21 June 2018

# Butterflies in the wider countryside: United Kingdom, 1976 to 2017

Since 1976, the habitat specialists butterflies index has fallen by 77%.

Over the same period, the index for species of the wider countryside has fallen by 46%.

Large fluctuations in numbers between years are a typical feature of butterfly populations, principally in response to weather conditions. 2017 was a relatively bad year for butterflies; the fourth worst in the 42-year series and it was likely due to periods of poor weather during the spring and summer months.

**In this release**

This release covers 2 measures of annual butterfly population abundance: the first for specialist butterflies (species strongly associated with semi-natural habitats such as unimproved grassland) and the second for more widespread butterflies found in both semi-natural habitats and the wider countryside. These statistics contribute to a suite of indicators due to be updated in July this year (UK Biodiversity Indicators, 2018); earlier data availability is allowing their release ahead of that publication.

The statistical assessment of change is made on an analysis of the underlying smoothed trends.  Since 1976, populations of habitat specialists and species of the wider countryside have declined significantly but both trends show no significant change since 2012.

## Habitat Specialists

Habitat specialist species, which are vulnerable to semi-natural habitat loss and fragmentation, have not recovered from population declines experienced in the late 1970s. These declines were mainly attributed to the knock-on effects of the drought conditions experienced in 1976.  The habitat specialist index declined by 77% between 1976 and 2017 (Figure 1). Underlying analysis shows that this decrease was due to a statistically significant reduction in relative abundance over the period 1976 to 2000 that was more pronounced in the late 1970s and early 1980s.   The index showed an increase over the period 2012 to 2017, from 19% to 23% of the 1977 level, however, this short-term change is not statistically significant.

Species fare differently within the overall trend. Habitat specialist species showing the greatest decline since 1976 include: heath fritillary, wood white, Lulworth skipper and pearl-bordered fritillary. Grayling, grizzled skipper and large heath show a decline in the short term since 2012. Silver-spotted skipper, dark green fritillary, large heath, adonis blue and silver-washed fritillary show significant increases over the long term, whilst black hairstreak is the only habitat specialist to show a statistically significant increase since 2012.

**Figure 1: Trends in butterfly populations in the UK: habitat specialists, 1976 to 2017**
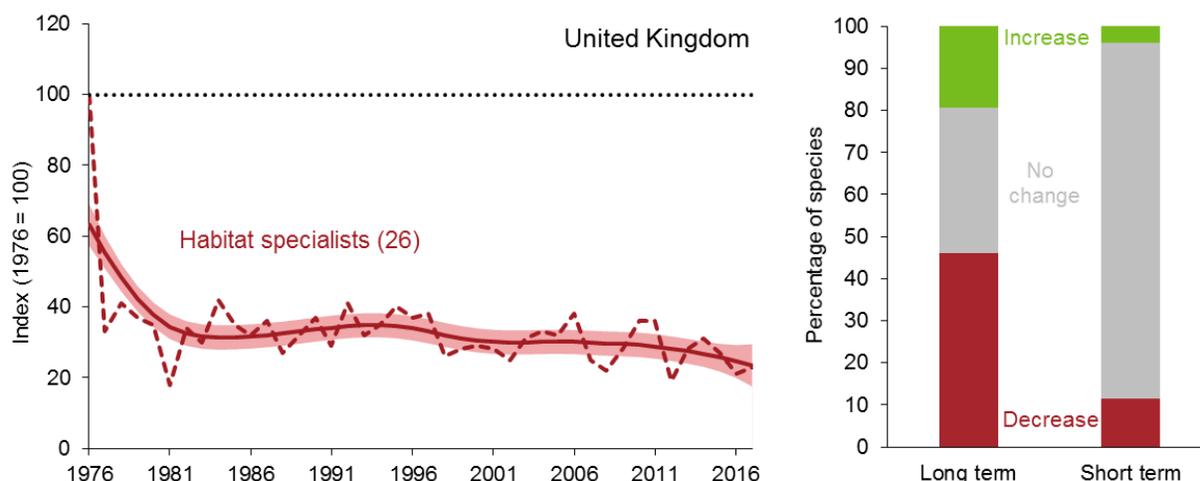


