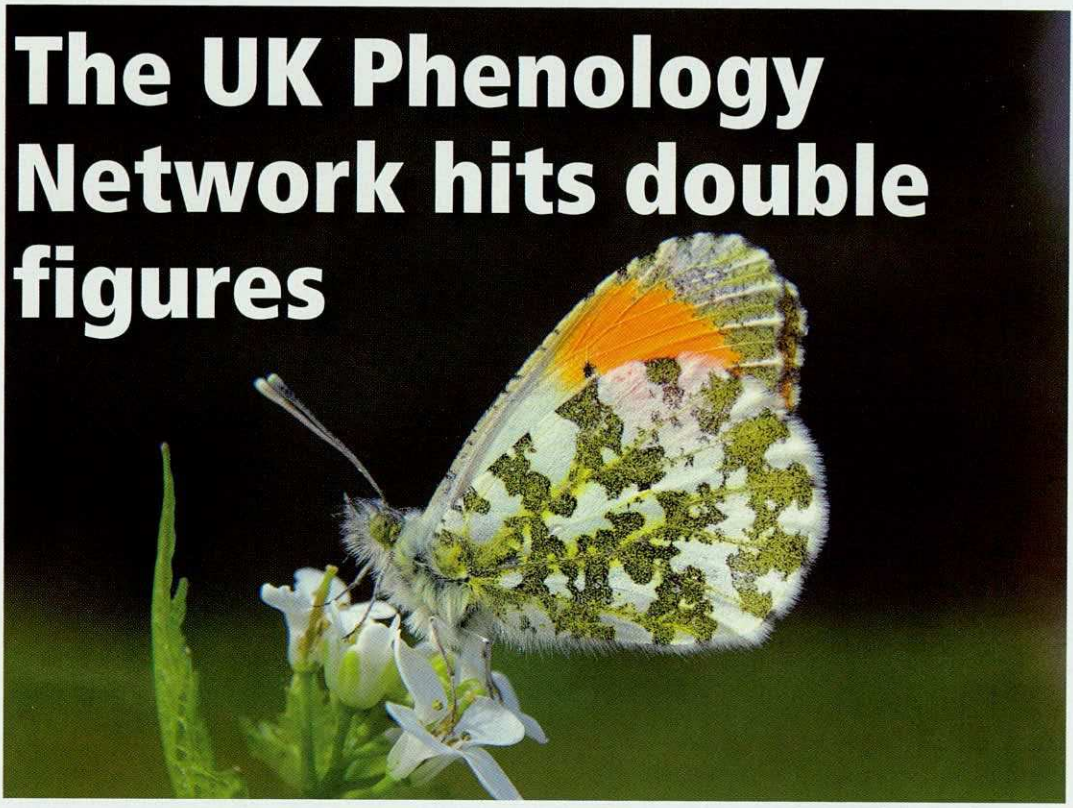
The UK Phenology Network hits double figures



Orange Tip butterflies had a remarkably early spring in 2007.
Paul Sterry/Nature Photographers

Tim Sparks and Nick Collinson

The UK Phenology Network passed a milestone in 2007, when it completed its first ten years of recording. From its humble beginnings in 1998, it has become a sophisticated operation with support from a dedicated army of recorders. When we look back to the original article in *British Wildlife* (Sparks *et al.* 1998), two statements now seem ironic. First, we hoped to be able to achieve 400 recorders, but 40,000 are now registered to record (although not all of these people record every year). Secondly, we suggested that phenology might be viewed as a poor relation by the scientific community, yet there has been a complete reversal in its fortune; it features very prominently in the latest Intergovernmental Panel on Climate Change report as one of the major pieces of evidence of the natural world responding to a warming climate.

Not another early spring?

Have we become blasé about early springs? Certainly, they have been such a feature of recent years that we have already come to accept them as the norm. For example, in 14 of the past 17 years the January-April mean Central England Temperature has been above the 1961-1990 average. When we do get an average year, as for example in 2006 (Fig. 1), we consider the spring to be cold and late. We are no longer surprised to see bumblebees *Bombus* and Red Admirals *Vanessa atalanta* in flight in January, or dandelions *Taraxacum* and Daisies *Bellis perennis* flowering in winter.

Despite this, spring remains a fascination to most naturalists, relieved perhaps that the natural cycles have persevered for another year. To put current springs in context, it is necessary to consider them in the longer term. A report in the *Cambridge Evening News* stated 'Does the present succession of mild Januaries suggest something in the nature of a change in climate? Today amateur gardeners have ... a show of flowers usually retarded by frost until spring.' This article, however, was written in January 1933.

