The Bedfordshire Naturalist 52 (Part 1)

Journal for the year 1997

Bedfordshire Natural History Society 1998
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BEDFORDSHIRE NATURAL HISTORY SOCIETY 1998

(Established 1946)

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Finance: Mr A. Cutts, Mr S. Halton, Mr E. Newman, Mr C. Rexworthy, Mr K. Sharpe, Mrs M. Sheridan, Mr P. Wilkinson.

Scientific: Mr C. Baker, Miss R. Brind, Mr P. Cannings, Mr J. Comont, Mr A. Fleckney, Dr P. Hyman, Mr P. Irving, Mrs H. Muir-Howie, Dr B. Nau, Mr E. Newman, Mr D. Odell, Ms A. Proud, Mr R. Revels, Mr H. Winter.

Programme: Mrs G. Dickins, Mr D. Green, Mr J. Niles, Ms A. Proud.

Registered Charity No. 268659

THE BEDFORDSHIRE NATURALIST

No. 52 Part 1 (1997)
Edited by R.A. Brind
Photographic Editor : R.C. Revels

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The Bedfordshire Bird Report for 1997 is published separately as Part 2 of the *Bedfordshire Naturalist*

The Society would like to thank Bedford Museum, Bedford Borough Council for a grant towards publication of the Journal.

THE BEDFORDSHIRE NATURALIST

The Bedfordshire Naturalist is the official Journal of the Bedfordshire Natural History Society, a body which has been a prime contributor to botanical and zoological knowledge of the county. Published since 1946, the Journal is noted for its original papers on all aspects of natural history, especially distribution, status, population, habitat and field ecology. It caters for the professional and amateur alike and aims for the middle ground.

The Journal is published in two parts; Part 1 comprises meteorology, geology and all aspects of natural history excluding birds. Part 2 comprises the annual bird report and all articles relating to birds.

Relevant papers on the natural history of the county are welcomed. Guidelines are obtainable from the Editor who will be pleased to discuss inclusion of any articles.

Contact: Honorary Editor, Bedfordshire Naturalist, BNHS c/o Bedford Museum, Castle Lane, Bedford MK40 3XD

Front cover: Adders are the subject of a survey as part of the Greensand Ridge Project. *Photo: Richard Revels.*

REPORT OF COUNCIL FOR 1997

The Society continued to maintain a high standard of meetings. During the year there were 31 field meetings and 18 indoor meetings. The Golden Jubilee "repeats" ran into 1997, continuing the celebrations.

Twelve of the outdoor meetings were specifically bird-related and organised by the Bird Club, the remainder being on very varied topics ranging from pond-dipping to historic landscapes. A weekend field meeting was held in the Brecon Beacons National Park during June. Eight of these meetings were "repeats" of those held during the first year of the Society (1946/7). A "Badger Network Day" was held in conjunction with the Wildlife Trust for Bedfordshire and the Bedfordshire Badger Network. The highlight of the year, to which many members contributed a great deal, was the Golden Jubilee Conference held at Silsoe College on 27th April.

Because of numerous comments by members, a change was made to the venues for indoor meetings to enable members to park more easily and close to the hall. The 1997/8 winter meetings were therefore held either in the villages of Elstow or Toddington as well as one or two at Haynes; Bird Club meetings continue to be held at Maulden meanwhile.

Six of the indoor meetings were in association with the Bird Club. These were very well attended with more modest attendances at other meetings.

The publication of the latest Society book, *The Butterflies and Moths of Bedfordshire*, early in the year was received with some of the best reviews from expert critics and was eagerly purchased by members and non-members alike. To further celebrate the Golden Jubilee, Council has commissioned Richard Revels to illustrate a new book, *Wild Bedfordshire*, which will cover some fifty of the more important wildlife sites in the county.

Still behind the scenes, work has continued on the *Red Data Book for Bedfordshire*, a joint venture with the other natural history groups. Thanks to the dedicated work of our Recorders and other members, this is nearing completion; a concise version for general publication should be available in summer 1998.

The finance committee indicated that it would be prudent to raise subscription levels from 1998; Council and members duly approved this action later in the year. Because of the intended programme of publications over the next few years, the Society will be running a small annual deficit for some years to come which will be funded from the reserves. This is in line with Council's intention of putting our large collection of records and our members' expertise to good use and for the benefit of future generations of naturalists and historians.

Council would like to thank the many people who have contributed to the work of the Society during the year, in particular the various Committees and the Recorders. Special thanks are due to four retiring Recorders - Vic Arnold (macro-moths), Chris Malumphy (Homoptera), Derek Reid (fungi), and Martin Palmer (joint bird Recorder). It should be noted that Derek has served the Society for 50 years and he will be much missed. Four members of Council stepped down, Joan Childs, Rob Dazley, Phil Irving and Paul Trodd; they have all been very active in promoting the Society over the years.

Ro Madgett stepped down as editor of "Muntjac" after four years during which we saw yet more improvements; Sue Larkin took on the post and is settling in well. To both we proffer our thanks for doing one of the most arduous, and sometimes thankless, jobs within the Society. Council would also like to thank once again the members of the Bird Club for making it such a success.

Membership of the Society 1993–1997

	1993	**1994**	**1995**	**1996**	**1997**
Ordinary	450	430	414	395	394
Associate	68	41	48	66	57
Student	5	3	2	6	5
Corporate	13	10	7	9	11
Life	5	5	4	4	3
Hon. Life	1	1	1	1	3
Total	**542**	**490**	**476**	**481**	**473**

(Totals include Bird Club members)

Council wishes to reverse the slight decline in membership over the past few years by actively promoting the Society outside its normal activities.

ERROL NEWMAN
Hon. Secretary

PROCEEDINGS

Indoor Meetings

8th January, Bedford. "Ecology of Ringlet butterflies" by Dr S. Warrington. Chair: Mr C. Baker.

21st January, Dunstable. "Birds of Bedfordshire – changes over the last 50 years" by Mr P. Trodd and Mr R. Dazley. Chair: Ms A. Proud.

28th January, Maulden. "The search for Sylvia" by Mr D. Cotteridge. Chair: Mr B. Nightingale.

5th February, Bedford. "Moths, Little and Large" by Mr D. Manning and Mr V. Arnold. Chair: Mr R. Cornes.

13th February, Luton. "Pond-life" by Mr S. Cham, Dr B. Nau and Mrs H. Muir-Howie. Chair: Mr D. Anderson.

18th February, Dunstable. "Four Corners – craters, canyons, cacti, contrasts" by Dr & Mrs P. Madgett and Miss A. Madgett. Chair: Mrs K. Anderson.

5th March, Bedford. "Planning and wildlife" by Mr R. Watts, Beds CC. Chair: Mr A. Cutts.

11th March, Luton. "Insect life" by Mr C. Baker and Dr P. Hyman. Chair: Dr B. Nau.

18th March, Maulden. Annual General Meeting.

25th March, Maulden. Bird Club members' evening. Chair: Mr B. Nightingale.

27th April, Silsoe. Golden Jubilee Conference.

30th April, Maulden. "Springtime in Spain" by Mr M. Wilkes. Chair: Mr B. Nightingale.

30th September, Maulden. "A tale of six birds" by Mr P. Cannings (Bedfordshire Police Wildlife Liaison Officer). Chair: Mr B. Nightingale.

9th October, Elstow. "Natural History and the Historic landscape" by Mr S. Coleman (Historic Environment Information Officer, Beds CC). Chair: Mr J. Comont.
15th October, Toddington. "A closer look at lichens" by Mr T. Chester (Churchyards Co-ordinator of the British Lichen Society). Chair: Dr B. Nau.
26th October, Haynes & Priory Country Park, Bedford. National Badger Day – talks for BNHS and the public. Organised in conjunction with Bedfordshire Badger Network and the Wildlife Trust.
28th October, Maulden. "The agony and the ecstasy – of birdwatching" by Mr T. Marr. Chair: Dr J.T.R. Sharrock.
13th November, Haynes. Royal Photographic Society slides show. Presenter: Mr R. Revels.
19th November, Toddington. "Serengeti Safari" by Mr P. Symonds. Chair: Mr C. Baker.
25th November, Maulden. "Focus on owls" by Mr C. Shawyer (Director of Conservation for the Hawk & Owl Trust). Chair: Mr P. Wilkinson.
10th December, Haynes. Christmas social evening. Organiser: Mr R. Revels.

Field Meetings

Rutland Water 19th January. Wintering birds. Leader: Mr P. Almond.
Lea Valley, Herts 16th February. Looking at birds starting from Rye House Marsh Reserve. Leader: Mr T. Donnelly.
Haynes 23 February. Winter wildlife wander. Leaders: Mr J. Adams & Mr D. Parsons.
River Ouzel 16th March. General natural history starting at Tiddenfoot Waterside Park. Leaders: Dr & Mrs P. Madgett.
Felmersham Gravel Pits 5th April. Pond dipping. Leaders: Mr S. Cham & Mrs H. Muir-Howie.
Blows Downs 20th April. Looking for spring migrants, starting at Skimpot Lane, Luton. Leader: Mr R. Dazley.
Maulden Woods 4th May. Dawn Chorus. Leader: Mr P Trodd.
Dunstable Sewage Treatment Works 7th May. Waders and other migrants. Leader: Mr P. Trodd.
Minsmere RSPB Reserve, Suffolk 18th May. Leader: Mr G. Redgewell.
Great Hayes Wood 1st June. Botanical and invertebrate survey. Leader: Mr H.A. Smith.
Wavendon Heath, near Woburn 11th June. Looking for birds of the Greensand Ridge. Leader: Mr D. Odell.
Totternhoe Knolls 14th June. Butterflies. Leader: Mr C. Baker.
Brecon weekend field trip 20th – 22nd June. Organiser: Dr P. Madgett.
Pegsdon Hills 25th June. General natural history. Leader: Mr S. Halton.
Willington to Great Barford 29th June. Riverside walk starting at Willington Dovecote. Leader: Mr P. Almond.
West Wood, near Souldrop 6th July. General natural history. Leader: Mr M. Powell, Resident Forester.
Flitwick Moor 11th July. Evening moth trapping. Leaders: Mr L. Field & Mr V. Arnold.
Clapham Park, Bedford 17th July. General natural history. Leader: Mr J. Niles.
Ickwellbury House 25th July. Evening bat survey. Leaders: Bedfordshire Bat Group.
Yelnow New Wood and Odell Great Wood 26th July. Butterflies. Leader: Mr H.A. Smith.

Sharpenhoe Clappers 3rd August. Butterflies. Leaders: Mr M. McCarrick and Mr J. Adams.
Marston Vale 17th August. Birds of the clay pits. Leader: Mr K. Sharpe.
Whipsnade Heath 27th August. Dormouse box check. Leader: Mr C. Tack.
Rammamere Heath 30th August. Heathland regeneration and Orthoptera survey. Leaders: Mr P. Irving & Mr K. Sharpe.
North Norfolk Coast 14th September. Looking for autumn migrants, starting at Cley. Leader: Mr D. Green.
King's Wood, Heath and Reach 21st September. Golden Jubilee fungus foray. Leader: Dr D. Reid.
Maulden Wood 28th September. Looking for small mammals. Leader: Mr D. Anderson.
Ashridge, Herts 25th October. General natural history. Leader: Mr S. Halton.
Paxton Pits, Cambs 2nd November. Birdwatching. Leader: Mrs B. Matthews.
Brogborough 9th November. Historic landscapes and natural history. Leader: Mr S. Coleman.
RSPB Sandy Lodge 7th December. Birdwatching. Leader: Mr P. Soper.
Woburn Park 26th December. A Boxing Day walk through the Park. Leader: Mrs M. Sheridan.

REPORT OF THE TREASURER

The Society again received grants towards its publications including donations towards the book *The Butterflies and Moths of Bedfordshire*; the sum of £11,225 was paid from the Woolwich Building Society for the book. The M & G Charifund Accumulative Units continued to do well, but this type of investment can go down as well as up.

The final year end position is that the total assets of the Society have increased by £101 and now stand at £58,520.

P.S.Clark
Hon.Treasurer

INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 31ST DECEMBER 1997

	1996	1997
OPENING BALANCE (Current Account and Building Society Account)	22,615	26,672
INCOME		
Subscriptions (for 1997)	2,940	3,174
Subscriptions (for 1998 received in 1997)	787	1,090
Sales	11	298
Journal and Bird Report sales	48	8
Receipts from meetings	217	119
Sundries/Donations/Grants	3,564	5,734
Interest received from Building Society	859	585
Interest received from Bank (gross)	46	84
Interest received from City of Nottingham Bonds		360
Receipts from Publication Account	324	6,983
SUB TOTAL – Income	**8,796**	**18,435**
EXPENDITURE		
Postage and stationery	114	273
Sundries	73	117
Insurance	282	286
Officers' expenses	179	161
Computer	178	-
Bank charges (Safe Custody)	13	23
	839	**860**
MEETINGS		
Hire of halls	456	633
Lecturers and leaders	465	530
Programmes	-	
	921	**1,163**
PUBLICITY/DEVELOPMENT/MEMBERSHIP		
Sundries (Postage, Printing)	2,864	5,798
PUBLICATIONS ACCOUNT – EXPENDITURE		
Expenditure	115	16,527
SUB TOTAL – EXPENDITURE	**4,739**	**24,348**
CLOSING BALANCE (Current Account and Building Society Account)	**26,672**	**20,759**

STATEMENT OF ASSETS AS AT 31ST DECEMBER 1997

FIXED ASSETS	1996	Cost	Depreciation Total	Depreciation per Year	1997
Display Boards	171	371	220	20	151
Display Table	27	69	49	7	20
Computer	1,237	2,431	1680	486	751
Projection Equipment	1,130	1,130	226	226	904
	2,565				**1,826**

CURRENT ASSETS	1996	1997
Stock at cost - Vertebrate Fauna of Bedfordshire	165	82
- Bird Atlas	3,400	-
-- Moths & Butterflies of Bedfordshire	-	4,916
Bank Current Account	2,995	5,062
Woolwich Building Society	23,677	15,697
City of Nottingham Bonds to 30/6/99 (at 7.50%)	3,000	3,000
City of Nottingham Bonds to 30/6/99 (at 7.50%)	3,000	3,000
M & G Charifund Accumulation 475 Units Cost £10,000		
Bid Price at 21/12/97 5.250 pence per unit	19,617	24,937
TOTAL CURRENT ASSETS	**55,854**	**56,694**
Fixed Assets (see above)	2,565	1,826
TOTAL ASSETS	**58,419**	**58,520**
CURRENT LIABILITIES		
Subscriptions received during 1997 for 1998	787	1,090
NET ASSETS OF THE SOCIETY	**57,632**	**57,430**

P.S. Clark
Hon. Treasurer

P.A. Giles (F.C.C.A.)
Hon. Auditor

METEOROLOGY
by Mike Williams

In 1997 the weather in Bedfordshire reflected both local and national events. In England and Wales as a whole January 1997 was the driest since 1880, but in Bedfordshire not quite as dry as January 1987. March was also very dry and very warm, warmer than in 1957 (the previous warmest January in the Silsoe record) and probably the warmest since 1938. A very dry March was followed by a very dry April. May saw the occurrence of two related and extreme weather events which affected the west of the county (and neighbouring parts of Buckinghamshire); a fall of very large, damaging hail, and an equally damaging tornado.

June was exceptionally wet with more than twice the average rainfall, but though the wettest June this century generally in England, in Bedfordshire not quite as wet as June 1958. August 1997 was generally the second hottest August in England in a sequence running from 1659. This was also true in Bedfordshire, but taking daytime maxima alone this August (in Bedfordshire) surpassed even record breaking 1995. The remainder of the year was less exceptional, but December proved to be an unusually stormy month with a notable gale on Christmas Eve. Overall it was another warm year, but rainfall exceeded 90% of average despite some very dry months early on. From a natural history perspective the exceptional wetness of June may well have had a significant and probably detrimental effect on the county's wildlife.

January

The very cold weather of late December persisted for the first ten days, and many inland waters remained completely or partially frozen including Brogborough and Stewartby. Some light snow also occurred at times, typical of a cold easterly airstream in Bedfordshire some 100 miles inland from the east coast. Thereafter milder conditions prevailed. The first half of the month was noteworthy for a run of ten days during which no sunshine was recorded. This was also a dry period, but with light rain on many of the remaining days.

February

This was an unusual month being very mild and wet (February on average being the driest month of the year). Strong and gusty winds were also commonplace throughout the month.

March

March continued the warm trend which had started in February, but it was a very dry month with rainfall less than 25% of normal. In consequence it was quite a sunny month. The most spring-like day was the 11th when the temperature reached 17.3°C (63°F) with 8.6 hours of sunshine. Clear skies at this time also contributed to one of the month's two air frosts. Indeed daytime temperatures in particular were in excess of those to be expected in an average April. The month finished with four particularly fine days with maximum temperatures of 11.6°C, 13.0°C, 14.4°C and 16.1°C respectively, and 11.1, 5.2, 10.9 and 11.4 hours of sunshine.

April

This was another very dry month, though with a little more rain than in March. All but 0.7mm of the 13.2mm total fell in the last seven days. Prior to that light showers occurred on just three days out of 23. It was another warm month with a maximum of 22.2°C (72°F) recorded on the 9th, a day which also recorded 10.4 hours of sunshine. The clear skies however meant that night-time temperatures did not match the relative warmth during the day with air frost occurring on seven nights.

May

This was the third warm, dry and sunny month in sequence, though less marked than in the previous two. The warmest periods were the first three days, mid-month (16th – 18th) and the last three days. A small area to the west of the county was severely affected on 17th May by violent storms including exceptionally large hail and a tornado which struck Wootton. Details of these weather events are described separately below. On a day when Woburn Sands is reputed to have recorded 86mm of precipitation (Webb 1997, 1998) Silsoe recorded just 0.1mm. Weather records submitted to the Recorder from Cranfield (which was within the affected area) show a total of 17mm but with the householder absent on holiday at the time there is no way of knowing how accurate this figure is, particularly as newspaper reports refer to the fire brigade pumping out twelve flooded houses in Cranfield on 17th May. The events of 17th May are an extreme example of how localised weather events can be, and emphasize the need for descriptive notes to be made of such events and submitted to the Recorder.

June

June provided a marked contrast to the preceding months; it was extremely wet with more than twice the month's expected rainfall, and not unexpectedly it was less sunny than normal with daytime temperatures just a little below average. Perhaps because of the cloudy skies the nights were relatively warm. The wettest day of all was 26th June when Silsoe recorded 34.2mm of rainfall which in itself is equivalent to about 75% of the normal rainfall for June. The 27th and 28th were also particularly wet days. The potentially damaging effect of such excessive wetness at this time of year on the wildlife of the county has already been commented on. Across England and Wales June 1997 was the wettest this century, but in Bedfordshire June 1958 was wetter (total 117.6mm), and June 1987 was nearly as wet (total 107.8mm).

July

The weather returned to a warm, dry and sunny format for July but without reaching any of the extremes experienced earlier in the year. The warmest day was the 7th reaching 25.3°C (79.7°F). The 31st July was the wettest day (14.6mm) accounting for nearly half the month's total rainfall.

August

This was an exceptional summer month. A daytime temperature of 26.7°C (80°F) was reached or exceeded on sixteen days, with the month's highest temperature of 32.0°C (89.6°F) occurring on 11th August. It was particularly warm from 6th to 20th

with the hottest spell from 8th to 12th during which maximum temperatures exceeded 30°C (86°F) on every day. Night-time temperatures were also well above average; only 26th August recorded a minimum below 10°C (50°F). The first three weeks were also extremely dry, most of the month's rainfall (still only 50% of average) falling in the last, somewhat cooler week.

Looking at the mean maximum temperature for the month makes August 1997 the hottest on record at Silsoe (26.1°C compared with 25.8°C in both 1983 and 1995). However, comparing night-time minima shows 1983 as the warmest with a mean of 19.4°C, compared with 11.6°C in 1995 and 14.3°C in 1997. Overall August 1983 still remains the warmest ever for Silsoe, Bedfordshire, with 1997 second and 1995 third.

September

Yet another dry, warm and sunny month, but daytime maxima seldom reached any extreme values. The warmest day occurred on 29th of the month with a temperature of 24.1°C (75.4°F). The 18th of September was the wettest day (12.5mm) accounting for over 60% of the month's total. No air frost was recorded but it is likely that some places in Bedfordshire experienced their first ground frosts at the end of the third week.

October

For once rainfall was above the average; only February and June had previously seen totals above the norm in 1997. However, October was the first of three months with above average rainfall. In October 1997 the majority of this rain fell on just five days between 6th and 14th, the rest of the month being dry and sunny. With clear skies, air frosts became frequent towards the end of the month and the minimum of -8.0°C recorded on the morning of 29th October was the lowest since 3rd January this year. Nor did any colder nights occur in the remaining two months of the year.

November

November was mild throughout, with the mildest weather occurring mid-month. Frosts were infrequent and there was little else worthy of comment.

December

The last month of 1997 was quite variable in nature. The first four days were cold with a little snow and overnight frost. The next seven days were very mild with strong south-westerly winds and some rain. A large anticyclone over Siberia began to influence Britain's weather and there was a little sleet on the 16th and 17th before slightly milder conditions prevailed. The period from 23rd to 25th December was particularly mild with very strong winds (Christmas Eve) and rain. Temperatures then returned to near normal and it remained windy till the year's end.

Summary

Overall 1997 was a warm year, the warmest since 1988, including an exceptionally wet June and a notably hot August. While many people may have been left with the impression that 1997 was a dry year, rainfall totals exceeded 90% of average, helped by the very wet June. However, precipitation in the summer months tends to evaporate

very quickly so this rainfall will have contributed very little to ground water levels. There were also two extreme and localised weather events in May which are described in detail below. 1997 was certainly not without interest meteorologically.

All the figures in the above report are taken from Silsoe unless otherwise stated and a summary of the readings from this site appears in Table 1. The table has been modified from the format of previous years. Figures for ground frost were no longer available so the opportunity has been taken to show how the monthly means and totals compare with the longer term average, in this case for the period 1951–1980 at the original recording site in Wrest Park. Thirty years is the standard period over which longer term averages are calculated. It would be appropriate to use the more recent period of 1961–1990, but the original site at Wrest Park was closed down before the end of 1990, and there is no single station in this area which provides a continuous record over the required period. Readers should also bear in mind that the data in Table 1 is from Silsoe College, about half a mile from the original Wrest Park site, so the comparison with the long term means should be taken as indicative rather than absolute.

	Mean Max °C	Mean Min °C	Highest Temp °C	Lowest Temp °C	Rainfall mm	Sunshine hours	Air Frost days
January	5.5 (-0.5)	-1.5 (-2.0)	11.2	-10.2	13.2 (29%)	54.2 (103%)	20
February	10.5 (+4.0)	3.3 (+2.7)	13.8	-3.0	56.9 (159%)	66.3 (102%)	3
March	13.3 (+3.9)	4.5 (+2.9)	17.3	-1.2	9.7 (25%)	151.9 (136%)	2
April	14.5 (+2.1)	3.4 (-0.2)	22.2	-5.4	24.8 (34%)	186.0 (127%)	7
May	17.8 (+1.7)	5.3 (-1.1)	25.1	-1.5	34.6 (86%)	257.3 (134%)	2
June	19.1 (-0.3)	10.3 (+1.3)	25.5	5.9	112.5 (235%)	153.0 (76%)	0
July	22.8 (+1.8)	11.4 (+0.3)	27.3	6.3	32.8 (67%)	223.2 (121%	0
August	26.1 (+5.3)	14.3 (+3.4)	32.0	9.1	30.4 (51%)	195.3 (115%)	0
September	20.2 (+1.8)	9.9 (+0.7)	24.1	2.0	20.0 (45%)	174.0 (120%)	0
October	15.4 (+1.0)	5.2 (-1.3)	25.1	-8.0	58.6 (125%)	155.0 (148%)	8
November	12.0 (+2.6)	5.0 (+1.8)	15.8	-4.0	51.7 (102%)	63.0 (99%)	5
December	8.5 (+0.7)	3.0 (+1.4)	14.5	-1.8	52.4 (102%)	31.2 (63%)	6
Year	**15.5 (+2.1)**	**6.2 (+0.9)**	**32.0**	**-10.2**	**499.3 (91%)**	**1710.4 (116%)**	**53**

Table 1. Weather data for 1997 as recorded at Silsoe College

The Events of 17th May 1997

There were two separate but related weather events which occurred on Saturday 17th May 1997. One was the occurrence of very large hail almost a year after a similar event on 7th June 1996 (Williams 1997); the second was a major tornado of strength T3 on the TORRO Scale (Meaden 1976). The Recorder was out of the county on the relevant date (and subsequently) and the information presented here is from other sources.

The 17th May was Cup Final day, and the afternoon saw the outbreak of severe thunderstorms and two (possibly three) tornadoes across the country. The Bedfordshire

hailstorm affected an area including Woburn, Woburn Sands, Ridgmont, Brogborough and Aspley Guise. According to BNHS member Barry Nightingale (pers. comm.) heavy rain began falling in the Woburn area at about 1630 hours followed by hailstones about 1cm in diameter. The storm eased but then came a second burst with hailstones "between golf ball and chicken egg size". Barry reported that such was the ferocity that plants with fleshy wide leaves in his garden were ripped to shreds. In trying to rescue some of his patio pots Barry says he was forced to retreat under cover, his arms covered in bruises from the hailstones. Barry also reported that a neighbour, a market garner in Ridgmont, lost dozens of panes of glass from his greenhouses. Other inhabitants reported smashed conservatories, greenhouses, and one instance of a badly dented caravan. The Recorder also heard of at least one car in Aspley Guise whose body work was badly damaged, and another in the Brogborough area (M1) was similarly affected. In both instances repairs cost several thousand pounds.

The rain/hail finally stopped at around 1900 hours. Barry concludes by saying that he had never witnessed the sheer ferocity of hail or the size of the stones as he did on that Saturday.

There were reports (Webb 1997, 1998a, 1998b) that 86.4mm of rain (approximately twice the average rainfall for the whole of May) fell at Woburn Sands between 1630 and 1800 GMT, and that hailstones up to 38mm across were measured at the same location. Flood water up to 1.5m deep was reported in High Street. Some homes in Cranfield were reported flooded to a depth of 0.5m. Stagsden recorded irregularly shaped hailstones 13mm to 18mm diameter. The *Journal of Meteorology* (*J. Met.* 1998)

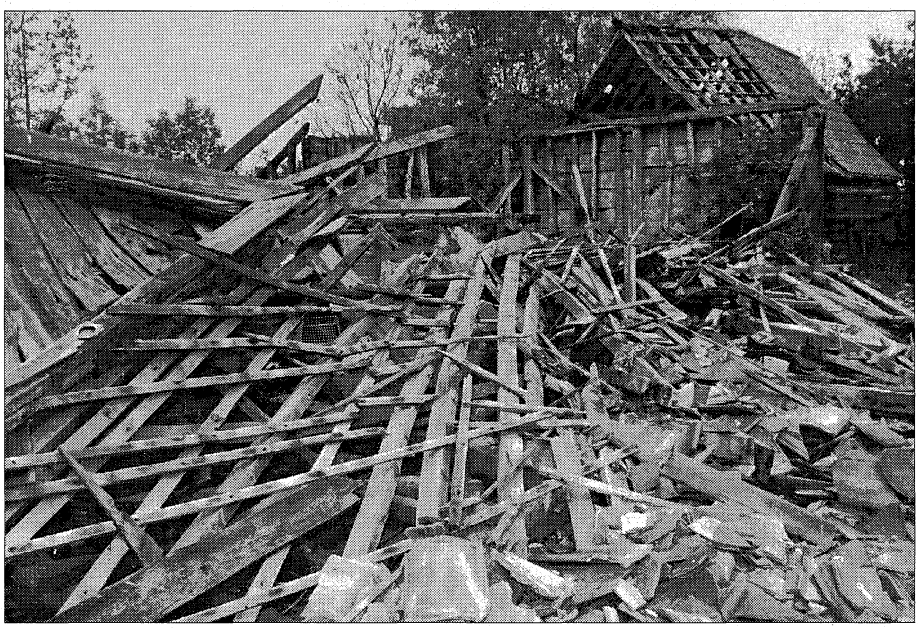

Fig. 1 A barn in Keeley Lane, Wootton, almost completely demolished by the T3 strength tornado of 17th May 1997 *Photo courtesy of Times & Citizen*

reported "big chunks of ice about the diameter of a 50-pence piece" in the Brogborough area (SP9638) denting the roof and bonnet of a car. The old-style 50-pence piece is 30mm across. From these measurements it would appear that the hailstones in the 1997 storm (up to 38mm diameter) exceeded those of the 1996 storm (up 25mm diameter) in size, though it is impossible to rule out local and unobserved (or unreported) variations.

