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WHAT COMES AROUND – THE LAMP – GOES AROUND, OR DOES IT ?

PRESIDENTIAL ADDRESS DELIVERED TO THE SOCIETY ON 15TH FEBRUARY 2005

M.R.Hall
Hopefield, Norwich Road, Scole, Diss, Norfolk, IP21 4DY.

When Council did me the honour of inviting me to be your President for this year my first reaction was complete surprise quickly followed by a feeling of pride and then misapprehension or even panic. Like, I suspect, many before me my thoughts soon turned to "The Presidential Address" and the need for at least the title to be decided in the not too distant future. Thinking about my interests and prejudices I decided on the title you see in the programme. It was some time later that I realised the title also has another significance, at least in part. I am not the first person to live in the village of Scole who has been the President of this Society and we must all be forever grateful to my predecessor. He was Dr. Michael Beverley the man in many ways responsible for the founding of the Society. It was in his rooms in the Norfolk and Norwich Hospital in the 1860s that like minded people discussed the idea of a natural history society and the Norfolk and Norwich Naturalists' Society was born in 1869. It was in 1872 – 73 that Dr. Beverley became the Society's third president and a short passage from his presidential address on the 25th March 1873 is uncannily pertinent to my theme:

"In the discussion which followed Mr. Barrett's paper (on the irregular appearances of the Camberwell beauty butterfly), *it appeared to be the opinion of the Entomologists present, that the sudden and irregular appearances of these butterflies are to be attributed to some peculiarity in the season favouring their development – that the eggs may remain dormant until such circumstances occur – and that sound, perfect insects are doubtless to be found every year which continue the race – but that their occurrence in numbers is owing to climatic influence, and certainly not to immigration."*

Dr. Beverley left residence in the hospital to live in Prince of Wales Road and then moved to Scole, where he stayed for more than ten years, before moving to Overstrand. His presence in the village is still remembered by some of the older residents in the name of a track which passes behind the house where he lived – it is known to them as "doctor's lane" but sadly few of the younger generation use that name today.

Regretting the loss of some traditions and what must seem to the young to be a desire to halt change are among the penalties of getting old. However, there are compensating benefits and in the world of biological recording to be able to look back and see changes, developments and patterns that are not immediately obvious in the short term is one of them. I believe that having regularly recorded moths for more than 20 years I can, in some measure, quantify some of the changes that have undoubtedly occurred in the populations of the species of moths to be found in and around my garden at Scole. I am going to outline how such information is dependent on effective trapping and recording techniques and then how such records can indicate changes in both the biology and ecology of some of the species observed. Such changes would be much less obvious from a more sporadic recording regime or one that moved from site to site.

In recent years we have all heard much about Biodiversity Action Plan (BAP) species. These are usually species that have declined in numbers or distribution or both, or appear to have declined, and have been designated as in need of some action to halt and hopefully reverse the perceived trend. By their very nature such plans are aimed at the less numerous (rare) species where quantitative data are much more difficult to obtain than they would be for common species. In the world of moths this problem is greatly exacerbated by the very nature of the group and the limitations in the techniques used to record them.

At the time of Dr. Beverley and the pre-eminent Victorian entomologist Mr.Charles Barrett mentioned in his address, who was resident in Norfolk for some time and produced the first list of Norfolk moths which was published in the Society's *Transactions* in 1873, moths were studied by field-craft techniques such as beating, sweeping, smoking, sugaring, sallowing, ivying

etc. and when they were attracted to gas lights in the street, house lights and paraffin lanterns – The Lamp – which were taken into the field. Emphasis was also placed on searching for larvae, pupae and even eggs and rearing as many species as possible in confinement – from both larvae found in the wild and eggs from captured females. It was by such means that for many species (but not all) the life cycle was discovered as was much of the biology, distribution and what today we call ecology. Based on their knowledge Barrett and his colleagues, at that meeting in 1872, decided that fluctuation in the appearances of the Camberwell beauty, *Aglais antiopa* (Linn.), could not be due to immigration. In that we now know they were wrong but they were well aware that such variations could be due to climatic influences (not perhaps such long term dormancy in eggs as they suggested, although eggs for some species do take considerably longer to hatch at some times of the year than they do at others) something that is once again to the fore in our considerations as to the possible effects of global warming. Many species of moths exhibit cyclical fluctuations in their populations. These cycles can be short, medium or long term and are not always readily picked up with less than daily recording over quite long periods and sometimes not even then.

Today many of the techniques favoured by the Victorian lepidopterists have been sidelined by the use of the ubiquitous mercury vapour light-trap. To set up such light-traps is an easy and superficially effective way of sampling moth populations and with modern, small generators can be done almost anywhere. However there are limitations to such a technique especially if it is used as the sole means to assess the status of many species particularly those that are less numerous and restricted in their distribution.

Moth Traps, Trapping and Recording

Little changed in the way moths were recorded between the time of Barrett and the end of the second world war except for a steady increase in the use of electric light and the availability of "portable" generators which were really extremely bulky and mainly the province of the wealthy. Pressurised paraffin lanterns – Tilley Lamps – were still the mainstay of most field recording for virtually all the amateur enthusiasts. In January 1950 a paper was published in the very first edition of the *Entomologist's Gazette* in which the authors (Robinson and Robinson, 1950) detailed experiments to determine an

effective and practical light source that could be operated with their design of a trap which had "all round visibility" and the prototype of what became known as the "Robinson Trap" was introduced to entomologists. Subsequently (Robinson, H.S., 1952) modifications to the design were reported and the Robinson Trap of today arrived – albeit initially somewhat deeper, which is significant. The advent of this trap, which made mercury vapour light (and thus a percentage of ultra-violet light) available to lepidopterists and the increasing availability of smaller, truly portable generators to operate such lights in the field meant moths were frequently seen in unprecedented numbers. Some species like the lobster moth, *Stauropsfagi* (Linn.) and the alder moth, *Acronicta alni* (Linn.), which had been regarded as rare and a great prize for the collector, were found to be much more widespread and quite regularly found in the trap. Whilst many species like the oak beauty, *Biston strataria* (Hufn.), the marbled brown, *Drymonia dodonaea* (D.& S.) and the lunar marbled brown, *Drymonia ruficornis* (Hufn.) came to the new traps in great numbers, others that had been regularly attracted to sugar and were thus known to be quite widespread seemed singularly unimpressed by the improved equipment and were seen much more rarely. Such species, like the old lady, *Mormo maura* (Linn.), and buttoned snout, *Hypena rostralis* (Linn.) are still shy of light and although odd ones are attracted by mercury vapour traps they are more usually recorded by other techniques – sugaring and searching for larvae. Despite the almost universal enthusiasm for the "new trap" with variously exaggerated claims as to from just how far away moths would be drawn into it, the designers were already questioning the effectiveness of the mercury vapour moth trap (Robinson, 1960) and came to the conclusion that moths had to be within 20 or so yards of the trap before they became disorientated and spiralled into it.

However the mercury vapour light was a great advance and just how much is shown by the following comments about a particularly common moth, the large yellow underwing, *Noctua pronuba* (Linn.), which were written more than 100 years apart. At the end of the 19thC. Barrett (1897) wrote: *"In places and seasons where and when it is more than usually plentiful, sugaring is rendered almost useless, since nothing else can withstand the eager multitudes of this species which hover over and settle upon the tempting bait. As is usual with moths with simple antennae it is not strongly*

attracted by light, though occasional specimens will fly to a gas lamp or come to a window."

At the beginning of the 21st C. Waring and Townsend (2003) wrote: *"Comes to light, sometimes abundantly – a single Robinson trap occasionally captures several thousand in a night"*. Either the moth has changed or reacts differently to the different types of light and it fairly obviously is the latter.

In the late 1960s a much lighter, battery powered, trap was designed (Heath, 1970) which utilised a small 6 watt florescent tube, was collapsible and could be easily carried in a rucksack. It was also much cheaper and was the first trap I bought, in 1974. The basic design of the Robinson trap has been used for many years but there have been one or two modifications to either make field work easier when working with the trap all the time it is operating – the collapsible Skinner trap (Fry and Waring, 2001) which still needs a 240 v. power supply – or a modified dustbin (Haggett, 1988) which gives better retention of moths trapped overnight when the catch is left until the morning. I started using Haggett dustbin traps in 1992 and with some subsequent variations in recording techniques find them particularly effective.

Whilst checking traps after 1992 I soon realised there was a significant difference in the number of species I was recording from the Haggett dustbin trap when compared with my Robinson trap. In 1997 I tried to quantify this difference using the two traps, clearly visible from each other and without any obstruction between them, about 18 yards apart and found that through the summer months I was recording both more moths and more species from the Haggett trap.

There is a difference in the effectiveness of the two traps between summer and winter recording and this has been consistent over the years. Although I have no real evidence to support the idea, I think it may be something to do with the actual height of the trap entrance and the variation in height above the ground at which moths fly in the colder and warmer months. The figures below show a definite advantage in favour of the Haggett trap during those months when many more species of moths are on the wing.

Table 1. Comparison between almost adjacent Robinson and Haggett Traps showing daily average of number of species recorded in each month in 1997

Month	Robinson	Haggett
January	2.2	1.3
February	1.3	1.1
March	5	4
April	4.6	5
May	10.4	14.3
June	26.1	34.3
July	35.3	43.5
August	28.4	29
September	12.8	13.2
October	8.5	6.8
November	1.8	1
December	1.1	0.9

When the number of days in each month when either the Robinson or Haggett trap attracted and retained most species of moths is analysed, this advantage is even greater.

Table 2. Number of days per month in which either Robinson or Haggett Traps retained most species May to September 1997

Month	Robinson	Haggett	Equal
May	3	26	2
June	5	24	1
July *	2	20	1
August *	11	18	-
September	7	13	10

* Traps off for 8 days in July and 2 days in August due to illness

From both recording in the garden and from field trips around East Anglia it was obvious that multiple trapping was more effective than using just one

trap and in 1993, by which time I was regularly using three in the garden, I decided to try to quantify this benefit in terms of number of species recorded. Two consecutive nights in June were very similar in conditions and the following tables show the variation in number of species recorded in the three traps for the first of those two nights.

Table 3a. Number of species recorded, by trap, on 9th June 1993

Number of Species			
Total	Trap 1	Trap 2	Trap 3
82	53	48	44
% of Total	64.6%	58.5%	53.6%

When this is broken down further – Table 3b – it is interesting to see that in those three traps the total of species recorded from just one is greater than those in either two or three, as would be expected.

Table 3b. Species frequency, by trap, for night of 9th June 1993

	Trap 1	Trap 2	Trap 3	**Total**	% of Overall Total
Species in all three traps	21	21	21	**21**	25.6%
Species in any two traps	17 7 with no. 2, 10 with no. 3	11 7 with no. 1 4 with no. 3	14 10 with no. 1 4 with no. 2	**21**	25.6%
Species in just one trap	15	16	9	**40**	48.8%

On the 10th June 1993 the breakdown between traps was very similar although the actual species seen differed a bit. There were 17 species recorded on the 9th June that were not seen on the 10th and 22 came to the lights on the 10th

that were absent on the 9th. This means for the two nights together a total of 104 different species were recorded On the 9th both southern wainscot, *Mythimna straminea* (Treits.) and flame wainscot, *Mythimna flammea* (Curtis) were recorded as singletons in the same trap and on the 10th a single silver barred, *Deltote bankiana* (Fabr.) came to another of the traps. The first two species are specialist reed-bed moths and the third, although also associated with wetlands, was more probably a migrant. Without virtually continuous, multiple trapping it is unlikely I would have recorded any of those species which indicates the value of such practice when investigating the movements of less common moths. For a complete list of species for the two nights, with breakdown by trap and night, see Appendix 1.

When conditions seem less than ideal for moth flight there are still benefits from continuous trapping in terms of recording the more elusive species. Again two consecutive nights, this time in September 2003, bear this out. On the 6th and 7th September daytime temperatures were 22½° C. and 20° C. respectively and both nights the temperature fell to 7½° C. which is a little cool for this time of year. On the 6th I recorded 23 species, none of which was exceptional, and again on the 7th there were 23 species in the traps but this time one of them was the dark spectacle *Abrostola triplasia* (L.) which, although by no means rare, has been only infrequently recorded in Norfolk. As with the nights in June 1993 each night produced some different species with a total of 30 for the two nights. For a complete list of species for these two nights, with a breakdown by trap and night, see Appendix 2.

A further example of the value of continuous trapping at a single site as one of the tools for helping to understand the ecology of moths comes from a little later in September 2003. During the week from the 14th to the 20th five of the seven days were very similar in both day and night temperatures and the nightly record of species noted only varied from 29 to 31. However the overall total for these five days was 60 and the percentage of this total seen on any one night was around 50%.

When the figures below are considered in conjunction with the number of species seen on all five days against those seen on only one of the five days the value of continuous recording is even more compelling.

Table 4a. Number of species recorded on five days between 14th and 20th September 2003

Date	14/9	15/9	16/9	19/9	20/9
Max. day temp.	23½° C.	23° C.	24½° C.	24° C.	25° C.
Min. night temp	10° C.	10° C.	11° C.	11° C.	11° C.
No. of Species	30	30	29	31	29
% of Total	50%	50%	48.3%	51.7%	48.3%

Table 4b. Frequency of appearance of species on each day from 14th to 20th September 2003

Species seen on 5 days	12	20% of total
Species seen on 4 days	1	1.7% of total
Species seen on 3 days	12	20% of total
Species seen on 2 days	11	18.3% of total
Species seen on 1 day	24	40% of total

Once again the highest percentage of species was seen on only one day of the five (not necessarily the same day) indicating how many would have been missed if recording had not been continuous. During the week considered, records for the 17th and 18th have been omitted as on those two nights the overnight minimum temperature was 13°C. which is around the threshold for optimum moth activity, at this time of year. With this higher temperature 38 species were recorded each night and thus they were not really comparable with the other five nights.

During the years I have been recording moths, on two occasions I have had serious problems with birds entering the traps early in the morning and decimating the catch. This first happened in 1988 with the Robinson trap and after several abortive attempts to combat the problem the only way to stop such carnage was to turn the trap off. It was left off until the start of 1990 by which time the culprits had either forgotten or were dead. With the subsequent reliance on Haggett traps I felt the problem was a thing of the past as there is no pool of light on the ground around the trap and thus at dawn

there are no (or very few) moths sitting around the trap to attract birds and then arouse their interest in its contents. However at the end of June 1999 the problem re-occurred and very quickly all traps were subject to early morning bird attack. Again the only viable solution was turn off the traps and wait. Although I did record occasionally through the rest of the year and in 2000 I feel it is virtually impossible to interpret these sporadic records and adequately relate them to the much more complete information available from both before and after this break, so both years have been excluded from any analyses. Discussions with friends during this second "waiting" period suggested that time of checking the traps in the morning might also be a factor. Although they were checked early, well before 7.00 am, at the height

Table 5. Totals of macro-moth species recorded each Year from 1984 to 2004 related to number and type of trap

Year	No. of Traps	Type of Traps	No. of Species
1984	2	2 Heath	164
1985	2	1 Heath, 1 Robinson	194
1986	2	1 Heath, 1 Robinson	207
1987	2	1 Heath, 1 Robinson	241
1990	1	1 Robinson	266
1991	1	1 Robinson	277
1992	3	1 Robinson, 2 Haggett	304
1993	3	1 Robinson, 2 Haggett	312
1994	4	1 Robinson, 3 Haggett	352
1995	4	1 Robinson, 3 Haggett	349
1996	4	1 Robinson, 3 Haggett	351
1997	4	1 Robinson, 3 Haggett	343
1998	4	1 Robinson, 3 Haggett	324
2001	2	2 Haggett	302
2002 *	2	2 Haggett	319
2003 *	2	2 Haggett	333
2004 *	2	2 Haggett	320

* In 2002, 2003 and 2004 traps checked at dawn
Traps not run 1988/1989 and 1999/2000 as birds decimating the catch

of the summer there was still at least three hours daylight before checking and birds rise at dawn. When the traps were reinstated for regular recording in 2001 I did check them earlier through that summer but since 2002 I have been checking around dawn right through the year and as well as no problems with birds (so far) it has also significantly increased the number of species recorded. In 2002, 2003 and 2004 I have recorded as many species each year with two traps as I did in 1992 and 1993 with three and almost as many as in 1994 to1998 with four.

The above table shows how the number of species recorded each year has increased with number and effectiveness of traps and then with time of checking. Increase in number of species recorded during the early years is also due, at least in part, to increasing expertise in identification and during those years, particularly before 1984, I received much help with this.

In the same way that the cumulative total of different species recorded in any week is greater than the total recorded on any single day, the cumulative total over a period of years is greater than for any individual year. This over-all total for macro moths recorded at Scole from 1984 to 2004 inclusive is 444 but it is more significant that in those twenty years there have been 23 species seen just once. These 23 are species that are generally regarded as residents in Britain and do not include recognised migrants. With 5% of the species recorded falling into this category it again emphasises the importance of continuous recording.

It was in 1984 that I began recording daily numbers for all macro species seen and this continued until the end of 1987. By then this was becoming a particularly time consuming exercise. At the same time I was plotting daily occurrence, without details of numbers, for each species and with these "year-on-year" charts being on the same piece of paper differences in time and duration of appearance began to emerge. After the break in 1988 and 1989, to combat bird problems, when recording began again in 1990 I did not continue with noting numbers of individuals for species.

The on-going "year-on-year" charts were indicating changes for many species and with a general but unquantified impression of quite significant variation

in numbers for some species I decided, in 2003, to once again count and record numbers for some 30 selected species. I decided on which species to count by taking into consideration noticeable changes in the "year-on-year" charts such as time of appearance, increases and decreases in occurrence and, subjectively, in numbers and voltinism. Many species have a tendency for additional broods which frequently manifests itself with odd individuals appearing much later, or occasionally earlier, than the norm. In recent years, for some species, these singletons have "grown" into definite additional broods, which is not always an advantage. I have also tried to choose species that are representative of the different families but have only considered those that have occurred in sufficient daily numbers (at least for some of the time) to make any subsequent analysis of the figures meaningful. This means that only common species have been considered.

Preliminary Analyses of Species Records

A large number of the species I see at Scole occur fairly regularly but not in sufficient numbers to warrant a more detailed analysis of populations. Of the 444 species recorded to the end of 2004, 244 have been sufficiently consistent in both occurrence and numbers for trends to be subjectively assessed from the "year-on-year" charts (represented by the species tables in this paper).

(i) Changes in time of appearance

Allowing for natural variation in appearance time according to season, discounting exceptionally early singletons and placing more emphasis on the peaks of emergence for individual species, of this 244 nearly half, 114, may be flying a few days earlier now but really have shown virtually no change in recorded flight times between 1990 and 2003; 42 species are between one and two weeks earlier after the fourteen years; 55 are between two and three weeks earlier whereas 13 species are between one and two weeks later and 20 between two and three weeks later. Many of those with later first sightings appear less frequently through the flight period which is also becoming shorter and they may in fact be declining either cyclically or more permanently. For many species the period 1994 to 1996 saw more individuals over a longer period than the years either side.

The year-on-year flight chart for the garden carpet, *Xanthorhoe fluctuata* (L.)

shows some variation in time of appearance but little sustained change since 1990 and numbers have been reasonably consistent all the time. It has been seen from as early as the 19th April to a latest date of 17th October.

