

# **BUTTERFLY MONITORING SCHEME**

**Report to recorders 1999**

INSTITUTE OF TERRESTRIAL ECOLOGY

(NATURAL ENVIRONMENT RESEARCH COUNCIL)

# **The Butterfly Monitoring Scheme**

## **Report to Recorders**

**1999**

J NICK GREATOREX-DAVIES & DAVID B ROY

ITE Monks Wood  
Abbots Ripton  
Huntingdon  
Cambs PE17 2LS

March 2000

## CONTENTS

	Page
Introduction	1
Summary of the 1999 season	3
Percentage of counts completed	7
The proportion of annual indices calculated	8
Annual indices for the scarcer species	9
The number of weeks recorded for each site	10
Map showing the BMS regions and the distribution of monitored sites	11
The number of sites contributing data to the BMS	12
Comparison of the 24 years of the BMS	13
Numbers of butterflies recorded	14
Summary of changes at site level 1998-99	16
Individual species accounts	18
Publications in 1999/2000	29
Publications due in 2000	29
References	29
Acknowledgements	29
Appendix I: Graphs showing fluctuations in all-sites indices for 34 species	31

## LIST OF FIGURES

Figure		Page
1	The number of sites with completed transects in each recording week in 1998	7
2	The number of sites with completed transects in each recording week in 1999	7
3	The number of annual indices calculated for the scarcer species compared with the number of sites where the species was actually recorded in 1998	9
4	The number of weeks recorded for each transect in 1998	10
5	The number of weeks recorded for each transect in 1999	10
6	The number of sites contributing data to the scheme.	12
7	Comparison of the years 1979-1999 for butterflies	13
8 a-d	Log collated indices 1976-99	30-35
Not numbered	Selected species / site histograms	18-25

## LIST OF TABLES

Table		Page
1	Summary of UK weather in 1998/99	3
2	Summary of changes 1998/99	6
3	Percentage of counts completed 1988-99	7
4	The proportion of annual indices that could be calculated for 115 transects in 1997, 119 transects in 1998 and 120 transects in 1999	8
5	Sum of site indices and order of abundance for 1998 and 1999	14
6	Summary of changes at site level 1998/99	16

## MAP

Map		Page
1	Butterfly Monitoring Scheme and Environmental Change Network sites in 1999	11

## **INTRODUCTION**

The 1999 season began rather slowly for butterflies. This was probably largely due to the wetter than normal weather during the first half of the year, May was cloudier than usual and June was cool and wet for the third year in succession. However numbers of butterflies seen improved markedly from the latter part of June onwards as the weather improved, particularly during July.

It was an average year for butterflies in general and in some respects similar to 1998. There were almost equal numbers of increases and decreases in all-sites collated indices. Some species changed little from the previous year and only the Holly Blue showed a big change indicating a massive decline in numbers.

### **Sites from which the BMS receives data**

1999 completed the 24th year of the Butterfly Monitoring Scheme (BMS). At least some data were received from 109 (of 114) BMS and 11 Environmental Change Network (ECN) transects.\* However only 99 transects provided sufficient data to produce at least some index values. Twenty-nine sites produced sufficient data for all the site annual indices to be calculated and a further 23 sites sufficient for all but one or two indices.

*During the rest of this report BMS and ECN transects will simply be referred to as BMS transects as all potentially contribute to the scheme in providing data for the calculation of the all-sites collated indices.*

### **Sites lost and gained from the BMS in 1998**

No transects were lost to the scheme in 1999, however three transects failed to produce any data at all and data from a further two sites are still to be received! However it is expected that data will continue to be gathered in future years at all these sites

Three new transects came into the scheme in 1999. These were Gere Sands, a coastal Silver-studded Blue site in Cornwall; Carty Port, a neutral grassland and ex horticultural nursery site near Newton Stewart in Dumfries and Galloway; and Blackford Hill, a City Council Local Nature Reserve on the outskirts of Edinburgh.

### **Electronic recording form**

We are constantly looking for ways of improving the BMS, including improving the efficiency and speed with which we handle incoming data each year without compromising its quality. In time we hope to be able take in data from a larger number of sites.

For the first time this year, we are offering recorders the facility to record their transect records digitally. Some recorders already put their data on computer and we wish to encourage more to do so. The digital form is based on the field recording form that recorders already use. It also has various additional features that enable the recorder to summarise their data and produce summary

---

\* the Environmental Change Network (ECN) was set up in 1993 with funding from the Department of the Environment, Transport and the Regions in conjunction with a number of research organizations (including the Institute of Terrestrial Ecology) to monitor changes in the environment, particularly in relation to climate change. Butterfly monitoring is just one part of this program. ECN transects are not managed as part of the BMS, but data from some of the ECN sites are now used together with the BMS data to calculate the annual all-sites collated indexes. Two of the BMS transects are also ECN transects, making a total of 13 ECN transects, these were part of the BMS before joining the ECN.

graphs. Recorders can then send their data to us digitally by e-mail at the end of the recording season so that it can be downloaded directly into the BMS ORACLE database, thus saving us valuable time on data input. We ask that recorders continue to use the paper field recording form while walking their transect (rather than a notebook or dictaphone) as data are likely to be recorded more accurately and errors are more likely to be avoided in the transcription of data to the electronic form.

### **Developing the analysis and interpretation of BMS data**

Estimates for missing weeks have continued to be calculated using the semi-automated method developed by David Roy in 1998. However a substantial amount of time is still required to check the data subsequently by hand and some subjective decisions are still necessary. Consequently David Roy, in collaboration with Peter Rothery (one of our resident statisticians) is working on an improved method for estimating values for missing weeks. It is hoped that this will become more widely available and used by others monitoring butterflies so that that results can be compared in a consistent manner using a standard technique.

### **BMS web-site**

The BMS has a web site on the internet that is now up and running. It can be accessed at the following url: <http://bms.ceh.ac.uk/>. Most pages are complete but the site is still under construction. All pages should be complete by Easter this year. It will also soon be possible to access summary BMS data via the site, for example all-sites collated indices. The web-site includes information on the background, history and aims of the scheme, sites in the scheme, availability of data, some examples of the type of use to which the BMS data has been put, and a full bibliography of publications relating to the BMS or which make use of BMS data. There is also a "news" page, which will contain monthly updates, at least during the recording season, of news and information on butterflies and the BMS as the season progresses.

### **Change of name**

As from April 1<sup>st</sup> 2000, the Institute of Terrestrial Ecology ceases to exist. It has been subsumed into a larger organisation called the Centre for Ecology and Hydrology (CEH), which comprises the old ITE, the Institute of Freshwater Ecology, the Institute of Hydrology and the Institute of Virology and Environmental Microbiology. CEH remains part of the larger organisation the Natural Environment Research Council along with other "institutes" such as the British Antarctic Survey and the British Geological Survey to mention a couple. This change is unlikely to affect the BMS.

### **Habitat classification for recording habitat at section level**

The habitat classification for recording transect section habitat information is now ready. It is based on EUNIS (the European Nature Information System) which was largely developed by ITE. It has been adapted jointly by Butterfly Conservation and ourselves to suit our various requirements. Through its use information will be provided that will significantly enhance the usefulness of BMS data in enabling us to analyse butterfly data at the habitat level. This year we are asking recorders / site managers to record details of section habitat using this classification.

## SUMMARY OF THE 1999 SEASON

### Important features of the weather in 1999 and apparent effects on butterflies

The year began with a series of wet and mild months. January and April were particularly wet. As in 1998, and associated with the milder than normal weather, there were more reports than usual of hibernating species of butterfly seen on the wing or basking in weak sunshine in the early months of the year <sup>1</sup>, well before the start of the transect recording season. However non-hibernating spring species did not begin to emerge as early as in 1998, and it was not until April that these butterflies began to emerge in any numbers.

May was generally mild but cloudier than usual and numbers of butterflies seen were reduced. Numbers of butterflies recorded were even more depressed by the beginning of June and it was reported to be the worst late spring in living memory for butterflies in general <sup>2</sup>. June was overall rather cool, especially in the north and west, and wet for the third year running, but not as wet as 1997 and 1998. However temperatures improved during the latter part of the month and numbers of butterflies also began to improve.

There was a considerable improvement in the weather in July, except in northern Scotland. The month was generally warm, dry and sunny, with the south of England having less than half of its average rainfall. The improved conditions had a significant effect on the numbers of butterflies

**Table 1.** Shows a summary of UK weather in 1998/99 and is taken from a weather summary provided by Dr M. Hulme of the University of East Anglia on the internet at web site: <http://www.cru.uea.ac.uk/~mikeh>. The information is also published in *The Guardian* newspaper. The summary is for the UK as a whole and so will not necessarily describe weather in particular regions precisely. [Anomalies are with respect to the 1951-80 average]

1998	Daytime Temp (°C)	Rainfall (%)	Sunshine (%)	Brief description
September	+0.6	+7	-3	Mild, wet in the south
October	-0.8	+68	+8	Very wet and rather cool
November	-0.5	+2	+37	Very sunny and rather cool
December	+0.3	0	+4	An average month
<b>1999</b>				
January	+1.1	+52	+15	Very wet and quite mild
February	+0.7	+10	+42	Very sunny and rather mild
March	+1.5	+16	+14	Mild, wet and sunny
April	+0.9	+49	+1	Mild and very wet
May	+1.2	0	-5	Mild and quite cloudy, wet in Scotland
June	-0.6	+37	-4	Rather wet, cool in the north
July	+1.3	-36	+14	Warm, dry and sunny, except in northern Scotland
August	+0.4	+30	+6	Dry and sunny in Scotland, wet and cloudy in England and Wales
September	+1.7	+38	+9	Wet and very warm

<sup>1</sup> see Bowles, N (April 1999) Wildlife Reports: Butterflies, *British Wildlife*, **10**, (4) 275-277

<sup>2</sup> see Bowles, N (August 1999) Wildlife Reports: Butterflies, *British Wildlife*, **10**, (6) 428-430

seen. August was dry and sunny in Scotland but wet and cloudy in England and Wales. Apart from June, temperatures were generally above average and the months of July to September a little sunnier than average. Overall 1999 was the warmest year in the UK since records began some 340 years ago.

### **An average year for butterflies – similar number of declines and increases with little change for some species.**

For butterflies 1999 was an average year (see *new* comparison of years for butterflies figure: Figure 7, page 13) and one of mixed fortunes (Details are summarised in Tables 2 and 6). Of the 33 species for which all-sites collated indices have been produced, there were 16 increases and 17 decreases (considering second generation / summer indices only, of double-brooded / two flight period species). The magnitude of the declines was generally greater than the increases, but changes were generally less pronounced than from 1997 to 1998. Eight species showed little change from 1998 (<10%), these were **Large Skipper**, **Dingy Skipper**, **Green-veined White** (which had a very poor first generation), **Orange Tip**, **White Admiral**, **Red Admiral**, **Peacock** and **Marbled White**.

### **Holly Blue crashes in summer generation**

The biggest change of the season was for the **Holly Blue**. After three seasons when numbers have been high, it was expected that numbers would drop considerably in 1999 in line with the strong cyclic fluctuations in numbers that are characteristic of this butterfly, thought to be largely due to the influence of its host-specific ichneumonid wasp parasite *Listrodromus nycthemerus*. Numbers did indeed drop. The spring collated index fell by about half and the summer index crashed to a tenth of its 1998 value (see Table 6, page 17 and Figure 8e, page 35).