The other event, of a tornado, caused very significant damage in Wootton, and was described at some length in the local press (*Bedfordshire Times & Citizen, Bedford & Kempston Herald*). The worst affected areas were Tithe Barn Road, Neil Road, St Mary's Road and the lower part of Keeley Lane. According to one resident at 6pm on 17th it became very black as though there was going to be a thunderstorm. Suddenly there was a tremendous noise and objects started hitting the windows. Main instances of damage were as follows:

Roof demolished, repair £10,000 (Tithe Barn Road), roof damaged (St Mary's Road), conservatory badly damaged by flying bricks (St Mary's Road), caravan lifted up and deposited nine metres from its original site, brick shed demolished, barn demolished (Keeley Lane). Up to thirty properties are reported to have been damaged in total.

The TORRO Tornado Scale was established in 1972 (Meaden 1976) and like the Beaufort wind scale runs from T0 (Light Tornado) up to T12 (Super Tornado). The Wootton event was classified as strength T3 (Strong Tornado) with wind speeds around 100mph. This is the strongest form of Tornado to occur on an annual basis in Britain. Tornadoes with strength T4 and T5 occur about once every ten years, strength T6 and T7 about once a century. A tornado of strength T6 occurred in Linslade on 21st May 1950, and one of strength T6/7 at Woburn on 29th August 1672.

ACKNOWLEDGEMENTS

I am once again grateful for the provision of detailed meteorological records from Silsoe College, and also for additional records and/or notes from Dr. A. Aldhous (Potton), Mrs A. Bucknall (Cranfield), Mrs B. Chambers (Meppershall), Mr. B. Nightingale (Woburn) and Mr A. Smith (Carlton). It is pleasing that more information on the county's weather (both quantitative and descriptive) is now being submitted to the Recorder.

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Mike Williams is the Society's Recorder for Meteorology, a position he has held in an honorary capacity since 1981.

GEOLOGY AND PALAEONTOLOGY
by Peter Smart

This report is based on the Recorder's research at specific Cretaceous locations within the county, once again no records having been received from other sources. This latter aspect is to be regretted but, despite the disadvantages of an individualistic approach, a number of interesting and important discoveries can be added to the county's palaeontological data base.

As in previous years, the Lower Cretaceous sediments were extensively studied, the Lower Albian beds around Leighton Buzzard being the focus of the writer's field work primarily to obtain specimens for the Natural History Museum before successive temporary sections were lost. This was of particular importance this year due to the proposed closure of the Chamberlain's Barn quarry on 31st October, and the consequential loss of a temporary exposure of the Gault-Woburn Sands junction beds that yielded a number of rare and important ammonites (Smart 1997).

The Upper Aptian *Parahoplites nutfieldiensis* Zone beds near Clophill (around TL099380) were also investigated at intervals throughout the year on behalf of Dr Raymond Casey, in the hope that ammonites indigenous to this Zone would be discovered in the large phosphatic concretions or doggers that occur – or should occur – in Beds 5 and 6 of the succession (Smart 1996). Unfortunately, the doggers were again conspicuous by their absence but, on 4th July, the Recorder observed a single very large dogger in tipped material. This concretion, in a mixed matrix of Beds 5 and 6, is shown in Figure 1 before being excavated out and rolled some 50 metres to a safer position, the tip being in use for overburden dumping. Being too heavy to lift, the

Figure 1. Large phosphatic concretion (dogger) in newly excavated and tipped overburden from Beds 5 and 6 at western end of Clophill Fuller's Earth quarry, around TL099380.
Lower Cretaceous, Lower Greensand (Upper Aptian) *Parahoplites nutfieldiensis* Zone. 4 July 1997.
Photo: P.J. Smart

dogger was carefully split into a number of large but manageable fragments weighing in total approximately 60kg which were then transported by dumper vehicle to the site office and the writer's car, a distance of some 1000 metres.

Much to the Recorder's and Dr Casey's disappointment there proved to be no evidence of an ammonite fauna within this particular dogger. Nevertheless, an interesting though small assemblage of fossils occurred in the hard phosphatic matrix and the structure of the dogger itself was unusual, not being solid throughout but having an ovoid core of soft white marly sand roughly 200mm x 150mm in size. This soft core was encased in an extremely hard, dark grey phosphatic matrix rendered very brittle by numerous clusters of narrow, irregularly contorted serpulid worm tubes, each tube being 1mm or less in diameter and with up to fifty or sixty tubes in each cluster. A small example was determined by Paul Jefferey of the Natural History Museum Dept. of Palaeontology as *Sarcinella plexus* (J. de C. Sowerby) the individual tubes, however, being narrower than in the Museum material.

Preservation of the clusters, which extended throughout the dogger, was exceptionally good due to the hardness of the matrix and several larger specimens were later donated to the NHM collection. A typical example from the Clophill assemblage is shown in

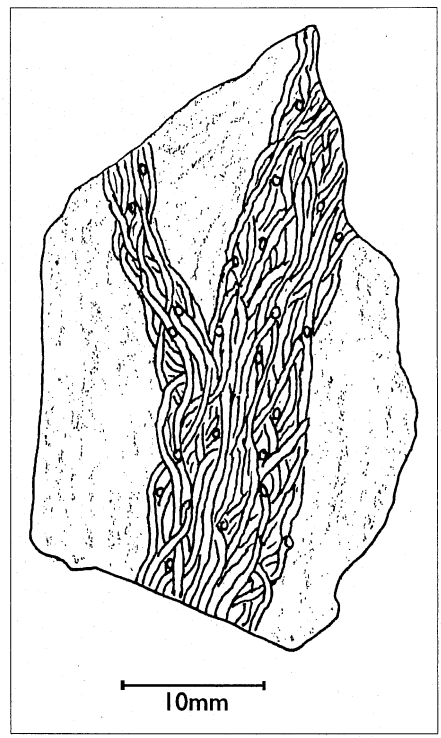

Figure 2. Clustered, irregularly contorted tubes of the serpulid worm *Sarcinella plexus* (J. de C. Sowerby) in fragment of the large phosphatic dogger shown in Figure 1.
Upper Aptian *Parahoplites nutfieldiensis* Zone, Clophill Fuller's Earth quarry (Beds 5 and 6). 4 July 1997.

Figure 2, drawn from a specimen remaining in the Recorder's collection, and exhibiting the tubes so excellently preserved in the hard rock. The clustering of the tubes is characteristic of the species, which ranges from the Lower Jurassic Sinemurian to the Lower Cretaceous Upper Albian.

The dogger also yielded a single small irregular echinoid (Sub-Order Spatangina) that was also taken up to the Natural History Museum in November, where it was determined by Dr Andrew Smith as a species of *Hemiaster* or *Toxaster*, based on the somewhat eroded phosphatic cast. The portion of the dogger that contained this natural cast was also in the Recorder's possession, and this was later sent separately to Dr Smith in December for a latex mould to be prepared from the impression in the rock. This, when completed, will show the echinoid's external test morphology, and both natural cast and associated matrix were also donated to the Museum, Register number BMNH EE 6077.

Other fossils from the dogger were a single brachiopod and two large lamellibranchs, the former a small rhynchonellid (*Cyclothyris* sp.). Preservation of the three specimens was poor, the fossils being uncrushed but exposed to considerable abrasion by protruding through the surface rind. The lamellibranchs could be determined only to the genus *Panopea*, *P. gurgitis* (Brongniart) being a fairly common, moderately large bivalve ranging through the Aptian and Albian, a range that includes the *Parahoplites nutfieldiensis* Zone at Clophill.

It was stated in last year's report that the extension to the quarrying would be in a northerly direction during 1997 but this did not materialise, the present workings being at the southern end of the western side. There is no doubt that the phosphatic nodules and doggers have become very uncommon in Beds 5 and 6 towards the western end of the quarry complex, the single example found this year confirming this. It is to be hoped that expansion of the pits in a northerly and easterly direction will be undertaken within a year or two, exposing the beds some 100 metres north of where the doggers frequently occurred in past years.

The Leighton Buzzard Albian sections were investigated more frequently this year, Chamberlain's Barn quarry being visited many times following the important ammonite discoveries made in the Gault-Woburn Sands junction beds (Smart 1996, 1997). These beds became obscured early in the year due to infilling with overburden material and clay-contaminated sand which reached to the top of Bed 2, Beds 3(i) and above being obliterated by clay slip and downwash of the overlying Gault clays. By August only a 20m long section exposing Bed 3(ii) remained accessible and this disappeared under slipped Gault after the first heavy rains in September. The eastern side of the pit north of the southern section was, however, excavated over a short distance and this cut-back of the clays resulted in a temporary section exposing Beds 1 to 5, approximately 140m north of Vandyke Road.

This temporary section, at right angles to the eastern side, was a mere 19.8 metres in length yet yielded from the basal beds of Bed 3 a small assemblage of extremely rare ammonites in addition to previously recorded species, some of which had not been recorded from the area (R. Casey, pers. comm. 1997). Numerous visits were made to the location and several tonnes of Bed 3(i) and 3(ii) clays excavated out for close study. Clay slip of the overlying Lower Gault was a constant threat to the exposure, and on

each visit it became necessary to dig away an ever-increasing quantity of Gault, particularly as the year progressed, creep and slumping of the clays becoming a serious problem.

As in most soft sedimentary rocks the majority of fossils in the clays are crushed by pressure and are uncollectable except as impressions in matrix. "Solid" preservation of fossils, particularly ammonites in the junction beds, are in the form of phosphatic casts and represent a small proportion of the fauna. Many are imperfectly preserved, being fragmentary and forming part of a gritty nodule; some are part-phosphatised with one side only being preserved uncrushed. Many specimens occurring in the junction beds consist of body-chambers only, the inner whorls and phragmocones being represented by impressions or crushed remnants in the clay. An example of such body-chamber preservation is illustrated in the 1996 Report (Fig. 1, a – c), and species with compressed whorls such as *Cleoniceras* and *Beudanticeras* appear to be particularly vulnerable in this respect. Casey (1960–1980, p xxxiv) describes a method by which the complete form of a part-phosphatised ammonite can be reconstituted, but his examples refer to those in relatively hard rocks including phosphorite. The Recorder has had no success in his attempts to reconstitute part-phosphatised specimens from the Leighton Buzzard Albian clays.

The rare ammonites from Beds 3(i) and 3(ii) of the temporary section in Chamberlain's Barn pit, and subsequently presented to the Natural History Museum are:

(a) *Cleoniceras* (*Cleoniceras*) aff. *seunesi* Bonarelli (BMNH CA 1688)
Cleoniceras (*Cleoniceras*) sp. (BMNH CA 1686)
(b) *Cleoniceras* (*Neosaynella*) *sublaeve* (Casey) (BMNH CA 1685)
(c) *Cleoniceras* (*Cleoniceras*) *dimorphum* Casey (BMNH CA 1682)
(d) *Cleoniceras* (*Cleoniceras*) *seunesi* Bonarelli (BMNH CA 1683)
Cleoniceras (*Cleoniceras*) *floridum* Casey (BMNH CA 307)
Protanisoceras (*Protanisoceras*) *acteon* (d'Orbigny) (BMNH CA 1687)
Protanisoceras (*Protanisoceras*) *blancheti* (Pictet & Campiche) (BMNH CA 1689)

Single specimens only were obtained of these species as listed, the Natural History Museum Register numbers being shown in parentheses. It is of particular interest that hitherto the distribution of (a), (b), (c) and (d) in the UK has not included the Leighton Buzzard district, the distribution of (a) and (d) being Kent and Surrey; (b) Kent, Surrey and the Isle of Wight; and (c) Kent (Casey 1960–1980, 553–574).

In addition to the listed species, three small well preserved specimens of *Beudanticeras arduennense* Breistroffer and one *Douvilleiceras orbignyi* Hyatt were collected during the year from this same temporary section, the first record of these two species made by the writer from the Gault-Woburn Sands junction beds in Chamberlain's Barn. The importance of this assemblage is that in addition to updating the ammonite biostratigraphy, it provides valuable confirmation of the continuing variability of the Gault-Woburn Sands junction beds in Chamberlain's Barn pit, such variability already being demonstrated in sections further north and west by, principally, Lamplugh & Walker (1903); Lamplugh (1922); Wright & Wright (1947); Casey (1961); Owen (1972) and Smart (1977).

The Gault clays above the junction beds were also investigated regularly, particularly with regard to vertebrate remains. Such fossils are generally uncommon and no reptilia were noted. Several teleost and shark teeth were collected from the middle *Hoplites*

spathi Subzone clays, the most important being an exceptionally well preserved upper jaw anterolateral tooth of the hexanchid shark *Notorynchus aptiensis* (Pictet). This was first discovered near the top of the Gault (Bed 8), and is the first hexanchid tooth found by the Recorder in the Leighton Buzzard area for over two years.

The tooth possesses three distal cusps in addition to the principal cusp, and is very unusual in having all four cusps undamaged. The majority of the specimens in the writer's collection, and those described previously which are now in the Natural History Museum (Smart 1995a) have some kind of imperfection such as a cusp devoid of the apical portion, a root eroded or broken, or the principal cusp mesial serrations worn down. It is unfortunate that a small part of the mesial edge of the root is missing, but this blemish is less important than the undamaged crown of a tooth from a species of shark that is extremely rare in Lower Cretaceous sediments. The specimen is illustrated in Figure 3.

Other interesting shark teeth in the small assemblage from the Chamberlain's Barn Lower Gault were two anterior teeth of *Synechodus recurvus* (Trautschold), both discovered on the eastern side approximately 1.5m above the *Lyelliceras lyelli* Subzone. These were not, however, associated despite their rarity, and the removal of 20 – 25 kg of clay from the exact position of these and the *Notorynchus aptiensis* tooth, which was later washed and sieved for others without success, confirmed that these three were isolated teeth almost certainly shed naturally during life.

Relatively little field work was carried out during 1997 at other Cretaceous locations and none at all at Jurassic sites in the north of the county. Attention was focused on Chamberlain's Barn, in particular the temporary section that yielded the important

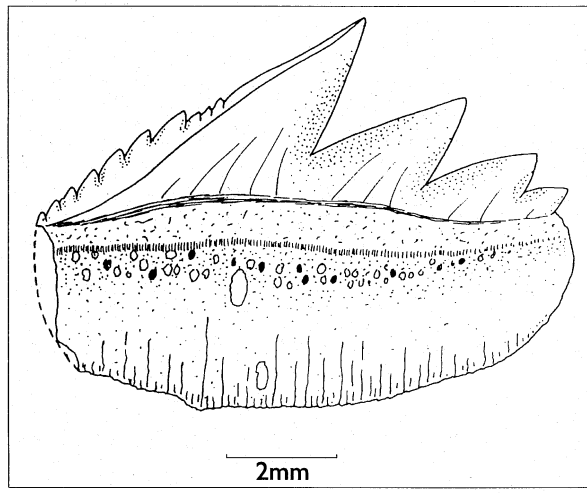

Figure 3. Upper jaw anterolateral tooth of *Notorynchus aptiensis* (Pictet), a Lower Cretaceous hexanchid shark.
Well preserved tooth, possibly from 3rd or 4th anterolateral file, lingual view.
Hoplites dentatus Zone, middle *Hoplites spathi* Subzone, Chamberlain's Barn pit, Leighton Buzzard (near SP931264).

PJS Coll. 15591 M

Cleoniceras and *Protanisoceras* specimens. This became necessary due to the impending closure of the quarry, learned of by the Recorder during the summer and scheduled for 31st October. This news came as a severe blow, an extension of the pit in a north-easterly direction towards Shenley Hill being discussed less than a year before. It was therefore a great disappointment, to both the writer and Natural History Museum palaeontologists, to learn of this and to have the closure confirmed by locked gates in November. There is hope that the quarry may re-open in a few years time although it is far too early to obtain tentative dates. Records made during the past few years, therefore, are of considerable scientific importance as, apart from updating data, over a hundred specimens have been donated to the Natural History Museum from this one section in the Lower Greensand.

Billington Road (Pratt's) quarry (around SP930241) was, however, surveyed on several occasions to take advantage of an extensive expansion of the pit, the southern side being cut back southwards for approximately 100 metres then extended eastwards, this eastward excavation being of considerable size and due to continue into 1998. The gritty phosphatic nodules were well in evidence in the junction beds but, as observed in other sections of the pit, were not rich in fossils. Several surveys and the breaking open of numerous nodules resulted in only one ammonite; a small *Leymeriella* (*Neoleymeriella*) *regularis* (Bruguière) d'Orbigny sp. which was later presented to the Natural History Museum. An unusual discovery from this same nodule band was a large portion of the nautiloid *Cymatoceras* sp. which was also preserved as part of a gritty nodule. The specimen measures 116mm x 96mm in size and is part of the body-chamber, the cephalopod when alive being well over 30cm in diameter.

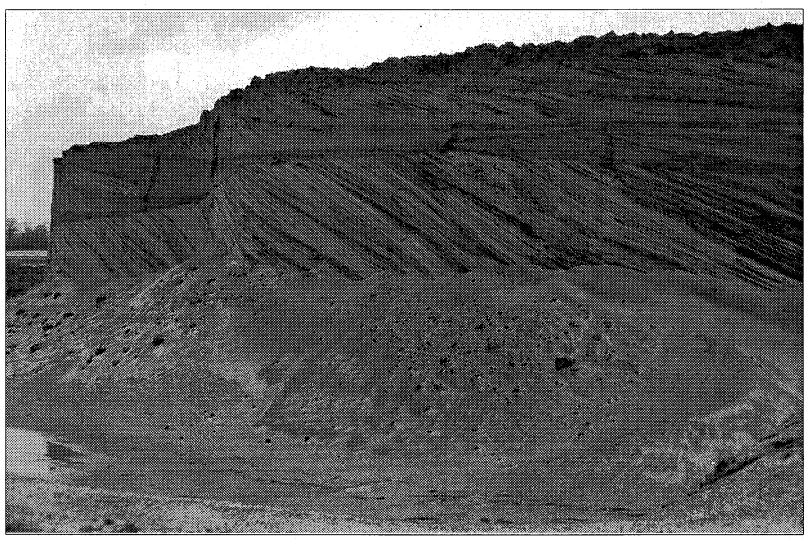

Figure 4. False bedding in Upper Aptian Woburn Sands, characteristic of shallow water deposition under the influence of strong currents.
Eastern side of new southerly extension, facing due east. Billington Road (Pratt's) quarry, Leighton Buzzard (near SP 930241). November 1997 *Photo: P.J. Smart*

Vertebrate remains in the junction beds and overlying *H. dentatus* Zone clays were rare, the few shark teeth found being from previously recorded species. Of particular interest this year, however, were the Upper Aptian Woburn Sands exposed along the eastern and western sides of the new southerly extension. The false bedding of these sands, the beds more or less horizontal when observed in the southern face, were remarkably well demonstrated when seen "from the side", a view of these current bedded sands rarely observed in Billington Road pit. Part of the eastern side of the new excavation was photographed in November and is shown in Figure 4.

Following the closure of Chamberlain's Barn pit, Munday's Hill quarry (around SP936279) and the adjoining Nine Acre pit were paid three visits. The expected extension at the western end had not materialised, and the occasional thin streaks and lenses of calcareous debris in the iron-pan at the top of the silty beds had remained virtually unchanged since being exposed (Smart 1995b). These streaks and lenses are undoubtedly made up of current-winnowed Shenley Limestone fragments and iron-pan debris containing fauna of a higher Zone than the true Shenley Limestone lenticles, indicating considerable re-working of limestone deposits on the ocean floor. No identifiable fossils were found in these deposits, although fragments of fossil wood occurred in a lens near the south-west corner of the pit adjoining Nine Acre.

The current excavations on the eastern side of Munday's Hill pit were also disappointing, no unrecorded species occurring and the phosphatic nodule beds not being so well developed as in the exposures further west.

The final field visit of the year was made to the Arlesey Brick Works quarry (TL188348) in November. The Butterley Brick Company has regrettably closed down, the quarry currently being a waste tip operated by Shanks and McEwan Ltd. The Upper Gault, Cambridge Greensand and Lower Chalk are still exposed and accessible at the eastern end of the quarry, parallel to the main railway line, but the vertical sections seen on previous occasions have now been lost. The present section consists of a slope of approximately 30° extending from the base of the Upper Gault exposure to the surface which, although facilitating field investigations, has blurred the Formation divisions. Macrofossils throughout the section were uncommon, as has been noted in previous reports, and none were found in the Upper Gault *Stoliczkaia dispar* Zone below the Cambridge Greensand. Two well preserved phosphatised specimens of the Lower Cretaceous brachiopod *Moutonithyris dutempleana* (d'Orbigny) were however obtained from the Cambridge Greensand, a species previously recorded from this bed although never very common. The most interesting discovery on this single visit nevertheless came from the Lower Chalk (Chalk Marl) *Mantelliceras mantelli* Zone.

The basal beds of the Chalk Marl were somewhat blurred by the matrix and small phosphatic pebbles of the Cambridge Greensand spread by the excavating plant, this extending some 2 metres up the slope from the Greensand horizon. The Chalk was traversed along its length of approximately 100m several times, numerous fragments of large bivalves *Inoceramus* spp. being frequent in the higher beds. No other fauna was recorded until the sixth traverse of the section, when part of a large tooth was observed *in-situ*, protruding from a calcareous mudstone fragment in one of the several beds of mudstone in the Chalk Marl section. Some 10mm of the apical portion of the tooth was visible, the mudstone slab being removed in its entirety and the specimen extracted

by subsequently immersing the matrix in dilute ethanoic acid. The tooth was readily determined by its size and the numerous post-mortem cracks in the enameloid as an upper jaw tooth of the teleost *Protosphyraena ferox* Leidy, the first such specimen found by the Recorder in the Bedfordshire Lower Chalk.

Species of *Protosphyraena*, Family Pachycormidae, are very rare in UK Cretaceous sediments. A partial tooth identifiable only to generic level was discovered by the writer in the Lower Gault *Hoplites dentatus* Zone, upper *Hoplites spathi* Subzone of Munday's Hill quarry, Leighton Buzzard, in 1992. This was illustrated and discussed (Smart 1992) with a more complete tooth of *P. ferox* from the Hertfordshire Lower Chalk for comparison, both specimens exhibiting typical post-mortem cracks in the enameloid surfaces. The Arlesey specimen, a maxilla tooth crown of *P. ferox*, is in a better state of preservation. It measures 35.1mm in height to the estimated apex and is shown in Figure 5, a slightly larger symmetrical tooth being figured and described as a lower front tooth of this species by Woodward (1908).

ACKNOWLEDGEMENTS

My grateful thanks are due to Dr Colin Patterson, FRS, Dr Hugh Owen, Dr Peter Forey, Miss Alison Longbottom and Miss Sally Young of the Department of

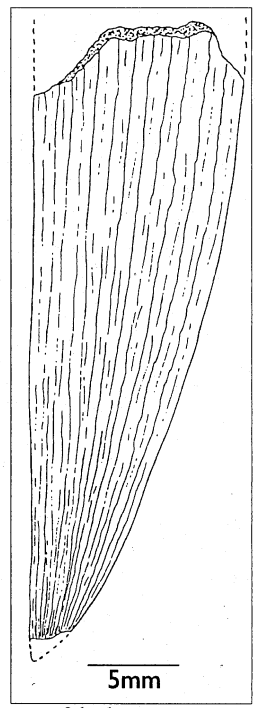

Figure 5. Upper jaw (maxilla) tooth crown of the large Cretaceous teleost fish *Protosphyraena ferox* Leidy. Upper Cretaceous Lower Chalk (Chalk Marl), *Mantelliceras mantelli* Zone, Arlesey Brick Works quarry (TL188348), 11 November 1997.

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Palaeontology, the Natural History Museum for identifying material, allowing me access to the National collection, and for providing research facilities in furtherance of my hexanchid shark investigations. My sincere thanks also to Dr Raymond Casey FRS, for information relating to the revising of his monograph on Lower Greensand Ammonoidea, much of it unpublished, particularly with regard to Upper Aptian ammonites.

For consent to visit their various properties my sincere appreciation is also due to Shanks and McEwan Ltd.; Arlesey Brick Works quarry; Bardon Aggregates Ltd,. Eastern Way, Heath & Reach, Leighton Buzzard; Hepworth Minerals and Chemicals Ltd., Eastern Way, Heath and Reach, leighton Buzzard; Mr J. Gann and Mr J. Hedges of Laporte Earths, Luton; Mr Frank Garnett and Mr Peter Clarke of the Clophill Fuller's Earth quarry, and their staff who are always very helpful.

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MAMMALS
by Cliff Tack

Review of 1997

Once again records were received from nearly one hundred observers and it is thanks to them that we can publish such a detailed mammal report. There were 28 species recorded during the year with another 450 tetrads marked onto the distribution maps. For the first three years of the survey we now have 2,560 tetrads mapped for 34 species. This is a fantastic effort by all concerned and I send my thanks to them all whether an observer with a single record or the stalwarts with many.

Red-necked Wallabies have become a regular feature of the mammal reports in recent years and 1997 was no exception. With three records during the year there must be a continuous escape from captivity or an ability to live wild in Bedfordshire.

There were two more species of exotica reported during the year namely Wild Boar, *Sus scrofa*, and Mara, *Dolichotis patagona*. Together with a belated 1996 report of Chipmunks, *Eutamias* sp., it seems there is no end to what can turn up in Bedfordshire. We welcome all records just in case a species mirrors the success in establishing itself of Grey Squirrel or Muntjac Deer.

Small mammal records were abundant in 1997 with Yellow-necked Mouse being reported from three sites. The difficulty in identifying them from Wood Mice probably masks their true distribution. Another pleasing record was that Dormouse was found in another tetrad in the county. Its relative the Fat or Edible Dormouse was found in three more tetrads and early indications are that it is increasing in Bedfordshire which is at the northern most part of its very restricted range, perhaps aided by a series of mild winters.

The carnivores in the county were all well recorded although the roads still take a heavy toll. Once again Badger road kills reached the 50 mark.

Also, 11 of the 12 Ferret and Polecat records came from road kills. It is good to have the reports coming in but frustrating not to get more detail. Only two of the twelve were identified to a species so we really do need to collect the bodies or at least photograph them for identification purposes. With such a large number of records it is probable that Polecat, Feral Ferret or perhaps both are breeding in Bedfordshire. We just need to prove it!

Otter records are also increasing but as yet we have no evidence of cubs being born in Bedfordshire to sustain the population. Dave Odell was lucky enough to see one in its riparian habitat whereas Linda Parsons saw hers crossing the new Bedford bypass. Unfortunately, her husband Dave, a county mammal enthusiast, was not with her at the time.

Deer records were the only disappointment of the year with only three species recorded during 1997 against the six species we had in 1996. Having said that the three species we did record, Chinese Water, Fallow and Muntjac, all showed an increase in the number of records and, like the majority of mammals included in the report, seem to be doing well in Bedfordshire.

SYSTEMATIC LIST FOR 1997

Red-necked Wallaby *Macropus rufogriseus*

There were three records during the year. A road casualty was reported from SP93Z in the summer. The other records were of animals seen at Millbrook (TL03E) in spring (TM) and finally one at Kingshoe Wood (SP93X) in late december (BP).

Mole *Talpa europaea*

An extra 25 new tetrad records were added during the year making a total of 279 for the first three years of the distribution survey.

Hedgehog *Erinaceus europaeus*

The first record of the year was of one at Turvey (HW) on 16th January. There were no records received from February which was the only month without a sighting. Animals were still active in December with reports from Woburn on 18th (BN) and Studham on 20th (CT). There were 28 new tetrad records during the year bringing the total of tetrads to 246.

Pygmy Shrew *Sorex minutus*

Records were received from five tetrads during the year. One in February was found in a dormouse nestbox 1.5 metres above the ground at Souldrop (SP96W) (RW). In September one was caught on a BNHS small mammal trapping meeting at Maulden (TL03U) from 27 Longworth traps set (DA).

Common Shrew *Sorex araneus*

Recorded from 16 new tetrads during the year making a total of 60 tetrads for the first three years of the survey.

