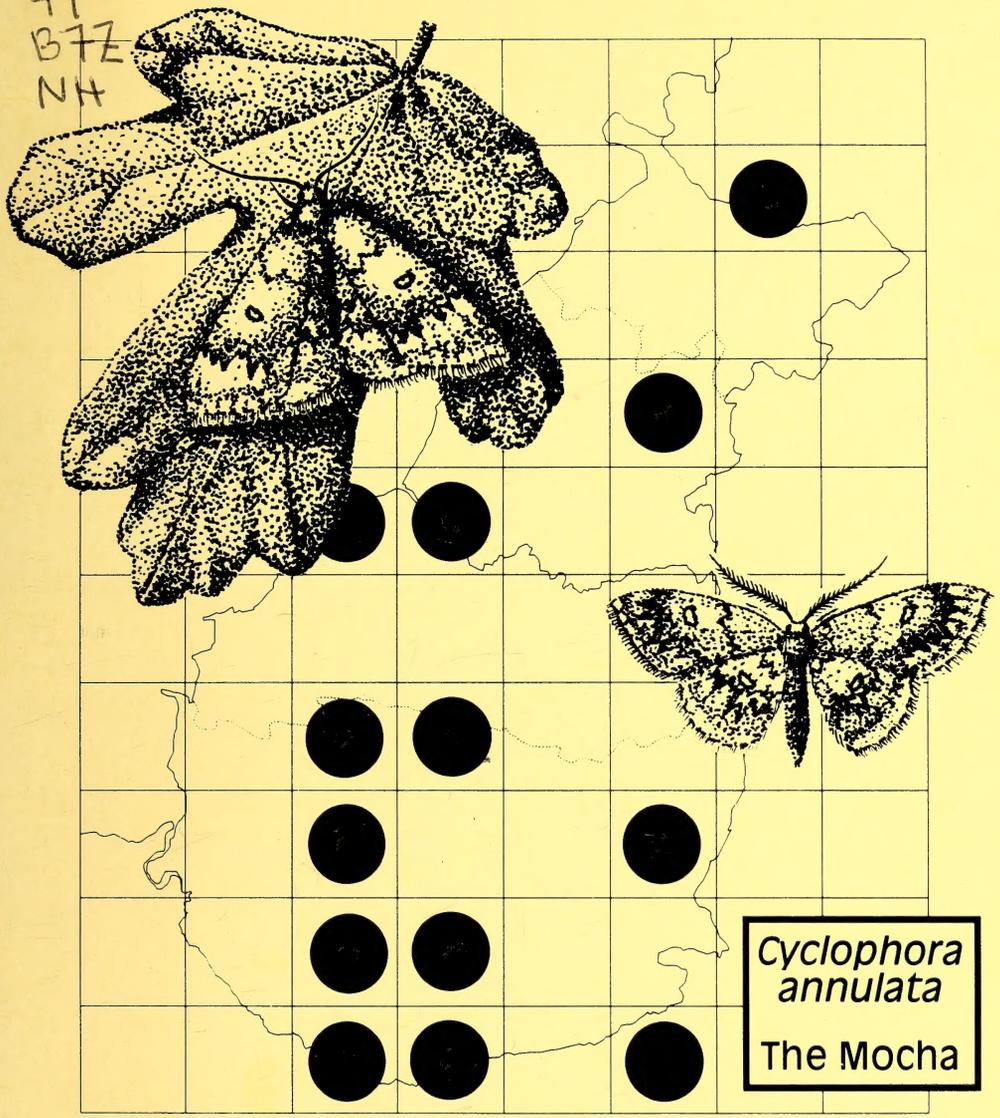


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NATURE IN AVON

PROCEEDINGS OF THE BRISTOL NATURALISTS' SOCIETY, 1994

ISSN 0068-1040

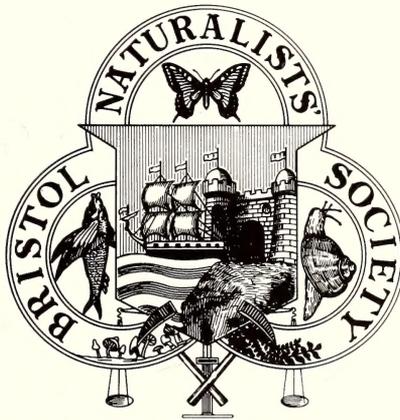
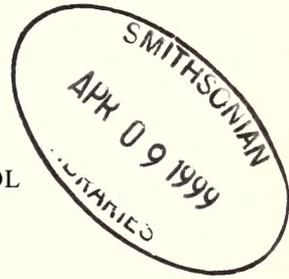
NATURE IN AVON

THE PROCEEDINGS OF THE BRISTOL
NATURALISTS' SOCIETY

VOLUME 54 (for 1994)

EDITED BY A. F. HOLLOWELL

ASSISTED BY A COMMITTEE



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Printed for the Society by Healey's, Fore St, Ipswich

COUNCIL, 1994

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President:

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B.M.J. Gray

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R. G. Holmes

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Dr G. Jones

D. P. C. Trump

Miss A. Heckels

D. A. Wilson

Dr N. Malcolm

VOLUME 54

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FRONT COVER by Philippa Burrell: The moth *The Mocha Cyclophora annulata* (Schulze) ($\times 2$), and its distribution in the Bristol district.

REPORT OF COUNCIL, 1994

Membership at 31 December was 563, twelve fewer than in December 1993. At the Annual General Meeting in January, Mr D. A. Wilson was re-elected President and the Officers and Members of Council were elected (see list on page 2). Council met nine times during the year. Mr and Mrs R. G. Symes produced the customary ten issues of the Bulletin, which reached its 30th birthday in April. Council thanks them for contributing the substantial amount of work entailed, and also the volunteers who distributed many copies, saving the Society some £450 in postage during the year.

The Society's *Proceedings* for 1992 appeared in September, after delays outside the control of all those concerned. By the end of the year work on the 1993 *Proceedings* was well advanced and our Hon. Editor, Dr P. R. Crowther, kindly undertook to oversee its completion, although he had indicated his intention not to seek re-election in 1995. Council records its appreciation of his great professionalism and the large amount of time and effort he has devoted in producing several issues over six years. The Avon Bird Report for 1993 was published in September, with for the first time a front cover in colour. The Report is produced by the Avon Ornithological Group, a consortium of the Society and Bristol Ornithological Club. A revised version of the Society's publicity brochure being needed, Council arranged for its illustration in black and white by wildlife artist and Society member Greg Poole.

Besides the regular programme of lectures and field visits, several field visits were devoted to invertebrates and to mammals, as well as some geology working parties, making a total of 68 events during the year. At the Annual Supper, held in April at a new venue, St Ursula's School, Miss M. H. Rogers and Miss E. Fleure described their travels through the varied habitats of Costa Rica. For the general indoor meetings it was decided to return, after several years, to using lecture theatres at the University, as the facilities at the Victoria Church Hall were proving inadequate.

A grant was made from the Hector Hockey Memorial Fund towards the cost of an interpretation board at a geological field site on the Bristol/Bath Railway cycle path. Council also donated £50 from the Conservation Fund to the Gloucestershire Wildlife Trust, in support of its education initiative, "Learning for Life". The Conservation Fund is composed of donations made by members, often as additions to their annual subscriptions, and Council commends it as a way in which even small sums can be combined to give effective support to conservation.

Members continued to contribute to numerous natural history projects, including the work of specialised local groups studying invertebrates and mammals. The Ornithological Section has continued long-running local studies and has participated in national surveys mounted by the British Trust for Ornithology, to which the Society is affiliated. Also, members have contributed time and expertise to the work of the Severn Estuary Conservation Group, the adjoining County Wildlife Trusts and English Nature, forging links which are important to the Society and which demonstrate its continuing interest in and support for nature conservation.

Council records with regret the deaths during the year of Mrs N. J. Gibbs (see *Bristol Botany in 1994*), Miss M. Hunter and Mrs L. J. Thomas.

SYLVIA KELLY, *Hon. Secretary.*

GENERAL & SECTIONAL PROCEEDINGS

GENERAL MEETINGS, 1994

- 16 Jan. Annual General Meeting & Presidential Address - "Scenery and natural history of eastern Almeria, Spain", by Mr D. A. Wilson.
- 10 Feb. "The National Trust - a biological survey", by Dr K. Alexander.
- 12 Mar. Joint meeting with Ornithological Section. "The wildlife of the Arctic", by Prof. R. Vaughan.
- 22 Mar. Annual Supper. "Travels through Costa Rica", by Miss M. H. Rogers and Miss E. Fleure.
- 8 Oct. "The natural history of Sand Bay", by Mr M. Evans.
- 3 Nov. "Close-up and macro-photography - the photography of small things", by Mr V. Marsden.
- 1 Dec. Sheep and goats in nature conservation", by Dr D. Bullock.

SYLVIA KELLY, *Hon. Secretary.*

GENERAL FIELD MEETINGS, 1994

- 5 Mar. Miss S. Garden. Royal Botanic Gardens, Kew. Spring bulbs made a fine show, especially the 1.6 million crocuses donated by The Readers' Digest in 1988. All the glass-houses provided something of interest.
- 1 Apr. Miss S. McCarthy. Hay-on-Wye. A walk over fields to Hay Common. Good patches of Toothwort and Yellow Saxi frage but too windy for birds. A visit was made to the village of Clyro which has connections with Parson Kilvert, author of the famous diary.
- 14 May Miss M. Morris. Gwent Wildlife Trust Reserve at Penallt, Monmouthshire, to see wildflower meadows, some with orchids. Afternoon walk in woods and fields above the River Wye near Catbrook.
- 25 Jun. Miss R. Lee. Bredon Hill near Tewkesbury. A walk over the hill from Overbury to Elmley Castle, with excellent views from the hilltop. Many flowers characteristic of limestone were found, including Pyramidal Orchids and some fine plants of Woolly Thistle.
- 23 Jul. Dr N. Malcolm and Mr A.G. Smith. Craig-y-Llyn, Rhondda Valley. A very successful visit, in a heatwave, to two corrie lakes and to the top of the scree slopes above them. There were many acid-loving plants in the water and at the edge, including Water Lobelia, Quillwort and Bulbous Rush.
- 17 Sep. Mr D. Cullen. Studland area. A rewarding walk along the edge of Brands Bay and then over heathland near Little Sea. Many interesting birds were seen including Little Egrets.
- 22 Oct. Miss M. McCarthy. Forest of Dean. A circular walk from The Dean Heritage Centre to Blaise Bailey and back, passing some historical features of the Forest. Afternoon walk round the Soudley Pools, with magnificent autumn colours, then a visit to The Dean Heritage Centre itself.

GENERAL & SECTIONAL PROCEEDINGS

12 Nov. Miss M. Morris. Tewkesbury area. Sixteen members braved a very damp day to walk by a disused canal, along the River Severn and around Frampton Pools, for birds, and some late flowers and fungi.

RACHEL C. LEE, *Hon. Secretary, Field Committee.*

REPORT OF THE GEOLOGICAL SECTION, 1994

At the Annual General Meeting held on 19 January, the President, Dr M. J. Simms, the Hon. Secretary, Dr P. R. Crowther, the Hon. Field Secretary, Mr S. C. Carpenter and the Hon. Treasurer, Mr V. D. Dennison were re-elected. The Committee comprised Dr M. J. Benton, Mr D. Cope, Mrs M. Poolman and Mr D. Wilson.

The following indoor meetings were held:

- 19 Jan. Annual General Meeting and Presidential Address, "Geological ramblings in Gloucestershire, Avon and Somerset", by Dr M. J. Simms.
- 16 Feb. "The Oxford Clay world", by Dr N. Hollingworth.
- 16 Mar. "Volcanoes in Space", by Dr P. Gravestock.
- 19 Oct. "Ice, ash and the deep blue sea", by Mr J. B. Hunt.
- 15 Nov. "Birds in the fossil record", by Mr P. G. Davis.
- 14 Dec. Members' Evening.

The following field meetings were held, under the leadership of those shown.

- 13 Mar. Mesozoic rocks of the Chepstow area. Dr M. J. Simms.
- 17 Apr. The Frome Valley, Bristol. Mr R. Smith.
- 10 Jul. Dundry Hill, Bristol. Mr A. Bentley and Mr S. Carpenter.
- 3 Sep. Wootton Bassett mudsprings. Dr N. Hollingworth.
- 5 Nov. Geologists' Association Reunion, London. Combined meeting with Bath Geological Society.

MICHAEL J. SIMMS, *Hon. Secretary.*

REPORT OF THE BOTANICAL SECTION, 1994

At the Annual General Meeting, held on 4 January 1994 at the Westmorland Hall, Durham Park, the following were elected: President - Mr A. C. Titchen; Hon. Secretary and Treasurer - Mr A. G. Smith; Committee - Miss I. F. Gravestock, Mrs C. Kitchen, Mr M. Kitchen, Dr N. Malcolm, Mr L. Taylor, Mrs H. Titchen and Mrs N. Vaughan Davies. Miss P. Pockson, who retired after serving the Section since 1989, was warmly thanked for her work and the support she had given.

The following indoor meetings were held:

- 4 Jan. Annual General Meeting and Presidential Address, "The flora of Tenerife", by Mr A. C. Titchen.

GENERAL & SECTIONAL PROCEEDINGS

- 1 Feb. "Foul play on the bottom" (seaweeds), by Dr R. Fletcher.
9 Mar. "The making of the Wiltshire Flora", by Mr D. Green
20 Oct. "Managing the Avon Gorge SSSI and National Nature Reserve", by Mr A. Robinson.
3 Nov. Joint General/Botanical Section Meeting. "Close-up and macro-photography - the photography of small things", by Mr V. Marsden.
28 Dec. "Botany and the land of Israel", by Dr N. Malcolm & Mr A. C. Titchen.
- The following field excursions took place under the leadership of those shown.:-
- 6 Mar. Stogumber and Upper Vexford, Mrs H. Titchen.
13 Mar. Rocky shore at Westward Ho, Mr A. G. Smith.
20 Apr. Botany and current projects at Folly Farm, Miss P. Pockson.
8 Jun. The remnant flora of Worle Hill, Mr M. Evans.
18 Jun. Priddy Pools and Stockhill Forest, Miss P. Pockson.
22 Jun. Churchill Hall arboretum, Bristol University, Mr A. C. Titchen.
9 Jul. Cheddar Cliffs, Dr N. Malcolm.
20 Aug. Rodway Hill, Mr M. & Mrs C. Kitchen. (Marsh St John's Wort rediscovered).
4 Sep. Forde Abbey, Mr A. C. Titchen.

A. G. SMITH, *Hon. Secretary*

REPORT OF THE ORNITHOLOGICAL SECTION, 1994

At the 70th Annual General Meeting on 12 January, Mr T. G. Evans was elected as President in succession to Mr B. M. J. Gray, and the Hon. Secretary and Treasurer, Mr R. G. L. Holmes was re-elected. Mrs J. Fowles and Mr and Mrs J. Prince were elected to the Committee and Mr P.J. Chadwick and Mrs P. M. Woodbridge retired from the Committee.

The following indoor meetings were held:

- 12 Jan. Annual General Meeting and a video presentation: "Endangered Species and Habitats".
11 Feb. "The Birds of Florida and Texas", by Mr M. Sainsbury.
12 Mar. Joint General/Ornithological Section meeting. "The wildlife of the Arctic", by Prof. R. Vaughan.
12 Oct. "The Wildlife of the Northumbrian Coast", by Miss W. Dickson.
11 Nov. "Some Birds of Sri Lanka", by Mr P. J. Chadwick.
7 Dec. "The Wildfowl and Wetlands Trust", by Mr D. Paynter.

GENERAL & SECTIONAL PROCEEDINGS

The following 18 field meetings were held, under the leadership of those shown:

- 15 Jan. Slimbridge, Wildfowl & Wetlands Trust. Mr D. Paynter.
- 19 Feb. Exe Estuary and Dawlish Warren. Dr H. E. Rose.
- 13 Mar. Brean Down / Axe Estuary. Mr B. M. J. Gray.
- 24 Apr. Sand Point. Mr P. J. Chadwick.
- 5 May Snuff Mills. Mr R.L. Bland.
- 8 May Nagshead, Forest of Dean. Mr T. G. Evans.
- 18 May Inglestone Common. Mr R. G. L. Holmes.
- 21 May North Stoke, near Bath. Mr B. M. J. Gray.
- 2 Jun. Blaise Woods. Mr J. Tully.
- 15 Jun. Leigh Woods. Mr A. Robinson.
- 23 Jun. Eastwood Farm, Brislington, Bristol. Mr B. M. J. Gray.
- 11 Sep. Hinkley and Durleigh Reservoir. Mr P. J. Chadwick.
- 15 Oct. Chew Valley Lake. Mr R. Curber.
- 20 Nov. Greater Westhay and Catcott Lows. Mr R. G. L. Holmes.
- 26 Dec. Clevedon Sea Wall. Dr H. E. Rose.
- 28 Dec. Exe Estuary and Dawlish Warren. Mr B.M.J. Gray

During the year, members took part in national surveys including the Roosting Gulls Survey, the Birds of Estuaries Survey, Duck Counts and the Heronry Census. For the new BTO Breeding Birds Survey, recording was carried out in 65 one-km squares. Fieldwork also included our Overwintering Warblers Survey, Song Thrush, Buntings and Woodland Birds Surveys and the long-running Birds in Garden Survey. Numerous nest record cards were completed for the B. T. O.

RICHARD HOLMES, *Hon. Secretary.*

LIBRARY REPORT, 1994

Mr R. G. Symes was elected as Library Committee Chairman for 1994. Mr S. G. Thomas, a regular user of the Library, was welcomed as a new Committee Member. Committee members staffed the Library at the opening times advertised in the Bulletin; from November 1st, the opening time on Wednesdays was extended to 1 hour, from 12.30 to 1.30 pm.

Although usage of the Library decreased during the year, 211 visits were made by 26 members who borrowed 133 items.

Five books were purchased, and 31 donated books were accepted into the library stock together with 13 reports and reprints and over 100 issues of journals. For these donations we are indebted to the University of Bristol and Dr L. C. Frost, Mr P. J. M.

Nethercott, Mr R. G. Symes, Mr D. A. Wilson, Prof. A. J. Willis, and the estate of the late Dr Mary Green. Special name plates are added to books given to the collection by members. Most books and journals received as gifts are retained in the Library but for various reasons some are sold and the proceeds used for the benefit of the Library. Thirty-one journals were purchased on subscription, 50 were received as exchanges, and 5 were free or gifts. No binding was done, it having become extremely expensive.

The Committee met four times, and three working parties were organised. Work was aimed at further reorganising and labelling the shelving, and seeking to reduce holdings of items which are little used or of minor local interest in order to create space for the collection to continue growing. Amongst disposals a short run of early journals was given to Manchester City Library, which was delighted to receive them. An aluminium ladder was purchased to improve access to the higher shelves.

The Society wishes to thank Mrs Hilary McGowan, Divisional Director (Museums and Heritage), Leisure Services, Bristol City Council for the continued use of the Library room and for the assistance given to members during the year by Museum staff.

The Committee is pleased to commend to members the improvements which have been achieved in the Library, and looks forward to a busy year with members taking advantage of the extended opening hours on Wednesdays. Any suggestions for improvements to the Library are always welcomed by the Committee.

R. G. SYMES, *Chairman, Library Committee*

THE SOCIETY'S ACCOUNTS FOR 1991 AND 1992

In preparing the Accounts for 1989 for the printer, some editorial changes were made from the versions prepared by the then treasurer, Mr P. J. M. Nethercott and audited by Mr T. B. Silcocks. The software then used to prepare the copy for the printer was unable to cope with the Accounts, so these were prepared separately using spreadsheet software. It was still necessary to delete as many words as possible and to arrange one below another items that were originally in one line. The same procedures were used in 1990, 1991 and 1992, new figures being placed in the same spreadsheet design.

Inadvertently the 1991 version appeared with the wrong signing date as, by an oversight, the spreadsheet's "today's date" facility had been turned on. Also, a note about the Hector Hockey Fund, which had appeared in former years, was deleted from the Accounts for 1991 and 1992 yet still appeared in the printed version as it had not been deleted from the spreadsheet. Mr Nethercott tells us that neither he nor Mr Silcocks saw proofs of the printed Accounts for 1991 and 1992, so these mistakes were not detected before printing. We apologise for this omission, which probably occurred in the rush to meet printing deadlines, and also for the errors in the printed versions.

At Mr Nethercott's request we reprint on the following four pages the Accounts for 1991 and 1992 exactly as they were originally prepared, which is possible with the modern software now in use. We are glad to do this, especially in view of his long service as treasurer. It is emphasised that though some details were omitted all the totals as originally printed were correct, and that the editorial changes made in 1991 and 1992 were the same as those made, and approved, in 1989 and 1990.

A. F. Hollowell, *Honorary Editor, 1995-96.*

BENEFACTORS' FUNDS

Receipts and payments for the year ended 31 December

<u>1991</u>	<u>1992</u>		
£	£		
		<u>Harry Savory Illustrations Fund</u>	
288	288	Fund at 31 December 1991	
<u>288</u>	<u>290</u>	Additions to it in 1992	
		<u>Conservation Appeal</u>	
167	167	Fund at 31 December 1991	
<u>167</u>	<u>282</u>	Additions to it in 1992	
		<u>Hector Hockey Memorial Fund</u>	
6677	6677	Fund at 31 December 1991	
	<u>573</u>	Add Year's income on investments	
	7250		
	<u>300</u>	Less grant made (<i>Proceedings</i> 1990)	
<u>6677</u>	<u>6950</u>		
		<u>R. G. Williams Memorial Fund</u>	
630	630	Fund at 31 December 1991	
		Additions to it in 1992 (Miss D. Parsley be- quest 200, Mrs D. Grenfell in memory of Adrian 100, friends in memory of Miss M. Plater 60)	
	<u>360</u>		
	990		
	<u>517</u>	Grant made (1), purchase of projector	
<u>630</u>	<u>473</u>		

NOTES:

(1) No value is placed upon the contents of the library and stocks of publications.

(2) These accounts do not record balances held by sectional treasurers or the Ornithological Section's Special Fund of £706-07.

P. J. M. Nethercott T. B. Silcocks
Hon. Treasurer, 1992 Hon. Auditor
28 March 1993 23 April 1993

GENERAL & SECTIONAL PROCEEDINGS

STATEMENT OF ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 1994

<u>Income and Expenditure for the year</u>		<u>Balance Sheet at 31 December 1994</u>	
1993	1994	1993	1994
£	£	£	£
	<u>Income</u>		<u>Assets</u>
4139	Members' subscriptions		Income Bonds (National Savings)
202	Donations	5000	National Savings Bank
-	Income tax repayment	1677	Cash at banks - current accounts
195	Bank interest	693	- interest account
201	Supper, profit	8579	Prepayment
149	General field meetings, surplus	<u>15949</u>	16595
2371	Proceedings: sales (), and grants ()	3494	Less creditors (subscriptions in advance
<u>168</u>	Sales of surplus journals and books	<u>303377</u>	(187), hire of rooms (180), <i>Proceedings</i>
<u>6038</u>	Total income	<u>12355</u>	1991 (1459), other (81)
	<u>Expenditure</u>		<u>1907</u>
85	Bank charges		<u>14688</u>
21	Donations		
1966	Proceedings (1482) and Bird Report (495)	4593	General Fund at 31 Dec. 1991
572	Library - books (208), journals (279), insurance (138), fittings (42), other (25)		<u>2100</u>
690	Postage and telephone	288	Benefactors' Funds:
1070	Printing and stationery	167	Harry Savory Illustrations Fund
481	Indoor meetings	6677	Conservation Appeal
130	Grants to Sections	<u>473</u>	Hector Hockey Memorial Fund
5134	Total expenditure	<u>12355</u>	R. G. Williams Fund
904	Surplus on year	<u>7311</u>	
<u>6038</u>			
			4593
			6693
			253
			255
			6778
			<u>459</u>
			<u>14688</u>

BENEFACTORS' FUNDS

Receipts and payments for the year ended December 31

1993

£

1994

£

Harry Savory Illustrations Fund

193 Fund at 31 December 1993

60 Additions to it in 1994

193

193

60

253

Conservation Appeal

185 Fund at 31 December 1993

120 Additions to it in 1994

305

50 Less grant (Glos. Wildlife Trust)

282

185

120

305

50

255

6580

Hector Hockey Memorial Fund

6580 Fund at 31 December 1993

398 Add Year's income on investments

6978

200 Less grant made (NOTE 3)

6950

6580

398

6978

200

6778

R. G. Williams Memorial Fund

459 Fund at 31 December 1993 and 31 Dec-

ember 1994

459

459

459

NOTES

(1) No value is placed upon the contents of the library and stocks of publications.

