

UK Biodiversity Indicators 2019

This documents supports
C4b. Status of UK priority species: distribution

Technical background document

For further information on C4b. Status of priority species – distribution visit
<http://www.jncc.gov.uk/ukbi-C4b>

For further information on the UK biodiversity indicators visit
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Indicator C4b. Status of UK priority species: distribution

Technical background report, 2019

Prepared¹ by Jack Hatfield, Gary Powney, Charlotte Outhwaite, Tom August, Nick Isaac; Biological Records Centre, Centre for Ecology and Hydrology.

NB this paper should be read together with Indicator C4a <http://www.jncc.gov.uk/ukbi-C4a> which presents a companion statistic based on time series of the relative abundance of priority species.

1. Introduction

The adjustments to the UK biodiversity indicators set as a result of the adoption of the [Strategic Plan for Biodiversity](#) (including the Aichi Targets) at the 10th Conference of Parties of the Convention on Biological Diversity mean there is a need to report progress against Aichi Target 12:

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Previously, the UK biodiversity indicator for threatened species used lead partner status assessments on the status of priority species from 3-yearly UK Biodiversity Action Plan (UK BAP) reporting rounds. As a result of the devolution of biodiversity strategies to the UK's 4 nations, there is no longer reporting at the UK level of the status of species previously listed by the BAP process.

This paper presents one of the 2 indicators which aim to provide a robust measure of the status of threatened species in the UK, with 'species identified as conservation priorities' being taken as a proxy for 'threatened species'. Although biodiversity monitoring in the UK is probably as good as anywhere else in the world, and a wide range of data and novel analytical approaches have been used, it should be recognised from the outset that any indicator on the status of priority species will be hampered by short comings in the availability of data.

2. Species List

The UK BAP list has been superseded by the biodiversity lists of the 4 UK countries (Section 41 of the Natural Environmental and Rural Communities (NERC) Act 2006 in England, Environment (Wales) Act 2016 section 7 in Wales, Northern Ireland priority species list in Northern Ireland and the Scottish biodiversity list in Scotland). As a result, there is no single list of species that represents the UK's species of conservation priority. The criteria for inclusion in each of the 4 biodiversity lists are derived from those used to identify the UK BAP priority species list, most recently in 2007, but there has been some divergence in approaches, see Table 1. For example, the Scottish biodiversity list and the Northern Ireland priority species list both have criteria based on rarity alone, whereas the UK BAP criteria did not consider rarity; rare species were only listed if they were considered threatened or declining.

¹ NB some text re-used from 2013 BIYP Indicator C4b prepared by the Species Indicator Initiative working group and we wish to acknowledge the input from the authors of that original document.

For the purposes of this indicator, an inclusive approach has been taken, whereby a species only has to be included in one of the country lists to be included on the combined list. The Scottish Biodiversity list has a final criterion based on the importance of species to people, however, species listed as a result of this criterion were not considered here. The taxonomic composition of the combined 4 Country List (FCL) is shown in Table 2.

Some countries have included a small number of taxa below the species level (i.e. sub-species) on their biodiversity lists. Such infra-specific taxa were only retained on the combined 4 country biodiversity list if the associated species was not included. For example, a sub-species of the grass rivulet moth (*Perizoma albulata*) is included on the Scottish biodiversity list but it is a full species on the Northern Ireland priority species list, thus on the combined list only the full species was retained.

Table 1: The biodiversity lists of the 4 countries of the UK

Country	Number of Taxa	Criteria for species inclusion
England (S41)	943	On the 2007 UK BAP list
		Hen Harrier
Northern Ireland (NI) priority species list	481	1: On the 2007 UK BAP list
		2: Rapid decline of $\geq 2\%$ per year
		3: Decline of $\geq 1\%$ per year and NI holds $\geq 50\%$ of Irish, or $\geq 20\%$ of UK population or Irish/UK population restricted to NI
		4: Rare in NI (1-2 sites) and NI holds $\geq 50\%$ of Irish, or $\geq 20\%$ of UK population or Irish/UK population restricted to NI
		5: $\geq 20\%$ of a well recognised sub-species in NI
		6: Irish Red data book species
		7: Red list Birds of Conservation concern Ireland or UK
Scottish Biodiversity List	2,090	S1: On the 2007 UK BAP list
		S2: International obligation
		S3: Species defined as 'nationally rare' in GB/UK ($< 15 \text{ km}^2$), which are present in Scotland
		S4: Species present in $\leq 5 \text{ km}^2$ or sites in Scotland
		S5: Decline of $\geq 25\%$ in 25 years in Scotland
		S6a: Endemic
		S6b: Endemic subspecies if also meets another criterion
Wales (S42)	567	International importance, IUCN Global Red List or Red listed in $\geq 50\%$ of EU countries where data is available or other source indicating international threat or decline
		International responsibility $\geq 25\%$ of EU/Global population in Wales and decline $\geq 25\%$ in 25 years in Wales
		Decline in Wales $\geq 50\%$ in 25 years
		Other for example decline and very restricted range
UK total (combined 4 country list)	2,890	

Table 2: Taxonomic breakdown of combined 4 country biodiversity list

Group	Number of Species
<i>Invertebrates</i>	
insect – beetle (Coleoptera)	191
insect – butterfly	25
insect – dragonfly (Odonata)	4
insect – hymenopteran	103
insect – moth	174
insect – orthopteran	6
insect – other	4
insect – riverfly	8
insect – true bug (Hemiptera)	15
insect – true fly (Diptera)	94
other Invertebrate	233
<i>Vertebrates</i>	
amphibian	4
bird	127
fish	57
marine mammal	22
terrestrial mammal	26
reptile	10
<i>Plants and fungi</i>	
vascular plants	409
alga	254
stonewort	15
lichen	546
bryophytes	301
fungi	262
Total	2,890

3. Data Sources

Biological records data were collated to produce an indicator of change based on trends in occupancy of a set of priority species in the UK. Biological records are observations of species in a known place in space and time. Most records are made by volunteer recorders and whilst these data may be collected following a specific protocol, the majority of records in these datasets are opportunistic. The intensity of recording varies in both space and time (Isaac *et al.* 2014), which is a challenge for estimating robust quantitative trends. Fortunately, a range of methods now exist for producing such trends using unstructured biological records data (e.g. Szabo *et al.*, 2010; Hill, 2012; Isaac *et al.*, 2014). Bayesian occupancy models have been shown to be more robust and more powerful than these other methods when analysing this kind of data (Isaac *et al.*, 2014), specifically because the occupancy model explicitly models the data collection process and

produces annual estimates for each species of the proportion of occupied sites (van Strien *et al.*, 2013).

