

Development of an Upland Bird Indicator for the UK and for England

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Introduction

The wild bird indicators published annually by the UK Government comprise multi-species indicators for breeding birds of farmland, woodland, waterways and wetlands, and seabirds. However, the UK also includes a large area of internationally important uplands, spread across all four countries and comprising about 10% of Europe's peatland area and about 13% of the world's blanket bog (Bain *et al* 2011). Upland habitats such as mountains, moors and heaths cover about 4.5 million ha of the UK and 693,000 ha of England and are a major element of our landscape, culture, economy and natural environment. The inclusion here of uplands in the suite of wild bird indicators increases the ability of those indicators to report comprehensively on the state of the UK and England's biodiversity.

There are a range of pressures upon our upland environment and its biodiversity, including agricultural intensification, farm abandonment, afforestation, atmospheric pollution, intensive grouse moor management, as well as climate change (Bonn *et al.* 2009). Uplands are predicted to be amongst the most susceptible of environments to the impacts of climate change. The way uplands are managed have changed in response to policies such as the Common Agriculture Policy and associated Rural Development Programme. The way in which CAP payments was distributed directly influenced upland farming with associated positive and/or negative impacts on habitats and the wildlife living there. Effects of environmental change upon upland biodiversity are already apparent. Burns *et al.* 2013, in an assessment of quantitative trends in abundance or range across a wide range of taxa, found a higher proportion of declining species (65%) in uplands than in any other broad habitat. There is also evidence that upland birds are at risk. An overview of trends in range between 1968 and 2011 in the Bird Atlas 2007-11 (Balmer *et al.* 2013) stated '*Perhaps the two main 'new' groups of concern revealed by this analysis are breeding waders and upland birds. Atlas findings suggest that uplands merit considerably more attention.*' Upland areas, including marginal in-by-land, hold extremely important populations of breeding waders such as Lapwing *Vanellus vanellus*, Curlew, Snipe *Gallinago gallinago* and Redshank *Tringa totanus* so upland areas encompass both of the groups of conservation concern highlighted in the atlas.

When the suite of wild bird indicators was first developed for England and the UK in the late 1990s, it was felt that insufficient data was available to be able to produce a sufficiently robust indicator for upland habitats. With the continuation and growth of the BTO/JNCC/RSPB UK Breeding Bird Survey, targeted efforts to improve coverage in the uplands (such as the NE-funded Upland Breeding Bird Survey and the BBS's Upland Rovers initiative), as well as further repeated surveys of scarcer breeding species under the SCARABBS (Statutory Conservation Agency and RSPB Annual Breeding Bird Scheme) programme, it was considered now feasible to develop a robust and sufficiently long-term upland indicator alongside those for other habitats. In doing so we can fill an obvious gap in the reporting on England and the UK's biodiversity, on the drivers upon it, and the success of efforts to protect our important upland environment.

Methods

The general approach used in the development of a new upland bird indicator was the same as used for the existing wild bird indicators, i.e. a multi-species indicator based on the geometric mean of the annual indices for constituent species. This widely used method in producing aggregate biodiversity indicators has a number of useful attributes: each species has an equal weight in the indicator and increases and decreases are treated proportionally such that a doubling of the population size in one species is balanced by a halving in another species. Agreed protocols are employed to handle species with time series that do not span the entire period of the indicator. Species for which data is not available at the start are brought into the indicator with their initial index standardised to the geometric mean of the other species in their start year. Similarly, species for which reliable information ends before the last year, are assumed to change values subsequently at the same change rate as the geometric mean of the remaining species. Effectively, this means that species with incomplete time series only influence changes in the indicator during the period that they are monitored.

A number of species are not well monitored by the BBS because of their scarcity, their preferred habitats tending to be in remote areas not covered as intensively by the survey, or because bespoke recording methods are used. Species monitored by these periodic National Surveys at intervals of 10-12 years rather than every year required special handling to incorporate them into the indicator. First, population sizes were interpolated between the years in which surveys took place using the equation:

$$\text{Annual Growth Rate} = (\text{Last Value}/\text{First Value}) ^ {1/(\text{End Year}-\text{Start Year})}$$

Second, these species were incorporated into the indicator as described above for other species with incomplete time series.

The key decision in the development of the upland bird indicator is the list of contributing species. Gibbons *et al.* (1993) identified 38 of the UK's regular breeding species as being upland specialists, and many more species, including some that feature in wild bird indicators for other habitats (e.g. Skylark *Alauda arvensis*), have substantial populations in our uplands. This provided an initial long list of species which could potentially contribute to an upland indicator.

Population trends for upland specialists

The first filter was data availability. Sources of trends for upland species are available from the BTO/JNCC/RSPB Breeding Bird Survey (BBS), the Waterways Breeding Bird Survey and its predecessor – the Waterways Bird Survey, and from periodic single species surveys such as raptors where bespoke recording protocols are used. It was decided early in the process that too few upland species had been monitored effectively by the Common Birds Census, the predecessor of the BBS which started in the 1960s but comprised mainly farmland and woodland sites. The best source of data was the BBS and hence the upland indicator was calculated from its starting date in 1994. BBS participants record all species but some species are detected too rarely for population trends to be produced. Hence, scarcer upland species such as Wood Sandpiper and scarce montane species such as Ptarmigan had to be excluded.

The second filter was population size. Following the approach used in the existing bird indicators for farmland and woodland, species with population sizes of less than 500 breeding pairs in the UK or less than 300 breeding pairs in England, are excluded from indicators on the grounds that they are too scarce and also likely to be found in too few sites, to be considered representative of the wider countryside.

