United Kingdom
Butterfly Monitoring Scheme

Annual Report 2020

UKBMS Annual Report 2020

The UKBMS

The UKBMS is organised and funded by Butterfly Conservation (BC), the UK Centre for Ecology & Hydrology (UKCEH), British Trust for Ornithology (BTO), and the Joint Nature Conservation Committee (JNCC). The UKBMS is indebted to all volunteers who contribute data to the scheme.

The members of the UKBMS Steering Group in 2020 were Tom Brereton, Ian Middlebrook and Nigel Bourn (BC), David Roy (CEH), David Noble and Sarah Harris (BTO), Kirsi Peck and Anna Robinson (JNCC), Jon Curson (NE), Dylan Lloyd (NRW), Simon Foster (NatureScot), Richard Weyl (DAERA), Colin Edwards (SF) and Jay Doyle (FC).

Team for 2021

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Citation

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This report can be downloaded from
https://ukbms.org/publications

UKBMS partners

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https://www.ceh.ac.uk

Butterfly Conservation, Manor Yard, East Lulworth, Wareham, Dorset, BH20 5QP
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https://www.bto.org

Joint Nature Conservation Committee, Monkstone House, City Road, Peterborough, PE1 1JY
https://jncc.gov.uk

Silver-washed Fritillary aberration. *Photograph by Mark Searle.*

Acknowledgements

We would like to acknowledge the financial contribution by the Joint Nature Conservation Committee, Butterfly Conservation, the British Trust for Ornithology and the UK Centre for Ecology & Hydrology.

We are indebted to all the volunteers who co-ordinate and contribute data to the scheme throughout the United Kingdom, as well as to those who allow access to their land and in some cases actively promote butterfly monitoring thereon. We would like to thank the photographers for allowing their images to be used in this report.

Finally, we would like to thank JRS Creative Services - part of UK Research and Innovation (UKRI) - for designing and printing the report.

Cover photograph of Dark Green Fritillary. This butterfly had its best year since 1977. *Photograph by Mark Searle.*

Contents and online resources

Comma. *Photograph by Mark Searle.*

Gatekeeper. *Photograph by Ian Middlebrook.*

Online resources

Further information on the UK Butterfly Monitoring Scheme, including individual species and site trends, and how to take part in butterfly monitoring can be found at:
https://www.ukbms.org/

For the Wider Countryside Butterfly Survey go to
https://ukbms.org/wider-countryside-butterfly-survey

For online data entry go to
https://ukbms.org/MyData

For information on Biodiversity Indicators go to
https://jncc.gov.uk/our-work/uk-biodiversity-indicators/

The following links provide more information on the UKBMS partner organisations:

Butterfly Conservation:
https://butterfly-conservation.org/

UK Centre for Ecology & Hydrology:
https://www.ceh.ac.uk/

British Trust for Ornithology:
https://www.bto.org/

Joint Nature Conservation Committee:
https://jncc.gov.uk/

UKBMS News

HIGHLIGHTS IN NUMBERS

45

The number of years of data contributing to the UKBMS

232

The number of days on which UKBMS counts were made in 2020

2,504

The number of UKBMS locations monitored in 2020

6,015

The total number of UKBMS locations monitored across all years

26,790

The number of recording visits made to standard transects and WCBS squares in 2020

1,715,436

The number of butterflies counted on standard transects and WCBS squares in 2020.

CHANGES TO THE TEAM AT BUTTERFLY CONSERVATION

Tom Brereton has moved on after over 20 years of service.

As reported last year, Tom Brereton has now left Butterfly Conservation following over 20 years of incredible service to the organisation. Tom played a huge role in building up the organisation's reputation within the field of scientific monitoring. He initially worked tirelessly to pull together butterfly monitoring data from diverse sources, then collaborated with UKCEH to combine all data and launch the UKBMS in 2006. He was instrumental in developing the Wider Countryside Butterfly Survey (WCBS) and increasing Butterfly Conservation's profile in the field of ecological research, with numerous scientific publications to his name. Tom's extensive knowledge and experience will be sorely missed by the scheme, but we wish him well in his future endeavours.

Now that Ian Middlebrook has taken on many of Tom's UKBMS responsibilities, Rachael Conway has been drafted into the team to help provide support and advice for transect walkers, branch co-ordinators and new website users. Our volunteers in Northern Ireland will already be familiar with Rachael, who has worked with BC there for over five years on volunteer engagement. She will be combining her UKBMS responsibilities with work developing some of BC's other recording initiatives through the 'Supporting Science' Project. Megan Lowe remains the primary contact for BC volunteers in the WCBS.

Rachael Conway has joined the UKBMS team.

UKBMS GUIDANCE – FREQUENTLY ASKED QUESTIONS (FAQS)

As the UKBMS continues to welcome many new transect walkers and WCBS recorders to the scheme, these volunteers may have many questions about the best way to carry out their surveys. We are therefore preparing some FAQs for the UKBMS website, and have included a few below regarding which data recorders should, or should not, be entering into the system.

I was only able to complete part of the transect route this week due to deteriorating weather/blocked access etc. Should I still enter the data?

No, you should only supply data for transect walks that have been completed. Nearly all our analysis is carried out with site totals, rather than using section level data. An incomplete walk misses the butterflies on the remaining sections. The resulting totals, at a site level, will under-estimate the population figures and could contribute to a false negative trend.

If I only manage to complete part of the route one day, can I go back and finish it the next day?

Unfortunately this is not possible – data should only be supplied for complete transect walks, for the reasons given above. Conditions on the two days may well be different and it is not possible to combine two partly complete walks without compromising the data. If you find that you need to return to the site the next day, then you should start again and walk the whole transect.

I sometimes/often walk my transect with a colleague/ friend. Should we count all the butterflies we see between us?

No, there should always be just one nominated recorder for each walk who records only what they see and those are the data that should be supplied to the UKBMS. It's inevitable that we will miss some butterflies, particularly when they are very active, but the most important thing is consistency, so that data from each walk are comparable. If you include additional butterflies seen by others walking alongside you, this will artificially inflate the population figures for the site and could contribute to a false positive trend.

Can we enter data from walks carried out in poor weather?

We know that some recorders try to walk their transect every week, regardless of the weather conditions. This is not necessary, and you should be aware that any data which do not meet the weather criteria are excluded from the main trend analysis that we carry out each year. Nevertheless, you may enter data from walks in sub-optimal conditions into the website, provided you supply accurate weather data, and these counts can then be made available for other research uses such as climate change studies. Having said that, some Branch Co-ordinators would prefer that you do not enter these walks, as it makes their local analysis more difficult. If in doubt, please refer to your local Branch Co-ordinator before entering data for these walks.

Should we still enter data if we didn't see any butterflies?

Yes please! If you have conducted a valid transect walk (full route, appropriate weather) then you should always enter the details of that walk, regardless of whether any butterflies were seen. A true zero count reflects the prevailing conditions and butterfly activity at that point in the season, and is as valid as any other count. As the BTO say, this makes you a 'zero hero'.

We walked the transect more than once during a week, should we enter all the data or only the walk with the highest counts?

Please supply us with your data from all valid transect walks during the week. The Annual Summary table on the website will show an average count for these walks, whilst all data points contribute equally to the main trend analysis that we carry out each year. If you pick and choose the best walks, this will artificially inflate the population figures for the site – particularly in comparison with years when you could only walk the route once per week. This could contribute to a false positive trend.

Can I use the 'Notes' field to let you know when I've done something different?

No, I'm afraid this is not a suitable way to inform us of any variations you have made to the standard recording practice. With over 25,000 transect walks conducted each year, it is simply not feasible for UKBMS staff to read the notes from each walk before we approve them for analysis. If you have not followed the standard methodology, hopefully the answers above will inform you of what you should do with the data. If you are in doubt, please ask your Branch Co-ordinator or a member of the UKBMS team before you enter any data.

Can I use the 'Notes' field to tell you more about what I've seen?

We are only likely to refer to your notes if we have specific queries with the data. If you have recorded a butterfly on your transect that is unusual or new to the site, or perhaps very early/late in the season, then it would certainly be helpful if you confirm this sighting in your notes. That way we'll not need to contact you further. However, if you make additional butterfly sightings 'off-transect' then you should submit these records separately to your county butterfly recorder – perhaps through the iRecord Butterflies App or via **https://www.butterflyrecording.org/**. We are not able to convert comments in the 'Notes' field into standard biological records.

PURPLE HAIRSTREAK MONITORING TRIAL

As a canopy species, only low numbers of Purple Hairstreaks tend to be recorded during standard butterfly transects – the majority of site counts received for this species are of 10 individuals or fewer per year. There are some concerns that UKBMS trends for Purple Hairstreak may not be representative due to low encounter rates and a small (and possibly inconsistent) proportion of the population sampled. Furthermore, their chief habitat, the canopy, is not sampled during a standard transect walk. However, large numbers (up to 300) may be encountered in suitable habitat (the edges of mature oak woodland) during the early evening, especially from 18:00-19:30 on overcast, muggy, summer evenings.

We are currently working with volunteers to design a consistent methodology for collecting better data on the abundance of Purple Hairstreak. This is a priority because the butterfly appears to be in decline in several regions (based on both abundance and occupancy data), and we need to be sure that our data are an accurate representation of how the species is faring. A proposed method is being trialled by some volunteers during 2021, which involves an early evening transect, with the recording box centred around the canopy top along suitable linear and woodland edge habitats. Once feedback has been received, we aim to publish a guidance note ahead of the 2022 Purple Hairstreak season.

An early evening transect at canopy level is being trialled for monitoring Purple Hairstreak

Research Publications

The following new research using UKBMS data has been published since the last Annual Report:

Bell, F., Botham, M., Brereton, T.M., Fenton, A. & Hodgson, J. (2021). Grizzled Skippers stuck in the south: Population-level responses of an early-successional specialist butterfly to climate across its UK range over 40 years. *Diversity and Distributions* 27:962-972.

Breeze, T.D., Bailey, A.P., Balcombe, K.G., Brereton, T., Comont, R., Edwards, M., Garratt, M.P., Harvey, M., Hawes, C., Isaac, N., Jitlal, M., Jones, C.M., Kunin, W.E., Lee, P., Morris, R.K.A., Musgrove, A., O'Connor, R.S., Peyton, J., Potts, S.G., Roberts, S.P.M., Roy, D.B., Roy, H.E., Tang, C.Q., Vanbergen, A.J. & Carvell, C. (2021). Pollinator monitoring more than pays for itself. *Journal of Applied Ecology* 58:44-57.

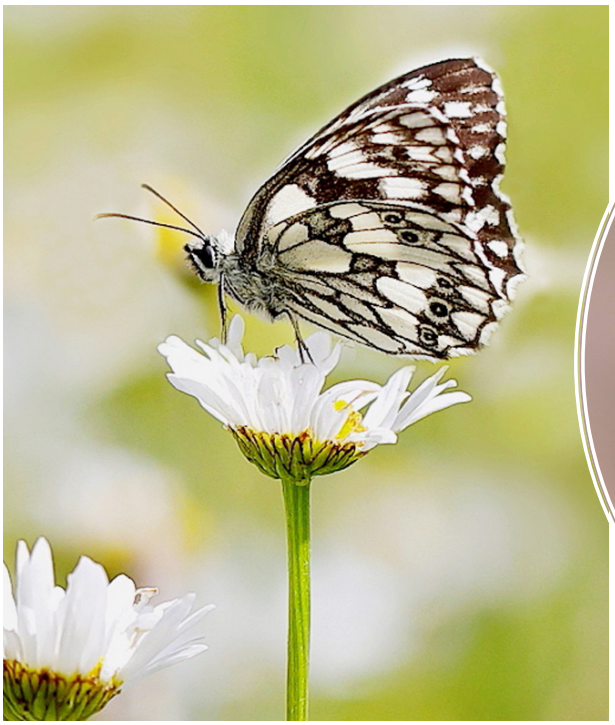
Clarke, H.E. & Dennis, E.B. (2020). A new method for calculating butterfly abundance trends for small regional areas. *Journal of Insect Conservation* 24:779–790.

Freeman, S.N., Isaac, N.J.B., Besbeas, P., Dennis, E.B. & Morgan, B.J.T. (2021). A generic method for estimating and smoothing multispecies biodiversity indicators using intermittent data. *Journal of Agricultural Biological and Environmental Statistics* 26:71-89.

Greenwell, M.P., Botham, M.S., Bruford, M.W., Day, J.C., Evans, L.C., Gibbs, M., Middlebrook, I., Roy, D.B., Watts, K. & Oliver, T.H. (2021). The influence of chalk grasslands on butterfly phenology and ecology. *Ecology and Evolution* 11:14521-14539.

Pellissier, V., Schmucki, R., Pe'er, G., Aunins, A., Brereton, T., Brotons, L., Carnicer, J., Chodkiewicz, T., Chylarecki, P., del Moral, J., Escandell, V., Evans, D., Foppen, R., Harpke, A., Heliölä, J., Herrando, S., Kuussaari, M., Kühn, E., Lehikoinen, A., Lindström, Å., Moshøj, C., Musche, M., Noble, D., Oliver, T., Reif, J., Richard, D., Roy, D., Schweiger, O., Settele, J., Stefanescu, C., Teufelbauer, N., Touroult, J., Trautmann, S., van Strien, A., van Swaay, C., van Turnhout, C., Vermouzek, Z., Voříšek, P., Jiguet, F. & Julliard, R. (2020). Effects of Natura 2000 on nontarget bird and butterfly species based on citizen science data *Conservation Biology* 34:666-676.

Warren, M.S., Maes, D., van Swaay, C.A.M., Goffart, P., Van Dyck, H., Bourn, N.A.D., Wynhoff, I., Hoare, D. & Ellis, S. (2021). The decline of butterflies in Europe: Problems, significance, and possible solutions. *Proceedings of the National Academy of Sciences* 118:e2002551117.