By using occupancy models to analyse occurrence records, greater taxonomic coverage was achieved for the 2015 C4b indicator. Further improvements to the occupancy modelling framework has enabled the inclusion of more taxonomic groups (for example, lichens, craneflies and weevils) and more species from groups previously included in the indicator. The Bayesian occupancy approach is described in detail in the [Bayesian indicator development technical report](#). Although improvements to the modelling process meant that more species could be included, estimates could not be established for all priority species.

For the occupancy models, occurrence records were extracted at the 1km grid square scale with day precision. Data were collated through the Biological Records Centre and include data from the following recording schemes: Aquatic Heteroptera Recording Scheme, Bees, Wasps and Ants Recording Society, British Arachnological Society Spider Recording Scheme, British Bryological Society, British Isles Neuropterida Recording Scheme, British Lichen Society, Centipede Recording Scheme, British Myriapod and Isopod Group, Millipede Recording Scheme, Bruchidae & Chrysomelidae Recording Scheme, Conchological Society of Great Britain and Ireland, Cranefly Recording Scheme, British Dragonfly Society, Empididae & Dolichopodidae Recording Scheme, Fungus Gnat Recording Scheme, Gelechiid Recording Scheme, Ground Beetle Recording Scheme, Hoverfly Recording Scheme, , National Moth Recording Scheme, Orthoptera Recording Scheme, Riverfly Recording Schemes: Ephemeroptera, Plecoptera and Trichoptera, Soldierflies and Allies Recording Scheme, Staphylinidae Recording Scheme, Terrestrial Heteroptera Recording Scheme - Shield bugs and allied species and the Weevil and Bark Beetle Recording Scheme + Scolytidae, as well as a number of local record centres.

Data from between 1970 and 2016 were extracted as this represents a core period of recording for many of the taxonomic groups. However, some datasets finished at different years within this time period. Since the 2018 C4b indicator the Biological Records Centre has received substantial updates of the scheme data from the Cranefly Recording Scheme, the Hoverfly Recording Scheme and the Bruchidae and Chrysomelidae Recording Scheme. This has enabled the improvement of model estimates for certain years, particularly 2016.

For C4b in 2019, priority species of freshwater fish and Hypogean Crustacea were removed due to current data issues and the low number of contributing species.

4. Generating species' trends

Recent studies have highlighted the value of Bayesian occupancy models for estimating species occurrence in the presence of imperfect detection (van Strien *et al.*, 2013; Isaac *et al.*, 2014). This approach uses 2 hierarchically coupled sub-models, an occupancy sub-model (i.e. presence verses absence), and a detection sub-model (i.e. detection verses non-detection), together these sub-models estimate the conditional probability that a species is detected when present. A Bayesian occupancy model, following van Strien *et al.* (2013) and Isaac *et al.* (2014), with improvements based on Outhwaite *et al.* (2018) was applied to all priority species from those taxonomic groups for which data were available. For each site-year combination the model estimates presence or absence for the species in question given variation in detection probability: from this the proportion of occupied sites ('occupancy') was estimated for each year. These annual occupancy estimates were scaled so the value for 1970 was set to 100. The annual value of the composite indicator was calculated as the arithmetic mean of scaled species-specific occupancy estimates and uncertainty in the species-specific annual occupancy estimates was propagated through to the final indicator. A detailed description of the occupancy model, and the creation of

the composite indicator, can be found in the [technical document on the Bayesian indicator development](#).

5. Thresholds for species-specific trends

Species were grouped into one of 5 categories based on both their short-term (over the most recent 5 years of data) and long-term (all years) mean annual change in occupancy (Table 3).

Table 3: Thresholds used to define individual species trends

Category	Thresholds	Threshold – equivalent
Strong increase	Above +2.81% per annum	+100% over 25 years
Weak increase	Between +1.16% and +2.81% p.a.	+33% to +100% over 25 years
Stable	Between -1.14 % and +1.16% p.a.	-25% to +33% over 25 years
Weak decrease	Between -2.73% and -1.14% p.a.	-50% to -25% over 25 years
Strong decrease	Below -2.73% p.a.	-50% over 25 years

Asymmetric percentage change thresholds are used to define these classes as they refer to proportional change, where a doubling of a species index (an increase of 100%) is counterbalanced by a halving (a decrease of 50%).

The threshold values for each category were based on those of the wild bird indicator; whether an individual species is increasing or decreasing has been decided by its rate of annual change over the time period (long or short) of interest. If the rate of annual change would lead to an occupancy increase or decrease of between 25 per cent and 49 per cent over 25 years, the species is said to have shown a ‘weak increase’ or a ‘weak decline’ respectively. If the rate of annual change would lead to a population increase or decrease of 50 per cent or more over 25 years, the species is said to have shown a ‘strong increase’ or a ‘strong decline’ respectively. These thresholds are used in the [Birds of Conservation Concern](#) (PDF 1.6MB) status assessment for birds in the UK. See the [technical document on the Bayesian indicator development](#) for further detail on the calculation of the species-specific trends.

6. Indicator Methods

Table 4 shows the number of species on the combined 4 Countries List within the taxonomic groups for which data were collated, and the number of species in each group whose modelled trends met the inclusion criteria for the indicator. As mentioned above, the Bayesian approach

incorporates species-specific uncertainty in the indicator, a detailed description of this method can be found in the [Bayesian indicator development technical report](#).