Exclusion of species too rare in the UK or England and/or too rare to be monitored resulted in a shorter list of candidate upland species monitored effectively by the BBS, the WBBS/WBS or by periodic surveys. Note that although the BBS started in 1994, the WBBS was not implemented until 1998 and hence trends for candidate species of upland riparian habitats (e.g. Dipper, Grey Wagtail) were calculated by jointly modelling results from the WBBS and its predecessor, the WBS. In all of these cases, we used the overall population trend in accordance with the approach used in the farmland and woodland bird indicators.

We also used population trends from solely upland BBS squares for five species classified as upland specialists. The two waders (Snipe and Curlew) also occupy lowland agricultural habitats and wetlands and wetland trends for these species are used in the Breeding Wetland Bird Indicator. Ravens now occupy many non-upland habitats and Wheatear are often recorded in non-upland habitats during migration, so use of upland BBS squares excluded those records. Meadow Pipits are characteristic birds of uplands but so widespread that a reliable upland BBS population trend could be calculated.

Population trends for non-upland specialists

The next step was to decide how to deal with species not classified as upland specialists by Gibbons et al. (1993) but which have large populations in upland habitats. These include species such as Wren, whose overall population trend is used in the woodland indicator, Skylark, whose overall population trend is used in the farmland indicator, and more generalist species such as Carrion Crow which are found in many habitats including the uplands. For these species, we used a bespoke BBS population trend derived solely from BBS squares in the uplands, to ensure that the trend reflected the species status in uplands and to differentiate from the overall population trends used elsewhere. It was therefore only possible to calculate suitable upland trends for widespread species with sufficiently large and significant populations in the uplands.

To classify the BBS squares as upland we used Environmental Zones. These six broad categories are based on aggregations of subsets of land classes as shown in Table 1. The classification used were Environmental Zone 3 (Upland) in England, Wales and Northern Ireland, and Environmental Zone 5 (Intermediate uplands and islands in Scotland) and Environmental Zone 6 (True uplands in Scotland).

Table 1. The complete list of land classes in the selected upland Environmental Zones.

Land class	Land class description
17	Rounded intermediate slopes, mainly improvable permanent pasture
18	Rounded hills, some steeper slopes; varied moorlands
19	Smooth hills, mainly heather moors; often afforested
20	Midvalley slopes; wide range of vegetation types

21	Upper valley, rocky outcrops and bogs
22	Margins of high mountains, moorlands; often afforested
23	High mountain summits, with well drained moorlands
24	Upper steep mountain slopes, usually bog covered
28	Varied lowland margins with heterogeneous land use
29	Sheltered coasts with varied land use, often crofting
30	Exposed coasts dominated by bogs
31	Cold exposed coasts with variable land use and crofting
32	Windswept low hills covered with bogs

Expert consultation

Prior to finalising the indicator and deciding on whether to present sub-indicators for specific habitats within the uplands, trial upland indicators were first presented to an internal panel of experts on upland birds and/or upland land use policies from within BTO, RSPB, JNCC, NatureScot and Defra Policy. Following this consultation, several further decisions were made to refine the species composition of the upland indicator and on the presentation of sub-indicator lines. These were as follows:

- It was agreed to exclude population trends for species strongly associated with upland woodland and to not produce a separate sub-indicator for species of upland woodlands. These woodland birds, including species such as Lesser Redpoll, Crossbill and Tree Pipit, are already included in the Woodland Bird Indicator using overall population trends. Moreover, many of them are relatively scarce and it would not be possible to produce a reliable uplands-only BBS trend from existing data.
- It was also agreed to exclude population trends for species associated with coastal high-latitude wetlands such as found on Scottish islands and northern coastal areas, and to not produce a separate sub-indicator for these species. There were five upland species, including gulls and divers, potentially included in this group but most are only monitored by periodic surveys are only partially by BBS. Moreover, species in this group are likely to be as strongly influenced by pressures in marine systems as well as terrestrial factors.
- Consultation with the expert panel resulted in additional species being dropped from the indicator on the grounds that they were not considered sufficiently upland in habitat preference, despite their inclusion on the long list of candidate species derived from Gibbons et al. (1993). These included Corncrake (really a farmland bird), Teal (not sufficiently upland), Common Gull and Black-headed Gull, which do have upland breeding populations but which are not well monitored by existing surveys.
- It was agreed to retain population trends for a suite of four upland riparian specialists (Dipper, Grey Wagtail, Common Sandpiper and Goosander) using data from the two waterways schemes - WBBS and WBS, in the overall Upland Bird Indicator and to include a sub-indicator in the upland suite for this group. These four species are also included in the indicator for breeding birds of wetlands and waterways but are considered sufficiently characteristic of upland riparian habitats to be part of the Upland Bird Indicator.

As a result of these filters based on data availability and species rarity and the recommendations from the expert panel, the resultant Upland Bird Indicators for the UK and England are comprised, respectively, of 32 and 28 species. Both the UK and England Upland Bird Indicators include a sub-indicator for upland riparian species (four species). The UK Upland Bird Indicator includes sub-indicators for Upland Specialists (15 species) and Upland Generalists (13 species). The England Upland Bird Indicator includes sub-indicators for Upland Specialists (12 species) and Upland Generalists (12 species).

As noted above, the list of upland specialists is comprised of all species from the long list of candidate upland species defined by Gibbons et al (1993) minus those excluded by the data availability filters and the recommendations of the expert panel. For these specialists, the trends used in the indicator are derived from (i) the overall BBS trend rather than solely upland BBS squares on the grounds that these species are already strongly associated with uplands or (ii) periodic surveys.

The list of generalists or non-upland specialist species is derived from a list of species known to have significant populations in the uplands which are not defined as upland in Gibbons et al (1993). Most of them are defined in Gibbons et al (1993) as farmland, woodland, wetland or 'not specified', the latter category including many generalist species such as Carrion Crow. For these species, which are found in significant numbers outside uplands, we used the uplands-only BBS trend as described above. For the four riparian species, we used trends derived from the WBBS/WBS joint trends covering the period from 1994 to the last available year of data. The complete list of species, their categorisation as specialist, non-specialist or riparian, and the data source (all BBS, upland-only BBS, WBBS/WBS or periodic National Surveys) are listed in Table 2 below.

