



United Kingdom Butterfly Monitoring Scheme

ANNUAL REPORT 2007





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Tracking changes in the abundance of UK butterflies

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Cover photograph of a Clouded Yellow by Tim Hoeflich. The Clouded Yellow (*Colias croecas*), seen here sheltering from the rain, was one of many butterflies that had a bad year due to the poor summer weather. The butterfly was recorded at less than half the number of sites in 2006, with the majority occurring late on in the season in better weather.

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About the UKBMS

Welcome to the second report of the United Kingdom Butterfly Monitoring Scheme (UKBMS).

Changes in the abundance of butterflies throughout the United Kingdom have been monitored using transects since 1976. Over the past 32 years, recorders have made over 180,000 weekly visits to 1605 different transects, walking almost 435,000 km and counting nearly 13 million butterflies!

The UKBMS is based on a well-established and enjoyable recording method and has produced important insights into almost all aspects of butterfly ecology.

Butterflies are uniquely placed amongst British terrestrial insects and other invertebrate groups to act as indicators of the state of the environment, allowing us to assess the impacts of habitat change, climate change and the progress of government policy initiatives such as the UK Biodiversity Action Plan, agri-environment schemes and the condition of Sites of Special Scientific Interest (SSSIs). Not only are butterflies biologically suitable as indicator species, having rapid lifecycles and, in many cases, high sensitivity to environmental conditions, but the recording and monitoring volunteer networks and datasets built up by Butterfly Conservation (BC) and the Centre for Ecology and Hydrology (CEH) enable accurate assessment of their trends.

The UKBMS is run as a partnership between BC and CEH. The scheme also benefits from the active involvement of the National Trust, the Royal Society for the Protection of Birds (RSPB), the Forestry Commission and several wildlife trusts and local authorities.

The UKBMS project has been funded for three years (2005-2008) by a multi-agency consortium led by the Department of the Environment, Food and Rural Affairs (Defra), and including the Joint Nature Conservation Committee, (JNCC) Countryside Council for Wales (CCW), Natural England (NE), Environment & Heritage Service (Northern Ireland) (EHSNI), Forestry Commission (FC), Scottish Executive, Environment and Rural Affairs (SEERAD), and Scottish Natural Heritage (SNH).

UKBMS Objectives

- To maintain and develop a network of transect and other monitored sites in order to assess and interpret changes in the abundance and status of UK butterflies.
- To encourage participation in butterfly monitoring by supporting volunteer recording networks.
- To ensure a high level of quality assurance for butterfly monitoring data by development and promotion of standards, and by applying rigorous data validation and verification procedures.
- To secure and manage butterfly monitoring data and provide access to academia, governments, industry and the public.
- To advance knowledge in butterfly ecology through interpretation of butterfly monitoring data.
- To provide scientific underpinning for solutions to butterfly conservation issues arising from environmental change.
- To provide a knowledge base, including indicators of change, for government policies addressing environmental issues.
- To promote public awareness and understanding of butterflies through communication of the results of the scheme.

Much information on the UKBMS can be found on our website www.ukbms.org

Contacts

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Meet the team



David Roy has worked for CEH since 1994. He took over from Dorian Moss as manager of the BMS in 2003 and is now based in the Biological Records Centre (BRC). He is an ecologist who specialises in data analysis. He manages the UKBMS database and his research focuses on the impacts of climate change. Previously located at Monks Wood, he and his colleagues have recently moved to the CEH Wallingford site in Oxfordshire



Jim Bacon joined CEH in 2007 as a website designer. His role has included updating and extending the UKBMS site, including the development of online recording for the wider countryside monitoring scheme.



Tom Brereton has worked for BC since 1997 after completing a PhD on the ecology of the Grizzled Skipper. At BC he is Head of Monitoring, and project manages the UKBMS for BC. Tom is particularly involved in

developing butterfly indicators and farmland research, management and policy.



Katie Cruickshanks joined BC in April 2006 after completing a PhD in ecology at Southampton University. In her role as wider countryside co-ordinator, Katie is responsible for planning and conducting the pilot studies for

the wider countryside monitoring scheme.



Ian Middlebrook joined BC in January 2007 as their Butterfly Monitoring Co-ordinator. He had already been based with BC at Manor Yard for 6 years, leading conservation work on a suite of rare (non-lepidopteran)

invertebrates through the 'Action for Invertebrates' partnership project. Ian is the first point of contact for UKBMS recorders and local transect co-ordinators.



Stephen Freeman joined CEH in 2008. Before this he studied models for population dynamics and demography at the Universities of Kent, Oxford and London, and spent ten years modelling the widespread

declines in British bird species for the British Trust for Ornithology. Stephen's role at CEH is as a modeller specializing in the application of statistical methods and mathematical models in ecology. He collaborates on the analysis of UKBMS data.



Marc Botham joined CEH in 2007 as a Post-doctoral Research Assistant following a PhD in behavioural ecology at the University of Leeds. In May 2008 he took the position of Butterfly Ecologist. His role with

the UKBMS is to conduct data analysis and lead research applications. He will also oversee the collation of the dataset and take a leading role in the production of UKBMS reports.



Survey methods

In the UKBMS, data on the population status of UK butterflies is derived from a wide-scale programme of site-based monitoring. The majority of sites are monitored by butterfly transects (Pollard & Yates 1993). The transect method, which was established in 1976, involves weekly butterfly counts along fixed routes through the season made under strict criteria for weather, recording area and time of day. Weekly counts for each species are summed to generate annual abundance indices. For sites with missing weekly counts, a statistical model (a Generalised Additive Model, 'GAM') is used to impute the missing values and to calculate the index (Rothery & Roy 2001).

For a number of specialist species (especially the fritillaries) two 'reduced effort' scientific methods; adult timed counts (Warren *et al.* 1981) and larval web counts (eg. Lewis & Hurford 1997), are also used to monitor annual abundance, especially in remoter parts of the UK. In both timed and larval web counts, systematic recording is made on single days in suitable weather (when UKBMS recording criteria are met), with the counts converted to a robust index that accounts for both the size of the colony and the time in the season when the count was made.

Data from transects (currently 1351 sites in total) and timed counts/larval webs (219 sites) is combined each year to derive regional and national 'Collated' Indices (CI) and to estimate trends over time. Because not all sites are monitored each year, a statistical model (using log-linear regression) is needed to estimate missing values and to produce indices and trends. The model takes into account the fact that for a particular butterfly species, some years are better than others (a year effect), typically due to the weather, and some sites support larger populations than others (a site effect). The precision of indices and trends is estimated by a further statistical technique called 'bootstrapping'.

This is now the third year that data from a combined UKBMS dataset has been used to calculate trends in butterfly populations. In 2007, 765 transects and 110 timed/larval web counts were monitored with good geographic coverage (see Map 1). This enabled us to calculate Collated Indices for 50 of the 59 regular species of butterfly in the UK. As in previous years, trends were assessed for four canopy species; Purple, White-letter and Brown Hairstreaks and the Purple Emperor, even though transects are generally not considered the best monitoring method for them. However, they are included because 'extreme' high or low years in the abundance of these species can be determined from transect monitoring.

Graphs showing these Collated Indices are presented in Appendix I. The Collated Index for each species is updated each year with the inclusion of additional monitoring data and therefore will not correspond exactly to that presented in the 2006 report. Similarly, the rank order used to show those years in which butterflies fared better or worse compared to other years in the history of the BMS, will be modified by these additional data (see Table 1). As in the 2006 report, we have produced a single index for each species rather than separate indices for species with more than one generation per year. In the future we aim to split our analyses for those species with more than one brood in a year.

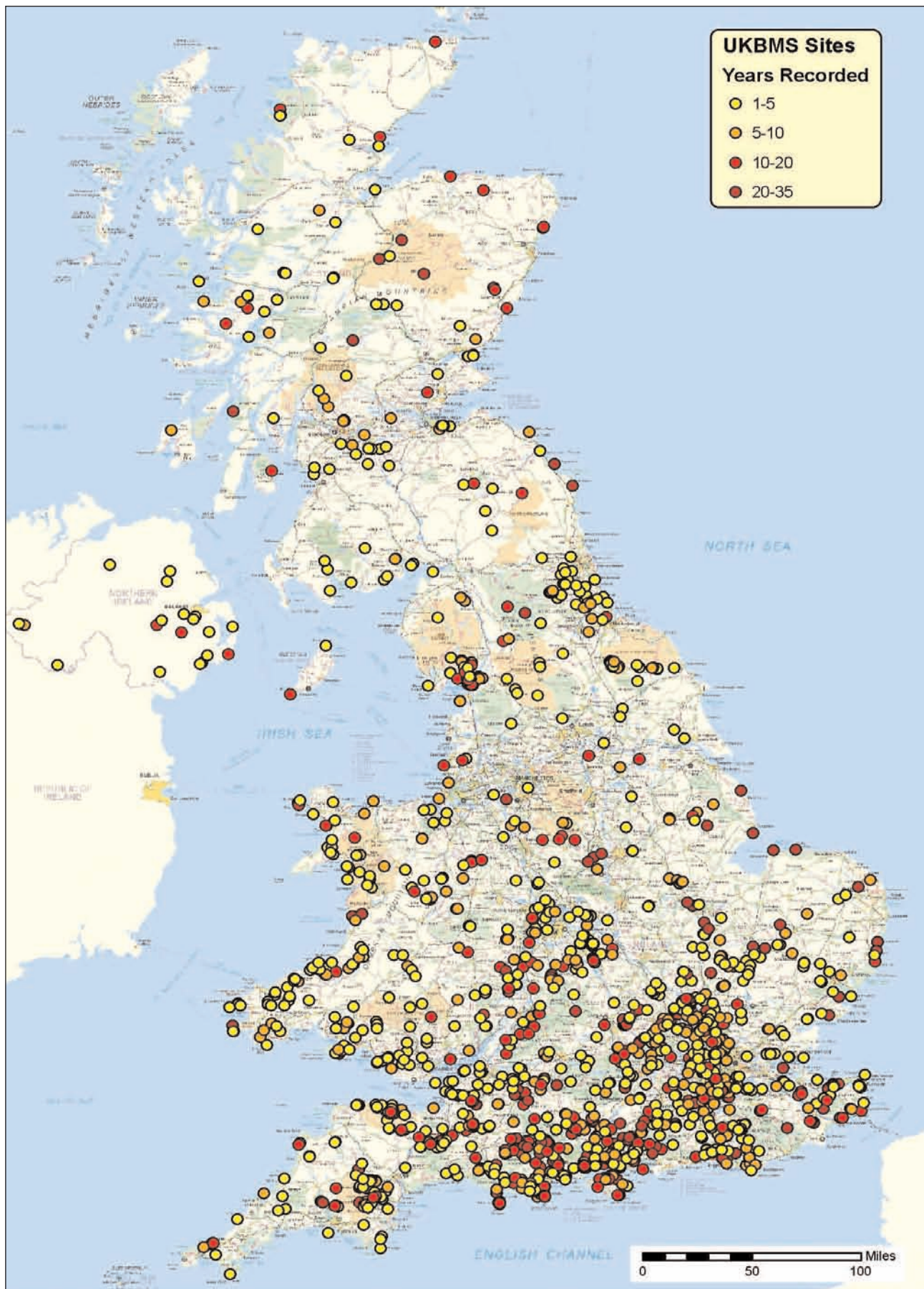
Review of species status on monitored sites in 2007

The following section describes the status of species in 2007 with particular reference to changes over the previous year and in relation to major weather events. Further details of the weather in 2007 can be found at <http://www.metoffice.gov.uk/climate/uk/2007>. A summary of changes in the Collated Indices of each species between 2006 and 2007 can be found in Table 3. In this table we also present the current and previous year's rankings for each species and the trend in the Collated Index for each species since it has been recorded in the UKBMS.

The year started off extremely mild with January temperatures being the warmest since 1916. Following on from an exceptionally late record of a Brimstone in Wiltshire at the end of December 2006, there was a spate of butterfly sightings in the mild January 2007 weather with Red Admirals in at least 12 counties on New Years Day, and six other species recorded including Painted Lady, Small Tortoiseshell, Peacock, Comma, Brimstone and Large White.

The early spring weather was fabulous. April was the driest and warmest on record (1914-present). The month's temperature of 10.2 °C was 3.5 °C above the 1961-1990 average whilst on average only 26.8 mm of rain fell over the UK. There was plenty of sunshine too, with March and April more sunny than average. March 2007 was the 5th sunniest March in the series and April 2007 was the 2nd sunniest April since records began with an average of 142.8 hrs and 203.5 hrs sunshine respectively.

The hot, dry weather brought about a third of all species out earlier than ever, with many species emerging between 3 and 6 weeks early. Among the highlights, the Lulworth Skipper broke all records by being spotted in



Map 1. Location of UKBMS sites showing how many years in which butterflies have been recorded at each site.



Dorset on the 28th of April, 7 weeks earlier than normal, while the Chalkhill Blue was recorded in the 16th of May in Sussex, 6 weeks early. Both the Small Copper and Small Blue were spotted in May, 4 weeks earlier than normal.

Spring species were not only flying early, but were seen in good numbers too. Species present in above average numbers on monitored sites in April in the warmer parts of the UK included Grizzled Skipper, Dingy Skipper, Orange-tip, Green-veined White, Wood White, Green Hairstreak, Peacock, Pearl-bordered Fritillary and Marsh Fritillary. All these species (except the Marsh Fritillary) showed an increase in their numbers from 2006 to 2007, though none of these species had a 'top five' year (out of the 32 year series) reflecting the impact of the weather that was to follow.....

Unfortunately, the glorious weather did not last, and much of the remainder of the summer was characterised by heavy rain, severe localised flooding, low levels of sunshine and unseasonal cold spells. The heavy rains arrived in May, with this month being the 4th wettest of the series and the wettest May since 1967, with 116.3 mm of rainfall. June 2007 was the wettest June of the series and July 2007 was the 4th wettest July of the series with 136.0 mm and 145.1mm rainfall respectively on average over the UK. Temperatures dropped substantially in May, and although they were above average in this month and in June and July, they were cooler than recent years. Only August received lower than average temperatures, with the month being the coldest August since 1994, with an average temperature of 14.4°C. May-July 2007 received below average sunshine hours and June 2007 was the dullest June since 1998 with only 142.3 hrs of sunshine on average over the UK.

The poor weather precipitated a disastrous summer for butterflies, the worst since 1982. Butterflies that reached their lowest ever levels in the 32-year series included Lulworth Skipper, Small Skipper/Essex Skipper, Small Tortoiseshell, Common Blue, Grayling and Wall. Three of these, Small Skipper/Essex Skipper, Small Tortoiseshell and Wall previously had their worst year in 2006 and are all showing a negative trend in abundance over time (Table 3). Other late spring/summer species which fared badly included Chalkhill Blue, Silver-studded Blue, High Brown Fritillary and Northern Brown Argus.

In the late autumn/early winter period, the weather was average in terms of rainfall, sunshine and temperature, but this did not prevent a run of late butterfly sightings. In November at least 15 species were seen 'off transect' including Clouded Yellow, Brimstone, Large White,

Small White, Small Copper, Common Blue, Holly Blue, Brown Argus, Red Admiral, Painted Lady, Comma, Small Tortoiseshell, Peacock, Speckled Wood and Meadow Brown. Sporadic sightings of several species, especially Red Admirals were made towards the year end as has become the norm in recent years.

In summary, following some average years between 2003 and 2006, 2007 was overall a very poor year for butterflies and the year ranked as the third worst in the 32 years of transect recording (Table 1). More than three quarters of species showed a decrease over the previous year, whilst only 12 showed an increase and one showed no change (see Table 3).

In terms of long-term trends, eight species have increased significantly whilst twelve have decreased significantly (see Table 3 and plots in Appendix I)

Table 1. UKBMS years ranked according to how good each year was relative to the others. Ranks are calculated by taking the ranks of the 51 most common butterfly species for the period 1976-2007. Ranks are expressed in order of best to worst with 1 being the best year.

Year	Rank	Year	Rank
1976	10	1992	1
1977	31	1993	22
1978	20	1994	15
1979	19	1995	6
1980	27	1996	4
1981	32	1997	3
1982	5	1998	24
1983	12	1999	26
1984	2	2000	18
1985	16	2001	29
1986	23	2002	28
1987	21	2003	9
1988	25	2004	14
1989	11	2005	13
1990	7	2006	17
1991	7	2007	30

2007 was also poor for the original list of UK Biodiversity Action Plan (BAP) Priority species. Seven of the eight species for which collated indices were calculable decreased in abundance from 2006 to 2007. For five species, abundance dropped by more than half (Table 2).



Table 2. Trends in the original list of UK Biodiversity Action Plan Priority species. Given are the number of transects on which each species has shown an increase over the series and the number of transects on which species has shown a decrease over the series. This includes only those transects that have operated for >10 years and have at least one index in the last 5 years. Included is the long-term trend across all sites for each species and the % change in numbers across all sites from 2006 to 2007 for each species.

Species	No. sites showing increase	No. sites showing decrease	Long-term trend	% Change between 2006-7
Silver-spotted Skipper	20	5	2710	-53
Silver-studded Blue	5	9	-5	-62
Northern Brown Argus	6	10	-36	-51
Adonis Blue	31	14	62	-74
Pearl-bordered Fritillary	15	23	-64	52
High Brown Fritillary	12	18	-36	-1
Marsh Fritillary	16	22	65	-38
Heath Fritillary	6	9	-82	-70

Of the 50 species for which indices were calculated in 2007, there are 24 habitat specialists and 24 wider countryside species. The remaining two species are both migrants (Red Admiral and Painted Lady). The average change in CI from 2006 to 2007 was not different for habitat specialists and wider countryside species. There was a -19.4% and -19.3% decrease respectively for the two groups (Figure 1). However, proportionally more of the wider countryside species (20 of 24) showed decreases than did the habitat specialists (16 of 24).

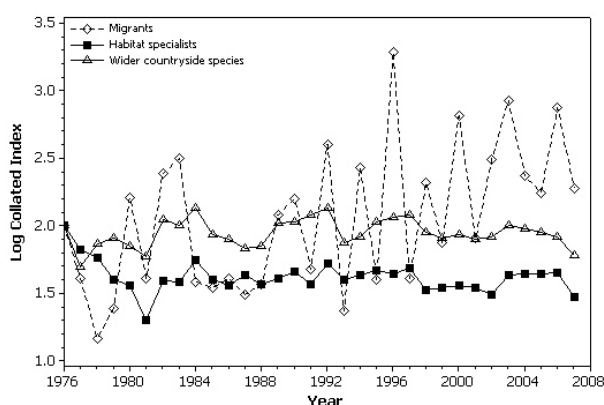


Figure 1. The Annual Collated Index for Habitat specialists, Wider countryside species and Regular Migrants.

Species accounts

The skippers

Of the six skipper species for which Collated Indices were calculated, the two spring-flying species were more abundant in 2007 compared to 2006, whilst the four summer species all decreased. Of the increasing species, the **Dingy Skipper** showed a small increase

(5%) over 2006, but still produced one of its lowest Collated Indices in the series (the 5th worst out of 32). For the tenth year in a row, the Collated Index was below the average of the series. The highest **Dingy Skipper** site index in 2007 was 181, recorded at West Yatton Down in Wiltshire, this being 20% higher than the value the previous year. The **Grizzled Skipper** also produced its lowest Collated Index of the series in 2006, but showed a substantial 42% increase in 2007, but this was only sufficient to produce an average Collated Index across the 32-year series. A noteworthy increase occurred at Levin Down, West Sussex where the annual index went from 10 in 2006 to 94 in 2007. Nationally the butterfly has declined significantly by 37% since 1976.

