United Kingdom
Butterfly Monitoring Scheme

ANNUAL REPORT 2005

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THE UKBMS

Welcome to the first report of the United Kingdom Butterfly Monitoring Scheme (UKBMS). The UKBMS is a recently formed merger of the long-running Butterfly Monitoring Scheme (BMS) run by the Centre for Ecology and Hydrology (CEH) with Butterfly Conservation's (BC) co-ordination of 'independent' transects. The report replaces the former BMS report to recorders and is jointly produced by CEH and BC.

Changes in the abundance of butterflies throughout the United Kingdom have been monitored using transects since 1976. Over the past 30 years, recorders have made over 140,000 weekly visits to 1228 separate sites, walking almost 350,000 km and counting around 10.5 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.

The UKBMS is run as a partnership between the CEH, BC and the Joint Nature Conservation Committee (JNCC) with 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.

Butterfly monitoring is entering into a new and exciting phase in the United Kingdom. It is currently undergoing major re-development and expansion through the UKBMS project 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 Countryside Council for Wales (CCW), English Nature (EN), Environment & Heritage Service (EHS), Forestry Commission (FC), Scottish Executive, Environment and Rural Affairs (SEERAD), and Scottish Natural Heritage (SNH).

The UKBMS was officially launched on 15th May 2006, along with its website at www.ukbms.org, at a meeting at the Royal Society in London.

This year for the first time we are able to produce collated indices for 46 species (more than in any previous report) by using data from the extensive UKBMS dataset.

UKBMS aims

The primary aims of the UKBMS are:

- To assess and interpret changes in the abundance and status of UK butterflies.
- To assess the impact of local factors such as habitat change and management on butterfly populations.
- To provide novel information on almost all aspects of butterfly ecology.

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CONTACTS

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

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MEET THE TEAM

David Roy has been based at CEH Monks Wood 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.

Tom Brereton has worked for Butterfly Conservation (BC) since 1997 after completing his PhD on the ecology of the Grizzled Skipper (Pyrgus malvae). At BC he is head of monitoring. In recent years Tom has put a considerable amount of effort into analysing butterfly transect data with respect to benefits, or otherwise, to butterflies of agri-environment schemes. This work has been carried out under contract to Defra (and formerly MAFF)

Tom Wigglesworth has been working for Butterfly Conservation since 2001. He spent three years working on threatened species projects, in particular the Large Blue (Glaucopsyche arion), Heath Fritillary (Mellicta athalia) and Pearl-bordered Fritillary (Boloria euphrosyne), before taking on the role of Butterfly Monitoring Ecologist. He was be the overall co-ordinator of the UKBMS and the first point of contact for recorders and local transect co-ordinators, however since this report was drafted he has now left BC to take up a post elsewhere.

Nick Greatorex-Davies has been co-ordinator of the BMS based in the BRC since 1995 when he took over from Tina Yates. He has worked at Monks Wood as an entomologist since 1974 where he has specialised in moths and butterflies. His role in the future will be to develop the quality control and data validation side of butterfly monitoring.

Val Burton has been based in the BRC at Monks Wood since 1971. Her involvement with the BMS really began in 1990 when she took over the task of data entry each autumn. Her speed and accuracy in data entry has made her an invaluable part of the team.

Francis Rowland started work with CEH in 2000, and joined BRC in 2003. Although he has a background in Environmental Science, he works as a web developer, producing and managing several websites of key importance to BRC projects. Most recently, he was responsible for the production of the UKBMS website (http://www.ukbms.org/). Since the first draft of this report was written Francis has left CEH to take up a post elsewhere.

Katie Cruickshanks joined BC in April 2006 after completing a PhD in ecology at Southampton University. In her role as wider countryside field researcher, Katie is responsible for planning and developing the pilot studies for the wider countryside monitoring scheme. Over the next two years Katie will be conducting field surveys and coordinating volunteers to determine an appropriate design for the new scheme.

Peter Rothery has been based at CEH Monks Wood since 1995. He is a biometrician specializing in the application of statistical methods and mathematical models in ecology. He collaborates with David Roy on the analysis of the BMS data.

Since this report was first drafted Francis Rowland and Tom Wigglesworth have left CEH and BC respectively to take up posts elsewhere. Obviously this is a blow to the rest of the team but we wish them both well for the future. In due course others will take over their roles.

SUMMARY OF THE 2005 SEASON

Summary of weather on 2004/2005
In the following summary of the weather for 2005 we have tried to pick out features most likely to have influence butterfly numbers (e.g. focusing on weather variables in particular months or periods), which are likely to be of greatest importance for butterflies and which may help in the interpretation of the butterfly results for 2005. This information was summarised from the weather statistics supplied on the Met. Office web site where more detail can be found: http://www.met-office.gov.uk/climate/uk/2005/index.html.

Rainfall: The November 2004 to March 2005 rainfall was the driest for England and Wales since the winter of 1975/76. Rainfall for the rest of the year remained below average in England and Wales for all months except April and October. Scotland and Northern Ireland had high rainfall in May, and was also above average for Scotland in June and August.

Sunshine: May was a sunny month throughout the UK, as were August and September, (except Northern Ireland). June and July were mostly average months for sunshine but June was particularly poor in Scotland and Northern Ireland, in fact for Northern Ireland all months from June to October had below average sunshine. March also had poor sunshine values.

Temperature: Temperatures were well above average for the whole of the UK from January to October, with the sole exception of Scotland in May where the mean temperature was slightly below average. Despite being sunny across the UK May and August were relatively cooler months although still above average.

In summary; it was a dry year overall with some sunny months during the butterfly season, though the important months of June and July had only average sunshine and was low for Scotland in June and for Northern Ireland from June to October. It was a very warm year overall with temperatures for all months up to and including October being well above average.

An above average year for butterflies
2005 was overall an above average year for butterflies. It ranked 11th out of the 30 years of monitoring (1976-2005) (Figure 1), and was on a par with the previous two years which ranked 10th and 12th respectively. Butterflies produced a very mixed response with no group of species showing a particularly negative or positive result. Had the months of June and July also had above average sunshine we would have expected a much greater response from butterflies in terms of numbers of summer flying species.

Similar numbers of increases and decreases
Collated indices were produced for 46 species. Similar numbers of species showed increases as decreases. Twenty-three species showed an increase, though most were small, and 21 showed a decrease, again most were small changes. One species showed no change. The figures indicating these changes are given in Appendix II.

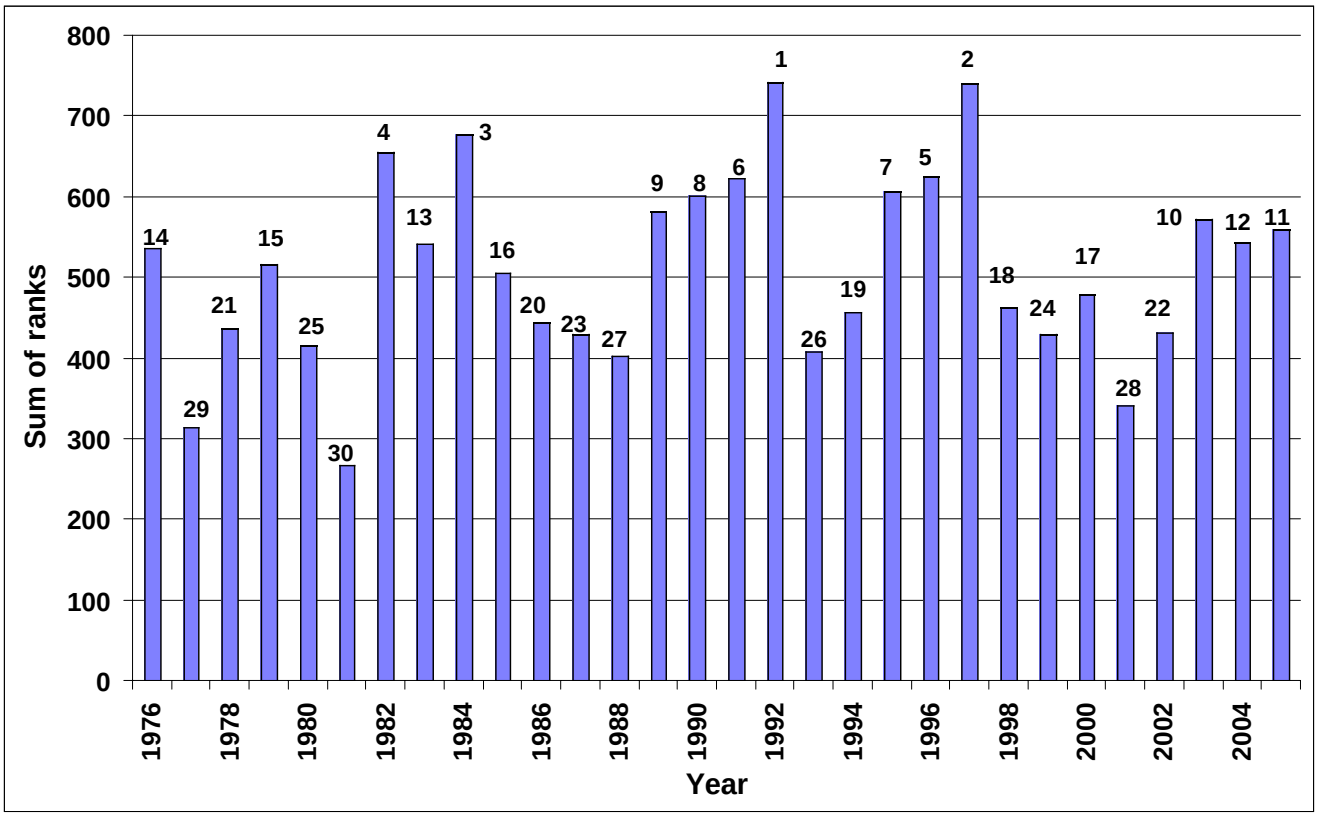


Figure 1. Histogram showing the sum of the ranks of 33 species for the period 1976-2005. This gives a measure of how good or bad each year was for butterflies in general relative to other years in the series.

Changes in individual species: no highest or lowest indices

For the second year running, no species produced its highest or lowest index of the series. However the **Adonis Blue** *(Polyommatus bellargus)* has done consistently well in recent years and produced its second highest index of the series in 2005, however this was a combined index for both generations. Looking at just the sites where separate indices for each brood were available, both generations did well (both ranking 4th). Another species of chalk downland, the **Silver-spotted Skipper**, also had another good year, ranking 4th highest in the series. This species continues to colonise new sites and to increase in abundance on chalk downland in the south east of England (see section on **Silver-spotted Skipper** in this report, the **Small Blue** *(Cupido minimus)* and the **Large Heath** *(Coenonympha tullia)* also produced high indices (3rd highest in both cases). At the other end of the spectrum the **Small Tortoiseshell** *(Aglais urticae)* had a particularly poor year falling 50% from an about average year in 2004 to its 2nd lowest index of the series.

The Adonis Blue at Lydden temple Ewell in Kent. This species has been doing comparatively well at many sites in recent years.

Mixed fortunes for migrants

It was a good year for the **Red Admiral** *(Vanessa atalanta)* with a high collated index (8th highest) indicating that numbers were more than double those of 2004. The **Painted Lady** *(Cynthia cardui)*, on the other hand, had a below average year with numbers dropping by nearly 75% from the relatively high index of 2004. The **Clouded Yellow** *(Coleus croceus)* showed a small drop and the index was the lowest since 2001 but remained well above average (9th highest). Numbers have been relatively high for the past four years, but are dwarfed by the large influx of **Clouded Yellows** in 2000 (Figure 2), which itself was only equalled (nearly) in 1983. Relatively high counts for the majority of years since 1992 indicate increased numbers of migrants arriving in Britain compared with the earlier years of the scheme. These higher counts correspond to the generally warmer temperatures since 1989 and may be a direct response to this with larger numbers of migrants arriving to our shores as a result. Further evidence that the **Clouded Yellow** is responding to climate change is that it has been reported overwintering successfully (as larvae) for several years on the coast near Bournemouth on the south coast (Skelton 2001, 2003), but it is unlikely that adults resulting from these would have a significant impact on numbers seen in the UK. Evidence is mounting that similar overwintering may be occurring in other parts of southern England, but as yet no larvae have been reported from other sites (Richard Fox *pers. comm.*).

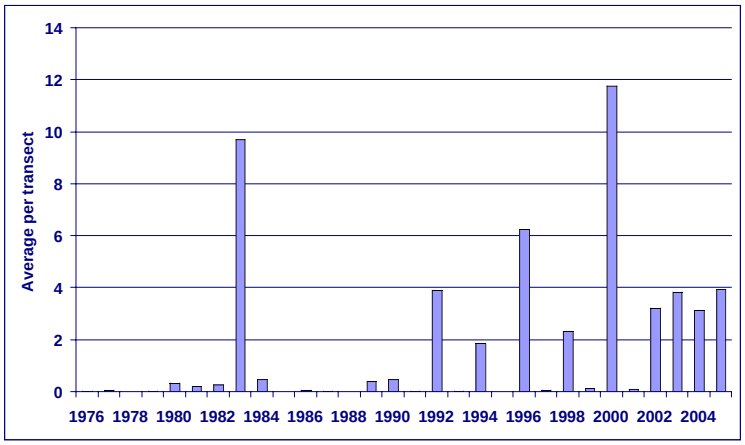
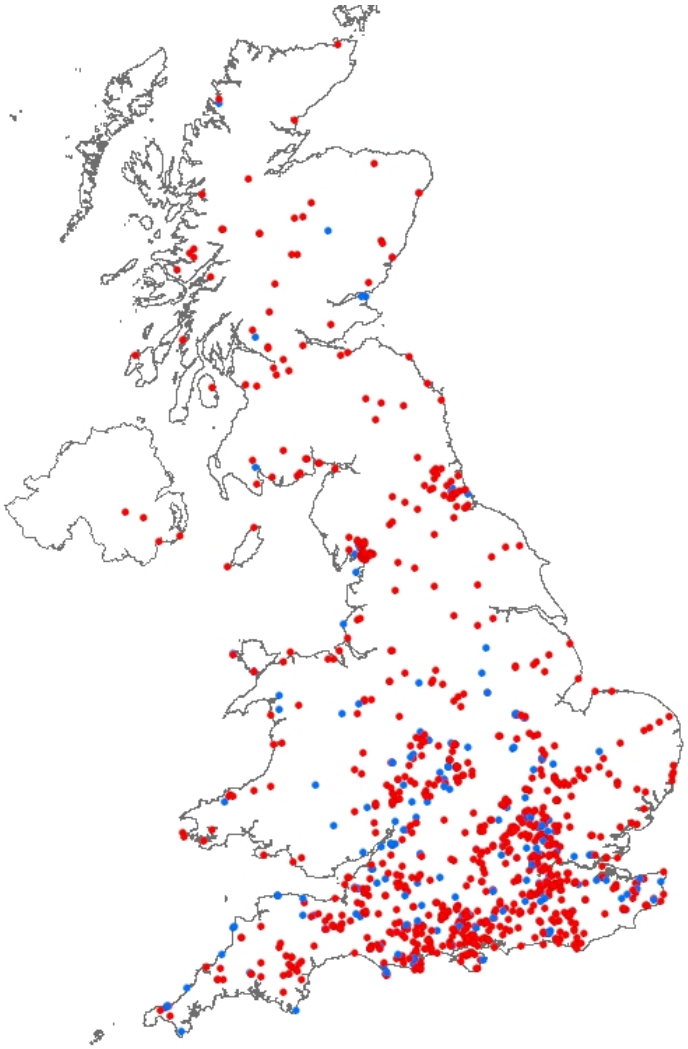


Figure 2. Clouded Yellow average count per UKBMS transect 1976-2005.

A mixed year for some garden species

According to the summer Butterfly Report in British Wildlife (Vol. 17 No. 1, October 2005), butterflies were scarce in gardens except for **Large White** (Pieris *brassicae)* **Small White** *(Pieris rapae)* and **Holly Blue** *(Celastrina argiolus)*. However it was noted in the same article that butterflies were not so scarce in semi-natural habitats. Butterfly monitoring data indicate that many of the species found commonly in gardens did fare well in semi-natural habitats monitored by transects. The **Large White** had a good second generation (ranking 8th in the series). The **Brimstone** *(Gonepteryx rhamni)* also did well particularly in the summer. Both **Small** and **Green-veined Whites** *(Pieris napi)* were below average, but **Peacock** *(Inachis io)* numbers were slightly above average and certainly not scarce. On the other hand, as already mentioned, the **Small Tortoiseshell** had a very poor year and were generally very scarce. Second generation **Holly Blue** may have been plentiful In gardens, but on BMS transects the second generation showed a sharp drop from 2004 whereas the spring generation had showed an increase. It seems likely that the decline will continue in 2006 for this species whose dramatic cyclic fluctuations are thought to be largely driven by its host-specific hymenopteran parasite *Listrodromus nycthemerus*. However over the last four or five years the collated indices have not produced a continuation of the cyclic pattern that has been apparent in the past. We can offer no explanation for this at present

Small Tortoiseshell at Monks Wood in Cambridgeshire. This species had a very poor season generally in 2005.



