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THE LONDON NATURALIST

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 83 2004

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LONDON NATURAL HISTORY SOCIETY

The Society welcomes new members, both beginners and experts. Its recording area (the London Area) lies within a 20-mile (32-km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises Sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology, or rambling, there is a Section ready to help.

Publications

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area and beyond, including records of plants and animals.

The *London Bird Report,* also published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins of news items, including the Society's *Newsletter* and the *Ornithological Bulletin,* are sent to members throughout the year.

Indoor meetings

These are held in most weeks throughout the year, with lectures, discussions, colour slides and films on all aspects of natural history.

Field meetings

Led by experts to visit interesting localities, both within and outside our Area. These excursions are very popular with beginners wishing to increase their knowledge, and enable members to get to know one another.

Library

A large selection of books and journals on most aspects of natural history is available for loan or consultation by members free of charge.

Reading circles

Many important natural history journals are circulated by the Sections at a fraction of the cost of subscribing direct.

SUBSCRIPTIONS

ORDINARY MEMBERS	£20.00
JUNIOR MEMBERS	£5.00
SENIOR MEMBERS	£16.00
FAMILY MEMBERS	£4.00
CORPORATE SUBSCRIBERS	£20.00

Junior membership is for persons under 18, or under 25 and receiving full-time education, and senior membership is for persons over 65 who have been continuous members of the Society for ten complete years. All except family members receive one free copy of *The London Naturalist* and the *London Bird Report* each year. Cheques and postal orders, payable to the London Natural History Society, should be addressed to:

The Assistant Treasurer, LNHS,
Robin Blades,
32 Ashfield Road, London N14 7JY

THE LONDON NATURALIST

Further copies of this issue of *The London Naturalist* may be obtained (price £8 plus £1 postage and packing in the UK and the Republic of Ireland) from Catherine Schmitt, 4 Falkland Avenue, London N3 1QR. Back numbers of most recent issues of both *The London Naturalist* and *London Bird Report* are also available from the same address. Cheques should be made payable to the London Natural History Society.

Top: *Leucocoprinus birnbaumii,* the stovehouse agaric, fruiting in the open on a woodchip pile in Highgate Woods, August 2003. The first confirmed outdoor record for this tropical species in the UK. See page 218. *Photo: E. G. D. Tuddenham*

Bottom: *Ganoderma lucidum,* the lacquered bracket, is rare in Britain, so this was a most unexpected and exciting discovery on Hampstead Heath making it a new record for the site. It is usually found near the roots or amongst the soil surrounding the roots as a saprophyte (recycler) of dead broadleaved trees, especially oak. See page 198.

Photo: A. Overall

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THE LONDON NATURALIST

Journal of the LONDON NATURAL HISTORY SOCIETY

No. 83

for the year 2003

Edited by K. H. Hyatt

ISSN 0076 0579
ISBN 0 901009 16 4
World list abbreviation: *Lond. Nat.*

Published December 2004
© London Natural History Society 2004, London
Printed by Cravitz Printing Company Limited
1 Tower Hill, Brentwood, Essex CM14 4TA

LONDON NATURAL HISTORY SOCIETY

Founded 1858

President

JAN HEWLETT, B.SC., PH.D.
30 Arlington Gardens, London W4 4EY

Honorary Vice-Presidents

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Editor, *The London Naturalist:* K. H. Hyatt, 1 Tremcelynog, Rhandirmwyn, Llandovery, Carmarthenshire SA20 0NU.

Editor, *London Bird Report:* A. Self, 16 Harp Island Close, London NW10 0DF.

Editor, *Newsletter:* G. Lyall, 15 The Esplanade West, Sunderland SR2 7BG.

Editor, *Ornithological Bulletin:* N. Tanner, 11 Collins House, Newby Place, London E14 0AX.

Elected Members of Council: N. Anderson, M. Burgess, Ms A. Chipchase, A. J. Leppard, Miss F. J. Turtle.

Representative Members of Council: BOOKHAM COMMON SURVEY — Dr I. S. Menzies; BOTANY — R. A. Blades; ECOLOGY AND ENTOMOLOGY — Mrs C. M. Schmitt; HAMPSTEAD HEATH SURVEY — Dr C. Bowlt; ORNITHOLOGY — Miss N. A. Duckworth.

The Society's Recorders

Botany

Flowering plants and vascular cryptogams: R. M. Burton, MA, FLS, Sparepenny Cottage, Sparepenny Lane, Eynsford, Dartford, Kent DA4 0JJ (01322 863216).

Lichens: Ms A. J. H. Waterfield, B.SC., 29 Gloucester Crescent, London NW1 7DL (020-7267 8060).

Fungi: Prof. E. G. D. Tuddenham, 17 Bedford Road, London N22 7AU (020-8374 5167).

Ecology and Entomology

Mammals: C. Herbert, 67a Ridgeway Avenue, East Barnet, Hertfordshire EN4 8TL (020-8440 6314).

Reptiles and amphibians: T. E. S. Langton, B.SC., 12 Millfield Lane, London N6 6RA (01986 784518).

Fishes: Dr Ruth Kirk, School of Life Sciences, Faculty of Science, Kingston University, Penrhyn Road, Kingston upon Thames, Surrey KT1 2EE (020-8547 2000 ext. 62732; home 020-8401 6766).

Arachnida: J. E. D. Milner, B.SC., 80 Weston Park, London N8 9TB (020-8341 2158).

Coleoptera (Carabidae and Coccinellidae): P. R. Mabbott, B.SC., 49 Endowood Road, Sheffield S7 2LY (E-mail: peter-mabbott@supanet.com).

Coleoptera (Lucanidae and Buprestidae): Dr D. S. Hackett, FRES, 3 Bryanstone Road, London N8 8TN (020-8292 6134).

Coleoptera (families not otherwise listed): M. V. L. Barclay, 47 Tynemouth Street, London SW6 2QS (020-7371 9095).

Lepidoptera (butterflies): L. R. Williams, 34 Christchurch Avenue, Kenton, Harrow, Middlesex HA3 8NJ (E-mail: leslie.williams1@ntlworld.com).

Lepidoptera (moths), Syrphidae, and invertebrates not otherwise listed: C. W. Plant, B.SC., FRES, 14 West Road, Bishops Stortford, Hertfordshire CM23 3QP (E-mail: cpauk1@ntlworld.com).

Orthoptera: Miss S. L. Bain, 232 Brecknock Road, London N19 5BQ (020-7609 0430).

Hymenoptera Aculeata: R. W. J. Uffen, 4 Mardley Avenue, Welwyn, Hertfordshire AL6 0UD (01438 714968).

Heteroptera: Vacant.

Odonata: Neil Anderson, B.SC., 52 Beechwood Avenue, Greenford, Middlesex UB6 9UB (020-8578 2464).

Plant galls, Isopoda and Myriapoda: K. Hill, BA, FLS, 93 Elmhurst Drive, Hornchurch, Essex RM11 1NZ (01708 456652).

Mollusca: Vacant.

Records may be sent to the appropriate recorder (where shown) or to Colin Plant who will distribute to each recorder the relevant data from a mixed set of records.

Geology

c/o R. E. Butler, B.SC., FGS, 205 Barnett Wood Lane, Ashtead, Surrey KT21 2DF (01372 274103).

Ornithology

Inner London: D. McKenzie, 28 Braithwaite Tower, Hall Place, London W2 1LP.

Hertfordshire: A. D. D. Wilson, 7 Douglas House, Davison Drive, Cheshunt, Hertfordshire EN8 0SZ.

Buckinghamshire: A. V. Moon, 46 Highfield Way, Rickmansworth, Hertfordshire WD3 2PR.

Kent and Lower Thames (London Bridge to Tilbury): D. Miller, 65 Whitemill Road, Crayford, Kent DA1 4AB.

Surrey and Upper Thames (London Bridge to Staines): S. J. Spooner, 32 Berkeley Drive, West Molesey, Surrey KT8 1RA.

Middlesex: R. E. Innes, 27 Dominion Close, Hounslow, Middlesex TW3 1PJ.

Essex: S. R. Harris, 155 Downsell Road, London E15 2BS.

Requests for information should be made to the appropriate recorder.

Contents

Report of the Society for the year ending 30 June 2003

Approved at the Annual General Meeting on 10 December 2003

The previous Annual Report was the last prepared by Tony Barrett who retired in December 2002 after eleven years as secretary. Council, and your new secretary in particular, are grateful to Tony for continuing to chair the Administration and Finance Committee. Thanks too are due to Colin Bowlt who took on the chairmanship of Council at short notice, handing over at the AGM in December 2002 to our new president, Jan Hewlett.

The president's address to the AGM followed a remarkable 16-mm film of the City of London in the 1950s, taken by Bunny Teagle and edited, with Bunny's contemporary commentary, by Pat Sellar. Jan contrasted the bomb sites and their opportunistic wildlife with today's different but no less interesting habitats and species in the City. The president, having reported that a handsome leather-bound copy of *The Natural History of Buckingham Palace Garden* (LNHS 1999, 2001) had been sent to Her Majesty the Queen to mark her Golden Jubilee, then presented similar volumes to Mark Lane, head gardener at Buckingham Palace, and Colin Plant, editor.

A highlight of the year was the publication of *The Breeding Birds of the London Area* (LNHS 2002), edited by Jan Hewlett and with a foreword by Richard Fitter, our former president. We were delighted to welcome Richard to launch the book at a special conference on London's birds. This marks the completion of a major recording project to which very many members have contributed. A historical perspective was provided by Max Nicholson, distinguished ornithologist, environmentalist of international repute and a member of your Society for nearly seventy years. Sadly, we record Max's death in April, at the age of ninety-eight. Obituaries in the national press testified to the esteem in which this self-effacing but enormously influential man was held. Max's *Bird-watching in London* (LNHS 1995) describes how as a young man he revolutionized the scientific study of bird behaviour in a regional context, and inspired others to continue and extend his work. An obituary by Richard Fitter will appear in *The London Naturalist*. Others whose deaths we record include J.K.Adams, Marjorie Campbell (member since 1949), Brian Fletcher, Don Freshwater (1947), Jean Leith-Buchanan, Brian Mist, R. H. Slader and Joyce Smith (1954).

Membership and communication

Robin Blades succeeded the late Ruth Day as membership secretary, assisted by Jenny Devos who manages the Society's database. Robin's title of assistant treasurer recognizes the importance of subscription income to the Society's viability. The AGM in 2002 approved an increase in subscriptions, the first for six years, to take effect from January 2004.

Membership at 30 June 2003 was 1,010, a decline of 10 per cent in three years and 20 per cent in six. The Society's vitality as a recording and conserving body, as well as its financial well-being, depends on healthy recruitment, and the concerns raised over several years are now a real worry. Thus, Council has commissioned a full-colour publicity leaflet to attract new members. And with so many campaigning organizations now entering the environmental arena, the Society must make sure its historic objectives remain relevant today. Your president and Council wish to hear the views of members and urge you to attend a full-day open meeting at the London Wetland Centre on 1 February 2004 when the main purpose will be to consider the Society's aims and activities.

The *Newsletter*, now edited by Graeme Lyall in succession to Tony Leppard, continues to be the main channel of communication with members. This Society has been slower than some to embrace new technology but the website is now well established though not all activities yet appear on it. While

recognizing that only some of our volunteer members have IT skills, Council will encourage all sections to maintain attractive webpages which are many people's introduction to the Society.

Publications and journals

The London Naturalist No. 81, edited by Keith Hyatt and published in December 2002, contained peer-reviewed research papers, compilations of recent and archival records, historical surveys and scholarly contributions on various themes, as well as reports from the Society's sections, book reviews and obituaries. As usual some articles were of more than local or even regional significance — for example, Edward Milner's report of a spider new to Britain that he discovered at Mile End Park, which was the subject of an article in *The Times* of 24 December 2002.

The *London Bird Report* No. 64, for 1999, was published in September 2002, with articles and illustrations of the high standard we have come to expect. The fact that some 450 observers contributed records confirms the depth of interest among our members, as well as the logistical task facing the editor Andrew Self and his team.

Catherine Schmitt, our publications sales officer, has now sold the very last copy of Rodney Burton's *Flora of the London Area,* twenty years after publication. Copies of Colin Plant's *Butterflies of the London Area* and *Larger moths of the London Area,* and Max Nicholson's *Bird-watching in London,* are still available.

Research stations

Bookham Common Survey. The major survey of the Common's vegetation and its changes over fifty years is now complete, and Bryan Radcliffe and Ken Page's account will appear in *The London Naturalist.* This will also include Ian Menzies' discovery of the rare strawberry spider, *Araneus alsine.* Over 1,500 beetle species have now been recorded, while among the birds, raptors such as common buzzard and red kite have been reported.

Roof damage to our hut at Bookham, and a request by The National Trust to move it to a new site, led to Council reviewing the Society's requirements. It was concluded that a new, larger hut would relieve overcrowding and enable members to continue indefinitely their survey work on behalf of the Society and the Trust. Council agreed to name the new facility The Ruth Day Memorial Hut. An appeal to members for contributions has had a gratifying response and it is hoped to have the new hut ready in good time for next season.

Hampstead Heath Survey. Begun in 1996, this is a relatively new activity for the Society, and at present suffers from a lack of volunteers willing to carry out methodical species recording. Nevertheless the long-awaited *Flora* of the Heath, to replace the GLC's booklet of 1986, is nearly complete, and it is reported that the superintendent of the Heath was greatly impressed when he inspected the Society's work during an unscheduled visit to our base, provided by the City Corporation, on the Heath Extension.

Sections

Botany. The varied programme of field meetings, over twenty in all, attracted good numbers of members. Notable among the indoor meetings was Chris Preston's talk on changes to the British flora with reference to the *New atlas of the British & Irish flora.* Members who had collected records for this, and Rodney Burton who tirelessly collated, sifted and submitted all Middlesex records as well as being the Regional Co-ordinator, were pleased with the generally enthusiastic reception of the *New flora.*

Ecology and Entomology. The Section held several well-attended field meetings. Members represented your Society at the Amateur Entomologists' Society (AES) annual exhibition at Kempton Park, and an advertisement has been

placed in the new edition of the *AES Directory*. Indoor meetings including the Brad Ashby Memorial Lecture were well supported. The office of chairman remains vacant, following John Thompson's resignation. The Section's secretary, Catherine Schmitt, again organized a most enjoyable social evening for all members.

Ornithology. This very active Section held fifty field meetings, both within London and by coach to points far beyond, and many members took part in the national bird surveys. The Society was represented by members of the Section at the 2nd Lee Valley Bird Fair, and reported brisk sales of *The breeding birds of the London Area*. David Darrell-Lambert is the Section's new chairman, succeeding David Rear.

Library

The addition of ninety-six books and reports brought total holdings to some 7,000 after pruning to remove duplicates and superseded editions. A hundred and forty journals are also taken. Most volumes are on open shelves at Imperial College but some more valuable items are in the library's basement office. Our librarian Linda Hewitt has produced data which show that the sixty or so members who hold reader's tickets made about two visits each per year, in addition to casual visits by members without tickets. Though the Library is used mostly for reference, readers borrowed about three books each last year. These are the first reliable figures for library usage. Council is grateful to Linda for her hard work throughout the year, and the staff at Imperial College for their co-operation.

During the year your Council approved a revised version of the library policy which appears in the *Programme*. The library's co-location with those of Imperial College and the Science Museum, and adjacent to the collections and libraries of the Natural History Museum, is conducive to both research and casual reading and it is a pity it is not more used by members. An on-line catalogue including most of the Society's holdings is available by searching under 'Imperial College' at http://www.copac.ac.uk/copac.

Conservation and biodiversity

The London Biodiversity Partnership (LBP), representing public and private bodies interested in conservation issues, is responsible through its members for implementing London's Biodivsity Action Plan (London BAP). The Society is a partner in LBP and your Council, after considering the matter carefully, has signed the Partnership's Memorandum of Understanding. Your conservation officer, David Bevan, will represent the Society on the Partnership's policy-making body, the Project Board. Council is being consulted about the Partnership's business plan and is represented by your secretary on the Business Planning Group. Members of the Society contribute to several of the working groups of the London BAP, including those for house sparrows and mistletoe.

The LBP can only help protect and conserve London's wildlife if it has access to a comprehensive database of existing habitats and species. Plans to set up a London Biodiversity Records Centre (LBRC) are well advanced and Council received a presentation from the London Wildlife Trust, the lead partner in a planning consortium that includes your Society. The relationship between the LBP and LBRC is a critical one, with your Council advocating an independent Records Centre supplying neutral data to customers including the LBP. Since members of the Society are responsible, in a wholly voluntary and private capacity, for a large proportion of the species records that the LBRC will hope to process, a satisfactory outcome is of considerable concern to Council.

Away from local politics, an event of national significance is the discovery by our member Brian Wurzell of creeping marshwort *Apium repens* on Walthamstow Marsh, only the second British site for this extremely rare plant. English Nature and other organizations have implemented ambitious measures to conserve and enhance the habitat, and accounts of the discovery are in preparation.

Other matters

The treasurer's report describes the decline in value of the Society's investments and the steps being taken to counteract this and to bring income and expenditure into balance. An important duty of Council is to examine and mitigate any threats to the Society's viability, and the results of a recent risk assessment will be considered carefully. Such matters are relatively new concerns but the Society cannot afford to ignore them.

Finally, Council is enormously grateful to all those members who offer their services freely and willingly, and especially to those who serve as officers and in other capacities. It is clear from the activities reported above that thanks to all their efforts the Society is continuing to meet its charitable objectives, first formulated nearly 150 years ago.

Fuller reports on the activities of the Research Stations and Sections are published in *The London Naturalist.*

Members of Council (the Trustees), 1 July 2002–30 June 2003

N. Anderson
A. J. Barrett*
K. F. Betton
D. Bevan
R. A. Blades* (Assistant Treasurer)
Dr C. Bowlt
Miss E. P. Brown
M. Burgess
R. M. Burton*
R. E. Butler
Miss A. Chipchase
Dr P. F. S. Cornelius
Miss N. A. Duckworth*
Dr J. A. Edgington* (Secretary)
R. S. R. Fitter
R. W. Hale
Mrs L. Hewitt
Dr J. F. Hewlett* (President)
P. C. Holland
K. H. Hyatt
A. J. Leppard*
Dr I. S. Menzies
D. J. Montier*
E. M. Nicholson, deceased April 2003
R. M. Payne
C. W. Plant
Mrs C. M. Schmitt
A. Self
P. J. Sellar
R. A. Softly
Miss F. J. Turtle
M. J. West* (Treasurer)
H. M. V. Wilsdon*

*Members of Administration and Finance Committee as at 30 June 2003.

Treasurer's report for 2002/2003

At the end of the financial year on 30 June 2003, the total net assets of the Society were £324,352, compared with £376,714 the previous year, representing a decrease of around 14 per cent.

Income for the year totalled £34,548, compared with £27,192 in 2001/2. Subscription income at £15,822 was below the previous year's figure of £17,314. Sales of the Society's various publications generated £9,073, compared with £1,308 in the previous year. Investment income fell from £8,120 to £7,824, reflecting a change in the mix of the investment portfolio.

At the end of the year the market value of the Society's portfolio of listed investments stood at £262,078. At the end of the previous year a total of £365,509 of investments were held by the Society. Including portfolio cash, the Society's investments were valued at £313,784 at the end of the year, compared with £371,136 in the previous year.

Overall expenditure during the year was £57,136, compared with £39,560 in the previous year, a difference reflecting the costs of publishing *The breeding birds of the London Area* of £17,592. Donations and sales income were received to offset this increased cost.

Reserves policy

The majority of unrestricted general funds can be regarded as expendable endowment since they are invested to provide a regular source of income as well as capital growth for the Society.

Statement of trustees' responsibilities

Law applicable to charities in England and Wales requires the trustees to prepare financial statements for each financial year which give a true and fair view of the charity's financial activities during the year and of its financial position at the end of the year. In preparing those financial statements the trustees are required:

- to select suitable accounting policies and then apply them consistently
- to make judgements and estimates that are reasonable and prudent
- to state whether applicable accounting standards and statements of recommended practice have been followed subject to any departures disclosed and explained in the financial statements
- to prepare the financial statements on the going concern basis unless it is inappropriate to presume that the charity will continue to operate

The trustees are responsible for keeping accounting records which disclose with reasonable accuracy at any time the financial position of the charity and enable them to ensure that the financial statements comply with the Charities Act 1993. They are also responsible for safeguarding the assets of the charity and hence for taking reasonable steps for the prevention and detection of fraud or other irregularities.

Independent auditors' statement to the trustees of the London Natural History Society

We have examined the summarized financial statements set out below.

Respective responsibilities of trustees and auditors

The trustees are responsible for preparing the summarized financial statements in accordance with the recommendations of the charities SORP.

Our responsibility is to report to you our opinion on the consistency of the summarized financial statements with the full financial statements, on which we reported to you on 17 October 2003 and Annual Report. We also read the other information contained in the summarized annual report and consider the implications for our report if we become aware of any apparent misstatements or material inconsistencies with the summarized financial statements.

Basis of opinion

We conducted our work in accordance with Bulletin 1999/6 'The auditors' statement on the summary financial statement' issued by the Auditing Practices Board for use in the United Kingdom.

Opinion

In our opinion the summarized financial statements are consistent with the full financial statements and the Annual Report of the London Natural History Society for the year ended 30 June 2003.

1st Floor
46 Clarendon Road
Watford, Herts. WD17 1JJ
11 November 2003

BAKER TILLY
Registered Auditor
Chartered Accountants

Summarized accounts for the year ended 30 June 2003

These summarized accounts have been extracted from the Society's annual accounts for 2002/2003. They may not contain sufficient information to provide a full understanding of the financial affairs of the Society. For further information the full accounts, the auditors' report on these accounts and the trustees' report should be consulted. Copies can be obtained from the Hon. Treasurer, M. J. West, 52 Trinity Road, Ware, Hertfordshire SG12 7DD.

The annual accounts were approved by the trustees on 17 October 2003.

Summarized statement of financial activities for the year ended 30 June 2003

	Unrestricted general funds 2003 £	2002 £
Incoming resources		
Activities in furtherance of the charity's objects:		
Subscriptions received from members	15,822	17,314
Publications/journals income	9,073	1,308
Interest receivable	194	300
Investment income	7,824	8,120
Other income	1,635	150
Total incoming resources	34,548	27,192
Resources expended		
Costs of generating funds	2,156	(2,592)
Net incoming resources available for charitable application	32,392	29,784
Costs in furtherance of the charity's objects:		
Publications and other costs	47,846	34,221
Management and administrative expenses	7,134	7,931
Total resources expended	54,980	42,152
Net outgoing resources before revaluations and investment asset disposals	(22,588)	(12,368)
Losses on investment assets	(29,774)	(55,431)
Net movement in funds	(52,362)	(67,799)
Fund balance brought forward at 1 July	376,714	444,513
Fund balance carried forward at 30 June	£324,352	£376,714

Balance sheet as at 30 June 2003

	2003 £	2002 £
Fixed assets		
Tangible fixed assets for use by charity	1,174	2,056
Investments at market value: listed	262,078	365,509
cash	51,706	5,627
	314,958	373,192
Net current assets	9,394	3,522
Total net assets	£324,352	£376,714
Represented by:		
Unrestricted funds	£324,352	£376,714

Official and sectional reports for 2003

CONSERVATION

The Society continues to be an active partner of the London Biodiversity Partnership which oversees the development and implementation of the London Biodiversity Action Plan. This year has seen progress with many elements of the Plan, and members of the Society have made some useful contributions. The conservation officer has, for example, been particularly closely involved with the action plans for woodland and for gardens. Woodland is very unevenly scattered in London, with some boroughs (such as Hillingdon and Bromley) being very well endowed, and others possessing mere fragments. An ambitious application to the Heritage Lottery Fund has been prepared, which will cover both the management and enhancement of selected woods, and also promote woodland throughout London as a valuable recreational and educational resource. We are hopeful that this first-stage application will enable us to fund a project planning officer to develop the proposals.

At the end of June, there was a conference at the Natural History Museum to promote gardens as habitats for wildlife. Occupying around a fifth of the area of London, gardens have great significance as resources for nature. The 'Londoners Wildlife Gardening Conference' was organized by the group overseeing the London garden BAP. There were workshops on managing garden ponds, creating butterfly gardens, conserving house sparrows, and many other wildlife gardening topics. The conservation officer spoke about using native wild flowers in the garden. The conference was greatly enhanced by the presence and active participation of David Bellamy, who took a large group around the Museum's Wildlife Garden.

In July, the BTCV organized a conference to look at ways of encouraging people to become more active in biodiversity conservation. The conference, 'Biodiversity: Connecting People', recruited volunteers from many parts of the country. The morning session was chaired by our member Professor David Goode, Head of Environment at the GLA, and the keynote speech was given by Chris Packham, the well-known broadcaster and photographer. The conservation officer spoke about his work with volunteers in the London Borough of Haringey. In the afternoon session, chaired by Tom Flood, Chief Executive of BTCV, Jenny Schofield, Conservation Manager, London Wildlife Trust, spoke about the Trust's work with volunteers.

The Nature Conservation Working Group organized a joint meeting with the London Wildlife Trust to visit Morden cemetery on 28 June. The cemetery includes some superb grassland, woodland and hedgerows. This half-day walk allowed participants to see the contrasts between formal gardens and wilder areas with a mix of habitats.

DAVID BEVAN, *Conservation Officer*, FREDA TURTLE, *Secretary, Nature Conservation Working Group*

BOTANY

The Botany Section organized two formal meetings: in March there was a talk from Rodney Burton about his travels in Turkey, and another talk from Rodney on London's Changing Flora at the AGM in November. Informal meetings included the usual Best Botanical Slides in January and two identification meetings: a general one in June led by George Hounsome, and one for fungi in October with Ted Tuddenham and Keir Mottram.

There has been a great diversity of field meetings, which provide the opportunity for visits to a number of interesting places where we enjoy plenty of common and unusual plants in pleasant company. There were winter visits to

Whitewebbs Park, to the National *Selaginella* Collection at the Barbican, and to Wimbledon Common for mosses. Later on visits were made to Highgrove Wood, the North Downs, North Greenwich, the Isle of Dogs, Whippendell Wood and Croxley Common Moor, Mile End Park, Banstead Downs and Howell Hill, Merrow Downs, Hockley Woods, Norbury Park and Happy Valley, Hampstead Heath, Horsenden Hill and Greenford Country Park, Ham River Lands (joint with the Wild Flower Society), the Isle of Grain, the Hampshire and Basingstoke Canal, a second meeting at Whitewebbs Park, Scratchwood for ferns, and the usual fungus foray at Haringey to finish off the season. In addition there were three meetings designed to record for the BSBI Local Change Project, in Bickley, Biggin Hill and Pinnerwood, and a meeting for beginners at Railway Fields Local Nature Reserve. We are grateful to George Hounsome for his hard work in arranging such a varied and interesting programme, and our thanks are also due to all the speakers and leaders who give us their time and expertise.

Our tireless higher plant recorder Rodney Burton has been asked by the BSBI to take part in an update to their 1987–8 Monitoring Scheme, and has organized field meetings for this purpose; he has dealt with a number of enquiries and is still actively collecting records (which now number an impressive 64,836) and is working on the best way to store and export them; he has also written some useful guidelines on recording. Amanda Waterfield, our lichen recorder, has surveyed the 'Magnificent Seven' London cemeteries, and also attended HAP and BAP meetings of the GLA and Camden. We are also glad to have a new fungus recorder, Ted Tuddenham, who says he is looking forward to recording London's fungi.

Finally, the Section has been actively involved in the London Species Action Plans for mistletoe and black poplar.

DAVID BEVAN, *Chairman,* MARY CLARE SHEAHAN, *Secretary*

ECOLOGY AND ENTOMOLOGY

The Section has operated for most of the past year without a chairman, treasurer or indoor meetings secretary which largely explains the few meetings in the programme for this Section. At the AGM in October, long-standing committee members, George Loveland and Florence Frost stood down. However, we were pleased to elect Colin Bowlt and Mick Massie as new committee members. We would welcome more members willing to join us to carry on the work of the Section and the Society.

Our AGM once again followed the successful formula of reports from the Section's recorders, one written and six in person. This meeting benefited further from a report from Mandy Rudd of London Wildlife Trust on progress on the London Biodiversity Records Centre.

At February's informal meeting, Barry Hilling and Paul Wheeler again delighted us with stunning slides. In March John Thompson told us about 'Zoos past and present'. For our annual joint meeting with the British Entomological and Natural History Society in September, Leslie Williams, our butterfly recorder, gave the Brad Ashby Memorial Lecture on monitoring butterflies in London.

Five field trips were organized during the year. The first, to Nunhead Cemetery in May, was led by spider recorder, Edward Milner. No previous records existed for this site. On a perfect day in June Neil Anderson led a most successful trip to Cheshunt and Cornmill Meadows to look for dragonflies and other insects. Later in the month, Caroline Ware led an evening visit to the Natural History Museum's Wildlife Garden. On a hot Sunday afternoon in August Sandi Bain, Orthoptera recorder, helped us hear and see grasshoppers and crickets in Greenwich Park, and in late November we searched for winter-active spiders with Edward Milner at Osterley Park.

Once again the Section represented the Society at the Amateur Entomologists' Society exhibition in October, selling our books and journals as well as making the work of the Society known to a wider public. We were pleased to be able to hand out the Society's excellent new membership leaflet and to sign up two new members.

CATHERINE SCHMITT, *Secretary*

ORNITHOLOGY

The Ornithology Section continued to expand, with a very varied programme of field and indoor meetings. There was a talk by John Wyatt on waders, on the birds of Pembrokeshire by John Buckingham and a talk on the future of the great bustard in Britain. There were also several talks on birding abroad. These covered Cuba and the Dominican Republic, the Antarctic, Turkey and Australia and, at our AGM, our chairman David Darrell-Lambert, gave a talk on Rare Birds in the 21st Century. The coach trips, well organized and led by Neil Anderson, visited Rutland Water, Dungeness, Titchwell and Holme next the Sea. On the Rutland Water trip, a small detour was made en route to the Tesco store at St Neot's off the A1 for some stunning waxwings and at Rutland Water there were three short-eared owls, a wealth of winter wildfowl and some tree sparrows. Support for the coach trips has varied but it is an easy way to see good but distant birding areas. Neil would welcome more support from members for the coach trips.

There were also field trips, ably organized by Jennifer Hayden, who also succeeded in cajoling some new members into leading walks on their local patch. There was a trip nearly every week to a key birding area around London. These included the Lee Valley Park, Carshalton Ponds, the Colne Valley, Bedfont Lakes, Morden Hall, the Isle of Sheppey, Lonsdale Road Reservoir, Trent Park, Hampstead Heath, Epping Forest, Tower Hamlets Cemetery, Sevenoaks Wildfowl Reserve, Berwick Ponds, East Tilbury, Beddington Sewage Farm, Swanscombe, Fairlop Meadows, Charlton, the North Kent Marshes, Rye Meads, Two Tree Island at Leigh-on-Sea, Foots Cray, Kew Gardens and Swanscombe and, in the summer, visits included searches for both dragonflies and birds at Bushy Park, Cornmill Meadows, Trent Park and for crickets at Wraysbury. These trips provide a wealth of ornithological interest and new members are especially welcome. Helen Baker organized outings to Regent's Park, where a good selection of birds is always seen: these meetings are very suitable for beginners. There were also trips to Greenwich to identify gulls, Bookham Common to identify bird song, and to find sparrowhawks on Wandsworth Common. In February 2003, Mike Trier, Catherine Schmitt, Sarah Barnes and Angela Linnell manned the LNHS stall at the Lea Valley Bird Fair and sold many of our publications and gave out leaflets

The *London Bird Report* for 2000 is making fairly slow progress. Mike Trier has replaced Patricia Brown as papers editor. The Ornithology Research Committee, which has organized the Ornithology Section research for many years, was disbanded, as other organizations such as the BTO are now conducting major surveys in the London area, with greater resources. However, an ad hoc working party could be set up to deal with research, if necessary, which would report directly to the Ornithology Committee.

On a sad note, the Ornithology Section has lost a key member with the death of Ken Osborne. He had been the Inner London recorder and on the Rarities Committee for many years and had made a substantial contribution to our London bird atlas. He also edited the *London Bird Report* from 1972 to 1978. Ken's obituary appears in this issue.

DAVID DARRELL-LAMBERT, *Chairman,* NICOLA DUCKWORTH, *Secretary*

The changing face of nature conservation in London, 1946–2003

JAN HEWLETT

30 Arlington Gardens, Chiswick, London W4 4EY

Presidential Address delivered at the Annual General Meeting on 10 December 2003

Abstract

This paper traces the development of nature conservation in and around London from the 1940s to the present day. It attempts to show how the London Natural History Society paved the way for a much broader conservation agenda by the end of the twentieth century, which would rely increasingly on professional work. It also tracks the fate of many of the sites that were recommended as nature reserves by the LNHS in the 1940s. Although a few have fallen by the wayside, many remain London's top nature sites, recognized as SSSIs or in some cases even internationally important Special Areas for Conservation or Special Protection Areas for Birds.

This evening I would like to trace the development of nature conservation in London from the 1940s to the present day. I will attempt to show how the London Natural History Society played a key role in initiating nature conservation in and around the capital, paving the way for the much broader biodiversity agenda today. The story begins well before my own active participation, but none the less represents a personal perspective. I should stress that any opinion expressed herein is my own and not that of my present or any previous employer or any other organization. I am grateful to English Nature and the Herts., Bucks., Surrey and London Wildlife Trust Biological Recording Centres for providing information on Sites of Nature Conservation Importance.

The initial stimulus for my presentation to the Society's AGM was a small, and seemingly insignificant incident in the offices of the Greater London Authority (GLA) in the summer of 2002. The environment team was preparing to 'move house' from our old offices in Marsham Street to the new City Hall — the striking, oval building designed by Norman Foster on the South Bank by Tower Bridge. We had been instructed to prepare for a modern, electronic office, with minimum of paper, and were only allowed to take about a third of our files. The rest would either be archived off site or dispatched for recycling. A small group of ecologists was therefore gathered in a damp musty basement, sifting through rows and rows of files, collectively representing almost twenty years' work of the former London Ecology Unit. It seemed like files full of people's life's work flying in all directions. I caught sight of an old, yellowing paper flying towards the recycling heap, with 'London Natural History Society 1952' neatly stencilled on its cover. It proved to be Eric Groves's (1952) paper on sites which the Society recommended as nature reserves in Surrey — I had not realized till then the extent of this organization's work on nature conservation so long ago. From Eric's paper, I followed the trail back to Cyril Castell's (1947) paper in *The London Naturalist* for 1946 and this will represent a baseline for the discussion which follows.

Nature conservation in London in the 1940s to 1950s

Castell's paper was written at a time when planning and nature conservation were coming up the Government's agenda at the end of the Second World War. The Government had set up a Wildlife Conservation Special Committee, chaired by Julian Huxley, to advise on nature conservation at a national level. Two eminent members of this Society, Richard Fitter and the late Max Nicholson

were key players. There was also a Nature Reserves Investigation Committee, which had begun work a few years earlier, to identify possible sites for nature reserves. The Society was asked to advise on sites for protection in the London Area. The first Greater London Development Plan, Professor Abercrombie's (1945) *Greater London Plan*, was being formulated at around this time. This document acknowledged that London might benefit from an increase in nature reserves, and promoted the concept of a Green Belt around London, though it failed to recognize a need to protect the capital's flora and fauna more generally.

The 1940s were early days for nature conservation in Britain. It was still a few years before the start of the Nature Conservancy or its successor the Nature Conservancy Council, and before the term SSSI (Site of Special Scientific Interest) had come into our language. This concept came out of the National Parks & Access to the Countryside Act, 1949. It was also long before the GLA boundaries were drawn up, so the Society worked to its own recording area, the familiar circle of twenty miles radius centred on St Paul's Cathedral.

Figure 1, which is reproduced from *LN* **26** for 1946, shows the sites the Society recommended for nature reserves — about 120 in total. In addition to those shown on this map, they included all the major reservoirs, recognizing their importance for over-wintering wildfowl, and all the Royal Parks, which were acknowledged as bird sanctuaries in the heart of the city. It is noticeable that apart from the Royal Parks, most of the sites lie in the outer parts of the LNHS area, many of them in what became designated as the Green Belt, and most of them are substantial in size. Some familiar examples include Black Park (Site B1), Harefield Moor (M1) and Ruislip Woods (M2) in Bucks. and west Middlesex; Scratchwood (M5) and Broxbourne Woods (H9) in north London and Herts.; Walthamstow reservoirs and marshes (E6), Epping Forest (E1) and Thorndon Park (E15) in Essex; Keston Common (K2) and Lesnes Abbey Wood (K1) in Kent; and Box Hill (S25), Farthing Down (S18) and several other fine chalk grassland and woodland sites in Surrey. A little further into town were sites such as Syon Marsh (M14) at Brentford, Osterley Park and Farm (M15), Perivale Wood (NR1) and Horsenden Hill (M12) in west London and Kenwood (M9) and Highgate Woods (M8). Surprisingly, Rainham is not marked. Perhaps it was still too heavily used for military activities.

The sites were classified in three main categories: nature reserves which should be protected with limited public access, conservation areas where public access could fit alongside nature conservation, as at Epping Forest and Cuffley Great Wood, and amenity reserves where greater emphasis could be placed on public enjoyment of nature, for example Ruislip Woods. The recommended nature reserves in turn were divided into larger habitat reserves and smaller species reserves, for key populations of rare species, for example a small wood near Hertingfordbury known as Roxford Copse, which had winter aconite *Eranthis hyemalis*. There was also a series of geological sites (but this paper deals only with the biological sites).

Eric Groves's paper of 1952 described the Surrey sites in more detail and added a few more for good measure, including what was then the only known west London site for a rare mollusc, the two-lipped door snail *Lacinaria biplacata*, near the Thames at Kew. One of the recommended nature reserves was just a single rather special old sessile oak pollard, at Mickleham. Nowadays we would be more likely to seek a Tree Preservation Order.

Nature, species and landscape

One of the aspects of Castell's paper which I particularly liked is the way it captured the relationship between species, habitat and landscape in the public enjoyment of nature:

'. . . the beauty and interest of landscape in this country does not depend solely or even mainly upon the sculpturing of the earth's surface, but upon the nature of the living carpet which covers and surrounds these physical features.' He

writes about people's experience of the lifeless landscape in the desert during the war, comparing this with the hard lifeless landscape of towns and cities, in contrast to the living landscapes of downland, woodland and rivers. I like this concept 'living landscape' which brings the whole breadth of natural history and landscape together.

It has always seemed to me unfortunate that landscape and ecology have been managed through separate organizations and disciplines in this country. To an extent the 1949 National Parks & Access to the Countryside Act set this in stone, by separating a science-led Nature Conservancy from the wider aesthetic issues of landscape and public enjoyment of the countryside, which would be progressed by the National Parks Authorities and later the Countryside Agency. The reasoning — according to Sir Dudley Stamp (1969) in *Nature Conservation in Britain* — was partly that one of the main functions of nature reserves was scientific research, but also, and perhaps more importantly, that public access and disturbance were seen as the main threats to nature conservation. During the later decades of the twentieth century, however, changes in farming practice as well as motorways and built development would come to be the major concerns of those who sought to protect the English countryside.

The 1960s to 1970s

I tried to build up some idea of the Society's activities during the 1960s to 1970s from the conservation reports in *The London Naturalist.* It seems the Society had a close working relationship with the Nature Conservancy up to this period. Many of the sites in the 1946 and 1952 reports became designated as SSSI and others were added to the list. The Society had obviously become an important watchdog for nature conservation. It also gave management advice to some of the local authorities for important sites, such as the bog on Keston Common. By the late 1950s to early 1960s County Naturalists' Trusts or Wildlife Trusts had become established in all the surrounding counties and from the notes in the *LN* it would appear the Society enjoyed good relationships with its new neighbours.

Our Nature Conservation Committee seemed to reach new heights under Pearl Small's chairmanship in the late 1960s to 1970s. I was working in environmental education in London during the mid 1970s, and was fortunate to meet Pearl with a group of educationists who were out at Perivale Wood, looking for ways to interest schoolteachers in the potential of London's wildlife for education. Pearl was an inspiring figure. From the notes in the *LN* it appears that her committee were foreshadowing much of the work which would later be done by London Ecology Unit and London Wildlife Trust.

Another initiative around this time was the establishment of the Ecological Parks Trust, led by the late Max Nicholson, which set out to provide ecological activities for inner city school children. Their flagship project was the William Curtis Ecological Park on the south bank of the Thames near Tower Bridge. Many LNHS members will be familiar with a photograph of this site, which appears on the cover of Rodney Burton's (1983) *Flora of the London Area*. It had little demonstration plots of various habitats and a fine pond. Sadly, the park has long since disappeared (and in truth it was conceived partly as a short-term use of temporarily vacant land). The site is now occupied by City Hall.

Winds of change 1981 to 1983

The 1970s and the start of the 'Thatcher Era' may be seen as a high point in public concern over changes in the countryside at the hands of modern agriculture and development. These sentiments were captured eloquently by Richard Mabey (1980) in *The Common Ground* and more forcefully in Marion Shoard (1980) in *The Theft of the Countryside*. Many of the protestors were in fact city dwellers, so it is not perhaps not surprising that concern for the countryside should be followed by an increased awareness of wildlife within

by books such as Bunny Teagle's *The Endless Village* (1978). By the early 1980s, the ecological agenda in London was 'warming up'.

Three key factors lay behind this trend — firstly, the passage of the 1981 Wildlife & Countryside Act. Amongst other provisions, the Act gave stronger protection to SSSIs than previous legislation and all SSSIs had to be reassessed. This was a major exercise for the Nature Conservancy Council's regional office and several of London's former SSSIs, which had been declared under the 1949 Act, failed to meet the new, more stringent criteria. One such example was Perivale Wood, and concern was raised over several others. The second major influence was the establishment in 1982 of the London Ecology Unit (LEU), led by Dr David Goode, at what was then the Greater London Council (GLC). This was during Ken Livingstone's first reign over London back at County Hall. We tend to take this kind of programme for granted nowadays, but to appoint a team of ecologists to work in a capital city was a remarkable step in 1982. The Unit eventually evolved into the Greater London Authority's (GLA) Biodiversity Group.

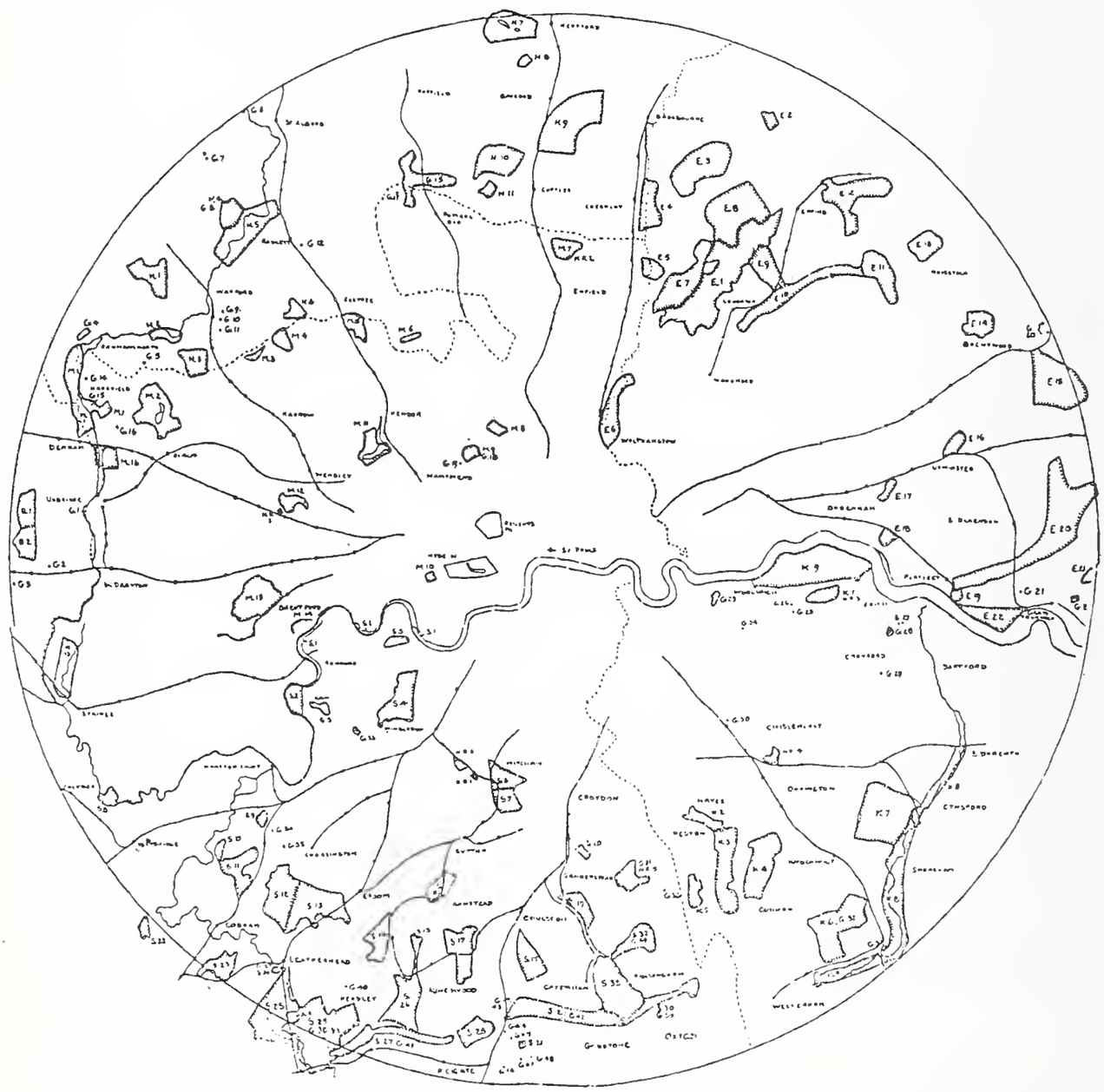

FIGURE 1. Proposed nature reserves in the London Area, from Castell (1947).