**Notes:**

1.  The figure in brackets shows the number of species included in the index.
2.  The graph shows the unsmoothed trend (dashed line) and the smoothed trend (solid line) together with its 95% confidence interval (shaded).
3.  The bar chart shows the percentage of species within the indicator that have shown a statistically significant increase, statistically significant decrease or no statistically significant change.
4.  In 2017, an improved analysis method has been used to derive the species indices (see 'Background' section for further information).
5.  The graph is not directly comparable to previous versions of this publication. Improvements in the modelling technique have allowed the inclusion of more data, resulting in slight alternations in the trends for individual species.

**Source:** Butterfly Conservation, Centre for Ecology & Hydrology, Defra, Joint Nature Conservation Committee.

## Species of the wider countryside

The species of the wider countryside index decreased by 46% between 1976 and 2017 (Figure 2); the underlying analysis indicates that this decrease was chiefly due to a statistically significant reduction in abundance over the period 1976 to 2006. The index

showed an increase over the period 2012 to 2017, from 36% to 54% of the 1976 level, however, this short-term change is not statistically significant.

Species again fare differently within the overall trend. Species of the wider countryside showing the greatest declines since 1976 include: white-letter hairstreak, wall, and small tortoiseshell; scotch argus was the only species in this index to show a decline in the short term since 2012. Comma, marbled white, speckled wood and ringlet show increases over the long term; no species show a short-term increase since 2012.

**Figure 2: Trends in butterfly populations in the UK: species of the wider countryside, 1976 to 2017**
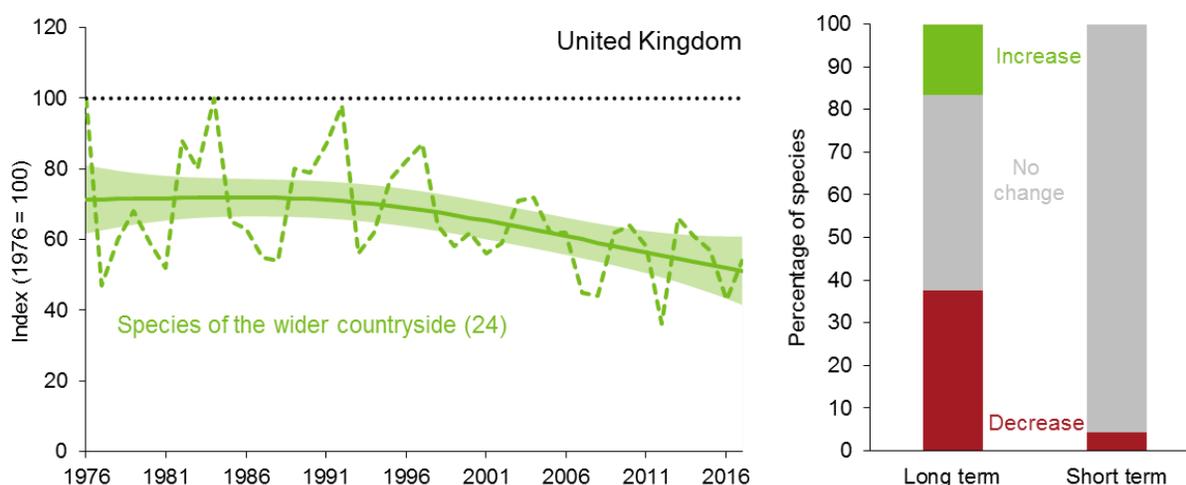