Table 2. Species used in the Upland Indicator in 2022, the data source, grouping for the sub-indicators and whether included in the UK and/or England Upland Indicator.

SPECIES	DATA SOURCE	Include in UK	Include in ENG	Group	COMMENTS
Golden Eagle	National Surveys	Y		Specialist	
Red Grouse	All BBS Squares	Y	Y	Specialist	
Black Grouse	National Surveys	Y	Y	Specialist	
Golden Plover	All BBS Squares	Y	Y	Specialist	
Ring Ouzel	All BBS Squares	Y	Y	Specialist	
Merlin	National Surveys	Y	Y	Specialist	
Twite	National Surveys	Y	Y	Specialist	
Whinchat	All BBS squares	Y	Y	Specialist	
Hen Harrier	National Surveys	Y		Specialist	
Dotterel	National Surveys	Y		Specialist	
Snipe	Upland BBS Squares	Y	Y	Specialist	
Wheatear	Upland BBS Squares	Y	Y	Specialist	Migrants outside upland
Meadow Pipit	Upland BBS Squares	Y	Y	Specialist	

Raven	Upland BBS Squares	Y	Y	Specialist	Specialist in England
Curlew	Upland BBS Squares	Y	Y	Specialist	
Common Sandpiper	WBS-WBBS	Y	Y	Riparian	
Goosander	WBS-WBBS	Y	Y	Riparian	
Grey Wagtail	WBS-WBBS	Y	Y	Riparian	
Dipper	WBS-WBBS	Y	Y	Riparian	
Stonechat	Upland BBS Squares	Y	Y	Non-specialist	
Redshank	Upland BBS Squares	Y	Y	Non-specialist	
Peregrine	Upland BBS Squares	Y	Y	Non-specialist	Expanding its use of habitats
Oystercatcher	Upland BBS Squares	Y	Y	Non-specialist	
Hooded Crow	Upland BBS Squares	Y		Non-specialist	
Cuckoo	Upland BBS Squares	Y	Y	Non-specialist	
Lapwing	Upland BBS Squares	Y	Y	Non-specialist	
Buzzard	Upland BBS Squares	Y	Y	Non-specialist	
Skylark	Upland BBS Squares	Y	Y	Non-specialist	
Pied Wagtail	Upland BBS Squares	Y	Y	Non-specialist	
Red Kite	Upland BBS Squares	Y	Y	Non-specialist	
Wren	Upland BBS Squares	Y	Y	Non-specialist	
Carrion Crow	Upland BBS Squares	Y	Y	Non-specialist	

Estimating confidence in the Upland Bird Indicator

Estimates of confidence in the indicators were calculated using a bootstrapping approach as is done for wild bird indicators for farmland, woodland and wetlands. For each species monitored using BBS or WBBS/WBS, we generated 199 bootstraps and used these to construct 199 versions of each multi-species indicator. For species whose trends are based on full counts from national surveys, we used the same annual species index value in each of the 199 bootstrapped indicators. The 95% upper and lower confidence intervals were then calculated from the percentiles of the 199 indicator values for each year.

Results

The Upland Bird Indicator for the UK is shown in Figure 1 below. Overall, the indicator comprised of all upland bird species or populations has declined significantly by 11% over the long-term period from 1994 to 2020, based on the smoothed trends (Table 3). There was relatively little difference in the rates of decline of any of the UK sub-indicators, although the 25 year significant decline for the non-upland specialists was marginally less (a nonsignificant -7%) than for specialists (-15%) or riparian species (-12%). The most recent five year change was of a slight decline of ca 4% and similar, between 3% and 5% for all sub-indicators (Table 3). A summary of the short and long term trends for each of the 32 constituent species in the UK Upland Indicator are provided in Table S3 of the Appendix.

Table 3. An assessment of the percentage change in the smoothed UK Upland Bird Indicator over a 5 year period (2015-2020) and a 25 year period (1994-2020) with 95% upper and lower confidence limits. * represents significant change.

Upland Indicator	Five year % change in smoothed index (2015-2020)	Long-term % change in smoothed index (1994-2020)	LCL of long-term index	UCL of long-term index
All Species	- 4	- 11*	- 19	- 7
Specialists	- 3	-15*	-21	- 11
Riparian	- 5	-12*	-29	- 3
Generalists	- 4	- 7 (NS)	- 16	+ 5