### **Some lowest indices and other declines**

Several species produced their lowest collated index since the BMS began, these were the **Brimstone**, **Small Tortoiseshell** and the **Small Pearl-bordered** and **Pearl-bordered Fritillaries**. For these last two species, comparisons for collated indices could only be done for a few sites, nine and six sites respectively. This is the second successive drop for the **Small Tortoiseshell**, which had its highest index ever in 1997. Several other species also showed a decrease in their collated indices with declines of greater than 30%. These were the **Grizzled Skipper**, **Large White**, **Small Copper** and **Painted Lady**. Smaller declines were indicated by the indices of the **Dark Green Fritillary** and **Small Heath**, the latter dropping to a level only just higher than its lowest index of 1994.

### **One highest index and other increases**

The **Ringlet** produced its highest index since the scheme began in 1976. The **Common Blue** (double-brooded) and **Grayling**, both with a nearly two-fold increase on the 1998 figures, showed the biggest increases of the year. For the **Grayling** this was its highest index since 1990. Other species which increased were the **Small / Essex Skipper**, **Brown Argus**, **Chalkhill Blue**, **Comma**, **Wall Brown** and **Hedge Brown** all increasing by about 30% or more. This was the second consecutive increase for the **Wall Brown**. There were increases in the indices of all the Satyrids except the Small Heath.

Details of the above changes are summarised in Table 2 with further details in Table 6.

In the last column of Table 2 (Trend in all-sites [collated] index), significant trends are identified using simple regressions of  $\log_{10}$  all-sites collated index on years as originally done by Moss *et al* (1995). The figure gives the degree of slope (trend) of the regression line, positive or negative. Asterisks indicate the degree of statistical significance of trend: \*  $P < 0.05$ , \*\*  $P < 0.01$ ; \*\*\*  $P < 0.001$ . It should be noted that simple regression results may give rather too many significant results with population data (Diggle, 1990), so these figures should be treated with caution. Nevertheless they do give an indication as to how the different species are faring on monitored sites. So for example according to the regression for the Dingy Skipper there has been a highly significant decline in numbers of this species as recorded on transects over the monitoring period, indicated by the negative value and the three asterisks. Particular caution needs to be exercised in looking at the results for species for which relatively few sites are used for the calculation of all-sites collated indices such as Common Blue (northern univoltine), Chalkhill Blue, Small Pearl-bordered and Pearl-bordered Fritillaries,. The very big fluctuations in the index for the Holly Blue make testing for a trend here virtually meaningless.

## PERCENTAGE OF COUNTS COMPLETED

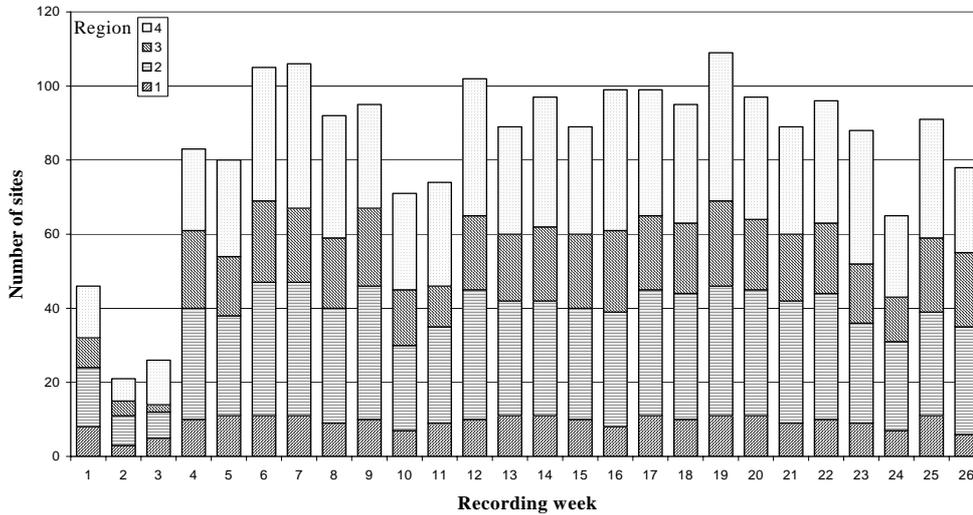
The overall percentage of counts completed in 1999 was 73 %, an improvement on last years low figure. Figures for earlier years are different from those shown in previous reports as they have been calculated using different criteria. In the past only those sites producing some annual indices have been included. Here all sites submitting at least some data have been included and therefore the percentages are slightly lower that shown previously.

**Table 3.** Percentage of counts completed 1988-99

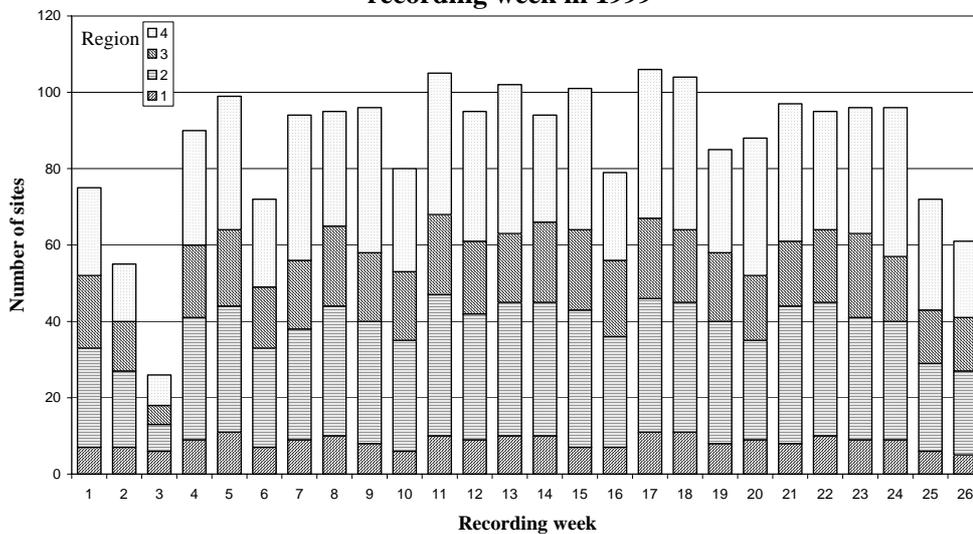
Year	1988	98	90	91	92	93	94	95	96	97	98	99
% completed	73	77	78	74	77	72	70	73	71	74	68	73

As can be seen in Figure 2 the worst affected weeks were 2 & 3, 6 and 25 & 26. A histogram for 1998 is shown for comparison (Figure 1). For details of regions see Map1 on page 11.

**Figure 1. Number of sites with completed transects in each recording week in 1998**



**Figure 2. Number of sites with completed transects in each recording week in 1999**



## THE PROPORTION OF ANNUAL INDICES CALCULATED

Site annual indices are calculated for each species for each transect where the species occurs and where data are sufficient.\* There was an overall increase in the percentage of annual indices that could be calculated in 1999 as compared to 1998, however there were still 15 transects which provided too few data for any annual indices to be calculated (Table 4).

**Table 4.** The proportion of annual indices that could be calculated for 115 transects in 1997, 119 transects in 1998 and 120 transects in 1999.

	0%	1-20%	21-40%	41-60%	61-80%	81-99%	100%	<b>Total</b>
No. of transects in 1997	7	7	12	7	12	25	45	<b>115</b>
No. of transects in 1998	22	0	8	14	15	36	24	<b>119</b>
No. of transects in 1999	15	3	12	8	13	40	29	<b>120</b>

As mentioned in the introduction to this report, the process of calculating estimates has been partly automated and will be improved upon. Generally no estimates have been calculated for a species, (and therefore no annual index), when estimates would comprise 30% or more of the annual index, except in some cases where numbers were very low. This has meant that in a few cases where a week has been missed at the peak of the flight period no estimate has been calculated.

In the past estimates were calculated by simply taking the mean of the values from the weeks on either side of the missing week(s). The semi-automated method takes three recorded values and interpolates the missing value from these. Although the two methods are slightly different we believe that the results of the two methods compare favourably and differences in figures obtained are likely to be insignificant. This will be more fully tested during the coming year.

---

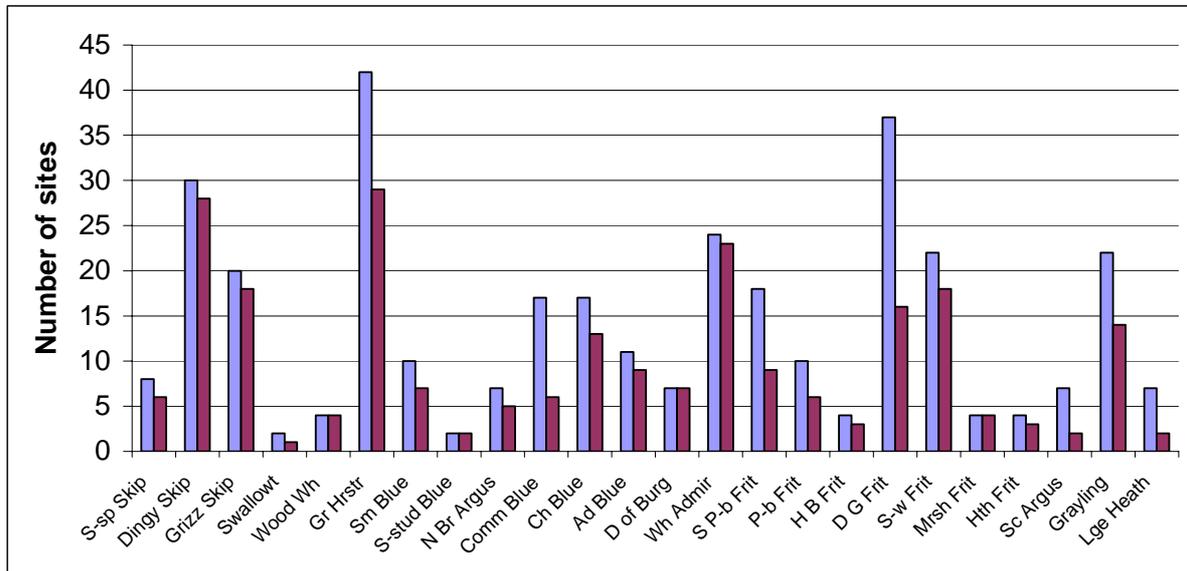
\* An annual index for a species is simply the total mean weekly count on a transect for the year including estimates. Where a species is double-brooded or, in the case of the hibernating species Peacock and Brimstone where there is a separate spring and summer flight, two separate indices are calculated. Where species produce a third brood (notably Small Copper and Wall Brown) third brood figures are combined with those of the second brood. In some cases the divisions between the broods are indistinct and a single index is given for the year. These species are: Red Admiral, Painted Lady, Small Tortoiseshell, Comma, Speckled Wood and Small Heath.