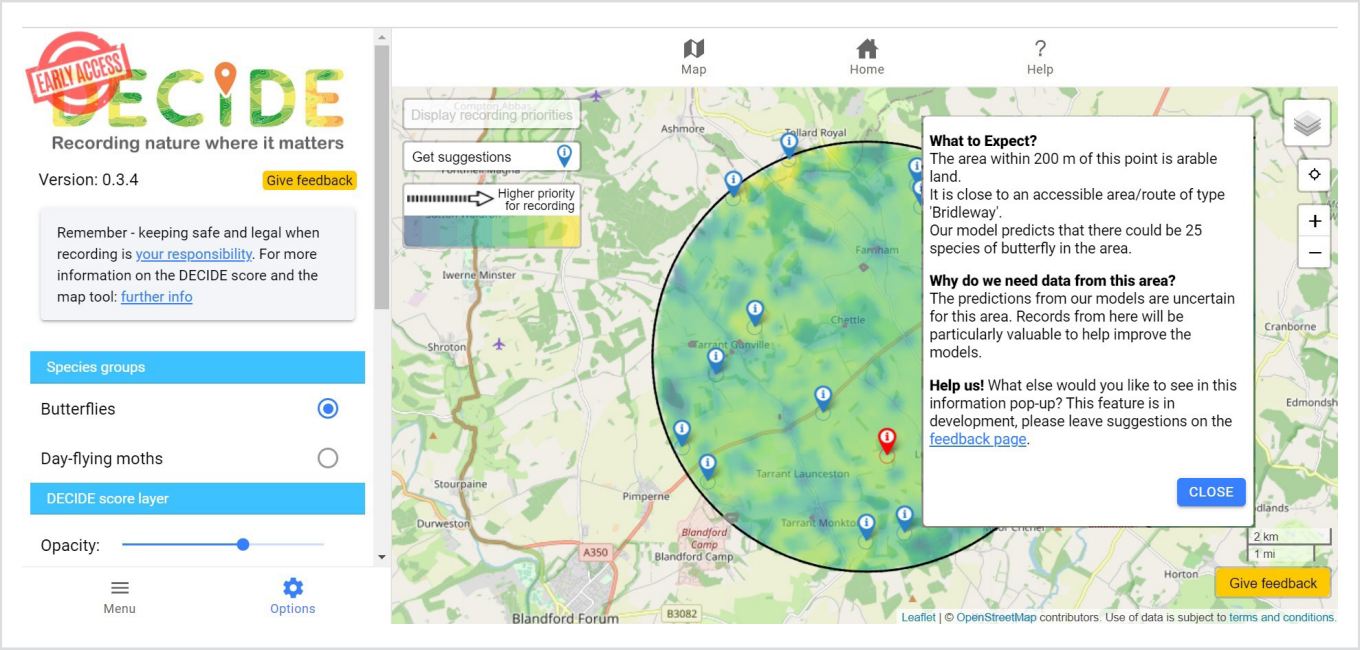


Marbled White. *Photograph by . Mark Searle.*

Large Skipper. *Photograph by Mark Searle..*

News from other schemes and projects

THE DECIDE PROJECT - RECORDING NATURE WHERE IT MATTERS



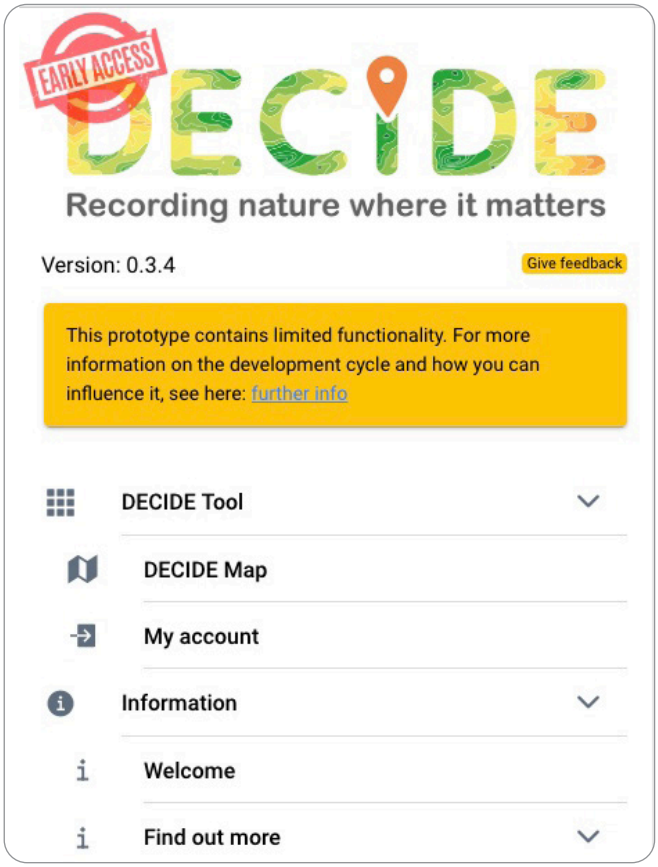
DECIDE is an exciting new two-year project being led by UK Centre for Ecology & Hydrology alongside an interdisciplinary team of partner organisations, including Butterfly Conservation and JNCC. The project team are using a novel approach to identify and encourage people to fill important gaps in recording coverage, with the ultimate aim of improving access to fine-scale butterfly and moth distributions in Great Britain and help inform management decisions.

Species Distribution Models are increasingly used in conservation to predict where butterflies and moths are likely to occur and how their distributions might change under different environmental scenarios and management. These predictions come with uncertainty, but this uncertainty can be reduced with more records from the right places.

It would be impossible to get enough fine-scale records of butterflies and moths to cover all of Great Britain, so the DECIDE project uses models to predict species distributions for each hectare (100m square). The project team have been developing an online tool which highlights the areas on a map where new records would be most valuable in improving these models. Additional information about suggested areas is provided, to help recorders select places they would like to visit.

Importantly, the DECIDE Tool is being developed with input from the recording community – it is developed with recorders and for recorders. Feedback on early versions of the tool has informed functionality of the current version. The project is keen to engage with a wide range of recorders to find out how it can work for them.

You can explore the DECIDE Tool via this link **https://decide.ceh.ac.uk/**. Take a look and see what you think. There are more details of the project on the website, including details of how you can take part in the tool's co-design. Please get involved if you can.



NEW REPORTS ON THE STATE OF DRAGONFLIES AND MOTHS

Our WCBS volunteers are encouraged to record dragonflies and day-flying moths in their 1km squares, alongside butterflies. Many transect walkers also like to record additional taxa, including dragonflies and moths, during their weekly walks. For example, 29,975 individuals of 34 dragonfly species were recorded by UKBMS volunteers whilst walking their transects or WCBS squares during 2019. These data are made available to the relevant recording schemes and have contributed to the production of two new reports.

The State of Dragonflies in Britain and Ireland 2021 report was published online by the British Dragonfly Society (BDS). It covers a 50-year period from 1970 to 2019 and is based on over 1.4 million dragonfly records from 17,000 recorders, including contributions from the Centre for Environmental Data and Recording in Ireland. The verified records resulting from the BDS Recording Scheme were analysed by the UK Centre for Ecology & Hydrology and this report is based on the population trends produced.

The new report shows that dragonflies are clearly bucking the trend of declining species in Britain and Ireland. In the dragonfly world there have been far more gains than losses. Over 40% of resident and regular migrant species have increased since 1970, while only 11% have declined. Although this sounds like good news for dragonflies, it is in fact yet another indicator of climate change. Dragonflies are a mainly tropical group of insects, so most will benefit from rising average temperatures.

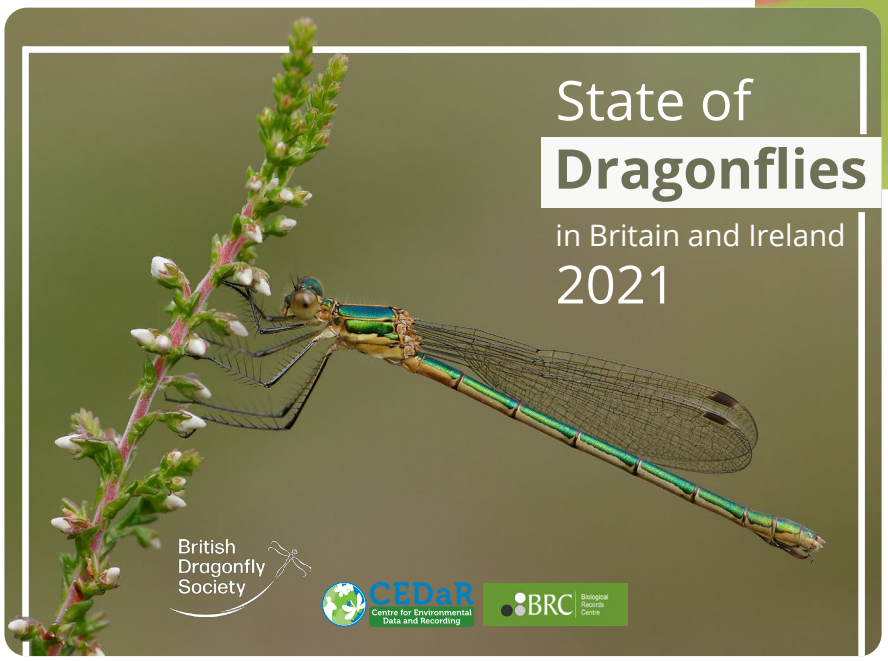
The State of Britain's Larger Moths 2021 was published during the year. This new report, led by Butterfly Conservation, summarises current knowledge of about 900 species of larger moths, presenting analyses of long-term change based on millions of records gathered through the Rothamsted Insect Survey (RIS) and National Moth Recording Scheme (NMRS).

The total abundance of larger moths caught in the RIS light-trap network in Britain decreased by 33% over 50 years (1968–2017). Losses were greater in the southern half of Britain (39% decrease) than in the northern half (22%). Where it was possible to calculate significant long-term abundance trends for species, 175 had decreased and only 42 increased. However, distribution trends based on over 24 million NMRS records revealed a different picture. Of 511 larger moth species for which long-term trends could be calculated, 32% (165 species) decreased in distribution and 37% (187 species) increased. Other analysis showed that the northern range margins of moths have, on average, shifted northwards by about 5km per year (1995–2016).

The full reports can be downloaded from these links:

https://british-dragonflies.org.uk/recording/state-of-dragonflies-2021/

https://butterfly-conservation.org/moths/the-state-of-britains-moths/



UKBMS background and methods

DATA COLLECTION

Data on the population status of UK butterflies are derived from a wide-scale program of site-based monitoring and sampling in randomly selected 1km squares. The original Butterfly Monitoring Scheme (BMS), operated by the Institute of Terrestrial Ecology (ITE), started in 1976. This scheme was rebranded as the UKBMS in 2006 when the Centre for Ecology & Hydrology (now UKCEH – successors to ITE) joined forces with Butterfly Conservation and, supported by JNCC and government agencies, incorporated all the additional butterfly monitoring data that Butterfly Conservation had been collating into the scheme. Trends in butterfly populations are now compiled from a network of 6,015 locations across all years, including 2,503 sample locations in 2020.

The majority of sites are monitored by butterfly transects, also known as 'Pollard walks'. The standard transect method involves weekly butterfly counts along fixed routes through the season made under strict criteria for weather conditions, recording area and time of day (Pollard & Yates 1993). Where possible, counts should be made each week from 1st April through to 29th September. The gaps in transect counts (i.e. weeks without data) due to periods of unsuitable weather or recorders being unavailable, are accounted for within the analysis of trends.

For a number of habitat-specialist species (especially the fritillaries) 'reduced effort' methods are also used to monitor annual abundance at the site level, especially in more remote parts of the UK. These include adult timed counts for fritillaries (Warren *et al*. 1981), larval web counts for **Marsh Fritillary** (Lewis & Hurford 1997) and egg counts for **Large Blue** (Thomas et al. 2009). For timed count and larval search methods, systematic recording is carried out on single days in suitable weather with the counts converted to a site index that accounts for both the size of the colony and the time in the season when the count was made. From 2015, winter egg counts for **Brown Hairstreak** have also been incorporated into the UKBMS.

Most site-based monitoring has historically been biased towards good quality semi-natural habitat relatively rich in butterflies, which does not accurately reflect the UK countryside as a whole, so the Wider Countryside Butterfly Survey (WCBS) was established in 2009 to improve the representativeness of our sampling network. In the WCBS, Butterfly Conservation recorders are allocated randomly selected 1km squares, whilst recorders from the BTO are given the opportunity to survey their existing Breeding Bird Survey squares, which have also been randomly selected. Surveyors are required to walk a standardised route across these squares, following the same methodology and criteria as standard transects. This should be done at least twice over the July and August period, while additional spring visits are also encouraged. Due to the low level of sampling effort (and unlike conventional transects), WCBS data are not routinely used to derive local measures of butterfly abundance.

SPECIES INDICES AND TRENDS

Techniques for analysing the UKBMS data have developed rapidly in recent years, with increased computing power allowing more complex statistical models to be applied to the data.

Weekly counts for each species are summed to generate annual site abundance indices. For sites with missing weekly counts, a Generalised Additive Model (GAM) is used to impute the missing values and to calculate a site index (Rothery & Roy 2001).

Since 2017, the compilation of annual species indices has used a Generalised Abundance Index (GAI) method developed by Dennis *et al*. (2016). There is an additional modification in the final stage of analysis, such that data are weighted relative to the proportion of the species flight period surveyed that year for that site. All butterfly counts collected at both UKBMS sites and WCBS squares are used to estimate the seasonal pattern of butterfly abundance for that year, and this is used to extrapolate from observed data to account for gaps in the recording. This ensures that observed data have a stronger effect upon the final indices than extrapolated data. This new method is used for all species and utilises data from all survey types.

COMPOSITE MEASURES OF BUTTERFLY ABUNDANCE

Multi-species (composite) indices of butterfly abundance are calculated using a Generalised Linear Model (GLM) accounting for species and year. Grouped measures have been compiled for all resident species, wider countryside species, habitat specialists and the three regular migrants. In addition, sites are further categorised by broad habitat groupings (farmland and woodland) (Brereton *et al*. 2011). Within these measures, each individual species trend is given equal weight, and the annual figure is based on 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.