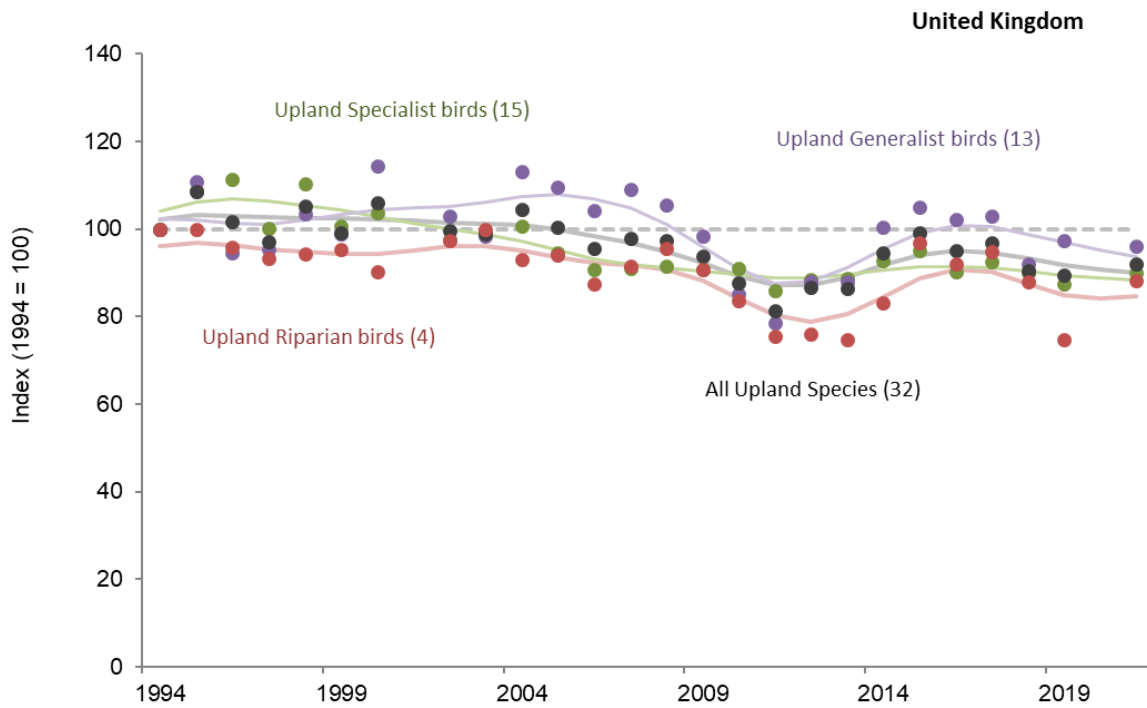
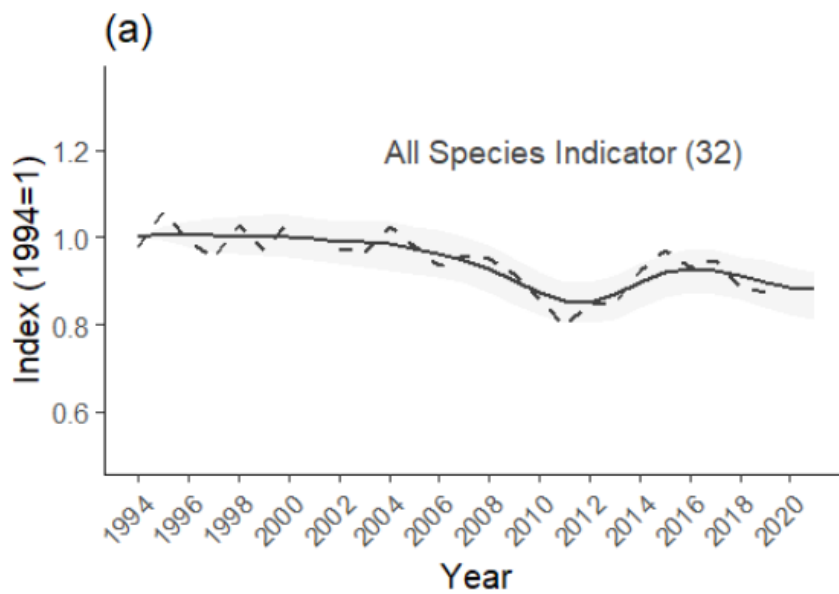


Figure 1. UK Upland Indicators for (black), Specialists (green), Generalists (purple), and Riparian species (red). The smoothed indicator is represented by the solid lines and the dots are the unsmoothed indicators.