Throughout the 20 years covered by the table below the earliest date for the garden carpet has varied between 28th May and 19th April and from these dates the first assumption would be that it appears at least a month earlier now than in did in 1984. However in the first few years the trapping capability was less than for the period since 1990 so it is quite likely that

Table 6. Daily flight records of Garden Carpet from 1984 to 2004

Year	First Generation					Second Generation				
	from	to	**4**	**5**	%	from	to	**9**	**10**	%
1984	28/5	6/7	40	6	15	15/8	8/9	25	7	28
1985	22/5	7/7	47	14	29.8	16/8	10/9	26	9	34.6
1986	27/5	29/6	34	3	8.8	17/8	6/9	21	10	47.6
1987	11/5	12/6	33	7	21.2	18/8	31/8	14	6	42.9
1990	12/5	17/6	37	3	8.1	27/7	4/9	40	11	27.5
1991	12/5	all broods					14/9	126	38	30.2
1992	23/4	all broods					27/9	158	42	26.6
1993	19/4	all broods					23/9	158	44	27.8
1994	27/4	all broods					10/10	167	95	56.9
1995	23/4	all broods					10/10	170	107	62.9
1996	22/5	all broods					12/10	144	93	64.6
1997	24/4	all broods					17/10	177	117	66.1
1998	3/5	all broods					13/10	164	114	69.5
2001	10/5	all broods					9/10	153	81	52.9
2002	20/4	all broods					10/10	174	91	52.3
2003	24/4	all broods					12/10	172	80	46.5
2004	27/4	all broods					10/10	165	95	57.6

Columns **4** and **9** show the over-all flight period in days
Columns **5** and **10** show the number of days when the species was seen
% is the percentage of days in the flight period when moth recorded

individuals were missed at the beginning and end of the flight time. It does seem that in those early years the species was flying in two broods, May and June and August and September, as indicated by South (1909) but there were also singletons recorded on the 19th September 1986, the 9th July 1987 and the 16th and 30th September 1987.

With more traps used from the early 1990s these two broods were seen to be more prolonged with the probability of an occasional and partial third brood (Skinner, 1984), and there was an exceptionally early sighting on 9th April 1995 (omitted from the table). Since 1991 the earliest appearance has moved forward by around two weeks but with 2001 being little different from 1991 and 2004 the same as 1994 these fluctuations could just reflect differences in the seasons and not real change in flight time. By 2003 there seemed to be three overlapping broods, as suggested by Waring and Townsend (2003), and whilst daily counting of individuals showed no appreciable peaks the more detailed recording revealed newly emerged specimens coming to light on 17th June, 2nd July, 15th July, 21st July, 11th August, 12th and 13th September and 11th October. This seems to indicate the species is continuously brooded in the current warm summers. I believe these changes show the garden carpet is flying up to a week earlier now than in 1990. It is representative of some 150 of the species for which I have substantial data.

The final column in Table 6 "percentage days recorded" shows a periodic fluctuation in occurrence with peaks in 1986 and 1998 and probably the start of one in 2004 with a trough in 1992 and a shallower one in 2002/3 – very approximately a ten year cycle which is not immediately obvious from "snap-shot" recording.

Another common and widespread species where the year-on-year chart is similar to that for the garden carpet is the lesser yellow underwing, *Noctua comes* Hb. It is single brooded, my earliest first record is the 22nd June with the latest first record being the 30th July and in 20 years it has fluctuated quite widely between these dates. Latest records vary between 20th September and 13th November with the majority falling around the middle of October and again the first interpretation of Table 7 below is that this species is flying a week to ten days earlier now than it did in the 1980s and that there was a peak

Table 7. Daily flight records of Lesser Yellow Underwing from 1984 to 2004

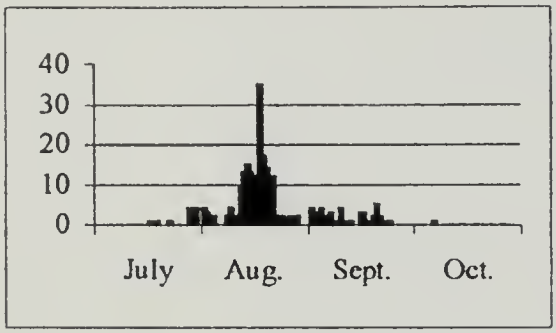
Year	Single Generation				
	from	to	**4**	**5**	%
1984	30/7	6/10	69	32	46.4
1985	26/7	20/9	57	16	28.1
1986	22/7	6/10	77	40	51.9
1987	17/7	6/10	82	48	58.5
1990	12/7	11/10	92	59	64.1
1991	18/7	9/10	84	56	66.7
1992	29/6	20/10	114	78	68.4
1993	13/7	10/10	90	70	77.8
1994	6/7	19/10	106	93	87.7
1995	10/7	13/11	127	87	68.5
1996	4/7	14/10	103	84	81.6
1997	23/6	15/10	115	88	76.5
1998	22/6	16/10	117	85	72.6
2001	9/7	13/10	97	72	74.2
2002	10/7	24/10	107	76	71.0
2003	2/7	28/10	119	72	60.5
2004	26/6	23/10	120	81	67.5

Column **4** shows the overall flight period and column **5** the number of days when seen
% is the percentage of days in the flight period when moth recorded

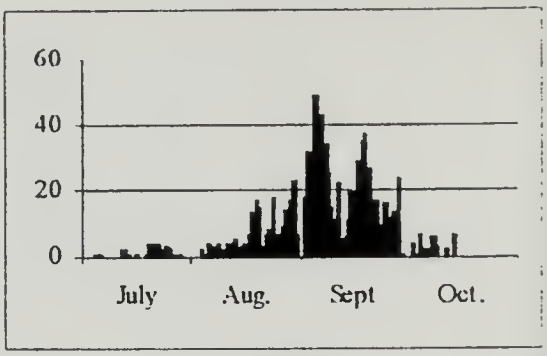
n both length of flight period and days actually recorded from 1993 to 1997. When individual numbers recorded on a daily basis are plotted the graphs do not quite bear this out.

The charts below show that numbers vary quite significantly from year to year and that the peak emergence seems to fluctuate from the second half of July in 2003 to mid August in 1987 and late August to mid September in 1996. This would appear to be a fairly normal fluctuation with a tendency to become a little earlier in recent years but there is a hint of a definite second peak in 1996 and a much more definite one in 2003 which was evident again in 2004. The lesser yellow underwing is stated to be single brooded, flying

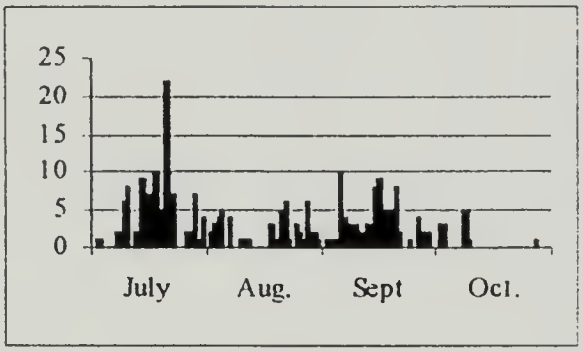
Figure 1. Lesser Yellow Underwing – Numbers recorded daily



1987



1996



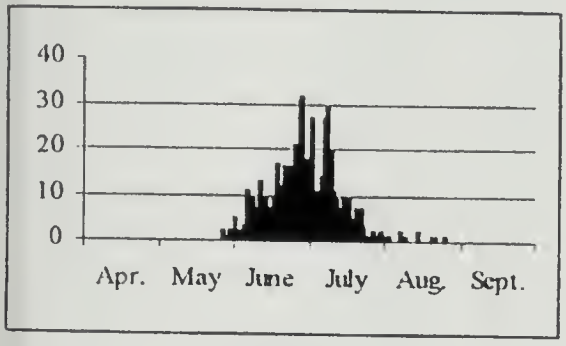
2003

from June to September/October and there is no mention of immigration or aestivation. It almost certainly has a somewhat protracted emergence which is more pronounced in its close relative the large yellow underwing, *Noctua pronuba* (Linn.), a species which does have local populations supplemented by immigrants. There is no indication of aestivation, which is known to occur with another congener, the lunar yellow underwing *Noctua orbona* (Hufn.) (and suspected in another, *Noctua janthe* (Borkh.)pers. comm. G. Haggett) but one of these possibilities may explain the two peaks in appearance time – a change in the ecology of the species in response to warmer summers perhaps – or just natural fluctuation.

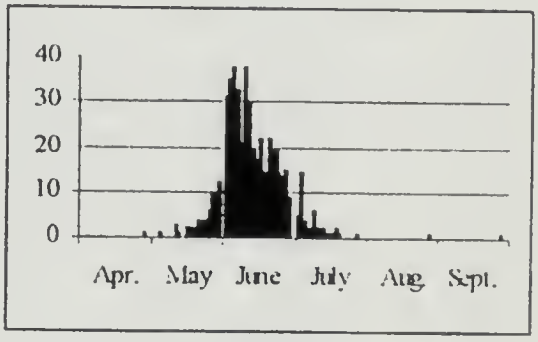
The heart and dart, *Agrotis exclamationis* (Linn.) is another common species where the year-on-year chart shows it is now flying earlier than in did in the 1980s, although there were several extremely early individuals in 1990 starting on the 27th April. That year also saw the latest record on the 14th

October. From the first record in 1984, the 3rd June, to the first sighting in 2003, the 29th April, it is over a month earlier so allowing for the sort of fluctuation seen in 1990, and to lesser extent in 1997, an average of between two and three weeks earlier is a reasonable interpretation of the data. The peaks in the following flight charts, for 1987 and 2003, show this to be about right.

Figure 2. Heart and Dart - numbers recorded daily



1987



2003

The chart for 2003 also shows two late records from the end of August and September which indicate an occasional and partial second brood. This was much more obvious in 1994 and 1995 when the moth was flying from the last week in August to the last week in September. With the individual mentioned above in October 1990 and two or three September/October records in 2001 and 2002 the occurrence of this second brood seems to be cyclical, occurring every four or five years for a year or two. It may also be becoming more frequent as a result of warmer summers allowing larvae to feed up more quickly. The heart and dart is a species that can show quite marked variation in the wing pattern and at such times as an appreciable second generation these varieties are seen more frequently, which was the case in 1995.

Table 8. Daily flight records of Brindled Beauty from 1984 to 2004

Year	Single Generation				
	from	to	**4**	**5**	%
1984	18/4	25/5	38	25	65.8
1985	11/4	25/5	45	10	22.2
1986	19/3	21/5	53	22	41.5
1987	15/4	10/5	26	17	65.4
1990	31/3	17/5	48	25	52.1
1991	9/4	19/5	41	15	36.6
1992	10/4	19/5	40	21	52.5
1993	2/4	24/5	53	27	50.9
1994	19/4	12/5	24	21	87.5
1995	10/4	26/5	47	13	27.7
1996	22/4	17/5	26	6	23.1
1997	6/4	2/5	27	7	25.9
1998	22/4	8/5	17	7	41.2
1999	21/4	1/5	11	6	54.5
2001	27/4	2/5	6	3	50
2002	21/4	seen on just one day			
2003	no sightings				
2004	4/5	5/5	seen on only 2 days		

1999 records included, as an early flying species and recorded before traps turned off

Although Table 8 above, for the brindled beauty, *Lycia hirtaria* (Cl.) shows the species to be flying two to three weeks later in 2004 than it was in the late 1980s it also shows marked fluctuation with poor years in 1985, 1995 to 1997 and since 2001, with much better and roughly similar years otherwise. This species also feeds on a wide range of broadleaved trees and shrubs and is found in many different habitats. However, it does fly comparatively early in the year and much of the variation seen in table 8 may really reflect cold springs when the activity of moths is greatly reduced and they are not around to be attracted to light, rather than any decline in the population.

The nutmeg, *Dicestra trifolii* (Hufn.) is another species first seen now, in any numbers, considerably later than at any time in the 1990s.

Table 9. Daily flight records for Nutmeg from 1987 to 2004

Year	First Generation					Second Generation				
	from	to	**4**	**5**	%	from	to	**9**	**10**	%
1987	31/5	16/7	47	18	38.3	24/7	29/8	37	16	43.2
1990	24/4	Continuous flight time					13/10	173	131	75.7
1991	7/5	Continuous flight time					4/9	121	87	71.9
1992	22/4	Continuous flight time					29/9	161	112	69.6
1993	24/4	Continuous flight time					1/10	161	96	59.6
1994	13/5	Continuous flight time					9/10	150	84	56
1995	16/4	Continuous flight time					25/10	193	132	68.4
1996	25/4	Continuous flight time					26/10	185	133	71.9
1997	5/4	Continuous flight time					23/10	202	141	69.8
1998	23/4	Continuous flight time					21/9	152	102	67.1
2001	19/5	seen only one day				6/8	13/8	8	5	62.5
2002	no April, May or June records					1/7	11/9	72	18	25
2003	30/5	31/5	-	2	-	4/7	27/9	86	48	55.8
2004	6/5	Continuous flight time					26/9	144	52	36.1

Records from 1987 only, as earlier identifications are unreliable; Columns **4** and **9** show the over-all flight period for that generation, where applicable; Columns **5** and **10** show the number of days when the species was seen; % is the percentage of days in the flight period when moth recorded

The above species flight table for the nutmeg shows both a fairly standard fluctuation, with a fall in the population in 1993 and 1994, and what seems to be a fairly dramatic change in either population or voltinism or both from 2001 onwards. Although this species is described as being double brooded with the first flight from May to early July (Barrett, 1897) or April to June (Skinner, 1984 and Waring & Townsend, 2003) and the second in July and August (Barrett, 1897) or August to September (Skinner, 1984 and Waring & Townsend, 2003) my records show a consistent flight period from April/May to September/October for the 1990s. There was no "dip" as if to indicate two

generations, although daily numbers were not counted. From 2001 what could be considered as the "early" brood was absent except for odd individuals although in 2004 moths were seen on seven days in early May and five in early June but only as singletons (which might have been just 2 or 3 individuals) and with the species flying from July to September, in reasonable numbers, this approximates to its described habit in Britain from the Midlands northwards where it is single brooded (Skinner, 1984 & Waring et. al. 2003). Intriguingly Barrett (1897) makes no mention of a single generation in the north although all authors indicate the species is only locally common, predominantly in the east and south-east, and favours an open habitat on light soils, particularly the coast and Breckland. I do not know whether the recorded changes in the flight patterns of the nutmeg at Scole represent just a period of extreme fluctuation, a change in the number of broods, the start of a local change in habitat requirement or a period of decline but hope more detailed recording in the next few years may provide some answers.

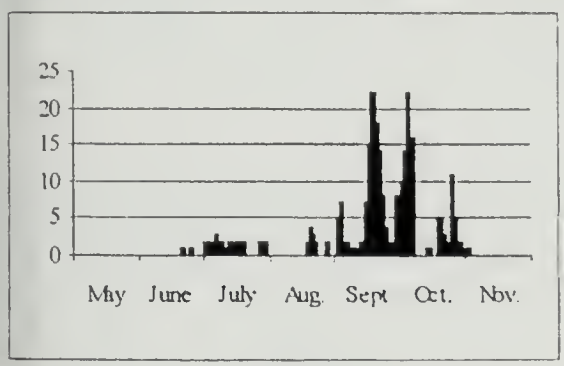
(ii) Increases in the size or number of generations

It is possible that the nutmeg has lost a generation in the last few years but in the last twenty years several species have either increased their number of generations, sometimes from one to two and sometimes from two to three, or what was a partial or virtually non-existent generation has become regular and substantial. The setaceous hebrew character, *Xestia c-nigrum* (Linn.) is a species about which there has been discussion on this matter for more than a century.

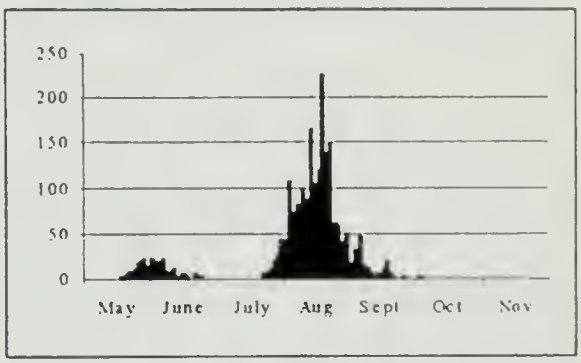
Writing in the late 19th C. Barrett (1897) said the species flew principally from August to October and added, about the smaller numbers seen in May, June and July, "*the earlier emergence is so seldom found in any abundance that pupae have been supposed to occasionally lie over from the previous year*" (the species usually overwinters as larvae with a relatively short pupal period). Early in the 20th C. it was suggested by South (1907) that in favourable seasons some larvae may pupate either in the autumn or the early months of the year and so "*attain the moth state greatly in advance of the majority*". In a later edition (South, 1961) the revising editors, Edelsten and Fletcher, add that "*our stocks are reinforced by immigrants*". In more recent

times Skinner (1984) says the species is "*Probably double-brooded appearing from May to July and again, more abundantly, from late August to October*". Waring and Townsend (2003) agree with this, adding that there is only one generation in northern Britain and comment that "*It has been stated that the first generation is too small to have produced such large numbers* (in the second) *so their numbers must be increased by immigrants*" but also suggest that high winter mortality could be followed by rapid population expansion of the summer brood. The following flight charts show how these two flight periods have been recorded at Scole in 1987 and 2003.

Figure 3. Setaceous Hebrew Character – numbers recorded daily



1987



2003

The above charts do show the second generation is much larger than the first even though there were ten times more individuals recorded in 2003 than 1987 and that both generations are flying at least a month earlier in 2003. In 1987 there are two peaks for the second generation which could be indicative of a resident population being augmented by immigrants or it could reflect a protracted emergence. There is no such double peak shown in 2003 but there was an indication of one in 2004 so perhaps significant immigration is not a regular occurrence . Whilst the explanations proposed by Barrett and South may both have some validity maybe there is another contributory explanation for this disparity in brood size. On the 8th October 2003 I took a gravid female from my Haggett trap and two days later she had laid around 100-150 eggs. A day later these had all darkened along the ribs which meant that a further 50-100 laid on the 12th October stood out as new white eggs among

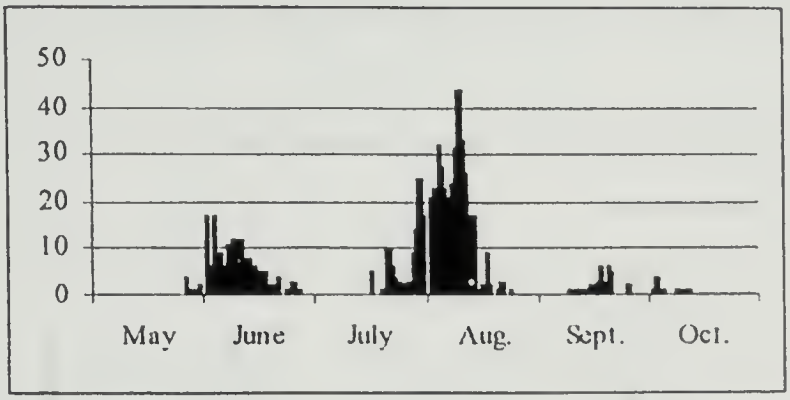
the darker ones. By the 14th October all had darkened, which usually means they are fertile and will hatch in a couple of weeks. The literature indicates that eggs from the setaceous hebrew character usually hatch in nine to ten days but by the 11th November, a month later, they showed no movement. By now they were completely darkened but had not collapsed in on themselves (a sign that they will not hatch). They started to hatch on the 13th November and by the 30th November about one third of the total had hatched. The rest still looked all right. Even though several different potential foodplants were offered to the young larvae they progressively perished and by 1st March 2004 all were dead. The unhatched eggs had still not collapsed and on the 9th March 2004 two larvae hatched. These refused to eat and soon died and no other eggs subsequently hatched. This delayed hatching is reminiscent of the comment made by Barrett at that 1872 meeting of the Society, reported in Dr. Beverley's Presidential Address of 1873, concerning the erratic appearances of the Camberwell beauty.