All of the 'Golden Skippers' showed decreases from 2006 to 2007. The **Lulworth Skipper** had its worst year in the 16-year series for which indices were calculable (since 1992). On average, numbers were approximately half of those seen in 2006, which in any case was a below average year. The situation was not bad everywhere, and at Broadcroft Quarry on the Isle of Portland, Dorset the index rose from one in 2006 to 19 in 2007. The **Silver-spotted Skipper** showed a decrease between years of 53%, although the long-term trend for this butterfly is favourable, due to a combination of climate change, recovery in rabbit numbers and conservation grazing (Davies et al. 2005). The biggest drop in **Silver-spotted Skipper** numbers at a single site was at Lullington Heath NNR, East Sussex where the index went from 99 in 2006 to just 9 in 2007.



Despite a north and west expansion in the UK distribution of the Small Skipper, pictured here in Bevill's Wood, Cambridgeshire, this species produced its lowest CI of the series in 2007 and has shown a significant decline since transect recording began in 1976. *Photo Nick Greatorex-Davies*

The **Large Skipper** had another poor year (the 5th worst out of 32) and was down by 11% over 2006. This butterfly has not had a good year since 1996. The **Small/Essex Skipper** species aggregate produced its lowest Collated Index of the series for the second year running, dropping a



SPECIES	2006 all-sites index	2007 all-sites index	% change	No. years with an index	2006 rank of all years with an index	2007 rank of all years with an index	Comments	Trend in all-sites index
Small/Essex Skipper	46	31	-33	32	31	32		-40*
Lulworth Skipper	67	34	-49	16	13	16		-77
Silver-spotted Skipper	348	164	-53	29	5	13	Substantial decrease following long-term increase	2710***
Large Skipper	78	70	-11	32	26	28	Below average for 10 years	-5
Dingy Skipper	70	74	5	32	29	28	Below average for 10 years	-38**
Grizzled Skipper	61	87	42	32	32	17	Increase after several poor years	-37*
Wood White	28	80	188	31	31	20	Substantial increase after large decline	-68*
Brimstone	126	117	-7	32	6	8		21
Large White	90	67	-26	32	18	30	Large decrease	-28
Small White	92	57	-38	32	15	30	Large decrease	-7
Green-veined White	64	67	6	32	31	29		-9
Orange Tip	87	91	5	32	23	22		22
Green Hairstreak	81	83	2	32	26	23		-26
Brown Hairstreak	142	50	-64	25	6	23	Large decrease	203*
Purple Hairstreak	63	62	-0	32	24	25		23
White-letter Hairstreak	47	36	-23	32	23	26		-75**
Small Copper	115	86	-25	32	14	20		-12
Small Blue	111	55	-50	30	16	25	Large decrease	-7
Silver-studded Blue	138	52	-62	29	8	28	Huge decrease	-5
Brown Argus	164	71	-57	32	6	25	Large decrease	19
Northern Brown Argus	58	28	-51	29	26	28	Large decrease	-36
Common Blue	131	35	-73	32	9	32	Huge decrease	-7
Chalk-hill Blue	163	55	-67	32	1	31	Huge decrease	17
Adonis Blue	263	70	-74	32	1	20	Huge decrease	62
Holly Blue	134	213	59	29	16	10	Large increase	269
Duke of Burgundy Fritillary	70	94	34	29	25	17	Substantial increase	-23
White Admiral	134	72	-46	32	10	23	Large decrease	-54**
Purple Emperor	201	108	-46	29	4	13	Large decrease	20
Red Admiral	234	201	-14	32	4	6		341***
Painted Lady	606	142	-77	32	3	14	Huge decrease	433*
Small Tortoiseshell	35	34	-3	32	31	32	Lowest in series for 2 years running	-47
Peacock	80	111	38	32	26	14	Substantial increase	54*
Comma	210	111	-47	32	2	19	Large decrease	274***
Small Pearl-bordered Fritillary	70	84	20	32	26	20	Substantial increase	-63***
Pearl-bordered Fritillary	47	71	52	32	30	24	Large increase	-64***
High Brown Fritillary	40	39	-1	30	27	28		-36
Dark Green Fritillary	263	188	-28	32	2	5	Substantial decrease	99
Silver-washed Fritillary	314	136	-57	32	1	10	Large decrease	74*
Marsh Fritillary	194	120	-38	25	4	11	Substantial decrease	65
Heath Fritillary	129	39	-70	24	11	20	Huge decrease	-82**
Speckled Wood	136	105	-23	32	9	17		131***
Wall Brown	46	26	-44	32	31	32	Lowest in series for 2 years running	-72***
Scotch Argus	80	54	-32	29	23	26	Substantial decrease	88
Marbled White	151	111	-26	32	3	16		103**
Grayling	97	38	-61	32	16	32	Huge decrease	-55***
Gatekeeper	91	61	-32	32	22	30	2nd year in succession of substantial decrease	-18
Meadow Brown	103	87	-15	32	11	24		17
Small Heath	87	48	-45	32	23	30	Large decrease	-53***
Large Heath	191	206	8	30	5	4		-20
Ringlet	139	125	-10	32	9	18		274***

Table 3. Summary of % changes in the Collated Indices of individual butterfly species from 2006 to 2007. Additionally the 'Trend in all sites index' refers to the % change for the whole series with significance levels: *P < 0.05 (significant), **P < 0.01 (highly significant), ***P < 0.001 (very highly significant).



further 33%, and there has been significant national decline since 1976. However, it was not all doom and gloom. Both the **Small Skipper** and the **Essex Skipper** species continue to spread north and west. For example following colonisation in Ireland in Co Waterford in 2006, a number of new **Essex Skipper** sites were found in 2007.

At the five sites in Scotland where the **Chequered Skipper** is monitored by transects, numbers were fairly similar to those in 2006 at four of the sites, although at the fifth, Pollach, the index dropped by more than 50%.



The Grizzled Skipper, pictured here at Woodwalton Marsh in Cambridgeshire, had a good year in 2007. Many spring species were seen earlier in the year than usual and in good numbers due to the superb spring weather. *Photo Marc Botham*

The whites

The two cabbage whites, **Large White** and **Small White** had poor years, with numbers down by a quarter over the previous year, and for both species it was the third worst year in the 32-year series. **Green-veined White** had a slightly better year than in 2006, but the fourth worst in the 32-year series. There was a notable increase at Bradfield Woods, Suffolk where the index went from 192 in 2006 to 566 in 2007. The **Brimstone** had an above average year (ranked 8th out of 32 years), and had a modest 8% increase in numbers from 2006 to 2007. Pamber Forest in Hampshire was the premier monitored site for this butterfly, with an annual index of 388. The **Wood White** did particularly well compared to 2006, in which it produced its lowest Collated Index of the series, showing a 188% increase from 2006 to 2007 – an increase greater than any other habitat specialist species over the period. The largest **Wood White** annual index of 419 was produced at Haugh Wood South in the West Midlands. This is potentially good news as the **Wood White** has declined significantly by 68% since 1976. The **Orange-tip** Collated Index was 5% higher in 2007 than in 2006, but this was a below average year for the butterfly (ranked 11th worst out of 32 years). By far and away the largest **Orange-tip** site index of 138 was recorded at Oxwich in South Wales.



Whilst most of the whites had a poor or average year in 2007, the Wood White, pictured here at Whitecross Green Wood, Oxfordshire, did well, increasing by 188% from 2006 to 2007. *Photo Chris Goddard.*

The blues, coppers and hairstreaks

The 'blues' fared particularly badly in 2007 with only two species showing an increase. Both of these species, the **Green Hairstreak** and the **Holly Blue** (first generation), fly early in the year, coinciding with the warm and sunny spring that kick-started the butterfly season in 2007. The **Holly Blue** produced its 10th highest Collated Index in the 32-year series and had a corresponding 59% increase in abundance over 2006 – the biggest between-year increase for any wider countryside species over the reporting period.

The grassland blues did very poorly in 2007, with all suffering greater than 50% declines from 2006 to 2007. The **Adonis Blue** had its first bad year since 2002, and the sharp drop in numbers between years was more acute than any other UK habitat specialist butterfly. The biggest decrease in the **Adonis Blue** was detected at Anchor Bottom, Sussex where there were nearly 8000 fewer in 2007 compared to 2006! The **Chalkhill Blue** had its second worst year since 1976, with the biggest site decline detected at Brading Quarries, Hampshire where the index went from 5139 in 2006 to 1062 in 2007. There were some gloomy figures for the **Small Blue** as well, with decreases from 89 in 2006 to three in 2007 at Park Bottom, Wiltshire and from 53 in 2006 to two in 2007 at Melbury Down, Dorset.

The **Common Blue** produced its lowest Collated Index of the series, and there was a 73% decrease from 2006 to 2007 – a bigger drop than any other wider countryside species. Figure 2 shows individual sites where the **Common Blue** showed its largest increases and decreases from 2006 to 2007. Most of the largest decreases occurred in southern England, whilst the increases generally occurred further north in Wales and Scotland and in eastern England.

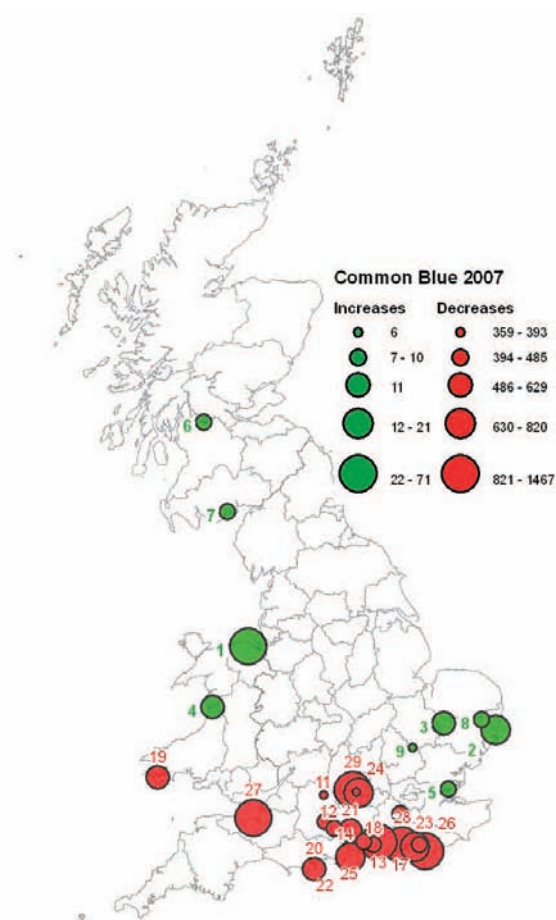


The **Silver-studded Blue** declined by 62% between 2006 and 2007. In 2006 this species had shown a substantial increase from 2005 and produced an above average Collated Index. The Collated Index produced for 2007 was well below average for the series. Some sites bucked the trend though, for example the annual index increasing slightly at Sopley Common, Dorset from 88 in 2006 to 99 in 2007. Whilst the **Northern Brown Argus** showed a similar decrease (-51%) from 2006 to 2007, the Collated Index for 2006 was already below average. In recent years the general trend for this species is of a decline whereas the **Silver-studded Blue** has shown great fluctuations throughout the series. The Brown Argus also had a poor year (the 8th worst out of 32), with the index dropping by more than 50% since the previous year. At Potton Wood, Bedfordshire numbers collapsed from 141 in 2006 to just 6 in 2007. The **Small Copper** declined by 25% from 2006 to 2007, with 2007 being a below average year for the butterfly. The premier monitored site for this butterfly is at Cavenam Heath in Suffolk, where there was an encouraging increase in the annual index from 496 to a whopping 875.

It was a below average year for the **Green Hairstreak**, although overall abundance in 2007 was similar to that in 2006. Trends in abundance for other hairstreaks must be treated with caution, as transects are not considered to be the best method of monitoring these predominantly arboreal species, whilst site indices are invariably low. Even so, both **White-letter** and **Brown Hairstreaks** showed large decreases (23% and 64% respectively) whilst the **Purple Hairstreak** showed no change in the Collated Index between 2006 and 2007.



The Common Blue is the UK's most widespread blue. However, this species produced its lowest Collated Index of the series in 2007. *Photo David Dennis*



Key to site numbers:

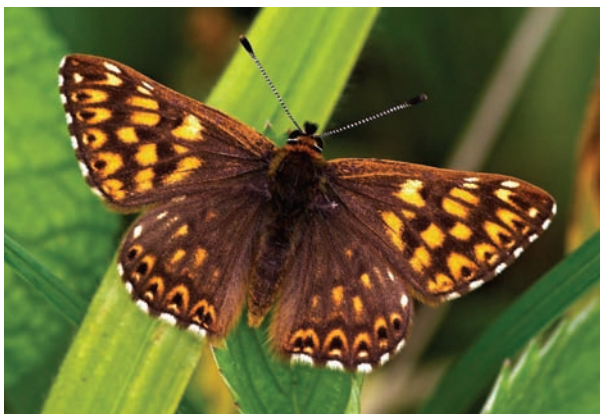
Site no	Site name
1	Pen-y Gelli
2	Upper Abbey Farm
3	Cavenham Heath
4	Ynys Hir
5	Leigh Marshes
6	Mugdock CP 4 - Khyber Fields
7	Dalbeattie Forest - 'Lovers Loup'
8	Tythe Farm
9	Therfield Heath, Top of Rifle Range (2)
10	Lardon Chase
11	Barbury Castle
12	Broughton Down 2
13	Catherington Down
14	Boscombe Down A (MOD)
15	Box Hill, Zig Zag
16	Box Hill, Viewpoint
17	Malling Down
18	Kingley Vale
19	Somerton
20	Durlston Country Park West
21	Magdalen Hill Down extension
22	Whippingham (fields)
23	Castle Hill
24	Hartslock
25	Levin Down
26	Frog Firl Farm
27	Hinkley Point Power Station
28	Anchor Bottom
29	Aston Upthorpe Downs



Holly Blue, New Forest, Hampshire. This was the only blue to do well in 2007 with a greater than 50% increase over 2006. Photo John Vallender

The metalmarks

There was a welcome increase in the **Duke of Burgundy** in 2007, with a 34% increase over the previous year. This is another butterfly which has declined rapidly in recent years (see feature article). Whilst 2007 was still only an average year, it is a considerable improvement for this species, as numbers in 2006 were well below average.



The Duke of Burgundy, pictured here in Bentley Wood, Wiltshire, showed an increase from 2006 to 2007. However, 2007 was still only an average year for this declining species. Photo John Vallender

The nymphalids – excluding fritillaries and migrants

After a good year in 2006, the **Purple Emperor** had only an average year in 2007 and showed a 46% decrease from 2006 to 2007. This is another species that can be elusive because of its arboreal habits, and the observed decrease should be interpreted with caution. Another woodland species that fared badly in 2007 was the **White Admiral** which also showed a 46% decrease from 2006 to 2007. 2007 was a below average year for this butterfly, which has declined significantly by 54% over the 32-year series.

The **Small Tortoiseshell** decreased by almost 50% from 2006 to 2007, to produce its worst Collated Index in the series. There have now been three very bad years in succession and this formerly abundant butterfly is currently disappearing from the countryside at an alarming rate. The butterfly did particularly badly in the West Midlands and across central-southern England, but elsewhere the situation was mixed. The butterfly was recorded on ~80% of transects, but on average each transect had an annual index of only 10 butterflies. Assuming a mean transect length of 2.7km and that the mean number of visits per year is 16, this roughly equates to seeing 0.23 Small Tortoiseshells per km of recording effort (i.e. one per every 5km walked in the countryside over the year). At Castle Hill NNR, East Sussex, 4023 butterflies were counted but not a single **Small Tortoiseshell** was seen and only 1% of all butterflies counted on UKBMS transect sites were of this butterfly. The **Small Tortoiseshell** has been the focus of recent concern since the arrival of a parasitic tachinid fly, *Sturmia bella*, to the UK in 2000 (Ford et al. 2000). However, in years subsequent to the arrival of *S. bella*, **Small Tortoiseshell** numbers fluctuated greatly and the exact mechanism behind the more recent heavy decline in numbers requires further study. Drought has also been shown to heavily influence the abundance of this butterfly (Pollard et al. 1997). Whilst 2007 may be remembered as a very wet year overall, spring temperatures were high and there was very low rainfall with April being the driest April in the series. Thus, those larvae resulting from over-wintering adults may have been affected by these dry conditions which is known to reduce the quality of the food-plant (Pollard et al. 1997).

The **Comma** decreased by 47% from 2006 to 2007, with 2007 being a below average year for the butterfly. In contrast, the **Peacock** increased by 38% from 2006 to 2007, but 2007 was no more than an average year for this butterfly. Both species have increased significantly since 1976, the **Comma** by 274% and the **Peacock** by 54%.



The White Admiral, pictured here in the New Forest in Hampshire, is a woodland species that fared badly in 2007 showing almost a 50% decrease from 2006. Photo John Vallender.



The Nymphalids - fritillaries

Five of the seven fritillaries suffered a decrease in their Collated Indices in 2007, though for three of these species this partly reflects decreases that often occur following a good year. The **Heath Fritillary** declined by 70% from 2006 to 2007 - more substantially than any other fritillary. Over the whole series (24 years, since 1984), this fritillary has the largest negative trend in its Collated Index. However, there have been some successes in recent years with population increases on Exmoor (Bulman pers. comm.) and Kent (Brereton, 2006) due to improved conservation management. The **Silver-washed Fritillary** decreased by 57% from 2006 to 2007, though it was still a relatively good year (the 10th best out of 32) for this butterfly, following on from the record breaking year of 2006. The **Marsh Fritillary** decreased in abundance from 2006 to 2007 by 38%. However, the 2007 Collated Index was still above average for the series and the overall trend in recent years has been favourable due to a run of relatively good years since 2000. The **Marsh Fritillary** is still a species requiring urgent conservation action as many populations are threatened by a range of factors including development, habitat fragmentation, abandonment and unfavourable land management. **Dark Green Fritillary** numbers dropped by 28% from 2006 to 2007, but once again it was actually a rather good year (the 5th best out of 32), making it the fifth good year in succession. Finally, the **High Brown Fritillary** is another highly threatened species that has declined acutely since the early 90s and fewer than 50 colonies now remain. Although there was a slight decrease in numbers from 2006 to 2007, this was only by 1% and therefore of a considerably smaller magnitude than in the previous year.



Another species of great conservation concern is the Heath Fritillary pictured here in Greenscombe Wood, Cornwall. This species decreased more than any other fritillary between 2006-07. *Photo Alexander Henderson*

Both the **Pearl-bordered Fritillary** and the **Small Pearl-bordered Fritillary** showed large increases from

2006 to 2007. The 52% increase in the **Pearl-bordered Fritillary**, was particularly welcome, as this butterfly is in rapid decline and faces enormous conservation management challenges. However, 2007 was still a below average year and in fact there has not been an above average year for this butterfly in the last decade - the last good year was 1997. Table 4 shows individual sites in which the **Pearl-bordered Fritillary** showed its highest increases and decreases. It is encouraging to note that the top three sites in this table are all being positively managed for the butterfly. Whilst not quite of the same magnitude, the closely related **Small Pearl-bordered Fritillary** also fared well in 2007 compared to 2006, showing a 20% increase. This is another butterfly in need of a good year. 2007 was a below average year and the last good year was more than a decade ago. Both species have declined significantly in abundance since 1976 by more than 60%.

Table 4. Sites where the Pearl-bordered Fritillary showed its largest increases and decreases in abundance from 2006 to 2007.