Water Shrew *Neomys fodiens*

There were no definite records although a dark shrew seen at Wavendon during shrub clearing was probably this species (PI).

Rabbit *Oryctolagus cuniculus*

There were 26 new tetrad records during the year making Rabbit the most widely distributed mammal in Bedfordshire with records from 291 tetrads. There was only one report of melanistic Rabbit and that was from Whipsnade.

Brown Hare *Lepus capensis*

The largest counts were of 12 at Telegraph Hill in February (LJ) and of 17 in two fields at Potsgrove in April (AP) There were 20 new tetrad records during the year making a total of 169.

Dormouse *Muscardinus avellanarius*

There was a record from a new tetrad in March when the diagnostically gnawed hazelnuts were found along the Icknield Way (TL12J) (DA and KA). In this area there seems to be a high population just over the border in Hertfordshire (SHa). In the Studham area the only animals found in nestboxes were of a low bodyweight and probably did not breed due to another cool spring.

Fat Dormouse *Glis glis*

In June some animals were reported from the loft of a house in Studham. This was at a site where they have not been reported from in recent times. Also in Studham there was evidence in late September that *Glis* were using several dormouse nestboxes. They had gained entry by gnawing and enlarging the entrance holes. Two young animals, born in the summer, were found using the boxes. One was found alongside the edge of a wood and the other in an overgrown hedgerow.

Bank Vole *Clethrionomys glareolus*

Numbers were well down after the peak of 1996. This was illustrated by the cat catch chart from Woburn (BN) where 38 were caught during the year, well down on the 91

caught during 1996. As would be expected there was a summer peak of nine caught in July and 11 in August. Elsewhere two were caught from 27 small mammal traps set at Maulden Woods in September (DA). There were 19 new tetrad records during the year bringing the total to 48.

Short-tailed Vole *Microtus agrestis*

Fourteen more tetrad records were added during the year to make a total of 52.

Water Vole *Arvicola terrestris*

Reported from the River Lea in Luton during the spring but then low water levels and engineering works along the banks gave cause for concern at this former stronghold (BC, LJ). Early results from a survey by The Wildlife Trust records evidence of presence on the rivers Gt. Ouse, Hiz and Flit. Animals were also reported from the River Til, near Yeldon (TS). There was also a sighting at Tiddenfoot Waterside Park (SP92B), on a BNHS walk in March (RA).

Harvest Mouse *Micromys minutus*

There were three records reported during the year. A disused nest found in TL14A (DP), a breeding nest with young near Biddenham (PN) and finally a dead animal found on a path at Stewartby in December (PS, RN).

House Mouse *Mus musculus*

Nine new tetrad records were received bringing the total to twenty-nine.

Yellow-necked Mouse *Apodemus flavicollis*

Four records were received. The first was of an animal trapped and released at Old Warden tunnel Nature Reserve in February (RL). Two males were caught by cats at Ickwell Green in April and May (ND) and finally a dead animal was also found in May at Maulden Wood (JC, AA).

Wood Mouse *Apodemus sylvaticus*

Four were caught from 27 small mammal traps at Maulden Wood in September (DA). As well as a common mammal of woods and hedgerows they also occur commonly in houses. Animals were reported from Studham (CB, PB), Whipsnade (LR), Gt. Barford (WC), Carlton (TS), Stondon (KW) and Woburn (BN). Twenty-one new tetrad records brings the total to 67.

Brown Rat *Rattus norvegicus*

A further 25 tetrad records were received during the year making a total of 101.

Grey Squirrel *Sciurus carolinensis*

Twenty-one new tetrad records were received during the year bringing the total to 209. Black colour phase animals were reported from two new tetrads TL02B and TL14F. They were also seen at Kensworth and Woburn. There are now records of black squirrels from 24 tetrads.

Fox *Vulpes vulpes*

There were 32 new tetrad records added during the year which brings the total to 206.

Badger *Meles meles*

Recorded from 26 new tetrads making a total of 141. There were two interesting sightings reported. In September a group of 11 was seen feeding on gleanings in a stubble field and in October one was seen killing and eating a hedgehog at Linslade (MB). There were 50 road deaths reported.

Monthly totals are as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	10	14	3	5	3	0	6	1	5	0	1

Although an average number of road deaths was reported it was notable that over fifty per cent of the total was reported from the first three months of the year.

Otter *Lutra lutra*

Some excellent work on the Otter survey led to evidence of otters being added for another 16 tetrads (JG). This now makes a total of 28 tetrads for the first three years of the survey.

Reported sightings during the year included two animals seen in May: on the River Gt. Ouse (DO) and on the River Ivel (SH). In November one was seen in a much more dangerous situation when it crossed the new Bedford bypass at night (LP).

Ferret or Polecat *Mustela* sp.

There were 10 records of either Polecats or Polecat-type Ferrets. They must remain unassigned as no bodies were collected or detailed descriptions or photographs taken. Only one animal was seen alive which approached some badger watchers near Haynes in May (JA, DP, CW). All the other records were of road casualties with a peak of records in summer and autumn. There were singles at Luton and Haynes with the other seven around the Barton/Hexton area.

Polecat *Mustela putorius*

There were two records, both of road casualties: a female found on Bison Hill Whipsnade in September (AR) and an unsexed animal just south of Dunstable in October (CT).

Mink *Mustela vison*

Twenty-three new tetrad records were received, making a three year total of 62 tetrads. On New Year's Day one was seen eating a fish on the ice at Stewartby Lake (AC). Other animals were recorded from wide-spread sites across the county including Bromham Lake (BT), Bushmead, Dunstable Sewage Treatment Works, Kensworth, Rookery Pit and Whipsnade Wild Animal Park. Evidence of Mink occurence was also found along the main river systems during the Otter Survey (JG).

Weasel *Mustela nivalis*

There were 28 new tetrad records making a total of 87. Several of the records were of animals seen scurrying across roads and footpaths.

Stoat *Mustela erminea*

With another 27 new tetrad records added during the year the three year total now stands at 99. A family of four at Carlton (SP95M) in June was causing more than a little consternation to a pair of pheasants (TS). A rare sighting in the county was that of a white stoat or ermine that was seen killing a rabbit at Barton Springs (TL02Z) in February (JN).

Chinese Water Deer *Hydropotes inermis*

Only two new tetrad records were added during the year bringing the total up to 38. Twelve records were received of single animals or two together.

The largest counts were of five in two fields, at Potsgrove (SP93K) in April (AP), and seven feeding on maize at Eversholt in September (JA,CW).

Fallow Deer *Dama dama*

Four new tetrad records were added during the year making a total of 32. Seven were seen together at Waterloo Thorns (TL15 W) in June (AP) with 11 at Eversholt in October (SP93X) (JA, CW). Also reported from Hudnall Corner, Pegsdon, Studham and Woburn (outside deer park).

Muntjac Deer *Muntiacus reevesi*

With another 28 new tetrad records added during the year the total now stands at 199. Two seen between Biddenham and Kempston Mill were notable as the observer had not seen any in this area for about 20 years (DO). A pair seen in Chicksands Wood had very dark coats with the male being described as being almost black (JA).

An unusual sight at Luton in August was that of one jumping into the River Lea to escape when disturbed from cover alongside the riverbank (LJ).

ACKNOWLEDGEMENTS

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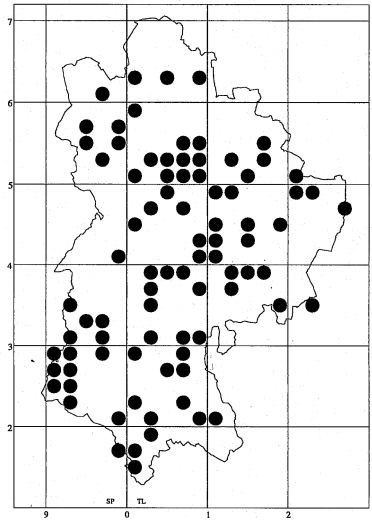
Cliff Tack is the Society's Mammal recorder, a position he has held in an honorary capacity since 1991.

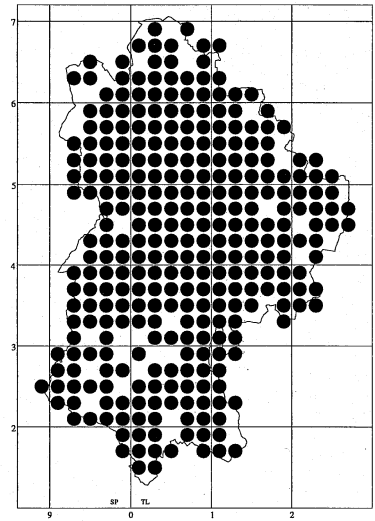
MAMMALS – BATS
by Joan Childs and Tony Aldhous

Bat records from 1987 to 1997

In 1997 bats were recorded in 85 tetrads (2 km x 2 km squares). This is a little lower than in previous years: 1996 – 90, 1995 – 96, 1994 – 94, 1993 – 88, 1992 – 88, 1991 – 101 and 1990 – 98 tetrads. 1997s records are approximately evenly spread across the county. There were 188 records of bats during the year. The number of tetrad records is lower than the actual number of bat records, because some tetrads will have more than one bat record, and some records will not be attributable to tetrads.



Bat records for 1997



Bat records from 1987 to 1997

Earliest active bat records

The first flying bat, an unconfirmed pipistrelle, was seen on 11 March by Peter Almond in his garden in Bromham. A grounded 'bandit' pipistrelle was found on 9 February in a garden in Studham, a 'brown' pipistrelle was found on 18 February in the swimming pool of a house in Renhold, and an unidentified bat was seen on 25 February flying in a bedroom in a house in Felmersham.

Latest active bat record

John Adams reported four bats flying in his garden (where he has a confirmed 'bandit' pipistrelle roost) in Haynes on 19 October. An underweight confirmed pipistrelle was found on 20 October in Flitwick, and a confirmed brown long-eared bat was found in a house in Tempsford on 11 November.

Daubenton's Bat *Myotis daubentonii* (Kuhl, 1819)

Confirmed records: 1 summer roost
3 winter roosts
2 sightings

Unconfirmed records: 6 sightings

Summer roost:

None of the roosts known at Stockgrove Country Park were active during 1997. The only active roost recorded was in Old Warden Tunnel. This was confirmed when three bats were mist-netted by Tony Aldhous (under licence from English Nature) on 26 September as they emerged from the tunnel entrance. One of the bats was male, the other two female, one of which had a chin spot indicating that it was probably born in 1997.

Winter roosts:

Hibernating Daubenton's bats were found in January, February and December. Old Warden Tunnel, Silsoe ice-house and Woburn rockery tunnel were the sites used by this species. Five bats were found in Old Warden Tunnel during December, but the other records were for only one bat.

Other records:

Daubenton's bats were mist-netted by Tony Aldhous (under licence from English Nature) at Chicksands Base. A female was caught on 29 April, and three females were caught on 30 May. On 6 August a juvenile Daubenton's bat was found grounded in the centre of Bedford. After a few days in captivity the bat was released along the river in Bedford. Unconfirmed Daubenton's bats were reported flying over water at Strawberry Hill Farm in Knotting Green, Ickwell Bury, Sharnbrook Manor, Stockgrove Country Park, Rushmere House near Stockgrove, and Ampthill Park.

Natterer's Bat *Myotis nattereri* (Kuhl, 1818)

Confirmed records: 8 winter roosts
2 sightings

Unconfirmed records: 2 sightings

Winter roosts:

Hibernating Natterer's bats were identified in Silsoe ice-house, Woburn ice-house, Woburn rockery tunnel, Linslade wine-cellar, Barton lime-kiln tunnel, Southill ice-house, Moggerhanger ice-house and Old Warden Tunnel. They were seen hibernating in January, February and December. The maximum number seen together was 11 in Old Warden Tunnel. Silsoe, Southill and Woburn ice-houses all held good numbers. Although this species is uncommonly found in the summer, it is the commonest species recorded in the winter.

Other records:

A pregnant female Natterer's bat was caught by a cat in Ampthill on 6 July. The baby was still-born and the adult died later. On 20 July a juvenile was found dead at The Old Vicarage in Southill. Unconfirmed bats were located flying over the lake at Ickwell Bury, and flying in a Dutch barn at Strawberry Hill Farm in Knotting Green.

Noctule *Nyctalus noctula* (Schreber, 1774)
Confirmed records: 2 summer roosts
Unconfirmed records: 3 sightings
Summer roosts:

Two summer roosts were located in Stockgrove Country Park. One was a traditional roost located in an oak tree. The bats were first recorded there on 9 June and were last recorded there on 23 June. Numbers peaked at 20. Noctules also roosted in a bat box on a Scot's pine, which is the first time that noctules have been recorded in a bat box in the county. One bat was seen on 28 April, and numbers built up to three on 12 and 26 May. On 26 May a bat was caught (under licence from English Nature) as it emerged, and it was found to be a male. Flying bats were seen feeding over the lake at Stockgrove between 21 April and 22 September. Despite the large numbers of bats roosting in the park, a maximum of only three was seen feeding over the lake at any one time (2 June).

Other records:

Flying bats were also seen at Ickwell Bury, Ickwell Green, and Rushmere House near Stockgrove.

Pipistrelle *Pipistrellus pipistrellus* (Schreber, 1774)

Wherever possible, pipistrelles were identified to species, either 45 kHz 'bandit' pipistrelles or 55 kHz 'brown' pipistrelles (see following page).

45 kHz 'Bandit' Pipistrelle
Confirmed records: 3 summer roosts
1 winter roosts
29 sightings
Unconfirmed records: 1 summer roosts
7 sightings
Summer roosts:

The three confirmed summer roosts were one above the back door of a house in Ickwell Green, the roost in Haynes which peaked at 113 bats on 6 July and a roost in a house in Keysoe.

The unconfirmed roost was in a house in Wootton from which nine babies were found.

Winter roost:

Two bats were found on 25 March when a soffit board was removed from a house in Shefford. These bats may have been hibernating.

Other records: A female was caught by Tony Aldhous in a mist net at Chicksands Base on 30 May. The other 28 confirmed sightings were all of grounded, injured or dead bats, or bats that had entered buildings. On 15 July five dead bats were found in a garden in Ampthill. It is unknown why the bats died, but a neighbour was having major building work undertaken.

The unconfirmed sightings were of bats in flight from various locations in the county.

55 kHz 'Brown' Pipistrelle

Confirmed records: 3 summer roosts
5 sightings
Unconfirmed records: 5 sightings

Summer roosts:

Three bat boxes were used at Stockgrove Country Park. Most boxes had one or two bats, but a maximum of at least six bats were noted.

Other records:

The confirmed sightings were all of grounded or injured bats: a lactating female from Putnoe, Bedford, a juvenile male from Henlow, an injured female from Harrold, a cat-caught bat from Flitwick and a female in a swimming pool in Renhold.

The unconfirmed sightings were all bats identified in flight from: Potton, Ickwell Bury, Old Warden, Rushmere House at Stockgrove, and King's Wood, Heath and Reach. Flying bats were also monitored at Stockgrove Country Park. 'Brown' pipistrelles tended to be out earlier than 'bandit' pipistrelles.

Pipistrelles not identified to species

Confirmed records: 6 summer roosts
10 sightings
Unconfirmed records: 13 summer roosts
21 sightings

Summer roosts:

The confirmed roosts were:

- A maternity roost of 200+ bats in Great Barford which had a dead adult in the water tank and, in the loft, three dead babies and a fourth baby that later died.
- A maternity roost under the north-facing eaves of a house in Tempsford. There were droppings in the loft against both the north and south ends, and a baby bat was found in the house.
- A maternity roost in a house in Aspley Heath which had live and dead babies out of the roost.
- A roost under the gable end of a house in Bedford where a baby bat had to be returned to the roost.
- A roost in the loft of a house in Aspley Guise where a mother and baby were found in the kitchen, probably brought in by the cat. The baby died but the adult was released.
- A roost in a house in Renhold where 40 dead bats were found in the roof.

The unconfirmed roosts were in:

Meppershall Church, the porch of Marston Moretaine church, under fascia boards on a house in Kempston, a maternity roost in a house in Aspley Guise, under fascia boards on a house in Shefford, a dead baby at a roost in a house in Bedford, and roosts in three almost adjacent houses in one street in Potton where 11 bats were counted out of one roost by the side of a porch and another was under north-facing eaves.

Other records:

The confirmed sightings were grounded or injured bats, or baby bats where the roosts could not be located. One baby was found in the conservatory of a house in Clapham and although there were a few droppings in the conservatory, a roost could

not be found. Another baby was found by a householder on her drive in Pavenham and although she had had a bat roost in the past, it was not active this year.

The unconfirmed sightings were grounded, injured or dead bats, bats in buildings, bats flying round gardens, and bats seen in Chicksands Wood, Maulden Wood (at dawn), and flying around Old Warden Tunnel Nature Reserve.

Unidentified bats

Records:	9 summer roosts
	1 winter roost
	18 sightings

Summer roosts:

Five of these were in houses, two in churches and two in farm buildings. Twenty-four bats were counted from one roost in a house next to Rowney Warren which had piles of bat droppings in the loft. Eight bats were counted out of a house in Ampthill.

Winter roost:

The report was of a bat attempting to hibernate in a crevice behind a box on a house in Heath and Reach.

Other records:

There were eight records of bats in houses, two of bats in offices, and two of bats setting off burglar alarms in offices. Three householders reported seeing bats in their gardens with possible roosts, and one bat was seen during work on a hotel in Bedford where it is possible that there was a roost. There were an additional two sightings of flying bats. Many of these bats are likely to have been pipistrelles.

Brown Long-eared Bat *Plecotus auritus* (Linnaeus, 1758)

Confirmed records:	10 summer roosts
	9 winter roosts
	6 sightings
Unconfirmed records:	8 summer roosts
	1 feeding roost
	3 sightings

Summer roosts:

The confirmed summer roosts were nine at Stockgrove and one in the loft of a farmhouse in Studham. The unconfirmed roosts were in farmhouses, farm buildings and large houses in Heath and Reach, Renhold, Meppershall, Turvey and Sutton, and in Chicksands Priory and Willington Stables. The feeding roost was in a barn in Riseley.

Winter roosts:

The winter roosts were in Moggerhanger ice-house, Southill ice-house, Silsoe ice-house, Old Warden Tunnel, Whipsnade bear pit, Woburn rockery tunnel, Barton lime-kiln tunnel and Barton tunnel 3. In addition to the regularly surveyed sites, a hibernating bat fell out of a barn in Everton during building work. Hibernating bats were found in January, February and December. Records were usually of a single bat, but two were found in Silsoe and Southill ice-houses and Woburn rockery tunnel, and a maximum of four bats were found in Old Warden Tunnel.

Other records:

The six confirmed sightings were a grounded lactating female in Blunham with injuries consistent with being hit by a car, a grounded bat in Pavenham also with injuries consistent with being hit by a car, a grounded bat in Cranfield, a bat in a house in Tempsford and another in Woburn, and two bats mist netted by Tony Aldhous (under licence from English Nature) in Swiss Gardens. The unconfirmed sightings were of bats flying at Old Warden Tunnel and Strawberry Hill Farm in Knotting Green, and a bat in a wood-burner in Wrestlingworth.

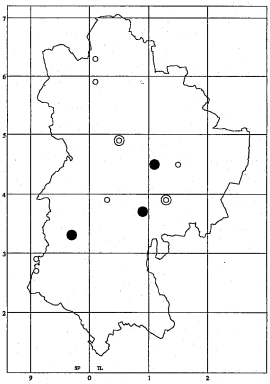
Barbastelle *Barbastella barbastellus* (Schreber, 1774)

Confirmed records: 1 winter roost

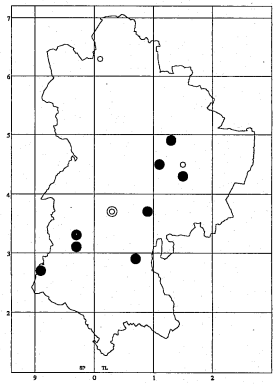
Winter roost:

A hibernating barbastelle was found in Old Warden Tunnel in February and December. The choice of crevice in this site leads us to believe that this is the same bat that has hibernated in the tunnel since December 1995 and is the sixth barbastelle record for the county this century.

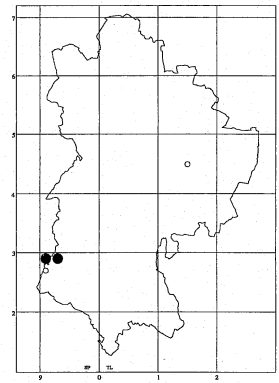
Joan Childs and Tony Aldhous are the Society's joint Bat Recorders. They have held these positions in an honorary capacity since 1991. They run the Bedfordshire Bat Group which produces an annual report and a quarterly newsletter *Bats in Beds*.



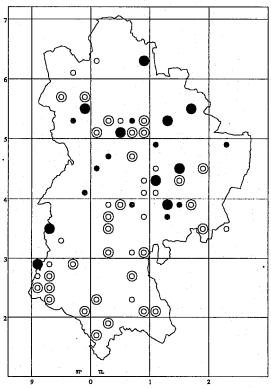
Daubenton's Bat



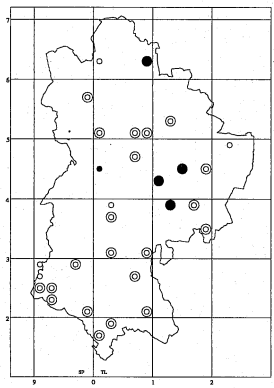
Natterer's Bat



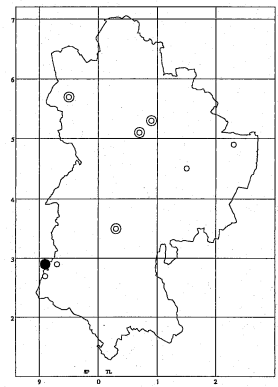
Noctule



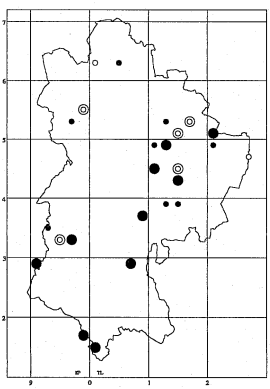
Pipistrelle



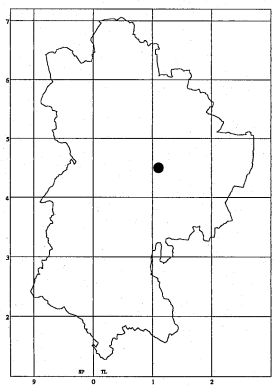
'Bandit' Pipistrelle



'Brown' Pipistrelle



Brown Long-eared Bat



Barbastelle

Key for species distribution maps

- ● Confirmed roost
- ⊙ Confirmed bat and unconfirmed roost
- ◎ Confirmed bat
- · Unconfirmed roost
- ▫ Unconfirmed bat

FISH
by Harvey Winter

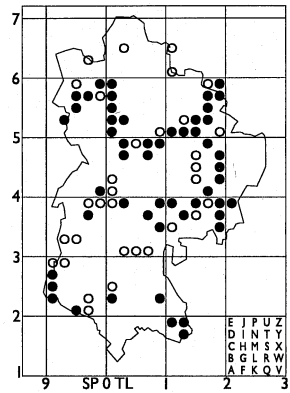
Introduction

This report for the year 1997 differs from previous reports, consisting as it does principally of distribution maps for all species and hybrids recorded from five or more county tetrads. Although a fish recorder (F.G.R. Soper) was numbered amongst the first recorders appointed by the Society following its formation, complete tetrad maps have not been previously published. This report provides an opportunity to reproduce these maps to illustrate the extent recording has progressed during the succeeding 50 years.

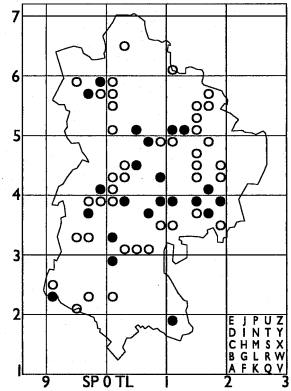
Brief mention of all other species and natural hybrids recorded from less than five tetrads, including purely historical records, is made following the maps.

It should be remembered that tetrad maps show the distribution of any species and offer a visual comparison to similar species only. Other details – the number of sites within each tetrad, the dates and frequency of records, etc – are not indicated. For details of individual sites reference must be made to the separately maintained site records.