Map 1. Showing approximate location of all transects that have produced indices, blue dots are those transects which did not produce indices in the 2001-2005 period.

Background to index calculations and integrating CEH and BC datasets

This year for the first time data are included from many of the transects which are co-ordinated through Butterfly Conservation's local branch network (over 1000 transects in total). These data have been included for all years for which they are available. Comparison with graphs of the log collated indices in this report (Appendix I) with those in previous years annual reports show a considerable degree of correspondence in the fluctuations for most species despite the inclusion of so much additional data. This is very encouraging and is a measure of how robust the indices are. This is particularly apparent for the more common species. The reliability of the indices is also illustrated in Figure 3, which shows for 2005 the rank order (out of 30 years, 30 = best year, 1 = worst year), of the collated indices for species for which a collated index was calculated under the old BMS (plus the **Silver-spotted Skipper** *(Hesperia comma))* compared with those for all UKBMS sites. Only species with a single index are included.

However because of the inclusion of so much extra data there are inevitably changes in the degree of increases and declines of species in previous years compared to what was reported in previous reports and also in the rank order (best versus worst years) for individual species and for all species combined.

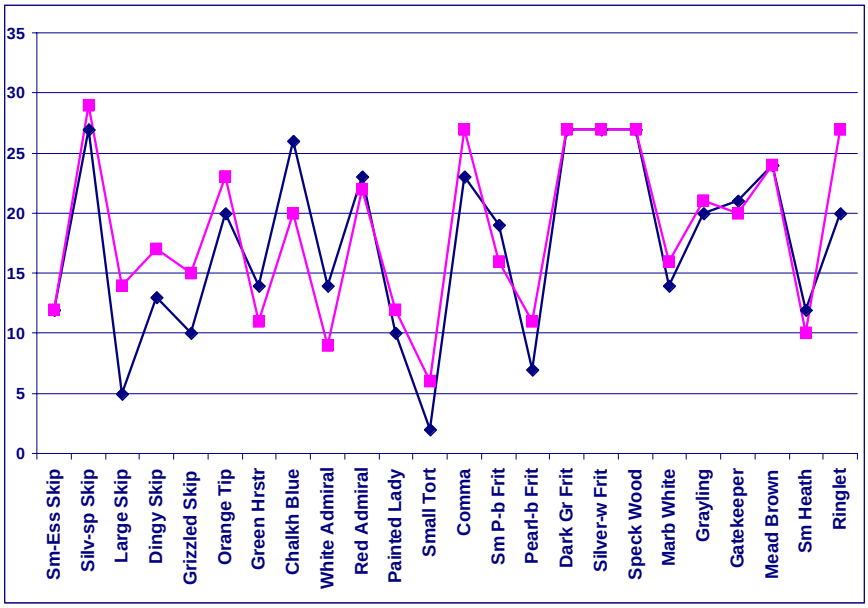


Figure 3. Rank orders 2005: all UKBMS transects (blue) and 'old' BMS transects (pink).

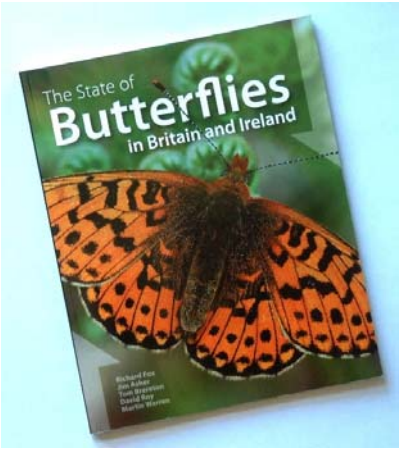
This year we have not produced separate indices for double-brooded species or for those which have a spring and summer flight for all the UKBMS sites, as these are not readily available for many of the additional transects, but we expect to provide separate indices for these species in future years. Instead we have produced a combined single index for all sites. Correspondence with graphs in previous reports is, not surprisingly, less apparent with these species. However we have produced first and second brood (and spring and summer/autumn flight) indices for the relevant species for sites where these figures were available so that comparisons between broods can be made. These have not been included in this report.

Species for which we have not produced collated indices include canopy species where records tend to be too few to provide reliable indices, even though in the case of the **Purple Emperor** *(Apatura iris)* and the **Brown** and **White-letter Hairstreaks** *(Thecla betulae* and *Satyrium w-album)* they are recorded at a reasonable number of sites. However the **Purple Hairstreak** *(Neozephrus quercus)* has been included as it is recorded on many transects. Several other species are recorded at too few sites for a meaningful index to be calculated, these are **Chequered Skipper** *(Carterocephalus palaemon)*, **Lulworth Skipper** *(Thymelicus acteon)*, **Mountain Ringlet** *(Erebia epiphron)* and **Glanville Fritillary** *(Melitaea cinxia)*. Also there are no collated indices given for the rare migrants such as the **Bath White** *(Pontia daplidice)*, Queen of **Spain Fritillary** (*Issoria lathonia)* and **Camberwell Beauty** *(Nymphalis antiopa)* among others, as they are only very rarely recorded on transects.

Photo © Tom Brereton

Heath Fritillary, one of three additional species for which trends have been calculated by using new UKBMS data.

OFFICIAL LAUNCH OF THE UKBMS.



Launch of UKBMS and SOBBI

May 15th 2006 saw the official launch of the BC and CEH transect monitoring schemes, the UKBMS (http://www.ukbms.org/), together with the launch of the book The State of Butterflies in Britain and Ireland (SOBBI) (the book is a update to the millennium butterfly atlas but includes trends for most species from transect data: http://www.naturebureau.co.uk/shop/books/StateofButterflies.html).

The scheme was officially launched by the new Biodiversity Minister, Barry Gardiner who made some welcome comments on the great work that butterfly recorders do and on the valuable role butterflies can play as biodiversity indicators. The story was covered in the Times, Independent, Guardian and widely in regional newspapers and on radio stations.

The UKBMS launch attendees included BC trustees and transect co-ordinators, Defra policy staff and the media as well as BC and CEH staff directly involved with the UKBMS.

Launch of UKBMS website

A new website for the UKBMS was also launched on 15th May. This can be found at www.ukbms.org. The old BMS website is no longer available, but all relevant material has been transferred to the new website. Data for all the transects that have been co-ordinated by BC branches will also be made available on the website in due course.

Photo © Butterfly Conservation

Authors of the new butterfly atlas, the State of Butterflies of Britain and Ireland, with the Biodiversity Minister at the launch of the book and of the UKMBMS on May 15th 2006 at the Royal Society in London.

From left to right. Tom Brereton (BC), Richard Fox (BC), Brian Gardiner MP, Jim Asher (BC), David Roy (CEH) and Martin Warren (BC).

NEW VERSION OF TRANSECT WALKER

We are pleased to announce that a new version of this transect recording software has now been released. Transect Walker 2 can be downloaded from the UKBMS website (www.ukbms.org/resources). The download package also includes a new suite of guidance notes and recording forms. A limited number of CDs are being produced, and copies will be sent to all local transect co-ordinators in due course. For those recorders without internet access wishing to obtain the software, a CD can be requested from BC (see contacts page for details).

Enhancements in the new version include:

- Error checking during initial translation process.
- Facility to add extra species (including other insects), weeks, and more than one walk in a week.
- More sophisticated method of estimating values for missed weeks.
- Generating indices from sparser data.
- Rapid data transfer via a Save and Package to email facility.

Note of caution

The structure of Transect Walker 2 data files is significantly different to those created by Transect Walker 1.3, and as a result you cannot read or edit files created in one version using the other. The new version has a 'Translator' program to convert files from the old format to the new (but not the other way round). However, the translator program is very good at finding errors in the data, such as incorrect dates or missing recorder names. You have to correct these before you can proceed, so it is recommended that the conversion is done by whoever holds the original paper records, with the data to hand.

Photo © Nick Greatorex-Davies

The Common Blue is still considered a common and widespread butterfly, but there is evidence that it has declined at the local scale. Wider countryside monitoring will help us to understand how this and other common species are faring more generally.

THE ORIGIN AND GROWTH OF BUTTERFLY MONITORING IN THE UK AND BEYOND.

Beginnings…

The first attempt to use transect counts to monitor butterflies was by Norman Moore as early as 1963 at Monks Wood Experimental Station in Cambridgeshire (now CEH Monks Wood) (Moore 1975). The method was further developed by Dr Ernie Pollard and others, also at Monks Wood, during the mid 1970s (Pollard *et al.* 1975, Pollard 1977) and after three years of trials a national scheme for monitoring butterflies was launched in 1976. This was called the Butterfly Monitoring Scheme (BMS) with butterflies being monitored by a simple and repeatable recording methodology, following strict standardised criteria for recording so that results could be compared year on year and across sites (see Pollard *et al.* 1975, Pollard & Yates 1993). A synopsis of the first 15 years of the scheme was published as a book in 1993 (Pollard & Yates 1993). The scheme began with 35 transects and by 1993 there were nearly 110 transects contributing data to the scheme. This increased further to nearly 140 by 2005.

The stimulus for trialling and subsequently launching the BMS was an increasing awareness that many of our native butterflies were declining, some dramatically. Most of these declines could be directly attributed to loss of suitable habitat due to changes in woodland management, particularly the loss of coppicing, and to agricultural intensification which had taken place since the Second World War. It was clear that there was a need to provide objective information on changes in the abundance of individual butterfly species to help gain information on the nature of these declines and to inform conservation priorities at local, regional and national levels.

The extent of the declines of many of our butterfly species was highlighted by the publication of the first butterfly atlas (Heath *et al.* 1984). Eighteen species were identified as having experienced major contractions in range; many others were known to have declined within their range. Only a few species were increasing in their range and/or abundance.

Butterflies that showed the greatest declines were species that were confined to areas of semi-natural habitat and often to small patches within those areas. Many of them have relatively poor powers of dispersal. Pollard and Yates (1993) referred to these butterflies as 'island' (as opposed to 'matrix') butterflies, but these are now more generally referred to as 'habitat specialists' as opposed to 'wider countryside species' or 'generalists' (Asher *et al.* 2001). These species have become increasingly confined to diminishing islands of semi-natural habitat in a 'sea' of intensively managed farmland or otherwise unsuitably managed land. Reduction in area and increasing isolation of suitable habitat, with often a reduction in the size of remaining butterfly colonies, has meant that these colonies have become increasingly vulnerable to extinction, with opportunities for natural recolonisations becoming increasingly rare as

Ernie Pollard walking a transect in Bevill's Wood in the mid 1970s.

was part funded by the then Nature Conservancy Council whose main interest was in the status of rarer species. Also NCC staff could be most readily recruited as recorders. Consequently most BMS transects were set up on protected sites, such as nature reserves, with semi-natural habitats (biotopes). Setting up butterfly transects on many of these sites has enabled changes in populations at individual sites to be monitored and, by collating the results across sites, to see how species are faring more generally.

BMS aims

The original main aim of the BMS was to provide objective information on changes in the abundance of butterflies and to detect trends in abundance that might indicate a change in status (also distribution, e.g. range changes). A second aim was to help assess changes in abundance of butterflies at site or local level that might be due to habitat change such as that directly attributable to management, with the data being used to inform site management.

Information gained from BMS was fed back to NCC through annual reporting to inform the NCC at local and national level so that appropriate responses could be made in terms of management policy on nature reserves. Today that information is also fed back to relevant government departments (e.g. Defra) through the JNCC so that appropriate policy responses can be developed and implemented.

Much valuable information gained

The data obtained from the BMS and many additional transects (see below) has proved to be extremely valuable. It has provided a standardised annual measure of the changing status of butterfly species, which can be used to generate short-term trends; something that cannot be derived from distribution recording. These data have played a key role in many of the advances in knowledge of butterfly ecology in the UK over the past three decades (Pollard and Yates, 1993). Through the data, scientists have greatly improved our understanding of the dependence of butterfly populations on climate (e.g. Pollard 1988, Pollard and Yates 1993, Roy *et al.* 2001). Not only has this paved the way for assessments of the impact of global warming on our biodiversity, but

has greatly helped our understanding of how landscape, land-use and habitat changes affect butterflies. To date in excess of 100 scientific publications have been produced using butterfly monitoring data.

The over-riding influence of the weather can be allowed for in the analysis of transect data, thus enabling other influences on particular butterfly populations to be detected. For example, site managers can assess the impact of small-scale habitat management and policy makers can monitor the effectiveness of national-scale agri-environment schemes (Brereton *et al*. 2005)

The need for wider countryside monitoring first recognised

Because of the strong bias of transects towards semi-natural habitats, the national population trends generated by the BMS may not have been representative of the landscape as a whole. In the early to late 1990s proposals were put forward to the Department of the Environment (as it was then) for a pilot project to monitor butterflies in the wider countryside (i.e. on sites with no conservation status) to try and address the issue of understanding what is happening to many of our commoner butterflies on farmland. At that stage these proposals failed to attract the necessary funding.

Growth of the BMS and 'independent' transects

The BMS grew steadily from the outset but was initially limited in growth by the number of new transects being set up. By 1990 there were almost 100 transects contributing to the scheme. From early 1990's many new transects began to be set up, but due to a lack of resources only a limited number of these could be taken into the BMS. Many (but by no means all) of the new 'independent' transects were operated by members of Butterfly Conservation (BC). Most were concentrated in the south of England on areas of semi-natural habitat, and increasingly local co-ordination of results was undertaken by pioneering Branches of Butterfly Conservation. By 2003, over 500 'independent' transects were being recorded by more than 1000 recorders, with 80 new ones established in that year alone (Brereton *et al*. 2006). Figure 4 shows the number of transects known to be in existence in each year from 1976-2004. Table 1 shows the number of transects known to be operating in each UK country during different time periods.

Some BC branches built up a large local network of butterfly transects, most of which were independent of the BMS. Some of the BC branches produced their own annual reports summarising the results from their local group of transects. However national collation and analysis of all these independent transects only commenced in 1998 when BC secured a contract with the then Ministry of Agriculture Fisheries and Food (MAFF) (see below).

The path to a unified scheme

As early as April 1997 discussions began between BC, CEH and JNCC to look at ways of expanding the BMS and how the additional data from the many 'independent' transects could be included.

In 1999 BC secured a contract from MAFF to investigate the impacts of agri-environment schemes on grassland butterflies. This enabled BC to collate and analyse data from a large number of independent transects. Building on their Branch network and on the local schemes already in operation, this funding also enabled BC to develop a network of BC Branch transect co-ordinators for the whole of the United Kingdom.

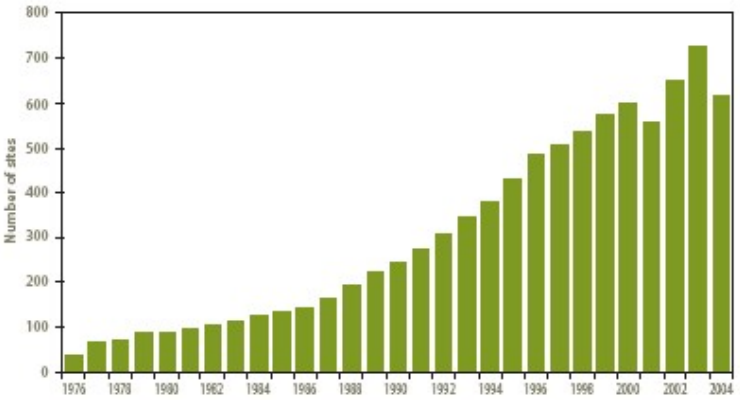


Figure 4. Growth in numbers of transects walked from 1976 to 2004.

Period	England	Wales	Scotland	Northern Ireland	Total
1976-79	63	11	11	1	86
1980-89	202	12	14	1	229
1990-99	606	15	23	3	647
2000-04	805	20	55	4	884
Total	917	29	62	4	1012

Table 1. Number of UKBMS transects per decade for each country.

Many new transects have been instigated as a result including in parts of the UK where there were previously few or no transects. The project has also led to the development of new analysis techniques and recording software.

Although most transects co-ordinated by Butterfly Conservation were started relatively recently and do not have the benefit of long time-series of data, the large number of monitored sites has enabled the calculation for the first time of reliable collated indices for rare and threatened species (of greatest concern to conservationists).

It soon became clear that there were now two largely separate butterfly monitoring schemes, one run by CEH and one run by BC, but that it was desirable to bring the two together so that the strengths and resources of the

two organisations could be used in the best and most efficient way. There would also be obvious benefits from having one larger combined dataset. The main benefits from a combined dataset would be collated indices for a wider selection of rare species, and robust collated indices at a regional and biotope level for a wide range of species. In addition it was felt that there was real virtue in using butterflies as biodiversity indicators (representative of insects more generally, sensitive to habitat and climate change, complementary to birds etc.) and that we should seek to press government for the adoption of butterflies as biodiversity indicators (see section in this report on butterflies as biodiversity indicators).