## ANNUAL INDICES FOR THE SCARCER SPECIES

In general, all-sites collated indices are only calculated if data from seven or more sites are available in every year since the start of the BMS in 1976, (data from sites where a zero index was produced in both of any pair of years are excluded). This limit was set based on a subjective assessment on the number of sites needed to produce a meaningful index at the start of the scheme in 1976. Usually the number of sites is much larger than this, and for the majority of species the number of sites for which data are available has increased greatly since the start of the scheme as the number of sites in the scheme has increased. However the fewer the number of sites then the less reliable are any trends shown in the data likely to be. The species whose collated indices need to be treated with the greatest caution are Common Blue (northern, univoltine), Chalkhill Blue, White Admiral (though the number of sites providing data for this species has increased markedly over the years), Small Pearl-bordered Fritillary and Pearl-bordered Fritillary. Consequently for these and other species represented on a relatively low number of sites, it is important to make sure that recording fully covers the flight periods so that site annual indices can be calculated which in turn will enable more reliable all-sites collated indices to be produced.

**Figure 3.** The number of annual indices calculated for the scarcer species compared with the number of sites where the species was actually recorded in 1998 and / or 1999.

The figure shows for scarcer species (includes species too poorly represented on BMS sites to consider starting to produce an all-sites collated index), a). (the first column) the number of transects on which the species indicated was recorded in at least one of the last two years, 1998 and 1999 (including where an annual index could not be calculated), b). the number of sites for which an annual index could be calculated in both years (other than a zero in both years) and therefore the number of sites which contributed to the all-sites collated index.



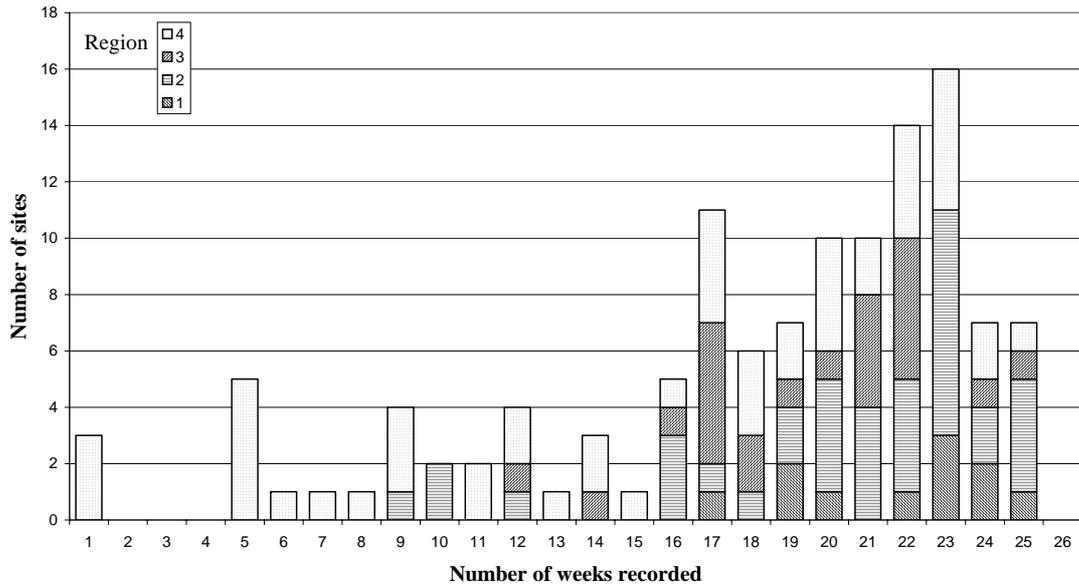
Of particular note is that for several species a relatively high number of sites did not produce enough data for annual indices to be produced in both years and therefore could not be used in the calculation of the all-sites indices. The most extreme examples are Common Blue (northern, univoltine) (17 and 6 sites), Small Pearl-bordered Fritillary (18 and 9 sites), Dark Green Fritillary (37 and 16 sites) and Grayling (22 and 14 sites). The Scotch Argus and the Large Heath also show a big discrepancy between the number of sites on which the species were recorded and the number of sites which produced annual indices in both years.



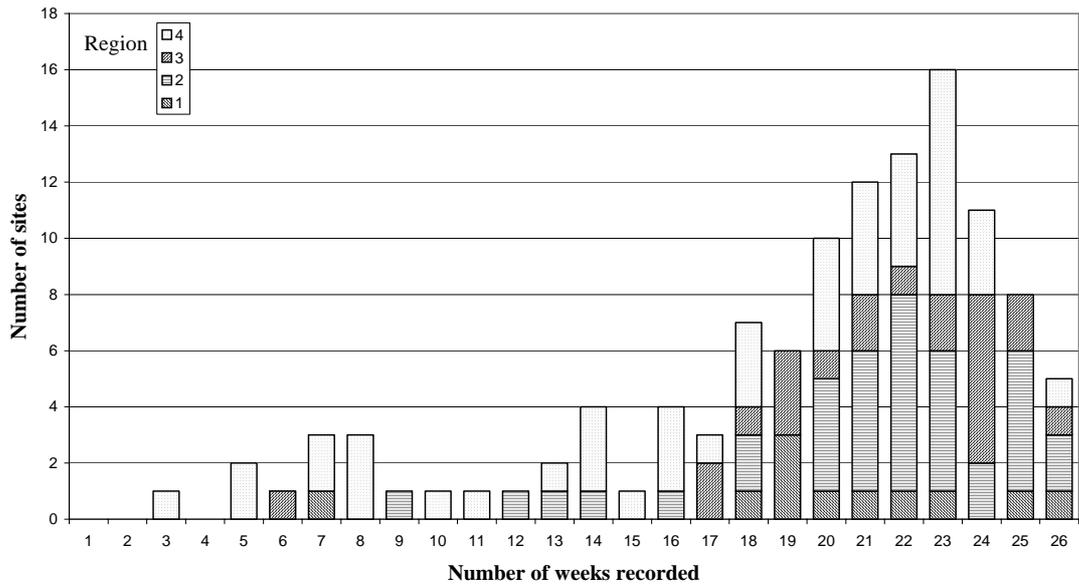
**THE NUMBER OF WEEKS RECORDED FOR EACH TRANSECT**

The number of weeks recorded for each transect in 1998 and 1999 are shown in Figures 4 and 5 respectively. Note that there were no transects in 1998 where all 26 weeks were recorded, but in 1999 all 26 weeks were recorded on five transects. The area covered by each region is shown on Map 1.

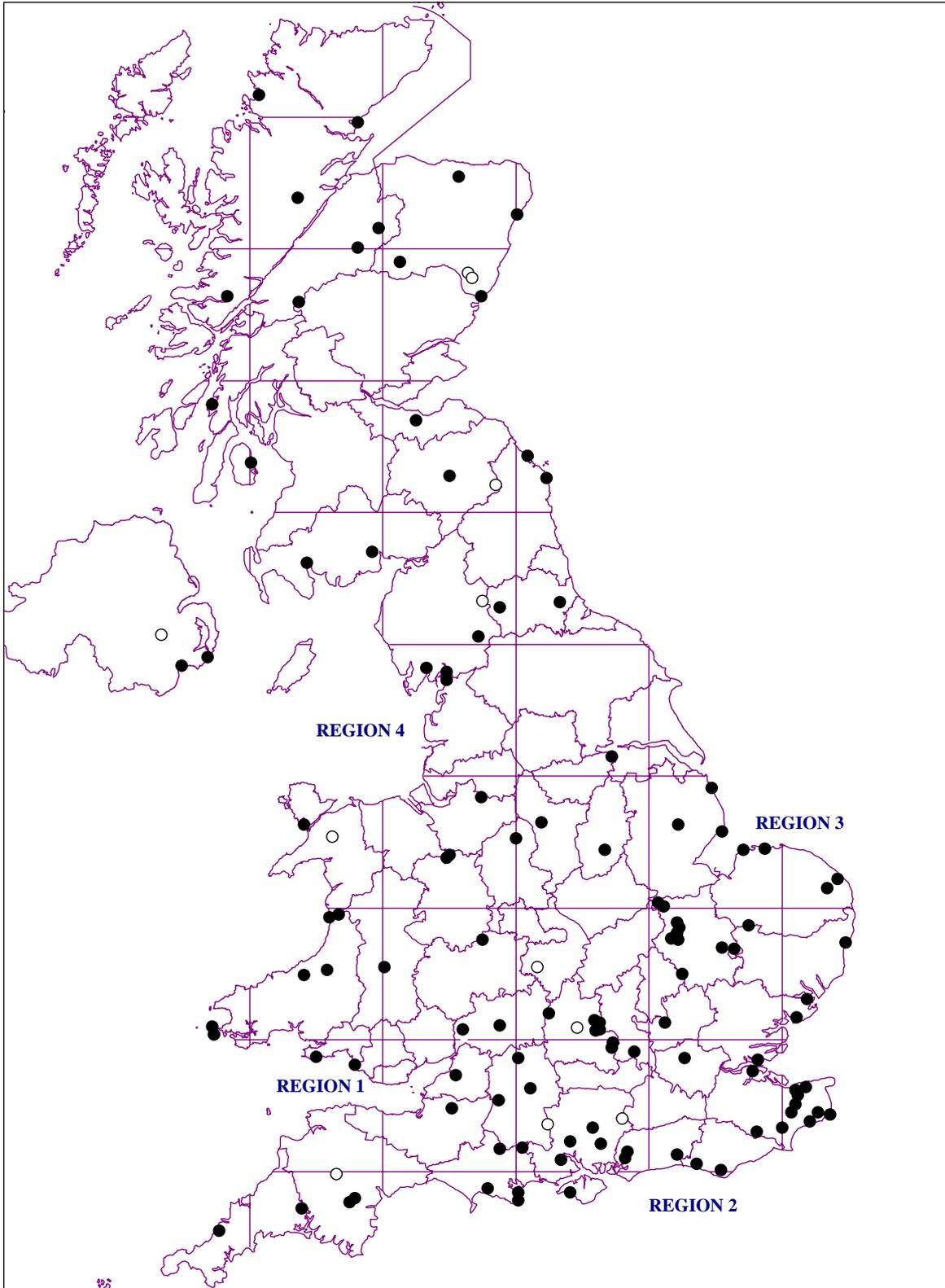
**Figure 4. Number of weeks recorded for each transect in 1998.**



**Figure 5. Number of weeks recorded for each transect in 1999.**



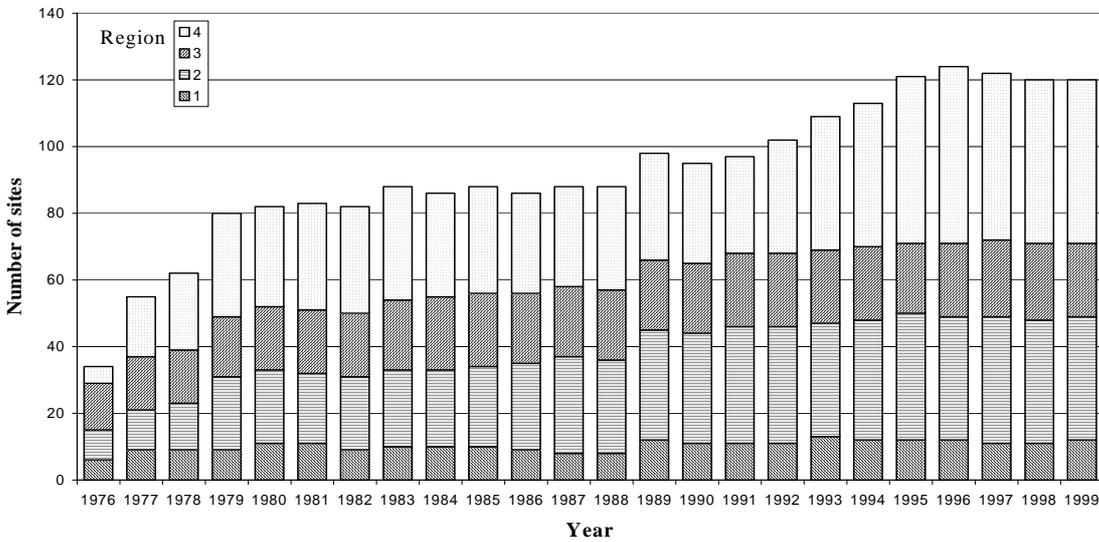
**Map 1.** Butterfly Monitoring Scheme and Environmental Change Network sites monitored for butterflies in 1999, (BMS = Solid circles, ECN = open circles), showing county boundaries (*not* Vice-counties) and the four BMS regions.