Site	BC Branch	2006 Collated Index	2007 Collated Index	% Change
West Down (Dartmoor)	Devon	9	46	411
Bentley Wood - North	Wiltshire	42	82	100
Pignal Inclosure	Hampshire & IOW	22	37	68
Holme Park Fell	North West	11	2	-18
Glasdrum	Scotland	22	9	-41
Warton Crag LNR	North West	24	8	-67
Warton Crag LWT	North West	81	19	-67



The Pearl-bordered Fritillary, pictured here in the New Forest, Hampshire, is a species in decline and is of great conservation concern. 2007 was a good year for this species with more than a 50% increase over 2006. *Photo John Vallender*



The Browns

Nine of the ten brown species dropped in abundance from 2006 to 2007. The **Grayling** suffered the biggest decrease (-61%) and there were few sites nationally showing any increases, but plenty of sites with substantial decreases (Table 5). The **Grayling** has declined significantly in abundance by 55% since 1976.

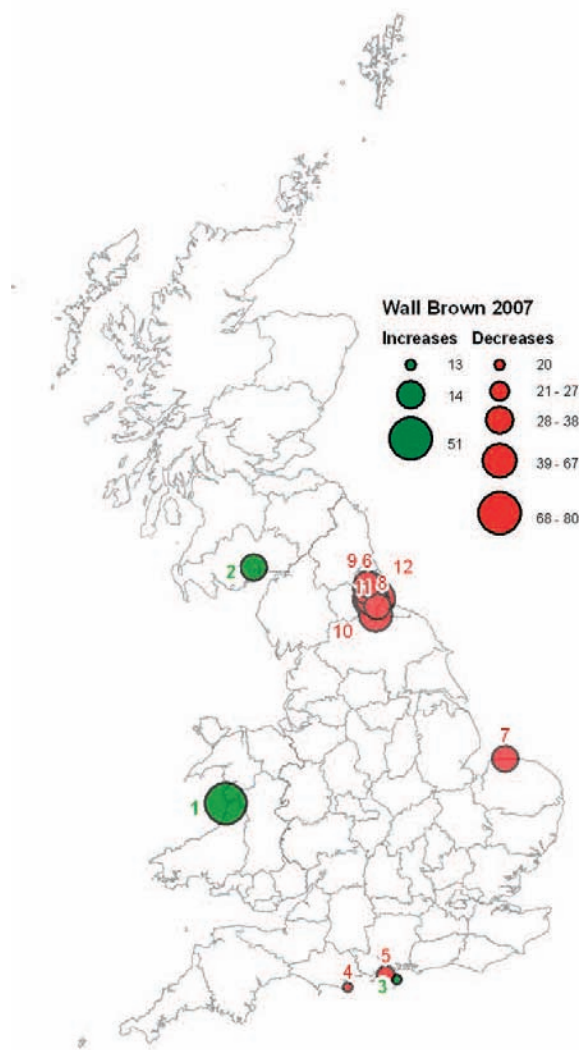
Table 5. Selected sites where the Grayling showed its largest increases and decreases in abundance from 2006 to 2007.

Site	BC Branch	2006 Collated Index	2007 Collated Index	% Change
Yarner Wood	Devon	3	10	233
Newborough Warren	North Wales	80	103	29
Upton Heath North	Dorset	170	104	-39
West Moors (RAOC)	Dorset	1352	797	-41
Tentsmuir Point North Revised	Scotland	100	50	-50
St. Abb's Head	East Scotland	176	70	-60
Bovey Heath	Devon	480	168	-65
Chobham Common North-east	Surrey	292	91	-69
North Warren	Suffolk	246	66	-73
Chobham Common	Surrey	169	38	-78
Loch Fleet	Scotland	354	76	-79
Brentmoor Heath	Surrey	173	30	-83
Upton Heath South	Dorset	106	18	-83
Lindisfarne	North East England	122	17	-86
Studland Heath	Dorset	137	14	-90
Gait Barrows NNR (Warden's)	North West	66	2	-90

Gatekeeper and **Small Heath** also had poor years, both species recording their third lowest Collated Indices in the 32-year series. Small Heath has declined significantly by 56% since 1976. Following a substantial decrease in abundance (36%) from 2005 to 2006, the **Wall Brown** underwent a further 44% decrease from 2006 to 2007. There has been a significant long-term decline of 72% since 1976. Few **Wall Brown** sites showed increases of any magnitude (Figure 3). This once common species has become decidedly scarce in many inland counties, the reasons for which are unclear. UKBMS data are being used in a PhD study by Rebecca Harker and Tim Shreeve of

Oxford Brookes University, to try to help understand the causes of the decline.

Numbers of **Speckled Wood**, **Marbled White** and **Ringlet** showed modest decreases in numbers from 2006 to 2007, though all three species had average years across the 32-year series in 2007. All three species have increased significantly since 1976.



Key to site numbers:

Site no	Site name
1	Dyfi
2	Mabie Forest
3	Brading Quarries
4	Durlston Country Park East
5	Parkhurst Forest 2
6	Brass Castle - Waldrige North
7	Holkham
8	Stillington Forest Park
9	Newton Hall Junction
10	Thrislington Plantation
11	The Whinnies
12	Bishop Middleham Quarry

Figure 3. Selected sites throughout the UK in which the Wall Brown showed its largest increases and decreases from 2006 to 2007.



Wall Brown, Lymington, Hampshire. This butterfly was once common throughout the UK but has been in decline since transect recording began, particularly at inland sites. 2007 was another poor year. *Photo John Vallender*

The only brown which had an improved Collated Index from 2006 to 2007 was the **Large Heath**. This species has undergone large declines caused by a loss of its habitat (Franco et al. 2006). Whilst it did not suffer a decrease between 2006 and 2007, there was only a small increase (8%) and the trend data should be treated with caution as the number of monitored sites is low. In spite of poor weather, at Knowetop Lochs in south-west Scotland the **Large Heath** index increased from 20 in 2006, to 45 in 2007.



The Grayling, pictured here, is another brown that has declined greatly in recent years. It produced its lowest Collated Index of the series in 2007. *Photo Peter Eeles*

Migrants

2007 was a poor year for migrant butterflies (and moths). Following a general trend of increase in numbers over the last few years and a very good year in 2006, in which all three common migrants had one of their best years of the series, the migrants did not fare so well in 2007. All three species showed decreases with the **Red Admiral** showing the smallest decrease (-14%). **Painted Lady** numbers showed a large 77%

decrease from 2006. **Clouded Yellows** were not observed frequently enough for a Collated Index to be calculated in 2007, though there were reasonable numbers at some sites including at Durlston Country Park, Dorset. Overall, regular migrants are still more common in the UK than they used to be and although a relatively bad year compared to recent years, 2007 was still above average. All three species have increased significantly since 1976. The influx of migrants is very variable from year to year and good years are often followed by relatively poor years (see Figure 1).

There were a number of **Large Tortoiseshells** recorded in the UK during July and August, especially in southern counties. At least some of which were suspected to be genuine migrants, but none were picked up on transects. A single **Camberwell Beauty** was recorded on the transect at Blean Woods, Kent.



Camberwell Beauty - a nice find on the Blean Woods transect, Kent. *Photo Peter Eeles*



UKBMS Funding update

We are delighted to report that, in August 2008, BC and CEH started a 2¼ year research and development project to continue maintaining and improving the UKBMS. The project entitled 'Extending the use of butterfly recording data in the UK' is funded by a consortium of governmental, nature conservation and land management bodies led by Defra. The project has three elements. The primary objective is to maintain the current level of monitoring activities including refinements to existing data collection and analysis methods. The second element is to report on butterfly trends each year and to assess and interpret trends in butterfly populations. This element includes new work to develop indicators of the biological impact of climate change. The final objective of the project is to produce a monitoring strategy for all UK butterfly species by evaluating the effectiveness of the existing monitoring network, investigating other approaches for monitoring species not well covered by traditional transect monitoring (e.g. species that fly in woodland canopies for example) and plans for integrating wider countryside monitoring within the standard scheme. The new project builds on the great success in developing the scheme over the last 3 years and is an important step in securing the UKBMS as one of the most important insect monitoring schemes in the world.

Data collation

The new system for data collation established in 2006 was rolled out again in 2007 and there was another fabulous response from recorders and data inputters.

A total of 765 transect datasets were received by the UKBMS for 2007 (compared with 735 in 2006), with the majority submitted in advance of the end-November deadline. This represents nearly 90% of all transects that we believe are still active. Data processing was made much easier for us by the fact that 95% of these datasets were received as full data in electronic (Transect Walker) format. The latest version of this software is available for download from the UKBMS website at www.ukbms.org/resources.htm.

The response in Wales has been particularly pleasing, with data received from 44 sites in 2007. This represents a massive 69% increase on the 26 sites of recent years, and is a great reflection on the local support and development work that has been undertaken there since the instigation of the UKBMS project.

Of course, in addition to the transect counts, we are still working to collate data for some key species through

other monitoring methods, such as timed-counts and larval web counts. The combined UKBMS database now contains data from over 1500 sites across the UK (Table 6), with nearly 1000 sites actively monitored in 2007.

Table 6. All monitored sites on the UKBMS database (1976-2007)

Transect	Active	Defunct	Total
England	731	390	1121
Scotland	72	27	99
Wales	44	17	61
Northern Ireland	14	24	38
Non-transect			
England	89	24	113
Scotland	0	0	0
Wales	22	71	93
Northern Ireland	12	0	12
Total			
England	820	414	1234
Scotland	72	27	99
Wales	66	88	154
Northern Ireland	26	24	50
Total	984	553	1537

The greater support for volunteers that can be provided through the combined UKBMS has also helped lead to a net growth in transect monitoring across the country in the form of 195 new transects being started up and improved retention of existing transects (e.g. 39 transects stopped in 2005, compared to 59 in 2003.). We aim to consolidate this growth as the UKBMS project moves into a new phase.

Transect data validation and standards

The UKBMS comprises the biggest database of scientifically collected butterfly abundance records in the world. These data are vitally important in conservation and research and the scheme is held in wide regard by scientists, conservationists and policy makers in the UK and overseas - due to the high quality of the data collected. CEH have consistently set exacting recording standards and developed intensive data validation procedures since the scheme was launched in 1976. It is very important that these standards are maintained and that both field and electronic data are quality assured.

On an annual basis, much work is done in checking the butterfly counts that come in – a task which needs to become more automated as the number of sites grows. In addition, there is an ongoing process to ensure that



we have complete and up-to-date information on all the sites that are being monitored. Finally, because the data are largely collected by volunteers rather than paid professionals, it is important to funding bodies that checks are carried out to provide evidence that high scientific standards are being maintained.

This article describes some of the issues that we are addressing, and which will result in many of you hearing from us again during the forthcoming year.

Transect Route Maps

We currently hold route maps for the majority of active transects, and we have an ongoing project to digitise these routes and make them available on the UKBMS website. However, recent experience has shown that a few of these maps are no longer a true reflection of the current route, or lack sufficient clarity to enable them to be followed on the ground. So, as well as seeking maps from those remaining sites that are missing, we will also be sending out many of the existing maps for checking.

Site/Section Habitat and Management Data

Many recorders have already completed Site Details forms and we have been able to extract details on other sites from the Transect Walker files that we receive each year. But there are still many sites where it is unclear what habitats are being monitored. This means we are unable to utilise data from those sites for all but the most basic analyses. In order to fill in these gaps and make better use of the data we will be requesting the habitat information from principal transect contacts for the relevant sites.

Unusual Counts

From time to time, we notice a count or index for a particular site on our database which seems highly irregular – whether it is an unusual species or exceptionally high numbers. We will be investigating any such anomalies as they arise, and if we cannot resolve them through reference to the original data that we hold, we may well need to get back in touch with some recorders.

Volunteer Support

With around 1000 regularly monitored sites in the UK, it is no longer practical for a national co-ordinator to visit all sites on a rolling programme – in the way that Nick Greatorex-Davies once did. But it is still very important that we maintain contact with those who contribute to the scheme, so we will be making efforts to meet up with as many of you as possible. As much as we are keen to visit many important butterfly sites across the country, it will more importantly provide a direct opportunity for transect walkers and co-ordinators to raise any issues or queries that you may have –

particularly regarding the ‘Best Practice’ advice published in last year’s UKBMS Annual Report.

Validation monitoring

One of the issues that has been raised over the years, is the variation between counts made by different recorders along the same transect route. We will be undertaking a research project in an attempt to quantify this feature, which will partly involve analysis of data from sites that are walked by multiple recorders. We will also be collecting fresh data by conducting our own repeat transect walks at a selection of sites throughout the year. In some instances, we may be contacting you to try to conduct our walks around the same time that you are doing yours during the week. Other walks may be conducted unannounced, as and when the opportunity arises. In either case, if we walk your transect, it is not because we are ‘checking up on you’ individually – we are simply gathering data to validate the quality of the data or to highlight any recording issues where training or more guidance may be required.

We look forward to meeting many of you over the course of time.

The CEH UKBMS team move to Wallingford

2008 marks the closure of CEH Monks Wood. The 31st of December 2008 is the official date on which all scientific activity at this site will cease. The new site location for CEH staff in the UKBMS team is in Crowmarsh Gifford near Wallingford, less than 15 miles south of Oxford in the Thames Valley. The UKBMS paper archive is now situated at CEH Wallingford. David Roy has relocated to CEH Wallingford, whereas Nick Greatorex-Davies, Pete Rothery and Val Burton have taken retirement following the closure of Monks Wood. We therefore welcome two new members of CEH to the UKBMS team, both of whom are based at the Wallingford site with David.

Marc Botham took the position of Butterfly Ecologist with CEH in 2008 and will take on much of Nick’s role in the UKBMS group. He will be responsible for the analysis of UKBMS data, organisation of the reports, writing research applications, publications and overseeing the collation of the UKBMS dataset. Day to day enquiries previously dealt with by Nick, however, will now be dealt with by Ian Middlebrook of Butterfly Conservation. Stephen Freeman joined CEH as a Statistical Modeller in 2008 and will now deal with all statistical analyses associated with the UKBMS dataset in place of Pete.



There are currently three UKBMS transects running at Monks Wood and they are of historical and scientific significance as the BMS methodology was developed at these sites in 1973 (Figure 4). All three transects have been operational since 1976 when transect recording began and have a full series of data and contain rare species, so we are extremely keen to keep them running. In the short-term CEH staff will continue to walk these transects, but we are currently looking at long-term solutions to keeping these historical transects running and seek volunteers who may be interested in walking these transects in the future (if interested please contact Ian Middlebrook for more details). David and Marc, along with other CEH staff at Wallingford will be helping to record transects in South Oxfordshire including sites such as Swyncombe Down, which is good for Silver-spotted Skippers, and Aston Upthorpe Downs which is a site for the Duke of Burgundy.

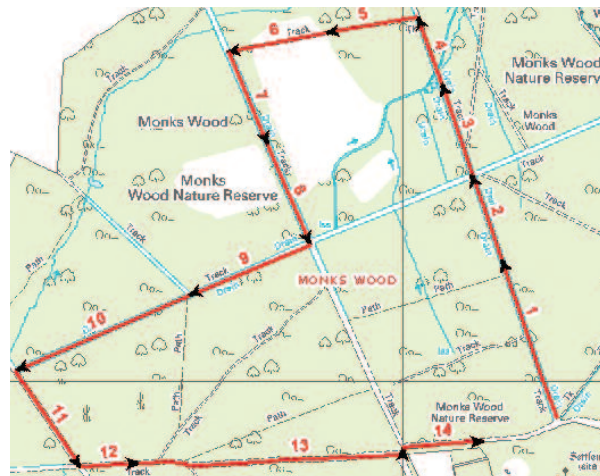


Figure 4. The transect method was developed at Monks Wood and recording has been carried out continuously since 1973. Due to the CEH move to Oxfordshire, new transect walkers are needed at this site.

A goodbye from, and a tribute to, Nick Greatorex-Davies

Time to say goodbye!



Nick Greatorex-Davies in full transect regalia, poised at the start of the Monks Wood transect

After more than 34 years of working at Monks Wood, I have decided it is time to call it a day and ‘hang up my net’ (we’ll not the latter just yet!). With the closure of Monks Wood I have decided to take early retirement and therefore I am leaving CEH and the UKBMS team at the end of this year. I count it as a real privilege and joy to have been so involved in the UKBMS over the last 14 years. I am very aware that not many people get the opportunity to pursue their life-long passion (in this case Lepidoptera and their conservation), as part of their job! I have also loved the people side of the job, meeting so

many of you and getting to know some of you as friends. I have greatly appreciated the time and hospitality many of you have given me over the years as I have visited sites all over the United Kingdom and walked your transects with you. Mind you, it hasn’t always been easy to find ways of firmly but tactfully pointing out that certain practices are not how transects should be done. For example I learnt that one recorder recorded part of his transect from a Land-rover! Another told me: “If I just wait here for a few minutes a Speckled Wood is sure to turn up”! I cannot remember exactly how I responded to these and other revelations but I can say that without exception I have enjoyed meeting everyone that I have met and it has been a whole lot of fun! I will definitely miss you but hopefully I will remain involved in the science and conservation of Lepidoptera and so will continue to meet some of you from time to time. As yet I don’t know what I shall be doing, but I plan to take a few months off at the beginning of next year to take stock and consider my options.

I leave the UKBMS team feeling very privileged to have been involved over a period when butterfly monitoring has gone from strength to strength. I believe the UKBMS makes an important contribution at several different levels to nature conservation and to improving our scientific knowledge and understanding of butterflies that has a knock-on effect (considering butterflies as ‘flagship’ species) for the conservation of wildlife in general. Not only does the UK government now take it seriously enough to use butterflies as Headline Indicators, but through Butterfly Conservation Europe, there are now two butterfly indicators produced for the European Union. This means that what happens to butterflies really can affect policy!



Finally, and most importantly, I want to acknowledge all you out there who record or organise transects (or have done so in the past), and on behalf of all those in the UKBMS team express our gratitude again for all you do. Some of you have done it since the beginning in 1976 (some from the pilot years before that). There can hardly be a situation where it would be truer to say 'without you none of this would be possible'!

Since 1995 I have walked many miles of transects, I have learnt a lot about butterflies, met an awful lot of people, seen most parts of the United Kingdom and seen huge changes in butterfly monitoring. It is with a certain degree of sadness that I leave all this, but I intend to stay involved as a volunteer recorder if possible in this very worthwhile enterprise. I hope you will continue too.

Nick Greatorex-Davies

A tribute to Nick

It is with great sadness that we bid farewell to Nick Greatorex-Davies as part of the UKBMS team. One of the great strengths of the UKBMS, and the BMS before it, has been the continuity of staff working on the project. Over the last 14 years Nick has made an important contribution towards making the UKBMS the great success it is today. Without his dedication to upholding the strong foundations laid down by Ernie Pollard and others, the recent expansion of transect monitoring in the UK would not have been possible.

Nick's contribution has been most influential in promoting 'best practice' in transect monitoring, ensuring that standards are adhered to and giving the scheme a strong scientific basis. Each year he has reviewed the great volume of data submitted to the scheme, and although the general standard of butterfly recording in the UKBMS is incredibly high, Nick's keen eye for detail and his encyclopaedic knowledge of butterfly flight periods has resolved a number of data problems.

Nick has also been a long-standing recorder of the three butterfly transects in close proximity to Monks Wood; each has a near-complete monitoring record as a result. He first monitored a transect route in 1985 and has now recorded for 21 years, undertaking almost 800 walks, counting almost 56,000 individual butterflies and walking 1078 miles! With Nick's passion for natural history, it is no surprise that this has been one of the roles he has most enjoyed.

Any of you who have had the privilege of being in the field with Nick will appreciate that he is a first class naturalist whose identification skills cover a wide range of taxonomic groups. He honed his natural history skills

as an ecologist at Monks Wood working on a range of important projects. Some of Nick's most influential publications have been on generating management guidelines for butterflies and other insects of woodland rides, work that is still important in shaping woodland conservation policies. Nick's knowledge of the ecology of butterflies and his skill in interpreting trends in their status will be sorely missed.