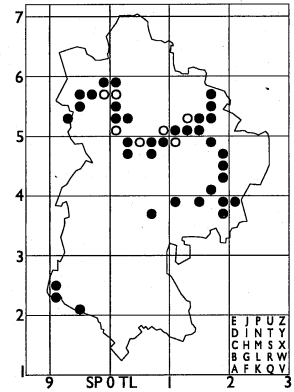
Family CYPRINIDAE



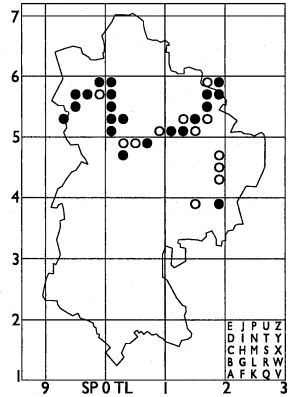
Roach, *Rutilus rutilus*



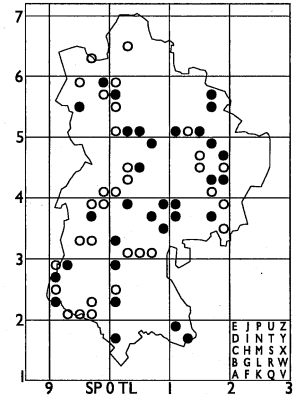
Rudd, *Scardinius erythrophthalmus*



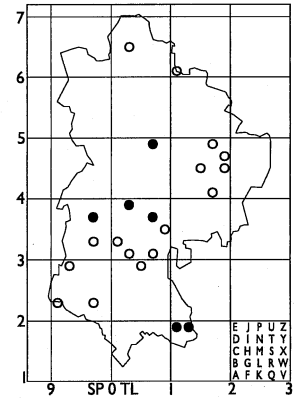
Dace, *Leuciscus leuciscus*



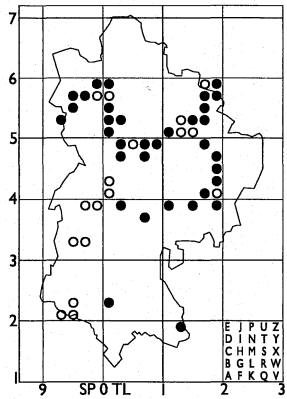
Bleak, *Alburnus alburnus*



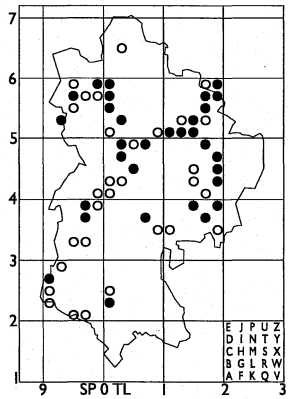
Common Carp, *Cyprinus carpio*



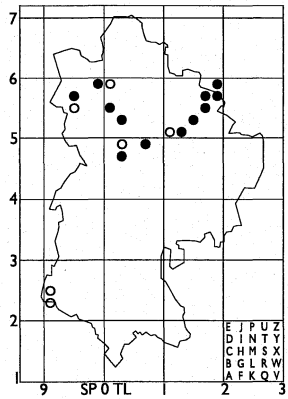
Crucian Carp, *Carassius carassius*



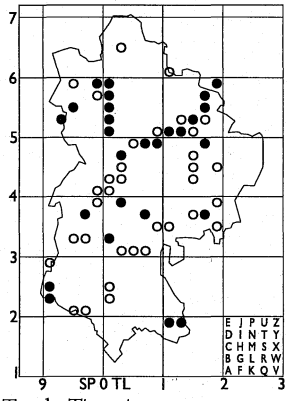
Chub, *Leuciscus cephalus*



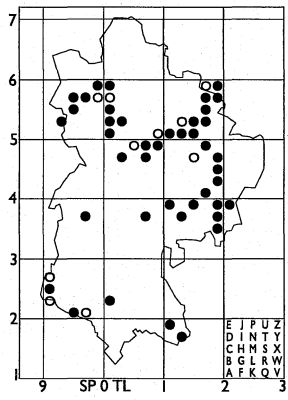
Common Bream, *Abramis brama*



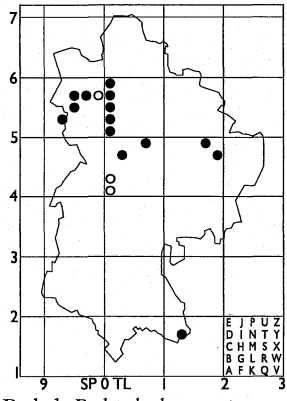
Silver Bream, *Blicca bjoerkna*



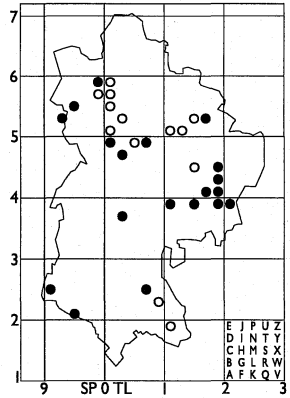
Tench, *Tinca tinca*



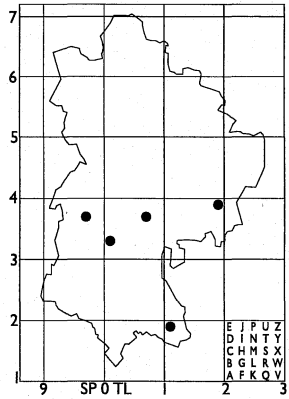
Gudgeon, *Gobio gobio*



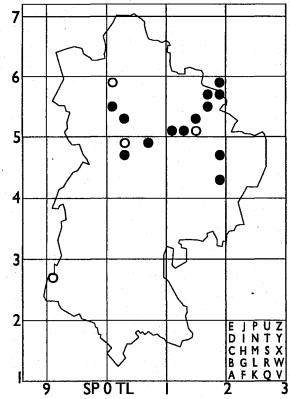
Barbel, *Barbus barbus*



Minnow, *Phoxinus phoxinus*



Orfe, *Leuciscus idus*



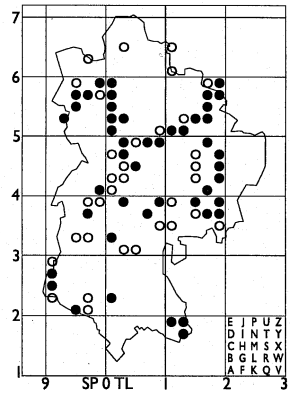
Roach × Common Bream (Natural Hybrid)

Key to tetrad maps

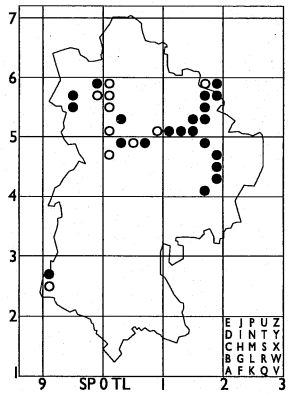
O Open circle indicates a record made between 1947 and 1989 inclusive

● Solid circle indicates a record made between 1990 and 1997 inclusive

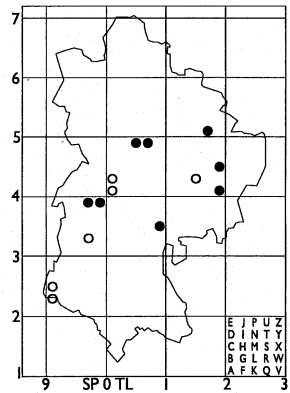
Family PERCIDAE



Perch, *Perca fluviatilis*

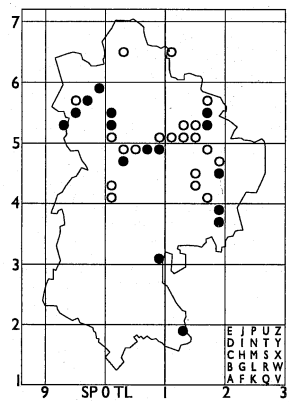


Ruffe, *Gymnocephalus cernus*



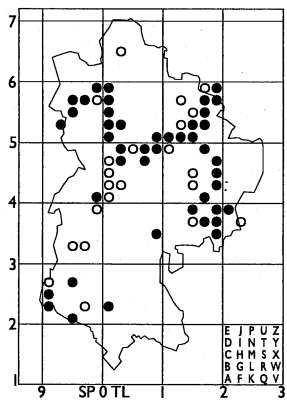
Zander, *Stizostedion lucioperca*

Family ANGUILLIDAE



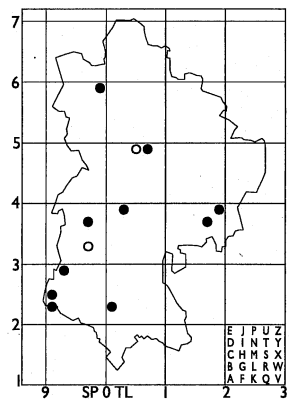
Eel, *Anguilla anguilla*

Family ESOCIDAE



Pike, *Esox lucius*

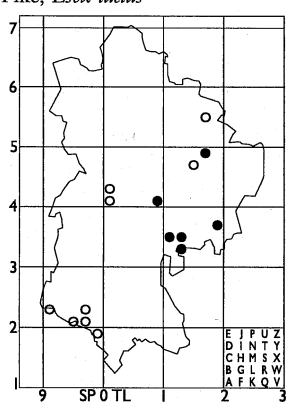
Family SILURIDAE



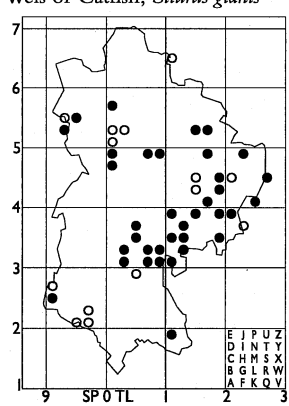
Wels or Catfish, *Silurus glanis*

Family SALMONIDAE (right)

Family COTTIDAE (far right)

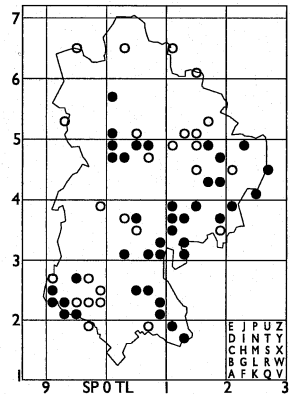


Rainbow Trout, *Salmo gairdneri*

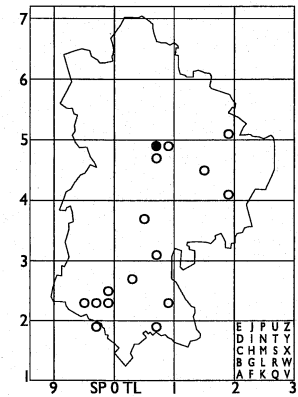


Bullhead, *Cottus gobio*

Family GASTEROSTEIDAE

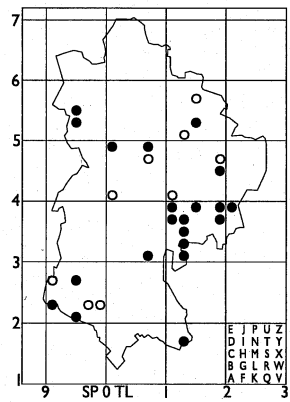


Three-spined Stickleback, *Gasterosteus aculeatus*

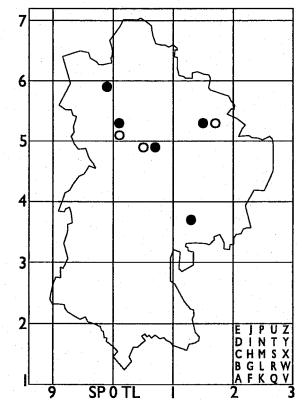


Ten-spined Stickleback, *Pungitis pungitis*

Family COBITIDAE



Stone Loach, *Noemacheilus barbatulus*



Spined Loach, *Cobitis taenia*

Species and hybrids with fewer than five tetrads recorded

Family Salmonidae

Salmon *Salmo salar*

Three records mentioned in the *Victoria County History,* all from the Great Ouse. The most recent is for 1880 from Kempston Mill.

Brown Trout *Salmo trutta*

Four county records, widely distributed. The most recent for 1996 from the River Ivel.

Family Thymallidae

Grayling *Thymallus thymallus*

This species was last recorded from the River Ivel during the 1950s following introduction.

Family Cyprinidae

Common Goldfish *Carassius auratus*

Two county records. A record from the River Lea in Luton is obviously of a released aquarium specimen. One current record from a still water site in the south of the county.

Grass Carp *Ctenopharyngodon idella*

A lake in Woburn Park, 1976, provides the only record of this species from the county.

Family Cobitidae

Weather Loach *Misgurnis fossilis*

A record of 1994 for Priory Country Park, Bedford presumably represents a released aquarium fish.

Family Petromyzonidae

Lampern *Lampetra fluviatilis*

The most recent records are from the Great Ouse at Tempsford Mill and Goldington Mill, 1914. These are recorded by hand-written notes made by J.S.Elliott in his interleaved copy of the *Victoria County History* in the Bedford Museum collection. *The Natural History of the Hitchin Region* (1934) also mentions this species as once prolific in the River Ivel at Tempsford and reaching as far upstream as Arlesey.

Family Gadidae

Burbot *Lota lota*

The Burbot is considered to be scarce, possibly now extinct, in this country. An unconfirmed press report (*Anglers Mail*, 2nd Oct, 1969) of a specimen taken from the Great Ouse at Tempsford Sluice appears to be the only record of the species from this county.

Hybrids

Roach × Bleak

A single specimen from the Great Ouse at Bedford in 1950 is the only record from the county. This fish was fully described by F.G.R. Soper in his report in *Bedf. Nat.* **5** (1950).

Roach × Rudd

Two records supplied by the National Rivers Authority; the River Hiz in 1991 and the River Ivel in 1995.

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HINE, R.L. (Ed.) 1934 *The Natural History of the Hitchin Region.*

MARLBOROUGH, D. 1970 The status of the Burbot, *Lota lota* (L) (Gadidae) in Britain *J. Fish. Biol.* **2** 217–222.

SOPER, F.G.R. 1950 Fishes *Bedf. Nat.* **5** 37.

THOMPSON, A.R. 1904 Fishes in *Victoria County History of Bedfordshire* **Vol. 1** (Ed. Doubleday, H.A. and Page, W.) 98–101.

ACKNOWLEDGEMENTS

Thanks to the following individuals and organisation who have supplied records and information this year. Thanks also to everyone who has supplied records and assistance in years past enabling these maps to be produced.
R. Allston, J. Bains, R. Bates, S. Cham, Ms J. Childs, M. Clark, C. Dean, Mrs H. Muir-Howie, D. Nash, Dr B. Nau, M. Paine, N. Perkins, T. Peterkin, R. Revels, B. Ritchie, H.A. Smith, R. Spendlove and the Environment Agency.

Harvey Winter is the Society's Fish Recorder, a position he has held in an honorary capacity since 1990. He is a Fellow of the Royal Entomological Society and Zoological Society of London.

FRESHWATER CRAYFISH
by Harvey Winter

There were four reports of crayfish found in the county during 1997, two of which were of the native White-clawed Crayfish.

White-clawed Crayfish *Austropotamobius pallipes*

Several specimens were accidentally caught while rubbish was cleared from a stream running to the east of Barton-le-Clay. This is a site long associated with crayfish but this is the first sighting recorded from there in recent years (DL, TP).

The native species was also found to be present at the previously known site at a small stream near Shillington (RS).

Signal Crayfish *Pacifastacus leniusculus*

An introduced North American species the Signal Crayfish is now widely established in this country and there were two new records from the county this year.

Recorded from Elstow Brook to the east of Bedford (RS).

Recorded by the Environment Agency from the River Ouzel at a location south-west of Eaton Bray and just within the county boundary.

ACKNOWLEDGEMENTS

Thanks to the following individuals and organisations for their records and assistance this year:
T. Clough, D. Lomax, D. Nash, T. Peterkin, R. Revels, R. Spendlove and the Environment Agency.

Harvey Winter is the Society's Recorder for Crayfish, a position he has held in an honorary capacity since 1992. He is also the Society's Fish Recorder.

REPTILES AND AMPHIBIANS 1996 and 1997

by Helen Muir-Howie

A national research project on frog mortality was begun in 1996 to find the cause of "Red Leg" as this has been a mystery since the problem first appeared. Findings are beginning to suggest that high ammonia levels in the water may be to blame. I have not had any reports of suspected red leg disease within Bedfordshire although each year I get records of adult frogs dying in garden ponds during the winter. It may be that garden ponds cannot offer the right conditions for successful overwintering.

Joan Childs reported frogspawn appearing for the first time in her garden pond in Potton; unfortunately it disappeared before hatching. I have also had records of Common Frog from Luton, Woburn, Bromham, Gt. Hayes Wood and Stotfold over the two year period.

Common Toad records came from Priory Country Park, Stockgrove Country Park, Ickwell, Luton, Carlton, Stotfold, Bromham and Cople Pits Nature Reserve.

Common Newts were recorded in Luton and Bromham, and Great Crested Newts in Stotfold, Willington and Cople.

1996 saw the start of an Adder survey as part of the Greensand Ridge Project. Jim Foster, the Common Species Adviser with Herpetofauna Conservation came to Bedfordshire to visit King's Wood, Heath and Reach, and also Rammamere Heath to give advice on how best to proceed with the survey. It was hoped the survey would continue through 1997 as well.

Grass Snakes are being seen more frequently in recent years mainly in known sites such as Felmersham, Harold & Odell Country Park and Bromham, but occasionally in new sites such as a garden in Shortstown, Odell Great Wood and Great Hayes Wood.

Common Lizards were seen in a garden in Cople and at Sharnbrook Summit.

ACKNOWLEDGEMENTS

I would like to thank the following people for supplying records: Vic Arnold, Joan Childs, Tony Smith, Peter Almond, Patty Phillips, Ann Hurst, Paul Madgett and Bridget Parsonage.

Helen Muir-Howie is the Society's Recorder for Reptiles and Amphibians, a position she has held in an honorary capacity since 1977. She is also East Midlands representative for Herpetofauna Groups of Great Britain.

SOCIAL WASPS
by Richard Revels

From my own observations and from other records received for 1997, it seems to have been a generally poor year for social wasps. The cool, damp and dull weather during June was probably the main cause, affecting the aerial nesting species more than the cavity nesting wasps.

Hornet, *Vespa crabro*, records and sightings were down on the past few seasons, but it is still widespread in the county. Records of nests came from West Wood in the north and Potton Wood in the east. Other sightings came from the Old Warden and Southill area, Turvey in the west, and Woburn and Linslade further south. Overall, the Hornet seems to be holding its own in Bedfordshire.

The Tree Wasp, *Dolichovespula sylvestris*, was seen at Sharpenhoe on the BNHS meeting on 3rd August. Nancy Dawson had a nest in a ventilator grill of her bathroom at Ickwell and Tom Thomas had to deal with about a dozen nests of this species in Luton, which is up on the last few years.

Tom Thomas had considerably fewer nests of the Median wasp, *D. media*, to deal with this year, and this species seems to have been generally much less plentiful during 1997 than in the previous years. Dave Hillyard (Ace Pest Control) also reported fewer aerial nests that needed treating during 1997; these were presumably mostly Median Wasps. Tom Thomas treated four Saxon Wasp nests, *D. saxonica*, in the Luton area during 1997 but I have no other records of the wasp this year.

Both the Common Wasp, *Vespula vulgaris*, and the German Wasp, *V. germanica*, still seem to be as common as ever within the county.

ACKNOWLEDGEMENTS

I should like to thank the following for sending me records:
P. Almond, C. Baker, V. Arnold, B. Chambers, M. Chandler, N. Dawson, J. Green, S. Hawkins, D. Hillyard, P. Madgett, D. Manning, B. Nightingale, A. Smith, T. Thomas, A. Vaughan-Jones, H. Winter and I. Woiwod.

Richard Revels is the Society's Recorder for Social Wasps, a position he has held in an honorary capacity since 1994.

DRAGONFLIES
by Steve Cham

The year 1997 saw the wettest June across England and Walessince 1860 and one of the dullest. This is a critical month for the county's rarer species such as *Brachytron pratense* which had a shortened flight season because of the poor weather. Despite the wet conditions, water levels at many sites fell to all time lows during the summer. Cityfield Pit at Henlow, a previously good dragonfly site, was dry throughout the year, as was the marl lake at Houghton Regis quarry. Neither of these sites supported any dragonflies during the year. At other sites, normally submerged ridges became visible above the water surface. The stagnant conditions experienced at many sites saw extensive algal blooms and duckweed (*Lemna* sp.) growth covering the water surface. This has a negative impact on dragonflies.

On a more favourable note the White-legged Damselfly, *Platycnemis pennipes*, continues its expansion along the Rivers Ivel and Flit and was recorded at a number of sites for the first time. It now has a scattered distribution along the rivers from Tempsford as far down as the River Flit at Chicksands.

The Scarce Blue-tailed Damselfly, *Ischnura pumilio*, had a reasonable season at Sundon Quarry where good numbers were observed during the flight season. There have been no records from Houghton Regis Chalk Pit for several years and in view of the dry conditions at the site the future of this colony must be questionable.

The Hairy Hawker, *Brachytron pratense*, also had a good season at Felmersham Nature Reserve. A number of exuviae were found in early May in areas of *Schoenoplectus lacustris* demonstrating successful development and emergence. Later in the same month territorial males were observed throughout the site, with ovipositing females on the lakes either side of the road.

All other species were recorded in usual numbers throughout the county.

Thank you to all those who sent records for the year. I would like to put out a special request for as many records as possible over the next two seasons. I am in the process of preparing a publication for the BNHS, in line with the Lepidoptera book published by the Society last year, and would like to include as many records and observations as possible. If anyone would like more RA70 recording cards or further details please contact me.

New Tetrad Records

Banded Damoiselle *Calopteryx splendens* SP92W, TL04GS(3)
White-legged Damselfly *Platycnemis pennipes* TL13J*, TL15K, TL14QU*(4)
Large Red Damselfly *Pyrrhosoma nymphula* TL04TX(2)
Blue-tailed Dameselfly *Ischnura elegans* SP92W, TL04XY, TL13U(4)
Azure Damselfly *Coenagrion puella* SP95T, TL04T, TL14W, TL15L(4)
Brown Hawker *Aeshna grandis* TL04T, TL15N(2)
Southern Hawker *A. cyanea* TL04TY(2)
Migrant Hawker *A. mixta* TL04S, TL15N(2)
Broad-bodied Chaser *Libellula depressa* TL04G
Four-spotted Chaser *L. quadrimaculata* TL04X

Black-tailed Skimmer *Orthetrum cancellatum* TL04TX(2)
Common Darter *Sympetrum striolatum* TL15N
Ruddy Darter *S. sanquineum* TL15N
*New 10km record

Steve Cham is the Society's Recorder for Dragonflies, a position he has held in an honorary capacity since 1987. He is also regional recorder (for the East Anglian region) for the national recording scheme for dragonflies.

GRASSHOPPERS AND CRICKETS
by Kevin Sharpe

1997 was yet another record breaking year in more than one way. New squares are still being found for all the common species. Roesel's bush-crickets have continued to spread north in the county but, most importantly of all, there is a new addition to the county list, the Long-winged Cone-head.

Oak Bush-cricket *Meconema thalassinum*

Recorded in 21 tetrads from July to September, at SP92E/J, SP93F/H/M/N/Q, SP94S, SP95Z, SP96V/W, TL01I, TL03Y, TL04V/W/X/Z, TL14A/F/K and with one previous unrecorded tetrad of:

SP93S - Woburn Park

Dark Bush-cricket *Pholidoptera griseoaptera*

Recorded in 48 tetrads from 18th June to 4th November at SP92J, SP93N/T, SP94L/M/R/S, SP95P/Q/U/V/Z, SP96V/W, TL01C/D/E, TL02U, TL03U, TL04M/N/R/S/V/W/X/Y/Z, TL05A, TL06C, TL14A/F/K and with 15 previous unrecorded tetrads of:

SP93E - Stockgrove Park; SP93F - King's Wood, Heath and Reach;
SP93G - Lowes and Charle Wood; SP93H - Wavenden Heath;
SP93K - Potsgrove; SP93L - Woburn; SP93M/S - Woburn Park;
SP93T - Ridgmont; SP93Y - Beckerings Park
SP94G - Wharley End
SP95W - Stevington Country Park
TL01D - Whipsnade Churchyard
TL04L - Great and Little Thickthorn Farm; TL04T - Shortstown

Roesel's Bush-cricket *Metrioptera roeselii* (for distribution see Fig. 1)

Recorded in 38 tetrads from 28th July to 30th October at SP92J, SP93M/N/T, TL02N/P/U, TL03F/K/L/N, TL04B/G, TL11I, TL14W and with 23 previous unrecorded tetrads of:

SP92K - Ouzel Brook; SP92N - Ouzel Brook Bypass, SP92R - Stanbridgeford
SP93F - A5; SP93N - Woburn; SP93S - Woburn Park
SP94L/R - Cranfield
TL01C - Ravensdell Wood
TL04L - A6/Wilstead; TL04M - Elstow Industrial Estate; TL04N - Elstow;
TL04Q - Haynes; TL04R - Wilstead; TL04T - Shortstown;
TL04X - Cotton End; TL04Y/Z - Cardington
TL05F - Bedford; TL05G - Clapham/A5; TL05J - Thurleigh Road verge
TL06G - Riseley
TL14Q - Stanford Mill

Long-winged Cone-head *Conocephalus discolor*

In 1996 I wrote an article "50 Years of Orthoptera in Bedfordshire" *Bedf. Nat.* **50**(1). I finished the piece by speculating on what the next species would be:

> "For new species, how about Long-winged Cone-head? They could colonise the county if they got here. At the moment they are found in Hertfordshire, near the boundary in the Pegsdon area, so could 'hop over' at any time."

They are a small bush-cricket usually green with brown dorsal stripe on the head and pronotum with brown wings. The abdomen underside is reddish-brown and

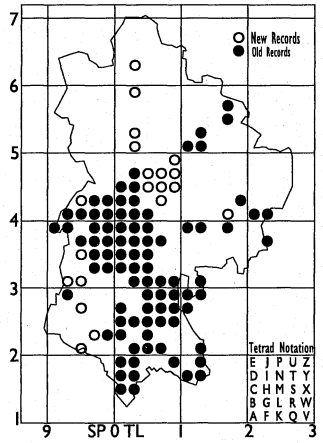


Fig. 1 Distribution of Roesel's Bush-cricket, *Metrioptera roeselii*, in Bedfordshire

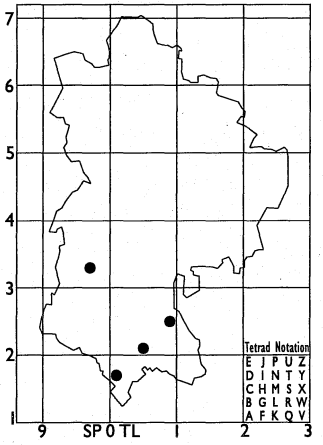
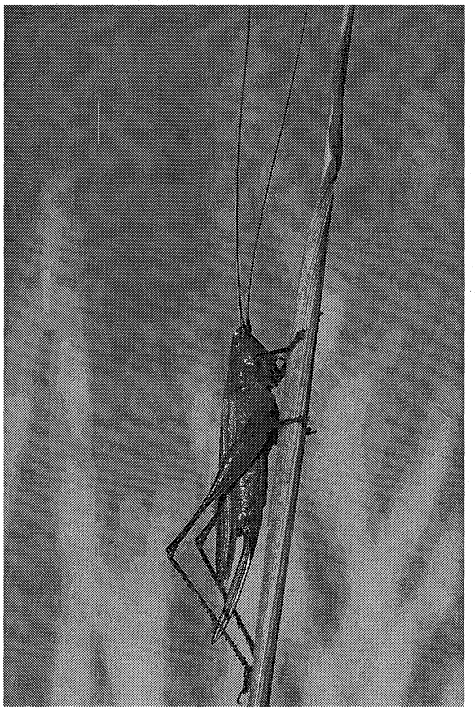


Fig. 2 Distribution of Long-winged Cone-head, *Conocephalus discolor*, in Bedfordshire



Long-winged Cone-head, *Conocephalus discolor*, found by a footpath near Milebarn Farm, 6.9.1997
Photo: Charles Baker

occasionally all-brown forms occur. Both sexes are fully winged, which extend normally to just beyond the abdomen and the hindwings are slightly longer than the forewings. Their length overall is about 16 to 22 mm, in both sexes. This species likes rough ungrazed downland turf, urban wasteland, large woodland rides and clearings, plus wet and dry heathland.

The Long-winged Cone-head has now been recorded in the county so please keep an eye out for them and send me any records you may find. Thank you.

SP93R - Eversholt - Singing male
TL01C - Milebarn Farm/Ravensdell Wood - 1 male and 1 female
TL02K - Cottage Bottom, Dunstable - Male
TL02X - Cowslip Meadow, Luton - Male

Speckled Bush-cricket *Leptophyes punctatissima*

Recorded in 20 tetrads from July to October at SP92E, SP93T, SP95P/V/W, SP96V/W, TL04N/V/W/X/Z, TL05A, and with seven previous unrecorded tetrads which are:

SP93F - King's Wood, Heath and Reach
SP93G - Charle and Lowes Wood, Woburn; SP93M/S - Woburn Park
SP95Z - Felmersham Pits
TL04R - Wilstead
TL14W - Biggleswade

House Cricket *Acheta domesticus*

Recorded in three tetrads in September at TL04M/N and one previous unrecorded tetrad of:

TL03I - Cedar Close, Ampthill

Slender Ground-hopper *Tetrix subulata*

Recorded in ten tetrads from July to November at SP93J, SP95Z, TL02N, TL04Z, TL05A and with five previous unrecorded tetrads of:

SP92E - Stockgrove Park
SP93S - Woburn Park
TL04M - Elstow Industrial Estate; TL04T - Harrowden
TL24E - Sandy Heath

Common Ground-hopper *Tetrix undulata*

Recorded in eight tetrads from July to October at SP92E, SP92J, TL04R and with five previous unrecorded tetrads of:

SP93G - Charle Wood; SP93H - Wavenden Heath
SP95X - Stevington Marsh
TL04X - Exeter Wood
TL24E - Sandy Heath

Common Green Grasshopper *Omocestus viridulus*

Recorded in 14 tetrads from July to September at SP91Z, SP92E/J, SP93F/H, SP95Q, TL01D, TL05A/F and with five previous unrecorded tetrads of:

SP93S - Woburn Park
SP95P - Odell Wood; SP95V - Bromham Hospital
TL04E - River Ouse Meadow
TL14W - Biggleswade

Field Grasshopper *Chorthippus brunneus*

Recorded in 54 tetrads from 7th May to 30th October at SP91Z, SP92E/J, SP93F/G/H/I/K/L/M/N/S/T/Y, SP94R/S/Z, SP95Q/X/W, SP96V/W/Y, TL01C/D/E/Z, TL04E/L/M/N/P/R/T/V/X/Y/Z, TL05A/F, TL11E/I/J, TL14A/F/K/W, TL24E

and with six previous unrecorded tetrads of:

SP91Y - Whipsnade Zoo
SP94L - Cranfield Airfield
SP95Z - Felmersham
TL01I - Studham
TL04S - Duck End; TL04W - Manor/Hammerhill Farms

Meadow Grasshopper *Chorthippus parallelus*

Recorded in 30 tetrads from 15th May to 30th October at SP91Z, SP93E/J, SP93F/G/H/N/T/Y, SP94R/S/Z, SP95Q/V/W/X/Z, SP96V/W, TL01C, TL04W/X/Y, TL05A/F, TL14A/F/K and with two previous unrecorded tetrads of:

SP93S - Woburn Park
TL11I - Luton Sewage Works

Lesser Marsh Grasshopper *Chorthippus albomarginatus*

Recorded in 42 tetrads from 7th May to 30th October at SP93H/I/M/N/S/T/Y, SP94Z, TL04E/L/M/N/P/T/V/X/Y/Z, TL05A/F, TL14A/F/K/W, TL24E and with 15 previous unrecorded tetrads of:

SP92E - Stockgrove Park; SP92F/J - King's Wood, Heath and Reach
SP93G - Charle/Lowes Wood
SP93K - Potsgrove; SP93L - Woburn
SP94G - Wharley End; SP94L - Cranfield Airfield
SP94R - Bourne End; SP94S - Cranfield
SP95Z - Felmersham
SP96V - Sharnbrook Tunnel
SP96Y - Newton Bromswold
TL04S - Duck End; TL04W - Manor/Hammerhill Farm

Mottled Grasshopper *Myrmeleottix maculatus*

Recorded in three tetrads from July to August at SP923, SP93H and TL24E.