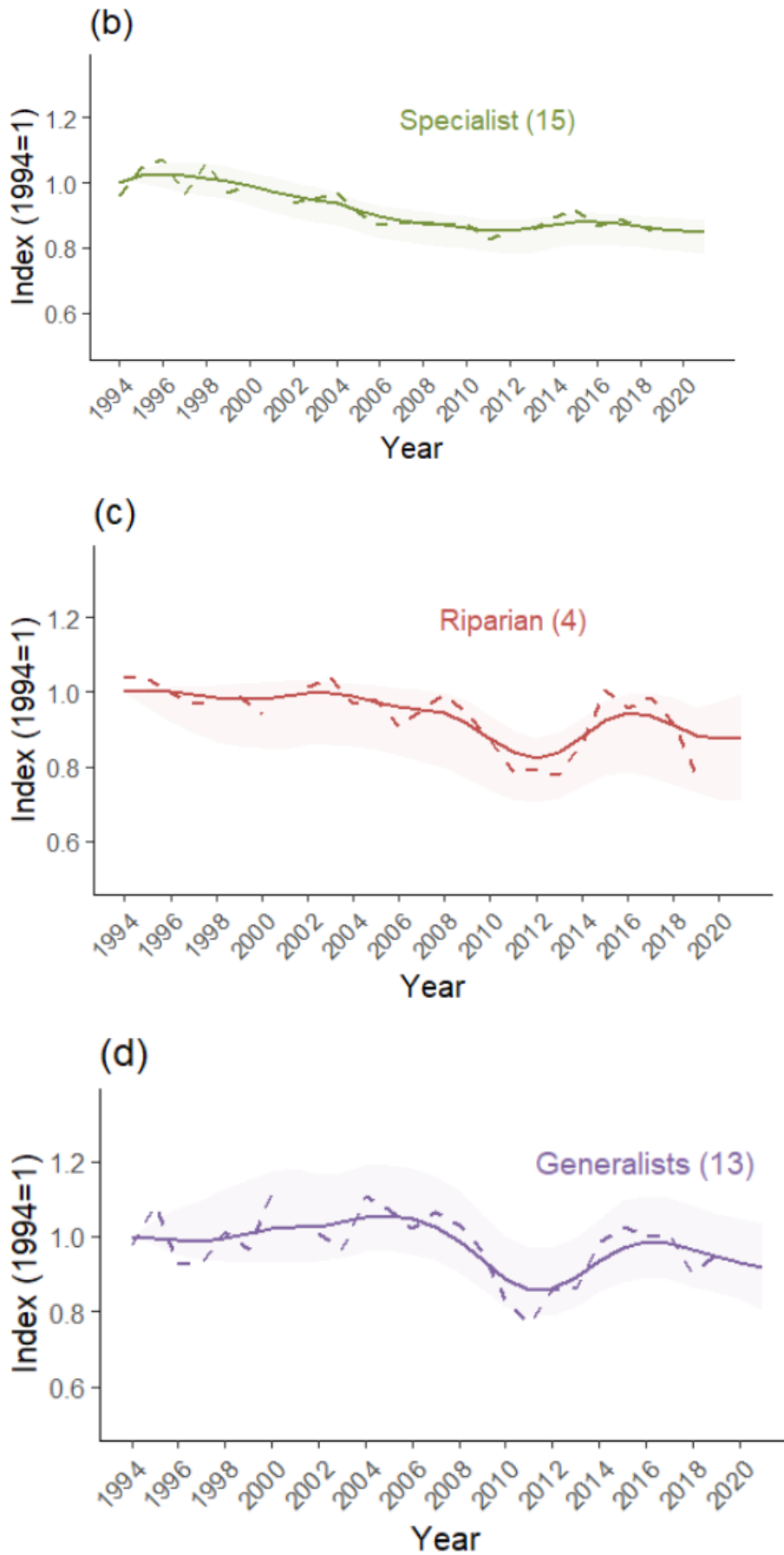


Figure 2. Upland UK Indicators separated for a) all species, b) specialist species, c) riparian species and d) generalist/non-specialist species. The dashed line is the unsmoothed indicator standardised to

the smoothed solid line and the shading is the smoothed 95% confidence limits. Index is set at 1 in 1994. Note that unsmoothed data for 2001 and 2020 are missing due to Foot and Mouth Disease in 2001 and Covid-19 in 2020.

The Upland Bird Indicator for England is shown in Figure 3 below. The indicator comprised of all 28 upland species or populations has declined significantly, by 11% over the long term period 1994 to 2020 and by 7% in the short term. Only the generalist/non-specialist indicator showed stability, with a non-significant increase of 6%. The greatest rate of decline was seen in the upland specialists indicator (-23%) and the upland riparian species indicator (-17%). The five year trend for the England Upland Indicator (all species) was a 7% decline. All sub-indicators showed declines, varying from 6% for the upland specialists but -15% for upland riparian species (Table 4). A summary of the short and long term trends for each of the 28 constituent species in the England Upland Indicator are provided in Table S4 of the Appendix.

Table 4. An assessment of the percentage change in the smoothed England Upland Bird Indicator over a 5 year period (2015-2020) and a 25 year period (1994-2020) with 95% upper and lower confidence limits. * represents significant change.

Upland Indicator	Five year % change in smoothed trend (2015-2020)	Long-term % change in smoothed trend (1994-2020)	Long-term LCL	Long-term UCL
All Species	- 7	- 11*	- 19	- 3
Specialists	- 5	- 23*	- 32	- 13
Riparian	- 15	- 17*	- 34	- 10
Generalists	- 6	+ 6 (NS)	- 9	+ 25