To identify underlying patterns in composite population trends, assessment of change is based on trends in the underlying smoothed indices. The calculation of smoothed indices, trends and confidence intervals are assessed by structural time-series analysis and the Kalman Filter as implemented in the program TrendSpotter (Soldaat *et al*. 2007). A statistical test is performed using the software TrendSpotter to compare the difference in the smoothed index in the latest year versus all other years in the series.

Analysis and modelling methods are constantly evolving and alternative methods are being tested, such as those proposed by Freeman *et al*. (2021).

These composite measures are increasingly used by government agencies as one of the indicators of the health of our national biodiversity. The most recently published indicators can be found via these links:

UK Biodiversity Indicators: C6. Insects of the wider countryside (butterflies)
https://jncc.gov.uk/our-work/ukbi-c6-insects-of-the-wider-countryside/

England Biodiversity Indicators: 5. Farmland species
England Biodiversity Indicators: 6. Woodland species
https://www.gov.uk/government/statistics/england-biodiversity-indicators

Scotland's Indicators: Terrestrial Insect Abundance – Butterflies
https://www.nature.scot/doc/scotlands-indicators-terrestrial-insect-abundance-butterflies

The Large Blue trend is primarily based on egg counts.
Photograph by Mark Searle.

Brereton T.M., Roy D.B., Middlebrook, I., Botham, M. and Warren, M. (2011). The development of butterfly indicators in the United Kingdom and assessments in 2010. *Journal of Insect Conservation* 15:139-151.

Dennis, E.B., Morgan, B.J.T., Freeman, S.N., Brereton, T.M. & Roy, D.B. (2016). A generalized abundance index for seasonal invertebrates. *Biometrics* 72:1305-1314.

Freeman, S.N., Isaac, N.J.B., Besbeas, P., Dennis, E.B. & Morgan, B.J.T. (2021). A generic method for estimating and smoothing multispecies biodiversity indicators using intermittent data. *Journal of Agricultural Biological and Environmental Statistics* 26:71-89.

Lewis, O.T. & Hurford, C. (1997). Assessing the status of the Marsh Fritillary (*Eurodryas aurinia* Rott.) – an example from Glamorgan (UK). *Journal of Insect Conservation* 1:159-161.

Pollard, E. & Yates, T.J. (1993). Monitoring Butterflies for Ecology and Conservation. Chapman & Hall, London.

Rothery, P. & Roy, D.B. (2001). Application of generalized additive models to butterfly transect count data. *Journal of Applied Statistics* 28:897-909.

Soldaat, L.L., Visser, P., van Roomen, M. & van Strien, A. (2007). Smoothing and trend detection in waterbird monitoring data using structural time-series analysis and the Kalman filter. *Journal of Ornithology* 148:351-357.

Warren, M., Thomas, C.D. & Thomas, J.A. (1981). The Heath Fritillary. Survey and conservation report. Unpublished report to the Joint Committee for the Conservation of British Insects. Butterfly Conservation, Wareham.

Dingy Skipper had a strong second brood in Kent during 2020.
Photograph by Mark Searle.

The 2020 Season

UKBMS SAMPLE COVERAGE IN 2020

Standard transects

The number of standard transect sites in the UKBMS fell to 1,544 in 2020 from the all-time peak of 1,863 the previous year (a fall of 17%), whilst the number of walks undertaken fell by 32% to 25,176 (from 36,761 in 2019). It is clear that the spring lockdown, and other travel restrictions imposed through the coronavirus pandemic, played a major part in this drop. In fact, the volume of monitoring was much higher than we expected, given the unique situation that we all found ourselves in. This is great testament to the resilience of our volunteers during a very difficult year and we are extremely grateful for all their efforts.

In a survey of recorders who stopped contributing to the scheme during the year, 80% of respondents cited coronavirus as one of their reasons for doing so. However, looking ahead, the really positive news from this survey was the intention of these volunteers to resume butterfly monitoring once they are free to do so, with 80% expressing their desire to contribute to the scheme in the future.

At the country level, there were 1,354 standard transect sites in England, 98 in Scotland, 35 in Wales, 22 in Northern Ireland, 34 from the Channel Isles and one on the Isle of Man. In percentage terms, it was Wales which had the largest fall from the previous year (-44%), reflecting the tougher travel restrictions enforced by the Welsh Government.

The number of new transects contributing to the scheme also fell significantly in 2020. Co-ordinators had been advised to concentrate on supporting existing transects, at a time when on-site meetings with volunteers or site managers to set up new routes may not be legal, desirable or practical. Nevertheless, there were 105 new transects, with 82 in England (including 16 in the East Midlands), 16 in Scotland (with nine in Glasgow & SW Scotland), five in Wales and one each in Northern Ireland and the Channel Isles.

Fewer sites were monitored in 2020 due to the coronavirus 'lockdown' (NHS poster).

The five branches of Butterfly Conservation returning the most transects in 2020 remained unchanged from the previous year, though each of them understandably saw a reduction in numbers.

Rank	Butterfly Conservation Branch	No. of transects in 2020 (change from 2019)
1	Hampshire & Isle of Wight	152 (-12)
2	East Midlands	145 (-6)
3	Surrey & SW London	114 (-14)
4	Dorset	79 (-3)
5	Upper Thames	72 (-9)

Apart from the reduced number of sites, coronavirus restrictions also had an effect on the seasonal pattern of recording (see figure 1). The first six weeks of the season were marked by a national lockdown, with recorders only able to walk a transect if they could incorporate it into their daily exercise.

This lockdown was then eased at different times across the devolved countries of the UK. England was first to lift most restrictions on travel and outdoor activities in mid-May, but it was another 2-3 weeks before other countries started to make similar changes, though some limits on travel remained in place. It was not until 6th July that we were able to advise that butterfly monitoring was possible in all countries of the UK without travel restrictions. Even then, transect walking rightly required the support of landowners and ability to maintain social-distancing.

The result of these restrictions was an average of just 392 transect walks per week recorded over the six weeks through April and early-May. This compares to an average of 1124 walks per week over the remainder of the 2020 season and 1391 walks per week, on average, across the 2019 season.

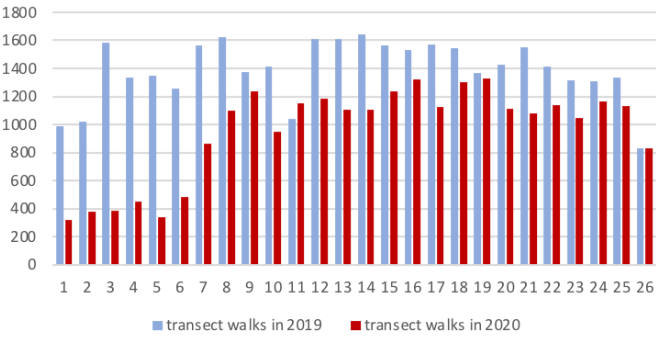


Figure 1. The number of standard transect walks conducted per week in 2019 and 2020.

Wider Countryside Butterfly Survey (WCBS) squares

The WCBS ran for a 12th year in 2020, supplying count data that contribute towards our collated indices – chiefly for common and widespread species. Although the core WCBS survey period of July and August avoided the strictest coronavirus restrictions, there is no doubt that the ongoing pandemic still had a significant impact on participation through, for example, the understandable reluctance of some landowners to allow access, the difficulties of maintaining social-distancing and the obvious desire from all parties to reduce the risks of spreading the virus.

The number of squares visited during 2020 fell by more than 100 from the previous year, down to 717 squares, representing the lowest number of squares surveyed since 2010. The total number of visits dropped by 18.5% to 1,595*.

The number of squares surveyed by BTO/JNCC/RSPB Breeding Bird Survey volunteers understandably fell to their lowest level since the WCBS was rolled out, with 251 squares visited (down 60 from 2019). Butterfly Conservation volunteers surveyed 466 squares (down by 52). At the country level, there were a total of 640 squares surveyed in England (-89 compared with 2019), 47 in Scotland (-1), 18 in Wales (-13), 11 in Northern Ireland (-9), and one on the Isle of Man (same as 2019).

Over the core period of July and August, 557 squares (78% of the total) received the required two visits, during which 70,834 butterflies of 44 species were recorded (the same number of species as 2019). There were also 224 spring visits to 154 squares, targeting early flyers, with **Orange-tip** being recorded in 43 of these squares.

Additional monitoring data for key species

Additional (non-transect) monitoring data were received from 235 sites, which was a drop of 26% from the previous year. These included adult timed counts, egg counts and larval web counts. The greatest loss was in the number of timed counts undertaken for **Pearl-bordered Fritillary** in the spring – down to just 15 counts in 2020 from 63 counts in 2019. **Marsh Fritillary** web counts were received from 92 sites (down from 104 in 2019), including all four countries of the UK, while the number of timed counts for **Heath Fritillary**, **High Brown Fritillary** and **Duke of Burgundy** remained on a par with the previous year. Egg counts for **Brown Hairstreak** contributed to the scheme for the fifth year, with 35 counts being submitted from the winter of 2019-20.

Despite the reduction in all types of monitoring due to the coronavirus pandemic, the overall number of sites monitored in 2020 still exceeded 2,500 and was higher than any other year before 2015 (see figures 2 & 3). This demonstrates both a benefit of the scheme having grown so strongly in recent years, and also the determination of our volunteers to continue making their contributions to the scheme through very difficult circumstances.

*Additional data for 19 visits across eight WCBS squares were received too late for the separate WCBS analysis, but are included in the overall UKBMS results.

THE WEATHER IN 2020

The 2020 butterfly season was preceded by an unsettled winter of mild temperatures and storms across the UK. Temperatures in January were 2.0°C above average, while storms Ciara and Dennis contributed to the wettest February on record, with many places recording more than three times their average rainfall.

Ironically, some of the best weather for butterflies arrived while the country was deep in lockdown. 2020 gave us the sunniest spring on record, with most areas receiving around 50% more sunshine than normal, while temperatures remained consistently above average (by 1.7°C in April). It was also a very dry period – rainfall remained below 50% of normal values through April and May. This was more marked in northern areas in April and southern areas the following month, giving us the driest May on record in England and second driest in Wales.

By contrast, the summer months were rather unsettled. June saw overall rainfall figures well above average with thunderstorms causing flooding in many areas, although south-east England remained relatively warm and dry.

Spells of wet weather continued through July, which was also cooler and cloudier than average in most areas. The month was only rescued by an unusually hot day in central and southern England on the 31st, reaching a peak of 100°F (37.8 °C) at Heathrow.

A more settled period of warm weather arrived in the second week of August, which meant the month overall was 1°C warmer than average. However, thanks to the arrival of Storms Ellen and Francis, disruption returned across much of the UK in the latter part of that month. September was a more settled month with somewhat drier and sunnier weather than average in most places, although the final week saw heavy hail showers in Yorkshire and high winds in eastern England.

Adapted from the monthly and season summaries published by the Met Office:

https://www.metoffice.gov.uk/research/climate/maps-and-data/summaries/index

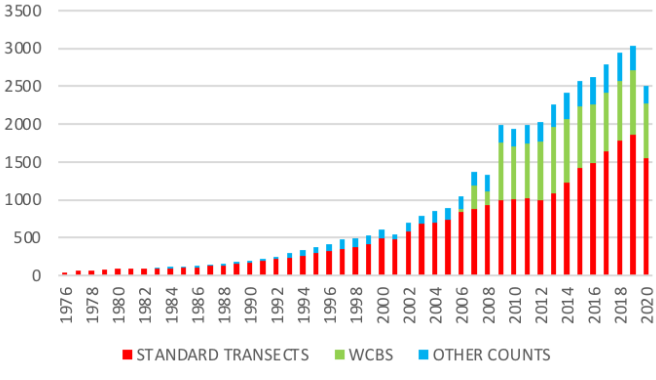
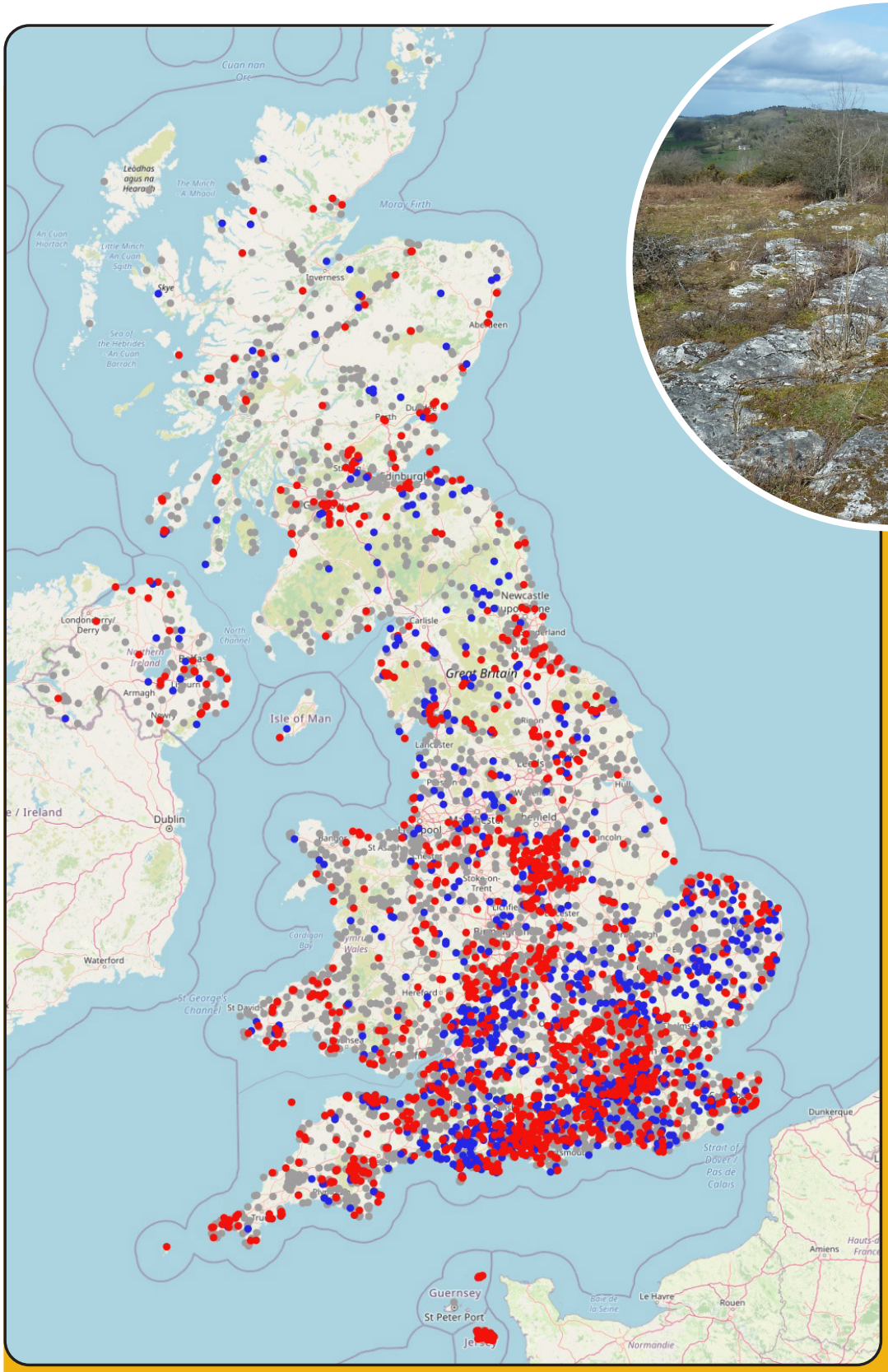


Figure 2. The total number of sites monitored by the UKBMS each year.