We recently received from a recorder a scanned copy of the *Cumberland Pacquet* of 11th May 1779. It contains a letter contrasting the two very

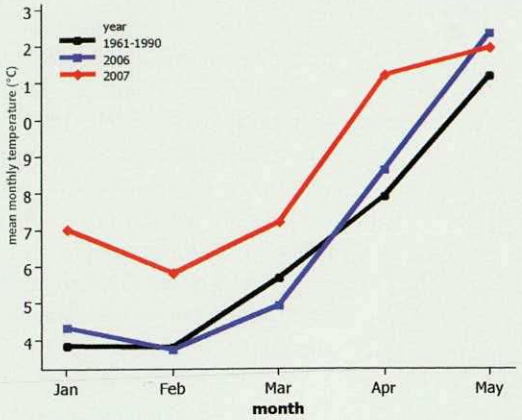


Figure 1 Central England Temperatures for January-May 2006 and 2007 in comparison with the 1961-1990 average.

different seasons of 1778 and 1779. The average flowering date in Carlisle in 1779 was 35 days earlier than that in 1778, making 1779 remarkably early.

Clearly, these examples demonstrate that we need to be cautious in pointing to climate change as the reason for milder springs, and any claims that we make about long-term changes need to be on the basis of recorded observations, not anecdote and certainly not memory. The late Richard Fitter recorded a vast quantity of data. His record showing an advance in flowering dates of Dog's Mercury *Mercurialis perennis* is illustrated in Fig. 2. In comparison with data from deep within the European continent, it also reveals that there is much greater variability in the UK springs.

Spring 2007

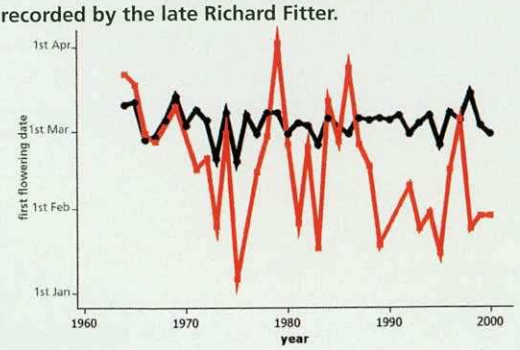
The mean Central England Temperature for January to April 2007 was warmer than in any other year over the 350 years during which records have been kept. It beat the next warmest year (1990) by almost 0.3°C. Fig. 1 shows that temperatures in each month from January to April were well above average. Indeed, those in January and April exceeded the average by over 3°C. It was warm right across Europe, with many temperature and (lack of) rainfall records being broken in April. Switzerland even had to contend with forest fires in April. When all the data are assembled, they will probably reveal the earliest European spring on record. What, then, happened in the UK, and how did it contrast with the more normal temperatures in the previous spring?

From Table 1 it is clear that spring 2007 was considerably earlier than that of 2006, with the exception of the timing of arrival of migrant birds. Leafing dates were an average of two weeks

Species/event	Mean date	Days earlier than 2006
Leafing		
Ash *Fraxinus excelsior*	30 April	5
Silver Birch *Betula pendula*	11 April	12
Beech *Fagus sylvatica*	**19 April**	9
Elder *Sambucus nigra*	**8 March**	21
Horse-chestnut *Aesculus hippocastanum*	4 April	14
Pedunculate Oak *Quercus robur*	**16 April**	17
Hawthorn *Crataegus monogyna*	18 March	22
Rowan *Sorbus aucuparia*	13 April	10
Sycamore *Acer pseudoplatanus*	11 April	13
Lawn first cut	**9 March**	24
Flowering		
Horse-chestnut *Aesculus hippocastanum*	**21 April**	15
Lesser Celandine *Ranunculus ficaria*	**23 February**	23
Blackthorn *Prunus spinosa*	**11 March**	29
Hawthorn *Crataegus monogyna*	**20 April**	18
Bluebell *Hyacinthoides non-scripta*	9 April	18
Snowdrop *Galanthus nivalis*	21 January	10
Meadow Foxtail *Alopecurus pratensis*	**29 April**	15
Migrant birds		
Cuckoo *Cuculus canorus*	29 April	0
Swift *Apus apus*	**4 May**	0
Swallow *Hirundo rustica*	19 April	-2
House Martin *Delichon urbica*	**25 April**	0
Resident birds		
Blackbird *Turdus merula* nesting	**19 March**	8
Blackbird feeding young	20 April	7
Song Thrush *Turdus philomelos* singing	**8 February**	6
Blue Tit *Cyanistes caeruleus* nesting	**26 March**	10
Blue Tit feeding young	**7 May**	9
Rook *Corvus frugilegus* nesting	**3 March**	6
Amphibians		
Common Frog *Rana temporaria* spawn	**26 February**	17
Tadpoles	**26 March**	15
Insects		
Orange Tip *Anthocharis cardamines*	**16 April**	17
Red Admiral *Vanessa atalanta*	**16 March**	37
Small Tortoiseshell *Aglais urticae*	**25 March**	19
Peacock *Inachis io*	19 March	26
7-spot Ladybird *Coccinella 7-punctata*	**6 March**	16