(2) These accounts do not include any balances held by sectional treasurers or the Ornithological Section's Special Fund of £777-?7p.

(3) The Hector Hockey Memorial Fund is represented by the Income Bonds and the National Savings Bank Account. The grant made from the fund during 1994 was towards the cost of an interpretation board at a geological site.

S. M. Taylor
Hon. Treasurer

T. B. Silcocks
Hon. Auditor

PAST PRESIDENTS

WILLIAM SANDERS	1862
HENRY E. FRIPP	1876
GEORGE FORSTER BURDER	1880
JOHN BEDDOE	1883
Professor WILLIAM RAMSAY	1884
Rev. THOMAS HINCKS	1887
Professor C. LLOYD MORGAN	1890
Professor ADOLPH LEIPNER	1893
Professor SYDNEY YOUNG	1894
S. H. SWAYNE	1897
Professor C. LLOYD MORGAN	1899
ARTHUR B. PROWSE	1901
C. K. RUDGE	1904
JAMES W. WHITE	1907
G. MUNRO SMITH	1910
Miss I. M. ROPER	1913
G. C. GRIFFITHS	1917
ERNEST (later Sir Ernest) COOK	1919
H. WOMERSLEY	1922
Professor O. V. DARBISHIRE	1924
JAMES RAFTER	1927
A. L. FLEMMING	1930
J. W. TUTCHER	1930
F. S. WALLIS	1933
Professor O. V. DARBISHIRE	1934
G. E. J. McMURTRIE	1935
Professor MACGREGOR SKENE	1938
H. TETLEY	1942
Sir LEWIS L. FERNOR	1945
F. W. EVENS	1948
H. H. DAVIS	1950
Professor W. F. WHITTARD	1952
J. H. SAVORY	1954
R. BASSINDALE	1956
Miss M. H. ROGERS	1958
F. COLES PHILLIPS	1960
H. H. DAVIS	1962
R. J. G. SAVAGE	1963
A. F. DEVONSHIRE	1965
F. R. STERNE	1966
R. BRADSHAW	1968
S. M. TAYLOR	1970
Mrs A. F. HOLLOWELL	1972
D. H. PEREGRINE	1974
D. HAMILTON	1976
J. F. W. McOMIE	1978
J. W. COWIE	1980
J. G. PRINCE	1982
V. D. DENNISON	1983
R. M. PAYNE	1985
T. E. THOMPSON	1987
Miss R. C. LEE	1989
R. G. SYMES	1991

AVON & DISTRICT INVERTEBRATE REPORT, 1994

Compiled by R.J. BARNETT

City Museum and Art Gallery, Queen's Road, Bristol BS8 1RL

INTRODUCTION

In the summer of 1994, four field meetings, particularly aimed at invertebrate recording, were organised by members of the Society, . The intention was to test the feasibility of re-forming the Entomological Section following its demise at the beginning of the decade. Attendance was not sufficient to enable plans for the re-formation of the section to go ahead immediately; more support was hoped for in 1995. The meetings were as follows.

<i>Site</i>	<i>Date</i>	<i>Leader</i>
Weston Big Wood & Middle Hill Common	4 June	Bill Dixon
Dolebury Warren	18 June	Justin Evans
Goblin Combe	17 July	Justin Evans
Leigh Woods	13 August	Tony Smith

Invertebrate recording organised from outside the Society continued in a number of areas and often included substantial contributions from B.N.S. members. The Avon Butterfly Project continued to gather information from across the county as did the Bristol & District Moth Group, and the Mollusc Atlas Project, organised by the Somerset Invertebrate Group. Other cross Avon/Somerset work was carried out regularly by the West Mendip Invertebrate Group and by Ted and Dave Levy, hoverfly experts from Yeovil. On the Avon Levels, the Gordano Valley Invertebrate Group added further to the species lists for the National Nature Reserve. Of the latter work, Simon Randolph and Jeff Holmes' transect survey work on Odonata revealed interesting correlations between rhyme management and dragonfly abundance.

Taken together, these various groups and schemes reflect more activity aimed at gathering knowledge of invertebrates in the region than has been seen for a long time.

There were no major surprises with regard to our resident butterfly fauna during 1994. The Small Blue came under close scrutiny at Worle Hill near Weston-super-Mare. Ken Poole recorded the butterfly at this site from 1937 into the mid-1980's and Frank Bowson confirmed its continued existence during 1994. Martin Evans and Phil Tollerton worked on conserving this site and other threatened colonies close-by. At Dolebury Warren, the Small Blue was the subject of an in-depth study of the ecology of the butterfly by Jerry Board. This should considerably contribute to conservation measures on this site.

Elsewhere, there was the usual sprinkling of Large Tortoiseshell sightings attributed to captive-bred, released stock. This year they were augmented by a number of Swallow-tail butterflies whose origin is known to be artificial. The introduced colony of the Glanville Fritillary had another good year. Rupert Higgins recorded a Queen of Spain Fritillary at a time which coincided with other insect immigrations and so this could have been a genuine visitor. Clouded Yellow sightings were sporadic at this time.

The Moth Group failed to find the Narrow-bordered Bee Hawk at Shapwick and the Light Orange Underwing at Wetmoor, but the latter's absence was probably due to the weather on the day. Night-time meetings were more successful and members attended a nationally organised event at Tintern in the Wye Valley and recorded its three specialities: the Scarce Hook-tip, Pauper Pug and *Salebriopsis albicilla*. A Dormouse, visiting a light-trap, was an added bonus. Migrant moths had a good year with records of Humming-bird Hawk-moths and the Vestal, but in greatest numbers was the Rush-veneer.

Bristol's rarest moth, the Silky Wave was the subject of a confidential report commissioned by English Nature, the Countryside Council for Wales and Butterfly Conservation, during 1994. The report aimed to assess the current status of the moth in the British Isles and make recommendations to ensure its continued survival.

The most significant event concerning Odonata during 1994 was the discovery of a new species for Avon, the Keeled Skimmer. The appearance of a single Yellow-winged Darter was an added bonus, since it is a rare migrant to our shores.

Occasional ladybird swarms appeared and the media also picked up on continental wasps *Dolichovespula media* and *D. saxonica*, and also on the possible threat to earthworms by the introduced New Zealand Flat-worm. Despite numerous claims, no substantiated reports of the latter were received from the region.

As usual, I am extremely grateful to John Weeks for the weather synopsis included in this report and also to Robert Cropper for his summary of the Orthoptera. Robert continues to work on an 'Atlas of Orthoptera and allied Insects in Somerset'. My thanks to all who have taken the time to identify invertebrates and then submit the records to the Society, the Bristol Regional Environmental Records Centre (BRERC) and the various recording schemes and groups. As mentioned in previous years, the records listed represent a personal and subjective judgement of those of most interest.

Recorders mentioned in the species list: Rick Andrews (RA), Mike Bailey (MB), Ray Barnett (RJB), Des Bowring (DB), Bristol & District Moth Group (BDMG), Dave Clark (DC), Robert Cropper (RSC), Dixie Dean (EAD), Bill Dixon (WD), Roger Edmondson (RE), Justin Evans (JE), Martin Evans (ME), Derek Foxwell (DJF), Rupert Higgins (RH), John Martin (JM), Cyril Mathews (CM), Tony Moulin (TM), Tony Parsons (AJP), Ken Poole (KP), Mike Powell (MP), Steve Preddy (SP), Andy Pym (AP), Simon Randolph (SR), Tony Serjeant (TS), Tony Smith (AGS), Phil Sterling (PS), Peter Sturgess (PSs), Kurt Vickery (KV), Darrell Watts (DW), Hilary West (HW), West Mendip Invertebrate Group (WMIG), David Wilson (DWi), Nick Williams (NW), Neil Woodward (NWo).

Scientific nomenclature follows the checklists of Agassiz (1987), Bradley *et al.* (1972), Bradley & Fletcher (1979), Duff (1993), Fitton (1978), Kerney (1976), Marshall & Haes (1988), Pope (1977), Potts (1964) and Smith (1976).

Correction to the 1993 Report: on p.18, 'Yellow Shell' should read 'Yellow Belle'.

WEATHER SYNOPSIS (by John Weeks)

The details refer to a weather station at Yatton. The winter was mild overall, but there was a little snow, which lay for a day in January and four days in February – a feature absent in both 1993 and 1992. There was no outstandingly severe frost in either month, but there was the rarity, for these parts, of a maximum temperature below freezing on 14th February (-1.6°C). March started the spring on an encouraging note, but April reversed the trend, with a mean temperature only a fraction of a degree higher than March's. There were also three days on which snow fell, lying early on the 9th, which was also the wettest April day in recent records (32.1 mm). April did, however, produce one day (29th) with a temperature 'in the seventies' (max. $23.2^{\circ}\text{C}/74^{\circ}\text{F}$). May could not match this feat – its extreme maximum was only $20.1^{\circ}\text{C}/68.3^{\circ}\text{F}$ on 11th.

TABLE 1. Monthly and Seasonal Trends in climate during 1994

	<i>Monthly differences</i>			<i>Seasonal differences</i>	
	<i>Max. T°C</i>	<i>% Rain</i>	<i>% Sun</i>	<i>Max. T°C</i>	<i>% Rain</i>
Dec. '93	0	11.55	5.08		
Jan. '94	+ 1.4	7.48	7.72		
Feb.	0	8.82	5.61	+ 0.8	9.3
March	+ 0.9	8.39	5.61		
April	- 0.4	7.92	5.93		
May	- 1.6	7.41	4.44	- 0.8	8.66
June	0	2	7.05		
July	+ 1.8	4.81	7.72		
Aug.	- 0.5	6.11	4.77	+ 0.7	4.49
Sept.	- 1.5	7.72	4		
Oct.	+ 0.5	7.72	7.92		
Nov.	+ 3.0	5.36	2.68	+ 1.4	117

Summer was the season nearest to normal, with some high temperatures at the end of June (26.7°C on 28th), in early July (27.3° on 1st) and in late July (29.1° on 23rd). There were only 20 rain days in the three months – 4, 6 and 10 respectively – but these included the third wettest day of the year when 27.0 mm fell on 6th July.

September continued the wet spell, which went on intermittently through most of the autumn, the only outstanding features of which were, first, a remarkable spell of no

measurable rain from 3rd to 17th October, after which 90% of the month's total fell in the last week, including the year's second wettest day (29 mm on 29th); and second, that November's mean temperature was a little higher than October's. December ended the calendar year warm (+ 1.3°C on average) and very wet (182% of average rain).

With a mean temperature of 11.2°C, 1994 was the third warmest year in the last ten, following 1990 (11.7°) and 1989 (11.5°). It was also by far the wettest, with a total rainfall of 1031 mm – the first for many years to exceed 40 inches (1016 mm). This total represented 123% of the long-term average. There were 204 rain days, against an average of about 170 per year.

SPECIES OF NOTE IN 1994

ORTHOPTERA (grasshoppers and crickets) (all records RSC, unless otherwise stated)

Oak Bush-cricket *Meconema thalassinum* (Deg.) Lascot Hill, Wedmore ST4348, 15 August; a female in a hedgerow – the second record for this 10km square.

Great Green Bush-cricket *Tettigonia viridissima* L. Near Red Quarr Farm, Chewton Mendip ST5651, 27 August, at least three singing males in nettles and scrub. First record for this 10km square.

Slender Ground-hopper *Tetrix subulata* (L.) Kingston Seymour ST4167, 9 October. Included form *bifasciata*.

Common Ground-hopper *Tetrix undulata* (Sowb.) Great Elm ST7448, 15 May; Worminster Sleight ST5742, 8 October.

Large Marsh Grasshopper *Stethophyma grossum* (L.) Peat Moors, 20 August (one adult female, several nymphs) and 11 September (four adult males, one adult female, several nymphs).

Woodland Grasshopper *Omocestus rufipes* (Zett.) East Harptree ST5554, August (SP - confirmed 13 August RSC).

Rufous Grasshopper *Gomphocerippus rufus* (L.) Dulcote Hill ST5644, 13 August, large colony in rough field; Worminster Sleight ST5742, 8 October, stridulating in fair numbers on scrubby slopes.

DERMAPTERA (earwigs) (all records RSC unless otherwise stated)

Lesser Earwig *Labia minor* (L.) Steep Holm ST2360, 21 August, one female at MVTH light (AJP).

Lesne's Earwig *Forficula lesnei* Finot Dulcote Hill ST5644, 13 August, male on oak; Milton Hill, Wells ST5346, ST5347 & ST5446, 15 October, large population in scrub and old quarry.

ODONATA (dragonflies)

White-legged Damselfly *Platycnemis pennipes* (Pallas) River Avon, Freshford ST7960, 5 June (RSC); River Avon ST7862, ST7863, ST7963, 14 June (DB); River Avon, Keynsham ST6669, 16 June (RE).

Red-eyed Damselfly *Erythromma najas* (Hanse.) Shapwick Heath ST4241, 8 June (RE); River Avon ST7862, 14 June (DB).

Keeled Skimmer *Orthetrum coerulescens* (Fabr.) ST45 (JM).

Yellow-winged Darter *Sympetrum flaveolum* (L.) Chew Valley Lake ST56 (RA, JM).

HEMIPTERA (true bugs)

Sciocoris cursitans (Fabr.) Loxton Hill ST3655, 1 May, recorded here previously in 1979; Brean Down ST2858 & ST2958, 17 July, recorded here previously in 1978 (all records RSC).

Zicrona caerulea (L.) Brean Down ST2859, 15 May, one feeding on caterpillar (RSC); Walton Common N.R. ST4273, 6 July, one nymph (RJB).

Peritrechus lundi (Gmelin) Loxton Hill ST3655, 1 May (RSC).

Macrodemia micropterum (Curt.) Westhay Moor N.R. ST4543, 11 September (RSC).

Nabis ericetorum Sch. Westhay Moor N.R. ST4543, 11 September (RSC).

NEUROPTERA (lacewings)

Osmylus fulvicephalus (Scop.) Lords Wood ST6363, 19 August (RJB).

LEPIDOPTERA (butterflies)

Essex Skipper *Thymelicus lineola* (Ochs.) Priddy Pool ST5451, 28 June (RE).

White Admiral *Ladoga camilla* (L.) Street Heath ST4639, 3 July (RSC); Lords Wood ST6363, 15 July (RJB).

Small Pearl-bordered Fritillary *Boloria selene* ([D. & S.]) Cross Plain ST4155, 11 June (KV); Cheddar Gorge ST4754, 18 June (KV); Priddy Pool ST5451, 28 June (RE).

Queen of Spain Fritillary *Argynnis lathonia* (L.) Ashlands, Portbury ST57, 22 August (RH).

Marsh Fritillary *Eurodryas aurinia* (Rott.) Shapwick Heath ST4041, 27 May (RJB, ME, AHP); Shapwick Heath ST4241, 30 May (RSC).

LEPIDOPTERA (macro-moths)

Lunar Hornet Moth *Sesia bembeciformis* (Hb.) Cheddar Valley Railway, Yatton ST4265, timber collected, adult bred out (TM, det. RJB); Slimbridge SO7204 (NWo).

Currant Clearwing *Synanthedon tipuliformis* (Cl.) Westbury-on-Trym ST5676, June (DWi).

Satin Lutestring *Tetheella fluctuosa* (Hb.) Leigh Woods ST5573, 14 June (JM, RH, AP).

Silky Wave *Idaea dilutaria* (Hb.) Avon Gorge, Black Rocks ST5674, 29 June (JM, PS).

The Vestal *Rhodometra sacraria* (L.) Slimbridge, SO7204 (NWo).

Chalk Carpet *Scotopteryx bipunctaria* ([D. & S.]) ssp. *cretata* Prout Draycott Sleights ST45, 17 July (JM); Tytherington Quarry ST6589, 8 August (NW).

Beech-green Carpet *Colostygia olivata* ([D. & S.]) Leigh Woods ST5573, 30 August (JM, RH, AP *et al.*).

Marbled Pug *Eupithecia irriguata* (Hb.) Leigh Woods ST5573, 6 June (JM, RH).

Juniper Pug *Eupithecia pusillata* ([D. & S.]) *pusillata* ([D. & S.]) Horfield, Bristol ST5976 (RH).

Cypress Pug *Eupithecia phoeniceata* (Ramb.) Whitchurch ST66, 15 August (RA); Weston-super-Mare ST3362 (KP); Timsbury ST6758 (CM).

Poplar Hawk-moth *Laothoe populi* (L.) Whitchurch ST6067, 21 September (DJF).

Humming-bird Hawk-moth *Macroglossum stellatarum* (L.) Crook Peak ST35, 16 June (ME, AGS); Folly Farm ST6060, 30 June (JM); Dolebury Warren ST45, 30 June (JM); Newton St. Loe ST6964, 30 June, 28 July (DW); Draycott Sleights ST45, 17 July (JM); Nailsea ST47, 7 October (HW); Timsbury ST6558 (MB).

Great Prominent *Peridea anceps* (Goeze) Wetmoor ST7487, 13 May (PSs).

White Satin Moth *Leucoma salicis* (L.) Slimbridge, SO7204 (NWo).

Red-necked Footman *Atolmis rubricollis* (L.) Priddy ST5550, 1 July (JM, MP).

White-line Dart *Euxoa tritici* (L.) Weston-super-Mare ST3362 (KP).

Portland Moth *Ochropleura praecox* (L.) Berrow ST25 (EAD).

Shore Wainscot *Mythimna litoralis* (Curt.) Berrow ST25, 23 June (EAD).

Svensson's Copper Underwing *Amphipyra berbera* Rungs ssp. *svenssoni* Fletcher. Timsbury ST6758 (MB).

Bordered Straw *Heliothis peltigera* ([D. & S.]) Weston-super-Mare ST36, 17 September (EAD).

Golden Plusia *Polychrysis moneta* (Fabr.) Timsbury ST6758 (CM); Timsbury ST6558 (MB).

The Blackneck *Lygephila pastinum* (Treit.) Filton ST6179 (AP).

White-line Snout *Schrankia taenialis* (Hb.) Sand Bay ST36 (EAD); Leigh Woods ST5573, 11 July, 27 July (JM, RH, AP *et al.*).

LEPIDOPTERA (Micro-moths)

Telephila schmidtellus (Heyd.) Cleaves Wood, Wellow ST7657, 22 July (BDMG).

Sophronia semicostella (Hb.) Walton Common, NR ST4273, 6 July (RJB, AP).

Catoptia falsella ([D. & S.]) Town Quarry, Weston-super-Mare ST3262, 17 September (EAD).

Schoenobius gigantella ([D. & S.]) Yatton ST4365, 13 August (TM).

Evergestis pallidata (Hufn.) Leigh Woods ST5573, 24 July (RJB).

Sitochroa palealis ([D. & S.]). Timsbury ST6558 (MB).

Mecyna flavalis ([D. & S.]), ssp. *flavicularis* Carad. Folly Farm ST6060, 4 August, first Avon record of this very local moth (JM).

Euzophera cinerosella (Zell.) Portishead ST46 (WD).

Phycitodes maritima (Tengst.) Avonmouth ST5379, 18 July (JE, det. confirmed by RJB)

COLEOPTERA (beetles)

Carabus granulatus L. Shapwick Heath ST4041, 27 May (RJB)

Hydroglyphus geminus (Fabr.) Catcott Heath ST4041, 27 February (RSC)

Hydroporus discretus Fairmaire Priddy ST5451, 6 February (RSC)

Hydaticus transversalis (Pont.) Brent Knoll ST3351, 19 November (RSC)

Sinodendron cylindricum (L.) Shapwick Heath ST4041, 28 May (RJB)

Rose Chafer *Cetonia aurata* (L.) Clifton, Bristol ST5773, 15 March (RJB)

Scirtes orbicularis (Panz.) Ford Common, Berrow ST3053, 8 July (RSC)

Cantharis fusca L. Catcott Heath ST4041, 28 May (RSC)

Silis ruficollis (Fabr.). Street Heath ST4639, 3 July (RSC); Westhay Heath ST4141, ST4142, 9 July (RSC)

Opatrum sabulosum (L.) Brean Down ST2958, 20 March (RSC).

Pseudocistela ceramboides (L.). Ivy Thorn Hill ST4634, 3 July (ME, det. RJB).

Melandrya caraboides (L.) Gordano Valley N.N.R. ST4372, 19 June (RJB).

Oncomera femorata (Fabr.) Christon Plantation ST3758, 18 April (ME); Folly Farm ST6060, 22 April (BDMG).

Strangalia quadrifasciata (L.) Westhay Heath ST4142, 9 July (RSC); Shapwick Heath ST4140, 16 July (RSC).

Musk Beetle *Aromia moschata* (L.) Gordano Valley N.N.R. ST4372, 27 August (DC).

Phytoecia cylindrica (L.). Ashton Court ST5572, 8 June (RJB).

Plateumaris braccata (Scop. Ford Common, Berrow ST3053, 8 July (RSC).

Chrysolina violacea (Mull.) Brean Down ST2958, 15 May (RSC).

Chrysomelea populi L. Shapwick Heath ST4041, 27 May (RJB).

HYMENOPTERA (bees, wasps and ants)

Dolichovespula media (Retz.) Burnham-on-Sea ST3149, 29 July (RSC); Shapwick Heath ST4140, 21 August (RSC).

Dolichovespula rufa (L.) Priddy ST5450, 18 May, queen (RJB).

ENTOMOLOGICAL REPORT, 1994

Ectemnius cavifrons (Thom.) Westhay Moor ST4544, 20 August (RSC).

Ectemnius cephalotes (Oliv.) Burnham-on-Sea ST3149, 12 August (RSC).

DIPTERA (flies)

Odontomyia ornata (Meig.) Tealham Moor ST4145, 8 May, several larvae (RSC);
Tealham Moor ST4044, ST4045, ST 4145, 11 June, several adults (RSC)

Odontomyia tigrina (Fabr.) Tealham Moor ST4145, 11 June, plentiful (RSC); Shapwick Heath ST4041, 27 May (RJB).

Stratiomys furcata (Fabr.) Tealham Moor ST4045, ST4145, 11 June (RSC).

Asilus crabroniformis L. Near Shute Shelve ST4254, 26 September (KV).

Megasyrphus annulipes (Zett.) Bishopston, Bristol ST5875, 30 August (RJB).

Volucella inflata (Fabr.) Avon Gorge, tow path ST5573, 15 June (RJB).

Volucella zonaria (Poda) Redland, Bristol ST5874, 13 July (RJB).

Tropidia scita (Harris) Gordano Valley N.N.R. ST4372, 19 June (SR).

Criorhina asilica (Fall.) Cheddar Wood ST4455, 2 May (RSC).