Whilst my observations are by no means conclusive as nothing reached maturity, the possibility of differential hatching times for eggs laid by the second generation females contributing to a small first and much larger second generation should be considered. Such a strategy may be much more effective without the artificial conditions created by captivity which probably resulted in the larval deaths and also the non hatching of eggs in March.

The setaceous hebrew character has been a long term inhabitant of my garden having been recorded when I was trapping on an irregular basis in the 1970s. A comparative newcomer which first appeared as a singleton on 13th October 1984 is the straw dot, *Rivula sericealis* (Scop.) which at that time was regarded as inhabiting marshes, fenland, the damper parts of woodlands, heaths and commons (Skinner, 1984). Not seen in 1985 the straw dot appeared again in 1986, being recorded just once in both the June/July and August/September broods, and since then numbers have steadily increased. As with other species, the flight times became progressively earlier with a late individual appearing on 14th October 1996 suggesting a possible third brood. The original record twelve years earlier may have arisen from a similar increase in population and broods at another site from which my specimen came. By 2002 there was a definite third brood which was even

stronger in 2003 as shown in the flight chart below. However it was absent in 2004.

Figure 4. Straw Dot – numbers recorded daily in 2003

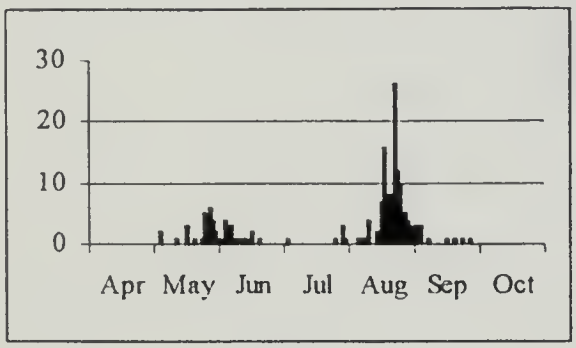


Although the number of broods has increased in the twenty years since the species first appeared here, the sightings have fluctuated with highs in 1993 to 1995 and again in 2002 and 2003 and comparative lows in 1992 and 1997/1998. These fluctuations show the irregular nature of population change as does the very presence of the species in a environment a little different from its preferred habitat. It is possible that during the next twenty years this species may decline or even disappear from my garden as the wider population decreases but almost certainly still flourish in its wetland habitat.

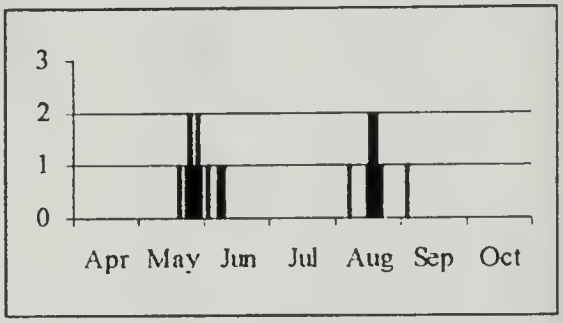
Another species that has gone from two to three broods over the period I have been recording, flourishes in a garden environment and has fairly certainly been here for many years, is the shuttle-shaped dart, *Agrotis puta* (Hb.) The changing description of its flight time by various entomological authors during the last century is indicative of a progressive change in its voltinism which may actually reflect population changes. Barrett (1896) writes that it is on the wing in July and August and then adds. "*but occasionally, though rarely, in May and June.*" South (1907) reiterates this but by the time of the 4th edition (1961) the revising editors amended the comment to, "*out in April and May and again in July and August*". Skinner (1984) takes this a stage further by saying it is flying any time from late April to early October and adds. "*there being two or three protracted and overlapping broods*". Waring

and Townsend (2003) are a little more cautious as after giving the same April to October as the flight period write, "*There are spring and summer generations but it is not clear whether autumn individuals represent a third brood or slower larval development*". Records from Scole indicate a change from two to three generations in the last twenty years which seems to be related to an earlier flight time and probably an increasing but fluctuating population.

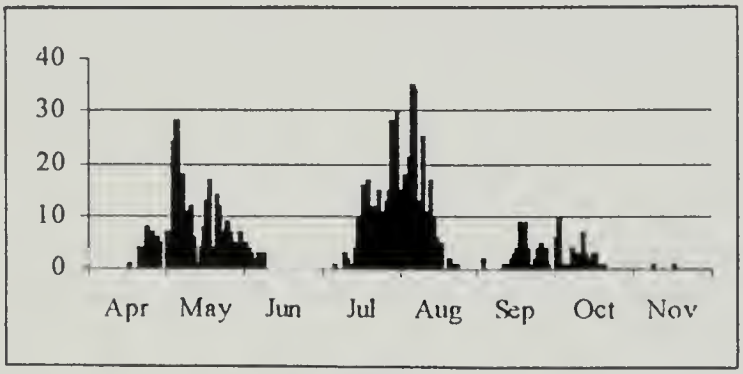
Figure 5. Shuttle-shaped Dart – numbers recorded daily



1984



1987



2003

The three charts show that since 1984 the shuttle-shaped dart is flying about two weeks earlier in both the first and second generations and that a third brood is flying in September/October. The very small number of records for 1987 show the species was at a very low ebb that year, which it was for the next three or four as well. This is typical fluctuation, probably related to season. The 2003 flight chart shows three distinct flight periods which almost certainly represent three broods. There is no scatter of records

between the broods (just an isolated individual) which I believe there would be if the third flight period had resulted from slower larval development by some of the progeny of the spring brood. This pattern was repeated in 2004 but with a smaller third brood.

(iii) Species that exhibit irregularity in numbers of individuals

For many species the year-on-year flight charts give a good indication of how the population is fluctuating but, obviously, for really conclusive data individuals should be counted each year, which in most cases has not been done.

Table 10. Daily flight records for White Ermine from 1984 to 2004

Year	First Generation				
	from	to	**4**	**5**	%
1984	3/6	11/7	39	31	79.5
1985	20/5	7/7	49	36	73.5
1986	26/5	8/7	44	31	70/5
1987	24/5	14/7	53	30	56.6
1990	30/4	30/6	62	21	33.9
1991	22/5	9/7	49	14	28.6
1992	15/5	16/6	33	24	72.7
1993	2/5	22/6	52	36	69.2
1994	9/5	3/7	56	41	73.2
1995	3/5	30/6	59	43	72.9
1996	21/5	12/7	53	25	47.2
1997	29/5	15/7	48	10	20.8
1998	13/5	23/6	42	22	52.4
2001	11/5	3/7	54	42	77.8
2002	23/4	23/6	62	49	79.0
2003	24/4	21/6	59	46	78.0
2004	13/5	5/7	54	34	63.0

Column **4** shows the over-all flight period and column **5** the days when seen : % is the percentage of days in the flight period when the mothwas recorded

The year-on-year flight chart (table) above, for the white ermine *Spilosoma lubricipeda* (Linn.), shows population fluctuation very well. There is a distinct falling-off in records in 1990/1991 and 1997, with only slightly better years either side of these low points. There is virtually no over-all change in flight time but in 2001 a singleton was recorded on the 21st August and in 2003 there was one on the 10th August and a second on the 12th (or the same one returning). These late sightings may or may not have any significance for a potential second generation – time may tell.

Table 11. Daily flight records for Small Square-spot from 1984 to 2004

Year	First Generation					Second Generation				
	from	to	**4**	**5**	%	from	to	**9**	**10**	%
1984	6/6	21/6	16	6	37.5	19/8	17/9	30	22	73.3
1985	21/5	30/6	41	22	53.7	19/8	7/9	20	4	20
1986	2/6	1/7	30	22	73.3	21/8	4/10	44	10	25
1987	26/5	21/6	27	22	81.5	13/8	21/9	40	31	77.5
1990	12/5	26/6	46	27	58.7	27/7	4/9	40	33	82.5
1991	22/5	24/6	34	6	17.6	9/8	5/9	28	8	28.6
1992	21/5	7/6	18	6	33.3	4/8	6/9	34	19	55.9
1993	25/5	12/6	19	11	57.9	3/8	19/9	48	35	72.9
1994	13/5	17/6	36	29	80.6	27/7	7/9	43	37	86.0
1995	9/5	26/6	49	38	77.6	24/7	2/9	41	40	97.6
1996	28/5	29/6	33	21	63.6	6/8	8/9	34	21	61.8
1997	9/5	17/5	9	3	33.3	30/7	7/9	40	13	32.5
1998	22/5	30/5	9	3	33.3	8/8	2/9	26	15	57.7
2001	27/5	24/6	29	24	82.8	2/8	7/9	37	36	97.3
2002	23/4	19/6	58	43	74.1	27/7	10/9	46	41	89.1
2003	7/5	11/6	36	27	75	28/7	2/9	37	19	51.4
2004	19/5	3/6	16	2	12.5	10/8	27/8	18	10	55.5

Columns **4** and **9** show the over-all flight period for that generation, where applicable
Columns **5** and **10** show the number of days when the species was seen
% is the percentage of days in the flight period when moth recorded

A similar picture is revealed by the year-on-year flight table for the small square-spot, *Diarsia rubi* (View.), which is a double-brooded species.

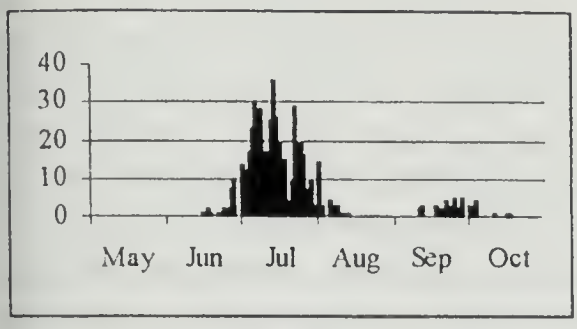
From the above table it can be seen that population of the small square-spot was low in 1985, 1991, 1997 and 2004 for both broods whereas in 1984, 1992 and 1998 it was only the population of the first brood that seems significantly down. Against this the second generation in 1986 was also poor but there was an isolated mid-brood record on 11th July 1986 and late records on 5th October 1996 and 4th and 11th October 2002 (none of which are included in the table). It is a little difficult to interpret variation in population between broods in the same year but the fact that in 1991 and 1992 the shuttle-shaped dart also had poor years as did the flame, *Axylia putris* (Linn.) and the white ermine was particularly low in both 1991 and 1997, these downturns may be reflecting conditions at the time which affect some species but not others. With the brindled beauty showing low population levels in 1985, 1995/6/7 and since 2001 and the nutmeg being particularly low in 2002 and 2004 it seems that adverse conditions do not affect all species either at the same time or in the same way but it still may be climatic conditions, such as cold nights, rather than biological factors, such as levels of parasites or predators, that control the numerical variation seen in the populations of many species of moths.

Another species that shows variation in population is the buff arches, *Habrosyne pyritoides* (Hufn.) but unlike either the small square-spot or the white ermine, which virtually disappeared in their poorest years, this has only gently fluctuated. The normal flight time for this species is late June to early August but singletons were recorded on 5th October 1997, 20th October 2001 and 28th September 2002. This is a phenomenon that has been noted elsewhere and reported in the entomological literature and could indicate the propensity for a second brood. First sightings have advanced by about ten days since 1990, from the 27th to the 17th June, and the percentage of days in the flight period when the species was recorded varied between 60% and 79% with one exceptionally low year at 20% and one very high at 97% (but that was for a very short flight period). I do not consider this level of fluctuation to be cyclical, merely a reflection of the season.

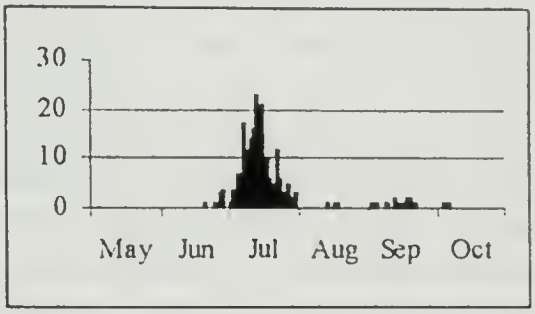
(iv) Species that have disappeared or are reduced in numbers

Several species that were regular visitors through the 1980s and early 1990s are no longer recorded at Scole. Some like the pale eggar, *Trichiura crataegi* (Linn.) and the figure of eight, *Diloba caeruleocephala* (Linn.) whilst regular were never numerous whereas others such as the lackey, *Malacosoma neustria* (Linn.) and garden tiger, *Arctia caja* (Linn.) almost reached pest proportions at times with their larvae seemingly everwhere. These four species do not have a lot in common at first sight. There are areas of similarity however: the pale eggar, figure of eight and lackey all overwinter as an egg; the larvae of all three feed on broadleaved trees and shrubs with perhaps a preference for members of the Rosaceae and all are described in the literature as common in England, at least as far north as Yorkshire. The garden tiger overwinters as a small larva which feeds on a wide range of herbaceous plants but the decline of this species since the 1980s has been noted right across southern Britain. There is perhaps a clue in the comment by Waring and Townsend (2003) that there is recent statistical evidence linking lower numbers of moths with mild, wet Januarys followed by colder weather in February. Their other suggestion that the decline of the garden tiger could be linked to an increased used of chemical herbicides certainly does not apply at Scole (or the immediate surrounds) as we have not used any chemicals in the garden for over 25 years. Both the pale eggar and the lackey are regarded as scarce to the immediate west of the pennines, where there is traditionally high rainfall, and the figure of eight is absent from Cornwall, another area with wet, if mild, winters. My last record for the figure of eight was in 1994, the last pale eggar in 1996, the last garden tiger in 1998 and although I recorded an isolated lackey in 2002 the last consistent records were also in 1998. From gardening records and details about cultivation times we have had milder and wetter Januarys since the mid 1990s, with very few periods of prolonged frost and cold, wet Februarys have delayed work for most years. Whilst there is no statistical evidence from my records to support this suggestion it seems to me highly likely that this is a major contributing reason for the current downturn in the fortunes these species and with the predicted effects of global warming there seems little prospect for improvement in the near future.

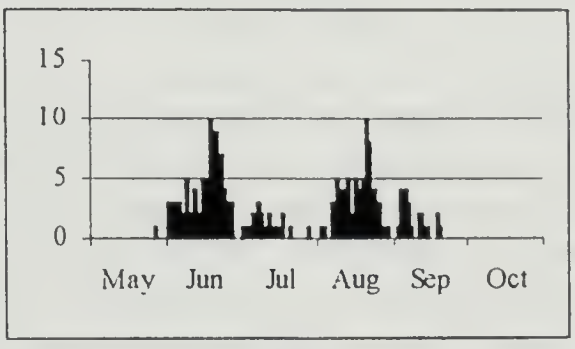
Figure 6. Burnished Brass – numbers recorded daily



1985



1987



2003

Another species where numbers have dropped right away but is still present is the burnished brass, *Diachrysia chrysitis* (Linn.) which overwinters as a small larva and feeds most commonly on perennial nettle but also white dead-nettle and other herbaceous plants. It is said to have one main generation, flying in June and July, and a partial second , in southern Britain, in August and September. The year-on-year flight chart does not really show a decline in this species but my subjective impression while checking the traps in the last few years made me think there were many fewer burnished brass than ten years ago. As I had drawn yearly flight charts for both 1985 and 1987 I decided to count individuals in 2003 and the charts above show the results

The 1985 and 1987 charts show much the same pattern but with fewer moths seen in 1987 and the spread of records for 2003 is greater with both broods coming about a month earlier. However, when numbers are analysed fewer than half those seen in 1987 were recorded in 2003 with a meagre maximum

of ten in a day. As this species generally overwinters as a small larva it may also be susceptible to warmer, wetter Januarys.

Other species that, from a subjective assessment of numbers in traps rather than from counting individuals, I believe to be at a low ebb at the moment include the canary-shouldered thorn *Ennomos alniaria* (Linn.), dusky thorn *Ennomos fuscantaria* (Haw.), red chestnut *Cerastis rubricosa* (D.& S.), the mouse moth *Amphipyra tragopogonis* (Cl.) and the bird's wing *Dypterygia scabriuscula* (Linn.). Like the burnished brass these species are all still present in the traps but at a much lower frequency than a few years ago. Again this may just indicate a periodic downturn or it may be a more permanent response to climatic or other change.

(v) Species that are newly arrived and increasing

As is to be hoped in a balanced but changing environment, when some species disappear there are new arrivals to replace them. Some are fleeting but others seem to be more permanent, at least in the medium term, and among these recent newcomers are the heart and club, *Agrotis clavis* (Hufn.) which first appeared in 1993; the small clouded brindle, *Apamea unanimis* (Hb.) first recorded in 1994; the knot grass, *Acronicta rumicis* (Linn.) which was a newcomer in 1995 and the twin-spotted quaker, *Orthosia munda* (D.& S.) which came in 1996. All arrived as singletons, although there was a second heart and club in its first year, and have become more numerous in subsequent years with an odd blank year for both the heart and club and the small clouded brindle. These four species do not have much in common although both small clouded brindle and knot grass are regarded as inhabiting damp grassland as one of their preferred habitats and may possibly thrive in damper winters. One of the favoured foodplants of the small clouded brindle is reed canary-grass, *Phalaris arundinacea* L. and the variegated, striped form "Gardener's Garters", to which the larvae seem particularly partial, grows well in the garden. This species has progressed from the single sighting in 1994 to more than a dozen in 2003 and 2004. Similar increases have been seen with the heart and club, which has been recorded through the second half of June and the beginning of July for the last three or four years, and the knot grass which has become quite prolific in its autumn brood in July and August although not quite so numerous in the May/ June flight. That the

twin-spotted quaker seems to have established here is a bit more of a surprise as it is usually regarded as a moth of deciduous woodland or at least well-treed areas. We have established a very small copse in part of the garden so this is perhaps why it has remained for the last eight years with sightings going from one day to sixteen days in that time.

I believe that whatever has "persuaded" these species to establish here they all arrived initially because of population pressure at other, probably preferred, sites when the cycle there was at a high point. Without climatic changes, probably due to global warming, they would possibly disappear again in the not too distant future.