At least annual meetings between JNCC, BC and CEH were held to seek for ways in which the organisations could work together in partnership with respect to butterfly monitoring, culminating in the signing of a partnership agreement in 2004. However, although the intent to work together in a full partnership was there, it was clear that funding would need to be secured before any major progress could be made.

Finally in late 2004 a contract was secured from a consortium of organisations, led by Defra (successor to the Department of the Environment and the Ministry of Agriculture, Fisheries and Food), for BC and CEH to work together on butterfly monitoring. There are three main objectives to the project. The first of these is to combine the two schemes. The second is to address the issue of wider countryside monitoring as mentioned earlier in this section. A third aim of the project is to investigate the use of butterflies as Biodiversity Indicators. The plan for this work is outlined in last years BMS report and is on the UKBMS website. Progress on the work is outlined in the section 'UKBMS project and progress'.

The value of transect monitoring is being increasingly recognised as playing a key role, along with distribution data, in assessing and informing conservation priorities particularly with regards to the UKBAP process.

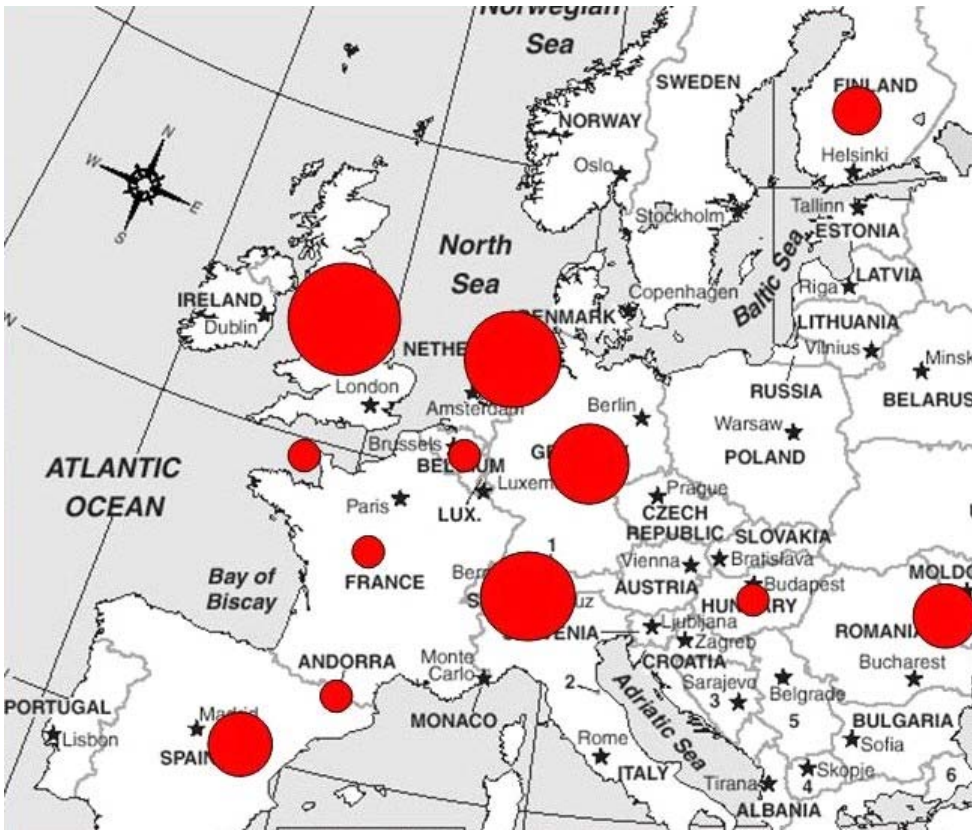
Butterfly monitoring overseas

The success of butterfly monitoring in the UK has not gone unnoticed by the rest of the world, particularly Europe. The first scheme to be set up in another country was the in Netherlands in 1990, the Dutch Butterfly Monitoring Scheme (De Vlinderstichting). This is based on similar methodology to the UKBMS, though there are significant differences. The scheme has been hugely successful and currently operates in excess of 450 transects. Since the Netherlands scheme was launched a further 10 European countries are now also operating butterfly monitoring schemes. These are in Catalonia (NE Spain), Spain, Finland, Belgium, Germany, Jersey (Channel Isles), France, Switzerland, Estonia and the Ukraine.

Butterfly transects are not restricted to Europe, but are being carried out in other parts of the world too such as USA (mid-west), Japan and Western Australia.

Towards European Butterfly Biodiversity Indicators

In November 2004 European Butterfly Conservation was founded following an initiative headed by BC and the Dutch BMS (http://www.bc-europe.org). One of the objectives of this organisation is to develop butterfly monitoring across Europe and it has put forward proposals to the European Commission for butterflies to be adopted as Biodiversity Indicators.



Map 2. European countries currently operating butterfly monitoring schemes. The size of the red spot indicates the relative size of the schemes.

THE UKBMS PROJECT

In January 2005 Butterfly Conservation (BC) and the Centre for Ecology and Hydrology (CEH) started a 3¼-year research and development project, the UK Butterfly Monitoring Scheme (UKBMS), to develop substantially butterfly monitoring in the UK. The UKBMS project is funded by a consortium of governmental, nature conservation and land management bodies lead by Defra. The scope of the new project represents the single most important development in monitoring butterfly abundance in the UK since the establishment of the Butterfly Monitoring Scheme 30 years ago. The UKBMS project has two key elements. Firstly to develop an integrated UK-wide Butterfly Monitoring Scheme by merging and developing CEH/BC transect monitoring datasets and extending more effective, targeted coverage across the UK and secondly to develop a suitable method of monitoring butterflies in the wider countryside, where current recording and monitoring schemes are less than effective. The integrated scheme will enable far better national indices and trends to be calculated for habitat specialist species occurring in semi-natural habitats, whilst a new wider countryside method will enable the future status of common and widespread species to be assessed accurately at a national scale.

Integration and expansion of the existing network of butterfly transects

Transect data collated by the Butterfly Monitoring Scheme (BMS) and from other 'independent' sites collated by Butterfly Conservation have been combined into a single UKBMS database. In total, the combined database contains over 2.6 million records of butterfly abundance, covering all years since 1973 (the methodology was piloted during 1973-1975, before the formal launch of transect monitoring in 1976). This body of data represents over 140,000 weekly visits made by recorders to 1228 separate sites, walking almost 350,000 km and counting around 10.5 million butterflies! Plans are being developed to maintain and expand this network to comprehensively assess trends in our butterfly populations.

With the potential development of a new scheme to monitor common species and widespread habitats, butterfly transect monitoring will increasingly focus on specialist sites and habitats, especially those of relevance to the UK Biodiversity Action Plan (BAP) process. However, transects with long data runs, which monitor common/widespread species and habitats will also be of considerable importance for conservation (e.g. to assess climate change impacts).

Key sites can be defined as those which have one or more of the following attributes:

- Monitor one or more BAP (including Priority, SCC (Species of Conservation Concern), and BC candidate BAP/local high priority) species.
- Monitor BAP habitats, SSSIs, Higher level Environmental Stewardship (including CSS and ESA) agri-environment scheme agreement, or other important semi-natural habitats (e.g. ancient woodlands).
- Have long data runs (>10 years).
- Are located in areas with very low transect coverage (grossly under-sampled regions).

BAP Priority	**Proposed BAP Priority Species**
Adonis Blue *(Polyommatus bellargus)*	Brown Hairstreak *(Thecla betulae)*
Chequered Skipper *(Carterocephalus palaemon)*	Dingy Skipper *(Erynnis tages)*
Heath Fritillary *(Mellicta athalia)*	Duke of Burgundy *(Hamearis lucina)*
High Brown Fritillary *(Argynnis adippe)*	Glanville Fritillary *(Melitaea cinxia)*
Large Blue *(Glaucopsyche arion)*	Grayling *(Hipparchia semele)*
Marsh Fritillary *(Euphydryas aurinia)*	Grizzled Skipper *(Pyrgus malvae)*
Northern Brown Argus *(Plebeius artaxerxes)*	Large Heath *(Coenonympha tullia)*
Pearl-bordered Fritillary *(Boloria euphrosyne)*	Lulworth Skipper *(Thymelicus acteon)*
Silver-spotted Skipper *(Hesperia comma)*	Mountain Ringlet *(Erebia epiphron)*
Silver-studded Blue *(Plebeius argus)*	Small Blue *(Cupido minimus)*
BAP SCC	Small Heath *(Coenonympha pamphilus)*
Black Hairstreak *(Satyrium pruni)*	Small Pearl-bordered Fritillary *(Boloria selene)*
Chalkhill Blue *(Polyommatus coridon)*	Wall Brown *(Lasiommata megera)*
Purple Emperor *(Apatura iris)*	White Admiral *(Limenitis camilla)*
Silver-washed Fritillary *(Argynnis paphia)*	White-letter Hairstreak *(Satyrium w-album)*
Swallowtail *(Papilio machaon)*	Wood White *(Leptidea sinapis)*

Table 2. target butterfly species.

Photo © Nick Greatorex-Davies

The widespread and once common Small Heath has shown a 29% decline at monitored sites. It seems likely that this species will have experienced an even greater decline away from protected sites.

Photo © Nick Greatorex-Davies

The Wall Brown, formerly a common countryside butterfly, has declined in abundance by >40% over the past 10 years and has virtually disappeared from a large part of central southern England.

Ancient and/or species-rich hedgerows	Lowland raised bog
Aquifer fed naturally fluctuating water bodies	Lowland wood-pasture and parkland
Blanket bog	Machair
Coastal and floodplain grazing marsh	Maritime cliff and slopes
Coastal saltmarsh	Native pine woodlands
Coastal sand dunes	Purple moor grass and rush pastures
Coastal vegetated shingle	Reedbeds
Fens	Upland calcareous grassland
Limestone pavements	Upland hay meadows
Lowland beech and yew woodland	Upland heathland
Lowland calcareous grassland	Upland mixed ashwoods
Lowland dry acid grassland	Upland oakwood
Lowland heathland	Wet woodland
Lowland meadows	

Table 3. Target habitats (Priority habitats of importance to BAP & other habitat specialist butterflies).

Other important habitat for habitat specialist butterflies

- Brownfield sites.
- Bracken-dominated grassland in Wales, NW England and SW England.

Other target sites

- Sites entered into agri-environment schemes, especially Higher Level Environmental Stewardship in England.
- Statutory Protected Sites SSSIs, excluding aquatic, intertidal and marine Geological SSSIs.

With these criteria in mind, the current transect network has been assessed in relation to the distribution of species (from the Butterflies for the New Millennium atlas data). Priorities for new species transects in region of the UK have been developed and are detailed in a regional development plan which can be downloaded from http://www.ukbms.org/Downloads/TransectDevelopmentPlan.pdf.

Development of a new monitoring scheme for common species in the wider countryside

A major objective of the UKBMS is the development of a new monitoring scheme to more effectively monitor common and widespread species in the general countryside. This is likely to involve a random sampling approach to ensure that the results are representative of the UK landscape as a whole.

Why do we need a new scheme?

The UKBMS transect scheme, while providing invaluable information on population trends for nearly all UK butterfly species, is biased towards sites of high conservation value. Although this provides a representative sample of sites for most 'specialist' butterflies (low mobility species restricted to semi-natural habitats), there are concerns over whether transects adequately reflect the population trends in 'generalist' or 'wider countryside' species, which occur in a wider range of habitats over the UK landscape such as ordinary farmland, moorland and urban green space. A further concern is that the transect method is very labour intensive for ordinary countryside habitats where relatively few butterflies are seen.

Photo © Tom Brereton

The Small Copper is one of a number of wider countryside species in decline.

A less labour intensive but scientifically robust new monitoring method is required to more effectively monitor common and widespread butterflies in the general countryside.

Declines in many wider countryside species have been detected by the UKBMS transect scheme (e.g. **Small Copper** *(Lycaena phlaeas)* 41% decline in abundance over last 10 years, **Small Heath** *(Coenonympha pamphilus)* 29% decline over same period). It is possible that these species are faring even worse in the wider countryside where pressures such as agricultural intensification and loss of habitat are often greater. At the same time new agri-environment schemes, such as Environmental Stewardship launched in England last year, aim to achieve environmental benefits over a large proportion of the farmed countryside and could improve conditions for wider countryside species. A new scheme is necessary to address these and other questions.

Photo © Tom Brereton

The wider countryside is currently poorly represented by transects, the new scheme is designed to address this issue.

Design of the new scheme

Since wider countryside butterflies are found in a variety of habitats, we are testing a random-sampling approach in 1km squares, with between 2 and 4 visits to a site in each year. In doing so we will avoid targeted surveys of specialist habitats that are already well covered by the transect network.

This project is in its pilot stage and key issues will be addressed during 2006 and 2007. We are particularly interested in whether the proposed design is practical and scientifically robust, and what potential there is for volunteer participation in this new scheme. It is hoped that the scheme will be fully rolled out in 2008.

How you can help

You can help us develop this important new monitoring scheme by field-testing the survey method. For more information please contact our field researcher:

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BUTTERFLIES AS BIODIVERSITY INDICATORS

Even in Britain, which has probably the best-studied insect fauna, the assessment of priority and implementation of conservation action are often hampered by insufficient data. Because of this problem, ecologists have sought species or groups of species that can be used as indicators for overall species richness, for assessing habitat quality and for measuring the consequences of environmental change. Butterflies are increasingly being recognised as valuable environmental indicators, both for their rapid and sensitive responses to subtle habitat or climatic changes and as representatives for the diversity and responses of other wildlife (Oostermeijer and van Swaay 1998, Parmesan 2003, Thomas 2005).

One of the principal objectives of the UKBMS project is to investigate and develop the role of butterflies as indicators of the state of biodiversity in the UK.

What makes butterflies good indicators?

Butterflies have short life cycles and thus react quickly to environmental changes. Their limited dispersal ability, larval foodplant specialisation and close-reliance on the weather and climate make many butterfly species sensitive to fine-scale changes. Recent research (Thomas 2005) has shown that butterflies have declined more rapidly than birds and plants emphasising their potential role as indicators.

Butterflies occur in all main terrestrial habitat types in the UK (except for dead wood), so they have the potential to act as indicators for a wide range of species and habitats (Ehrlich 1994, Thomas 2005). Unlike most other groups of insects, butterflies are well-documented, their taxonomy is understood and they are easy to recognise.

Because insects make up the largest proportion of terrestrial wildlife (more than 50% of species), insect monitoring data is vital if we are to monitor the overall state of biodiversity. Being typical insects, the responses seen in butterflies are more likely to reflect changes amongst other insect groups, and thus the majority of biodiversity, than established indicators such as those based on birds (Conrad et al. in press, Hickling et al. 2006, Thomas and Clarke 2004, Thomas et al. 2004).

Progress with indicator development

The goal of the UKBMS is to produce Governmental butterfly biodiversity indicators for all of the UK countries and for the UK as a whole. Initial work has focussed on England, as the dataset is more extensive. The candidate indicators listed below have been developed to help the Government measure progress against targets within the England Biodiversity Strategy (EBS). These are:

1. Populations of butterflies in England – see Figure 5 below *(Headline indicator)*
2. Populations of butterflies on farmland in England *(Agriculture policy workstream indicator)*
3. Populations of butterflies in English woodland *(Woodland policy workstream indicator)*

It is hoped these candidate indicators will be adopted by Defra in time for inclusion in the next EBS assessment of progress report due late 2006.

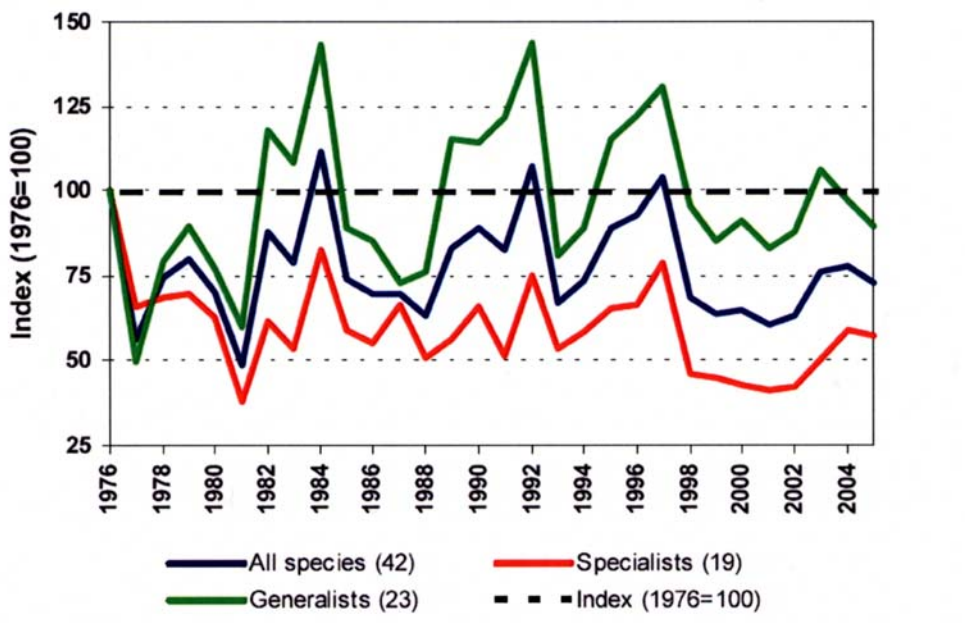


Figure 5. Headlies Indicator: Populations of butterflies in England 1976-2005 (Number of species in indicator shown in brackets).