Note. Figures 1–3 are shown here all at a similar and rather small scale to facilitate broad geographical comparison. Note also that Figure 1 extends to the whole LNHS area, whilst Figures 2 and 3 relate only to the GLA area. For clearer detail see Castell (1947), Mayor of London (2002) and the website www.wildlondon.org.uk

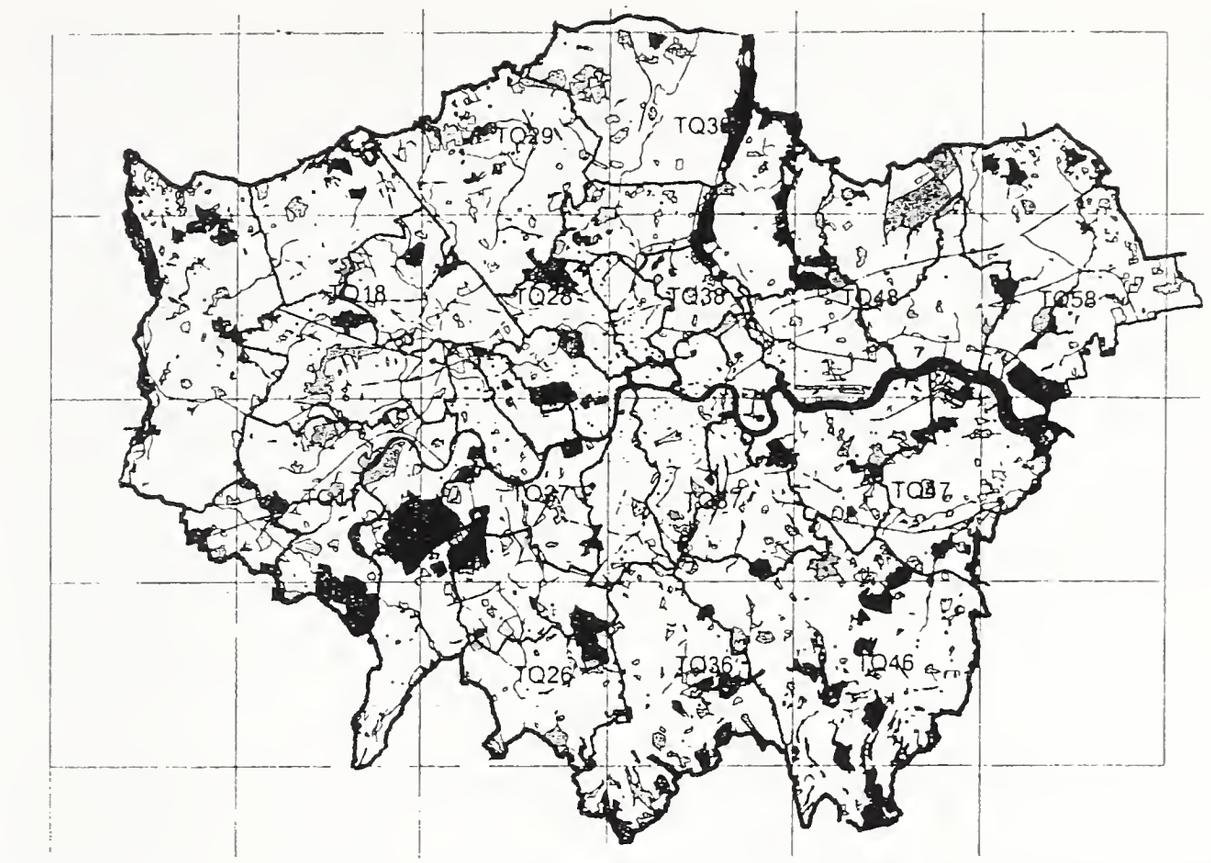

FIGURE 2. Sites of Importance for Nature Conservation in Greater London. The darkest shade represents the Sites of Metropolitan Importance for Nature Conservation, the paler shades the sites of Borough and Local Importance.

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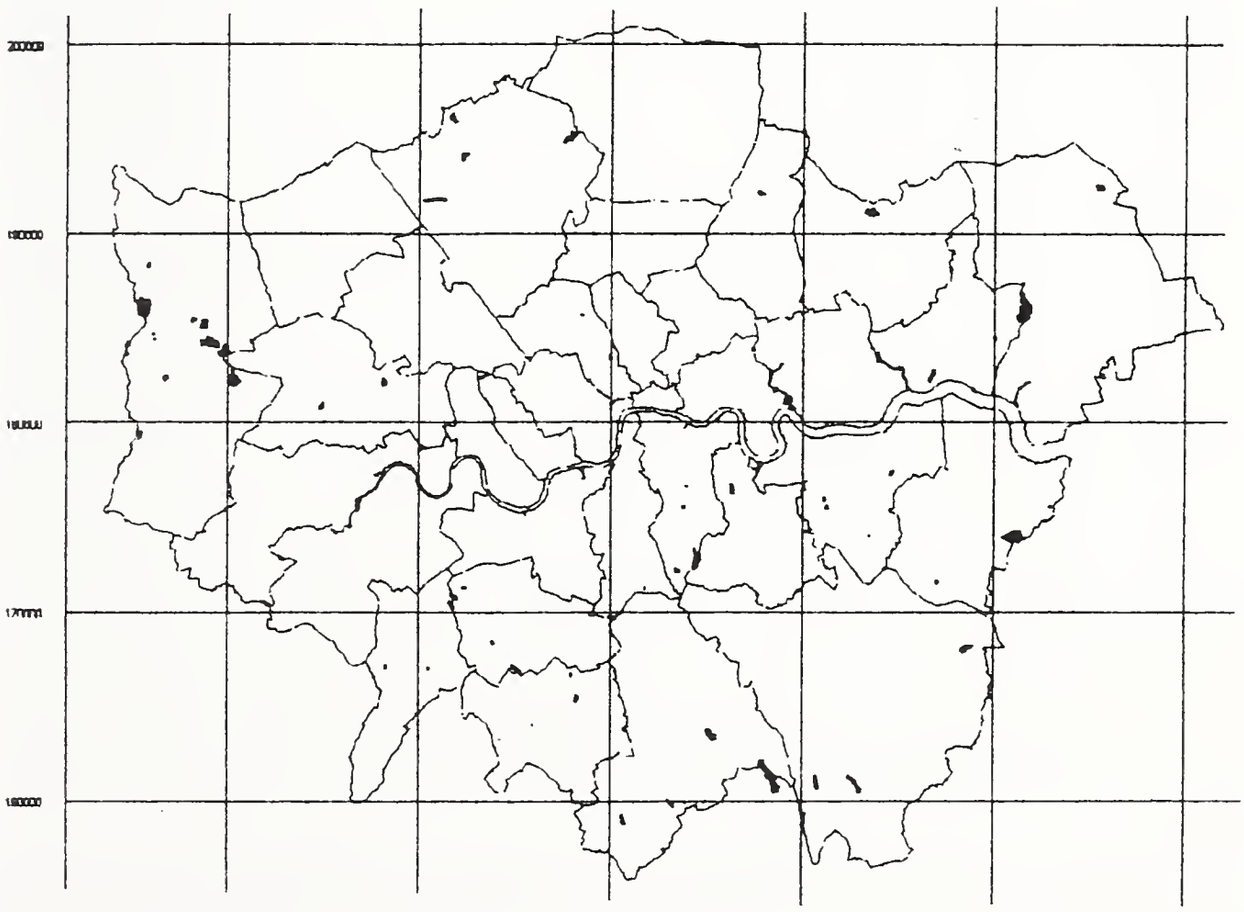

FIGURE 3. Nature reserves managed by the London Wildlife Trust.

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One of LEU's first projects was a Wildlife Habitat Survey covering all open spaces in London above a certain size, and more detailed surveys have followed since then. A great strength of these surveys was their standardized methodology, which made it easier to compare sites with one another and to identify the better ones as Sites of Importance for Nature Conservation (SINCs), which could be protected through the boroughs' Unitary Development Plans. The sites were described in detail in a series of handbooks for most of the London boroughs. Figure 2 shows the complete series of SINCs at the time the LEU became part of the GLA. The four shades represent different grades: Metropolitan, which includes all the SSSIs, Borough (subdivided into grades I and II) and Local in decreasing ecological value. The darkest shade represents the Sites of Metropolitan Importance, the palest grey the Sites of Local Importance and the intermediate shades the Sites of Borough Importance grades I and II. For a colour version see *Connecting with London's Nature. Mayor's Biodiversity Strategy* (this can be accessed through the GLA website www.London.gov.uk/ Mayor's publications /strategies). It is noteworthy that the Thames is graded a Site of Metropolitan Importance — the highest grade on the London scale. It would have been unlikely to reach this grade in the 1940s–1950s, when it was far more polluted and virtually fishless from Docklands to Kew.

It is by no means suggested that all the Sites of Nature Conservation Importance should become nature reserves, but rather the system represents a formal mechanism for recognizing the best of what is available in each locality for protection through statutory planning. A Borough or Local grade site might be just a park or churchyard, where local people have some opportunity to enjoy a few birds and wild flowers. Areas of London where there are no easily accessible sites of Borough grade importance for nature conservation are mapped as Areas of Deficiency in accessible nature sites.

To an extent the LEU surveys superseded some of the earlier work of this Society, but the LNHS was not entirely left out of the picture. As LEU surveyors, we were always expected to jot down 'notable' species, and notable was taken to mean 'occurs in less than 10 per cent of tetrads in the Society's *Flora of the London Area*'. So the *Flora* was always on people's desks and affectionately known about the office as 'Rodney'.

Another important strand of LEU's work was habitat management, helping the boroughs with management plans for Sites of Importance for Nature Conservation. Where the nature conservation interest was very limited, we considered habitat creation. Camley Street Natural Park near King's Cross was the most ambitious project, created on a barren lorry park. Over the past twenty years it has provided natural history activities for thousands of schoolchildren. It is now the flagship project for London Wildlife Trust.

The third factor which raised the profile of nature conservation in London in the early 1980s was the launch of a new wildlife conservation charity, the London Wildlife Trust (LWT). I suspect this was a mixed blessing for the LNHS, at least at first. In the Nature Conservation Committee's 1980 report in *LN* **60** there is more than a hint of sadness. I have always felt that London Wildlife Trust could have benefited hugely from the wisdom of experience and wealth of ecological knowledge held by members of this Society. Equally some aspects of the then new and youthful Wildlife Trust could doubtless have benefited LNHS. Unfortunately that was not to be, at least for some time to come.

LWT has grown substantially since 1981, both in size and in the quality of its work. It has about 5,000 members and around twenty staff. Thankfully the relationship between the two organizations is greatly improved (I should note that I am a trustee of both). Figure 3 shows all the sites that are managed by the Trust. It contrasts sharply with LNHS's proposed nature reserves in Figure 1. For a start, most of LWT's sites are much smaller and further into town. I could

only find two sites which are covered by both maps, a small plot of coppiced woodland on Wimbledon Common called Fishponds Wood, and a nice stretch of chalk grassland at West Kent Golf Course, near Downe.

Most of LWT's sites have been acquired opportunistically, often growing out of a campaign by a local group to defend a particular site against development. One such example is Sydenham Hill Wood, in Southwark, where part of the site was threatened with housing. In many cases the Local Authority has granted the Trust a lease or licence to manage the land. Since most of the nature reserves are relatively small, their potential to protect significant wildlife populations is limited. However, they undoubtedly offer people a chance to encounter species which might not otherwise occur in their locality, and many of the sites act as a community focus, with members who lobby their councils over local issues. Hence the influence radiates well beyond these sites.

Most of the Trust's projects have a strong community flavour, reaching people who would not otherwise be involved in nature conservation, including ethnic minorities and people with learning difficulties. They undertake much excellent educational work in schools and through informal nature clubs. One of their most successful projects is a Centre for Wildlife Gardening in Peckham, created from scratch in a bare concrete yard and now a vibrant community project. This has become recognized as a champion for wildlife gardening.

A few case studies and some personal recollections

Gunnersbury Triangle

My own small contribution began in 1982 and first concerned a small patch of woodland near my home, which is now known as Gunnersbury Triangle. It lies wedged between the District and Silverlink railways in Chiswick. A local resident, Anne Mayo, who lived across the railway from the site, was in her garden one day, when she spotted workmen chopping down some trees. With remarkable presence of mind she contacted the Council and persuaded them to put a temporary Blanket Tree Preservation Order on the site, then called a public meeting in the local Wimpy Bar. Although the site is hidden from the main roads, it turned out to be well known to local naturalists, as the trains pass along the woodland edge en route from Kew to the Natural History Museum.

The project soon attracted a remarkable group of people, including several Kew botanists, who demonstrated its botanical richness, noting it was one of the best fern sites in Middlesex, and others from the Natural History Museum, including Peter Hammond, who identified 108 species of beetles. We also have a lot of media people living locally. A local journalist soon got our story into *New Scientist*. Another, who worked for BBC television, brought David Bellamy along. We also had strong support from Dr David Goode and the GLC's then new Ecology Unit. The upshot was a victory at a Public Inquiry in 1983 which became recognized as a Test Case for nature conservation as a land use in urban areas. The site is now run by the London Wildlife Trust as a Local Nature Reserve. At first it was kept closely protected, and opened only when a volunteer or warden was on hand to keep a watchful eye. Today people are allowed to come and go as they please. It seems to be valued as a place to get away from it all, an antidote to the dusty, noisy streets. It gives me huge pleasure to see people just wandering round enjoying the bird song and its refreshing atmosphere.

After the Triangle Inquiry our phone used to ring night after night for some time, with people wanting to know how to save their local patch. Notable amongst these was Ollie Natelson at Coppets Wood. We began to explore other nearby sites, rather like the LNHS in the 1950s but on a very local scale.

Duke's Hollow

One was a patch of damp woodland in Duke's Meadows, near Barnes Railway Bridge, which we named Duke's Hollow. It has two rare snails — the two-lipped

door snail, referred to earlier, and the German hairy snail *Perforatella rubiginosa*, as well as a rather fine hydrocere flora, which LNHS botanists visited a few years ago. Like Gunnersbury Triangle, this site was threatened with development, but thanks to protection by Hounslow Council it too is now a Local Nature Reserve.

Wormwood Scrubs

Another of the groups who used to phone regularly were concerned with Wormwood Scrubs. Alongside the Great Western Railway, there used to be a broad strip of rough scrubland and allotments, which could be seen through the train window soon after you leave Paddington, where the view opens up across the playing fields towards the watchtowers of Wormwood Scrubs prison. A local schoolboy, Lester Holloway, had been keeping detailed ecological records of the site for some years. The site supported a large population of common lizard *Lacerta vivipara*, as well as slow-worm *Anguis fragilis*, and a huge variety of insects and birds. But the group was up against a proposal for engine sheds for the Channel Tunnel trains.

In the short term, almost inevitably, the campaigners lost out. However, most of the reptiles were rounded up and taken to a suitable refuge, and some of the vegetation — complete with its meadow anthills — was transferred into a small plot on the main park next door, which was dubbed the 'habitat enclosure'. Part of the remaining soil was built up into a bank to screen the view of the new train sheds. Then a year or two later some of the reptiles were brought back into the habitat enclosure.

Few people had much faith in this so-called habitat transfer. But the story has another twist. About ten years later, I was asked by Hammersmith Council to advise on a new management plan for Wormwood Scrubs Park. One of my recommendations was to commission a reptile survey. To my delight they found around 200 lizards. Part of the park is now being developed as a Local Nature Reserve and there are plans to clear much of the Japanese knotweed *Fallopia japonica*, which inevitably colonized the bank, to make sun-basking spots for the lizards.

Barnes Wetlands

My next example concerns the old Barn Elms reservoirs. I helped with this project for a few years during the early 1990s. The reservoirs had been designated as an SSSI under the 1949 Act for their winter wildfowl, largely I suspect, thanks to the bird recording efforts of this society. However, by the late 1980s the bird counts had fallen, and the SSSI status was being questioned, with the more stringent requirements of the 1981 Act. Moreover, Thames Water no longer required this site for water storage. Had the SSSI status been lost at that stage, the political balance for the site would have been very different and I doubt if we would have the Wetland Centre today.

Fortunately NCC and its successor English Nature took a rounded approach, supporting a proposal to convert the reservoirs into what is now the WWT London Wetland Centre. The reconstruction of the water bodies and development of the centre cost around £13 million, with most of the money coming from a housing development by Berkeley Homes at the northern end of the site. It was, perhaps, a 'first' for big business and nature conservation putting their minds together on a grand scale, rather than working in opposition. It also marked a break with the idea of conservation working solely or primarily through 'preservation'. Whilst we all recognize that some habitats — ancient woodland for example — are irreplaceable and must be protected at all costs in their natural form, others, such as ponds and reedbeds, can be created through human effort. The Centre now attracts over 200,000 visitors a year, and has been highly successful in introducing new audiences to birdwatching in London.

Rainham

Rainham Marshes is another site with a long association with this Society. The largest surviving area of the once extensive Inner Thames Marshes, it is hugely important for wetland birds, water voles, dragonflies, rare wetland plants and much else besides. However, it lies within an area called The Thames Gateway, which the Government has identified for major development. At one time there was a proposal for a theme park on the lines of EuroDisneyland, though fortunately that was withdrawn. Then the A13, Rainham bypass, was allowed to march across the SSSI on giant concrete legs (SSSI designation protects scientific interest but apparently — at least in this case — with little regard to landscape). The Channel Tunnel Rail Link was a further threat. Many conservation organizations got together to see what could be done. LWT produced an excellent paper 'Gateway or Doormat' (Newton 1994).

About eight years ago, I visited the site with the late Sir William Wilkinson, the former head of the Nature Conservancy Council, whom I was privileged to get to know during my years with WWT. We were standing at the Rainham end, where the rubbish was piled so high it was called the Rainham Alps, gazing across this scarred landscape, conscious that although it was scientifically important, we could not deny a need for change. By a curious twist, the rubbish tips, where we were standing, turned out to be part of the solution. The following year the Government brought out the Landfill Tax Credit Scheme, whereby landfill operators can reduce their tax burden through giving grants to environmental projects. This scheme, together with a major bid to the Heritage Lottery Fund, enabled the RSPB to purchase Aveley and Wennington Marshes for a nature reserve. Another piece of the jigsaw fell into place when Ken Livingstone brought out his manifesto for the first London Mayoralty in 2000, which includes a commitment to protecting the Rainham SSSI in its entirety. Havering Council has now agreed that the western marsh will be developed as a country park, rather than an industrial site.

Work on both projects is now under way. The RSPB have begun clearing the ditches on their part of the site, as well as building crucial links with the local community. Public opening is scheduled for autumn 2004. The old landfill tips have been smoothed down and capped off as rounded grassy 'hills', earning a new nickname amongst the RSPB team — the Essex Chilterns. Despite a distinctly organic odour emanating through the capping, the new 'hills' have already attracted breeding skylark and grey partridge. A small area around the eastern end of the marshes will be lost to the Channel Tunnel Rail Link, but the nature reserve and country park together will make up several hundred hectares. This is another example where the early scientific work by our Society paved the way for what will become an important nature reserve, with fantastic birdwatching opportunities for the wider public.

1996 to 2003 — nature conservation becomes biodiversity

The years 1996 to 2003 represent another period of great change for London's nature conservationists. As in the early 1980s, several factors have been at work.

Biodiversity Action Plans

Firstly, there is a huge programme stemming from the Rio de Janeiro Convention in 1992 with both national and local Biodiversity Action Plans. London Biodiversity Action Plan has become a major driver in London, with various working groups seeking to improve a wide range of habitats and species. For example, the Woodland Habitat Action Plan is currently working up a bid to the Heritage Lottery Fund for six important woodlands, with an emphasis on improving public enjoyment and accessibility. The Heathland Habitat Action Plan aims to re-create areas of heathland to augment London's few remaining

fragments of this special habitat. The Chalk Grassland Habitat Action Plan seeks to reinstate grazing in several areas on the North Downs to encourage rare orchids and other wild flowers. Many of the Action Plans undertake projects to increase public awareness. The House Sparrow Action Plan drew in more than 11,000 responses for a mapping project on house sparrow distribution in 2002. The Mistletoe Action Plan plans to reintroduce mistletoe to high-profile sites where people have a chance to see the plant in its natural form, rather than simply as over-priced twigs on a market stall.

The Biodiversity Action Plan process has been effective in bringing people of different organizations together — English Nature, the Environment Agency, BTCV, Royal Parks, London Wildlife Trust and of course the LNHS. This has helped to improve relationships between the various groups.

The Mayor's Biodiversity Strategy

The Mayor of London's (2002) Biodiversity Strategy is the only regional biodiversity strategy to have statutory status (as it is a requirement of the GLA Act 1999) and it is likely to become a major influence over the next few years. It has three main themes — site and species protection linked to surveys and planning; improving habitat management; and improving access to nature, especially in areas of need. There are just two main targets:

- No net loss of wildlife habitat in the Sites of Nature Conservation Importance — this is primarily site protection through the London Plan
- Reduction in areas of deficiency for accessible wildlife sites — aiming that everyone should be within easy walking distance of somewhere they can enjoy nature

Work on the latter may include negotiating access for sites which are currently closed to the public, improving footpath connections, or improving some of the less ecologically interesting parks by planting up native trees or shrubberies, creating ponds or wildflower areas, or perhaps creating new nature parks. I am conscious that some habitat creation projects are seen as controversial in this Society. Curiously, people often seem less happy about introducing herbaceous native plants than trees or shrubs. Perhaps this reflects a longer-established tradition of tree planting. I appreciate the thrill of discovering a new species in an unexpected location, and the disappointment if it turns out to be an introduction. Equally, it seems hard to rule out the opportunity for inner city dwellers to enjoy wild flowers. Perhaps a key is to make sure such projects are well documented at local records centres and planned to take account of important, naturally occurring species in the locality.

Funding for nature conservation

Another major factor is funding. There is big money out there if you know how to pursue it. Nature conservation has come a long way since we sold busy lizzies and spider plants to 'Save the Gunnersbury Triangle' in 1982. However, the procedures are complex and — except for the smallest schemes — generally too onerous for a purely volunteer organization like this Society. One of the most significant programmes is the Heritage Lottery Fund. Originally focused on built heritage, it now increasingly supports natural heritage, including projects which meet UK Biodiversity Action Plan targets. Another, smaller, but extremely effective, programme has been 'Wildspace', which is managed by English Nature and gives a financial incentive to local authorities to manage some of their landholdings as Local Nature Reserves. Back in 1987 Gunnersbury Triangle was only the fourth site in London to be designated as a Statutory Local Nature Reserve. Now there are over seventy.

The influence of development and regeneration

Whilst the new funding streams open up exciting opportunities for nature conservation, a serious concern must be a projected increase in London's population by about 700,000 over the next twenty to thirty years. Much of this will be in east London. The intention seems to be that most of the new development will be high-density building, with much talk of sustainable development. Nonetheless it is bound to put pressure on the natural environment. This will be greatest on 'brownfield' sites. These sites may appear visually scarred, but often have a distinctive flora and uncommon invertebrates. It is interesting to note that, although our LNHS predecessors fifty years ago clearly enjoyed exploring London's bomb sites, they did not propose them for nature reserves. Perhaps the wasteland communities were considered robust enough to look after themselves. They would re-establish quickly enough on any vacant plot. Today such patches are becoming more highly valued as a part of London's ecology and one that is under increasing threat. Vacant land tends to be recycled more quickly than in the past, leaving little opportunity for plant and animal communities to establish before the bulldozers move in.

Development, at one time seen mainly as a scourge to conservationists, is now politely termed regeneration. Although, by its very nature, it must often threaten wildlife habitat, there can be positive opportunities. An example is river restoration. During the 1960s, the engineers' solution to suburban flooding problems was often to enclose small rivers in bare concrete channels or even to bury them underground. We are now beginning to see this process reversed. One example is along the River Brent, a short way downstream from Brent Reservoir. For decades the river had run in a dank concrete channel through Tokyngton Park in the Stonebridge Estate, near Wembley Stadium. It offered little aquatic habitat, no refuges for fish fry and no reeds for damselflies, and fenced in on either side could hardly be considered a positive contribution to the landscape. With funding mainly from the European Community, the Environment Agency worked in partnership with Brent Council and the Groundwork Trust to reconstruct the channel, creating meanders with gravel shoals and hence a more natural landscape. A few waterside plants were added for immediate interest, and others will no doubt colonize before long. Similar projects have been carried out on the Ravensbourne and its tributary the Quaggy River in south-east London, and the Environment Agency is keen to reinstate naturalistic river channels where possible elsewhere.

Where land is at the highest premium, one option is green roofs. Often this takes the form of a carpet of low-maintenance succulent plants such as *Sedum*, although there are examples of living roofs based on a stony substrate and designed to be colonized by wasteland flora and to attract black redstarts. Roof gardens can offer respite for office workers in their lunch break through providing a small patch of 'living landscape' in the most built-up areas, and they also have potential as undisturbed nest sites for birds. A pair of black redstarts has already nested successfully on a green roof near Canary Wharf. However, they will never be a substitute for real countryside.

Castell's sites revisited

I will now return to the sites that were recommended for protection by this Society in 1946 and seek to trace their fate. It was not possible to visit all of them in the time available. However, many are documented in various reports, maps and databases held by English Nature and the GLA, and the Biological Records Centres for Surrey, Bucks. and Herts. provided information for the sites which lie outside the GLA boundaries. I was also able to gain a 'virtual' bird's-eye view of the whole area through aerial photographs on the web site, www.multimap.com. This enables one to focus in on individual sites, or even individual trees (as in the case of Mickleham's special sessile oak).

It is heartening to see that most of the sites recommended by Castell and his colleagues have remained as open green space. Many of them were designated as SSSI under the 1949 Act, and most, but not all, of these have retained SSSI status under more recent legislation. Excluding the Royal Parks, about 40 per cent of the sites on his list are currently designated as SSSI, although in many cases the designation applies only to a part of the site which holds particular interest. The protection of SSSI has improved further under the Countryside and Rights of Way (CROW) Act 2001, which gives English Nature greater powers over their management.

Three of the sites — Ruislip Woods, Richmond Park and Ashtead Common, have become National Nature Reserves. Some are also protected under the European Habitats Directive as Special Areas for Conservation, for example Box Hill and Headley Heath, Wimbledon Common, Richmond Park and Epping Forest. The major reservoirs and some of the associated wetlands in the Lee Valley have been designated as a Special Protection Area for Birds under EC legislation and there is another Special Protection Area for Birds on the reservoirs and gravel pits in the Colne Valley. These sites are also protected as wetlands of international importance under the Ramsar Convention. Kew Gardens has been designated as a World Heritage Site.

Many of the sites that did not meet the SSSI criteria have become recognized as Sites of Metropolitan or Borough Importance for Nature Conservation under the GLA system, or as County Wildlife Sites under systems applied by the surrounding county authorities. Organizations like the Royal Parks Agency and the Corporation of London take nature conservation very seriously on their land holdings and both employ excellent ecologists.

However, it has not all been good news. The largest areas of Castell's recommended nature sites that have been lost to built development are what is now Thamesmead, the western part of West Thurrock marshes, and an area on the western side of Loughton. Parts of several reservoirs have also gone, such as Kempton and Stoke Newington. The only site I could not find at all in my research was Roxford Copse, the proposed species reserve for winter aconites near Hertingfordbury, but since my presentation to the AGM our treasurer Mike West has informed me that the woodland probably survives at least in part, within a gravel works at Roxford. This site contains a fragment of an old woodland garden formerly known as Grotto Wood, complete with its winter aconites.

Inevitably motorways and built development have left their mark. Scratchwood lost a substantial chunk to the M1 in the 1960s and the North Circular was allowed to cut straight through an outlier of Epping Forest near Woodford in the 1970s. However, when the M25 came along, part of the road was placed in a tunnel to reduce its impact on the northern end of the forest. The M4 sliced through the Osterley estate, separating the northern farm fields from the park.

Staines Moor seems to have lost out quite badly. Part of the site was lost to the construction of Wraysbury Reservoir and later, other parts to the M25, although curiously Wraysbury Reservoir itself is now an SSSI. Beddington is currently going through a major upheaval, with gravel extraction and landfill, although it will be converted to a country park and nature reserve in the longer term. Fortunately the management are taking good care of the site's important population of tree sparrows, thanks to Derek Coleman and his team.

Many of the sites have of course changed in other ways, even if they are occupying a similar geographical area. At Epping Forest, the old beech pollards are struggling with traffic fumes, as well as enormous visitor pressure. At Totteridge Common, natural succession is silting up some of the ponds, and there are problems with an invasive alien, New Zealand pigmy-weed *Crassula helmsii*. At Syon Marsh, tunnels of chinese mitten crabs are eroding the river bank and the area has become very noisy both with the large number of passing

aircraft and the raucous cries of ring-necked parakeets *Psittacula krameri.* However, I was pleased to find Mickleham's special old pollarded sessile oak is still going strong.

Some conclusions

When I look back over all the positive things that have happened since I was first involved in nature conservation in London twenty years ago, I am sometimes amazed at how much has been achieved. Much of it — particularly on the larger open spaces — builds an ecological dimension onto the efforts of earlier generations and bodies such as The Commons and Open Spaces Society and the Metropolitan Public Gardens Association to save important areas of open land, like Epping Forest and Hampstead Heath. In the case of the Royal Parks it is of course the monarchy we have to thank in the first instance.

We have had our share of disappointments. I find it somewhat ironic that I could take you to Duke's Hollow in Chiswick and virtually guarantee to find a two-lipped door snail within ten minutes, and perhaps with a little more time also a German hairy snail *Perforatella rubiginosa.* Yet I've seen not seen a house sparrow in my back garden on more than one or two occasions in the past twelve months. We do not have all the answers.

Is there still a role for the LNHS?

With so much effort from professional bodies, it might be easy to consider the Society has played its part and can now leave others to look after nature conservation in London. However, I strongly believe that volunteers still have a role to play. The Society is now signed up as a member of the London Biodiversity Partnership and members are always welcome to join its working groups. It is unlikely that there will ever be sufficient public funding to pay for all the monitoring needed to track the status of even our commonest birds. One of the key 'quality of life' indicators in the Mayor's State of the Environment Report is bird populations as recorded through the Breeding Bird Survey. This relies crucially on volunteers for fieldwork, drawing on professional staff for the analysis. The BTO plans to increase the number of squares covered in London, which will improve our ability to track London's bird populations. They will need our help. John Edgington's (2003) fascinating study of ferns in central London has brought out changes in the distribution of several species over the past thirty years. This is of great interest in relation to air quality and shows how volunteer studies can contribute to the wider environmental picture.

Volunteers still have a role as watchdogs. It was Helen Baker's survey that first alerted us to the decline in house sparrows in London and led to the establishment of a house sparrow working group in the London Biodiversity Action Plan. Volunteers can also add to the records of the GLA's habitat survey. A local naturalist who visits regularly may come across an uncommon plant that could be missed in routine survey, especially inconspicuous species or those that are seasonal in appearance. In 2002, Brian Wurzell's amazing find of the national rarity, creeping marshwort *Apium repens*, on Walthamstow Marshes led to changes in management of the SSSI.

One of the most valuable things we could do is to encourage more people to take a serious interest in London's natural history, through learning to identify plants and animals. Although broader environmental issues may be well covered in educational programmes, few schoolchildren now learn to recognize individual species of plants and animals — identification skills have somehow come to be regarded as less 'cool'. This is a major challenge.

Further changes at national level

As I was preparing my talk for this AGM, the Government released the Haskins report (Haskins 2003). After more than fifty years of working with

separate organizations for landscape with amenity on the one hand and nature conservation plus scientific research on the other, this report recommends combining parts of the work of the Countryside Agency with English Nature, plus the Rural Development Service of the Department for Environment Food and Rural Affairs, into a single body which will oversee protection and management of the countryside. This could have far-reaching consequences for nature conservation and public enjoyment of the countryside. We will await the outcome with interest.

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Book review

Shieldbugs of Surrey. Roger D. Hawkins. Surrey Wildlife Trust. Pirbright, Woking. 2003. 192 pp. 24 col. pl. ISBN 0 9526065 7 7. Available direct from Atlas Sales, Surrey Wildlife Trust, School Lane, Pirbright, Woking GU24 0JN, £15 plus £2.40 p. & p.

This is the eighth volume in this series on the wildlife of Surrey, based around a set of tetrad distribution maps, in this case of records made since 1970. Older records are mentioned where appropriate, but these are not mapped.

This is the first volume that treats of a group of animals that has not yet achieved popularity either traditionally or by being a small group of large and conspicuous diurnal insects that have attracted the attention of conservationists or of ornithologists with less to do in high summer. The book covers the biggest and most conspicuous of our terrestrial plant bugs, including some families related to the shieldbugs. Starting from a simple statement as to what similar insects are not shieldbugs, the true shield bugs can nearly all be identified using a hand magnifier and the simple, diagrammatically illustrated keys provided. The introduction is written for the non-entomologist.

Text on the individual species concentrates on recognition, habits and the interpretation of the bar charts of seasonality of the adults and early instars, often in the light of the author's experience of rearing the bugs. Many species are shown to be dependent on fruits and seeds for their development. This text is extended by anecdotal description of the author's field insight into habits and life cycles of these bugs.

The excellent colour plates illustrate the adult bugs and a selection of their often distinctive early instars, but given a shieldbug nymph, it would not be easy to identify it (and so to know what to feed it on) from this book. It is also a pity that eggs, the stage of a shieldbug's life cycle that is most likely to catch the attention of a lepidopterist, have not been actively studied by the author. The eggs of only four species are illustrated.

Be warned that if you buy this excellent book distilled from thirty years of field experience the practical advice given will have you hooked on rearing shieldbugs for yourself.

RAYMOND UFFEN

The Fulham oak in London

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'Today Lucombe and Fulham oaks are becoming increasingly rare . . . . Unfortunately few nurseries grow plants vegetatively now, and in time the originals may become extinct' (More and White 2003)

Summary

London's own Fulham oak, *Quercus* × *crenata* (*Q.* × *hispanica*) 'Fulhamensis', once the pride of its parks and gardens, has sunk into obscurity. Few specimens are positively identified, many being classified as Lucombe oaks. Like the latter, it is a hybrid derived from *Q. cerris* Turkey oak and *Q. suber* cork oak. Habit and foliage are distinctive, but both are subevergreen and tend to have corky bark, so they are often confused. These hybrids need to be propagated through grafting, as the seeds do not breed true. However, during the nineteenth century many non-typical specimens were raised from their acorns, and grew into mature trees. Several of these survive, scattered throughout London, adding to current confusion. Nomenclature and descriptions have from the first provided further grounds for misunderstandings. These problems are briefly examined. A number of mature specimens, known or believed to be Fulham oaks, are listed, but DNA testing is needed to determine which are derived vegetatively from the original tree.

Origins

Both the Lucombe and the Fulham oak originated during the early 1760s. The former was raised in the nursery of Lucombe, Pince & Co. near Exeter, where the parent trees stood close to each other. Lucombe sowed acorns from the Turkey oak, which had by chance been fertilized by pollen from the cork oak. 'When they came up, he observed one amongst them that kept his leaves throughout the winter; struck with the phenomenon, he cherished and paid particular attention to it, and propagated, by grafting, some thousands from it' (Holwell 1772). No such precise information exists regarding the original Fulham oak, although it has from the first been associated with the Fulham nursery in West London.

The Fulham nursery

The Fulham nursery was founded before 1700 by William Gray. He died in 1729, and the nursery was taken over by his son Christopher, an associate of such notable plantsmen as Philip Miller of the Chelsea Physic Garden, and Peter Collinson, who had a botanic garden at Mill Hill. As a young man Christopher had acquired plants from Bishop Compton's famous collection at Fulham Palace, on the Bishop's death in 1713. His nursery dealt in plants of finest quality, and was patronized by such connoisseurs as Horace Walpole of Strawberry Hill and Dr Fothergill of West Ham. It was situated towards the western end of the New King's Road, in part on the north side but mainly between it and Hurlingham Road (then called Back Lane), in all about twelve hectares (thirty acres).

Gray died in 1764, and the nursery passed to the Burchell family, who owned land and property in the area. About 1810, while retaining the freehold of the land, they leased the nursery to Whitley, Brames and Milne. By 1833, all these becoming aged or infirm, Whitley took on Robert Osborn as partner. Whitley died in 1835 but the business continued for some time to trade under their two names. Then it became 'Osborn and Sons'.

It was at this period that Loudon (1838*a*,*b*) provides a glimpse into the nursery, with its 'magnificent specimen' of the Fulham oak, then 75 feet (25m) tall. He had 'portraits' drawn of this tree (1838*a*), one showing it in November 1836, with full foliage, and the other in May 1837 (Figure 1). The latter is almost leafless, but he comments that, in mild winters, the leaves do not begin to drop until March or April. An old employee of the nursery, 'who remembers the tree above 45 years, says that it always went by the name of the Fulham oak, and that he understood it to have been raised there from seed'. They examined the base of the tree and failed to find any sign of grafting.

FIGURE 1. The original tree in the Fulham nursery, 1 May 1837 (Loudon, *Arboretum et Fruticetum Britannicum* 1838*b*, 7: 278b).

However, not long after, the following note by 'W.K.' (1842) was published in the *Gardeners' Chronicle*: 'The magnificent sub-evergreen oak, growing in the nursery of Messrs. Whitley and Osborn at Fulham, and known as the *Quercus cerris fulhamensis*, was supposed to be a seedling tree, and the original one of the variety, but above two years since, it emitted a small twig an inch above the ground, proving it had been grafted or budded on one of the native species.' Many years later, the *Gardeners' Chronicle* published an article by 'Zed' (1877), which included a further comment on the subject, stating that 'there is unmistakable evidence of its being a grafted plant, the union being clearly visible in the bark a short distance above the ground. A small sucker from the stock near the ground has sprung up, and as far as the appearance of the leaves go seems to be *Quercus pedunculata*' [*Q. robur*].

The article was mainly devoted to a glowing description of the Fulham nursery and its contents, accompanied by an idealized illustration of the original Fulham oak (Figure 2). In fact, the nursery was then not far from closure. Thomas Osborn had died in 1873, soon to be followed by other members of the family. Meantime, Burchell's lease of the land was running out. In 1882 the property was sold.

FIGURE 2. The Fulham oak shortly before closure of the nursery (*Gardeners' Chronicle* 1877, **2**: 145).

Shortly before the sale was completed and the land cleared, George Nicholson of Kew visited the nursery. On 21 September 1881 he collected leaf specimens from the old Fulham oak, and also shoots of *Q. robur* common oak, still sprouting from the grafting stock. These are preserved in Kew Herbarium.

New housing soon obliterated most traces of the nursery site, but two older buildings on the north side of Hurlingham Road remain. One is Italian Villa (no. 62), built in 1809, and the other is The Vineyard (no. 76), an older property standing in its own grounds, which extend back to Bettridge Road. Apparently nothing remains of Ivy Cottage, which lay about halfway along a private path between Hurlingham Road and New King's Road. This modestly-named residence had evolved into an elaborate villa 'in the gothic style, and consists of two stories. The entrance at the east end somewhat resembles, as to its exterior, the towers of the Old Temple at Paris' (Faulkner 1815). The interior was adorned with stained glass and 'gothic' murals. In 1818 it was bought by the Burchells and let to various tenants, eventually becoming the Osborn family home. In 1853 it was noted that 'close to Mr Osborn's cottage stands the original Fulham oak, a noble tree of fair proportions, and though upwards of 100 years of age, as hale and vigorous as could possibly be desired . . . . We also remarked a very fine example of the cork-tree (*Quercus suber*) in excellent condition, though doubtless very old' (Anon. 1853). Much earlier, Faulkner, referring to the 'Fulham Nursery and Botanic Garden', had noted this too: 'The cork-tree, *Quercus suber*, was introduced here at a very early period, and has for many years perfected its acorns'.

To the south of the Fulham nursery, across Hurlingham Road (Back Lane) and reaching to the Thames, the land was occupied by several properties. In due course one of them, Hurlingham House, took over the whole of this area and in 1869 the exclusive Hurlingham Club was founded as a centre for fashionable sporting activities. The grounds were thus secured from building developments. In 1946, a portion was acquired for public use and Hurlingham Park was established.

Minimal disturbance of the site has resulted in the survival of a few trees which must have originated in the Fulham nursery. Four appear to be true Fulham oaks. Two are within the Hurlingham Club precincts, close to the mansion. Another is enclosed within the courtyard of Hurlingham Lodge (formerly Edenhurst, built 1856), but is visible from Broomhouse Lane. The fourth is to the left of the entrance to Hurlingham Park from Broomhouse Lane. There are two other old oaks to the right, but deciduous and with untypical foliage — possibly seedlings from the original Fulham oak.

An interesting local feature is the site of the old 'drawdock' at the top of Broomhouse Lane. From here a ferry used to cross the Thames to Wandsworth. This nearby facility must have provided the nursery with useful access to clients up, down and across the river.

Birthplace of the Fulham oak?

Since the 'original tree' in the Fulham nursery proved to have been grafted, the source of the original seedling is the subject of speculation. A link between the Exeter nursery and the Fulham oak was suggested by Robert T. Pince, William Lucombe's grandson. In an account published in Loudon's *Gardener's Magazine* (Pince 1835) he described a century-old tree at Mamhead, not far from Exeter. He found it to be very like the Fulham oak. 'The leaf, the bark, the habit and contour of the two trees are so very similar, that, if the tree at Mamhead be not the *true* Fulham oak, it so nearly approaches to it that I am unable to distinguish any difference'. However, he admitted to having compared the foliage of this veteran with that of very young nursery trees.

Elwes (Elwes and Henry 1910) visited Mamhead in search of the tree described by Pince but found no trace of it. 'We can only conjecture that the Fulham oak, like a large *Q. lucombeana*, which grew beside it in the Fulham nursery, was procured from Lucombe. Different in foliage and in fruit from the original Lucombe oak, it is possibly one of its earliest seedlings, of which no record was kept'.

It is surely also possible that the seedling occurred in the Fulham nursery and was grafted to form the famous tree. There may be a clue in the fact that the Exeter nursery normally propagated the Lucombe oak and its subvarieties by grafting on *Q. cerris,*while in the Fulham nursery 'the stock ordinarily used is the common oak' [*Q. robur*] (Loudon 1838*a*). Whatever the source of the original seedling, from the beginning the Fulham oak was firmly associated with the Fulham nursery, where it was propagated by the thousand and widely distributed. Unfortunately, uncertainties about its source have led to taxonomic ambiguities and confusing name-changes.

Descriptions, names, authorities

The Latin name of the hybrid *Quercus cerris* × *Q. suber* is *Quercus* × *crenata* Lam., according to the second edition of Stace's (1997) *New flora of the British Isles*. This shows only the English name for the Lucombe oak, and does not mention the Fulham oak. They are usually distinguished as 'Lucombeana' and 'Fulhamensis'.

From *Q. suber* cork oak, both inherited subevergreen foliage and variable degrees of corky bark, but they differ in leaf-form. The leaves of the Fulham oak are ovate, about 8 cm long × 4 cm wide, with 6–8 teeth on each side. The leaves of the original Lucombe clone are longer, about 12 × 5 cm, and irregularly lobed while those of its subvar. *crispa,* raised in 1792 and widely distributed, are similarly lobed but smaller (Figure 3).

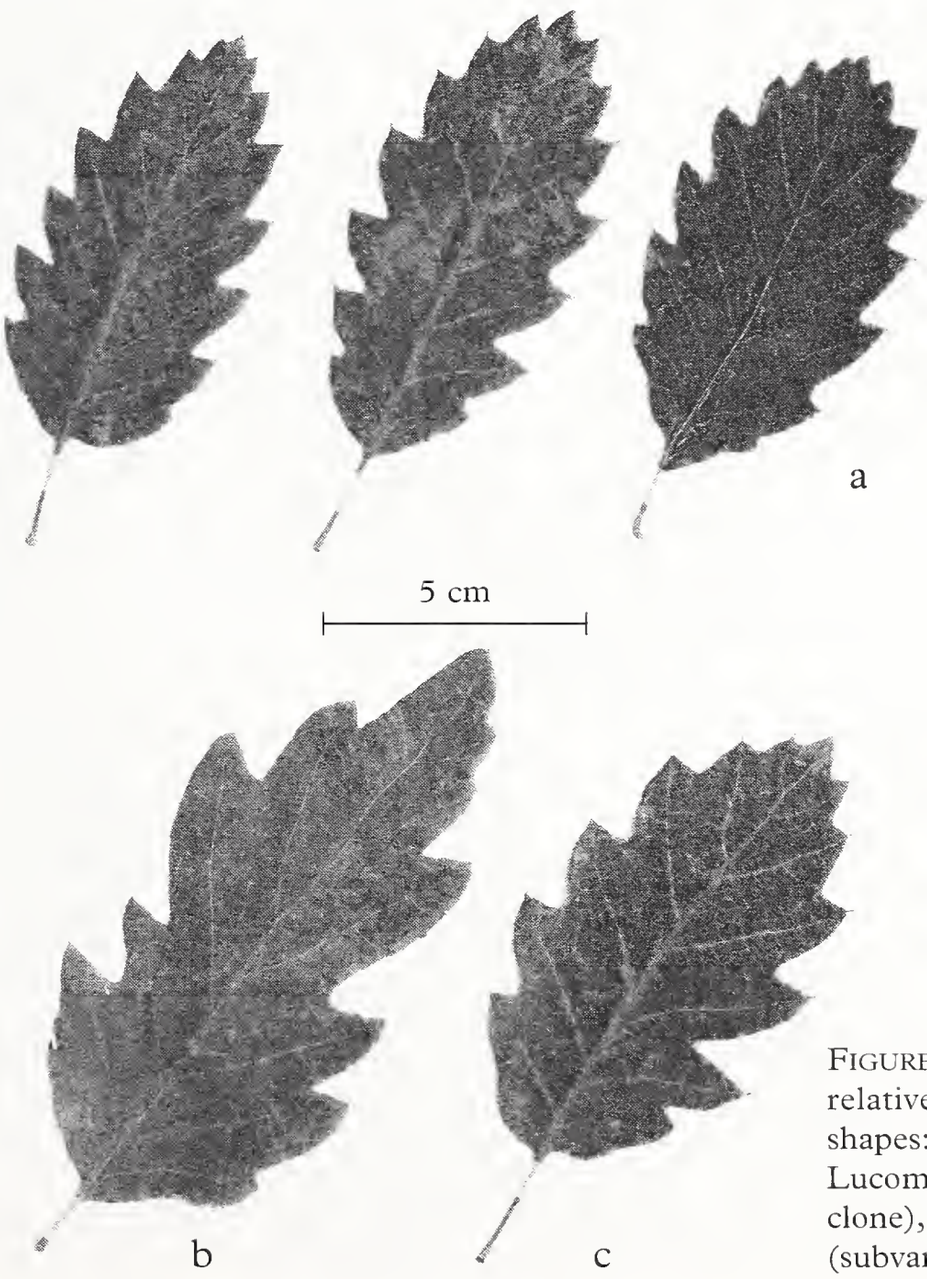

FIGURE 3. Indications of relative leaf sizes and shapes: a Fulham oak, b Lucombe oak (original clone), c Lucombe oak (subvar. *crispa*).

The first published reference to these is that of Lamarck (1783). He describes three hybrid oaks of English origin, then growing in the Trianon royal gardens at Versailles. One was a Lucombe oak , commonly and mistakenly known as 'Le Chêne de Gibraltar'. Another was a Fulham oak, referred to as 'Le Chêne à feuilles d'Ægylops' (*Q. aegilops* Valonia oak is a south European species also with ovate toothed leaves, but larger and harder textured than those of the Fulham oak). The third was a Turner's oak (Wiltshire and Coombes 2001).