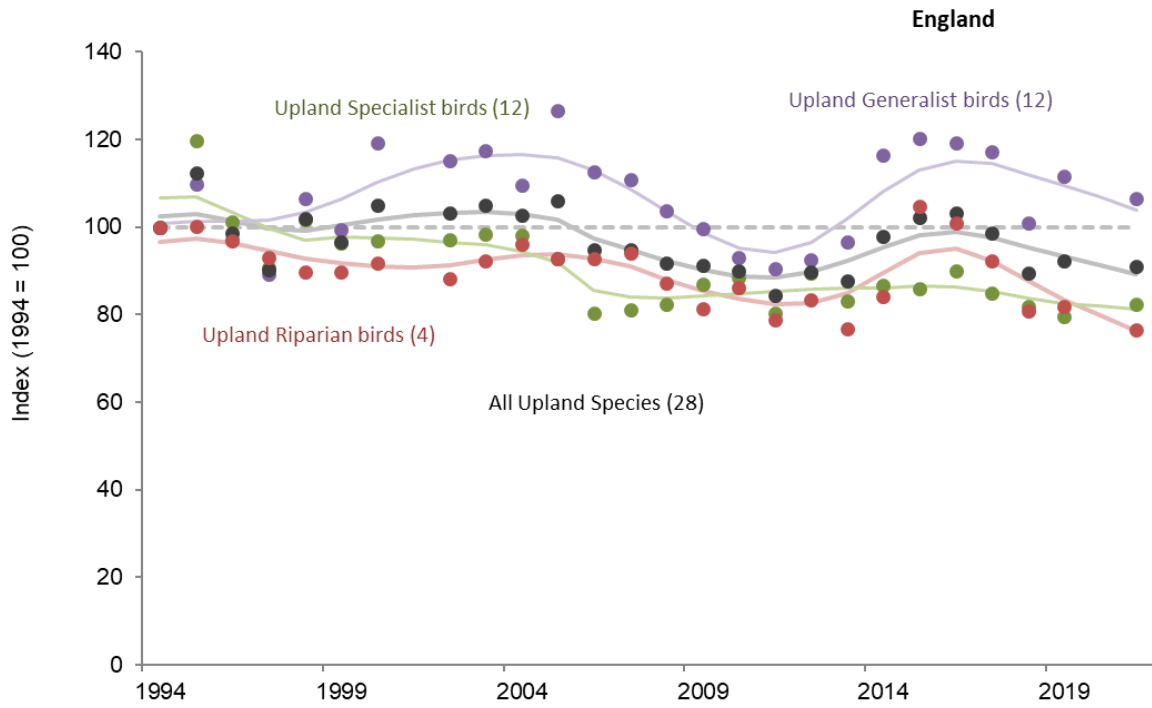
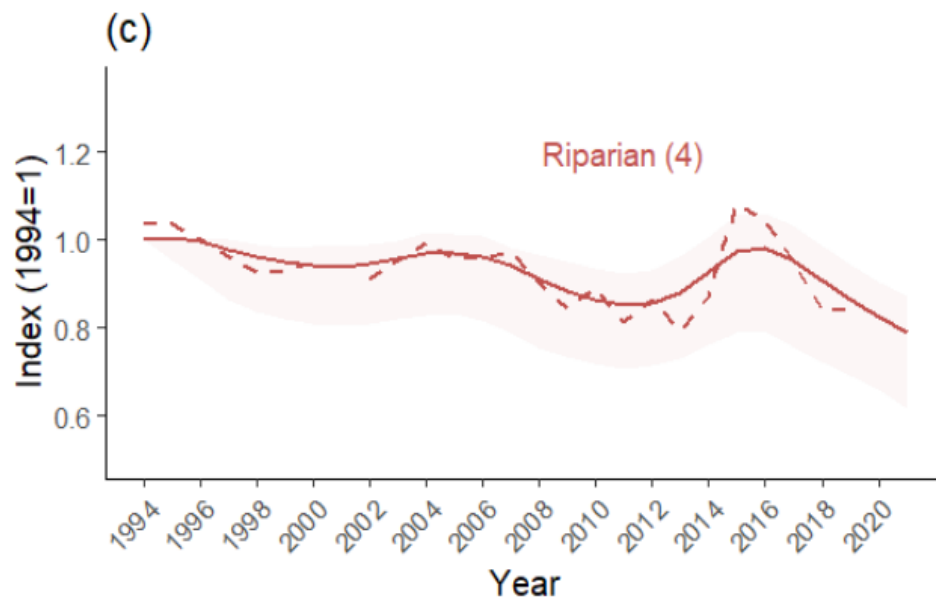
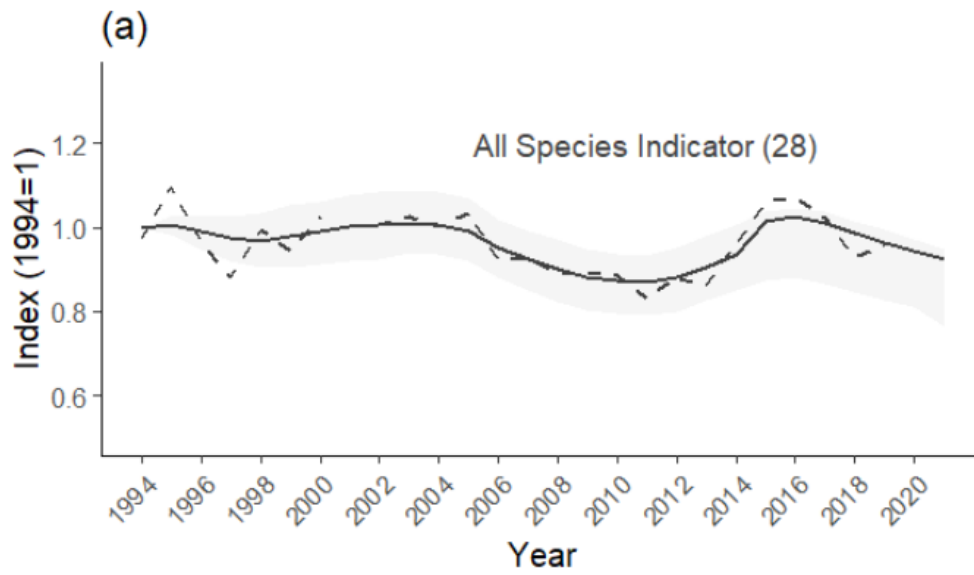


Figure 3. England Upland Indicators for All Species (black), Specialists (green), Generalists (purple), and Riparian species (red). The smoothed indicator is represented by the solid lines and the dots are the unsmoothed indicators.



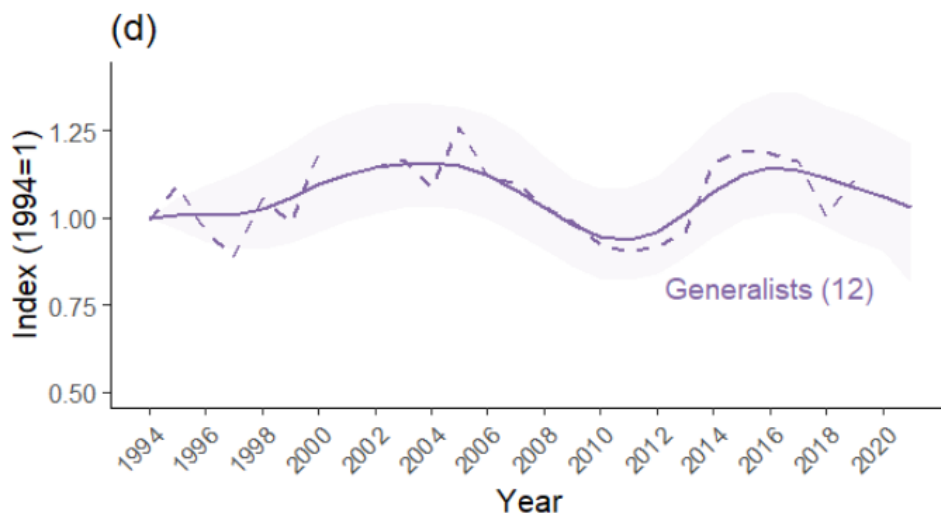


Figure 4. Upland England Indicators separated for a) all species, b) specialist species, c) riparian species and d) generalist/non-specialist species. Index is set at 1 in 1994. Note that unsmoothed data for 2001 and 2020 are missing due to Foot and Mouth Disease in 2001 and Covid-19 in 2020. .