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BUGS (Hemiptera-Heteroptera)
by Bernard Nau

In the year under review, 1997, the number of additions to the County List is back to normal after an exceptionally high number in the preceding year. Both of the additions listed below were found on the same day, at Willington. Other species found at the same time include *Chorosoma schillingi* and *Aelia acuminata*, in neglected grassland adjoining gravel workings. The former was fairly common and included two mating pairs. Each of these species is apparently consolidating after spreading from a nucleus at Sandy. *Arenocoris falleni* is also apparently now well established, numbers being seen at Cox's Hill, Sandy, and at Maulden Wood. At the latter site *Spathocera dahlmanni* were seen again this year; on the 19th August three adults and two 5th instar nymphs were seen where previously seen.

This year persistence was rewarded. During the last year or two I have been trying to find a small black shield-bug, *Thyreocoris scarbaeoides*, reputedly associated with violets. Only a single specimen had been seen in the county, on rubbish on Sundon rubbish tip in September 1944 by Edgar Milne-Redhead. I deduced that the appropriate violet should be Hairy Violet, as this is locally common on the chalk escarpment, and therefore I was concentrating on this plant. On 15th May 1997 I found a male and female under Hairy Violet on Pegsdon Hills. Ten days later six were found under the same host on Bison Hill, Whipsnade, followed on the 27th by five at Sharpenhoe Cutting and seven on Barton Hills. Very satisfactory!

It is good to be able to report further records of a large but scarce Bedfordshire species, *Alydus calcaratus*, in a disused sand quarry at Clophill, 7th August, and on a filled-in sandpit at Billington Road, Leighton Buzzard, 15th June. A specimen of the tiny lace-bug *Acalypta parvula*, was swept by Rammamere Heath on 13th September, a new 10 km square record of a species probably much overlooked. *Nysius senecionis*, a ground-bug only recently added to the British list, and *Metapoplax ditomoides*, another which has 'exploded' from great rarity, were found at further sites in the county this year. New sites for the black Forget-me-not shield-bug, *Sehirus luctuosus*, were added at Aspley Wood, 2nd May, and Sundon Quarry, 29th May.

Bugs seen in exceptional numbers included: *Coreus marginatus* 99 at Maulden Wood on 28th September and 20 at Hollington on 2nd October; and *Palomena prasina* 56 at the edge of Leete Wood, Barton on 18th October.

ADDITIONS TO THE COUNTY LIST

[...] denotes the revised national Red Data Book status ('RDB') in Kirby (1992, *A review of the scarce and threatened Hemiptera of Great Britain.* JNCC).

Coreidae

Bathysolen nubilus (Fallén) : ['Notable B']

On 3rd August 1997 two adults and two nymphs were found on the former railway track at Willington, amongst rosettes of Common Storksbill (*Erodium cicutarium*) growing on sparsely vegetated 'cinders'. The host plants are reportedly medicks, some of which were present nearby. The British distribution is centred on Kent, with some scattered records from East Anglia, the London area and Buckinghamshire. Another

possible nymph of this species was seen in a disused sand quarry at Clophill on 7th August.

Miridae

Monosynamma bohemani (Fallén) : [RDB 3, 'Rare']

At Willington gravel quarry on 3rd August 1997 numbers of *Monosynamma* were found on young willows growing on sand in a lagoon used to collect silt from gravel washing. Their identity is not a simple issue; three species of *Monosynamma* are recognised from Britain by Woodroffe (*The Entomologist*, **100**, 217–222, Sept.1967). However, these can only be separated by comparing series of specimens, as differences between species are slight. The most widespread is *M. sabulicola*, which has been found in habitat similar to Willington both in Bedfordshire (in 1981 at Odell and Radwell) and elsewhere in the Midlands (Kirby, *op. cit.*); it also occurs in coastal dunes. The identity of the 1981 Bedfordshire specimens was confirmed by W. R. Dolling. A second species, *M. bohemani*, is known in Britain from only one site, Virginia Water in Surrey, where it was found in the early 1960s (Woodroffe, 1962, *Ent. mon. Mag.*, **98**, 272). At Willington I collected two male and three female *Monosynamma* and from measurements of Woodroffe's diagnostic ratios (3rd antennal segment:vertex, and pronotum width: head width) all but one should be assigned to *bohemani*. They do not overlap Bedfordshire *sabulicola*; the odd bug out has an exceptionally long 3rd antennal segment which puts it far into the band for *sabulicola*. On the other hand, although the lengths of the Willington bugs are generally below the range given by Woodroffe for *M. sabulicola.*, they are larger than the Bedfordshire *sabulicola*.! Furthermore, Woodroffe (1967, *op. cit.*) points out that the British *Monosynamma* have to be regarded as 'a group of sibling species pending further evidence'. In the light of the Bedfordshire situation it seems increasingly likely that *sabulicola* and *bohemani* are one species, and the Red Data Book status should be down-graded, in the meantime the Willington bugs are considered here as *M. bohemani*.

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BUTTERFLIES
by Charles Baker

General

The 1997 butterfly season started very early with the unusually warm weather in March and April leading to exceptionally early emergence of some species. The deterioration of the weather in June may have interfered with flight and egg-laying of some species which could result in lower numbers in 1998. July and August were mostly hot and dry and species flying at this time were mostly around in good numbers. The warm spells which continued into October allowed a third generation to emerge in some species. Both the Bedfordshire Chalk Grasslands Butterfly Survey and the various transect walks continued to play a key role in monitoring butterfly numbers. References to them in the paragraphs that follow relate to the report by Herbert (1998) in which the results are set out in detail.

The totals of sightings and number of species ( ) for the various transects were:

	1995	1996	1997		
Barton Hills	2822 (25)	3673 (28)	4485 (27)	(GB & DW).
Blows Downs – north	1571 (25)	984 (19)★	1477 (23)	(EM and others)
Blows Downs – west	2057 (22)	895 (23)★	731 (21)★	(EM and others)
Bradgers Hill	2449 (21)	2202 (16)	2150 (22)	(TT)
Dunstable Downs	1302 (20)	1069 (27)	1018 (25)	(PO and others)
Galley & Warden Hills	1947 (21)	2872 (27)	3131 (24)	(MM)
Hill Rise, Bedford	579 (19)	943 (22)	1133 (22)	(B&YA)
Potton Wood	4112 (25)	4251 (22)	9284 (22)	(IW, BF)
Priory Park, Bedford	2532 (20)	2680 (21)	1920 (19)	(RB & EN)
Sharpenhoe Clappers	–	5837 (30)	7079 (29)	(D&LC)
Sundon Quarries	–	5215 (28)	2676 (27)	(PG)
Totternhoe Quarry	1793 (29)	2565 (30)	2215 (26)	(AW & LJB)
Whipsnade Downs	4223 (28)	8026 (29)	7464 (28)	(GH and others)

★ – not comparable with other years.

Comparisons with 1996 in the paragraphs on individual species (below) are based on up to eight of the transect reports for which such comparison can be made. Owing to unavoidable variations in the level of monitoring of some transects, it has not been possible to use the same transects for these comparisons as in the 1996 report. The totals for 1996 are given in ( ) after the 1997 totals.

Skippers

Small Skipper *Thymelicus sylvestris* and **Essex Skipper** *Thymelicus lineola*

Usually not distinguished in transect counts. Numbers similar to 1996 (total for 8 transect sites was 1273 (1338); increased at 5 out of the 8 sites). On 23 July 185 Essex Skippers were counted in about 200 yards on a field track near Haynes (CB & JCA).

Large Skipper *Ochlodes venata*

More common in 1997 than in 1996. The total for 8 transect sites was 766 (370) but increased at only 4 out of the 8 sites. A large increase in the number seen on Galley and Warden Hills accounted for much of the increase on the totals.

Dingy Skipper *Erynnis tages*

A good year with much increased numbers on several sites including Barton Hills, Sharpenhoe Clappers and Totternhoe Knolls and Quarry. The total for the 4 transect sites on which it was found was 82 (27); increased at 3 out of the 4 sites. The clay pits in the Marston Vale continued to be a focus for this species. A welcome recovery after a number of years with low numbers.

Grizzled Skipper *Pyrgus malvae*

Increased substantially on Whipsnade Downs (47 (23)) but fewer were seen on Dunstable Downs (17 (36)). It was not seen on two other transect sites so the total count on the 4 transect sites on which it was found in 1996–7 was only 64 (62). Records in Great Hayes Wood and adjacent to Odell Great Wood (HAS) were two new sites and some were also seen in the clay pits in the Marston Vale.

Whites

Wood White *Leptidea sinapis*

No reports have been received of Wood White being seen. One can only hope it is still hanging on in the county.

Clouded Yellow *Colias croceus*

Only one unconfirmed report was received.

Brimstone *Gonepteryx rhamni*

Although this species seemed particularly common in the spring in Chicksands Wood (JCA) and some other areas, the total for the 8 transect sites was 418 (607). It increased at only 1 out of the 8 sites. Several courting pairs were seen on the Downs in mid-May. This is the only time when it is possible to see the uppersides of the wings of this species which always rests with the wings closed.

Large White *Pieris brassicae*

More common than in 1996 on many sites. The total for 8 transect sites was 1391 (212); increased at all 8 sites.

Small White *Pieris rapae*

Especially common towards the end of the season with 1490 counted on one occasion in Potton Wood. The total for 8 transect sites was 6992 (1123); increased at 7 out of the 8 sites.

Green-veined White *Pieris napi*

Appeared variable in numbers but the total for 8 transect sites was 2012 (426). Much of the difference was due to the large numbers in Potton Wood although 7 out of the 8 sites showed an increase.

Orange Tip *Anthocharis cardamines*

Reported as abundant in the Haynes area (JCA and K&MW) and numbers were slightly up on most transect sites. The total for 8 transect sites was 114 (68); increased at 5 out of the 8 sites.

Hairstreaks

Green Hairstreak *Callophrys rubi*

Perhaps slightly less common, the total for 5 transect sites was 32 (42); increased at only 2 out of the 5 sites on which it was found.

Purple Hairstreak *Quercusia quercus* and **White-letter Hairstreak** *Satyrium w-album*

We have no counts of these species but they could both be seen in their usual haunts. Several new sites for the latter were reported, including Halsey Wood (HAS), Studham Common(CB) and Woburn (BN).

Black Hairstreak *Satyrium pruni*

Very few were seen, probably because they were already over by the time people started looking for them.

Coppers, Blues and Metalmarks

Small Copper *Lycaena phlaeas*

Had a good year on some sites such as Chicksands Wood (JCA) and Whipsnade Downs. The total for 8 transect sites was 59 (42); increased at 5 out of the 8 sites.

Small Blue *Cupido minimus*

Abundant on some sites. An opportunity to visit Kensworth Quarry revealed great areas of Kidney Vetch and many Small Blues, a welcome sight in this working quarry which is not normally accessible. New sites reported included the old Dunstable to Luton railway line (SH) and the Barton A6 cutting (RCR). The total for 3 transect sites was 25 (13); increased at only 1 out of the 3 sites on which it was found.

Brown Argus *Aricia agestis*

Seemed to be much less common generally. The total for 8 transect sites was 636 (1599); declined at all the 8 sites. Only a few were seen at Cople Landfill site where it was present in hundreds in 1996 (RCR). A partial 3rd brood was flying in late September and early October.

Common Blue *Polyommatus icarus*

Numbers similar to those in 1996. The total for 8 transect sites was 1022 (1039); increased at only 4 out of the 8 sites.

Chalkhill Blue *Lysandra coridon*

Very abundant on some of the downland sites. Through the season 1780 were counted on Barton Hills and 1291 on Sharpenhoe Clappers. The total for the 6 transect sites on which it was found was 4402 (3198); increased at 3 out of the 6 sites. Groups of males could be seen on dung and rabbit carcases.

Holly Blue *Celastrina argiolus*

Numbers overall were similar to 1996. The total for 8 transect sites was 208 (211); increased at 4 out of the 8 sites. It was common in the spring but high levels of parasitism were found on the summer caterpillars (RCR). The autumn flight was sparse and a number of parasites emerged in the autumn from the resulting pupae (RCR).

Duke of Burgundy *Hamearis lucina*

Was flying very early and was more common than in 1996 with a total of 67 (34) in Totternhoe Quarry and on Whipsnade Downs, the only 2 sites on which it was seen.

Nymphalids

White Admiral *Ladoga camilla*

Scarce in Chicksands Wood where forestry operations may have damaged the honeysuckle (JCA) but excellent numbers were present in West Wood where 30 were counted on 9 July between 4 and 6 pm (HAS). Two examples of the black form without the white bands, ab. *nigrina*, were seen there on one day (RCR).

Red Admiral *Vanessa atalanta*

Widespread though less common than in 1996. The total for 8 transect sites was 47 (150).

Painted Lady *Cynthia cardui*

Very few seen, far less than in a "normal" year and in marked contrast to 1996. The total for 8 transect sites was 4 (1707).

Small Tortoiseshell *Aglais urticae*

A large immigration of Small Tortoiseshell was reported on the East Coast at the end of August and it is possible that their abundance in Bedfordshire was in part due to this. The total for 8 transect sites was 1465 (790); increased at 7 out of the 8 sites.

Peacock *Inachis io*

Seemed to be slightly down in numbers in the late summer flight, although over 100 were counted on one transect walk on Whipsnade Downs. The total for 8 transect sites was 886 (1818); increased at only 2 out of the 8 sites.

Comma *Polygonia c-album*

As in 1995 the warm weather in April allowed early egg-laying so at the beginning of the next emergence many of the butterflies were the *hutchinsonii* form. The total for 8 transect sites was 103 (83); increased at 5 out of the 8 sites.

Fritillaries

Dark Green Fritillary *Argynnis aglaja*

The highlight of the year in Bedfordshire was the sighting of numbers of this fine species on Barton Hills, Smithcombe and Sharpenhoe Clappers. The total for the 2 transect sites was 13 (3). The presence of several females raises hopes that breeding colonies are now established there. Perhaps they will spread out into other areas. Singletons seen elsewhere include Cranfield (DA), Charle Wood (DB) and a probable in Southill Park (DB). On a historical note, both N.Dawson and T.J.Thomas have written that the record for Old Warden Tunnel in 1984, included in Arnold *et al.* (1997), was a mis-identification.

Silver-washed Fritillary *Argynnis paphia*

As in previous years there were several sightings in the county, including one in Odell Great Wood (PA, HAS). Other sightings were reported from just over the county boundary in Markyate and further west in the Chilterns but it is still not clear whether these represent releases or natural spread.

Browns

Speckled Wood *Pararge aegeria*

Numbers were up on some downland transect sites but reported as somewhat down in numbers in some woods. The total for 8 transect sites was 459 (343); increased at 6 out of the 8 sites.

Wall Brown *Lasiommata megera*

Although still present on Sharpenhoe Clappers in reduced numbers, the virtual absence of this species elsewhere continues to cause concern. The total for 8 transect sites was 30 (70); declined at all the 8 sites. The few that appeared late in the season are unlikely to have produced any offspring. Very little seems to be known about the natural fluctuations in numbers of this species so we do not know if the low numbers are due to natural or man-made causes.

Marbled White *Melanargia galathea*

Continues to be found in new localities and appears to be now breeding in sites where single individuals were seen in previous years. A sighting in Conduit Street in Bedford showed the value of watching out for the unexpected (B&YA). Numbers were up on most downland sites: the total for 8 transect sites was 1707 (1249); increased at 6 out of 6 sites where it was found.

Gatekeeper *Pyronia tithonus*

Present in its usual large numbers in Chicksands Wood (JCA) and well represented elsewhere. The total for 8 transect sites was 3432 (3622); increased at 5 out of the 8 sites.

Meadow Brown *Maniola jurtina*

Remains very common though counts were slightly down on some sites compared with 1996, particularly at Priory Park. The total for 8 transect sites was 4667 (5936); increased at only 1 out of the 8 sites.

Ringlet *Aphantopus hyperantus*

Also common with numbers up on 1996. The total for 8 transect sites was 1674 (971); increased at all the 8 sites.

Small Heath *Coenonympha pamphilus*

Continues to be an anomaly, being locally common but absent from other sites which appear equally suitable. The total for 8 transect sites was 1750 (1807); increased at 4 out of the 8 sites.

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Bedfordshire Naturalist for 1997, No. 52 (Part 1) (1998)

THE LENGTH AND QUALITY OF SHRUB-GRASSLAND BOUNDARIES AS DETERMINANTS OF GATEKEEPER BUTTERFLY ABUNDANCE AND DISTRIBUTION

by Brian Anderson

Introduction

The Gatekeeper (or Hedge Brown) butterfly, *Pyronia tithonus* (Linn.) (**Lepidoptera: Satyrinae**), has for some years been reported as extending its range. There seems to have been a northward extension of range of about 1° of latitude between 1940 and the present day (reports of a distribution extending into southern Scotland in the nineteenth century have been largely discounted). (Ford 1945, Heath *et al* 1984, Thomas & Lewington 1992, Pollard & Yates 1993, 7 & 125, Thomson 1980). This is anecdotally illustrated by a comment from Keele (Emley 1996): "This species was unheard of in North Staffordshire 10 years ago but now it is quite common. At Keele we are getting increasing numbers...". Indeed, a great deal of the increase in range (on average about 120km) has occurred since 1970. This raises questions as to how the species colonises new areas (or recolonises areas subjected to previous extinction) and what factors may influence the abundance of the Gatekeeper in any particular location or habitat type.

This study investigates the possible link between the length of "optimum" margin (or ecotone) and the index of abundance (Pollard & Yates 1993, 10–20) for a range of sites, and the pathways that may exist for the mutual reinforcement of populations between two Local Nature Reserves (LNRs) towards the north of Bedford.

The shrub-grassland boundary as a determinant of abundance index: methodology

The preferred habitat (or more strictly biotope) of the Gatekeeper is a shrubby area with ample sunlight and tall grass and herbs at the foot of the shrubs. Such biotopes are represented by open scrub, wood margins and relatively (but not totally) unmanaged hedges. The definition of what constitutes an ideal margin for the successful establishment and maintenance of a Gatekeeper population is, from the standpoint of this paper, subjective. Initially, it was assumed, on the basis of a pilot study (Anderson & Sparkes, unpublished data) that defining the optimum or adequate habitat would be relatively straightforward. However, after a number of frequently walked transects in Bedfordshire were selected for the analysis, together with one from Norfolk, and had been visited, it was clear that the proposed methodology was too simplistic. It had been assumed that a simple linear measurement of the margin would suffice, qualified by double-edged areas such as green lanes and woodland rides, and the need to quantify shrub-grassland margins in open scrub. However, the visits, and discussion with regular site recorders showed that careful observation would be required. In particular:

- Some woodland rides and edges met the condition that there were tall grasses and herbs at the edge of trees, but often there was no shrub layer and the ride vegetation was lush and very tall (Woiwod 1997).

- Open scrub on a number of sites was on over-grazed grassland and did not meet the condition of the adjoining herb layer. The amount of scrub included in the study was limited to that not more than 10 metres from the transect, since over greater distances Gatekeepers were unlikely to be included in the transect survey.
- Conversely, some sunken lanes supported significant Gatekeeper populations although there were few shrubs.
- Management of the sites played a significant role: a shrub margin might appear on one visit to be ideal, but later in the season, wholesale mowing would reduce the suitability significantly.

As a result, the methodology was adapted to take account of what might be called the microtopography. The linear distances were derived both from pacing the transects and from maps. The indices of abundance were taken from Herbert (1997): only one year was chosen as variations in abundance from year to year are significant and different sites have been recorded over different numbers of years (Parkwood LNR had its first transect recording in 1997). Also, the use of only one year was adopted with some confidence since Gatekeeper populations at different sites show close synchrony (Pollard & Yates 1993 68).

The shrub-grassland boundary as a determinant of abundance index: results

Figure 1 shows the index of abundance plotted against optimum habitat length for some 12 sites. The data are given numerically in Table 1.

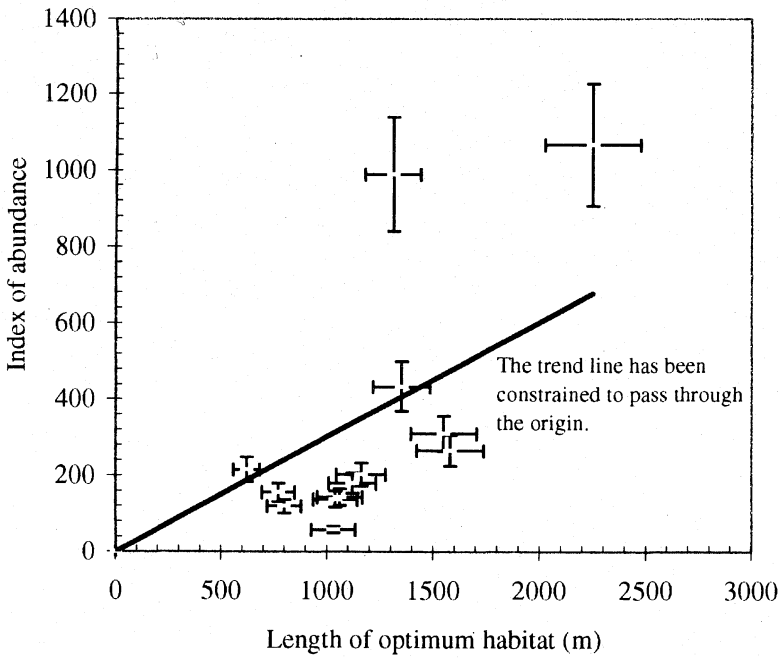

Fig. 1 Length of optimum habitat vs. abundance

Table 1: Length of optimum habitat vs index of abundance

Site name and number	Grid reference	Length of suitable habitat on transect (m)	1997 index of abundance	Index per 100m
1. Hill Rise	TL0451	770	156	20
2. Parkwood	TL0451	1030	59★	6
3. Priory	TL0749	1350	434	32
4. Snettisham (Norfolk)	TF6533	1040	138★	13
5. Whipsnade	TL0018	2250	1067	47
6. Potton Wood	TL2550	800	120	15
7. Sharpenhoe	TL0630	1310	990	76
8. Warden Hills	TL0926	1580	266	17
9. Dunstable Downs	TL0020	1120	180★	16
10. Blows Downs North	TL0322	1060	144	14
11. Blows downs West	TL0322	620	216†	35
12. Barton	TL0930	1550	310	20
13. Totternhoe	SP9822	1160	202	17

★ Interpolated data included. † Partial data: remainder of emergence estimated from mean of all other sites normalised against available date from site.

It is intuitively clear from the regression line in Figure 1 that there is a relationship between the optimum habitat length and the Gatekeeper population as represented by the index. A simple linear regression suggests that about 10 percent of the population size can be attributed a linear measure of suitable habitat (but see note on statistics).

Hedges and hedge-like structures as corridors for Gatekeeper dispersal: Methodology

The fact that a large and apparently isolated Gatekeeper population exists on Hill Rise LNR (TL065510) has been mentioned elsewhere (Anderson 1996). The establishment of regular transect recording at the new Parkwood LNR (transect start at TL045513) led to speculation that the respective Gatekeeper populations might be linked by the exchange of

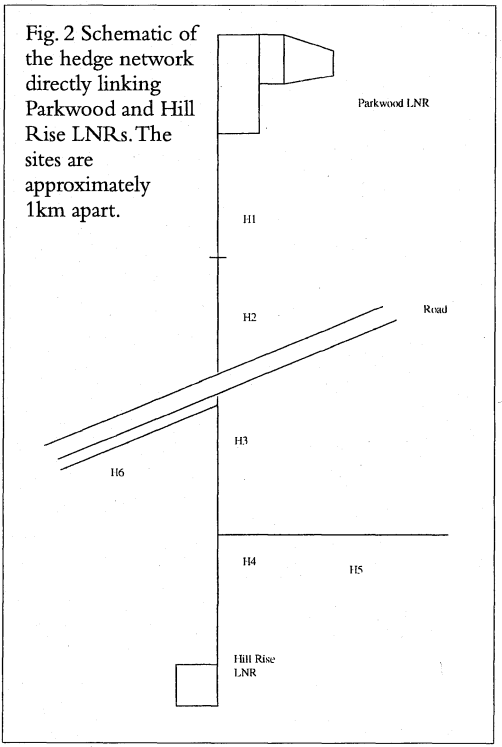

Fig. 2 Schematic of the hedge network directly linking Parkwood and Hill Rise LNRs. The sites are approximately 1km apart.

the occasional adult. Over the 1997 season, regular surveys were conducted over the hedges that most directly linked Parkwood and Hill Rise – these are shown schematically in Figure 2.

Initially , the use of mark and recapture techniques was considered to establish whether the two populations were linked, but an examination of the results presented in Anderson (1996, 1997) indicated that the chance of recapturing a marked individual in one reserve whose origin was in the other was small (less than 4 percent of about 10 individuals). Thus, it was decided that the study would be conducted using the abundance index and mobility studies.

Results

The results of the survey of the hedges H1 to H4 are shown in Table 2:

Survey week	Hedge number and weekly mean			
	H1	H2	H3	H4
18	4	0.3	0	1
19	7	2	0	1.5
20	5	0	2	1.3
21	6	2	0	0
22	3	0	0	0.5
23	1	0	0	0
Abundance	26	4.3	2	4.3

The survey weeks are those used in the Butterfly National Monitoring Scheme

Over the same period, a more general survey was conducted over the whole area lying between Hill Rise and Parkwood. In total, some 15 Gatekeepers were seen, all but one flying along a hedge or hedge-like feature. It can be seen from Table 2 that the largest number of Gatekeepers in the hedge survey was seen at H1. This may be thought unsurprising since it is so close to Parkwood, but in fact it is over 190m from the nearest suitable habitat on the reserve.

The direction of Gatekeeper flight on each hedge was also recorded. In the majority of cases (where any flight direction was discernible) the insects flew along the hedge – there was little inclination for individuals to fly away from the hedge.

Discussion

(i) Population size and shape

This study was prompted in part by a comment made by Warren (1992) that the Gatekeeper needs an area of not less than 1 – 2ha to maintain a viable population. This seemed counter-intuitive – an area parameter for a species like the Meadow Brown, *Maniola jurtina*, is quite valid; it is a species of open grassland. But the Gatekeeper is a species whose populations are, for the most part, geographically linear in distribution. However, Warren was doing no more than reflecting the conventional wisdom of the late eighties – butterflies were sedentary or they were mobile – they had closed or open populations. Although these descriptions still have some use, this view has been

largely rejected for population studies over time (Warren 1998: personal communication): butterfly populations are regarded as complex dynamic structures. This change in understanding is prefigured by Pollard and Yates (1993, 226), where they state that, certainly for common and widespread butterflies, species occur in more or less interconnected populations and that "it is likely that, in any one year, only some of these populations reach their resource limit; these 'successful' populations may produce a surplus of individuals which disperse to, and so sustain the less successful populations". This approach to interconnectivity has been formalised by Thomas (1995) whose work on metapopulations has shown that the elements of a more widespread population can be seen as a mosaic of smaller, perhaps temporary, populations with varying degrees of connectivity.

Gatekeeper population size has been shown above to be a function of suitable habitat length. As was discussed above, establishing habitat suitability is not always a simple matter. The Gatekeeper requires seral stage 3 (tall grass and herbs with scattered shrubs) to establish a viable population (Shreeve 1992a). This statement conceals details which are definite habitat requirements or restrictions: the turf height should be between 5 and 20cm (Brakefield *et al* 1992) or 8 to 15cm (Porter *et al* 1992). Sheltered sites offering respite from the wind, and aestivation and warming spots are of benefit, as is a range of perennial nectar sources and topographical or botanical features allowing perching at a continuous range of heights up to 2m. North-facing sites, over-lush growth and heavy shading are generally not favoured.