C. H. Persoon (1807) in *Synopsis plantarum* listed the Fulham oak as *Quercus ægylopifolia*.

P. W. Watson (1825) gave the name as *Quercus cerris* var. *dentata*, with 'Toothed-leaved Turkey oak (Fulham oak)' as common form. He described the leaves as ovate-elliptic, with margins 'largely dentate (not lobed)', and illustrated them (Figure 4). He gave details of the Fulham nursery tree, then 60 feet tall.

R. S. Sweet (1827) was the first to use the name *Quercus lucombeana* for the Lucombe oak. For the Fulham oak, he followed Watson with *Quercus cerris hybrida* var. *dentata*.

About 1830, the Exeter Nursery raised a new form of the Lucombe oak and named it 'var. *dentata*'. It was 'scarcely distinguishable from the original Lucombe oak' (Elwes and Henry 1910) and does not seem to have become popular, but the name caused confusion with that of the Fulham oak.

Loudon (1838) renamed the Fulham oak *Quercus cerris fulhamensis*, preferring it to Watson's name of *Q. cerris* var. *dentata*, 'because the latter will apply equally to several varieties, and is as characteristic of the Lucombe oak as of the Fulham oak'. He thus disposed of an epithet which clearly identified the distinctive toothed character of the leaves. Making matters worse, he pronounced the Lucombe and Fulham oaks to be alike in foliage. Reputedly, Pince of the Exeter nursery 'never forgave Mr Loudon for writing the Lucombe tree as a synonym of *Quercus cerris fulhamensis*' (Napper 1902).

D. A. Webster (1888), early in his London career, published a brief note in the *Gardeners' Chronicle* on 'Ornamental varieties of oak', including the Lucombe and Fulham oaks. His opinions are clearly based on Loudon's of fifty years before, including the statement that the leaves of the Fulham oak 'in shape and size are a counterpart of those of the Lucombe form'. Webster went on to manage Regent's Park from 1896 until his retirement in 1920, and also had a general interest in trees throughout London. His knowledge is summed up in his book *London Trees* (Webster 1920). In it, he describes Lucombe and Fulham oaks as 'excellent for planting in London, where many specimens of 70 feet and upwards are to be seen'. Considering that he was so familiar with both, it is surprising that, in describing them, he once again paraphrases Loudon's mis-statement. 'Except in habit, the Fulham oak can scarcely be detected from the Lucombe variety, the leaves being identical in shape, form and texture.'

H. J. Elwes and A. Henry (1910) included a wide-ranging study of Lucombe and Fulham oaks in their great work *Trees of Great Britain and Ireland*, referring to the former as *Quercus lucombeana* and treating the latter as its var. *fulhamensis*, owing to the lack of evidence regarding its origin. They recognized the distinctive features of each form, including those of foliage. As well as examining the finest specimens in Britain and Ireland, they checked out examples of 'Lucombe oaks' which had occurred spontaneously in southern Europe — a description of one, *Q. pseudosuber* Santi, found near Florence, had been published at Pisa in 1795.

Alfred Rehder (1919) 'placed the Lucombe oaks as varieties of *Q.* × *hispanica* Lam., the name he used for the spontaneous hybrids between *Q. cerris* and *Q. suber*. He gave the range of these hybrids as from Southern France to the Balkan Mountains, and makes no reference to Spain or the Iberian Peninsula' (Mitchell 1994). It was not relevant to the English-raised specimens which Lamarck saw in the Trianon gardens, but the name passed into common usage. Mitchell denounced it as 'hopelessly invalid'. For the Fulham oak, Rehder referred back to Watson and devised the combination *Q.* × *hispanica dentata* (Wats.) Rehd.

FIGURE 4. The Fulham oak. From a coloured plate depicting botanical features (Watson, *Dendrologia Britannica* 1825, **2**: 93).

Ironically, in the first edition of Stace's (1991) *New flora of the British Isles* and in Kent's (1992) *List of vascular plants of the British Isles*, though '*Quercus* × *hispanica*' was declared invalid, it was surprisingly replaced with *Q.* × *pseudosuber* Santi. This was soon altered, and in the second edition of Stace (1997) it was replaced by *Q.* × *crenata* Lam. This is also the form used in the *New atlas of the British and Irish flora* (Preston et al. 2002). However, '*Q.* × *hispanica*', having been in common use for some eighty years, is likely to remain the most recognizable name for some time to come.

A selection of London's Fulham oaks

It is nearly two and a half centuries since the initial seedling was raised. From the original grafted tree thousands of clones were propagated, and these in turn became sources of further propagation. During the nineteenth century, the Fulham oak, subevergreen and corky-barked, was a favourite choice for London parks, both private and public. Connoisseurs sometimes planted it in contrast to a Lucombe oak, to show off the differences between them of form and foliage.

Now only a remnant survives of trees planted at that period. Most are in parks with public access. A few have become isolated by changes in land use.

The planting dates of old trees, such as those listed below, are rarely recorded. Their ages have to be estimated by any available means. Some are associated with the establishment of properties or parks, the erection of buildings, events, notable people, illustrations and published references. Estimates can be roughly checked against girth dimensions of the trees. On average, growth rate is 2.5 cm (1 inch) per year, subject to various factors such as species, age, location, etc. Dimensions shown here (almost all provided by Owen Johnson) consist of height in metres, and girth in centimetres at 1.5 m unless otherwise indicated. These records were made during the period 2001–2004.

A place of honour at the head of this list is given to three magnificent trees, outstanding for their size, age, condition and historic settings. One is in the grounds of Chiswick House, and the other two in West Ham Park.They have been confirmed as Fulham clones by DNA tests at Michigan State University (Plovanich-Jones et al. 1999).

Chiswick House. London Borough of Hounslow. This architectural gem was built during the early eighteenth century for the Third Earl of Burlington (1694–1753), and surrounded by sumptuous gardens. After Lord Burlington's death the property passed to the Dukes of Devonshire. The grounds were modified from time to time, including by the Sixth Duke (1790–1858), a horticultural enthusiast, and his head gardener Joseph Paxton. The massive, multistemmed Fulham oak, 16 × 434 at 0.4 m, is a striking feature of the park, but its planting date is apparently unknown.

West Ham Park. London Borough of Newham. Formerly the grounds of Upton House (demolished), home of John Fothergill (1712–1780), medical doctor, philanthropist and collector of rare plants. During his time this was a botanic garden which rivalled Kew. After his death the estate was sold, and remained in private ownership until opened as a public park in 1874. It contains two superb wide-spreading Fulham oaks, 12 × 380 at 0.3 m and 11 × 302 at 0.8 m, whose evergreen branches reach to the ground. They resemble the Chiswick House tree, although not quite as large. No planting date has been traced.

The remaining sites follow in alphabetical order.

Abney Park. London Borough of Hackney. A cemetery established in 1840, at first planted as an arboretum by Loddiges' nursery. Long overcrowded with burials and overgrown with vegetation, it is now a nature reserve in which some very old trees remain. There are remnants of an 'oak grove', including two Fulham oaks, the larger 19 × 295. The girth of the other is 240 cm.

Ashburton Park. London Borough of Croydon. 'The park, with some good trees . . . belonged to an older mansion known as Stroud Green House', demolished in 1927 (Cherry and Pevsner 1983). Near the pavilion is a fine Fulham oak, 14 × 352.

Crystal Palace Park. London Borough of Bromley. Laid out in 1854 when the Crystal Palace was moved from Hyde Park. There are two old Fulham oaks on the north-east boundary embankment near Fisherman's Gate. One, of girth 330 cm (EW), is a fine tree with good foliage. The other is in poor condition.

Hampstead Heath. London Borough of Camden. A Fulham oak, 21 × 380 at 1.1 m, forms part of a pretty scene by the pond in the Vale of Health. A photograph of *c.*1905 shows that it was already a picturesque feature at that time. Perhaps it was planted around 1871, when the Heath was acquired for public use.

Hurlingham Park. London Borough of Hammersmith & Fulham. Established in 1946 on former private lands. Previously, the nearby Fulham nursery had provided miscellaneous trees for the boundary along Broomhouse Lane. This is shown by the presence of three old oaks, two of which are untypical and deciduous, apparently raised from Fulham acorns. However, the third, on the left of the entrance from Broomhouse Lane, has toothed leaves which are retained through winter, and appears to be a true Fulham oak. Its girth is 300 cm (EW).

Kennington Park. London Borough of Lambeth. Opened in 1854. Webster (1920) commented: 'There are many hybrid oaks, the variety *Fulhamensis* occurring in most parts of the grounds, one side of a square containing about twenty-five of these trees, which average 30 feet in height'. During the Second World War this park suffered heavy bombing, which must have destroyed these trees. Today, a line of nine matching Fulham oaks, on average 13 × 214, partially replaces them and is a striking feature of the park.

Kew Gardens. London Borough of Richmond. A specimen in the oak collection is 16 × 198. Two larger Fulham oaks, now gone, believed to have been grafts from the original tree, once stood near the northern boundary of the Gardens (Elwes and Henry 1910).

Muswell Hill. London Borough of Haringey. A tree 19 × 248 by tennis courts in Methodist church grounds, Pages Lane, formerly the property of neighbouring nineteenth century North Bank House.

Regent's Park. London Borough of Camden. St Katharine's Lodge, near the eastern edge of the park, was built in 1825 and had landscaped surroundings. 'There are several rare and interesting trees in these grounds, chief of which is a giant specimen of the Fulham oak, with a trunk girth of 7½ feet at a yard up and a total height of 80 feet. The bark is remarkably thick and cork-like' (Webster 1920). Age and weather have since taken their toll of its height, and perhaps it also suffered in 1944 when bombs destroyed the Lodge. This forked tree is now 16 × 324 at 0.7 m.

Roehampton. London Borough of Wandsworth. A particularly fine Fulham oak 25 × 380, a 'Great Tree of London', stands at the junction of Danebury Avenue and Tangley Grove in the Alton Estate (Figure 5). Now surrounded by modern housing, it is a survivor from an earlier wealthy estate.

Syon Park. London Borough of Hounslow. This historic collection of trees includes two Fulham oaks, 26 × 368 and 23 × 302, located north of the lake. Measurements of one, 'probably a graft from the original Fulham oak', were published by Elwes and Henry (1910) as 81ft × 9ft 4in (25 × 284).

Victoria Park. London Borough of Tower Hamlets. This spacious east London park was established in 1845 but Victoria's only visit to it was in 1873. Perhaps the Fulham oak, girth 237 cm (EW), near Queen's Gate, was planted to commemorate the occasion (though she actually entered and departed via St Agnes Gate).

West Wickham. London Borough of Croydon. A magnificent tree 23 × 427, isolated on the grass verge of Wickham Road, just west of the junction with Monks Orchard Road.

'Bastard oaks'

Although seed from *Quercus* × *crenata* hybrids does not breed true, it used to be sown in hopes that marketable subvarieties might result. William Napper (1902), recalling his apprenticeship at the Exeter nursery during the late 1860s, wrote that it was one of his duties to gather fallen Lucombe acorns, 'which invariably produced what we knew as bastard oaks'. However, three subvarieties — *crispa*, *suberosa* and *incisa* — had been raised there in 1792, followed in 1830 by *dentata* and *heterophylla*.

FIGURE 5. Roehampton Fulham oak, 2002, a 'great tree of London'. *Photo: Elinor Wiltshire*

Successes were rare but no doubt encouraged other growers to keep trying. Promising seedlings might occasionally emerge, to be planted out at suitable sites. This would account for the presence in London of various non-typical 'Lucombe' and 'Fulham' oaks, perplexing to recorders. Their parentage may be indicated by at least some winter foliage, but others are deciduous. Leaves are usually of non-standard forms.

There is an example of 'Fulham' type near Marlborough Gate in Kensington Gardens, a compact old tree with subevergreen dentate foliage. Maynard Greville measured it as '*Quercus lucombeana*' in 1954, noting that 'Leaves still on March 12th'. Its current dimensions are 22 × 285, Peter Bourne, 2003). DNA testing (Plovanich-Jones 1999) showed that it was not true Fulham, nor did it match any other variants. Another Kensington Gardens oak (21 × 308), near the west end of the Flower Walk, also has dentate leaves but is deciduous.

A similar situation applies at other London sites. Elwes and Henry (1910) commented on 'a number of trees at Syon, which appear in the old catalogue under various names, which resemble the Lucombe or Fulham oak in their leaves and subevergreen character, but which are not typical of either in their habit. They are most probably seedlings from the Fulham nursery'.

It is sometimes hard to tell from appearances if trees are 'true' Lucombe or Fulham oaks, or if they are 'bastards'. In doubtful cases, DNA tests can settle the matter. Increasingly, detailed recording of London trees is taking place, and accurate determination of such specimens is of value.

Conclusion

Distinguishing between various forms of *Quercus* × *crenata* hybrids, which share subevergreen foliage and corky bark, is often difficult. The original form of Lucombe tended to be upright with a central stem, and was clearly separable from Fulham oaks with their broader crowns. However, in 1792, the popular *crispa* subvar. was raised from a Lucombe acorn, and, with its spreading crown and shorter leaves, sometimes superficially resembles the Lucombe oak.

The trees listed above vary in appearance, age and history, but could all be good Fulham oaks. However, only DNA testing can confirm with certainty which are derived through vegetative propagation from the original tree. Identification of such specimens would help to guarantee perpetuation of this notable hybrid, which has adorned London's landscapes for nearly two and half centuries. Otherwise its future is precarious.

Acknowledgements

I am grateful to Allen Coombes for facilitating DNA tests carried out at Michigan State University by Anne Plovanich-Jones and colleagues, and for commenting on a draft of this paper. Also to Owen Johnson, who drew attention to unfamiliar sites and generously contributed dimensions of almost all the trees mentioned. Sylvia Reynolds read a draft of the paper and made helpful suggestions. Henry Girling kindly provided copies of Maynard Greville records. Assistance was given on many occasions by the Botany Library staff at the Natural History Museum.

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Book review

Arable plants — a field guide. Phil Wilson and Miles King. WILD*guides* Ltd., Old Basing, Hampshire. 2003. 312 pp., 88 coloured plates, numerous line drawings. £15 hardback. ISBN 1 903657 02 4. Accessible in electronic format via the WILD*guides* website: www.wildguides.co.uk

The title of this book is rather misleading. It is certainly not a 'field guide' as generally understood, because many common arable plants are not covered. It is essentially a book about *rare* arable plants. It would have helped if this had been made clear in the introductory text; instead we have to turn to page 50, to discover that the plants covered are those that are 'listed in the *British Red Data Book (Vascular plants), Scarce Plants in Britain*, and the *UK Biodiversity Action Plan*. A few additional species are included which are in serious decline'. Given this important clarification, the book, which was produced in collaboration with English Nature, gives a good introduction to 'the group of plants showing the steepest decline of the British flora over the last 25 years'.

Three short introductory chapters cover the origins and spread of arable plants and their basic biology. This is followed by the largest section of the book which is devoted to an account of around a hundred declining arable species. For each of these there is detailed information about identification, habitat and soil preference, management requirements, life cycle, and the reasons for its decline. A small distribution map, based on the *New Atlas of the British and Irish Flora*, is also included. Each chosen species has a full-page photographic portrait, which often includes an inset picture showing close-up details. The quality of these photographs is generally high. There are also helpful line drawings of critical features. The plants are arranged alphabetically by English name, so that although the five species of poppy, and four species of cornsalad are found together, the seven umbellifers are widely separated and difficult to locate. By way of compensation, a later section draws family members together and provides diagnostic keys. Nine of our ten native fumitories have full-page profiles; the tenth, white ramping-fumitory *Fumaria capreolata* has, rather oddly, been relegated to the family key section, where an attempt is made to provide a tabulated key to this difficult group. Unfortunately, this and other family keys contain mistakes. In the key to the Asteraceae, for example, the scientific names of corn marigold and corn chamomile have been transposed and, more seriously, we are erroneously informed at one point in the key, that scented mayweed *Matricaria recutita* has 'broad chaffy scales', and then, correctly, (under 'key differences') that there are 'no chaffy scales present'. In the 'Identification key to arable grasses' it is incorrectly claimed that Italian rye-grass *Lolium multiflorum* has 'no awns'. In the key to the Scrophulariaceae it is stated that the 'seed shape' is diagnostic in separating several species of *Veronica*, when what is meant is the shape of the capsule. These, and other unnecessary errors, detract from what might otherwise have been a useful section of the book.

Eight profiled species are now thought to be extinct in the wild in Britain. I felt that some of these, for example the small bur-parsley *Caucalis platycarpos*, which has not been seen since 1962, might have been given less comprehensive treatment, so that room could have been found to include other extant species. I was disappointed, for example, to find that annual knawel *Scleranthus annuus*, which heads the list of native species showing the greatest relative decrease in the BSBI *New Atlas*, was not included — perhaps because it occurs in other habitats as well?

Towards the end of the book there is a very brief account of the bryophytes associated with arable fields. This is followed by a discussion of the current threats (including the use of genetically modified crops), and opportunities (agri-environmental schemes, etc.) facing arable plants today. There is a chapter on management for plant conservation, which contains some useful practical guidelines, and the book ends with ten 'case studies'. These outline some encouraging examples of sites throughout Britain where rare arable plants have been successfully managed and allowed to flourish.

This is an instructive and enjoyable book in many ways, but do not expect to use it as a conventional field guide — too many widespread arable species are omitted entirely. For example, on a recent visit to a particularly rich arable field in south Hertfordshire, being sympathetically managed for the benefit of its flora under a Countryside Stewardship Scheme, I recorded around sixty species (including annual knawel!) growing amongst the barley. Only nine of these were covered in the main illustrated section of the book. A further ten were listed in an appendix covering 'Some commonly occurring arable plants', where the reader is directed to the family key section about which, as indicated above, I have some reservations. None of these commonly occurring plants is listed in the main index, so it is difficult to discover which plants have been included and which left out.

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'Very rare and distinct' form of Lucombe oak in Abney Park

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Summary

Abney Park in Stoke Newington, north-east London (London Borough of Hackney), was established as a cemetery in 1840. The grounds were initially beautified with rare trees and shrubs by Loddiges' famous nursery, based in nearby Hackney. The site, long since filled with burials, is now overgrown by vegetation and is protected as a nature reserve. In the midst of this, some trees from the original planting survive, including remnants of an oak grove. Among these is a specimen of the very rare *Quercus* × *crenata* (*Q.* × *hispanica*) 'Lucombeana' subvariety *heterophylla*. This was propagated from a seedling of the Lucombe oak, raised in Lucombe's Exeter nursery in 1830.

Background

The early history of the Lucombe oak is known very precisely. It is a hybrid between *Quercus cerris* Turkey oak and *Q. suber* cork oak, which occurred spontaneously about 1762 through cross-fertilization in the Exeter nursery of Lucombe, Pince & Co. A remarkably vigorous and almost-evergreen seedling resulted, which in due course was propagated by grafting and widely distributed. The Lucombe oak became recognized as one of the finest ornamental trees in Britain.

Inspired by the success of the Lucombe oak, nurseries experimented with growing its acorns. With hybrid parentage they could not breed true to the original, but might randomly produce some exotic variant. In 1792, the younger Lucombe raised three 'subvarieties' of the Lucombe oak, named *crispa*, *suberosa* and *incisa*. In 1830, two other forms were raised in the Exeter nursery — *dentata* and *heterophylla* (Loudon 1838).

Quercus × *crenata* 'Crispa' is a picturesque, corky-barked, virtually evergreen tree, which proved popular and remains in cultivation. Of the other subvarieties, the small-leaved *suberosa* seems to have passed out of favour, while the foliage of *incisa* and *dentata* hardly differed from the original Lucombe oak. For connoisseurs, there remained 'the very rare and distinct' *heterophylla* (Mitchell 1994) (Figure 1).

George Loddiges must have relished the appearance of the new subvariety, distributed from the Exeter nursery from about 1837. It coincided neatly with the establishment of the Abney Park arboretum, adding to a display which for some years 'was unrivalled as the largest collection of named trees and shrubs in Britain outside of Loddiges' Nursery' (Solman 1995: 61-62).

In time, Abney Park became filled with burials and overgrown by vegetation. It was closed in 1974, purchased by Hackney Borough Council, and is now a nature reserve. Its long slow decline has protected a few of George Loddiges' trees — among them the rare *heterophylla* subvariety of the Lucombe oak.

Description

Loudon (1838) published particulars of the five Lucombe subvarieties, including illustrations of their differing leaf-forms. Of the brand new *heterophylla* there was only a brief comment, that it had 'very variable foliage'. Fortunately, there are also illustrations of three specimen leaves, which show their distinctive character very clearly (Figure 2). It was left to Elwes and Henry (1910) to put these into words, as follows: 'Leaves oblong-lanceolate, 3 to 4 inches long, 1 to

1.5 inches broad, acute at the apex, irregularly and deeply lobed, with the middle part of the leaf occasionally reduced to a narrow fringe on each side of the midrib'. The deep lobes and narrow fringes are characteristic features.

FIGURE 1. Lucombe oak subvariety *heterophylla* — specimen from the tree in Abney Park.

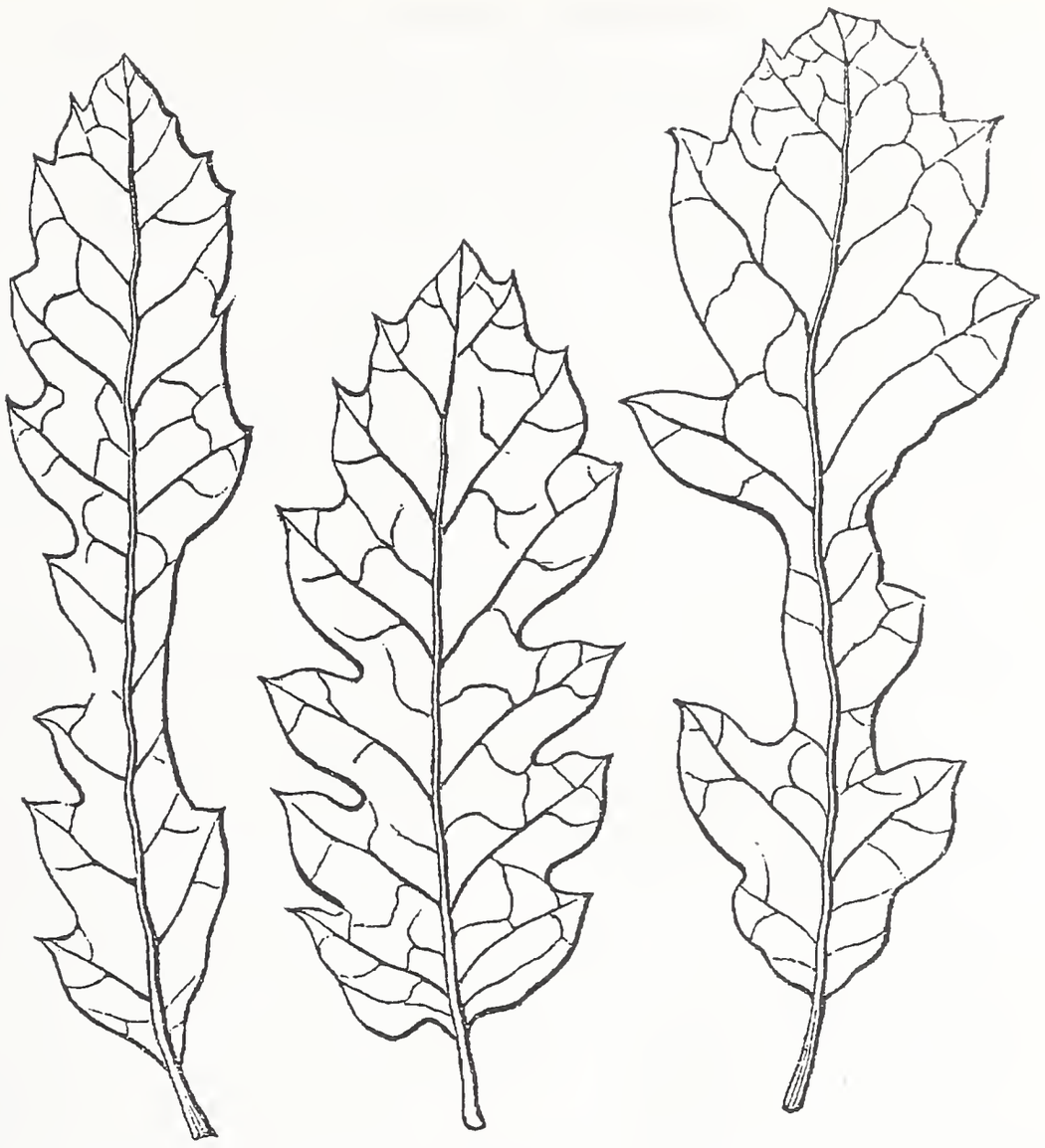

FIGURE 2. Lucombe oak subvariety *heterophylla* — leaf illustrations (Loudon, *Arboretum et Fruticetum Britannicum* 1838, **3**: 1859, fig. 1719).

Another conspicuous feature of this tree is its almost evergreen character. Robert Pince, William Lucombe's grandson, reported to Loudon that the subvarieties appeared to be closer to true evergreen than their parent tree — 'in the month of May, when the young leaves burst forth, the old ones . . . are still quite fresh and green'.

Present status

If there are living examples of *heterophylla* in Britain, other than the Abney tree, they have yet to be traced. A few old specimens labelled *heterophylla* are preserved in the Herbarium at Kew, but the foliage in all cases differs from that of the Abney tree.

Acknowledgements

The assistance is gratefully acknowledged of Karen Byers, tree officer at Abney Park; of Melanie Thomas in the Kew Herbarium; and of Allen Coombes for information and comments.

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Book review

An introduction to copepod diversity. Geoffrey A. Boxshall with Sheila H. Halsey. The Ray Society. 2004. 966 pp. in two hardbound A4 volumes, Part I, pp. 1–421, Part II, pp. 422–966. ISBN 0 903874 31 8. £150 + 10% p.&p. (£15) from Scion Publishing Ltd, Bloxham Mill, Barford Road, Oxford OX15 4FS.

In 1991, Professor Geoff Boxshall co-authored The Ray Society's *Copepod evolution,* which was reviewed in *LN 71* (1992). However, after two and a half centuries of traditional taxonomic endeavour, the most urgent need was for a synthesis, summarizing the current state of this crustacean group, known from marine plankton to subterraneum froms, from parasites to minute inhabitants of the interstices between sediment particles, from the deep-sea floor to the high Himalayas. In global terms, the subclass Copepoda, currently containing about 11,500 valid species, is a relatively small group of arthropods, but it is spectacularly abundant. There are probably more copepods on Earth than insects — an estimated 1.37×10^{21} planktonic copepods inhabit the pelagic realm, the largest biome on the planet. As well as dominating the zooplanktonic communities in both marine and fresh waters, freeliving copepods are also a major component of benthic communities, and the story would be incomplete without consideration of the staggering variety exhibited by the parasitic forms. The result is this two-part work with 289 pages of detailed line drawings and numerous keys. Part I opens with a watercolour painting by Beatrix Potter of *Diaptomus castor,* a widespread British freshwater species known from amongst other places, Bookham Common. This is followed, in Chapter one, by sections on habitats, classification and morphology. Chapter two takes the reader straight into the copepod orders and families, and this forms the remainder of the work. This will enable the student to identify to genus in the majority of cases and will provide an entry point into the biological literature.

Although The Ray Society has a distinguished history of publishing major works on copepods — this is the twelfth — the subjects covered since its inception in 1844 range widely from monographs on British flowering plants to spiders and sea anemones. Their previous work was *Flora of Middlesex — a supplement to 'The historical flora of Middlesex'* by our late member Duggie Kent. Membership of the The Ray Society is open to any person willing by subscription (currently £6 per annum) to promote its work. Members are entitled to purchase one copy of each new volume at a concessionary price and may also purchase earlier works at a discount. Details of membership may be obtained by writing to The Honorary Secretary, The Ray Society, c/o Natural History Museum, London SW7 5BD. Non-members can purchase the publications at bookshops.

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Hedgerow restoration at Fryent Country Park, 1983–2003

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Abstract

A programme to restore the hedgerow landscape at Fryent Country Park, Middlesex, has been in progress for twenty years. The hedgerows were resurveyed in 2003 and the results compared with surveys of 1983 and 1993. The length of hedgerow was estimated at 11.8 kilometres, and to have increased by 1,656 metres since 1993 and by 3,877 metres (49 per cent) since 1983. This was due to the restoration work aided by natural regeneration. Data on changes in the length of hedge-lines, the area of hedgerow, and of the number and species of standard (timber-sized) trees is also presented; together with a species list of trees in the hedgerows. Comparison of the data with that of aerial photographs and other documents provided estimates for the condition of the hedgerows in the 1960s and 1970s. Comment is provided on some aspects of the hedgerow restoration and on the control of blackthorn *Prunus spinosa*.

Introduction

A restoration programme for the hedgerow landscape at Fryent Country Park, Middlesex, has been in progress for twenty years led by Brent Council and the volunteers of Barn Hill Conservation Group. A baseline survey of the hedgerows was undertaken in 1983 (Williams and Cunnington 1985) and the hedgerows were resurveyed in 1993 (Williams 1994). This paper presents the results of the survey of 2003.

Fryent Country Park is a 103-hectare remnant of the countryside of Middlesex, now in the London Borough of Brent. The centre of the Park is approximately two kilometres north of the new National Stadium at Wembley, and approximately fifteen kilometres north-west of central London. Surrounded by suburban London and bisected by the A4140 Fryent Way, the Country Park is a semi natural landscape of woodland, hedgerows, hay meadows, ponds and other habitats. The Park is almost entirely on London Clay, though with pebble gravel capping Barn Hill.

The restoration programme has several objectives including landscape restoration, recreation and biodiversity. On the Kingsbury parish side of the Country Park, the All Souls College (1597) map has been used as a guide for the restoration. On the Harrow parish side of the Park, some of the hedgerows on Barn Hill were incorporated into a landscape scheme designed by Humphry Repton in about 1793 (Williams, Cunnington and Hewlett 1985).

In this paper the term 'hedgerow' has been used to describe hedge-lines or sections, with a more or less continuous shrub component. This definition is independent of the origin of the hedgerow. Hedgerows may have originated as a boundary during woodland clearance (assarting), from natural growth along an undisturbed boundary feature or have been planted. The term 'hedge-line' is used collectively to describe hedgerows, remnant hedgerows on which the shrub component has been lost, and newly planted hedges. Remnant hedgerows may exhibit evidence of features including a hedge bank and ditch and / or scattered

standard trees on the line of a former hedgerow. Thus data for the length of hedge-lines includes that for hedgerows. 'Standard trees' are trees that have grown to a size suitable for use as timber. Though the application of that definition can be subjective, standard trees would include mature oak and ash trees but not a mature hawthorn. The area of hedgerow is the area covered by shrubs or trees, and excludes significant areas of the rough grassland, herbaceous edge and the other habitats of hedge-lines lacking woody species cover, or of the tree canopy extending over adjacent habitats.

Botanical names follow Stace (1997).

Methods

The 2003 resurvey used the same method as that for the 1993 survey. This was a simplified version of the method used in 1983. As the resurveys of 1993 and 2003 were primarily concerned with change, there was no need to re-estimate the age of the hedgerows, though a list was compiled of the species of shrubs and trees, and of the species and number of standard trees. The total length of each hedge-line and of each hedgerow was measured. For the 2003 survey, a Geographic Information System (GIS) was employed to measure the lengths and the widths of hedgerows. The data from the surveys of 1983 and 1993 have been restated slightly in this paper. This was due to the use of GIS to confirm measurements and to other checks.

The estimates for '1961' and '1974' were obtained by a comparison of data from the 1983 survey with documentary sources. These sources were a Royal Air Force aerial photograph dated *c.*1961 by Brent Museum Service (pers. comm.); annotated field notes for each hedge-line compiled by Leo Batten in 1968 in preparation for a paper on bird populations (Batten 1972); and two aerial photographs dated *c.*1974. For each hedge-line on these sources, estimates were made of the hedge-line length, hedgerow length, the width and hence the area of the hedgerows, and the number and species of standard trees.

Results

The results from the field surveys of 1983–2003 are presented first, followed by data estimates from the earlier documentary sources. Data for all years are shown in Table 1.

The total length of hedge-line in the Country Park increased from 10.9 km in 1983 to 13.1 km in 2003. There was a gain of 0.7 km between 1983 and 1993, of 1.4 km between 1993 and 2003, and a total gain of 2.2 km between 1983 and 2003. This represents increases of 13 per cent over the 1983 baseline between 1993 and 2003, and by 20 per cent between 1983 and 2003.

The total length of hedgerow in the Country Park increased from 7.95 kilometres in 1983 to 11.8 kilometres in 2003. There was a gain of 2.2 kilometres of hedgerow between 1983 and 1993, of 1.7 kilometres between 1993 and 2003, and a total gain of 3.9 kilometres between 1983 and 2003. This represents increases of 21 per cent over the 1983 baseline between 1993 and 2003, and by 49 per cent between 1983 and 2003. Note that 77 metres of hedgerow that was lost between 1983 and 1993 due to damage during an unauthorized vehicle occupation, had been restored by the time of the 2003 survey.

The estimated total area of the shrub component of the hedgerows in the Country Park increased from 5.6 hectares in 1983 to 9.2 hectares in 2003. There was a gain of 1.8 hectares between 1983 and 1993, of 1.8 hectares between 1993 and 2003, and a total gain of 3.6 hectares between 1983 and 2003. This represents increases of 33 per cent over the 1983 baseline between 1993 and 2003, and by 65 per cent between 1983 and 2003. Note that the increase in hedgerow area implies a loss of area of other habitat. Primarily the increase in hedgerow had been at the expense of grasslands. Rough grassland

on hedge-lines had been lost, as the shrub component of the hedgerows had grown to cover the same area. In addition, both rough grassland and hay meadow were lost where hedgerows had increased in width into adjacent fields.

TABLE 1. Changes in hedgerow features at Fryent Country Park from *c.*1961 to 2003.

Year	*c.*1961	*c.*1974	1983	1993	2003
Data status	Estimate	Estimate	Field survey	Field survey	Field survey
Hedge-line length (m)	10,893	10,893	10,893	11,628	13,067
Hedgerow length (m)	8,659	5,905	7,951	10,172	11,828
Area of hedgerow (square metres)	38,965	26,572	55,657	73,524	91,706
Trees:					
Oak, *Q. robur*	238	238	230	223	227
Ash, *F. excelsior*	44	44	43	40	45
Elm, *U. procera*	114	114	0	0	0
Others	19	19	16	10	13
Totals	415	415	289	273	285

Notes:
Hedge lengths: From the documentary sources available, the total length of hedge appeared to be similar in 1961 and 1974 to that surveyed in 1983.
Widths: An estimated average width of 7 metres was used for the 1983 estimates; in 1993 sample widths were measured in the field; and measurements were made by GIS for 2003.

The increases in the total length of hedge-lines, the total length of hedgerow and the area of hedgerow were largely accounted for by the hedgerow restoration programme. Three main factors were identified. The major contribution was the practical conservation work that involved the planting and consequent growth of lost hedge-lines marked on historic maps and to a lesser extent, the planting of new hedge-lines. For the hedgerow length, this accounted for approximately 2,570 m (66 per cent) of the total increase in hedgerow. The natural regrowth of hedgerow to fill gaps in hedge-lines was responsible for an estimated 997 metres (26 per cent) of the increase in hedgerow. The unaided establishment and growth of new hedge-lines alongside twentieth-century linear features accounted for approximately 310 metres (8 per cent) of the increase.

The hedgerow restoration programme commenced in about 1983. Several thousand trees have been planted on the hedge-lines, while naturally growing young trees have been encouraged, for example, by the use of tree guards to provide protection from field voles. The planted species have aimed to include species of both the shrub component of hedgerows and potential standard trees. The numbers of trees planted and the proportions of each species varied from year to year, depending upon factors such as availability, the priorities for each hedge-line and the need to replace trees that did not establish. The species selected for planting was guided by a list of species that were considered to be natural to the hedgerows based on the initial survey of 1983. An indication of the naturally occurring species can be obtained from the hedgerow species list presented below. For planting, variations from this list have included the

practical problems of sourcing English elm *Ulmus procera*; the early exclusion of blackthorn *Prunus spinosa* on account of the invasive characteristics of this species and the management resources that were being expended in control work; and increased proportions of fruit-bearing species (particularly Rosaceae) and more recently of old varieties of apple and damson species. Initially, the tree stock was sourced from commercial nurseries, and then from a tree nursery managed by Barn Hill Conservation Group at Roe Green Walled Garden using seed collected from Fryent Country Park. This nursery is managed organically. Since 1998 when Fryent Country Park achieved the Soil Association Organic Standard, the varieties of fruit trees have been sourced from commercial, organically certified nurseries.

Some of the remnant hedge-lines with no obvious evidence of original features have required prior excavation, either manually or with mechanical machinery, to re-excavate a bank and ditch.

The botanical composition of the hedges-lines was listed at the time of the 1983 survey (Williams and Cunnington 1985) and a more comprehensive list was included in Williams (1996). The hedgerows provide the main habitat within Fryent Country Park for *Cardamine impatiens* narrow-leaved bitter-cress, a nationally scarce plant, the population of which has been monitored at the Country Park (Williams 2000).

The shrub and tree species of the hedgerows are listed below and comment is provided as appropriate: *Taxus baccata* yew, *Ulmus procera* English elm, *Quercus robur* pedunculate oak. *Betula pendula* silver birch was occasional and possibly all the trees were planted. *Carpinus betulus* hornbeam did not occur naturally in the hedgerows but was present in hedgerows on Barn Hill that coincided with the belts of a landscape scheme of Humphry Repton. *Corylus avellana* hazel. *Populus* × *canescens* grey poplar was possibly introduced. *Populus nigra* black poplar occurred as a few young trees introduced from nursery stock. *Populus* × *canadensis* black Italian poplar was probably introduced. The willows were *Salix fragilis* crack willow, *Salix viminalis* osier, *Salix caprea* goat willow, *Salix* × *reichardtii (S. caprea* × *S. cinerea),* and *Salix cinerea* grey willow. *Rubus fruticosus* agg. brambles have not been identified to microspecies. *Rosa arvensis* field rose, *Rosa canina* dog rose. *Prunus cerasifera* cherry plum appear to have all been planted in the early 1980s to mid 1990s. *Prunus spinosa* blackthorn was present in most of the hedgerows and often as the dominant tree, *Prunus* × *fruticans* (*P. spinosa* × *P. domestica)* was tentatively identified in one hedgerow and some of the *P. domestica* trees may actually be referable to this hybrid, *Prunus domestica* ssp. *insititia* occurred in several hedgerows and though there is much variation between the trees they appeared to be bullace rather than damson. *Prunus avium* wild cherry. *Pyrus communis* pear was present in at least one hedgerow, though some of the young trees grown from seed collected from old pear trees on the edge of the Humphry Repton landscaping of Barn Hill appeared closer to *Pyrus pyraster* wild pear. *Malus sylvestris* crab apple occurred in several hedgerows, while *Malus domestica* apple included old varieties of apple trees that had been planted as part of the hedgerow restoration programme. *Sorbus aucuparia* rowan, *Sorbus torminalis* wild service tree. *Pyracantha coccinea* was of planted origin in one roadside hedgerow. *Crataegus monogyna* common hawthorn, *Crataegus* × *media* hybrid hawthorn was probably more common than either of the two parent species (Williams 1989), and *Crataegus laevigata* woodland hawthorn. *Cornus sanguinea* dogwood, *Euonymus europaeus* spindle, *Ilex aquifolium* holly. *Acer platanoides* Norway maple had been planted or grew from wind-blown seed. *Acer campestre* field maple. *Acer pseudoplatanus* sycamore had been planted or grew from wind-blown seed. *Hedera helix* ivy, *Fraxinus excelsior* ash, *Ligustrum vulgare* wild privet, *Sambucus nigra* elder. *Symphoricarpos albus* snowberry was introduction from an unknown source.

The total number of standard trees recorded in 2003 was 285. This comprised 227 pedunculate oak, 45 ash, 3 field maple, 3 hornbeam, 2 black-Italian poplar, 2 grey poplar, 1 wild service tree, 1 wild cherry and 1 sycamore. In the hedgerows of Barn Hill, various proportions of oak, ash, wild cherry, and all of the hornbeam coincide with the landscape scheme designed by Humphry Repton *c.*1793. The black-Italian poplar, grey poplar and sycamore were of planted or naturalized origin.

The 2003 total of 285 trees compared with 273 in 1993 and 289 in 1983. The actual changes between 1993 and 2003 were a net gain of 4 oak (loss of 6, gain of 10), gain of 5 ash, gain of 1 field maple, loss of 1 crack willow, gain of 2 grey poplar and gain of 1 sycamore. One of the oak trees was lost through criminal damage when a car was burnt under the tree. Reasons for the other losses are not known, but probably include age-related factors. All of the gains were through the growth of younger trees.

This net gain of twelve standard trees during the ten years from 1993 to 2003 partially reversed the loss of sixteen trees between 1983 and 1993. Losses between 1983 and 1993 included those due to the storms of 1987 and the early 1990s, and of fly-tipping and fires from 1986–1990. Between 1983 and 2003, 8.7 per cent of the 1983 standard tree stock was lost, but there was a gain of 7.3 per cent, giving a net loss of 1.4 per cent. The turnover of standard trees was lowest for oak, higher for ash, and highest for the collective grouping of all other species.

Table 1 includes estimates from aerial photographs and documentary sources, for the condition of the hedge-lines *c.*1961 and *c.*1974. Whilst the length of hedge-line appeared to be similar in 1961 and 1974 to that of 1983, the length of hedgerow was 8.7 kilometres in 1961, 5.9 kilometres in 1974 and 7.95 kilometres in 1983. The reduction of 2.7 kilometres between 1961 and 1974 was due to the cutting to the base of the hedgerow shrubs on the east side of the Country Park area by a tenant farmer in 1966 or 1967 (Leo Batten, pers. comm.). About 2 kilometres of that had regenerated by 1983, albeit frequently dominated by blackthorn.

The area of hedgerow is partially a function of the length of hedgerow, but also of the management of hedgerows in terms of their widths. The *c.*1961 photographs suggest grazing pressure on the hedgerows and the total area was estimated at 3.9 hectares. The area declined to an estimated 2.66 hectares in 1974 following the hedgerow clearance of the mid 1960s. The natural regeneration of the hedgerow length by 1983 was also accompanied by a reduction in grazing or cutting, and the average hedgerow width increased to give a total estimated area of 5.6 hectares. As noted above, subsequent increases in hedgerow length and widths, resulted in estimated hedgerow areas of 7.4 hectares in 1993 and 9.2 hectares in 2003.

There were approximately 415 standard (timber) sized trees on the Country Park area in *c.*1961 and *c.*1974. An estimated 114 of these were of English elm *Ulmus procera,* which suffered from the Dutch elm disease epidemic of the mid 1970s. All of these elm trees had been lost by the time of the 1983 survey (and probably by the late 1970s), though subsequently one or more generations of elm suckers have regenerated. It is estimated that eight oak trees and three other standard trees were also lost between 1974 and 1983.

The hedgerow restoration programme has had to devote considerable resources to the control of blackthorn *Prunus spinosa* which suckers extensively and formed dense scrub corresponding to the *Prunus spinosa-Rubus fruticosus* scrub community of the National Vegetation Classification (Rodwell 1991). The community is capable of out-competing much of the other hedgerow vegetation and of suckering into the adjacent habitats to form hedgerows that in some cases exceed twenty metres in width. A range of techniques was employed to control the blackthorn, with the most practical and effective identified by trial and error. Note that as the Country Park is managed organically, no chemical

control has been used. Locally, no effective biological control has been identified, though the blackthorn suckers and young trees are susceptible to ring-barking by the field vole *Microtus agrestis*. Apart from a few horses that are grazed in fields on the eastern edge of the Park, no domesticated animals have been grazed at the Country Park since the 1970s.

The control techniques have included cutting to prevent the suckering of blackthorn into adjacent habitats. This involved both the annual harvesting of the adjacent hay meadows and mechanical cutting of mown paths alongside the hedgerows. Within the hedgerows, manual cutting of blackthorn with hand tools was relatively effective over small areas, though considerable time was required to extract and dispose of (stack) the cut material. Stumps were cut to ground level to reduce the trip hazard, but also to reduce regeneration and crucially to enable cutting machinery to control any blackthorn regeneration where grassland was to be re-established. Side-mounted mechanical flail cutting of the blackthorn, though effective in trimming overhanging branches, was relatively ineffective as a control technique, since the machinery was unable to cope with the larger branches or the main stems. Mechanical side cutting also had disadvantages in that it left an untidy finish, increased the health and safety risks of subsequent manual work, encouraged regrowth to interweave and thus made subsequent manual control more difficult; and reduced berry production for approximately two years.

Recently the control work has emphasized the ecological principle of competition. Rodwell (1991) noted a dichotomy in that whilst blackthorn in the *Prunus spinosa-Rubus fruticosus* scrub community can form a dense canopy, blackthorn is itself not shade tolerant. This suggested that it would be effective to cut blackthorn growing adjacent to other tree species to alter the competitive balance. Work on cutting blackthorn within the single-species stands was given a lower priority, other than the continuing work to control encroachment into adjacent habitats.

Discussion

It was estimated that in England and Wales there were 449,270 kilometres of hedge-line in 1988; of which 188,230 kilometres were in the eastern lowlands in addition to an estimated 21,070 kilometres of remnant hedge (Department for Environment, Food and Rural Affairs / Natural Environment Research Council 2003). The increase of 16 per cent in hedgerow length at Fryent Country Park between 1993 and 2003 compared with an average decline in hedge (hedgerow) length of 1.5 per cent between 1990 and 1998 of hedges in the eastern lowlands of England and Wales. For the period 1983–2003 the Fryent Country Park hedgerows increased in length by 49 per cent, whereas there was a decline of 13 per cent in the hedgerow length in the eastern lowlands of England and Wales between 1984 and 1998.

The monitoring of the hedgerows at Fryent Country Park commenced in 1983 and continued using the same basic method in 1993 and 2003. In 2002, the national Steering Group for the UK Biodiversity Action Plan for Ancient and/or Species-rich Hedgerows published the *Hedgerow Survey Handbook* (Bickmore 2002) as a standard procedure for local surveys in the UK. There is much overlap between the national and the Fryent Country Park survey methods, though the national standard is more comprehensive. At the time of the 2003 survey at Fryent Country Park, the resources were not available to undertake the full survey as in the national standard.

The objectives of the hedgerow restoration programme at Fryent Country Park have included an emphasis on promoting the multi-purpose functions of hedgerows for biodiversity, recreation, and for economy. There are historical records for the collection of (fire) wood from the local hedgerows and in the historic past the standard trees were probably planted or encouraged for their

use as timber. Currently, the Country Park is managed organically and holds the Soil Association Organic Standard certification. The local use of the hedgerows for food is one objective of the hedgerow restoration programme, and for example, old varieties of fruit trees have been planted on the new hedge-banks that have been excavated on the lines of lost hedges-lines. Craft use is made of some of the wood, particularly blackthorn that is cut as part of management works.