This indicator is a composite index that includes 42 of the 54 native resident English butterfly species, the remainder being excluded as insufficient monitoring data are available. The indicator includes a breakdown for 19 specialist (low mobility species restricted to semi-natural habitats) and 23 generalist (mobile species that occur in a wide range of habitats in the wider countryside) species, from data collected at approximately 1000 sites.

USING TRANSECT DATA IN CONSERVATION RESEARCH - ROUND UP OF RECENT PROJECTS

Butterfly transect data continues to be in high demand for conservation and research. In 2005, projects using the data included:

Land use policy and habitat management

- Assessing the impacts of management to achieve favourable condition on SSSIs for butterfly populations (with Oxford University)
- An assessment of the impacts of agri-environment schemes and habitat management on butterflies (with Defra and the University of East Anglia)
- Managing habitats for the Dark Green Fritillary (with English Nature)
- Causes of decline in the Small Heath in the Lea Valley (with Royal Holloway College)
- The habitat requirements for Adonis Blue and Chalkhill Blue at Malling Down and management implications (with C. Holloway)

Climate change research

- Cross-taxa analyses of trends in the abundance of birds, butterflies and moths (with Rothamsted Research, British Trust for Ornithology and York University)
- Testing the link between distribution and phenology changes in birds, butterflies and plants (with British Trust for Ornithology and York University)
- Evolution of migration in a changing climate (with York University)
- Development of indicators of climate change for Scotland.
  - Sparks, T.H., Collinson, N., Crick, H., Croxton, P., Edwards, M., Humber, K., Jenkins, D., Johns, D., Last, F., Maberly, S., Marquiss, M., Pickup, J., Roy, D., Sims, D., Shaw, D., Turner, A., Watson, A., Woiwod, I., and Woodbridge, K. (2006). *Natural Heritage Trends of Scotland: phenological indicators of climate change*. Scottish Natural Heritage Commissioned Report no. 167 (ROAME no. F01NB01).
- Phenology and reproductive asynchrony in British butterflies (with University of Maryland)
- Phenological advancement in the Silver-spotted Skipper (with York University)
- Geographic and temporal variability in butterfly phenology
  - Menzel, A., Sparks, T.H., Estrella, N., & Roy, D.B. (in press). *Global Ecology and Biogeography.*

Butterfly population dynamics

- Marsh Fritillary populations dynamics and interactions with weather and parasitoids (with Oxford University)
- A unified approach to studying animal abundance: integrating evolution, ecology and scale dependency (with the Institute of Zoology)
- The effects of visual apparency on bias in butterfly recording and monitoring (with Oxford Brookes University)
  - Dennis, R.L.H., Shreeve, T.G., Isaac, N., Roy, D.B., Hardy, P.B., Fox, R. and Asher, J. 2006. *Biological Conservation*, 128, 486-492.
- Population dynamics, weather and habitat management effects on the Wall Brown (with Oxford Brookes University)
- Metapopulation dynamics of the silver-studded blue butterfly in stable and dynamic habitats (with York University)
- A book chapter on population structure and dynamics of butterfly populations (including metapopulations) for a book on the *Ecology of Butterflies in Europe* (with Universidad Rey Juan Carlos, Madrid)

Methodological developments

- Development of indicators of butterfly abundance for Europe (with Butterfly Conservation Europe and partners monitoring butterflies in Europe)
- Developing methods to monitor the condition of butterfly habitats.
- Design of a wider countryside butterfly monitoring scheme (with British Trust for Ornithology and Defra)
- Developing indices of abundance for UK Butterflies using Generalised Additive Models (GAMs) applied to full transect data (with Centre for Research into Ecological and Environmental Modelling)
- The use of butterfly monitoring in an expanded Environmental Change Network (ECN) for *Targeted Monitoring of Air Pollution and Climate Change Impacts on Biodiversity* (with Defra)

Butterfly atlases and status reviews

- The state of butterflies in Britain and Ireland
  - Fox, R., Asher, J., Brereton, T., Roy, D.B & Warren, M. 2006. *The State of Butterflies in Britain and Ireland*. Pisces Publications.
- A review of the Biodiversity Action Plan (BAP) Priority species list for butterflies
  - Bourn, N.A.D., McCracken, M.E., Wigglesworth, T., Brereton, T., Fox, R., Roy, D., Warren, M.S., 2005. Proposed changes to the BAP Priority Species list: butterflies. Butterfly Conservation Report SO5-23, Wareham.
- The butterflies of Cambridgeshire (with Cambridgeshire and Essex Branch of BC).

For more information on any of these projects contact David Roy or Tom Brereton

SITE FOCUS

Introduction

Data from butterfly transects can give a great deal of insight into local habitat conditions and to changes that have taken place to the habitat on a site, changes that may otherwise escape un-noticed or at least be hardly noticed. In combination with other environmental data, butterfly transect data can be a very useful tool for informing site managers of the impacts of management or lack of it. In some cases, as here, major changes have occurred that are not due to direct management intervention nor at first sight obviously due to any lack of management. Again the data help us to understand the impacts of the changes that have taken place.

At Monks Wood National Nature Reserve in Cambridgeshire, a butterfly transect has been operated on exactly the same route for over 30 years. The annual counts have revealed remarkable increases over the period in a few species of butterfly that feed on coarse grasses. In this section, following some background to the wood, Nick Greatorex-Davies explains some of the changes that have taken place and reasons for the changes are suggested and discussed. Factors thought to be the main influence of the changes discussed here are likely to be present at other sites in lowland England and so may be relevant to other sites managed for conservation. For a further account of these changes refer to Pollard *et al.* 1998, Greatorex- Davies *et al*. 2005 and Cooke 2006.

CHANGES IN THE BUTTERFLY FAUNA OF MONKS WOOD NNR AS INDICATED BY TRANSECT COUNTS, WITH PARTICULAR REFERENCE TO THE DRAMATIC INCREASES OF BUTTERFIES WHOSE LARVAE FEED ON COARSE GRASSES

Historical background to the butterflies of Monks Wood

Monks Wood has been noted for the richness of its Lepidoptera fauna, particularly butterflies, since at least the middle of the 19th century. In 1828 the **Black Hairstreak** *(Satyrium pruni)* was discovered for the first time in Britain in Monks Wood. A total of 48 butterfly species have been recorded in the Monks Wood area and at the beginning of the 20th century 43 species of butterfly could be found in Monks Wood or its immediate surrounds (Steele & Welch 1973). An additional four species were reputed to have occurred in or around the wood during the 19th century. Today only 30 species of butterfly (including two non-resident migrants) can be found in the Monks Wood area. The **Black Hairstreak** is thankfully still common in the wood. Most of the losses had occurred by 1973 when a record of the fauna and flora of the wood was published as a book (Steele and Welch 1973) (Table 4).

Photo © Nick Greatorex-Davies

Black Hairstreak at Monks Wood, Cambridgeshire, in 2006 where the species is flourishing.

An assessment of the butterfly species of Monks Wood, and the reasons for the many losses was considered by Pollard & Yates (1994). They concluded that changes in woodland management resulting in increased shading, particularly the loss of commercial coppice (that had been carried out in the wood for centuries) and the lack of management following the felling of much of the wood after the 1st World War, and the loss of unimproved herb-rich grassland in the area surrounding the wood were the primary reasons for most of the losses. Nearly all the butterfly species lost are those associated in woodland with permanent clearings or newly felled areas (especially coppice) such as most of the violet feeding fritillaries. They also suggested that weather had played a part and that cooler weather in the 1950s and 1960s coinciding with unfavourable changes in habitat, may have exacerbated the decline and subsequent extinction of some species. By the time the wood was declared a National Nature Reserve in 1953 several butterfly species had been lost and the reintroduction of non-commercial coppicing to 10% of the wood was insufficient to prevent further losses.

Broad habitat description

Today Monks Wood can be described as largely derelict coppice maturing to high forest. It is dominated by Ash *(Fraxinus excelsior)* and Pedunculate Oak *(Quercus robur)* and is dissected by fairly wide (up to 10m), but often shady, rides and with some small and larger glades. There are significant stands of Aspen *(Populus tremula)* and Smooth-leaved Elm *(Ulmus carpinifolia)* within the wood. Field Maple *(Acer campestre)* and Silver Birch *(Betula pendula)* also occur scattered throughout many parts of the wood, and in smaller numbers Wild Service Tree *(Sorbus torminalis)*. The wood has a rich shrub under storey amongst which Hawthorn *(Crataegus monogyna)*, Midland Hawthorn *(Crataegus laevigata)* and stands of Blackthorn *(Prunus spinosa)* are abundant. Many other shrub species occur throughout the wood particularly on the ride edges.

The ground flora was once a rich mix of spring flowering plants fairly typical of coppiced woodland on clay soils.

19th century records only	
Black-veined White *(Aporia crataegi)*	Small Blue *(Cupido minimus)*
Large Blue *(Glaucopsyche arion)*	Marsh Fritillary *(Euphydryas aurinia)*
Pre NNR 20th century extinctions	
Duke of Burgundy *(Hamearis lucina)* (1940s)	Purple Emperor *(Apatura iris)* (1941)
Small Pearl-bordered Fritillary *(Boloria selene)* (1939)	
Post NNR extinctions	
Chequered Skipper *(Carterocephalus palaemon)* (1975)	Dingy Skipper *(Erynnis tages)* (early 1970s)
Wood White *(Leptidea sinapis)* (1923) (1984-88)	Large Tortoiseshell *(Nymphalis polychloros)* (1962)
Green Hairstreak *(Callophrys rubi)* (~1987)	Pearl-bordered Fritillary *(Boloria euphrosyne)* (1966)
Brown Hairstreak *(Thecla betulae)* (mid 1970s)	High brown Fritillary *(Argynnis adippe)* (1962)
Silver-washed Fritillary *(Argynnis paphia)* (1970)	Dark Green Fritillary *(Argynnis aglaja)* (1955)
Extant	
Small Skipper *(Thymelicus sylvestris)*	Common Blue *(Polyommatus icarus)*
Essex Skipper *(Thymelicus lineola)*	Holly Blue *(Celastrina argiolus)*
Large Skipper *(Ochlodes sylvanus)*	White Admiral *(Limenitis camilla)* (1st in 1953)
Grizzled Skipper *(Pyrgus malvae)*	Red Admiral *(Vanessa atalanta)*
Clouded Yellow *(Coleus croceus)*	Painted Lady *(Vanessa cardui)*
Brimstone *(Gonepteryx rhamni)*	Small Tortoiseshell *(Aglais urticae)*
Large White *(Pieris brassicae)*	Peacock *(Inachis io)*
Small White *(Pieris rapae)*	Comma *(Polygonia c-album)*
Green-veined White *(Pieris napi)*	Speckled Wood *(Parage aegeria)*
Orange-tip *(Anthocharis cardamines)*	Wall Brown *(Lasiommata megera)*
Purple Hairstreak *(Neozephrus quercus)*	Marbled White *(Melanargia galathea)* (<1976, 1992-)
White-letter Hairstreak *(Satyrium w-album)*	Gatekeeper *(Pyronia tithonus)*
Black Hairstreak *(Satyrium pruni)*	Meadow Brown *(Maniola jurtina)*
Small Copper *(Lycaena phlaeas)*	Small Heath *(Coenonympha pamphilus)*
Brown Argus *(Plebeius agestis)* (<1960; 1995-)	Ringlet *(Aphantopus hyperantus)*

Table 4. Butterflies of Monks Wood, past and present. For extinct species, the last year (where known) it was recorded is given in brackets. The Brown Argus and the Marbled White both recolonised the wood and the surrounding area during the 1990s.

Dog's Mercury *(Mercurialis perennis)* and Bluebells *(Hyacinthoides non-scripta)* were particularly abundant in some parts of the wood. Following the colonisation by, and subsequent increase of, Muntjac Deer (Muntiacus reevesi) in the wood, the ground flora has experienced a dramatic change and of particular note today throughout large sections of the wood is the scarcity of many formerly common species of the spring-flowering woodland ground flora. In the place of the spring ground-flora coarse grasses, notably False Brome *(Brachypodium sylvaticum)*, and Pendulous Sedge *(Carex pendula)* are now dominant and in many of the woodland compartments form almost a monoculture of one or the other species. However, following deer management in recent years the spring ground flora is showing signs of recovery in parts of the wood. Coarse grasses have been described as species of grass with relatively large broad leaves, which produce a lot of litter, decay slowly, and are generally very competitive (see Pollard *et al.* 1998).

Management of the wood

Apart from management of the deer to reduce their numbers, a variety of management is carried out in the wood each year. The rides are mown annually, a section of the coppiced area is re-coppiced, (though this ceased for the period 1995-2005 because of unacceptable browsing damage to the coppice regrowth), two or three small sections of ride edge are coppiced, and two large glades are cattle-grazed during the late summer and autumn. Two large deer exclosures were erected during the winter of 1999-2000 and in these particularly the spring ground flora is showing signs of recovery. Tamworth Pigs have been used in one of these exclosures to help break up areas of Pendulous Sedge and to create areas of bare ground with the hope that there will be more tree regeneration and that a more varied ground flora will develop, but this appears to have had only limited success.

The butterfly transect

The BMS did not start until 1976, however the first butterfly transects to be carried out in Monks Wood NNR were in 1973. The Monks Wood transect was one of those used to trial, test and develop the transect methodology in the years 1973-75 (Pollard & Yates 1993). Though not fully representative of the wood the transect covers sufficient areas of the wood to monitor the status of most species within the wood. All the butterfly species known to occur currently in the Monks Wood area have been recorded on the butterfly transect. Full season data (up to 26 weeks per season) are available for the transect from 1974 to 2005, though analysis of the data that is reported on here is for the 30-year period 1974 to 2003.

A total of well over 106,000 butterflies were recorded on the transect between 1974 and 2003. The most frequently recorded species is the **Meadow Brown** *(Maniola jurtina)* (25% of records) followed by the **Ringlet** *(Aphantopus hyperantus)* (20%). Apart from the

rare migrant Clouded Yellow (recorded once), the re-introduced **Wood White** *(Leptidea sinapis)* (which survived about five years after it was re-introduced in 1984), vagrants or recent colonists, the most infrequently recorded species is the White-letter Hairstreak (17 individuals on 8 occasions).

Butterfly numbers have increased

The number of butterflies recorded on the transect has increased dramatically. During the first few years of recording annual counts ranged from between about 500-1000. Since 1979 annual counts have increased to between 2000-3000. Despite the increase in numbers, more species have declined over the recording period than have increased, but a few species have increased dramatically. Table 5 lists those species which have shown significant trends in abundance over the 30-year period and gives some suggested causes for the increases or declines.

Dramatic increases of some species that feed on grasses

The butterfly species that have shown the most dramatic increases on transect counts (Table 5), are three species of butterfly that feed on coarse grasses. These are **Large Skipper** *(Ochlodes sylvanus)*, **Speckled Wood** *(Parage aegeria)* and **Ringlet**. The combined count of the grass feeding **Small** and **Essex Skippers** *(Thymelicus sylvestris & T. lineola)* (difficult to separate on transect counts) has also increased dramatically. All these increases were noted by Pollard *et al*. (1998). Due to the difficulty in separating the two *Thymelicus* skippers to species while walking the transect, a combined index only is calculated. Separating the species where possible on transects in recent years shows both to be common but mostly on different parts of the transect route, but whether the dramatic increase is in one or both species is unknown.