Outside of work Nick has a busy family life, enjoying time with his wife and four sons. He is also a keen photographer and leaves the UKBMS with an impressive gallery of butterfly and moth images, as well as many photos of transect routes. A less well-known talent is his impressive guitar playing, nowadays in a blues band but seen below in guitar-wielding full flow at a Monks Wood Christmas party.



Nick Greatorex-Davies in full Rock'n'Roll mode at a Monks Wood social event.

Nick is someone who is passionate about natural history, passionate about butterflies (and moths) and passionate about conservation. Nick's enthusiasm for the natural world is infectious, and he is incredibly generous in sharing his knowledge with others. If you want to experience this first hand, I'm sure he would welcome you in joining the butterfly tour groups he has been leading in Bulgaria since 2003.

On behalf of the UKBMS team, I wish Nick every success in the future.

David Roy



Update on butterfly biodiversity indicators

Through the UKBMS, butterfly biodiversity indicators have been developed for the English, Scottish and UK Governments, using annual monitoring data going back to 1976. In 2005, the English Government adopted three indicators, including a headline indicator, 'Populations of Butterflies', together with separate indicators for Populations of Butterflies in farmland and woodland to help measure progress in implementing the England Biodiversity Strategy. In March 2007, Defra published a set of 18 top level biodiversity indicators for the UK, including "1b Trends in populations of butterflies", which charts changes in the abundance of habitat specialist and wider countryside butterflies. In Scotland, a Butterfly Indicator was compiled for Scottish Natural Heritage (SNH) in November 2006. The indicator was developed in the same way as for the UK and England, with separate trends for all-species, habitat specialists and wider countryside (generalists) species.

In 2007, annual updates were made to these indicators, with the inclusion of 2006 data. An important development was that the trends were treated with a statistical smoothing procedure, known as structural time series modelling as implemented in the program Trendspotter. The purpose of this smoothing procedure is to identify the underlying trend in the time series, whilst allowing for the fact that butterfly numbers may go up and down over one or a series of years in a non-linear (curved) way. Previously, trends were assessed in a simpler way, by fitting a straight line through the time series. The Trendspotter approach is likely to provide a more realistic assessment of changes, especially those in the short-term which policy makers often want to determine.



Widespread species like the Small Tortoiseshell are doing better in Scotland compared to England and the UK as a whole.
Photo Tom Brereton

The indicators developed for England, Scotland and the UK show that butterfly numbers have fluctuated from year-to-year, mainly due to weather conditions. However, a general pattern is apparent in the long-term smoothed trends, with significant abundance declines in habitat specialist species and improved trends in generalists (wider countryside) species, giving an overall stable trend for all-species combined (Table 7). In England and across the UK as a whole, the long-term trend in generalist species is classed as stable, whilst in Scotland there has been a significant increase, consistent with northerly range expansions of generalist species in response to climate change. In England, significant long-term declines in specialist species have been detected in both the farmland and woodland butterfly indicators. In these habitats, the rate of decline in specialist species has been of sufficient magnitude to give significant declines for all-species combined, even where generalist species have had more favourable trends (farmland). Short-term trends in the butterfly indicators are less apparent, though significant declines have been detected for all-species on both farmland and woodland in England.

The declines are most extreme in woodland habitats in England (Figure 5), where butterfly abundance has approximately halved since 1990 including for generalists. The sharp decline in woodland butterflies is thought to be largely attributable to a corresponding loss of open habitats within woodlands, due to the decline in traditional woodland management (e.g. coppicing), the reduction in felling areas and the resulting shading of rides and glades. The decline is also linked to increasing deer numbers (locally) and habitat fragmentation.

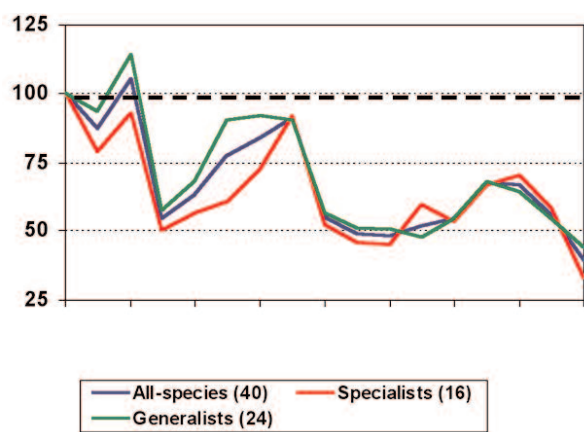


Figure 5. Indicator of butterfly populations in woodland in England 1990-2006

There is a strong commitment to updating and publishing the butterfly indicators to inform conservation policy initiatives, whilst there are plans to generate new indicators at the country level and to assess climate change impacts on biodiversity (see news section). We look forward to updating you with the latest results and developments in future UKBMS annual reports.



Table 7. Trends in Butterfly indicators developed for Governments in England, Scotland and the UK up to 2006. Underlying trends in the indicators over short and longer-term time scales have been assessed by smoothing the data using structural time series modelling as implemented in the program Trendspotter.

Indicator	No. spp.	Period	% change	Status assessment (2006 versus other years)
Long-term trends				
Eng. All butterflies	42	1976-06	-1	Stable
Eng. Specialist butterflies	19	1976-06	-53	Moderate decline 1976-78
Eng. Generalist butterflies	23	1976-06	13	Stable
Eng. All farmland butterflies	42	1990-06	-21	Moderate decline 1990-05
Eng. Specialist farmland butterflies	19	1990-06	-28	Moderate decline 1990-05
Eng. Generalist farmland butterflies	23	1990-06	-14	Stable
Eng. All woodland butterflies	35	1990-06	-48	Moderate decline 1990-05
Eng. Specialist woodland butterflies	13	1990-06	-42	Moderate decline 1990-01
Eng. Generalist woodland butterflies	22	1990-06	-55	Moderate declines/increases
Scotland All butterflies	21	1979-06	21	Stable
Scotland Specialist butterflies	7	1979-06	-45	Moderate decline 1979-86
Scotland Generalist butterflies	14	1979-06	65	Moderate increase 1979-05
UK All butterflies	52	1979-06	14	Stable
UK Specialist butterflies	24	1979-06	-46	Deteriorating
UK Generalist butterflies	25	1979-06	15	Stable
UK Migrant butterflies	3	1979-06	171	Uncertain
Short-term trends				
Eng. All butterflies	42	2000-2006	0	Stable
Eng. Specialist butterflies	19	2000-2006	14	Uncertain
Eng. Generalist butterflies	23	2000-2006	-7	Stable
Eng. All farmland butterflies	42	2000-2006	-9	Moderate decline 2000-05
Eng. Specialist farmland butterflies	19	2000-2006	-13	Moderate decline 2000-05
Eng. Generalist farmland butterflies	23	2000-2006	-6	Stable
Eng. All woodland butterflies	35	2000-2006	-24	Moderate decline 2000-05
Eng. Specialist woodland butterflies	13	2000-2006	-19	Uncertain, ex. moderate decline 2001-02
Eng. Generalist woodland butterflies	22	2000-2006	-9	Moderate/strong decline 2002-05
Scotland All butterflies	21	2000-2006	4	Stable
Scotland Specialist butterflies	7	2000-2006	-8	Uncertain
Scotland Generalist butterflies	14	2000-2006	10	Moderate increase 2000-05
UK All butterflies	52	2000-2006	2	Stable
UK Specialist butterflies	24	2000-2006	16	Uncertain
UK Generalist butterflies	25	2000-2006	-7	Stable
UK Migrant butterflies	3	2000-2006	-2	Uncertain



Developments in Europe

Butterfly monitoring continues to develop rapidly in Europe. New schemes have been established in recent years in Jersey (2004), Estonia (2004), France (2005), Germany (2005) and Slovenia (2006), whilst schemes are proposed for Portugal, Ireland, Sicily, Denmark and Sweden. Currently there are butterfly monitoring schemes in 13 European countries, with ~2800 sites monitored annually. As described in the 2006 UKBMS Annual Report, the data has been used to develop and test a European Grassland Butterfly Indicator, which shows that both common and specialist grassland butterflies are declining rapidly across Europe. The butterfly indicator has been put forward by the European Environment Agency as one of 26 top-level indicators that will be used to assess whether the European Union has met its ambitious target to halt the loss of biodiversity by 2010. In addition to a grassland butterfly indicator, it is proposed to develop new butterfly indicators to assess trends in woodlands and the impacts of climate change. For the latter, things are moving rapidly and we hope to update you with more details in next years report, as well as giving confirmation on whether the grassland butterfly has been officially adopted as an indicator by the EU.

Research news

Butterfly transect data continues to be in high demand for conservation and research. Many of the projects listed in the 2006 report to recorders are ongoing, but in this section we detail two exciting new projects that have been initiated in the last year and have close links to the UKBMS. Both projects are beginning to explore the less well-known area of butterfly ecology – the role that parasites and pathogens are playing in the decline of some of our species.

Parasites and the Decline of Butterflies and Moths

The decline of many species of butterfly and moth in Great Britain has been well documented. The role of factors such as habitat loss, degradation and fragmentation and their interactions with climate change have often been studied. However, the way in which parasites, particularly microbial diseases, interact with butterflies and moths is rarely considered. Pathogens are rarely 'seen' in the field yet they could be playing an important role in the decline of butterflies and moths and this could be linked with changes in habitat and climate.

To investigate this further, the Centre for Ecology and Hydrology with the help of Butterfly Conservation initiated a 3-year project in spring 2008 to address three main questions:

- Are insect parasites important regulators of butterfly and moth populations?
- Does the impact of parasites on butterflies and moths depend on the quality of available habitat?
- Are butterfly and moth species that are expanding in range escaping pathogens?

How can you help?

Over the next three years, the research team will be undertaking a field study across the country, from Dorset to Scotland, to assess the impact of butterfly and moth parasites and pathogens. They will be using the UKBMS transect network to identify sites and to compare butterfly trends with infection rates of parasites and pathogens.

Your help with this project would be greatly appreciated. Please contact the research team (contacts below) if you notice evidence of parasitoid or pathogen infections of Lepidoptera populations that you are studying. If you regularly run a moth trap and have any spare (dead) insects then they would also like to receive specimens for assessment of covert pathogen infection.

For more information contact:

Helen Roy (hele@ceh.ac.uk) or

Helen Hesketh (hhesketh@ceh.ac.uk)

Why is the Small Tortoiseshell Declining?

Results from the UKBMS and other sources have identified a dramatic reduction in numbers of Small Tortoiseshell butterflies (*Aglais urticae*) in recent years. A newly-colonised parasitoid fly, *Sturmia bella*, has been identified as a potentially important agent of mortality to Small Tortoiseshell caterpillars in southern Britain, providing a possible explanation for the butterfly's decline.



Small Tortoiseshell larva. Photo Eddie John



To investigate the effects of *Sturmia bella* more thoroughly, Dr Owen Lewis (Oxford University) in collaboration with BC are requesting assistance from volunteers (see the BC website for news on how to take part). The aim of the research is to determine the frequency of parasitism of Small Tortoiseshell (and Peacock which is also attacked by this parasitoid) larvae from *Sturmia bella* and other parasitoids across the UK and to relate this to butterfly trends measured on UKBMS transect routes.

Hot off the press - Owen Lewis reports that of the Small Tortoiseshell larval groups sampled in 2007 across the southern half of the UK, around 30-40% were affected by *Sturmia bella*. Similar levels of parasitism were also found in samples of Peacock larvae. As has been discussed in the general summary of the 2007 season, understanding the relative role of natural enemies versus climatic factors in the recent decline in Small Tortoiseshell is an ongoing area of research.

For more information contact:

Owen Lewis

(owen.lewis@zoo.ox.ac.uk)

Recorder achievements - an update

Once again the total number of recorders walking transects was greater than 1,500 for 2007. The success of the UKBMS is down to the continued support and hard work of these volunteers. A detailed review of the outstanding effort and achievements of UKBMS recorders was undertaken in the 2006 report. Here we aim to give a brief overview of the advancement of some of these achievements.

Richard Williamson, the West Dean Wood and Kingley Vale NNR recorder, still tops the 1,000 mile group of long distance walkers for the greatest distance walked on butterfly transects with an astonishing 2,767 miles, which is exactly the same as the distance from Calcutta to Baghdad. Additions to this group in 2007 are **Mike Taylor**, **Brian G Nelson** (Holme Fen & Woodwalton Fen), **Malcolm Bridge** (Surrey transects: Headley Warren and South Norwood) and **Mike Slater** (Ryton Woods transects, Warwickshire).

New additions to the club of recorders who have recorded over 50,000 butterflies on transects are **Ted Baigent** (Old Winchester Hill and Beacon Hill) and **Mike Fuller** (Wiltshire transect co-ordinator). **Richard Williamson** still tops this group with an incredible 160,000 butterflies counted. In terms of the most transects walked, **Richard Williamson** now joins the

top ten list which otherwise remains much the same as in 2006 with **Ken Orpe** maintaining pole position.

Finally, with the passing of another year of the UKBMS the list of recorders who have been walking transects for twenty years or more has grown longer. Additions to the 20+ years group are **Ted Baigent**, **Derek Coleman** (Banstead Downs), **Derek Fox** (Snakehome Pit), **Colin Burningham** (Lydlinch Common), **Dave Hughes** (Castor Hanglands), **Albert Knott** (Martin Down, Pewsey Down, Yarner Wood and Bovey Valley), **Alec Mackonochie** (Deer Park Wood and Greenscombe Wood), **Richard Levett** (Wedleholme, Brownwich & Chilling and Botley Wood), **Brian Dicker** (Lydlinch Common, Piddles Wood and Deadmoor Common) and **Leslie Williams** (Fryent Country Park and Beane Hill).

These statistics are only a brief overview of the achievements made by a selection of some of the outstanding recorders that have participated in the UKBMS. The results obtained by the UKBMS, however, are only made possible by the summed contribution of all the recorders who have taken time to walk transects and submit their records. In this sense all recorders deserve mention when crediting the achievements of the UKBMS. We are currently updating our databases holding recorder information and aim to provide a full roll of honour with a complete list of recorders in the 2008 report which will also be made available on the UKBMS website in the near future.



Testing the wider countryside butterfly monitoring method in 2007

Introduction

In 2005 and 2006 a new UKBMS method was designed with the purpose of more effectively monitoring the changing abundance of common butterflies in the wider countryside. Unlike traditional transects, the wider countryside method is not designed to generate information on how well an individual site is doing. Instead, the results will be combined to assess butterfly trends at the UK, national and hopefully regional levels. The method involves making two visits over July and August to randomly selected 1-km squares. On each visit, butterflies and other insects with similar search images (i.e. including day-flying moths and dragonflies) are counted along two parallel, evenly spaced 1-km long survey lines that are placed in the same general location in every square. Counting is made in similar conditions to the UKBMS transects – in a 5m ‘box’ and under set weather conditions suitable for butterfly activity (for further method details see the 2006 UKBMS Annual report). Limited trials were made of the method in 2005 and 2006, chiefly by UKBMS staff.

In 2007, the main focus of work was to ‘road test’ the methodology on a wide-scale, involving a sample of volunteer recorders that would likely be the main future participants. This large-scale field trial not only gave valuable feedback on the suitability of the method for the wider countryside species and the (upland/intensive) habitats targeted, but also determined whether it was fit-for-purpose for volunteers and give an indication of the likely levels of participation if the scheme was rolled out all over the UK.

The volunteers invited to take part were mainly BC members and BTO recorders who contribute to the Breeding Bird Survey (BBS). BC and CEH have worked closely with the BTO in the development of this method, which is based on BBS, with simple adaptations for butterflies. There are a number of advantages in working with the BTO, in following the BBS design and in sampling BBS squares. These include: (1) using a tried, tested and scientifically sound field method and sampling framework, (2) involving a large body of bird recorders many of whom are keen to count butterflies and (3) enabling comparison of trends in the abundance of butterflies, birds and mammals from the same places.

Field testing in 2007

Four BC branches were selected to take part in the field trials: Somerset and Bristol, South Wales, Norfolk and Highland. These branches were chosen to cover a variety of habitats with a focus on uplands where remoteness, poor weather and low butterfly diversity have all

contributed to low monitoring coverage in the past. Within each branch, 30 1km squares were randomly selected with the aim of finding volunteers to visit each square twice between July and August with the option of two further visits between May and August. Survey co-ordinators were given the task of finding willing recorders in each branch (five co-ordinators were needed in South Wales Branch due to its size). BC recorders had the initial task of setting up routes through their squares for the first time, which often involved contacting multiple landowners. Habitat data were collected by BC recorders using a simplified version of the UK BAP Broad Habitats classification. As well as dragonflies and day-flying moths, volunteers were also invited to take part in optional surveys, to assess the abundance of selected insect groups (Bees, Ladybirds, Grasshoppers).



Upland grassland and moorland habitats were targeted in 2007.
Photo Tom Brereton

750 BTO recorders from 32 regions were invited to take part with co-ordination jointly carried out by the BBS organiser and Katie Cruickshanks of BC. Things were logistically more straightforward for BTO recorders as they only had to re-walk the existing routes through their BBS squares twice between July and August.

Results of field testing

How good was the coverage?

There was a fantastic response by volunteer recorders to the request to take part in the field testing. We expected to sample ~150 squares, but in the end achieved more than double this amount, with 310 squares surveyed across the UK (Figure 6). This included good coverage in target upland areas. In total 181 BBS squares were surveyed by 165 recorders, more than double the 75 squares expected. In the four BC Branches, 78 squares were surveyed by 86 recorders with a further 51 squares completed by other interested BC volunteers and staff, giving a grand total of 129 squares. The most squares were surveyed by the Norfolk Branch (27) followed closely by Somerset and Bristol (25) and in joint third



position South Wales and Highland Branch with 13 squares each. Outside the main survey window, 50 squares were visited during May and June. The majority of sample squares were in England (258) followed by Wales (31), Scotland (20) and one square in Northern Ireland (Figure 6).

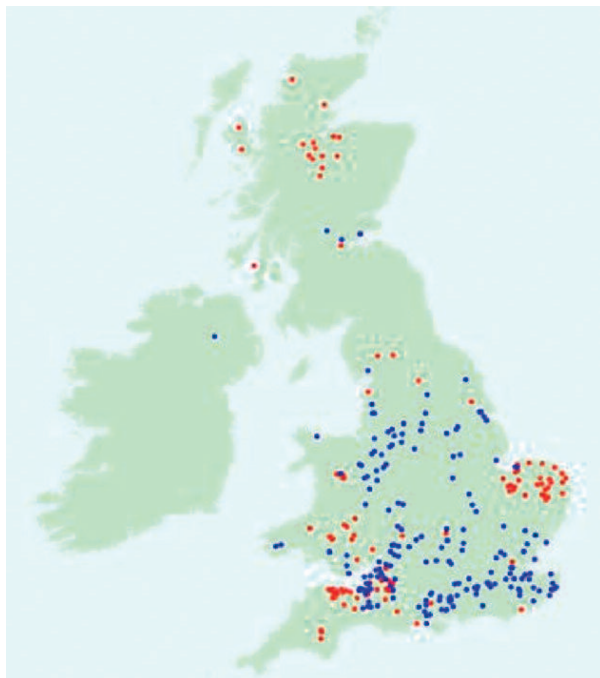


Figure 6. 310 squares were surveyed in 2007 by BC (red) and BTO (blue) recorders.

Recording effort was highly successful, with 297 of the 310 squares visited at least once in suitable weather – an excellent result given the poor summer weather and the fact that many of the squares were in the uplands.

Which species were detected?

In spite of the poor weather in 2007, 42 butterfly species were seen across the UK, on surveys including nearly all of the target wider countryside species (except White-letter Hairstreak), plus all the regular migrants, a selection of habitat specialist species and a rare migrant – the Queen of Spain Fritillary.