Eyarth Rocks (Clwyd) is a key site monitored for Pearl-bordered Fritillary. *Photograph by Clare Williams.*

Figure 3. Location of UKBMS monitored sites in 2020. WCBS squares (blue), standard transects and other monitoring methods (red), previously monitored sites and squares (grey).

BUTTERFLY COUNTS IN 2020

Summary
Overall, 2020 was a good year for butterflies without being remarkable for abundance, ranking 10th best since 1976. At UK level, 31 species were recorded in above average numbers, while 27 species fared worse than their long-term average. The warm, sunny, dry spring meant that many species emerged and peaked a week or two earlier than usual.

National trends were calculated for 58 of the 59 resident species and regular migrants. At the UK level none of them had either their best or worst year on record, although **Large Blue**, **Dark Green Fritillary** and **Cryptic Wood White** all recorded their second best year in 2020.

At the country level, **Small Pearl-bordered Fritillary** recorded its worst year in England, while **Small Heath** had its best year in Scotland. In Northern Ireland, **Small Tortoiseshell** recorded its best year and **Large White** its worst year, though these are over shorter time periods. It was not possible this year to produce trends for **Small Blue** in Scotland, or for **Pearl-bordered Fritillary** in Wales, due to insufficient sampling – a direct result of the 'lockdown'. However, given the restrictions placed on our volunteers, particularly through the spring period, it is remarkable that these were the only species trends that could not be updated.

The following species summaries for 2020 are based entirely on monitoring data submitted to the UKBMS.

Family: Papilionidae (Swallowtails)

Swallowtail was recorded on eight transect sites in *Norfolk*, the earliest sighting being on 15th May at *Bure Marshes*, and it was seen before the end of May on all of its regular sites. The seven highest weekly counts for the year all came from *Sutton Fen*, where it peaked on 17th June with a count of 37. The latest sighting of the year came from *Les Landes* (*Jersey*) on 24th August.

Family: Hesperiidae (Skippers)

The earliest transect counts for **Dingy Skipper** were in the south-east of England, at *Chapel Bank* (*Surrey*) and *Mottistone Down* (*Isle of Wight*) on 15th and 16th April respectively. *Barbury Castle* (*Wilts*) recorded the highest weekly counts of the year, with 97 seen on 6th May and another 65 the following week. Other sites with multiple counts above 40 were *Coombe Hill* (*Glos*) and *Oxted Downs* (*Surrey*). *Bishop Middleham Quarry* (*Co. Durham*) provided the highest counts in northern England, which saw a peak of 39 on 25th May. A second brood, peaking in late July, was particularly strong in *Kent* where three sites (*Cheriton Hill*, *Lydden Hill* and *Folkestone Escarpment*) saw several counts in double figures.

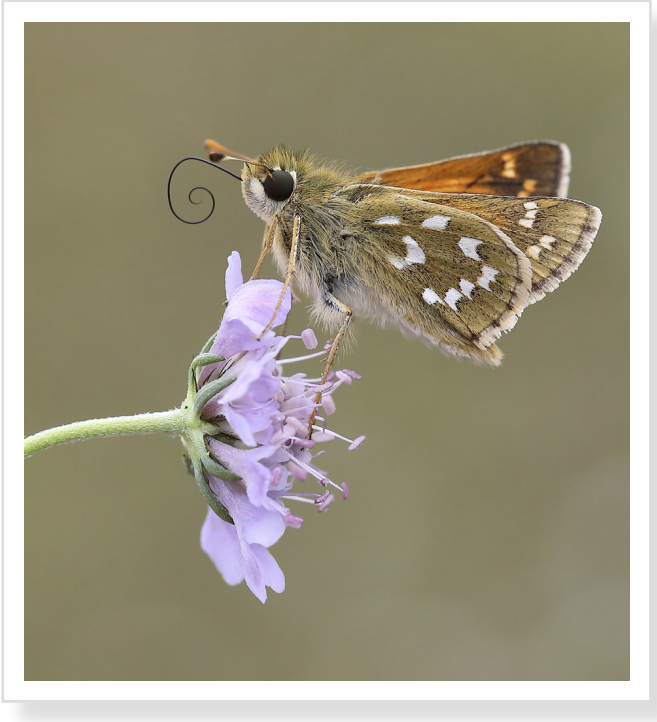
Grizzled Skipper had its best year since 2012. *Stinchcombe* (*Glos*) saw the earliest transect count on 10th April, followed by *Oxted Downs* and *Magdalen Hill Down* (*Hants*) two days later. As with **Dingy Skipper**, it was at *Barbury Castle* (*Wilts*) where the highest weekly counts were recorded – 24 each on 24th April and 6th May. Other sites with multiple counts in double figures were *Clubmens Down* (*Dorset*), *Magdalen Hill Down* (*Hants*), *Ubley Warren* (*Somerset*) and *Twyford Sanctuary* (*Lincs*). The final transect count came on 26th June at *Dean Hill* (*Wilts*).

Grizzled Skipper had its best year since 2012. *Photograph by Ian Middlebrook.*

The **Chequered Skipper** transect season in Scotland spanned less than a month, with the first count on 20th May at *Glen Loy Oakwood* (*Highland*) and the last on 18th June at *Glasdrum* (*Argyll & Bute*) – the latter site also recording the highest weekly count of 51 on 31st May. The species was only recorded on three transect routes in 2020 due to coronavirus restrictions, although several timed counts also contributed to the trend.

The earliest transect record for **Essex Skipper** was at *Hothfield Common* (*Kent*) on 1st June, with another seen on WCBS square *SU9651* (*Surrey*) the following day. The highest counts were seen around the East Midlands region, peaking at 130 for *Gibraltar Point* (*Lincs*) on 25th July. *Manor Farm* at *Long Eaton* (*Notts*) and *Pleasley Pit* (*Derbys*) both recorded weekly counts above 40, as did two WCBS squares in the East of England region – *TF2015* (*Cambs*) and *TL7673* (*Suffolk*). The final transect sighting for 2020 was recorded at *Coombe Bissett Down* (*Wilts*) on 29th August.

The *Purbecks* in *Dorset* saw the first transect records for **Small Skipper** on 21st May at *Bindon Hill* and *Nine Barrow Down*. The highest numbers were seen at *Priddy Minneries* (*Somerset*), where four weekly counts exceeded 120 – peaking at 254 on 20th July. In Scotland the highest weekly count was 66 at *Little France Park* (*Edinburgh*) on 9th July, and in Wales at *Somerton* (*Dyfed*) where 18 were seen on 6th July. There were several records very late in the season, particularly in *Derbyshire*, where they were seen at both *Grin Low Wood* and *Alsop Moor* on 21st September.



Silver-spotted Skipper had its best year since 1999. *Photograph by Mark Searle.*

Lulworth Skipper was recorded on 13 transect routes and two WCBS squares in *Dorset*, in a flight season spanning over three months. The earliest sighting was on 20th May at *Durlston Country Park*, while the final individual was recorded at *Ballard Down* on 23rd August. The highest counts were recorded from a WCBS square (*SY8779*) with 44 seen on both 11th and 29th July, while the *Bindon Hill* transect recorded 25 or more on five separate occasions.

Silver-spotted Skipper had its third best year in the series, and best since 1999. The first and last transect records both came from *Surrey*, with the season extending from 12th July at *Norbury Park* to 17th September at *Denbies Landbarn*. The highest weekly counts were 156 at *Malling Down* (*East Sussex*) on 6th August and 102 at *Headley Warren* (*Surrey*) four days later. The transect at *Aston Rowant South* (*Oxon*) and two routes on *Box Hill* (*Surrey*) also recorded weekly counts of over 50 individuals.

The first **Large Skipper** transect record came from *Middlebarrow Wood* (*Lancs*) on 9th May – a full week before the next record at *Avon Gorge* (*Somerset*). The two highest counts of the year both came on 28th June, with 117 seen at *Waterperry Wood* (*Oxon*) and 106 at *Frohawk* in the *New Forest* (*Hants*). The season continued through July and August, with the final transect sighting recorded on 1st September at *Blatchford Down* (*Surrey*). *Mersehead* (*Dumfries & Galloway*) was the only transect in Scotland to return counts of **Large Skipper**.

Family: Pieridae (Whites etc.)

Wood White was recorded on 24 transect routes across 15 different sites in England, where *Oaken Wood* (*Surrey*) saw the earliest counts on 20th April. The first brood saw numbers peak in the *West Midlands*, with 66 seen at *Bury Ditches* (*Shrops*) on 25th May, while the second brood peaked in *Surrey* with 89 recorded at *Chiddingfold Forest East* on 28th July. The final record came from *Kingspark Wood* (*West Sussex*) on 26th August.

Cryptic Wood White had its second best year since 2009 and was recorded on four transects in Northern Ireland, with timed counts received from two additional sites. Sightings spanned eight weeks from 3rd May at *Cave Hill* (*Co. Antrim*) until 26th June at *Lagan Meadows* (*Co. Down*), while the highest weekly counts came from *Craigavon Lakes* (*Co. Armagh*) where 61 were seen on 21st May and another 50 the following week.

The highest weekly counts for **Orange-tip** all came from *Derbyshire*, with 53 seen at *Cunningdale* on 6th May, 39 at *Mapleton* on 24th April and 38 at *Rowthorne Trail* on 23rd April. Outside of England, the only counts above 20 were at *Ecos Park* (*Co. Antrim*) on 24th April and 6th May. On most sites this species was not seen beyond the end of June, but there was a very late record at *Benfleet Down* (*Essex*) on 1st September – the first time a 'second brood' individual had been seen at that site.

A pre-season transect sighting of **Large White** on 22nd March at *Rue Grant* (*Jersey*) was followed by the first mainland record of the year on 1st April at *Dodman Point* (*Cornwall*). *Ashlawn Cutting* (*Warks*) was the only site to record weekly counts of 20 or more before the end of May, but mid-summer counts peaked at 134 for *Cock Marsh* (*Berks*) on 22nd June and 131 at *Danebury Hill Fort* (*Hants*) on 12th July. The largest count of the year was reserved for the late summer brood, which was most noticeable in *Cornwall*, when 145 were seen at *Treluggan Cliffs* on 6th September and *Nare Head* recorded counts of 118 and 89 later in the month. The highest weekly counts in Wales were both in *Clwyd*, with 25 seen at *Marford Quarry* on 10th July and *Mynydd Marian* on 7th August. This species had its worst year in Northern Ireland since 2006 and there were no counts in double figures.

The spring emergence of **Small White** saw high counts in the *East Midlands* where 45 were recorded at *Bingham Linear Park* (*Notts*) on 25th April and 44 at *Rowthorne Trail* (*Derbys*) on 25th May. *St Martins* (*Isles of Scilly*) also returned two weekly counts above 25 towards the end of May. The highest count in mid-summer was at *Reculver Country Park* (*Kent*) where 261 were seen on 12th July. Several high counts were also seen on WCBS squares during their July visit – *TM0553* (*Suffolk*), *SP9431* (*Beds*) and *TG1139* (*Norfolk*) all recording over 150. Late summer saw *Bingham Linear Park* return to the top with a count of 217 on 22nd August, while *Hucker's Bow*, *Sand Point* (*Somerset*) also exceeded 200 on 10th September. Beyond England, *Blaye* (*Alderney*) recorded a count of 68 on 11th August, and the highest count in Scotland came from a WCBS square at *NT4164* (*Lothian*) where 49 were seen on 19th August.

The highest spring counts of **Green-veined White** came in *Warwickshire*, where 33 were recorded at *Fenny Compton Tunnels* on 5th May and 29 at *Ryton Pools Country Park* on 16th April. Summer counts exceeded 100 on two sites – 117 at *Melbury Down & Wood* (*Dorset*) on 12th August and 111 at *Breamore* (*Hants*) on 12th July. The highest counts in Northern Ireland and Wales both came from WCBS squares, with 78 seen at *D2204* (*Co. Antrim*) on 11th August and *SJ2656* (*Clwyd*) recording counts of 47 and 46 on 12th July and 8th August respectively. Scotland saw counts above 50 at *Sandford Moor* (*South Lanarkshire*) and *Aberlady Bay* (*Lothian*), both on 8th August.

The place to see **Clouded Yellow** in 2020 was *Levin Down* (*West Sussex*) where they were recorded during nine weekly walks between 24th May and 29th September, when the highest count of 25 was recorded. Although in smaller numbers, *Ryewater Nursery* (*Dorset*) also saw this migratory species during 11 weekly transect walks.