Table 1. Mean first dates for a selection of events recorded in 2007, and a comparison with timing in 2006. Dates in bold are the earliest, or match the earliest, recorded so far for the UKPN.

Figure 2 First flowering dates of Dog's Mercury 1964-2000 in Tatarstan, Russia (black line), and Oxfordshire, UK (red line). The UK data were recorded by the late Richard Fitter.



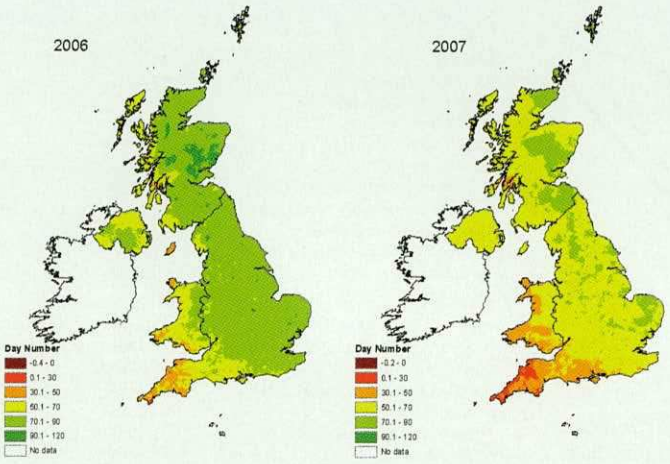


Figure 3 First spawning dates in the UK for the Common Frog in 2006 and 2007. The scale is in days after 31st December, so that days 50-70 equate to 19th February to 10th March.

earlier. We are now used to the modest response of Ash *Fraxinus excelsior* and large response of Hawthorn *Crataegus monogyna* to warming. The arrival dates of the four species of migrant bird were either on a par with 2006 or slightly later. Breeding activity by resident birds averaged a week earlier than in 2006, and flowering dates 18 days earlier. Among the butterflies, records of Red Admirals were over a month earlier than in 2006, reflecting the massive increase in overwintering and early-spring activity by this species. Even the non-hibernating Orange Tip *Anthocharis cardamines* was 17 days earlier on average. Frog spawning dates also averaged 17 days earlier, and the stark contrast between 2006 and 2007 can be seen in Fig. 3, where much of England in 2007 is in the day 50-70 range, as opposed to the day 70-90 range of 2006.

Of course, we cannot draw any firm conclusions about spring 2007 from comparison with spring 2006. However, if we look in the longer term, 22 of the 34 events in Table 1 were earlier or as early as any recorded by the network since 1998. Other dates were typically only marginally later than the earliest. That not every event had its earliest date confirms that different species respond to different cues, for example soil temperature rather than air temperature. Combined with the record high temperatures, this probably makes spring 2007 the earliest one ever documented.

Whether the spring of 2007 was actually the earliest on record or not is perhaps little more than a headline. The important point is the apparent increasing prevalence of record-breaking springs, in terms of both temperature and the timing of natural events. Certainly, our recent observations and our collections of phenological data from the last few centuries, when analysed against temperature, lead us to believe that the scale and rapidity of recent changes are unprecedented.

Of course, temperatures have varied in the past and, as reported above, some springs in past decades and centuries have been very mild, with resultant early phenology. However, it is the fact that 14 of the last 17 springs have been warmer than the 30-year average which begins to tell the story. It certainly tallies with all the other climate-change observations and, ten years on, phenology in the UK is now, undoubtedly, seen as a real-time and very relevant science.