Table 4: Summary of species time-series included in the Priority Species Bayesian measure

Taxonomic group	Number on FCL	Number meeting criteria for inclusion in the indicator
Ants	9	3
Aquatic Bugs	6	3
Bees	60	49
Bryophytes	301	48
Carabids	34	3
Centipedes	1	0
Craneflies	30	8
Dragonflies	4	3
Empid & dolichopodid flies	8	0
Ephemeroptera (mayflies)	2	2
Fungus gnats	8	0
Gelechiid moths	2	0
Hoverflies	21	7
Leaf and seed beetles	21	4
Lichens	545	72
Millipedes	3	0
Molluscs	82	28
Macro Moths	172	117
Neuroptera (lacewings)	2	0
Orthoptera	6	3
Plecoptera (stoneflies)	2	1
Rove Beetles	7	0
Shield Bugs	1	1
Soldierflies	16	8
Spiders	40	2
Trichoptera (caddisflies)	4	0
Wasps	34	28
Weevils	14	5
Total	1435	395

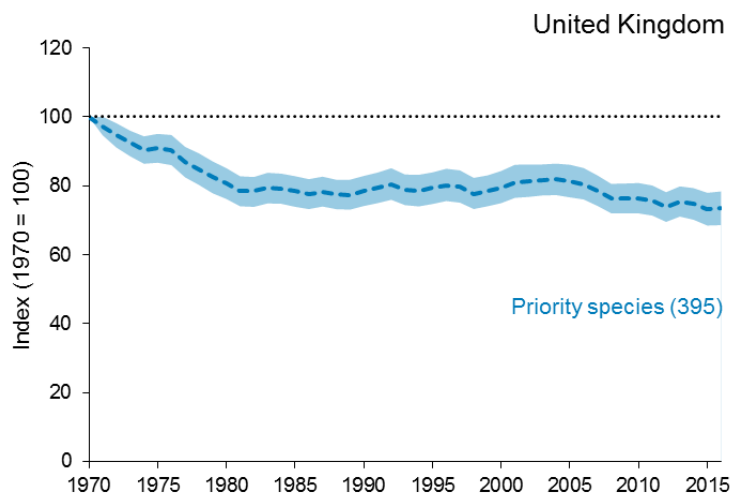
Models were run for all species on the FCL within the taxonomic groups for which data could be collated. In order to reduce the influence of species with highly uncertain annual occupancy estimates, species with fewer than 50 total records or a gap between records greater than 10 years or less than 10 years of estimates were excluded from the indicator. Species' contribution to the indicator was restricted until after their first occurrence record. This additional filter further reduced the contribution of uncertain estimates to the indicator and was taken due to the fact that some of the recording schemes have greatly expanded over the time period with many additional sites added. In addition following the advice of the recording schemes and the methodology used in D1c hoverfly, bee, wasp and ant estimates prior to 1980 did not contribute to the indicator. Species also only contributed up until the last year for which scheme data was available. For example, no lichens directly contribute to the 2016 index value as scheme data is only available to 2015.

Overall these changes to the method for the C4b 2019 measure have reduced the number of species included (395 compared to 714 species in the 2018 C4b indicator) and the length of some time series, however, these reductions have resulted in the indicator being based on more robust occupancy estimates.

7. Headline C4b Indicator

The headline indicator was generated by combining time series of change in the proportion of occupied sites for 395 species (Figure 1).

Figure 1: Change in the occupancy (proportion of occupied sites) of priority species in the UK between 1970 and 2016



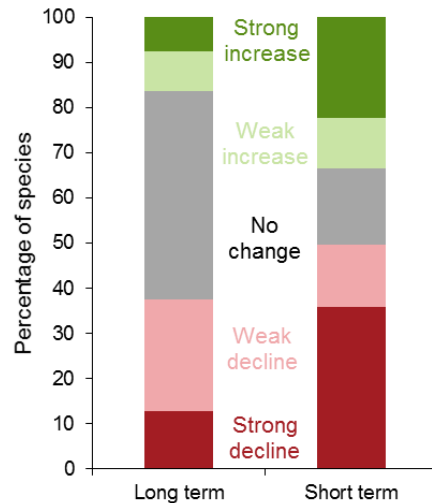
Notes:

1. The graph shows the unsmoothed trend (dashed line) with variation around the line (shaded area) within which users can be 90% confident that the true value lies (credible interval).
2. The figure in brackets shows the number of species included in the composite index.

Overall the indicator shows an overall decline between 1970 and 2016. The composite indicator showed a gradual decline between 1970 and 1981, which was followed by a relatively stable period until 2010 with the subsequent trend indicating a minor decrease. The index value of the

final year of the time series (2016) was 27% lower than the value in 1970, thus indicating a decrease in priority species occupancy. The 90% credible interval of the indicator value in 2016 did not span 100, suggesting a significant decrease in priority species occupancy between 1970 and 2016. The balance of increasing and decreasing species showed higher numbers of decreasing than increasing species in both the long- and short-term (Figure 2).

Figure 2: The proportion of priority species in each trend category based on mean change in occupancy over both a) the long term (all years) and b) the short term (the most recent 5 years)



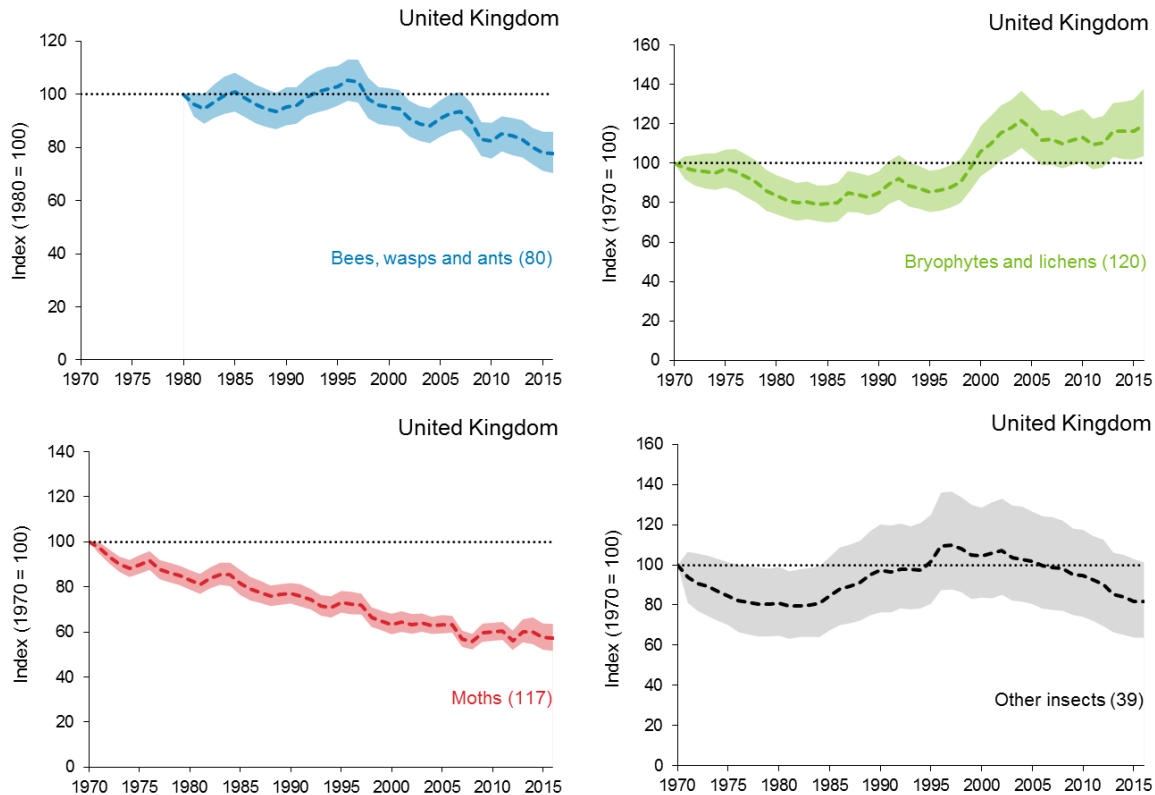
Note: The bar chart shows the percentage of species within the indicator that have increased, decreased or shown no change in distribution (measured as the proportion of occupied sites), based on set thresholds of change.

