32	4		
Oystercatcher	-39	-2			-39	-2		
Grey Heron	-40	-34						
Common Sandpiper	-51	-28					-51	-28
Capercaillie	-51	-2	-51	-2				
Lapwing	-55	6			-55	6		
Hooded Crow	-56	-13					-56	-13
Black Grouse	-56	-3					-56	-3
Curlew	-59	3					-59	3
Kestrel	-61	14			-61	14		
Dotterel	-64	-5					-64	-5
Swift	-68	-28						
Greenfinch	-68	-3			-68	9		