Brimstone started the season with a bang at *Grafton Wood* (*Worcs*) where 50 were seen on 5th April. This was just four short of the highest spring counts, which were at *Levin Down* (*West Sussex*) on 24th and 28th May. *Grafton Wood* also featured amongst the highest summer counts, when 63 were recorded on 17th July. This was matched at *Breamore* on 30th July and beaten only by 78 at *Danebury Hill Fort* on the same day (both *Hants*). Into September, *Tansley Dale* (*Derbys*) was the only site to twice record double figures.

Family: Nymphalidae (Browns, Fritillaries, Admirals etc.)

The earliest record of **Wall** came from *Grouville Golf Course* (*Jersey*) on 3rd April, followed by *Dodman Point* (*Cornwall*) five days later. The highest spring count was on the *Kent* coast at *Kingsdown Leas*, where 13 were seen on 15th May, but the summer brood saw two counts above 50 – at *Trois Vaux* (*Alderney*) on 17th August and *Carrick Shore* (*Dumfries*

Brimstone started the season with a bang. *Photograph by Mark Searle.*

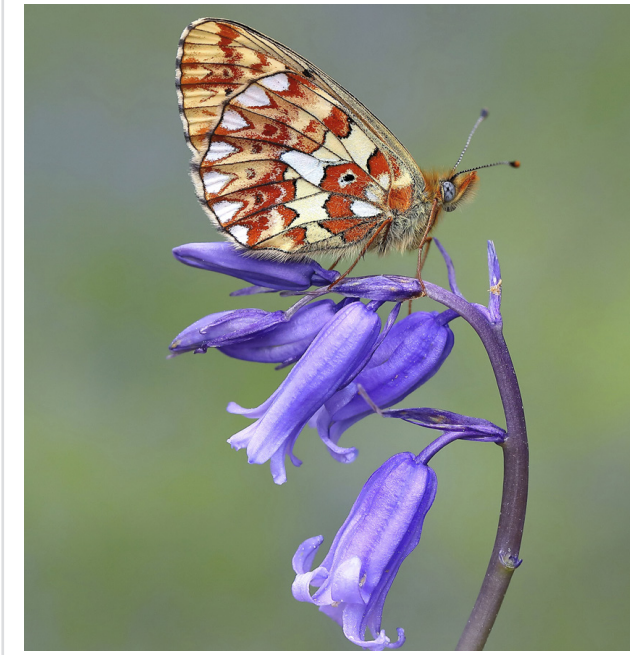
The highest Speckled Wood count was seen in Cumbria. *Photograph by Mark Searle.*

& *Galloway*) two days later. A late flurry saw 26 recorded at *Malling Down* (*East Sussex*) on 29th September. In Wales, this species suffered its second worst year since 1976, with *Marloes Mere* (*Dyfed*) returning the only count in double figures.

The highest **Speckled Wood** counts in spring were generally confined to southern England, with 53 recorded at *Home Farm Marsh* (*Devon*) on 21st May, although a good count of 27 was seen in Wales at *Broad Haven* (*Dyfed*). Summer counts were higher across all parts of the UK. *Wakebarrow* (*Cumbria*) recorded a peak of 77 on 20th August, having seen 61 the previous week, while the highest count in Scotland was 58 at *Carron Woodlands* (*Moray*) on 31st August.

Large Heath was recorded on just nine transects, although it was also picked up in three WCBS squares. The earliest count came on 28th May at *Bettisfield Moss*, while the highest count of 36 came from nearby *Whixall Moss* on 23rd June. Both these routes are on the same NNR which straddles the England/Wales border. Scotland saw a peak count of 16 recorded at *Creag Mhòr* (*Islay*) on 17th June. The final sightings were recorded on 12th August at *Upper Killyean* (*Argyll & Bute*) and WCBS square *NY5970* (*Cumbria*).

It was a rather mixed year for **Small Heath** in different parts of the UK, recording its best year in Scotland since 1979 but its 5th worst year in Wales since 1976. The earliest records came on 8th April at *Waterford Heath* (*Herts*) and *Hartlebury Common* (*Worcs*). *Whippingham Fields* (*Isle of Wight*) recorded the highest weekly counts for both spring and summer broods, with 557 seen on 29th May and 363 on 8th August. The five highest counts in Scotland were all recorded at *Loch Fleet* (*Sutherland*) in July – peaking at 233 on the last day of the month. By contrast, Northern Ireland and Wales recorded their highest counts in May and June respectively – 47 at *Murlough* (*Co. Down*) on 28th May and 27 at *Stackpole Warren* (*Dyfed*) on 24th June.



Pearl-bordered Fritillary had its second best year in Scotland since 2002. *Photograph by Mark Searle.*

There were just two counts of **Mountain Ringlet** submitted to the UKBMS in 2020, from *Ben Lawers* (*Perthshire*) and *Glasdrum* (*Argyll & Bute*), with the former registering a count of 50 on 25th June.

Scotch Argus was recorded on as many WCBS squares as standard transect sites in 2020, with 12 of each providing counts. The earliest record was at *Carron Woodlands* (*Moray*) on 12th July, while the two highest counts of the year came from *Glasdrum* (*Argyll & Bute*), recording counts above 300 on both 14th and 19th August. *Smardale Gill* (*Cumbria*) and WCBS square *NG8886* (*Highland*) both recorded counts above 200, and *Loch Garten* (*Strathspey*) provided the final transect record on 17th September.

The first records of **Ringlet** came on 29th May from *Cresswell Crags* (*Derbys*) and *Danebury Hill Fort* (*Hants*). Two transects in England recorded weekly counts just above 450 – at *Monks Wood* (*Cambs*) on 5th July and *Ferneydale Harpur Hill* (*Derbys*) the following week – while the highest WCBS count of 202 was recorded in Scotland at *NJ9736* (*Aberdeenshire*) on 16th July. The final transect sightings for the year came at *Cross Plain* (*Somerset*) and *Wootton Coppice* (*Hants*) on 6th September. This species recorded its worst year in Northern Ireland since 2008.

Meadow Brown was on the wing from early May in England, being recorded on the opening day of that month on the transect at *Hengistbury Head* (*Dorset*). Six of the eight highest weekly counts came from *Whippingham Fields* (*Isle of Wight*) – peaking at 2,848 on 22nd June. *Heath's Meadows* (*Lincs*) and *Grendon & Doddershall Woods* (*Bucks*) also recorded counts over 1,000 in the second half of June. By contrast, the highest counts in Wales, Northern Ireland and Scotland were not seen until August, with peaks of 361 at *Stackpole Warren* (*Dyfed*), 220 at *Killard* (*Co. Down*) and 192 at *St Cyrus* (*Aberdeenshire*).

There was just one transect record of **Gatekeeper** in May, on the final day of the month at *Le Hurel* (*Jersey*), with the earliest records from England on 2nd June at *Foxholes* (*Oxon*) and *Napton Church* (*Warks*). Sightings in England and the Channel Isles continued through to the end of September, but the season in Wales was somewhat shorter, with the earliest record from 20th June at *Roundton Hill* (*Powys*) and the latest at *Bennar Dunes* (*Gwynedd*) on 3rd September. The highest weekly count of the season came at *Durlston Meadows* (*Dorset*) where 421 were seen on 22nd July. *Marloes Mere* (*Dyfed*) was the only transect in Wales to record over a hundred in one visit, with 139 seen on 12th August.

Durlston Country Park (*Dorset*) saw the first transect record of **Marbled White**, on 20th May, and they were still active on the same site (though a different transect route) on 20th August. Two of the three highest weekly counts were seen in *Gloucestershire*, with 405 at *Strawberry Banks* and 398 at *Prestbury Hill*, both on 26th June. This species was recorded on just three transect routes in Wales, with *Great Traston Meadows* (*Gwent*) returning the highest count of 20, also on 26th June. The highest count in a WCBS square came in Wiltshire, where 144 were recorded at *ST9446* on 24th June.

Grayling has had a run of poor years across the UK recently and 2020 was the worst year in Wales since 1998, although a modest recovery in England meant it was the best year there since 2014. Out of 21 sites to record this butterfly before the end of June, 15 were in Scotland or northern England, with the earliest transect record coming on 15th June at *Middlebarrow Wood* (*Lancs*). *Les Landes* (*Jersey*) was the only transect to see over 100 on a weekly walk, recording 118 on 6th August, whilst the only counts in Scotland to reach double figures were in WCBS squares – *NR2741* (*Islay*) and *NR7150* (*Kintyre*). Southern sites dominated the September records, with *Rôskestal West Cliff* (*Cornwall*) returning the final sighting on 1st October.

Pearl-bordered Fritillary had its second best year since 2002 in Scotland, where data on this species were contributed from eight timed counts and four transects. The highest count of 129 came on 26th May at a site near *Ballater* (*Aberdeenshire*). The earliest transect sighting in England was on 20th April at *Rowland Wood* (*East Sussex*), and peak weekly counts of 28 were seen at *Bentley Wood* (*Wilts*) on 7th May and *Frohawk* (*Hants*) on 20th May. The final records were at *Whitbarrow NNR* (*Cumbria*) where it was seen on two separate transect routes on 14th June.

It was not a good year for **Small Pearl-bordered Fritillary**, which suffered its worst year in England since 1978 and worst in Wales since 2004. The two sites with the highest weekly counts were both in Scotland, where 103 were seen at *Glasdrum* (*Argyll & Bute*) on 31st May and 39 at *Clune* (*Fife*) on 8th June. Double brooded populations in *Cornwall* provided most of the early and late records for this species – first seen

on 7th May at *Upton Towans* and last at *Rôskestal West Cliff* on 26th August. The second generation was also evident in Wales, where the highest count of 18 was recorded on 9th August at *Bennar Dunes* (*Gwynedd*).

The opening day of June saw the first **Silver-washed Fritillary** record at *Blackmoor Copse* (*Wilts*), though it was not seen in Wales until the 23rd of that month. That was at *Brechfa Forest* (*Dyfed*), which also provided the highest count in Wales on 31st July – though just seven were seen. Four sites in England recorded weekly counts above 50, with the highest being 56 at *Hatfield Forest* (*Essex*) on 12th July. The final count of the year came from *Kerswell Down* (*Devon*) on 10th September.

Dark Green Fritillary had its best year in England since 1977. The earliest record came from *Pewsey Downs* (*Wilts*) on 19th May and it reached a peak weekly count of 196 at *Hervey Memorial Reserve* (*Cumbria*) on 25th June. The previous two days had also seen counts in excess of 140 at *Calstone Down* (*Wilts*) and *Wakebarrow* (*Cumbria*). Outside of England, the first transect sighting was at *Portstewart Strand* (*Co. Londonderry*) on 1st June and the three highest weekly counts all came from *Loch Fleet* (*Sutherland*) – peaking with 43 on 9th July. The final records of the season came on 1st September at *Wynyard Woodland Park* (*Durham*) and *Hawnby Hill* (*North Yorks*).

The earliest transect record for **High Brown Fritillary** was also the highest weekly count for the year in England, when 40 were seen at *Aish Tor* (*Devon*) on 1st June. However, this species is mainly monitored in south-west England by timed counts, and a count of 66 had been made at *Trentishoe Coombe* (*Devon*) the previous day. Higher still was a count of 189 in Wales at *Alun Valley & Old Castle Down* (*South Glamorgan*) on 15th June. In north-west England it was recorded on seven different transect routes, though the highest weekly count was just five. The final record, from *Heathwaite* (*Cumbria*), came on 29th July.

Webb's Wood (*Wilts*) recorded both the earliest transect record of **White Admiral**, on 1st June, and the highest weekly count on 24th June, when 33 were seen. Elsewhere there were two sites where counts exceeded 20 twice during the season, at *Orlestone Forest* (*Kent*) and *Briddlesford Woods* (*Isle of Wight*). The final count of the main brood came on 17th August at *Wootton Coppice* (*Hants*), though there were also a couple of second generation sightings – the last being on 21st September at *Danemead* (*Herts*).

Purple Emperor was recorded on 24 transects and in one WCBS square during the year, though the only route where it was seen on more than two weekly walks was at *Bookham Common* (*Surrey*). Transects are not the best method for monitoring this species, and only six of the counts related to more than one individual – the highest count being the three seen on 28th June at *Ryton Wood* (*Warks*). The core flight period was between 22nd June and 31st July, with just one earlier and one later count.

Red Admiral was recorded during every week of the transect season, though there were only four counts in Scotland and one in Northern Ireland before June. During mid-summer, the highest weekly counts came in southern England – 48 at *Melbury Down* (*Dorset*) and 45 at *Breamore* (*Hants*), both on 6th July. However, the highest counts for the year came in late summer. *Calf of Man* (*Isle of Man*) saw 91 recorded on two occasions – 19th and 27th September – while 82 were seen at *Broad Haven* (*Dyfed*) on 18th September.

It was not a year of high counts for **Painted Lady**, despite being recorded in every month of the transect season and every country of the UK. *Scolt Head Island* (*Norfolk*) was the only site to record counts in double figures, with 11 on 20th June and 30 on 12th August.

The peak of the spring emergence of **Peacock** came very early in the transect season, with *Grafton Wood* (*Worcs*) recording counts of 77 and 72 on 5th and 9th April respectively. *Blean Woods* (*Kent*) and *Shapwick Heath* (*Somerset*) also recorded weekly counts above 50 in the first half of April. The highest counts of the summer generation came at *Bishop Wood* (*North Yorks*) with 222 recorded on 24th July and another 400 seen six days later, while there were some good counts in WCBS squares in eastern England – peaking with 187 on 12th July at *TM0553* (*Suffolk*). The summer brood peaked a few weeks later in Scotland, where *Crombie Country Park* (*Tayside*) recorded 240 on 31st August.