## THE NUMBER OF SITES CONTRIBUTING DATA TO THE BMS

The BMS was officially launched in 1976 with just 36 sites contributing to the scheme. However three years of trials preceded this when data were being gathered to test the methodology. Seven sites still in the BMS, which were monitored during this period as part of this process, have data going back to 1974. The number of sites contributing to the BMS (Figure 6) has gradually increased over the years with at least one site being added to the scheme in most years. 120 sites submitted at least some data to the scheme in 1999. A further five sites remain in the scheme, though no data have been received from them for 1999. The distribution of the sites currently part of, or contributing to, the BMS is shown on Map1.

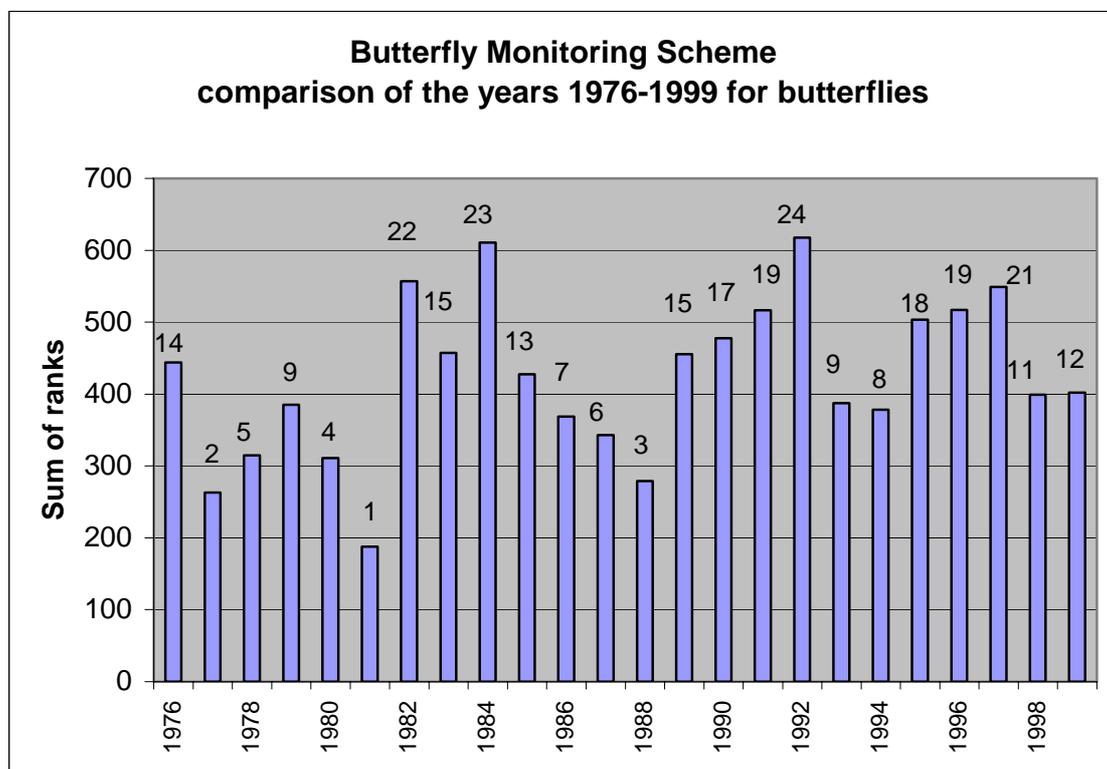
**Figure 6. Number of sites contributing data to scheme**



## COMPARISON OF THE 24 YEARS OF THE BMS

Tim Sparks, one of our statisticians, has provided a useful method of comparing years in terms of how good they were for butterflies in general. For each species for which all-sites collated indices are calculated, the years have been ranked according to how good they were for that butterfly. These ranking have then been combined and the years ranked according to how good they were for butterflies in general. The rank order of the combined ranks (1 to 24, where 1 is the worst year and 24 the best) for each year is shown at the top of each column. By this method 1981 comes out as the worst year for butterflies and 1992 as the best.

**Figure 6.** Histogram showing the sum of the ranks of each species for which a collated index is calculated for each year of the Butterfly Monitoring Scheme.



## NUMBERS OF BUTTERFLIES RECORDED

The number of sightings of butterfly species recorded on BMS transects in 1999 are listed in Table 5. Numbers included in this analysis are only those where sufficient data were provided in either 1998 or 1999 for site annual indices to be calculated. Although Swallowtails and Glanville Fritillaries were recorded in 1998 at the single sites monitored for each of these two species, key weeks were missed during their flight periods and therefore no annual index could be calculated in either case. No White-letter Hairstreaks were recorded on transects in 1999, and no Black Hairstreaks were recorded in either year.

**Table 5.** Sum of site indexes and order of abundance for 1998 and 1999

ENGNAME	1998	1999	1998 order	1999 order
Meadow Brown	61255	60195	1	1
Gatekeeper	10192	12898	3	2
Ringlet	10315	11540	2	3
Green-veined White	9442	9349	4	4
Speckled Wood	6956	6822	5	5
Small Skipper	4803	6633	11	6
Common Blue	4832	6618	10	7
Small Heath	6495	6200	6	8
Chalk-hill Blue	6334	6183	8	9
Marbled White	6345	5551	7	10
Peacock	4840	4393	9	11
Small White	3089	3594	13	12
Large Skipper	2432	2508	15	13
Large White	3713	2365	12	14
Common Blue (northern)	2575	1841	14	15
Brimstone	2146	1840	16	16
Adonis Blue	901	1627	24	17
Wall Brown	1035	1551	22	18
Brown Argus	739	1230	26	19
Small Tortoiseshell	1769	1221	18	20
Red Admiral	1186	1210	20	21
Scotch Argus	1347	1195	19	22
Dark Green Fritillary	882	1068	25	23
Silver-spotted Skipper	1071	1066	21	24
Orange Tip	1023	1052	23	25
Small Copper	1935	981	17	26
Dingy Skipper	657	853	28	27
Comma	485	726	31	28
Heath Fritillary	582	641	29	29
Grayling	534	530	30	30
Silver-washed Fritillary	305	429	36	31
Northern Brown Argus	316	379	34	32
Green Hairstreak	274	306	37	33
Small Blue	70	182	44	34
Grizzled Skipper	317	181	33	35
Marsh Fritillary	381	167	32	36

ENGNAME	1998	1999	1998 order	1999 order
Holly Blue	726	164	27	37
Large Heath	38	141	48	38
High Brown Fritillary	216	133	38	39
White Admiral	129	123	41	40
Pearl-bordered Fritillary	305	120	35	41
Silver-studded Blue	58	106	47	42
Painted Lady	190	101	39	43
Wood White	66	98	45	44
Small Pearl-bordered Fritillary	109	91	42	45
Purple Hairstreak	90	80	43	46
Duke of Burgundy Fritillary	65	58	46	47
Swallowtail	0	44	58	48
Lulworth Skipper	6	37	50	49
Glanville Fritillary	0	26	55	50
Clouded Yellow	161	17	40	51
Brown Hairstreak	18	16	49	52
Purple Emperor	3	2	51	53
White-letter Hairstreak	1	0	52	58
Black Hairstreak	0	0	53	54
Camberwell Beauty	0	0	54	55
Large Copper	0	0	56	56
Pale Clouded Yellow	0	0	57	57

## SUMMARY OF CHANGES AT SITE LEVEL 1998/99

The following table summarises the changes in the site indexes for all species from 1998 to 1999 (number of sites for which site annual indices could be calculated, increases, decreases, no change). The all-sites collated indices for 1998 and 1999 are shown where these are calculated and the species names shown in bold type. Many of the rarer species do not have collated indices because they are recorded on too few BMS transects for a meaningful index to be calculated. Where collated indices have been calculated for species recorded on relatively few transects these figures should be treated with caution. These include Chalkhill Blue, Small Pearl-bordered and Pearl-bordered Fritillaries and Silver-washed Fritillary. For species with two distinct flight periods the second is used here.

**Table 6.** Summary of changes at site level 1998/99

SPECIES	No. of sites with index in 1998 or 1999	No. of sites with index in 1998 and 1999	Increase	Decrease	No change	Zero index in 1998 and 1999	1998 only	1999 only	All-sites collated index 1998	All-sites collated index 1999
<b>Small / Essex Skipper</b>	84	55	35	18	2	8	10	11	149	192
Lulworth Skipper	1	1	1							
Silver-spotted Skipper	10	6	1	4	1	1		3		
<b>Large Skipper</b>	85	61	22	33	6	4	6	14	145	143
<b>Dingy Skipper</b>	39	28	14	13	1	8	1	2	15	16
<b>Grizzled Skipper</b>	35	18	4	13	1	12	3	2	49	28
Swallowtail	2	0						2		
Wood White	9	4	2	2		4		1		
Pale Clouded Yellow	5	0				4		1		
Clouded Yellow	60	18		18		13	9	20		
<b>Brimstone</b>	73	46	12	31	3	7	9	11	101	68
<b>Large White</b>	96	72	14	55	3	1	14	9	138	91
<b>Small White</b>	92	68	43	22	3	1	13	10	62	74
<b>Green-veined White</b>	98	70	30	38	2	3	9	16	398	377
<b>Orange Tip</b>	89	55	25	29	1	5	14	15	120	115
<b>Green Hairstreak</b>	45	29	15	11	3	3	8	5	143	174
Brown Hairstreak	9	4	1	3		3		2		
Purple Hairstreak	48	25	10	12	3	11	6	6		
White-letter Hairstreak	21	1		1		14	5	1		
Black Hairstreak	4	0				3		1		
<b>Small Copper</b>	87	51	16	28	7	8	21	7	84	58
Large Copper	1	0				1				
Small Blue	17	7	5	1	1	4	1	5		
Silver-studded Blue	6	2	2			3	1			
<b>Brown Argus</b>	49	25	17	7	1	7	9	8	66	92