The short-term trends tend to have a greater number of species showing increasing or decreasing trends, and of them, a greater number falling into the “stronger” categories than the long-term trends. This is likely to be a result of the high level of short-term variation in priority species populations. The species-specific trends were calculated as the mean percentage change in occupancy per year, therefore over a 40+ year period the influence of short-term variation on the trend is reduced compared to its influence on a 5 year trend.

8. Change in priority species by taxonomic group

The headline indicator (Figure 1) masks variation within and between taxonomic groups. Figure 3 shows indicators for each taxonomic group separately. These were generated using the same methods as the overall indicator.

Figure 3: Change in distribution of UK priority species, by taxonomic group, 1970³ to 2016



Notes:

1. The graphs show the unsmoothed trend (dashed line) and variation around the line (shaded area) within which users can be 90% confident that the true value lies for each of the taxonomic groups included in the composite indicator.
2. The figures in brackets show the number of species included in each measure.
3. The indicator for bees, wasps and ants starts in 1980.

The trends of the taxonomic groups included within a multi-species indicator are often obscured by its composite nature, therefore trends for a number of sub groups are presented here to provide clearer insight.

Bees, wasps and ants remained stable over the earlier period but have undergone a decline post 2000 with the 2016 index at 78 of the 1980 index (100). After early declines, bryophytes and lichens have shown a recent increase with a value in 2016 of 120. Other terrestrial insects (a group comprising carabids, craneflies, empid & dolichopodid flies, fungus gnats, hoverflies, leaf and seed beetles, Neuropterida, Orthoptera, plant bugs, rove beetles, shield bugs, soldier beetles, soldierflies and weevils) declined with the final year value being 82 of the 1970 index (100). The largest decline was found for priority moth species with index only being 57 in the final year.

9. Overall long-term change in the relative abundance and distribution of priority species

In the 2018 publication, both indicators C4a and C4b were combined for assessment. This has not been updated in 2019, so does not apply to the revised indicators. The following text from section 9.1 has been retained for information on how the combined assessment was calculated.

9.1 Background

Currently, the priority species indicator comprises of 2 measures; this indicator ([C4b](#)) based on distribution data and [C4a](#) based on abundance data. The assessment is made separately for these 2 data types, resulting in 2, potentially conflicting priority species indicator assessments. The C4b assessment is described fully in this document, however in summary, it is based on the mean growth rate across species, with an approach that incorporates the uncertainty in the individual species index estimates into the indicator. The C4a indicator is based the geometric mean index value across species, with uncertainty of the indicator calculated via bootstrapping across species (see the associated [technical background document](#) for further detail). Ideally, these would be combined into a single assessment, however such a combined indicator needs to address challenges about differences in the data types that contribute to C4a and C4b. Simply combining the species trends would assume equivalence across the 2 datatypes, i.e. that a 10% change in abundance is equivalent to a 10% change in distribution. This has, to date, been deemed an unreasonable assumption to make. Furthermore combining change from different datatypes leads to a lack of clarity around what the indicator is actually measuring when using magnitude of change.

The following section describes a technique to produce a combined evaluation of priority species, using both abundance and distribution data. The key development is that rather than assessing the indicator based on magnitude of change, the indicator assessment is based on the balance of increasing versus decreasing species. This is consistent with existing indicators, in that the assessment is a statement of confidence in whether the overall line has increased, decreased or showed no overall change. It also sidesteps the challenges of combining different data types by assuming only that the confidence with which we can assign a species as increasing or decreasing can be compared across data types.

9.2 Combined assessment calculations

First, for each species 1,000 index values for the first and last year in its time series (either abundance or distribution) are extracted. The values are random draws from a normal distribution informed by the mean and standard error of the indices in question, thereby propagating the uncertainty in these annual indices forward to the indicator assessment. For each of the 1,000 pairs of values, an assessment is made as to whether the species increased (1) or decreased (0) over the course of its time series. This provides a combined total of 1,000 1s and 0s per species. For simplicity, these 1,000 1s and 0s are referred to as change indices. The mean of these 1,000 change indices for each species is the best estimate of the probability that the species has increased. For example, a value of 0.2 indicates a 20% probability that the species increased, so it could be said that, with 80% confidence, the species has declined. The change indices for each species are then collated into a matrix with 1,000 rows and n columns, where n is the total number of priority species in the indicator. For each row, the balance between increasing and decreasing species are calculated as the mean of the change indices across all species. These species means estimate the proportion of species that are

increasing: values > 0.5 suggest that more species increased than decreased, values < 0.5 suggest that more species decreased. This gives 1,000 values of the balance between increasing and decreasing species, which is summarised using the mean and 95% confidence intervals (CIs). The assessment is made using the 95% CIs;

- If the 95% CIs span 0.5, the trend in priority species will be assessed as no overall change.
- If the 95% CIs are below 0.5, the trend in priority species will be assessed as a decline.
- If the 95% CIs are above 0.5, the trend in priority species will be assessed as increasing.