In an interesting study by Dover (1996), where a number of factors that that may influence the abundance of Gatekeepers is examined, it is shown that the distribution of Gatekeepers on a North Hampshire farm is strongly influenced by nectar sources and shelter. Nectar sources were the principal positive variable in determining the abundance of females, and shelter was the primary variable for males. Dover also shows a significant negative variable for Gatekeeper abundance for those cases where the hedge was adjacent to a farm track. He concludes that frequently used farm tracks may coat the vegetation with dust, thus reducing the palatability of the grasses used by the larvae (*Agrostis*, *Festuca* and *Poa* species and others), and that farm tracks may act as wind tunnels, reducing butterfly activity. This last assertion is not supported by this current study, nor by other studies which have found green lanes of positive benefit – indeed, Dover undermines his own argument in his calculation of shelter scores for butterflies. It may be that Dover has missed one factor from his analysis: farm tracks tend to be managed more frequently than similar boundaries. The current study certainly found that on those sites where apparently suitable habitat was subject to frequent mowing, the Gatekeeper abundance was reduced. The fact that Dover finds a greater negative effect for females than males adds weight to the assumption that the effect on the larval foodplant is significant. Further, an examination of the natural history of the Gatekeeper suggests that mowing would have a deleterious effect on numbers. Eggs are attached singly to grass blades adjacent to shrubs; the larvae rest in the basal area during the day and the pupae are suspended low in the foodplant (Brakefield 1992). The net result is that close mowing will induce significant mortality. It must also be admitted that modern ploughing techniques reduce habitat by cultivating closer to hedges, whether adjacent to a track or not (Baker & Arnold 1997).

Dover also concludes that the presence of Cow Parsley, *Anthriscus sylvestris*, is negatively correlated with Gatekeeper abundance, since by July the dead stalks swamp other emergent vegetation. One site extensively examined during the present study (Hill Rise) does not provide support for this conclusion – a relatively high Gatekeeper abundance is correlated with extensive Cow Parsley growth.

Summarising, it is clear that whether assessed by numerical and statistical survey, by mobility studies or by subjective assessment of numbers, the size of a Gatekeeper population is strongly dependent on the length of good habitat.

But does this have anything to do with how the species colonises or recolonises?

(ii) Colonisation, recolonisation and movement between colonies

It is demonstrated in the results of this study that the Gatekeeper benefits from the linear nature of its population distribution in that corridors for dispersal are presented anywhere where a network of hedges, wood edges or patches of open scrub exist: the population shape itself presents opportunities for movement. It is an established fact that Gatekeepers will change their flight direction when they meet a hedge or other tall vegetation (Shreeve 1992b). This tends to be observed as the butterfly approaches the obstacle at some angle and then flies along a direction parallel to it. Anderson (1996, 1997) showed Gatekeepers are more likely to fly along a hedge than over it, although gaps or sections of reduced height will facilitate access to both sides. Both males and females will be seeking shelter and nectar, males will be patrolling for mates (Shreeve 1992a) and females seeking egg–laying sites. Further studies on the influence of landscape features on butterfly mobility are given in Dover and Fry (1996) and Dover *et al* (1996).

The results reported on surveys on the hedges linking Hill Rise and Parkwood LNR's (Table 2) suggest that hedges may act as conduits for movement between the two sites. However, there is a strong suggestion that hedge H1 may support a small, possibly temporary, population of Gatekeepers. The abundance index for Parkwood in 1997 was 59. For H1 it was 26. It is hard to believe that the equivalent of 44 percent of the population of Parkwood migrated to a section of hedge some 190m away. H1 is a mixed hedge with shrubs Hawthorn, *Crataegus monogyna*, Crab Apple, *Malus*, Blackthorn, *Prunus spinosa*, Roses, *Rosa*, Dogwood, *Cornus sanguinea*, Bramble, *Rubus fruticosus* and Elder, *Sambucus nigra*, Tall herbs such as Ragworts, *Senecio*, Bristly Ox-tongue, *Picris echioides*, Black Horehound, *Ballota nigra*, and Knapweeds, *Centaurea*, as well as the larval foodplant mentioned above. There are also some standard trees of Oak, *Quercus robur*, and Poplar, *Populus*.

It is not clear whether the limit of the population at H1 is determined by the apparent length of adequate habitat – the path adjacent is mown during the Gatekeeper emergence and may create a limit to the species' abundance (but see note on statistics).

The other surveyed hedges on the Hill Rise–Parkwood route do not seem to have resident populations – indices for H2 to H4 inclusive were each less than 5, and mobility studies showed that these Gatekeepers were tending to fly long (greater than 10m) distances along the hedge without stopping. This is unsurprising in that hedges H2 to H4 tend to have rather sparse herb and grass boundaries, and H4 is especially of

limited suitability to Gatekeepers as the shrubs are widely spaced and heavily shaded by trees. Nevertheless, the total of some 11 individuals on H2 to H4 represents the group that is available for colonisation elsewhere. From Anderson (1996, 1997) it is possible to very roughly estimate the actual numbers of Gatekeepers that may leave Hill Rise and so be potential colonisers. Mark and recapture studies and transect recording showed that the total emergence was around 1,500 (scaled for 1997) and the weekly mean was around 50 respectively. This would suggest about 30 individuals leaving Hill Rise over a season. If half fly north, then 15 would reach the junction of H4 and H5 shown in figure 2. H5 was recorded as having an index of 8 in 1997. It therefore seems reasonable to assume that between 8 and 13 Gatekeepers could reach the northern end of H3 where the only serious impediment to progress is reached in the form of a busy road. Although one Gatekeeper was seen within 5m of the road on H3, it seems likely that the butterflies would tend to fly along hedge H6 bordering the road rather than flying across the road. The situation is different for butterflies moving south from H1 – here the hedge ends abruptly within 2m of the road, and Gatekeepers may be able to take a visual cue from the hedge on the other side. Again a Gatekeeper was seen within 2m of the road edge, this time flying south, eventually returning north on the other side of the hedge. The conclusions cannot be conclusive but the movement of Gatekeepers north to south from H1 to H4 (and hence to Hill Rise) seems to be more likely than the reverse, even though Hill Rise has the largest abundance. Since a network of hedges extends north from Parkwood to Clapham Park Wood, it is likely that linkage exists between these two sites, although it has not been examined in this study.

A similar but more detailed study of the Ringlet, *Aphantopus hyperantus*, by Sutcliffe and Thomas (1995) shows the butterfly using woodland rides as corridors between glades, rather than direct flight through the woodland. They suggest (from a combination of mark and recapture and mobility studies) that over 98% of Ringlets choose these routes, even though the ride entrance typically represented less than 1% of the glade perimeter. This method of migration is more or less analogous to the Gatekeeper routes described here. An earlier study by Shreeve (1992b) on the Heath Fritillary *Mellicta athalia* comes to the same conclusion about movement between coppiced areas. Further, the study suggests that that the ratio of adults staying in an area of optimum habitat to those migrating elsewhere is of the same order as that suggested by the indices measured at Hill Rise, Parkwood/H1 and H2 to H4/H5 (i.e. about 1%).

It is probably also worth noting that the route H1 to H4 was observed as being used as a corridor by Orange Tips, *Anthocharis cardamines*, Holly Blues, *Celastrina argiolus* and Speckled Woods, *Parage aegeria* during the 1997 season, and was probably the route by which Ringlets recently reached Hill Rise.

Why has the Gatekeeper expanded its range?

It will have been noticed that the foregoing has described the way in which the size, shape and mobility of Gatekeeper populations are dependent upon the geometry of the landscape. What has not been discussed is why the Gatekeeper has expanded its range in the last 60 years. It may be thought surprising that this has occurred, especially since networks of hedges and wood edges have been so reduced. There is no evidence

that the increase in range is reflected in an increase in abundance in the areas where the Gatekeeper is already established. Brakefield (1987) suggested that the phenology (the effects of seasonal change on the life history of an organism) effectively limited the northern range of the Gatekeeper. Unlike the Meadow Brown, where the flight period becomes shorter with increasing latitude, the Gatekeeper's flight period is a very slow function of latitude and this may limit its northward expansion. The main reason for the expansion seems to be climate change (Pollard & Yates 1993, 227–233). The northward expansion of this and other species has reached the attention of the national press (Dean & Neale 1998). It is by no means clear where the northern limit of the Gatekeeper's range will eventually be set.

A note on statistics

The trend line at Figure 1 has been constrained to pass through the origin on the assumption that no suitable habitat will be correlated with a zero count – this obviously ignores casual sightings. The regression plot shows a noticeable scatter of points around the line. It is possible to quantify some of the errors that lead to this scatter.

(i) Observer error. Different observers obtained the data for the various sites. In two references by Pollard and Yates (1993, 26 & 200), the effect of different observers is examined. In the first there was no discernible difference. In the second the differences were of the order of ± 30%. Observer error of ± 15% is taken for this study – such variation may be taken as systematic and not random.

(ii) Transect length. The use of pacing and maps is an inexact method of estimating the length of optimum habitat. An error of ± 10% is presumed.

The error bars in figure 1 represent these errors.

Besides these errors, there are others, which it has not been possible to estimate numerically. These include the precise effect of aspect and shelter, the condition of larval foodplants, the frequency, method and extent of management, and the degree of predation and parasitism. The effect of all sources of errors can be given as the Standard Error, and is measured from the data as ± 70 on the abundance index. The Gatekeeper index per 100m has been calculated in Table 1. Irrespective of the conclusions that may be drawn from the trend line and the associated Standard Error, it is worth noting that 8 of the site indices per unit length are within ± 5 of 15 Gatekeepers per 100m. If the data are partitioned into units of 5, then the mode of the indices is 15 –19. This number is a good predictor of the 1997 season for the 8 sites. It is also true that at hedge H1 the Gatekeeper abundance per 100m is around 20. The sites where the indices fall well outside this range probably have special factors. The two highest index sites (Sharpenhoe and Whipsnade) have exceptionally favourable sections of transect both in terms of the floristic quality and the aspect. The lowest (Parkwood) may have suffered from mowing and scrub clearance in 1996 in preparation for its formal declaration as an LNR. Extension of the methodology to earlier years shows some degree of consistency, declining in the earliest years (Anderson 1998, unpublished data).

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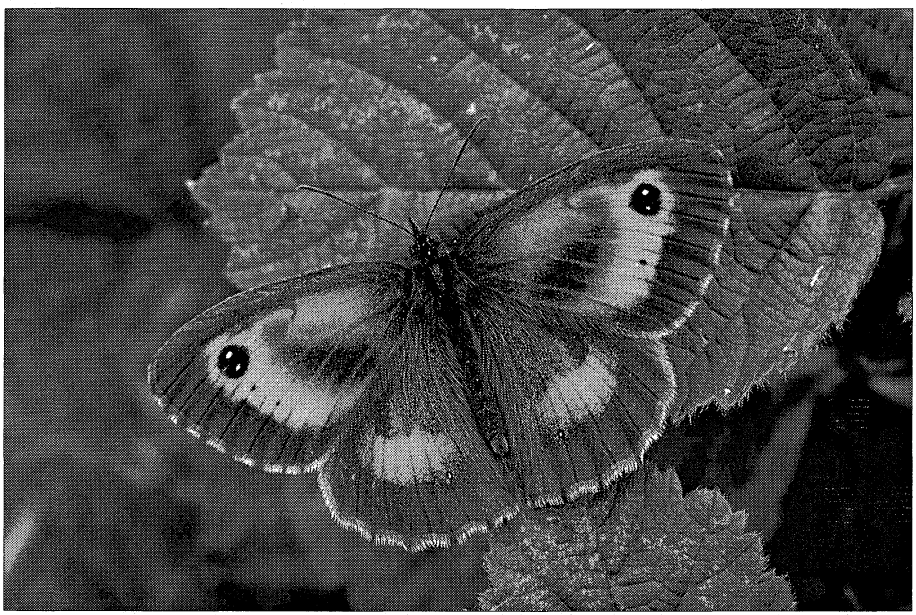
Brian Anderson has had a lifelong interest in butterflies. He was involved in the early stages of establishing the Local Nature Reserve at Hill Rise in Bedford where he currently records butterflies on a transect route, as well as other taxonomic groups.



Male Gatekeeper, *Pyronia tithonus*. *Photo: Richard Revels*

MACRO-MOTHS
by Len Field

This being my first year as recorder I have very much been getting my "feet under the table" and so give my apologies to those people I perhaps should have spoken to and have not. I effectively took over in May and by then the season was well underway and I have been trying to catch up ever since.

1997 followed the trends of recent years whereby it has been getting warmer earlier. This has had the effect of making the moth recording season longer although it is possible to see moths in all months of the year. This year there were a number of earliest ever records for some species.

Generally, however, the number of recorded sightings is down on previous years even with the more common moths. 1996 was considered to be a peak year due to the activity involved in the completion of the book *The Butterflies and Moths of Bedfordshire* but 1997 was even down on 1995. This may be due to the earlier start to the season as there is no evidence of increases in numbers of the moths recorded.

Since the last recorder's report there have been forty-four new 10Km square records. Some of these relate to late 1996 and earlier records only just received. Thirteen of the new records relate to SP93 from Mrs Kelso who has just reported records covering the years 1993 to 1997. Apart from one record still to be confirmed there were no new county records for last year. This possible new record came from the eastern side of the county.

One other record worth identifying was the second sighting for the county of the Scarce Silver Y. The second record was found in SP95, as was the first. This is a moth that may not get the attention that it deserves. A more detailed look at any captures may turn up some interesting results.

All numbers and English names are as per *A Recorder's Log Book or Label List of British Butterflies and Moths* by J.D. Bradley and D.S. Fletcher (Curwen, London 1979).

INDIVIDUAL SPECIES RECORDS FOR 1997

380 **Red Tipped Clearwing**
Recorded by Bernard Nau at Priory Park Bedford (TL05).

1633 **Small Eggar**
Once again recorded as larvae but numbers appear to be well down on 1996. As in previous years records were only from SP95.

1637 **Oak Eggar**
Recorded at Biggleswade (TL14) in his garden by R.C. Revels.

1642 **The Lappet**
Apparently plentiful in the 1980s. Only recorded 4 times in the 1990s and no records for the last two years.

1680 **Maidens Blush**
Recorded for the first time in 1996 at The Lodge, Sandy (TL24) by Joan Childs.

1749 **Dark Spinach**
Recorded for the first time since 1991 at Studham (TL01) by Charles Baker.

1790 **The Tissue**
First record since 1986. Recorded at Ridgmont (SP93) by Mrs Kelso on 1st April 1997.

1835 **White Spotted Pug**
No records received for the first time since 1980. There were never many records but none this year.

1864 **The Streak**
No records received for the first time since 1981.

1874 **Dingy Shell**
Recorded at the Society moth evening at Flitwick Moor on 11th July 1997. This is the first record since 1985.

1972 **Convolvulus Hawk Moth**
Three records in 1997. All three were new 10Km square records. This is a migrant hawk moth and can turn up at any place but these moths are readily available from dealers as larva and we have to consider the possibility of releases or escapees. The new records are Melchbourne (TL06) by M.J. Webb on 2nd September 1997, a dead specimen was found by N.Dawson in a supermarket in Shefford (TL13) on 5th September 1997 and a larva was handed to David Manning on 24th October 1997 from SP95 but unfortunately it did not survive.

1984 **Humming Bird Hawk Moth**
Not recorded in the county for the first time since 1988. Another migrant that was recorded in ten 10Km squares in 1996.

2029 **Brown Tail**
Larvae web handed in to the Luton Council Pest Control Department on 13th May 1997. The record comes from TL02R. Could become an unwanted visitor.

2040 **Four Dotted Footman**
Recorded from the Rothamsted trap at Cockayne Hatley (TL24) on 6th July 1997 and from Chicksands Wood (TL14) by Mark Hammond on the 14th June 1997.

2268 **The Suspected**
Recorded at the Society moth evening on 11th July 1997 at Flitwick Moor (TL03). This is the first record since 1990.

2447 **Scarce Silver Y**
Recorded by Brother John Mayhead at Turvey Abbey on 10th August 1997. This is the second record for the county. Both are for SP95.

2465 **The Four Spotted**
This is a species that is declining nationally and we are lucky to now have four recorded sites for this moth. The fourth site is Eaton Bray (SP92) 28th July 1997 where it was captured in a Rothamsted trap.

From the above it would seem that a number of species are in decline and I am sure that this is not the case. I have tried to highlight the effect that it has on the county records if these moths are not recorded for one year. I am sure that they are still there to be recorded and, as demonstrated by the 32 new 10Km records, will be seen by somebody if they are looked for.

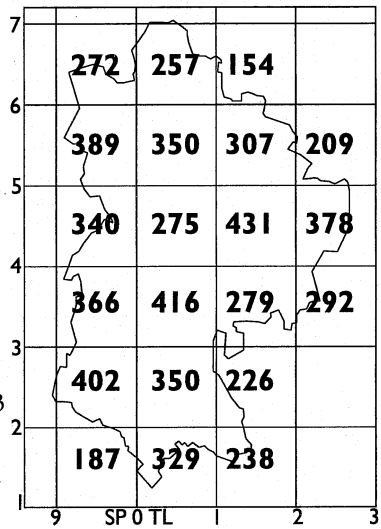
As mentioned earlier there is one possible new record for the county. The moth is the Oblique Striped (1718). Recorded by Joan Childs at Potton (TL24) on 6th August 1997. This is some 70 miles from its normal range. It was apparently plentiful across the border in Cambridgeshire and the Bedfordshire specimen was confirmed by moth trappers from Cambridgeshire. This is a moth to look out for in 1998.

NOTE: For those people who would like to annotate their copy of *The Butterflies and*

Moths of Bedfordshire I have listed below the new 10Km square records, including the 1996 sightings.

SP92 2371(1996 Rothamsted record), 2465
SP93 1705, 1707, 1715, 1766, 1790, 1794, 1839, 1853, 1883, 2157, 2331, 2336 and 2338
SP95 1870, 1972, 2033, 2265 and 2336
SP96 2369
TL01 1647, 1749, 1812, 1840, 1856, 1882 and 2033
TL02 2029, 2088 and 2301
TL05 380
TL06 1952 and 1972
TL13 1972
TL14 1637, 2040 and 2147
TL23 1653 (omitted from book in error) and 2033
TL24 1647, 1680, 2033 and 2040

The revised map by 10Km square with number of species is as opposite.



Number of species recorded in each 10km square – as at 31/12/97

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Len Field is the Society's Recorder for Macro-Moths, a position he took on in an honorary capacity in 1997.

MICRO-MOTHS
by David Manning

My report for 1997 includes the recording of ten species new to the county list. These records can be added to the Society's book, *The Butterflies and Moths of Bedfordshire* as follows:

Haplotinea insectella (Fabricius) (212)
One in the RIS trap at Eaton Bray in August 1997.
Flight: June to August (week 32)★
Larval Food: Stored animal and vegetable products. Fungi out of doors.
Map: SP92

Coleophora conyzae Zeller (521)
One in RIS trap at Cockayne Hatley in July 1996.
Flight: July (week 27)★
Larval Foodplants: Ploughman's spikenard and Common fleabane
Map: TL03

Coleophora asteris Mühlig (562)
One specimen of this coastal species to MV (mercury vapour) light at Sharnbrook on 20 August 1997.
Flight: July, August (week 34)★
Larval Foodplant: Sea aster
Map: SP95

Elachista alpinella Stainton (599)
One to MV light at Sharnbrook on 18 July and one in the RIS trap at Cockayne Hatley in the week 20–26 August 1997
Flight: July to September (weeks 29, 34)★
Larval Foodplant: Sedges
Map: SP95, TL24

Elachista adscitella Stainton (622)
One netted at Chicksands Wood by C.R.B.Baker on 14 June 1997.
Flight: May to August (week 24)★
Larval Foodplant: Tufted hair-grass and Blue moor-grass
Map: TL14

Aroga velocella (Zeller) (796)
One moth swept from heather at Cooper's Hill on 11 July 1997.
Flight: May, July and August (week 28)★
Larval Foodplant: Sheep's sorrel
Map: TL03

Gelechia senticetella Staudinger (801a)
Two in the RIS trap at Eaton Bray in 1997. This moth from Southern Europe was first found in Britain in 1988 and is now recorded in a few southern counties.
Flight: July, August (weeks 31, 32)*
Larval Foodplant: Junipers, including garden varieties
Map: SP92

Syncopacma taeniolella (Zeller) (847)
One netted on chalk grassland at Studham on 23 July 1997.
Flight: July (week 30)*
Larval Foodplants: Bird's-foot trefoil, clovers and medicks
Map: TL01

Cydia pallifrontana (Lienig & Zeller) (1243)
Several swept from foodplant at Souldrop on 3 June 1997.
Flight: June, July (week 22)*
Larval Foodplant: Wild liquorice
Map: SP96

Pempeliella diluta (Haworth) (1462)
One in the RIS trap at Eaton Bray in 1996.
Flight: July, August (week 30)*
Larval Foodplant: Wild thyme
Map: SP92

* Flight times recorded in Bedfordshire. Standard week numbers are described in Arnold *et al* (1997) and are those used by the Rothamsted Insect Survey (RIS).

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GOLDEN JUBILEE FUNGUS FORAY, 1997 KING'S WOOD NATIONAL NATURE RESERVE and STOCKGROVE PARK, HEATH and REACH

by Derek Reid

The annual fungus foray was held at King's Wood National Nature Reserve and Stockgrove Park, Heath and Reach, on Sunday 21st September 1997 and was led by Dr Derek Reid. About 20 people attended including a number of visitors.

It was on Sunday 12th October, 1947, that the Society held its first Fungus Foray, with the venue being "King's Wood and Rushmere, Heath and Reach". The leader on that occasion was the eminent mycologist Dr R.W.G. Dennis, then Head of the Mycology Section, of the Royal Botanic Gardens, Kew.

A report of this foray duly appeared in the *Bedfordshire Naturalist* No 3 for the year 1948, and the hope was expressed that The Fungus Foray would become an annual event in the Society's programme. So it is fitting that this year we celebrated this 50th anniversary by returning to approximately the same location as that visited by those early members of the Society, fifty years ago. However the report of the inaugural foray was published in an extraordinary manner, under the title "The 1948 Fungus Foray" which was held at Aspley Wood. The report was divided into two parts comprising (a) a species list from Aspley Wood (b) a similar list of species from King's Wood or Rushmere. However, species found at both Aspley Wood, 1948 **and** in King's Wood or Rushmere, 1947 were listed only once, i.e. under Aspley Wood, with an asterisk to indicate that they also occurred in King's Wood or Rushmere. So, to obtain the complete list of species collected on the inaugural foray of 1947, one has to extract the names from both parts of the published report. Even then there is a paragraph at the end of the report headed "Moulds" - and it is impossible to know when or from where the five listed mould species were collected.

In general the species collected from King's Wood and Rushmere 1947 were common and unexceptional, although *Lepiota lilacea* remains a distinct rarity at National level, and has never again been found in the county.

It would have been satisfactory to produce a table showing a comparison between the list of species found in 1947 with those gathered during the current foray. However, the original foray list is so short, comprising a mere 31 species that it cannot possibly be taken as representative of the abundance of fungi in the woodland under consideration, which I know to be highly productive. Such a short list is totally inadequate to serve as a base line against which to monitor changes in species composition over the last 50 years. Furthermore the areas surveyed in 1947 and 1997 are not strictly comparable since Rushmere was included in 1947, but was not visited in 1997. Finally, comparison of lists from a given site compiled from single visits can also be highly misleading, even when taking into account the time of year when the collections were made, the extant weather conditions, and the transient nature of fungi.

One thing is certain, those original forayers back in 1947 would be surprised to learn that 50 years on we are continuing to add new species of fungi to the County List, at a fairly constant rate. Still much more work remains to be undertaken to help increase our knowledge of the composition of the Mycological Flora of Bedfordshire, and the

distribution of the various species within the county, but such data are being slowly accumulated.

Returning to the current foray, it is interesting to note that a total of 165 species was collected of which 9 of the species were new to the county.

Of the novelties *Amanita rubescens* var. *annulosulphurea* is merely a variant of the well known "Blusher" (*A. rubescens* var. *rubescens*) with a yellow ring on the stem.

Small species of *Mycena* always present a problem of identification, but *M. amicta*, which has a greyish cap paling with age is notable for having a pale grey-brown stem with a blue-green tint at the base. Microscopically it has ellipsoid spores, measuring 7-10 x 4-5µm, which are amyloid, and narrowly elongate cystidia. Occasional collections of *M. amicta* are met with, in which the cap shows evanescent radial blue-green fibrils; this variant is sometimes recognised as var. *iris*.

Russula heterophylla var. *chlora* was the cause of confusion in the field, since it very closely resembles *R. violeipes*, in having a uniformly pale citron-yellow cap. However, the presence of very elongated, tapering, thick-walled refractive hairs on the cap cuticle demonstrated its true affinity.

The earth ball *Scleroderma areolatum*, is so similar to the common *S. verrucosum* that it cannot be distinguished with any degree of confidence until spore measurements have been made. The spores of both species are globose with a strong spiny ornament, but whereas those of *S. areolatum* measure 11-14µm diameter those of *S. verrucosum* have a range of 9-11µm (exclusive of the ornament). In the field it is sometimes possible to observe that the scales on the surface of the fruitbody of *S. areolatum* are each surrounded by a halo of small granules, a feature not present in *S. verrucosum*.

Scleroderma bovista shows some features of both *S. areolatum* and *S. verrucosum* on the one hand, and *S. citrinum* on the other. Like the two former species it has a thin peridial layer, a short pseudostipe, and possesses clamp connections; in contrast to these two taxa in which the spore ornament consists of prominent isolated spines, in *S. bovista* it comprises a complete reticulum very similar to that of the spores of *S. citrinum*.

Of the Discomycetes collected, only *Catinella olivacea* was new to the county. This species produces small, sessile shallowly saucer-shaped, dark olive coloured discs, to 10mm diam., on wet logs. The spores, which are elliptic with a slight median constriction, have a range of 7-11 x 4-5µm, and are initially almost hyaline, but gradually become olive brown. There are also cylindrical paraphyses in the hymenium with the tips capped by an amorphous brown substance.

The remaining additions to the County List are all microfungi, but of these mention should be made of the discovery of *Puccinia conii*, since this is a rare rust throughout Britain, despite the frequency of its host, Hemlock, *Conium maculatum*.

The list of species follows:

Agaricus bitorquis S; *Amanita citrina* var. *alba* K; *A. phalloides* K; *A. rubescens* inc.* var. *annulosulphurea* S; *Boletus badius* S; *B. chrysenteron* S; *B. pruinatus* S; *B. subtomentosus* S; *Calocybe* (=*Tricholoma*) *carnea* S; *Clitocybe clavipes* S; *C. fragrans* S; *C. gibba* (*infundibuliformis*) S; *C. odora* S; *C. phaeopthalma* S; *C. rivulosa* S; *Collybia cirrhata* S; *C. confluens* S; *C. dryophila* S; *C. fusipes* S, K; *C. maculata* S; *C. peronata* S; *Coprinus atramentarius* S; *C. comatus* S; *C. lagopus* S; *C. plicatilis* S; *Entoloma rhodopolium* S; *Gymnopilus penetrans* S; *Hebeloma crustuliniforme* S; *H. mesophaeum* S; *Hygrophoropsis aurantiaca* S, K; *Hypholoma fasciculare* K; *Inocybe asterospora* K; *I. bongardii* K; *I.*

rimosa (fastigiata) S; *Laccaria laccata* S; *L. proxima* S; *Lactarius britannicus* S; *L.turpis* S; *Leccinum scabrum* S; *L.versipelle* S, K; *Lepiota cristata* K; *L. sistrata* K; *Lyophyllum connatum* S; *L. decastes* S; *Marasmius oreades* S; *M. rotula* S; *Melanoleuca melaleuca* S; ⋆ *Mycena amicta* S; *M.galericulata* S; *M. galopus* S; *M. galopus* var. *candida* S; *M. haematopus* K; *M. pura* S; *M. speirea* K; *M. vitilis* S; *Paxillus atrotomentosus* S; *P. involutus* S; *Pholiota tuberculosa* S; *Pleurotus pulmonarius* S; *Pluteus cervinus* S; *Psathyrella candolleana* S; *P. marcescibilis* S; *P. piluliformis (hydrophila)* S; *Rickenella fibula* S; *Russula aeruginea* S; *R. atropurpurea* S; *R. betularum* S; *R. cyanoxantha* S; *R. delica* K; *R. fragilis* S; ⋆ *R. heterophylla* var *chlora* S; *R. lepida* S; *R. nigricans* K; *R. ochroleuca* S; *R. parazurea* S; *R. xerampelina* S, K; *Tricholoma fulvum* S.