Conops quadrifasciata DeG. Berrow Dunes L.N.R. ST2953, 27 August (RSC).

Alophora hemiptera (Fabr.) Shapwick Heath ST4140, 21 August (RSC).

Liptoptena cervi (L.) Meare Heath ST44, 29 October (WMIG).

ISOPODA (woodlice and slaters)

Androniscus dentiger Gordano Valley N.N.R. ST4372, 19 June (WMIG).

Oniscus asellus Gordano Valley N.N.R. ST4372, 19 June (WMIG).

Philoscia muscorum Gordano Valley N.N.R. ST4372, 19 June (WMIG).

Porcellio scaber Gordano Valley N.N.R. ST4372, 19 June (WMIG).

DIPLOPODA (millipedes)

Cylandroiulus latestriatus Gordano Valley N.N.R. ST4372, 19 June (WMIG).

Nanagona polydesmoides Gordano Valley N.N.R. ST4372, 19 June (WMIG).

CHILOPODA (centipedes)

Lithobius forficatus Gordano Valley N.N.R. ST4372, 19 June (WMIG).

MOLLUSCA (slugs and snails)

Abida secale (Drap.) Rodney Stoke Wood N.N.R. ST4951, 14 May (RSC).

Ena montana (Drap.) Rodney Stoke Wood N.N.R. ST4950, 14 May (RSC).

Limax cinereoniger Wolf Outlook Cave, Ebbor Gorge N.N.R. ST5248, 6 November (RSC).

Pisidium pulchellum Jenyns Gordano Valley N.N.R. ST437 (TS)

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1) The editor welcomes original papers on the natural history of Avon and surrounding areas for consideration for publication in the *Proceedings*. Inexperienced authors may obtain advice from members of the Publications Committee. Authors should bear in mind that their readers will not usually be specialists in the particular subject, and that unnecessarily technical language can be a barrier to understanding.

2) All items for consideration should reach the editor by the end of February in each year. If there is likely to be a problem with this target date please contact the editor in advance.

3) Manuscripts should be double-spaced, with wide margins, and on one side of the paper only. The author should retain a copy.

4) The wording should follow the style and format of the *Proceedings*. Abbreviations should not normally be used, especially in the references. An abstract should be supplied, and the text should be broken up by appropriate headings and sub-headings and accompanied by relevant illustrations. Captions to illustrations should be given separately at the end of the text.

5) Originals, not copies, of photographs, slides, line drawings, diagrams and maps should be submitted - returnable on request. Drawings and other diagrams should not be more than twice final size, and made in black medium. Photographs and slides may be submitted as prints, positives or negatives, preferably monochrome. Graphs, charts and simple diagrams may most readily be produced by computer graphics; advice and help with this are available.

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Book: AUTHOR (DATE). *Title*. Place of publication, Publisher. E.g.,

RACKHAM, O. (1986). *The history of the countryside*. London, J. M. Dent.

Paper: AUTHOR (DATE). *Title*. *Journal name*, volume, (part), page nos. E.g.,

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7) It is very helpful if the text can also be submitted on a magnetic disk readable under MS-DOS (any version) or *Windows*, either as an ASCII ("text" or "print" file) or as a formatted file produced by any well-known word processing software. A formatted version is especially valuable where many scientific names are involved.

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AVON MAMMAL REPORT, 1994

Compiled by D. P. C. TRUMP, Avon Mammal Recorder

ADAS, Burghill Road, Westbury-on-Trym, Bristol BS10 6YW

INTRODUCTION

This is the sixth recent mammal report for Avon. Its intention is to be a wide-ranging review of studies and records of mammals in and around Avon during 1994.

REPORTS ON MAMMALS

INSECTIVORA (hedgehogs, moles and shrews)

Hedgehog *Erinaceus europaeus*. The Mammal Society Hedgehog Road Kill Survey continued in 1994. Analysis of the results so far is proving somewhat confusing, and what initially seemed to be a straightforward method of assessing hedgehog populations nationally is not proving to be quite so useful. The inter-regional differences may be real but a number of other variables are clouding the issue. The data collected over the last 4 years are currently being re-analysed (P. Morris, personal communication).

Pat Morris reports that hedgehogs recently reported as wandering around during the winter when they should be in hibernation are not "affected by global warming" but more mundanely are simply moving to new winter nest sites. His studies published over 20 years ago showed that hedgehogs regularly wake up and move to a new nest. Indeed, between 1960 and 1992, 6% of recorded hedgehog road casualties happened in the last 10 weeks of the year (Morris, 1995). [see SMT note on MS]

Mole *Talpa europaea*. Letters to the Observer in March 1994 suggested some novel ways of persuading moles to leave gardens. These varied from "telling them kindly but firmly to go away", to "placing chewing gum in the mole's tunnels so that when the mole eats the gum, thinking that it smells of female moles, it bungs up his insides and kills him!"

More seriously, a study by David MacDonald and Rob Atkinson of the Oxford University Wildlife Conservation Research Unit investigated the use of the repellent "Renardine" (bone oil) against moles. Moles were radio-tracked in Oxfordshire pastures and an urban park before and after the addition of paper pellets soaked in Renardine to tunnels in each of their home ranges. They stayed out of treated areas for up to 27 days. It took moles an average of 26 days to cross a Renardine-treated border consisting of a 50 cm deep slit dug with a drainage plough (Atkinson and MacDonald 1994). Perhaps this non-lethal method of solving mole problems may be appropriate, with more development, in home and market garden situations.

Atkinson *et al.* (1994) reported on the results of two questionnaire surveys, conducted in 1981 and 1992, on the perceived status of the mole as an agricultural pest. Whilst many farmers (64% in the 1992 survey) considered moles to be pests, the damage attributed to them is slight on the great majority of farms. The most widely cited agricultural problem attributed to moles was spoiling of silage grass, caused by contamination with the soil bacteria *Clostridium* and *Listeria* in mole hills. However, fewer than 1% of the respondents reported that 10% or more of their silage was seriously affected by mole activity. The mean cost of moles to the farmer - losses due to mole activity and costs of control - was £126 for 1992, with a maximum of £800 on one farm.

Methods of mole control discussed included clearance by gassing, shooting, poisoning with strychnine-baited earthworms and kill-trapping, the latter two being the methods most commonly used, and indirect control, including removal of mole hills by harrowing and rolling, increasing mower height and treatment of silage with additives that destroy *Clostridium* and suppress *Listeria*.

The unpleasant action of strychnine and the risks to the user and to non-target animals, the concerns over its misuse, and the questionable humaneness of trap action revealed by this study all support moves to encourage alternative, indirect methods of mole control.

CHIROPTERA (bats)

Bat records for Avon in 1994 have been compiled by Dr Gareth Jones of the University of Bristol, with additional notes from Mark Brookes. Records are from: G Jones (GJ), P L Duvergé (PLD), Dean A Waters (DAW), Mick Furlong (MF), Kate Barlow (KEB), Elena de Fanis (EdeF), Mark Brookes (MB).

Rhinolophidae (horseshoe bats)

Greater Horseshoe Bat *Rhinolophus ferrumequinum*. First noted back at traditional spring "feeding up" site on 10 April, when an adult male was present. Maximum of 13 counted there, 5 May. At the nursery areas near Bristol, maximum counts in August were 37 at the underground sites, 77 in the converted stable block (PLD, GJ). Most bats are now breeding in the stable block, with perhaps only a dozen young born in the underground site. 119 counted in underground sites in south-east Avon during January. Maximum count from north-west hibernacula was nine.

Lesser Horseshoe Bat *Rhinolophus hipposideros*. 125 counted in underground sites in south-east Avon in January. Maximum count from north-west hibernacula was 16. One hibernating in Long Ashton, spring and autumn.

Vespertilionidae (vespertilionid bats)

Whiskered/Brandt's Bat *Myotis mystacinus/brandtii*. At least five in underground sites in south-east Avon during January. One in north-west hibernacula, April.

Daubenton's Bat *Myotis daubentonii*. Tree roost occupied by a small number (usually 1-3) at Abbot's Pool ST5373 during the spring (GJ). Bridge roost at Avon Farm Railway Bridge (River Avon) ST6868, up to 10 in area 1 May; up to 10 around Eastville Lake ST6175, May; up to 5 at Hunstrete Lake ST6462, 29 May (all MB).

Serotine *Eptesicus serotinus*. Maximum count at Blagdon nursery roost was 117 on 25 July (PLD).

Leisler's Bat *Nyctalus leisleri*. Juvenile grounded at Bristol Zoo ST5674, 28 July. Maximum count from the Clifton roost was 161 on 21 July, this being before any young would be flying. A very pale individual frequented this roost for the second successive year, and five bats were radio-tracked from there in August/September. They fed in a wide variety of habitats, from sites within central Bristol to pasture around Barrow Gurney. New tree roosts were discovered at Ham Green and in Ashton Court. Several bats foraged around pasture on the Ashton Court Estate (GJ, DAW, MF). Single bat in Staple Hill ST6576, 22 June (MB).

Noctule *Nyctalus noctula*. 27 in tree roost near Eastville Park ST6175, 9 May (PLD), 11 on 23 May (MB). One at railway bridge over River Avon ST6868, 1 May. One at Abbots Pool ST5373, 24 May. Two in Kingswood ST6573, 25 August. Two in Wills-bridge valley ST6670, 4 and 8 September. Several overhead in Downend ST6477, 12 June. Two over pond at Stoke Park ST6177, 8 September. (All records MB.)

Long-Eared Bats *Plecotus spp.* One in north-west hibernacula, April. Two in Stanton Prior Church ST6762, 27 August (MB).

Pipistrelle *Pipistrellus pipistrellus*. One flying in daylight during the afternoon, Clifton, 3 February. Kate E. Barlow continued a study at Bristol University on how '45 kHz' and '55 kHz' types of pipistrelles partition resources. The two types are almost certainly sibling species.

45 kHz Male, Clifton, 5 May (GJ). Roosts included 30 at Stoke Bishop, 26 June; 17 at Hambrook, mid-June; and 103 at Priston, 18 July (KEB).

55 kHz c.125 in roost at Midford, 11 July (GJ). Other roosts were 162 at Barrow Gurney, 17 June and 620 at Ubley, 30 May (KEB). Bats taken into captivity for scientific study, under licence from English Nature, showed evidence of "milk stealing", with young occasionally found suckling from females which were not their mothers (EdeF). Research at Bristol University showed how females from one roost could recognise one another by scent cues alone, and how females were attracted to scents of other females from their own roost, rather than to scents of females from another roost (EdeF).

Other pipistrelle records from the following 1 km squares (all MB): ST5373, ST6175, ST6361, ST6377, ST6477, ST6575, ST6576, ST6762, ST6868, ST6883 and ST7564.

Other Bat News

The Avon Bat Group's bat boxes at Chew Valley and Blagdon Lakes were checked twice in 1994. A female pipistrelle was found in one of a pair of boxes on a sycamore tree at Blagdon (ST5159) on 22 May. On 11 September nine pipistrelles, all female, were found in the other box of the pair and two further pipistrelles (one male, one female) were found in a box on an ash tree, also at ST5159. These boxes have been used by bats in previous years, so it would appear that once bats have 'found' a box they are likely to use it on a regular basis. Bat droppings, probably all pipistrelle, were also found in four other boxes. Birds continue to use the bat boxes; six blue tit nests, one great tit nest and one wren nest were found. Two bat boxes were occupied by wasps! At 11 September 1994 there were 77 boxes at the lakes, in five groups.

The Wiltshire Bat Group recently constructed a bat hibernaculum in a disused railway tunnel in Marlborough. It is principally used by Natterers Bats but Whiskered, Brandt's, Daubenton's, Long-eared and a single Barbastelle also use the tunnel, now protected

from interference by purpose-built grilles (*British Wildlife*, 6 (1), 44).

Dr Gareth Jones and L. Duvergé reported on a three-year radio-tracking study of Greater Horseshoe Bats from three breeding roosts, one in woodland south of Bristol, one in a river valley near Bath and one in a wooded valley in Gloucestershire (Duvergé and Jones, 1994). A total of 67 bats fitted with radio transmitters were followed by vehicle or on foot. The longest continuous period of tracking was 21 consecutive nights, the shortest a mere 5 minutes! Typically, bats emerged from the nursery roosts 15-30 minutes after sunset and flew straight to their preferred feeding sites, usually within 1.5 and 3 km from the roosts. They would feed on average for 1¼ hours, then spend 1-3 hours at a convenient night roost before a final feeding session, returning to the nursery roost 5-30 minutes before sunrise.

The favoured feeding habitats were pastures with cattle (38%), ancient semi-natural woodland (16%), pastures with stock other than cattle (10%) and meadows grazed by cattle in the autumn (9%). Lepidoptera and Coleoptera made up 30-45% of the diet, Diptera (mostly Tipulidae) 10-20% and Hymenoptera (mostly Ichneumonidae) 5-10%. In the spring a large proportion of the diet (up to 35%) was made up of the Maybug or Cockchafer *Melolontha melolontha*. In the early summer, Lepidoptera formed the bulk (up to 80%) of the diet. As the summer progressed dung beetles of the genus *Aphodius* (in particular *A. rufipes*) were the most frequently taken prey item.

The report ends with a plea for the maintenance and preservation of unimproved pastoral habitats with wide thick hedgerows and tree lines as feeding areas for the endangered Greater Horseshoe Bat, together with protection of their roosts and the habitat in the immediate vicinity.

Of recent concern is the effect of cattle wormers containing Avermectins on the numbers of insects emerging from dung. Laurent Duvergé is currently investigating the possible effects of Avermectins on bat populations in a project funded by the Vincent Wildlife Trust.

LAGOMORPHA (rabbits and hares)

Brown Hare *Lepus europaeus*. The report on the National Hare Survey is due to be published by the Joint Nature Conservancy Council in 1995. Mike Hutchings and Prof. Stephen Harris of the University of Bristol report that the mid-winter population is estimated to be 680,000-950,000 animals, much lower than earlier estimates. Hare populations are now very heavily biased towards arable landscapes, with Cambridgeshire, Norfolk and Suffolk holding nearly 25% of the total. Hares are now said to be very infrequent in the South-west; reasons are changes from hay production to silage grass production, especially the use of faster cutters and more frequent cuts; and increasing stocking densities - hares avoid livestock. (Hutchings & Harris, 1995.)

Rabbit *Oryctolagus cuniculus*. Rabbit Viral Haemorrhagic Disease (VHD) has been confirmed in wild rabbits in Kent and near Exeter in Devon. (*Hansard*, 26 November 1994, WA p. 624.) A provisional licence for a vaccine against VHD in rabbits was issued on 17 November 1994 (*Hansard*, 23 November 1994, WA p. 231).

Nationally, rabbit numbers are estimated at about 30% of pre-myxomatosis levels, that is about 30 million, and are rising at a rate of 2% per year. In some areas the population is back to pre-myxomatosis levels. (*Hansard*, 6 July 1994, WA pp. 239-40.)

RODENTIA (rats, mice and voles)

Common Rat *Rattus norvegicus*. Richard Bevan (Pest Control Manager, Bristol City Council) again reported a decline in the number of rat problems with 743 cases reported in the year up to March 1994, cf. 852 in the previous year.

Black Rat *Rattus rattus*. A report in the *Guardian* on 16 November said that the black rat was threatening to recolonise Britain. Port health inspectors from Weymouth to Lerwick were reporting Russian trawlers infested with rats, many apparently picked up in the arctic port of Murmansk.

House Mouse *Mus domesticus*. "Mouse started fire at Stadium", shouted a headline in the *Bristol Evening Post* in February. Tens of thousands of pounds of damage resulted in part of Eastville Stadium, Bristol from a fire thought to be caused by a mouse gnawing through electricity cables.

A report on the MAFF National Rodent Survey is due to be published in 1995 (*Hansard*, 24 November 1994, WA p. 317). Preliminary results show a general increase in pest rodent problems throughout the UK, possibly as a result of milder winters, more fast food litter and demolition work.

Grey Squirrel *Sciurus carolinensis*. It is estimated that the damage to forests caused by grey squirrels leads to a loss in excess of £1 million each year. The Forest Authority is undertaking research into alternative silvicultural systems which may reduce the amount of damage (*Hansard*, 25 April 1994, WA p 74-5). Researchers at Sheffield University are working on the development of a contraceptive vaccine that can be placed in food put out in hoppers specially designed for grey squirrels (*New Scientist*, 22 October 1994).

Red Squirrel *Sciurus vulgaris*. The latest population estimates for red squirrels in Great Britain are: Scotland, 121,000; England, 30,000; and Wales, 9000. English Nature's species recovery programme which aims to achieve long-term sustainable survival of endangered species includes the red squirrel (*Hansard*, 21 June 1994, WA p. 103).

English Nature and the Forest Authority are currently involved in a joint red squirrel recovery project at Thetford Forest in Norfolk. EN are also supporting various initiatives throughout the country including the Isle of Wight where there are estimated to be about 3000 red squirrels (*The Times*, 19 June 1994).

Dormouse *Muscardinus avellanarius*. The Great Nut Hunt launched by English Nature in October 1993 proved to be a spectacular success, with 11,000 survey packs being sent out. Pat Morris and his team at Royal Holloway College examined nearly 10,000 hazel nuts, of which 12% had been nibbled by dormice, confirming their presence at 295 sites in England and Wales. The top dormouse counties are Devon and Dorset, followed closely by Sussex, Somerset (south Avon?) and Hampshire. More than 50% of the nuts had been opened by squirrels, 12% by mice, 10% by voles and 13% unidentified (*British Wildlife*, 5 (6), p 384-5). David Clarke's survey of dormice boxes in woodland near Cleve continued, with regular counts of over 40 dormice in the 100 boxes. Other species using the dormouse boxes included yellow-necked mice, wood mice, common shrews and a number of birds. Regular checks were made of the boxes in the Avon Gorge National Nature Reserve, and a single male dormouse was found in a nest box (ST5673) in September by David Clarke and Mary Marsh.

The success of a variety of dormouse translocation techniques has been investigated in ancient oak-ash-lime-hazel woodland on the Mendips in Somerset (Bright & Morris, 1994). Groups of dormice fitted with radio-transmitters were subject to four types of release:

- (a) 'Early hard releases' - wild-caught dormice placed into nest boxes at the release site on the day of capture (May-June);
- (b) 'Late hard releases' - as (a) except experiment conducted in August-September;
- (c) 'Soft releases' - wild-caught dormice placed into nest boxes in weldmesh pre-release pens for eight nights with food and water provided, before being allowed to leave;
- (d) 'Captive-bred releases' - as (c) except that they involved dormice bred in captivity.

Early hard releases (May-June) lost significantly more weight than later hard releases, in line with the suggestion that May-July is a period of food scarcity for dormice and also with previous findings that translocated animals initially fail to locate food sources or to utilise sub-optimal food sources.

After soft release, dormice continued to nest at their release point and utilised supplementary food, whereas hard releases often dispersed, ignoring food provided.

After release, captive-bred animals travelled significantly less far, both in total and from nest boxes each night, than wild-caught animals. This would be likely to reduce their chances of finding natural food sources and suggests that they would establish more slowly in novel habitats.

The study shows that soft releases, supplementary feeding and nest boxes would be needed for successful translocations. Use of supplementary food by soft releases suggests that translocation could be conducted in early summer. Dormice sustained at this time with supplementary food might then breed in the first year of release, so greatly increasing the probability of a viable population becoming established.

Water Vole *Arvicola terrestris*. A survey conducted by the Vincent Wildlife Trust during 1989-90 and published in April 1993 showed that water voles were found in only 32% of the 1,044 sites they were known to have inhabited in 1900. Predation by introduced American mink *Mustela vison* is said to be the main cause of the decline. There is some evidence that the decline began before mink were so widespread, and was a result perhaps of pollution and habitat destruction. On current trends, the prediction is that water voles will eventually disappear from 94% of their former sites (Strachan & Jeffries, 1993). One of the best sites locally to see water voles is at the Wildfowl and Wetlands Trust, Slimbridge, Gloucestershire.

Harvest Mouse *Micromys minutus*. The only record this year was of a nest with four young and two adults in tall grass just off the A46 at Tormarton ST7577, found by Paul Chadwick on 20 August.

SMALL MAMMALS

The Mammal Society Survey of Woodland Small Rodents Mallone & Flowerdew (1994) reported on the preliminary results of the 1982-87 Mammal Society Survey of

Woodland Small Rodents. One of the 13 survey sites was Longwood, a mixed deciduous-coniferous woodland near Cheddar. The two main species studied were the woodmouse *Apodemus sylvaticus* and the bank vole *Clethrionomys glareolus*. Woodmice and voles were live-trapped using standard methods every May/June and September/November from 1982 to 1987. Woodmouse numbers were generally higher in the winter than in the summer, with bank vole numbers fluctuating less regularly. These seasonal population fluctuations, especially those at Longwood, closely mirror those for the same species in the hedgerow on the Avon/ Gloucestershire border which was studied as part of the ADAS/Mammal Society National Survey of Small Mammals in Farm Hedgerows (Trump, 1991).

In deciduous woodland, mean densities of both bank vole and wood mouse are significantly greater in the winter and the following summer after a good seed crop than after a poor one. It is suggested that populations of each species in deciduous woodland are synchronised over the country in summer and that wood mice are also synchronised in winter; highs and lows tend to coincide between different sites. Yields of tree seed vary significantly from year to year and may be the cause of the synchrony. Weather effects may also be involved.

The Mammal Society National Field Vole Survey organised by Michael Woods was launched successfully in 1994, with 11 sites being studied. "Our" site is in the Gordano Valley National Nature Reserve and our preliminary trapping period in November, using a grid of 50 Longworth live-capture small mammal traps, resulted in a total of 6 short-tailed field voles *Microtus agrestis*, 36 bank voles *Clethrionomys glareolus*, 18 wood mice *Apodemus sylvaticus* and 5 common shrews *Sorex araneus* being caught, then weighed, sexed and marked before being released again. One of the bank voles, a male, was caught on each of the five trapping sessions! Only two of the other ten sites reached double figures for field voles (Moat Meadow in Cambridge had 26) and two other sites yielded no field voles at all. The literature suggests that 20 field voles in a grid of the size being used in this study (25 pairs of traps on a 5 by 5 grid with 8 m between trap points) would not be unusual (M.Woods, personal communication). The survey is planned to continue for a further five years, with trapping sessions each spring and autumn.

The Mammal Society Owl Pellet Survey launched in 1993 has had a relatively good response. To date, ten species of small mammal have been found, mainly in barn owl *Tyto alba* pellets. Top prey species is the field vole, followed by common shrew, wood mouse, harvest mouse, pygmy shrew, bank vole, house mouse, water shrew, brown rat and water vole. The survey continues for a further three years (*British Wildlife*, 5 (4).

PINNIPEDIA (seals) and CETACEA (whales, dolphins and porpoises)

Grey Seal *Halichoerus grypus*. John Hutchinson reported seeing a seal (probably a grey seal) off Littleton Warth ST5991 on 2 June. The Atlas of Mammals in Britain shows only two previous records of grey seals in the upper reaches of the Severn, in the 10 km squares ST36 (off Weston-super-Mare) and ST57 (central Bristol!). Seals have been seen off the main beach in Clevedon every year since 1991, usually in October and November. Ivor Ashford, Clevedon Pier Master, reported seeing one swimming close to Clevedon Pier on 31 August. Previous sightings have been off Wains Hill and Clevedon Pill. In 1991 a young seal was stranded near the Marine Lake and had to be rescued by the RSPCA and Coastguard. The seals are thought to be following the salmon

heading upstream to their spawning grounds in the upper reaches of the Severn (*Bristol Evening Post*, 1 September 1994).