The mean across the 1,000 iterations is the best estimate of the balance of increasing vs decreasing species. The balance between increasing and decreasing priority species over the long term is 0.45 (95% CI: 0.43 to 0.47). Therefore, the overall assessment is that 45% of species increased and 55% declined: whilst the value is close to 50:50, the small width of the 95% CIs gives confidence in the assessment that declines outnumber increases. Thus, the combined 2018 C4 priority species indicator would be assessed as a decline using this new approach.

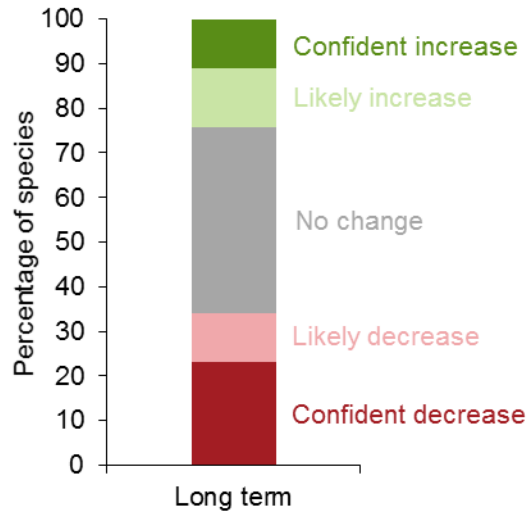
9.3 Presentation

As noted above, concerns have been raised around combining estimates of magnitude of change between abundance and distribution trend data. As a result, to date, no combined bar plot documenting the proportion of increasing and decreasing species has been presented. Here, rather than assessing species based on the magnitude of change, assessments of species are based on the probability that they were increasing or decreasing. Species were classified into one of 5 bins based on the mean value across the 1,000 binary estimates of change for the species in question as follows:

- Species were classified as a confident increase if the mean value was above 0.95.
- Species were classified as a confident decrease if the mean value was below 0.05.
- Species were classified as likely increasing if the mean value was above 0.75.
- Species were classified as likely decreasing if the mean value was below 0.25.
- The remaining species were classified as having no clear trend.

Of the 929 priority species included in C4a and C4b, 103 (11%) were classified as a confident increase, 122 (13%) as likely increasing, 387 (42%) as having no clear trend, 103 (11%) as likely decreasing and 214 (23%) as a confident decrease (Figure 5).

Figure 5: Overall change in the relative abundance and distribution of priority species in the UK, 1970 to 2015



Notes:

1. Based on 929 species included in the 2018 update of indicators C4a and C4b. Each species contributes once only – so either to C4a or to C4b.
2. The graph provides information on the percentage of species which have increased, decreased or remained unchanged; it does not assess the amount of change in those species.

In summary, 225 species (24%) have increased, 317 (34%) have decreased and 387 (42%) have shown no significant change in either abundance or distribution between 1970 and 2015. Overall, the long-term trend for the combined measure of priority species abundance and distribution in the UK is declining.

10. References

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Appendix 1 – Species List

Species	Group
<i>Eopyrenula grandicula</i>	Fungi
<i>Stenocybe septata</i>	Fungi
<i>Cneorhinus plumbeus</i>	Coleoptera
<i>Carabus intricatus</i>	Coleoptera
<i>Cicindela sylvatica</i>	Coleoptera
<i>Donacia impressa</i>	Coleoptera
<i>Donacia marginata</i>	Coleoptera
<i>Donacia thalassina</i>	Coleoptera
<i>Donacia vulgaris</i>	Coleoptera
<i>Pelenomus canaliculatus</i>	Coleoptera
<i>Poecilus kugelanni</i>	Coleoptera
<i>Poophagus sisymbrii</i>	Coleoptera
<i>Thryogenes nereis</i>	Coleoptera
<i>Notaris bimaculatus</i>	Coleoptera
<i>Aeshna isosceles</i>	Odonata
<i>Coenagrion hastulatum</i>	Odonata
<i>Coenagrion mercuriale</i>	Odonata
<i>Ammophila sabulosa</i>	Hymenoptera
<i>Ancistrocerus parietum</i>	Hymenoptera
<i>Andrena cineraria</i>	Hymenoptera
<i>Andrena coitana</i>	Hymenoptera
<i>Andrena denticulata</i>	Hymenoptera
<i>Andrena fuscipes</i>	Hymenoptera
<i>Andrena helvola</i>	Hymenoptera
<i>Andrena marginata</i>	Hymenoptera
<i>Andrena nigroaenea</i>	Hymenoptera
<i>Andrena nitida</i>	Hymenoptera
<i>Andrena praecox</i>	Hymenoptera
<i>Andrena ruficrus</i>	Hymenoptera
<i>Andrena semilaevis</i>	Hymenoptera
<i>Andrena tarsata</i>	Hymenoptera

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<i>Anoplius concinnus</i>	Hymenoptera
<i>Anthidium manicatum</i>	Hymenoptera
<i>Anthophora furcata</i>	Hymenoptera
<i>Bombus (P.) barbutellus</i>	Hymenoptera
<i>Bombus (P.) campestris</i>	Hymenoptera
<i>Bombus distinguendus</i>	Hymenoptera
<i>Bombus humilis</i>	Hymenoptera
<i>Bombus muscorum</i>	Hymenoptera
<i>Bombus ruderarius</i>	Hymenoptera
<i>Bombus ruderatus</i>	Hymenoptera
<i>Bombus (Psithyrus) rupestris</i>	Hymenoptera
<i>Bombus sylvarum</i>	Hymenoptera
<i>Cerceris quinquefasciata</i>	Hymenoptera
<i>Ceropales maculata</i>	Hymenoptera
<i>Colletes daviesanus</i>	Hymenoptera
<i>Colletes floralis</i>	Hymenoptera
<i>Colletes fodiens</i>	Hymenoptera
<i>Colletes halophilus</i>	Hymenoptera
<i>Crabro peltarius</i>	Hymenoptera
<i>Crossocerus megacephalus</i>	Hymenoptera
<i>Crossocerus quadrimaculatus</i>	Hymenoptera
<i>Diodontus tristis</i>	Hymenoptera
<i>Dipogon subintermedius</i>	Hymenoptera
<i>Dipogon variegatus</i>	Hymenoptera
<i>Astata pinguis</i>	Hymenoptera
<i>Ectemnius cephalotes</i>	Hymenoptera
<i>Ectemnius continuus</i>	Hymenoptera
<i>Epeolus variegatus</i>	Hymenoptera
<i>Eucera longicornis</i>	Hymenoptera
<i>Evagetes crassicornis</i>	Hymenoptera
<i>Formica aquilonia</i>	Hymenoptera
<i>Formica fusca</i>	Hymenoptera
<i>Formicoxenus nitidulus</i>	Hymenoptera
<i>Gorytes tumidus</i>	Hymenoptera
<i>Hedychridium ardens</i>	Hymenoptera
<i>Hylaeus brevicornis</i>	Hymenoptera
<i>Hylaeus hyalinatus</i>	Hymenoptera
<i>Lasioglossum fulvicorne</i>	Hymenoptera
<i>Lasioglossum nitidiusculum</i>	Hymenoptera
<i>Lasioglossum rufitarse</i>	Hymenoptera
<i>Lasioglossum smeathmanellum</i>	Hymenoptera