Other grass feeding species have declined

Other grass feeding butterfly species that occur in the wood (including **Meadow Brown**) have shown an overall decline. Of these, two have shown statistically significant declines - **Wall Brown** *(Lasiommata megera)* and **Small Heath**. Both these species have declined nationally. Both were commonly recorded in the early days of the transect, but now only the **Small Heath** is recorded annually and only in very small numbers. The **Wall Brown** is an open ground species particularly favouring areas where there is plenty of bare ground or sharply defined edges such as path edges and fence lines (Thomas & Lewington 1991). It feeds on a range of grasses amongst which False Brome is one of its favourites. The **Small Heath** feeds on fine grasses in generally short swards in open habitats. In both cases the required habitat is greatly reduced in Monks Wood even though in the case of the **Wall Brown** the foodplants

SPECIES	BROOD	SUGGESTED CAUSES
Increases		
Speckled Wood	All	Increase in shade and coarse grasses especially False Brome
Ringlet	1	Increase in coarse grasses especially False Brome
Large Skipper	1	Increases in coarse grasses especially False Brome
Small / Essex Skipper	1	Unknown (Essex skipper increases could be attributed to increase in coarse grasses)
Brown Argus	2	Recolonisation in line with range expansion due to improved climatic conditions and increased habitat availability.
Peacock	1	Increased overwintering survival due to mild winters
Purple Hairstreak	1	Maturing oaks supporting larger populations
Comma	All	Ameliorating climatic conditions
Declines		
Small Heath	All	Increased shading of open rides, ranker vegetation, and increase in coarse grasses at the expense of finer grasses in East and West fields
Brimstone	2	Unknown
Wall Brown	2	Ranker vegetation and loss of bare patches in open areas. Increased shading of rides.
Large White	1	Unknown
Grizzled Skipper	1	Increased shading of rides, ranker vegetation and loss of bare patches in open areas especially in East and West Field.
Orange-tip	1	Unknown
Wall Brown	1	Increased shading of rides, ranker vegetation and loss of bare patches in open areas.
Brimstone	1	Unknown
Peacock	2	Unknown
Green-veined White	1	Unknown
Small White	1	Unknown
White-letter Hairstreak	1	Further death of elms in vicinity of the transect route

Table 5. Butterfly species recorded on the Monks Wood butterfly transect between 1973 and 2003 showing significant trends in abundance. 37 species/broods were tested. Significant changes ordered with the greatest first.

Photo © Nick Greatorex-Davies

The Large Skipper has shown a dramatic increase in numbers at Monks Wood in Cambrideshire, but elsewhere in the region only at Chippenham Fen has there been a similar increase.

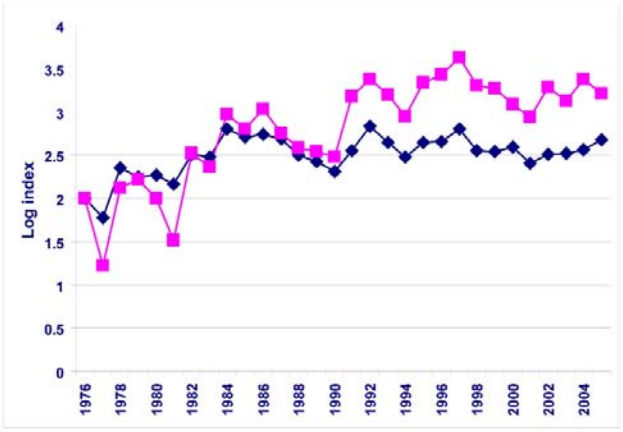


Figure 6. Large Skipper: Monks Wood log annual indicies (pink) and east of England (BMS Region 3) log collated indicies (blue) Showing the greater increase in numbers at Monks Wood compared with other sites in general in the region. Both indicies are set to a value of 2 (log 100) in 1976.

Photo © Nick Greatorex-Davies

The Speckled Wood has increased dramatically at Monks Wood in Cambridgeshire, but has also increased dramatically regionally as it has colonised may new sites over the past few decades.

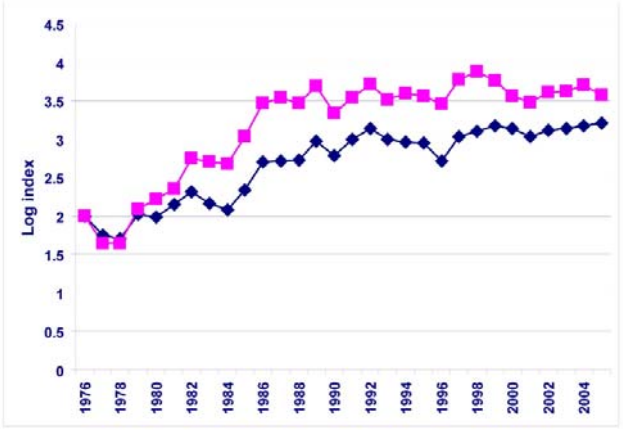


Figure 7. Speckled Wood: Monks Wood log annual indicies (pink) and east of England (BMS Region 3) log collated indicies (blue) Showing the greater increase in numbers at Monks Wood compared with other sites in general in the region. Both indicies are set to a value of 2 (log 100) in 1976.

Photo © Nick Greatorex-Davies

The Ringlet has increased more at Monks Wood, Cambridgeshire than it has regionally over the monitoring period.

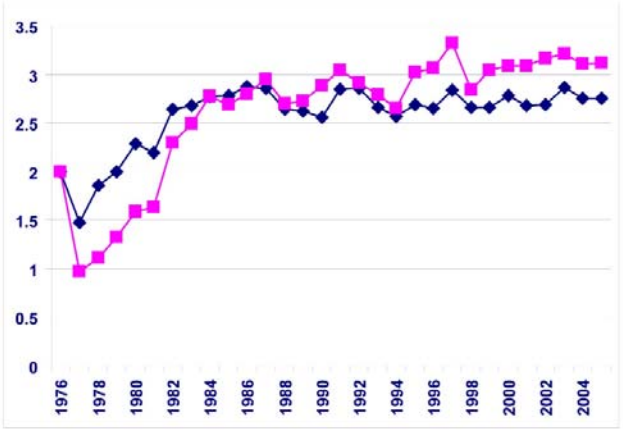


Figure 8. Ringlet: Monks Wood log annual indicies (pink) and east of England (BMS Region 3) log collated indicies (blue) Showing the greater increase in numbers at Monks Wood compared with other sites in general in the region. Both indicies are set to a value of 2 (log 100) in 1976.

are abundant. Instead the grassland in open areas is mostly tall and rank by mid-summer and importantly there is very little bare ground in open situations.

Comparison with east of England trends
Comparison of the Monks Wood transect data for the three species that feed on coarse grasses with the combined data from other monitored sites in eastern England ('old' BMS Region 4 sites only) shows that the numbers of all three species have also increased regionally but in all cases more in Monks Wood than the overall regional trend (Figures 6-8). The difference in the increase is most marked with the **Large Skipper** and least marked with the **Speckled Wood**. In addition there is no other site in the eastern region where all three species have increased so dramatically.

Conclusions

The increase in coarse grasses has benefited some species
The massive increase in coarse grasses in Monks Wood has clearly benefited those butterflies (and incidentally the moths) that feed on them. This is evidenced by the dramatic increase in these species on transect counts (and in light trap catches) (Pollard *et al.* 1998, Greatorex-Davies *et al.* 2005). Among the coarse grasses that have increased, False Brome has shown the most dramatic increase for it not only grows in the rides and glades of the wood but also dominates, along with Pendulous Sedge, many areas under the under the tree canopy. However other coarse grasses have increased in the open areas, notably Cock's-foot *(Dactylis glomerata)*, Tufted Hair-grass *(Deschampsia cespitosa)* and Wood Small-reed *(Calamagrostis epigejos)* (Pollard *et al.* 1998). There has been a corresponding decrease in herbs, especially spring flowers that grow under the tree canopy or in the coppice areas such as Bluebells *(Hyacinthoides non-scripta)*, Violets *(Viola spp.)*, Primroses (Primula vulgaris), Wood Anenome (Anemone nemorosa) and Dog's Mercury *(Mercurialis perennis)*, but there has also been a reduction in herbs that grow in the rides and glades, (Cooke 2006).

Photo © Nick Greatorex-Davies

False Wood-brome has become abundant under the tree canopy in many of the woodland compartments of Monks Wood NNR replacing much of the spring ground flora that used to carpet the woodland floor.

The three butterflies showing the greatest increases, i.e. **Ringlet**, **Speckled Wood** and **Large Skipper**, all feed on False Brome as well as other grasses such as Cock's-foot. The combined count for the **Small** and **Essex Skippers** also shows a dramatic increase. Although they have other main hostplants both these species will also feed on False Brome, particularly the **Essex Skipper** (Asher *et al.* 2001), whose main hostplant is Cock's-foot, a grass which has increased in the rides of the wood. It is not known whether Yorkshire Fog *(Holcus lanatus)* which is the main hostplant of the Small Skipper, has increased, but it is common in some of the open areas of the wood. The trend for all these species for the eastern region ('old' BMS sites) show an increase, however in every case the increase is greater in Monks Wood. There are some other eastern England sites that show dramatic increases for one or two of these species but not for all.

The **Speckled Wood** has been expanding its range in eastern England and elsewhere during the monitoring period and it has now colonised almost all the 10km squares of the eastern counties as far as North Yorkshire as a comparison with the 1984 and 2005 atlases shows (Heath *et al.* 1984, Fox *et al.* 2005). This expansion in range has been picked up on transect counts and many transect sites have been colonised by the **Speckled Wood** during the monitoring period. Numbers increase rapidly for a few years after colonisation as the species becomes established before levelling off in synchrony with the regional or national trend (Pollard *et al.* 1996). Because of this the extent of the increase of the **Speckled Wood** in Monks Wood might be expected to be closer to that of the regional trend, nevertheless the **Speckled Wood** has increased more in Monks Wood than other sites in general in the region (Figure 7).

The influence of Muntjac deer
Other woods in the vicinity of Monks Wood (Huntingdonshire vice-county) do not have the high levels of False Brome and Pendulous Sedge that Monks Wood has (Sparks *et al.* 2005). Although there is little historical information on the vegetation of these woods it is likely that they have not seen changes in recent decades on the scale that Monks Wood has and spring ground flora species are still common in other ancient woods in the area. Muntjac deer, which were first noted in the wood in the early 1970s, have been strongly implicated as being the main driving force behind the change in vegetation in Monks Wood (Cooke 2006). Atmospheric Nitrogen deposition may also be a contributory factor (Pollard *et al.* 1998), though clearly this is much more generally distributed and therefore its impact is likely to be widespread. Muntjac occur in many other woods in the area, however until recently, before the introduction of deer culling in Monks Wood, they occurred at a much greater density there than in other woods in the area. This is likely to be because of the

relatively large size of Monks Wood and especially the size of the woodland compartments (~5 ha) compared to other woods in the area (often <1ha) and the amount of dense Blackthorn scrub that occurs in the wood which serve as hideouts for the deer (Cooke 2006 and unpublished).

Muntjac became abundant in Monks Wood during the mid 1980s. They tend to feed selectively on young, nutritious plants and shoots and cause particular damage to the spring flora early in the season when there is little else to eat; they also eat the flowers of those that do survive. The herbs seem largely unable to withstand this intensive grazing, whereas grasses, particularly coarse grasses, survive. Before culling of the Muntjac commenced in 1998 deer numbers were so high that during the early months of the year little ground vegetation was apparent in the woodland compartments. Only the unpalatable Ground Ivy *(Glechoma hederacea)* seemed to escape deer-browsing. What little did exist was severely browsed by the deer and in a few years the spring herbs declined dramatically. It has been estimated, for example, that Dog's Mercury declined from about 34% to about 1% ground cover between the early 1970s and 1994 (Cooke *et al*, 1995). Grasses, notably False Brome, and sedges, notably Pendulous Sedge, however survive the browsing and have flourished in the place of the woodland herbs.

Since deer culling was instituted the deer population may have halved in Monks Wood and there are signs of recovery in the ground flora in some parts of the wood, particularly within the deer exclosures. However coarse grasses remain dominant and it can be expected that, other factors considered, numbers of **Large Skipper**, **Speckled Wood** and **Ringlet** will remain high for the foreseeable future.

The **Silver-spotted Skipper** is a diminutive, highly active and strikingly patterned butterfly that occurs

Photo © Paul Glendell (English Nature)

SPECIES FOCUS

The following article by Tom Brereton indicates the value of butterfly monitoring and distribution data for helping to assess the changing status of butterflies and the impacts of habitat management and changing environmental conditions on their populations. In this case with our most rapidly increasing butterfly species, the Silver-spotted Skipper (Hesperia comma), still considered one of our rarer butterflies, and certainly still highly localised in its distribution. The information summarised in this article illustrates the huge value of the UKBMS database in providing data from many sites even for a rare species.

CHANGING STATUS AND CONSERVATION MANAGEMENT OF THE SILVER-SPOTTED SKIPPER

Monitoring the changing status of the Silver-spotted Skipper

locally in southern England on dry calcareous grasslands. The butterfly declined rapidly in the decades following the Second World War, as downland colonies were lost through agricultural intensification practices such as ploughing, overgrazing and abandonment. The situation was compounded by the loss of rabbit grazing following the introduction of myxomatosis in the 1950s which resulted in the loss of many colonies on remaining unimproved downland. This rapid decline led to the **Silver-spotted Skipper** being identified as one of 11 priority species for conservation action in the UK Government's Biodiversity Action Plan.

Silver-spotted Skipper perched on a bare ground patch.

Thankfully, recent distribution and monitoring data have highlighted a welcome recovery in the fortunes of this butterfly. A targeted survey in 1982 found just 68 populations in Britain. A repeat survey carried out in 2000 identified 257 populations, representing more than a threefold increase. This re-colonisation of its former range continues, with 12 new 10-km squares recorded in the latest national distribution survey (Fox *et al.* 2006).

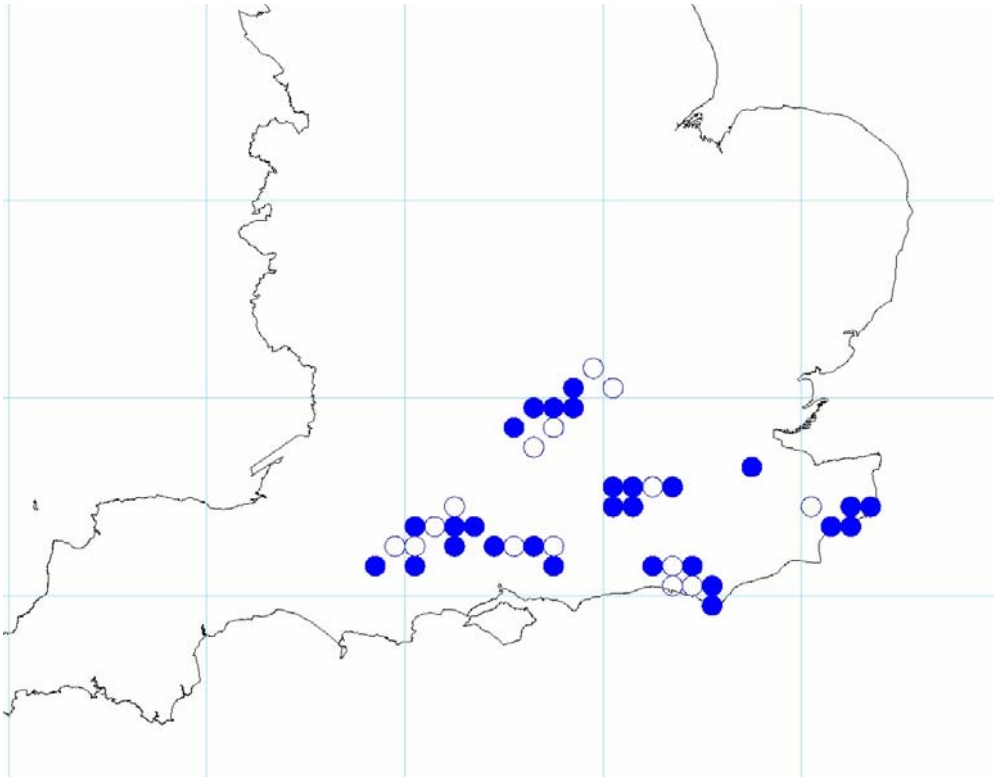
The addition of Butterfly Conservation's database of independent transects to the BMS, has increased the number of **Silver-spotted Skipper** monitored sites from a dozen to nearly 60, whilst there are a further 220 or so unoccupied calcareous grassland sites. With this powerful new combined UKBMS database, we can build up a much more accurate picture of the changing population status of the butterfly across England, with for example monitoring at more than 280 calcareous grassland sites. The data confirms the remarkable recovery of the Silver-spotted Skipper in southern England, in both range and abundance.

Improved fortunes

Over the last 30 years, the butterfly has increased on average by more than 10% per annum at monitored sites. In fact, the rate of increase adds up to more than 1500% over the last 30 years, making it Britain's most rapidly increasing species, with the rate being more than four times that of any other resident! Over the period, there have also been at least five colonisations at monitored sites.

The recent increase has been studied in detail and has been linked to a combination of factors, which have improved the quantity and quality of chalk grassland habitat available to the **Silver-spotted Skipper**: These include: (1) conservation management to maintain a short, sparse turf and prevent scrub invasion (especially through agri-environment schemes and management to achieve favorable condition on SSSIs); (2) increasing rabbit populations (which also help to maintain suitable turf); (3) climate change, niche broadening and re-introductions (Davies *et al.* 2004). Warmer temperatures have increased the extent of habitat suitable for breeding to include areas that were

Typical Silver-spotted Skipper habitat - Broughton Down, Hampshire & Isle of Wight Wildlife Trust nature reserve.



previously

Map 3. Annual monitoring coverage of the Silver-spotted Skipper in relation to it's overall distribution in GB and Ireland. Map key: open circles = 10km squares where species was recorded in 1995-04 BNM surveys, but no transect coverage, closed circles = 10km squares where species has been monitored at one or more transects.