A MAFF News Release on 15 June 1994 reminded people working with seals and small cetaceans of the need to take proper precautions, and for the general public not to handle any marine mammals, to prevent any risk of infection. This follows a recent discovery of previously unrecorded *Brucella* organisms in seals, dolphins and porpoises in waters around Scotland.

CARNIVORA (carnivores)

Polecat *Mustela putorius*. The Polecat Project sponsored by the Vincent Wildlife Trust continues under the direction of Dr Johnny Birks. Any records of polecats in northern Avon and southern Gloucestershire are of particular interest and value, so that the return of the polecat can be monitored (J. Birks, personal communication). A coloured leaflet about the polecat and the current project has been produced by the Vincent Wildlife Trust.

Otter *Lutra lutra*. The Taw-Torridge Estuary in Devon, made famous by Tarka the Otter, is now so polluted that the Ministry of Agriculture has banned the collection of shellfish there (*The Guardian*, 16 November 1994).

Pine Marten *Martes martes*. A recent survey of 180 km of forest paths in northern England by Paul Bright and Professor Stephen Harris of the University of Bristol failed to find any signs of pine martens. It is not known whether any survive in North Wales. Plans to re-introduce pine martens from their stronghold in Scotland to southern parts of England, will now have to wait until researchers have identified the cause of their demise (*New Scientist*, 2 April 1994).

Fox *Vulpes vulpes*. Foxes continue to hit the headlines in Bristol. "Urban Foxes are a Menace" (*Bristol Evening Post*, 9 November 1994) - a fox caused an estimated £3,000 damage to a photographic studio, darkroom and storeroom in a garage in Westbury-on-Trym. "Fox Killing Horror in Park" (*Bristol Evening Post*, 5 April 1994) - a man was seen setting his dogs on a fox in Snuff Mills Park, Bristol; the RSPCA are investigating the case. "Famous Foxes in Danger - disease hits TV favourites" (*Bristol Evening Post*, 1994) - an outbreak of sarcoptic mange has hit British foxes. Mange is caused by a parasitic mite that burrows into the skin. It is thought that rural foxes brought the disease into the south-west of the city, where it has been present for the last few years. The disease is treatable but it would be impractical to catch and treat all the infected animals. Professor Stephen Harris and his colleagues at the University of Bristol are investigating the practicalities of treating foxes by dosing food put out by fox-lovers (*BBC Wildlife*, February 1995).

Piran White and colleagues at the University of Bristol have been studying the interactions between urban foxes belonging to different family groups. They found that foxes encountered members of their own family group on average twice a day, and that they encountered 'foreign' foxes 0.77 times per day in winter but only between 0.05 and 0.23 times per day from spring to autumn. These findings may lead to changes in the official policy for controlling foxes in the event of a rabies outbreak. The current policy involves poisoning all foxes within a 19 km radius of the point of an outbreak; this is based on Canadian estimates of how frequently urban foxes come into contact with each other. The Canadian study found averages of 0.9 encounters per day between

adult foxes from different groups during the winter and 0.6 encounters per day in the spring and autumn. Since White's averages are lower than the Canadian ones, the model based on the Canadian data overestimates the speed at which a rabies outbreak would spread in British urban conditions. This is particularly true in the spring, when the number of inter-family encounters falls off dramatically. White's figures suggest that the disease could be controlled within a smaller area (White & Harris, 1994).

Badger *Meles meles*. Badgers continue to be in the news, whether because they are being threatened by development - "Hope for Badger Sett in New Land Scheme" (*Bristol Evening Post*, 25 August), "Badger Family Faces Move on Home Front" (*Bristol Evening Post*, 14 March) - or are themselves causing damage to property "Brock the Badger Undermines an Abbey" - in this instance Glastonbury Abbey in Somerset (*Daily Telegraph*, 4 January).

Following a successful appeal in the High Court, the Joint Master of the Beaufort Hunt was cleared of aiding and abetting the illegal stopping of badger setts (*Daily Telegraph*, 15 December).

Since the introduction of the Protection of Badgers Act 1992, the Agriculture Department (MAFF) has been responsible for issuing licences to interfere with badger setts. In 1993, 236 licences were issued for the purpose of 'preventing serious damage', 46 for 'agricultural or forestry operations' and 20 for 'maintenance etc. of watercourses or drainage work'. The corresponding figures for January to September 1994 were 205, 58 and 28 respectively. No licences to interfere with badger setts for the purposes of 'preventing the spread of disease' or for 'controlling foxes' were issued during the period January 1993 to September 1994 (*Hansard*, 26 October 1994, WA p. 624).

Second National Badger Survey Following the 1985-88 badger survey, a repeat survey funded by the People's Trust for Endangered Species began in September 1994. As in the previous study, pre-selected 1 km squares will be surveyed for setts and other signs of badger activity and the habitat in these squares will be mapped. The field work will be carried out by volunteers during the winters of 1994/5 and 1995/6 under the direction of Gavin Wilson and Professor Stephen Harris of the University of Bristol, who are due to report on their findings at the end of 1996 (*Mammal News* 99, Autumn 1994).

Badgers and Bovine Tuberculosis TB testing of live badgers was due to begin on 1 November 1994. An estimated 2000 badgers from setts around the country will be tested over a 5-year period. Any found carrying TB will be destroyed along with all the others in the sett. A comparison will then be made of the incidence of TB in cattle around those badger setts with the incidence in herds close to setts where no TB tests are carried out (*Farmers Weekly*, 7 October 1994).

MAFF scientists have begun work on a project to vaccinate badgers against TB. It is likely that a vaccine will not be available for at least 15 years (*Farmers Weekly*, 17 June 1994).

ARTIODACTYLA

Red Deer *Cervus elaphus*. The ban on the Quantock Stag Hounds hunting over Somerset County Council land at Over Stowey Common was overturned by a High Court Judge in February 1994. The ruling is likely to affect the 34 other County Councils

(including Avon) which have banned hunting on council-owned land (*The Times*, 10 February 1994).

A three-year study funded by, amongst others, the Exmoor National Park, the League Against Cruel Sports, the British Field Sports Society, the National Trust and the RSPCA will examine how best to manage the largest herd of wild deer in England on Exmoor and the Quantocks. Currently, local stag hounds kill about 100 deer per year, with farmers and others shooting a further 500 out of an estimated population of 5,350. Dr Jochem Langbein of the University of Southampton's Deer Management Research Group is to study the impact of grazing on the ancient oak and holly woodland. Over-grazing by deer, cattle and sheep is preventing natural woodland regeneration. Up to 60 red deer will be fitted with radio collars, the first time radio tagging has been used in England to gather information on their movements. (*The Observer*, 26 June 1994).

Reeves' Muntjac *Mutiacus reevesi*. Norma Chapman, Professor Stephen Harris and Angela Stanford reported on a review of the status of Reeves' Muntjac in Britain (Chapman *et al.*, 1994). The section on Avon is reproduced below.

"In Avon, the earliest record was probably in 1959, when a small deer fitting the description of a Muntjac was seen at Hanham Abbots (ST6470); it had undoubtedly been brought to the area. Sightings were made from almost the same spot (ST6370) in 1989 and nearby at Combe Hay (ST7359) and South Stoke (ST7460) about 1986 and 1992, respectively. Despite their long history in the county, their spread has been slow. On the Badminton estate (ST88), Muntjac were first seen about 1977 but were still uncommon in the early 1990s. Similarly, in the Marshfield area (ST7972) the first sighting was in 1978, but in the early 1990s they were still regarded as just becoming established in the area. A thin scatter of sightings in the 1980s and 1990s were from Bathford (ST7966), Blagdon (ST5058), Brockley Combe (ST4766), Burrington (ST4758), Failand (ST5271), Frenchay (ST6477) on the edge of Bristol, Goblin Combe (ST4765), Hinton Charterhouse (ST7758), Mangotsfield (ST6576), Sopers Wood (ST7467) and Westonbirt Arboretum (ST8590)."

Roe Deer *Capreolus capreolus*. Only three records for 1994, for ST7775, ST7473 and ST7373, all from Paul Chadwick.

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BRISTOL BOTANY IN 1994

by A. J. WILLIS

Department of Animal and Plant Sciences, The University, Sheffield, S10 2TN

The year 1994 was overall rather warmer than normal. Although the annual mean maximum temperature was very slightly below average, the annual mean minimum was 1.3°C higher than usual. February was rather cold but temperatures were above average in January and March. In the summer months, except for July, mean maximum temperatures were lower than normal but mean minimum temperatures were higher throughout. The year ended with a record-breaking mild November, with no ground frosts at all and night temperatures exceeding the daytime norms; the temperature in December was also well above average. Rainfall was high in the first five months, considerably below normal in June and July (these two months had a total of 44 mm rainfall, sharply contrasting the long-term average of 123 mm), but much above normal at the end of the year when there was flooding in the Somerset Levels. Total rainfall for 1994 at Long Ashton, to which meteorological records relate, was 988 mm, some 14% above average. More than 0.2 mm of rain fell per day on 209 days of the year, and in Bristol the period 18-20 April was recorded as the first three consecutive dry days since the previous November.

The mild winter led to early flowering. In January *Helleborus foetidus* was flowering well on Churchill Batch, *H. viridis* was in flower in Mendip Lodge Wood, *Ruscus aculeatus* at Upper Langford and *Stellaria pallida*, *Erophila verna* and *E. glabrescens* on Brean Down. In February *Hornungia petraea* was starting to flower at Charterhouse, although there was light snow on the high ground. Both *Cyperus fuscus* in the Gordano valley and *Himantoglossum hircinum* at Berrow did well in 1994. At the end of the year the exceptionally mild conditions, notably in November, resulted in many species coming into flower unseasonally in December. These included *Trifolium arvense* at Berrow, *Caltha palustris* on Tealham Moor and *Centaureum erythraea* on Brean Down (all records RSC).

As in previous years, reports include new localities for a considerable number of species and several instances of the continued existence of plants in localities from which they have not been listed for a long time and were feared lost. A new site for the uncommon grass *Gastridium ventricosum* has been found in the Avon Gorge, and for the Deptford Pink (*Dianthus armeria*) near Cheddar. A number of hybrids of *Rumex* have been reported in a range of sites; these are certainly under-recorded taxa in the past and probably still so. The list of alien species has been extended; the shrubby perennial *Cerastigma plumbaginoides*, a native of China grown as a rock plant, is a new record for v.c. 6. Of much interest is the report of the Narrow-leaved Bird's-foot-trefoil (*Lotus glaber*) in the Sea Mills area, last recorded in this general vicinity in 1919, and illustrative of the very long persistence of some species in small numbers in sites, albeit much changed, where they were formerly abundant. Also of considerable note is the record of the Yellow Bird's-nest (*Monotropa hypopitys*) in the Leigh Woods area, last

reported here in 1945 (*Bristol Botany in 1945*, p. 73). A remarkable record is of *Vicia bithynica* near Powder House Wood, Shirehampton. Although listed from this site in the middle of the last century, J.W. White (*Flora of Bristol*, 1912) doubted these records; this vetch is now reported in substantial quantity here.

Much information is given about the ecology and history of the Mendips, especially of the eastern parts, by Miss Eunice Overend, in an account entitled 'The Changing Ecology of Mendip' in the Somerset County Council publication *Mendip Limestone Quarrying. A Conflict of Interests*, ed. F. Raymond, 1994, pp. 59-66. Many of the well-known Mendip sites and their notable plants are mentioned here, including the loss of what is believed to be the last stand of Juniper (*Juniperus communis*) in Somerset from a Laverton farm, but the continued existence of the Somerset Skullcap (*Scutellaria altissima*) in a valley near Mells.

Also published in 1994 was a full illustrated account of experimentation in the Avon Gorge from 1964 to 1967 aimed to establish the effect of the addition of mineral nutrients on the distinctive vegetation of the limestone grassland. The findings are given in the *University of Bristol Avon Gorge Project Report No. 18* entitled 'The Influence of Added Mineral Nutrients on the Vegetation of the Avon Gorge' (36 pp.) by AJW. Enhancement of the major nutrients (N, P, K) resulted in much increased growth of the grasses *Bromopsis erecta* and *Festuca ovina*, to conserve the rare species, which appear to depend to a considerable extent on the low fertility and open nature of the habitat, these characteristics need to be maintained and invasion by woody species prevented. A shorter account of these studies is given in Vol. 49 of these *Proceedings* for 1989 (issued 1991), pp. 55-68.

A loss to the B.N.S. is the long-standing member Mrs N. J. Gibbs of Westbury-on-Trym, who died in July 1994. Her interests in botany were wide; she found the Early Spider-orchid (*Ophrys sphegodes*) new to v.c. 34 near Dursley in 1975 (*Bristol Botany in 1975*, pp. 16, 19), and followed its performance for a number of years. This considerable extension to the range of this rarity is noted by M.J. Hutchings in 'The Population Biology of the Early Spider Orchid, *Ophrys sphegodes* Mill. I. A demographic study from 1975 to 1984' (*Journal of Ecology*, 1987, 75, 711-727).

Names of contributors associated with several records, or with the determination of specimens, are abbreviated thus:

JRA	Dr J.R. Akeroyd	PRG	P.R. Green
RAB	R.A. Barrett	DTH	Dr D.T. Holyoak
PJC	P.J. Chadwick	LH	Ms L. Houston
EJC	E.J. Clement	CK	Mrs C. Kitchen
VC	Miss V. Copp	MARK	M.A.R. Kitchen
CJC	C.J. Cornell	ACL	Dr A.C. Leslie
RSC	R.S. Cropper	DM	Mrs D. Maxwell
GAC	Miss G.A. Crouch	PJMN	P.J.M. Nethercott
IFG	Miss I.F. Gravestock	EGMN	E.G.M. Niblett
PG	I.P. Green	PGR	P.G. Rooney

The area covered by this report is essentially that defined by J.W. White for his *Flora of Bristol* (1912). The eastern boundary is taken as the old boundary of Wiltshire where it meets the old boundaries of both Gloucestershire and Somerset. The southern limit is taken as approximately the course of the River Brue along some of its length. The area

comprises the northern part of the Watsonian vice-county of North Somerset (v.c. 6) and the southern part of West Gloucestershire (v.c. 34). In the following records these parts are designated S and G respectively.

Plant names are in accordance with C. Stace *New Flora of the British Isles*, 1991.

Cystopteris fragilis (L.) Bernh. Persistent on old walls in wooded valley, Chilcompton, S, RSC.

Polypodium cambricum L. With *P. interjectum* Shivas also in the vicinity, Carboniferous limestone cliffs, Goram's Chair, Blaise Woods, Bristol, G, LH, conf. MARK & CK. On rocks on north-facing slope, Tor Hill, Wells, S, ACL, with *P. interjectum*.

Botrychium lunaria (L.) Sw. Thirty specimens, with *Ophioglossum vulgatum* L. and *Thlaspi caerulescens* J.S. & C. Presl, on two humps south of the Tynning's Farm swallet, north of Cheddar, S, PRG.

Helleborus viridis L. A flourishing colony on stream bank, North Wootton, S, RSC.

Aconitum napellus L. In brambles in Nether Wood, near Charterhouse, S, DM & J. Maxwell.

Aquilegia vulgaris L. Beside lane, Penpole Quarry, Shirehampton, G, IFG. One plant and only occasionally seen in earlier recent years, Durdham Down, Bristol, G, PJMN. No longer 'still plentiful' as noted here by J. W. White (1912) *Flora of Bristol*, p. 129. A large patch near car park, Hunstrete Lake, S, RSC.

Fumaria muralis Sonder ex Koch One plant in garden, Burnham-on-Sea, S, RSC.

Arabis scabra All. A survey in 1994 in the Avon Gorge gave 3154 plants on the city side and 1837 on the Leigh Woods side, G & S, LH.

Viola canina L. A good flowering patch in rough grassland above rock outcrop, Draycott, S, RSC. Also *Vulpia bromoides* (L.) Gray.

Hypericum androsaemum L. Abundant, lane, Stoke Bishop, Bristol, G, IFG.

H. maculatum Crantz A large patch on road verge, Leighton, S, IPG.

Dianthus armeria L. A single plant in Carboniferous limestone pasture near Cheddar Wood, S, K. Vickery, conf. MARK & CK. Also reported by A. Woodhall.

Cerastium diffusum Pers. (*C. atrovirens* Bab.) Plentiful in gravel on bridge over motorway, Biddisham, S, IPG; also with *C. semidecandrum* L. on largely bare areas on side of motorway flyover, Highbridge, S, IPG.

C. semidecandrum L. In plenty, roadside verge, Burnham-on-Sea, S, IPG.

Stellaria pallida (Dumort.) Piré In small quantity on edge of pavement, Rooks Bridge, S, PRG.

Spergularia media (L.) C. Presl ssp. *angustata* (Clavaud) Greuter & Burdet In saltmarsh by River Avon, Pill, S, P. Macpherson, det. JRA.

Malva neglecta Wallr. Single plant on soil heap by old railway line, Kingston Seymour, S, RSC.

Anthyllis vulneraria L. Kilmersdon, S, RSC.

Lotus glaber Miller (*L. tenuis* Waldst. & Kit. ex Willd.) Towards Sea Mills, G, PJMN. This record represents a rare and unexpected survival in this area. The plant was noted by N. Sandwith in the saltmarsh below Shirehampton in *Bristol Botany in 1919*, p. 135. In 1799 it was reported under *L. diffusus* as abundant below Cook's Folly by Turner and Sowerby. In 1805 it was recorded in *The Botanist's Guide through England and Wales* by D. Turner and L. W. Dillwyn as observed by Sir T. G. Cullum 'In the low meadows about a mile beyond the Hot Wells near Bristol'. Sir Thomas Gery Cullum (1741-1831), a Suffolk medical man and botanist, contributed records for several counties in the *Botanist's Guide* but appears to have been overlooked in the history of the botany of Bristol. *Lotus glaber* is also referred to in *Memorials, Journal and Botanical Correspondence of Charles Cardale Babington* (Cambridge, MacMillan and Bowes, 1897); in 1836, in connection with the visit of the British Association to Bristol, Babington wrote 'Lingwood and I walked down the river as far as Sea Mills. We found there *Lotus tenuis*, *Rottboellia incurvata* ...', PJMN.

Vicia sylvatica L. On side of track at edge of wooded area, Brimscombe, Weare, S, PRG.

V. sepium L. var. *ochroleuca* Bast. Sneyd Park, Bristol, G, PJMN. This white-flowered form, not previously recorded in or near the Avon Gorge, is given by White (1912) *Flora of Bristol*, p. 248, under sub-var. *Rouy* as rare.

V. bithynica (L.) L. About two thousand plants in Carboniferous limestone grassland, between Powder House Wood and Crabtree Slip Wood, Shirehampton, G, PGR & T. N. Twiggs. In the *Flora of Bristol* (1912), p. 247, J. W. White refers to the record by T. B. Flower in *Phytologist* I (1841), p. 68, giving this species as plentiful in Powder House Wood; this report was verified by E. H. Swete in *Flora Bristolensis* (1854), p. 24, by inspection *in situ* by Swete. However, White suspects an error, suggesting that in 1841 Flower, then 'a very young botanist', misidentified the plant and that Swete would not have detected the error. White also questioned Flower's records of *V. bithynica* for 'Green Valley', Clifton Down, and for St. Vincent's Rocks, regarding these records to refer to a narrow-leaved form of *Lathyrus montanus* (*L. linifolius*), and suggested that Swete himself in his earlier years misunderstood the plants. The present record indicates that White's caution over the Powder House Wood site was misplaced and gives a striking example of the long persistence of a plant remaining unnoticed for nearly a century and a half.

Lathyrus sylvestris L. Avon Gorge, G, PJMN. Long known from the Great Quarry and survived the engineering works here between 1989 and 1994.

Potentilla argentea L. On new ride in Postlebury Wood, Truddoxhill, north of Witham Friary, S, CJC & VC. Persistent on slag heaps at Charterhouse, S, RSC.

P. × *mixta* Nolte ex Reichb. Churchyard, Marston, S, PRG.

Crataegus laevigata (Poiret) DC. One bush in field hedge, Oakhill, S, IPG.

Sorbus torminalis (L.) Crantz Litton Wood, Litton, S, P. White.

Epilobium roseum Schreber By side of track, Middleway Wood, East Horrington, S, IPG; also several plants on roadside, Oakhill, S, PRG.

Hippuris vulgaris L. Small patch, Hunstrete Lake, S, RSC.

Rumex crispus L. × *R. obtusifolius* L. (*R. × pratensis* Mert. & Koch) A single plant in field by road, Litton, S, IPG.

R. obtusifolius L. × *R. sanguineus* L. (*R. × dufftii* Hausskn.) With both parents on old railway line, Cheddar, S; also a single specimen with both parents on roadside, Westbury, S, IPG.

R. obtusifolius L. × *R. conglomeratus* Murray (*R. × abortivus* Ruhmer) With both parents on old railway line, Cheddar, S, IPG.

R. obtusifolius L. × *R. palustris* Smith (*R. × steinii* A. Becker) With both parents on peat cuttings on Westhay Heath, Catcott Burtle, S, IPG, conf. JRA.

R. sanguineus L. × *R. pulcher* L. More than twenty plants, with both parents, in old grassland at edge of wood, Old Down, near Emborough, S, IPG.

Salix × sericans Tausch ex A. Kerner (*S. viminalis* L. × *S. caprea* L.) In roadside hedge, Pilton, S, PRG.

Monotropa hypopitys L. ssp. *hypopitys* Towpath, Avon Gorge, Bristol, S, PGR. The Yellow Bird's-nest has been rarely recorded in the Leigh Woods area; this appears to be the first record for the towpath.

Limonium binervosum (G. E. Smith) Salmon Recent colonists of a strip of saltmarsh along the River Parrett, Pawlett, S, RSC.

Primula vulgaris Hudson × *P. veris* L. (*P. × polyantha* Miller) A single plant in hedge, Cleaves Wood, west of Hinton Charterhouse, S, RSC. Also *Colchicum autumnale* L.

Origanum vulgare L. var. *albiflorum* Lej. Below Leigh Woods, Bristol, S, PJMN. The white-flowered variety is little recorded. Annotations by the Sandwiths in their copy of White's *Flora of Bristol* (1912) give this form for under Leigh Woods; slopes below Sea Walls, Clifton; Cadbury Hill, Yatton; wood border east of Tickenham. Noted by Miss I. M. Roper (unpublished 'Notes') for the Clack Mill, Westbury-on-Trym.

Campanula latifolia L. The statement in *Bristol Botany in 1993*, p. 40, that this plant is 'rare in the Bristol region' was intended to refer particularly to its native occurrence in v.c. 6. A record of this Bellflower as naturalized on the former Backwell Hill House estate is given in *Bristol Botany in 1963*, p. 383. In v.c. 34, records include Hambrook (*Bristol Botany in 1956*, p. 183) and Stapleton and Frenchay (*Bristol Botany in 1964*, p. 28).

Valerianella carinata Lois. Wall, Stoke Bishop, G, and also Durdham Down, Bristol, G, IFG.

Senecio viscosus L. Two flowering plants on ballast along quarry railway, Great Elm, S, RSC.

Cirsium eriophorum (L.) Scop. At least 140 plants on sloping pasture and 30 near road, Battlefields, G, PJC. Also at Kilmersdon, S, RSC.

Lactuca serriola L. Catcott Heath, S, and Westhay, S, RSC.