The highest spring count for **Small Tortoiseshell** came from *Murton Fields* (*Northumberland*), where 53 were seen on 8th April and three other weekly counts in April exceeded 25. *Mapleton* (*Derbys*) was another productive site in April, with three counts of 30 or more. The early-summer brood saw higher counts in the midlands, peaking with 89 at *Besford Court* (*Worcs*) on 22nd June, but the highest counts were reserved for the late summer generation. *Ferneydale Harpur Hill* (*Derbys*) recorded two counts of 100 or more in September, while 107 were seen at *Thrislington Plantation* (*Co. Durham*) on 31st August. Outside of England, *Ecos Park* (*Co. Antrim*) recorded two counts above 50 in early July, and 51 were seen at *Cathkin Marsh* (*South Lanarkshire*) on 18th September.

Small Tortoiseshell fared poorly in south-east England. *Photograph by Mark Searle.*

An interesting regional pattern for **Small Tortoiseshell** was identified across England in 2020. It appears this species fared poorly in south-east England, compared to elsewhere in the country. Also, there was barely any sign of a late-summer brood in the south-east, suggesting that the adults entered hibernation after mid-summer, whereas northern England experienced a strong second generation in late-summer. Midland counties also saw a second brood, a couple of weeks earlier than northern England, but it was somewhat smaller than the first brood. Figure 4 illustrates selected counties but elsewhere, in general terms, south-west England showed a similar pattern to the Midlands, Wales and Northern Ireland were similar to northern England, while Scotland had a later second brood.

Early counts for **Comma** reached double figures, even before the transect season started, at *Pickett Wood* (*Wilts*), *Highnam Woods* (*Glos*) and *Brockham Lime Kilns* (*Surrey*) between 21st and 23rd March. The highest summer count came at *Kemphill Moor Copse* (*Isle of Wight*), where 31 were recorded on 1st July, while *Langley Vale Wood* (*Surrey*) also saw weekly counts of 28 and 29 during July. Late summer counts saw a peak of 21 at *Wilsey Woods* (*Cornwall*) on 17th September. The highest count outside England was on 19th July at *Llanymynech* (*Powys)* when six were seen.

Marsh Fritillary suffered its worst year since 2012 in most parts of the UK, apart from Northern Ireland, where *Murlough* (*Co. Down*) supplied both the highest transect count (405 on 28th May) and the highest larval web count of 1164. *Calstone Down* (*Wilts*) provided the highest transect counts in England, with two separate routes both recording over 100 individuals on 20th May. Data were received from 92 larval web counts in addition to 37 transects and one WCBS square. *Blaen Cynon* (*Mid Glamorgan*) supplied the highest web count from Wales, while monitoring began at several new sites in Scotland.

Data for **Glanville Fritillary** were received from 11 transects in 2020, including five sites on *Alderney*. On the *Isle of Wight*, the transect season started at *Mottistone Down* on 4th May and ended at *Coombe Bottom* on 16th June. It was the former

Marsh Fritillary suffered its worst year since 2012 in most parts of the UK. *Photograph by Mark Searle.*

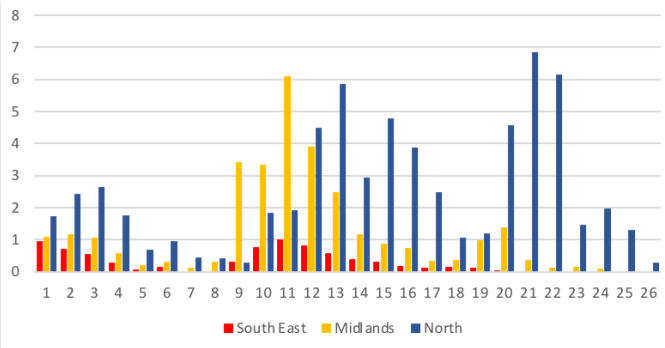


Figure 4. Average transect count of Small Tortoiseshell per week in parts of the South East (Hampshire, Sussex, Surrey, Kent), the Midlands (Warwickshire, Worcestershire, Herefordshire) and northern England (Cheshire, Lancashire, Yorkshire, Co. Durham).

site that supplied the highest count of the year, when 36 were seen on 21st May. The season was a few weeks later on *Alderney*, with transect counts recorded from 27th May to 3rd July. A single late sighting was returned from *Chapel Bank* (*Surrey*) on 20th August.

The earliest records for **Heath Fritillary** came on 15th May from three different counties – *Pound Wood* (*Essex*), *Blean Woods* (*Kent*) and *Greenscombe Wood* (*Cornwall*). *Blean Woods* also supplied the highest weekly transect count of 292 on 18th June, while a timed count of 191 was received from *Aller Coombe* (*Somerset*) on 2nd June. A partial second emergence was recorded at *Hadleigh Great Wood* (*Essex*) on 22nd August and also in *Blean Woods*, where the latest sighting came on 17th September.

Family: Riodinidae (Metalmarks)

Duke of Burgundy was recorded on 21 transects in 11 different counties during the season, first seen in *Cumbria* on 22nd April and at *Noar Hill* (*Hants*) the following day. The latter site also provided the highest weekly count of 33 on 7th May, followed by 25 at *Denge Wood* (*Kent*) on 15th May. The final transect count came from *Larkhill* (*Wilts*) on 8th June. Timed count data were also received from the *North Yorkshire* populations, where the highest count of 72 was made at a site near *Hawnby* on 27th May.

Family: Lycaenidae (Coppers, Hairstreaks and Blues)

Small Copper was recorded in each week of the transect season, with the first sighting coming on 5th April at *Ballard Down* (*Dorset*). *Whippingham Fields* (*Isle of Wight*) provided the highest counts for both the spring brood (15 on 2nd May) and late summer emergence (98 on 20th September) in England. The summer brood peaked with a weekly count of 31 at *Seaford Head* (*East Sussex*) on 23rd June. The highest counts outside England came in Scotland's second brood, where four counts of 20 or more were recorded at *Clune* and *Tentsmuir Point* (both *Fife*) between 10th and 31st August.

The **Brown Hairstreak** season was underway in mid-July with early records from *Hutchinson's Bank* (*Surrey*) on 13th, followed by *Trench Wood* (*Worcs*) and *Alners Gorse* (*Dorset*) on 17th. Adult counts were received from 62 transects and two WCBS squares, and these were combined with 35 egg

Silver-studded Blue had its joint best year since 1996. *Photograph by Mark Searle.*

counts from the previous winter. The highest transect count came from *Ashtead Common* (*Surrey*) where seven were seen on 21st September – no other weekly count exceeded four adults. The highest egg count of 321 came from *West Williamston* (*Dyfed*).

The earliest counts for **Purple Hairstreak** came from *Ampfield Wood* (*Hants*) on 7th June and *Steart Marshes* (*Somerset*) two days later. Six counts of 75 plus were recorded on evening transects at *Ryton Wood* (*Warks*) – peaking with 103 on 16th July. The highest count during 'regular' transect hours came at *Northaw Great Wood* (*Herts*) on 22nd July, when 62 were seen – likened to a 'swarm' by the recorder. Counts outside England were scarce, with just one count each from Jersey, Scotland and Northern Ireland. *Bryn Pydew* (*Gwynedd*) provided the five highest counts in Wales, peaking at 10 on 31st July. *Ashtead Common* (*Surrey*) returned the final count of the year on 2nd September.

The highest **Green Hairstreak** count came from *Les Landes* (*Jersey*), where 80 were recorded on 30th May and the same transect saw five other weekly counts above 25. Another productive area was the *Fenn's*, *Whixall* and *Bettisfield Mosses NNR* on the *Clwyd/Shropshire* border, where six counts across two transect routes also exceeded 25. This species was active before the start of the transect season, with *Stinchcombe* (*Glos*) providing a record on 26th March, and the flight season was over in most parts of the UK by the end of June. However, it was seen at *Turbary Common* (*Dorset*) during four weekly counts in July, and the final sighting at Les Landes was not until 24th August.

The first transect record for **White-letter Hairstreak** came at *Benfleet Downs* (*Essex*) on 9th June, and this site was also the only one to record double figures on two weekly counts during the year. The highest counts of 13 were seen at *Leftwich Woods* (*Cheshire*) on 24th June and *Markham North Tip* (*Derbys*) the following day. The final records came on 14th August at *Nothwood Carr* (*Derbys*) and *Llanelli Millennium Wetlands* (*Dyfed*).

Black Hairstreak was recorded on eight transect routes during 2020, with the season spanning just over a month from 25th May at *Monks Wood* (*Cambs*) to 29th June at *Rushbeds Wood* (*Bucks*). *Monks Wood* also recorded the highest weekly count of the year on 30th May when 11 were seen.

The earliest transect record of **Small Blue** came on 24th April at *Barbury Castle* (*Wilts*). Most of the highest counts came during the first brood, peaking on 27th May with 296 at *Old Down* (*Hants*), which also saw three other spring counts above 100. The highest weekly count of the summer brood was 95, which came on 17th July at *Durlston Meadows* (*Dorset*) – a site which also recorded the final count of the season on 27th September. **Small Blue** was recorded on one transect in Scotland and three in Wales, where the highest count of six was seen at *Whiteford Burrows* (*West Glamorgan*) on 8th June.

Holly Blue had its second best year since 2004 in England and best year in Wales over the same time period. The four highest counts in spring all came from *Kent*, peaking with 27 at *Montefiore Wood & Dumpton* on 30th May. During the summer months, there were some particularly good counts from WCBS squares, with the highest count of 41 recorded at *TG1139* (*Norfolk*) on 7th August. The highest count in Wales was also recorded in a WCBS square when 17 were seen at *SS8185* (*West Glamorgan*) on 2nd August. The highest summer transect count came at *Selborne Common* (*Hants*) when 29 were seen on 22nd July.

Large Blue is principally monitored by egg counts across the range of the ongoing re-introduction programme. Egg counts were received from nine sites, two of which recorded their highest count in the series. Adults were recorded on just one transect in *Gloucestershire* during the year, between the 15th and 25th June.

2020 was the joint best year for **Silver-studded Blue** since 1996. The earliest transect sightings were shared across three counties, with *Hasley* (*Hants*), *Rôskestal West Cliff* (*Cornwall*) and *Studland Heath* (*Dorset*) all recording this species on 25th May. Two sites in *Suffolk* saw weekly counts above 600 on 21st June – at *Dunwich Forest* and *Minsmere* – but the highest count of 651 was at *Black Down* (*Hants*) three days later. It was recorded on four transects in Wales, with *Great Orme* (*Gwynedd*) producing the highest count of 166 on 2nd July. The final transect sighting came on 16th September at *Sopley Common* (*Dorset*).

Brown Argus was first seen on transects this year on 23rd April, at *Mottistone Down* (*Isle of Wight*) and *West Yatton Down* (*Wilts*). *Magdalen Hill Down* (*Hants*) recorded the highest counts in both spring and summer broods, with 26 seen on 6th May and 82 on 30th July. Three other sites returned weekly counts above 30 – *Abbotts Hall Farm* (*Essex*),

Boscombe Down (*Wilts*) and *Ballard Down* (*Dorset*). It was recorded on nine transects on *Jersey*, though the six highest counts all came from *Les Mielles*.

The first transect sighting of **Northern Brown Argus** in England came on 21st May at *Kilnsey* (*North Yorks*) and in Scotland on 6th June at *Alva Glen* (*Clackmannanshire*). *Kincraig* (*Fife*) recorded both the highest count of the year on 24th June, when 103 were seen, and the final count on 20th August. In England, both *Kilnsey* and *Smardale Gill* (*Cumbria*) recorded weekly counts above 50 on the 15th and 16th June respectively.

Jersey provided the earliest records of **Common Blue** – at *Grouville Golf Course* and *Upper Dunes transects* on 9th and 10th April – with the first record on mainland Britain coming on 15th April at *Holkham* (*Norfolk*). The number of generations varied according to latitude. *Loch Fleet* (*Sutherland*) had a single brood, peaking with 178 on 31st July. *Greenabella Marsh* (*Co. Durham*) had two broods, recording the highest spring count with 269 on 28th May. *Whippingham Fields* (*Isle of Wight*) recorded the highest summer count, with 219 on 8th August and, like most southern sites, went on to see a third brood. This late emergence provided the highest weekly counts at *Mill Hill* (*Sussex*) where 144 were seen on 11th September. *Craigavon Lakes* (*Co. Armagh*) recorded the highest count in Northern Ireland, when 48 were seen on 2nd June. This site did not see a second brood, but *Portstewart Strand* (*Co. Londonderry*) saw a peak count of 26 on 8th August.

The earliest transect records for **Adonis Blue** came on 2nd May at *Boscombe Down* (*Wilts*) and *Malling Down (East Sussex*). *Pewsey Downs West* (*Wilts*) supplied the highest weekly counts for both spring and summer broods, first peaking at 371 on 27th May and then at 149 on 17th August. Spring counts were generally higher, with *Anchor Bottom* and *Mill Hill* (*East Sussex*) both recording counts in excess of 100.

Chalk Hill Blue was first recorded on 24th June at *Brush Hill* (*Bucks*), and again three days later at *Devil's Dyke* (*Cambs*). The latter site also produced the two highest counts of the year, with a peak of 817 on 25th July. *Deep Dean* (*East Sussex*), *Coombe Hill* (*Glos*), *Fleam Dyke* (*Cambs*) and *Mottistone Down* (*Isle of Wight*) all recorded two weekly counts above 400, and the butterfly was still flying at *Mottistone Down* on 29th September – the final day of the transect season.

The highest Common Blue count was at Greenabella Marsh (Co. Durham). *Photograph by Mark Searle.*

Scar Close (North Yorks) has been monitored for Northern Brown Argus since 2004. *Photograph by Kay Andrews.*

Long-term trends

Long-term trends, 10-year trends and annual % changes for butterfly species, at UK and country level, are presented in full at the end of this report (Tables 1-5). Further information on each species, including collated index plots, phenology charts and distribution maps of monitored sites, can be found on the UKBMS website at: **https://ukbms.org/species**.

What follows here is a brief summary of the long-term trends.

UNITED KINGDOM

For the UK we are able to report on long-term and 10-year trends for 58 of the 59 regularly occurring species, with **Mountain Ringlet** being the only species with insufficient data for a trend.