The most widespread and abundant species in each of the main butterfly families were Meadow Brown, Small Tortoiseshell, Large White, Holly Blue and Small Skipper. The Meadow Brown was the most frequently recorded and abundant butterfly species, being seen in four-fifths of squares, whilst 70% more individuals were counted than the next most abundant species – the Gatekeeper. Seven other species were seen in more than half of the survey squares, whilst another four species were seen in a quarter of the squares and five more were seen in a tenth of squares. Three of the six most common species were browns and there were, for example, twice the number of Speckled Woods compared to Small Tortoiseshells.

Table 8. Occupancy (% of squares recorded in) and abundance (total number counted) of butterflies in the 297 sampled squares that were surveyed in suitable weather.

Species	No. of squares recorded in	No. of squares surveyed*	% of squares recorded in	Total no. counted
Meadow Brown	238	297	80	6133
Large White	216	297	72	1995
Gatekeeper	200	281	71	3569
Peacock	186	297	62	1237
Small White	183	297	61	3003
Speckled Wood	174	297	58	1227
Red Admiral	172	297	58	744
Green-veined White	159	297	53	1261
Small Tortoiseshell	131	297	44	683
Ringlet	101	282	36	1182
Comma	89	297	30	202
Holly Blue	76	297	26	213
Small Skipper	65	282	23	370
Small Heath	59	297	20	415
Common Blue	50	297	17	192
Green Hairstreak	6	44	14	17
Painted Lady	39	287	14	131
Large Skipper	37	286	13	148
Brimstone	38	297	13	65
Small Copper	26	297	9	68
Essex Skipper	23	280	8	130
Marbled White	22	282	8	65
Grizzled Skipper	3	44	7	4
Silver-washed Fritillary	18	280	6	64
Wall Brown	13	288	5	30
Orange-tip	7	221	3	11
Scotch Argus	8	273	3	231
Dark Green Fritillary	8	286	3	59
Pearl-bordered Fritillary	1	44	2	3
Small Pearl-bordered Fritillary	5	221	2	15
Grayling	5	281	2	15
Brown Argus	5	290	2	19
Purple Hairstreak	3	249	1	3
Clouded Yellow	3	273	1	3
Dingy Skipper	1	105	1	1
White Admiral	2	282	1	2
Large Heath	2	286	1	9
Brown Hairstreak	1	225	<1	1
Silver-studded Blue	1	267	<1	26
Chalkhill Blue	1	273	<1	7
Purple Emperor	1	280	<1	1
Queen of Spain Fritillary	1	286	<1	1

*=over the flight period for that species



On average, nearly 100 butterflies and ten species were seen per square per two summer visits, showing that taking part in this survey in the future should produce a good diversity of butterflies for recorders (see Table 8). There were, however, 15 squares where recorders saw no butterflies on single visits, although at the other extreme one recorder in Kent counted an enviable 672 butterflies on one visit. The most species-rich squares were in Norfolk and Somerset both with 15 species recorded on single visits. In Scotland there were some encouraging results, with Scotch Argus recorded in 40% of squares and a few sightings of Small Pearl-bordered Fritillary and Large Heath - one of the latter sightings being potentially at a completely new site. In Wales, nearly all squares surveyed were in the uplands and 18 species were seen, with the Small Heath recorded on nearly half of the squares.



Scotch Argus was seen on 40% of the squares surveyed in Scotland. Photo Peter Eeles.

Is the method suitable for the uplands?

Of the 75 upland squares surveyed, 119 visits were made to 66 squares within the monitoring criteria. In total, 29 butterfly species were recorded with the most species-rich squares being in the Yorkshire Dales. Eight habitat specialists were recorded with Large Heath present in 3% of upland squares and Small Pearl-bordered Fritillary, Dark Green Fritillary and Green Hairstreak appearing in more than 6% of squares. On average five species and 35 individuals were seen per square in the uplands.

These results are highly encouraging as they show that a visit to a hilly survey square will on average produce a reasonable diversity of butterflies including target species - even in a bad weather year.

Monitoring other insects in addition to butterflies

Recording other insects with a similar search image, at the same time as butterflies proved popular. Dragonflies were recorded in more than half of the squares and day-flying moths were recorded in a quarter of squares.

A small number of volunteers also tested quick methods to sample additional species groups (ladybirds, bumblebees and grasshoppers) at the end of the survey, along a 100m section. Additionally, a method was developed and tested by UKBMS staff to sample a range of common and relatively well known insects including the seven-spot ladybird, the green shield bug and the common red soldier beetle through timed foliage and nectar searches in the last survey line section. The results from these surveys were mixed, and further development work is required to identify the best approach to monitoring other insects as part of wider countryside butterfly monitoring.

Can recording be carried out beyond the times permissible in the UKBMS?

Field research was carried out in 2007 to determine whether the current time period over which recording is carried out could be extended earlier and/or later into the day, to make the method more attractive to potential participants. In the research, butterfly behaviour and abundance was recorded continuously through the day in a range of site conditions that might prevent opportunities for early or late recording, e.g. sunny east facing slopes in the morning.

The studies confirmed that, if a sample area is unshaded and UKBMS weather criteria have been met (i.e. it is warm and sunny), recording could also take place from 09:30-10:45 and from 15:45-16:30. This is good news, as potentially it gives recorders an 'extra' two hours in the day in which to complete their surveys.

What did recorders think of the method?

Results of an online questionnaire showed that the method was popular with a 95% satisfaction rate! Many letters were received from participants with constructive comments about the new method - in particular many people enjoyed the surveys and were often surprised by how many butterflies they saw.

Recorders liked the general approach, though some problems were encountered, mainly regarding setting up a route and gaining access when there were multiple landowners. Recorders liked having the flexibility to do optional extra visits, especially in the spring to pick up new species like Orange-tip. The questionnaire results highlighted a requirement for training, especially for the identification of other insect groups in the field.

Most encouragingly 74% of respondents intimated that they would be happy to take part on a regular basis in the future. We hope that this figure would increase further with more training, publicity and support.



Was online recording successful?

An online recording system was set up in 2007 specifically for wider countryside data. Overall it was successful, with nearly half of BC recorders and over four-fifths of BTO recorders using it. Online recording is important because it would make a future wider countryside butterfly monitoring scheme far more cost effective and would enable results and feedback to be disseminated more rapidly.

What level of future participation might be expected ?

The level of participation achieved in the 2007 field testing, is useful to help predict the likely level of uptake in a nationwide scheme. In 2007, an eighth of BC Branches were invited to take part and 86 volunteers actually submitted data. Scaling this up across all BC Branches, we estimate ~700 BC volunteers would likely take part. Similarly up to 700 BBS recorders could be expected to take part since only a quarter of BBS recorders (750) were invited in 2007 and 165 (22%) of them took part. Taking into account potential turnover of people participating year on year, we have made a conservative estimate that at least 1000 1km squares would be surveyed if the scheme was launched in 2009 or 2010.

Will the scheme detect the target species?

For wider countryside species, we recommend that a species needs to be recorded on at least 30 sites ('occupied' squares) to generate a robust annual UK-wide index. Thus, if 1000 sites are monitored (our conservative prediction), a species needs to be detected on at least 3% of squares to reach the 30-square threshold. From the 2007 results presented in Table 8, 28 species would be reported on if 1000 squares were sampled (i.e. 28 species are present in 3% or more of squares), including Wall Brown, Small Copper and Small Heath. This figure increases to 32 species with 1500 squares, including Grayling and Small Pearl-bordered Fritillary, the latter of which is scarce in England but is quite common over much of northern Scotland.

Conclusions

With the help of volunteers we believe we have developed a method that if launched across the UK, would generate improved, unbiased annual abundance estimates for all the target wider countryside butterflies species. The method is likely to be popular with volunteer recorders. Such a scheme would run alongside transect monitoring, which would continue to be the main scheme to provide accurate trend data for habitat specialist species – as these species are too localised to be detected through a wider countryside approach. To this end, both schemes would compliment each other rather well and running them in parallel would be a substantial step forward for UK butterfly monitoring.

Future plans

A repeat survey is planned for 2008. This will enable a direct comparison of trends in common species over two years in the wider countryside with those derived from conventional transects and to determine if the trends are different. Further work will be carried out to develop other insect monitoring methods and habitat survey methods. The results of the 2008 fieldwork combined with the development of a Butterfly Monitoring Strategy will help to determine the future of the scheme, whilst further funding is being sought for a national launch in 2009 or 2010.

To find out more please contact Dr Katie Cruickshanks: kcruickshanks@butterfly-conservation.org or visit the UKBMS website:

www.ukbms.org/wider_countryside_pilot.htm

Monitoring and conserving the Duke of Burgundy

Tom Brereton (BC), Sam Ellis (BC) and Rob Petley-Jones (Natural England)

Monitoring and status

The Duke of Burgundy is a localised butterfly in England occurring on scrubby calcareous grasslands and in woodland rides, glades and clearings, where the larval foodplants Cowslips and/or Primroses (*Primula*'s) grow in sheltered, tussocky vegetation 5-20cm tall. The butterfly has suffered a rapid contraction in range in recent decades, with extinction from more than 50% of 10-km squares since the 1970s (Fox et al. 2006). This is not just a UK problem, with a substantial range contraction detected across Mainland Europe (van Swaay and Warren 1999, Anthes et al. 2008). The latest results from Butterflies for the New Millennium surveys indicate that there are almost certainly fewer than 200 colonies left in the UK, and that the current number may be even lower than a hundred (Hoare 2008.).

In terms of population monitoring, 120 sites have contributed Duke of Burgundy indices to the UKBMS since 1976, with monitoring coverage throughout the species range (Figure 7). In 2007, 65 sites contributed scientifically validated indices to the Duke of Burgundy UKBMS Collated Index, compared to 5 in 1976 and a high of 80 in 2000. The Duke of Burgundy generally occurs in low numbers on butterfly transects, with an average count of 5-6 butterflies per site in the peak week across the 32-year series. Over the last 25 years, the average site index has varied from a high of 15 in 1990 and 2001 to a low of four in 2007. In 2007, 44 of the 65 indices were zeros, with the sum of validated site



indices totalling only 275! Whilst the timing of the flight season varies considerably from one year to the next, analysis of UKBMS weekly count data shows that the peak period for all years and sites combined is the middle/end of May.

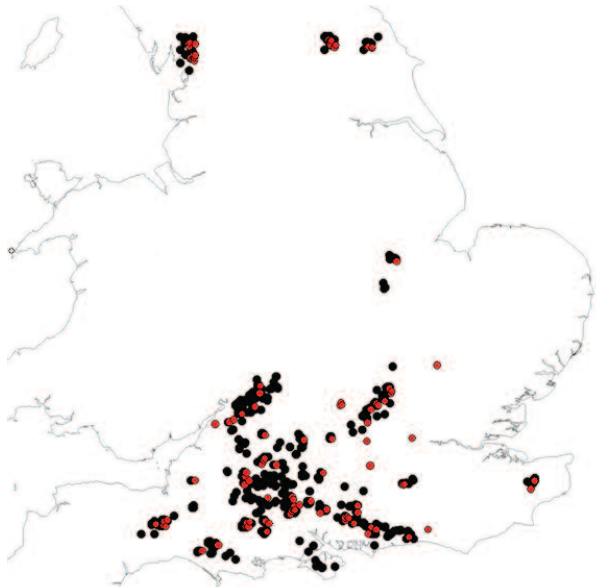


Figure 7. Distribution of the Duke of Burgundy 1995-2007 (black circles) and sites contributing scientifically validated indices to the UKBMS 1976-2007 (red circles).

Latest analysis of UKBMS data shows that the Duke of Burgundy has undergone a highly significant decline in abundance of 44% over the last 25 years. The butterfly has declined significantly in all regions (Table 9), possibly more so in central and northern areas, though the apparent differences in trends between regions are not statistically significant.

Table 9. Regional trends 1993 - 2007

Region	Change 1993-07	95% Confidence Limits	No. of years	Trend
South-east	-32%	±27%	15	Significant moderate decline
Midlands/North	-67%	±38%	15	Highly significant moderate decline
South-west	-58%	±25%	15	Highly significant moderate decline
UK (All England)	-36%	±23%	15	Highly significant moderate decline

Significance levels: *P < 0.05 (significant), **P < 0.01 (highly significant), ***P < 0.001 (very highly significant).

The declines have been more substantial in woodland compared to grasslands habitats. From 1985 to 2005, the butterfly declined significantly by more than 90% at woodland monitored sites, compared to a non-significant but suspected decline of ~25% on grassland sites. The more substantial decline on woodland sites concurs with the results from the BNM (Asher *et al.* 2001, Fox *et al.* 2006) and an earlier study by Warren (1993). There are now so few woodland sites in the UKBMS, that it is not currently possible to calculate a woodland index. Establishing new monitoring sites is a priority, though this is problematic as fewer than 20 woodland colonies remain (Asher *et al.* 2001).

In an analysis of abundance trends for the period 1990-2003 (Brereton *et al.* 2005), of 55 transect sites which monitored populations of the Duke of Burgundy for at least five years over the period, significant declines were detected at 15 of the sites, whilst declines were suspected at a further five. Seven of the 55 sites had a stable population trend, whilst a significant increase was detected at only one site though an increase was suspected to have occurred at one other. No colonisations were detected over the period. There were widespread extinctions in tandem with the abundance declines, with losses from 26 of the 55 sites. Our current assessment in 2007 suggests that the butterfly has become extinct at a further five sites accelerating the extinction rate since 1990 to 56%.



The Duke of Burgundy, pictured here in Bentley Wood, Wiltshire, has declined sharply in abundance over the last 25 years, whilst the extinction rate has been more than 50%. *Photo John Vallender*

Causes of decline

The long-term decline in the Duke of Burgundy in the UK has been attributed to three main factors (1) a corresponding decline in the traditional management of ancient woodlands by coppicing, (2) the conversion of downland to intensive agriculture and (3) excessive scrub invasion on grasslands through the abandonment of stock grazing (Bourn & Warren, 1998, Asher *et al.* 2001). Similar problems exist in Mainland Europe



(Ebert and Rennwald 1991). Habitat fragmentation may have also played a part in declines, with small, isolated colonies becoming extinct due to natural factors such as drought (Oates, 1985, Bourn & Warren 1998), whilst more recent factors include (1) climate change, leading to losses at range margins (Parmesan et al. 1999) and (2) inappropriate conservation management (Davies et al. 2006).

In terms of UKBMS monitored sites, a recent study (Brereton et al. 2005) assessed the likely causes of decline at 46 sites monitored over the period 1990-2003, through detailed investigation of site trends in relation to habitat and management data obtained from site managers. The results of the study suggested that the main cause of decline on grassland sites was overgrazing by rabbits and/or stock animals (68% of sites), whilst other factors were conversely a lack of management (18%) and/or habitat fragmentation (14%).

These results highlight the problems the Duke of Burgundy faces on high nature value calcareous grasslands, many of which have protected status (nature reserves or Sites of Special Scientific Interest - SSSIs) and/or are being specially managed for conservation, for example through agri-environment schemes. A particular concern in recent years for the Duke of Burgundy and indeed other butterflies requiring variable turf conditions/mosaic habitats has been the potential impacts of the drive to restore SSSI downlands to favourable condition as part of Common Standards Monitoring (CSM). Management to achieve favourable condition, when the conservation interest has been defined chiefly on botanical grounds, has typically involved creating uniformly short swards by increasing grazing pressure and extensive removal of scrub. To investigate this issue further an assessment was made of abundance levels and trends in the Duke of Burgundy (and other butterflies) over the period 1994-2003 at SSSIs assessed into different condition categories (Davies et al. 2006). Of concern, the butterfly was found to have significantly higher population levels at SSSIs classified in the 'unfavourable no change' condition category, than those classified as in one of the favourable condition categories.

The Duke of Burgundy has also declined to a greater degree on UKBMS monitored calcareous grassland sites entered into agri-environment schemes compared to UKBMS monitored grasslands in the wider countryside (Brereton et al. 2002). That the Duke of Burgundy is at risk from inappropriate conservation management, is further highlighted in an analysis by Oates (2008) who looked at the suspected causes of decline at 57 sites in Southern England since the 1980s. The most important factor implicated in the decline was conservation

grazing (37% of sites), followed by neglect (37%), overgrazing by rabbits (37%), drought (18%) and farm grazing (9%).

Detailed investigation has not been carried out of the causes of change on UKBMS woodland monitored sites, though neglect or inappropriate management activity and habitat fragmentation effects are thought to have been the main factors leading to declines or extinctions (Bourn & Warren, 1998, Asher et al. 2001).

Site management

The current status of the Duke of Burgundy is an urgent cause for conservation concern and the butterfly has been identified as a priority species for action in the new UKBAP list.

The Species Team at BC are currently compiling a dossier of all the remaining sites, to act as reference sources for future conservation. The Duke of Burgundy requires both sensitive site management and landscape-scale conservation to maintain and restore viable colony networks. Site conservation will only be successful if management prescriptions are implemented which create a continued supply of suitable habitat. To this end the Duke of Burgundy is not an easy species to manage for, because it requires a precise and often transient habitat structure that in many instances requires a carefully planned, 'successional' management approach tailored to individual site conditions.

Box 1. Examples of beneficial management regimes for the Duke of Burgundy 1990-2003

1. Annual scrub management, targeted in areas to benefit the butterfly. Small (<0.1hectare) scalloped patches removed from dense scrub edges and cut (and raked) on a 2-year rotation. Light rabbit grazing. Scrub cover >50%. (*Thurlbear Quarrylands, Somerset*).
2. Annual scrub clearance, targeted in areas to benefit the butterfly. Light rabbit grazing. Annual scrub cover >75%. (*Totternhoe Quarry, Bedfordshire*).
3. Annual scrub management and grazing targeted in areas to benefit the butterfly. Rotational winter sheep grazing (Beulah Speckled-Face or Soay), with hard grazing for a short period to remove seasons growth and litter (0.5LuHaYr). Annual, rotational (10-year) winter scrub cutting of 1.5-3m scrub. Annual cutting of <1m Bramble and other low scrub by flail mower (blade height 7-10cm) in the winter/early spring. Light rabbit grazing. Scrub cover >50%. (*Whipsnade Downs, Bedfordshire*).
4. Continuous spring to autumn cattle grazing (0.3-0.38LuHaYr) over an extensive area (ca190 hectares), with periodic grazing in other months by cattle and sheep (0.12-0.27 LuHaYr). Periodic scrub clearance and light rabbit grazing. (*Rodborough Common, Gloucestershire*).

Note: LuHaYr = Stocking densities defined as the number of livestock units per hectare per year



In an analysis of trends on UKBMS grassland monitored sites over the period 1990-2003, of the seven sites with favourable (stable or increasing) population trends two were unmanaged, four were maintained by successional scrub management, and two were managed by a combination of stock grazing and successional scrub management (Brereton et al. 2005). The annual index at one of the unmanaged sites, the Meon Valley was approximately three times that of any other UKBMS site, highlighting the value to this butterfly of recently abandoned chalk grassland suffering scrub invasion. Examples of highly successful management regimes are summarised in Box 1. In addition, light winter cattle grazing has benefited the butterfly on a steep south-facing slope at Sutton Coombe Valley, Dorset. Several reserve managers have commented on the value of winter pony grazing to control *Brachypodium sylvaticum* and encourage the spread of Cowslips.

At woodland sites, the outstanding example of successful management is at Gait Barrow NNR, Cumbria (Figure 8), which incidentally is also the only one of two sites (of 11) in north-west England where the butterfly is doing well. Gait Barrows has been monitored for butterflies since 1977 when the site was declared an NNR. The 'BMS transect' was established in 1977 to cover western woodland areas, whilst in 1982 a 'Warden's' transect was established to sample central woodland and limestone grassland habitats.