- Potamogeton crispus* L. In small quantity in sheep dip near road, Priddy, S, DM.
- Groenlandia densa* (L.) Fourr. In reservoir, Cheddar, S, and plentiful in moat of Bishop's Palace, Wells, S, IPG. A good patch, deep water, Priddy Pool, S, RSC.
- Polygonatum multiflorum* (L.) All. Persistent in woodland, Great Elm, S, RSC.
- Ornithogalum angustifolium* Boreau Small patch on road bank, Marshfield, G, PJC. Scattered clumps on roadside bank, Burnham-on-Sea, S, PRG.
- Paris quadrifolia* L. Several plants adjoining path, Horrington Bottom, S, RSC.
- Juncus foliosus* Desf. Fruiting luxuriantly on bridleway, Mark, S, RSC.
- J. acutus* L. Increasing, with several small fruiting plants near the original colonist, Berrow, S, RSC.
- Cephalanthera damasonium* (Miller) Druce Near path, in shady scrub, South Stoke, S, RSC.
- Neottia nidus-avis* (L.) Rich. In wood, Thrupe, west of Oakhill, S, CJC. In shady woodland and at edge of clearing, Great Elm, S, RSC. Also in shade adjoining Hunstrete Lake, S, RSC.
- Ophrys apifera* Hudson Nearly two and a half thousand on south-facing road bank, and another forty nearby, Aust, G, PJC. Nearly thirty near roundabout, Cold Ashton, G, PJC. Flowering well at Easton-in-Gordano, but only one seen on the Long Ashton Bypass and none at Cambridge Batch, S, PJC. Three plants in field near Clevedon Golf Course, Walton-in-Gordano, S, EGMN. Plentiful on south side of Harter's Hill, Coxley, S, PRG.
- O. apifera* Hudson var. *trollii* (Hegetschw.) Reichb. f. A small colony near road and onto rough ground, Cribbs Causeway, north of Bristol, G, PJC.
- Orchis morio* L. One flowering plant, where never seen previously, on roadside bank which has been mown for thirty years, Bishop Sutton, S, D. Warden. Also three pale pink flower spikes with hundreds of plants with normal flowers, Villice Parkland, Stoke Villice, S, D. Warden.
- Dactylorhiza praetermissa* (Druce) Soó At least 140 plants on sloping pasture and 30 near road, Battlefields, G, PJC. Also at Kilmersdon, S, RSC.
- Arum italicum* Miller Clump on road verge, Brinscombe, Weare, S, PRG.
- Eriophorum latifolium* Hoppe The highest ever count over many years of 190 fruiting heads, Max Bog, Winscombe, S, RSC.
- Carex binervis* Smith Many large fruiting plants on ground recently cleared of conifers, Stock Hill, Priddy, S, RSC. Also *C. pilulifera* L. in abundance and fruiting.
- C. digitata* L. A substantial population on steep north-facing cliffs adjoining quarry, Leigh Woods, Bristol, S, LH.
- C. acuta* L. With *C. rostrata* Stokes, large stand in field by rhyne, Godney, S, IPG.
- Aira caryophyllea* L. Plentiful on retaining wall of railway, Corston, S, RSC. Also *Arabidopsis thaliana* (L.) Heynh.

Gastridium ventricosum (Gouan) Schinz & Thell. In 1993, an estimated thousand plants, at edge of Gully, over Black Rock Quarry, Avon Gorge, Bristol, G, LH, MARK & CK. This is a new station in the Gorge for the Nit-grass which is very local as a native.

ALIENS

Laurus nobilis L. A small, self-sown bush in hedge, Huntspill, S, IPG.

Hirschfeldia incana (L.) Lagr.-Fossat A few plants, edge of Weston Big Wood, Weston-in-Gordano, S, C. Greenway, conf. T. C. G. Rich.

Erysimum cheiri (L.) Crantz (*Cheiranthus cheiri* L.) Rock above River Avon under Leigh Woods, Bristol, S, PJMN. Known from St. Vincent's Rocks for a great many years, where noted by E. H. Swete (1854) *Flora Bristolensis*, p. 10; the wallflower is now well established on the other side of the Avon Gorge near the Suspension Bridge.

Amaranthus retroflexus L. A single plant on roadside verge, Leighton, east of Cranmore, S, GAC.

Limnanthes douglasii R. Br. Waste area, Wookey Hole, S, CJC & VC.

Alcea rosea L. In 1993, one plant on roadside verge, Avonmouth, G, DTH.

Melilotus albus Medikus Waste ground by old railway adjoining new road, Brindham, Glastonbury, S, IPG & DM.

Spiraea × arguta Zabel Siston Common, G, MARK & CK, det. EJC. This is a first record for v.c. 34. Herb. MARK.

Potentilla recta L. Single plant on bank of old railway, Wells, S, IPG.

Cotoneaster franchetii Bois In wood, in rocky area of Tor Hill, Wells, S, ACL.

C. rehderi Pojark. In 1993, one bush on rock ledge, Avon Gorge, G, DTH.

Sorbus decipiens (Bechst.) Irmisch Avon Gorge, G, PJMN. Engineering works in the Great Quarry area have made it difficult to follow the fate of this species originally planted near the site of the old tennis courts. The two survivors of the original planting have died, but at least seven saplings are growing in the site or on the quarry face.

S. graeca (Spach) Kotschy Sneyd Park, Bristol, G, PJMN. In woodland, mainly of specimen trees, given to the Woodland Trust in 1983 by Benson Bros. (Bristol) builders, some native trees, including *S. torminalis* (L.) Crantz, have been planted and also a few *Sorbi* which are provisionally named *S. graeca*. These have flowered and fruited well but further study is desirable.

Tellima grandiflora (Pursh) Douglas ex Lindley Clump on side of track, North Wootton, S, PRG; also one clump in strip of trees adjoining road, Chewton Mendip, S, IPG; Beacon Wood, Beacon Hill, Oakhill, S, D. Green.

Zauschneria californica C. Presl This garden relict persists (non-flowering patch) at Sand Point, Kewstoke, S, RAB, MARK & CK, conf. EJC.

Myriophyllum aquaticum (Vell. Conc.) Verdc. In rhyme near Westhay Nature Reserve, Meare, S, DM.

Persicaria amplexicaulis (D. Don) Ronse Decraene Lane, Stoke Bishop, Bristol, G, IFG.

Alnus incana (L.) Moench Plentiful in boggy wooded area adjoining Wellow Brook, Ston Easton, S, IPG. The very large Grey Alder trees here were self-seeding freely.

Quercus × *pseudosuber* Santi (*Q. cerris* L. × *Q. suber* L.) In 1993, one sapling of the Lucombe Oak in hedge at edge of cliff, Avon Gorge, Bristol, G, DTH.

Ceratostigma plumbaginoides Bunge A patch about a metre long growing out of churchyard wall, Wells, S, PRG, conf. D. McClintock. Specimen lodged in British Museum (Natural History).

Cyclamen hederifolium Aiton A well established small patch in woodland, Ridgewood, Chipping Sodbury, G, M. J. Trotman.

Nicandra physalodes (L.) Gaertner Three plants on waste ground of farm buildings adjoining road, Litton, S, IPG.

Lamiastrum galeobdolon (L.) Ehrend. & Polatschek ssp. *argentatum* (Smejkal) Stace Roadside, Sneyd Park, Bristol, G, and side of lane, Stoke Bishop, Bristol, G, IFG.

Conyza sumatrensis (Retz.) E. Walker A single specimen, with *C. canadensis* (L.) Cronq., by house adjoining bridge over River Brue, Burtle, S, IPG.

Lagarosiphon major (Ridley) Moss Plentiful in sheep dip near road, Priddy, S, DM.

Muscari botryoides (L.) Miller Waste ground, Shirehampton, Bristol, G, IFG.

Juncus tenuis Willd. One clump in grassy parking area near Church, Berrow, S, IPG.

Allium roseum L. A large flowering patch on south-facing Carboniferous limestone grassland encompassed by scrub, Worle Hill, Weston-super-Mare, S, MARK & CK. Found on a B. N. S. meeting led by M. Evans.

A. subhirsutum L. Well established on small area of coastal strip, Sand Bay, Kewstoke, S, RAB. Confirmed later by MARK & CK on field visit.

Tristagma uniflorum (Lindley) Traub (*Ipheion uniflorum* (Lindley) Raf.) Three plants by rhyme well away from houses, Shirehampton, Bristol, G, IFG.

Lagurus ovatus L. Car park, Southmead Hospital, Horfield, Bristol, G, MARK & CK.

Setaria pumila (Poiret) Roemer & Schultes A single plant in gateway near road, Cheddar, S, IPG & GAC.

Sorghum halepense (L.) Pers. Large clump on roadside in village, Croscombe, S, PRG.

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I thank everyone who has supplied records and helped with these, especially Mr I. P. Green, Mr M. A. R. Kitchen and Mr P. J. M. Nethercott. I am indebted to Mr D. J. Lovell at Long Ashton Research Station for meteorological records.

THE RARE LARGER RESIDENT MOTHS OF THE BRISTOL DISTRICT

by R. J. BARNETT

City Museum & Art Gallery, Bristol BS8 1RL

M. EVANS

Flat 7, 16 Kewstoke Road, Worle, Weston-super-Mare BS22 9JF

and A.J. PYM

109 Conygre Grove, Bristol BS12 7DW

INTRODUCTION

The Bristol & District Moth Group ('the Group') was set up in 1991 under the umbrella of the City Museum's Bristol Regional Environmental Records Centre (BRERC). Since then, the Group has been collecting and assimilating data on the district's moth fauna. The Group has concentrated on the area within the present County of Avon, but it has also assembled records from beyond the Avon boundary though within the Watsonian vice-counties of North Somerset (v.c.6) and West Gloucestershire (v.c.34), although excluding that part of v.c.34 west of the River Severn. Figure 1 shows the recording area. A major source of such records has been the Bristol Naturalists' Society. The Group is also grateful to the Somerset Moth Group and to Mr Roger Gaunt, the Gloucestershire Moth Recorder, for information on the status of species outside the County of Avon but within the respective vice-counties.

Moth recording is mainly carried out by utilising specialist light-traps, which are both costly and difficult to transport to the remoter sites. This, together with the relatively small number of moth enthusiasts, limits recording coverage. Day-flying moths tend to be under-recorded as enthusiasts concentrate on light-trapping. Nevertheless, from 1980 to 1993 inclusive, 573 species of larger moths (macro-moths) have been recorded in the 53 ten-km squares contained in the area described. Judged by the records of species known to be common, such as the Large Yellow Underwing *Noctua pronuba*, whose distribution is plotted in Figure 2, the data appeared adequate to allow a preliminary assessment of the relative status of the larger resident moths within the district.

To facilitate discussion of rarity or commonness within the data, a series of crude categories was set up, defined according to the number of ten-km squares in which the species had been observed. These definitions are given in Table 1. Using them, 84 species, or 14% of the total of 573 species represented, are to be considered rare in the Bristol district. These locally rare species are listed in Appendix Table A1. Of the remaining 489 species which are not rare in the district, 23 are nationally uncommon.

TABLE 1. Categories of abundance used, defined according to the number of ten-km squares in which a species was recorded, out of the 53 squares in the area.

<i>Category</i>	<i>No. of ten-km squares with records</i>
Rare	1 to 2
Local	3 to 5
Frequent	6 to 7
Abundant	8 or more

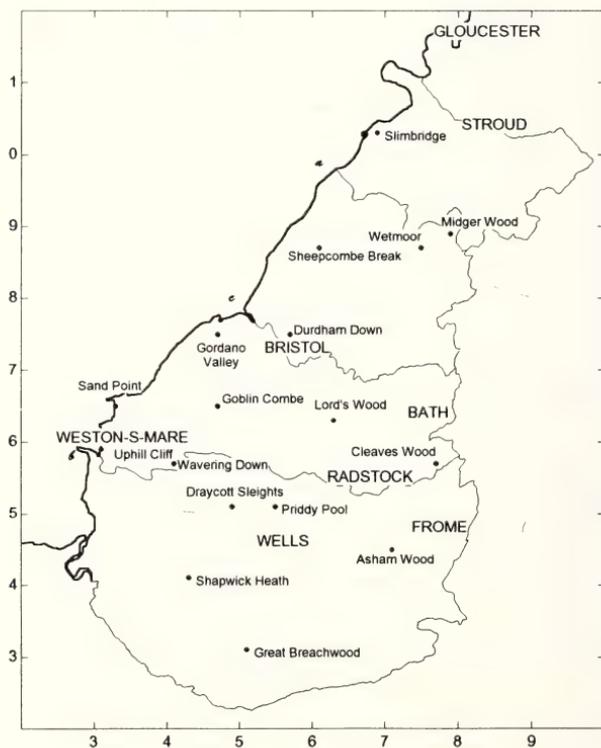


FIGURE 1. The area within which moth distribution has been plotted. This is the recording area of the Bristol Regional Environmental Records Centre and comprises Watsonian Vice-county 6 and the portion of Vice-county 34 east of the R Severn. The west to east lines *a* and *b* mark the boundaries of the present County of Avon. The boundary *c* between these is the division between vice-counties 34 and 6.

RARE MOTHS OF THE BRISTOL DISTRICT

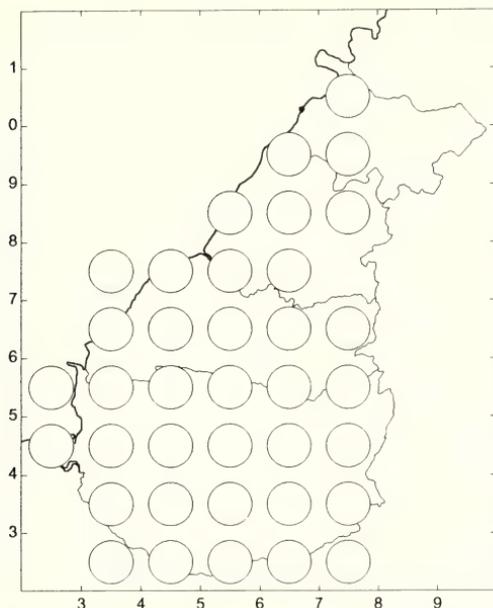


FIGURE 2 Distribution map for the Large Yellow Underwing, *Noctua pronuba*, which is common in the district, plotted by ten-km squares; data from 1980 onwards.

These 23 species are listed in Appendix Table A2. The Appendix tables also give the national status of each species according to Ball and to Waring (see below).

NATIONAL RARITY DEFINED

For many invertebrate groups, a report produced by the Nature Conservancy Council, as it then was, provided the first national framework of rarity to be established (Ball, 1986). The report provided lists of species included in the Conservancy's Invertebrate Site Register as of Red Data Book (RDB) or Nationally Notable (N) status, and has proved a useful tool at the local as well as the national level. It includes categories for the larger or macro-moths and provisional listings for the micro-moths.

Since 1986, the status of species within the national categories has been under revision by Dr Paul Waring, in preparation for a national atlas of rare moths (Waring 1994). In the light of information gained since 1986, Waring has added two new categories, 'local' and 'common'. Revisions to Waring (1994) have been used in this paper (Waring, personal communication). The national categories first defined by Ball (1986), and the two now added by Waring, are defined as follows.

- RDB 1 - *Endangered*.
 Species showing rapid decline over last 70 years.
 Species now in five or fewer ten-km squares.
- RDB 2 - *Vulnerable*.
 Species believed likely to move into Endangered category if causal factors continue to operate.
- RDB 3 - *Rare*
 Species with small local or thinly scattered populations, known from 15 or fewer ten-km squares nationally.
- RDBK - Believed to be rare but too recently discovered for placing to be certain.
- Na Known from between 16 and 30 ten km squares nationally.
- Nb Known from between 31 and 100 ten-km squares nationally.
- Local Known from 101 - 300 ten-km squares nationally since 1980.
- Common Known from over 300 ten-km squares nationally since 1980 (this does not imply occurrence everywhere in Britain or in all habitats).

SPECIES RARE IN THE BRISTOL DISTRICT

SPECIES WITH RED BOOK STATUS

The BRERC database lists five species with Red Data Book status, as shown in Table A1 of the Appendix. These are the Barberry Carpet, the Silky Wave, the Four-spotted, the White-spotted Pinion and the Goosefoot Pug.

Barberry Carpet, *Pareulype berberata*, ([D. & S.]). A colony discovered in 1983, outside Avon, but within vice-county 34, was only the second known in the country, though a third was found later. The larva feeds on the barberry, *Berberis vulgaris*, an uncommon plant which is actively discouraged by farmers as it is a secondary host for the Wheat Rust Fungus, *Puccinia graminis*. The Gloucestershire discovery was particularly significant as for the first time larvae were found feeding on a cultivated variety of barberry. The occurrence is fully described in Waring (1991).

Silky Wave, *Idaea dilutaria* (Hb). This was first discovered in Britain in 1851 at Durdham Down, Bristol and was reported in the *Zoologist* (Sircom, 1851). Later it was found on the Great Orme, Caernarvonshire, and these are still the only two confirmed colonies in the country. Other occasional sightings are probably due to confusion with the Dwarf Cream Wave, *Idaea fuscovenosa* (Goeze), which has even been referred to in the past as *dilutaria*, further adding to the confusion. The Bristol colony is the focus of a continuing study by some members of the Group. During the 1993 and 1994 seasons, the moth was confirmed at two discrete but small open sites within the Avon Gorge. Unconfirmed sightings were also made at two other small localities on the northern slopes of the Gorge.

A study of the Silky Wave on the continent has been made by Ryrholm (1988) with emphasis on its Scandinavian localities. These, together with its British colonies, are the most northerly in Europe. Ryrholm has shown that its distribution is restricted to sites

where the local micro-climate provides significantly higher temperatures, year round, than in the surrounding area. This suggests that the moth occurs in relict populations surviving from a time when a generally more favourable climate allowed it to occur more widely. The Bristol population is consistent with this, surviving on tiny patches of downland on south-facing, well-drained carboniferous limestone. Its continued existence will depend upon sensitive management to prevent scrub encroachment reducing further the areas where the larvae can feed on withered leaves of plants such as the Rock Rose, *Helianthemum mummularium* (South, 1961). At the same time, some shrub layer must be available to provide habitat and shelter for the adults. It is conceivable that other gorges in the district could harbour undiscovered colonies of this moth.

Four-spotted, *Tyta luctuosa* ([D. & S.]). This is recognised as a species which has always fluctuated in range and abundance. However, its decline in the last forty years appears to have been exacerbated by the reduction in the open downland on which it lives and also, perhaps, by climatic factors (Heath & Emmet, 1983). It is currently known in this region only from Somerset (Somerset Moth Group, personal communication) and from just one of the ten km squares shown in Figure 1.

White-spotted Pinion, *Cosmia diffinis* (L). This has declined nationally as the larva feeds on mature elm trees, which have themselves declined as a consequence of Dutch Elm Disease. There are two records from the early 1980s and just one from the late 1980s.

Goosefoot Pug, *Eupithecia sinuosaria* (Evers). This is the only other moth with an RDB designation, listed in Table 1 of the Appendix. The first British specimen was recorded by Mr Brian Slade on 13 June 1992 (Slade & Agassiz, 1992). A second British specimen was recorded in that year in Hertfordshire but the status of the moth remains unclear.

OTHER LOCAL RARITIES

The remaining species listed in Table 1 of the Appendix are of varied local status, below Red Data Book level. Some, such as the **Cream-bordered Green Pea**, *Earias clorana* (L), and the **Marsh Oblique-barred**, *Hyphenodes humidalis* Doubl., both of which are found on the Somerset Levels, are genuinely rare in the district and are restricted to certain habitats. Others may be common but under-recorded through difficulties of identification and of recording; thus, the **Northern Winter Moth**, *Operophtera fagata* (Scharf) is not easily differentiated from the Winter Moth, *Operophtera brumata*, and also it is on the wing at a time when few recorders are active. Species which are undoubtedly increasing include the **Juniper Carpet**, *Thera juniperata* (L), utilising cultivated juniper, while amongst those species which are still declining is the **Broad-bordered Bee Hawk-moth**, *Hemaris fuciformis* (L).

NATIONALLY UNCOMMON SPECIES NOT RARE IN THE DISTRICT

The database held by BRERC has been used to list those species which were considered by Ball as nationally uncommon because they have a restricted national distribution but which, nevertheless, are not locally rare. The species which fall into this category are shown in Table A2 of the Appendix.

The **Small Eggar**, *Eriogaster lanestris* (Linn), was thought in 1986 to be nationally vulnerable and to be threatened by hedge cutting and by agricultural sprays, which destroy the larval webs on hawthorn and blackthorn hedges. Since that time, the activities of the Bristol and Somerset Moth Groups, in particular, have helped to show that we have a stronghold for this species in the area south-west of Bristol. Consequently the national status of this species is likely to be reduced from RDB2 to Nb, and indeed it is 'common' in our district.

Table A2 of the Appendix shows that the Bristol district contains important populations of certain woodland species, especially the **Mocha**, *Cyclophora annulata* (Schulze), **Blomer's Rivulet**, *Discoloxia blomeri* (Curt), **Red-necked Footman**, *Atolmis rubricollis* (Linn) and **Dotted Chestnut**, *Conistra rubiginea* ([D. & S.]). Crucial to their occurrence must be the presence of certain larval food plants such as Wych Elm for Blomer's Rivulet. The relatively mild and damp climate of the district is also probably important. Other species listed in Appendix Table 2 indicate the importance of habitats such as unimproved grassland for the **Cistus Forester**, *Adscita geryon* (Hb), wetlands for the **Silky Wainscot**, *Chilodes maritimus* (Tausch) and coastal habitats for the **Sand Dart**, *Agrotis ripae* (Hb).

IN CONCLUSION

The categories here assigned to the Bristol larger moth fauna are still provisional and will continue to be refined. Obviously, new resident species may be discovered in the area but combining Tables A1 and A2 gives us a list of species of particular importance in the district. It is envisaged that surveying sites for these species will enable conservation agencies to identify the quality of sites with respect to the moth fauna of the Bristol district, and to better target and refine techniques of habitat and species management to conserve biodiversity.

ACKNOWLEDGEMENTS

We thank the Somerset Moth Group, in particular Mr. Keith Brown and Mr. Kim Leaver, and also the Gloucestershire Moth Recorder, Mr. Roger Gaunt, for access to information gathered as part of their recording schemes. We are grateful to all moth recorders in the region who have submitted data to the Bristol, Somerset and Gloucestershire schemes, recorders too numerous to list. Finally we thank Dr Paul Waring for access to his unpublished revisions of the national status of the larger moths and for commenting on a draft of this paper.

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APPENDIX

TABLE A1. National status of the larger resident moths recorded as rare in the Bristol district, 1980-1993 inclusive. Status levels according to Ball (1986) and Waring (1994) are defined in the text. Species mentioned in the text are in bold type.