The proportionate changes in the numbers of oak, ash and other standard trees suggest that the turnover for oak is relatively low per unit of time, whereas that for ash and for other species collectively is higher. The implications for the hedgerow restoration programme are that whereas oak is the main component of the standards of the local hedgerow landscape, restoration of the landscape in the short to medium term could be achieved more quickly with other species of standards. The biodiversity, landscape and economic considerations of such a policy would need to be considered.

Acknowledgements

The volunteers of Barn Hill Conservation Group have been involved with the hedgerow restoration programme from the early 1980s and I would particularly like to thank Kathy Northcroft, Norah Bostock, Mike Andre, Monica Green and Brenda Hatcher. Kathy Northcroft and Norah Bostock have also managed a tree nursery that has used local seed to grow trees for planting into the hedgerows. Many volunteers have been involved with the project and others who have given long service include Rose Bennett, Graham Bennett, Larry Bosman, Helga Hindler, Simon Mercer, Kim Williams and Alan Williams. The Countryside Stewardship scheme, currently managed by the Department for Environment, Food and Rural Affairs, provided funding for some of the restoration works. Brent Council Parks Service manages Fryent Country Park and thanks are due to, amongst others, Shaun Faulkner (Head of Parks Service), Jill Connolly, Paul Hutchinson and Malcolm Edmunds. I would also like to thank Dr Leo Batten for providing field notes from his 1968 survey, a referee of the manuscript for making useful comments, and Caroline Williams.

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Book review

Time to fly — exploring bird migration. Jim Flegg. BTO, Thetford, Norfolk. 184 pages. £12.50. ISBN 1 904870 08 2.

This latest book from the British Trust for Ornithology (BTO) follows on from their mighty tome, *The Migration Atlas* published in 2002. That was an in-depth heavyweight analysis from ringing records in the UK and Ireland whereas *Time to Fly* is an easier read relying more on short summaries.

The species accounts are grouped in habitat chapters. Inevitably this means that the more ubiquitous species are found in habitat sections that seems a little odd, for instance sand martin comes under 'Mountain, moorland and heath' instead of the 'Wetlands' section. This can make some species accounts difficult to compare although the author has tried to keep similar species in the same chapter and there is always the index to refer to.

Each chapter has an introduction to each habitat which seems a bit of waste of space; most people would know what the 'Wetlands' section was going to be about for instance, and they do nothing to assist with the book's subtitle of 'Exploring bird migration'.

Most species accounts are buried within each chapter and have no title although maps are provided for most species. These show plotted ringing recoveries for birds trapped in the UK and arrows denoting migration routes. However these are only for birds ringed in the UK and give a false impression that entire populations either pass through or winter in the UK. No attempt has been made to show the migration routes taken in the rest of Europe. Selected species have a much larger write-up but the selection appears random. There are few comparisons between species and none between entire families and their different migration strategies. Although the book mentions that the lesser whitethroat takes a totally different migration route from the common whitethroat it doesn't explore why.

It is also a shame that the bulk of the book is based on ringing recoveries and very little mention is made of visible migration although there a few references to the relatively new technology of satellite tracking.

However, despite the lack of substance, there are many interesting facts buried in this book, such as a juvenile osprey which flew almost 5,000 km in twenty days and how one wood warbler was trapped on the Isle of Man one day and by the following day was found near Glasgow and had attracted a mate and started nest building!

Additionally, reading through the book it is surprising to learn that we still don't know that much about some common UK birds such as the house martin, whose wintering quarters have never been located.

If you're interested in migration then you ought to buy this book although you may find many questions unanswered.

ANDREW SELF

The survival of hedges in the London Borough of Barnet

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Summary

All surviving hedges in a 7km^2 area of the London Borough of Barnet were examined and compared with the field boundaries shown on the large-scale Ordnance Survey maps of the 1860s. The extent to which the hedges had survived was recorded, as were the present composition and management of the hedges. The occurrence and distribution of certain hedgerow species were examined in more detail. Some comparisons were made of other hedgerow studies. Most of the hedges still exist and show considerable diversity, and their wildlife value in an outer London borough affirmed.

Introduction

Hedges have been a subject of study for a number of years, prompted in part by their widespread destruction especially in arable farmland in the last fifty years. These studies have been carried out in various parts of the country and using a variety of methods. Many studies have examined the relationship between the diversity of species in a hedge and the age of the hedge. The 'Hooper rule', that the number of species in a thirty-yard stretch of hedge is roughly equal to the age of the hedge in centuries has been tested in various places and modifications proposed (Hooper 1970, Pollard et al. 1974, Hewlett 1973, Rands and Nau 1976, Cameron and Pannett 1980, Willmot 1980).

In respect of individual species in the hedge, nearly all studies carried out in lowland England found hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa* and elder *Sambucus nigra* to be the commonest species, accompanied, either as timber trees or as bushes in the hedge, by common oak *Quercus robur*, ash *Fraxinus excelsior* and elms *Ulmus* spp.

Particular attention has been focused on certain woodland species which are generally slower to colonize hedges; they are often considered as indicative of the antiquity of the hedge or of its proximity to old woodland. Pollard et al. (1974) examined the distribution of maple *Acer campestre*, hazel *Corylus avellana* and dogwood *Cornus sanguinea*. In the East Midlands and East Anglia they found that the presence of such species was an indication that the hedge was of considerable age or that it was close to old woodland. However, they noted that in parts of Kent and Sussex these three species were frequent in nearly all hedges and attributed this fact to the numerous old woods in these counties. Pollard (1973) named hedges in eastern England which contained maple, hazel and dogwood as 'woodland relic' hedges. He considered the herbaceous plants wild bluebell *Hyacinthoides non-scripta* and dog's mercury *Mercurialis perennis* also to be indicators of such hedges. In Derbyshire Willmot (1980) categorized hazel, maple and dogwood, along with crab apple *Malus sylvestris* and holly

Ilex aquifolium as forming a group of species he called 'rarer shrubs and small trees'. They were uncommon in the hedges examined but became, except for crab apple, more frequent in older roadside hedges. Cameron and Pannett (1980) in Shropshire found maple, hazel and dog's mercury to be common in a group of hedges they named ' woodland assart' hedges, but were also frequent in hedges bordering old lanes. Their data show that crab apple and holly were also more frequent in these types of hedge. Williams and Cunnington (1985), summarizing the results of various hedgerow studies, suggested that maple, hazel and dogwood, together with wild service *Sorbus torminalis,* appear to be indicators of woodland relic hedges over much of the country.

Apart from the work of Williams and colleagues in Brent few studies of hedges have taken place within the London area (Williams and Cunnington 1985, Williams et al. 1987, Williams and Smith 1988, Williams 1989*a*).

Purpose

The purpose of the study is to conduct a preliminary survey of the hedges in a part of outer north London that has remained open land. This paper will document and discuss the composition and management of these hedges with some comparisons of the results of other studies.

The present work was carried out as part of a study of the wildlife of Barnet undertaken by members of the Barnet Group of the London Wildlife Trust.

Definition of the survey area

For the purpose of this paper the survey area comprised the open land within a rectangle stretching from Whetstone in the east to the M1 motorway in the west and from High Barnet and Arkley in the north to Totteridge and Mill Hill in the south. Excluded from the survey was all land given over to housing, or otherwise built up, even where old hedges were still to be seen within these areas. Also excluded were the corridors formed by the London Underground Northern Line and the A1 Barnet Bypass road, as the hedgerows had been destroyed in the construction of these routes. The survey area, so delimited, amounted to just under 700 hectares or 7 km^2. Figure 1 shows the survey area.

In the eastern two-thirds of the area, the land slopes down both from the north and the south to the valley of Dollis Brook, a tributary of the River Brent. This stream flows west to east across the centre of the survey area, but towards the east then turns to flow north to south. In the extreme west, another tributary of the Brent, Deans Brook, runs north-south across the land. The highest land rises to about 145 metres in the north and west and to 125 metres along the south ridge while in the south-east and south-west corners, in the river valleys, the altitude is only about 65 metres. The north and south ridges are capped by Claygate Beds, overlying which in some places are the Pebble Gravels. A thin strip of alluvial soils is marked along part of the line of Dollis Brook. However 88 per cent of the land lies on London Clay.

The survey area will be described more fully below, but it includes the Totteridge Fields, a site graded as of metropolitan importance by the London Ecology Unit. Hare (1998:15), surveying these fields in the late 1980s, stated that they were 'an extensive and particularly fine example of the traditional English pastoral landscape' and was moved to write of one field 'where the grasses and herbs stand tall, and where a solitary and ancient oak tree stands in a corner . . . with very large hedges behind it'. Further west lies another site of metropolitan importance, Scratch Wood, centred on an ancient woodland. Griffith (1986) has published a flora covering a good part of the area.

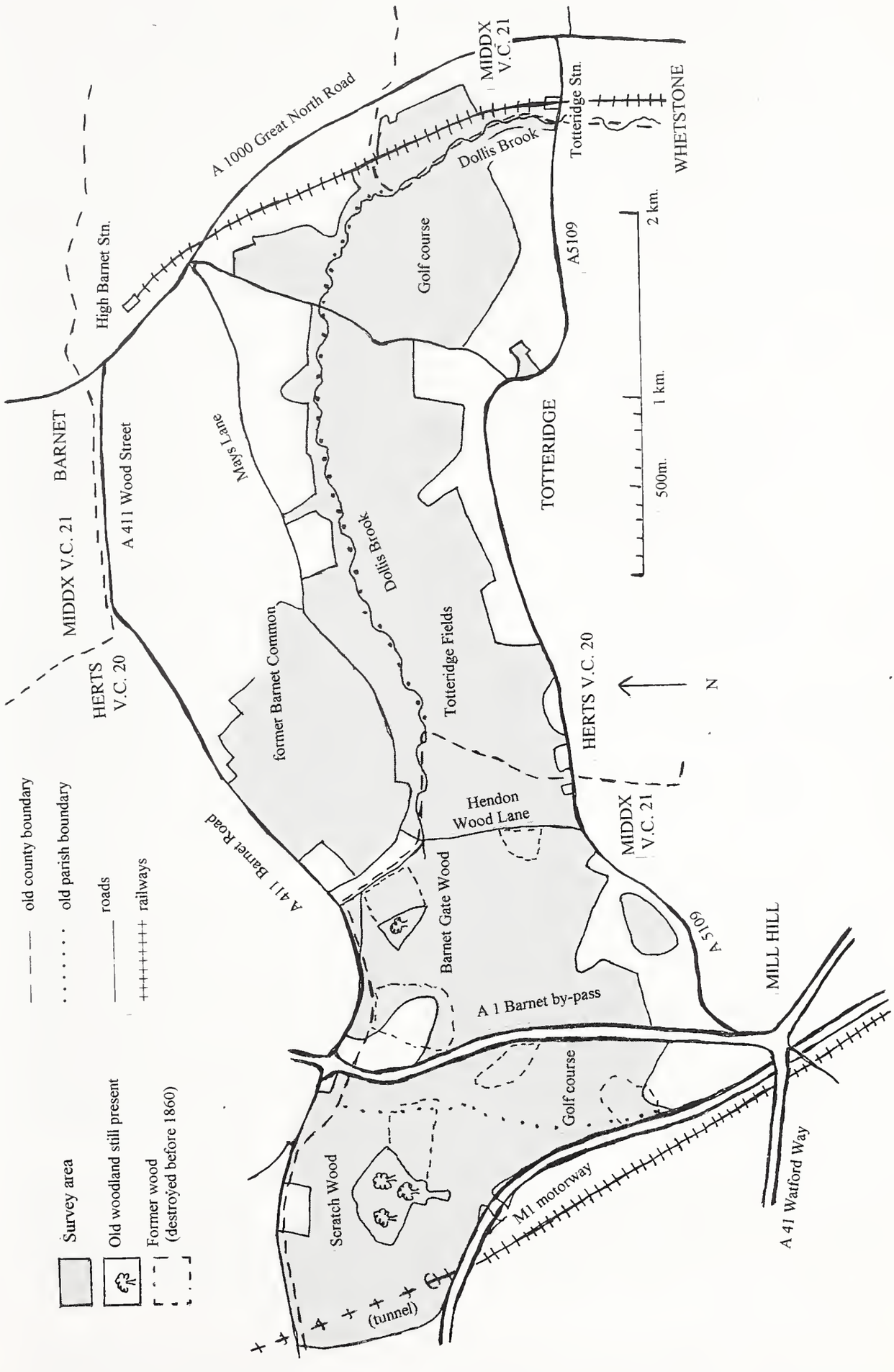

FIGURE 1. Barnet hedge survey. Shaded parts represent the survey area.

Methods

1. Literature sources

The first edition of the Ordnance Survey map at a scale of 1:2500 was the baseline used in this study. These maps were, for the survey area, produced between 1860 and 1870, often parish by parish. The maps indicate woodland, scrub, field ponds, isolated trees in fields or elsewhere and many other details. They show all field borders and identify quite precisely the location of hedgerow trees along these boundaries. Harley (1979: 40–41) quotes an officer of the Ordnance Survey saying in 1886 'we show . . . the trees along every hedgerow, scattered ornamental timber in parks and generally speaking, every single tree of the large or "forest" class wherever it may appear . . .. In our maps the single trees are delineated in the correct position, but where they stand too close together, along a hedge, avenue or elsewhere, to admit of every one being drawn on the map, in that case some of the less important ones are left out'. Rackham (1986: 222–223) also points out that where hedgerow trees were very closely spaced along a hedge, not every tree could be shown on the map.

Although the main historical comparison made was between the hedge-borders of the 1860s and those of the late twentieth century, earlier documentary sources were also used whenever they were available. Tithe maps of about 1840 are available for the various former parishes included within the area; the maps show field boundaries but not trees, while the accompanying text gives the size, use and ownership of the particular parcels of land. Earlier parish or manorial maps and text provide similar information, and in the survey area go back to 1754 for the parish of Hendon. One still earlier map source was a map of the manor of Edgware produced by All Souls College Oxford in 1599, but the only section within the survey area was in the extreme north-west, north and west of Scratch Wood.

Hedges which existed before the 1860s, but which were no longer field boundaries by that time, were not included in the survey. Traces of these earlier hedges could sometimes still be made out in the 1990s as an interrupted line of trees crossing a field or within secondary woodland. The 'ancient oak' mentioned by Hare and cited above in the introduction is, in fact, a survivor of one such older hedge removed before 1860.

2. Field methods

All surviving hedges and hedge-fragments in the survey area were examined and the species and their abundance noted. Herbaceous vegetation apparently associated with the hedge was selectively recorded. The way in which the hedge was maintained was also noted, as were such features as the existence of a bank or ditch associated with the hedge. Where a large field bordered two smaller fields in a T-junction then the hedge bordering the large field was treated as two separate hedges. However, where what had originally been one hedge had been separated into two or more fragments, the fragments were regarded as part of a single hedge. Such a situation might arise for example on a golf course when the construction of a fairway destroyed the centre section of a hedge but left the two ends intact.

A distinction was made between the old **timber trees** and the **hedge-bushes** in the hedge. In traditionally managed hedgerows, a timber tree was a tree that was left growing when the rest of the hedge was cut back or plashed. Sometimes, a tree may itself have been pollarded, that is to say its branches cut off at a height of two to four metres from the ground in order to provide wood for various purposes.

In the present survey the author has tried to identify hedgerow trees of the 'large or "forest" class' in the same way as the Ordnance Survey in the nineteenth century. However, because many of the hedges have had little or no maintenance for up to fifty years, some of the hedge bushes had developed into

what the map-makers of the Ordnance Survey in the nineteenth century might have regarded as hedgerow trees. The general definition of a timber tree in this paper, therefore, is a tree with a substantial trunk not obviously arising from a hedgerow stub which appeared to be a hundred years old or more. In addition some willows with similarly sized trunks but which were probably younger were also counted. Despite the unmanaged state of many of the hedges surveyed, there was rarely any difficulty in distinguishing the old timber trees of the hedgerow from the hedge bushes. Such old trees form a valuable element to the wildlife of the habitat.

A hedge bush was defined as a woody species growing within the hedge and not classified as a timber tree. Woody species included roses *Rosa* spp., honeysuckle *Lonicera periclymenum* and gorse *Ulex europaeus,* but excluded brambles *Rubus* spp., ivy *Hedera helix* and bittersweet *Solanum dulcamara.*

Hedges were classified as follows. A hedge was termed a **full** hedge when there was a reasonably continuous strip of bushes along the hedge-line. With a **relic** hedge there were gaps where sections of the original hedge had been destroyed, or, sometimes, where the hedge-bushes were being shaded out by secondary woodland. A **trace** hedge was one where the bushes and trees had been destroyed along most of the hedge-line, or where just an occasional bush or tree marked the original line. (In an earlier study of the hedges of Hampstead Heath open space the writer had used the phrase 'ghost hedges' for such remnants (Vaughan 1998); in this paper the more prosaic term 'trace hedges' has been preferred). A **recent** hedge meant a hedge which did not exist before the 1860s and had been planted since. Finally a **vanished** hedge was one that had existed in the 1860s, but which had been completely destroyed.

The minimum age of the hedge was estimated using the historical sources consulted. There is an element of guesswork here, because while old maps showed field boundaries this did not necessarily mean that every such boundary was a complete field hedge.

Whenever a field hedge was reasonably complete, then the bushes of the hedge were roughly ranked in order of abundance. A species that comprised more than 50 per cent of the biomass of the hedge was termed **predominant**; one that formed between 10 and 50 per cent was termed **frequent** and one representing less than 10 per cent was termed **occasional**. Timber trees were excluded from this analysis.

While most of the hedges in the 1860s bordered fields, some bordered woodland or land that had been woodland in the previous hundred years. Others bordered roads or lanes, and others again ran along the county or parish boundaries existing at the time. The composition of these hedges was compared with the remainder to see if any differences existed.

Hedges were also classified according to the soil as shown on Geological Survey drift maps. Nearly 90 per cent of the area was on London Clay. However it was found that about 7 per cent of hedges were on the Claygate Beds, a mixture of loam and sand, less than 2 per cent were on Pebble Gravel, and about 3 per cent of hedges bordered Dollis Brook on what the geological map showed as Alluvium.

A 'hedge' in this study could be anything from 25 metres to 300 metres or more. The mean hedge-length of the 'full' and 'relic' hedges was 128.5 m. While all woody species forming the hedge were noted, no attempt was made to divide the hedge into standard lengths, such as 30 yards or 30 metres and count the number of species in them. The aim of the study was to map the distribution of species in a large number of hedges in one defined area and was not primarily concerned with the age of particular hedges.

Taxonomic note

In the survey, a hawthorn which seemed to conform in all respects to the woodland hawthorn *Crataegus laevigata* was scored as such. All other hawthorns

were lumped as common hawthorn *C. monogyna,* though bushes of intermediate appearance were frequent. Williams (1989*b*) found in one survey in Brent that the presumed hybrid between the two species (*C.* × *media*) was commoner than either species. Such may have been the case in Barnet, but time did not permit the examination of every hawthorn bush. As for roses, the field rose *Rosa arvensis* was distinguished from the dog rose *R. canina,* but no attempt was made to scrutinize every dog rose to see if it might have been a closely related species or hybrid. The maps in Preston et al. (2002) do not indicate much likelihood of other rose species in the area, with the possible exception of *Rosa tomentosa.*

Scientific names of vascular plants in this paper follow those used in Stace (1997).

The survey area

The survey area includes parts of two traditional counties (Middlesex and Hertfordshire) and six traditional parishes. The old county boundary, which represents the border between vice-counties 20 (Herts.) and 21 (Middlesex) meanders through the area. The Hertfordshire section of the survey area in the 1860s comprised parts of the parishes of Chipping Barnet, Totteridge and a very small part of Elstree. In Middlesex were parts of Finchley, Hendon and Edgware parishes.

Land-use past and present

Various documents suggest that in the Middle Ages there was a good deal of woodland, but it appears that much of this was converted to farmland in the sixteenth century. In 1599 All Souls College Oxford produced a map of their land in the parish of Edgware, in which fields were carefully distinguished from both woods and hedges (All Souls College Oxford 1599, Fletcher 1885). However, at that time in the north-east of Edgware a manor or sub-manor of Boyseland existed which was not owned by the college and so did not appear on the maps. The survey area in this study extends into the old Edgware parish mainly in that part which was once separated as Boyseland. The map therefore depicted only a small part of the survey area. Edgware was at that time 85 per cent farmland, but the map showed three or four woods within the survey area which by the nineteenth century had become ordinary fields. At what date the wooded areas of 1599 were cleared of trees is not known. The hedges shown on the maps appear to be filled with trees and a later All Souls document of 1662 records the utilizable trees in three areas within Edgware parish. Two farms had over 700 timber trees, while an area described as wood had only 68. Presumably the wood was almost entirely coppiced while the farms had numerous large trees in their hedges (Fletcher 1885 part IV). Virtually all the timber trees were listed as oaks, there being only twelve ash and eight elm trees.

By the middle of the eighteenth century the land was a mixture of pasture and arable fields most of which still exist today. There were a few settlements around the edges of the area. There was possibly less woodland in 1750 than today, but between 1750 and 1840 five small woods, all in the west of the area, and a half of a sixth were destroyed.

In general this area corresponds to the 'old countryside' of Rackham (1986) and not the planned countryside. Strip-farming had gone, if it had ever existed, by the later Middle Ages (Hewlett et al. 1997). Throughout most of the survey area, therefore, many of the hedge-lines are likely to be several hundred years old.

In 1700 there was, however, one large unenclosed common, namely Barnet Common in the north of the survey area. In the early eighteenth century this common was important as a pasture for horses traded at Barnet's horse fairs. (Hewlett et al. 1997: 10) Some fifty-five hectares of the common were enclosed

in 1729. These enclosures were not all at the edge of the common and two tracks had to be driven across the common for access to the newly enclosed fields; these tracks now resemble green lanes. Hedges here can therefore be dated to the early eighteenth century. The remainder of the common was enclosed in 1815. Much has now been built up, but some open land with hedges still exists.

In most of the area, the heavy clay soils were more suitable for livestock or hay than for arable farming, and in the eighteenth and nineteenth centuries this land was well placed to supply the burgeoning population of London with milk and its horses with hay.

Another feature of the eighteenth century was the development of landed estates. The relatively high ground of much of the area and its proximity to London encouraged the gentry to purchase land and develop country estates. In the Mill Hill area, for example, the wife of Sir Stamford Raffles (founder of Singapore) had an estate next door to one owned by William Wilberforce (the anti-slave trade campaigner). These estate owners sometimes destroyed parts of the old field system, planted woods and shelterbelts, dug lakes and created parks.

Although the population of London had already reached three million, the Ordnance Survey maps of the 1860s showed an almost completely agricultural landscape. A few modest country estates with their parks were portrayed, but otherwise showed a land of hedged fields used for pasture and more rarely for the growing of crops. A few settlements with housing occurred in the north-east (High Barnet) and to a lesser extent in the south (Totteridge). By 1867, however, a railway line had been constructed along the west side of the survey area, running from St Pancras via Hendon to St Albans to be followed a few years later by a second line, going north from Finchley to High Barnet in the eastern part of the area. The existence of this line (then a part of the Great Northern Railway, but which in 1937 became part of the London Underground Northern Line) stimulated the construction of much housing in the north-east (Barnet). In one estate, in Totteridge, parkland gave way to a series of rectangular fields, all of them hedged. On other estates in the west, further small woods and shelter-belts were created. During the twentieth century housing covered much of the north-east and south-west and extended along the roads. The development of motor transport led in the 1920s to the construction of the Barnet Bypass, an arterial road (eventually a six-lane expressway) running north-south through the west of the area. However Green Belt legislation from the late 1930s preserved much of the area from being built up. Some publicly owned land, once fields, was left to its own devices and by the end of the twentieth century had developed into scrub and young woodland.

Local authorities, combined from 1965 into the London Borough of Barnet, owned many of the existing open spaces. However, much of this council-owned land was leased to farmers, riding schools or golf clubs. In the last twenty years of the twentieth century appreciation of these open spaces by the Borough led to the whole area being designated as Green Belt as defined in the Council's unitary development plan. In the west the Scratch Wood and Moat Mount Countryside Park was formed, and part made into a local nature reserve; two named footpaths, the London Loop and the Dollis Valley Greenwalk, now cross the area.

The London Ecology Unit designated about 150 hectares as Sites of Metropolitan Importance (Scratch Wood and Totteridge Fields), and a further seven sites, totalling about 160 hectares, as Sites of Borough Importance. Most of the fields are also classified as Countryside Conservation Areas. Part of Totteridge Fields is a London Wildlife Trust reserve.

Present land-use of the open spaces

About 153 hectares of the survey area consists of public open spaces, ranging from parkland with amenity grassland and planted ornamental trees through

more or less traditional meadows to ancient woodland; playing fields add another sixty hectares. Two golf courses cover about 110 hectares and allotments (working and disused) a further ten hectares. About half the area, however, can be described loosely as 'farmland' — consisting of pastures, paddocks, leys or cultivated ground (352 hectares).

In terms of vegetation the open land can be grouped as:

- Amenity mown grassland with scattered trees (playing fields, parks and the fairways of golf courses) — about 186 ha
- Arable land, short-term leys (mainly farmland but including active allotments) — 167 ha
- Permanent pasture (grazing for cattle and horses) — about 103 ha
- Paddocks (like the above but exclusively for horses, often with stables in the field, with post and wire fencing separating parts of the field, and often over-grazed) — 33 ha
- Meadows, that is to say grassland that was not grazed during the survey period, but maintained as meadow by at least one grass-cutting a year — 97 ha
- Young woodland and scrub — about 47 ha
- Mature secondary woodland — 28 ha
- Ancient woodland — 19 ha
- Miscellaneous rough ground (such as abandoned allotments) — 16 ha
- Lakes and ponds — 2 ha

Results

Hedges then and now

Within the survey area of 698.26 ha, there were in the 1860s, some 615 hedge-borders. These totalled 88.225 km of hedgerow. Along these borders 4,146 trees were marked, giving on average a hedgerow tree every 21.28 m. However, in the fields that were formerly part of Barnet Common trees were less frequent — only one every 38 m, suggesting that the promoting of hedgerow trees was beginning to fall out of favour in the early nineteenth century.

How have these hedges fared in the subsequent 140 years? By the 1990s there were about 61.74 km of old hedge and 2.43 km of 'recent' (that is, post-1860s) hedge. Some 318 hedges, totalling 44.9 km were substantially still in existence and classified as 'full' hedges, retaining on average 99 per cent of their 1860s length. Another 146 hedges, amounting to 21.86 km of 1860s hedge, were considered by the 1990s to be 'relic' hedges, their present length being about 67 per cent of their 1860s length. Some 17.56 km of 1860s hedge (119 hedges) were in a highly fragmentary state or represented only by isolated timber trees and were put in the category of 'trace' hedges, their combined length by the 1990s being only 12 per cent of their 1860s length. Some 33 hedges, 3.65 km in length, had vanished completely.

About 51 per cent of the surviving old hedges were situated within areas designated as farmland, public open space, golf courses or playing fields. The rest bordered roads, built-up areas, or formed the boundary between these various land-uses. An analysis was undertaken of the hedges in the first category to see to what extent different types of land use favoured the retention of hedges. It was found that 75 per cent of hedges within the 'farmland' areas were still present; there was, however, a distinction between the land given over to permanent pasture or meadow and that used as arable or short-term ley. In the latter category the total length of the hedges was only 56 per cent of the 1860s length, while within the land given over to permanent grass over 85 per cent of the 1860s length was still present. Within the public open spaces, the total length of the hedges was about 72 per cent of that existing in the 1860s. The hedges within areas given over to sports facilities fared worst. Within playing

fields the length of the hedges in the 1990s was less than 10 per cent of the 1860s length, while on golf courses the proportion was 45 per cent. Clearly playing fields and hedges do not mix, though an occasional timber tree was left standing if it was not in the way. When a golf course was formed hedges were sometimes left to provide barriers between fairways, but often the passage of a fairway would mean that of, say, a 200-m hedge the middle part would have vanished and perhaps 50-m at each end would remain.

Table 1 provides a summary of the area's hedges.

TABLE 1. Hedgerows in Barnet survey area: 1860s and 1990s.

1860s hedges		1990s hedges			
Number	**Length (km)**	**Type**	**Number**	**Length (km)**	**Proportion of 1860s length**
615	88.26	Full	318	44.9	99%
		Relic	146	14.7	67.25%
		Trace	118	2.14	12.24%
		Vanished	33	0	0%
		Recent	18	2.43	—

Species composition of the hedges

In the following analysis, emphasis will be placed on the 464 present-day hedges which fell into the 'full' or 'relic' category, in other words those hedges where a reasonable part or all of the hedge has survived. The fragments of hedges classified as 'trace' hedges do not lend themselves so readily to numerical analysis. No additional species were recorded from the trace hedges.

The composition of the hedges included almost seventy species, though about twenty species occurred only once. Where a species in a hedge was represented only by a timber tree, this is also indicated in Table 2. The 'recent' hedges are excluded from Table 2.

The following species occurred in three hedges: Dutch elm *Ulmus* × *hollandica*, unidentified elm *Ulmus* sp., cultivated apple *Malus domestica*, wild privet *Ligustrum vulgare*, Japanese privet *L. ovalifolium*, snowberry *Symphoricarpos albus*, and the cut-leaved variety of the elder *Sambucus nigra* var. *laciniata*. Occurring in two hedges were: Turkey oak *Quercus cerris*, Swedish whitebeam *Sorbus intermedia*, and the common buckthorn *Rhamnus cathartica*, and as timber trees only the hybrid between the common and sessile oak *Quercus* × *rosacea* and alder *Alnus glutinosa*.

These species were recorded from one hedge: an unidentified lime *Tilia* sp., grey poplar *Populus* × *canescens*, and four willows: one an unidentified bush *Salix* sp., the osier *S. viminalis*, the green-leaved willow *S.* × *rubra* (*S. purpurea* × *viminalis*), and the silky-leaved osier *S.* × *smithiana* (*S. viminalis* × *cinerea*); mock orange *Philadelphus* sp., red currant *Ribes rubrum*, gooseberry *R. uva-crispa*, Japanese rose *Rosa rugosa*, wild pear *Pyrus pyraster* (on an old county-boundary hedge-line), whitebeam *Sorbus* cf. *aria*, guelder-rose *Viburnum opulus*, spindle *Euonymus europaeus*, and a honeysuckle of garden origin *Lonicera* section *Caprifolium*. Occurring as timber trees only in a single hedgerow were the Scots pine *Pinus sylvestris*, walnut *Juglans regia* and two poplars, the Lombardy poplar *Populus nigra* 'Italica' and the hybrid black poplar *P.* × *canadensis*.

TABLE 2. Present composition of Barnet survey area hedges.

Species	Presence as hedge bush in full or relic hedge (n=464)	Presence only as timber tree in full or relic hedge	Total
Common hawthorn *Crataegus monogyna*	437		437
Common oak *Quercus robur*	167	210	377
Blackthorn *Prunus spinosa*	325		325
Elder *Sambucus nigra*	296		296
Ash *Fraxinus excelsior*	144	125	269
Woodland hawthorn *Crataegus laevigata*	246		246
Maple *Acer campestre*	142	5	147
Dog rose *Rosa canina*	145		145
Field rose *Rosa arvensis*	113		113
Hornbeam *Carpinus betulus*	97	11	108
Hazel *Corylus avellana*	98		98
Holly *Ilex aquifolium*	96		96
English elm *Ulmus procera*	87		87
Crab apple *Malus sylvestris*	79	1	80
Sycamore *Acer pseudoplatanus*	77	2	79
Grey willow *Salix cinerea*	59		59
Dogwood *Cornus sanguinea*	51		51
Crack willow *Salix fragilis*	19	20	39
Honeysuckle *Lonicera periclymenum*	32		32
Wild cherry *Prunus avium*	25	2	27
Sessile oak *Quercus petraea*	8	17	25
Wild service *Sorbus torminalis*	16	2	18
Horse chestnut *Aesculus hippocastanum*	13	5	18
Wild plum *Prunus domestica*	17		17
Silver birch *Betula pendula*	15		15
Goat willow *Salix caprea*	14		14
White willow *Salix alba*	3	11	14
Beech *Fagus sylvatica*	6	4	10
Wych elm *Ulmus glabra*	9		9
Gorse *Ulex europaeus*	8		8
Yew *Taxus baccata*	7		7
Rowan *Sorbus aucuparia*	7		7
Norway maple *Acer platanoides*	6	1	7
Downy birch *Betula pubescens*	5		5
Aspen *Populus tremula*	5		5
Cherry plum *Prunus cerasifera*	5		5
Rhododendron *Rhododendron ponticum*	4		4
Cherry laurel *Prunus laurocerasus*	4		4
Common lime *Tilia* × *europaea*	1	3	4

The following general points emerge from the data collected:

1. Despite the proximity of gardens and ornamental parks, the surviving hedgerows remain composed very largely of native species traditionally found in hedges. Among introduced plants, only the sycamore *Acer pseudoplatanus* is in the top twenty.
2. Because no calcareous soils occurred in the survey area, species with a preference for these soils were rare. Wild privet *Ligustrum vulgare* was found in only three hedges, buckthorn *Rhamnus cathartica* in two and spindle *Euonymus europaeus* in just one. Dogwood *Cornus sanguinea*, which also likes calcareous soils but is tolerant of others, was, however, moderately widespread.
3. The proximity of suburban gardens and parkland, the earlier existence of landed estates, and some planting by local parks departments explains the occasional presence in the hedges of a long list of ornamental species such as horse chestnut *Aesculus hippocastanum*, Norway maple *Acer platanoides*, and rhododendron.
4. The distribution and abundance of the hedgerow species is in general agreement with other studies which have taken place in the last thirty years, but the hedges in the survey area have some special features which will be examined later.

Abundance of species in Barnet hedges

In those hedges which were more or less complete, it was possible to give an estimate of the abundance of particular species in the hedgerow. Thus a hedge might be 60 per cent hawthorn, 20 per cent blackthorn, while three or four other species were also growing in the hedge. Timber trees are excluded from the analysis. The most frequent twenty-seven species are listed in Table 3.

Timber trees in the hedges

In the 1860s there were 5.94 trees per hectare, or 2.4 trees an acre on what is now the survey area. This figure can be compared with Rackham's study, also working with the nineteenth century large-scale Ordnance Survey maps, but in eastern England, who found an average of only one field or hedgerow tree per acre (Rackham, 1986:222). In the mid nineteenth century, therefore, there was plenty of hedgerow timber in the survey area.

In the 1990s a count was made of old timber trees in the hedgerows, using the criteria described above in the section on methods. The total came to 2,380. This gives a figure of 3.4 old hedgerow trees per hectare. Of these trees some appeared to be the same as those recorded on the 1860s Ordnance Survey maps, as they seemed to be in exactly the same position in the hedge. In the intervening years these old trees had been joined by hundreds of saplings and young trees that had developed in unmanaged hedges.

In addition about eighty-three trees occurred in 'recent' hedgerows, that is hedgerows not marked on the 1860s maps. The owners of these hedges tended to eschew the traditional English hedge trees in favour of ornamentals such as Lombardy poplars *Populus nigra* 'Italica', hybrid black poplars *P.* × *canadensis* and horse chestnuts *Aesculus hippocastanum*. Table 4 lists the old trees recorded in the hedges existing in the 1860s.

Notes on individual species: bushes and trees

This study found that hawthorn, blackthorn, oak, ash and elder were the most widespread components of the hedges and the most abundant. These findings are in general agreement with the conclusions of the other hedgerow studies referred to earlier. The survey area lies within that part of Britain where the

TABLE 3. Abundance of species (pre-1860s hedgerows) — timber trees excluded.

Species	Abundance rating in hedges where recorded for frequency (see note 1)	Presence in other hedges (n=167) (see note 2)
Common hawthorn *Crataegus monogyna*	1,681	141
Blackthorn *Prunus spinosa*	664	89
Woodland hawthorn *Crataegus laevigata*	275	77
Elder *Sambucus nigra*	253	87
English elm *Ulmus procera*	181	25
Common oak *Quercus robur*	137	50
Dog rose *Rosa canina*	132	22
Hornbeam *Carpinus betulus*	120	36
Ash *Fraxinus excelsior*	116	44
Field rose *Rosa arvensis*	113	8
Maple *Acer campestre*	111	41
Crab apple *Malus sylvestris*	82	31
Holly *Ilex aquifolium*	79	30
Hazel *Corylus avellana*	74	44
Sycamore *Acer pseudoplatanus*	51	33
Grey willow *Salix cinerea*	48	16
Dogwood *Cornus sanguinea*	45	10
Wild plum *Prunus domestica*	22	2
Crack willow *Salix fragilis*	19	3
Honeysuckle *Lonicera periclymenum*	18	14
Wild cherry *Prunus avium*	18	9
Silver birch *Betula pendula*	13	6
Goat willow *Salix caprea*	12	2
Cherry plum *Prunus cerasifera*	11	1
Horse chestnut *Aesculus hippocastanum*	10	3
Wych elm *Ulmus glabra*	10	2
Wild service *Sorbus torminalis*	9	7

Note 1. The scores given here are based on awarding a score of 7.5 to species that were **predominant** in the hedge; 2.5 to those that were **frequent** in the hedge and a score of 1 to those ranked **occasional** in the hedge.

Note 2. Some 167 hedges could not ranked according to the abundance of the hedge-bushes, sometimes because the hedge was too fragmentary, or because secondary woodland had grown up on both sides of the hedge.

woodland or Midland hawthorn is commonly found and so it joins the common hawthorn as one of the most widespread and abundant members of the hedgerow community.

TABLE 4. Number of timber trees in pre-1860s hedges.

Species	No. of trees recorded
Common oak *Quercus robur*	1,673
Ash *Fraxinus excelsior*	431
Sessile oak *Quercus petraea*	60
Crack willow *Salix fragilis*	54
White willow *Salix alba*	53
Hornbeam *Carpinus betulus*	28
Maple *Acer campestre*	14
Horse chestnut *Aesculus hippocastanum*	14
Common lime *Tilia* × *europaea*	12
Sycamore *Acer pseudoplatanus*	7
Scots pine *Pinus sylvestris*	5
Wild cherry *Prunus avium*	5
Beech *Fagus sylvatica*	5
Intermediate oak *Quercus* × *rosacea*	4
Alder *Alnus glutinosa*	3
Wild service *Sorbus torminalis*	3

Elms *Ulmus* spp. Elms, somewhat less widespread than those cited above, were often rated as 'frequent' in the hedges in which they occurred and so were a relatively abundant hedgerow species. Elms were present in just over a hundred hedges, and where frequent or predominant tended to eliminate other bushes from the hedge so that elm hedges were often relatively poor in species. No mature trees were seen, but until the 1970s it probably rivalled ash as the second commonest hedgerow tree. The English elm *Ulmus procera* was the typical species of the area.

Maple *Acer campestre*, hazel *Corylus avellana* and dogwood *Cornus sanguinea*. It was noted in the introduction that these three species have been the subject of particular attention from others who have studied hedges. In the hedges of the survey area maple was the most widespread and dogwood the least. Hedges containing one or more of these species were scattered over the area. Just over half the full or relic hedges — 235 out of 464 — contained one or more of these three species. The extent to which hedges containing these species might form a distinctive type will be considered later.

Hornbeam *Carpinus betulus*. Hornbeam is a common tree of the underwood in Scratch Wood in the north-west of the survey area and is frequent in the only other extant ancient woodland, Barnet Gate Wood. Fragments of woods containing hornbeam lie to the east and south of the survey area. Hornbeams occurred widely in hedges near present or former old woodland as well as in other hedges and their status will be discussed later. Its distribution is shown in Figure 2.

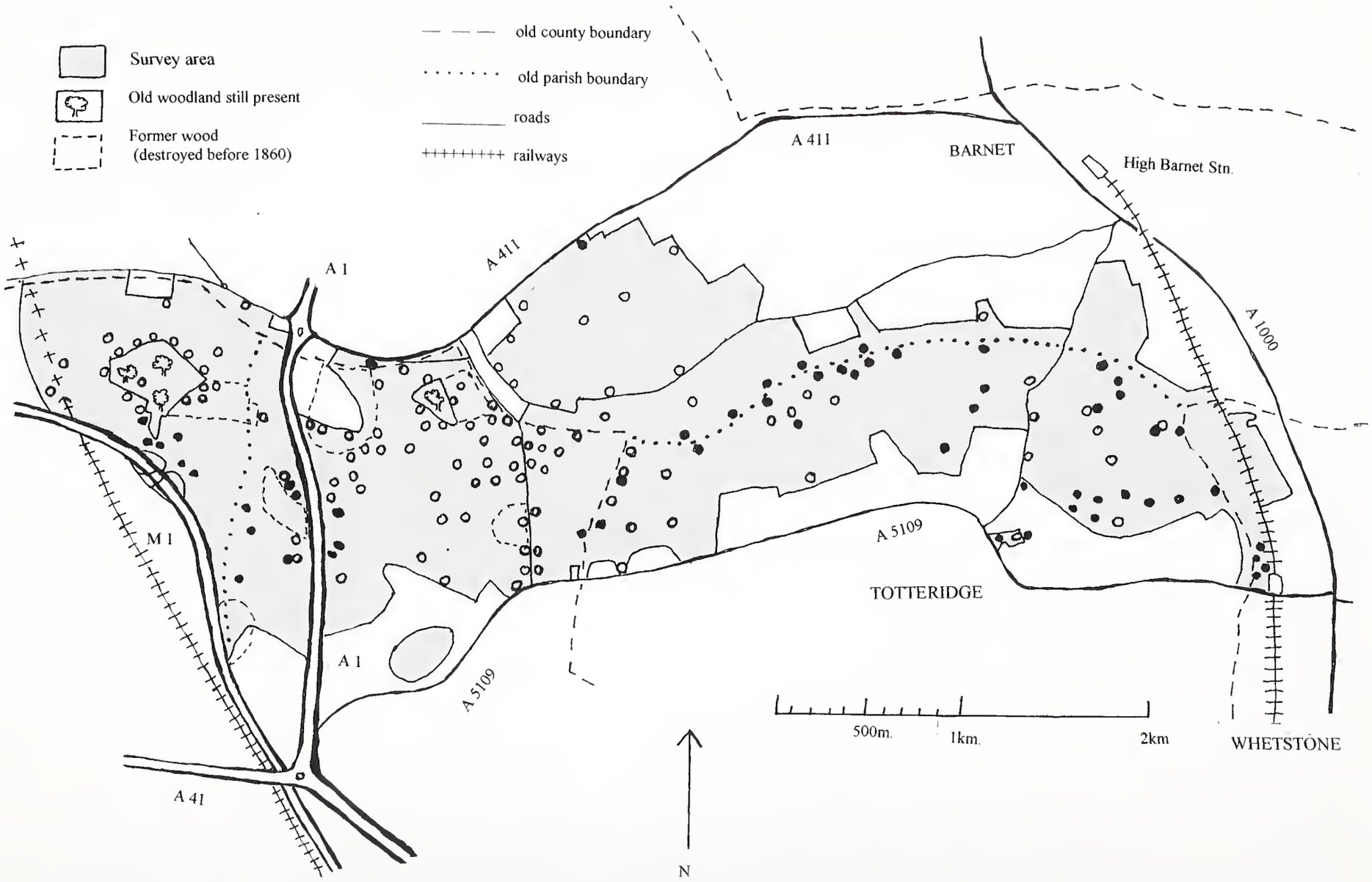

FIGURE 2. Hornbeam and dog's mercury in Barnet hedges. Hedges containing hornbeam are marked with an open circle (○). The occurrence of dog's mercury in a hedge is indicated by a solid circle (●).

Crab apple *Malus sylvestris*. The crab apple is a typical member of old woodlands and old hedges, but rarely occurs in any quantity. Rackham (2003: 355) describes it as 'being very non-gregarious' and a tree which 'seldom occurs more than singly'. Such was its distribution throughout most of the survey area. However, in hedges on the former Barnet Common, crab apples were classified as 'frequent' in about fifteen hedges, all of which bordered fields created with the first, partial enclosure of the Common in 1729. Away from Barnet Common, the tree was scattered in the more diverse hedgerows, but usually only as a single bush in each hedge; it occurred in fifty-four hedges, in forty-four of which one or more of maple, hazel, hornbeam, dogwood or dog's mercury also occurred. Hedges on Barnet Common where crab apple was scored as 'frequent' are shown on Figure 3.

Holly *Ilex aquifolium*. Holly is another species whose presence in hedges is sometimes considered as an indication of age. In the Barnet survey area the species had colonized many of the more recent hedges. Hollies are common in the shrubberies of the larger houses around the survey area, and in old and newer woodland within the area. From such places holly could seed itself in hedges throughout the area. It showed some preference for the Claygate Beds or Pebble Gravels — a quarter of all holly hedges were on such soils as opposed to less than ten per cent for all hedges. Four of the five hedges in which holly was recorded as 'frequent' rather than 'occasional' were on these soils.

Wild service *Sorbus torminalis*. Wild service was a scarce hedgerow species. It occurred in eighteen hedges, six of which were 'woodland' hedges. The remaining twelve all contained one or more of maple, hazel, hornbeam or dogwood. There are small numbers of wild service trees in both of the old woodlands of the area — Scratch Wood and Barnet Gate Wood. Its distribution is shown in Figure 3.

Sessile or durmast oak *Quercus petraea*. The sessile oak was not widespread in the survey area. Over ninety-six per cent of the oak timber trees were regarded as common oak *Quercus robur*. In the north-west of the area, Scratch Wood is nevertheless mostly a sessile oak wood, except for the southern and south-western parts which are predominantly *Q. robur*. There were several records of sessile oak trees in hedgebanks close to Scratch Wood. A little further east there was a group of records in hedges near to a former wood called Hivers Hill Wood that had been destroyed between 1754 and 1796, though here *Q. robur* remained the commoner hedgerow tree. The only other existing old woodland is the small Barnet Gate Wood, where again a few sessile oaks occur in nearby hedges. The oaks in the wood today are mainly common oaks. The final cluster of sessile oak records occurs close to Dollis Brook in the east of the survey area, near to the point where the brook turns from being eastward to southward flowing. Here there were a number of mainly large and old trees. In the London area the sessile oak is found mainly on the higher ground, often where the soil is sandy or gravelly, while the common oak normally predominates elsewhere (Ingrouille and Laird 1986). The river valley habitat is therefore somewhat unusual for this species in London.

A hedge containing sessile oak usually contained one or more of maple, hornbeam, hazel and dogwood. One hedge contained all four species and some wild service. Figure 3 shows the distribution of all sessile oak records in hedges.

Willows *Salix* spp. Willow scored relatively highly as timber trees in the older hedges. Because both white willow *Salix alba* and crack willow *Salix fragilis* grow fast they can obtain tree size relatively quickly. Most occurred in the public open spaces where local councils had planted orderly rows especially near water. The more bushy grey willow *Salix cinerea* and goat willow *Salix caprea* occurred in some hedges, the former about four times as frequently as the latter.