When some species are new arrivals it is more to do with national, or even international, range expansion and some of these relatively quickly become well established. In 1982 I saw the first treble brown spot, *Idaea trigeminata* (Haw.) at Scole when its range was expanding northwards. Since then it has occurred regularly and consistently. Similarly in 1996 I recorded the first least carpet, *Idaea rusticata atrosignaria* Lempke for both Scole and Norfolk. Previously regarded as a species to be found around the Thames estuary, London, Surrey and parts of East Sussex it had rapidly expanded into East Anglia. Whilst still flourishing in Suffolk it has been less in evidence at Scole in the last two years but nevertheless still present.

(vi) Arrivals and fluctuations associated with changes in foodplant availability

It seems very likely that the small clouded brindle has established here because of the striped reed canary-grass grown in the garden and the presence of other species can be directly linked to the availability of appropriate foodplants. On the 25th August 1995 I recorded a single lesser treble-bar, *Aplocera efformata* (Guen.) which I believe was the first record for Norfolk. This species feeds on St. John's-worts and at the time the piece of unused land next to our garden was covered with perforate St. John's-wort, *Hypericum perforatum* L. which was already supporting a thriving colony of the much commoner treble-bar, *Aplocera plagiata* (Linn.). The lesser treble-bar appeared for the next three years and in 1997 was seen twice during the first brood and sixteen times for the autumn generation. However, in that

autumn the vegetation on the unused land was closely cut, the cut material pulverised and then the land was rotavated. I have seen just one more lesser treble-bar, on the 6th June 1998, and the species has now gone although the foodplant has recovered, as no further work was carried out on the land following a change in tenant. At the same time the exensive areas of mugwort *Artemisia vulgaris* L., which had also flourished on this field, were destroyed and the frequency with which I had been seeing the bordered pug *Eupithecia succentariata* (Linn.), the wormwood pug *Eupithecia absinthiata* (Cl.) and the wormwood, *Cucullia absinthii* (Linn.) dramatically declined although the latter had never been as common as the two pugs.

On a more positive note since establishing a high, beech hedge *Fagus sylvatica* L. to protect a herb garden and ash trees *Fraxinus excelsior* L. around the perimeter of the garden the barred sallow *Xanthia aurago* (D.& S.) has flourished with the beech and the centre-barred sallow *Atethmia centrago* (Haw.) with the ash. Both had been present but numbers increased significantly with much more locally available foodplant

Another species that blossomed for a short while is the chamomile shark, *Cucullia chamomillae*(D.& S.). It is a species that I see from time to time but it has never been numerous. In 1994, 1995 and 1996 we were somewhat lax in our management of the vegetable garden and had quite substantial areas of scentless mayweed *Tripleurospermum inodorum* (L.) which is a major foodplant for this species. The moth flourished, in comparative terms, in 1996 and 1997 and in the latter year I found many of the beautiful and variable larvae on the mayweed. Since controlling such extensive areas of an unwanted weed the chamomile shark is once again an irregular visitor to the traps.

For most of the time I have been regularly recording moths the small rivulet, *Perizoma alchemillata* (Linn.) has been an equally regular visitor to the traps in July and early August. It has been in such numbers as to indicate that it is breeding locally, almost certainly in the garden, and the moths are not travellers from Billingford Common which is a couple of miles to the south-east. Billingford Common is the nearest site on which the only currently named foodplants, hemp-nettles *Galeopsis* spp. grow, although Waring and

Townsend (2003) do suggest that hedge woundwort *Stachys sylvatica* L. might also be utilised. This is given as a foodplant by Barrett (1902) and is scattered throughout the garden as is the closely related black horehound, *Ballota nigra* L. Black horehound becomes a problem at times and is removed, but not totally, and whenever it has been "thinned" the numbers of small rivulet are down the next year although no amount of searching of either plant has revealed the larvae feeding on their seeds. Logic says one or other of these Lamiates must be the foodplant for the small rivulet at this site.

When related species regularly occur at the same time and for many years in roughly the same proportions when one starts to differ from the rest it is more noticeable than if the occurrence of that species was changing in isolation.

Table 12. Days seen, each year from 1990 to 2004 for four *Xanthorhoe* species

Year	Large Twin-spot Carpet	Silver ground Carpet	Red Twin-spot Carpet 1st brood	Dark-barred Twin-spot Carpet 1st brood	Red Twin-spot Carpet 2nd brood	Dark-barred Twin-spot Carpet 2nd brood
1990	3	21	7	5	18	15
1991	1	19	5	2	10	10
1992	1	25	5	4	19	9
1993	2	27	7	5	17	4
1994	9	33	13	9	27	19
1995	11	37	12	9	32	10
1996	13	25	16	4	30	5
1997	6	27	29	3	31	12
1998	6	23	20	3	22	2
2001	10	21	11	1	25	5
2002	8	28	19	1	31	5
2003	12	26	24	2	31	1
2004	4	22	15	-	26	3

The first two species in Table 12, large twin-spot carpet *Xanthorhoe quadrifasciata*(Cl.) and silver-ground carpet *Xanthorhoe montanata* (D.& S.) are single brooded and the other two, red twin-spot carpet *Xanthorhoe*

spadicearia (D.& S.) and dark-barred twin-spot carpet *Xanthorhoe ferrugata* (Cl.) are double brooded (the red twin-spot carpet had a partial third brood in September 2004, being seen on 5days). All four species are said to feed, by Waring and Townsend (2003), on a range of herbaceous plants and they mention bedstraws *Galium* spp., gound-ivy *Glechoma hederacea* L., docks *Rumex* spp., primrose *Primula vulgaris* Hudson and violets *Viola* spp. all of which are widely available in the garden. From the above table it can be seen that whilst three species have remained reasonably constant, certainly in their proportions to each other, the number of sightings of dark-barred twin-spot carpet has significantly dropped off since 1998 or possibly 1997, particularly so since 2001, and in both broods. One possible explanation for this is that it is much more selective in its choice of foodstuff. Indeed Skinner (1984) only goes as far as to say "*on unspecified low plants*".From the early 1980s there was a good supply of lady's bedstraw *Galim verum* L. in parts of the garden but in 1996 we stopped keeping sheep and although they grazed off the lady's bedstraw when they were feeding in that part of the garden it always recovered and was never totally removed. After they had gone, other herbage rapidly out-competed the lady's bedstraw and by 1999 it had disappeared completely. This is circumstantial evidence that the dark-barred twin-spot carpet feeds on lady's bedstraw and not other bedstraws nor the other suggested foodplants (at least in my garden) and the population cannot be adequately sustained without it

(vii) Differences between closely related species with similar ecology

The dark-barred twin-spot carpet would seem to have a different larval foodplant requirement from its congeners even though they can all be reared on the same things in captivity. Similar anomalies may well exist with other closely related species which, although known to feed on slightly different ranges of foodplants, are broadly regarded as very similar in their requirements. One such pair is the brown-spot pinion *Agrochola litura* (Linn.) and the beaded chestnut *Agrochola lychnidis* (D.& S.) which are both autumn species, flying August to October, associated with broad-leaved woodland, scrub, hedgerows, gardens and other habitats and feed on various herbaceous plants with Skinner (1984) adding some trees and shrubs for the former and grasses for the latter. From 1990 to 1998 their occurrence at Scole was

broadly similar but since 2001 the brown-spot pinion has fallen away as shown in the table below.

This pattern is more or less repeated with another pair of closely related moths the beautiful golden Y *Autographa pulchrina* (Haw.) and the plain golden Y *Autographa jota* (Linn.) which both fly at much the same time in June and July and are both regarded as having the perennial nettle *Urtica dioica* L. as a primary larval foodplant

Table 13. Percentage of days in the flight periods from 1990 to 2004 when Brown-spot Pinion and Beaded Chestnut were Recorded and when Beautiful Golden Y and Plain Golden Y were Recorded

Year	Brown-spot Pinion	Beaded Chestnut		Beautiful Golden Y	Plain Golden Y
1990	88.7	64.5		65.2	48.1
1991	77.3	77.1		61.1	47.6
1992	95.1	91.2		51	82
1993	78.4	93.9		54	63.8
1994	58.3	97.8		54.5	80
1995	78.3	76.1		36.4	84.6
1996	62	92		12.1	34.8
1007	81.1	72.1		10	47.2
1998	75	74.1		17.4	51.4
2001	39.1	83.9		-	20
2002	62.5	81.6		11.8	25.7
2003	55.9	82.5		-	30
2004	63.3	83.7		*	*

*Plain golden Y only seen on 5 occasions in 2004 – 14,17,30 June & 3,5 July
Beautiful Golden Y only seen once in 2004 – 14 June

Although the above table does show something of a falling off in number of appearances for the brown-spot pinion in the last few years, without detail of actual numbers it could just as easily be interpreted as showing no more than the fluctuation expected. Unfortunately actual numbers have not been recorded but whereas the beaded chestnut was regularly present with up to a dozen or more individuals at a time and for a longer period the brown-spot

pinion has never appeared in more than ones and twos in the last three years which is why I believe it is declining whilst its congener is not and without an immediate explanation.

The picture shown by Table 13 for the two golden Ys is similar but the disparity between the two species has been more marked since 1998. It is possible that this difference is as a result in changes in the availabilty of suitable foodplants and the two species not having the same preference for common perennial nettle. It is possible that the beautiful golden Y may rely more heavily on dead-nettles, both white *Lamium album* L. and red *L. purpureum* L. both of which have become much scarcer in the garden in the last five years. As the difference in current status of the two species is not repeated at many other sites in the county this, or some similar foodplant variation, may well be the cause here at Scole. It is highly probable that there is a similar explanation for the difference between the two *Agrochola* species as well.

(viii) Irregularly or sparsely, yet comparatively widely, distributed species

Over the years I have trapped a number of species which, whilst neither particularly rare nor really restricted in distribution by selective habitat preference, are only infrequently recorded here. Some are known to exhibit quite dramatic expansions in both population and range and may then apparently be absent from a given area for some years whilst others are regularly at a low density across their known range for most of the time.

In the former group is the small eggar *Eriogaster lanestris* (Linn.) which I recorded in ones and twos from 1992 to 1998 since when it has disappeared again. These sightings followed the discovery in June 1991, by my wife, of more than 100 larval nests in a 650 metre stretch of hedge beside a local main road about a mile to the south-east of our garden. This was an obvious resurgence of a species, whose larvae feed on hedgerow shrubs, and for which current explanations as to why it exhibits such dramatic fluctuations are not completely convincing. The dotted rustic *Rhyacia simulans* (Hufn.) was similarly present for four years in the 1980s, from 1984 to 1987, when it was known to have expanded eastwards from populations in south-west

England. The larval foodplants for this species are unknown but like the small eggar they must be plants that are widely distributed and sufficiently prolific to support large populations, if only for a year or two. Another species where the larval foodplant is unconfirmed in the wild is the pale shining brown *Polia bombycina* (Hufn.) which I recorded as singletons from 1981 to 1985. Whilst it is an occasional migrant it was widely and well distributed in southern and south-eastern England, including East Anglia, until the 1970s. Since then it has apparently declined quite alarmingly but had a flurry of local records in the 1990s.

The record of the ruddy carpet *Catarhoe rubidata* (D.& S.) on 2nd July 1994, and a second on 29th June 2004 (both being females!) are two of only very few for Norfolk and again show the value of continuous recording. It is known from a wide scattering of sites across southern England and with larvae feeding on lady's bedstraw and hedge bedstraw *Galium mollugo* L., it is difficult to see why it is quite so scarce. The dusky-lemon sallow *Xanthia gilvago* (D.& S.), with larvae feeding on wych elm *Ulmus glabra*, is another species that is thinly distributed. I have recorded a handful of singletons in 1985, 1995, 1996 and 1997 and it has since disappeared since Dutch Elm Disease has decimated the elm population. Among other species regarded as widespread but local are the poplar lutestring *Tethea or* (D.& S.) and the poplar kitten *Furcula bifida* (Brahm) and as the names imply both feed on poplars *Populus* spp. with the poplar lutestring showing a preference for aspen *Populus tremula* L. I have recorded the poplar lutestring just once, on the 9th August 1997 whilst the poplar kitten has been a little more plentiful being recorded in both 1994 and 1995 but it is difficult to see why either species is so rare here as aspen grows well in our wooded area.

Both the pale-lemon sallow *Xanthia ocellaris* (Borkh.) and the black rustic *Aporophyla nigra* (Haw.) have been recorded once, the former on the 7th October 1997 and the latter on the 16th September 2002, yet both are locally distributed throughout East Anglia. The pale-lemon sallow, with larvae feeding on black poplar hybrids, is a suspected immigrant so this may explain my record but Breckland is a strong area for the species. The local population of the black rustic in East Anglia is increasing so, with larvae

feeding on various woody and herbaceous plants, this could be a species I will see more frequently in the future.

(ix) Species usually associated with specialised habitats

The site at Scole is a rural, village garden of about one and a half acres bounded by a dual carriageway bypass, a builders yard, a piece of unused land and a minor road, surrounded by an agricultural estate. However, during the last twenty years I have recorded species usually found in deciduous woodland or wetlands or heathland or even on the coast. Most of such species have occurred just once but a few have appeared two or three times.

I have seen a small white wave *Asthena albulata* (Hufn.), whose larvae feed on hazel *Corylus avellana* L. and hornbeam *Carpinus betulus* L. and which favours ancient deciduous woodland, on the 1st June 1994 and a red-green carpet *Chloroclysta siterata* (Hufn.) on the 9th November 1994. This latter species, with larvae feeding on various broadleaved trees and overwintering as fertilised females, is more tolerant of established hedgerows and other well-wooded areas. On the 12th July 1995 two orange moth *Angerona prunaria* (Linn.) were in the trap but that is the only time I have seen this species. The larvae feed on many woody broadleaved plants and in recent years it has been much more numerous, particularly in Suffolk and Lincs.

Two specialist reed *Phragmites australis* (Cav.) feeding species, the flame wainscot *Mythimna flammea* (Curtis) and the reed dagger *Simyra albovenosa* (Goeze) may have strayed from their reed-bed home. The former, which is a nationally scarce species but may also be a migrant (Waring, 2003), occurred on the 9th June 1993 and again in 1996. The reed dagger, also a suspected migrant (Waring, 2003), occurred on the 26th June 1986. In both 1994 and 2004 I recorded a single water ermine *Spilosoma urticae* (Esp.) which is known to feed on herbaceous marshland plans rather than common nettle as its name suggests. This species had been at a very low ebb in East Anglia for some years but the population seems to have increased in the last two or three years so my latest visitor may well have resulted from such an increase. It is also possible that this species has a population cycle of around ten years. The oblique carpet *Orthonama vittata* (Borkh.) is a much less robust species than the other fenland species I have seen at Scole. The larvae feed on bedstraws,

particularly marsh bedstraw *Galium palustre* L., and like the foodplant it is not restricted to reed-beds. Although this species is thinly distributed, in a fairly specialist habitat, I have seen it in 1986 and 1995.

A relative of the oblique carpet is the oblique striped *Phibalapteryx virgata* (Hufn.) but this species is local on heathland and downland and relatively widespread in Breckland with the larvae feeding on lady's bedstraw. I have seen this species on three occasions, in 1984, 1991 and 1995. Other Breckland species have also been recorded at Scole with the grey carpet *Lithostege griseata* (D.& S.) being the rarest to come to my traps. This is exclusively a Breckland species, where it is quite well established, feeding on flixweed *Descurainia sophia* (L.). The singletons that arrived at Scole in 1995 and 1996 were almost certainly wanderers from this population and although the foodplant is well established in the garden it is unlikely that the grey carpet will breed here. The cream-spot tiger *Arctia villica britannica* Oberth. is another heathland species recorded at Scole. On 9th June 1997 the specimen that came to the traps was a slightly aberrant form and as aberrations are more obvious with larger populations, may indicate a recovery in the status of this species following several years when it was very scarce. Another heathland species, which is also a recognised migrant, that has been more numerous in recent years after a spell in obscurity, is the tawny wave *Scopula rubiginata* (Hufn.). This is a species I first recorded on 21st August 1987 and then again in 1994 and 1997. The most regular of the heathland moths to come to Scole has been the white colon *Sideridis albicolon* (Hb.) with sightings in 1981, 1983, 1992, 1995 and 1997. This, like the two preceding species, is a coastal as well as a heathland species and my visitors may have come from the Suffolk coast rather than Breckland.

Although the great brocade *Eurois occulta* (Linn.) is a resident in Scotland it is an immigrant in southern England and the one recorded on the 16th August 1994 certainly was. However, as I recorded this species again in 1995, 1996 and 1997 and several times in those years it is just possible that for a year or two it was a transient resident here.

On two occasions, in 1995 and 1997, I have recorded the feathered ranuncelus *Polymixis lichenea* (Hb.) and although it is regarded as a coastal

species it has been recorded at other inland sites along the Norfolk/Suffolk border. Another coastal species that I have seen in 1996, 1997 and 1998, the saltern ear *Amphipoea fucosa paludis* (Tutt), has also been recorded at Redgrave Fen – even further inland. The most exceptional of the coastal species to be recorded at Scole is the shore wainscot *Mythimna litoralis* (Curtis) which came to light on the 8th August 1996. The larvae of this nationally scarce species feed on marram grass *Ammophila arenaria* (L.) and can be found by scraping the sand away from the base of marram tussocks that are growing a little away from the front dune line. This is one of the Victorian field-craft techniques that brings us virtually full circle.

Limitations, Reservations and Conclusions

My assessment of the relative merits of different moth traps and my views as to the efficacy of continuous recording are empirical and the data have not been analysed statistically.

All my data have come from the one site and any conclusions drawn from that information can only relate to moths at that site. Analysis of similarly collected data from other sites across a county, region or country could lead to totally different conclusions being drawn about the same species of moths. It is highly probable that fluctuation in numbers and status will be completely out of step at different sites and in general terms this will mean that the status of the species is probably stable. However, if such changes are synchronised from diverse sites then it may be right to draw conclusions as to changes in the overall status of the species but again I believe continuous recording is the key to such conclusions being meaningful. It would still be important to allow for disparity in trapping power and consider differences in temperature variation between sites and years.

Moths usually fly for more than just one night and no account has been taken of individuals returning to the trap(s) on more than one occasion. As I am considering overall length of flight period and peak numbers flying at any one time such returns will not devalue any conclusions drawn.

Care must be taken not to disregard the effect of cold nights in reducing the activity of moths but not necessarily their abundance, particularly in late

spring and early summer. With reduced movement they are much less likely to come within the 18 metres or so that seems to trigger disorientation, spiralling into the trap and eventual recording. With a number of consecutive cold seasons it is easy to jump, too soon, to pessimistic conclusions.

I have suggested that the fluctuation in numbers recorded for some species can be related to known changes in availability of larval food plants. It is possible that similar variation in other species is also related to changes in food plant availability that have not been recognised - changes that have resulted from alteration to management practices for the garden as a whole.

Much of my argument has been based on the analysis of records for common species, exclusively macros, for which detail of distribution, time of appearance, larval food plants etc. is generally regarded as being well known. I believe that I have demonstrated with these species that change is a permanent feature of their ecology and much of this change is of a recurring nature, which I first suggested, on evidence from only the first few years, in an earlier paper in these *Transactions* (Hall, 1990). These variations can be short, medium or long term intervals. There is a general tendency for many species to fly earlier in the year now than they were fifteen to twenty years ago. It has also become evident that, under favourable conditions, there is considerable mobility for most species, even those that are traditionally regarded as confined to specialist, discrete habitats. If these conclusions apply to the common species of moths there is every reason to believe that they also apply to those species regarded as rare – biodiversity action plan species – and thus with the obvious limitations in obtaining similar data for these species, extreme care must be exercised in drawing conclusions as to the true status of such species.