**Notes:**

1. The figure in brackets shows the number of species included in the index.
2. This indicator includes individual measures for 25 species of butterflies; the wider countryside index, however, only includes 24 trends. This is because an aggregate trend is used for small skipper (Thymelicus lineola) and Essex skipper (Thymelicus sylvestris); these 2 species have been combined due to historical difficulties with distinguishing them in the field.
3. The graph shows the unsmoothed trend (dashed line) and the smoothed trend (solid line) together with its 95% confidence interval (shaded).
4. The bar chart shows the percentage of species within the indicator that have shown a statistically significant increase, statistically significant decrease or no statistically significant change.
5. In 2017, an improved analysis method has been used to derive the species indices (see 'Background' section for further information).
6. The graph is not directly comparable to previous versions of this publication. Improvements in the modelling technique have allowed the inclusion of more data, resulting in slight alternations in the trends for individual species.

**Source:** Butterfly Conservation, Centre for Ecology & Hydrology, Defra, Joint Nature Conservation Committee.

| Assessment of change in butterfly populations | | | |
|---|---|---|---|
| | **Long term** | **Short term** | **Latest year** |
| Semi-natural habitat specialists | ❌ 1976–2017 | 😐 2012–2017 | Increased (2017) |
| Species of the wider countryside | ❌ 1976–2017 | 😐 2012–2017 | Increased (2017) |

The traffic lights are determined by comparing the value of the measure in the base/start year with the value in the end year of the period over which change is to be assessed.

✔️ Improving          ❌ Deteriorating

😐 Little or no overall change      ⋯ Insufficient or no comparable data

Long and short-term assessments are based on smoothed data, with the analysis of the underlying trend undertaken by the data providers. Latest-year changes are based on unsmoothed data.

**Background**

This indicator is comprised of 2 multi-species indices compiled by Butterfly Conservation (BC) and the Centre for Ecology & Hydrology (CEH) from data collated through the UK Butterfly Monitoring Scheme (UKBMS) and, for the wider countryside measure, the Wider Countryside Butterfly Monitoring Scheme (WCBS). The indicator includes individual measures for 26 habitat specialist butterflies (low mobility species restricted to semi-natural habitats) and 25 more widespread butterflies which use both semi-natural and general countryside habitats using data collected at 5,104 sites (Figure 3). The wider countryside measure, however, only includes 24 trends because an aggregate trend is used for small skipper (*Thymelicus lineola*) and Essex skipper (*Thymelicus sylvestris*). These 2 species have been combined due to historical difficulties with distinguishing them in the field.

The year-to-year fluctuations of butterflies are often linked to natural environmental variation, especially weather conditions; therefore, to identify underlying patterns in population trends, the assessment of change is based on smoothed indices. The smoothed trend in the multi-species indicator is assessed by structural time-series analysis. A statistical test is performed using the software 'TrendSpotter' to compare the difference in the smoothed index in the latest year versus other years in the series. Within

the measures, each individual species trend is given equal weight, and the annual figure is the geometric mean of the component species indices for that year.

Populations of individual species within each measure may be increasing or decreasing, irrespective of the overall trends.  The bar chart provided alongside each habitat trend graph above shows the percentage of species within that indicator that have shown a statistically significant increase, a statistically significant decrease or no statistically significant change. A list of the species that are included in each index can be found below. A more detailed table summarising the estimated long-term and short-term changes for each species together with an assessment of whether the individual species trends are increasing or decreasing can be found in the accompanying Datasheet.

The method for compiling species annual indices was improved in 2017. Indices are calculated for all species using the Generalised Abundance Index (GAI) method developed in 2016 (Dennis *et al.* (2016) BIOMETRICS: DOI: 10.1111/biom.12506) with an additional modification that the data from each site in each year is weighted in the final stage relative to the proportion of the species flight period surveyed that year for that site. This weighting is necessary as the GAI extrapolates from observed data to estimate the total count across the season, accounting for gaps in the recording, and ensures that the observed data have a stronger effect upon the final indices than the extrapolated data.

The new method uses all butterfly counts collected at both UKBMS sites (3,164 compared with 2,383 in 2014) and randomly selected 1km squares of the Wider Countryside Butterfly Survey (1,940).  The method uses all butterfly counts in a season to estimate the seasonal pattern of butterfly counts for that year, using a concentrated likelihood method; the resulting indices and species trends are similar to those generated through previous analysis methods.