Autumn 2007

Full analysis of autumn 2007 was not complete at the time of writing. As we have come to expect, however, an early spring was followed by early fruit ripening. In 2007, Blackthorn *Prunus spinosa*, Bramble *Rubus fruticosus* agg., Hawthorn and Horse-chestnut *Aesculus hippocastanum* all produced the earliest fruit-ripening records so far collected by the network. On average, they were between three and ten days earlier than in 2006. However, autumn temperatures in 2007 were markedly lower than those in 2006. Consequently, first leaf-fall dates of Ash, oaks *Quercus* and Silver Birch *Betula pendula* were also all earlier than previously recorded, and were between 15 and 20 days earlier than in 2006. Tree-bare dates for these species were five to ten days earlier than in 2006 but were not the earliest ever. The final lawn-cutting averaged 29th October, five days earlier than in 2006.

No longer the poor relation

Phenology has achieved greater scientific and political status in recent years as its ability to reflect temperature has become recognised. As it is the most responsive and easily detected aspect of

the natural environment to warming temperatures there has been a surge in interest worldwide, even the USA starting a national phenology network, as concern about climate change has risen on everyone's agendas. Our own UK Spring Index (the mean first dates of Swallow *Hirundo rustica*, of Orange Tip, and of Horse-chestnut and Hawthorn flowering), discussed in an earlier *British Wildlife* (Collinson & Sparks 2005), is now one of the UK's 2010 Biodiversity Indicators (Defra 2007). An England Spring Index now forms an indicator of England's Biodiversity Strategy. The latest Intergovernmental Panel on Climate Change report, in the section dealing with impacts, featured phenology prominently, including a separate box for the pan-European study on phenological change that included data from the UK Phenology Network.

Robert Marsham

The year 2008 also marks the 300th anniversary of the birth of the Norfolk naturalist considered to be the father of British phenology. More details about him can be found at www.robertmarsham.co.uk. Modern-day phenologists caught up with the compulsive recording bug should be able to sympathise with the desperate plea from Marsham to his cousin seeking the Blackthorn flowering date for that year. Marsham had lost his and was 'half ruin'd'.

The first decade

Each passing year boosts the numbers of records which we hold. Collaboration with the BBC over its *Springwatch* and *Autumnwatch* programmes certainly boosted recordings; for example, we received nearly 30,000 frogspawn records in 2006. Ten years gives us a reasonable timescale in which to look at temperature responses, although it might still be too short, in isolation from other records, to detect long-term change. To illustrate this, look at the last ten years of Richard Fitter's records in Fig. 2. The data here would not reveal any overall trend. Nevertheless, we continue to be astonished by how responsive to temperature some of our recorded events are. For example, Fig. 4 reveals how flowering dates for the grass Yorkshire-fog *Holcus lanatus* respond at a national level to April temperature.

The phenology website (www.naturescalendar.org.uk) has achieved new levels of sophistication so that, for example, progression of events across

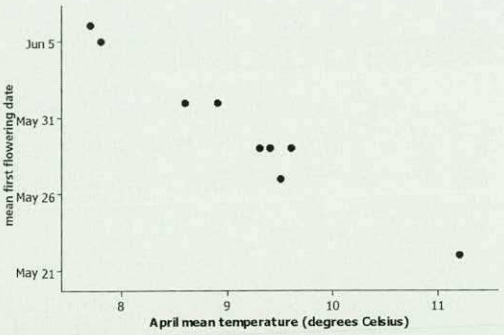


Figure 4 Mean UK first flowering date of Yorkshire-fog 1999-2007 in relation to April mean Central England Temperature. A 1°C increase in temperature is associated with earlier flowering by four days.

the UK can now be compared directly for different years or for different events. The network may be a victim of its own success. Certainly, the costs of developing the website and the running costs of a network of this size are substantial. All of these costs have been borne by the Woodland Trust, and the lead author would like to acknowledge publicly his gratitude to the trust as the saviour of phenology. In a bid to reduce costs, there will be a gradual shift in emphasis away from paper to electronic recording and communication. However, the network remains vigorous and healthy and, at the start of its second decade, is set to become an increasingly powerful tool for detecting environmental impacts. Beside all of this, it is 'Jolly Good Fun' for the recorders.

Acknowledgements

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References

Collinson, N, & Sparks, T 2005 Nature's calendar – 2004 results from the UK Phenology Network. *British Wildlife* 16: 251-256

Defra 2007 Biodiversity indicators in your pocket 2007 Defra and National Statistics. www.jncc.gov.uk/biyp

Sparks, T, Crick, H, Bellamy, D, & Mason, C 1998 Spring 1998 A summary of the first pilot year of a revived UK phenological network. *British Wildlife* 9: 77-81

Tim Sparks is a statistician/environmental scientist with the Centre for Ecology and Hydrology at Monks Wood. Nick Collinson is Head of Conservation Policy with the Woodland Trust.