These constraints as to regularity and continuity of recording do not apply in the same way to effective surveying of day-flying moths which are much more akin to butterflies in terms of ease of recording and assessment of status. Neither can micro moths be considered in quite the same way (they have been virtually left out of the analyses of records and from the species lists in Appendix 1.) as many are recorded in other than the adult state and for a large number so little is accurately known about their current over-all

distribution at less than 10 km square level that to assess status and threat is very difficult. However one notable exception is the basil-thyme case bearer, *Coleophora tricolor* Wals.(Haggett 2001 and 2002), which is found only in Breckland and has been extensively researched and its habitat, distribution and food plant extremely well surveyed in the last couple of years. For the larger moths, the macros, their biology is well understood – by and large – as is their distribution but the same cannot always be said for their ecology, however it does seem that many are down in numbers and reasons for such a "decline", particularly for some that are usually regarded as common, are far from obvious.

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Appendices

Appendix 1. Moth Species Recorded in Three Traps on the 9th and 10th June 1993, indicating the value of continuous trapping.

Species		Trap 1		Trap 2		Trap 3	
English Name	**Scientific Name**	**9th**	**10th**	**9th**	**10th**	**9th**	**10th**
Common Swift	*Hepialus lupulinus*	☑			☑	☑	
Oak Hook-tip	*Watsonalla binaria*	☑					
Chinese Character	*Cilix glaucata*		☑				
Figure of Eighty	*Tethea ocularis octogesimea*	☑	☑	☑	☑		☑
Little Emerald	*Jodis lactearia*					☑	
Clay Triple-lines	*Cyclophora linearia*	☑					
Blood-vein	*Timandra comae*		☑	☑	☑		
Small Dusty Wave	*Idaea seriata*						☑
Single-dotted Wave	*Idaea dimidiata*		☑			☑	
Treble Brown Spot	*Idaea trigeminata*	☑					
Riband Wave	*Idaea aversata*		☑				☑
Silver Ground Carpet	*Xanthorhoe montanata*	☑	☑		☑		☑
Garden Carpet	*Xanthorhoe fluctuata*					☑	

Common Carpet	*Epirrhoe alternata*	☑	☑	☑		☑	
Common Marbled Carpet	*Chloroclysta truncata*	☑				☑	
Grey Pine Carpet	*Thera obeliscacta*	☑		☑	☑		
May Highflyer	*Hydriomena impluviata*						☑
Sandy Carpet	*Perizoma flavofasciata*	☑	☑			☑	
Mottled Pug	*Eupithecia exiguata*	☑	☑		☑	☑	
Lime-speek Pug	*Eupithecia centaureata*	☑	☑		☑	☑	☑
Freyer's Pug	*Eupithecia intricata arceuthata*	☑	☑	☑			☑
Currant Pug	*Eupithecia assimilata*		☑				
Common Pug	*Eupithecia vulgata*	☑	☑	☑			☑
White-spotted Pug	*Eupithecia tripunctaria*				☑	☑	
Grey Pug	*Eupithecia subfuscata*		☑				
V-Pug	*Chloroclystis v-ata*	☑					
Sloe Pug	*Pasiphila chloerata*	☑					
Green Pug	*Pasiphila rectangulata*	☑	☑			☑	☑
Clouded Border	*Lomaspilis marginata*			☑			
Brown Silver-line	*Petrophora chlorosata*	☑			☑		
Scorched Wing	*Plagodis dolabraria*	☑	☑	☑		☑	☑
Brimstone Moth	*Opisthograptis luteolata*					☑	☑
Peppered Moth	*Biston betularia*		☑	☑	☑		
Mottled Beauty	*Alcis repandata*			☑			
Clouded Silver	*Lomographa temerata*	☑	☑	☑	☑	☑	☑
Privet Hawk-moth	*Sphinx ligustri*	☑	☑			☑	
Eyed Hawk-moth	*Smerinthus ocellata*		☑	☑			
Poplar Hawk-moth	*Laothoe populi*	☑			☑	☑	☑
Elephant Hawk-moth	*Deilephila elpenor*		☑			☑	☑
Iron Prominent	*Notodonta dromedarius*		☑		☑		
Lesser Swallow Prominent	*Pheosia gnoma*		☑				
Swallow Prominent	*Pheosia tremula*		☑				
Coxcomb Prominent	*Ptilodon capicina*	☑					
Pale Prominent	*Pterostoma palpina*	☑			☑	☑	
Marbled Brown	*Drymonia dodonaea*		☑				
Buff-tip	*Phalera bucephala*	☑	☑	☑	☑		
Lobster Moth	*Stauropus fagi*		☑	☑			
Pale Tussock	*Calliteara pudibunda*	☑	☑				
Common Footman	*Eilema lurideola*			☑			
White Ermine	*Spilosoma lubricipeda*	☑	☑	☑	☑		☑
Buff Ermine	*Spilosoma luteum*	☑	☑	☑	☑	☑	☑
Turnip Moth	*Agrotis segetum*			☑	☑	☑	☑
Heart and Dart	*Agrotis exclamationis*	☑	☑	☑	☑	☑	☑
Flame	*Axylia putris*	☑	☑	☑	☑	☑	☑
Flame Shoulder	*Ochropleura plecta*	☑	☑	☑	☑	☑	☑
Large Yellow Underwing	*Noctua pronuba*					☑	☑
Small Square Spot	*Diarsia rubi*			☑		☑	☑
Setaceous Hebrew Character	*Xestia c-nigrum*	☑	☑	☑		☑	☑
Double Square Spot	*Xestia triangulum*	☑			☑		
Nutmeg	*Discestra trifolii*		☑			☑	
Shears	*Hada plebeja*				☑		

Cabbage Moth	*Mamestra brassicae*				☑		
Broom Moth	*Melanchra pisi*	☑	☑	☑		☑	☑
Light Brocade	*Lacanobia w-latinum*			☑	☑		
Bright-line Brown-eye	*Lacanobia oleracea*		☑	☑	☑	☑	☑
Broad-barred White	*Hecatera bicolorata*				☑		
Campion	*Hadena rivularis*				☑		
Tawny Shears	*Hadena perplexa*		☑				
Varied Coronet	*Hadena compta*		☑				☑
Lychnis	*Hadena bicruris*	☑		☑		☑	☑
Southern Wainscot	*Mythimna straminea*			☑			
Common Wainscot	*Mythimna pallens*	☑	☑	☑	☑	☑	☑
Flame Wainscot	*Mythimna flammea*			☑			
Dark Brocade	*Blepharita adusta*	☑					
Poplar Grey	*Acronicta megacephala*			☑			☑
Sycamore	*Acronicta aceris*	☑			☑		
Miller	*Acronicta leporina*				☑		
Dark Dagger	*Acronicta tridens*			☑			
Grey Dagger	*Acronicta psi*	☑		☑	☑	☑	
Brown Rustic	*Rusina ferruginea*	☑	☑	☑	☑	☑	☑
Small Angle Shades	*Euplexia lucipara*			☑	☑		
Angle Shades	*Phlogophora meticulosa*			☑			☑
Dark Arches	*Apamea monoglypha*		☑	☑	☑		☑
Light Arches	*Apamea lithoxylaea*			☑			
Clouded-bordered Brindle	*Apamea crenata*		☑		☑	☑	☑
Large Nutmeg	*Apamea anceps*	☑	☑	☑	☑	☑	☑
Rustic Shoulder-knot	*Apamea sordens*	☑		☑		☑	☑
Marbled Minor	*Oligia strigilis*	☑	☑	☑	☑		
Tawny Marbled Minor	*Oligia latruncula*	☑	☑	☑	☑	☑	☑
Middle-barred Minor	*Oligia fasciuncula*	☑	☑	☑	☑	☑	☑
Treble Lines	*Charanyca trigrammica*	☑	☑		☑		
The Rustic	*Hoplodrina blanda*		☑				
Mottled Rustic	*Caradrina morpheus*	☑	☑	☑		☑	☑
Pale Mottled Willow	*Paradrina clavipalpis*	☑	☑				
Silver Barred	*Deltote bankiana*		☑				
Cream-bordered Green Pea	*Earias clorana*	☑	☑	☑		☑	☑
Green Silver-lines	*Pseudoips prasinana britannica*						☑
Burnished Brass	*Diachrysia chrysitis*	☑		☑		☑	
Plain Golden Y	*Autographa jota*	☑					☑
Spectacle	*Abrostola tripartita*		☑	☑	☑	☑	
Straw Dot	*Rivula sericealis*	☑				☑	
Snout	*Hypena proboscidalis*	☑		☑	☑	☑	☑

Nomenclature and taxonomic order from *Log Book of British Lepidoptera*, J. D. Bradley, 2000
Micro-moths have not been included in the above list

Appendix 2. Moth species recorded in two traps on the 6th and 7th Sept. 2003

Species English Name	Scientific Name	Trap 1 6th	Trap 1 7th	Trap 2 6th	Trap 2 7th
	Celypha lacunana				☑
	Agriphila geniculea	☑			
	Nomophila noctuella		☑		
Oak Hook-tip	*Watsonalla binaria*			☑	☑
Chinese Character	*Cilix glaucata*	☑			
Blood-vein	*Timandra comae*		☑	☑	
Small Dusty Wave	*Idaea seriata*	☑			
Garden Carpet	*Xanthorhoe fluctuata*		☑		
Green Carpet	*Colostygia pectinataria*		☑		
Brimstone	*Opisthograptis luteolata*	☑	☑		
Mottled Beauty	*Alcis repandata*	☑			
Flame	*Axylia putris*	☑			
Flame Shoulder	*Ochropleura plecta*	☑			
Large Yellow Underwing	*Noctua pronuba*	☑	☑	☑	☑
Lesser Yellow Underwing	*Noctua comes*	☑	☑	☑	
Broad-bord. Yell. Underwing	*Noctua fimbriata*	☑	☑		
Setaceous Hebrew Character	*Xestia c-nigrum*	☑	☑	☑	☑
Square-spot Rustic	*Xestia xanthographa*	☑	☑	☑	☑
Nutmeg	*Discestra trifolii*	☑			
Bright-line Brown-eye	*Lacanobia oleracea*	☑			
Antler Moth	*Cerapteryx graminis*	☑			
Smoky Wainscot	*Mythimna impura*	☑	☑	☑	☑
Centre-barred Sallow	*Atethmia centrago*		☑		
Angle Shades	*Phlogophora meticulosa*		☑		☑
Flounced Rustic	*Luperina testacea*			☑	
Rosy Rustic	*Hydraecia micacea*	☑	☑	☑	☑
Frosted Orange	*Gortyna flavago*	☑	☑	☑	☑
Vine's Rustic	*Hoplodrina ambigua*		☑		
Pale Mottled Willow	*Paradrina clavipalpis*		☑		
Burnished Brass	*Diachrysia chrysitis*	☑	☑	☑	☑
Silver Y	*Autographa gamma*		☑		
Dark Spectacle	*Abrostola triplasia*				☑
Snout	*Hypena proboscidalis*		☑	☑	☑

Nomenclature and taxonomic order from *Log Book of British Lepidoptera*. J. D. Bradley, 2000

Miscellaneous observations

Is Breydon silting up? As part of a study of the sediments in the rivers and broads using diatoms, the fate of sediments in Breydon Water was of primary importance. Since the Breydon Bridge was opened at Yarmouth I have driven over it many times and wondered at the apparent rapid growth of the salt marshes to' the west. Breydon would seem to be a huge silt trap for the fine material brought in by the rising tide. Loss of this silt trap would have fearsome consequences for the Broads which might then silt up rapidly themselves.

If Breydon was silting up the best way of measuring this was a study of the growth of the salt marshes. Fortunately, not only have a series of air photographs been made since 1946 but the 6" to' the mile map of 1904 recorded the salt marshes accurately at that time.

I am grateful to Dr Martin George who, on hearing of the problem, immediately sent me his own prints of the 1946 flight. I am also grateful to Andrea Kelly who gave me access to subsequent air photographs in possession of the Broads Authority

With one exception our study shows that the salt marshes on Breydon have not changed in the last hundred years. The exception is upstream of the end of the Lower Drain (an area visible from the bridge) and some other small areas west of the Lower Drain.

Of course, it may be that there is a gradual shallowing of the whole of the mudflats. This would be shown by cores taken on the flats. Because of the nature of Breydon mud this would be a difficult and hazardous undertaking.

Keith Clarke

Bombylius major L. is one of the small number of the UK bee flies. In early April 2005 a sudden emergence of these tawny coloured, furry flies, each with its long, thin proboscis, saw twelve hovering amongst the spring flowers in our small cottage garden in Tacolneston. Within the week they had disappeared.

Roy Baker

RECORDS OF RARE AQUATIC MOLLUSCS IN NORFOLK GRAZING MARSHES

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Introduction

The invertebrates of Norfolk grazing marshes have not been investigated in any detail for about 25 years since Driscoll (1976, 1982) and Driscoll & Lees (1973) undertook extensive surveys of a wide area of the marshes. In 1997 the Broads Authority started a programme of surveys for aquatic beetles and molluscs of the grazed marshes to assess their abundance and distribution, and to identify the relationship between the distribution of key species and the community composition with the physical parameters and macrophytes in the dykes (Jackson & Howlett, 1999; Drake, 2002, 2003). Some uncommon molluscs were found in two surveys undertaken in the Yare and Bure marshes, and are reported here.

Methods

The surveys were undertaken between mid September and early October 2001 in the Yare valley and late September to mid October 2002 in the Bure valley. Samples were taken using a pond net at 598 ditches whose vegetation had been surveyed by the Broads Authority a few years earlier. Details of the methods are given in Drake (2002, 2003); in brief, the samples were collected in 30 second sweeps and were either preserved in the field and later sorted in the laboratory (Yare marshes) or sorted live on the bank (Bure marshes). *Pisidium* were collected but not identified. A number of environmental variables were measured and some are listed in Table 1.

Marshes surveyed in the Yare valley extended on the north side of the river from Strumpshaw Marsh to Limpenhoe Marshes, and on the south side from Rockland Broad to the confluence with River Chet, and included marshes along the Chet itself. Marshes surveyed in the Bure valley extended from Ranworth Marshes to Acle on the south of the River Bure, eastward along Muck Fleet, to Repps along the River Thurne and to How Hill along the River Ant.

Results

Five rare species were found: *Anisus vorticulus* (Troschel) (Red Data Book 2, Vulnerable), *Segmentina nitida* (Müller) (RDB1, Endangered), *Valvata macrostoma* Mörch (RDB2), *Oxyloma sarsi* (Esmark) (RDB2) and *Vertigo moulinsiana* (Dupuy) (RDB3, Rare). The first two of these are priority species in the UK Biodiversity Action Plan, and *V. moulinsiana* is listed in the EU Habitats and Species Directive.

Anisus vorticulus. In the Yare valley, this small snail was found in a swathe of nine ditches across the marshes near Claxton (with Rockland Marsh) and Carleton marshes. The snail was frequent in four of the ditches, including one on RSPB land next to neglected pasture. In the Bure valley, *A. vorticulus* was found at 11 ditches on four marshes, mostly to the west of the Bure. There was a clear cluster of seven ditches at Upton Marshes, although the sample with most individuals was from a ditch at South Walsham Marshes where *Segmentina* was also recorded. Altogether, it was found in 3.3% of ditches.

When compared with ditches where *A. vorticulus* was not found, those supporting *A. vorticulus* had significantly lower mean conductivity and a higher mean percentage cover of submerged vegetation (Table 1). The cover of floating vegetation was also slightly higher than for the whole dataset, and that of emergent vegetation slightly lower, but neither difference was significant. In the Bure, *Stratiotes aloides* L. was abundant or dominant at seven ditches and *Hydrocharis morsus-ranae* L. was usually at least frequent where *A. vorticulus* occurred. The implication is that *A. vorticulus* lived in ditches usually containing slightly cleaner water that is often associated with more prolific growth of submerged plants, although six of the ditches were next to improved pasture where fertiliser was presumably used.

Segmentina nitida. Two colonies of the shining ram's horn snail were located in the Yare valley. On marshes east of the River Chet, it was numerous in one ditch (together with *Valvata macrostoma*) and scarce in an adjacent permanently flowing drain, both with swampy margins. At Limpenhoe Marshes it was found in nearly every ditch sampled north of the railway below Limpenhoe Hill (but not in the ditches north of the track near the sugar

plant settling lagoons), and reached a little way south of the railway in ditches close to the two tracks passing under the railway; thus despite being frequent here, the colony occupied a remarkably small area. The snail was more widespread in the Bure valley, occurring in 18 ditches at six marshes, and was numerous at two ditches at both Fleggburgh and South Walsham and frequent at two ditches at Ranworth; elsewhere only one or a few individuals were recorded. Altogether, it was found in 5.6% of ditches.

The characteristics of the ditches support what is already known of this species' preference for conditions late in the hydroseral succession. Such conditions were met at the margins of several ditches which were themselves not too far hydroserally advanced. These ditches stood out markedly from the average of the dataset, with significantly different mean values for many variables (Table 1). Compared to most ditches, they had low banks which were usually heavily grazed and trampled, often with a well developed shelf a little below or at water level which promoted wet grassy margins or a floating mat at the margin or even right across the ditch. Emergent and raft-forming vegetation was far denser, particularly *Glyceria maxima* at sites in the Yare valley, and consequently submerged vegetation and open water covered less of the ditches. Conductivity was lower than average and may have indicated the prevailing semi-improved pasture rather than arable or intensively managed dairy pasture. The estimated time since the ditches were last cleaned was far greater than average. Although ditches with *Segmentina* were significantly shallower than ditches without the snail, the difference was slight, and this serves to emphasise the importance of the structure of the margins to this snail and many other invertebrates.

Valvata macrostoma was found in two ditches on the Chet marshes where it was abundant and may have been more widespread, and in a single ditch where it was infrequent on Strumpshaw Marsh. There were no features in common to these three ditches which spanned the range from completely open to well vegetated with dense emergent vegetation.

Oxyloma sarsi. This is a large amphibious snail with a very limited distribution in The Broads and in Essex / Hertfordshire. The amphibious behaviour of this succineid, which is more pronounced than in the common

O. pfeifferi (Rossmässler) and *Succinea putris* (L.), should have made it frequent in pond-net samples but, as few specimens were large and dissection proved frustrating, it may have been overlooked as the common *O. pfeifferi*. It was found at 11 ditches on five marshes in the Yare valley and in two ditches in the Bure valley (2.2% of all ditches). These ditches appeared to have nothing in common, and no significant differences were found in the mean values of variables for ditches with and without the snail. Those in the Yare valley ranged from wide, open ditches with abundant submerged vegetation to ditches covered in floating vegetation, and from those with no effects due to cattle to very well poached and grazed sites. The two Bure valley sites were a heavily self-shaded reed-dominated ditch with an empty water column, and the other a rather small ditch with a solid mat of vegetation. No ditch was of interest in other respects.