Since 1976, just under a third of butterfly species assessed in the UK are showing a significant long-term decline in abundance (31%), compared to 28% showing a significant long-term increase. However, the situation over the last decade is more positive, with seven species (12%) showing a statistically significant increase compared to two species (3%) showing a significant decline (**Scotch Argus** and **Small Pearl-bordered Fritillary**). Since the previous years' assessment, the long-term trend class for **Brimstone** has improved from no significant change to increasing.

The species showing the greatest population increases since 1976 across the UK are (in order) **Large Blue**, **Clouded Yellow**, **Silver-spotted Skipper**, **Large Heath**, **Black Hairstreak**, **Ringlet**, **Silver-washed Fritillary** and **Red Admiral**, which have all increased by 250% or more in that time.

The most severe long-term declines are demonstrated by (in order) **Heath Fritillary**, **Wall**, **Wood White**, **Small Tortoiseshell**, **White-letter Hairstreak**, **Lulworth Skipper**, **Grayling**, **Small Skipper**, **Small Pearl-bordered Fritillary**, **Pearl-bordered Fritillary** and **High Brown Fritillary**, which have all declined by 65% or more.

There have been several, mostly positive, changes in the 10-year UK trends. **Grizzled Skipper**, **Grayling** and **Chalk Hill Blue** have improved their trend class from decreasing to no change, while **Black Hairstreak**, **Holly Blue** and **Silver-studded Blue** are now classed as increasing. However, the 10-year trends for **Meadow Brown** and **Painted Lady** no longer show a significant increase. These changes should be treated with caution, as 10 years is quite a short time to assess butterflies and the trends are sensitive to start and end year values.

Combined measures of butterfly abundance, published as biodiversity indicators by the UK Government, show that habitat specialist butterflies (26 species) have declined significantly between 1976 and 2020, whilst butterflies of the wider countryside (24 species) show no significant change over the same period (see figure 5). The unsmoothed indices for these groups have fallen by 61% and 22% respectively.

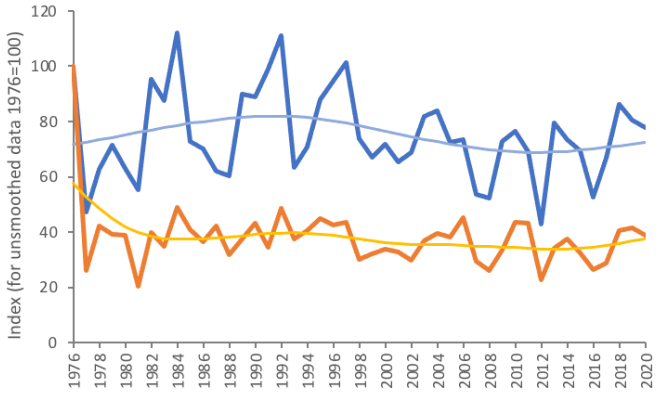


Figure 5. Composite trends in UK butterfly populations for wider countryside species (blue) and habitat specialists (orange) 1976-2020. Darker lines are unsmoothed indices, paler lines are smoothed trends.

ENGLAND

For England we are able to report on long-term and 10-year trends for 55 of the 57 regularly occurring species, with insufficient data for **Mountain Ringlet** and **Large Heath**.

Since 1976, over a third of butterfly species assessed in England are showing a significant long-term decline in abundance (36%), compared to 25% showing a significant long-term increase. However, the situation over the last decade is more positive, with seven species (13%) showing a statistically significant increase compared to just one species (2%) showing a significant decline (**Small Pearl-bordered Fritillary**). Since the previous years' assessment, the long-term trend class for **Holly Blue** has improved from no significant change to increasing.

Combined measures of butterfly abundance, published by the UK Government, show that butterflies of the wider countryside in woodland in England (24 species) have declined significantly between 1990 and 2020, whilst butterflies of the wider countryside on farmland in England (22 species) show no significant change over the same period (see figure 6). The unsmoothed indices for these groups have changed by -41% and +1% respectively.

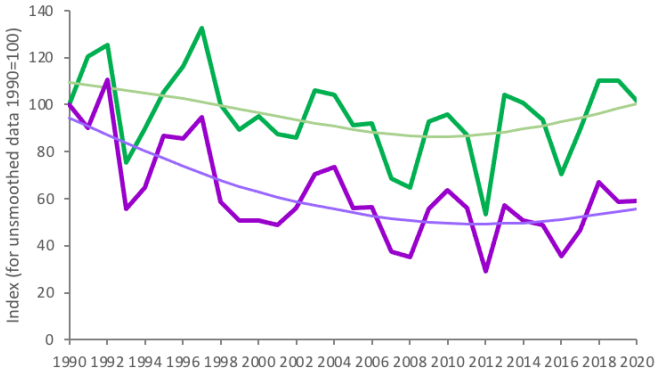


Figure 6. Composite trends in England butterfly populations for wider countryside species on farmland (green) and in woodland (purple) 1990-2020. Darker lines are unsmoothed indices, paler lines are smoothed trends.

SCOTLAND

For Scotland we are able to report on long-term and 10-year trends for 25 of the 34 regularly occurring species. Since 1979, nine of these species (36%) show a significant long-term increase, with just two species (8%) in significant long-term decline (**Grayling** and **Small Tortoiseshell**).

The species showing the greatest population increases in Scotland are (in order) **Red Admiral**, **Wall**, **Orange-tip**, **Ringlet** and **Peacock**, which have all increased by 250% or more. Note that long-term trends for most of these rapidly increasing species only stretch back to the 1990s, as there were not recorded in sufficient numbers in Scotland in the earlier years of the scheme.

WALES

For Wales we are able to report on long-term and 10-year trends for 32 of the 41 regularly occurring species. Since 1976, eight of these species (25%) show a significant long-term increase, with seven species (22%) in significant long-term decline. The number of species increasing has fallen by one since the previous assessment, because monitoring restrictions meant that we were not able to update the trend for **Pearl-bordered Fritillary**.

The species showing the greatest long-term population increases in Wales are (in order) **Green Hairstreak**, **Orange-tip**, **Ringlet**, **Comma** and **Speckled Wood**, which have all increased by 250% or more. The species in most severe long-term decline are (in order) **Grayling**, **Dark Green Fritillary** and **Small Pearl-bordered Fritillary**, which have all declined by 65% or more.

NORTHERN IRELAND

Trends in Northern Ireland are available for 14 species, covering time periods ranging from 11 to 17 years. Two of these species (**Large White** and **Small White**) show significant long-term declines, whilst the others show no significant change.

Peacock has undergone a long-term increase in Scotland. *Photograph by Mark Searle.*

Orange-tip numbers have increased substantially in both Scotland and Wales. *Photograph by by Mark Searle.*

Drivers of change of butterfly populations

Butterflies are excellent indicators of environmental change due to their rapid and sensitive responses to subtle habitat or climatic changes and there are several factors considered to be driving the changes that we see in butterfly populations.

Weather and climate change

Short-term changes in butterfly populations are often driven by the weather. Being 'cold-blooded', they need the sun's energy to raise their body temperature to a level that enables them to function. The impact of weather on different butterfly species is influenced by factors such as the timing of their flight period, how many generations are produced in a year, and in what life stage they overwinter. Consequently, what could be considered to be good conditions for one species can be less favourable or even detrimental for another. Adverse weather conditions can result in a large drop in butterfly numbers. While butterflies can bounce back from the impacts of unsuitable weather, they can take a long time to recover from a run of adverse weather years.

Longer-term changes in weather patterns as a result of climate change can have an impact on where butterfly species are found, their population sizes, and the timing of their lifecycles. Spring-flying species have been emerging progressively earlier in recent decades, and a number of single-brooded species are now able to produce a second brood in warm years. However, there may be negative impacts if butterfly species become active before their food sources are available. Any benefits of an earlier season may also be negated if the changing climate results in plants and flowers dying earlier than they used to, bringing a premature end to the flight season.

In recent years we have seen species more traditionally found in warmer parts of the UK, expanding their range and becoming more abundant in northern areas. However, the scope for northward range expansion may be limited, particularly for habitat specialist species, if networks of suitable habitat are too isolated.

Habitat related drivers

Habitat loss, degradation, and changes in habitat management, continue to be major drivers of change in UK butterfly populations, often resulting in population declines and/or range contractions.

The UK has seen major changes in land use since the UKBMS started in the 1970s, and the preceding decades and centuries. For example, the loss of important semi-natural habitats to conifer plantations, arable land, industrial, commercial or residential development. Wide-scale agricultural intensification has had a big impact on wildlife, with bigger fields and hence less wildlife-friendly margin habitat, and a greater use of herbicides and fertilisers. This has resulted in far fewer wildflowers, meaning less nectar sources for butterflies and a decline in some larval food plants.

Many semi-natural habitats in the UK depend on regular management to maintain their distinctive features that their component species rely on. A decline in traditional management activity can impact habitat quality, or even cause loss of that habitat completely due to vegetation successional change. Loss of habitat can have a disproportionately negative effect, as it can also increase habitat fragmentation. Habitat connectivity is key to a species being able to disperse to new sites and recover from population crashes.

Pesticides and pollution

Alongside the habitat mediated effects of agricultural intensification, the accompanying use of pesticides may have direct toxicity impacts on butterflies. Ongoing and future research into the effects of pesticides is an area of research where monitoring data is likely to help determine the extent to which butterflies are affected by farmland chemicals. Although little research exists on the direct effects of pollution on lepidoptera, nitrogen deposition is considered a major threat to biodiversity and ecosystem functioning. This nutrification, from both airborne pollution and the application of fertilisers, can affect the availability and quality of caterpillar food plants as well as the species composition and microclimate conditions within habitats.

Conservation action

Landscape scale conservation efforts can play a very important role in improving the fortunes of declining butterfly species. As our understanding of butterfly ecology increases, conservationists have been able to restore suitable habitat to help many declining species. This is especially the case for species with very specific habitat requirements or poor powers of dispersal, and where the appropriate conditions may often rely on active habitat management. These species can respond well to targeted habitat management, such as woodland coppicing to create more open areas or establishing a sympathetic grazing regime.

A more detailed, fully referenced review of the drivers of change of butterfly populations can be found on the UKBMS website at **https://ukbms.org/official-statistics**.

Notes on Summary Tables 1-5

In the following summary tables, where series trends have been provided, the number of sites monitored is a count of all sites monitored during the current year of analysis where the species was, or has previously been, recorded. This includes sites where the species may have been absent during the current year, but has still contributed to the national index.

Where there are insufficient data to calculate accurate trends for a species at country level (noted as N/A), the number of sites monitored refers only to the number of sites at which the species was recorded in the current year.

Note: some country-level changes are based on relatively small sample sizes and should be interpreted with caution.

Table 1. UK Summary of changes 2020. Summary of species abundance changes in the UK from 2019 to 2020 and long-term (over the entire time series; no. yrs max = 45) and short-term (last 10-years) changes. Significance of trends: * P < 0.05 (significant), ** P < 0.01 (highly significant), ***P < 0.001 (very highly significant). Red text has been used to highlight those species that had their worst year of the series in 2020, and blue text for those species that had their best year of the series in 2020.

Species	Start Year	No. years with Index in 2020	No. sites monitored in 2020	2020 Rank	% change 2019-2020	Series trend (%)	10-year trend (%)
Swallowtail	1976	44	24	16	66	34	-18
Dingy Skipper	1976	45	570	7	20	-11	-12
Grizzled Skipper	1976	45	357	18	21	-47***	-37
Chequered Skipper	2003	18	9	7	-62	9	93
Essex Skipper	1977	44	979	30	-19	-21	54
Small Skipper	1976	45	1707	35	-9	-71***	16
Lulworth Skipper	1992	29	23	17	-9	-76**	17
Silver-spotted Skipper	1979	42	64	3	20	640***	44
Large Skipper	1976	45	1713	24	0	-23	7
Wood White	1979	42	67	17	-2	-83***	117
Cryptic Wood White	2009	12	10	2	26	66	76
Orange-tip	1976	45	1538	6	-34	36*	26
Large White	1976	45	2153	14	29	-30	69
Small White	1976	45	2161	11	23	-16	89
Green-veined White	1976	45	2103	26	17	-13	-7
Clouded Yellow	1979	42	857	13	66	649*	189
Brimstone	1976	45	1615	5	-22	30*	93*
Wall	1976	45	667	39	-10	-87***	13
Speckled Wood	1976	45	2016	26	-16	105***	7
Large Heath	1990	31	35	7	-19	443***	-46
Small Heath	1976	45	1526	12	-5	-46**	38
Mountain Ringlet	N/A	N/A	4	N/A	N/A	N/A	N/A
Scotch Argus	1979	42	35	29	20	66	-54*
Ringlet	1976	45	2011	18	-41	364***	18
Meadow Brown	1976	45	2166	9	-15	2	36
Gatekeeper	1976	45	1923	29	-15	-43**	39
Marbled White	1976	45	1185	5	-28	76**	93*
Grayling	1976	45	297	37	3	-71***	-40
Pearl-bordered Fritillary	1976	45	134	32	-15	-66***	-26
Small Pearl-bordered Fritillary	1976	45	178	43	-19	-68***	-37*
Silver-washed Fritillary	1976	45	892	9	-19	257***	49
Dark Green Fritillary	1976	45	665	2	12	246***	6
High Brown Fritillary	1978	43	54	21	17	-65**	258*
White Admiral	1976	45	353	33	0	-61***	12
Purple Emperor	1979	42	112	17	-21	137**	33
Red Admiral	1976	45	2127	10	-21	254***	53
Painted Lady	1976	45	1957	37	-98	101	601
Peacock	1976	45	2112	7	31	6	39
Small Tortoiseshell	1976	45	2029	29	103	-79***	-18
Comma	1976	45	1918	21	-2	197***	27
Marsh Fritillary	1981	40	184	29	-44	2	72
Glanville Fritillary	1989	32	11	15	-31	23	432
Heath Fritillary	1981	40	36	33	0	-91***	21
Duke of Burgundy	1979	42	96	6	2	-34*	25
Small Copper	1976	45	1762	24	-11	-37*	27
Brown Hairstreak	1983	38	169	19	-4	-4	-36
Purple Hairstreak	1976	45	603	9	38	-27	134
Green Hairstreak	1976	45	661	16	-15	-29	71
White-letter Hairstreak	1976	45	277	22	7	-78***	111
Black Hairstreak	1995	26	12	4	-74	435*	2919*
Small Blue	1978	43	287	8	-8	14	37
Holly Blue	1976	45	1674	10	2	135	171*
Large Blue	1983	38	12	2	0	2191***	330**
Silver-studded Blue	1979	42	119	4	29	55	102*
Brown Argus	1976	45	1042	27	-38	24	97
Northern Brown Argus	1979	42	47	22	4	-56**	14
Common Blue	1976	45	1911	33	-10	-17	39
Adonis Blue	1979	42	169	30	-25	116*	-53
Chalk Hill Blue	1976	45	275	15	32	-5	-49

Table 2. ENGLAND Summary of changes 2020. Summary of species abundance changes in England from 2019 to 2020 and long-term (over the entire time series; no. yrs max = 45) and short-term (last 10-years) changes. Significance of trends: * P < 0.05 (significant), ** P < 0.01 (highly significant), ***P < 0.001 (very highly significant). Red text has been used to highlight those species that had their worst year of the series in 2020, and blue text for those species that had their best year of the series in 2020.