SPECIES	No. of sites with index in 1998 or 1999	No. of sites with index in 1998 and 1999	Increase	Decrease	No change	Zero index in 1998 and 1999	1998 only	1999 only	All-sites collated index 1998	All-sites collated index 1999
Northern Brown Argus	6	5	2	3				1		
<b>Common Blue (bivoltine)</b>	82	52	38	13	1	8	8	14	46	85
<b>Common Blue (univoltine)</b>	12	6	1	5			2	4	20	13
<b>Chalk-hill Blue</b>	24	13	10	2	1	7	2	2	104	139
Adonis Blue	12	9	7	2		1	1	1		
<b>Holly Blue (bivoltine)</b>	76	34	1	33		17	16	9	629	64
Duke of Burgundy Fritillary	14	7	5	2		3	4			
<b>White Admiral</b>	29	23	11	11	1	4	1	1	23	21
Purple Emperor	6	2		1	1	4				
<b>Red Admiral</b>	83	52	22	30		1	12	18	88	90
<b>Painted Lady</b>	75	35	8	27		12	12	16	448	241
<b>Small Tortoiseshell</b>	73	44	15	28	1		11	18	56	43
Camberwell Beauty	2	0				2				
<b>Peacock</b>	91	67	31	31	5	1	15	8	191	187
<b>Comma</b>	65	40	22	14	4		13	12	153	217
<b>Small Pearl-bordered Fritillary</b>	26	9	1	6	2	10	1	6	21	11
<b>Pearl-bordered Fritillary</b>	21	6	1	5		8	4	3	3	2
High Brown Fritillary	8	3		3		5				
<b>Dark Green Fritillary</b>	41	16	8	6	2	13	3	9	61	48
<b>Silver-washed Fritillary</b>	34	18	8	10		11	3	2	44	54
Marsh Fritillary	11	4	1	3		3	1	3		
Glanville Fritillary	1	0						1		
Heath Fritillary	4	3	1	1	1			1		
<b>Speckled Wood</b>	80	57	31	25	1	3	8	12	228	263
<b>Wall Brown</b>	80	38	25	10	3	24	10	8	21	27
Scotch Argus	6	2	1	1		1	2	1		
<b>Marbled White</b>	51	32	17	13	2	5	4	10	307	323
<b>Grayling</b>	28	14	9	5		6	6	2	41	78
<b>Gatekeeper</b>	89	67	48	17	2	2	10	10	85	110
<b>Meadow Brown</b>	99	76	48	26	2		11	12	139	161
<b>Small Heath</b>	87	48	21	27		13	8	18	30	26
Large Heath	4	2	2			1		1		
<b>Ringlet</b>	83	55	36	18	1	5	9	14	424	511

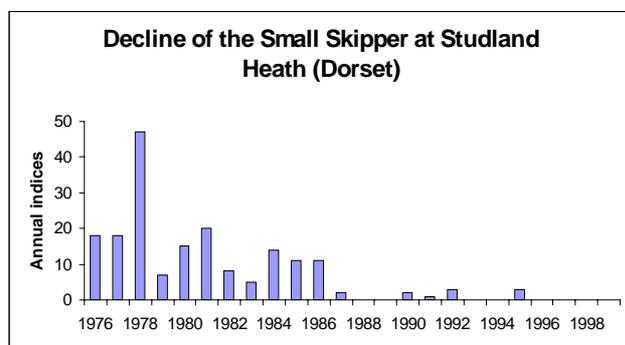
## INDIVIDUAL SPECIES ACCOUNTS.

The following accounts should be looked at in conjunction with Tables 2 and 6 (pages 5 & 6 and 16 & 17) and Figure 6 (Appendix I starting on page 30).

A year in the text below is described as average for a species in terms of its rank order not in terms of the mean of the collated indices. On the histograms showing site data, where the species was recorded but there were too few counts for the calculation of an index, or the species was not recorded, but there were too few counts made for a zero index to be assumed, then the histograms have a negative value (-2 or -1 respectively). In some cases this may not be visible on the histogram if the annual index scale is large.

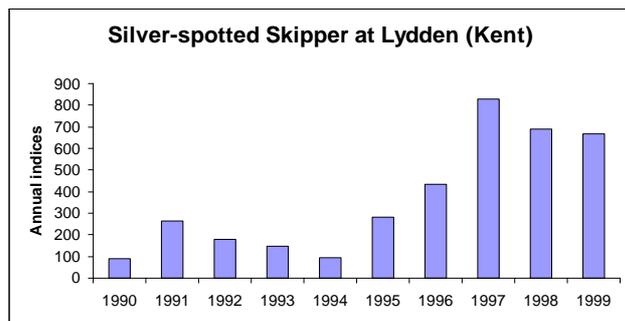
**Small/Essex skipper:** there was a moderate increase in the all-sites collated index after the low index of 1998, but numbers were still below average.

Several sites have been colonised by Small / Essex Skippers over the monitoring period and there have been increases at many other sites. However at other sites there have been appreciable declines, particularly at woodland sites which have presumably become increasingly shaded. Other declines are less easily explained as at Studland Heath in Dorset.

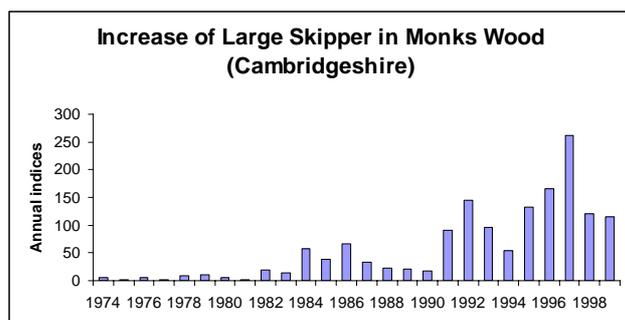


**Lulworth skipper:** the highest numbers recorded since 1994 at Swanage (Ballard Down) (Dorset), the only BMS site with this species. Numbers of this species are generally low at this site as it is a species of long turf, whereas Swanage is managed primarily for the Adonis Blue, a species of short turf in Britain.

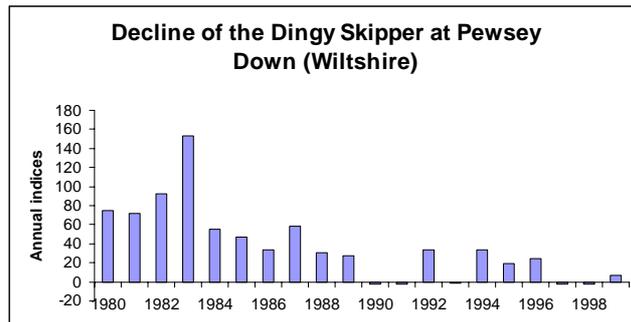
**Silver-spotted skipper:** this butterfly was recorded on nine transects in 1999 including the first (a singleton) for St. Margaret's Bay on the east Kent coast. Counts dropped on four of the five sites for which comparisons were possible, the only increase being at Porton Down in Wiltshire. However numbers remain high at Lydden in Kent. Overall, numbers have generally increased at BMS sites over the monitoring period.



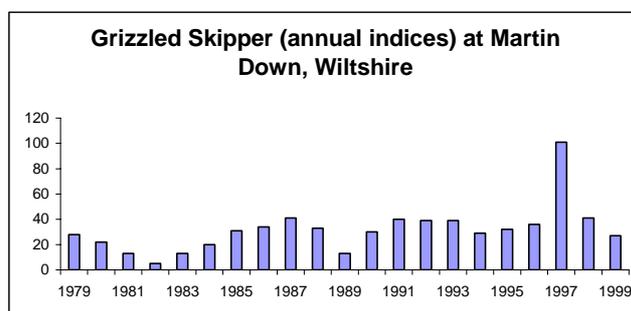
**Large skipper:** another poor year for this species with hardly any change from the 1998 collated index. This butterfly has tended to increase over the monitoring period at woodland sites in central and eastern England, the best example of this being Monks Wood (Cambridgeshire).



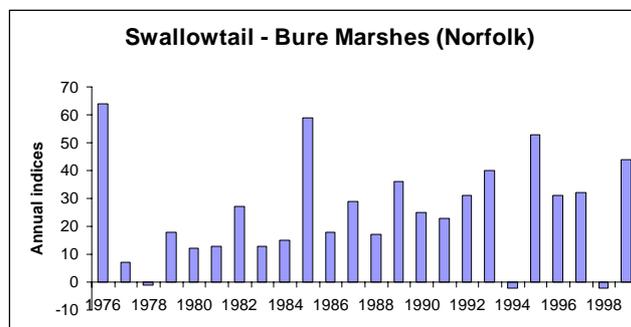
**Dingy skipper:** a slight increase on last year's low collated index. This butterfly has apparently become extinct at three woodland sites in the scheme: Wyre Forest (Worcestershire), Picket Wood (Wiltshire) and Ampfield Wood (Hampshire) all within the last six or seven years. Although doing well on some chalk grassland sites such as Wye & Crundale Down and Lydden (both in Kent), it has declined at others such as Kingley Vale (Hampshire) and Pewsey Down (Wiltshire).



**Grizzled skipper:** the second successive substantial fall in the collated index, making this *one of the lowest* indices since the scheme began. There were drops in the annual indices at 13 of the 18 sites for which comparisons are possible and increases at four, one remaining unchanged. This species is rarely recorded in more than double figures on BMS transects. Only three sites produced an index of more than 20: Martin Down (27), Lullington Heath (23) and Fontmell Down (43).

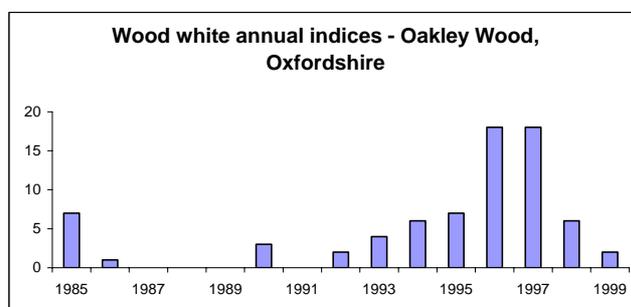


**Swallowtail:** an increase at Bure Marshes, one of only two sites in the BMS where this species is recorded regularly. Numbers have tended to increase after falling very low in 1977 after the high of 1976. No index could be calculated for Hickling Broad (Norfolk).



The Swallowtail was reintroduced for the second time to Wicken Fen in 1993 but has not been recorded on the transect since 1996 and is almost certainly extinct again at the site.

**Wood white:** the highest transect numbers annually (double figures only) are recorded at Hillsborough (Northern Ireland) and Whitecross Green (Oxfordshire), two of the four sites where this butterfly is regularly recorded on BMS transects. At both these sites counts increased in 1999, but they fell at the other two sites; Shabbington Wood (new) and Oakley Wood, both in Bernwood forest, Oxfordshire.



**Clouded yellow:** far fewer were recorded than in 1998, only being recorded at or near the coast at Swanage, Dorset (2 specimens), Skokholm, south-west Wales (11) and St Osyth, Essex (4). As a point of interest, larvae of this species were first recorded successfully overwintering in Britain at Bournemouth in Dorset in 1998/99 by Mike Skelton, one of the recorders for the Swanage transect (Skelton 1999). Adults resulting from these larvae were seen during late March to early May.

**Brimstone:** There was little change in the spring index but there was a substantial drop in the summer index (>30%) with decreases at more than two-thirds of sites for which comparisons were possible. This produced the *lowest summer index* since the BMS began for this butterfly whose collated indices have remained relatively stable over the years.