Vertigo moulinsiana was found at five ditches on Strumpshaw Marsh and one at Claxton marshes. The last record, of 6 individuals, was unexpected as the ditch was not typical *moulinsiana* habitat but was dominated by dense *Carex riparia / acutiformis* over a thatch of litter, with some *Phragmites australis* Trin. but little else. Records of this species will have been quite fortuitous since it lives high up on emergent vegetation. Its habitat preferences are well defined already (Drake, 2000) and bear no relationship to the variables measured in this survey. This is one of the species for which Broadland has been selected as a SAC.

Discussion

Jackson & Howlett (1999) made a case that the grazing marshes of the Waveney valley were probably the richest mollusc sites in Broadland since five Red Data Book species were found widely and sometimes in abundance. The claim may need revising in light of the results of the Yare and Bure surveys. The same range of snails were found in all surveys, although *Pisidium* were not identified so Jackson & Howlett's records for *P. pseudosphaerium* cannot be compared, and additionally *Vertigo moulinsiana* was occasionally found in the Yare survey. The percentage of ditches supporting *Segmentina* and *Anisus vorticulus* were almost identical in these areas (5.5% in the Waveney compared to 5.6% for *Segmentina*; 3.4% in the Waveney compared to 3.3% for *A. vorticulus*). The much smaller proportion

of *Oxyloma sarsi* recorded in the Bure and Yare surveys is almost certainly due to having taken place when most specimens were too small for accurate identification.

All three valleys have outstanding populations of *Anisus vorticulus*, *Segmentina nitida* and *Oxyloma sarsi*, and tiny populations of *Valvata macrostoma*. These results support other recent observations of grazing marsh ditches in Broadland, for example the frequent occurrence of *Segmentina*, *A. vorticulus* and *P. pseudosphaerium* in a small section of Halvergate marshes (Willing & Killeen, 1998). The Yare and Bure records duplicate most 10km square in Kerney (1999), and add a square for each of *A. vorticulus* (TG31) and *Valvata macrostoma* (TM39). Grazing marshes in East Sussex also support these species but only Pevensey Levels appears to be better for all of them (Watson & Ormerod, 2004a).

There seems to be little agreement about the type of ditch occupied by *A. vorticulus*. The present surveys seemed to suggest that more open, perhaps botanically diverse ditches were favoured (although with limited justification). Jackson & Howlett (1999) described the preferred ditches as being wide, comparatively deep with little emergent vegetation cover and quite heavily browsed. Willing & Killeen (1998, 1999) suggested that it prefers small or medium-width ditches with some shallow water such as that produced by trampling or by little recent management so that they are vegetation-choked. The results of Watson & Ormerod (2004a,b) partly corroborated those of Willing & Killeen, insofar as *A. vorticulus* was less frequent in wider and deeper ditches with more open water, although they found no strong association with marginal areas. However, there does seem to be consensus that the occupied ditches have better water quality than average for grazing marshes, and that the adjacent land-use should be unintensive pasture. One reason for a lack of agreement in these surveys may follow from the species' reputation as a poor coloniser. This may explain the clumped distribution in the Bure and Yare where past events, such as a period of unsympathetic land or ditch management, or saline incursion from the low-lying rivers, had eradicated the snail from apparently suitable sites. Such events would obscure trends in survey data.

Acknowledgements.
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Table 1. Selected environmental variables for *Anisus vorticulus* and *Segmentina nitida*. Mean values (with 95% confidence limits) are given for continuous variables and the median for nominal variables (slope, shelf, poaching) estimated on a scale of 1-3. Variance ratio (F) or Mann Whitney (U) is given for the comparison of the mean values for ditches with and without each species, and significance levels ($p \leq 0.05, 0.01, 0.001$) indicated by asterisks; ns = not significant.

	Anisus		*Segmentina*		whole dataset
	mean	F	mean	F or U	mean
depth (cm)	87 ± 12	ns	68 ± 10	4.66 *	78 ± 2
freeboard (cm)	36 ± 5	ns	36 ± 6	4.47 *	47 ± 2
conductivity (µS/cm)	725 ± 62	8.09 **	783 ± 75	7.44 **	971 ± 33
emergents %	19 ± 9	ns	48 ± 11	17.25 ***	28 ± 2
rafts %	7 ± 6	ns	20 ± 9	11.55 ***	9 ± 2
submerged %	65 ± 19	7.95 **	19 ± 11	7.46 **	38 ± 3
floating %	48 ± 17	ns	34 ± 12	ns	34 ± 3
open water %	32 ± 18	ns	21 ± 10	9.27 **	41 ± 3
last clean (years ago)	3.4 ± 0.8	ns	4.6 ± 0.8	13.29 ***	3.3 ± 0.2
slope	3	ns	3	6865 **	3
shelf	1	ns	2	11857 ***	0
poaching	2	ns	2	11430 **	2
N	20		35		579

NORFOLK TERRESTRIAL HETEROPTERA (part 4)

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Hemiptera
Heteroptera
Saldidae. Shore Bugs.

Most members of this family of terrestrial bugs are small, flattish and oval shaped with large prominent eyes. They are to be found around the edges of the water of ponds, bogs and coastal salt marshes hence their name.

Observing these insects in sunshine when they are active requires a lot of patience, the slightest movement will cause them to run, jump or fly, if they possess hind wings, to hide extremely quickly even under water. Their action can be described as "Now you see me, now you don't". Because of their small size and rapid movement it is easy to lose sight of them, especially as most species are remarkably camouflaged within their habitats.

They can be distinguished from other bugs by having a three sectioned rostrum and four long cells formed by looped veins in their forewing membrane. Some species exhibit a range of forms i.e. dark, light or intermediate which makes them difficult to name, the only certain feature being the claspers of the male sex. They are all predatory on other small insects.

Because some of them are associated with marine tidal waters it is worth mentioning here that there is one terrestrial bug that was once included in the Saldidae but is soley confined to a submarine aquatic existence, though not found here in Norfolk. It is called the marine bug *Aepophilus bonnairii* Sig. It is only 3mm long and is found inhabiting crevices in rocks on the south and west coasts where the adults and nymphs live in a subsocial existence surviving together most of the time under water and only moving about at low tide to feed on algae or marine worms on the seaweed. They have no wings or ocelli and have very small eyes since these are of no use in their marine environment.

Saldidae	Wat/Pre	VC
Chartoscirta cincta H&S	27	28
Chartoscirta cockii Curt.		28
Chiloxanthus pilosus Fln.	27	28
Halosolda lateralis Fln.	27	28
Micracanthia marginallis Fln.	?	
Saldula orthochila Fieb.	27	28
Saldula pilosella Thom.		28
Saldula saltatoria L.	27	28
Saldula pallipes Fab.		28
Saldula palustris Doug.	27	28
Saldula opacula Zett.	27	
Salda litteralis L	27	28
Salda muelleri Gmel.	27	28

Chartoscirta species. The pronotum has a furrow completely crossing to the lateral side margins which are concave. The tibial spurs are extremely small and the ocelli close together.

Figure 1A. *Chartoscirta cincta* H&S. 3.5-4.1mm. The head, pronotum and scutellum are shining black. The first antennal joint is black but yellow at the apex, joints two and four are black. The forewings are black with numerous pale spots, the outer margins also being pale. Found running on the mud amongst roots of rushes and reeds of ponds or marshes. Macropterous adults overwinter in leaf litter.

Figure 1B. *Chartoscirta cockii* Curt. 3.1-3.9mm. The head, pronotum ansd scutellum are shining black. The first and second antennal joints are yellow but black at the base, joints three and four are black and thicker than joint two,The forewings are black with a few pale spots, the side margins are pale yellowish. It is found in moss in boggy areas.

Figure 1C. *Chiloxanthus pilosus* Fln. 5.0-6.0mm. The lateral sides of the pronotum are pale yellowish and slightly convex, the transverse furrow is almost non existent but if seen it never reaches the lateral side margins. The head and scutellum are black, the forewings are pale but black by the sides of

the scutellum. There is also a large black spot on each forewing side margin just above the membrane base. The whole body is covered with long black erect pubescence. The ocelli are well separated. The second and third tarsal segments are approximately equal in length. A salt marsh species. The adults hibernate.

Figures 1A-1E

Figure 1D. *Halosolda lateralis* Fln. 3.7-4.0mm. The head, pronotum and scutellum are black but the lateral sides of the pronotum are yellow and convex. The third and fourth antennal joints are dark, the second tarsal segment is longer than the third. The forewings are pale, sometimes with spots at the apex. There are two forms light and dark. A saltmarsh species often numerous, it is flightless and can be found jumping on mud between marine shore plants. At high tide it will submerge on a plant as it does to escape capture.

Figure 1E. *Micracanthis marginalis* Fln. ssp. *immitata* L. 2.7-3.0mm, This exceedingly rare bug was reported from Norfolk in the early years of the last century, but is has not been seen in the county since. It was, however, rediscovered in its old habitat in the Chobham area of Surrey in 1957. The sides of the pronotum are straight, the second antennal joint is dark at the apex, the third and fourth are also dark and together they are longer than the second. All the femur are 2/3 dark but pale at the apex. The pale marks of the face show between the antennae.

Saldula species. These are flattish oval bugs. The forewings are often dark with various pale markings. The lateral margins of the pronotum being nearly straight or convex. There are eleven species in Britain,

Figure 2A. *Saldula orthochila* Fieb. 3.7-4.2mm. The head, pronotum and scutellum are black and shining, the lateral sides of the pronotum are straight. The forewings are black with a number of pale spots often hard to see with the naked eye, there is also a large white spot on each wing just above the membrane. The insect is usually found running about in drier places such as sandpits, sandy commons, heaths or fields.

Figure 2B. *Saldula pilosella* Thom. 4.0-4.5mm. The head, pronotum and scutellum are black as are the bases of the forewings. The rest of the wings being pale with three black spots near the side margins. It is less rotund than other bugs. Normally a saltmarsh species but in Norfolk it has been found in the Broads area. It makes for water when disturbed. Adults overwinter in leaf refuse.

Figure 2C. *Saldula saltatoria* L. Common shore bug. 3.7-4.5mm. Our most common and variable black species to the naked eye, but with magnification various pale markings can be distinguished. One certain feature, however, is on the dorsum of the fore tibia, the black central mark is separated from the black mark at the base of the tibia. It is found in a variety of habitats, i.e the margins of streams, ponds, ditches, muddy swamps and even garden ponds where it runs about in search of prey.

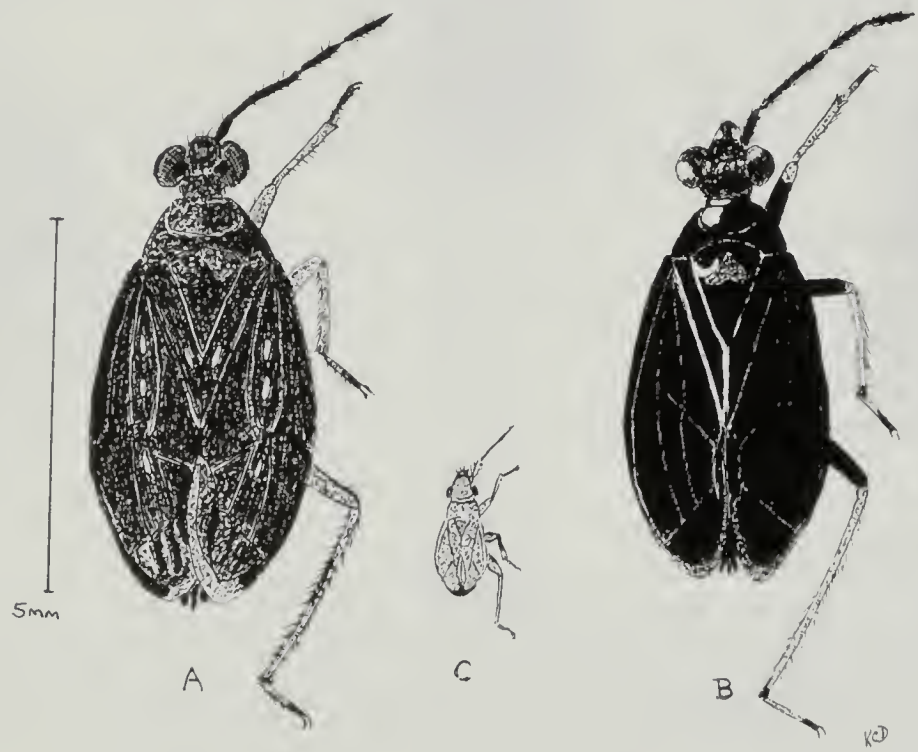
Figures 2A-2E

Figure 2D. *Saldula pallipes* Fab. 3.9-4.5mm. This shining black species has very variable pale markings. The first antennal joint is pale, the second black but pale at the apex, the third and fourth are also black. The long central steak on the dorsum of the fore tibia is connected to the black basal patch. It is found in sandy areas inland such as flooded gravel workings etc.

Figure 2E. *Saldula palustris* Doug, 3.0-4.0mm. Very similar to *S.pallipes* but slightly smaller and more rotund. It is also found in a different type of habitat, estuarine mudflats where it is often submerged on vegetation by the movement of the tides. One helpful tip is to examine the pubescence on the dorsal area, if viewed from the side it will be found to be noticeably more erect.

Saldula opacula Zett. 3.5-4.1mm. This rare species was recorded from Salthouse marshes in the very early years of the last century. It was considered to be a rarity then, but is was also mistaken with *S.saltatoria* var. *marginella* from which it differs in minute detail

Salda species. Here we have the largest species, but because they have extremely small hind wings they cannot fly. When disturbed they do not try to submerge but will run to hide in nearby vegetation. The lateral sides of the pronotum are either straight or slightly convex. Note the forewings do not overlap.



Figures 3A-3C.

igure 3A. *Salda litteralis* L. 6.0-7.0mm. A brownish-black species. The orewings are roughened and covered with a very fine golden pubescence iving it a dull appearance. There is a row of three pale spots just discernible n line down the centre of each forewing. It is found in silty margins of rivers vhere there is plenty of vegetation to allow the insect to retire to when listurbed.

igure 3B. *Salda muelleri* Gmel. 5.1-7.5mm. A bluish-black species. The orewings are slightly shining but without any pale spots like the previous pecies. Notice the two pale spots on the head between the antennae, also the lackish femurs. It is found in vegetation in fens and broads.

***eratocombidae* (= *Dipsococidae*)**	Wat/Pre VC
eratocombus coleoptratus Zett.	27

igure 3C. *Ceratocombus coleoptratus* Zett. 1.5-2.0mm. Quite a long cientific name for such a minute bug, just big enough to sit upon the head of normal pin. It is only found in moss or under dead leaves in damp areas. It as reported from Stratton Strawless and Ditchingham in the early years of ne last century, and also over the border at Barnby Broad in Suffolk on 8.9.1911. It was not reported in Norfolk again until it was discovered at leron's Carr, Barton Broad on 4.8.1999. They are mostly brachypteras but lly winged examples have been found elsewhere in the country. It is onsidered as a scarcity because of its small size and the fact that it cannot be ıken by sweeping but requires patient searching for on the knees. Good yesight is also recommended.

cknowledgements

ly thanks to Dr A.G.Irwin for the loan of the specimens from the Bedwell collection the Castle Museum, Norwich . Also Bernard Nau for his helpful information..

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SYROMASTES RHOMBEUS (COREIDAE) - A HEMIPTERAN BUG NEW TO NORFOLK.

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Syromastes rhombeus (Linnaeus 1767) is a ground dwelling hemipteran bug with a distinctive diamond-shaped abdomen, not previously recorded from Norfolk. The species is classified as having a 'Local' distribution and favours dry, sandy habitats (from early successional stages through to open pine-birch woodland and well-drained sand or chalk pits) within the southern part of Britain. Southwood & Leston (1959) note that the species is restricted to suitable localities, south of a line from Suffolk to South Wales. The species has been known from West Suffolk for many years (Bernard Nau, *pers comm.*) and it is likely that the Suffolk record cited by Southwood & Leston (1959) refers to the Suffolk Brecks. Suffolk records from Maidcross Hill, Wangford Warren, Icklingham Triangle, Cavenham Heath and the flood relief channel north of Barton Mills may well reflect the distribution of fieldwork activity by recorders, rather than the distribution of the species within the Brecks (Bernard Nau, *pers comm.*). It is perhaps unsurprising then, that the species has now been discovered in the Norfolk Brecks.

On 15th May 2004, during a series of field visits to check on the status of Dingy *(Erynnis tages*, Linnaeus 1758) and Grizzled *(Pyrgus malvae*, Linnaeus 1758) Skipper at previously recorded sites, the author encountered two unfamiliar ground bugs on a patch of bare ground adjacent to a forest ride near Cranwich (TL 772933). One of the individuals was photographed and taken away for identification, before later being released. The species was identified as *S. rhombeus* by using the key provided by Hawkins (2003) and subsequent comparison with a photograph in the same publication. The identification was later confirmed by Ken Durrant.

The favoured food plants of this species are thought to be various small members of the Caryophyllaceae (Woodroffe 1953), such as bladder campion *(Silene vulgaris*, Gareke), plus various spurreys and sandworts. It has also

been found on plants of other families (Masse 1963, Moulet 1995, Hawkins 2003). The two individuals were found together on bare ground, amid early successional vegetation that may have included suitable food plants – a more thorough examination of the site will be made during 2005.

Figure 1. *Syromastes rhombeus*

S. *rhombeus* is unlikely to be confused with other bugs, except perhaps the dock bug *Coreus marginatus* (Linnaeus 1758) which is larger and also has an expanded abdomen. The expanded abdomen in C. *marginatus* is rounded at the sides, whereas in S. *rhombeus* the angles are clearly distinct. In addition, *S.rhombeus* is a slimmer bug, with a pronotum little more than half as broad as the abdomen, while in C. *marginatus* the pronotum is almost as broad as the abdomen (Hawkins 2003).

Although this represents a new county record, it is likely that the species has been present within the Norfolk Brecks for some time. Global climate change is thought to be behind the northward expansion in range of several invertebrate species but it is unclear as to whether S. *rhombeus* has expanded its range northwards. It is worth noting that the species is thought to have declined considerably within Surrey over the last century (Hawkins 2003), presumably through the loss of suitable habitats. However, there are sufficient areas of potentially suitable habitat within Breckland for more records to emerge over the coming years.

Acknowledgements.
Thanks are due to Ken Durrant and Bernard Nau for help with background information included in this paper.

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HARLEQUIN LADYBIRD, FRIEND OR FOE

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Harmonia axyridis Pallas was first discovered in Britain by Dr A. Irwin when he photographed a strange larva in his garden in Norwich on July 3rd 2004. Soon afterwards reports were coming in from Great Yarmouth where large numbers of larvae were found on *Euronymus* shrubs in the churchyard of St Nicholas church. Numbers of pupae were also found on many gravestones where most of the early adults were to be found.

The adults are extremely variable, a feature which is also common with some other species of Coccinellidae. I sent some specimens to Dr Michael Majerus, the ladybird specialist at the Department of Genetics, Cambridge University, and he replied that reports were coming in from Kent, the London area, Essex, Suffolk, Sussex, Cambridge and Derby. In fact the south east of the UK was well covered.