Since 2015, the site index only data has been incorporated into the models; these data are most prevalent in earlier years and thus the graphs are slightly different to those previously presented. As there are delays in data submission, data for previous years are also updated retrospectively; in 2017 extra data were added for 2015 and 2016, for example.  This means that the species indices for individual years may vary from previous publications. Further details of the methods used can be found on the UKBMS website; in the Technical background document for this indicator; and in the UKBMS data capture, processing, validation and reporting summary document.

**Figure 3: Locations of the 3,164 UK Butterfly Monitoring Scheme sites (blue) and 1,940 Wider Countryside Butterfly Monitoring Scheme squares (red) as at 2 May 2018**
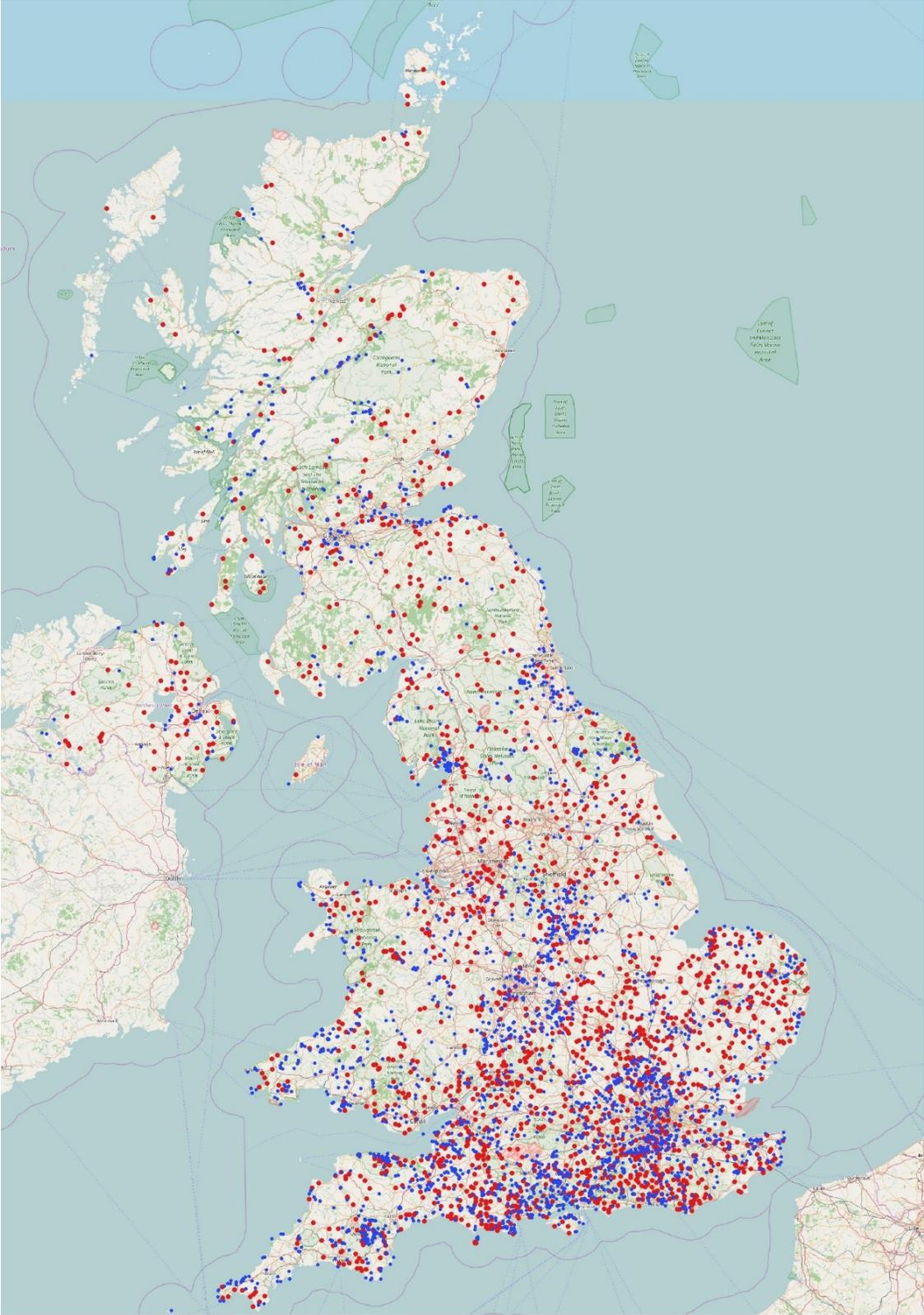
## Species included in the habitat specialists measure (26):