**Large white:** a low index for this species in both generations.

**Small white:** after the *lowest first generation index* of the series, numbers improved for the second generation, but still only produced an index well below average.

**Green-veined white:** after a very low spring index, second generation counts were high and produced a summer index well above average.

**Orange tip:** an about average index with very little change again from the previous year.

**Green hairstreak:** a good year for this species with a reasonable increase in the collated index (>20%) to give *one of the highest indices* of the series.

**Brown Hairstreak:** recorded on four of the nine BMS sites on which it occurs with one increase and three decreases.

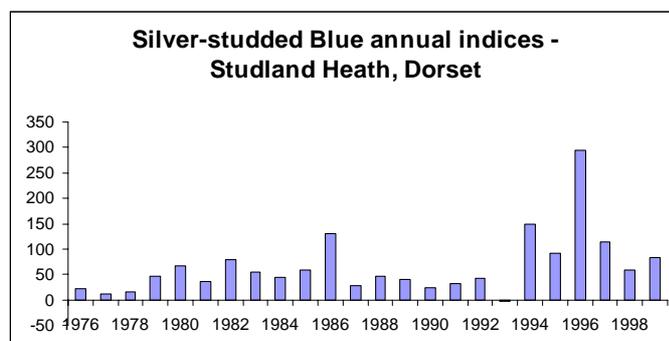
**Purple Hairstreak:** small numbers recorded on 21 BMS transects.

**White-letter Hairstreak** and **Black Hairstreak:** neither recorded on any BMS transect in 1999.

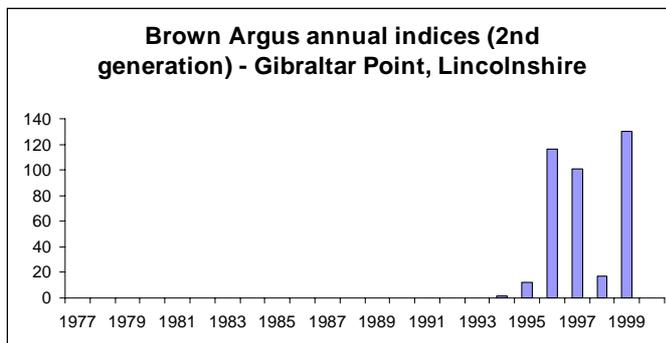
**Small copper:** counts fell in both generations and it was a below average year for this species on BMS sites.

**Small blue:** recorded on 10 BMS transects in 1999, mostly in single figures. However at Oxwich and Kenfig on the south coast of Wales there were big increases in the annual indices from 2 to 27 and 54 to 114 respectively. There were increases in the indices at five of the seven sites for which comparisons were possible and one decline.

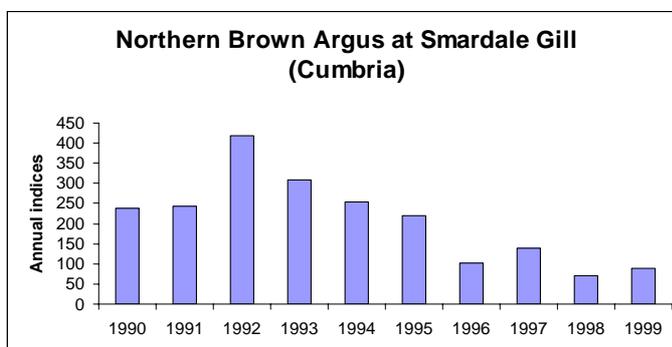
**Silver-studded blue:** numbers increased slightly at Studland Heath (Dorset) and after a nil count in 1998 at Tadmoll, 22 were recorded on the transect in 1999. The new transect at Gere Sands (Cornwall) produced an index of 208.



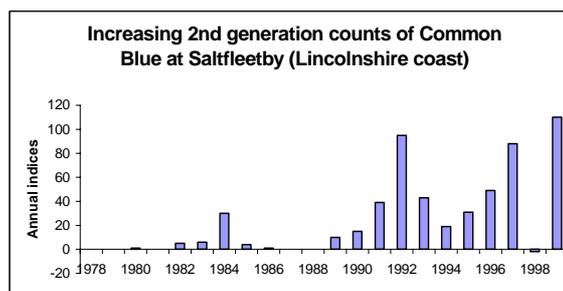
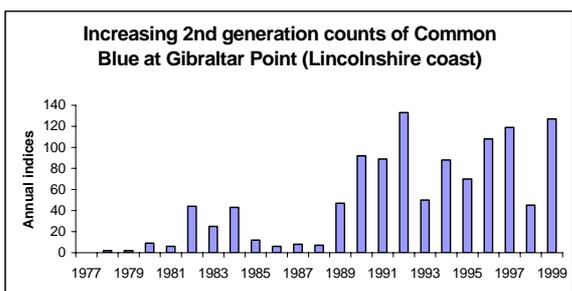
**Brown argus:** there was a further drop in the spring index, corresponding to the cloudy and wet weather in May and June but a 40 % increase on the 1998 figure for the second generation making this a rather better than average year. The butterfly appears to be persisting at many sites it has colonised in recent years, but for other sites this is uncertain. It was recorded for the first time in 1999 on the transect at Holme Fen (Cambridgeshire)



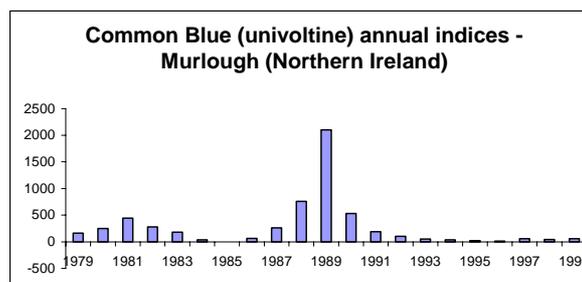
**Northern brown argus:** recorded on four of seven transects on which it occurs, with a small increase at Leighton Moss (Lancashire) and a moderate increase at Smardale Gill (Cumbria), though numbers have generally been declining at the latter site for several years. Numbers remained stable at Bishop Middleham Quarry (Co. Durham). No comparison was possible for the Derbyshire Dales transect, but numbers had probably dropped. Unusually none were recorded at St Cyrus (Grampian).



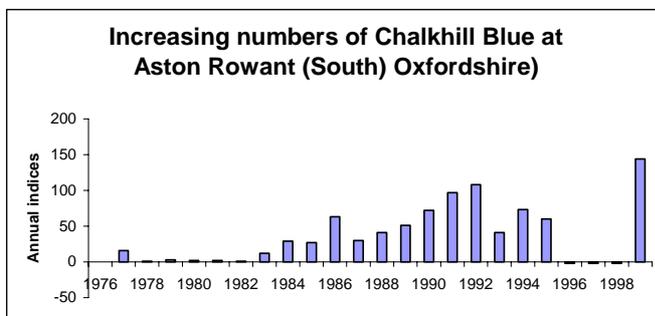
**Common blue (bivoltine, southern):** a substantial drop in the spring collated index *and one of the lowest* of the series but followed by a substantial increase in the summer index (nearly 90% up on 1998) making this an average year for this species in the summer generation.



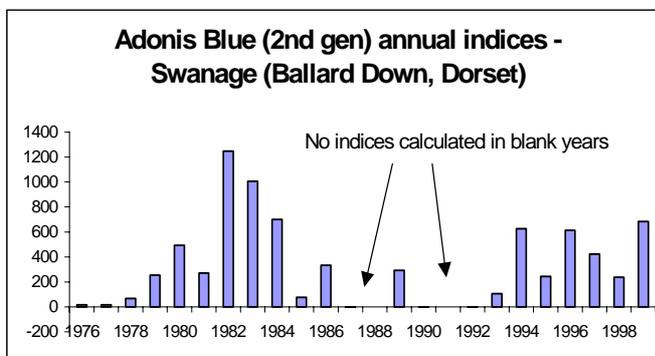
**Common blue (univoltine, northern):** comparisons could only be made at six of the 24 sites where this butterfly occurs and numbers declined at five of these sites.



**Chalkhill blue:** a more than 30% increase in the collated index with increases at 10 of the 13 sites for which comparisons were possible. Numbers appear to be increasing at Barnack Hills and Holes in north Cambridgeshire where the butterfly was unofficially introduced in 1987. The 1999 index was 23. Apart from a singleton in 1990 the butterfly has only been recorded on this transect for the last three years. Apart from a site in Lincolnshire this is the most northerly site in Britain for this species. Numbers are generally increasing on several other transects including at the two Aston Rowant sites in Oxfordshire.



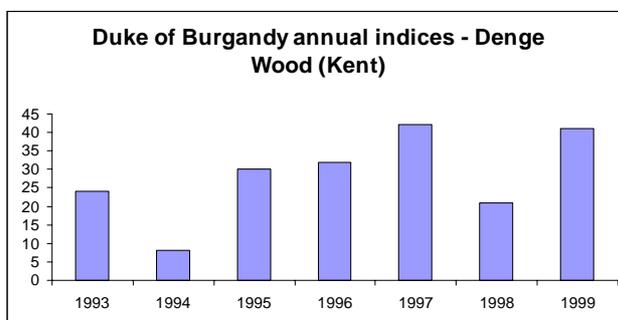
**Adonis blue:** this butterfly is recorded on 12 BMS transects (though not every year on two). First generation numbers were down on all seven transects for which comparisons were possible, but up on seven of the nine transects for which comparisons could be made for the second generation. At Swanage (Ballard Down, Dorset) the second generation count was the highest since 1984.



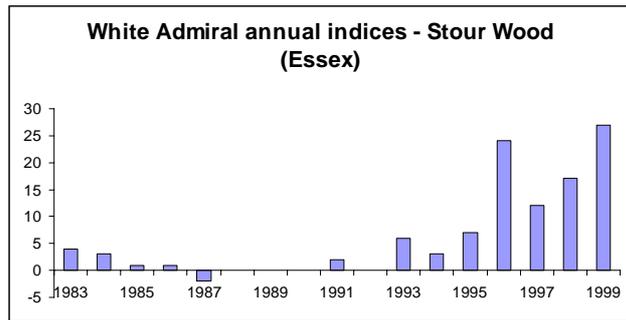
**Holly blue** (bivoltine, southern): a more than 50% drop in the spring collated index followed by a massive drop in the summer index of about 90% following the high values of the last three years.

**Holly Blue** (largely univoltine, northern): occurs at six sites in the scheme and second generation individuals have been recorded at all these sites except Hillsborough in Northern Ireland. Both generation comparisons were possible for two sites only, Leighton Moss and Gait Barrow (Lancashire) where counts (in both cases a single first generation individual only) indicated declines. A strong second generation was in evidence again at Coombes Valley (Staffordshire) for the second year running (index 65 in 1998 and 19 in 1999).

**Duke of Burgundy:** five increases and two declines on the nine sites for which comparisons were possible, with numbers recorded doubling at Denge Wood (Kent) which on average has the highest numbers recorded in the scheme overall. On the other two other transects, Kingley Vale and West Dean Wood (West Sussex), recorded numbers are always very low and zero values were recorded in both years.



**White admiral:** another poor year for this species, ranking 5<sup>th</sup> lowest in the series, though hardly any change in the collated index with an equal number of increases and decreases. The species appears to be doing well at Stour Wood (Essex).