Conclusions

This work demonstrates that it is possible to produce an Upland Bird Indicator based on population trends for a diverse array of species representative of upland habitats. These can be sub-divided into upland specialists, species associated with upland rivers and non-upland specialist species that nevertheless have significant populations in upland habitats. Differences in the trajectories of these sub-indicators suggest that the species in these groupings are responding to different drivers. The indicator comprised of upland specialists, which rely on upland habitats such as open moorlands, is likely to best reflect the conditions of uplands and the status of bird species that occupy them. Upland riparian species will also be influenced by factors such as river flow and water quality, and the species in the upland generalist category, which also occupy other habitats, are more likely to be affected by factors other than the condition of uplands.

Like other wild bird indicators, the Upland Bird Indicator is limited by the availability of sufficiently robust data for some species from which to calculate population trends. Specifically, this indicator excludes montane species such as Ptarmigan and Snow Bunting and rarer species such as Dunlin, Greenshank, Wood Sandpiper, Short-eared Owl and Red-breasted Merganser. However, some species for which data are lacking would be excluded anyway by the filters of 300 and 500 breeding pairs in England and the UK respectively. The indicator deliberately excludes species of upland woodland habitats but this grouping could potentially be incorporated subsequently for species with sufficient numbers detected in upland BBS squares.

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Supplementary Material

Table S1. Data sources for species monitored by periodic National Surveys and the UK population estimates for relevant survey years

Species	UK Data Source	Year
Black Grouse	Sim et al. 2008 and http://www.blackgrouse.info/about/conservation/uk.htm	1995
Black Grouse	Sim et al. 2008 and http://www.blackgrouse.info/about/conservation/uk.htm	2005
Black Grouse	Woodward et al 2020 https://app.bto.org/birdfacts/results/bob3320.htm	2016
Hen Harrier	Sim et al. 2001	1998
Hen Harrier	Hayhow et al 2013	2004
Hen Harrier	Wotton et al 2018 and Hayhow et al 2013	2010
Hen Harrier	Wotton et al 2018	2016
Merlin	Ewing et al 2011	1994
Merlin	Ewing et al 2011	2008
Dotterel	Hayhow et al. 2015	1987/88
Dotterel	Hayhow et al. 2015	1999
Dotterel	Hayhow et al. 2015	2011
Golden Eagle	Hayhow et al 2017	1982/83
Golden Eagle	Hayhow et al 2017	1992
Golden Eagle	Hayhow et al 2017	2003
Golden Eagle	Hayhow et al 2017	2015
Twite	Wilkinson et al. 2018	1999
Twite	Wilkinson et al. 2018	2013

Table S2. Data sources for species monitored by periodic National Surveys and the England population estimates for relevant survey years

Species	England Data Source	Year
Black Grouse	Sim et al. 2008 and http://www.blackgrouse.info/about/conservation/uk.htm	1995
Black Grouse	Warren et al 2015 https://www.tandfonline.com/doi/full/10.1080/00063657.2015.1013524	1998
Black Grouse	Warren et al 2015 https://www.tandfonline.com/doi/full/10.1080/00063657.2015.1013524	2003
Black Grouse	Sim et al. 2008 and http://www.blackgrouse.info/about/conservation/uk.htm	2006
Black Grouse	Warren et al 2015 https://www.tandfonline.com/doi/full/10.1080/00063657.2015.1013524	2007
Black Grouse	Warren et al 2015 https://www.tandfonline.com/doi/full/10.1080/00063657.2015.1013524	2015
Merlin	Ewing et al 2011	1994
Merlin	Ewing et al 2011	2008
Twite	Wilkinson et al. 2018	1999
Twite	Wilkinson et al. 2018	2014

Table S3. Species UK trends over 25 years 1994-2020 and 5 years 2015-2020, and the status of the population based on the trend: increasing, stable or declining. Long-term trends for the following species differ: ¹1995-2016, ²1994-2011, ³1994-2015, ⁴1998-2016, ⁵1994-2008, ⁶1999-2013. An asterisk indicates that the change in abundance is statistically significant. Status categories are based on the calculated annual rates of change and follow the Red-Listing approach. Hence, annual rates of declines equivalent to more than 25% over 25 years (Amber-listing) are classified as a weak decline and annual rates of decline equivalent to more than 50% over 25 years (Red-listing) are classified as strong declines. Increase categories are calculated as the geometric reverse of the declines.

Species Name	Indicator Category	Long-term Change (1994-2020)	Status based on annual rate of change	5 Year Change (2015-2020)	Status based on annual rate of change
Black Grouse ¹	Specialist	-25.45	Weak Decline	N/A	
Curlew	Specialist	-34.58 *	Weak Decline	5.02	Stable
Dotterel ²	Specialist	-49.73	Strong Decline	N/A	
Golden Eagle ³	Specialist	19.37	Stable	N/A	
Golden Plover	Specialist	-8.66	Stable	2.48	Stable
Hen Harrier ⁴	Specialist	0.88	Stable	N/A	
Meadow Pipit	Specialist	-11.33 *	Stable	-6.56	Weak Decline
Merlin ⁵	Specialist	-12.63	Stable	N/A	
Raven	Specialist	15.61	Stable	18.8	Strong Increase
Red Grouse	Specialist	3.56	Stable	-12.94 *	Strong Decline
Ring Ouzel	Specialist	-17.96	Stable	5.1	Stable
Snipe	Specialist	31.77 *	Stable	1.91	Stable
Twite ⁶	Specialist	-21.4	Weak Decline	N/A	
Wheatear	Specialist	-32.94 *	Weak Decline	-7.81	Weak Decline
Whinchat	Specialist	-56.77 *	Strong Decline	-11.54	Weak Decline
Common Sandpiper	Riparian	-41.78	Weak Decline	-38.16	Strong Decline
Dipper	Riparian	-19.17	Stable	-29.82	Strong Decline
Goosander	Riparian	18.74	Stable	21.54	Strong Increase
Grey Wagtail	Riparian	2.63	Stable	-10.15	Weak Decline
Buzzard	Non-specialist	11.18	Increasing	2.94	Stable
Carrion Crow	Non-specialist	-13.12	Decline	-8.67	Weak Decline
Cuckoo	Non-specialist	50.96 *	Weak Increase	27.51 *	Strong Increase