Figure 8. Typical glade habitat at Gait Barrows NNR. *Photo Rob Petley-Jones*

Since the early 1980s an extensive network of rotational coppice coupes, semi-permanent and permanent glades and inter-linking rides has been established to benefit the Duke of Burgundy and other specialist woodland butterflies (Figure 9). Monitoring data has demonstrated that this management, known locally as 'string of pearls' has been a great success. In the early 1980s the Duke of Burgundy was recorded in only a handful of areas in the eastern part of the site. By the early 2000s, the butterfly was widely distributed across the site and the population had increased significantly in western areas ($r=0.66$,

$n=30$, $p=0$) and maintained a stable population in central areas ($r=-0.17$, $n=26$, $p=0.41$). Habitats utilised by the butterfly at the site include small 'intimate' glades, the edges of coppice coupes and areas of early stage regrowth in coppice clearings. Of particular importance has been the creation of a network of sheltered *Primula*-rich permanent and semi-permanent glades 0.1-0.2 ha in size. The permanent glades are managed annually by rough mowing to prevent scrub encroachment and bramble infestation. Bracken infestation is a potential problem, but is checked by annual bruising. Semi-permanent glades are established in *Primula*-rich areas, and are maintained as open for up to three years, being regularly replaced by new semi-permanent glades on a short term coppice rotation.

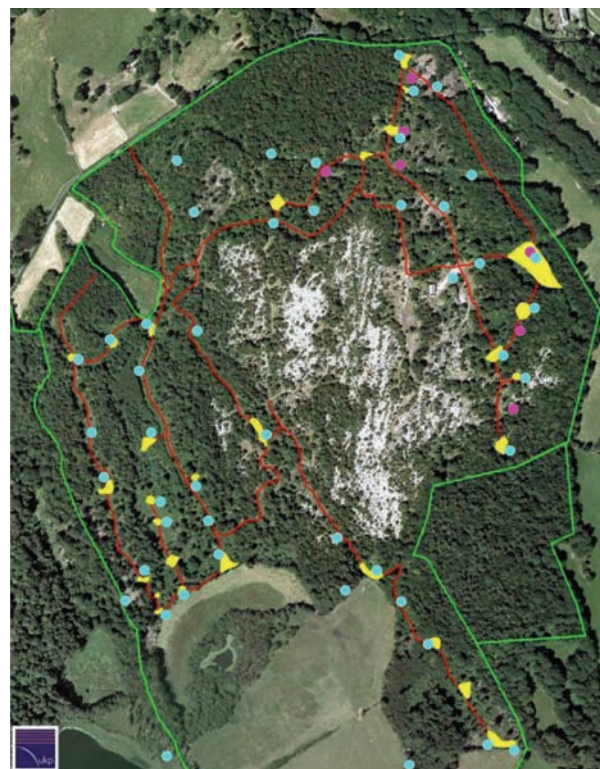


Figure 9. Expansion in distribution of the Duke of Burgundy at Gait Barrows NNR from the 1980s (pink circles) to the early 2000s (light blue circles) in response to positive conservation management (red lines - rides, yellow patches - managed glades. Note: coppice coupes are widespread, but not displayed). (Source: Rob Petley Jones).

Landscape-scale conservation

The widespread decline in the Duke of Burgundy has given new urgency to conservation efforts and prompted action on a range of fronts, from local status surveys by BC Branches, to individual site management, through to funded landscape-scale projects led by BC in three core areas.



In terms of landscape-scale conservation, one exciting initiative has been developed in the North York Moors National Park (NYMNP) since the early 2000s, under the auspices of the North York Moors Butterfly and Moth Action Group established by BC. In this region the butterfly is now restricted to just 13 small remaining populations in two networks on the edge of the National Park, with nine sites having lost the butterfly since 1994. The remaining sites chiefly occur on sheltered limestone grasslands located adjacent to woodland on steep slopes with thin ‘skeletal’ soils. Since 2003, through a combination of funding from the Hambleton and Howardian Hills Partnership Cultural and Natural Development Opportunity project (CAN DO) and partnership work with the NYMNP volunteers, management has been implemented on 16 of the 22 past and present sites to restore breeding habitat and improve habitat connectivity (Figure 10).

The main management prescription has been winter clearance of scrub and woodland vegetation, where it has encroached onto the edges of limestone grassland, with the specific aim of encouraging *Primula* regeneration in the bare areas created. This is a larger-scale approach to Duke of Burgundy management than at a number of other specially (micro) managed sites, where the emphasis is on the removal of individual bushes rather than whole blocks of scrub. Results so far, though mixed, are essentially highly encouraging. A number of likely extinctions have been prevented and the butterfly has increased in abundance at 6 of the 9 remaining colonies (Table 10). There is still much to be done and future plans over the next phase of the project include the restoration of rotational winter stock grazing and importantly coppicing of woodland areas, where most of the potential restorable habitat occurs.

Future prospects

Whilst old threats remain, new threats attributable to climate change emerge, including increased frequency of poor spring weather and summer drought and more grassy swards in both woodlands and grasslands. However, the butterfly monitoring case studies highlight how it is possible to maintain and restore healthy populations of this butterfly in both grassland and woodland habitats and new landscape-scale projects also give fresh hope. We need to act now with renewed vigour and purpose to ensure that this delightful butterfly is diverted from its current course towards extinction as a British species.

Table 10. The changing status of the Duke of Burgundy in response to management in the North York Moors National Park. (Site names withheld due to sensitivity.)

Site	Maximum Annual Index 5 years pre-management	Maximum Annual Index 5 years post-management
Site 1	16	44
Site 2	2	7
Site 3	0	8
Site 4	2	13
Site 5	13	24
Site 6	10	22
Site 7	7	2
Site 8	7	0
Site 9	2	0

Figure 10. Extensive scrub clearance at a North York Moors site before (left image) and after (right image) management. *Photo Sam Ellis*





Spotlight on a local co-ordinator – Chris Dawson

Experiences of the new Norfolk transect and wider countryside pilot co-ordinator – Chris Dawson, a personal perspective.



Chris Dawson - Norfolk Transect Co-ordinator. Photo Alan Dawson

My involvement in BC in Norfolk started only when I retired. Although I had a long standing interest in butterflies my enthusiasm was really kindled by going on a local outing to be taught by Mandy Gluth how to identify and monitor Silver-studded Blues on a translocation site. After joining the Norfolk

committee in 2006 I took on the vacant role of transect co-ordinator in February 2007. Events then rapidly overtook me when Norfolk was chosen as one of the four areas for the wider countryside pilot survey and co-ordinating this was added to my role.

The transect role had to be put on hold for a few months in favour of the wider countryside pilot. Volunteers had to be found to survey 30 randomly selected 1km squares across the county. Perhaps being new to Norfolk BC was an advantage because I did not know many of the existing recorders so had to start from scratch. My aim was to find participants who would not have to travel far to their square. Clearly, no one method would work and my general principle was that if you don't ask for help, no-one can say yes, and if they say no there is no harm done. I used several methods to find participants;

- talks at local meetings (7)
- an appeal in the Spring Newsletter (4)
- requesting volunteers at committee meetings (6 including me)
- a chance encounter by Mandy Gluth at a local nature reserve (1)
- contacting recorders from a 2005 casual recorders list (not up-to-date due to a change of County Recorder in 2006). (9 agreed, 18 declined)
- contacting members who live close to one of the squares (2).

Only one square was left and after contacting six people about it I gave up! So, 29 of the thirty squares had been 'filled'. Of the 29 participants not all were members and not all had done butterfly recording previously but

everyone was really keen. Because the instructions came in stages, I was in regular contact with the volunteers and this seemed to help to keep them on board. At the end of the pilot I organised a feedback workshop to allow the volunteers to meet Katie Cruickshanks and discuss the scheme. The recorders who came to the workshop hoped that the scheme would continue and I was delighted when we were asked to survey again in 2008 with a few changes to the instructions. Twenty of the original 29 participants have been involved in 2008. All the time I got excellent support from the Norfolk committee and, of course, Katie Cruickshanks from UKBMS.

I was amazed and impressed by the number of transects nationally listed on the UKBMS website. The dedication and work put in by transect walkers and co-ordinators is fantastic and I felt worried as to whether or not I could do the transect co-ordinator job. However, rather depressingly, Norfolk has less transects than any other County so it seemed that my role as transect co-ordinator would not be too onerous. The committee were aware of three transects but I discovered that no records had been received for these by UKBMS since 2003. Ian Middlebrook supplied information about a further four long-standing transects that had been organised by CEH, bringing the total to seven. The previous Norfolk co-ordinator had left the country so my first job was to try to find the lost data. Records were found for two of the three in the impressively well-ordered boxes of casual records held by the County Recorder. These two were 'reactivated', one with a new recorder, so the four went up to six by the end of 2007. The 'found' data provided me with excellent opportunity to become familiar with the Transect Walker programme. The missing data for the third site did not turn up and since UKBMS had never been sent a map I was unable to restart it, which was a pity because I would have been happy to take it over. This experience of data going missing made me very aware of the importance of data storage and management.

Clearly new sites were needed, so I made a list of suitable local Nature Reserves and contacted wardens. One established transect that had last been walked in 1999 was restarted and three new transects were established for 2008, all three being done by recorders from the wider countryside pilot survey. My GPS came in handy for helping to map the routes for two of these. So, the total in 2008 looked like ten, not many but more than when I started. Then, at a local wildlife event in September 2008 I met enthusiasts who had set up butterfly transects from information on the UKBMS website. So far we have gone from four to probably twelve transects since early 2007 and I hope to add steadily to Norfolk's total.



Contact details for local co-ordinators

RECORDING AREAS	NAME & ADDRESS OF MONITORING OFFICER	TELEPHONE	EMAIL
UK	Ian Middlebrook Butterfly Conservation, Manor Yard, East Lulworth, Wareham, Dorset, BH20 5QP	01929 400209	transect@butterfly-conservation.org
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NORTHERN ENGLAND	Dave Wainwright Butterfly Conservation, Low Barns Visitor Centre, Witton-le-Wear, Bishop Auckland, DL14 0AG	01388 488428	dwainwright@butterfly-conservation.org
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	Marjorie Brunt Kea House, Chapel Lane, Butleigh, Glastonbury, Somerset BA6 8TB	01458 850919	
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Denbigh, Flintshire & Wrexham	TBA		
Glamorgan	TBA		
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Monmouthshire	TBA		
Montgomeryshire	TBA		
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Although this funding support is essential for the existence and running of the UKBMS, without the contribution of an army of volunteers, it simply could not operate. As a consequence we are extremely indebted to all who co-ordinate and record butterfly transects throughout the United Kingdom, as well as to those who allow access to their land and in some cases actively promote butterfly monitoring thereon.

The success of the UKBMS depends on this level of volunteer support if it is to provide the knowledge base from butterfly monitoring to help preserve our nations butterflies and provide these data for ecological research, which itself feeds back into conservation by providing us with a better understanding of butterfly ecology. We will continue to try and give you the support and feedback you need and deserve.

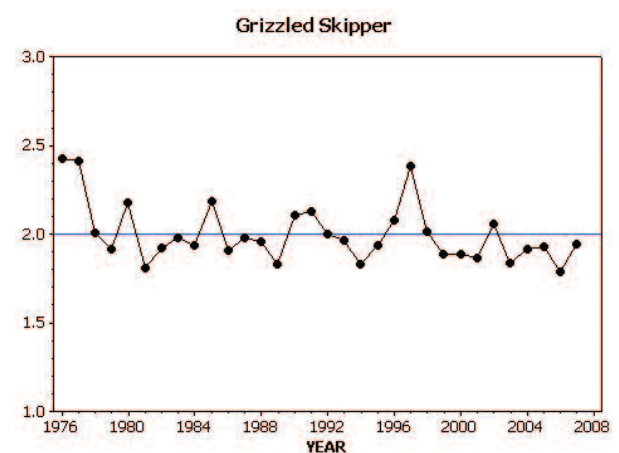
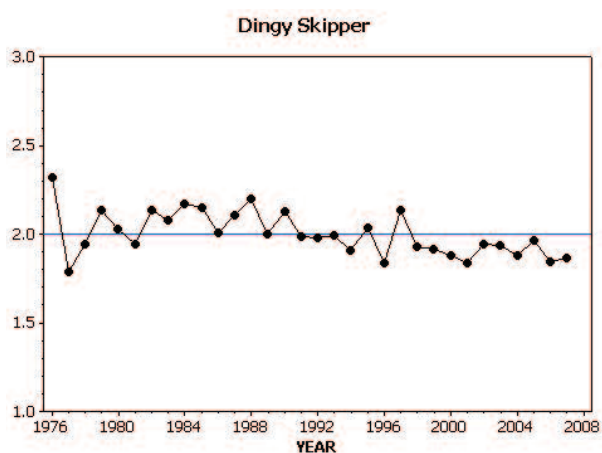
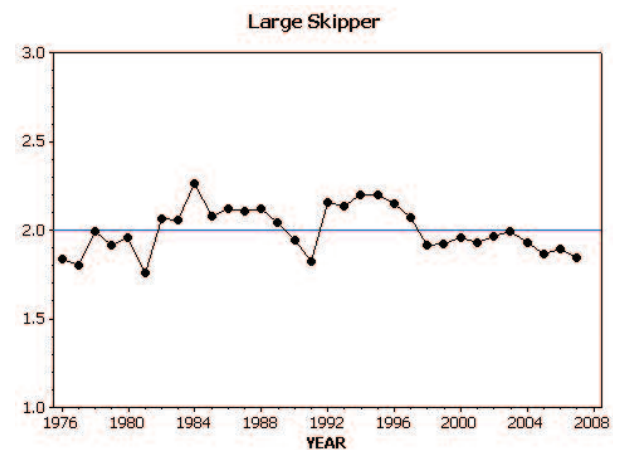
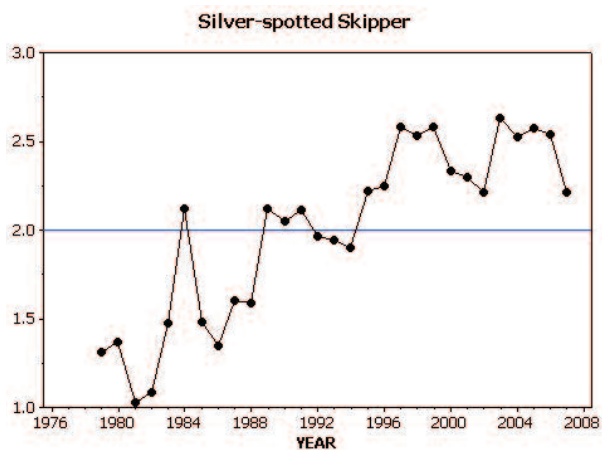
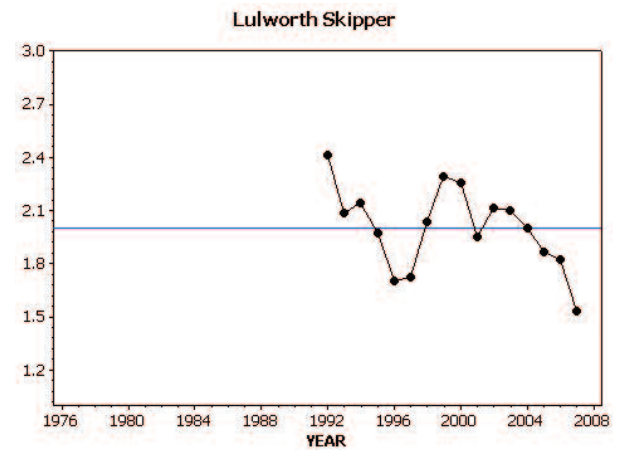
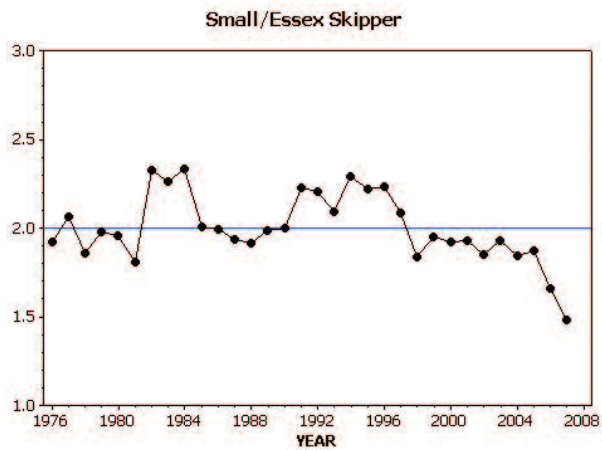
We would like to thank the photographers for allowing their superb images to be used in this report.

Finally we would like to thank Heather Lowther (CEH) and the Joint Reprographic Services (JRS) Unit - part of the support services to the UK Research Councils - for designing and printing the report.



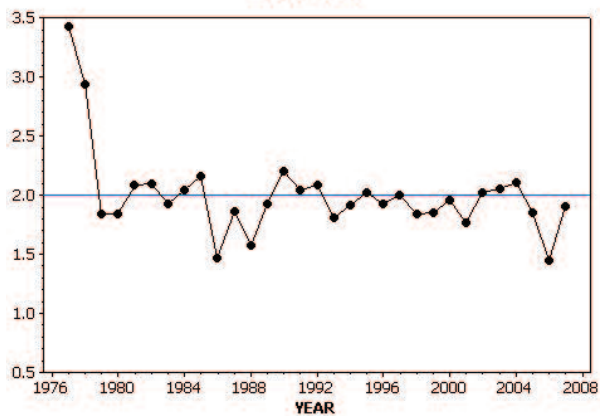
Appendix I

Appendix I: Figures showing the Collated Index (Log10) by year for each species for which an index was calculable in 2007. The horizontal blue line shows the average index score. The scale on the y-axis varies with species to highlight annual trends for each individual species. Thus, care must be taken when comparing the magnitude of annual differences in the CI for different species.