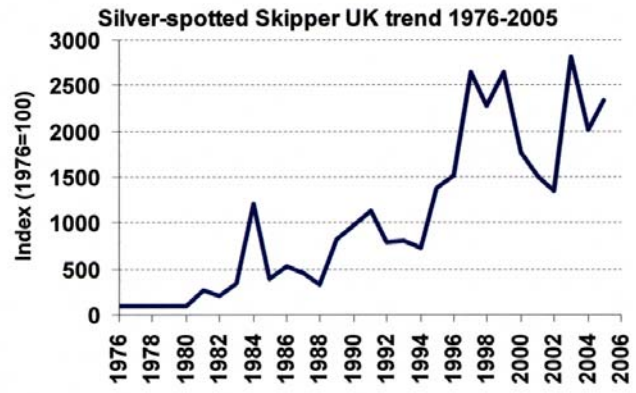


Figure 9. The Silver-spotted Skipper has increased in abundance more rapidly than and other British butterfly over the last 30 years, by more than 1500%.

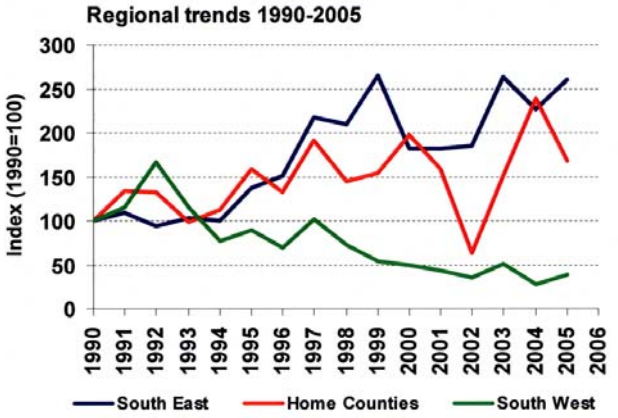


Figure 10. The Silver-spotted Skipper has continued to increase in the Home Counties and the South West, but moderate declines may have occurred across the South West (note the small sample size in this region though).

too cool for the butterfly (e.g. longer vegetation, areas absent in bare ground and west- and east-facing hillsides).

As a result of this favourable status change, as part of the current UK BAP review, the **Silver-spotted Skipper** has been proposed for downgrading from a Priority Species to a Species of Conservation Concern (Bourn *et al.* 2005).

Analysis of transect data at a regional level highlights some interesting contrasts, and suggests that the situation may not be rosy in all areas. Although the population status is buoyant in South East England and the Home Counties, in the South West of England, the limited monitoring data (from four sites) indicates a moderate decline.

Given this regional picture and the fact that the butterfly remains rare, there is no cause for complacency and it is important that appropriate management is instigated or maintained at remaining colonies.

Managing sites for the Silver-spotted Skipper – evidence from transect data

Butterfly Conservation has recently completed an extensive analysis of transect data to identify suitable management prescriptions for BAP and other threatened habitat specialist butterflies (Brereton *et al.* 2005).

In the study, population trends from the 1990s to the present were calculated at 46 **Silver-spotted Skipper** sites and assessed in relation to detailed habitat and management data obtained from recorders, landowners and site managers.

After 15 years of monitoring, Silver-spotted Skippers were first recorded on the malling Down Sussex Wildlife Trust Reserve Transect in 1999. By 2005, the annual index was 131. Data source Crispin Holloway.

Twenty-four 'key' sites were identified where population trends were important. Of the 24 key sites, the trend was highly favourable (colonisation, increase or large/medium and stable) at more than four fifths (20 of 24 sites). Four colonisations were noted. The butterfly was maintained at two introduction sites, from which additional colonisations have occurred, confirming the potential value (at least in the short-term) of re-introduction programmes for this species.

No more than a moderate degree of synchrony was found between site trends and the national trend (37% of trends significantly correlated) suggesting an uneven response across sites and a high proportion of site-specific management effects.

Declines were detected at four sites. At three of these, the decline was thought to be a consequence of overgrazing by rabbits and sheep over the summer. At the fourth site, the decline was linked to a corresponding decline in the rabbit population, with no substantial modification in the stocking level, leading to undergrazing.

The **Silver-spotted Skipper** requires short turf (1-5 cm tall); containing small tufts of Sheep's Fescue *(Festuca ovina)* growing amongst warm hollows, bare ground patches and plentiful nectar sources (Thomas *et al.* 1986; Warren et al. 1999). To maintain these conditions, moderate to heavy grazing is required outside the summer period, together with a mechanism to create a regular supply of bare ground.

Three of the sites with a favourable population status (Martin Down, Lullington Heath and Porton Down) were maintained solely by moderate to heavy rabbit grazing (and associated scraping activity). Rabbit grazing was also a feature of every other site supporting a favourable population, with 90% of successful sites having localised moderate to heavy grazing. Consequently the importance of rabbit grazing in creating fine-scale breeding patches for the butterfly cannot be overemphasised. Pony grazing (by Exmoors) was also considered an effective single grazing regime that created ideal habitat conditions (e.g. at Denbies Landbarn).

Where rabbit grazing is light to moderate, winter grazing by stock is likely to be essential to remove the season's grass growth. Cattle were the most frequent winter grazing animals at successful sites (57% of sites, with 35% cattle-only), followed by sheep (28%, with 21% sheep-only), then ponies (21%). Cattle-only stocking levels at sites lightly grazed by rabbits ranged from 0.2-1.0 LUHaYr (Livestock Units per Hectare per Year). There were no examples of successful sites where light rabbit grazing was mixed with sheep grazing and it seems unlikely that sheep grazing in isolation (i.e. without heavy rabbit grazing) will create suitable habitat conditions for the butterfly, as they do not effectively poach the ground surface. Cattle were preferred over sheep by managers because of the bare ground they create through poaching, though there were concerns by some managers that they did not create the short *Festuca* lawns as effectively as sheep within acceptable stocking levels. At sites where rabbit grazing was classed as moderate to heavy, stocking levels were in the range 0.05-0.4 LUHaYr and most frequently from 0.1-0.2LUHaYr. Periodic hard winter grazing (>1LuHa), to remove the build up of grass litter was noted as possibly improving long-term habitat conditions at a small number of sites where this was carried out.

It has been widely speculated by recorders that the rapid growth in numbers of the **Silver-spotted Skipper** over the early-mid 1990s was aided by a series of drought years, which lead to an increased frequency of bare ground patches and relatively shorter swards. A number of sites with winter-only grazing have suffered relative declines in recent years (though the overall trend is stable), which may possibly be linked to insufficient summer grazing. Targeted grazing outside the winter period including over the summer was carried out at

35% of successful sites and managers considered this valuable, especially in years of relatively high spring grass growth.

In conclusion, it seems that a variety of management regimes and conditions can benefit the **Silver-spotted Skipper** butterfly. The results outline the importance of focussing on creating/maintaining suitable habitat conditions through responsive and carefully targeted management (in response to changing natural conditions e.g. fluctuating rabbit numbers and annual weather), rather than sticking to a rigid set of management prescriptions – that may be beneficial in some years, but detrimental in others.

Photo © Tom Brereton

At Martin Down NNR, Hampshire, suitable habitat conditions are maintained solely by moderate to heavy rabbit grazing. Habitat condition surveys have confirmed high habitat quality, with a mean turf height of 4.8cm and respective frequencies (1-m2 square) of Sheep's-fescue tufts (96%), nectar plants (100%) and bare ground (68%). Data source - Linda Smith.

NOTES FROM RECORDERS

We hope this section will occur annually in UKBMS reports and is intended to give recorders an opportunity to share some insights and tips from their experience of recording transects, or maybe just interesting stories or experiences you have had while recording transects which you think may be of interest to others.

The following is a contribution from one of the schemes longest standing recorders in which he shares some tips on ways he has made recording his transect a little easier and which may be of use to others. At least some of you will know, or will have heard of, Ian Woiwod becasue for many years he has been in charge of the Rothamsted Insect Survey which has operated a light trap network in the UK since 1968. Results from this work were key to providing information for the book 'The State of Britain's larger moths' (Fox *et al*. 2006).

Methods like these detailed here can make recording the transect easier while recording remains consistent and without jeopardising the methodology in any way. If you would like to submit a contribution to a future report please let us know.

A COUPLE OF HINTS FROM A LONG-TERM TRANSECT WALKER (POTTON WOOD, BEDFORDSHIRE)

Ian Woiwod, Cockayne Hatley, Sandy, Bedfordshire.

I like to think I was the Butterfly Monitoring Scheme's first amateur transect walker. I know this might not be quite correct but it must be nearly so. I happened to know the reserve warden at Monks Wood when the butterfly transect methodology was being developed by Ernie Pollard and colleagues and casually suggested that I would like to try one out in a large local wood near Sandy, where I was living at the time. This offer was gratefully accepted as they were not sure how practical it would be for volunteers to cope with a weekly butterfly count. The year was 1974, and yes I did find it practical. By 1976 I had moved and, almost by chance, my new house was only a few hundred metres from the same Potton Wood that I had sampled in 1974. So I re-started the transect after a year's break and have carried on ever since.

Potton Wood is a large (87 ha) mixed woodland on the Bedfordshire/Cambridgeshire border and has relatively large butterfly populations because of its wide, flower-rich main rides. Like most transect walkers, when I started I had the fantasy of discovering a colony of rare butterflies that had been previously overlooked, perhaps **Black Hairstreak** or **Purple Emperor**, but I soon became more realistic and although I have recorded 31 species at the site, I normally have to content myself with the more mundane fare of **Ringlets**, **Meadow Browns**, **Green-veined Whites** and **Peacocks** that often abound in the wood. Over the 30 or more years that I have been monitoring I have noticed some population changes, perhaps the most memorable being the establishment of the **Speckled Wood** in 1986 and **Brown Argus** *(Plebeius agestis)* in 1995 and, more regrettably, the extinction of the **Wall Brown** in 1997. Just occasionally something more interesting drops by and I have recorded **Wood White**, **White Admiral** *(Limenitis camilla)*, **Silver-washed Fritillary** *(Argynnis paphia)* and even **Chalkhill Blue** *(Polyommatus coridon)*. With the exception of the **Chalkhill Blue**, which must have come from Royston Heath 10 miles away, I don't have a clue where the other species came from as there were no colonies close by when recorded, although all three are potential future colonists.

There are two devices which I did not have when I started the transect but which I now find indispensable. One is a pair of close focussing binoculars. As soon as I obtained a pair I immediately found I could separate accurately and count **Small** and **Essex Skippers**, whereas previously I had always had to lump these two species together, as even with a net I couldn't catch all individuals for close scrutiny. I also find they help considerably in the often difficult **Small** verses **Green-veined White** separation when trying not to disturb resting but active individuals. I would recommend binoculars with a close focus of about 2 metres for butterfly watching. Fortunately, such close-focussing bins

Photo © Ian Woiwod

Bank of tally counters used for counting butterflies on the transect at Potton Wood in Bedfordshire.

are becoming more available and reasonably priced than formerly.

The other bit of apparatus which I didn't know I needed until I tried it was a banked set of tally counters (see photo). I started using these on the suggestion of a colleague, John Bater who does the Rothamsted Farm transect. I was a bit sceptical initially but I find that when large numbers of individuals are about in July and August they make life very much easier. They also undoubtedly make recording more accurate as you can keep your head up and your walking pace more even when you are only stopping occasionally to record the less common species. A bank of six tally counters seems to be about the optimum number and you can quickly learn how to use them without the need to look down. When using them, at the beginning of the walk you have to guess which are going to be the six dominant species and you label these 1-6 on your recording sheet before setting off, sit the counter comfortably in your hand then set off. At the end of each transect section you just record the number on each counter, reset them all to zero, then off you go on the next section. The main use of banked tally counters seems to be for traffic surveys so there must be drawers full of unused ones in offices up and down the country.

I have come across the following web sites for firms that supply them, although there may well be others, and although a bank of 6 can be rather expensive they are well worth the money in my opinion.
http://www.roadrunner-tca.co.uk/htc.html
http://www.wolflabs.co.uk/ECONOMY%20COUNTERS.htm
http://www.supplies4mro.com/category_sublist.asp?catmain=Tally%20Counters

Photo © Nick Greatorex-Davies

A flower-rich ride in Potton Wood, Bedfordshire, one of the sections on the transect where numbers of butterflies can be high and the bank of tally counters particularly useful.

UKBMS publications 2005/2006

Dennis, R.L.H., Shreeve, T., Arnold, H. & Roy, D.B. 2005. Does diet breadth control herbivorous insect distribution size? Life history and resource outlets for specialist butterflies. *Journal of Insect Conservation*, 9: 187-200.

Dennis, R.L.H., Shreeve, T.G., Isaac, N., Roy, D.B., Hardy, P.B., Fox, R. & Asher, J. 2006. The effects of visual apparency on bias in butterfly recording and monitoring. *Biological Conservation*, 128: 486-492.

Brereton, T., Roy, D. & Greatorex-Davies, N. 2006. The contribution to conservation and ecology of butterfly-monitoring in the UK. *British Wildlife*, Volume 17: 162-170.

Fox, R., Asher, J., Brereton, T., Roy, D. & Warren, M. 2006. *The State of Butterflies in Britain and Ireland*. Pisces Publications, 112 pp.

Westgarth-Smith, A.R., Leroy, S.A.G. & Collins, P.E.F. 2005. North Atlantic Oscillations and UK butterfly populations. *Biologist*, 52: 273-276.

Westgarth-Smith, A.R., Leroy, S.A.G., Collins, P.E.F. & Roy, D.B. 2005. Mechanisms for the control of UK butterfly abundance by the North Atlantic Oscillation. *Antenna*, 29: 257-266.

Westgarth-Smith, A.R., Leroy, S.A.G., Collins, P.E.F. & Roy, D.B. 2005. The North Atlantic Oscillation and UK butterfly cycles, pigmentation, morphology, behaviour and conservation. *Antenna*, 29: 186-196.

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We would like to acknowledge the tremendous input and commitment of the many transect walkers who have contributed to butterfly monitoring, some over many years. We would like to thank you all – without you there would be no UKBMS today. We also thank Regional Co-ordintors who commit many hours of their time to co-ordinating transects locally and to gathering, inputting and collating butterfly transect data each year.

We would like to thank Ian McLean (JNCC) for reading through a draft of this report and for his comments. We also thank Ian McLean and Martin Warren (BC) for their continued support for butterfly monitoring here in the UK and for their valued advice. We also thank Ernie Pollard who continues to be available for advice. Our thanks also to Shelly Beamish who has designed and put together this report from the various articles, photographs and figures we have provided. Thanks also to Juliet Francis who, as part of our admin team in the Biological Records Centre at Monks Wood, helps with mail-outs and other administrative tasks from time to time.

REFERENCES

Asher, J., Warren, M., Fox, R., Harding, P., Jeffcoate, G. & Jeffcoate, S. 2001. *The Millennium Atlas of Butterflies in Britain and Ireland.* Oxford University Press, Oxford, 430 pp.

Bourn, N.A.D., McCracken, M.E., Wigglesworth, T., Brereton, T., Fox, R., Roy, D., & Warren, M.S. 2005. *Proposed changes to the BAP Priority Species list: butterflies*. Butterfly Conservation. Report SO5-23, Wareham.

Brereton, T., Roy, D. & Greatorex-Davies, N. 2006. The contribution to conservation and ecology of butterfly-monitoring in the UK. *British Wildlife*, Volume 17: 162-170.

Brereton, T., Wigglesworth, T., Warren, M.S., & Stewart, K. 2005. BD1446: *Agri-environment schemes and butterflies: re-assessing the impacts and improving delivery of BAP targets*. Butterfly Conservation Final Project Report, supplied to Defra.

Conrad, K.F., Warren, M., Fox, R., Parsons, M., & Woiwod, I.P. 2006. Rapid declines of common, widespread British moths provide evidence of an insect biodiversity crisis. *Biological Conservation,* 132: 279-291

Cooke, A.S. 2006. *Monitoring Muntjac Deer* (Muntiacus reevesi) *and their impacts in Monks Wood National Nature Reserve*. English Nature Research Reports, no 681. English Nature, Peterborough, 172 pp.

Cooke, A.S., Farrell, L., Kirby, K.J. & Thomas, R.C. 1995. Changes in abundance and size of Dog's Mercury apparently associated with grazing by Muntjac. *Deer*, 9: 429-433.

Davies, Z.G., Wilson, R.J., Brereton, T.M., & Thomas, C.D., 2005. The re-expansion and improving status of the silver-spotted skipper butterfly *(Hesperia comma)* in Britain: a metapopulation success story. *Biological Conservation,* 124: 189–198.