**Purple emperor:** one recorded on the West Dean Wood (West Sussex) transect and one on the Shabbington Wood transect (Oxfordshire).

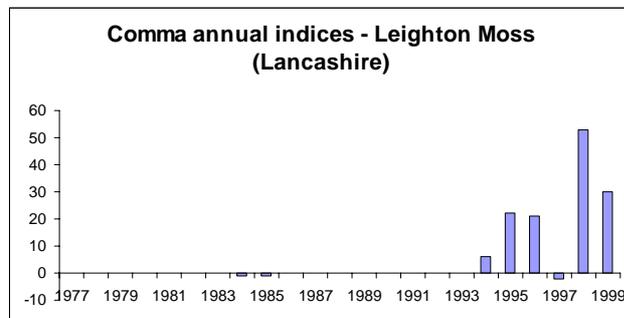
**Red admiral:** Very little change from the 1998 collated index with a very small increase.

**Painted lady:** a fall in the collated index but an average year for this species. Low numbers were recorded on 38 transects throughout England and Wales and at Murlough in Northern Ireland, but none were recorded on Scottish transects. A total of 115 individuals were recorded with the maximum of 12 being recorded at Swanage (Ballard Down, Dorset).

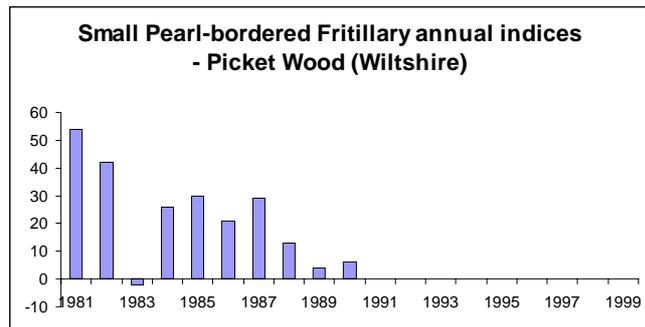
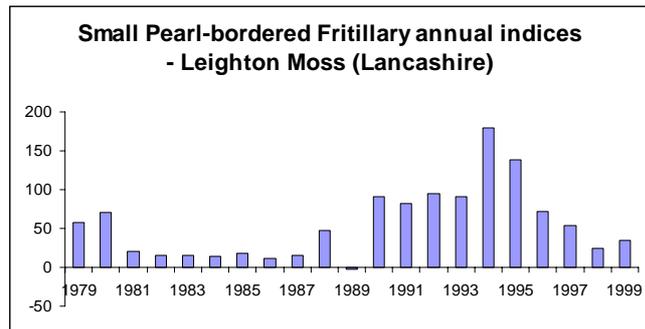
**Small tortoiseshell:** after a large drop in the collated index in 1998 resulting in a very poor year, there was a further drop in the index in 1999 making this the the *lowest index* since the scheme began.

**Peacock:** a very small drop in the collated index with equal numbers of increases and decreases, but it was an above average year for this species. Nearly half of the 110 sites currently in the scheme where this species is or has been recorded failed to provide sufficient data for a spring index to be calculated. This was probably largely due to two poor weeks of weather in mid April.

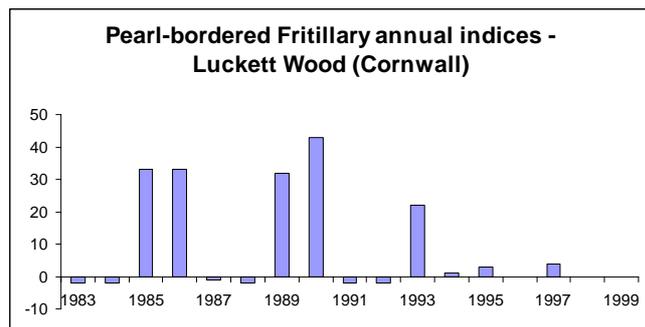
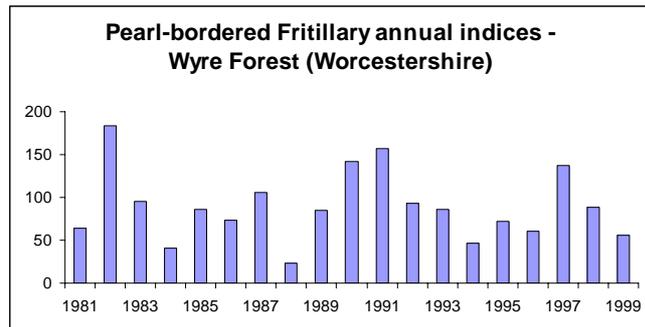
**Comma:** a more than 40% increase in the collated index making this a rather better than average year for this species. The butterfly now appears to be well established at both Gait Barrow and Leighton Moss in Lancashire.



**Small pearl bordered fritillary:** this species only occurs more or less regularly on about 21 transects currently in the BMS and spasmodically, or hardly ever, on a further 14 transects. It is probably extinct at at least five of these sites and appears to be near extinction at Lockett Wood in Cornwall. Comparisons were only possible on nine sites in 1999 and the resulting collated index was the *lowest* since the scheme began being half that of the previous lowest index of last year. If the BMS results are anything to go by the future looks bleak for this species in Britain. However double figures are still usually recorded on several BMS transects including Leighton Moss and Gait Barrow, both in Lancashire, Wyre Forest in the Worcestershire, Glen Strathfarrar in the Highlands and Newborough Warren on Anglesey.

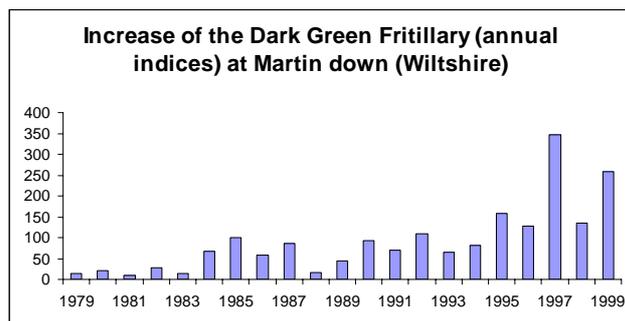
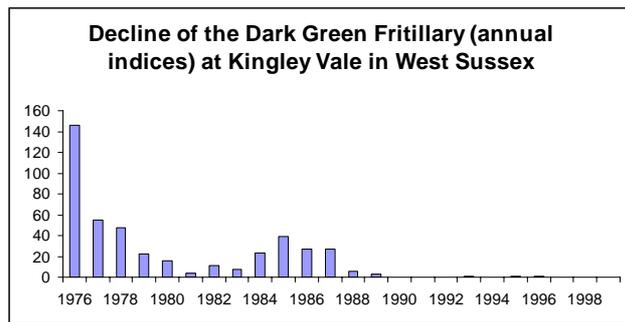


**Pearl-bordered fritillary:** another very bad year for this species but comparisons were only possible for six of the 12 sites where this species is still regularly recorded. There were declines at five of these sites. Of the 32 sites currently in the BMS where the species has been recorded on transects, it is almost certainly extinct at nine of these sites and near or perhaps already extinct at a further three sites for example Lockett Wood in Cornwall. As for the Small Pearl-bordered Fritillary counts in double figures occur on only about five transects: Leighton Moss and Gait Barrow in Lancashire, at Wyre Forest in Worcestershire, Glen Strathfarrar in the Highlands and Mabie Forest in Dumfriesshire.

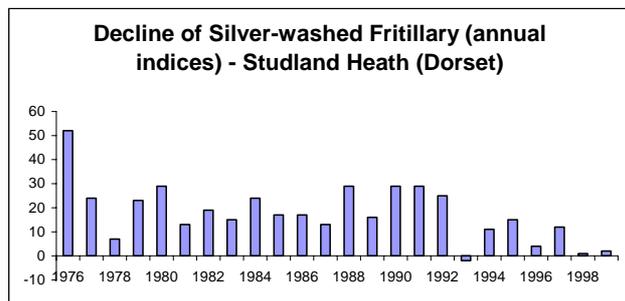


**High brown fritillary:** recorded on four sites in 1999 but comparisons were only possible at three; Leighton Moss and Gait Barrow in Lancashire and Bovey valley in Devon. There were declines at all three sites.

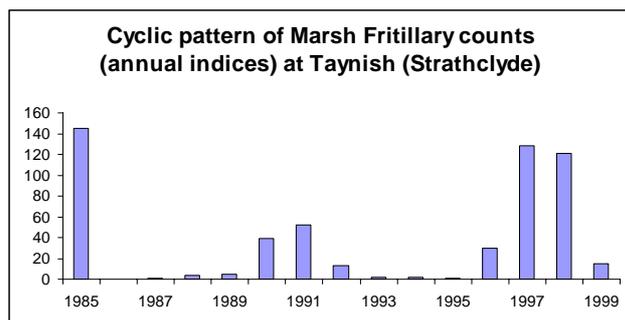
**Dark green fritillary:** A further decline (21%) in the collated index with comparisons possible for 16 sites only, although the species was recorded on 32 transects. There were increases at 8 sites, however there was a big drop in the number recorded at five of the six sites which showed a decline in their annual index. It was recorded (a singleton) for the first time on the transect at Lydden in Kent.



**Silver-washed fritillary:** a modest increase (22%) in the collated index with comparisons possible on 18 sites but with declines on more sites (10) than increases (8). The butterfly has been recorded on 34 transects in the last 5 years but is only recorded regularly (usually annually) on about 17 sites.



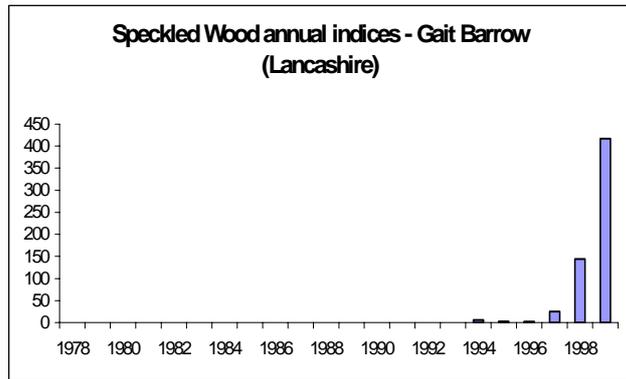
**Marsh fritillary:** recorded on four transects in 1999 with declines at three sites. The biggest drop was at Tainish (Strathclyde), but this was expected in line with its cyclic pattern influenced by its host-speciefic parasite.



**Heath fritillary:** comparisons were possible for three of the four BMS transects where this species is recorded. Little change from 1998, though numbers probably declined at Blean Woods where data were too few for an index to be calculated in 1998. A single second generation adult was recorded on the transect at Blean Woods in September. [Large numbers of second generation adults were recorded at Hockley Wood in Essex in September (Bailey, 2000)].

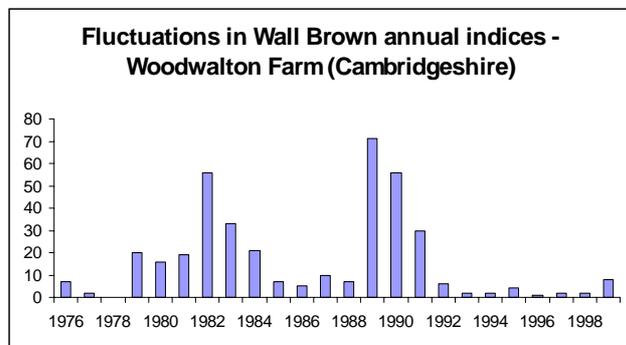
**Speckled Wood:** the third consecutive increase in the collated index taking it to the second highest of the series, the highest index being in 1992.