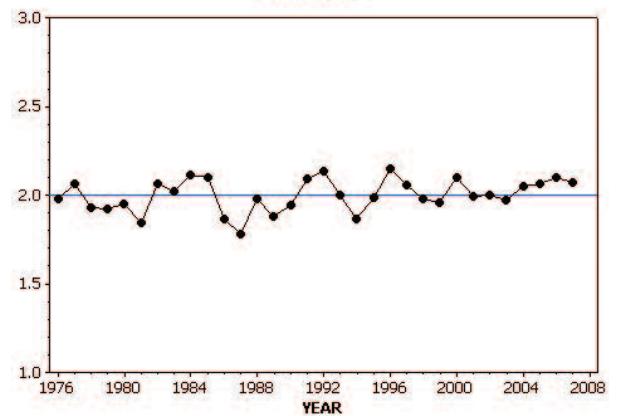




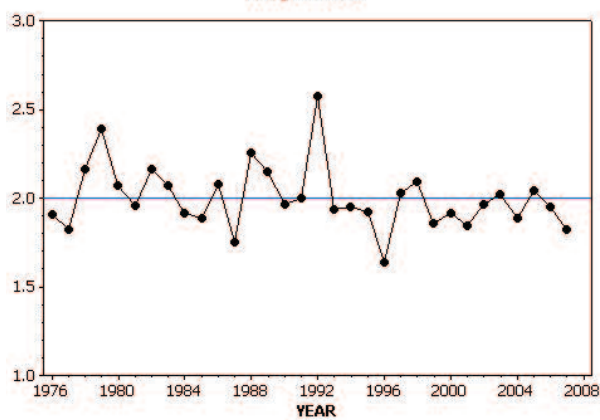
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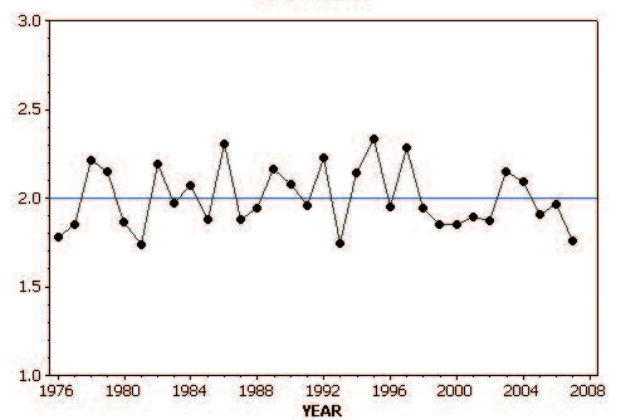
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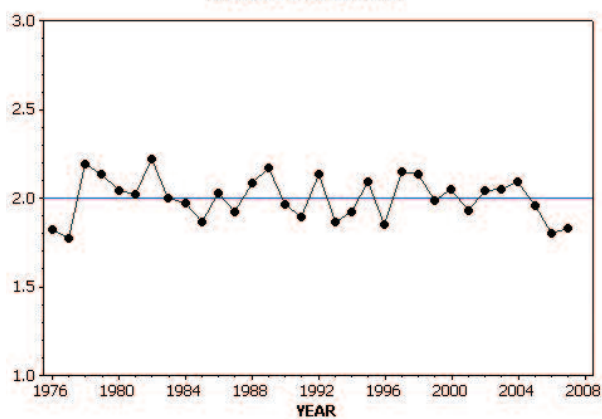
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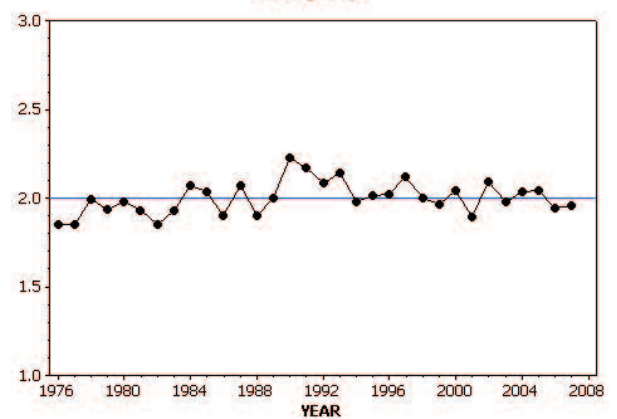
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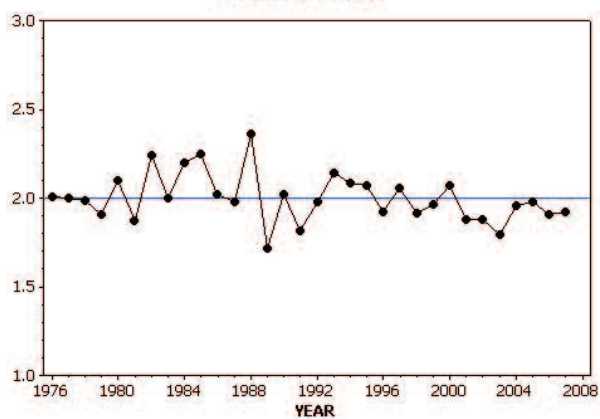
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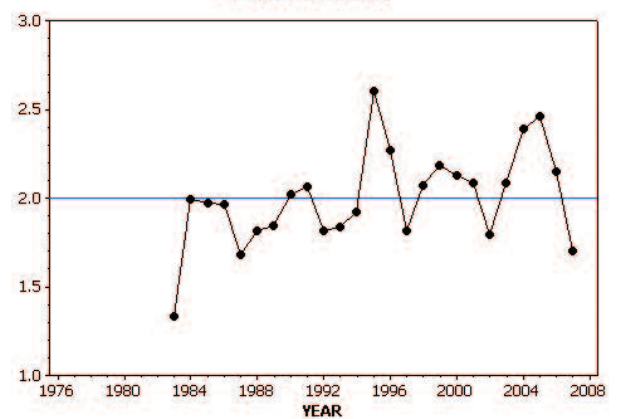
Orange Tip