Ehrlich, P.R. 1994. Energy use and biodiversity loss. *Philosophical Transactions of the Royal Society B,* 344: 99-104.

Fox, R., Conrad, K.F., Parson, M.S., Warren, M.S. & Woiwod, I.P. 2006. *The state of Britain's larger moths.* Butterfly Conservation and Rothamsted Research, Wareham, Dorset. 33pp.

Fox, R., Asher, J., Brereton, T., Roy, D., & Warren M. 2006. The State of Butterflies in Britain and Ireland. Pisces Publications, Newbury, 112 pp.

Greatorex-Davies, N., Sparks, T. & Woiwod, I. 2005. Changes in the Lepidoptera of Monks Wood NNR (1974-2003). In: Gardiner, C. & Sparks, T. eds. *Ten years of change: Woodland research at Monks Wood NNR, 1993-2003. Proceedings of the 50th Anniversary Symposium, December 2003,* 90-110. English Nature Research Report, no. 613. English Nature, Peterborough.

Heath, J., Pollard, E. & Thomas, J.A. 1984. *Atlas of butterflies in Britain and Ireland. Viking,* Harmondsworth, 158 pp.

Hickling, R., Roy, D.B., Hill, J.K., Fox, R., & Thomas, C.D. 2006. The distributions of a wide range of taxonomic groups are expanding polewards. *Global Change Biology,* 12: 450-455.

Moore, N.W. 1975. Butterfly transects in a linear habitat. *Entomologist's Gazette*, 26: 71-78.

Oostermeijer, J.G.B., & van Swaay, C.A.M. 1998. The relationship between butterflies and environmental indicator values: a tool for conservation in a changing landscape. *Biological Conservation*, 86: 271-280.

Parmesan, C. 2003. Butterflies as bioindicators for climate change effects. In: Boggs, C.L., Watt, W.B. & Ehrlich, P.R. eds. *Butterflies – ecology and evolution taking flight,* 541-560. University of Chicago Press, Chicago.

Pollard, E. 1977. A method for assessing changes in the abundance of butterflies. *Biological Conservation*, 12: 115-134.

Pollard, E. 1988. Temperature, rainfall and butterfly numbers. *Journal of Applied Ecology*, 25: 819-828.

Pollard, E., Elias, D.O., Skelton, M.J. & Thomas, J.A. 1975. A method of assessing the abundance of butterflies in Monks Wood National Nature Reserve in 1973. *Entomologist's Gazette*, 26: 79-88.

Pollard, E., Rothery, P. & Yates, T.J. 1996. Annual growth rates in newly established populations of the butterfly *Parage aegeria*. *Ecological Entomology,* 21: 365-369.

Pollard, E., Woiwod, I.P., Greatorex-Davies, J.N., & Welch R.C. 1998. The spread of coarse grasses and changes in numbers of Lepidoptera in a woodland reserve. *Biological Conservation*, 84: 17-24.

Pollard, E. & Yates, T.J. 1993. *Monitoring butterflies for ecology and conservation*. Chapman & Hall, London, 274 pp.

Pollard, E. & Yates, T.J. 1994. Butterflies in Monks Wood 1953-93. In: Massey, M.E. & Welch, R.C. eds. *Monks Wood National Nature Reserve, 40th Anniversary Symposium*, *23 July 1993*, 29-40. English Nature, Peterborough.

Roy, D.B., Rothery, P., Moss., D., Pollard, E. & Thomas, J.A. 2001. Butterfly numbers and weather: predicting historical trends in abundance and the future effects of climate change. *Journal of Animal Ecology*, 70: 201-217.

Skelton, M.J. 2001. A year in the life of a Clouded Yellow *Coleus croceus* (Geoff.) colony: Further evidence of ovewintering. *Atropos,* 14: 18-21.

Skelton, M.J. 2003. The Clouded Yellow in Bournemouth, 1998-2003. In: Taverner, J. ed. *Hampshire and Isle of Wight butterfly and moth report 2003*, 15-18. Hampshire and Isle of Wight Branch of Butterfly Conservation.

Sparks, T., van Gaasbeck, F., Waasdorp, D. & Willi, J. 2005. Monks Wood NNR and its neighbours: a comparison with local woods. In: Gardiner, C. & Sparks, T. eds. *Ten years of change: Woodland research at Monks Wood NNR, 1993-2003. Proceedings of the 50th Anniversary Symposium, December 2003*, 59-64. English Nature Research Report, No 613, English Nature, Peterborough.

Steele, R. C. & Welch, R.C. 1973. *Monks Wood, a nature reserve record*. Huntingdon: The Nature Conservancy, Huntingdon, 337pp.

Thomas, J.A. 2005. Monitoring change in the abundance and distribution of insects using butterflies and other indicator groups. *Philosophical Transactions of the Royal Society B,* 360: 339-357.

Thomas, J.A. & Clarke, R.T. 2004. Extinction rates and butterflies. *Science,* 305: 1563-1564.

Thomas, J.A & Lewington, R. 1991. *The Butterflies of Britain & Ireland*. Dorling Kindersley, London, 224 pp.

Thomas, J.A., Telfer, M.G., Roy, D.B., Preston, C.D., Greenwood, J.J.D., Asher, J., Fox, R., Clarke, R.T., & Lawton, J.H. 2004. Comparative losses of British butterflies, birds and plants and the global extinction crisis. *Science,* 303: 1879-1881.

Thomas, J.A. Thomas, C.D., Simcox, D.J., & Clarke, R.T. 1986. Ecology and declining status of the silver-spotted skipper butterfly *(Hesperia comma)* in Britain. *Journal of Applied Ecology,* 23: 365-380.

Warren, M.S. Thomas, J.A., & Wilson, R.J. 1999. *Management options for the silver-spotted skipper butterfly: a study of the timing of grazing at Beacon Hill NNR, Hampshire, 1983-1998*. Butterfly Conservation, Wareham, Dorset.

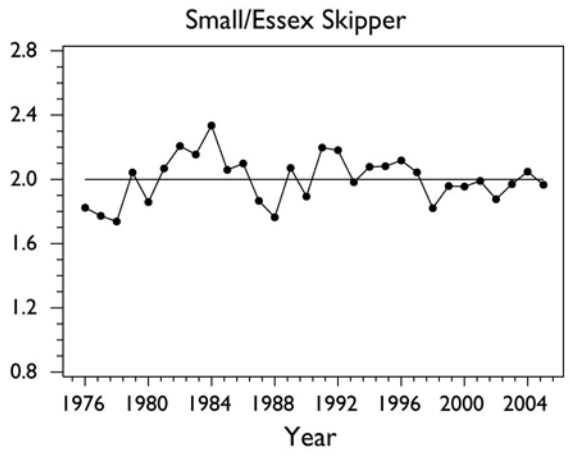
Wells, T.C.E. 1984. Changes in vegetation and flora. In: Massey, M.E. & Welch, R.C. eds. *Monks Wood National Nature Reserve, Proceeding of the 40th Anniversary Symposium, 23rd July 1993*, 19-28. English Nature, Peterborough.

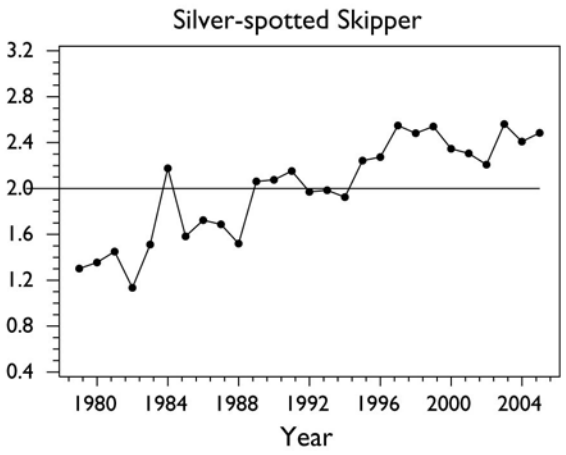
APPENDICES

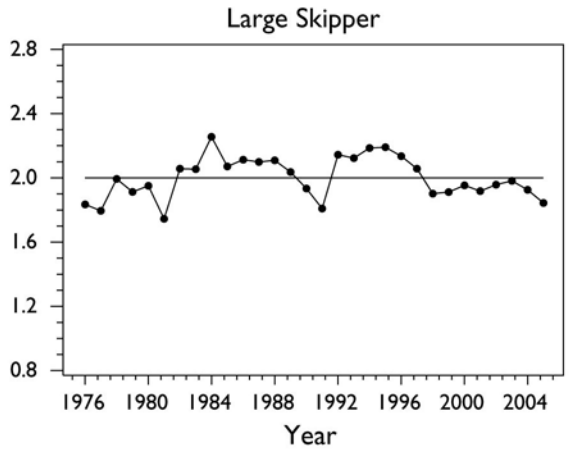
Appendix I: Log collated indices 1976-2005

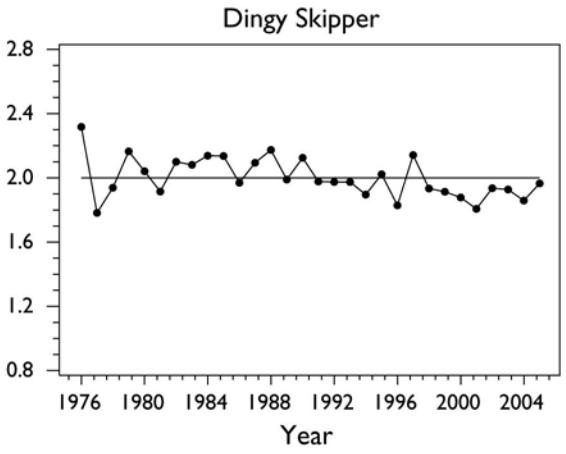
The graphs on the following pages show the fluctuations in the UKBMS all-sites collated indices for 46 species. A single all-season index is given for all species which have more than one brood (e.g. Common Blue) or flight period (e.g. Peacock).

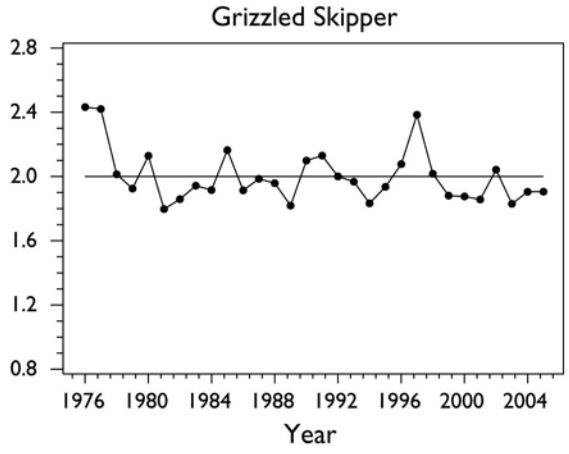
Log collated indices, 1976-2005

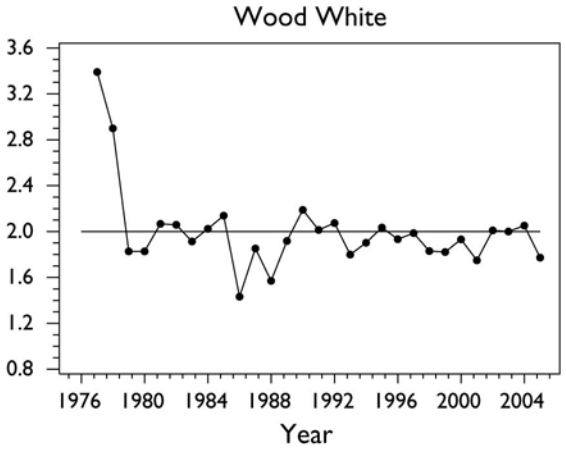












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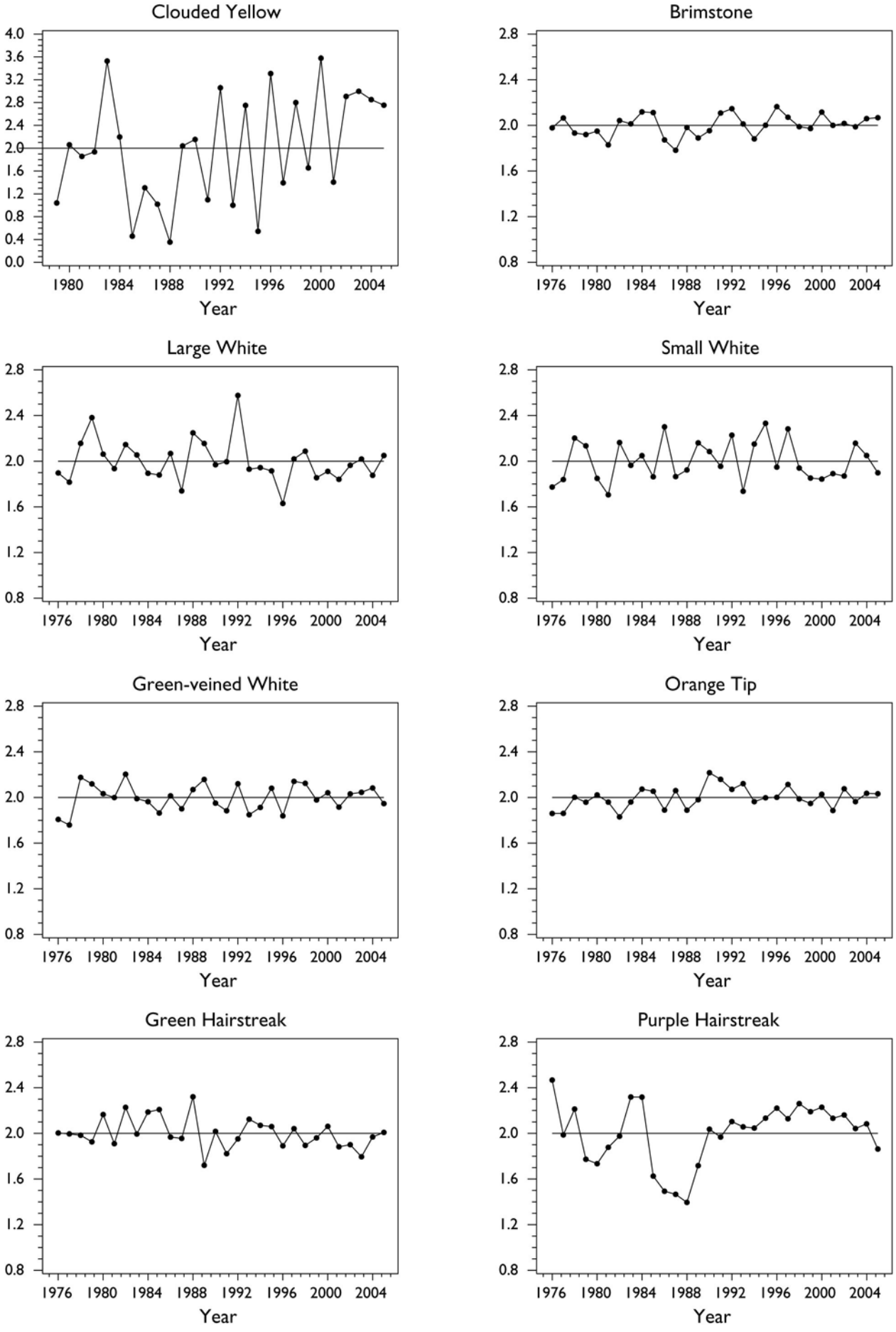