Common Name	Scientific Name	Ball (1986)	Waring (1994)
Five-spot Burnet (chalkland race)	<i>Zygaena trifolii</i> (Esp) ssp. <i>palustrella</i> Ver.	-	Local
Currant Clearwing	<i>Synanthedon tipuliformis</i> (Cl.)	Nb	Nb
Orange-tailed Clearwing	<i>Synanthedon andrenaeformis</i> (Lasp.)	Na	Nb
Red-tipped Clearwing	<i>Synanthedon formicaeformis</i> (Esp)	Na	Nb
Red-belted Clearwing	<i>Synanthedon myopaeformis</i> (Esp.)	Na	Nb
Red-tipped Clearwing	<i>Synanthedon formicaeformis</i> (Esp.)	Na	Nb
Six-belted Clearwing	<i>Bembecia scopigera</i> (Scop)	Nb	Nb
Grass Eggar	<i>Lasiocampa trifolii</i> (ID. & S.)	Na	Na
Poplar Lutestring	<i>Tethea or</i> (ID. & S.)	Nb	Local
Satin Lutestring	<i>Tetheella fluctuosa</i> (Hb)	Nb	Nb
Light Orange Underwing	<i>Archiearis notha</i> (Hb)	Na	Nb
False Mocha	<i>Cyclophora porata</i> (L)	-	Local
Mullein Wave	<i>Scopula marginepunctata</i> (Goeze)	-	Local
Dotted-border Wave	<i>Idaea sylvestraria</i> (Hb)	Nb	Nb
Silky Wave	<i>Idaea dilutaria</i> (Hb)	RDB3	RDB2
Large Twin-spot Carpet	<i>Xanthorhoe quadrifasiata</i> (Cl)	-	Local

[continued

July Belle	<i>Scotopteryx luridata</i> (Hufn)	-	Common
Royal Mantle	<i>Catarhoe cuculata</i> (Hufn)	-	Local
Small Argent & Sable	<i>Epirrhoe tristata</i> (L)	-	Common
Devon Carpet	<i>Lampropteryx otegiata</i> (Metc)	Na	Nb
Juniper Carpet	<i>Thera juniperata</i> (L)	Nb	Common
Beech-green Carpet	<i>Colostygia olivata</i> ([D. & S.])	Nb	Local
Barberry Carpet	<i>Pareulype berberata</i> ([D. & S.]	RDB1	RDB1
Argent & Sable	<i>Rheumaptera hastata</i> (L)	Nb	Nb
Cloaked Carpet	<i>Euphyia biangulata</i> (Haw)	Nb	Nb
Northern Winter Moth	<i>Operophtera fagata</i> (Scharf)	-	Common
Pretty Pinion	<i>Perizoma blandiata</i> ([D. & S.]	Nb	Nb
Marbled Pug	<i>Eupithecia irriguata</i> (Hb)	Na	Nb
Pinion-spotted Pug	<i>Eupithecia insigniata</i> (Hb)	Na	Nb
Marsh Pug	<i>Eupithecia pygmaeata</i> (Hb)	-	Local
Bleached Pug	<i>Eupithecia expallidata</i> Doubl.	Nb	Nb
Campanula Pug	<i>Eupithecia denotata</i> (Hb)	Na	Na
Shaded Pug	<i>Eupithecia subumbrata</i> ([D & S])	Nb	Local
Goose-foot Pug	<i>Eupithecia sinuosaria</i> (Evers)	RDBK	RDBK
Ochreous Pug	<i>Eupithecia indigata</i> (Hb)	Nb	Common
Pimpinel Pug	<i>Eupithecia pimpinellata</i> (Hb)	Nb	Nb or even local
Golden-rod Pug	<i>Eupithecia virgaureata</i> Doubl.	Nb	Local
Dentated Pug	<i>Anticollix sparsata</i> (Treit)	Na	Na
Waved Carpet	<i>Hydrelia sylvata</i> ([D. & S.]	Nb	Nb
Drab Looper	<i>Minoa murinata</i> (Scop)	Nb	Nb
Barred Umber	<i>Plagodis pulveraria</i> (L)	-	Local
Horse Chestnut	<i>Pachycnemia hippocastanaria</i> (Hb)	Nb	Nb
Small Brindled Beauty	<i>Apocheima hispidaria</i> ([D & S])	-	Local
Dotted Carpet	<i>Alcis jubata</i> (Thumb)	Nb	Nb
Sloe Carpet	<i>Aleucis distinctata</i> (H.-S.)	Na	Nb
Pine Hawk-moth	<i>Hyloicus pinastri</i> (L)	-	Local
Broad-bordered Bee	<i>Hemaris fuciformis</i> (L)	Na	Nb
Hawk-moth			
Alder Kitten	<i>Furcula bicuspis</i> (Borkh)	Nb	Nb
Great Prominent	<i>Peridea anceps</i> (Goeze)	-	Local
Scarce Prominent	<i>Odontosia carmelita</i> (Esp)	-	Local
Clouded Buff	<i>Diacrisia sannio</i> (L)	-	Local
Water Ermine	<i>Spilosoma urticae</i> (Esp)	Nb	Nb
Small Black Arches	<i>Meganola strigula</i> ([D. & S.]	Na	Na
Portland Moth	<i>Actebia praecox</i> (L)	Nb	Nb
Stout Dart	<i>Spaelotis ravida</i> ([D. & S.]	-	Local
Barred Chestnut	<i>Diarsia dahlui</i> (Hb)	-	Local
Square-spotted Clay	<i>Xestia rhomboidea</i> (Esp)	Nb	Nb
Beautiful Yellow Underwing	<i>Anarta myrtilli</i> (L)	-	Common
Bordered Gothic	<i>Heliophobus reticulata</i> (Goeze)	Nb	Na
Beautiful Brocade	<i>Lacanobia contigua</i> ([D. & S.]	Nb	Local
Glaucous Shears	<i>Papestra biren</i> (Goeze)	-	Local
Marbled Coronet	<i>Hadena confusa</i> (Hufn)	-	Local
Silver Cloud	<i>Egira conspiciaris</i> (L)	Na	Na
The Wormwood	<i>Cucullia absinthii</i> (L)	Nb	Nb

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Brindled Ochre	<i>Dasyptolia templi</i> (Thunb)	Nb	Local
Suspected	<i>Parastichtis suspecta</i> (Hb)	-	Local
Light Knot-grass	<i>Acronicta menyanthidis</i> (Esp)	-	Local
Bird's Wing	<i>Dipterygia scabriuscula</i> (L)	-	Local
Angle-striped Sallow	<i>Enargia paleacea</i> (Esp)	Nb	Nb
White-spotted Pinion	<i>Cosmia diffinis</i> (L)	Nb	Na/RDB3
Large Ear	<i>Amphipoea lucens</i> (Frey)	-	Local
Ear Moth	<i>Amphipoea oculea</i> (L)	-	Common
Webb's Wainscot	<i>Archanara sparganii</i> (Esp)	Nb	Nb
Fen Wainscot	<i>Arenostola phragmitidis</i> (Hb)	-	Local
Silver Hook	<i>Deltote uncula</i> (Cl)	Nb	Local
Cream-bordered Green Pea	<i>Earias clorana</i> (L)	Nb	Nb
Gold Spangle	<i>Autographa bractea</i> (ID. & S.)	-	Common
Four-spotted	<i>Tyta luctuosa</i> (ID. & S.)	RDB2	RDB3, even Na
Beautiful Snout	<i>Hypena crassalis</i> (Fabr)	Nb	Local
Buttoned Snout	<i>Hypena rostralis</i> (L)	Nb	Nb
White-line Snout	<i>Schrankia taenialis</i> (Hb)	Nb	Nb
Pinion-streaked Snout	<i>Schrankia costaestrigalis</i> (Steph)	-	Local
Marsh Oblique-barred	<i>Hypenodes humidalis</i> Doubl	Nb	Nb
Common Fan-foot	<i>Pechipogo strigilata</i> (L)	Nb	Na

TABLE A2. Nationally uncommon species which are of Local, Frequent or Common occurrence in the Bristol region, based on records from 1980-1993 inclusive, with their national status according to Ball (1986) and Waring (1994). Status levels are defined in the text. Species referred to in the text are in bold type.

Common Name	Scientific Name	Ball	Waring	Bristol
The Forester	<i>Adscita statices</i> (Linn)	Nb	Nb	Frequent
Cistus Forester	<i>Adscita geryon</i> (Hb)	Na	Nb	Frequent
Small Eggar	<i>Eriogaster lanestris</i> (Linn)	RDB2	Nb	Common
The Mocha	<i>Cyclophora annulata</i> (Schulze)	Nb	Nb	Common
Oblique-striped	<i>Phibalapteryx virgata</i> (Hufn)	Na	Nb	Local
Chalk Carpet	<i>Scotopteryx bipunctaria</i> (ID. & S.)	Nb	Nb	Frequent
Ruddy Carpet	<i>Catarhoe rubidata</i> (ID. & S.)	Nb	Nb	Frequent
Valerian Pug	<i>Eupithecia valerianata</i> (Hb)	Nb	Nb	Local
Blomer's Rivulet	<i>Discoloxia blomeri</i> (Curt)	Nb	Nb	Common
Little Thorn	<i>Cepphis advenaria</i> (Hb)	Nb	Nb	Local
Grass Wave	<i>Percuria strigillaria</i> (Hb)	Nb	Nb	Local
Narrow-bordered Bee Hawk Moth	<i>Hemaris tityus</i> (Linn)	Na	Na	Local
Red-necked Footman	<i>Atolmis rubricollis</i> (Linn)	Nb	Nb	Common
Orange Footman	<i>Eilema sororcula</i> (Hufn)	Nb	Nb	Local
Square-spot Dart	<i>Euxoa obelisca</i> (ID. & S.)	Nb	Nb	Local
Light Feathered Rustic	<i>Agrotis cinerea</i> (ID. & S.)	Nb	Nb	Frequent

[continued

Sand Dart	<i>Agrotis ripae</i> (Hb)	Nb	Nb	Local
Lunar Yellow Under-wing	<i>Noctua orbona</i> (Hufn)	Na	Na	Local White Colon
<i>Sideridis albicolon</i> (Hb)		Nb	Local	
Shore Wainscot	<i>Mythimna litoralis</i> (Curt)	Nb	Nb	Local
Dotted Chestnut	<i>Conistra rubiginea</i> (D. & S.)	Na	Nb	Common
Crescent Striped	<i>Apamea oblonga</i> (Haw)	Nb	Nb	Local
Silky Wainscot	<i>Chilodes maritimus</i> (Tausch)	Nb	Nb/Local	Frequent

RARE MOTHS OF THE BRISTOL DISTRICT



PLATE 1. From top: **Small Eggar** *Eriogaster lanestris* (L.) (a) larva, (b) imago. Nationally notable (Nb), "common" in the Bristol district. (c) **Sand Dart** *Agrotis ripae* (Hb). Nationally notable, "local" in the Bristol district. (d) **Blomer's Rivulet** *Discoloxia blomeri* (Curt.). Nationally notable (Nb), "common" in the Bristol district. Photographs by Martin Evans.



PLATE 2. From top: (a) **Juniper Carpet** *Thera juniperata* (L.). Nationally "common", "rare" in the Bristol district. **Silky Wave** *Idaea dilutaria* (Hb.): (b) larva; (c) imago. Nationally Red Data Book 2, "rare" in the Bristol district. (d) **The Mocha** *Cyclophora annulata* (shulze). Nationally notable (Nb), "common" in the Bristol district. Photographs by Martin Evans.

THE BROWN'S FOLLY GEOLOGICAL TRAIL: A GEOLOGICAL CONSERVATION PROJECT IN THE BATH AREA

by R. B. J. SMITH

45 Oakleigh Gardens, Oldland, Bristol BS15 6RJ

INTRODUCTION

The Brown's Folly Nature Reserve is an area of about 37 hectares (91 acres) on the hillside overlooking the valley of the River Avon, about a kilometre south east of the village of Bathford. The reserve belongs to the Avon Wildlife Trust (AWT). Its location is shown in Figure 1.

The Trust acquired some of the land in 1972 with funds raised by public subscription, and bought the remainder in 1984, almost trebling the size of the reserve. Extraction of limestone from the hillside by open quarries and mines, which took place from the 18th to the early 20th century, has left many exposures of rock. The reserve is now designated as a Site of Special Scientific Interest (SSSI), both for its biological and for its geological interest. It takes its name from the prominent tower standing on the hill-top at the eastern edge of the reserve. The tower was built by a quarry owner, Mr Wade Brown, and is known locally as 'The Pepper Pot'.

Geological site identification and conservation in the County of Avon received a considerable impetus in 1980, with the formation of Avon Wildlife Trust's Geological Conservation Group. The Group visited Brown's Folly for the first time in 1981 to discuss site conservation. In the same year, the author logged and described one of the larger rock exposures as his practical project for the Certificate in Science (Geology) of the University of Bristol. He continued working after the original project had been completed and published a field guide to the reserve, with a map indicating the location of 24 exposures and descriptions of nine of them in some detail (Smith, 1986).

GEOLOGY OF THE RESERVE

The SSSI citation for the reserve, issued in 1986, describes the geology as follows:-

'A composite section through the Middle Jurassic Great Oolite and the lower part of the Forest Marble is exposed on the escarpment beneath Brown's Folly and to the north towards Bathford. The section is entirely of Upper Bathonian age, ranging from the Hodsoni Zone up into the lower Discus Zone. The section exposed consisting of a mixture of limestone and subordinate clays,

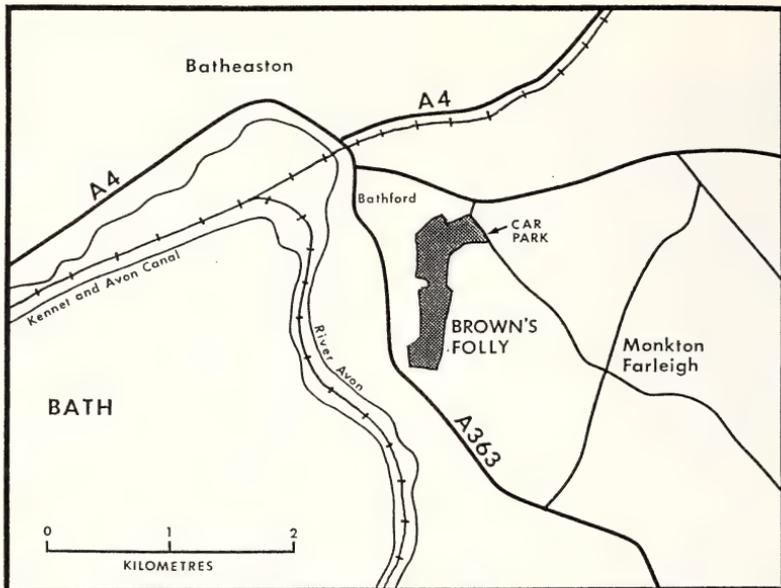


FIGURE 1. The location of Brown's Folly Nature Reserve, owned and managed by the Avon Wildlife Trust.

illustrates the development of the Great Oolite and Upper Rags of the Bath area. It was for these rock units in the Bath area that William Smith originally coined the name 'Great Oolite' and after which the 'Bathonian' was named. The succession is of considerable sedimentological interest. Parts of the succession are fossiliferous; in particular a thin clay, resting on an oyster-encrusted hardground at the top of the Upper Rags, which has yielded elements of the Bradfordian fauna including *Digonella*, *Apiocrinus* and rhynchonellids. The section is of major importance in the context of the British Bathonian stratigraphy.'

TABLE 1. Jurassic rock formations of Brown's Folly - composite section through hillside, from Green & Donovan (1969).

<i>Stratum</i>	<i>Thickness, m</i>
Forest Marble	7.76
Great Oolite :	
Upper Rags	6.84
Bath Oolite	6.53
Twinhoe beds	4.05
Combe Down Oolite	5.28

Green and Donovan (1969) included Brown's Folly in their investigation of the Great Oolite of the Bath area and this is the most complete account of the geology of the reserve available. Table 1 summarizes the composite section through the hill-side which they recorded. In a more recent work on the Bathonian strata of the Bath and Frome area, Penn and Wyatt (1979) have included the Upper Rags in the Forest Marble.

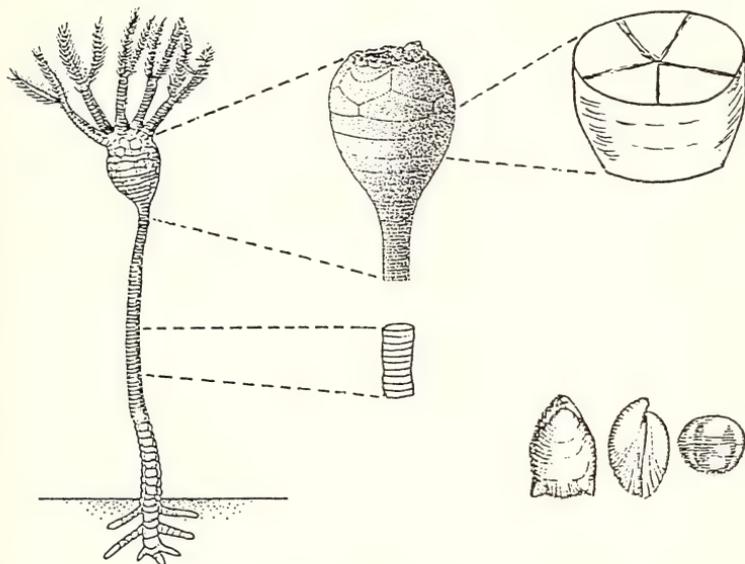


FIGURE 2. Elements of Bradfordian fauna visible at several sites along the trail, reproduced from the trail guide (Smith 1989). Left, a crinoid *Apiocrinus* sp., $\times \frac{1}{2}$, showing the parts usually found as fossils; bottom right, the brachiopod *Digonella digona*, $\times 1$.

SELECTION OF TRAIL SITES

The sites chosen were spread through the whole range of rock units available so as to show, as far as possible, the junctions between the various units. Eventually thirteen sites were selected from the 24 already located, using the following criteria:

- ◆ the amount of conservation required; many exposures were very overgrown and hard to locate;
- ◆ the nature of the conservation required, and the need for it to be friendly to the other interests on the reserve;
- ◆ the feasibility of making the chosen sites safe for visitors;
- ◆ the presence of features important for students of geology, such as an oyster-encrusted surface, which might also interest the general visitor.

The sites vary from isolated rock faces produced by open quarrying, and blocked mine entrances with a rock face above, to faces resulting from the collapse of the overlying strata into mines, illustrating the various methods of stone extraction involved. The rocks of Brown's Folly have fossiliferous bands, and screes have formed at some sites so that visitors may easily collect geological samples, which should help to stimulate their interest. Figure 3 shows the chosen sites in relation to the geology of the reserve.

Examples of features selected for inclusion are a **channel in Forest Marble**, shown in a large exposure, which is probably one of the best in the area (site 4); a **patch reef**, showing the reef's development, although the face is very weathered (site 7); **complex cross-bedding** of an isolated block of rock (site 9); the **entrance to a mine** which penetrated the hill for only about 30 m and was presumably stopped because it reached rock which was unsuitable for use as building stone (site 10) and **large blocks of Combe Down Oolite** which have slipped on the underlying Fuller's Earth to make a striking feature (site 11).

SITE CLEARANCE

Many of the exposures were very overgrown and it was clear that a considerable amount of clearance would be needed. Early in 1986 the author joined the AWT's Reserve Management Committee, so ensuring the co-ordination of geological work with other conservation activities. After discussions with Antony Merritt, then AWT's Conservation Officer, about possible sources of labour for geological conservation work, some site cleaning was done during 1986 and 1987 by AWT and by British Trust for Conservation Volunteers (BTCV) working parties.

In late 1987 the author approached the Geologists' Association with regard to financial support for site clearance, and once agreement had been obtained AWT submitted a detailed proposal. Early in 1988 a grant of £540 was made, the site work to be supervised by the author and by another member of the Bath Geological Society whilst AWT was to administer the financial aspects. This grant allowed the number of BTCV working parties to be greatly increased, and the clearance work progressed well. Most of the workers came via the government-funded work experience scheme, and when this was terminated at the end of 1988 the labour available was much reduced, but fortunately by then the site clearance work had been completed.

The working parties involved in the clearance were made up of young people having an interesting mix of backgrounds and included two geology graduates. All were briefed on the project before work started, presenting an opportunity to explain the aims of geological conservation, a concept foreign to most of them. The term 'site' was used to refer to the locations to be cleared, and in each case covered not only the rock face but also the surrounding area and the means of access. In clearing sites, the aim was to ensure that the site was accessible and the exposed rock was easily visible.

Few of the sites could have been reached by rock-moving equipment. In any case, machinery would have caused damage to the paths and surrounding areas and its use would have been strongly opposed by all concerned with the reserve. This was borne out by the outcry which arose over the construction of a road to remove timber, after all the geological site work had been completed.

THE ROCKS OF BROWN'S FOLLY

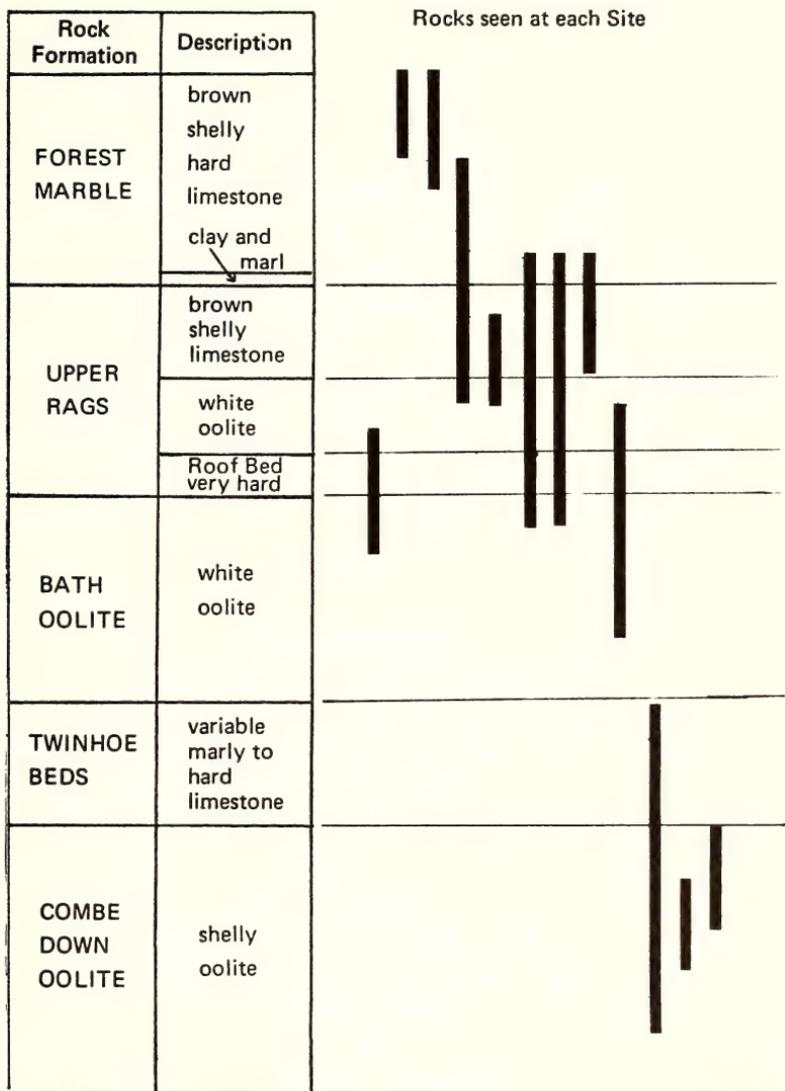


FIGURE 3. The approximate ranges of rock units visible at each trail site. Site 9 is omitted as the rock exposed is probably not in its original position. Diagram adapted from Trail Guide (Smith, 1989).

A large part of the work consisted of removing low ground cover, such as bushes and small hawthorn trees. Trees up to 150 mm (6 inches) in diameter were removed with hand-saws. They were then cut up and burned under controlled conditions at times when there would be no disturbance to nesting birds. Most sites that could be cleared with hand tools took a working party of five members a day to complete. Trees too big to be cut by hand were dealt with by specialist chain-saw teams. Tree stumps were treated with an approved chemical to prevent regrowth, although this was not always effective. The removal of trees around exposures led to drier, more open conditions and somewhat cleaner rock faces. In many cases, a more interesting selection of plants grew up. The felling of trees was by far the most contentious aspect of site clearance, and objections were often expressed by volunteer workers, frequently resulting in interesting discussions.

All the rock faces on the reserve are weathered and no serious efforts have yet been made to clean those at the sites, although the use of algicides was considered, together with the possibility of cutting faces with a power saw or using a chisel on them.