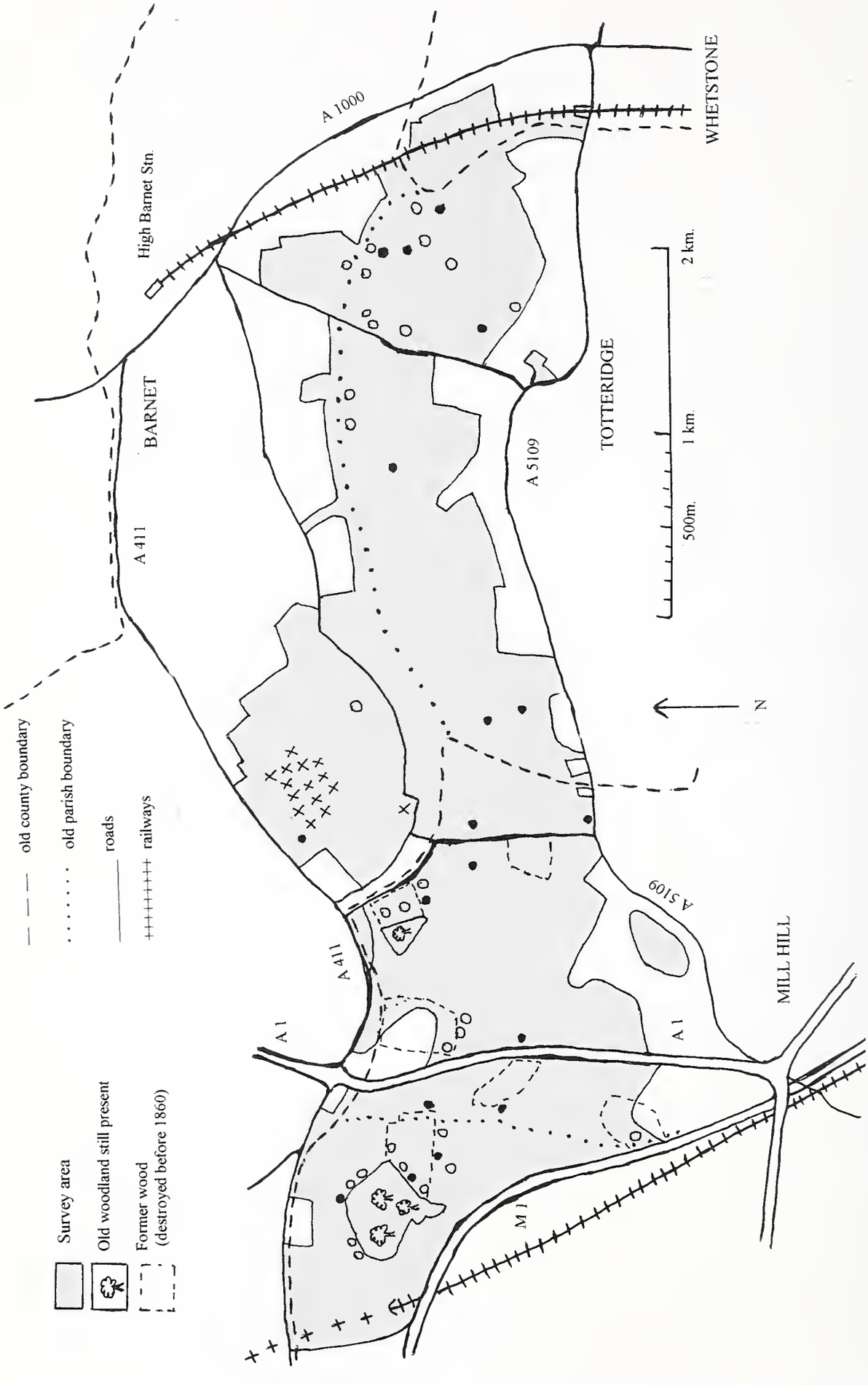

FIGURE 3. Sessile oak, wild service and crab apple. The occurrence of sessile oak is indicated by an open circle (○), and wild service by a solid circle (●). Hedges where crab-apple was recorded as 'frequent' are indicated by ✕. Its occurrence in other hedges is not shown.

Aspen *Populus tremula*. Aspen is a tree of woods rather than hedges; only five hedges were recorded as containing aspen; four of them also contained hornbeam and one contained both maple and hazel.

Notes on individual species: herbaceous plants

A number of workers have considered the herbaceous flora of hedges including Pollard et al. (1974), Helliwell (1975) and Rackham (1986). Helliwell, working in Shropshire, found a difference between hedgerows with some herbaceous woodland species and those with few or none. Pollard (1973), in a study in Huntingdonshire, singled out dog's mercury *Mercurialis perennis*, wild bluebell *Hyacinthoides non-scripta*, primrose *Primula vulgaris* and wood anemone *Anemone nemorosa* as species particularly associated with hedges near to present or former woodland. In the present survey primrose was found in only one hedgerow close to houses. Wood anemone occurred in both of the old woodlands in the survey area, but was noticed in only two hedges near to Scratch Wood. The plant becomes difficult to spot after June when the leaves die down. Bluebells were found quite widely in hedgerows in the survey area, about eighty hedges were recorded as containing the wild species. A few hedges contained bluebells which were considered to be the garden or Spanish bluebell *Hyacinthoides hispanica* or which appeared to be hybrids between that species and the wild bluebell (*H.* × *massartiana*). However, as with wood anemone, bluebell withers after flowering and it was undoubtedly overlooked in those hedges that were surveyed in the late summer. Therefore only for dog's mercury can the survey furnish reasonably reliable records.

Dog's mercury *Mercurialis perennis*. Dog's mercury is a plant of woods and old hedgerows, becoming more abundant on calcareous soils. It occurs, but not abundantly, in Scratch Wood where the soils are acid. As a constituent of hedgerows, dog's mercury was recorded in only fifty-nine hedges but may have been overlooked in some. In thirty-four of these hedges it occurred with one or more of maple, hazel, hornbeam, dogwood, wild service and sessile oak, but in the other twenty-five hedges it was accompanied by none of these. It showed no particular affinity with roadside hedges or with those bordering present or known former woodland. It occurred in only three out of sixty-six roadside hedges and in three of the forty-seven 'woodland' hedges. It was absent from a farming zone in the mid-west of the survey area where there were twenty or thirty mainly species-rich hedges. The species was common along Dollis Brook which forms a parish or county boundary and flows within a narrow strip of alluvial soil in the lower reaches.

Foxglove *Digitalis purpurea*. Foxglove was a moderately widespread plant growing by hedges and was one of a few species strongly associated with the Claygate Beds and Pebble Gravels — somewhat lighter and sandier soils than the clay. About half of all foxglove records came from hedges on these soils.

Greater burnet saxifrage *Pimpinella major*. Within the survey area there grows one plant species that is rare in the London area. The greater burnet saxifrage occurs in Surrey and Kent but north of the Thames is found in only a few localities around Barnet (Burton 1983). Kent (1975: 330) described it as 'abundant' in one place within the survey area, but it is not so now. Rackham (2003: 85) says that in Eastern England it is a 'circumboscal' plant, that is to say a plant that grows close to ancient woods but not inside them. In this study, it was recorded in just two hedgerows, both one field away from the present Barnet Gate Wood. It was also found not far away on the embankment of the A1 Barnet Bypass road, created in the 1920s, and close to the limits of the former Hivers Hill Wood (destroyed before 1796), demonstrating either its powers of dispersal, or its ability to withstand earthmoving operations.

Special categories of hedge

The distribution of the species of the hedge was examined in terms of the special categories of hedge mentioned earlier. Of the 464 hedges, totalling 59.6 km of hedge classified as 'full' or 'relic', forty-seven hedges, with a total length of 5.6 km, bordered old woodland or land known to have been woodland until the late eighteenth or early nineteenth centuries. These are termed **woodland** hedges.

Hedges bordering old roads and those along parish or county boundaries are often considered older than ordinary field hedges. Some sixty-six hedges, amounting to 9.3 km, bordered roadsides in existence in the 1860s and whose alignment is unchanged. These are referred to as **roadside** hedges. There are nearly 5 km of parish boundary crossing the survey area and hedges occur along about 3.5 km of that length. The old county boundary between Middlesex and Hertfordshire which runs through the survey area has a total length of about 6 km. Some 4 km of hedge now represent the boundary. These **administrative boundary** hedges number fifty-eight.

A few hedges fell into more than one of the above categories. For example, a woodland hedge might also border a road, or a roadside hedge might also be on a county boundary. To avoid double-counting, the decision was made to give the 'woodland' category priority over the other two, and a 'roadside' hedge priority over an administrative boundary hedge.

An attempt was also made to see if the distribution of species in hedgerows varied according to the underlying soil. Some thirty-four hedges (4.4 km) were over the Claygate Beds, a sandy loam overlying the London Clay; nine hedges (0.8 km) grew on Pebble Gravel which overlies the Claygate Beds. Bordering part of Dollis Brook in the survey area was a narrow strip of alluvial soil on which grew twelve hedges (2 km).

The situation was complicated by the fact that the roads in the survey area often kept to the higher ground where the soil was Claygate Beds or Pebble Gravel. Part of the county and parish boundaries, too, followed Dollis Brook so that their hedges would be recorded in places as being on alluvial soils. Therefore, although twelve per cent of all hedges were on soils other than London Clay, twenty-one per cent of roadside hedges and twenty-eight per cent of parish or county boundary hedges were on non-clay soils. In practice, it usually proved impossible to disentangle the possible effects of the soil from the other factors. All hedges not classified as 'woodland', 'roadside' or 'administrative boundary' hedges were simply termed 'other'. There were 288 of these with a total length of 37 km.

Five species were selected to see if the composition of the hedges in the special categories stated above differed from the 'other' hedges. Maple *Acer campestre,* hazel *Corylus avellana,* dogwood *Cornus sanguinea* and wild service *Sorbus torminalis* were chosen as studies already cited have shown that they are commonly found in older or more diverse hedges. The fifth species selected, hornbeam *Carpinus betulus,* is also associated with woodland relic hedges, as, at least in Britain, it is slow to colonize hedges from adjoining woodland (Rackham 1986).

It may be objected that since the hedges in all these categories are of very varying length, no comparisons can be drawn about their composition. However, the pattern of variation in length is much the same in all categories, with similar proportions of short, medium and long hedges, and therefore providing the total number of hedges is sufficiently large, a pattern will emerge.

Woodland hedges. Hornbeam and hazel were found to be much more likely to be present in the forty-seven woodland hedges than in hedges in the 'other' category. Some 66 per cent of woodland hedges contained hornbeam compared with 17 per cent of the 'other' hedges. In those hedges where the species could be ranked according to abundance, hornbeam was dominant in one and frequent

in several other woodland hedges. Hazel was found in 60 per cent of woodland hedges but only 18 per cent of those in the 'other' category. In the case of maple the difference was less striking: 34 per cent of woodland hedges had maple compared with 24 per cent of the 'other' hedges. However only three woodland hedges had dogwood which was relatively more widespread in non-woodland hedges. Wild service was an uncommon hedgerow species and occurred in only eighteen 'full' or 'relic' hedges, of which six were woodland hedges.

Roadside hedges. The sixty-six 'full' or 'relic' roadside hedges were slightly less distinctive in their composition than were those adjoining present or former woodland. However hornbeam was twice as likely to be present, occurring in thirty-four per cent of roadside hedges compared with 17 per cent of the other category, and maple and dogwood were also noticeably more widespread, occurring respectively in 44 per cent and 17 per cent of roadside hedges as against 24 per cent and 9 per cent in the 'other' hedges.

Administrative boundary hedges. Only maple showed a distinctive pattern in these fifty-eight hedges, as half of all parish and county boundary hedges contained maple, compared with just under a quarter of the 288 hedges in the 'other' category. The occurrence of hornbeam, hazel and dogwood did not differ from that in the 'other' category hedges.

Barnet Common hedges

Land that had been part of Barnet Common contained about a hundred hedges in the 1860s of which seventy-eight remain as 'full' or 'relic' hedges. These hedges were grouped into four categories:

1. Those believed to be associated with the first enclosure of 1729. Included in this group were 1.6 km of hedges bordering tracks or green lanes, thought to have been created at the time of the first enclosure to allow access from surrounding roads to the enclosed fields. There were thirty-five hedges thought to date from the 1729 enclosure with a total length of 4.38 km (these were termed '1729 hedges'). It was in some of these hedges that crab apple was frequent.
2. Hedges on land enclosed at the time of the second enclosure of 1815. There were twenty-two hedges totalling 2.38 km ('1815 hedges').
3. Hedges along roads bordering the former common: eighteen hedges covering 2.62 km ('roadside hedges').
4. A small group of three hedges (total length 410 m) thought to be on an alignment of a track marked crossing the common on an undated map of the late seventeenth century (termed here '1690 hedges').

The following species were selected to give an indication of the diversity of these hedges: maple, hazel, dogwood, wild service, hornbeam and the herbaceous plant dog's mercury.

In general, all these species were poorly represented in Barnet Common hedges. None of the '1815' hedges contained any of the selected species. They were thinly represented in the '1729' hedges but even there twenty-nine of the thirty-five hedges did not contain any of them. In the roadside hedges seven out of eighteen contained one or more of the species listed above. The three '1690' hedges contained over twenty large old oaks, one of which was the sessile oak *Quercus petraea*, in a part of the survey area where old hedgerow trees were rather few. None of the selected species was present.

Hedge management

What did the Barnet hedges look like? In general, they showed little resemblance to the annually flayed bushes of agricultural England beyond the London area. Two-thirds of the hedges were recorded at the time of the survey

as 'unmanaged': that is to say that they appeared to the observer as having been left alone for the previous ten or more years. These unmanaged hedges could be loosely divided into two categories. Firstly, where the field system still existed, the hedges grew tall and wide, and the oaks and ashes in them were growing into trees. Secondly, in some public open spaces, the fields themselves had been unmanaged and had developed into scrub and then woodland. The old field hedges had, visually, merged with the younger woodland; only the taller timber trees standing out. Such hedges had probably received no maintenance since the 1920s when the land came into public ownership and had long since ceased to perform any of the functions of a hedge.

About 15 per cent of the hedges were recorded as being browsed by cattle or horses. Many of these hedges were otherwise unmanaged. As a result, the branches were allowed to develop above the browsing line. In a number of hedges bordering pastures mounds of rose bushes or brambles hindered animals' access to the hedge; in a few others, a post-and-wire fence prevented browsing at the base of the hedge. Where browsing was unrestricted, then the hedge bushes had no low growth and often resembled a line of young trees.

A further 15 per cent of hedges were cut or trimmed by humans. Hedges bordering roadsides or paths were often trimmed laterally. A number of others had been cut down and allowed to regenerate naturally — these were often hedges bordering leys or temporary meadows. Only a very few hedges were cut on both sides and on the top to provide a thick dense hedge but one where flowering spikes, still less emergent trees, had little chance to develop. No hedge had recently been plashed or laid in the traditional manner.

Discussion

The results of the survey raised a number of questions not all of which can be answered with the data available. Any general remarks should be interpreted to refer only to hedges growing in lowland England. Field boundaries in upland Britain differ in their composition or origin too much for comparisons to be valid.

The survey area in Barnet is part of the 'old countryside' rather than the 'planned countryside' of other parts of England (Rackham 1986). However, the 113 'woodland' and 'roadside' hedges in the present survey differ somewhat in their composition from the rest. Many of these hedges approach the type described by Cameron and Pannett (1980) as 'woodland assart' or 'roadside' hedges, and by Pollard (1973) as 'woodland relic' hedges. They differ in that the Barnet hedges also contain hornbeam which was absent from the hedges of the other authors who studied areas where hornbeam was absent as a native tree. The Barnet hedges almost completely lack spindle which was for Pollard a good indicator of woodland relic hedges. The soils in the Barnet survey area do not seem to suit spindle.

Cameron and Pannett (1980: 191) also refer to a survey of roadside hedges in Shropshire and report that 'field maple is not found in hedges without hazel; dog's mercury in only two sites without hazel'. This association was not evident in the Barnet survey area. Of 203 'full' or 'relic' hedges containing either maple or hazel, only forty contained both species. The distribution of dog's mercury will be discussed below.

The former Barnet Common forms the only part of the survey area where existing hedges can be dated with some degree of accuracy. These hedges were planted after the enclosures of 1729 and 1815. Normally such hedges were made up entirely of hawthorn, with perhaps some oak or elm trees. One striking feature of the Barnet Common 1729 enclosure hedges is the frequency of crab apple, presumably deliberately planted to accompany the hawthorn. In other respects, the Barnet Common enclosure hedges differ from the rest in the absence or rarity of hazel, maple, dogwood and hornbeam.

The hedges along the roads bordering Barnet Common differed somewhat in their composition from those created within the common. Cameron and Pannett (1980) noted that the 'woodland relic' character of old lane hedges in Shropshire was retained even when these lanes passed through areas that were once common pasture. In eastern England, such roads were rarely hedged, but the authors conclude that in Shropshire they were bordered by hedges, presumably to prevent the grazing livestock from straying. It seems likely that similar considerations operated in Barnet, and that the Barnet Common hedges bordering the roads were in existence before the first enclosure of the common in 1729.

The survey has suggested that the hedges bordering woodland or former woodland, those bordering old roads and those on the former Barnet Common were all distinctive in one way or another. What of the 250 or so other hedges? With the data available, it was not possible to classify them further. In most of them the two species of hawthorn, or the common hawthorn alone, predominated; in about forty hedges, however, blackthorn or elm was the predominant species. Those species considered to be associated with woodlands or roadside hedges, such as maple, hazel, hornbeam and dogwood were scattered widely in these hedges but at a low density. A few county boundary hedges were particularly rich in these species, which were also well represented in the rather fragmentary hedges on the more easterly of the two golf courses, but in general, no distributional pattern emerged.

The studies referred to earlier made no mention of hornbeam as the sites surveyed were outside the range of this species. The tree is considered to be slow to colonize new ground but in woods within its range it is often abundant (Rackham 2003). The presence of hornbeam in this survey's 'woodland' hedges is therefore not surprising. More unexpected was the presence of hornbeam in a variety of other hedges sometimes at some distance from any known wood. Its pattern of distribution was rather similar to that of the other species associated with 'woodland relic' hedges, and particularly with hazel.

There are at least three possible reasons for the present distribution of hornbeam. Firstly, those hedges containing hornbeam were created by the destruction of adjoining woodland of which we have no record. The hedge so created would have been formed out of the bushes growing in the wood to create the boundary of the new field. Secondly, hornbeam may have greater powers of dispersal than thought. Thirdly, the species was deliberately planted in the hedge, either when the hedge was created or later. It is possible that two or all three explanations can account for its present distribution.

The occurrence of dog's mercury in the hedges of the survey area also raises questions. It has already been noted that Cameron and Pannett (1980) reported a very strong association between hazel and dog's mercury in certain Shropshire hedges. Pollard et al. (1974: 101-103) give examples of dog's mercury spreading into hedges from adjoining woodland: the rate of spread was estimated at 20–30 cm a year at most. They refer to studies made in Warwickshire where a clear association exists between woodland or former woodland and the presence of dog's mercury in hedges.

The pattern of distribution of dog's mercury in the Barnet survey area did not resemble that given by the authors above. It was widely but somewhat patchily distributed. Of the fifty-nine hedges containing dog's mercury three were classified as 'woodland' hedges, one bordering the present Scratch Wood, the other two a former woodland a little to the south-east. The absence of dog's mercury from other 'woodland' hedges suggests that the other former woods did not have dog's mercury in them. There was no particular association with hazel: nine hedges (15 per cent) containing dog's mercury also contained hazel.

Dog's mercury is a plant that spreads by rhizomes to form large patches. Detached pieces of rhizome can readily form new plants. The frequency of this species in the hedges bordering Dollis Brook may be due to past floods or bank

collapses which enabled the plant to spread downstream. Alternatively, it may be that the soils of the land bordering the brook suit this species. It is perhaps worth noting that the only records of two calcicolous bushes — common buckthorn *Rhamnus cathartica* and spindle *Euonymus europaeus* — came from brookside hedges. The widespread occurrence of dog's mercury on the golf courses may result from earth-moving operations carried out when the golf courses were being created. The rhizomes of dog's mercury would quickly establish themselves.

We may conclude that most of the hedges in the Barnet survey area do not exhibit the sharp contrasts recorded in some other surveys. We can distinguish one type of hedge which bordered woodland or former woodland, and which occurred in a slightly less distinctive form alongside old roads. The hedges on the former Barnet Common are also distinctive. The remaining field hedges vary considerably in their composition and do not comprise any one distinct type.

Conclusion

This study has been the result of a general survey of the hedges in a part of north London in which the pre-suburban field pattern has partially survived. Despite the proximity of parks and gardens containing ornamental trees and bushes, nearly all the hedges were found to consist mainly of traditional hedgerow species. Particular features of the Barnet survey area hedges include the abundance of woodland hawthorn and the widespread occurrence of maple, hazel, hornbeam, crab apple and dogwood. The hedges were still well-timbered with the common oak being much the commonest timber tree. Hedges bordering woodland or former woodland and those alongside old roads tended to be somewhat different from the rest, as did those hedges believed to have been planted during successive stages in the enclosure of the former Barnet Common.

In their physical appearance the hedges showed great variety, but most had received little or no attention for many years. Some had become almost invisible as scrub and secondary woodland had developed on each side; in others, cattle or horses had eliminated all the low growth. However, many hedges formed excellent wildlife habitats and contributed largely to the wildlife value of the area. Indeed the hedges were sometimes the main feature of wildlife interest, enclosing as they did farmland leys or football pitches.

Although the survey area is covered by various designations indicating its protected status, these designations may not be effective in preventing loss of hedgerows. Further studies, both historical and ecological, could establish the antiquity of these hedges as well as their wildlife value and so strengthen the case for their conservation.

Acknowledgements

The writer would like to thank Dr R. D. Meikle for kindly identifying some puzzling hedgerow willows and members of the Barnet Group of the London Wildlife Trust for support. He would also like to thank the local history and archives service of Barnet libraries for facilities and help.

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Book review

Medicinal plants in folk tradition. An enthnobotany of Britain and Ireland. David E. Allen and Gabrielle Hatfield. 2004. Timber Press, Swavesey, Cambridge. 431 pages, hardback. £22.50. ISBN 0 88192 638 8.

The authors of this book have spent much time researching through hundreds of published and unpublished sources, including information contained in over 1,000 manuscript volumes gathered by the Irish Folklore Commission, to write this account of the medicinal uses of wild plants by the country folk of Britain and Ireland. The purpose of the book is to show that country folk used a much wider range of plants and treated more ailments than those which have appeared in herbals. The book records the tradition of folk medicine with the aim of convincing historians and scholars of the worth and importance of folk medicine as well as providing a list of plants amongst which might be some for current scientific investigation. The authors appear to be well qualified to do this — David Allen being a past president of the Botanical Society of the British Isles and of the Society for the History of Natural History as well as a scientific associate of London's Natural History Museum; Gabrielle Hatfield is a research associate at the Royal Botanic Gardens, Kew and serves with Ethnomedica, collecting and preserving the medicinal plant traditions of Britain.

The book lists the folk medical uses traced for plants growing wild in Britain, Ireland or the Isle of Man although with some exclusions such as the Channel Islands, uses associated with more recent immigrant people, non-indigenous plants etc. It does not provide 'recipes' as such nor does it indicate whether a remedy works or not — indeed they have a clear disclaimer that they accept no responsibility for any situation or problems which could arise from experimentation with any of the remedies mentioned. The listings do however give the original source for a record if this has been traced, enabling people to check further. As well as a large plant section with remedies and information relating to the plant concerned, it also has an index listing plants under ailments and an appendix listing over a hundred different herbs used to treat animals.

I found this a fascinating book with some glimpses, facts and puzzles about how our native plants have been utilized by our forebears. Did you know that self-heal *Prunella vulgaris* had three distinct functions in folk medicine — to staunch bleeding, to ease respiratory complaints and to treat heart trouble; that in Somerset the leaves of greater plantain *Plantago major* were applied to rashes; that tansy *Tanacetum vulgare* had been strewn about in the fresh state to keep away noxious insects and mice; that in Worcestershire the acrid juice of the berries of lords and ladies *Arum maculatum,* although a dangerously poisonous plant rich in compounds capable of causing death, had been valued as a wart cure? I did not, and found much more of interest within these pages.

If you like plants and have an interest in our folk history and/or natural healing this book could well be for your bookshelf — note the disclaimer however. I shall certainly be buying my own copy. The book would also be a source of fascinating titbits for those people who lead guides walks to enliven the discovery or inspection of a plant whether well known or not.

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Freshwater fish in London's rivers

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Summary

The diversity, distribution and relative abundance of fish species found in freshwater tributaries of the River Thames in London are presented here using data sets compiled by the Environment Agency since 1991. Twenty-nine species are recorded including a number of marine and migratory fish known to frequent intertidal and or freshwater reaches. Of these, five are considered to be of conservation interest and two are included within the Thames Biodiversity Action Plan (BAP) (Environment Agency 2000). In addition bullhead *Cottus gobio* are present in a number of London's watercourses and is designated within the European Habitats Directive as being scarce at a European scale, although within southern England is known to be relatively abundant (Carter and Copp in prep.). Ranges of non-indigenous fish species have also been observed and are included in this review if their occurrence indicates an identifiable population. One such example being zander *Stizostedion lucioperca* which is now regularly recorded within the Lower River Lee (Copp et al. 2003). London's larger watercourses appear to sustain a greater diversity and abundance of fish reflecting the greater environmental stability and habitat diversity of larger water bodies in comparison with smaller ones.

Introduction

Fish populations of the River Thames and its tributaries have been described with great interest for many decades, however, much of the information before 1960 is largely derived from adhoc investigations having poorly described methodologies, or from catches made by recreational anglers and commercial fishermen (Wheeler 1979). The inception of River Boards in 1948 resulted in a better resourced and more strategic countrywide approach to fisheries management, and by the 1960s methodologies and equipment improved sufficiently to allow more accurate assessments of fish populations (Wheeler 1969). These developments have helped to consolidate fisheries science with management (Fort and Brayshaw 1961) giving rise to the modern era of fisheries management (Lightfoot and Jones 1979, Copp 1989, Mills and Mann 1985, Mann 1988 and Cowx 1988). Hence between 1960 and 1990 the quality and quantity of information recorded has greatly improved enabling, for example, fish populations of the River Thames and tributaries of London to be described better than ever before (National Rivers Authority 1991*a, b, c,* 1992*a, b,* 1993, 1994*a, b,* Environment Agency 1995*a,* 1996*a, b, c*).

Within current legislation, principally the Salmon and Freshwater Fisheries Act (1975), and implications from its current review (2000), fisheries investigations and management remain a national priority. Since the formation of the National Rivers Authority in 1989 and later the Environment Agency in 1996, fish populations across England and Wales have been studied with increasing regularity and consistency in methodology (Environment Agency 2004*a*). These measures form part of a strategic approach better to maintain and improve fish populations locally, as well as help record and report the state

of fisheries across the nation (Environment Agency 2004*b*). In addition, current expectations are to monitor freshwater fish populations for the purposes of the European Water Framework Directive (European Commission 2000).

Fish populations in London have varied considerably over the years, most likely with changes in water use and urbanization resulting in one of the most developed environments in the world. Records suggest that many fish species suffered considerable decline and/or extinction during the 1800s, principally during times of extreme poor water quality (Wheeler 1958, 1969, 1979, Wilson 1987). More recently fish populations are considered to be thriving (Kirk et al. 2002), perhaps due to improved regulation of water use, water quality and habitat management.

The River Thames and tideway attract much of this popular focus (Kirk et al. 2002, Environment Agency 1995*b* and 1999), however, it is equally important to consider the ecological status of London's arterial watercourses, which inherently contribute to the condition of the wider catchment. As such, records of fish populations for these watercourses collated by the modern river regulator, the Environment Agency and its predecessor organizations, are summarized and presented here. Data were gathered from a variety of reports (National Rivers Authority 1991*a, b, c,* 1992*a, b,* 1993, 1994*a, b,* Environment Agency 1995*a,* 1996*a, b, c*) and recent records from the Agency's National Fish Population Database (NFPD).

Study area

Eleven river catchments define the fisheries of London. These comprise the Brent, Crane, Colne, Lee (Lea), Roding, Beam and Ingrebourne draining basins from the north of the Thames and the Ravensbourne, Wandle, Beverley Brook and Hogsmill draining catchments from the south (Figure 1). London's

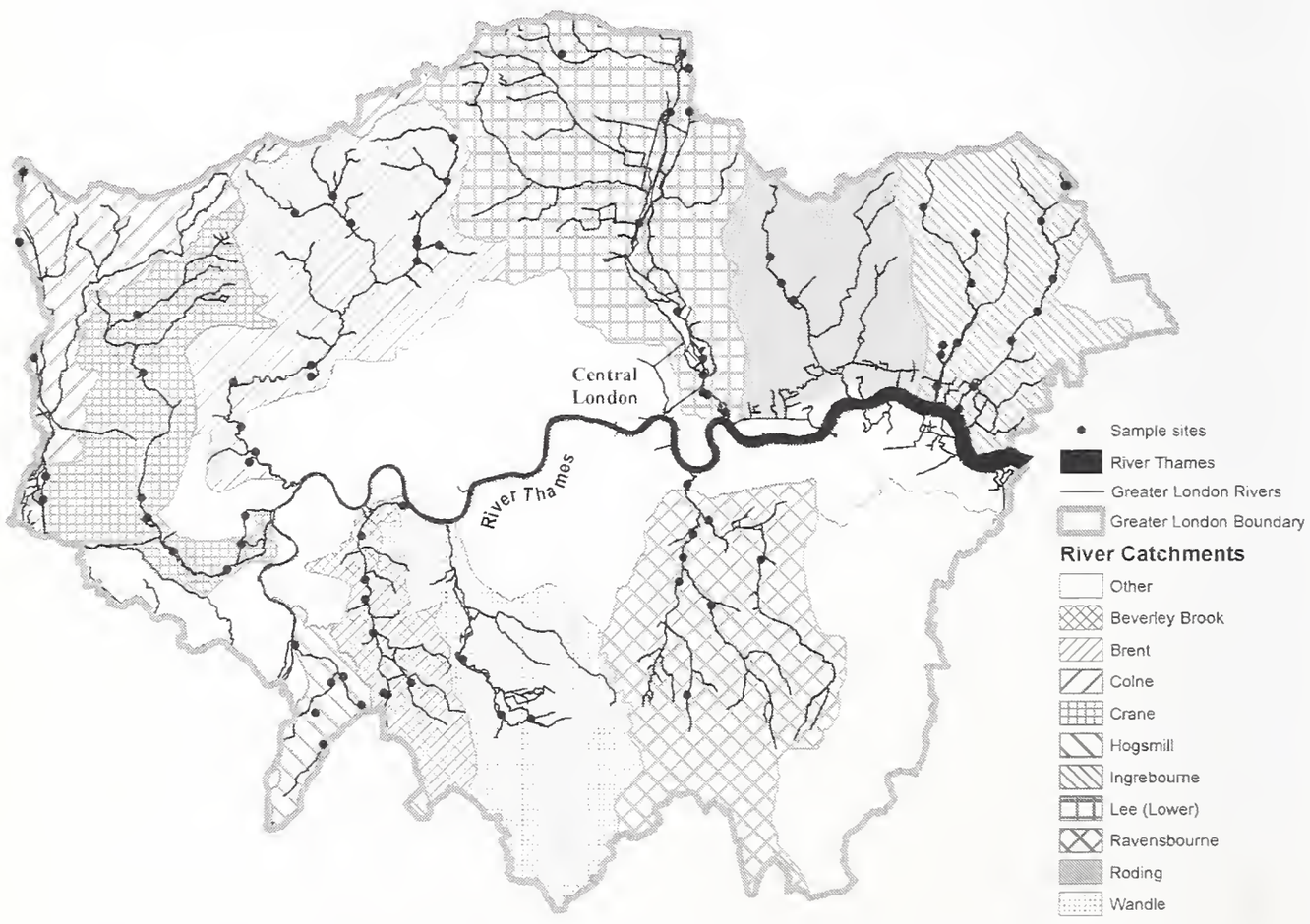

FIGURE 1. Fisheries monitoring sites within the different river catchments sampled during the period 1991–2003.

rivers vary in size from one to thirty metres in width and 0.1 to greater than 5.0 metres in depth, however, they share a number of common attributes. Most notably the majority of these rivers are constrained by urban and industrial development, being realigned, deepened, widened and reinforced with smooth sides to facilitate rapid discharge of floodwater away from people and property. Within extensive lengths of channels, wooden toe-boards have been used to stabilize banks limiting the extent of marginal habitat. Toe-boarding involves installing wooden revetments to the lower section of river banks using planks of wood to prevent erosion. In-channel structures including weirs and sluices are relatively common throughout all of these rivers, serving as hydraulic breaks during high flows and impoundments during low flows. These create structural steps in river gradient which interrupt natural geomorphological processes, meaning that gravel substrates, for example, if removed by dredging, are rarely replaced by downstream particle drift. Silt and clay deposits are inherently common, as are concreted artificial channels, with only occasional semi-natural sections having mixed gravel types. There are few opportunities for the colonization of diverse riparian vegetation and wildlife. More frequently these modified channels favour invasive and resilient species. Although less abundant, there are ecologically rich sections of river, having sinuous dynamic channels with pool and riffle sequences, containing more diverse assemblages of flora and fauna. Other notable features include rivers that flow through ponds, interconnected still waters and reservoirs, flood relief channels, culverted sections, navigations, lock gates, intertidal connections and areas of varying water quality.

Methods

During a twelve-year period, between 1991 and 2003, ninety-one sites were sampled for fish across the eleven river catchments in London. The majority of these surveys were undertaken during the summer months following a standardized three-catch depletion electric fishing methodology (Environment Agency 2004*a*), although the intertidal sites required the use of fine-meshed seine nets. Standard electric fishing apparatus included a Honda 1.5kVA generator delivering a pulsed DC output of approximately two amps at a frequency of 50Hz. Operatives fished using three-metre anode poles, having thirty-centimetre circular rings, for a minimum of three times in an upstream direction, either by wading or from a boat, between two fine-meshed stop nets enclosing a hundred metres of river. All species were recorded, including lengths and weights for most fish. Subsamples of scales taken for ageing purposes and estimates for fish density were calculated.

Results and discussion

A summary of fish species presence or relative abundance for each catchment is described and presented here. Native species occurring on one or more occasions in any survey is regarded as being present. Relative abundance is used as an arbitrary measure to emphasize a more frequent occurrence. Non-native species are only recorded if they occur in sufficient numbers to indicate an identifiable population at that location or a series of locations. Recording all non-native fish found in watercourses throughout London may otherwise lead the reader to a false conclusion.

Table 1 lists twenty-nine fish species recorded in London's freshwater rivers between 1991 and 2003. Neither species diversity nor relative abundance changed significantly during this period. Subtle changes in presence/absence were noted for a small range of species at a low number of sites, which is likely to be a result of infrequent sampling and seasonal variations in their distribution and ecology, rather than a simplistic disappearance or occurrence of a species within a river catchment.

TABLE 1. Fish species in London's rivers.

Catchment / Species		Lee	Roding	Colne	Crane	Ingrebourne	Brent	Rom/Beam	Wandle	Ravensbourne	Hogsmill	Beverley Brook
Brown trout	*Salmo trutta fario* L.	○		×								
Roach	*Rutilus rutilus* (L.)	○	○	○	○	○	○	○	○	×	×	
Dace	*Leuciscus leuciscus* (L.)	×	○	○	×	○	×	×	×	×		
Chub	*Leuciscus cephalus* (L.)	○	○	○	×	○	×	×	×	×	×	
Common bream	*Abramis brama* (L.)	○	○	×			×				×	
Pike	*Esox lucius* (L.)	○	○	○	×		×					
Perch	*Perca fluviatilis* (L.)	○	○	○	×	×	○	×	×	×	×	
Eel	*Anguilla anguilla* (L.)	○	○	○	○	○	×	×	○	○	○	○
Barbel	*Barbus barbus* (L.)			○		×			×			
Gudgeon	*Gobio gobio* (L.)	×	○	○	○	○	×		×			
Bleak	*Alburnus alburnus* (L.)	○		○	×							
Minnow	*Phoxinus phoxinus* (L.)	×	×	×	○	○	×			×		
Ruffe	*Gymnocephalus cernua* (L.)	×										
Bullhead	*Cottus gobio* (L.)	×	×	○	×				○			
Stone loach	*Barbatula barbatula* (L.)	×	○	×	×	○			×		○	
Three-spined stickleback	*Gasterosteus aculeatus* (L.)	×	○	○	○		○	○	○	○		○
Ten-spined stickleback	*Pugnitius pugnitius* (L.)								×			
Carp	*Cyprinus carpio* (L).	×	×			×	×	×				
Crucian carp	*Carassius carassius* (L.)					×		×				
Tench	*Tinca tinca* (L.)	×	×	×	×			×		×	×	×
Rudd	*Scardinius erythrophthalmus* (L.)					×		×				
Zander	*Stizostedion lucioperca* (L.)	×										
Thick-lipped mullet	*Chelon labrosus* (Risso)	×	×									
Bass	*Dicentrachus labrax* (L.)	×	×		×							
Sprat	*Sprattus sprattus* (L.)	×	×									
Goby	*Pomatoschistus microps* Kroyer	×	×									
Smelt	*Osmerus eperlanus* (L.)	×	×									
Sand smelt	*Atherina presbyter* Cuvier	×										
Flounder	*Platichthys flesus* (L.)	○	○		×							
Total species	29	24	19	15	15	12	10	10	11	8	7	3
Abundant species		8	11	11	5	7	3	2	4	2	2	2

EEL *Anguilla anguilla*

The European eel occurred most frequently, being present in all eleven catchments and relatively abundant in nine of these. The eel is an extremely adaptable species known to inhabit most estuaries, freshwater rivers and lakes throughout the British Isles (Environment Agency 2001*a*). Being catadromous

they have a relatively complex life history, involving lengthy spawning migrations to the Sargasso Sea and a return drift of juveniles back to European rivers (Sinha and Jones 1975). This complexity could contribute to their success, however, it may equally make them vulnerable to rapid changes of circumstance such as climate change, habitat degradation or susceptibility to new pathogens. Hence it is encouraging to find that eels are widespread throughout London's rivers, although future conservation measures may be needed to ensure their continued success.

Roach *Rutilus rutilus*

Roach were the next most frequently occurring species, being present in ten of the eleven catchments and considered abundant within eight of these. In particular, roach were most numerous in catches throughout the lower reaches of the River Lee. Marlborough (1972) also noted the presence of roach in the lower Lee, although mentions they were only found in small numbers. Environment Agency records show that roach populations in the lower Lee have neither increased nor decreased significantly since Marlborough's work (Thames Water 1976, National Rivers Authority 1991*c*, 1992*b*, NFPD data). For many decades roach have been regarded as one of the most frequently occurring and relatively abundant of the freshwater fishes in England (Mann 1973, Mills 1981*a*), known to be adaptable in nature and tolerant to a range of habitats and water qualities, including euryhaline conditions (Phillips and Rix 1985, Kirk et al. 2002). The Beverley Brook was the only river in London where roach were not recorded, having the overall lowest diversity of only three species, eel, three-spined stickleback *Gasterosteus aculeatus* and, curiously, tench *Tinca tinca*.

Lotic fish species

Tench, rudd *Scardinius erythrophthalmus*, carp *Cyprinus carpio* and crucian carp *Carassius carassius* are more commonly associated with still or slow-flowing waters (National Rivers Authority 1995), but were collectively present in ten of the eleven catchments. However, none of these species was present in the Wandle. Although tench commonly inhabit lowland rivers across southern England, they usually occur in the presence of a range of other cyprinids, for example, roach and bream *Abramis abramis* (Giles et al. 1990). Therefore, the relatively isolated occurrence of tench in the Beverley Brook suggests that these fish may have escaped from nearby interconnected still-water populations or from illegal introductions. A similar conclusion may be extended to the presence of carp, crucian carp and rudd that were found in other catchments, yet their origins and rates of colonization are also unclear. Marlborough (1972) refers to the increasing presence of carp throughout the Thames system and mentions an alleged introduction of the species into the River Roding at Ongar. Anecdotes of increasing numbers of local anglers who specifically fish for carp in the lower Lee, Colne and Roding suggest that this species may be more frequent than the records report here. Both crucian carp and rudd were found to occur only in the Rom / Beam and Ingrebourne. Marlborough (1972) makes a brief reference to observations of rudd at Rye Meads and Fieldes weir in the River Lee, again having a very localized distribution most likely associated with escapes from nearby still waters.

Other cyprinids

Dace *Leuciscus leuciscus* and chub *Leuciscus cephalus* were both present in the majority of the eleven catchments, excluding the Beverley Brook, and both considered relatively abundant in the Colne, Roding and Ingrebourne catchments. In addition, chub are considered abundant in the Lee catchment. These species require suitable gravel substrates and sufficient water velocities at

critical times to spawn and reproduce successfully (Mann 1976, Mills 1981*b*, Mann and Mills 1986, Garner and Clough 1996). This indicates that suitable conditions occur in these catchments and possibly occur more extensively where the fish are abundant. However, dace are known to migrate great distances to locate suitable spawning areas (Garner and Clough 1996), therefore impassable obstructions, for example, large weirs that constrain river sections and limit habitat variability, can potentially restrict dace populations (Garner and Clough 1996). Common bream were present in five catchments and notably abundant in the lower Lee and Roding. Local anglers consistently report catches of large mature bream between Enfield Lock and Ponders End on the Lee Navigation, as well as regular catches of smaller bream from Bow near to the tidal connection with the River Thames (Meadhurst pers. comm. 2004). Bleak *Alburnus alburnus*, once a species commercially exploited for their scales and subsequently noted by decline (Wheeler 1979), appear in more recent times to have made a moderate comeback (NFPD data). Bleak were recorded in three catchments, being present in the Crane, and relatively abundant in the lower Lee and Colne. Bleak tend to prefer large, impounded, slow-flowing lowland habitats (Phillips and Rix 1985) as found in the lower Lee and Colne, and to a lesser extent the Crane. Gudgeon *Gobio gobio* were recorded in seven river catchments and abundant in four, the Colne, Crane, Roding and Ingrebourne. This small benthic cyprinid is a gregarious and adaptable fish, capable of thriving in still waters and canals, but is also often associated with shallow, fast-flowing streams with fine gravel substrates (Phillips and Rix 1985, Mann 1980). Gudgeon are particularly abundant throughout the lower reaches of the Colne, perhaps due to its connectivity with the Grand Union Canal, which collectively offer this rather attractive little species a wide variety of habitat types. The minnow *Phoxinus phoxinus* is a prolific and adaptable species and could be expected to be present within all of London's rivers. Yet interestingly the minnow has only been recorded in seven river catchments and is considered relatively abundant in only the Crane and Ingebourne. Fish are often considered good ecological indicators (Meng et al. 2002), but they can also be used as a measure of the effectiveness of survey methodology. Given the widespread and abundant nature of minnows in many rivers across the British Isles (Phillips and Rix 1985), the records presented here suggest that methodologies and survey design could have resulted in minnows being unrecorded. Poorly managed but enthusiastic electric fishing operators are, for example, renowned for concentrating their efforts into catching large fish at the expense of small ones (personal observation).

Predatory fish

Although pike *Esox lucius* and perch *Perca fluviatilis* are considered to be the most piscivorous of all freshwater fish native to the British Isles (Giles et al. 1986 and Craig 1987, 1996). Other species, for example, chub and brown trout *Salmon trutta* are also known to be predatory (Phillips and Rix 1985). Being a widespread species in London's rivers, perch were present in ten of the eleven catchments and relatively abundant in four, the Brent, Lee, Colne and Roding. Like roach, perch are relatively tolerant, inhabiting a wide range of habitats and targeting a variety of food items including plants, invertebrates and fish (Craig 1987). Pike were recorded in five catchments, Colne, Brent, Crane, Lee and Roding, all north of the Thames. Again, pike are known to adapt to a wide range of habitats (Craig 1996), however, in comparison with perch they are more reliant on fish as a food source, which may exclude them from London's smaller rivers where prey items are limited.

Non-native fish

For many years fish have either escaped into rivers from lakes, have been discarded by owners intentionally, or illegally introduced for commercial and/or

recreational gain. Little is understood of how these species affect native freshwater ecosystems and there is growing concern of an increasing occurrence of non-native fishes in the rivers of London. Many isolated individuals have been either reported in surveys or observed by anglers in catches. Observations have included wels catfish *Silurus glanis*, channel catfish *Ictalurus punctatus*, top mouth gudgeon *Pseudorasbora parva* and golden orfe *Leuciscus idus*. These fish are not thought to be widespread or reproducing, although it is likely that some of these species may become established in the future. The zander *Stizostedion lucioperca* is an example of a non-native predatory fish that has in the last two decades become established in the middle and lower Lee, although it is not regarded as abundant (Copp et al. 2003).

Minor fish species

The three-spined stickleback was the most widespread and relatively abundant of the minor species, being present in nine of the eleven catchments and considered relatively abundant in eight of these. It is a resilient and adaptable species (Copp et al. 1998), probably being the most tenacious discussed here. The ten-spined stickleback *Pugnitius pugnitius*, in contrast was present only in the Wandle catchment, however, it is probable that they are more widespread than indicated here due to limited sample coverage and/or misidentification with the three-spined species. The distribution of ruffe *Gymnocephalus cernua* is restricted to the lower Lee, however, it is known to be more abundant in the middle and upper reaches of the Thames (NFPD data). Stone loach *Barbatula barbatula* are found in seven river catchments and are abundant in three, the Roding, Ingrebourne and Hogsmill. These fish are often associated with good water and habitat quality, although are adapted to a range of conditions (Phillips and Rix 1985). Their preferred habitat consists of shallow riffles over fine gravel and sand substrates with dense macrophyte growth (Carter and Copp in prep.).

Conservation fish species

Bullhead *Cottus gobio* were recorded in five catchments, being abundant in the Colne and Wandle. They are regarded as good indicators of favourable water quality and fish habitat (Langford and Hawkins 1997) and have significant conservation status being included within Annex 2 of the European Habitats Directive (Environment Agency 2001*b*). The Directive affords bullhead statutory protection only if they are listed for designated Special Areas of Conservation (SAC) or Candidate Special Areas of Conservation (CSAC). Barbel *Barbus barbus* were present in the Ingrebourne and Wandle catchments and relatively abundant in the Colne. Brown trout were present only in the Colne catchment. Both of these species are considered ecologically sensitive and are listed as Category 5 species within the Thames Biodiversity Action Plan (Environment Agency 2000). The BAP delegates a responsibility to the Environment Agency to encourage populations of brown trout and barbel as appropriate. The smelt *Osmerus eperlanus* is also considered to be of national conservation interest (Environment Agency 2004*c*). In recent years their numbers have notably declined in twenty-five per cent of the estuaries having previous records (Environment Agency 2004*c*), however, numbers in the Thames Estuary are still thought to be relatively high (Kirk et al. 2002).