Botryobasidium candicans S; *Bjerkandera adusta* S, K; *Clavulina cinerea* S; *Clavulinopsis helvola* S; *Coriolus versicolor* S; *Daedaleopsis confragosa* S; *Fistulina hepatica* S; *Ganoderma adspersum* S; *Heterobasidion annosum* S; *Hirschioporus abietinus* S; *Hyphoderma (Basidioradulum) radula* S; *Laetiporus sulphureus* S; *Merulius tremellosus* S; *Mycoacia uda* S; *Peniophora quercina* S; *Phaeolus schweinitzii* S; *Phellinus ferreus* S; *Phlebiella (Trechispora) vaga* K; *Piptoporus betulinus* S; *Polyporus badius* S; *Radulomyces confluens* K; *Resinicium bicolor* S; *Stereum hirsutum* S; *S. rameale* K; *S. rugosum* S; *Trechispora farinacea* S.

Calocera pallidospathulata S; *C.viscosa* S; *Dacrymyces stillatus* S.

Myxarium nucleatum S; *Tremella mesenterica* K.

Auricularia auricula-judae S.

Geastrum triplex S; *Lycoperdon nigrescens (foetidum)* S; *L. perlatum* S, K; *Phallus impudicus* S, K; ⋆ *Scleroderma areolatum* S; ⋆ *S. bovista* S; *S. verrucosum* S, K; *Vascellum pratense* S, K.

Kuhneola uredinis S, K; *Melampsora populnea* K; *Melampsoridium betulinum* S, K; *Phragmidium violaceum* S, K; *Puccinia annularis* S, K; *P. arenariae f. arenariae* (On *Moehringia trinervia*) S; *P. arenariae f. lychnidearum* S, K; ⋆ *P. conii* K; *P. glechomatis* S, K; *Pucciniastrum circaeae* K; *P. epilobii* K.

Aleuria aurantia K; *Bulgaria inquinans* K; ⋆ *Catinella olivacea* S; *Chlorociboria aeruginascens* S; *Coprobia granulata* K; *Helvella crispa* S; *Mollisia cinerea* S; *Orbilia inflatula* S; *O. xanthostigma* K; *Rhytisma acerinum* S, K; *Trochila ilicina* K.

Chaetosphaerella phaeostroma S; *Cordyceps militaris* S; *Creopus gelatinosus* S; *Diatrype stigma* S; *Diatrypella quercina* S; *Erysiphe circaeae* S, K; *E. galeopsidis* K; *E. heraclei* (On *Angelica* and *Heracleum*) S, K; *E. sordida* (On *Plantago*) K; *Hypoxylon fragiforme* S; *H. multiforme* S, K; *Lasiosphaeria hirsuta* S; *Microsphaera alphitoides* S, K; *Nectria cinnabarina* S, K; *N. episphaeria* S; *Rhopographus filicinus* S, K; *Uncinula bicornis* (On *Acer campestre*) K; *Xylaria hypoxylon* S, K.

Paecilomyces farinosus K; ⋆ *Ramularia ajugae* K; ⋆ *R. lactea* (On *Viola* sp.) K; *Sepedonium chrysospermum* S, K;

Spinellus fusiger K;

Ceratiomyxa fruticulosa S; *Fuligo septica* S; *Lycogala epidendrum* S, K.

⋆ New County Record
Total Number of Species = 165
Total new to the County = 9

Derek Reid has been the Society's Recorder for Fungi since 1952. He has now stood down after many years of leading the annual fungus forays and providing expert advice on fungi in Bedfordshire. He was formerly Head of Mycology at the Herbarium of the Royal Botanic Gardens, Kew for many years and is a mycologist of world renown.

FLOWERING PLANTS, FERNS AND FERN ALLIES (Spermatophyta and Pteridophyta)

by Chris Boon

There are now only two full years of recording to go for the BSBI Atlas 2000 project. There is still much 10km recording required from odd corners of the county – roadside verges, field corners, waste places etc. – to ensure the presence of ruderal weeds and all common species are noted. Data already obtained from the Flora Group, from surveys sponsored by the County Council and from other sources have been entered into the Biological Records Centre at Bedford Museum. The database is now virtually up-to-date with all botanical records collected in the county from 1987 to 1997, numbering nearly 120,000 records in all.

Probably the most interesting discovery of the year was by Philip Irving of a boggy area of Wavendon Heath which is in a low part of what was, up to several years ago, the large Fuller's earth extraction site - now infilled. Whether the wet area was part of the refill or was always present is not known. The assemblage of rare wetland Bedfordshire plants in this site (SP93H) is exceptional. Two rare rushes *Juncus bulbosus*, Bulbous Rush, and *J.squarrosus*, Heath Rush, are present. Also two rare ferns, *Blechnum spicant*, Hard Fern, and, most surprising of all, two young plants of *Osmunda regalis*, Royal Fern. Finally a rare sedge *Carex echinata*, Star Sedge, completed the excitement. All these records are from tetrad SP93H. The higher sandy areas in the vicinity also contained many unusual plants - in all 125 species were recorded from the area on two visits in May and July which, for an acid heath site, is a good number. It is to be hoped the area can be conserved. What makes it more interesting is that the nearby SSSI of Wavendon Heath Ponds has been known to contain many of these rarities. Hard Fern was known in the county only from the Ponds, where there are still a few old plants, whilst the new site, only about 500 metres away, has many young plants.

Many of Bedfordshire's plants occur only in one or two sites and are thus very vulnerable. Many of these have been checked out during the year and the following sample of findings are of interest. *Stellaria neglecta*, Greater Chickweed, is still present in profusion on Pennyfather's Moors (TL03T) in Maulden. *Potentilla anglica*, Trailing Tormentil, is still hanging on in Kidney Wood, Luton (TL01Z). *Viola canina* subsp. *canina*, Heath Dog-violet, is still at Waterloo Thorns (TL15V), with *Genista tinctoria*, Dyer's Greenweed, but appears to be decreasing. However, *Viola palustris*, Marsh Violet, could not be found at its only site on Cooper's Hill, Ampthill (TL03I), but, during the coming winter, the Wildlife Trust will be carrying out some clearance of Bracken and scrub in the area so, hopefully, conditions will be favourable for its survival.

Some plants were thought to have disappeared from the county in recent years. One of these was *Nepeta cataria*, Cat Mint. There are now, I believe, three populations on record from Knocking Hoe, Dunstable Downs and Pavenham. *Cerastium pumilum*, Dwarf Mouse-ear, was recorded by John Dony in his 1976 Atlas along the main railway lines in the north of the county, but it had not been seen for ten years or more until Mark Powell refound it (TL06A); still on the railway. A more remarkable return was *Erica tetralix*, Cross-leaved Heath, last recorded as a native in about 1880, from Maulden Wood (TL03U). This was first noted by Patrick Cook of Forest Enterprise a few years ago at the base of a recently planted pine tree. It was presumably brought in on the

roots of the young tree and seems to be thriving and is flowering well. It will be interesting to see how long it survives as its normal habitat is damp heathland whereas, in Maulden Wood, it is on rather dry sandy soil.

The vegetation of many of the county's country parks is of great interest and many rare plants are found within their boundaries. However, an exceptional discovery was a colony of about 50 *Dactylorhiza incarnata* subsp. *incarnata* in a wild part of Harrold/ Odell Country Park (SP95T). Also in a lake nearby is a thriving colony of *Ranunculus lingua*, Greater Spearwort. The presence of these species shows how valuable such sites are in the county.

One of the botanical features of the verge edges of the main arterial roads has been the salt tolerant plants spreading inland, with the commonest being the grass *Puccinellia distans*, Reflexed Saltmarsh-grass. Until the last few years *Cochlearia danica*, Danish Scurvy-grass, was noted from only one or two locations but it has recently increased dramatically. The M1 from the northern county boundary to the Toddington junction (Junction 12) passes through 12 tetrads (of which four are only very short stretches). In the remaining eight I was able to record *C. danica* in quantity from seven tetrads at a reasonable motorway speed. On a joint meeting with the Hertfordshire Flora Group we were walking along the A5 near Kensworth when one of the Herts group, Gerald Salisbury, noted a plant of *Spergularia marina* (Lesser Sea-spurrey). This was the first county record for this species; we were about 2 metres inside the county boundary (TL01N). No doubt it will spread along the roads and become a regular member of the county's flora.

NEW COUNTY RECORDS

CARYOPHYLLACEAE

Spergularia marina **Lesser Sand-spurrey**

Roadside A5 nr Kensworth. TL01N (GS).

POACEAE

Sasa palmata **Broad-leaved Bamboo**

Naturalised on pond edge, Woburn Park. SP93R (CB).

ASTERACEAE

Erigeron karvinskianus **Mexican Fleabane**

In pavement crack, Hightown Road, Luton. (First recorded 1994.) TL02W (SH).

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BRITISH AND IRISH FLORISTIC ELEMENTS APPLIED TO THE BEDFORDSHIRE FLORA

by Chris R. Boon

Introduction

The native British and Irish vascular plants have been classified into a new system of floristic elements which are based on the geographical range of the plants in the Northern Hemisphere (Preston and Hill, 1997). The major purposes of this classification are to establish categories of plants with similar climatic requirements and to highlight those which may have similarities in dispersal history. Two criteria are defined, firstly by nine major biomes which approximate to latitudinal distribution and secondly by six categories related to the eastern limit of distribution. Using a combination of these two criteria, each species can be assigned a floristic element. As shorthand, a two digit number, with the first representing the major biome number and the second representing the eastern limit, can be defined. In Britain and Ireland 1481 species have been so classified and it is the native ranges of these species which have been used for the purposes of the classification, not the ranges as modified by introduction. The individual distributions of subspecies are often not well known and thus, in these cases, the range of the species is used. Species that have not been included in the analysis are, firstly, those endemic to Britain and Ireland and, secondly, nine other species for which there is insufficient reliable distribution data.

The present paper assesses the vascular plants of Bedfordshire in relation to these British and Irish floristic elements. The main aims are:

a. to place the plants in their floristic element, and
b. to investigate whether the extinctions that have occurred are related to particular elements.

A secondary purpose is to provide a list of all the native plants that are considered to be present in Bedfordshire at the end of the 20th Century.

Definitions of the floristic elements

The definitions of the floristic elements are relatively complicated in detail but the following presents an outline of the full definitions given in Preston and Hill (1997). As mentioned above, each category is assigned two digits with the first digit, the major biome category (MBC), being assigned to those plants occurring in one or more of the major terrestrial biomes of the world which are defined by vegetation types which, in turn, are governed by climate. North of the tropics these biomes are related to both latitude and altitude, since an increase in the latter can be equivalent to an increase in the former. There are four major biomes of relevance here which are as follows (with the assigned digit after the name):

(a) Arctic-montane (1) – Species north of, or above, the tree line.
(b) Boreal-montane (4) – Main distribution within the coniferous forest zone.
(c) Temperate (7) – Main distribution within the broad-leaved deciduous forest zone.
(d) Southern (9) – South of the broad-leaved deciduous forest zone.

Many species' distributions straddle these biomes and, to take this into account, five further MBCs are defined as follows:

(e) Boreo-arctic Montane (2) – Species occurring in (a) and (b).
(f) Wide-boreal (3) – Distribution centred in (b) but occur widely in (a) and (c).
(g) Boreo-temperate (5) – Species occurring in (b) and (c).
(h) Wide-temperate (6) – Distribution centred in (c) but occur widely in (b) and (d).
(i) Southern-temperate (8) – Species occurring in (c) and (d).

The second digit, the eastern limit category (ELC), is assigned in relation to longitude. The main criteria are given here (with the assigned digit after the name) and apply to the main distribution of the species.

(a) Oceanic (1) – Species restricted to the Atlantic zone (from Norway south to Portugal).
(b) Suboceanic (2) – Species extending east of (a) to Sweden, western Central Europe and the western Mediterranean.
(c) European (3) – Species of mainly European distribution with an eastern limit of 60°E.
(d) Eurosiberian (4) – Species with an eastern limit between 60°E and 120°E.
(e) Eurasian (5) – Species with an eastern limit east of 120°E.
(f) Circumpolar (6) – Species found in Europe, Asia and North America.

In all there are 40 floristic elements defined for the plants of Britain and Ireland with between three and six ELCs for each MBC from 1 to 8. The Southern major biome (9) is a special case for which three special elements are defined based on the species' Mediterranean distribution.

Bedfordshire flora

All the plants that have been recorded from Bedfordshire since Gerarde (1597) to the present day, and which occur in the list of British and Irish natives in Preston and Hill (1997), are considered. The total number of species is 903. However, of these, 62 species have been introduced to Bedfordshire (Appendix 1) and are not within their native range. It should also be noted that seven species, now only present as introductions, were formerly natives (see Appendix 1). This results in the number of species that have been recorded in the county, and are considered native, being 841.

The number of species that have become or are considered to be extinct in the county is 96 (Appendix 2). This is 11.4% of the native flora and results in the number of extant native species being 745 (Appendix 3). This figure is 50.3% of the 1481 species given in Preston and Hill (1997). Thus Bedfordshire has approximately one half of the native British and Irish vascular flora.

Thirty three of the 43 defined floristic elements can be applied to the Bedfordshire flora, and the total numbers for each floristic element are shown in Table 1. The only major biome category that does not have any representation in Bedfordshire is, as might be expected, the Arctic-montane biome which contains four floristic elements (13 to 16). Four further elements, two in the Boreo-arctic Montane (21 and 24) and two in the Boreal-montane (41 and 42) MBCs are also absent. The remaining two absentees are in the Wide-boreal (34) and Southern (93) MBCs.

In the full list in Preston and Hill (1997) some species are shown as being doubtfully native in Britain and Ireland and these are indicated in the lists in the Appendices. However, for the purposes of the present study this qualification has been ignored and

all species are considered of equal status. Of the 48 endemic species listed for Britain and Ireland three are recorded for Bedfordshire. These are *Euphrasia anglica, E. pseudokerneri* and *Ulmus plotii* which are assigned to the floristic element Oceanic Temperate (71). Of these, *E. anglica* is extinct, having only been recorded on a single occasion, *U. plotii* may no longer occur in the county but *E. pseudokerneri* is still relatively frequent. Of the nine non-endemic species not included in the original paper because of lack of data, two occur in the county. These are *Poa humilis* and *Rorippa microphylla.*

Floristic elements

It is clear from Table 1 that a large number of species, 376, occur in the Temperate elements (71–76) which is 50.5% of the county's native flora. The majority of these, 221, occur in the European Temperate element (73). These numbers parallel the situation in the British and Irish flora of which over 37% (557) are assigned to the Temperate major biome with 297 in the European Temperate element. It is interesting to note that within the Temperate major biome the proportion of species assigned to the European Temperate element is 53.3% for the British and Irish flora and 58.8% for the Bedfordshire flora. These proportions are remarkably close.

If we consider all the "temperate" major biomes, which include the floristic elements from 51 to 86, the proportions of the numbers within each biome compared to the totals are very similar as shown in Table 2. As might be expected, because of the location of Bedfordshire in the southern half of Britain and at a latitude which is approximately central within the Temperate major biome, 94.1% of its flora occurs within these four MBCs. It is clear from Table 1 that for most of the other 14 floristic elements the numbers of species indicate that they are somewhat peripheral to the location of Bedfordshire with respect to Europe as a whole. This is to be expected from their definitions given above.

Clearly the Montane biomes are represented in the county by very few species. The Boreo-arctic Montane biome (elements 23 and 26) is represented by one species in each element. *Carex dioica* in (element 26) which was recorded in 1805 but not since and *Leymus arenarius* in (element 23) which has only been recorded as a casual species. The Boreal-montane biome is currently represented by four species *Alchemilla filicaulis, Coeloglossum viride, Potamogeton praelongus* and *Vaccinium myrtillus.* All are very rare in Bedfordshire and, indeed, *P. praelongus* may be extinct.

The other two non-temperate biomes are worthy of mention. Firstly the Wide-boreal, which is a small group of 18 species that are frequent throughout Britain and Ireland. Of these, ten still occur in Bedfordshire (elements 35 and 36) and there has only been one loss, *Chrysosplenium alternifolium.* Also there are only two introductions assigned to this major biome. Secondly, in the Southern biomes (elements 91 and 92), 51 species have been recorded for Bedfordshire out of a national total of 114. However, as might be expected a high proportion, 17 (33.3%), are considered introductions.

No.	Floristic Elements Major Biome	Eastern Limit	Total in Br+Hb 1600-1997	Total in vc30 1597-1997	Introd. in vc30 1597-1997	Native in vc30 1597-1997	Extinct in vc30 1597-1997	Native in vc30 1997	Loss 1597-1997 %	% of Br+Hb in vc30 %
23	Boreo-arctic Montane	European	10	1	1	0	0	0	0.0	0.0
26		Circumpolar	25	1	0	1	1	0	100.0	0.0
		subtotal	*35*	*2*	*1*	*1*	*1*	*0*	*100.0*	*0.0*
35	Wide-boreal	Eurasian	1	1	0	1	0	1	0.0	100.0
36		Circumpolar	17	13	2	11	1	10	9.1	58.8
		subtotal	*18*	*3*	*2*	*12*	*1*	*11*	*8.3*	*61.1*
43	Boreal-montane	European	27	1	0	1	0	1	0.0	3.7
44		Eurosiberian	9	1	0	1	0	1	0.0	11.1
45		Eurasian	5	1	1	0	0	0	0.0	0.0
46		Circumpolar	50	10	0	10	7	3	70.0	6.0
		subtotal	*91*	*13*	*1*	*12*	*7*	*5*	*58.3*	*5.5*
51	Boreo-temperate	Oceanic	8	1	0	1	1	0	100.0	0.0
52		Suboceanic	8	2	0	2	1	1	50.0	12.5
53		European	48	24	0	24	3	21	12.5	43.8
54		Eurosiberian	67	55	4	51	6	45	11.8	67.2
55		Eurasian	38	35	1	34	6	28	17.6	73.7
56		Circumpolar	64	50	2	48	11	37	22.9	57.8
		subtotal	*233*	*167*	*7*	*160*	*28*	*132*	*17.5*	*56.7*
61	Wide-temperate	Oceanic	1	1	1	0	0	0	0.0	0.0
63		European	3	1	0	1	0	1	0.0	33.3
64		Eurosiberian	11	11	0	11	0	11	0.0	100.0
65		Eurasian	5	5	0	5	0	5	0.0	100.0
66		Circumpolar	14	10	1	9	0	9	0.0	64.3
		subtotal	*34*	*28*	*2*	*26*	*0*	*26*	*0.0*	*76.5*
71	Temperate	Oceanic	48	11	1	10	4	6	40.0	12.5
72		Suboceanic	28	20	0	20	4	16	20.0	57.1
73		European	297	247	6	241	20	221	8.3	74.4
74		Eurosiberian	120	100	3	97	8	89	8.2	74.2
75		Eurasian	38	28	1	27	2	25	7.4	65.8
76		Circumpolar	26	22	0	22	3	19	13.6	73.1
		subtotal	*557*	*428*	*11*	*417*	*41*	*376*	*9.8*	*67.5*
81	Southern-temperate	Oceanic	25	4	1	3	0	3	0.0	12.0
82		Suboceanic	54	28	4	24	2	22	8.3	40.7
83		European	106	76	6	70	4	66	5.7	62.3
84		Eurosiberian	81	66	7	59	4	55	6.8	67.9
85		Eurasian	17	13	2	11	0	11	0.0	64.7
86		Circumpolar	13	11	1	10	0	10	0.0	76.9
		subtotal	*296*	*198*	*21*	*177*	*10*	*167*	*5.6*	*56.4*
91	Mediterranean-atlantic		67	14	11	3	0	3	0.0	4.5
92	Submediterranean-Subatlantic		47	37	6	31	8	23	25.8	48.9
		subtotal	*114*	*51*	*17*	*34*	*8*	*26*	*23.5*	*22.8*
??	Undesignated		9	2	0	2	0	2	0.0	22.2
	TOTAL		**1387**	**892**	**62**	**841**	**96**	**745**	**11.4**	**53.7**

NB. The total number of British and Irish species for all floristic elements is 1481

Table 1. Numbers of species in the floristic elements that occur in Bedfordshire

Major biome	British	% of total British	vc30	% of total vc30
Boreo-temperate (51-56)	233	15.7	132	17.7
Wide-temperate (61-66)	34	2.3	26	3.5
Temperate (71-76)	557	37.6	376	50.5
Southern-temperate (81-86)	296	20.0	167	22.4
Total	1120	75.6	701	94.1
All biomes	**1481**		**745**	**50.3**

Table 2. Species numbers in the "temperate" major biomes

Extinctions

The Wide-temperate major biome (elements 61 to 66) contains 34 species which are frequent throughout Britain and Ireland. Bedfordshire contains 26 of these as natives. Those not present have a coastal distribution and would not be expected to occur in an inland county as native species. Within this group there have been no extinctions and all are frequent throughout the county.

However, from the rest of the major biomes there have been many extinctions with 11.4% of the native vascular species of the county being lost over the years, this accounting for 96 species (Appendix 2). If we take the extinctions as occurring uniformly over the period from 1597 to 1997 then there is a loss of approximately one species every four years. However, if we consider that very little was recorded in Bedfordshire before Abbot (1798) then, during the last 200 years, the rate of loss has been approximately one species every two years.

If we consider the "temperate" major biomes, excluding the Wide-temperate, the losses from the Temperate biome is 9.8% and the Southern-temperate biome is 5.6%, together accounting for 51 species whilst 17.5%, accounting for 28 species, have been lost from the Boreo-temperate biome. Overall, 79 species (82.3%) of the total losses for the county are from these biomes which account for 10.6% of the recorded native flora. Whilst in no way acceptable, this level of loss is probably fairly typical for this part of Britain and further research would show in detail from which habitat types the losses have occurred. A cursory inspection reveals that a good proportion are from wetland habitats, which agrees with the findings of Dony (1977).

Two particular floristic elements have suffered significant decreases from a relatively small number of species. Firstly, the Circumpolar Boreal-montane element (46), which contains 50 species from the Britain and Ireland, has ten species which have been recorded from Bedfordshire. Of these, seven have been lost leaving *Carex curta*, *Coeloglossum viride* and *Potamogeton praelongus* as the only representatives. *C. viride* is not under threat in its present locations but *C. curta* was last recorded about 10 years ago and, as indicated earlier, the latter may already be lost. This element has lost 70.0% of its species.

The Submediterranean-Subatlantic element (92) has not suffered to quite the same extent. It contains 47 species nationally with 31 recorded locally as native of which eight have been lost (25.8%) leaving 23 species.

As a proportion these two peripheral elements have suffered the greatest losses. It might be expected that some species in these elements are on the limits of their ranges in Bedfordshire and are therefore more susceptible to climatic or habitat changes.

The Mediterranean-Atlantic element (91) has a high proportion of introduced species with only three native to the county and with no extinctions. One species, *Torilis nodosa*, is not uncommon whilst the other two are very rare, *Aceras anthropophorum* and *Umbilicus rupestris*. The latter has only been recorded recently for the first time (Boon, 1997).

Conclusions

The Bedfordshire flora has been categorised by floristic elements and analysis has shown that the native flora present today consists mainly of species (94.2%) within the four major biomes having a "temperate" content whilst 50.5% of the flora is contained within the Temperate major biome category. Overall 11.4% of the native flora has been lost and it is calculated that the rate of loss over the last 200 years has been approximately one species every two years. In the "temperate" biomes the losses are 10.6% whilst, in the peripheral biomes, the percentage losses are significantly higher. In particular the Circumpolar Boreal-montane element has suffered a 70.0% loss whilst the Submediterranean-Subatlantic element has lost 25.8%.

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NB. In all appendices nomenclature follows Stace, C.A. 1997 *New Flora of the British Isles* (2nd Edition) CUP.

Appendix 1. British and Irish native species introduced in Bedfordshire

Aconitum napellus 73
Apera interrupta 84
Arbutus unedo 91
Armeria maritima 36
Bolboschoenus maritimus 84
Bupleurum falcatum 85
Carduus tenuiflorus 82
Chenopodium vulvaria 84
Cochlearia danica 71
Cyperus longus 83
Cystopteris fragilis 36
Erodium moschatum 91
Euphorbia cyparissias 73
Euphorbia lathyris 83
Fritillaria meleagris 73
Fumaria bastardii 91
Fumaria capreolata 92
Fumaria muralis 81
Galanthus nivalis 83
Gastridium ventricosum 91

Geranium sanguineum 73
Gymnocarpium dryopteris 56
Gymnocarpium robertianum 56
Helleborus foetidus 82
Hypericum androsaemum 92
Juncus gerardii 66
Lathyrus aphaca 92 §
Lepidium latifolium 84
Leucojum aestivum 83
Leymus arenarius 23
Lithospermum purpureocaeruleum 83
Lonicera xylosteum 74
Marrubium vulgare 84
Matthiola sinuata 91
Medicago minima 84
Medicago polymorpha 92
Mibora minima 82
Muscari neglectum 84
Myosotis sylvatica 75
Onopordum acanthium 74
Parapholis incurva 91
Parentucellia viscosa 91
Pinus sylvestris 45
Polemonium caeruleum 54
Polypogon monspeliensis 91
Prunus padus 55
Puccinellia distans 54
Ruscus aculeatus 92
Salix pentandra 54
Salvia verbenaca 91
Saponaria officinalis 73
Schoenoplectus tabernaemontani 85
Silene gallica 92
Sisyrinchium bermudiana 61
Sonchus palustris 74
Spergularia marina 86
Stratiotes aloides 54
Taxus baccata 73
Teucrium chamaedrys 83
Trifolium glomeratum 91
Trifolium squamosum 91
Verbascum virgatum 82

Introduced species formerly present as native

Aquilegia vulgaris 73
Buxus sempervirens 92
Chenopodium urbicum 74
Colchicum autumnale 73
Erica tetralix 72
Galium pumilum 73
Hydrocharis morsus-ranae 74
Nymphoides peltata 75
Salvia pratensis 73

§ after name indicates species doubtfully native in Britain and Ireland.