Once cleared, the sites required some form of marking. Simple painted wooden posts were already in use for the nature trail on the reserve and after discussion, it was decided to use the same method for marking the geological sites. Where possible, a tree or a tree-stump was painted with a blue band to mark a site. Many of the first set of marker-posts disappeared but it was not clear whether this was due to vandalism or was done by people who objected to the new posts. The use of bigger posts driven well down seems to have overcome the problem.

THE TRAIL GUIDE

A guide to the cleared sites was an essential requirement of the project, and in 1986 its possible form was discussed. One suggestion was to include references to the geology of the reserve in a revised issue of the existing guide to the flora, fauna and features of general interest. The author of that work had left the AWT and the revision was likely to be long delayed, so it was decided to produce a separate geological guide, which was to meet the following criteria:

- ◆ it should enable visitors to locate sites as easily as possible;
- ◆ it should provide interest and information not only for the general visitor but also for the visitor with a developed interest in geology;
- ◆ it should be cheap to produce so that it could be sold at an attractive price, even though a relatively short print run was expected.

The guide, *The Rocks of Brown's Folly*, was produced in 1989 by a member of the Bath Geological Society; it consisted of five folded A4 sheets, giving 20 pages of text and figures. Two of the illustrations used (slightly amended) are shown as Figures 2 and 3 of the present paper. It was originally sold at only a little above production cost.

TRAIL SITE MAINTENANCE

The Brown's Folly Geological Trail has a strong association with the Bath Geological Society (BGS) through the present author and his colleagues. Parties of BGS members have been responsible for maintaining sites along the trail. Biannual visits by a working party supplemented by more frequent visits by one or two members has been sufficient not only to maintain the trail but also to increase the number of sites available and improve access to them. The 'adoption' of particular sites by groups or even by individuals is a very effective way of maintaining sites, though not always easy to arrange. Routine maintenance consists of little more than the removal of brambles and of new shoots from trees; the latter, despite the use of an approved stump-killing agent, are not always easy to control. With four people in the working party the task rarely takes more than half an hour per site, which can be reduced if a strimmer is available and site conditions allow it to be used.

The severe storms of 1989 caused very little damage to sites although a considerable number of trees on the reserve were blown down. There had been a reluctance, on conservation grounds, to the felling of some trees which were subsequently blown down during the storms. These then had to be cut up and taken away; in some cases the result was an increased area of rock on display, or easier access. Truly, 'It's an ill wind ...'.

CONCLUSION

The Brown's Folly Geological Conservation Project has made available thirteen sites on the reserve, which display its geology and to some extent, the methods of stone extraction which were carried out there. A guide to the sites has been produced to enable visitors to appreciate the geology of the reserve and hopefully to encourage a wider interest in the geology of the area. The crucial role of continuing site maintenance, following the original cleaning, must be stressed. It is essential if the considerable effort and expense of the original cleaning is not to be wasted. This may seem self-evident but there are many sites in the County of Avon which are becoming lost or are now of little use because of failure to keep up the maintenance.

It has been difficult to gauge the use of the trail by visitors to the reserve, or their interest in it; many may not even be aware of it since there are no descriptive boards along the trail and the guide is not available at the reserve. This is the case too with many other geological trails. Two local women's organisations have been taken round the trail as part of their programme of walks, and both showed considerable interest. A school whose geology teacher is a member of the BGS is, as far as the author knows, the only one to use the trail for teaching purposes.

Brown's Folly is an example of an area where the geological interest and the much more popularly widespread interest in the flora and fauna can be combined to heighten the 'nature consciousness' of the general public and where the 'geologically unaware' can be alerted to the considerable influence that geology has on their surroundings. Should geological trails be only for those whose chief interest is geology or is there a need to cover much wider interests?

ACKNOWLEDGEMENTS

This paper records the work of many people and the author is indebted to all those who have helped him in this project. Particular thanks are due to George Hibberd who has given much help at the sites and to Elizabeth Devon for her work on the trail guide and for arranging for the word processing of this manuscript. I am grateful to Dr Peter Crowther for his invitation to prepare this paper and for his advice and assistance.

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THE TRILOBITES OF THE BRISTOL DISTRICT

by R.M. OWENS

Department of Geology, National Museums & Galleries of Wales,
Cardiff CF1 3NP

ABSTRACT

Trilobites are known from rocks of Ordovician, Silurian and Carboniferous age in the area around Bristol. This account reviews these occurrences, based on published literature and museum collections, and considers aspects of their biostratigraphy and distribution. Selected species are figured.

INTRODUCTION

In the area around Bristol a wide diversity of rocks of different ages crop out, containing numerous groups of fossils. Vertebrates and ammonites from the Mesozoic, and plants from the Coal Measures are particularly well known. Trilobites are much less so, because they are only locally abundant and tend to be fragmentary and easily overlooked. Yet a fair number have been found, including representatives of most of the major orders now recognised. They have been recorded from Ordovician and Silurian rocks of the Tortworth and Tites Point inliers, from the Silurian of the East Mendips inlier and from the Carboniferous Limestone of the Avon Gorge, Mendip Hills and adjacent areas. The earliest published records of trilobites from this general area are those of Weaver (1824) from the Silurian of the Tortworth district, which was also the source of specimens described and figured by Murchison (1839) and by Salter (1849, 1864). Only one Carboniferous trilobite species from this district, from Vallis Vale, Frome, was figured in Woodward's (1884) monograph. In the present century, early Ordovician (Tremadoc) trilobites were discovered near Berkeley in 1932 (Smith 1933), and additional Silurian taxa have been described and figured by Curtis (1958, with further references), Owens (1973) and Thomas (1978, 1981), and Carboniferous taxa by Goldring (1958) and Hahn & Hahn (1973). Many species, particularly in the Carboniferous, await taxonomic and stratigraphical evaluation, although work is in progress on many of these. Wenlock taxa will be described in Thomas' Palaeontographical Society monograph, and Carboniferous species in that of Owens. The opportunity is taken here to figure a range of taxa from the Bristol district, including material not previously illustrated.

BRISTOL TRILOBITES

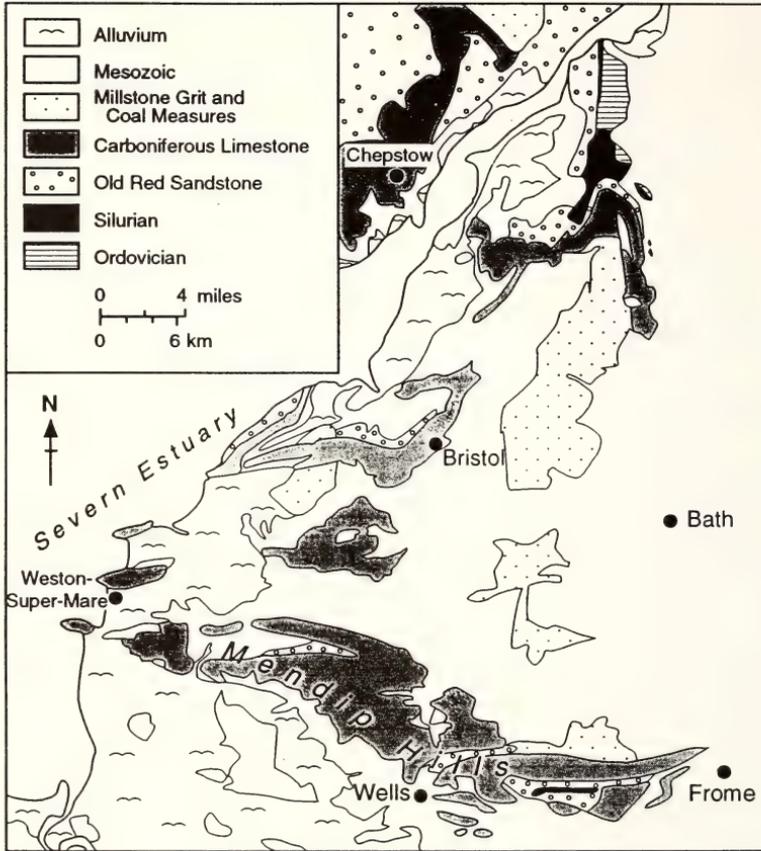


FIGURE 1. Generalised geological map of the Bristol district (from various sources).

ORDOVICIAN

In March 1932, Stanley Smith of the University of Bristol collected a series of fossils from soft grey shales, then thought to be of Silurian age, from an old shaft sunk for coal in the eighteenth century at Breadstone House, near Berkeley. They proved immediately that these rocks were, instead, of Tremadoc age, because they included trilobites identical or similar to those long known from rocks of this age in North Wales; the Breadstone fossils were described by Stubblefield (*in Smith, 1933*). At this time Tremadoc rocks were included in the Cambrian System, particularly by British geologists, but now it has been agreed internationally that they comprise the

earliest series of the succeeding Ordovician. However, many earlier accounts, including Smith's, describe the Breadstone trilobites as being of 'Cambrian' age.

The Tremadoc rocks in the Tortworth inlier comprise argillaceous Breadstone Shales overlain by the Micklewood Beds (shales with flaggy sandstone beds), and the succession has been described in detail by Curtis (1968). Unfortunately permanent outcrops are few, for the area is low-lying agricultural land, and most of our records have had to depend upon temporary exposures. Indeed, after Smith's collections from the Breadstone shaft, the only substantial additions were by Dr M.L.K. Curtis (formerly Curator of Geology at Bristol City Museum) and T.R. Fry in 1971 and 1972 from temporary water pipe trenches in the vicinity of Breadstone and Halmore. These have contributed trilobites new to the area and, in one case, new to science.

The Breadstone Shales include the *Rhabdinopora* [*Dictyonema*] *flabelliformis* and *Adelograptus* [*Clonograptus*] *tenellus* biozones (Stubblefield in Smith 1933; Curtis 1968), and their trilobite fauna is in general like that of the Tynllan Beds at Penmorfa, in the Tremadog district, North Wales. The olenid *Beltella depressa* (Salter in Murchison, 1859) is particularly common; it was redescribed by Fortey & Owens (1991a) on the basis of well-preserved specimens from Tortworth and from the Clarenville Formation of eastern Newfoundland, and its enrolment was further discussed and described by Whittington (1996, *in press*); of wide distribution, this species is restricted to the Lower Tremadoc.

By contrast another olenid, a new species of *Parabolinella*, has not been found outside the Tortworth inlier. It is characterised by a remarkable, strongly inflated preglabellar area, a feature not encountered in any other olenid, or indeed in any other *Parabolinella* species. This, and other 'bubble headed' trilobites are currently being described by R.A. Fortey and the author; the functional significance of this structure is not known.

The nileid *Platypeltoides croftii* (Callaway, 1877), which has been found outside Tortworth in the Shineton Shales (late Tremadoc, *Shumardia* (*Conophrys*) *salopiensis* Biozone) in Shropshire and in the early Tremadoc (*A. tenellus* biozone) in the Carmarthen district (Owens *et al.* 1982), is a long-ranging species. A large asaphid was described from the Breadstone shaft by Stubblefield (*in Smith* 1933) as *Niobella homfrayi smithi*, a subspecies distinguished from *N. homfrayi* (Salter, 1866), which occurs in the Lower Tremadoc of North Wales, by its more elongated glabella, broader and more clearly defined cephalic border and more strongly divergent preocular facial sutures. Taken together, these features are here considered to be sufficiently distinctive to be of specific value, and are shared by some specimens from the Tynllan Beds at Penmorfa in the collections of the National Museum of Wales (eg. NMW 23.196 G1a,b, 70.13G.103-104, 86.26G.393-394) which were identified as *smithi* by P.H. Whitworth, S. Jusypiw and the author. Here it occurs apparently in the same beds (but possibly not at precisely the same horizon) as *N. homfrayi*, which has subparallel preocular facial sutures. Both *N. smithi* and *N. homfrayi* are

restricted to the Lower Tremadoc. Occurring in smaller numbers in the Breadstone Shales are a shumardiid, an agnostid (*Micragnostus calvus* (Lake, 1906)), and a cheirurid (*Anacheirurus* sp.). The last-named may be conspecific with *A. frederici* (Salter, 1864) which occurs in the Tynllan Beds and at higher horizons in North Wales (see Whittard 1967).

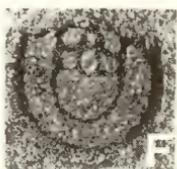
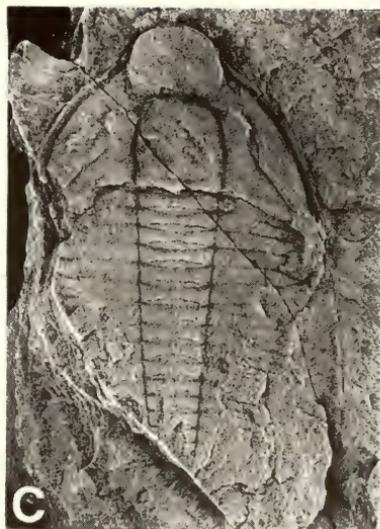
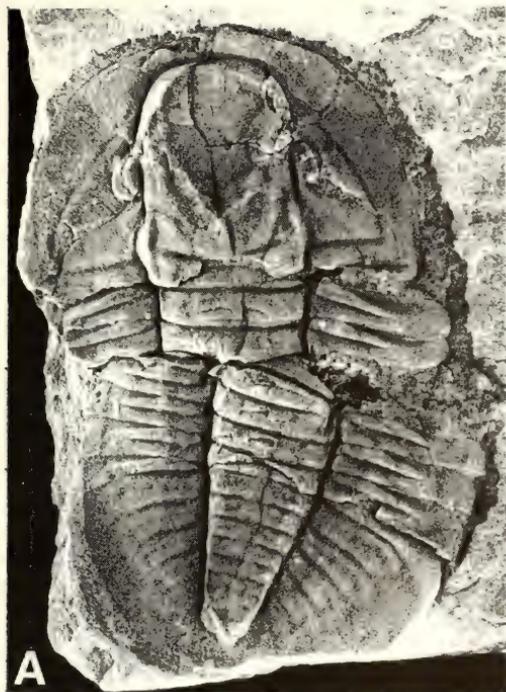
Few trilobites have been recorded from the Micklewood Beds, and Curtis (1968, pl. 9A,B) figured a cranidium and incomplete pygidium respectively as *Peltura olenoides* (Salter, 1866) and *Angelina sedgwickii* Salter in Murchison, 1859. These species are restricted to the Upper Tremadoc, and for this reason Curtis ascribed the Micklewood Beds to this division. Fortey & Owens (1991b, p.441), having re-examined these specimens identified them as *Beltella depressa* and a generically indeterminate remopleuridid. In containing *B. depressa*, the trilobite fauna of both the Micklewood Beds and Breadstone Shales is of Lower Tremadoc age, and there is no evidence of Upper Tremadoc (Fortey & Owens 1991b, p.441), and its characteristic species such as *Shumardia (Conophrys) salopiensis* (Callaway, 1877), *Parabolinella triarthrus* (Callaway, 1877) and *Asaphellus homfrayi* (Salter, 1866) have not been recorded from Gloucestershire. The Tortworth fauna differs slightly in composition from others of approximately the same age; for example, the Tynllan Beds have *B. depressa* and *N. smithi* in common, but *Psilocephalinella innotata* (Salter, 1866), common in N. Wales, is absent. And at Cwm Crymlyn, Carmarthen (Owens *et al.* 1982), *Platypeltoides croftii* is accompanied by *Macropyge chermi* and *Dichelepyge phylax*, which have not been found at Tortworth. These differences might be due to slight differences in age, or in facies.

PLATE 1 Ordovician trilobites from the Tortworth inlier.

All from Tremadoc Series, Cressagian Stage, Breadstone Shales. **A, B, E-H** from old shaft in orchard of Breadstone House, Breadstone; **C, D, I** from temporary trench 192m W 32°S of Crawless Old Barn, SSW of Breadstone.

A, B: *Niobella smithi* (Stubblefield in Smith, 1933); **A**, holotype, complete exo-skeleton, BGS GSM 51529, x1.5; **B**, paratype, cranidium, BGS GSM 51530, x2 (figured Stubblefield in Smith 1933, pl. 34, figs 4 and 3). **C, D:** *Parabolinella* sp. nov.; **C**, cephalon and thorax, BRSMG Cb4807b, x1; **D**, cranidium, BRSMG Cc2133, x 1.5. **E, F:** *Micragnostus calvus* (Lake, 1906); **E**, cephalon, BGS GSM 51524, x5; **F**, pygidium, BGS GSM 51524, x5 (figured Stubblefield in Smith 1933, pl. 34, figs 7 and 8). **G, H:** *Beltella depressa* (Salter in Murchison, 1859); **G**, axial shield, BGS GSM 51528, x 1½ (figured Stubblefield in Smith 1933, pl. 34, fig. 9); **H**, librigena, BGS GSM 51532, x2. **I:** *Platypeltoides croftii* (Callaway, 1877), complete exoskeleton with disarticulated thorax, BRSMG Cc2158, x2.5.

BRISTOL TRILOBITES



BRISTOL TRILOBITES

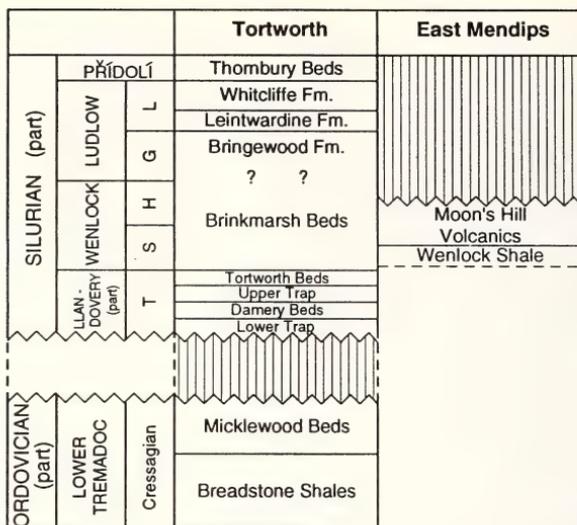


FIGURE 2. Ordovician and Silurian stratigraphy of the Tortworth inlier, and Silurian stratigraphy of the East Mendips inlier. Abbreviations for Silurian stages: T, Telychian; S, Sheinwoodian; H, Homerian; G, Gorstian; L, Ludfordian.

SILURIAN

In the southern part of the Tortworth inlier, Upper Llandovery and Wenlock rocks are exposed; the succession was described fully by Curtis (1972). In its northerly extension at Tites Point, rocks of Ludlow age crop out (Cave & White, 1971). The small East Mendips inlier contains only Wenlock strata, of which Hancock (1982) presented a detailed description. Trilobites have been reported from the entire succession, although many of those from the Wenlock await modern taxonomic analysis.

The Upper Llandovery Damery Beds and basal Tortworth Beds (including the *Palaeocyclus* Band), both of Telychian age, contain a rich shelly fauna dominated by brachiopods. The *Eocoelia*, *Pentameroides* and *Costistricklandia* brachiopod communities indicate an upwardly deepening sequence in the Damery Beds, whilst the farther offshore *Clorinda* community may be present in the Tortworth Beds (Curtis 1972). Trilobites, which were described by Curtis (1958), are fairly numerous, with *Dalmanites weaveri* (Salter, 1849) and *Encrinurus onniensis* Whittard, 1938 the commonest. These species range throughout the succession, along with smaller numbers of *Calymene replicata* Shirley, 1936, and all have also been found in the late Llandovery of Shropshire. An undescribed species of *Warburgella*, resembling *W. baltica* Alberti, 1964 and *Acernaspis* cf. *orestes* (Billings, 1860) have been recorded rarely from the Damery Beds, and the former, also found in the *Palaeocyclus* Band, may be conspecific with *W.* sp.1 of Owens (1973) from the Venusbank and Minsterley

formations in Shropshire. Single specimens each of a lichid, referred by Curtis (1958) to *Arctinurus* and a large proetid, described by him as *Proetus asaphoides*, have been found in the basal Tortworth Beds at Cullimore's Quarry, Charfield. The latter was placed with question by Owens (1973) in *Crassiproetus*, a Devonian genus, but it shows closer similarity to species of *Thebanaspis* Lütke, 1990, which occur in the Llandovery of Illinois and Ohio, and especially *T. channahonensis* (Weller, 1907) (see Lütke 1990 pl. 10, figs 67-72).

The trilobite fauna of the Brinkmarsh Beds of the Tortworth inlier is like that of the Coalbrookdale and Much Wenlock Limestone formations of the Welsh Borderland in comprising such species as *Proetus concinnus* (Dalman, 1827), *Calymene* cf. *blumenbachii* (Brongniart, 1817), *Dalmanites myops* (König, 1825) an *Eophacops* (recorded by Whittard & Smith (1944, p.71) as '*Phacops stokesi* cf. *uskensis* Reed, 1917'), and *Acaste downingiae* (Murchison, 1839), most of which range apparently through much of the succession. These belong to the shallow water *Proetus-Warburgella* association of Thomas (1980).

A thickness of 16m of siltstones and fine sandstones at the top of the Brinkmarsh Beds, exposed in the Buckover section (see Curtis 1972, p.21) has yielded a particularly distinctive fauna, with *A.* cf. *downingiae* (Murchison, 1839), *A.* cf. *inflata* (Salter, 1864) (see Shergold 1966, pp.191, 194), *Trimerus* sp. and *Dalmanites myops* (König, 1825), together with brachiopods including *Salopina conservatrix* (McLearn, 1924) and numerous bivalves. *Acaste*, *Trimerus* and *S. conservatrix* occur together in a similar facies (Ton Siltstone Formation) at Usk (Bassett 1972, p.41; Thomas 1980, p.447; Barclay & White in Barclay 1989, p.7) and in Pembrokeshire (Gray Sandstone Group - see Walmsley & Bassett 1976, p.204). This *Acaste-Trimerus-Salopina* association has been interpreted as shallow water and close inshore, and appears to recur at different horizons throughout much of the Wenlock Series in South Wales and in the southern Welsh Borderland. The question as to whether the *Trimerus* and *Acaste* species are the same at the various localities remains to be resolved, and it is possible that the trilobite species are not as long-ranging as *Salopina conservatrix*.

In the eastern Mendip Hills, the Silurian inlier forms a narrow belt in the core of the Beacon Hill Pericline. Igneous rocks were identified here during the nineteenth century (see Curtis 1955 for summary), and around the turn of the century S. H. Reynolds discovered Silurian fossils in tuffs at Sunnyhill Quarry, and nearby at Tadhil Farm (Reynolds 1907). These were identified as being of Llandovery age, and soon afterwards Wenlock fossils were discovered in sandy mudstones exposed along the line of a new mineral railway (Reynolds 1912). More recent research on the fossils, especially the brachiopods (see Ziegler *et al.* 1968, p.765; Bassett 1974, p.765) and my own on new collections of trilobites in the 1960s and 1970s, together with those of Reynolds), suggests that all are of Wenlock age. This was confirmed by Hancock (1982), who demonstrated that the succession as previously conceived was inverted, so that strata with 'Llandovery' fossils were shown to overlie those containing Wenlock forms.