Species	Start Year	No. years with Index in 2020	No. sites monitored in 2020	2020 Rank	% change 2019-2020	Series trend (%)	10-year trend (%)
Swallowtail	1976	44	15	9	71	40	-10
Dingy Skipper	1976	45	548	8	23	-6	-10
Grizzled Skipper	1976	45	352	18	21	-47***	-37
Essex Skipper	1977	44	952	30	-17	-22	52
Small Skipper	1976	45	1651	35	-9	-73***	18
Lulworth Skipper	1992	29	23	17	-9	-76**	17
Silver-spotted Skipper	1979	42	64	3	20	640***	44
Large Skipper	1976	45	1646	25	-2	-21	8
Wood White	1979	42	67	17	-2	-83***	117
Orange-tip	1976	45	1397	6	-31	22	25
Large White	1976	45	1943	13	29	-30	66
Small White	1976	45	1947	11	26	-13	94
Green-veined White	1976	45	1863	25	25	-17	-1
Clouded Yellow	1979	42	803	13	74	741*	225
Brimstone	1976	45	1581	6	-20	26	91*
Wall	1976	45	588	38	-4	-88***	13
Speckled Wood	1976	45	1865	28	-19	104***	7
Large Heath	N/A	N/A	9	N/A	N/A	N/A	N/A
Small Heath	1976	45	1360	15	-7	-52***	40
Mountain Ringlet	N/A	N/A	1	N/A	N/A	N/A	N/A
Scotch Argus	1995	26	9	23	-8	-75***	-47
Ringlet	1976	45	1819	21	-43	354***	20
Meadow Brown	1976	45	1941	10	-15	1	38
Gatekeeper	1976	45	1844	30	-17	-46**	42
Marbled White	1976	45	1175	5	-28	74**	93*
Grayling	1976	45	231	33	8	-59***	-34
Pearl-bordered Fritillary	1978	43	115	33	7	-72***	-41
Small Pearl-bordered Fritillary	1978	43	124	43	-26	-60***	-55**
Silver-washed Fritillary	1976	45	875	9	-17	285***	47
Dark Green Fritillary	1976	45	566	2	12	482***	11
High Brown Fritillary	1978	43	45	21	17	-66**	264*
White Admiral	1976	45	349	32	0	-61***	12
Purple Emperor	1979	42	112	17	-21	137**	33
Red Admiral	1976	45	1904	10	-22	257***	47
Painted Lady	1976	45	1752	37	-98	95	535
Peacock	1976	45	1883	8	38	3	30
Small Tortoiseshell	1976	45	1799	30	105	-79***	-16
Comma	1976	45	1806	21	-2	197***	26
Marsh Fritillary	1982	39	130	34	-34	-61*	51
Glanville Fritillary	1989	32	6	2	59	20	949
Heath Fritillary	1981	40	36	33	0	-91***	21
Duke of Burgundy	1979	42	96	6	2	-34*	25
Small Copper	1976	45	1578	22	-3	-32	40
Brown Hairstreak	1983	38	153	15	-22	0	84**
Purple Hairstreak	1976	45	581	9	38	-29	137
Green Hairstreak	1976	45	601	16	-11	-34*	68
White-letter Hairstreak	1976	45	268	22	5	-77***	110
Black Hairstreak	1995	26	12	4	-74	435*	2919*
Small Blue	1979	42	275	12	-13	-17	53
Holly Blue	1976	45	1602	10	4	146*	174
Large Blue	1983	38	12	2	0	2191***	330**
Silver-studded Blue	1984	37	113	4	29	-4	111*
Brown Argus	1976	45	1010	27	-40	26	95
Northern Brown Argus	1979	42	33	28	-6	-59**	-1
Common Blue	1976	45	1738	34	-12	-15	46
Adonis Blue	1979	42	169	30	-25	116*	-53
Chalk Hill Blue	1976	45	275	15	32	-5	-49

Table 3. SCOTLAND Summary of changes 2020. Summary of species abundance changes in Scotland from 2019 to 2020 and long-term (over the entire time series; no. yrs max = 42) and short-term (last 10-years) changes. Significance of trends: * P < 0.05 (significant), ** P < 0.01 (highly significant), ***P < 0.001 (very highly significant). Red text has been used to highlight those species that had their worst year of the series in 2020, and blue text for those species that had their best year of the series in 2020.

Species	Start Year	No. years with Index in 2020	No. sites monitored in 2020	2020 Rank	% change 2019-2020	Series trend (%)	10-year trend (%)
Dingy Skipper	N/A	N/A	4	N/A	N/A	N/A	N/A
Chequered Skipper	2003	18	9	7	-62	8	94
Small Skipper	N/A	N/A	15	N/A	N/A	N/A	N/A
Large Skipper	N/A	N/A	3	N/A	N/A	N/A	N/A
Orange-tip	1999	22	82	5	-51	444***	70
Large White	1979	42	95	26	-50	102	66
Small White	1979	42	103	20	-28	70	33
Green-veined White	1979	42	128	34	-43	4	-4
Clouded Yellow	N/A	N/A	7	N/A	N/A	N/A	N/A
Wall	1999	22	11	3	-15	607***	419*
Speckled Wood	2001	20	41	5	-44	106**	120*
Large Heath	N/A	N/A	21	N/A	N/A	N/A	N/A
Small Heath	1979	42	84	1	23	150***	58
Mountain Ringlet	N/A	N/A	3	N/A	N/A	N/A	N/A
Scotch Argus	1990	31	26	19	10	11	-52*
Ringlet	1996	25	113	4	-5	293***	21
Meadow Brown	1979	42	109	19	0	-6	29
Grayling	1990	31	19	29	-15	-90***	-79**
Pearl-bordered Fritillary	2002	19	17	2	-34	204***	122
Small Pearl-bordered Fritillary	1979	42	41	10	-8	78*	162***
Dark Green Fritillary	1979	42	59	16	-13	5	-26
Red Admiral	1980	40	112	4	0	902***	345
Painted Lady	1980	37	99	26	-99	147	1685
Peacock	1995	26	114	2	-17	256***	164
Small Tortoiseshell	1979	42	123	15	55	-59**	-38
Comma	2006	15	42	10	-19	209	83
Marsh Fritillary	2006	15	21	13	-35	-73	258
Small Copper	1979	42	91	37	-58	-42	-46
Purple Hairstreak	N/A	N/A	4	N/A	N/A	N/A	N/A
Green Hairstreak	1990	31	26	15	-31	17	37
Small Blue	N/A	N/A	3	N/A	N/A	N/A	N/A
Holly Blue	N/A	N/A	3	N/A	N/A	N/A	N/A
Northern Brown Argus	1981	40	14	3	70	26	152*
Common Blue	1979	42	79	14	0	48	5

Scotch Argus was recorded on as many WCBS squares as standard transects in 2020. *Photograph by Mark Searle.*

Small Heath had its best year in Scotland since 1979. *Photograph by Mark Searle.*

Table 4. WALES Summary of changes 2020. Summary of species abundance changes in Wales from 2019 to 2020 and long-term (over the entire time series; no. yrs max = 45) and short-term (last 10-years) changes. Significance of trends: * P < 0.05 (significant), ** P < 0.01 (highly significant), ***P < 0.001 (very highly significant). Red text has been used to highlight those species that had their worst year of the series in 2020, and blue text for those species that had their best year of the series in 2020.

Species	Start Year	No. years with Index in 2020	No. sites monitored in 2020	2020 Rank	% change 2019-2020	Series trend (%)	10-year trend (%)
Dingy Skipper	2004	17	16	7	-11	53	-16
Grizzled Skipper	N/A	N/A	5	N/A	N/A	N/A	N/A
Essex Skipper	N/A	N/A	3	N/A	N/A	N/A	N/A
Small Skipper	1984	37	42	33	-34	12	-57
Large Skipper	1977	44	37	33	3	-62***	1
Orange-tip	1978	43	32	12	-46	383***	9
Large White	1976	45	50	18	65	-7	15
Small White	1976	45	50	11	86	-47*	55
Green-veined White	1976	45	47	14	14	173**	-49
Clouded Yellow	N/A	N/A	16	N/A	N/A	N/A	N/A
Brimstone	1998	23	23	2	-27	111**	249***
Wall	1976	45	32	44	-61	-58**	-47
Speckled Wood	1978	43	46	18	-28	255***	38
Large Heath	N/A	N/A	2	N/A	N/A	N/A	N/A
Small Heath	1976	45	37	41	-41	-2	-34
Ringlet	1983	38	46	12	-21	299***	-9
Meadow Brown	1976	45	50	22	-15	16	-13
Gatekeeper	1978	43	46	29	-9	40	-33
Marbled White	N/A	N/A	7	N/A	N/A	N/A	N/A
Grayling	1976	45	20	44	-55	-95***	-60
Pearl-bordered Fritillary	N/A	N/A	2	N/A	N/A	N/A	N/A
Small Pearl-bordered Fritillary	1992	29	13	26	-45	-77**	-47*
Silver-washed Fritillary	1995	24	14	15	-7	-59	10
Dark Green Fritillary	1979	42	25	25	-28	-84***	5
High Brown Fritillary	1995	17	9	4	79	9	24
Red Admiral	1976	45	48	7	7	167*	242*
Painted Lady	1977	43	45	29	-99	45	1344
Peacock	1976	45	50	7	3	-20	91
Small Tortoiseshell	1976	45	48	7	105	-27	-28
Comma	1992	29	40	11	-6	276***	72
Marsh Fritillary	1990	31	24	24	-63	-65	58
Small Copper	1976	45	41	36	-45	-48*	5
Brown Hairstreak	2004	17	16	7	11	-38	-43
Purple Hairstreak	2002	19	11	3	232	-22	287
Green Hairstreak	1993	28	14	3	-17	432***	514**
White-letter Hairstreak	N/A	N/A	5	N/A	N/A	N/A	N/A
Small Blue	N/A	N/A	5	N/A	N/A	N/A	N/A
Silver-studded Blue	N/A	N/A	6	N/A	N/A	N/A	N/A
Holly Blue	1999	22	27	3	35	44	308**
Brown Argus	1997	24	11	6	-11	88	202
Common Blue	1976	45	44	42	-35	-26	-36

Table 5. NORTHERN IRELAND Summary of changes 2020. Summary of species abundance changes in Northern Ireland from 2019 to 2020 and long-term (over the entire time series; no. yrs max = 17) and short-term (last 10-years) changes. Significance of trends: * P < 0.05 (significant), ** P < 0.01 (highly significant), ***P < 0.001 (very highly significant). Red text has been used to highlight those species that had their worst year of the series in 2020, and blue text for those species that had their best year of the series in 2020.

Species	Start Year	No. years with Index in 2020	No. sites monitored in 2020	2020 Rank	% change 2019-2020	Series trend (%)	10-year trend (%)
Dingy Skipper	N/A	N/A	0	N/A	N/A	N/A	N/A
Cryptic Wood White	2009	12	10	2	26	66	76
Orange-tip	2007	14	22	5	-29	3	58
Large White	2006	15	29	15	-32	-61*	-58
Small White	2006	15	26	14	-38	-69**	-31
Green-veined White	2005	16	31	14	11	17	-48
Clouded Yellow	N/A	N/A	4	N/A	N/A	N/A	N/A
Wall	N/A	N/A	2	N/A	N/A	N/A	N/A
Speckled Wood	2007	14	29	5	-19	56	62
Large Heath	N/A	N/A	1	N/A	N/A	N/A	N/A
Small Heath	2004	17	16	12	-30	-44	-29
Ringlet	2006	15	30	13	-42	67	-48
Meadow Brown	2009	12	30	9	-31	-41	-22
Grayling	N/A	N/A	6	N/A	N/A	N/A	N/A
Silver-washed Fritillary	N/A	N/A	3	N/A	N/A	N/A	N/A
Dark Green Fritillary	N/A	N/A	12	N/A	N/A	N/A	N/A
Red Admiral	N/A	N/A	31	N/A	N/A	N/A	N/A
Painted Lady	N/A	N/A	28	N/A	N/A	N/A	N/A
Peacock	2006	15	30	4	-57	18	824*
Small Tortoiseshell	2010	11	30	1	297	13	68
Marsh Fritillary	2004	17	9	5	-63	92	255
Small Copper	2005	16	19	4	3	-37	2
Purple Hairstreak	N/A	N/A	1	N/A	N/A	N/A	N/A
Green Hairstreak	N/A	N/A	2	N/A	N/A	N/A	N/A
Holly Blue	N/A	N/A	11	N/A	N/A	N/A	N/A
Common Blue	2005	16	15	9	-34	-21	9

Murlough NNR (Co. Down) supplied the highest Marsh Fritillary counts in 2020. *Photograph by Sam Ellis.*

Large White had its worst year in Northern Ireland since 2006. *Photograph by Mark Searle.*

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