| | |
|---|---|
| adonis blue | *(Polyommatus bellargus)* |
| black hairstreak | *(Satyrium pruni)* |
| brown hairstreak | *(Thecla betulae)* |
| chalkhill blue | *(Polyommatus coridon)* |
| dark green fritillary | *(Argynnis aglaja)* |
| dingy skipper | *(Erynnis tages)* |
| Duke of burgundy | *(Hamearis lucina)* |
| grayling | *(Hipparchia semele)* |
| green hairstreak | *(Callophrys rubi)* |
| grizzled skipper | *(Pyrgus malvae)* |
| heath fritillary | *(Melitaea athalia)* |
| high brown fritillary | *(Argynnis adippe)* |
| large heath | *(Coenonympha tullia)* |
| Lulworth skipper | *(Thymelicus acteon)* |
| marsh fritillary | *(Euphydryas aurinia)* |
| northern brown argus | *(Aricia artaxerxes)* |
| pearl-bordered fritillary | *(Boloria euphrosyne)* |
| purple emperor | *(Apatura iris)* |
| silver-spotted skipper | *(Hesperia comma)* |
| silver-studded blue | *(Plebejus argus)* |
| silver-washed fritillary | *(Argynnis paphia)* |
| small blue | *(Cupido minimus)* |
| small pearl-bordered fritillary | *(Boloria selene)* |
| swallowtail | *(Papilio machaon)* |
| white admiral | *(Limenitis camilla)* |
| wood white | *(Leptidea sinapis)* |

## Species included in the species of the wider countryside indicator (24):

| | |
|---|---|
| brimstone | *(Gonepteryx rhamni)* |
| brown argus | *(Aricia agestis)* |
| comma | *(Polygonia c-album)* |
| common blue | *(Polyommatus icarus)* |
| gatekeeper | *(Pyronia tithonus)* |
| green-veined white | *(Pieris napi)* |
| holly blue | *(Celastrina argiolus)* |
| large skipper | *(Ochlodes sylvanus)* |
| large white | *(Pieris brassicae)* |
| marbled white | *(Melanargia galathea)* |
| meadow brown | *(Maniola jurtina)* |
| orange-tip | *(Anthocharis cardamines)* |
| peacock | *(Aglais io)* |
| purple hairstreak | *(Favonius quercus)* |
| ringlet | *(Aphantopus hyperantus)* |
| scotch argus | *(Erebia aethiops)* |
| small copper | *(Lycaena phlaeas)* |

| small heath | (Coenonympha pamphilus) |
| small/Essex skipper | (Thymelicus sylvestris/lineola) |
| small tortoiseshell | (Aglais urticae) |
| small white | (Pieris rapae) |
| speckled wood | (Pararge aegeria) |
| wall | (Lasiommata megera) |
| white-letter hairstreak | (Satyrium w-album) |

## Web links

| UK Butterfly Indicator | Insects of the wider countryside (butterflies): United Kingdom, 1976 to 2017 |
|---|---|
| Butterfly Conservation | The state of Britain's butterflies |
| UK Butterfly Monitoring Scheme | Butterflies as indicators |

**Next publication date:** Summer 2019