C4b. Status of UK priority species: distribution

<i>Lasioglossum villosulum</i>	Hymenoptera
<i>Lindenius albilabris</i>	Hymenoptera
<i>Psen dahlbomi</i>	Hymenoptera
<i>Mutilla europaea</i>	Hymenoptera
<i>Nomada armata</i>	Hymenoptera
<i>Nomada fabriciana</i>	Hymenoptera
<i>Nomada goodeniana</i>	Hymenoptera
<i>Nomada leucophthalma</i>	Hymenoptera
<i>Nomada striata</i>	Hymenoptera
<i>Odynerus melanocephalus</i>	Hymenoptera
<i>Osmia aurulenta</i>	Hymenoptera
<i>Osmia rufa</i>	Hymenoptera
<i>Osmia coerulescens</i>	Hymenoptera
<i>Osmia parietina</i>	Hymenoptera
<i>Oxybelus uniglumis</i>	Hymenoptera
<i>Pompilus cinereus</i>	Hymenoptera
<i>Priocnemis schioedtei</i>	Hymenoptera
<i>Pseudepipona herrichii</i>	Hymenoptera
<i>Omalus auratus</i>	Hymenoptera
<i>Sphecodes ferruginatus</i>	Hymenoptera
<i>Sphecodes gibbus</i>	Hymenoptera
<i>Sphecodes pellucidus</i>	Hymenoptera
<i>Stelis punctulatissima</i>	Hymenoptera
<i>Symmorphus mutinensis</i>	Hymenoptera
<i>Tachysphex pompiliformis</i>	Hymenoptera
<i>Nigrobaetis niger</i>	Ephemeroptera
<i>Potamanthus luteus</i>	Ephemeroptera
<i>Hepialus humuli</i>	Moths
<i>Cossus cossus</i>	Moths
<i>Adscita statices</i>	Moths
<i>Synanthedon scoliaeformis</i>	Moths
<i>Trichiura crataegi</i>	Moths
<i>Eriogaster lanestris</i>	Moths
<i>Malacosoma neustria</i>	Moths
<i>Endromis versicolora</i>	Moths
<i>Watsonalla binaria</i>	Moths
<i>Sabra harpagula</i>	Moths
<i>Cymatophorima diluta</i>	Moths
<i>Aplasta ononaria</i>	Moths
<i>Thalera fimbrialis</i>	Moths
<i>Hemistola chrysoprasaria</i>	Moths

C4b. Status of UK priority species: distribution

<i>Cyclophora pendularia</i>	Moths
<i>Cyclophora porata</i>	Moths
<i>Timandra comae</i>	Moths
<i>Scopula marginepunctata</i>	Moths
<i>Orthonama vittata</i>	Moths
<i>Xanthorhoe decoloraria</i>	Moths
<i>Xanthorhoe ferrugata</i>	Moths
<i>Scotopteryx bipunctaria</i>	Moths
<i>Scotopteryx chenopodiata</i>	Moths
<i>Epirrhoe galiata</i>	Moths
<i>Entephria flavicinctata</i>	Moths
<i>Entephria caesiata</i>	Moths
<i>Pelurga comitata</i>	Moths
<i>Eulithis mellinata</i>	Moths
<i>Ecliptopera silaceata</i>	Moths
<i>Eustroma reticulatum</i>	Moths
<i>Melanthia procellata</i>	Moths
<i>Pareulype berberata</i>	Moths
<i>Rheumaptera hastata</i>	Moths
<i>Perizoma blandiata</i>	Moths
<i>Perizoma albulata</i>	Moths
<i>Chesias legatella</i>	Moths
<i>Chesias rufata</i>	Moths
<i>Lithostege griseata</i>	Moths
<i>Minoa murinata</i>	Moths
<i>Trichopteryx polycommata</i>	Moths
<i>Chiasmia clathrata</i>	Moths
<i>Macaria carbonaria</i>	Moths
<i>Macaria wauaria</i>	Moths
<i>Epione vespertaria</i>	Moths
<i>Ennomos quercinaria</i>	Moths
<i>Ennomos fuscantaria</i>	Moths
<i>Ennomos erosaria</i>	Moths
<i>Lycia hirtaria</i>	Moths
<i>Aleucis distinctata</i>	Moths
<i>Siona lineata</i>	Moths
<i>Hemaris tityus</i>	Moths
<i>Diloba caeruleocephala</i>	Moths
<i>Thumatha senex</i>	Moths
<i>Parasemia plantaginis</i>	Moths
<i>Arctia caja</i>	Moths