Green Hairstreak

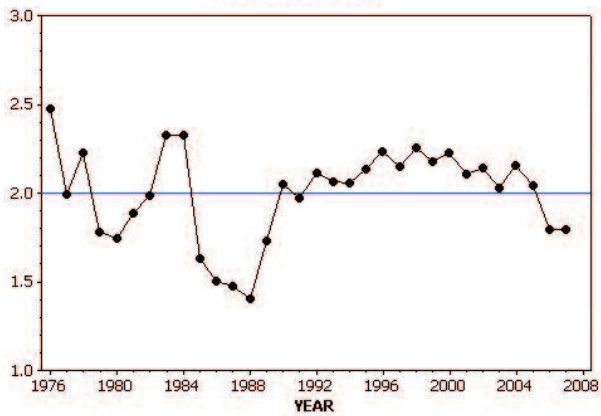


Brown Hairstreak

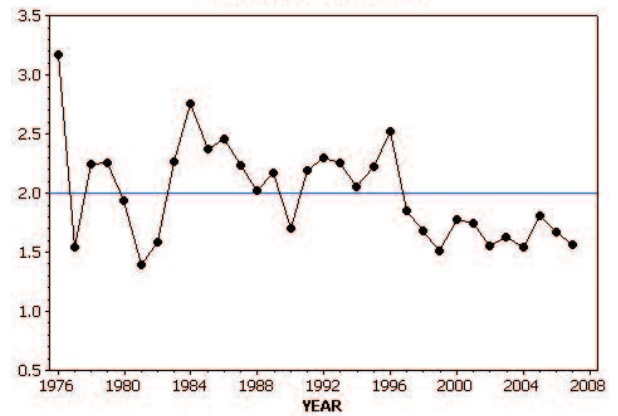




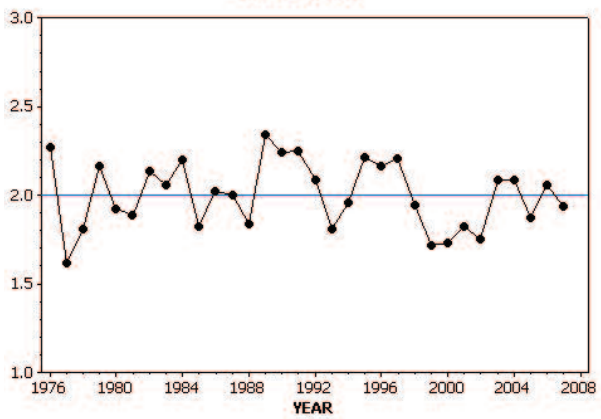
Purple Hairstreak



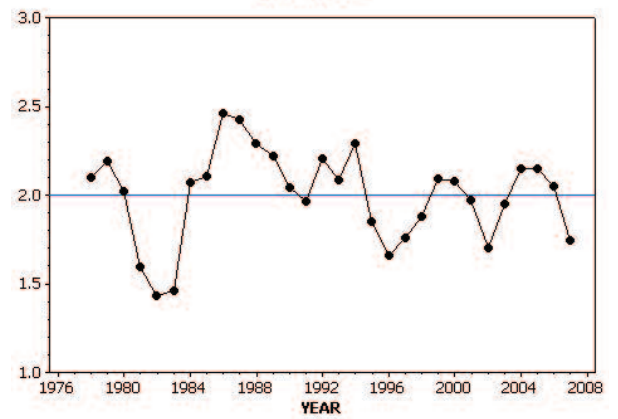
White-letter Hairstreak



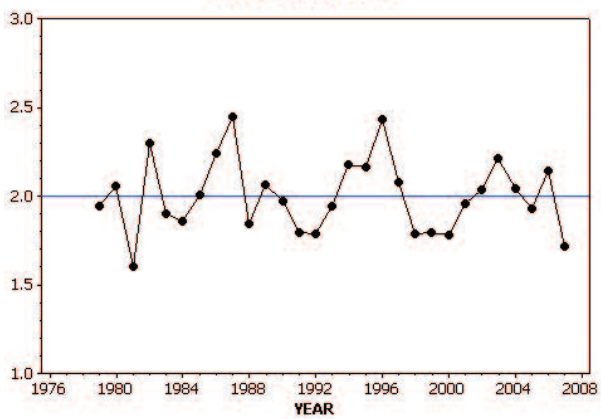
Small Copper



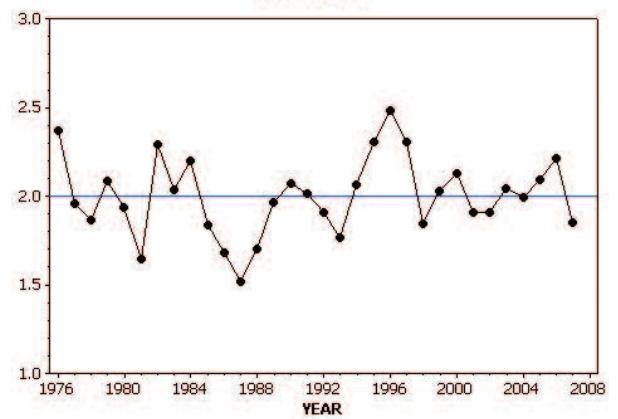
Small Blue



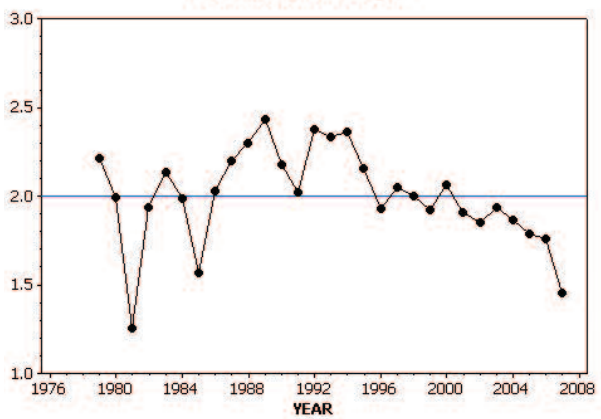
Silver-studded Blue



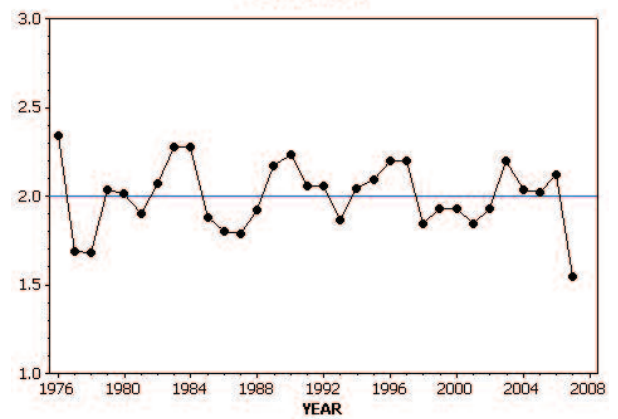
Brown Argus



Northern Brown Argus

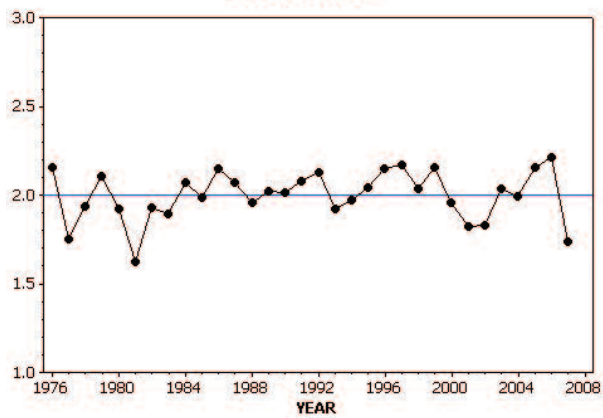


Common Blue

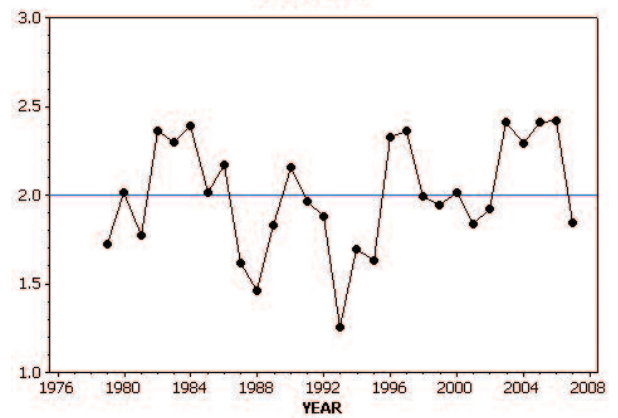




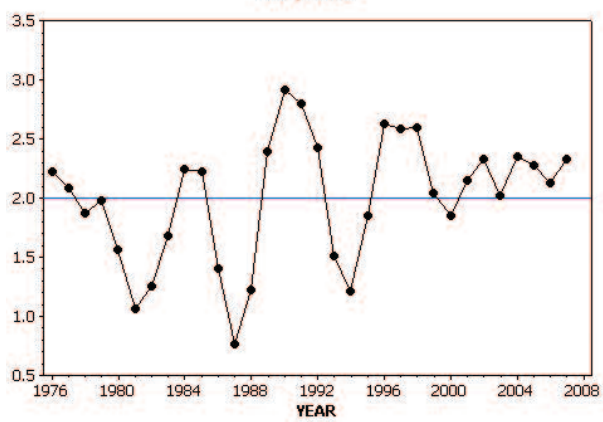
Chalk-hill Blue



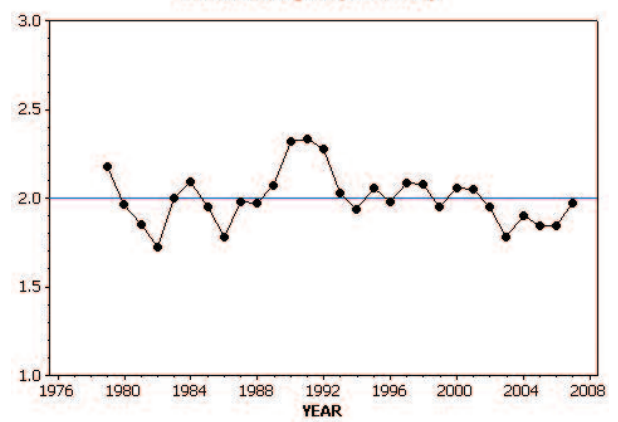
Adonis Blue



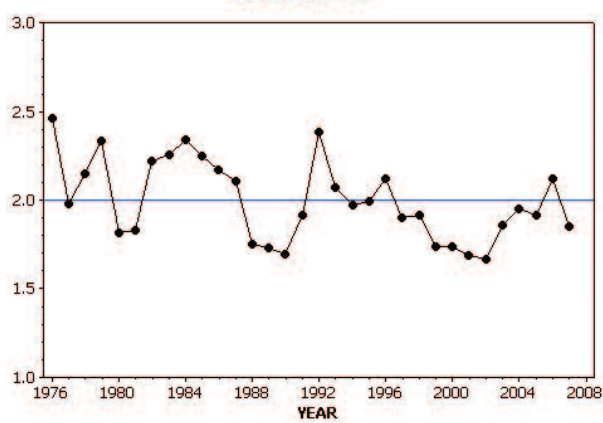
Holly Blue



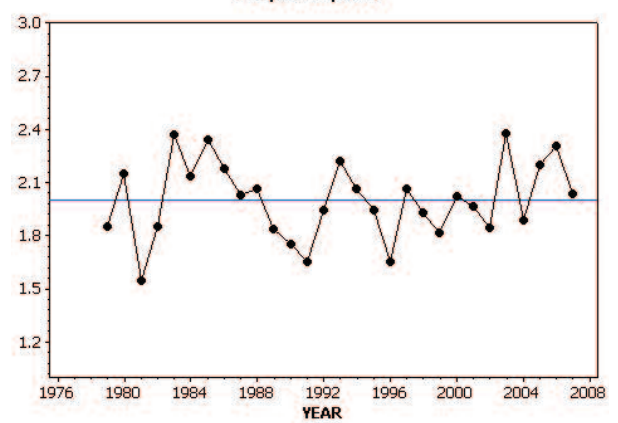
Duke of Burgundy Fritillary



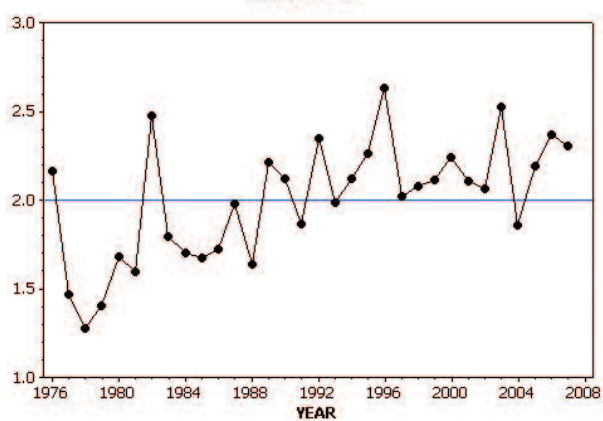
White Admiral



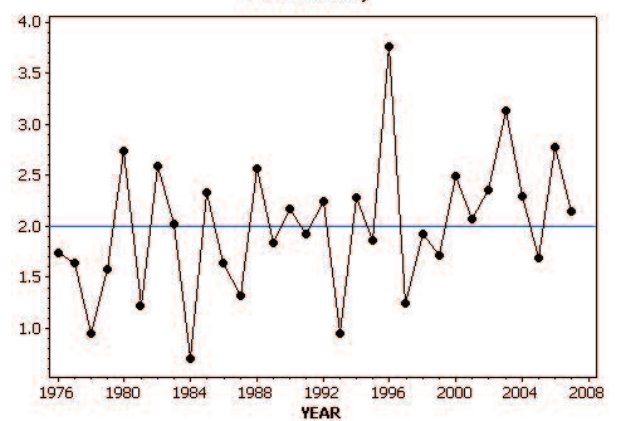
Purple Emperor



Red Admiral

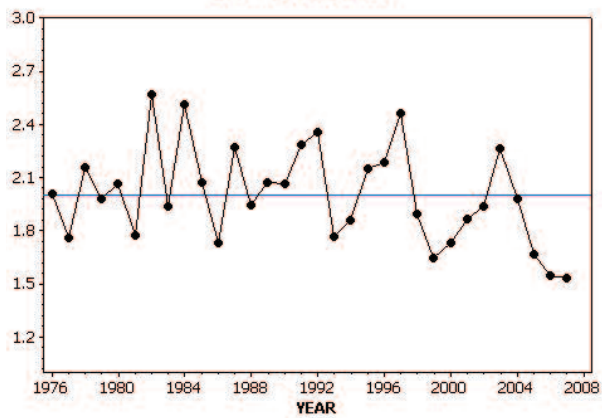


Painted Lady

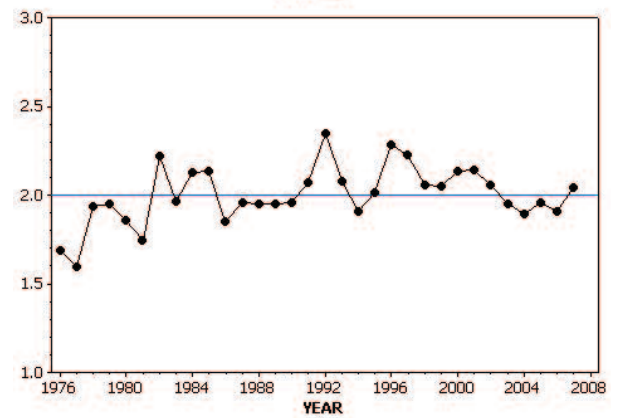




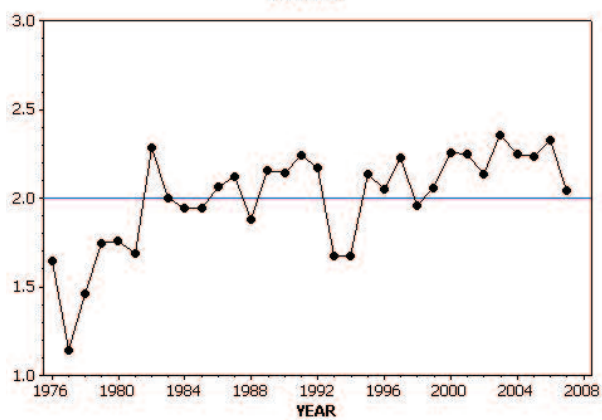
Small Tortoiseshell



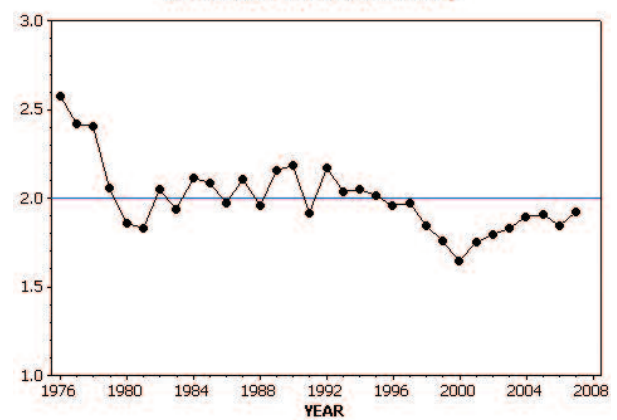
Peacock



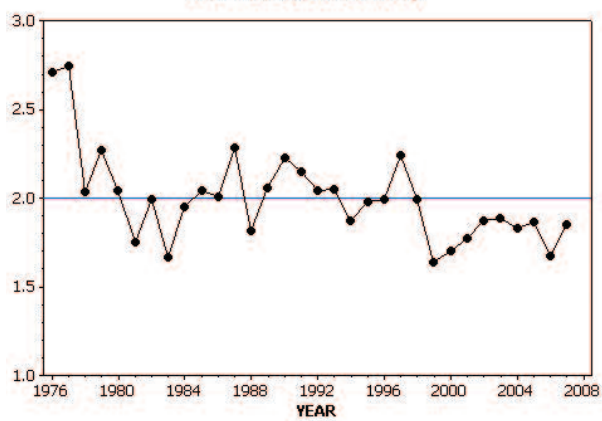
Comma



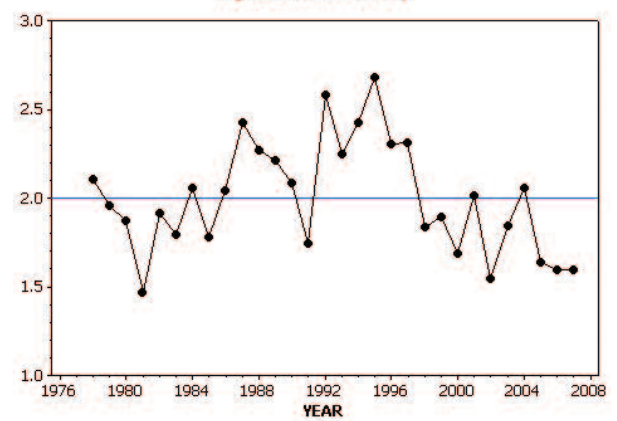
Small Pearl-bordered Fritillary



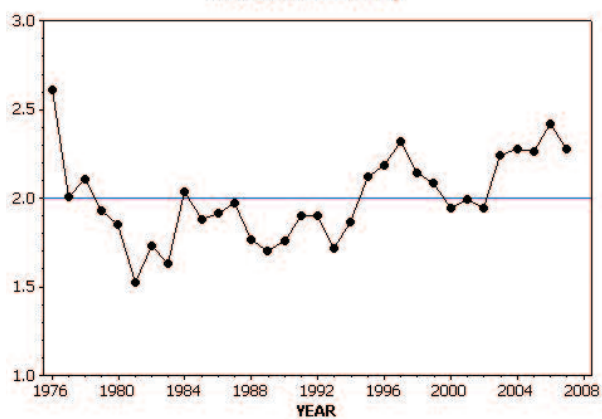
Pearl-bordered Fritillary



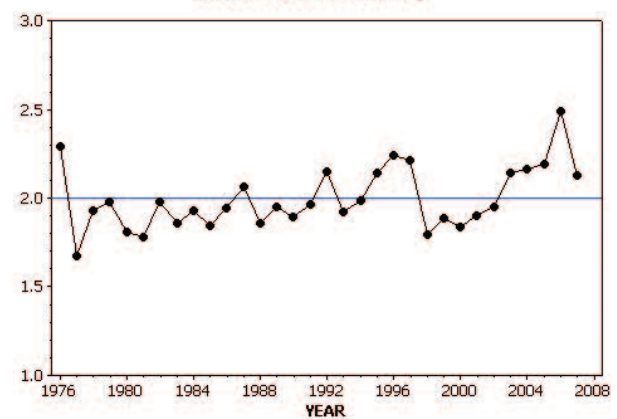
High Brown Fritillary



Dark Green Fritillary

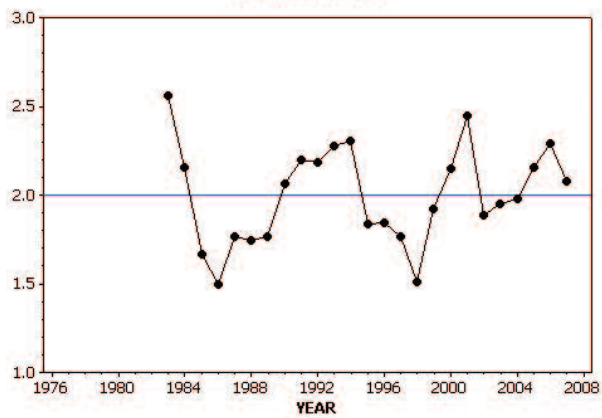


Silver-washed Fritillary

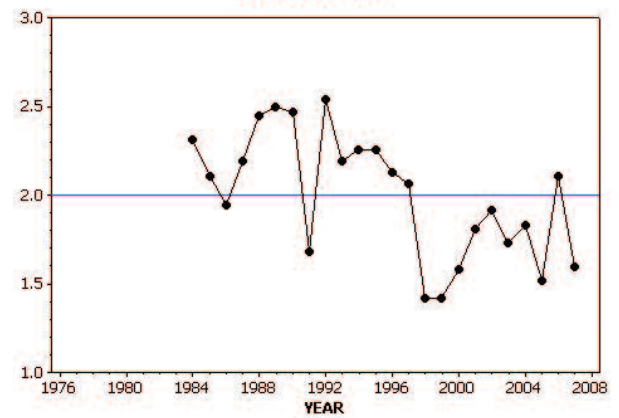




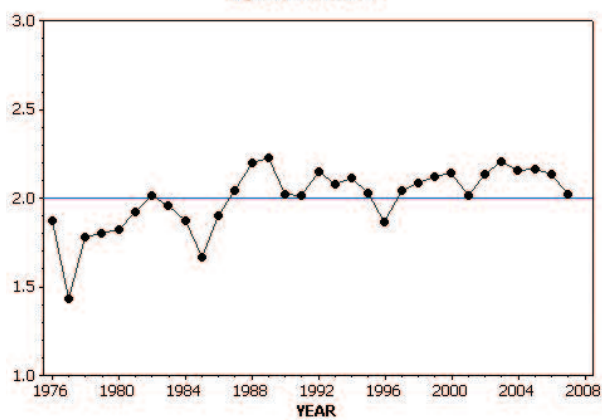
Marsh Fritillary



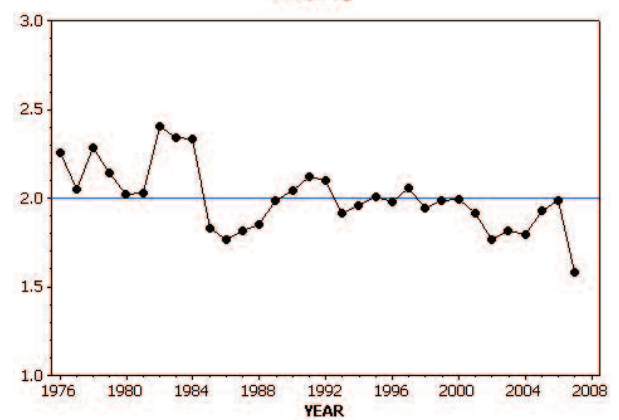
Heath Fritillary



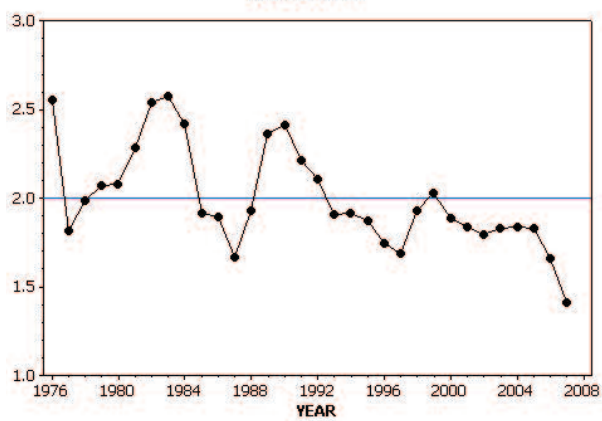
Speckled Wood



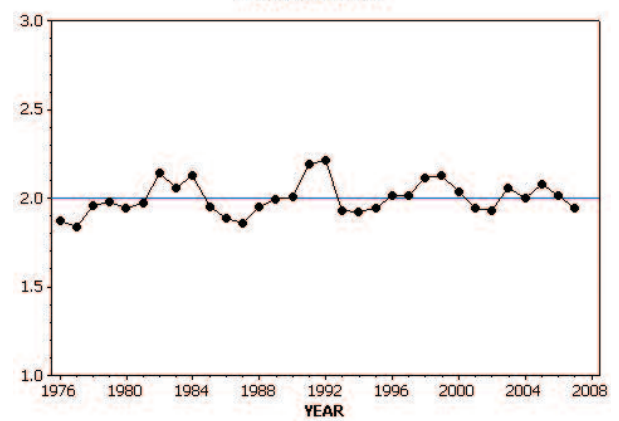
Grayling



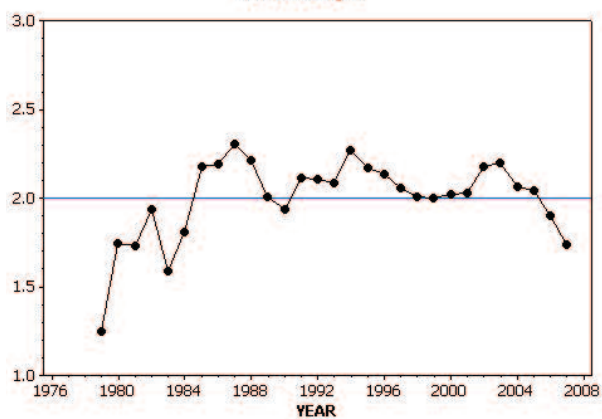
Wall Brown



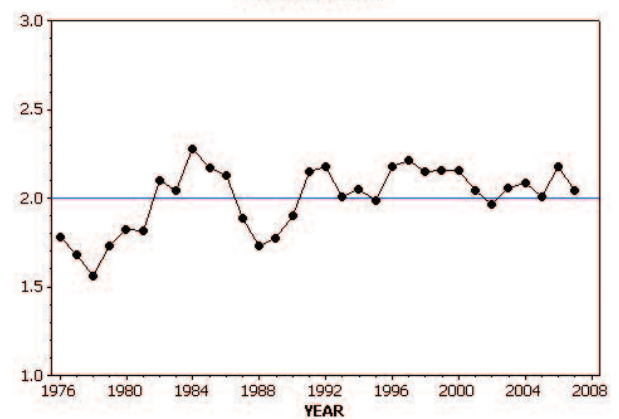
Meadow Brown

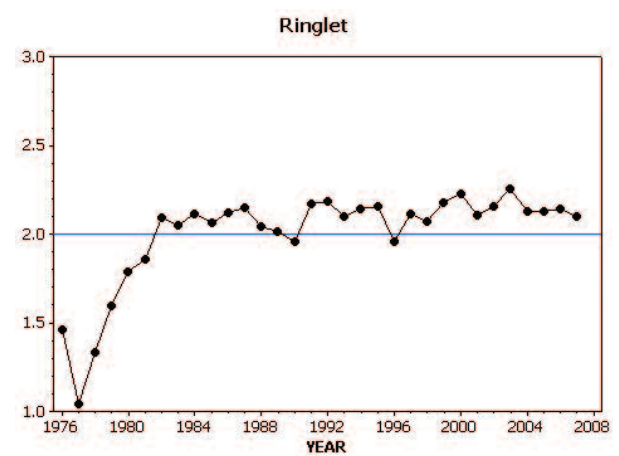
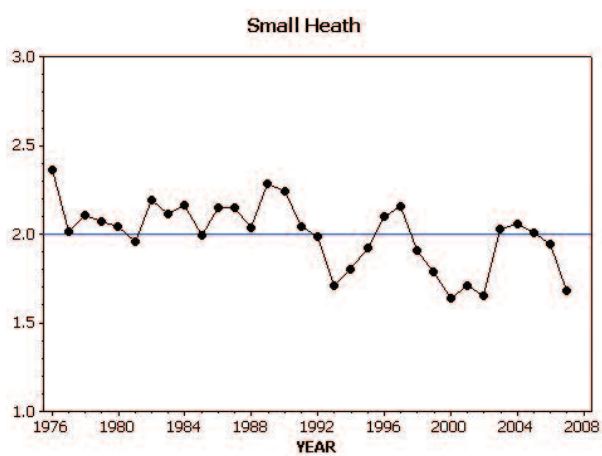
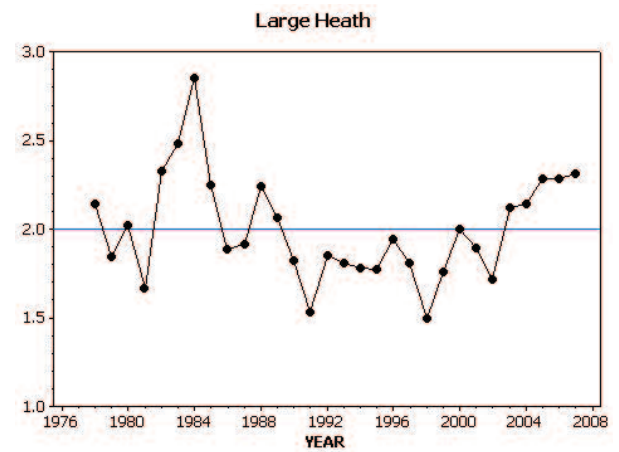
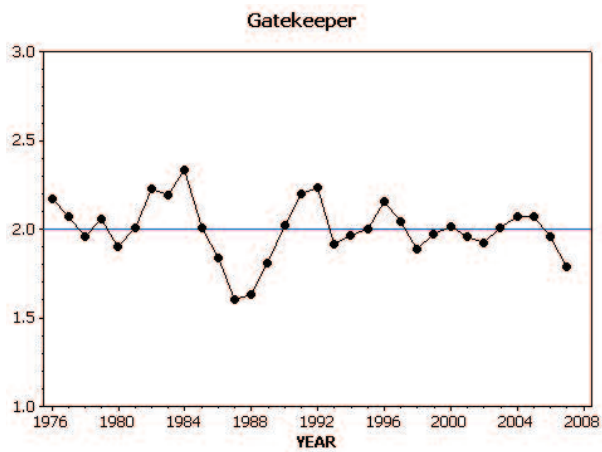


Scotch Argus



Marbled White





Chalkhill Blue, Devil's Dyke, Cambridgeshire. Like most blues, the Chalkhill Blue had a very poor year in 2007 producing its second lowest Collated Index of the series. *Photo Marc Botham*



Appendix II

Appendix II - Vernacular & scientific names of species referred to in this report

Butterflies

(order and nomenclature follows Fox et al. 2006).

Chequered Skipper	<i>Carterocephalus palaemon</i>	Red Admiral	<i>Vanessa atalanta</i>
Small Skipper	<i>Thymelicus sylvestris</i>	Painted Lady	<i>Vanessa cardui</i>
Essex Skipper	<i>Thymelicus lineola</i>	Small Tortoiseshell	<i>Aglais urticae</i>
Lulworth Skipper	<i>Thymelicus acteon</i>	Peacock	<i>Inachis io</i>
Silver-spotted Skipper	<i>Hesperia comma</i>	Comma	<i>Polygonia c-album</i>
Large Skipper	<i>Ochlodes sylvanus</i>	Small Pearl-bordered Frit.	<i>Boloria selene</i>
Dingy Skipper	<i>Erynnis tages</i>	Pearl-bordered Fritillary	<i>Boloria euphrosyne</i>
Grizzled Skipper	<i>Pyrgus malvae</i>	High Brown Fritillary	<i>Argynnis adippe</i>
Wood White	<i>Leptidea sinapis</i>	Dark Green Fritillary	<i>Argynnis aglaja</i>
Clouded Yellow	<i>Coleus croceus</i>	Silver-washed Fritillary	<i>Argynnis paphia</i>
Brimstone	<i>Gonepteryx rhamni</i>	Marsh Fritillary	<i>Euphydryas aurinia</i>
Large White	<i>Pieris brassicae</i>	Heath Fritillary	<i>Melitaea athalia</i>
Small White	<i>Pieris rapae</i>	Speckled Wood	<i>Parage aegeria</i>
Green-veined White	<i>Pieris napi</i>	Wall Brown	<i>Lasiommata megera</i>
Orange-tip	<i>Anthocharis cardamines</i>	Mountain Ringlet	<i>Erebia epiphron</i>
Green Hairstreak	<i>Callophrys rubi</i>	Scotch Argus	<i>Erebia aethiops</i>
Brown Hairstreak	<i>Thecla betulae</i>	Marbled White	<i>Melanargia galathea</i>
Purple Hairstreak	<i>Neozephyrus quercus</i>	Grayling	<i>Hipparchia semele</i>
White-letter Hairstreak	<i>Satyrion w-album</i>	Gatekeeper	<i>Pyronia tithonus</i>
Small Copper	<i>Lycaena phlaeas</i>	Meadow Brown	<i>Maniola jurtina</i>
Large Copper	<i>Lycaena dispar</i>	Ringlet	<i>Aphantopus hyperantus</i>
Small Blue	<i>Cupido minimus</i>	Small Heath	<i>Coenonympha pamphilus</i>
Silver-studded Blue	<i>Plebeius argus</i>	Large Heath	<i>Coenonympha tullia</i>
Brown Argus	<i>Plebeius agestis</i>		
Northern Brown Argus	<i>Plebeius artaxerxes</i>		
Common Blue	<i>Polyommatus icarus</i>		
Chalkhill Blue	<i>Polyommatus coridon</i>		
Adonis Blue	<i>Polyommatus bellargus</i>		
Holly Blue	<i>Celastrina argiolus</i>		
Long-tailed Blue	<i>Lampides boeticus</i>		
Large Blue	<i>Glaucopsyche arion</i>		
Duke of Burgundy	<i>Hamearis lucina</i>		
Purple Emperor	<i>Apatrua iris</i>		

Plants

(order and nomenclature follows Fox et al. 2006).

Bracken	<i>Pteridium aquilinum</i>
Cowslip	<i>Primula veris</i>
False Brome	<i>Brachypodium sylvaticum</i>
Primrose	<i>Primula vulgaris</i>