Estuarine fish species

A range of marine species was recorded in tidal sections of the lower Lee, Roding and Crane. Thick-lipped mullet *Chelon labrosus*, sprat *Sprattus sprattus*, goby *Potmatoschitus microps*, and smelt *Osmerus eperlanus* were present in the Lee and Roding and sand smelt *Atherina presbyter* was present only in the Lee. Bass *Dicentrachus labrax* and flounder *Platichthys flesus* were recorded in these catchments and also found within the lower Crane. These and many other estuarine species are known to inhabit the tidal Thames and are reviewed by Kirk et al. (2002).

Conclusions

Fish are intrinsically linked with their environment and do not thrive if conditions are inadequate. Records presented here suggest that the small, more heavily engineered rivers support relatively poor fish communities, typically consisting of tolerant species like the three-spined stickleback. In contrast, London's larger rivers support relatively diverse and abundant fish populations. Fish assemblages reflect the environmental stability of the water body, where large rivers are more resilient to perturbations and provide a greater diversity of habitats. The quality of water in London's rivers has been a point of concern and debate for centuries, however, the widespread occurrence of fish suggests that matters have greatly improved. Many of the species recorded in the surveys including brown trout, bullhead, stone loach and barbel are indicators of a healthy environment. Rivers containing only tolerant species indicate a degraded environment and suggests that there are issues associated with water quality, water quantity and/or habitat quality. A number of measures are under way to ameliorate these issues including campaigns to address storm-water overflows, misconnections and illegal discharges. In addition, habitat degradation is being addressed through a strategic approach to river restoration across London (Environment Agency 2002 and in prep.). It is anticipated that future surveys will show an improvement as a result of these measures.

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Book reviews

The living elephants. Evolutionary ecology, behavior and conservation. Raman Sukumar. Oxford University Press. 2003. 478 pp. Hardback. £45. ISBN 0 19 510778 0.

A brief review only will be given here since, even with advancing global warming, there is no potential for these animals to occur in the London Area! The book is a definitive review of elephants as would be expected from such an established and respected scientific publisher.

In addition to the expected topics set out in the sub-title, the book also thoroughly covers the cultural relationship of elephants with people and their conflict with the seemingly ever-growing human populations that threaten to encroach into their remaining habitats. A final chapter on their conservation is both timely and brings up to date the many well-publicized issues such as game hunting and ivory poaching.

In summary, this is an excellent book for both the elephant enthusiast and those seeking a comprehensive, scientific review of the taxon.

The ecology, exploitation and conservation of river turtles. Don Moll and Edward O. Moll. Oxford University Press. 2004. 393 pp. £40, hardback. ISBN 0 19 510229 0.

This will be another summary review since the taxon in question has no native species present in Britain. Although the book is not promoted by its publishers as a companion volume to *The Living Elephants*, one cannot help drawing comparisons with that work given its overall style, approach and content. It is both definitive and well researched, with over fifty pages devoted to literature references alone, and reasonably illustrated with many black-and-white photographs throughout.

It acts as a comprehensive review of a taxon that has been greatly exploited by people, principally for food, and it is this topic that dominates the book with rather less space devoted to the ecology of individual species than I personally was hoping to find. Topics covered, however, are wide-ranging and include a whole chapter about their methods of capture. Finally, there is a useful summary of their conservation management and rehabilitation to conclude this interesting publication.

Naturalized reptiles and amphibians of the world. Christopher Lever. Oxford University Press. 2003. 318 pp. Hardback £79.95. ISBN 0 19 850771 2.

One of the world's leading experts on introduced species, combined with a well-known academic publisher, should make this book one that is difficult to put down. And so it proved. It is true that the publication has a rather old fashioned feel to the layout and there are no photographs, but it is the text in such a work that determines whether it is purchased and ultimately its usefulness.

The text was as comprehensive as was expected and proved compulsive, if somewhat depressing, reading. Apart from a short introduction, together with an appendix comprising no less than sixty-two pages of references, the 268 species accounts dominate the work. Each account succinctly describes its non-native distribution and status by continent and then country, though one wonders how long the current situation will remain unchanged. Also discussed, where appropriate, is the ecological impact of the species in their various new geographical locations.

The blurb on the back cover states that this work completes the author's publications on the history and ecology of the world's naturalized vertebrate species. Given the ever changing climate and our propensity for deliberate and accidental introductions, however, it may not be long before he needs to consider a second edition! This book is thoroughly to be recommended to anyone with an interest either specifically in these taxa or in introduced species ecology.

CLIVE HERBERT

Behaviour of young and small fishes in the River Lee (Hertfordshire) over a twenty-four-hour cycle in midsummer

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KEYWORDS: dispersion, point abundance sampling, diel, nocturnal.

Summary

In a preliminary study of diel patterns in fish density and dispersion in a stretch of the River Lee, Hertfordshire, August 1996, data were examined with respect to time of day and in-stream location. Fish density, dispersion and the frequency of samples containing fish increased at night, the fish assemblage being comprised of minnow *Phoxinus phoxinus*, gudgeon *Gobio gobio*, chub *Leuciscus cephalus*, stone loach *Barbatula barbatula*, bullhead *Cottus gobio*, and barbel *Barbus barbus*, with a few specimens of three-spined stickleback *Gasterosteus aculeatus* occurring infrequently. Contagion in most species decreased at night, but minnow, stone loach and bullhead were the only species to demonstrate clear diel patterns in density. Fish densities and contagion in mid-channel reached their peak at dusk, whereas the highest densities at night were along the banks. The patterns observed here have been corroborated by subsequent investigations, but comparisons with published data under different moonlight conditions suggest that diel patterns in fish density are less clearly demonstrated in larger river systems, emphasizing the need for moonlight, prey and predator densities as well as other habitat characteristics to be taken into account when assessing diel patterns.

Introduction

Diel patterns in distribution, habitat use and feeding are characteristic of fish behaviour in fresh waters (Manteifel et al. 1978). Mathews (1971) was the earliest known researcher to have compared day and night densities of fish in European rivers, and he observed higher numbers at night in the majority of species and age classes along the banks of the River Thames, England. The poorly known post-graduate research of Schröder (1979) on the River Rhine, Germany, was probably the first in Europe to examine diel rhythms in riverine fish in more detail, and he found a decline in fish activity at night both in the field and under laboratory conditions. A number of similar investigations were being undertaken in the former USSR, with Manteifel et al. (1978) and Pavlov et al. (1978) being amongst the most prominent of these. Subsequent studies (Copp and Jurajda 1993, 1999, Bischoff and Scholten 1996, Baras and Nindaba 1999, 2000) demonstrated that non-salmonid fishes in European rivers undertake diel changes in distribution, abundance and behaviour similar to those observed in lakes and large reservoirs in which numbers and dispersion of fish tend to be greater at night (e.g. Vostradovský 1965, Vašek et al. 2000, Tischler et al. 2000). Not surprisingly, the few studies on diel feeding patterns

and interactions between non-salmonid fish and their prey and/or predators in rivers (Garner 1996*b*, Przybylski 1996, Copp and Jurajda 1999, Copp et al. 2004*a*) also found patterns similar to those well known in lakes and reservoirs (Flik et al. 1997, Macháček and Matena 1997, Masson et al. 2001).

However, most of the studies mentioned above, on non-salmonids in rivers, concerned planktivorous fish species. Most of the small water courses in the London area, such as the River Lee in Hertfordshire and its tributary streams, are dominated numerically by benthivorous fish species (Copp and Bennetts 1996, Pilcher and Copp 1997, Watkins et al. 1997) and this was reflected in the diet of otters reintroduced to the Lee catchment (Roche et al. 1995, Copp and Roche 2003). Observations in these studies of the Lee system did not suggest fish densities as high as those recorded in rivers of central Europe, where some recent studies of diel fish dynamics had been undertaken (Copp and Jurajda 1993, 1999), so diel patterns such as observed elsewhere were not expected. The aim of this preliminary study was to assess whether fishes of the River Lee, dominated primarily by benthivorous species, demonstrate diel patterns in number and distribution similar to those recorded elsewhere in Europe.

Study area, material and methods

The study site on the River Lee (Hertfordshire, England) has been described in detail elsewhere (Copp and Bennetts 1996, Watkins et al. 1997). Briefly, the River Lee is of chalk spring source, drains a largely urban catchment of about 1,420 km^2, and is a major tributary of the River Thames. The study stretch at Woolmer's Park (National Grid Reference: TL288100) contained a riffle/pool/run sequence, and had a riparian border of 2 to >40 m, a width of 3–12 m and depths up to 2 m (see Fig. 1 in Edmonds-Brown et al., this issue). Channel shape was generally natural, being protected from cattle damage by barbed-wire fences, and in-stream management had been limited to the removal of fallen trees and bushes (see Copp and Bennetts 1996).

Sampling was undertaken on 7–8 August 1996 using point abundance sampling by electrofishing, with a portable DEKA unit modified for small fishes (anode of 10 cm diameter; see Copp and Garner 1995). This sampling approach consists of numerous small samples collected at randomly chosen points; each point sample is assumed to be ≈ 0.071 m^2 (Copp 1989), though this area will vary according to water conductivity (Cuinat 1967). Sampling was generally undertaken from a dinghy, though some points were so shallow that sampling was undertaken by foot, with a discreet approach to the sampling point. The application of electrofishing with a small anode is generally biased towards fishes <70 mm SL (Copp and Garner 1995, Garner 1996*a*), so results for larger fishes should be viewed as tentative.

Twenty point samples were collected haphazardly (point of the finger, arm outstretched, with eyes closed), in an upstream direction, during each of nine sampling excursions, i.e. each three hours beginning at 09:00 on 7 August and ending after the 09:00 excursion of 8 August. Of these, 117 points were <2 m from the bank (bank samples) and 63 were ≥2 m from the bank (channel samples). Fish relative density was calculated as the number of specimens captured per total surface area sampled for each sampling excursion (Copp 1989, Copp and Garner 1995), with chub *Leuciscus cephalus* classed as 'small', i.e. non-piscivorous (<100 mm SL), and potentially 'piscivorous' (≥100 mm SL) as per Mann (1976). All times of day are given in local time. Climatic conditions remained uniform throughout the twenty-four-hour study (clear skies, with a few clouds; last quarter moon). River discharge during August varies diurnally, ranging from 55 to 65 $m^3 \cdot s^{-1}$ (Faulkner and Copp 2001).

The assessment of contagion in all samples combined by sampling excursion, the index of dispersion (variance/mean) was used, whereas for evaluations of fish aggregation patterns between bank and channel locations, I used Green's

(1966) index of dispersion, which is considered the only such index that is little influenced by differences in sample number (Elliot, 1977): $[(s^2/x)\text{-}1/nx\text{-}1]$, where s^2 is the variance, x is the mean number of fish per sample and n is the number of point samples. Samples were grouped as bank and mid-channel samples for some statistical tests. In comparisons of fish density, samples were grouped by time of day (dawn, 06:00; day, 12:00+15:00; dusk, 21:00; night, 24:00+03:00), approximating the official times for sunrise (06:02) and sunset (20:04). The Kruskal-Wallis test (corrected for ties) was used for comparisons of fish density between times of day, whereas the Mann-Whitney U-test (corrected for ties) was used for comparisons between bank and channel locations. Analysis of variance (ANOVA) was used to test for differences in fish size between times of day and between locations in the stream for a given time of day.

Results

The most frequently encountered fish species in the River Lee at Woolmer's Park were (in decreasing order): minnow *Phoxinus phoxinus*, gudgeon *Gobio gobio*, chub *Leuciscus cephalus*, stone loach *Barbatula barbatula*, bullhead *Cottus gobio*, and barbel *Barbus barbus*, with three-spined stickleback *Gasterosteus aculeatus* present at a few points during two sampling excursions only. Both the relative density (numbers of fish per m^2 sampled) of fish (Figure 1A) and the frequency of samples with fish (Figure 1B) increased at night, with the former statistically significant (Kruskal-Wallis test, $P = 0.0001$). Mean fish SL values and size ranges for all species indicate that the vast majority of specimens were 0+ fish, except for a few large, potentially piscivorous chub at midnight (Figure 1C), which resulted in a significantly greater SL at midnight ($F = 4.562$, $df = 65$, $P = 0.0003$). All other species were of similar size ranges, and thus are combined (Figure 1C), the mean SL varying sufficiently on an hour-by-hour basis to be significant (ANOVA, $F = 2.204$, $df = 224$, $P = 0.03$), but this was mainly due to a decline in size during the early morning. In particular, non-piscivorous chub were significantly larger at midnight ($F = 3.271$, $df = 63$, $P = 0.005$).

Significant increases in relative density at dusk (21:00) and/or midnight were observed in stone loach (Kruskal-Wallis, $P < 0.001$) and bullhead ($P = 0.05$), with a marginally significant increase in minnow ($P = 0.06$) and non-significant variations in gudgeon, barbel and chub (Figure 2A). According to in-stream location, stone loach densities were significantly higher (Kruskal-Wallis test) at night along the banks than at other times of day, with higher densities in minnow and barbel at night nearly significant ($P \leq 0.10$). None of the species demonstrated significant differences (Mann-Whitney test) between the bank and mid-channel during any interval of the twenty-four-hour cycle, but gudgeon and stone loach densities were nearly significantly higher in mid-channel at 09:00 and 15:00, respectively, and the barbel densities were nearly significantly higher along the banks at midnight (Ps ≤ 0.10).

Fish dispersal patterns were variable between species (Figure 2B). Barbel were clumped except at midnight and during the last excursion, when distribution was more random. Chub were mainly randomly distributed except around dusk and early evening (18:00, 21:00) and during the last excursion (09:00). Minnow had a pattern similar to chub, except for a second peak of contagion at dawn (06:00). Gudgeon were randomly distributed throughout the study period. Bullhead distribution was variable between random and weak contagion, whereas the other benthic species, stone loach, was distributed weakly random except around dawn and early morning (06:00 and 09:00).

With respect to in-stream location, contagion was most elevated in mid-channel at dusk and to a lesser extent at dawn (Figure 3A). Relative densities of non-piscivorous and piscivorous fishes did not differ between the bank and mid-channel (Figure 3B). Piscivorous fishes were observed at night only, but this

may be due to sampling bias. Densities of non-piscivorous fishes in the channel were greater at dusk and night than in the day, though not significantly (Kruskal-Wallis, $P = 0.38$), whereas they were significantly greater along the bank at night ($P < 0.001$). No difference in SL was found between the mid-channel and bank sampling points for bullhead, gudgeon, stone loach and minnow, but non-piscivorous chub caught in mid-channel points were significantly larger than those captured close to the bank ($F = 11.85$, $df = 67$, $P = 0.001$).

Discussion

The clear diel pattern of the fish densities observed in this preliminary study of the River Lee (Figure 1) were subsequently corroborated by very similar nocturnal increases observed in a subsequent, more intensive study at the same site under a new moon in August 1997 (Copp et al. 2004*a*) and also in a less extensive diel study at an adjacent upstream site under a waxing crescent moon in August 1999 (Vilizzi and Copp, unpublished data). However, our results for minnow are in contrast with those from experimental studies, which revealed the young-of-the-year to be more active in the day, with predominantly nocturnal activity only in autumn and winter (Peňáz, 1975). The only possible support in our data for Peňáz's (1975) laboratory results is evidence of greater contagion during the day (Figure 2B), which may result in lower density estimates (Figure 2A) that reflect shoaling behaviour-related predator-avoidance activity rather than foraging, as minnows in England are known to forage at dawn and move into shallow, marginal areas to digest their food in more predator-secure environment (Garner et al. 1998). Higher densities of young and small fish were also observed at night (compared to early morning), with variations between the shore and mid-channel, in the River Sieg (Bischoff and Scholten 1996), a small German stream (mean annual discharge: 33 $m^3 \cdot s^{-1}$). Whereas, in the moderately-sized River Meuse (mean annual discharge: 53 $m^3 \cdot s^{-1}$; Ministry of Equipment and Transport of the Walloon Region, DG2-SETHY), fish densities tended to be higher during the day except towards the end of the summer, when higher densities were observed in the evening (Baras and Nindaba 1999, 2000). Direct comparisons are difficult, however, despite the use of generally similar sampling methods to ours, because no daytime data were collected on the Sieg and none was collected at night on the Meuse. And neither of these studies mentioned the exact sampling dates so it was not possible to determine moon phase. Unpublished data from diel studies on the River Garonne, France, on 7–8 September (gibbous moon) and 23–24 September (waxing crescent moon) in 1998 (S. Mastrorillo and G. H. Copp, unpublished), and in a side-channel of the River Danube under a waxing gibbous moon on 24–25 August 1996 (Copp et al. 2004*b*) demonstrated less clear diel patterns in fish density and distribution than in the River Lee.

Fish dispersion and density at Woolmers Park reached their peak at midnight overall (Figure 1) but according to location, the highest densities and greatest contagion were observed at dusk in mid channel (Figure 3). This contrasts the results of Garner's (1996*b*) study of feeding and microhabitat use by 0+ cyprinids (mainly roach *Rutilus rutilus* and chub) along the banks of the River Great Ouse (about 45 m wide: 3.5 m maximum depth; generally lentic; mean summer discharge = 5.2 and 8.2 $m^3 \cdot s^{-1}$, Copp 1990) at River Lane, near Huntingdon in Cambridgeshire. Roach and chub densities both dropped at night in the Great Ouse and those of roach were observed to do so on three dates in 1994 under various moonlight levels (waning crescent, waning gibbous, first-quarter moon), which could suggest a regular off-shore migration regardless of moonlight levels. On the one date of the Great Ouse study that other species were present in sufficient density (waning gibbous moon), numbers of chub, perch *Perca fluviatilis*, gudgeon and bleak *Alburnus alburnus* all declined at dusk and/or night with only silver bream *Abramis bjoerkna*

showing a rise during the night (Garner 1996*b*). As such, the night-time increase in fish numbers observed by Mathews (1971) along the banks of the Thames is perplexing because the site's description (Williams 1965) is very similar to that of the Great Ouse at River Lane (Garner 1996*b*), though Mathews's sampling was under stronger moonlight (waxing gibbous or full moons). Clearly, a more precise measurement of moonlight intensity should be used (e.g. Angeli et al. 1995), but other factors than moon light intensity, such as prey/predator distributions and river size/character, are probably responsible for the range of patterns being observed in rivers of different size.

In conclusion, the increase in SL of at least some fish species at dusk and/or night observed in the River Lee (Figure 2) appears to be a pattern common to most rivers regardless of size (Copp and Jurajda, 1999; Baras and Nindaba, 1999, 2000; Copp et al. 2004*a*; Mastrorillo and Copp, unpublished data). From the available evidence, diel variations in fish density are generally associated with feeding rhythms (e.g. Garner, 1996*b*; Garner et al., 1998). However, invertebrate prey densities do not necessarily correlate inversely with those of fish (Copp et al. 2004*a*), indicating that studies of fish-invertebrate interactions cannot be based purely on correlations between fish and invertebrate densities (see Grenouillet et al. 2000) and should include gut analyses (e.g. Garner, 1996*b*; Copp et al. 2004*a*).

Acknowledgements

I am grateful to the late Mrs Lucas for permission to access the river on her estate and to M. Fox, K. Haynes and S. Newby for assistance in the field and/or laboratory.

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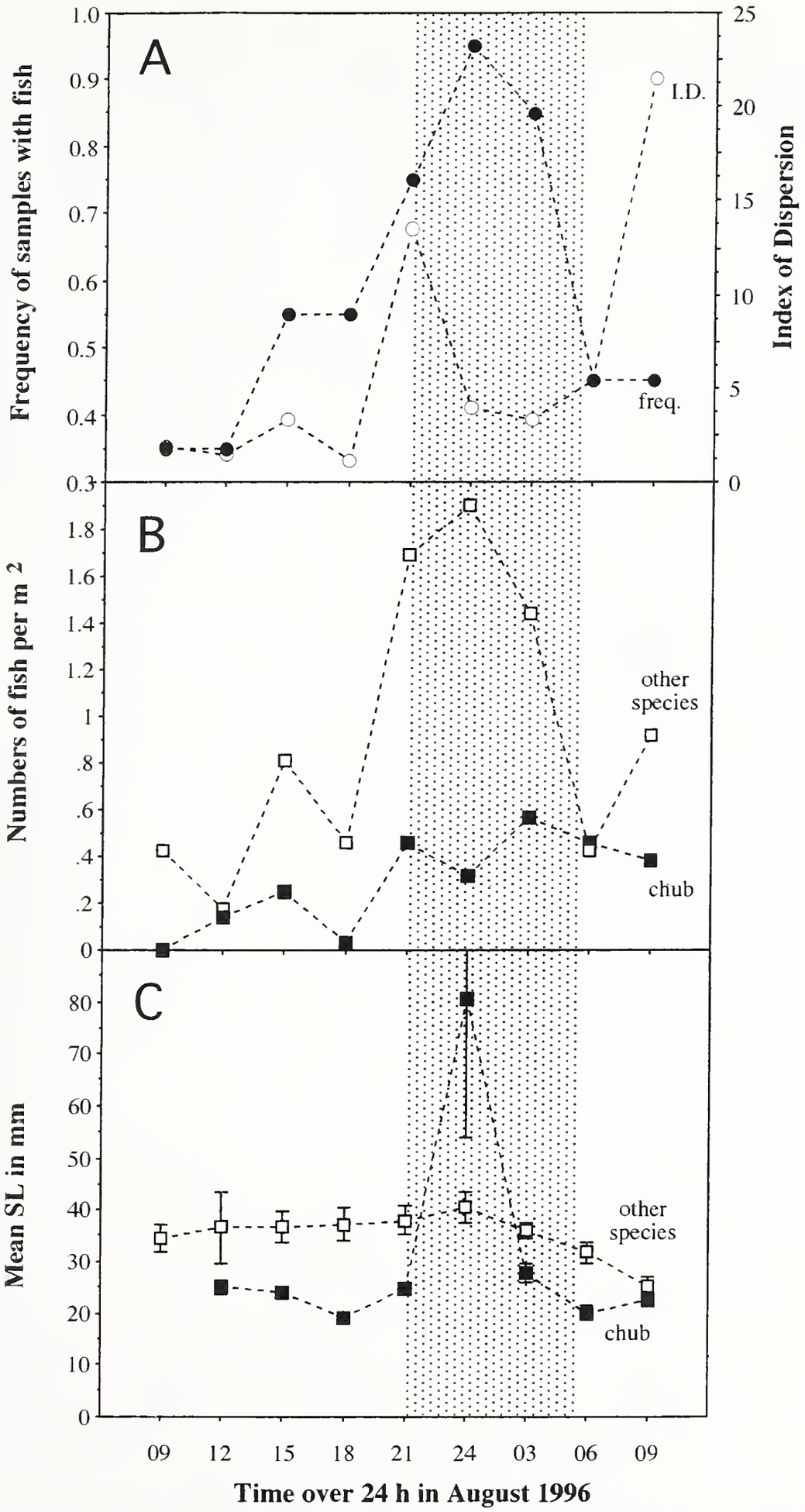

FIGURE 1. For fish in the River Lee, over a 24-h period (7–8 August 1996) at Woolmer's Park (Hertfordshire), (A) the frequency of samples with fish and the index of dispersion (variance/mean) for all fish species combined, (B) the relative density, and (C) the mean standard length (SL) of chub *Leuciscus cephalus* and all other species combined.

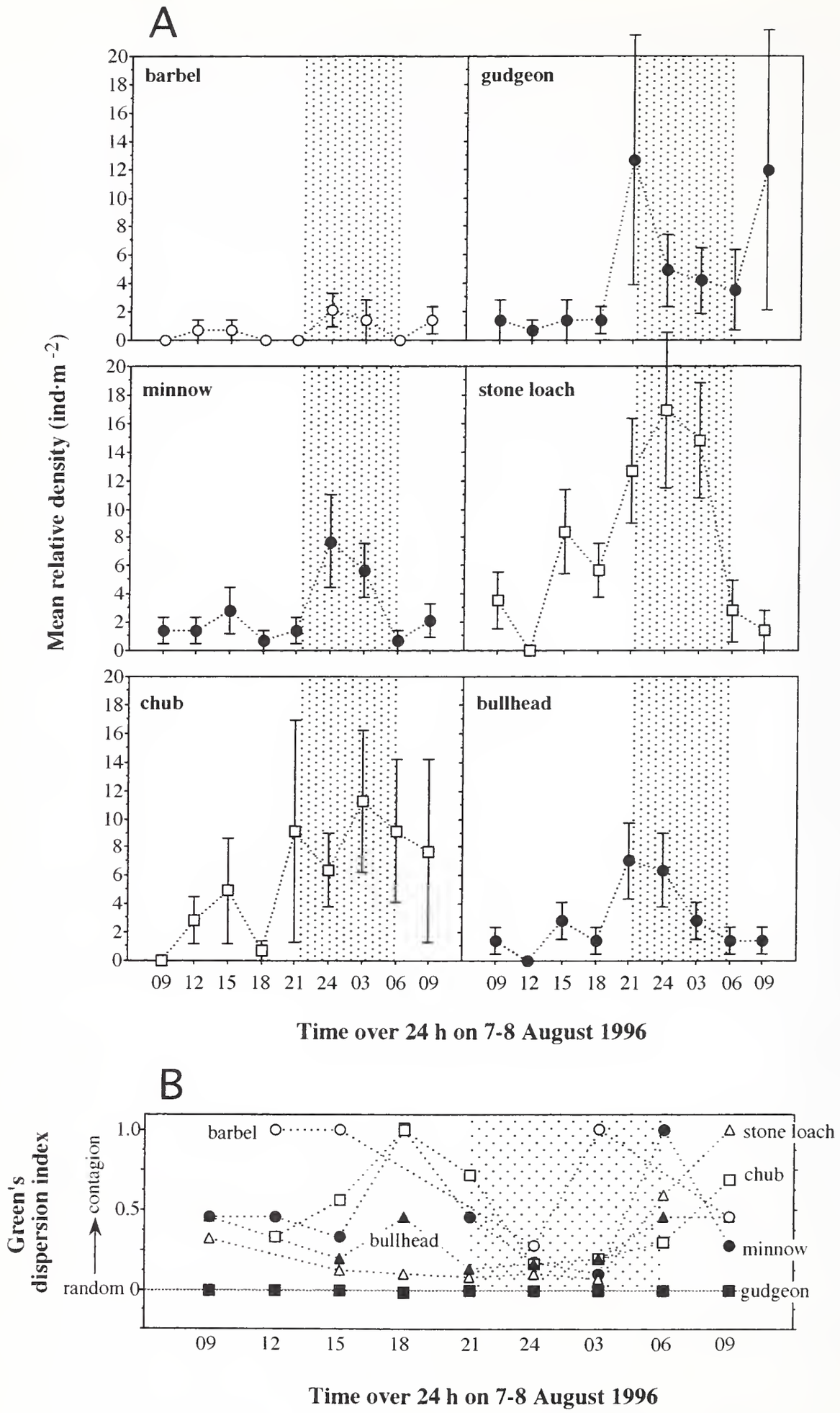

FIGURE 2. For major fish species captured over a 24-h period (7–8 August 1996) in the River Lee at Woolmer's Park (Hertfordshire), (A) the means and standard error bars of relative densities (ind·m^{-2}), and (B) Green's dispersion index.

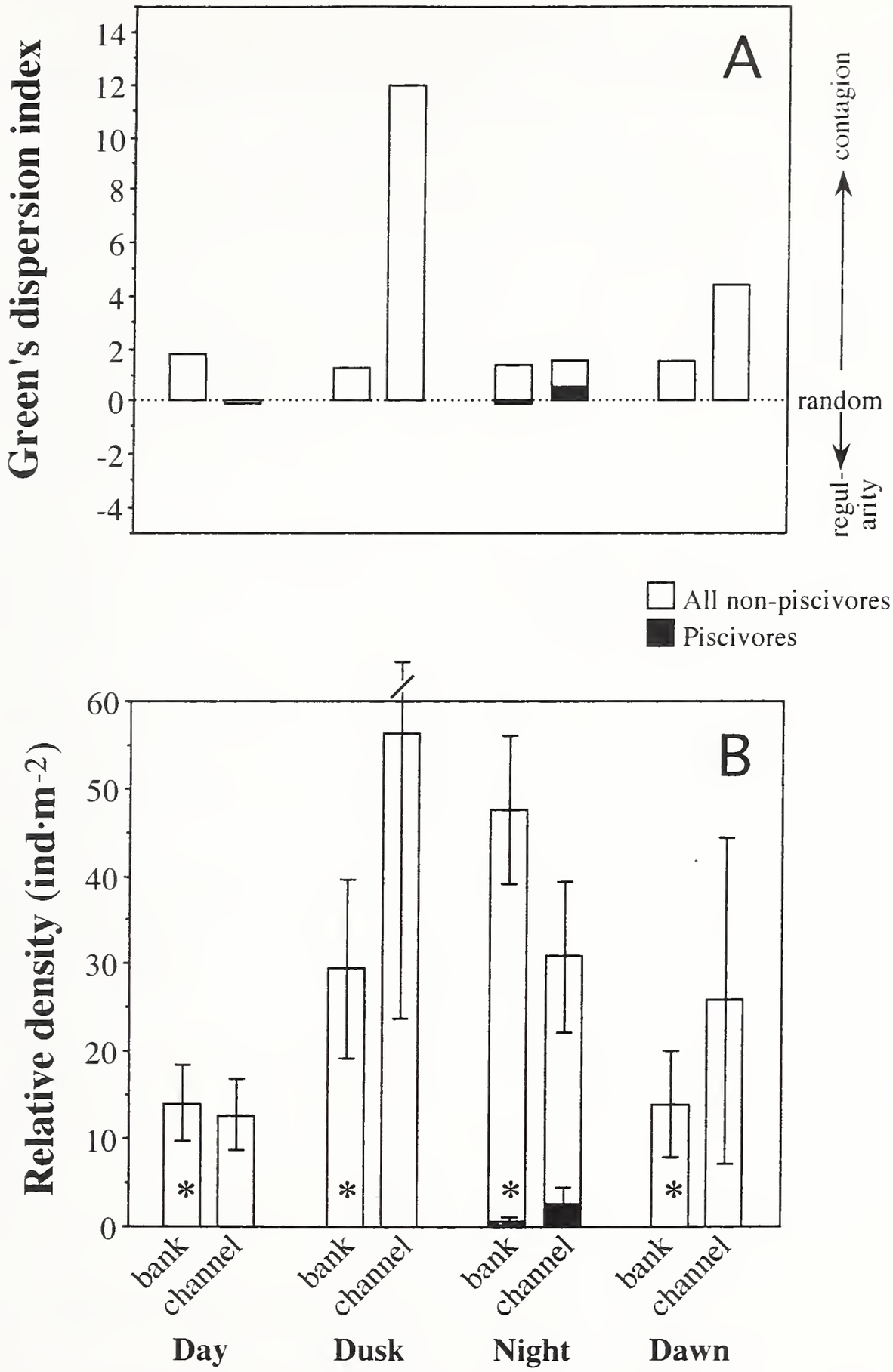

FIGURE 3. For major fish species captured near the banks and in mid-channel during the main periods of the day over a 24-h period (7–8 August 1996) in the River Lee at Woolmer's Park (Hertfordshire), Green's dispersion index (A) and (B) relative densities. Relative densities did not differ statistically between in-stream locations; asterisks indicate a significant difference (Kruskal-Wallis, $P < 0.001$) between sampling intervals for bank samples.

Book review

British and Irish pug moths (Lepidoptera: Geometridae, Larentiinae, Eupitheciini). A guide to their identification and biology. Adrian Riley and the late Gaston Prior. 2003. 264 pp. Harley Books, Colchester. £29.50. ISBN 0 946589 51 8.

The pug moths are a large assemblage of British species that have a notorious reputation for being difficult to identify. It is common for lepidopterists (even quite experienced people), to greet them with a groan or dismiss them out of hand. Melanic forms and worn specimens add to the problems. This long-awaited book aims to overcome this situation and to encourage further study of these moths.

The book starts with the authors explaining their aims and how to use it, including a systematic checklist of the British and Irish pugs. There are brief chapters giving a historical review of the species and on breeding and rearing pugs. Then follows the main body of the text in which each of the British species of *Eupithecia*, *Chloroclystis*, *Pasiphila* and *Gymnoscelis* is treated, including the recently recorded Epping pug *Eupithecia massilliata*. One species bearing the vernacular title 'pug' is omitted, namely the dentated pug *Anticollix sparsata* which does not belong with the Eupitheciini. The systematic order is basically the same as Bradley (2000), but with one change, i.e. the beached pug *Eupithecia expallidata* is placed next to the wormood pug *E. absinthiata*. There is no discussion of the species groups defined in the recent European guide by Mironov (2003), which is a pity since these do not entirely agree with the Bradley sequence. The text on each species presents information on identification criteria, including some features that have not been mentioned in recent guides, e.g. the antennal differences between male golden-rod pug *E. virgaureata* and grey pug *E. subfuscata*, life history and distribution.

The plates are presented with the specimens life-sized. Their production is good, but not outstanding. Similar-looking groups of species have been illustrated side by side to facilitate identification, which is a useful approach that has not been tried in other guides. Having said that, the group of similar species with pale forewings bordered grey excludes the species that would most obviously qualify, i.e. the bordered pug *E. succenturiata* which is instead included within the distinctive species. While it is true that *E. succenturiata* is generally an easy species to identify, the novice may well be confused. In contrast, the juniper pug *E. pusillata* and the Burren form of common pug *E. vulgata* f. *clarensis* are included in this group, though to my eyes the specimens illustrated hardly qualify as having this pattern.

There is also a set of plates with the same specimens arranged systematically. I'm not sure that I understand the need to illustrate the same specimens again in a different order. Inevitably people will compare the plates with Mironov (2003), where the species are very nicely shown at 1.5× life size. I would have though it worth doing something similar to at least one of these sets of figures. The plates of specimens are further backed up by a set of photos of live adults, again shown at about life size. There is some variation in the quality of these photos and the orientation of the examples shown, but they are useful since (for me at least) many pugs are easier to identify when alive rather than set as their posture accentuates differences in wing shape.

Distribution maps are provided for all species at the vice-county level. This includes the Channel Islands, which is fine although I have to disagree with the authors for treating these islands as part of the British Isles. I would have preferred to see 10km square maps since this gives a rather better idea of known distribution, although I appreciate that this would have necessitated considerable extra work. Three symbols are used, a large solid dot where a species is considered generally distributed, a smaller solid dot for not generally distributed species and an open circle for where the status of the species is uncertain (either there are only very old records or there are only one or two records of the species). The latter two categories encompass a wide variety of scenarios and the results occasionally seem rather surprising – e.g. I would have expected the green pug *Chloroclystis rectangulata* to be considered sufficiently common to warrant the larger dots. The maps are backed up by distribution details in the species accounts. The information is generally well up to date, though there have been a few references missed, e.g. Goater and Norris (2001) provide Hampshire records of the ash pug *Eupithecia fraxinata* feeding on *Tamarix* and for the pauper pug *E. egenaria*.

The larvae are figured with line drawings that include some of the variation exhibited by these insects. However, I think some will be disappointed that photos of live larvae were not included. Line drawings also illustrate the male aedeagus, sternal plates and female genitalia for each species. The authors state that they have not illustrated the rest of the male genitalia as they consider that there are no useful features. However, this is somewhat undermined by the generalized figures of various forms shown by these structures, i.e. there are features.

The book concludes with pages of references and indexes to the genera, species, common names and hostplants. The authors state that they have consulted all published county faunas but for reasons of space have not referenced them unless 'they contain important information such as foodplant lists or significant historical records'. I would certainly have preferred that these references were included and doubt that more than a couple of pages would have been added.

Riley and Prior have pulled together a huge amount of information on the pugs, not just dealing with identification, but also their natural history. Despite some niggles, this volume will be a must for most lepidopterists. It will be interesting to see if it achieves a more positive approach to the moths themselves.

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JOHN CHAINEY

'A little Society scandal' — Bouchard versus Harding: the Haggerstone Entomological Society, 1860

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Abstract

This narrative is an exploration of the background to a personal dispute between two late members of the Haggerstone Entomological Society (a predecessor of the London Natural History Society) and subsequent allegations that foreign specimens of Lepidoptera, particularly *Leucodonta bicoloria* (D.&S.) white prominent (formerly *Notodonta bicolora*), had been passed off as British species. Details are included of opinions found in records to have been expressed by a number of eminent Victorian entomologists on each side of the arguments.

The President's Address of 2 December 1947, reported in *The London Naturalist* No. 27 (Payne 1948), was entitled 'The Story of Our Society' and covered the period from 1858 until 1914 when it became the London Natural History Society. Mr L. G. Payne hoped that his narrative would be 'something more personal and intimate' than 'A History' and he went on later to outline 'a little Society scandal' based upon a sequence of items which appeared in the *Entomologist's Weekly Intelligencer* during the spring and summer of 1860. It is now possible to put some flesh on those bare bones following genealogical research by the writer, a great-great-grandson of one of the parties involved in the affair.

The protagonists were Peter Bouchard (1816–1865)*, thought to have been amongst the twenty members attending an inaugural meeting of the Haggerstone Entomological Society in 'Carpenters' Arms', Martha Street, Haggerstone on 17 June 1858, and Henry John Harding (1805?–1884), elected a member on 21 October 1858. An entry for each man in the 1859 *Entomologist's Annual*: List of British Entomologists, shows that No. 95, Bouchard 'Collects for entomologists and sells', whilst No. 365, Harding 'Collects Insects for sale: also purchases Insects'.

Bouchard was descended from a Huguenot silk-weaver who settled in the East End of London. The family continued this craft down the generations but the Spitalfields silk industry fell into terminal decline after tariff barriers against the importation of foreign silks were lifted in 1826 and, when he married on 26 December 1838, Peter Bouchard's trade was hearthrug maker in Back Lane, Hackney. Being an artisan equipped with only basic literacy, it is remarkable that he was able to develop a detailed knowledge of insects prior to 1845 but, as Mr Payne quoted from *The Common People* in relation to the 1850 period, 'There was a Society for the Diffusion of Useful Knowledge with publications circulating in millions — encyclopedias in penny parts and booklets on biology', which existed from 1826 to 1848 with the object of 'imparting useful information to all classes of the community, particularly to such as are unable to avail themselves of experienced teachers, or may prefer learning by themselves', and so Bouchard's efforts at self-enlightenment would have been very much in accordance with the spirit of that age.

In the 1851 Census for Bethnal Green, Bouchard gave his occupation as 'Entomologist' and, within two or three years thereafter, he moved to Sutton, Surrey, (where a 'Newtown' was being developed following extension of the London to Croydon railway) with the intention, it is believed, of seeking specimens

*See Gilbert (1977) for biographical listings of deceased entomologists.

on the North Downs. His address appeared in the *Entomologist's Annual*, 1857, Supplemental list of British Entomologists, as Marling Pits Cottage, Sutton.

The Census for 1851 also shows in relation to 1 Great York Street, Shoreditch, that the head of this household was Elizabeth Harding, aged 76, carrying on business as a bookseller and stationer. Unmarried children living with her were Elizabeth, 52, described as a 'Shop woman to Stationer', and Henry John, 45, who was employed as an 'Assistant to Stationer'.

The Entomologist's Annual for 1859 contains an article, Lepidoptera — New British Species in 1858, by the Editor, which observes that 'the occurrence of *Notodonta bicolora* in the south-west of Ireland will certainly tempt many next summer to visit that part of the country . . .': a picture is included on the frontispiece and it is reported 'A specimen of this conspicuous and pretty species was taken, last July (1858), by Mr Bouchard, in an extensive birch wood. The specimen is in Mr Waring's collection. On the Continent the perfect insect appears in May and June, and the larva feeds on birch in July.' Under Lepidoptera — Rare British Species Captured in 1859, the 1860 *Annual* records '*Notodonta Bicolora*; another specimen of this insect was taken near Killarney, by Mr Bouchard, at the end of June'.

On 20 June 1859 Edwin Birchall (1819–1884) of Dublin wrote to *The Entomologist's Weekly Intelligencer* from Killarney to announce '*Notodonta bicolora* has also been taken, but I am not at present able to offer it for distribution.'

Henry Harding, a dealer in specimens (in addition to being a retail distributor of *The Entomologist's Weekly Intelligencer*) from 1 York Street, Church Street, Shoreditch, appears to have been somewhat better educated than Bouchard and was an enthusiastic 'communicator'. He regularly exhibited at meetings of the Haggerstone Entomological Society items he had collected (notably '*N. bicolora*', 4 August 1859). On 10 November 1859 he read a paper to members entitled 'Entomology Past and Present with some Account and Anecdotes of Collectors past and gone: Entomology: its uses and superstitions: and, as they say in Theatrical Parlance, the whole to conclude with a Review of Entomology during the Past Year' — reported verbatim in the minutes — and he figures prominently in the correspondence columns of the *Intelligencer* as well as in other journals of the period.

On the 20 January 1856, H. J. Harding had written directly to Henry Tibbats Stainton, F.R.S. &c (1822–1892) to enquire how particular specimens could be determined to be British or Foreign (a species which was not native to Britain) because he could see no difference in them and examples formerly sold at 1/- each rose in price to 10/- each when reported to be British. During 1859 there was further debate about 'Foreigners' to which Harding contributed in a letter to the *Intelligencer* of 5 November. He referred to doubts that seemed to have been expressed about *Antiopa, Daplidice* and *Lathonia* breeding here and went on to ask whether there was any proof they did not. It was asserted *Daplidice* had been taken for many years on the Kentish coast and in various parts of the country, in some places miles inland. From observations he had made when he took his first specimen of *Daplidice* (on 1 August), they did 'not seem much adapted for long flights, as they fly but slowly, and seem to be most partial to the blossoms of the common scabious flying most leisurely from flower to flower. This specimen was in most splendid condition, and could not have been out long: the wind was blowing, as they say here, "off the land" and had been so for some days, which was more likely to blow them to the French coast than from it.' He reiterated that the Kent coast had long been a locality for this species, claiming the fact that the larva had never been taken 'goes for nothing'. *Lathonia* was also maintained to be a resident: he had no doubts about both species but was 'also certain that both are often sold in London as British, though not taken in this country, to persons who like to purchase "bargains" ', concluding 'it would be as well to let this "blown over" theory drop, or it may get overblown.'

Dr H. G. Knaggs (1832–1908) responded in the following week's edition supporting Harding's statement that unscrupulous London dealers often sold foreign specimens of *Daplidice* and *Lathonia* as British but, in addition, agreeing to the general assumption that *Daplidice*, *Lathonia* and *Antiopa* were resident British species. He pointed out, however, that reference to a 'first capture' left readers to infer that Harding had made subsequent ones and the latter was asked to specify the actual number.

In a letter published on 19 November 1859, Harding admitted he had taken only the one *Daplidice* himself although 'Another was taken by a friend, a few days after, near the same spot, which came into my hands.' He understood a late resident of Dover took the larvae but did not breed them whilst '*Antiopa* was taken in a lady's garden in the spring of the present year . . .'.

Lodged (under Bouchard) within the British correspondence collection of H. T. Stainton in the Entomology Library at the Natural History Museum, is a package of letters inscribed on the wrapper in Stainton's hand 'Papers respecting the important case of Bouchard v Harding !!!'. The series begins with some correspondence from Peter Bouchard regarding specimens which he had collected for sale, or proposed could be exchanged, but there then appears a letter from H. J. Harding dated 11 March 1860 asking for an advertisement to be inserted in the next number of the *Intelligencer*. The draft had been headed 'Important Notice' but this was deleted and 'Caution' substituted. It continued 'Having lent various sums of money to Peter Bouchard of Marling Pit Cottage for collecting purposes, not one penny of which he has (the honesty to — *deleted*) returned, I hereby caution all parties against trusting the said Peter Bouchard in any way (as they may expect to get what I have got — lies and abuse instead of their money — *all of these words struck through*).' This was published on page 197 of *The Entomologist's Weekly Intelligencer* No. 181 on 17 March 1860 without further amendment.

Bouchard had already written to H.T. Stainton on 14 March 1860 as follows (*with corrected spelling*) 'I merely write to inform you that H. Harding has threatened me by letter that he will do me a great injury by writing an article and having it published in your weekly intelligencer and if you think interesting enough for a place — I beg you will be kind enough to publish the enclosed reply. I can assure you I have not had anything to do with him for years — he is much annoyed at my telling that *N. Bicolora*, *A. Lithonia* [sic] and *Daplidice* which he said to be British came from Germany through Mr E. Newman.' The appendix is titled 'A reply to Harding's Scandal' and goes on 'I beg to inform the readers of the intelligencer that in 1845 I borrowed the sum of three pounds in different small sums of H. Harding and left with him ten cabinet drawers some corked with insects in that I valued above the amount as security — in 1847 I wanted my drawers and offered to pay the money but at last he told me I could not have them as he had got a case made and a few more drawers which had formed a nice cabinet. I then told him I should not pay the money. There the matter rested for about nine years until a circumstance happened at the Old Bailey where the said Harding had to give up some stolen property and he told me after the trial that they only found part of the property — he had got the other part all right. I at once cut his company and ever since he has been much annoyed with me.'

At 2.30 p.m. on 17 March 1860 Peter Bouchard called at Stainton's home address, Mountsfield, Lewisham (presumably having read the 'Caution' against him), leaving a note asking for the 'article in reply to H. Harding Scandal' to be returned to him as soon as possible. A response was made by letter on the same day which stated, 'It is not customary for Editors to return communications sent to them for publication. I cannot therefore comply with your request. If you wish your reply to Mr Harding modified in any way perhaps you will be so good as to let me know.' In the event, all the words from 'There the matter rested . . .' to the end were excised before the remainder was printed, with only cosmetic adjustments, in the edition of 23 March 1860.

It was Harding's turn to write immediately to the Editor, quibbling over alleged 'mistakes of Mr Peter Bouchard' before concluding, 'Honesty and truth with Mr Bouchard have long ago fell out. I am still as willing to settle the matter in any way as I always have been but remain one of his numerous victims.' Although, prudently, Stainton chose not to take matters any further following this missive, sufficient harm had already been done.

By the 7 May 1860 both Henry T. Stainton and Edward Newman (1801–1876), respectively editor and publisher of the *Weekly Intelligencer*, were being summoned to appear as witnesses on the part of the plaintiff, Peter Bouchard, before the Queen's Bench Court at Westminster Hall. The case of Bouchard v Harding was heard on 13 June 1860: a report in *The Times* for the following day reveals that the plaintiff was represented by Mr Overend, Q.C., with his Junior, the facts were presented and evidence given to show Bouchard had sustained some special damage but the defendant, Henry Harding, pleaded only 'the general issue' and, as there was no defence, the jury found for the plaintiff — Damages £30 (more than £1,300 in today's money although the amount would appear greater relative to what might have been his level of earnings in those days).

A City solicitor representing Bouchard wrote on 19 June 1860 separately to Stainton and Newman. He reminded them that the trial proved the printed statement to have been 'a most malicious and cruel Libel' before going on to enquire what course each meant to adopt and he proposed 'at least a Report of the Trial should be inserted in the next number together with an apology for having inserted such a libel.'