C4b. Status of UK priority species: distribution

<i>Spilosoma lubricipeda</i>	Moths
<i>Spilosoma luteum</i>	Moths
<i>Tyria jacobaeae</i>	Moths
<i>Euxoa tritici</i>	Moths
<i>Euxoa nigricans</i>	Moths
<i>Noctua orbona</i>	Moths
<i>Graphiphora augur</i>	Moths
<i>Protolampra sobrina</i>	Moths
<i>Eugnorisma glareosa</i>	Moths
<i>Diarsia rubi</i>	Moths
<i>Xestia alpicola</i>	Moths
<i>Xestia ashworthii</i>	Moths
<i>Xestia castanea</i>	Moths
<i>Xestia agathina</i>	Moths
<i>Polia bombycina</i>	Moths
<i>Heliophobus reticulata</i>	Moths
<i>Melanchra persicariae</i>	Moths
<i>Melanchra pisi</i>	Moths
<i>Hadena albimacula</i>	Moths
<i>Hadena caesia</i>	Moths
<i>Eriopygodes imbecilia</i>	Moths
<i>Tholera cespitis</i>	Moths
<i>Tholera decimalis</i>	Moths
<i>Orthosia gracilis</i>	Moths
<i>Mythimna comma</i>	Moths
<i>Shargacucullia lychnitis</i>	Moths
<i>Brachylomia viminalis</i>	Moths
<i>Asteroscopus sphinx</i>	Moths
<i>Dasypolia templi</i>	Moths
<i>Aporophyla lutulenta</i>	Moths
<i>Xylena exsoleta</i>	Moths
<i>Allophyes oxyacanthae</i>	Moths
<i>Blepharita adusta</i>	Moths
<i>Agrochola helvola</i>	Moths
<i>Agrochola litura</i>	Moths
<i>Agrochola lychnidis</i>	Moths
<i>Atethmia centrigo</i>	Moths
<i>Acronicta psi</i>	Moths
<i>Acronicta rumicis</i>	Moths
<i>Amphipyra tragopoginis</i>	Moths
<i>Dicycla oo</i>	Moths

C4b. Status of UK priority species: distribution

<i>Cosmia diffinis</i>	Moths
<i>Apamea remissa</i>	Moths
<i>Apamea anceps</i>	Moths
<i>Chortodes extrema</i>	Moths
<i>Amphipoea oculea</i>	Moths
<i>Hydraecia micacea</i>	Moths
<i>Hydraecia osseola subsp. hucherardi</i>	Moths
<i>Celaena haworthii</i>	Moths
<i>Archanara neurica</i>	Moths
<i>Rhizedra lutosa</i>	Moths
<i>Hoplodrina blanda</i>	Moths
<i>Caradrina morpheus</i>	Moths
<i>Acosmetia caliginosa</i>	Moths
<i>Stilbia anomala</i>	Moths
<i>Heliothis maritima</i>	Moths
<i>Catocala promissa</i>	Moths
<i>Catocala sponsa</i>	Moths
<i>Tyta luctuosa</i>	Moths
<i>Pechipogo strigilata</i>	Moths
<i>Paracolax tristalis</i>	Moths
<i>Trisateles emortualis</i>	Moths
<i>Leptophyes punctatissima</i>	Orthoptera
<i>Metrioptera brachyptera</i>	Orthoptera
<i>Stethophyma grossum</i>	Orthoptera
<i>Brachyptera putata</i>	Plecoptera
<i>Alydus calcaratus</i>	Hemiptera
<i>Gerris gibbifer</i>	Hemiptera
<i>Hebrus ruficeps</i>	Hemiptera
<i>Plea minutissima</i>	Hemiptera
<i>Anasimyia transfuga</i>	Diptera
<i>Brachyopa insensilis</i>	Diptera
<i>Cheilosia chrysocoma</i>	Diptera
<i>Cheilosia latifrons</i>	Diptera
<i>Lipsothrix nervosa</i>	Diptera
<i>Asilus crabroniformis</i>	Diptera
<i>Beris morrisii</i>	Diptera
<i>Bombylius minor</i>	Diptera
<i>Dictenidia bimaculata</i>	Diptera
<i>Dysmachus trigonus</i>	Diptera
<i>Leptarthrus brevirostris</i>	Diptera
<i>Nephrotoma cornicina</i>	Diptera

C4b. Status of UK priority species: distribution

<i>Nephrotoma guestfalica</i>	Diptera
<i>Nephrotoma scurra</i>	Diptera
<i>Nigrotipula nigra</i>	Diptera
<i>Oxycera pygmaea</i>	Diptera
<i>Pamponerus germanicus</i>	Diptera
<i>Thyridanthrax fenestratus</i>	Diptera
<i>Tipula cava</i>	Diptera
<i>Tipula melanoceros</i>	Diptera
<i>Heringia pubescens</i>	Diptera
<i>Parasyrphus nigratarsis</i>	Diptera
<i>Sphegina sibirica</i>	Diptera
<i>Anaptychia ciliaris</i> subsp. <i>ciliaris</i>	Lichens
<i>Anisomeridium viridescens</i>	Lichens
<i>Arthonia anombrophila</i>	Lichens
<i>Arthonia ilicina</i>	Lichens
<i>Arthopyrenia carneobrunneola</i>	Lichens
<i>Bacidia incompta</i>	Lichens
<i>Bactrospora homalotropa</i>	Lichens
<i>Caloplaca dichroa</i>	Lichens
<i>Caloplaca ochracea</i>	Lichens
<i>Collema fasciculare</i>	Lichens
<i>Cresponea premnea</i>	Lichens
<i>Flavoparmelia soledians</i>	Lichens
<i>Fuscopannaria sampaiana</i>	Lichens
<i>Graphina ruiziana</i>	Lichens
<i>Gyalideopsis muscicola</i>	Lichens
<i>Hypotrachyna sinuosa</i>	Lichens
<i>Hypotrachyna taylorensis</i>	Lichens
<i>Lecanactis subabietina</i>	Lichens
<i>Lecania sambucina</i>	Lichens
<i>Lecanographa lyncea</i>	Lichens
<i>Lecanora albella</i>	Lichens
<i>Lecanora horiza</i>	Lichens
<i>Lecanora populicola</i>	Lichens
<i>Leptogium brebissonii</i>	Lichens
<i>Leptogium burgessii</i>	Lichens
<i>Leptogium cyanescens</i>	Lichens
<i>Lobaria amplissima</i>	Lichens
<i>Lobaria pulmonaria</i>	Lichens
<i>Lobaria scrobiculata</i>	Lichens
<i>Lobaria virens</i>	Lichens