Appendix 2. Bedfordshire extinct species categorised by floristic element

26 – Circumpolar Boreo-arctic Montane
Carex dioica

36 – Circumpolar Wide-boreal
Chrysosplenium alternifolium

46 – Circumpolar Boreo-montane
Drosera anglica
Hammarbya paludosa
Pinguicula vulgaris
Potamogeton alpinus
Pyrola minor
Trichophorum cespitosum
Vaccinium oxycoccos

51 – Oceanic Boreo-temperate
Narthecium ossifragum

52 – Suboceanic Boreo-temperate
Myriophyllum alterniflorum

53 – European Boreo-temperate
Lycopodiella inundata
Nardus stricta
Pedicularis palustris

54 – Eurosiberian Boreo-temperate
Apera spica-venti
Dianthus deltoides
Geum rivale

Melampyrum pratense
Sagina nodosa
Salix repens

55 – Eurasian Boreo-temperate
Antennaria dioica
Cicuta virosa
Maianthemum bifolium
Platanthera bifolia
Stellaria palustris
Thalictrum minus

56 – Circumpolar Boreo-temperate
Botrychium lunaria
Drosera rotundifolia
Equisetum hyemale
Equisetum sylvaticum
Juniperus communis
Lycopodium clavatum
Parnassia palustris
Potamogeton friesii
Potentilla palustris
Rhynchospora alba
Utricularia minor

71 – Oceanic Temperate
Carex binervis
Erica cinerea
Genista anglica
Hypericum elodes

72 – Suboceanic Temperate
Apium inundatum
Eria tetralix
Polygala serpyllifolia
Potamogeton polygonifolius

73 – European Temperate
Alchemilla xanthochlora
Anagallis minima
Aquilegia vulgaris
Arnoseris minima
Campanula patula
Carex hostiana
Colchicum autumnale
Cynoglossum germanicum
Dianthus armeria
Filago lutescens
Fritillaria meleagris
Galium pumilum
Hypericum montanum
Oreopteris limbosperma
Pedicularis sylvatica
Ranunculus sardous
Salvia pratensis
Silene noctiflora
Stachys germanica
Viola tricolor

74 – Eurosiberian Temperate
Ceratophyllum submersum
Chenopodium urbicum
Epipactis palustris
Frangula alnus
Hydrocharis morsus-ranae
Pulicaria vulgaris
Sium latifoliium
Utricularia vulgaris

75 – Eurasian Temperate
Carex elata
Nymphoides peltata

76 – Circumpolar Temperate
Eleocharis uniglumis
Rumex maritimus
Thelypteris palustris

82 – Suboceanic Southern-temperate
Baldellia ranunculoides
Moenchia erecta

83 – European Southern-temperate
Fumaria parviflora
Hypochaeris glabra
Mentha pulegium
Oenanthe silaifolia

84 – Eurosiberian Southern-temperate
Lythrum hyssopifolia
Medicago sativa
Potamogeton trichoides
Schoenus nigricans

92 – Submediterranean-Subatlantic
Buxus sempervirens
Carex divisa
Epilobium lanceolatum
Filago pyramidata
Himantoglossum hircinum
Ophrys sphegodes
Verbascum pulverulentum
Vulpia unilateralis

Appendix 3. Bedfordshire native species assigned to floristic elements

35 – Eurasian Wide-boreal
Ranunculus acris

36 – Circumpolar Wide-boreal
Caltha palustris
Cardamine pratensis
Deschampsia cespitosa
Equisetum arvense
Eriophorum angustifolium
Festuca rubra
Hieracium murorum agg.
Luzula multiflora
Ranunculus trichophyllus
Tephroseris integrifolia

43 – European Boreo-montane
Alchemilla filicaulis

44 – Eurosiberian Boreo-montane
Vaccinium myrtillus

46 – Circumpolar Boreo-montane
Carex curta
Coeloglossum viride
Potamogeton praelongus

52 – Suboceanic Boreo-temperate
Callitriche hamulata

53 – European Boreo-temperate
Alopecurus geniculatus
Anthyllis vulneraria
Calluna vulgaris
Carex echinata
Carex panicea
Catabrosa aquatica
Convallaria majalis
Deschampsia flexuosa
Galeopsis tetrahit
Galium mollugo
Hypericum maculatum
Juncus bulbosus
Leontodon autumnalis
Montia fontana
Ranunculus auricomus
Rhinanthus minor
Salix aurita
Silene dioica
Thymus polytrichus
Veronica officinalis
Viola palustris

54 – Eurosiberian Boreo-temperate
Agrostis capillaris
Alopecurus pratensis
Angelica sylvestris
Betula pendula
Betula pubescens
Carex acuta
Carex nigra
Carex ovalis
Carex pallescens
Cerastium fontanum
Cirsium palustre
Dactylorhiza incarnata
Dactylorhiza maculata
Dryopteris carthusiana
Elymus caninus
Festuca pratensis
Galeopsis speciosa
Galium palustre
Gnaphalium sylvaticum
Lathyrus pratensis
Leucanthemum vulgare
Listera ovata
Luzula pilosa
Molinia caerulea
Myosotis arvensis
Nuphar lutea
Paris quadrifolia
Potentilla erecta
Ribes nigrum §
Rumex acetosa
Sagina procumbens
Sagittaria sagittifolia
Salix cinerea
Scutellaria galericulata
Stellaria graminea
Thalictrum flavum
Trifolium medium
Trifolium repens
Tussilago farfara
Urtica dioica
Veronica chamaedrys

Veronica scutellata
Vicia sepium
Vicia sylvatica
Viola canina

55 – Eurasian Boreo-temperate
Achillea millefolium
Achillea ptarmica
Anthriscus sylvestris
Calamagrostis epigejos
Festuca ovina
Filipendula ulmaria
Galeopsis bifida
Galium uliginosum
Galium verum
Geranium pratense
Glechoma hederacea
Gnaphalium uliginosum
Gymnadenia conopsea
Heracleum sphondylium
Lamium album
Linaria vulgaris
Oxalis acetosella
Persicaria bistorta
Populus tremula
Potamogeton compressus
Ranunculus repens
Salix caprea
Solidago virgaurea
Sorbus aucuparia
Tanacetum vulgare
Utricularia australis
Valeriana officinalis
Vicia cracca

56 – Circumpolar Boreo-temperate
Adoxa moschatellina
Agrostis canina
Alopecurus aequalis
Arabis hirsuta
Athyrium filix-femina
Campanula rotundifolia
Carex rostrata
Carex viridula
Cerastium arvense
Chamerion angustifolium
Epilobium palustre
Equisetum fluviatile
Equisetum palustre
Erigeron acer
Gentianella amarella
Hippuris vulgaris
Limosella aquatica
Mentha arvensis
Menyanthes trifoliata
Milium effusum
Myosotis laxa
Persicaria amphibia
Phalaris arundinacea
Poa nemoralis
Potamogeton berchtoldii
Potamogeton natans
Potamogeton obtusifolius
Potamogeton perfoliatus
Potentilla anserina
Ranunculus sceleratus
Rorippa palustris
Rubus idaeus
Sanguisorba officinalis
Sparganium emersum
Stachys palustris
Triglochin palustre
Veronica serpyllifolia

63 – European Wide-temperate
Ranunculus peltatus

64 – Eurosiberian Wide-temperate
Anthoxanthum odoratum
Atriplex patula
Atriplex prostrata
Capsella bursa-pastoris
Elytrigia repens
Fallopia convolvulus
Poa annua
Poa trivialis
Rumex acetosella
Schoenoplectus lacustris
Spergula arvensis

65 – Eurasian Wide-temperate
Chenopodium album
Eleocharis palustris
Plantago major
Polygonum arenastrum
Stellaria media

66 – Circumpolar Wide-temperate
Agrostis stolonifera
Alisma plantago-aquatica
Juncus bufonius
Phragmites australis
Poa pratensis
Polygonum aviculare
Potamogeton pectinatus
Prunella vulgaris
Taraxacum officinale agg.

71 – Oceanic Temperate
Ceratocapnos claviculata
Conopodium majus
Dactylorhiza praetermissa
Hyacinthoides non-scripta
Oenanthe fluviatilis
Ulex europaeus

72 – Suboceanic Temperate
Carex pulicaris
Carex strigosa
Centaurea nigra
Chrysosplenium oppositifolium
Galium saxatile
Glyceria declinata
Helleborus viridis
Hypericum pulchrum
Juncus squarrosus
Linaria repens
Lysimachia nemorum
Ornithopus perpusillus
Polypodium interjectum
Potentilla sterilis
Ribes rubrum §

73 – European Temperate
Acer campestre
Aethusa cynapium
Agrimonia procera
Agrostis vinealis
Ajuga reptans

Alliaria petiolata
Allium oleraceum
Allium ursinum
Allium vineale
Anthriscus caucalis
Aphanes arvensis
Aphanes australis
Arrhenatherum elatius
Arum maculatum
Asperula cynanchica
Asplenium adiantum-nigrum
Astragalus glycyphyllos
Atropa belladonna
Bellis perennis
Berberis vulgaris
Berula erecta
Blechnum spicant
Blysmus compressus
Brachypodium sylvaticum
Brassica nigra
Briza media
Bromopsis erecta
Bromopsis ramosa
Bromus commutatus
Bromus racemosus
Callitriche platycarpa
Callitriche stagnalis
Campanula latifolia
Campanula trachelium
Cardamine amara
Cardamine flexuosa
Carex hirta
Carex paniculata
Carex pilulifera
Carex remota
Carex spicata
Carpinus betulus
Cephalanthera damasonium
Cerastium diffusum
Cerastium pumilum
Cerastium semidecandrum
Chaenorhinum minus
Chaerophyllum temulum
Circaea lutetiana
Cirsium acaule
Cirsium eriophorum
Clematis vitalba
Clinopodium acinos
Clinopodium ascendens
Cornus sanguinea
Corylus avellana
Crataegus laevigata
Crataegus monogyna
Crepis biennis
Crepis capillaris
Cynosurus cristatus
Cytisus scoparius
Danthonia decumbens
Diplotaxis tenuifolia
Dipsacus fullonum
Dipsacus pilosus
Draba muralis
Dryopteris affinis
Dryopteris dilatata
Epilobium montanum
Epilobium obscurum
Epilobium parviflorum
Epipactis phyllanthes
Epipactis purpurata
Euonymus europaeus
Eupatorium cannabinum
Euphorbia amygdaloides
Euphrasia nemorosa
Fagus sylvatica
Festuca gigantea
Filago minima
Fraxinus excelsior
Galeopsis angustifolia
Galium aparine
Galium odoratum
Genista tinctoria
Gentianella germanica
Geranium columbinum
Geranium pyrenaicum §
Geranium robertianum
Glyceria fluitans
Glyceria notata
Groenlandia densa
Helianthemum nummularium
Helictotrichon pratense
Helictotrichon pubescens
Hippocrepis comosa
Holcus mollis
Hordelymus europaeus
Hordeum secalinum
Hottonia palustris
Hypericum humifusum
Hypericum tetrapterum
Inula conyzae
Jasione montana
Juncus acutiflorus
Juncus conglomeratus
Lamiastrum galeobdolon
Lamium hybridum
Lamium purpureum
Lapsana communis
Lathraea squamaria
Lathyrus linifolius
Lathyrus nissolia
Lathyrus sylvestris
Leontodon hispidus
Lepidium campestre
Ligustrum vulgare
Linum catharticum
Lotus pedunculatus
Luzula campestris
Luzula sylvatica
Lysimachia nummularia
Lythrum portula
Malus sylvestris
Malva moschata
Malva neglecta
Melampyrum arvense
Melica uniflora
Mentha aquatica
Mercurialis perennis
Moehringia trinervia
Mycelis muralis
Myosotis discolor
Myosurus minimus
Nymphaea alba
Oenanthe fistulosa
Ononis repens
Ophrys insectifera
Orchis mascula
Orchis morio
Orchis ustulata
Persicaria mitis
Petasites hybridus
Petrorhagia prolifera
Phyllitis scolopendrium
Pilosella officinarum
Pimpinella major
Platanthera chlorantha
Poa compressa
Polygala vulgaris
Polygonum rurivagum

Potentilla anglica
Primula elatior
Primula vulgaris
Prunus avium
Prunus spinosa
Pulsatilla vulgaris
Quercus petraea
Quercus robur
Ranunculus aquatilis
Ranunculus flammula
Ranunculus fluitans
Ranunculus penicillatus
Ribes uva-crispa
Rorippa sylvestris
Rosa arvensis
Rosa canina
Rosa micrantha
Rosa obtusifolia
Rosa rubiginosa
Rosa stylosa
Rosa tomentosa
Rumex hydrolapathum
Rumex obtusifolius
Rumex palustris
Rumex sanguineus
Sambucus nigra
Sanicula europaea
Saxifraga granulata
Scabiosa columbaria
Scleranthus annuus
Sedum acre
Senecio aquaticus
Senecio sylvaticus
Senecio viscosus
Serratula tinctoria
Sorbus aria
Sorbus torminalis
Stachys officinalis
Stellaria neglecta
Stellaria uliginosa
Symphytum officinale
Symphytum tuberosum
Teesdalia nudicaulis
Thymus pulegioides
Tilia platyphyllos
Trifolium dubium
Trifolium ochroleucon
Trisetum flavescens
Ulmus glabra
Ulmus minor
Ulmus procera §
Valeriana dioica
Valerianella dentata
Valerianella locusta
Valerianella rimosa
Veronica agrestis
Veronica montana
Viburnum lantana
Vicia hirsuta
Vicia lathyroides
Vicia tetrasperma
Viola odorata
Viola reichenbachiana
Viola riviniana
Viscum album

74 – Eurosiberian Temperate

Alnus glutinosa
Anchusa arvensis
Anemone nemorosa
Arabidopsis thaliana
Arctium lappa
Artemisia absinthium
Artemisia vulgaris
Barbarea vulgaris
Brachypodium pinnatum
Butomus umbellatus
Carduus crispus
Carduus nutans
Carex acutiformis
Carex caryophyllea
Carex disticha
Carex pseudocyperus
Carex riparia
Carlina vulgaris
Centaurea scabiosa
Chenopodium ficifolium
Chenopodium polyspermum
Chenopodium rubrum
Cirsium vulgare
Cruciata laevipes
Cuscuta europaea
Cynoglossum officinale
Dactylorhiza fuchsii
Echium vulgare
Epilobium roseum
Epilobium tetragonum
Filipendula vulgaris
Fragaria vesca
Fumaria vaillantii
Geranium pusillum
Geum urbanum
Humulus lupulus §
Hypericum hirsutum
Hypochaeris maculata
Isolepis setacea
Juncus compressus
Knautia arvensis
Lepidium ruderale
Lithospermum officinale
Lychnis flos-cuculi
Lycopus europaeus
Medicago lupulina
Melampyrum cristatum
Myosotis scorpioides
Myosoton aquaticum
Neottia nidus-avis
Nepeta cataria
Oenanthe aquatica
Onobrychis viciifolia §
Orobanche elatior
Pastinaca sativa
Phleum phleoides
Phleum pratense
Pimpinella saxifraga
Populus nigra
Potamogeton lucens
Potentilla argentea
Primula veris
Ranunculus lingua
Rhamnus cathartica
Rubus caesius
Salix fragilis §
Salix purpurea
Scirpus sylvaticus
Scrophularia nodosa
Senecio erucifolius
Senecio jacobaea
Silaum silaus
Sinapis arvensis
Sonchus arvensis
Stachys sylvatica
Stellaria holostea
Succisa pratensis
Tilia cordata
Tragopogon pratensis

Trifolium pratense
Tripleurospermum inodorum
Typha angustifolia
Verbascum nigrum
Verbascum thapsus
Veronica beccabunga
Viola arvensis
Viola hirta

75 – Eurasian Temperate
Arctium minus
Bidens tripartita
Campanula glomerata
Carex sylvatica
Chelidonium majus
Cirsium arvense
Epipactis helleborine
Herminium monorchis
Lysimachia vulgaris
Lythrum salicaria
Myriophyllum spicatum
Odontites vernus
Persicaria maculosa
Picris hieracioides
Plantago media
Polystichum aculeatum
Ranunculus circinatus
Rorippa amphibia
Salix triandra §
Salix viminalis §
Sedum telephium
Seseli libanotis
Thlaspi arvense
Torilis japonica

76 – Circumpolar Temperate
Asplenium ruta-muraria
Astragalus danicus
Bidens cernua
Calystegia sepium
Chenopodium glaucum §
Chenopodium hybridum §
Clinopodium vulgare
Dryopteris filix-mas
Glyceria maxima
Koeleria macrantha
Lemna trisulca
Monotropa hypopitys
Myriophyllum verticillatum
Ophioglossum vulgatum
Persicaria hydropiper
Pteridium aquilinum
Sparganium erectum
Veronica catenata
Viburnum opulus

81 – Oceanic Southern-temperate
Anagallis tenella
Lepidium heterophyllum
Ulex minor

82 – Suboceanic Southern-temperate
Aira praecox
Bunium bulbocastanum
Callitriche obtusangula
Digitalis purpurea
Hydrocotyle vulgaris
Iberis amara
Ilex aquifolium
Iris foetidissima
Lactuca virosa
Leontodon saxatilis
Lonicera periclymenum
Narcissus pseudonarcissus
Oenanthe crocata
Oenanthe lachenalii
Orobanche rapum-genistae
Osmunda regalis
Petroselinum segetum
Ranunculus hederaceus
Ranunculus parviflorus
Scrophularia auriculata
Stachys arvensis
Teucrium scorodonia

83 – European Southern-temperate
Aira caryophyllea
Ajuga chamaepitys
Alopecurus myosuroides
Anacamptis pyramidalis
Anisantha sterilis
Anthemis arvensis
Anthemis cotula
Ballota nigra
Bromus hordeaceus
Carex distans
Carex flacca
Carex pendula
Centaurium erythraea
Cerastium brachypetalum §
Cerastium glomeratum
Chrysanthemum segetum
Coronopus squamatus
Equisetum telmateia
Euphorbia exigua
Euphorbia peplus
Euphorbia platyphyllos
Filago vulgaris
Fumaria densiflora
Fumaria officinalis
Fumaria parviflora
Geranium dissectum
Geranium molle
Hedera helix
Holcus lanatus
Hypochaeris radicata
Iris pseudacorus
Juncus effusus
Juncus subnodulosus
Kickxia elatine
Kickxia spuria
Legousia hybrida
Lemna gibba
Lolium perenne
Lotus glaber
Matricaria recutita
Myosotis ramosissima
Ornithogalum angustifolium
Orobanche minor
Papaver argemone
Papaver rhoeas
Phleum bertolonii
Picris echioides §
Ranunculus bulbosus
Ranunculus ficaria
Reseda lutea
Rubus fruticosus agg.
Rumex pulcher
Sagina apetala
Sambucus ebulus §
Saxifraga tridactylites
Senecio vulgaris
Sherardia arvensis

Sisymbrium officinale
Sonchus asper
Sonchus oleraceus
Spergularia rubra
Spiranthes spiralis
Trifolium striatum
Valerianella carinata
Veronica arvensis
Veronica hederifolia
Vicia sativa

84 – Eurosiberian Southern-temperate
Agrimonia eupatoria
Alisma lanceolatum
Anagallis arvensis
Apium graveolens
Apium nodiflorum
Arenaria serpyllifolia
Cardamine hirsuta
Carex divulsa
Carex muricata
Carex otrubae
Centaurium pulchellum
Chenopodium murale
Cichorium intybus
Conium maculatum
Convolvulus arvensis
Cuscuta epithymum
Dactylis glomerata
Daucus carota
Erodium cicutarium
Erophila verna
Festuca arundinacea
Galium tricornutum §
Geranium rotundifolium
Hordeum murinum
Hyoscyamus niger
Hypericum perforatum
Juncus articulatus
Juncus inflexus
Lactuca serriola
Lamium amplexicaule
Lithospermum arvense
Malva sylvestris
Misopates orontium
Ononis spinosa
Papaver dubium
Plantago coronopus
Plantago lanceolata
Potentilla reptans
Pulicaria dysenterica
Ranunculus arvensis
Reseda luteola
Rorippa nasturtium-aquaticum
Rumex conglomeratus
Rumex crispus
Salix alba
Sanguisorba minor
Scandix pecten-veneris
Silene latifolia
Stellaria pallida
Torilis arvensis §
Trifolium arvense
Trifolium campestre
Trifolium fragiferum
Urtica urens
Veronica polita
Vulpia myuros

85 – Eurasian Southern-temperate
Agrostis gigantea
Epilobium hirsutum
Euphorbia helioscopia
Lotus corniculatus
Origanum vulgare
Potamogeton crispus
Silene vulgaris
Solanum dulcamara
Solanum nigrum
Verbena officinalis §
Veronica anagallis-aquatica

86 – Circumpolar Southern-temperate
Asplenium trichomanes
Ceratophyllum demersum
Lemna minor
Persicaria lapathifolia
Poa angustifolia
Potamogeton pusillus
Samolus valerandi
Spirodela polyrhiza
Typha latifolia
Zanichellia palustris

91 – Mediterranean-Atlantic
Aceras anthropophorum
Torilis nodosa
Umbilicus rupestris

92 – Submediterranean-Subatlantic
Blackstonia perfoliata
Bryonia dioica
Catapodium rigidum
Ceterach officinarum
Daphne laureola
Geranium lucidum
Luzula forsteri
Medicago arabica
Mercurialis annua
Minuartia hybrida
Ophrys apifera
Ornithogalum pyrenaicum
Papaver hybridum
Parietaria judaica
Polystichum setiferum
Sedum album §
Sison amomum
Tamus communis
Trifolium micranthum
Trifolium subterraneum
Vicia parviflora
Vulpia bromoides

?? – Undesignated
Poa humilis
Rorippa microphylla

ENDEMIC SPECIES

71 – Oceanic Temperate
Euphrasia anglica
Euphrasia pseudokerneri
Ulmus plotii

§ after name indicates species doubtfully native in Britain and Ireland.

RECORDERS 1997

Meteorology: Mr M.C. Williams, 2 Ivel Close, Barton-le-Cley, Bedford MK45 4NT
Geology and Palaeontology: Mr P. Smart, 46 Brecon Way, Bedford MK41 8DD
Mammals: Mr C. Tack, 1 Gate Cottage, Whipsnade Wild Animal Park, Dunstable LU6 2LR
Mammals (Bats): Ms J. Childs, 16 Judith Gardens, Potton SG19 2RJ
Dr A. Aldhous, 16 Judith Gardens, Potton, SG19 2RJ
Birds: Mr D. Odell, 74 The Links, Kempston, Bedford MK42 7LT
Mr M. Palmer, 48 Gilbert Close, Kempston, Bedford MK42 8RN
Bird Ringing Co-ordinator: Mr D.S. Woodhead, 26 Batcheldor Gardens, Bromham, Bedford MK43 8SP
Reptiles and Amphibians: Mrs H. M. Muir-Howie, "Vivarium", 19 Molivers Lane, Bromham, Bedford, MK43 8JT
Fish and Crayfish: Mr H. Winter, 34 The Silver Birches, Kempston MK42 7TS
Grasshoppers and Crickets: Mr K. Sharpe, 22 Russett Close, Stewartby, MK43 9LG
Dragonflies: Mr S. Cham, 45 Weltmore Road, Luton LU3 2TN
Bugs (Heteroptera): Dr B.S. Nau, 15 Park Hill, Toddington, Dunstable, Beds LU5 6AW
Bugs (Homoptera): Dr C. Malumphy, 36 Winsdon Road, Luton LU1 5JT
Lacewing Flies: Dr B. Verdcourt, The Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB
Butterflies: Mr C. Baker, 3 Holywell Close, Studham, Dunstable LU6 2PB
Moths (macro): Mr L. Field, 24 Kingsdown Avenue, Luton LU2 7BU
Moths (micro): Mr D.V. Manning, 27 Glebe Rise, Sharnbrook, Bedford MK44 1JB
Hoverflies: Miss L. Smart, 273 Park Street, Luton LU1 3HH
Social Wasps: Mr R. Revels, 73 London Road, Biggleswade SG18 8EE
Flowering Plants, Ferns and Fern Allies: Mr C. R. Boon, 68 Mill Lane, Greenfield, Bedford MK45 5DF
Lichens: Mrs F.B.M. Davies, "Rose Cottage", 69 The Hill, Wheathampstead, St. Albans AL4 8PR
Fungi: Dr D.A. Reid, 38 Norfolk Way, Elmer Sands, Middleton-on-Sea, West Sussex PO22 6JF
Sites: Miss R. Brind, c/o Bedford Museum, Castle Lane, Bedford MK40 3XD

Where a species is not covered by one of the Society's Recorders please pass the record on to Miss R. Brind, Bedford Museum, Castle Lane, Bedford MK40 3XD.

BEDFORDSHIRE NATURAL HISTORY SOCIETY

The Bedfordshire Natural History Society was formed in 1946 and its main function is to record the fauna and flora of the county. For this purpose it has over twenty active Recorders who cover many branches of natural history study and whose annual reports are published in *The Bedfordshire Naturalist.* Members also receive a quarterly newsletter, *The Muntjac* and programmes of meetings. These latter include field meetings to sites having a natural history interest within the county and occasional meetings further afield. During the winter months there are illustrated lectures, normally held at one of the following places: Toddington, Elstow, Haynes and Maulden. The Society depends on the annual subscriptions which are devoted to carrying out its work, as all officers are honorary. Membership is open to everyone, whether resident in the county or not.

THE BEDFORDSHIRE BIRD CLUB

The Bedfordshire Bird Club was set up in 1993 by birdwatchers, from both inside and outside the BNHS, to cater for their specialist needs. Its main functions are to record and document the avifauna within the county and to provide a forum for local birdwatchers. Members receive the annual bird report as Part 2 of *The Bedfordshire Naturalist* and also receive a bimonthly newsletter, *The Hobby*, and programmes of indoor and outdoor meetings. The winter meetings are held on the last Tuesday of the month between September and April at Maulden Village hall. Field meetings are equally spread between venues with a bird interest within the county and much further afield. The Club has a very active core of its membership participating in both locally and nationally organised surveys.

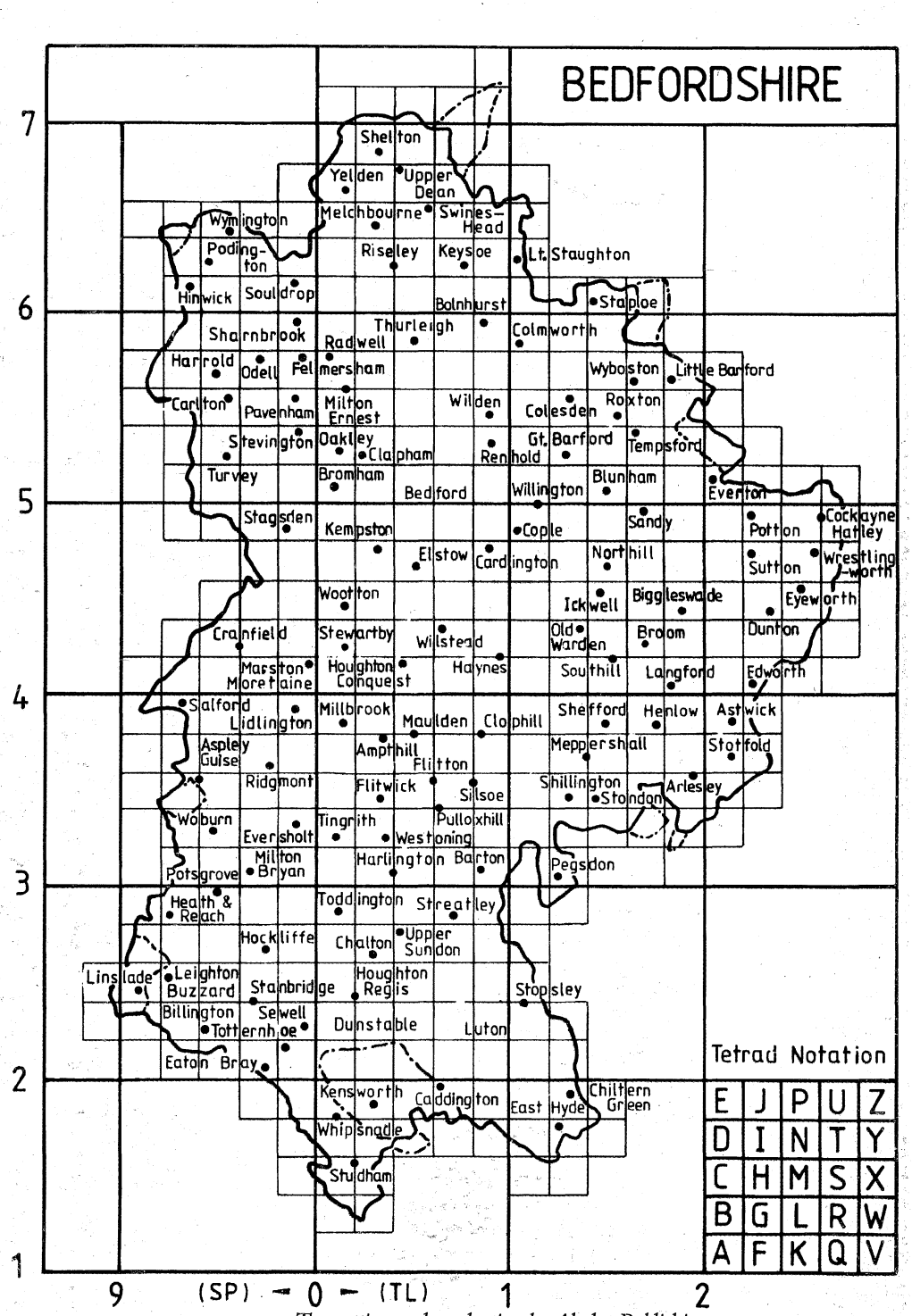
PUBLICATIONS

The Society has an excellent record of publications in addition to its annual Journal. *Bedfordshire Wildlife* published in 1987 gives a broad overview of our wildlife habitats, flora, fauna and geology. The *Bedfordshire Bird Atlas* maps the distribution of breeding birds within the county from 1968 to 1977, and this was followed by extensive fieldwork to produce the more recent *Atlas of the Breeding Birds of Bedfordshire 1988 – 92. The Butterflies and Moths of Bedfordshire* published in 1997 is the most comprehensive survey of the butterflies and moths of Bedfordshire ever produced, summarising the history and current distribution of more than 1,300 species found in the county as well as looking at changes in habitats and recent population studies.

MEMBERSHIP

For membership details of the Bedfordshire Natural History Society and the Bedfordshire Bird Club, write to:

Hon. Membership Secretary, 28 Chestnut Hill, Linslade, Leighton Buzzard, Beds LU7 7TR



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