Hooded Crow	Non-specialist	-49.17 *	Weak Decline	-22.76	Strong Decline
Lapwing	Non-specialist	-42.57 *	Weak Decline	0.39	Stable
Oystercatcher	Non-specialist	-7.39	Stable	11.77	Weak Increase
Peregrine	Non-specialist	-81.64 *	Strong Decline	-58.59 *	Strong Decline
Pied/White Wagtail	Non-specialist	-33.42 *	Weak Decline	-22.86 *	Strong Decline
Red Kite	Non-specialist	415.83 *	Strong Increase	29.96	Strong Increase
Redshank	Non-specialist	-58.29 *	Strong Decline	-7.03	Weak Decline
Skylark	Non-specialist	-4.14	Stable	6.81	Weak Increase
Stonechat	Non-specialist	213.68 *	Strong Increase	59.89 *	Strong Increase
Wren	Non-specialist	30.89 *	Stable	-12.73 *	Weak Decline

Table S4. Species England trends over 25 years 1994-2020 and 5 years 2015-2020, and the status of the population based on the trend: increasing, stable or declining. Long-term trends for the following species differ: ¹1994-2009, ²1995-2014, ³1999-2014. An asterisk indicates that the change in abundance is statistically significant. Status categories are based on the calculated annual rates of change and follow the Red-Listing approach. Hence, annual rates of declines equivalent to more than 25% over 25 years (Amber-listing) are classified as a weak decline and annual rates of decline equivalent to more than 50% over 25 years (Red-listing) are classified as strong declines. Increase categories are calculated as the geometric reverse of the declines.

Species Code	Species Name	Indicator Category	Long-term Change (1994-2020)	Status based on annual rate of change	5 Year Change (2015-2020)	Status based on annual rate of change
CU	Curlew	Specialist	-7.75	Stable	9.55 *	Weak Increase
GP	Golden Plover	Specialist	16.90	Stable	-25.27 *	Strong Decline
MP	Meadow Pipit	Specialist	-12.48	Stable	-10.85 *	Weak Decline
RG	Red Grouse	Specialist	8.65	Stable	-5.99	Weak Decline
RN	Raven	Specialist	-10.70	Stable	-11.01	Weak Decline
RZ	Ring Ouzel	Specialist	-36.55	Weak Decline	39.1	Strong Increase
SN	Snipe	Specialist	44.98	Weak Increase	4.63	Stable
W.	Wheatear	Specialist	-35.64 *	Weak Decline	-4.16	Stable
WC	Whinchat	Specialist	-54.12 *	Strong Decline	-25.87	Strong Decline
ML	Merlin ¹	Specialist	-24.94	Weak Decline	N/A	
BK	Black Grouse ²	Specialist	-15.67	Stable	N/A	
TW	Twite ³	Specialist	-72.06	Strong Decline	N/A	
CS	Common Sandpiper	Riparian	-42.37	Weak Decline	-28.1395	Strong Decline
DI	Dipper	Riparian	-12.10	Stable	-15.9616	Strong Decline
GD	Goosander	Riparian	-19.22	Stable	-18.087	Strong Decline
GL	Grey Wagtail	Riparian	13.66	Stable	5.173876	Stable
BZ	Buzzard	Non-specialist	-1.65	Stable	-6.65	Weak Decline
C.	Carrion Crow	Non-specialist	-11.43	Stable	-15.31 *	Strong Decline
CK	Cuckoo	Non-specialist	13.14	Stable	19.82 *	Strong Increase

KT	Red Kite	Non-specialist	288.27 *	Strong Increase	14.03	Weak Increase
gL.	Lapwing	Non-specialist	-16.10	Stable	0.03	Stable
OC	Oystercatcher	Non-specialist	80.80 *	Weak Increase	5.6	Stable
PE	Peregrine	Non-specialist	-86.07 *	Strong Decline	-63 *	Strong Decline
PW	Pied/White Wagtail	Non-specialist	-29.19 *	Weak Decline	-19.57 *	Strong Decline
RK	Redshank	Non-specialist	-53.06 *	Strong Decline	-8.36	Weak Decline
S.	Skylark	Non-specialist	-14.18	Stable	-11.59	Weak Decline
SC	Stonechat	Non-specialist	476.43 *	Strong Increase	93.21 *	Strong Increase
WR	Wren	Non-specialist	41.13 *	Weak Increase	-5.22	Stable



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Development of an Upland Bird Indicator for the UK and for England

When the suite of wild bird indicators was first developed for England and the UK in the late 1990s, it was felt that insufficient data was available to be able to produce a sufficiently robust indicator for upland habitats. With the continuation and growth of the BTO/ JNCC/RSPB UK Breeding Bird Survey, targeted efforts to improve coverage in the uplands (such as the NE-funded Upland Breeding Bird Survey and the BBS's Upland Rovers initiative), as well as further repeated surveys of scarcer breeding species under the SCARABBS (Statutory Conservation Agency and RSPB Annual Breeding Bird Scheme) programme, it was considered now feasible to develop a robust and sufficiently long-term upland indicator alongside those for other habitats. In doing so we can fill an obvious gap in the reporting on England and the UK's biodiversity, on the drivers upon it, and the success of efforts to protect our important upland environment.

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