Whilst it is not clear whether any apology was forthcoming, a bald report of 'An Entomological Trial' was accepted to appear in the *Intelligencer* of 30 June 1860.

Having agreed to that action, Bouchard's solicitor wrote back to those appointed to represent the other two parties 'I am sure both Mr Stainton and Mr Newman will see that my client is acting liberally towards them in not taking legal proceedings against them. Poor Mr Bouchard is much in debt now, consequent upon his usual means of support being taken from him, this you can well imagine when you consider that he has a wife & 9 children dependent upon him for support such being the case I appeal thro' you to the liberality of your clients in the hope that they will present him with a £10 note at least as some compensation for the great injury they have been the means of inflicting upon him — of course you will understand that I do not make this a condition it being left entirely to them to do so or not as they please. I am very glad matters are thus settled as it would be a source of great pain to me to be concerned against them. In conclusion I must remark that I consider it a great pity that the pages of the *Intelligencer* are open to foment quarrels between entomologists.'

In a paper dated 9 April 1860, forming part of the Haggerstone Society's archive, H.J. Harding was described as a 'late member' and on the following 16 August he wrote a letter sending some moths 'from the coast' with an invitation for members to visit him there but, at a Meeting on 6 December 1860, he was re-elected president for the third time. Seemingly, he had simply withdrawn until the storm 'blew over'.

Within months of the trial Bouchard had set himself up in a shop, 79 High Street, Sutton, where he carried on business as a tobacconist as well as continuing his activities as a naturalist. Perhaps he was enabled to do this with money received as compensation and his wife must have been the shopkeeper because he continued to travel widely in search of new specimens. Discoveries were reported to Henry Stainton for inclusion in the *Entomologist's Annual* in 1862 and 1863 and specimens including *Ophiodes lunaris* were acquired from him by the British Museum during 1864.

The Entomologist (conducted and printed by Edward Newman) for 1864 contains two pieces of relevance under Entomological Notes, Queries, Captures and Duplicates:

Page 71, Item 12 '*Notodonta bicolor* in Ireland — It is reported that Mr Bouchard has again taken this rarity in the Killarney District of County Kerry.'

Page 86, Item 25 '*Ophiodes* in Ireland — It is reported that this rarity has been captured in the South-west of Ireland, by that indefatigable collector Mr Peter Bouchard.'

A Catalogue of Irish Lepidoptera by E. Birchall was published by instalments in *The Entomologist's Monthly Magazine* and in the October 1866 issue it included, under PSEUDO-BOMBYCES, '*Notodonta Bicolora* — Several specimens taken by the late Mr Bouchard.'

Edwin Birchall in fact wrote an article for *The Entomologist* No. 40, April 1867, Irish Insect-Hunting Grounds, in which, on page 253, one finds:

'The following list comprises a few of the most interesting species which have been taken at Killarney:

'*Argynnis Lathonia* (Muckross) . . . *Notodonta bicolor* (Muckross) . . . *Ophiodes Lunaris* (at sugar under Cromaghlan) . . . . The most interesting of the above-named insects, *Notodonta bicolor*, I have never been fortunate enough to capture, though I have made several journeys to Killarney with that object. A man is apt to suffer in fame if he finds a species that cannot be discovered again, and something of this sort was poor Bouchard's fate in connexion with his discovery of *bicolor* at Killarney. The capture of specimens of the insect both in the larva and imago state, during the summer of 1866, I am glad to say removes any doubt as to its truly indigenous character: all the specimens yet taken have been beaten from birch trees on Muckross peninsula early in June . . .'.

In the *Intelligencer* of 13 April 1861, Harding announced a change of his address to 'Noah's Ark', Peter Street, Deal, Kent, an inn where he had stayed during earlier expeditions to the coast, but in later years he sent 'Entomological notes from Deal' to *The Entomologist* from Park Cottage, Upper Deal, and 131 Lower Street, Deal. Detailed reports in the *Deal, Walmer & Sandwich Mercury* for Saturday 25 August and 1 September 1866 disclose that Henry John Harding, naturalist of Deal, had a further brush with the law. He was accused of indecent assault upon two little girls and, although the case collapsed because statements made by an eight-year-old witness were contradictory, her evidence was regarded as sufficient to demonstrate that the defendant's 'conduct was of a most shameful character'. Nevertheless, Harding stubbornly pursued a counter-claim in respect of a consequential assault upon his person by the alleged victims' father because 'he did not like to have his character assailed as it had been' but 'A Voice' in the County Magistrates' Court opined that he never had one, before this case was dismissed by the Bench.

Letters to *The Entomologist* peter out in November 1868 with reports of specimens 'taken in my own garden', but Henry Harding may be identified within the 1871 Census, living on his own as a bachelor aged 64, at 131 Lower Street (a grocer's shop), in accommodation from which he carried on business as 'Naturalist & Book Seller' — later, in 1881, he is shown sharing a house at 10 West Street, Deal, with a young married couple, occupied as a gardener.

In fact, registers of the Union Workhouse Eastry show he had applied, on 29 July 1880, for relief, being wholly disabled and without earnings or relatives liable to provide assistance, to be given 7/- for 'Conveyance to the Union' in which establishment he remained until the following 6 August. By 14 March 1882 Harding had again been admitted to that Institution where he spent a substantial part of his remaining years before dying there on 29 October 1884 of 'Old Age — Natural Causes'. One side of this story then concludes with John Henry (sic) Harding being laid to rest in a secluded corner of the oldest section in Deal Cemetery, his passing unrecorded in the annals of the Haggerston Entomological Society.

Amongst the manuscript collection of the Janson family business in the Entomology Library the Natural History Museum, may be found the catalogue

produced by J.C. Stevens, Auctioneer, 38 King Street, Covent Garden, for a Sale on 28 March 1865, which announced disposals including 'The Collection of British Insects of Mr P. Bouchard, who has gone on a Natural History Exploration to South America' (listing many hundreds of specimens with drawers and cabinets comprised in 44 lots, annotated to show the sums realized). It may be inferred that funds were being raised both to finance the expedition overseas and to maintain the family whilst Bouchard was abroad.

Entomological Notes and Captures on page 204 of the May 1865 edition of *The Entomologist* covered Item 132, Entomological Collectors Abroad, 'I have only to say a few words in conclusion relative to our collectors abroad. Mr Bouchard who has gone out to the southern shores of the Gulf of Mexico, has, we hear, arrived at Santa Marta, and he is much pleased with the appearance (entomologically) of the country.'

In the *Transactions of the Entomological Society*, 6 November 1865, '(The President) also mentioned the death of Mr Peter Bouchard, so well known to all British Entomologists. Mr Bouchard had proceeded to Santa Marta, in New Granada, in order to collect insects, and had already sent home a valuable collection, when he was seized with fever, which carried him off in four days.' Apparently the report of his demise came from Samuel Stevens (1817–1899), younger brother and former partner of the auctioneer engaged to dispose of Peter Bouchard's collection of British insects, who, from 1848, carried on a Natural History Agency in London and represented a number of collectors who travelled to South America. Specimens sent back by Bouchard from Santa Marta were sold by 'Sam.' Stevens to the British Museum during 1866.

In the December 1873 edition of *The Entomologist's Monthly Magazine,* Edwin Birchall returned to the subject of The Lepidoptera of Ireland to observe 'No trustworthy confirmation has been obtained of the occurrence in Ireland of the following species included in the list of 1866; and I am of opinion that they should be struck out. Erroneous ideas or theories of Natural History are of comparatively little consequence, critics and time will certainly dispose of them; but it is obvious we can never arrive at correct conclusions if the facts from which they are deduced, or rather by which they must be tested, are false.' He goes on to mention *Notodonta bicolora* amongst others.

At once, Samuel Stevens responded from 28 King Street, Covent Garden, (for publication January 1874): 'In justice to the memory of a hard-working and honest collector, whose statements were never before doubted, I cannot allow Mr Birchall's List of the Lepidoptera of Ireland . . . which he states have been erroneously reported, and which includes *Notodonta bicolora*, to go forth without protesting against excluding that species; for, when I was in Killarney in the summer of 1871, I purposely made enquiry, and found where Mr P. Bouchard had lived, and met a man who saw one of the specimens he took alive in his box just after he had captured it, and the tree on which it was found was pointed out to me. I do not think because others have been there and not found it, there should be any reason to doubt the word of a man who I have every reason to believe never once attempted to pass off Foreign for British specimens. Dr Gill has the diary of the late Mr. Bouchard, with the dates of captures of the seven or eight specimens he took over three or four seasons' collecting. I should myself like to stay six weeks there at the proper time, if there were accommodation to be obtained in the neighbourhood, but it is five or six miles from Muckross, and no lodgings of any decent kind are to be found nearer; and the distance and fatigue of working the ground, which is very boggy and irregular, would be more, I think, than my strength would permit.'

By February 1874 three more letters appear on the topic of *Notodonta bicolora* in Ireland:

1. J. B. Hodgkinson, Preston: 'As Mr Birchall expresses a doubt as to *N. bicolora* being an Irish insect, I can abundantly satisfy him respecting it. First of all, Bouchard's captures were no doubt genuine, as a lady asked my opinion at the

time, saying he wanted £4 for a specimen*. Then Turner found wings in a spider's web; and after that John Hardy, Jun., of Manchester took a specimen which I saw on his return from Killarney. The year following he beat a larva into his net off birch whilst looking for beetles: he told me that he expected he had got a larva of *bicolora*, and this proved correct, and he brought me the specimen to look at alive; he found another larva crawling across the roads on Denis Island, Killarney, which he did not rear . . .'.

2. J. Ray Hardy, Manchester: 'Mr. Birchall, when doubting the authenticity of this species as Irish, was probably not aware of my both having captured and bred it, under the following circumstances. In the year 1867, I captured a male perfect insect, and the next season took a larva, from which in 1869, I reared a female (which I remember showing alive to Mr. Hodgkinson of Preston): both the male and the larva were taken not more than one mile from the Muckross Hotel; and I have also found wings of old specimens in a spider's web there. These two specimens are now in the collection of Mr. Alfred Beaumont of New House, Huddersfield, who I am quite sure will give any information about them, and show them to any one. He became possessed of them curiously enough, by drawing the number representing this insect in two consecutive years, on each occasion by my so distributing my captures among my subscribers. I was at Killarney for two years, and worked hard during each season, but never got more than these two moths. I know, also, that the late Mr. C. Turner worked hard day and night for this insect at Killarney though he never got it; and any one who remembers his shrewdness, will feel sure he would not have exerted himself to such an extent unless convinced the species really occurred there. I firmly believe that the late Mr. Bouchard also took the insect there as I stayed at the house where he stopped, and the master of it told me that Bouchard came in one day much excited, saying he had taken *bicolora*. The master of the house and others called the insect "Mychel Lorum", and used to ask me in joke if I had taken it; when I took the male, I showed it to him, and he recognised it instantly.'

3. Battershell Gill, Regent's Park: 'I am greatly obliged to my friend, Mr. Stevens for defending the memory of the late P. Bouchard. I knew the man somewhat intimately for many years (in fact he was my instructor in entomology), and I do not believe there exists a more honest or truthful entomologist, be he gentle or simple. The fact that *N. bicolora* has not been taken by other collectors proves nothing, for numbers of rare insects disappear for years, or turn up once in a lifetime. Passing over such instances as *Geometra smaragdaria*, *Pachnobia alpina*, *Noctua sobrina* (lately captured by the Messrs Hutchinson on the very line of trees where it was taken by Bouchard some dozen years ago), I would but mention *Eupithecia egenaria*, taken by Miss Sarah Hutchinson at Loughton, June 12,1869, on the occasion of her solitary visit to the forest, and now in my possession. I suppose, had some unfortunate dealer caught this insect, its foreign origin would have been considered by many as certain.'

Dr W. B. Gill (1823–1900) could well have had a vested interest in maintaining the authenticity of particular captures because, when his collection was dispersed in April 1886, J. C. Stevens' auction catalogue included, amidst the many lots: No. 224 '*Bicolora* 1, fine, taken by the late P. Bouchard at Killarney, 1864' (sold to Mason for 80/-) and No. 133 '*Smaragdaria* 2, 1 from Harding, of Deal . . .'.

On 2 February 1874, Edwin Birchall wrote in reply: 'After reading what has been urged in your January and February numbers, in support of the claim of *Notodonta bicolora* to a place in the list of Irish Lepidoptera, I must still hold to the opinion I have expressed, that its occurrence requires "confirmation". It is at present merely a dealer's insect, and will I expect gradually retire from the

*'The price of *Notodonta bicolora*, according to continental catalogues, varies from about six pence to one shilling. Without expressing any opinion on the point in question, we must admit to our utter

market like the *Apollo Podalirius* and *virgaureae* of the last generation. I was at Killarney at the time Bouchard professed to have captured *N. bicolora*, and my first suspicion of its foreign origin was raised by his own unprovoked charge against other collectors of importing pupae: thus showing what was in his mind, and that he was perfectly familiar with the process. He had been at Killarney several weeks before I arrived, and I asked to see his captures. Amongst them were many species not recorded as Irish, but, on my proceeding to make notes, he admitted he had bred them since his arrival, from pupae brought from England, alarmed, I suppose, at the number of insects I was going to make him responsible for. My conviction is strong that *N.bicolora* also crossed the "silver streak" in the pupa stage. It was Bouchard, not Turner, as Mr Hodgkinson states, who professed to have found a wing of *N. bicolora* in a spider's web. I saw it in his possession, and I know that Turner utterly disbelieved Bouchard's story.'

This was followed by another footnote: '(We decline to insert any further communications on this subject. — Eds.)'

It is impossible to account for Birchall's volte-face considering that all the reasons advanced above for harbouring doubt would have pre-dated his writings in April 1867 when he announced further specimens had already been taken subsequent to Bouchard's death. Was he, one wonders, really aiming at someone else — perhaps even J. Ray Hardy (1844–1921), who was claiming to have found both the insect and a larva? Since there were later discoveries reported in what follows, however, it appears that the required 'confirmation' was forthcoming, although apparently after Birchall himself died on 2 May 1884.

In a review of Entomological Sales in *Natural History Auctions 1700–1972*, J. M. Chalmers-Hunt (1976), observes: 'The final decades of the Victorian era also witnessed some remarkable changes: for instance, the prices of insects especially of certain Lepidoptera rose to unprecedented heights, with the increasing difference in value of a British insect compared with that of a foreign example of the same kind becoming most marked. This is shown by the huge prices paid at auction for rare immigrant species relatively common abroad; a Continental specimen of *Argynnis lathonia* L. (Queen of Spain Fritillary) or *Pontia daplidice* L. (Bath White) for example, though listed in dealers' catalogues at only a few pence each, might if British fetch as many pounds at auction. Inevitably this state of affairs gave rise to imported specimens being labelled as genuinely English by the unscrupulous, and in due course being bought by the gullible for sums far exceeding their original cost. Indeed, Edwin Birchall, writing in 1877, observed that whatever may have formerly been the case it had by then become impossible to make a private British collection of Lepidoptera unless the collector restricted himself to specimens of his own capture.'

As to the absence of provocation, as asserted by Birchall, Peter Bouchard might easily have felt aggrieved at Harding stealing his thunder by producing a specimen of *N. bicolora* at the Haggerstone meeting on 4 August 1859; it was not recorded how this had come into the latter's possession.

W. F. de Vismes Kane (1901) wrote in *A Catalogue of the Lepidoptera of Ireland:* '*Ophiodes lunaris*, Schiff. — Noticed as follows in Birchall's "Catalogue" (of Irish Butterflies and Moths 1866): Two specimens captured at Killarney by the late P. Bouchard in 1864. But in the "Supplementary Catalogue" of 1873 he includes *N. bicolora* and this species in the list of errata. There is no doubt in my mind of the authenticity of Bouchard's captures at Cromaglaun Glen. His character, according to the late Frederick Bond (1811–1899) and other contemporaries, was above suspicion; and the subsequent captures of the former species have dispelled all doubts as to its being indigenous in Kerry. The Irish climate being in no way unsuitable to the latter insect, I have no hesitation in reinstating the record in the Irish list, more especially as I have been shown a specimen of the same by Mr. Dillon, taken by Lord Clonbrock's gamekeeper in his demesne in 1894.'

After examining such evidence as has survived for approaching a century and a half, it seems clear that borrowing money and reneging on a debt, or an agreement to return the security for it, were never the real issues underlying the libel case; more likely, deep-rooted antipathy was brought to a head over questions of personal and professional integrity. The failure by Henry Stainton to anticipate that Harding's announcement might be defamatory is completely inexplicable even if the note from Bouchard on 14 March 1860, outlining the threat made against him, did not arrive in time to prevent publication. The conjunction of correspondence about 'Foreigners' with Peter Bouchard's allegations as to the provenance of specimens falsely said to be British could well be significant, especially when Edward Newman himself was claimed to be the source of imports from Germany and could have been called upon to verify this charge. Bouchard had some influential acquaintances amid the most prominent Entomologists of the day — one, or more, of whom could have advised and supported him in the engagement of a Queen's Counsel to pursue his case. That is not what a 'working class man' would have been expected to do acting solely upon his own initiative. Sadly, some mud seems to have stuck resulting in doubt being cast over important discoveries Bouchard made later and, although subsequently vindicated, he did not live long enough to know that truth finally prevailed. Volume 9 of *The Moths and Butterflies of Great Britain and Ireland* (Heath and Emmet 1983) indicates that *N. bicolor* was found 'sporadically in Co. Kerry until 1938. Since then none has been found despite much searching'.

In the summer of 2003, the Brownlow Arms, meeting place of the Haggerstone Entomological Society for almost thirty years from 1859 (where a specimen of *N. bicolora* had been exhibited by Harding), still stood in what is now called Scriven Street but the premises were closed down and gutted by fire. Since newly constructed flats crowded in upon the former public house, the property seemed destined for redevelopment.

Acknowledgements

I am very grateful for all the assistance provided in locating various pieces of material used to produce this tragic saga, especially by Julie Harvey, Entomology Librarian, and her colleagues at the Natural History Museum; Linda Hewitt and Paul Cornelius (respectively Librarian and Archivist of the LNHS); as well as members of the staff at the Centre for Kentish Studies and Deal Public Library. Thanks are also extended to John Murray of Butterfly Conservation, Herts. and Middlesex Branch, another descendant of the late Peter Bouchard, for drawing my attention to some of the references.

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Book review

The flora of Ely. R.M. Payne. 2002. 30 pp., paperback. A5. £4.50 post free. Obtainable from Summerfield Books, Main Street, Brough, Cumbria CA17 4AX. No ISBN.

Ron Payne is an honorary vice-president of the Society and one of our longest standing members. This *Flora* follows a number of earlier studies that he has published, including *The flora of King's Lynn* (1995), *The flora of walls in west Norfolk* (1998), and *The flora of roofs* (2000) — which I reviewed recently (*Lond. Nat.* **80**: 228). In each of these, the author's meticulous approach to his subject has resulted in a valuable contribution to our knowledge of the flora of the areas covered.

This, his most recent publication, sets out the results of a detailed botanical survey he carried out in 2001 – 2002 of the predominantly urban central part of the city of Ely (Cambridgeshire). This area, which included the ancient and extensive precincts of Ely Cathedral, covers around 1.3 square kilometres. In total 416 species of flowering plants and ferns were recorded. These are listed in an appendix, together with an indication of their frequency and the main habitats in which they were found.

The core of the booklet consists of an analysis of the flora by habitat, and comparisons are made with other recent urban studies, including some of those mentioned above. Despite the small survey area, the author uncovered some unusual plants, including, amongst the expected array of exotic garden escapes, the first English record of an Asiatic hyssop, *Agastache rugosa*. He also noted a remarkable ragwort growing on one of the old stone walls close to the Cathedral. Its flowers were typical of Oxford ragwort *Senecio squalidus*, but the leaves were like those of groundsel *S. vulgaris*. It differed, however, in various ways from the known hybrid between these two species (*S.* × *baxteri*). A similar plant has also been found in Cambridge. In cultivation in the Botanic Garden there, it was shown to differ from *S.* × *baxteri* in being a fertile perennial. At the time of publication no name had been given to this enigmatic plant, but it would appear to be very similar to the recently described York radiate groundsel *S. eboracensis* (Lowe and Abbott 2003).

This short booklet, with its handsome cover photograph of deadly nightshade in front of Ely Cathedral, is an excellent example of what can be achieved by an individual botanist studying a small urban area.

Reference

LOWE, A. J. and ABBOTT, R. J. 2003. A new British species, *Senecio eboracensis* (Asteraceae), another hybrid derivative of *S. vulgaris* L. and *S. squalidus* L. *Watsonia* **24**: 375–386.

DAVID BEVAN

Additions and corrections to the provisional list of the microlepidoptera of Middlesex (vice-county 21)

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Abstract

This work updates a list of the microlepidoptera presented in this journal by the same author two years ago. Eighteen additional species are given and each is supported by the details of at least one record. Data are also presented to support the inclusion of a further two species shown only as unconfirmed in the earlier list. One previously reported species is deleted. Supplementary data are given to update records or present other interesting information. The microlepidopteran fauna of Middlesex now stands at 899 species and a further 16 are either recorded in error or remain unsupported by valid data or a specimen.

Introduction

A provisional list of the microlepidopteran fauna of Middlesex (vice-county 21) was presented two years ago (Plant 2002) and showed a total of 880 reliably recorded species, together with a further 18 that had either been recorded in error or for which the supporting evidence was inconclusive. In the intervening period, interest in the micro-moths of the London area appears to have increased and, encouragingly, a number of new observers are now regularly investigating the fauna in areas that were previously uninvestigated. This increased interest has resulted in the addition of 18 species to the Middlesex fauna. At the same time as the increase in fieldwork, investigations of old records and, in particular, of voucher specimens, has allowed for two previously doubtful Middlesex records to be confirmed as valid. One record relating to Surrey had been included in error in the original list; since there are no further records, this species requires formal deletion. The Middlesex microlepidoptera fauna now comprises 899 species whilst a further 16 are either recorded in error or cannot be admitted in the absence of a voucher specimen. The number of additions and changes is now sufficient to warrant the publication of this first supplement.

The entries that follow adopt the style of presentation in the original list and the same abbreviations are used where appropriate.

Additions and deletions

The following species should be added to the list:

85 ***Stigmella suberivora* (Stt.).**
Forty Hall, Enfield, ii.2004 — mines (EG, det. CWP).

152 ***Adela rufimitrella* (Scop.).**
Horsenden Hill Farm, 24.v.2003 (Rachel Terry, det. CWP).

158 ***Antispila metallella* (D.& S.)**
Listed in *MBGBI* 2 without data.

219 ***Nemapogon ruricolella* (Stt.)**
Regent's Park, 1 male at m.v. light in the Leaf Yard, 7.vii.2003, identification confirmed by genitalia examination (TF).

— ***Cameraria ohridella* (Deschka & Dimic)**
Sunbury-on-Thames, tenanted mines on *Aesculus hippocastanum*, 2.x.2003 (DP det. CWP); Bushy Park, tenanted mines on *Aesculus hippocastanum*, 5.x.2003 (DP det. CWP); The Litten nature reserve, Greenford, tenanted mines on *Aesculus hippocastanum* 15.x.2003 (Rachel Terry, det. CWP); Hyde Park, tenanted mines in 2003 (DJLA). This species, the horse-chestnut leaf-miner, has been spreading westwards across Europe and has only very recently arrived in Britain.

473 ***Acrolepiopsis assectella* (Zell.)**
Horsenden Hill, March 2003, a male at mvl (Rachel Terry, det. CWP).

510 ***Coleophora juncicolella* Stt.**
Natural History Museum Wildlife Garden, 12.v.1998 (MHo) — not previously reported.

547 ***Coleophora discordella* Zell.**
Horsenden Farm, Horsenden Hill, vii.2003 (Rachel Terry, gen. det. Brian Goodey).

561 ***Coleophora therinella* (Tengst.)**
Natural History Museum Wildlife Garden, 24.vi.1997 — not previously reported (MHo).

638 ***Denisia augustella* (Hb.)**
Listed for Middlesex in the late John Bradley's *Checklist of Lepidoptera recorded from the British Isles*, published in 2000. No details currently available.

920 ***Scythris potentilella* (Zell.)**
A female, in association with both potential foodplants at Hampton Court Park, 8.viii.2003 (RWJU).

950 ***Aethes francillana* (Fabr.)**
Listed for Middlesex in *MBGBI* 5 (in prep.) but not supported by details (J. Langmaid, pers. comm.).

997 ***Epichoristodes acerbella* (Walker)**
An occasionally imported alien species intercepted at Heathrow Airport and noted in Covent Garden Market in the 1960s (Bradley, 2000 — *Checklist*). Note that in 2003 a wild-caught example of this species was recorded in Berkshire (VC 22).

1157 ***Crocidosema plebejana* Zell.**
Hampstead, a male, 7.xi.2000 (RAS, gen. det. CWP); Wood Green, x.2003 (MA).

1246 ***Grapholita tenebrosana* (Dup.)**
Regent's Park, 1 female at m.v. light 28.v.2003 (TF).

1279 ***Dichrorampha acuminatana* (Lienig & Zell.)**
Natural History Museum Wildlife Garden, 18.v.1998 — not previously reported (MHo).

1495 ***Marasmarcha lunaedactyla* (Haw.)**
Woodville Road, Barnet, one at m.v. light on 7.vii.2003 (Rachel Terry det. CWP).

1500 ***Platyptilia calodactyla* (D.& S.)**
Pinner, 10.viii.1947 (WEM in collection of ESB — John Langmaid, pers. comm.).

The following records, reported as unconfirmed in the original list, are now confirmed as correct:

388 ***Prochoreutis myllerana* (Fabr.)**
Delete square brackets. Delete existing text and add: Rick Pond area, Hampton Court — one male (gen. det.) and larval feedings on skull-cap *Scutellaria* sp., 8.viii.2003 (RWJU).

499 ***Coleophora limosipennella* (Dup.)**
Delete square brackets and add: Highgate, in Stainton's *Nat. Hist. Tineina* 4: 102–111.

[Though we now have confirmed records of both *Coleophora milvipennis* and *C. limosipennella* in Middlesex, there remains a need to confirm the presence of the alder-feeding *C. alnifoliae* Barasch in the vice-county].

The following species is erroneously reported and should be deleted from the list:

405 ***Argyresthia arceuthina* (Zell.)**
This record was made in Chingford, South Essex (David Agassiz, pers. comm.) and the Middlesex 'dot' in *MBGBI* is in error.

Corrections to valid records and other supplementary information

The following details of a record are incorrect and should be deleted, though the species remains on the list because other records are valid:

918 ***Scythris limbella* (Fabr.)**
'Upper Norwood, 18.vii.1939 (SW)' is, of course, a Surrey record.

The following details are now available for previously unsupported records:

767 ***Carpatolechia decorella* (Haw.)**
Brompton Cemetery, 17.iii.1998 (TF det. DJLA).

890 ***Mompha jurassicella* (Frey)**
Wood Green, 13.iv.2004 (MA, det. PHS).

1238 ***Pammene ochsenheimeriana* (Lien. & Zell.)**
Grove Farm, Horsenden Hill, a female on 24.iv.2004 (Rachel Terry, gen. det. CWP).

1247 ***Grapholita funebrana* (Tr.)**
Wood Green, 24.vi.2002 (MA).

The following additional records of species that have been previously reported significantly update the existing information or are of some other interest:

23 ***Ectoedemia argyropeza* (Zell.)**
Camley Street nature park, 8.xi.2003 (JRL & RJH).

85 ***Stigmella suberivora* (Stt.)**
Forty Hall, Enfield, ii.2004 — mines (EG, det. CWP)

228 ***Monopis weaverella* (Scott)**
Barnet, 4.v.2003 (Rachel Terry).

285 ***Caloptilia azaleella* (Brants)**
Barnet, one at m.v. light, 20.v.2003 (Rachel Terry)

331 ***Phyllonorycter lantanella* (Schr.)**
Camley Street nature park, 8.xi.2003 (JRL & RJH).

457 ***Ypsolopha lucella* (Fabr.)**
Barnet, viii.2003 (Rachel Terry, det. CWP).

632 ***Cosmiotes consortella* (Stt.)**
Horsenden Hill, 2003 (Rachel Terry).

729 ***Isophrictis striatella* (D.& S.)**
Hampton Court Park, viii.2003 (RWJU).

918 ***Scythris limbella* (Fabr.)**
Wood Green, 28.vii.2002 (MA, confirmed CWP).

1508 ***Stenoptilia bipunctidactyla* (Scop.)**
Since publication of the list, the genitalia of the (female) specimen from Buckingham Palace Garden, 11.ix.1975 have been transferred onto a slide by MHo and CWP agrees with MHo that the identification is correct. This remark is significant because some specimens of *S. bipunctidactyla* may, perhaps, be confused with *S. pterodactyla*, and whilst the latter species appears to be widespread in the South-East, *bipunctidactyla* appears to be somewhat more difficult to find.

Acknowledgements

I am most grateful to David Agassiz, Marcel Ashby, Bob Heckford, Martin Honey, Donald Prance, Rachel Terry and Raymond Uffen for records and the opportunity to examine specimens. I would like, also, to thank David Agassiz, John Langmaid and the late John Bradley for useful discussion which has clarified a number of records. Brian Goodey has kindly dissected a large number of *Coleophora* specimens for me and for this I am most grateful.

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Book review

On the wings of checkerspots. A model system for population biology. Paul R. Ehrlich and Ilkka Hanski (eds). 2004. Oxford University Press. 371 pp. Hardback, £40. ISBN 0 19 515827 X.

Checkerspots is a North American name for the group of butterflies for which the term 'Fritillary' is used in Britain. 'Checkerspots' refers to the repeated pattern on the wings while the word 'Fritillary' shares the same linguistic root as the plant genus *Fritillaria* that have checkered markings on the petals. The book summarizes research on two species of butterflies that became the models for the development of the spatially realistic metapopulation theory. Metapopulations can be defined as partially isolated populations of local populations of a species linked by pathways of migration. The two species are *Euphydryas editha* Edith's checkerspot with a scattered distribution in western north-America and *Melitaea cinxia* Glanville fritillary of the Palaearctic region including Britain (the Isle of Wight and a few other areas). Paul Ehrlich commenced research on Edith's checkerspot in California in 1959 and in the early 1990s this acted as a catalyst for research on the Glanville fritillary centred on a group of islands off the coast of Finland led by Ilkka Hanski. Consequent innovation in metapopulation theory led to the development of the spatially realistic metapopulation theory.

Introductory sections of the book explain the benefits of detailed long-term studies on a suite of species against model systems in population science. Later sections discuss metapopulation theory in relation to the taxonomy and ecology of the two checkerspot species, population structures and dynamics, reproductive biology, oviposition preference, larval biology, natural enemies, dispersal behaviour and evolution, genetics, comparison with other species, biological conservation and suggestions for further work. The references list approximately 1,300 publications.

The role of metapopulation theory in understanding the presence or extinction of species and how habitat fragmentation influences the persistence of species is relevant across natural history and ecology, and hence to policy measures for conservation. R. Levins had proposed in 1969 a mathematical model to demonstrate the possibility of metapopulation persistence of a set of extinction-prone local populations. This classic metapopulation theory assumed that different populations have independent dynamics, and hence there was time for recolonizations to compensate for local extinctions before the entire metapopulation would go extinct. The Levins model assumes an infinitely large network of identical habitat patches. The spatially realistic metapopulation theory assumes a finite number of dissimilar patches, takes into account the theory of island biogeography and aims to add a realistic description of landscape or habitat structure to the classic metapopulation models. The fundamental idea is that the key processes of classic metapopulation dynamics, colonization and extinction, are related to the structural features of fragmented landscapes; the areas, qualities and spatial location of the habitat. Indeed, island biogeography theory is now applicable to landscapes that have been fragmented by human activities.

The key factor determining the rate of establishment of new local populations of the two butterflies in empty but suitable habitat patches is connectivity to existing populations. Connectivity reflects how isolated the focal patch is from other occupied patches, not a measure of landscape structure independent of the locations of existing populations. The metapopulation capacity of a fragmented landscape can be defined as a single number using the equations of the spatially realistic metapopulation theory; and its value increases with the number, average size and average connectivity of representative habitat patches. The theory predicts a threshold value in the quality of the landscape, below which the metapopulation is predicted to go extinct.

Dispersal by individuals of a species keeps local populations together and is a necessary condition for long-term persistence at the metapopulation level, because all populations within the metapopulation exhibit a risk of extinction. Population variability provides a measure of extinction risk. Extinction of a population of Edith's checkerspot followed a long period of high-amplitude fluctuations and steadily declining average numbers, apparently caused by climatic change. However, metapopulation dynamics track environmental change with a substantial delay.

The authors suggest that the study of small populations is important, for many species now survive as small populations. They also suggest that for some species, the concept of 'species ecology' is questionable. Populations of the same checkerspot species often used different larval host plants, had different patterns of adult nectaring, varied in their spatial population structure, had different responses to environmental events and different relationships with parasites.

Metapopulation theory is applicable to practical issues of species conservation, habitat and nature reserve selection. The challenge is to arrest population declines before the extinction of populations, and eventually, of species. Population extinctions are caused by anthropogenic habitat loss and change, stochastic change e.g. weather, and other factors that affect populations once the above two factors have reduced populations. Understanding the spatial structure of populations is crucial to preserving patchily distributed species. Conservation should take into account the need to design and maintain topographic heterogeneity and other aspects of habitat diversity that can sustain individuals through adverse conditions. The book should have a wider relevance than for enthusiasts of fritillary butterflies alone. The concepts of metapopulation theory are applicable to London which for many species is a fragmented landscape.

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Freshwater macroinvertebrates in London's rivers, 1990–2000

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Summary

This paper summarizes mixed species-level records of aquatic macroinvertebrates obtained from surveys of running waters and canals within the Greater London area undertaken by the Environment Agency over the period 1990–2000. A total of 310 taxa that were mostly identified to species are listed. The occurrence of a *Red Data Book* pea mussel *Pisidium tenuilineatum* and ten nationally scarce invertebrates including one species afforded category A status (the riffle beetle *Oulimnius major*) are described. A further fifty-nine Local invertebrates, including some running-water species that probably warrant elevated or downgraded status within the Greater London area, were found. Species listings are provided for seventy-six watercourses or river segments, which include all the principal rivers within Greater London and most of their smaller tributaries. A summary of the representation of the major invertebrate groups is provided for each watercourse and aggregated for fifteen river sub-catchments. The total richness of individual watercourses ranged from 9 to 127 taxa and was greatest within the unpolluted reaches of larger rivers such as the River Colne and Duke of Northumberland's River. Small streams or headwaters supported comparatively modest numbers of species compared to their receiving waters, but the fauna of the better examples which retain some natural channel features and are unaffected by water quality limitations, contribute significantly towards the biodiversity of catchments. Differences in ecological quality associated with water quality and physical habitat degradation are examined and several Environment Agency initiatives to address persistent environmental problems are also described.

Introduction

Aston and Andrews (1978) presented the results of the earliest sustained biological monitoring of rivers in London conducted from 1970 to 1977 in order to assess the water quality and pollution status of the area. Since this time there have been many developments in the way that biological water quality is monitored. By the late 1980s a standard approach was adopted across the country following adoption of the Biological Monitoring Working Party (BMWP) biotic index (Chesters 1980). This score system requires the identification of macroinvertebrates to BMWP family level, with each family ascribed a score based on its perceived tolerance to organic pollution and the highest scores given to pollution-sensitive groups.

The approach presently adopted by the Environment Agency for the biological General Quality Assessment (GQA) of rivers and canals is to compare results for the BMWP indices with 'target' values obtained using software developed by the Centre for Ecology and Hydrology. The philosophy of the scheme is described by Sweeting et al. (1992) and the effectiveness of the approach is assessed by Moss et al. (1999). Further information including the results of recent classifications of rivers may be found on the Environment Agency's web site: www.environment-agency.gov.uk

A monitoring strategy based on family level data is relatively cost-effective and well suited to provide a robust assessment of water pollution impacts at regular spatial or temporal intervals, but information concerning species representation is overlooked. In order to bridge this gap, efforts to undertake species level identification of samples within the London area were made during the 1990s. Much of this work relied upon special investigations such as baseline and post project appraisals of river restoration schemes (eg. England 1997*a, b, c, d, e,* 2000). Several detailed catchment surveys were also undertaken which included additional sampling sites to improve spatial coverage of both the principal rivers and their many poorly known headwater streams (e.g. Leeming and England 1992, Leeming 1992*a, b, c,* 1993; Woodward 1995; Moore 2000; England et al. 2000). After the mid 1990s species-level catchment surveys were integrated within a rolling programme of monitoring aimed to update and extend knowledge of species-distributions and to identify local environmental impacts or important macroinvertebrate assemblages, in order to inform ecological and conservation-related input to Catchment Management Plans (CMPs) and their successors Local Environment Agency Plans (LEAPs).

Study area

This paper reviews information obtained from biological monitoring of running waters and canals within Greater London undertaken by the Thames Region of the Environment Agency. This study area is larger than that considered by Aston and Andrews (1978) but does not include the River Darent catchment which now falls within the Southern Region. The results of monitoring from the River Thames are presented elsewhere in works such as Attrill (1998), EMU (2000) and Davison (2002).

There are eleven principal catchments within Greater London of which seven drain from the north — Brent, Crane, Colne, Lee, Roding, Rom/Beam and Ingrebourne; and four drain from the south — Ravensbourne, Wandle, Beverley Brook and Hogsmill. For the purposes of this paper, the following sub-catchments are also identified; River Pinn (a part of Colne catchment) and the Turkey Brook, Salmon Brook and Pymmes Brook (parts of the Lee). Data for two artificial watercourses; the Grand Union Canal (Denham Reach–Paddington) and the Longford River (a distributary of the River Colne), which ultimately join the River Lee and River Thames respectively, do not fit easily within the fifteen catchments for which information has been condensed and are treated separately.

The watercourses within the study area vary greatly in size, geomorphology and naturalness. The smaller headwater streams draining clay hills are naturally 'flashy' with peak flows following quickly after rainstorms, which promotes steep, eroding banks and in-channel debris dams (e.g. the fallen limbs or branches of bankside trees). The fauna and flora of such streams may be limited by the severity of physical conditions, such as periodic scouring and susceptibility to drying. Downstream, as watercourse gradient and bank height reduces and the water width increases, a greater variety of plants and animals are naturally found (Vannote et al. 1980). In the larger brooks and smaller river channels a range of different physical environments — such as fast-flowing riffle areas, less-turbulent glides or runs and deeper pools — may be found within

relatively short sections of river, particularly where a channel follows a sinuous course. The physical heterogeneity of a river channel is a key influence upon the nature and variety of riverine habitats available for aquatic plants, macroinvertebrates, fish and other river-corridor wildlife (eg. Brown and Brussock 1991, Brewin et al. 1995).

The channels within London once supported a variety of river habitats, with a tendency for wide river margins to grade into adjacent areas of wetland within the main river valleys. Traditionally these floodplain areas supported a mosaic of sustainable land uses including cattle grazing, fishing and wildfowling with reed, sedge or willow growing for roofing materials or basket making and other crafts (Barton 1982, Wilson 1987, National Rivers Authority 1995*a*, *b*).

Progressive urbanization of the London area has caused physical alterations such as a loss of floodplain to urban development and increased rates of surface water run off and flashiness of rivers and streams. These changes have led to flood prevention measures including lowering of water levels through channel deepening, alteration to channel dimensions and the use of flow regulation structures and bank protection to prevent erosion (National Rivers Authority 1994, 1995*a*, *b*, Environment Agency 1996, 1997, 1999).

Presently there are a high proportion of highly modified river channels in London with degraded instream, river margin and bankside habitats, greatly reducing the ecological value and potential of watercourses. A lack of refugia during high flows is a particular problem in engineered, uniform or trapezoidal channels where obstructions provided by instream plants or irregular edges have been removed. Many species rely on these refugia to survive during times of high flow or pollution (Townsend 1989, Winterbottom et al. 1997.)

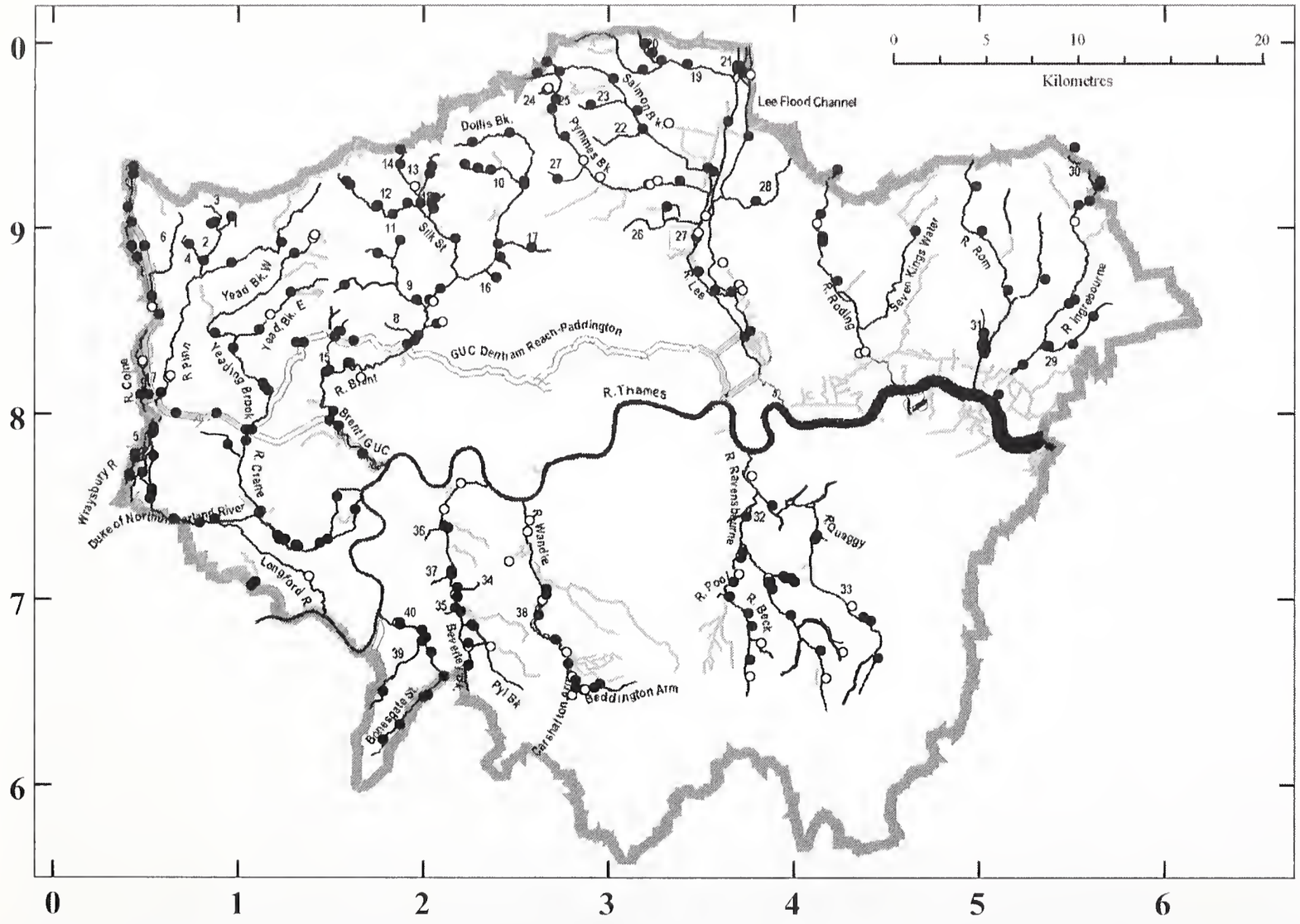
Urbanization has also had an influence on water quality. Increased use of rivers for sewage disposal has been accompanied by increasing volumes of polluted urban surface water entering watercourses. The loss of natural stream length associated with culverting or straightening of watercourses and the drainage of interconnected wetland areas has also reduced the capacity of rivers and streams to self-purify polluting loads (National Rivers Authority 1994, 1995*a*, *b*, Environment Agency 1996, 1997, 1999).

Locations of sampling points

Sites were selected to be broadly representative of the vicinity in which they were located. Individual reaches scheduled for assessment were defined primarily for the purposes of water quality monitoring, with special consideration given to monitoring the effects of consented discharges, such as Sewage Treatment Works (STWs) or other potentially polluting influences including tributary streams. The additional coverage provided by catchment surveys also enabled targeting of reaches with high potential including sections of watercourse with more natural characteristics. However, due to resource constraints many smaller streams (<5km in length) were represented by a single site located towards their downstream limit. The network of sampling points providing species-level data is relatively comprehensive, comprising around 240 sampling points situated at 2–5 km intervals along the lengths of the principal watercourses (Figure 1). Over 10,000 species records that were obtained from these sites during 1990–2000 are reviewed in this paper.

Methodology

Standardized collections of macroinvertebrates were obtained using a long-handled pond-net (mesh size 0.9 mm) for an active period of three minutes at each site. Kick sampling and net sweep techniques were used, as appropriate, to sample all available aquatic habitats broadly in proportion to their occurrence. A supplementary hand search of cobbles or other retrievable solid objects was also made for a total duration of one minute. A full description of the sampling



Key to numbered watercourses

1 Northwood Hills Stream
2 Cannon Brook
3 Copse Wood Stream
4 Mad Bess Brook
5 Bigley Ditch
6 New Years Green Bourne
7 Frays River
8 Wembley Brook
9 Wealdstone Brook
10 Folly Brook
11 Edgware Brook
12 Edgware Brook Tributary
13 Watling Ditch
14 Edgwarebury Ditch
15 Costons Brook
16 Clitterhouse Brook
17 Mutton Brook
18 Deans Brook
19 Turkey Brook
20 Cuffley Brook
21 Small River Lee
22 Hounsden Gutter
23 Merryhills Brook
24 Green Brook
25 Monkden Mead Brook
26 Moselle River
27 Friary Park Stream
28 Ching Brook
29 Berwick Pond Stream
30 Weald Brook
31 Wantz Stream
32 Ravensbourne — Downham Branch
33 Kyd Brook
34 Cannizaro Park Stream
35 Coombe Brook
36 Pen Ponds Overflow Stream
37 Keswick Avenue Ditch
38 Agfa Ditch
39 Surbiton Stream
40 Hogsmill River

FIGURE 1. Locations of watercourses in London. Watercourses with species data reviewed in this paper are shown by black lines and others in grey. Sampling points contributing species-level records are indicated by solid circles, others providing BMWP level information are represented by open circles.

protocol followed is provided by Murray-Bligh (1999). The sampling methodology is appropriate to a wide range of running-water site types and is capable of producing a reasonably comprehensive and reproducible listing of the taxa characteristic of a site (Furse et al. 1981). Previous sampling by Aston and Andrews (1978) is understood to have utilized quantitative sampling devices (Surber, shovel, grab and airlift samples) that are relatively ineffective at obtaining a comprehensive listing of species since river-edge habitats are usually overlooked.