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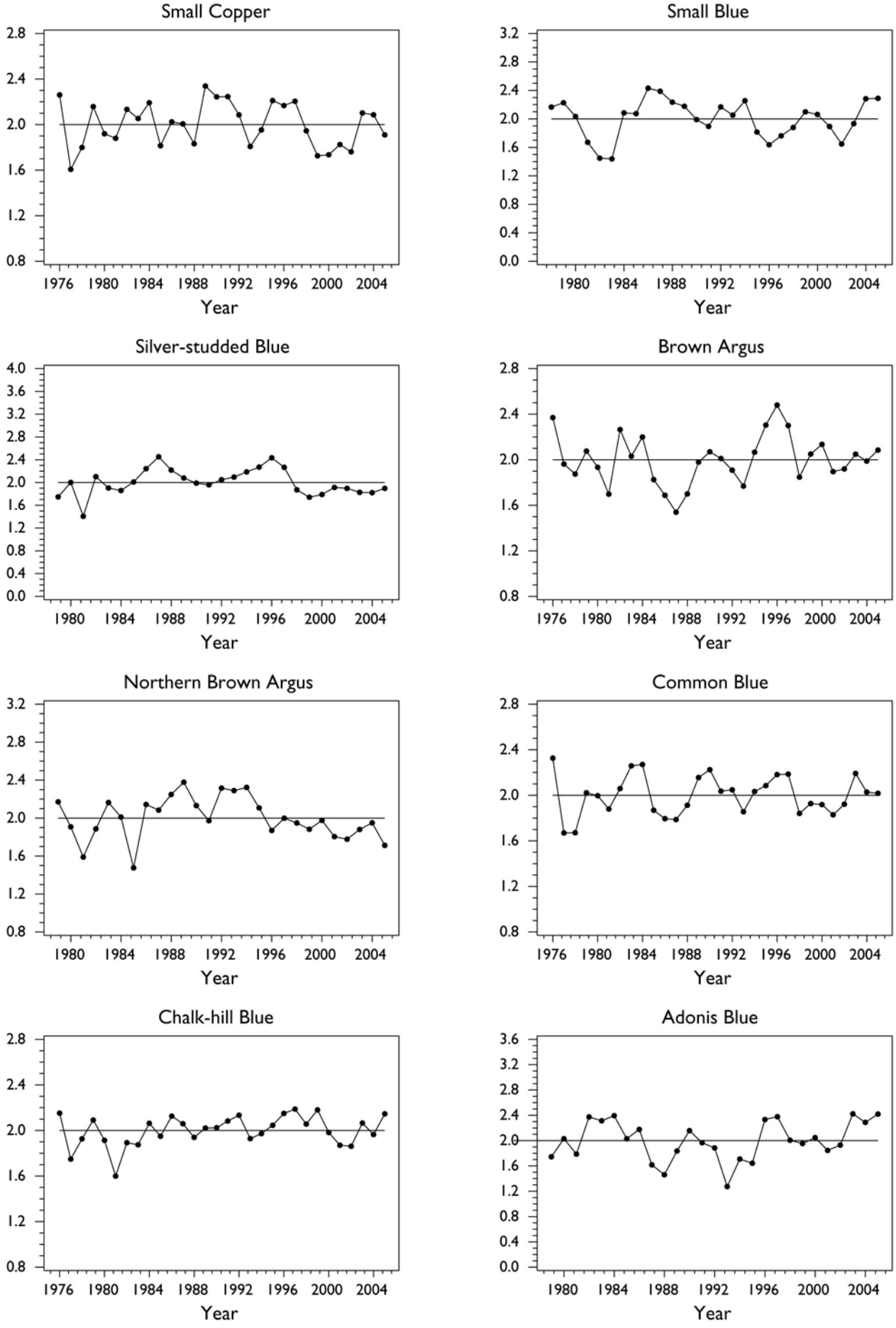

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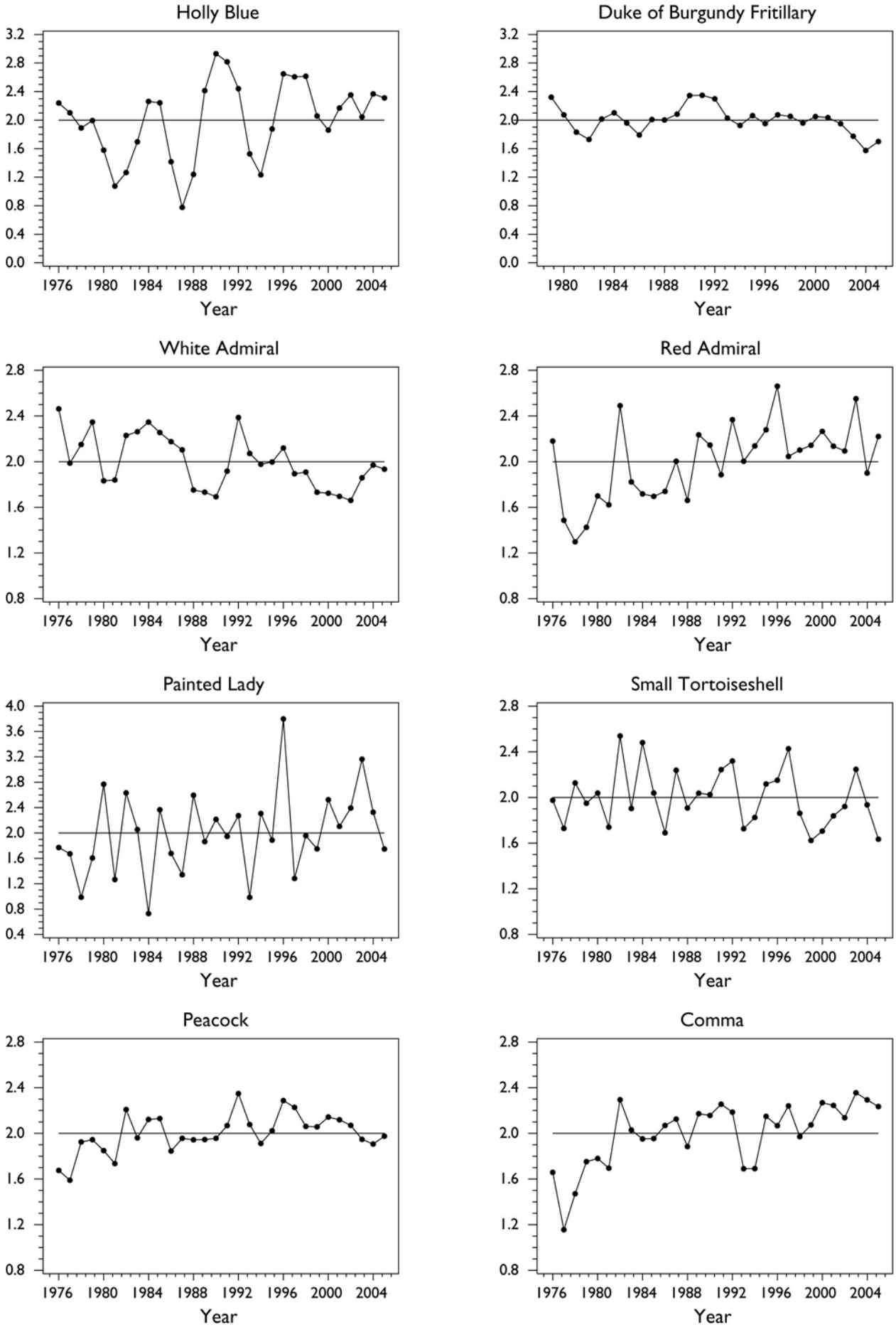

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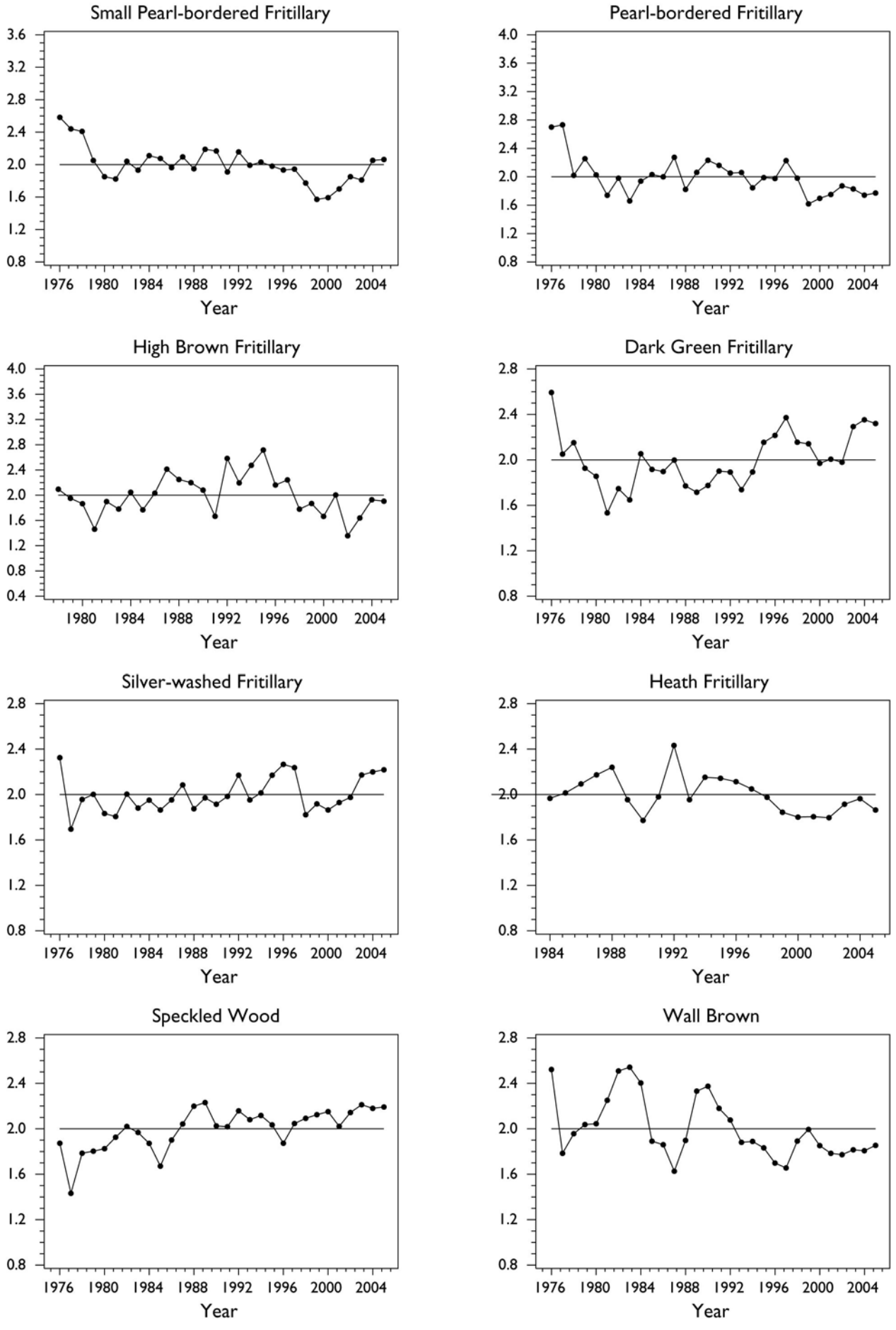

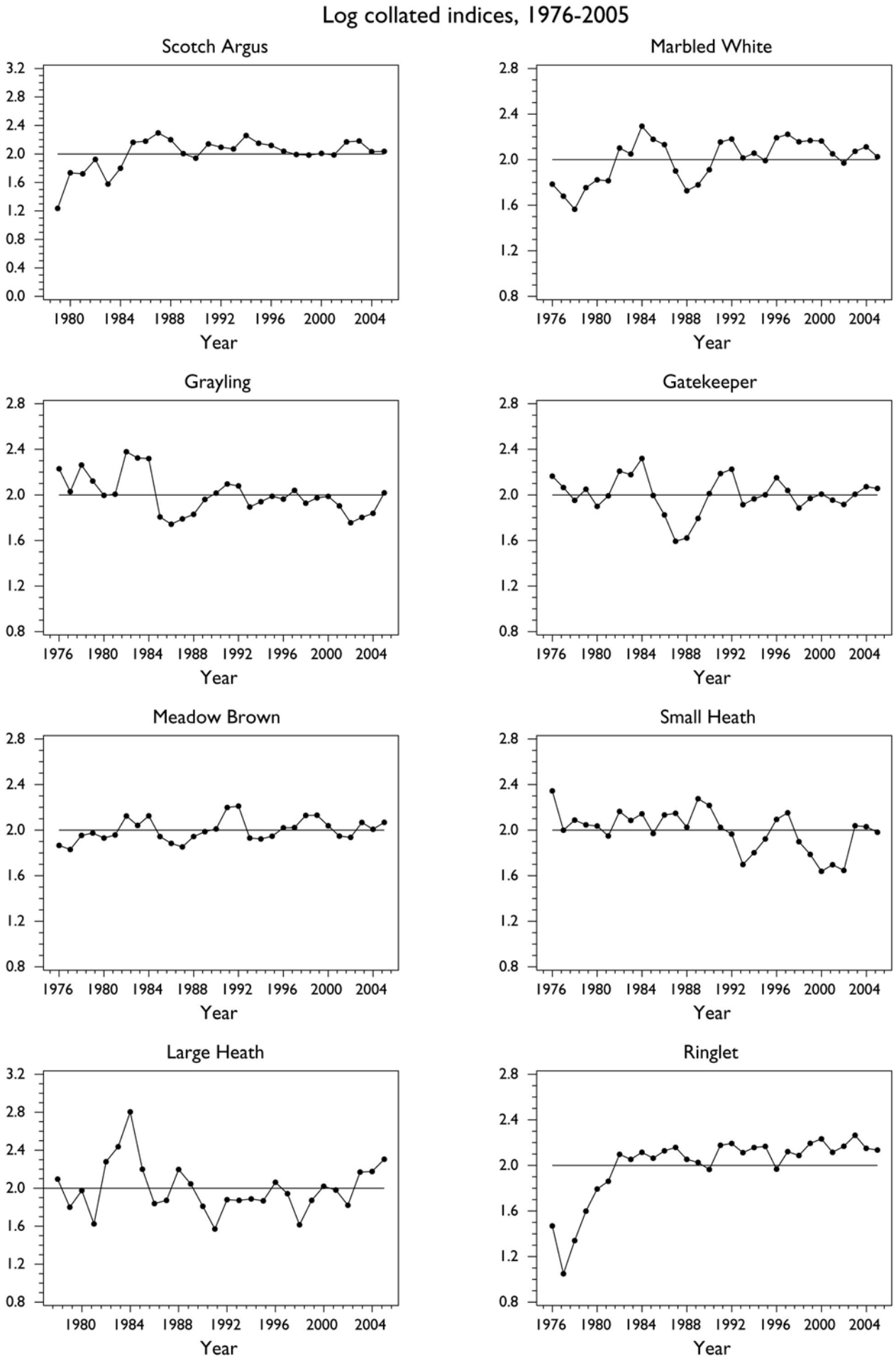
Log collated indices, 1976-2005
Scotch Argus
Marbled White
Grayling
Gatekeeper
Meadow Brown
Small Heath
Large Heath
Ringlet
Year

Appendix II: Summery of changes 2004/05

SPECIES	2004 all-sites index	2005 all-sites index	% change Down	% change Up	Rank order of 29 years 2004	Rank order of 30 years 2005	Lowest/highest all-sites index Comments	Comments	Trend in all-sites index
Small/Essex Skipper	112	92	18		13	19	Below average		8
Sliver-spotted Skipper	256	304		19	6	4	High	Dramatic long-term increase	2317***
Large Skipper	84	70	17		21	26	Low	Below average for 8 years	4
Dingy Skipper	72	92		28	27	18	Average	Highest since 1997. Long-term decline	-36**
Grizzled Skipper	80	80	-	-	22	21	Below average		-35
Clouded Yellow	708	565	20		7	9	Above average	Good numbers last 4 years	1908
Wood White	112	59	47				Below average		-66*
Brimstone	114	116		2	10	8	High		23
Large White	75	112		49	25	11		Highest since 1998	-23
Small White	112	79	29		12	19	Below average		8
Green-veined White	121	88	27		8	21	Below average		8
Orange Tip	109	108	1		10	11			23
Green Hairstreak	93	102		10	12	17	Average		-25
Purple Hairstreak	121	73	40		14	23	Low	Sizeable decrease	47
Small Copper	122	81	34		12	20	Below average		-11
Small Blue	191	194		2	4	3	3rd highest		5
Silver-studded Blue	66	79		20	23	18	Average		-5
Brown Argus	97	121		25	16	8	High		20
Northern Brown Argus	89	52	42		16	25	Low	Sizeable decrease	-26
Common Blue	107	104	3		14	16	Average		9
Chalkhill Blue	92	140		52	19	5	High	Substatial increase	36
Adonis Blue	194	262		35	1	2	2nd highest		56
Holly Blue	232	204	12		8	10	Above average		302
Duke of Burgundy	141	136	4		10	11	Above average		-39
White Admiral	93	86	8		16	17	Average		-61**
Red Admiral	79	166		110	19	8	High	Substatial increase	350***
Painted Lady	213	56	74		9	21	Below average	Sizeable decrease	394
Small Tortoiseshell	86	43	50		17	29	2nd lowest	Sizeable decrease	-27
Peacock	81	94		16	25	15	Average		80*
Comma	196	172	12		3	8	High		319***
Small Pearl-bordered Fritillary	112	115		3	11	12	Above average		-63***
Pearl-bordered Fritillary	55	59		7	26	24	Low		-67**
High Brown Fritillary	141	94	33		8	15	Average		-15*
Dark Green Fritillary	225	209	7		3	4	High		82
Silver-washed Fritillary	158	165		4	5	4	High		49
Heath Fritillary	92	73	21		13	17	Average		-53*
Speckled Wood	151	155		3	5	4	High		164**
Wall Brown	64	71		11	24	20	Below average		-65**
Scotch Argus	107	108		1	15	14	Average		164**
Marbled White	129	106	18		11	17	Average		118**
Grayling	69	104		51	24	11	Above average	Substatial increase	-48**
Hedge Brown	118	114	3		8	10	Above average		-9
Meadow Brown	102	117		15	14	7	High		29
Large Heath	150	202		35	7	3	3rd highest		-17
Small Heath	107	96	10		15	19	Below average		-51**
Ringlet	141	4		10	11		Above average		353***