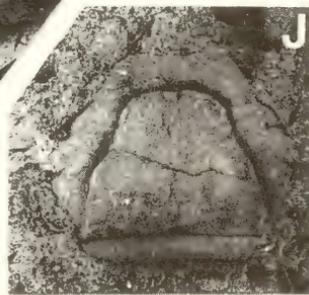
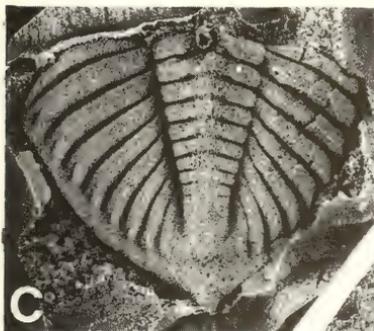
The sandy Wenlock mudstones are now known to be the oldest rocks of the inlier, and were exposed to the south of Moon's Hill Quarry and yielded a rich fauna of trilobites, brachiopods and ostracods. The presence of the brachiopod *Eocoelia angelini* (Lindström, 1861) establishes an early Wenlock (*riccartonensis* Biozone) age, and Hancock (1982) suggested that they were deposited on a deep shelf. The association of trilobites with *Dalmanites caudatus* (Brünnich, 1781), *D. myops* (König, 1825), *Encrinurus punctatus* (Wahlenberg, 1818), *Eophacops* cf. *musheni* (Salter, 1864), *Proetus latifrons* (M'Coy, 1846), *Dudleyaspis* cf. *quinquespinosa* (Morris, 1854) and a *Cyphoproetus* species is broadly consistent with such an environmental interpretation. Overlying the intervening extrusive andesites, the fossiliferous tuffs that were attributed originally a Llandovery age have yielded a fauna interpreted by Hancock as occupying a shallow inshore environment. It contains abundant specimens of the trilobite *Acaste* cf. *downingiae* (Murchison, 1839), associated with the brachiopod *Salopina conservatrix* (McLern, 1924) and clearly represents another example of this association, even though it lacks *Trimerus* which is associated with these species elsewhere (see above). The *Salopina* community succeeds the *Eocoelia* community in Wenlock brachiopod faunas (Walmsley & Bassett 1976, pp.204, 207) and establishes a probable post-*riccartonensis* Biozone age (probably within the Sheinwoodian Stage) for the tuffs.

PLATE 2 Silurian trilobites from the Tortworth inlier.

A-C, E-I, K from Llandovery Series, Telychian Stage (**A-C, E, I, K** from Damery Beds, **F-H** from basal Tortworth Beds); **D, J, L** from Wenlock Series, Brinkmarsh Beds.

A-C: *almanites weaveri* (Salter, 1849), vicinity of Damery Bridge; **A, B**, cephalon, latex cast from external mould, dorsal and lateral views, BGS GSM 90033b, x2.5 (figured Curtis 1958, pl. 29, figs 7a-b); **C**, pygidium, latex cast from external mould, BRSUG 12302a, x2 (figured Curtis 1972, pl. 2L). **D:** *Eophacops* sp., incomplete cephalon, Lower Shaft, Sturt Bridge, Wickwar, BRSUG 12481, x2.5. **E, F:** *Warburgella* aff. *baltica* Alberti, 1963, internal moulds; **E**, cranidium, Damery, BRSUG 12269a, x5; **F**, pygidium, stream section near Daniels Wood, BRSMG Cd3799, x6. **G:** *Arctinurus* sp., incomplete cranidium, Cullimore's Quarry, Charfield, BRSUG 12271, x4. **H:** *Thebanaspis?* *asaphoides* (Curtis, 1958), incomplete axial shield, Cullimore's Quarry, Charfield, BGS GSb4687, x1 (figured Curtis 1958, pl. 29, fig. 2 and Owens 1973, pl. 7, fig. 7). **I:** *Encrinurus onniensis* Whittard, 1938, complete specimen, internal mould, railway cutting, Charfield, BRSMG Cb3656, x3. **J:** *Trimerus* sp., cranidium, latex cast from external mould, Buckover cutting on A38, BRSMG Cb4804, x 2.5. **K:** *Calymene replicata* Shirley, 1936, pygidium, internal mould, Ironmill Grove, Damery, BGS GSM 90030, x1.5 (figured Curtis 1958, pl. 29, fig. 1). **L:** *Acaste downingiae* (Murchison, 1839), cranidium, internal mould, Buckover cutting on A38, BRSMG Cd3801a, x4.

BRISTOL TRILOBITES



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Strata of Ludlow age, cropping out at Tites Point, have yielded only a small number of trilobites (Cave & White 1971, pp. 244, 263; Curtis 1972, pp.32, 33); the generic composition (*Dalmanites*, *Calymene*, *Proetus*) is similar to that of the Wenlock Series, and the species that occur are the same as those in the Ludlow Series from the Welsh Borderland to the north.

CARBONIFEROUS

Compared with those from the Ordovician and Silurian, comparatively little is known of the Carboniferous trilobites of the Bristol district, and descriptions to date are limited to those of the lower Tournaisian (Goldring 1958) and from a restricted part of the mid Viséan (Woodward, 1884; Hahn & Hahn 1973; Tilsley 1988). Additional taxa are mentioned in faunal lists, commonly as '*Phillipsia*' and '*Griffithides*', generic names which now have a far more restricted definition than previously. All belong to the family Phillipsiidae.

Low in the Tournaisian, in Lower Limestone Shale (K₁) *Piltonia fryi* Goldring, 1958 occurs, joined higher in the succession (K₂) by *Moschoglossis decorata* Goldring, 1958. Both species have been reported from the Avon Gorge, and Portishead, and the latter also from Westbury-on-Trym. Goldring (1958) also identified *Piltonia fryi* from coeval strata in Belgium, together with the subspecies *Moschoglossis decorata brevicauda* Goldring, 1958. Hahn *et al.* (1987) however, assigned the Belgian specimens of the former to a different species; the latter is restricted to the Hastarian Stage, in Tn2b and Tn2c.

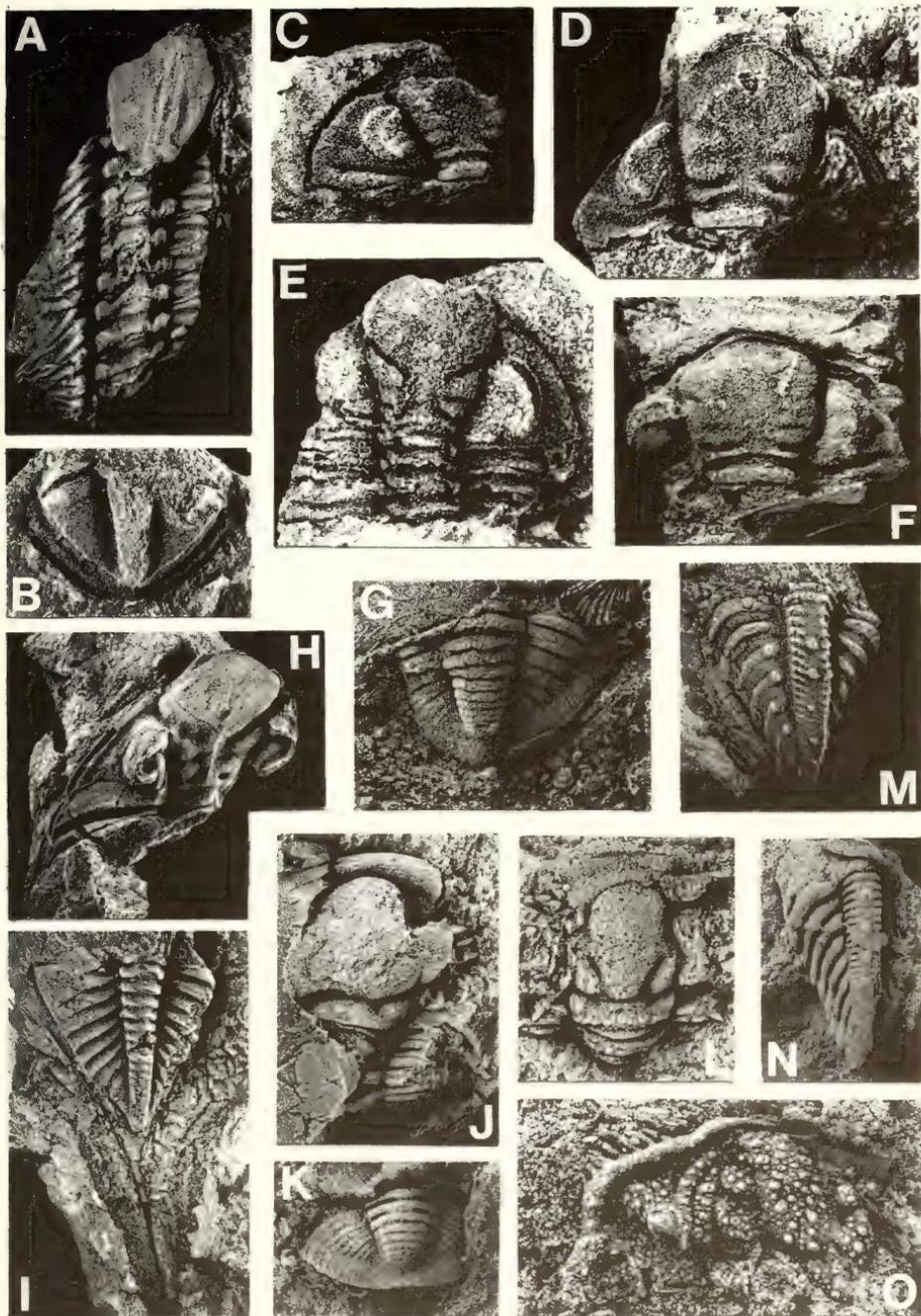
Phillipsia ornata Portlock, 1843 enters towards the top of the Lower Limestone Shales (high in K₂, see Goldring 1958, pp.231, 232), and ranges throughout the Black

PLATE 3 Silurian trilobites from the East Mendips inlier

A, B, H-O from shale of early Wenlock age, underlying andesites, south of Moon's Hill Quarry; **A, L** from vicinity of Hancock (1982) loc. 24; **B, H-J, M, N** from Reynolds (1912) loc. 92; **K, O** from Reynolds (1912) loc. 104. **C-G** from fossiliferous tuffs overlying andesites, field near eastern corner of Walltyning Plantation, c.300m SSW of Tadhil Farm (see Reynolds 1907; Hancock 1982).

A, B: *Eophacops* cf. *musheni* (Salter, 1864); **A**, NMW 78.57G.145a, cephalon and thorax, internal mould, x3; **B**, BRSUG 12591, pygidium, internal mould, x4. **C-G:** *Acaste* cf. *downingiae* (Murchison, 1839); all internal moulds except **G**, latex cast from external mould; **C, D, F**, cephalon, NMW 71.6G.120, x3, BRSMG Cd3802, x4, BRSMG Cd3803, x4; **E**, cephalon with attached thoracic segments, BRSUG 12579-1, x5; **G**, pygidium, BGS Zs442, x3. **H, I:** *Dalmanites caudatus* (Brünnich, 1781), internal moulds; **H**, incomplete cephalon, NMW 71.6G.112a, x1.5; **I**, pygidium, NMW 71.6G.111, x1.5. **J, K:** *Proetus latifrons* (M'Coy, 1846), latex casts from external moulds; **J**, cranidium with parts of five thoracic segments, NMW 71.6G.495b, x5 (counterpart figured Owens 1973, pl. 2, fig. 2); **K**, pygidium, BRSUG 26219, x4. **L:** *Cyphoproetus* sp. nov, latex cast from external mould, NMW 78.57G.144b, x8. **M, N:** *Encrinurus punctatus* (Wahlenberg, 1818), pygidia, internal mould and latex cast from external mould; **M**, NMW 71.6G.108, x2; **N**, NMW 71.6G.109, x3. **O:** *Dudleyaspis* cf. *quinquespinosa* (Morris, 1854), latex cast of external mould of incomplete cephalon, BRSUG 12552, x6.

BRISTOL TRILOBITES



BRISTOL TRILOBITES

		Avon Gorge	Eastern Mendips	Central and Western Mendips	
CARBONIFEROUS	VISÉAN	Brigantian	Upper Cromhall Sandstone	Hotwells Limestone	
		Asbian	Hotwells Limestone	Hotwells Limestone	
		Holkerian	Clifton Down	Clifton Down Limestone	Clifton Down Limestone
		Arundian	Limestone	Vallis Limestone	Burrington Oolite
		Chadian	Clifton Down Mudstone	Burrington Oolite	Burrington Oolite
	TOURNAISIAN	Courcèyan	Gully Oolite	Black Rock Limestone	Black Rock Limestone
			Black Rock Limestone	Black Rock Limestone	Black Rock Limestone
		Lower Limestone Shales	Lower Limestone Shales	Lower Limestone Shales	

FIGURE 3. Major lithostratigraphical divisions of the Carboniferous Limestone in the Avon Gorge, eastern Mendip Hills and central and western Mendip Hills.

Rock Limestone; it has been reported from numerous localities in these horizons including the Avon Gorge, Little Ulverstone, under the Severn Bridge (as *Phillipsia scabra* by Whittard 1949), Clevedon, Burrington Combe and Windsor Hill near Shepton Mallet. Farther afield it is known at equivalent horizons in South Wales, Ireland, and in Belgium, with different subspecies recognised from the latter and the southern Urals (see Osmólska 1970). Therefore this species is an important indicator of mid to later Tournaisian strata over a wide area. The only other Tournaisian species recorded from the Bristol district is *Cummingella? costabilulca* Goldring, 1958, but the precise horizon is not known; Goldring (1958, pp.240, 241) suggested that it was from the Lower Limestone Shale.

In the earlier part of the Viséan, trilobites are recorded from the Clifton Down Limestone. Woodward (1884) described *Phillipsia scabra* from this formation (S₁) in Vallis Vale, Frome; this species is now included in *Linguaphilipsia*. Subsequently it has been widely recognised in the same formation (ranging through S₁ and S₂) at several other localities. Vaughan (1906, p.114) described in Great Quarry on the right bank of the Avon, the 'Trilobite Bed', a shale parting in the Clifton Down Limestone, and this contains numerous pygidia, librigenae and cranidia of *L. scabra*. Kellaway & Welch (1993) suggested that this horizon is not laterally persistent, although *L. scabra* is also abundant in shaly partings in the Clifton Down Limestone at Whatley Quarry near Frome, where P.C. Ensom and the author collected numerous specimens in 1978, and it also occurs in this kind of lithology at Vallis Vale (Bush 1926, and author's collecting).

Hahn & Hahn (1973) described *Linguaphillipsia matthewsi* from the Clifton Down Limestone of Holwell Quarry, Frome, and comparison of their specimens with the type material of *L. scabra* shows that the two are conspecific (Tilsley 1988, p.157). These authors (1982) later described *L. matthewsi livesensis* from correlatives of the Clifton Down Limestone in Belgium, but the differences they recognised fall within the range of variation seen in the much larger sample of *L. scabra* now available, suggesting that they belong to this species. From the mid Viséan of the Moscow Basin, *Linguaphillipsia tulensis* (Ivanov in Weber, 1937) (see Osmólska, 1970, pl. 3, figs 7, 9, 11, 14, 18) is very similar to *L. scabra*, and it is possibly another synonym. Although *L. scabra* is locally abundant in the Clifton Down Limestone, other taxa are scarce. *Griffithides holwellensis* (Hahn & Hahn, 1973) (placed by these authors in *Phillipsia*, but assigned by Riley (1993) to *Griffithides*) and *Cunningella jonesii* (Portlock, 1843) have been recorded from the Frome district. The latter occurs also in Northern Ireland at the same horizon.

A different *Linguaphillipsia* occurs in the lower part of the Hotwells Limestone, and specimens have been identified by the author in core samples from the Ashton Park Borehole (Kellaway & Welch 1967) at the British Geological Survey. It is almost identical with *Linguaphillipsia* cf. *silesiaca* (Scupin, 1900) from a similar horizon in Belgium (see Hahn & Hahn, 1982, pl. 1, figs 5-7), and is probably conspecific. The only other trilobite recorded from the Hotwells Limestone in the Ashton Park Borehole is a *Cunningella*, which is distinct from *C. jonesii*, whilst a *Griffithides* species (recorded as *Cyphinium ashfellensis* Reed, 1943) was recorded from a borehole at Filton (Whitard & Smith, 1943).

At the top of the Hotwells Limestone in the eastern Mendips, Welch (1932) recorded '*Phillipsia* sp.' from the 'D₃ subzone'. This trilobite is referable to *Paladin*, and probably to *P. glaber* (Woodward, 1884) which has been found at a similar horizon in the 'Black Lias' on the Gower Peninsula. A conspecific *Paladin* occurs commonly in the '*Phillipsia* Band' of Smith (1930), a marine horizon within the Upper Cromhall Sandstone in the Wick Rocks inlier east of Bristol, from where it was recorded (Smith, 1930, p.347) as *Phillipsia eichwaldi*. At an approximately equivalent horizon in the 'Tanhouse Beds', Smith (1941, p.336) reported common *Phillipsia eichwaldi mucronata*. This occurrence is also referable to *Paladin*, but in this case a different species with a mucronate pygidium is represented, possibly *P. mucronata* itself. *Paladin* species occur widely in the later Viséan (see e.g. Osmólska, 1970), and are potentially important bio-stratigraphically once the various species have been fully described. In fact trilobites undoubtedly are more important biostratigraphically in the Carboniferous than has been recognised, as indicated by Riley (1993), and the albeit limited faunas of the Bristol area demonstrate their potential.

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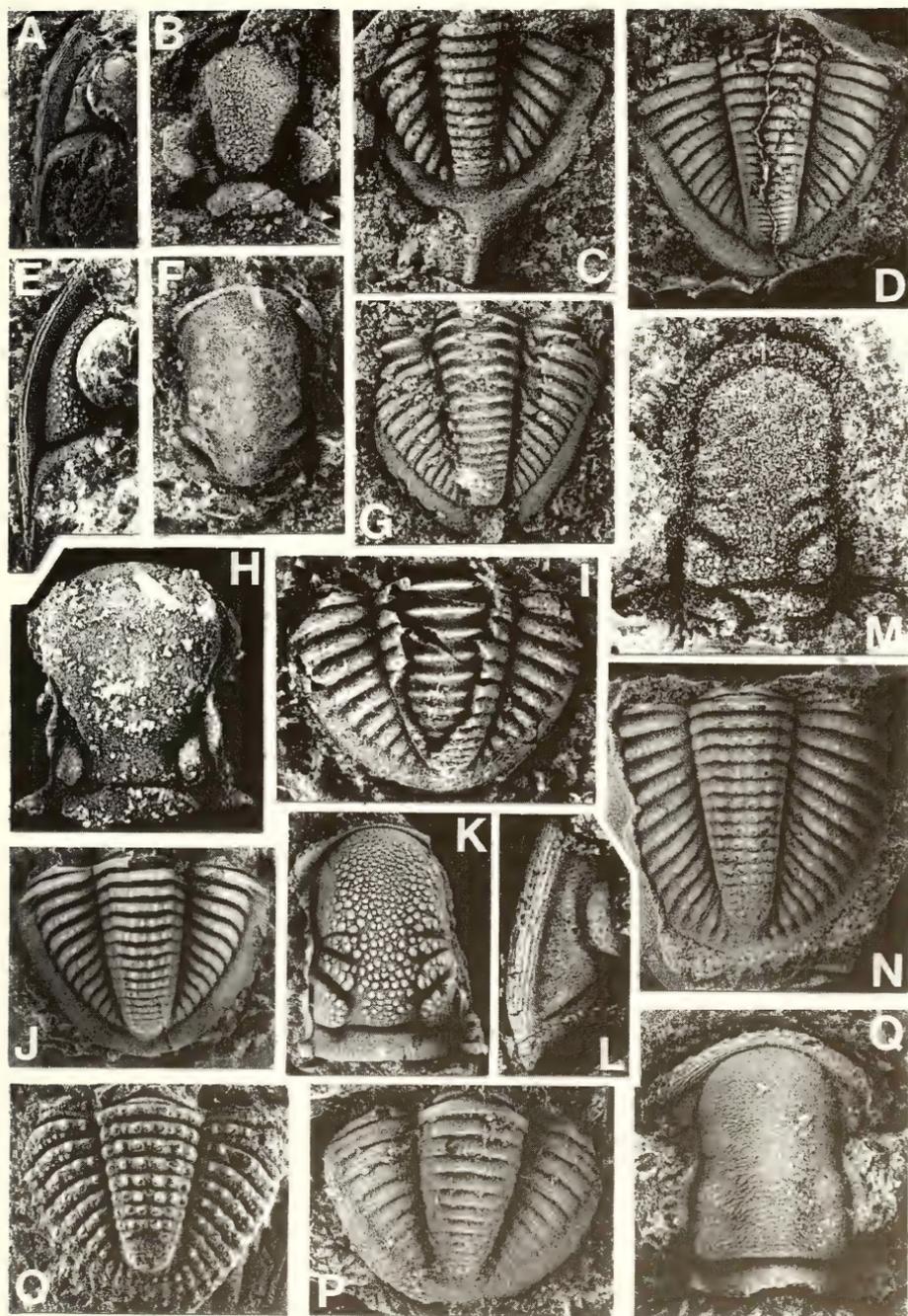
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 PLATE 4 Carboniferous trilobites from the Bristol district.

A-D from Brigantian Stage, Upper Cromhall Sandstone. **E-G, I** from Asbian Stage, Hotwells Limestone. **H, J, K** from Holkerian Stage, Clifton Down Limestone. **L, O, P, Q** from Courceyan Stage, Lower Limestone Shale. **M, N** from Courceyan Stage, Black Rock Limestone.

A: *Paladin* sp., librigena, Ashton Park borehole, Bristol, depth 1432'1", BGS Bk2759, x6. **B, C:** *Paladin ?mucronata* (M'Coy, 1844), cranidium and pygidium, latex casts from external moulds on same slab, Tanhouse Farm Quarry, Yate, BRSUG 1141-3, both x5. **D:** *Paladin* cf. *glaber* (Woodward, 1884), pygidium, latex cast from external mould, 'Phillipsia Band', Cleeve Bridge, Wick, BRSUG 1140b, x3. **E-G:** *Linguaphillipsia* cf. *silesiaca* (Scupin, 1900), Ashton Park borehole, Bristol; **E**, librigena, depth 1962'3", BGS Bk4862, x7; **F**, incomplete cranidium, depth 1968'9", BGS Bk4925, x6, **G**, pygidium, latex cast from external mould, depth 1961'3", BGS Bk4854, x6. **H:** *Griffithides holwellensis* (Hahn & Hahn, 1973), cranidium, Holwell Quarry, Frome, BRSUG 18875-1, x3.5. **I:** *Cummingella* sp., pygidium, Ashton Park borehole depth 1960'0", BGS Bk4834, x4. **J, K:** *Linguaphillipsia scabra* (Woodward, 1884), Whatley Quarry, Frome; **J**, pygidium, NMW 85.34G.4, x4; **K**, cranidium, NMW 85.34G.1a, x3 (figured Tilsley 1988, pl. 2, figs 5 and 1). **L, P, Q:** *Moschoglossis decorata* Goldring, 1958, librigena, pygidium and holotype cranidium, right bank of Avon Gorge, Bristol; **L**, BGS GSM 95324, x4 (figured Goldring 1958, pl. 43, fig. 4); **P**, BGS GSM 63062, x 3; **Q**, BGS GSM86982, x4 (figured Goldring 1958, pl. 43, figs 1-3). **M, N:** *Phillipsia ornata* Portlock, 1843; **M**, cranidium, internal mould, Little Ulverstone, Aust Cliff, BRSUG 1476-1a, x3; **N**, pygidium, latex cast from external mould, Windsor Hill Quarry, Shepton Mallet, BRSUG 11442, x 2.5. **O:** *Piltonia fryi* Goldring, 1958, holotype pygidium, right bank of Avon Gorge, Bristol, BGS GSM 86984, x4.

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The rare larger moths of the Bristol District, by R. J. Barnett, M. Evans & A. Pym

The Brown's Folly Geological Trail: a geological conservation project in the Bath area, by R. B. J. Smith

The trilobites of the Bristol District, by R. M. Owens.

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