Harmonia axyridis is an Asiatic species which was introduced into America

in 1916 as a biological control for aphids. However, it was soon discovered that there was a serious decline in many native species as it was found to be attacking caterpillars and other small insects and their eggs. I had an example of this behaviour recently when I was sent some larvae and adults in the same small box, by the time I received it only the adults were found plus one or two larvae legs.

The species eventually died out in America possibly due to the cold winters during the hibernation period. It was, however, re-established in 1988 in the southern states and is now common in America and Canada where it hibernates inside houses in vast numbers. It also causes damage to soft fruit in its search for moisture.

It is also sold by biological companies in Europe and is now found in increasing numbers in France, Belgium, and especially the Netherlands where most of our pot plants are imported from. It is possible that the ladybird has arrived here as eggs upon such imported plants.

It is hoped that *H. axyridis* is not released here as a biological control, we are already suffering from the accidental introduction of alien red lily beetle *Lilioceris lilii* Scop. also from the release of captive mink resulting in the loss of many local mammals and birds.

Harmonia axyridis is about the same size as our common seven spot ladybird. The illustrations show the type **Form** B with nineteen reasonable black spots on an orange elytra and on the white prothorax there is a black M mark if viewed from the rear.

Form A has much smaller spots and also small triangular black marks on the white prothorax.

Form C is the commonest variety, much darker than the type, most of the spots are coalescent and the prothorax is black with varied white margins.

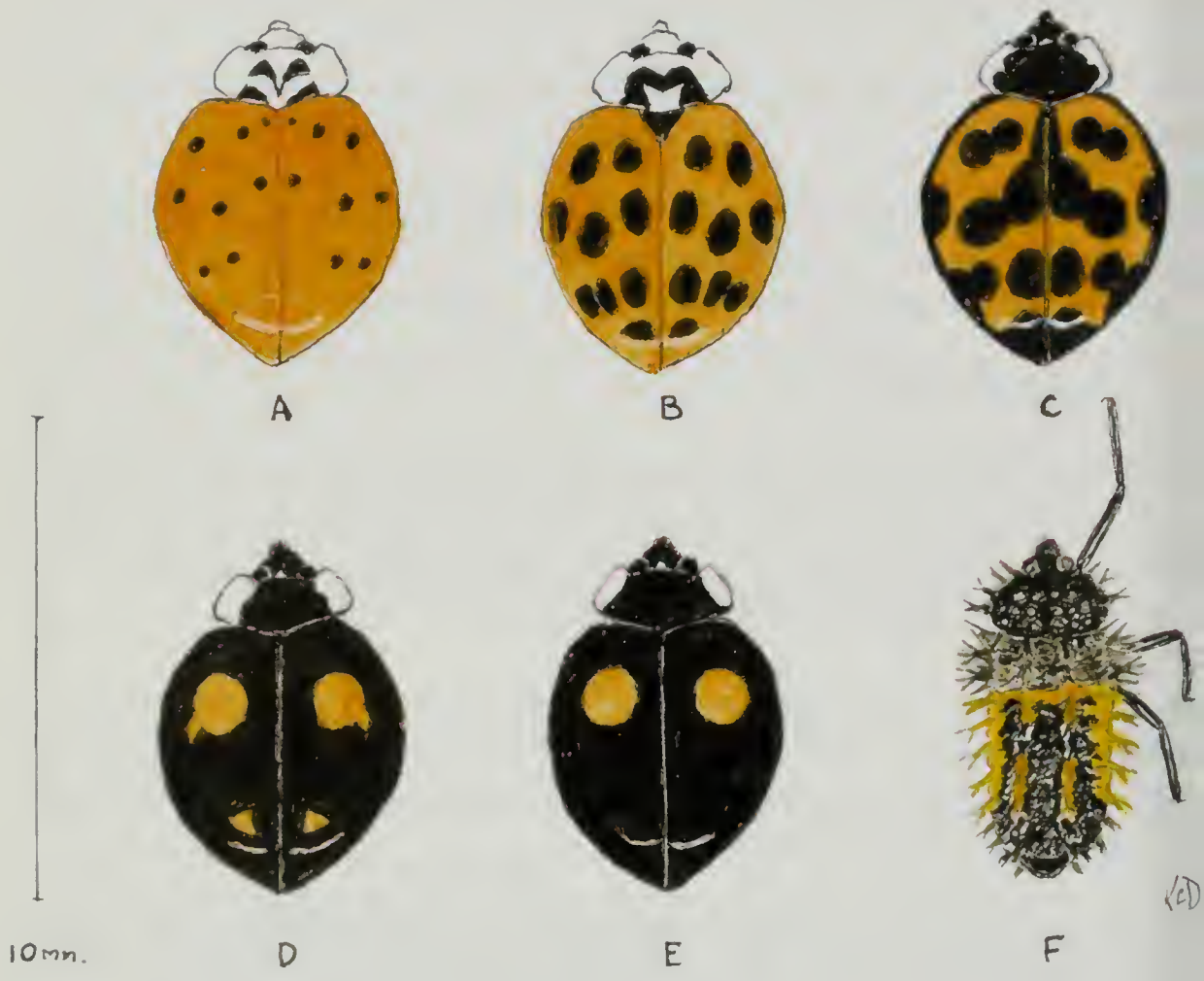

Figure 1. Harlequin Ladybird

Form D is almost melanistic except for four varied orange spots on the shining black elytra. The prothorax is black with varied white margins.

Form E is very similar to D but with only two orange spots.

Figure F is the larva which is extremely spiny. The head and prothorax are black with the spines at the sides of the prothorax single and twin spiked. The meso- and metathorax are black, each with up to five black spines on each side section, those on the dorsal bumps are black and twin spined, each spine is tipped with a hair. The abdomen segment I is pink or yellowish as are the twinned spines on the outer margins, whilst those on the dorsum are three pointed and the same colour. The abdomen sections 2-5 are black. The outer marginal spines are pink or yellow and twined, but the dorsal spines of segments 2 & 3 are black and three pointed, those on segments 4 & 5 are pink or yellow and three pointed. Abdominal segments 6-9 are black as are the three pointed spines which are smaller.

We already have another *Harmonia* species in Britain, the cream-streaked ladybird *Harmonia punctata* Pont. There are two forms, one with four spots and the commoner form with eight spots. The prothorax of both forms is white with eleven black spots.

I would be pleased to identify any suspect specimens found in Norfolk if sent to me in an empty matchbox containing a small amount of crumpled toilet paper to allow the specimen to hold firm during transport. All relevant records will be passed onto Dr Majerus at Cambridge.

Miscellaneous observations

White Admiral butterflies (*Ladoga Camilla* L.) were first recorded in Norfolk in 1932 at Aylmerton Roman Camp by Ken Durrant and by Mrs Lockhart Smith in 1933 at Ellingham near Bungay. By the mid-30s they were seen in many widely scattered Norfolk sites. At Wheatfen Ted Ellis recorded it in 1935 and then regularly until 1960 when it disappeared. David Griffin rediscovered it at Wheatfen in1994 and by 2004 David Nobbs reported seeing good numbers on the wing in early July.

Roy Baker

ORTHOPTERA REPORT 2004

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Highlights of 2004 were the expansion of long-winged conehead across th county and the discovery of an extraordinary site at Cranworth which ha yielded a total of twelve species, including an isolated colony of stripe winged grasshopper, 11 km to the north-west of the known breckland range The Cranworth site is a former gravel pit crossed by a public footpath. It wa visited in August 2004 as a potential site for Roesel's bush-cricket. As well a that species, which occupied areas of rank vegetation, there was short-winge conehead in rushes near a shallow pond, long-winged conehead in roug grass and stripe-winged grasshopper in shorter grass and on south facin banks. Dark and speckled bush-crickets were also present, while bot common and slender groundhopper were known from a previous visit. Green field, meadow and lesser marsh grasshopper complete the species list.

Oak bush-cricket *Meconema thalassinum*
A casual observation from Swaffham (TF8207) is the first new 10km square record since the publication of the millennium maps (Richmond 2001).

Roesel's bush-cricket *Metrioptera roeselii*
Range expansion continues with new 10km square records from TF80 (five tetrads around Great Cressingham and North Pickenham), TF90 (the previously mentioned Cranworth record), and TL88 (two tetrads aroun Weeting). Away from the brecks, a single individual was heard at Foxley Wood (TF02).

Long-winged conehead *Conocephalus discolor*
Previously known from only two sites, this species was discovered at Wes Rudham Common, the Peddars Way at Thompson, Cranworth, Eas Tuddenham, Sparham, Whitwell Common, Booton Common, Cawston an Pigny's Wood at North Walsham. In addition the species was confirmed to b still present beside the North Walsham and Dilham Canal at Witton, a reported in last year's Orthoptera Report (Richmond 2004). All th

discoveries were made with a bat detector and most were confirmed by visual observation.

Several of these sites have been the subject of regular study in recent years with the particular, and usually unsuccessful target of short-winged conehead. So the discovery of long-winged conehead in 2004 must represent recent colonisation, possibly only in the previous year. It may be recalled (Richmond 2004) that 2003 saw some significant movements of Roesel's bush-cricket from the south-west of the county, with macropterous males identified at Reepham and Wood Dalling (the author's home patch). It may be that long-winged conehead was part of that same dispersal, but because it only has a single year egg cycle, as opposed to the two year cycle of Roesel' s, its new colonies have become immediately apparent in the areas frequented by the author.

Francis Farrow has reported an expansion of the Beeston Regis colony, which now straddles a tetrad boundary. The rapid expansion at this site suggests the colony may have been of very recent origin when discovered, in a fairly restricted area of the common, in September 2000.

Short-winged conehead *Conocephalus dorsalis*
This insect has been discovered in four new 10 km squares in the east of the county: Belaugh (TG21), Little Hautbois (TG22), Pigny's Wood (TG23), Witton and Ridlington (TG33). All sites were typical wetland habitats with significant clumps of rush. More surprising were the records from dry grassland at Foxley Wood (TG02) and from a small area of rushes in the disused gravel pit at Cranworth (TF90).

Speckled bush-cricket *Leptophyes punctatissima*
One heard with a bat detector in nettles at Ridlington (TG33) was a new 10 km square record.

Stripe-winged grasshopper *Stenobothrus lineatus*
2004 brought more records of this species in the north-west of the county, where it has now been recorded from a total of ten tetrads. In 2004 it was found in new 10 km squares at Shernborne (TF73) and Harpley Common

(TF82), in both cases on roadside verges, that at Shernborne being particularly fine. It was also found on the disused railway at Harpley (TF72), the same 10 km square as the previous year's discoveries at Massingham and Grimston Heaths (Richmond 2004).

The new 10 km square record at Cranworth (TF90), which has already been mentioned, was totally unexpected, and again demonstrates the value of a bat detector in picking up the otherwise inconspicuous stridulation of this species. Hot weather also adds to the chances of success.

Meadow grasshopper *Chorthippus parallelus*
2004 brought final confirmation of the presence of this species at East Ruston (TG32). It had been reported by a visiting orthopterist in the late 1990's, but despite several visits to the area, the author had been unable to confirm the observations. A 2004 visit to East Ruston Common similarly drew a blank, but an arbitrary stop on a floristically attractive roadside verge to the north of the village finally brought the search to an end, with sound and sight records. This is still, very much an isolated record and the status of the species in the north-east of the county remains unclear. The author would be pleased to hear of any known or suspected colonies to the north of the River Bure.

Lesser marsh grasshopper *Chorthippus albomarginatus*
This species was found in five new 10 km squares in 2004, plus 21 new tetrads from within the known range. The appearance of the species in four tetrads in the author's home patch at Reepham (TG01 and TG02), where it was hitherto unknown, raises the question of whether it was part of a same weather borne dispersal that brought Roesel's bush cricket and long-winged conehead to the area in 2003. Other new 10 km squares were TG21 (Coltishall), TG22 (Little Hautbois) and TG23 (Pigney's Wood, North Walsham) all of which border the known range in east Norfolk.

Short-winged earwig *Apterygida media*
One fell out of the author's telephone at his workplace in Thorpe St Andrew, delaying the start of a meeting while it was identified. The amateur naturalist should remain forever vigilant!

Earliest and latest dates

The first emergence of nymphs was about 4 or 5 days later than in 2003. Dark bush-cricket nymph was seen on 25 April, and speckled bush-cricket on 14 May. The author's wife heard mottled grasshopper stridulating on the extremely early date of 31 May on a south facing bank on Kelling Heath. Common green grasshopper was heard on 5 June at Cranwich, the author's third earliest date.

For the first time since he began recording late dates, the author had no records of grasshopper species in November, though dark bush-cricket and speckled bush-cricket did survive until 17 November at Reepham, after which there was persistent heavy rain with hail and frosts. Alec Bull reported slender groundhopper at Swangey Fen on 6 November.

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Miscellaneous observations

During the first fortnight of last April I received many letters and telephone calls concerning the sudden arrival of hosts of small black flying insects that were making their presence felt in North Norfolk.

One had only to walk out into the garden and on returning indoors many small black beetles would fly off clothing and alight on the nearest south facing window. It was possible to remove 30 to 40 each time.

I identified the beetle as *Meligethes aenus* Fab. 1.5-2.5mm in length and often called flower or pollen beetles. There are 34 species in the genus and they are not the easiest to place a name on as their differences are minute. They are included in the family *Nitidulidae*.

K.C.Durrant

ERNEST THOMAS DANIELS 1911 – 2004

With the death of Ernest Daniels on 29th June 2004, the Society lost its longest serving member who had completed over seventy-five years of active membership; a record believed to be unique. For 63 of these years his wife Bessie, who died in January 2003, ably supported Ernest in his many interests and activities.

Ernest was born in Norwich on 11th November 1911 and was educated at The City of Norwich School. He began a life-long interest in natural history at an early age, inspired, he later wrote, by an ancient book on birds and another entitled *Adventures of a Young Naturalist.* In company with young friends he began to explore the world of nature including visits to the Castle Museum and the window of Mr Gunn's taxidermy shop. Eaton Park "and two adjoining fields" were their happy hunting ground where they secured many species of butterfly. The acquisition of a bicycle allowed him to explore more widely, including regular visits to Horsford Woods, adding many more species to his tally. Later, in the 1930s, he was part-owner of a gun-punt in which he explored the Broads while they were yet a tranquil haven for wildlife.

He first met Arthur Patterson in August 1926 at a time when he used to cycle to meet Ted Ellis, who lived in Yarmouth. When writing to Ernest, Ted illustrated the envelopes with natural history sketches in the manner frequently used by Arthur Patterson. Through this association Ernest was introduced to Mr H. J. Howard [President 1927-28] and subsequently the Society. He attended his first meeting in February 1927 when Jim Vincent was the speaker. Following this he resolved to become a member, achieving his wish in September 1928 when Mr Howard proposed his membership. His early friendship with Ted Ellis resulted in him acting as Best Man at the wedding of Ted and Phyllis.

On leaving school Ernest joined the staff of The Norwich Union Life Insurance Society where, apart from a break during the Second World War,

he spent his whole working career, retiring in 1971. He was called up into the Army in 1941 and saw active service in North Africa and Italy, not returning home until late 1945. He was able to continue his interests in natural history during these years overseas, particularly in making a study of butterflies whilst in Italy.

Ken Durrant first met Ernest whilst visiting the Norfolk Room at the Castle Museum. For a number of years in the late 1950s, they would visit Wicken Fen in Cambridgeshire where the day would be spent counting and recording the eggs and larvae of the rare Large Copper butterfly. These were found upon the leaves of the Water Dock plant, each plant being numbered on an associated cane. On one occasion so thorough was the search that they actually found the warden's keys that had been lost a few days earlier!

Ernest was the Society's expert on Caddis flies, but he later became disenchanted with all aspects of aquatic life when species that were once very common began to disappear due to the pollution in the water caused by the build-up of detergents in the rivers. He was joint editor of the entomological section of the British Association's publication *Norwich and its Region* when the Association visited Norwich in 1961.

In addition to his early interest in entomology, ornithology soon became a passion and later his contribution to botany was most significant. He was always ready to see unusual birds or botanical specimens reported throughout the County. Ken Durrant spent many happy times with Ernest and Bessie, either on the Society's outings or by pre-arrangement when he had good reason to visit a particular habitat. He was always delighted when a species was located, proved and entered in his notebook. He was involved in the Petch and Swann flora of the county published in 1968 and he has left a valuable legacy of maps and his notebooks detailing records of the County's less common plants. These have been deposited in the Castle Museum, Norwich.

Ernest also played his part in the management of the Society. He was a Committee member [1952-54 & 1966-68], Honorary Treasurer for eleven

years [1955-66], leaving Don Dorling a meticulous set of records when he succeeded him in that office, and he also served as editor of the Society's newsletter *Natterjack* for three years [1983-86]. He was President [1979-80], presenting his Presidential Address 'Natural History of Norwich', appropriately in the Norwich Library Lecture Theatre, on 8th February 1980. He was elected a Vice-President in 1970.

K.C.Durrant and D.A.Dorling

Postscript

My memories of Ernest Daniels. After retirement he was a regular and welcome visitor to the Norfolk Room at the Castle Museum to consult the herbarium. He would always take his leave saying he would be back next week DV (Dieu volante i.e. God willing). He had a particular interest in alien plants and added many records from the Norwich area and in particular from his favourite hunting ground of the old Harford Tip which was coming to the end of its active life. He was extremely knowledgeable on hawkweeds (*Hieracium* species), for instance finding *Hieracium maculatum* at Eaton Chalkpit. Because he often botanised in unfashionable habitats like main road verges, he was one of the first people to recognise in the 1970s that saltmarsh plants were moving inland along road verges in response to road salting. His friendship with Eric Swann, Charles Petch and Richard Libbey was very important in at least redressing the bias of botanical recording to West Norfolk in both the Petch & Swann Flora and its supplement.

Peter Lambley

MOLLUSC REPORT 2004

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An investigation into the molluscs at Billingford Common revealed the presence of the wall whorl snail *Vertigo pusilla* Müller Two specimens were found in leaf litter underneath small oak trees. The site appears to be unmanaged and in a very neglected state so in all probability the population of this species is much greater than the findings indicate.

Various surveys by the Wheatfen Partnership last year uncovered two new sites for three of our Red Data Book species. The first one at Griffin's Lane, Thorpe St Andrew (TG 275 085) led to the discovery of Desmoulin's whorl snail *Vertigo moulinsiana* (Dupuy) RDB3 in small numbers in reed and sedge beside a drainage ditch. The same ditch also contained a very large population of the very rare aquatic shiny ram's-horn snail *Segmentina nitida* (Müller) RDB1. The dyke shows a rich molluscan fauna typical of a degenerated dyke in need of dredging for drainage and flood control engineering. However, it is exactly this type of dyke which offers the greatest biological diversity.

The second site was the Butterfly Conservation Society fen at Catfield where *Vertigo moulinsiana* was recorded amongst sedges in a very wet area. Some of the small, shallow ditches with water violet contained *Segmentia nitida* and the false orb mussel *Pisidium pseudosphaerium* Schlesch. RDB3. The shiny ram's-horn snail was abundant in the surrounding fen amongst the waterlogged stems of reed and especially in the deeper tracts formed by Chinese water deer. The marsh appears to have been uncut for many years and this may provide the key to the continuing presence of the snail.