Another big increase at Gait Barrow and at Leighton Moss, two sites in Lancashire where this species is currently establishing. Only Monks Wood, with an index of 514, produced a higher index than Gait Barrow (index 417) in 1999. Shabbington Wood (Oxfordshire) was next with an index of 331.

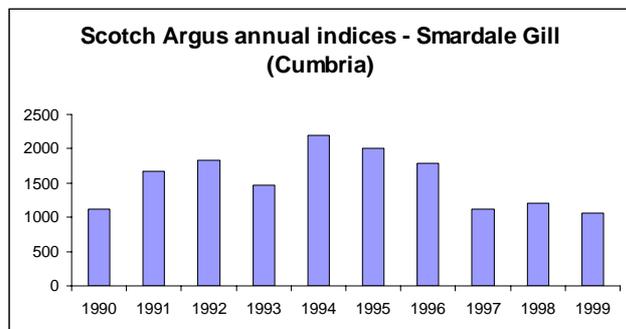


There was a rise in the numbers recorded at Woodwalton Fen after last year's mysterious crash.

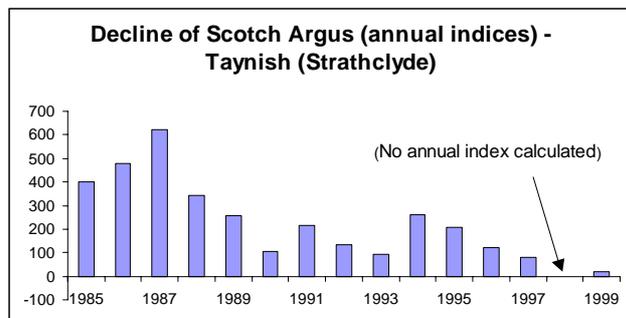
**Wall Brown:** little change in the spring collated index but the second consecutive increase (nearly 30%) in the summer index making the best year since 1994. Still no sign of the species at inland sites where it has become extinct, such as Gomm Valley (Buckinghamshire), Foxholes (Oxfordshire) and Alresford Farm (Hampshire). The increases tend to have been at or near the coast including some chalk grassland sites.



**Scotch argus:** comparisons could only be made for two of the eight BMS transects on which this species occurs annually. Numbers declined a little at Smardale Gill (Cumbria), where annual counts are always in excess of 1000, but increased at Culvie Wood (Grampian).



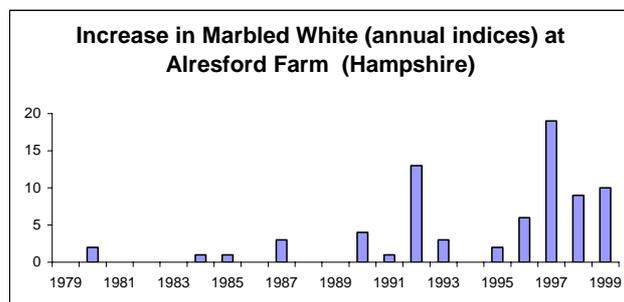
Numbers continue to decline at Tainish (Strathclyde).



**Mountain ringlet:** No index could be calculated at Ben Lawers, the only site currently in the scheme where this species occurs.

**Marbled white:** a slight increase in the collated index to make this the third highest in the series.

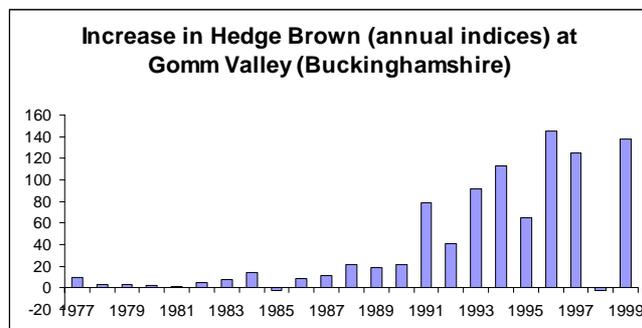
The butterfly has recently (within the last 2-3 years) colonised grassland immediately south and adjacent to Monks Wood (Huntingdonshire) and was recorded (a singleton) for the first time ever on the transect there in 1999. The source of the colonists is probably the railway embankments some two kilometres away where the butterfly was discovered in 1993, though odd specimens had been seen before then, including one on the Bevill's Wood (Huntingdonshire) transect in 1991. It was presumed extinct in Huntingdonshire in 1976 where it was last seen that year in Monks Wood, but not on the transect. It was also recorded for the first time in 1999 at Woodwalton Farm (Huntingdonshire) (which is nearer to the railway) and at Potton Wood (Bedfordshire), Drayton (Warwickshire), and Ham Street Wood (Kent). Singletons in each case except Ham Street Wood where two were recorded.



The butterfly is increasing in numbers at quite a few sites in the scheme.

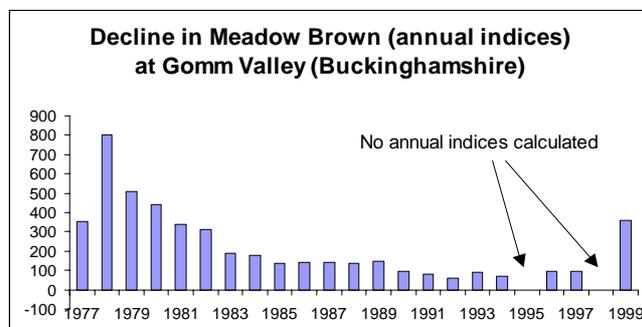
**Grayling:** a big increase (90%) in the collated index, though, as last year, comparisons could only be made for 14 sites. The species occurs almost annually at at least another eight sites.

**Hedge brown:** a 30% increase in the collated index after two successive declines with increases at a high proportion of sites.



At some sites, such as Gomm Valley (Buckinghamshire), there has been a steady increase in numbers over the years, but at a number of other sites the species has clearly declined.

**Meadow brown:** another fairly small increase in the collated index resulting in a fairly high index for this species.

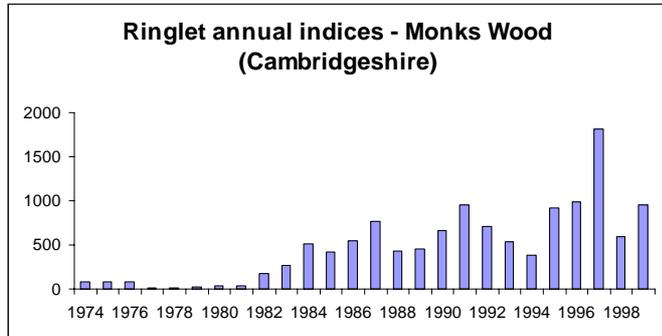


The increase in numbers of Hedge Brown and contrasting decrease in numbers of Meadow Brown recorded at Gomm Valley indicate that this chalk grassland site is becoming increasing scrubby.

**Small heath:** A small fall in the collated index and the *second lowest index* in the series. This species has declined significantly at many BMS sites.

**Large heath:** comparisons possible for only two of the six sites where this species is recorded regularly. There were increases at both sites: Thorne Moors in Lincolnshire and Whixall (C) in Shrophshire.

**Ringlet:** there was a 20% increase in the collated index to make this the *highest* of the series, but only very slightly higher than 1992. There were increases at two-thirds of the sites for which comparisons were possible.



## **PUBLICATIONS IN 1999/2000**

**Sparks T.H., Author: Hann J.P., Greatorex-Davies J.N.** (1999). The influence of field boundary structure on butterflies. In: *Field margins and buffer zones: ecology, management and policy*, edited by N.D. Boatman et al, Wellesbourne: Association of Applied Biologists. (Aspects of Applied Biology 54). p.235-240.

## **PUBLICATIONS DUE IN 1999/2000**

**Roy, D.B., Rothery, P., Moss, D., Pollard, E. & Thomas, J.E.** (in press, subject to revision) Butterfly numbers and weather: predicting historical trends in abundance and the future effects of climate change. *Journal of Animal Ecology*.

**Roy, D.B. & Sparks, T.H.** (in press) Phenology of British butterflies and climate change. *Global Change Biology*.

## **REFERENCES**

**Bailey, G.** (2000) Second generation of Heath Fritillary *Melitaea athalia* (Rott.) in South Essex. *Atropos*, **9**, 25-27).

**Diggle, P.J.** (1970) *Time series – a biostatistical introduction*. Clarendon Press, Oxford..

**Moss, D. & Pollard, E.** (1993). Calculation of collated indices of abundance of butterflies, based on monitored sites. *Ecological Entomology*, **18**, 77-83.

**Pollard, E., Moss, D. & Yates, T.J.** (1995). Population trends of common British butterflies at monitored sites. . *Journal of Applied Ecology*, **32**, 9-16.

**Skelton, M. J.** (1999). Successful overwintering by Clouded Yellow *Colias croceus* (Geoff.) in southern England. *Atropos*, **8**, 3-6.

## **ACKNOWLEDGEMENTS**

The Butterfly Monitoring Scheme is jointly funded by the Institute of Terrestrial Ecology and by the Joint Nature Conservation Committee acting on behalf of English Nature, Scottish Natural Heritage and the Countryside Council for Wales. This year the BMS has signed a six-year partnership agreement with JNCC. Previously contracts have been negotiated annually.

We particularly wish to express our gratitude to all the recorders and site managers who make the BMS possible through their enthusiasm and commitment to recording their transects as part of the scheme. We would especially like to thank Val Burton for all her willing hard work during the autumn months processing the incoming data and inputting it onto computer. We would also like to thank Tim Sparks and Peter Rothery for their statistical help and advice. The map showing the distribution of monitored sites was constructed using Alan Morton's DMAP programme. We also thank Ernie Pollard for his continued help and advice at various times throughout the year. Finally we would like to thank the Joint Reprographic Services Unit at the Natural Environment Research Council's headquarters in Swindon for producing this report for us again this year.

## APPENDIX I

**Figures 8a-e.** The graphs on the following pages show fluctuations in the national collated (all sites) index values for all species for which this figure is calculated. These collated indices are derived from the site annual indices (see footnote on page 8) using the method of Moss and Pollard (1993). For species for which two separate indices are produced, the second is shown here.

Graphs should be interpreted with caution for species which produce, or have produced, collated indices from relatively few sites, notably, Common Blue (northern, univoltine), Chalkhill Blue, White Admiral, Small Pearl-bordered Fritillary, Pearl-bordered Fritillary and Silver-washed Fritillary. The Brown Argus is now recorded on many transects and despite possible identification problems (especially confusion with brown Common Blue females), we consider that the collated index for this species has become increasingly reliable in recent years. All figures are of logged values and the same scale so that visual comparisons can be made.

In the cases of the Holly Blue and the Painted Lady, the fluctuations in the “all sites” indexes are somewhat greater than for other species. These are shown together on a separate figure (8e on page 35) so that they can be drawn at the same scale as the rest.

Please note that these figures are for information only and should not be quoted or used in any way without prior permission from ITE.