C4b. Status of UK priority species: distribution

<i>Menegazzia terebrata</i>	Lichens
<i>Micarea alabastrites</i>	Lichens
<i>Micarea stipitata</i>	Lichens
<i>Nephroma laevigatum</i>	Lichens
<i>Pannaria conoplea</i>	Lichens
<i>Pannaria rubiginosa</i>	Lichens
<i>Parmeliella parvula</i>	Lichens
<i>Parmeliella testacea</i>	Lichens
<i>Parmeliella triptophylla</i>	Lichens
<i>Peltigera britannica</i>	Lichens
<i>Peltigera collina</i>	Lichens
<i>Pertusaria ophthalmiza</i>	Lichens
<i>Phaeographis dendritica</i>	Lichens
<i>Phyllopsora rosei</i>	Lichens
<i>Porina coralloidea</i>	Lichens
<i>Pseudocyphellaria crocata</i>	Lichens
<i>Pseudocyphellaria intricata</i>	Lichens
<i>Pseudocyphellaria norvegica</i>	Lichens
<i>Punctelia borrieri</i>	Lichens
<i>Pyrenula laevigata</i>	Lichens
<i>Pyrenula occidentalis</i>	Lichens
<i>Ramalina fraxinea</i>	Lichens
<i>Rinodina roboris roboris</i>	Lichens
<i>Schismatomma cretaceum</i>	Lichens
<i>Schismatomma graphidioides</i>	Lichens
<i>Schismatomma niveum</i>	Lichens
<i>Schismatomma quercicola</i>	Lichens
<i>Sclerophora pallida</i>	Lichens
<i>Sticta fuliginosa</i>	Lichens
<i>Sticta limbata</i>	Lichens
<i>Sticta sylvatica</i>	Lichens
<i>Strigula taylorii</i>	Lichens
<i>Thelotrema macrosporum</i>	Lichens
<i>Thelotrema petractoides</i>	Lichens
<i>Toninia sedifolia</i>	Lichens
<i>Usnea articulata</i>	Lichens
<i>Usnea ceratina</i>	Lichens
<i>Usnea florida</i>	Lichens
<i>Pertusaria velata</i>	Lichens
<i>Wadeana dendrographa</i>	Lichens
<i>Calypogeia integristipula</i>	Liverworts

C4b. Status of UK priority species: distribution

<i>Cephaloziella massalongi</i>	Liverworts
<i>Fossombronia foveolata</i>	Liverworts
<i>Gymnomitrium concinatum</i>	Liverworts
<i>Lejeunea mandonii</i>	Liverworts
<i>Marsupella sprucei</i>	Liverworts
<i>Metzgeria pubescens</i>	Liverworts
<i>Pallavicinia lyellii</i>	Liverworts
<i>Petalophyllum ralfsii</i>	Liverworts
<i>Cephaloziella nicholsonii</i>	Liverworts
<i>Acicula fusca</i>	Molluscs
<i>Anisus vortex</i>	Molluscs
<i>Anodonta anatina</i>	Molluscs
<i>Anodonta cygnea</i>	Molluscs
<i>Aplexa hypnorum</i>	Molluscs
<i>Arianta arbustorum</i>	Molluscs
<i>Azeca goodalli</i>	Molluscs
<i>Cecilioides acicula</i>	Molluscs
<i>Cochlodina laminata</i>	Molluscs
<i>Helicella itala</i>	Molluscs
<i>Radix auricularia</i>	Molluscs
<i>Leiostyla anglica</i>	Molluscs
<i>Limax cinereoniger</i>	Molluscs
<i>Merdigera obscura</i>	Molluscs
<i>Monacha cantiana</i>	Molluscs
<i>Musculium lacustre</i>	Molluscs
<i>Omphiscola glabra</i>	Molluscs
<i>Pisidium henslowanum</i>	Molluscs
<i>Pupilla muscorum</i>	Molluscs
<i>Segmentina nitida</i>	Molluscs
<i>Spermodea lamellata</i>	Molluscs
<i>Theodoxus fluviatilis</i>	Molluscs
<i>Valvata macrostoma</i>	Molluscs
<i>Vertigo alpestris</i>	Molluscs
<i>Vertigo antivertigo</i>	Molluscs
<i>Vertigo moulinsiana</i>	Molluscs
<i>Zenobiella subrufescens</i>	Molluscs
<i>Zonitoides excavatus</i>	Molluscs
<i>Platygyrium repens</i>	Mosses
<i>Bryoerythrophyllum caledonicum</i>	Mosses
<i>Scopelophila cataractae</i>	Mosses
<i>Buxbaumia viridis</i>	Mosses

C4b. Status of UK priority species: distribution

<i>Tomentypnum nitens</i>	Mosses
<i>Abietinella abietina</i>	Mosses
<i>Pohlia andalusica</i>	Mosses
<i>Palustriella commutata sulcata</i>	Mosses
<i>Cryphaea lamyana</i>	Mosses
<i>Bryum archangelicum</i>	Mosses
<i>Dicranum spurium</i>	Mosses
<i>Drepanocladus vernicosus</i>	Mosses
<i>Epipterygium tozeri</i>	Mosses
<i>Rhynchostegium megapolitanum</i>	Mosses
<i>Eurhynchium schleicheri</i>	Mosses
<i>Fissidens rivularis</i>	Mosses
<i>Eurhynchium striatulum</i>	Mosses
<i>Leptodon smithii</i>	Mosses
<i>Aulacomnium androgynum</i>	Mosses
<i>Orthotrichum sprucei</i>	Mosses
<i>Microbryum curvicolle</i>	Mosses
<i>Didymodon acutus</i>	Mosses
<i>Aphanorhegma patens</i>	Mosses
<i>Tortula protobryoides</i>	Mosses
<i>Microbryum rectum</i>	Mosses
<i>Rhabdoweisia fugax</i>	Mosses
<i>Didymodon nicholsonii</i>	Mosses
<i>Rhytidium rugosum</i>	Mosses
<i>Schistostega pennata</i>	Mosses
<i>Scleropodium cespitans</i>	Mosses
<i>Scleropodium tourettii</i>	Mosses
<i>Seligeria acutifolia</i>	Mosses
<i>Seligeria calcarea</i>	Mosses
<i>Tortula marginata</i>	Mosses
<i>Bartramia ithyphylla</i>	Mosses
<i>Bryum torquescens</i>	Mosses
<i>Brachydontium trichodes</i>	Mosses
<i>Bryum donianum</i>	Mosses
<i>Monocephalus castaneipes</i>	Araneae
<i>Saaristoa firma</i>	Araneae