During the winter of 2004-05, the Wheatfen Partnership was involved in a conservation project for the Broads Authority to save freshwater swan mussels *Anodonta cygnea* (L.) from the mud suction dredge at the 4.3ha Crome's Broad (TG 376 198) which is divided into two parts separated by a stand of reed open in one place to facilitate water exchange. The operation entailed dredge netting the mussels from the path of the suction dredge and transferring them to a safe area of the same broad. Altogether over 50 mussels, many of them juveniles, were recovered and replanted. The highlight of the operation was the recovery of two very large swan mussels measuring 170mm and 190mm in length. By broadland standards these are very big specimens, this size was probably common many years ago but currently it is a rarity to find large specimens.. In early May 2005 large scale dredging of the River Yare at Brundall and Surlingham allowed us to transfer healthy populations of painter's mussels *Unio pictorum* (L.). compressed river mussels *Pseudanodonta complanata* (Rossmässler) RDB3 and a few Asiatic clams *Corbicula fluminea* (Müller) to other sites in the river valley.

PLANT NOTES FOR 2004

Gillian Beckett & Bob Ellis

In 2004, the discovery of a hybrid *Scutellaria* at Marham was reported. This year, however, members of the Flora Group visited the site to obtain a good voucher specimen and were quite unable to find it. Until we are able to do so, the record must remain unconfirmed and not added to any official list.

Apart from this disappointment, the Group had a busy and productive year, mainly completing the records for the national Local Change Project. This has involved re-visiting specific tetrads that were recorded for the monitoring scheme between 1985 and 1987. Bob Ellis is national co-ordinator for the project so we have all felt we had to pull out all stops to make Norfolk recording as complete as possible. The fact that only one tetrad has a lower score than it had fifteen years ago shows we were successful. The problem this has brought is that the apparent gain of plants says rather more for the Group's enthusiasm than for actual plant distribution, something not easy to explain statistically!

The *Limonium binervosum* aggregate, rock sea-lavender is group of apomictic taxa (i.e. where seed is produced entirely from unfertilised female origin), which is currently undergoing revision following molecular studies. The north Norfolk coast is something of a stronghold for *Limonium binervosum* – with us it is a salt-marsh plant so the vernacular name seems rather inappropriate – and we have carried out detailed mapping through most of its main distribution area from Holme to Salthouse and we hope to cover the outliers and remaining areas in 2005. Happily the colonies all seem to be healthy at present. The search for this plant also found us at Holme noting good colonies of the scarce grass *Vulpia fasciculata*, dune fescue and of *Centaurium pulchellum*, slender centaury amongst the treasures there, whilst between Cley and Salthouse several stands of the locally scarce *Carex extensa*, long-bracted sedge were discovered.

Two meetings were held on the area of forest at Cranwich where the Brecks Heathland Project has instigated clearance of conifers to try and re-create a

piece of the grass heathland which once covered so much of the area. This sort of re-creation has not always been very successful elsewhere, especially where modern ploughing has disturbed the soil patterns and added fertiliser has altered the basic chemistry. Here, in an area that hasn't been seriously disturbed, the original flora is already making headway, notably *Astragalus danicus*, purple milk-vetch on the more calcareous areas. Where a few years ago, recording the area before felling, we found just one or two plants surviving on the verges, it can now be seen to cover a large area, presumably growing from a strong rootstock. There was also a pleasing shortage of the normally ubiquitous field and waste-ground weeds, an indication of the grassland seed bank that has been exposed. One possible downside is the lack of open ground in sheep grazed grassland, a condition formerly created by rabbit grazing and occasional surface cultivation. In recent years plants which need this habitat, notably the Red Data Book *Herniaria glabra*, Glabrous Rupturewort, the scarce *Silene conica*, sand catchfly and *Medicago minima*, bur medick have thrived on the tracks kept open by forestry vehicles. We shall be watching this to see if the growth of grass on these areas could become a problem.

Another project was to complete the recording of *Genista anglica*, petty whin. A few plants were re-found at Great Ryburgh Common – they were discovered in 2000 on a Society excursion – but it was particularly pleasing to find it growing in small patches over a wide area of Cawston Heath. A survey of the flora of some chalky verges in southwest Norfolk rather sadly found that the sites there for *Campanula glomerata*, clustered bellflower and *Viola hirta*, hairy violet proved to be rank and without their specialities, but we finished the day on a cheerful note at Grimes Graves where the flora is flourishing.

There are, as usual, a number of interesting finds to report. Rubyna Sheikh discovered some large colonies of *Helleborus viridis*, green hellebore in a south Norfolk wood during a Society excursion – this had not been recorded in East Norfolk since 1953. Graham Peck reported *Senecio inaequidens*, narrow-leaved ragwort from an industrial area of Great Yarmouth – a first record for the county. By all accounts, this distinctive species is spreading rapidly, particularly in the southeast of England and is certainly one to watch

out for. *Polypogon viridis*, water bent is another species that seems to be spreading. It has been known from King's Lynn for some time and it has recently been reported from a garden path in Baconsthorpe and in gravel around stables at Bolwick. *Conyza sumatrensis*, Guernsey fleabane is continuing its march across the county. It is now well established in Norwich and Bob Leaney has reported it from East Ruston and Coltishall. Bob has also been keeping an eye on a colony of *Erigeron philadelphicus*, robin's-plantain and it seems to be established at the base of a wall in Coltishall.

A small selection of many other finds include *Misopates orontium*, weasel's-snout and *Stachys arvensis*, field woundwort on the Felbrigg Estate by Mary Ghullam, both scarce arable weeds; *Ophrys apifera* var. *chlorantha*, the pale form of bee orchid and *Ceratochloa carinata*, California brome at Roydon near Diss by Richard Mabey and Arthur Copping respectively; *Senecio x albescens*, the naturally occurring hybrid between the garden plant *S. cineraria*, silver ragwort and *S. jacobaea*, common ragwort, at Felthorpe by Laurie Hall and *Astragalus glycyphyllos*, wild liquorice near Sheringham by John Wagstaff, reported in 2003 and now spreading.

No plant report would be complete without mention of a bramble or two. Alec Bull reported *Rubus babingtonianus* from Billockby and *Rubus cantabrigiensis* from near Horsey Mere, both new to East Norfolk. The latter is also a new microspecies soon to be published by Alec Bull and Alan Leslie; it is widespread in parts of East Anglia but the Horsey location is something of an outlier.

We would like to thank all those who have sent in details of *Smyrnium olusatrum*, alexanders and *Campanula rotundifolia*, harebell. The maps are building up nicely, but there are still plenty of gaps, so please do continue to send in records.

In all our recording we have been very much helped by grants from the BSBI and FE to make GPS recorders available to group members. This means that 8-figure grid references have become the normal standard. A far cry from the days when a parish name was all that was given.

In June 2004 we held a workshop on the identification of willows, a notoriously difficult group. This was kindly led by Brian Eversham and was well attended and very informative. We have organised more activities of this nature in 2005, looking at pondweeds, sedges and ferns. A full programme of field meetings has been arranged by Frances Schumann and Bob Ellis with help from other members of the Group. Anyone who is interested in joining the Group at any time is welcome to a copy, just E-mail or write to Gillian Beckett or Bob Ellis (see NNNS Programme card for details).

WEATHER SUMMARY FOR 2004

J.G.Hilton
The Arable Group Research Centre, Morley, Wymondham NR18 9DB

Details of rainfall, sunshine and mean temperature for 2004 compared with the long-term averages are given in Table I. Data on the rainfall for the year and how they compare to the 36 year mean are presented graphically in Figure I, while the same is shown for sunshine hours in Figure 2 and mean temperature in Figure 3. The mean temperature for 2004 (10.3°C) was 0.8°C above the long-term average.

January was the wettest since 1995 with 152 percent of the long-term rainfall average. The mean temperature was 0.8°C above normal, whilst sunshine was the highest for three years. Snow fell on the 28th, leaving a covering of 5cm. A few light snow showers fell on the 29th but this was also the sunniest day of the month. The temperature rose steadily on the 31st to produce the warmest day of the month.

February was the dullest since 1993, and was the second consecutive cloudier than normal month of the year. The mean temperature was 1.4°C above the long-term mean: the mean minimum being 1.9°C above and the mean maximum 1.0°C. The first six days were much milder than normal and

the 4th (16.6°C) was the highest since the record breaking 17.2°C in 1998. The minimum of 12.4°C on the same day was the mildest February day at both Morley and Sprowston. Below-normal temperatures occurred after the 18th, when both air and ground frosts were recorded daily.

March was the wettest for three years but rainfall was only 75 percent of the long-term mean. It was also the coldest for three years but was still 0.3°C above normal. Sunshine was the lowest for three years, but was 8.5 hours above the average. It was cool and at times very cool until the 13th. Mild weather was recorded from the 13th to the 21st. Spells of rain alternated with dry sunny periods. Cold showery weather with bouts of sunshine was recorded from the 22nd to 27th. The rest of the month was mild and mostly dry, and very sunny on the last two days

April was the mildest for five years and was 1.5°C above normal. It was the wettest for three years and the dullest also for three, but sunshine was still 10.4 hours above the long term average. After a mild beginning temperatures fell to near normal on the 4th and it became much cooler from the 6th to 8th with heavy wintry showers. The 12th to 17th were mild and mainly dry and it became much milder than normal from the 21st to 27th. The next two days were wet but the end of the month was dry.

May was the coolest since 1997 and the sunniest for three years. Rainfall was lowest since 1998. The first thirteen days were mainly cooler than normal during the day, but near-to-normal at night. Heavy rain on the 3rd (13.6mm) and 4th (6.8mm) accounted for 66 per cent of the month's total. Showers persisted for the next four days and the month was then dry until the 30th as high pressure asserted itself. It became warmer and sunnier during the second half of the month.

It was the third consecutive **June** with above average temperatures and continued the trend of being cloudier than normal for the month. Rainfall was 16.6mm below the long term average. After a cloudy beginning it was very warm and dry from the 5th to 16th. The majority of the month's rain fell in the period the 18th to 24th and it was noticeably cool, wet and windy on the 23rd.

July was the wettest for three years and the fourth consecutive July with above-normal rainfall. It was the coolest for four years at 0.3°C below the long-term average, and also the dullest for four years with 14.1 fewer hours of sunshine than the mean. The month was generally unsettled. Thunderstorms occurred on several days and falls were heavy at times. The 9th was the coolest July day in our records (12.6°C). A rare warm spell was recorded towards the end of the month.

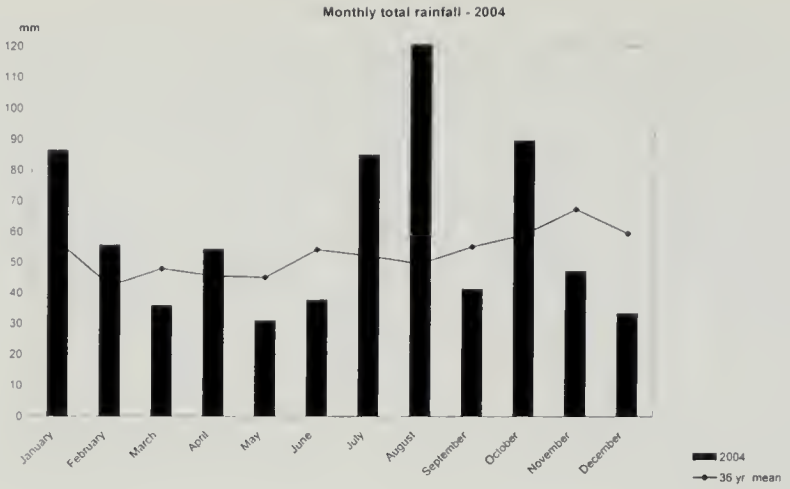
August was the wettest in our records. The month was dominated by low pressure, which brought cloudy and showery conditions and frequent thunderstorms. Rainfall exceeded 10mm on five days. The mean temperature was the highest since 1997 owing mainly to the high mean minimum temperature of 13.1°C. The minimum on the 9th (19.2°C) was the highest recorded in August at Morley.

It was the third consecutive drier than normal **September** with only 75 per cent of the long-term rainfall. It was the warmest for four years (0.7°C above average). Sunshine was 119 per cent of the normal value, and was higher than that of August. The first eleven days were much warmer than normal but there was a cool spell mid-month. A heavy shower (10.2mm) fell on the 30th. Incomplete data suggests that the month had near-normal sunshine and mean temperatures. Rainfall was much higher than normal. It was noticeably wet on the 3rd (11.8mm), 13th (17.0mm), 14th (10.6mm) and the 20th (11.2mm)

October. No data available.

November was the dullest and driest since 1995 as the region was influenced by anticyclonic gloom for much of the month. It was the coolest for three years but was still 1.0°C above the long-term average.

December was the driest and coolest for three years, but was still 0.4°C above normal. It was the sunniest for three years with 15.1 hours above the long-term average. The first two weeks were rain-free as high pressure influenced the weather. The Christmas period was dry, cold and sunny.


Monthly total rainfall - 2004
mm
120
110
100
90
80
70
60
50
40
30
20
10
0
January
February
March
April
May
June
July
August
September
October
November
December
2004
36 yr mean


Monthly total sunshine - 2004
hours
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
January
February
March
April
May
June
July
August
September
October
November
December
2004
36 yr mean

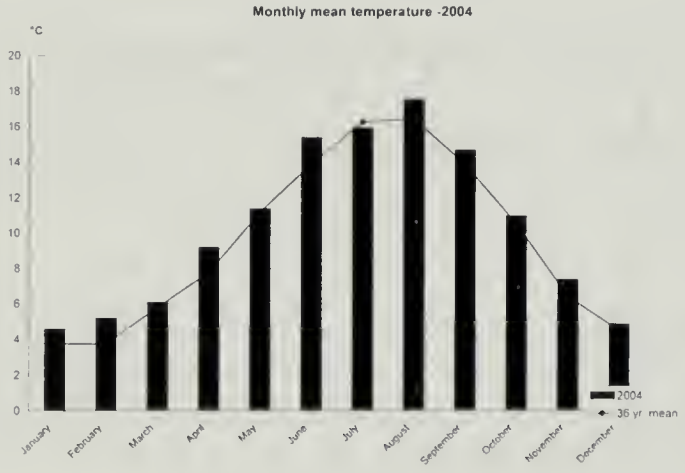
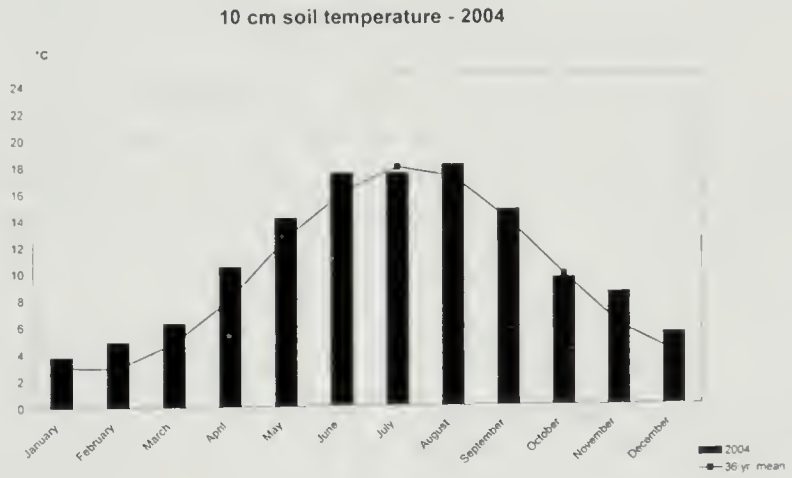

Monthly mean temperature -2004
°C
20
18
16
14
12
10
8
6
4
2
0
January
February
March
April
May
June
July
August
September
October
November
December
2004
36 yr mean

Table. *Weather records for Morley 2004*

	Rainfall (mm)		Sunshine (hours)		Mean temperature (°C)	
	1969-2004 36 yr mean	2004	1969-2004 36 yr mean	2004	1969-2003 36 yr mean	2004
January	57.0	86.6	58.1	55.9	3.8	4.6
February	42.4	55.8	79.9	71.1	3.8	5.2
March	48.0	36.0	104.7	113.2	5.8	6.1
April	45.6	54.4	154.8	165.2	7.8	9.2
May	45.2	31.0	207.2	204.6	11.2	11.4
June	54.2	37.8	195.1	185.8	13.9	15.4
July	52.2	85.0	198.4	174.3	16.2	15.9
August	49.6	131.8	190.1	154.2	16.4	17.5
September	55.2	41.4	136.7	162.7	13.9	14.7
October	59.1	89.6	106.0	103.3	10.5	11.0
November	67.4	47.2	67.7	45.0	6.4	7.4
December	59.5	33.4	49.8	64.9	4.5	4.9
Total	635.4	730.0	1548.5	1500.2		
Mean					9.5	10.3



THE YEAR AT WHEATFEN

These extracts from the Warden's Wildlife Report 2004 written by David Nobbs will be of interest to readers in showing the wealth of wildlife at Wheatfen and the surrounding region.

January – The year started with the lovely sighting of a kingfisher along the cleared Home Dyke and swans grazing on the pond weed there. On the 6th, with the temperature at 11°C and the sun shining, one might have thought spring had arrived. Goldcrests, chaffinches and marsh tits were all singing from the scrub by the boardwalk. By the 13th, plenty of Chinese water deer could be seen along the paths because of the flooding of the fens. This continued on the 14th and again on the 17th. On the 23rd a tiding of magpies was making its raucous presence heard behind the office. Towards the end of the month heavy snow covered Wheatfen from the 27th to 31st. Good flocks of geese were seen flying over the reserve.

May – Cloud and rain persisted for the first few days of May, but by the 6th the sun was out and I had a good view of a whitethroat by the cottage. On the 13th flag iris was in full flower along Home Dyke and orange-tip butterflies were on the wing. In a truly remarkable year for them to be seen, banded demoiselles were active along Link Dyke at Wheatfen Broad. On the 19th I had a good view of a cuckoo sitting in a low tree on Four Acres and, beside it, my first Chinese water deer fawn of the season. Many beetles, including cardinal and longhorn, were feeding on the vegetation along the paths of Smee Loke. On the 22nd I found a small jack-pike dead in Mack's Dyke. I always look forward to my first swallowtail butterfly and one fluttered past me on the 26th. The red-eyed damselfly was seen on water lily leaves at the end of Penguin Dyke on the 26th. Two Norfolk hawker dragonflies were seen along Middle Marsh Dyke and by the end of the month good numbers of swallowtail butterflies had emerged – a good foretaste of the weeks to come.

October – Continuing the weather pattern of the last few years, the month started warm and sunny. Geese, in skeins, could be seen flying overhead and on many days speckled wood, red admiral and comma butterflies were all in evidence. A kingfisher was seen on the 12th and Cetti's warblers were singing.

NOTES FOR AUTHORS

The *Transactions* are published each year in the early summer. Manuscripts should be with the editor by 1st February.

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The editor will be pleased to discuss proposals for papers by any member, and will help novice authors with the production of material.

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Mr Peter Lambley, The Editor, Norfolk and Norwich Naturalists' Society,c/o English Nature, 60, Bracondale, Norwich NRI 2BE.

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Photographer Peter Lambley

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