Samples were returned to the laboratory and sorted live within forty-eight hours of collection or fixed in 10 per cent formalin (4 per cent neutral buffered aqueous formaldehyde) for subsequent analysis. Sorting was performed by placing a small quantity of sample material, together with a small amount of water, into a shallow white flat-bottomed plastic tray (dimensions 35 × 25 cm) marked by a grid into equal-sized squares. Material was systematically inspected, using the grids as an aid, under good lighting. Sorting was not time-limited and usually lasted from one to three hours, depending upon the volume and type of sample material collected.

All aquatic macroinvertebrate taxa retained by a 500 μm aperture sieve, including larvae, pupae and adults, were identified as far as available keys allow. Invertebrates were usually identified to species (following nomenclature of Furse et al. 1978, 1998) or RIVPACS group (Wright et al. 1996) where maturity and condition allowed, except Oligochaeta (worms), Chironomidae (midge larvae) and Hydracarina (water mites) which were not routinely identified further. Poorly described taxa were not usually identified beyond genus or family level; this includes larvae of particular families of Diptera (true flies) and larvae of some Coleoptera (water beetles) e.g. Hydrophilidae (incl. Hydraenidae) and Haliplidae.

The current British conservation status of all recorded species, as assigned by the Joint Nature Conservation Committee (JNCC), was determined through use of RECORDER software (including version 3.2, 1996 for 'Local' and 'Common' designations). This information derives from the initial *Red Data Book* series (Ball 1986, Shirt 1987, Bratton 1991) and subsequent reviews of the status of various taxonomic groups, including Ephemeroptera and Plecoptera (Bratton 1990); Diptera (Falk 1991); Trichoptera (Wallace 1991); Coleoptera (Hyman and Parsons 1992, 1994, Foster 2000) and Hemiptera (Kirby 1992).

Results

Table 1 provides a checklist of the 310 macroinvertebrate taxa recorded from watercourses within Greater London between 1990 and 2000. Taxa identified at lower taxonomic resolution have been omitted for simplicity from this table but are included within Appendices A–D which provide full taxon lists for the individual watercourses. The frequency of occurrence of a taxon shown in Table 1 is the percentage of watercourses where it was found (from n = 76 watercourses or river segments, except *Pisidium* spp. identified from 58 watercourses to date). Oligochaete worms and the larvae of midges (Chironomidae) were found in all watercourses. These ubiquitous groups of freshwater animals ideally require further identification (which is prohibitively time-consuming) in order to assess their associations with site types or water quality influences. Oligochaete species identified during surveys of the Hogsmill River and the River Pool in south London (Leeming 1993, England 1997*e*) are listed on Table 1, although subsequent analysis in this paper utilises family-level information only.

The frequency of occurrence of the leech *Erpobdella testacea* is possibly overestimated as specimens have only been positively identified by the authors (and verified by John Blackburn of the CEH) from sites on the Duke of Northumberland's River and Wraysbury River. Other records for watercourses

within the Wandle and Beverley catchment in south London may have resulted from misidentification of *Trocheta* spp. since *E. testacea* are rarely encountered outside of standing water or ditch habitats (Leeming 2003).

The most widely recorded taxa in London's rivers, comprising chiefly pollution-tolerant running-water species with broad habitat requirements, are listed in Table 2. The distribution of the introduced bladder snail *Physa acuta* group has apparently increased in London's rivers since the mid 1970s as it was not recorded here during surveys conducted by Aston and Andrews (1978), although it was possibly overlooked. The species-group typically resembles *Physa acuta,* a southern European species, but may in fact turn out to be the North American *P. heterostropha* or *P. gyrina* — of which only the latter has so far been confirmed as resident in the British Isles (Anderson 1996, Kerney 1999). The native British species *Physa fontinalis* exhibited a more restricted distribution, occurring in less than 30 per cent of watercourses sampled, and is apparently associated with cleaner, well-vegetated waters.

Examples of taxa with a more limited distribution in the London area include species associated with unpolluted semi-natural headwater streams such as the caddisflies *Plectrocnemia conspersa, Beraeodes minutus*, *Glyphotaelius pellucidus*, *Limnephilus sparsus* and *L. centralis*, stoneflies *Nemoura cinerea, Nemurella picteti* and *Isoperla grammatica*, mayfly *Habrophlebia fusca* and beetles *Agabus guttatus, A. chalconatus*, *Limnebius truncatellus* and *Hydraena nigrita.* Examples of species that are associated with relatively clean, deeper water in slow-flowing large rivers or canals include the shrimp *Corophium curvispinum*, red-eyed damselfly *Erythromma najas*, riffle beetle *Oulimnius major*, the snails *Bithynia leachii* and *Lymnaea auricularia*, and caddisflies such as *Phryganea grandis*, *Molanna angustata*, *Ecnomus tenellus*, *Ceraclea* spp., *Agraylea* spp. and *Cyrnus* spp.

Small to medium sized rivers contain relatively fewer unique elements, but can be nonetheless very rich. Characteristic species of the higher quality rivers include the caddisflies *Goera pilosa*, *Sericostoma personatum*, *Agapetus fuscipes*, *Rhyacophila dorsalis*, *Lype* spp., *Polycentropus flavomaculatus*, *Halesus* spp., *Potamophylax* spp., *Athripsodes* spp. and *Mystacides nigra*, the beautiful demoiselle *Calopteryx splendens*, the nerite snail *Theodoxus fluviatilis*, and mayflies such as *Ephemera danica*, *Ephemerella ignita*, *Baetis scambus* or *Centroptilum* spp.

In general, many molluscs, water beetles, bugs and Diptera are not dependent upon particularly clean running water but tend to be associated with high quality grassy or muddy edge habitats, ephemeral waters, or well-established areas of submerged or emergent vegetation in more natural channels. The overall list of water beetles and bugs recorded is relatively modest and is poor within the majority of individual watercourses, reflecting the highly modified nature of most river channels within London. A number of species that are known to be widespread in standing waters within the area occurred very infrequently within the rivers (e.g., the beetles *Dytiscus marginalis*, *Hyphydrus ovatus* and *Hygrobia hermanni*, and the bug *Ilyocoris cimicoides*). Examples of riverine or *lotic* species from these groups which exhibited limited distributions in London's rivers include the bugs *Aphelocheirus aestivalis* and *Gerris najas* (see also Huxley 2003) and the beetles *Agabus paludosus*, *Platambus maculatus*, *Stictotarsus duodecimpustulatus*, *Orectochilus villosus*, and *Limnius volckmari.*

The nationally scarce white-barred soldierfly *Oxycera morrisii* and the water beetle *Haliplus laminatus* are quite widespread in watercourses within London and in the neighbouring Home Counties. *H. laminatus* occurs within slow-flowing or impounded reaches of eutrophic rivers and canals, whilst *O. morrisii* is found within smaller perennial streams or rivers with shallow edges where it is the most frequently encountered member of the genus.

A summary of the species richness of each taxonomic group found within individual watercourses and the principal river catchments is provided in Table 3.

These totals have been corrected to exclude taxa recorded at lower precision, as necessary. In cases where *Pisidium* spp. were not identified the figure for Bivalvia is likely to be an underestimate (shown by + after the recorded figure).

Watercourses monitored at a number of sites may derive a disproportionate number of their species occurrences from only a small subset of locations (sometimes an individual sampling point) which may not be representative of the watercourse as a whole. This situation applies within the Pymmes Brook and River Brent catchments in north London where the overwhelming majority of watercourse length supports only pollution-tolerant groups of species, with Trichoptera, Ephemeroptera, Plecoptera and other pollution-sensitive insects typically absent. In these catchments relatively isolated populations may persist within small sections of the main rivers upstream of more heavily urbanized areas or within individual tributary streams located within parkland or green belt areas (Leeming and England 1992, Leeming 1992*a, b, c*, Woodward 1995, Moore 2000, England et al. 2000). These populations are a potential source of colonists to other parts of a stream catchment if water quality or other environmental problems ameliorate, but in the meantime they may be vulnerable to channel-drying events (as in recent droughts), or to insensitive urban development of stream corridors if the local importance of a reach is not recognized.

More detailed information concerning the frequency of occurrence of taxa within samples, or recorded species distributions are beyond the scope of this paper and would be misleading for watercourses that were relatively under-sampled. A small number of sites on watercourses such as the Ingrebourne, Weald Brook, Wantz Stream, Pool and Colne have received greater attention than others, with repeat sampling in successive seasons lasting a number of years, whilst the data typically available ranges from two to six separate species lists at an individual site.

Sites which fall outside but in close proximity to the Greater London boundary are also known to support additional species within the London Natural History Society recording area. Worthy of mention is the occurrence of the fine-lined pea mussel *Pisidium tenulineatum* (RDB3) at a single sampling point in the River Misbourne near to its confluence with the River Colne in Denham Country Park, Buckinghamshire (TQ051862). This record is noteworthy since it falls well outside the area of historic sightings of the species within Buckinghamshire, which include the original type locality — the Grand Union Canal at Marsworth (Stelfox 1918) — where the species can no longer be found living (Kerney 1999). The bivalve was found in low numbers in six consecutive samples collected between 7 April 1997 and 13 October 1999, but was absent from four other sites situated within 500 metres that were monitored concurrently (Leeming 2000*a, b*). This demonstrates the patchiness of particular species populations and the possibility that they may be overlooked without adequate sampling coverage.

It should be stressed that the checklist of species provided for the River Colne, Wraysbury River and River Colne/Grand Union Canal are not comprehensive since they exclude records obtained from adjacent areas of Surrey, Buckinghamshire and Hertfordshire. The Nationally Scarce (category A) elmid beetle *Oulimnius major* has also been recorded from sites in the Colne Valley on the Colne Brook that fall outside the Greater London boundary. The upper reaches of the River Hogsmill above the Bonesgate Stream in Surrey and parts of the Turkey Brook, Rivers Lee and Roding in Hertfordshire or Essex are also known to contain additional species outside the Greater London boundary, yet within the LNHS recording area. In several rivers, notably the Hogsmill, Roding and Lee, ecological quality tends to deteriorate measurably as they enter the more urbanized surroundings within London, influenced by factors such as diffuse pollution sources and the increasingly modified nature of river channels that are described elsewhere in this paper.

Despite reservations as to the comparability of available data, the wide variations in representation of particular macroinvertebrate groups between catchments or between separate watercourses within individual catchments is informative. The Colne Valley watercourses clearly support important macroinvertebrate assemblages and achieve the greatest species richness for a number of groups, most notably Gastropoda, Trichoptera, Ephemeroptera and Coleoptera. The ecological value and significance of many small tributary streams or headwaters is often greater than may be immediately apparent through examination of their taxonomic richness. The best examples which retain some natural channel features and are unaffected by water quality limitations support distinctive faunal elements not found in their receiving waters, and they may contribute significantly towards the biodiversity of catchments in which they are located (see also Furse et al. 1991, 1992).

Discussion

The ecology of streams and rivers reflects both the natural influences associated with the physical and chemical characteristics of the catchments from which they derive water and the artificial influences resulting from human activities, (Downing 1984, Downes et al. 1993.)

River catchments within London have been altered by a range of human activities associated with the progressive urbanization of the area. Historically, river engineers have been charged with draining the land to alleviate flooding, which they did with great efficiency but often with unfortunate ecological consequences (e.g. Hey 1997). Although river engineering practices have improved beyond recognition compared to the past, with increasing consideration to ecological sensitivity and opportunities for environmental enhancement, the consequences of past engineering schemes are often irreversible. Downs (1994) in his study of the geomorphology of river channels in the Thames Basin concluded that '*once straightened few channels are capable of recovering their sinuosity after channel management, thus highlighting the importance of conserving currently sinuous channels and the restoration of previously straightened reaches.*' These physical changes have a direct influence upon the instream ecology of a watercourse through habitat changes and by interruption of the natural riverine process such as sediment transport (Chutter 1969, Brookes 1988, Miyake and Nakano 2002) and flow patterns (Brown et al. 1991, Rempel et al. 2000).

Chemical water quality has remained relatively stable or shown local improvements within London waterways over the last decade and is now regarded as fair to good in the majority of the prescribed Environment Agency water quality reaches within the area. However, there are localized sections of channel which are prone to chronic intermittent forms of pollution from diffuse sources that may go undetected by periodic collection of water samples (Leeming and England 1992, Leeming, 1992*a*, *b*, 1994, National Rivers Authority 1994, 1995*a*, *b*, Moore 2000, Environment Agency 1996, 1997, 1998, 1999, 2000*a*). Much of this contamination is in the form of untreated sewage which enters the river system via domestic misconnections to surface water outfalls (SWOs) or via combined sewer overflows (CSOs), whilst toxins including heavy metals such as cadmium, lead and copper may be derived from road surface run-off after rainfall in urban areas (e.g. Enserink et al. 1991, Mulliss et al. 1994).

Initiatives undertaken by the Environment Agency to counteract polluting surface water outfalls include water quality treatment schemes using artificial wetlands. This approach is well established and widely used for the treatment of municipal wastewater in Europe (Brix 1994), whilst balancing ponds to receive and attenuate road surface run-off are an established component of new road (or road-widening) schemes in the UK. In 1995 an ambitious project involving

construction of an on-line reed bed was implemented on the River Wantz in South Hornchurch after biological and chemical monitoring had highlighted gross contamination of this small watercourse by a series of SWOs. The new reed bed produced an improvement in chemical water quality and clarity and also increased the range of habitats available for macroinvertebrates, with benefits highlighted by biological monitoring (reviewed by Gowlett 2001). Future initiatives to address identified water quality problems are widespread across London. One example is within the Stonebridge Brook, Hermitage Brook and Old Moselle Brook catchments in South Tottenham where the Environment Agency is working in partnership with Haringey Local Authority and Thames Water Utilities Ltd to rectify some of the pollution problems in the area (WERM 2004).

Poor habitat quality is being addressed through a more environmentally sustainable approach to flood defence projects and through the promotion of river restoration schemes, now established as an important tool in the rehabilitation of river ecosystems and the conservation of biodiversity (England 2004). River restoration schemes already undertaken within the London area have demonstrated the ecological benefits of such work (e.g. England 1997*e*, 2004*b*). Key to the success of projects is the restoration of natural riverine habitats and processes. This includes reducing the barriers to colonisation or migration imposed by weirs or culverted reaches in order to reconnect the more diverse sections of watercourses. Most schemes seek to reinstate channel heterogeneity and natural margins to restore functional habitats that have been lost. The large-scale need for river restoration within London has promoted the requirement for a strategic approach (Environment Agency 2002 and in prep). It is anticipated that the benefits of improving water quality and restoring habitats will be demonstrated by future biological monitoring of such schemes.

The Environment Agency will continue to investigate the distribution of macroinvertebrates within London's watercourses and will examine the distribution of taxa within each of the different Boroughs for inclusion within the London Biodiversity Action Plan (BAP) under the streams and rivers Habitat Action Plan. Details of the London BAP can be found on the London biodiversity partnership web site www.lbp.org.uk

Acknowledgements

This paper summarizes records obtained over a substantial period during which a number of biologists employed by the Environment Agency or NRA, as well as several MSc students, assisted with sample collection and processing. The significant contribution to species-recording by Janet Moore within the study area, over a number of years, is particularly acknowledged. We are also grateful to John Blackburn at the CEH for undertaking a number of species identification checks for a variety of invertebrate groups, to Ian Killeen for verifying assorted pea mussels and for identifying a significant proportion of the *Pisidium* records summarized in this paper, and to Martin Drake for help with the determination of soldier fly larvae.

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TABLE 1. A checklist of taxa showing current status and percentage occurrence (n = 76 watercourses) in surveys of running waters and canals within the Greater London area 1990–2000.

Status	Species or taxa	%
	PORIFERA	
—	Spongillidae	13.2
	CNIDARIA	
	Hydrozoa	
—	*Hydra* sp.	3.9
	PLATYHELMINTHES	
	Microturbellaria	
—	Microturbellaria	1.3
	Tricladida	
Naturalized	*Planaria torva*	2.6
Common	*Polycelis nigra* group	61.8
Common	*Polycelis felina*	10.5
Naturalized	*Dugesia tigrina*	31.6
(Common)	*Dugesia polychroa* group	52.6
Common	*Dendrocoelum lacteum*	59.2
Local	*Bdellocephala punctata*	2.6
	NEMATODA	
—	Nematoda	28.9
	NEMATOMORPHA	
—	Chordodidae	3.9
	MOLLUSCA	
	Gastropoda	
Local	*Viviparus viviparus*	5.3
Local	*Theodoxus fluviatilis*	11.8
Local	*Valvata piscinalis*	28.9
Local	*Valvata cristata*	21.1
Naturalized	*Potamopyrgus antipodarum*	94.7
Common	*Bithynia tentaculata*	44.7
Local	*Bithynia leachii*	7.9
Common	*Lymnaea truncatula*	5.3
Common	*Lymnaea palustris*	19.7
Common	*Lymnaea stagnalis*	26.3
Local	*Lymnaea auricularia*	11.8
Common	*Lymnaea peregra*	92.1
Common	*Physa fontinalis*	30.3
Naturalized	*Physa acuta* group	60.5
Common	*Planorbis carinatus*	18.4
Common	*Planorbis planorbis*	19.7
Common	*Bathyomphalus contortus*	34.2
Common	*Anisus vortex*	39.5
Local	*Gyraulus albus*	39.5
Common	*Armiger crista*	21.1
Local	*Hippeutis complanatus*	15.8
Common	*Planorbarius corneus*	27.6
Common	*Ancylus fluviatilis*	52.6
Common	*Acroloxus lacustris*	43.4
—	Succineidae	6.6
—	Zonitidae	3.9
	Bivalvia	
Common	*Unio pictorum*	1.3
Local	*Anodonta cygnaea*	3.9
Common	*Anodonta anatina*	9.2
Common	*Sphaerium corneum*	60.5
Common	*Sphaerium lacustre*	18.4
Common	*Pisidium amnicum*	1.7
Common	*Pisidium casertanum*	60.3
Common	*Pisidium henslowanum*	20.7
Local	*Pisidium hibernicum*	10.3
Common	*Pisidium milium*	46.6
Common	*Pisidium nitidum*	53.4
Common	*Pisidium personatum*	36.2
Common	*Pisidium subtruncatum*	62.1
Local	*Pisidium supinum*	3.4
Naturalized	*Dreissena polymorpha*	2.6
	ANNELIDA	
	Hirudinea	
Common	*Piscicola geometra*	30.3
Common	*Theromyzon tessulatum*	28.9
Local	*Hemiclepsis marginata*	17.1
Common	*Glossiphonia complanata*	77.6
Local	*Glossiphonia heteroclita*	19.7
Common	*Helobdella stagnalis*	57.9
Local	*Haemopis sanguisuga*	31.6
Local	*Erpobdella testacea*	9.2
Common	*Erpobdella octoculata*	73.7
Local	*Trocheta bykowskii*	14.5
Local	*Trocheta subviridis*	48.7
	Oligochaeta	
—	Oligochaeta	100
Unknown	*Lumbriculus variegatus*	N/A
Unknown	*Stylodrilus heringianus*	N/A
Unknown	*Enchytraeidae*	N/A
Unknown	*Specaria josinae*	N/A
Unknown	*Nais elinguis*	N/A
Unknown	*Tubifex tubifex*	N/A
Unknown	*Limnodrilus cervix*	N/A
Unknown	*Limnodrilus hoffmeisteri*	N/A
Unknown	*Limnodrilus udekimianus*	N/A
Unknown	*Psammoryctides barbatus*	N/A
Unknown	*Potamothrix bavaricus*	N/A
Unknown	*Potamothrix hammoniensis*	N/A
Unknown	*Aulodrilus pluriseta*	N/A
Unknown	*Eiseniella tetraeda*	N/A
	CHELICERATA	
—	Hydracarina	65.0
	CRUSTACEA	
	Cladocera	
—	Cladocera	23.7
	Copepoda	
—	Copepoda	22.4
	Ostracoda	
—	Ostracoda	38.2
	Branchiura	
Common	*Argulus foliaceus*	5.3
	Malacostraca	
Naturalized	*Eriocheir sinensis*	1.3
Naturalized	*Pacifastacus leniusculus*	1.3
Common	*Asellus aquaticus*	98.7
Common	*Asellus meridianus*	10.5
Naturalized	*Corophium curvispinum*	7.9

Status	Species or taxa	%
Naturalized	*Crangonyx pseudogracilis*	42.1
Common	*Gammarus pulex*	81.6
Common	*Gammarus zaddachi*	2.6
	INSECTA	
	Collembola	
–	Collembola	10.5
	Ephemeroptera	
Local	*Baetis fuscatus* ?	1.3
Common	*Baetis rhodani*	59.2
Local	*Baetis scambus*	9.2
Common	*Baetis vernus*	15.8
Local	*Centroptilum luteolum*	3.9
Local	*Centroptilum pennulatum*	1.3
Common	*Cloeon dipterum*	19.7
Local	*Cloeon simile*	1.3
Local	*Habrophlebia fusca*	3.9
Common	*Ephemera danica*	7.9
Local	*Ephemerella ignita*	9.2
Local	*Caenis luctuosa*	28.9
Local	*Caenis robusta* ?	1.3
Common	*Caenis horaria*	3.9
	Plecoptera	
Common	*Leuctra fusca*	1.3
Common	*Nemoura cinerea*	5.3
Common	*Nemurella picteti*	1.3
Common	*Isoperla grammatica*	1.3
	Odonata	
Local	*Calopteryx splendens*	28.9
Common	*Coenagrion puella*	10.5
Local	*Erythromma najas*	1.3
Common	*Enallagma cyathigerum*	3.9
Common	*Ischnura elegans*	36.8
Common	*Aeshna cyanea*	2.6
Local	*Aeshna mixta*	1.3
Common	*Sympetrum striolatum*	3.9
	Hemiptera	
Common	*Hydrometra stagnorum*	21.1
Common	*Velia caprai*	11.8
—	*Microvelia* sp.	1.3
Common	*Gerris najas*	1.3
Common	*Gerris lacustris*	15.8
Common	*Nepa cinerea*	27.6
Local	*Ranatra linearis*	1.3
Common	*Ilyocoris cimicoides*	3.9
Local	*Aphelocheirus aestivalis*	5.3
Common	*Notonecta glauca*	17.1
Common	*Plea minutissima*	3.9
Common	*Micronecta poweri*	1.3
Local	*Cymatia coleoptrata*	2.6
Common	*Corixa punctata*	3.9
Common	*Hesperocorixa linnaei*	2.6
Common	*Hesperocorixa sahlbergi*	11.8
Common	*Sigara dorsalis*	26.3
Common	*Sigara distincta*	5.3
Common	*Sigara falleni*	10.5
Common	*Sigara fossarum*	1.3
Common	*Sigara lateralis*	2.6
Common	*Sigara nigrolineata*	1.3
	Megaloptera	
Common	*Sialis lutaria*	31.6
	Neuroptera	
—	*Sisyra* sp.	3.9
	Coleoptera	
Local	*Orectochilus villosus*	3.9
Common	*Gyrinus substriatus*	5.3
Common	*Haliplus lineatocollis*	11.8
Local	*Haliplus flavicollis*	2.6
Scarce B	*Haliplus laminatus*	9.2
Common	*Haliplus ruficollis*	1.3
Local	*Haliplus immaculatus*	6.6
Common	*Haliplus fluviatilis*	7.9
Local	*Haliplus wehnckei*	5.3
Local	*Hygrobia hermanni*	2.6
Local	*Noterus clavicornis*	5.3
Common	*Laccophilus hyalinus*	2.6
Local	*Laccophilus minutus*	1.3
Common	*Hyphydrus ovatus*	3.9
Local	*Hygrotus impressopunctus*	1.3
Common	*Hygrotus inaequalis*	1.3
Local	*Hydroporus discretus*	1.3
Common	*Hydroporus palustris*	1.3
Common	*Hydroporus planus*	2.6
Local	*Graptodytes pictus*	1.3
Common	*Nebrioporus elegans*	26.3
Local	*Stictotarsus duodecimpustulatus*	5.3
Common	*Dytiscus marginalis*	1.3
Common	*Platambus maculatus*	3.9
Common	*Agabus bipustulatus*	9.2
Scarce B	*Agabus chalconatus*	1.3
Local	*Agabus didymus*	13.2
Common	*Agabus guttatus*	2.6
Common	*Agabus nebulosus*	1.3
Local	*Agabus paludosus*	3.9
Common	*Agabus sturmii*	2.6
Common	*Ilybius ater*	1.3
Common	*Ilybius fuliginosus*	10.5
Common	*Colymbetes fuscus*	5.3
Scarce B	*Rhantus suturalis*	1.3
Common	*Helophorus aequalis*	2.6
Common	*Helophorus grandis*	2.6
Common	*Helophorus brevipalpis*	14.5
Common	*Helophorus obscurus*	2.6
Common	*Helophorus minutus*	1.3
Common	*Anacaena globulus*	11.8
Common	*Anacaena lutescens*	1.3
Common	*Anacaena limbata*	5.3
Local	*Laccobius striatulus*	1.3
Local	*Helochares lividus*	3.9
Common	*Hydrobius fuscipes*	6.6
Scarce B	*Cercyon ustulatus*	1.3
Common	*Ochthebius minimus*	1.3
Scarce B	*Hydraena nigrita*	1.3
Common	*Limnebius truncatellus*	1.3
—	*Elodes* sp.	7.9
Common	*Microcara testacea*	1.3
—	*Cyphon* sp.	1.3
—	*Scirtes* sp.	2.6
—	*Dryops* sp.	2.6
Common	*Elmis aenea*	23.7
Common	*Limnius volckmari*	3.9
Scarce A	*Oulimnius major*	1.3
Common	*Oulimnius tuberculatus*	5.1
—	*Phaedon* sp.	3.9
—	Curculionidae	5.3
	Lepidoptera	
Common	*Cataclysta lemnata*	1.3
Common	*Nymphula nymphaeata*	1.3
	Trichoptera	
Common	*Rhyacophila dorsalis*	5.3
Common	*Agapetus fuscipes*	5.3
Common	*Agraylea multipunctata*	3.9
—	*Hydroptila* sp.	22.4
—	*Lype* sp.	6.6

Status	Species or taxa	%
Common	*Tinodes waeneri*	19.7
Local	*Ecnomus tenellus*	1.3
Local	*Cyrnus flavidus*	2.6
Common	*Cyrnus trimaculatus*	5.3
Common	*Polycentropus flavomaculatus*	11.8
Common	*Neureclipsis bimaculata*	5.3
Common	*Plectrocnemia conspersa*	9.2
Common	*Hydropsyche angustipennis*	31.6
Common	*Hydropsyche contubernalis*	3.9
Common	*Hydropsyche pellucidula*	13.2
Common	*Hydropsyche siltalai*	7.9
Local	*Phryganea grandis*	6.6
Common	*Halesus radiatus*	7.9
Common	*Micropterna lateralis*	7.9
Common	*Micropterna sequax*	18.4
Common	*Potamophylax cingulatus*	1.3
Common	*Potamophylax latipennis*	3.9
Common	*Stenophylax permistus*	1.3
Common	*Chaetopteryx villosa*	2.6
Common	*Glyphotaelius pellucidus*	11.8
Common	*Limnephilus centralis*	2.6
Common	*Limnephilus extricatus*	2.6
Common	*Limnephilus flavicornis*	1.3
Common	*Limnephilus lunatus*	25.0
Common	*Limnephilus rhombicus*	3.9
Common	*Limnephilus sparsus*	1.3
Common	*Goera pilosa*	2.6
Local	*Beraeodes minutus*	1.3
Common	*Sericostoma personatum*	1.3
Common	*Molanna angustata*	13.2
Common	*Athripsodes albifrons*	1.3
Common	*Athripsodes aterrimus*	7.9
Common	*Athripsodes cinereus*	14.5
Common	*Ceraclea dissimilis*	5.3
Local	*Ceraclea fulva*	2.6
Common	*Ceraclea nigronervosa*	1.3
Scarce B	*Ceraclea senilis*	2.6
Common	*Mystacides azurea*	26.3
Common	*Mystacides longicornis*	11.8
Local	*Mystacides nigra*	2.6
	Diptera	
Common	*Tipula oleracea*	1.3
Common	*Tipula paludosa*	1.3
—	*Tipula montium* group	50.0
Local	*Nephrotoma analis*	2.6
—	*Dicranota* sp.	6.6
—	*Limnophila (Eloeophila)* sp.	3.9
—	*Pseudolimnophila* sp.	1.3
—	*Pilaria discicollis* group	3.9
—	*Pilaria filata* group	1.3
—	*Ormosia/Helius* sp.	6.6
Unknown	*Pericoma cognata*	2.6
—	*Pericoma trivialis* group	22.4
Unknown	*Pericoma fallax*	1.3
Common	*Psychoda alternata*	1.3
Common	*Psychoda cinerea*	5.3
Unknown	*Psychoda severini*	1.3
Unknown	*Peripsychoda fusca*	2.6
Unknown	*Chaoborus flavicans*	1.3
Common	*Anopheles claviger*	1.3
Unknown	*Aedes rusticus*	1.3
Common	*Culex pipiens*	2.6
—	*Culiseta litorea/morsitans*	2.6
—	*Culiseta annulata* group	5.3
Common	*Dixa nubilipennis*	1.3
Local	*Dixa submaculata*	1.3
Local	*Dixella autumnalis*	1.3
—	*Simulium angustitarse* group	2.6
—	*Simulium vernum* group	1.3
—	*Simulium aureum* group	10.5
Unknown	*Simulium equinum*	7.9
Unknown	*Simulium erythrocephalum*	7.9
—	*Simulium ornatum group*	34.2
Unknown	*Simulium noelleri*	1.3
—	Chironomidae	100
—	Ceratopogonidae	57.9
Common	*Pychoptera albimana*	1.3
—	Tabanidae	5.3
Common	*Sargus bipunctatus*	1.3
Common	*Chloromyia formosa*	9.2
Common	*Beris vallata*	1.3
Notable	*Oxycera morrisii*	5.3
(Notable)	*Stratiomys* sp.	5.3
Local	*Oplodontha viridula*	1.3
Notable	*Vanoyia tenuicornis*	1.3
—	*Clinocera* sp.	5.3
—	*Hemerodromia* sp.	3.8
—	*Chelifera* sp.	1.3
—	Dolichopodidae	9.2
—	*Eristalis* sp.	2.6
—	*Chrysogaster* group	2.6
—	Scathophagidae	1.3
—	*Hydrellia* sp.	1.3
—	*Tetanocera* sp.	9.2
Local	*Limnophora riparia*	40.8
—	*Bibio* sp.	2.6
	Scatopse sp.	1.3
	Calliphoridae	1.3
—	Chloripidae	1.3
—	*Fannia* sp.	2.6
—	*Lonchoptera* sp.	2.6

TABLE 2. The most widely distributed freshwater macroinvertebrates in London's rivers (taxa occurring in at least 50% of watercourses).

	%		%
Oligochaeta	100.0	*Sphaerium corneum*	60.5
Chironomidae	100.0	*Pisidium casertanum*	60.3
Asellus aquaticus	98.7	*Dendrocoelum lacteum*	59.2
Potamopyrgus antipodarum	94.7	*Baetis rhodani*	59.2
Lymnaea peregra	92.1	*Helobdella stagnalis*	57.9
Gammarus pulex	81.6	Ceratopogonidae	57.9
Glossiphonia complanata	77.6	*Velia* sp.	56.5
Erpobdella octoculata	73.7	*Pisidium nitidum*	53.4
Hydracarina	65.8	*Dugesia polychroa* group	52.6
Pisidium subtruncatum	62.1	*Ancylus fluviatilis*	52.6
Polycelis nigra group	61.8	*Tipula montium* group	50.0
Physa acuta group	60.5		

TABLE 3. Representation of the major aquatic macroinvertebrate groups within the watercourses and sub-catchments of the London area.

	TRICLADIDA	GASTROPODA	BIVALVIA	HIRUDINEA	MALACOSTRACA	EPHEMEROPTERA	PLECOPTERA	ODONATA	HEMIPTERA	COLEOPTERA	TRICHOPTERA	DIPTERA	OTHER GROUPS	TOTAL
River Colne	4	20	8	6	4	6	0	5	11	17	19	13	14	127
River Colne/GUC	1	8	2+	6	3	2	0	2	0	0	2	4	8	38
New Years Green Bourne	6	16	5	7	3	4	0	2	3	4	15	12	7	84
Frays River	3	18	3+	6	4	6	0	4	4	6	18	7	12	91
Wraysbury River	3	14	6	5	3	7	0	2	4	12	16	7	9	88
Bigley Ditch	0	3	0	1	2	1	0	0	1	10	1	11	6	36
COLNE VALLEY WATERCOURSES	**6**	**24**	**11**	**11**	**5**	**9**	**0**	**5**	**11**	**30**	**30**	**26**	**15**	**183**
River Pinn	2	15	7	5	2	2	0	3	3	4	8	6	7	64
Cannon Brook	0	1	2	2	2	0	0	0	1	0	0	5	3	16
Copse Wood Stream	0	3	1+	0	2	0	0	0	2	3	1	4	2	18
Mad Bess Brook	0	2	1	0	2	1	0	0	2	8	1	4	2	23
Northwood Hills Stream	0	3	1+	1	2	0	0	0	0	0	0	3	2	12
RIVER PINN SUB CATCHMENT	**1**	**15**	**7**	**5**	**4**	**3**	**0**	**3**	**6**	**12**	**10**	**11**	**7**	**84**
River Crane	3	19	9	9	4	5	0	2	9	4	11	4	12	91
Duke of Northumberland's River (Lower)	3	10	6	5	2	3	0	2	1	0	5	4	8	49
Duke of Northumberland's River (Upper)	4	19	10	9	4	9	0	3	7	12	19	13	12	121
Frogs Ditch	1	3	2	1	2	0	0	0	2	4	0	1	2	18
Yeading Brook	3	16	5	8	2	1	0	2	2	2	0	3	4	48
Yeading Brook East	1	3	3	3	2	0	0	1	1	2	1	2	3	22
Yeading Brook West	1	4	2+	3	2	1	0	0	1	2	0	2	3	21
RIVER CRANE CATCHMENT	**4**	**22**	**12**	**11**	**5**	**10**	**0**	**3**	**12**	**21**	**20**	**15**	**15**	**150**
LONGFORD RIVER	**0**	**12**	**4**	**6**	**3**	**4**	**0**	**3**	**6**	**2**	**8**	**4**	**7**	**59**
River Brent	4	11	4	7	3	2	0	1	1	4	2	7	7	53
River Brent/GUC	2	13	2+	3	3	1	0	1	1	0	1	1	5	33
Clitterhouse Brook	0	2	1+	1	1	0	0	0	0	1	0	1	2	9
Costons Brook	1	3	2	3	2	1	0	1	2	0	1	2	3	21
Wembley Brook	1	3	0	1	1	0	0	0	0	0	0	1	2	9
Dollis Brook	3	13	4	5	3	2	1	0	1	0	1	3	5	41
Folly Brook	0	4	2+	3	2	1	1	0	1	0	3	2	4	23
Mutton Brook	0	2	1+	1	2	0	0	0	0	0	0	1	3	10
Silk Stream	3	8	2+	5	3	0	0	0	0	1	0	4	6	32
Deans Brook	1	2	3	1	2	0	0	0	4	1	0	6	3	23
Edgeware Brook Tributary	0	3	1	2	2	0	0	0	1	0	2	2	2	15
Edgewarebury Brook	1	4	3	1	3	0	0	0	1	10	1	6	4	34
Edgware Brook	4	9	7	3	2	1	0	0	2	0	2	4	4	38
Watling Ditch	1	5	3	2	3	1	0	0	1	1	0	8	3	28
Wealdstone Brook	1	3	2+	3	1	0	0	0	0	0	0	1	3	14
RIVER BRENT CATCHMENT	**4**	**18**	**7**	**8**	**5**	**3**	**1**	**1**	**8**	**14**	**6**	**19**	**10**	**104**
GRAND UNION CANAL	**3**	**13**	**5+**	**5**	**3**	**3**	**0**	**3**	**7**	**4**	**7**	**5**	**9**	**67**
River Lee (Enfield-Pymmes Brook)	4	17	8	8	4	7	0	4	4	3	15	8	9	91
River Lee (Pymmes Brook-Thames)	4	15	8	6	3	0	0	2	3	4	1	3	8	57
River Lee Flood Relief Channel	3	4	4	3	3	5	0	1	2	1	8	4	5	43
Small River Lee	3	15	5	5	2	1	0	2	2	1	1	5	6	48
Ching Brook	0	4	4	2	2	1	0	0	3	0	0	2	3	21
LEE VALLEY WATERCOURSES	**4**	**22**	**8**	**10**	**4**	**7**	**0**	**4**	**9**	**6**	**17**	**13**	**10**	**114**

	TRICLADIDA	GASTROPODA	BIVALVIA	HIRUDINEA	MALACOSTRACA	EPHEMEROPTERA	PLECOPTERA	ODONATA	HEMIPTERA	COLEOPTERA	TRICHOPTERA	DIPTERA	OTHER GROUPS	TOTAL
Turkey Brook	3	12	5	7	3	6	0	0	5	8	13	8	9	**79**
Cuffley Brook	1	12	8	8	3	1	0	1	4	4	4	10	7	**63**
TURKEY BROOK CATCHMENT	**3**	**13**	**8**	**8**	**3**	**6**	**0**	**1**	**6**	**11**	**15**	**14**	**10**	**98**
Salmon Brook	4	13	5	8	3	3	0	2	7	11	8	10	13	**87**
Hounsden Gutter	1	3	2	2	2	0	0	0	0	1	0	2	5	**18**
Merryhills Brook	0	2	1+	2	2	1	0	0	1	2	2	5	5	**23**
SALMON BROOK CATCHMENT	**4**	**13**	**6**	**8**	**3**	**3**	**0**	**2**	**6**	**11**	**8**	**10**	**13**	**87**
Pymmes Brook	3	7	6	7	2	2	0	1	6	5	3	6	11	**59**
Monken Mead Brook	0	3	2	4	2	2	2	0	2	4	3	10	6	**40**
Green Brook	0	2	1	2	2	1	0	0	4	2	2	3	5	**24**
Friary Park Stream	4	3	3	3	3	1	0	0	3	0	2	8	7	**37**
Moselle River	1	2	3	2	1	0	0	0	0	0	0	1	7	**17**
PYMMES BROOK CATCHMENT	**4**	**9**	**7**	**7**	**3**	**3**	**2**	**1**	**6**	**7**	**5**	**15**	**13**	**82**
River Ingrebourne	5	10	7	8	3	2	0	4	7	12	6	13	12	**89**
Weald Brook	2	5	7	3	3	2	1	1	4	9	6	16	7	**66**
Berwick Pond Stream	3	11	5	6	3	1	0	1	9	8	4	10	11	**72**
INGREBOURNE CATCHMENT	**5**	**16**	**8**	**8**	**4**	**3**	**1**	**4**	**12**	**20**	**10**	**25**	**14**	**130**
River Rom/Beam	4	12	6	7	3	1	0	2	5	6	1	14	5	**66**
Wantz Stream	1	9	5	5	2	0	0	4	4	5	0	3	8	**46**
ROM/BEAM CATCHMENT	**4**	**14**	**7**	**8**	**3**	**1**	**0**	**5**	**7**	**8**	**1**	**15**	**8**	**81**
River Roding	4	15	8	8	3	2	0	3	3	9	9	7	9	**80**
Seven Kings Water	1	4	2	3	2	2	0	1	2	1	1	3	5	**27**
RODING CATCHMENT	**4**	**16**	**8**	**9**	**3**	**2**	**0**	**3**	**4**	**8**	**8**	**7**	**9**	**81**
River Ravensbourne	6	11	1	5	3	1	1	0	4	9	7	20	10	**78**
River Ravensbourne - Downham Branch	4	6	2	3	2	1	0	0	1	0	1	6	6	**32**
River Beck	4	9	4	5	2	0	0	0	1	1	2	4	7	**39**
River Pool	3	12	5	7	2	2	0	0	2	1	2	8	6	**50**
Kyd Brook	2	1	1+	3	3	2	1	0	0	0	2	7	4	**26**
River Quaggy	4	6	2	4	2	1	0	0	4	2	1	9	8	**43**
RAVENSBOURNE CATCHMENT	**7**	**14**	**5**	**8**	**3**	**3**	**2**	**0**	**6**	**13**	**10**	**23**	**12**	**106**
River Wandle	6	16	3	6	2	2	0	1	2	6	5	7	8	**64**
River Wandle - Beddington Arm	5	7	1+	4	3	1	0	1	2	3	1	7	9	**44**
River Wandle - Carshalton Arm	3	11	1+	7	2	2	0	0	2	4	7	7	8	**54**
Agfa Ditch	0	2	1	0	1	1	0	0	0	1	1	3	3	**13**
WANDLE CATCHMENT	**6**	**19**	**4**	**8**	**3**	**2**	**0**	**1**	**4**	**7**	**9**	**11**	**11**	**85**
Beverley Brook	4	6	6	6	2	1	0	2	1	3	1	6	8	**46**
Pyl Brook	3	4	2	4	2	0	0	0	1	0	0	6	7	**29**
Coombe Brook	0	4	2	2	1	0	0	0	1	0	0	3	2	**15**
Cannizaro Park Stream	1	0	0	2	2	1	0	0	0	0	3	3	4	**16**
Keswich Avenue Ditch	2	3	0	3	4	1	0	0	1	1	2	5	7	**29**
Pen Ponds Overflow Stream	1	3	2	1	3	2	1	2	1	4	3	7	8	**38**
BEVERLEY BROOK CATCHMENT	**4**	**6**	**6**	**6**	**4**	**3**	**1**	**3**	**3**	**6**	**5**	**11**	**11**	**69**
Hogsmill River	4	17	5	6	3	3	0	3	9	16	4	7	11	**88**
Bonesgate Stream	2	8	2+	4	3	2	0	0	5	8	4	7	7	**52**
Surbiton Stream	3	3	1+	3	2	1	0	0	5	2	2	4	5	**31**
HOGSMILL CATCHMENT	**4**	**17**	**5**	**6**	**3**	**3**	**0**	**3**	**9**	**20**	**6**	**10**	**11**	**97**

APPENDIX A

Macroinvertebrate occurrences in the Grand Union Canal, Lower Colne watercourses and River Crane catchment.

	Grand Union Canal	River Pinn	Northwood Hills Stream	Cannon Brook	Copse Wood Stream	Mad Bess Brook	Bigley Ditch	River Colne	River Colne/GUC	New Years Green Bourne	Frays River	Wraysbury River	Longford River	Yeading Brook East	Yeading Brook West	Yeading Brook	Crane	Duke of Northumberland's River (Upper)	Duke of Northumberland's River (Lower)	Frogs Ditch
Spongillidae								×		×	×						×		×	
Planaria torva										?										
Polycelis nigra group	×							×		×	×	×		×		×	×	×	×	
Polycelis felina (Dalyell)										?										
Dugesia tigrina (Girard)	×							×	×	×								×		
Dugesia polychroa group		×						×		×	×	×			×	×	×	×	×	×
Dendrocoelum lacteum (Muller)	×	×						×		×	×	×				×	×	×	×	
Nematoda		×						×			×						×	×	×	
Viviparus viviparus (L.)	×												×					×		
Theodoxus fluviatilis (L.)	×							×			×	×					×	×		
Valvata piscinalis (Muller)	×	×						×		×	×	×	×			×	×	×	×	
Valvata cristata Muller		×						×		×										
Potamopyrgus antipodarum (Gray)	×	×	×	×	×	×		×	×	×	×	×	×	×	×	×	×	×	×	×
Bithynia tentaculata (L.)	×	×						×	×	×	×	×	×			×	×	×	×	
Bithynia leachii (Sheppard)								×		×	×	×					×			
Lymnaea truncatula (Muller)							×													
Lymnaea palustris (Muller)							×	×		×	×						×			
Lymnaea stagnalis (L.)	×	×						×			×	×				×	×	×	×	
Lymnaea auricularia (L.)	×							×	×	×	×		×					×		
Lymnaea peregra (Muller)	×	×	×		×	×		×	×	×	×	×	×	×	×	×	×	×	×	×
Physa fontinalis (L.)								×			×	×	×			×	×	×	×	
Physa acuta group	×	×	×		×			×	×	×		×	×	×	×	×	×	×		×
Planorbis carinatus Muller								×		×	×	×				×	×	×	×	
Planorbis planorbis (L.)		×								×		×				×	×			
Bathyomphalus contortus (L.)		×						×					×			×	×	×		
Anisus vortex (L.)		×						×	×	×	×	×	×			×	×	×		
Gyraulus albus (Muller)	×	×						×	×	×	×	×				×	×	×	×	
Gyraulus (=Armiger) crista (L.)		×						×		×	×						×	×	×	
Hippeutis complanatus (L.)										×										
Planorbarius corneus (L.)	×	×						×			×					×	×	×		
Ancylus fluviatilis Muller	×	×						×			×	×	×		×	×	×	×	×	
Acroloxus lacustris (L.)	×	×						×	×	×	×		×			×	×	×		
Succineidae																×		×		
Zonitidae							×				×									
Unionidae																	×			
Unio pictorum (L.)	×																			
Anodonta sp.												×								
Anodonta cygnaea (L.)	×							×										×		
Anodonta anatina (L.)	×										×	×						×	×	
Sphaerium corneum (L.)	×	×						×	×	×	×	×	×	×	×	×	×	×	×	
Sphaerium lacustre (Muller)										×							×	×		
Pisidium sp.	×		×		×				×		×				×					
Pisidium casertanum (Poli)		×						×						×		×	×		×	×
Pisidium henslowanum (Sheppard)		×						×		×		×					×	×	×	
Pisidium hibernicum Westerlund								×									×	×		
Pisidium milium Held		×						×								×	×	×		
Pisidium nitidum Jenyns		×		×				×				×	×			×	×	×	×	

	Grand Union Canal	River Pinn	Northwood Hills Stream	Cannon Brook	Copse Wood Stream	Mad Bess Brook	Bigley Ditch	River Colne	River Colne/GUC	New Years Green Bourne	Frays River	Wraysbury River	Longford River	Yeading Brook East	Yeading Brook West	Yeading Brook	Crane	Duke of Northumberland's River (Upper)	Duke of Northumberland's River (Lower)	Frogs Ditch
Pisidium personatum Malm		×				×							×	×						×
Pisidium subtruncatum Malm		×		×				×		×		×				×	×	×	×	
Pisidium supinum Schmidt													×					×		
Dreissena polymorpha (Pallas)										×			×							
Piscicola geometra (L.)	×							×	×	×	×	×	×			×	×	×		
Theromyzon tessulatum (Muller)	×	×					×	×	×	×	×		×			×	×	×	×	
Hemiclepsis marginata (Muller)										×			×				×	×		
Glossiphonia complanata (L.)	×	×		×				×	×	×	×	×	×	×	×	×	×	×	×	
Glossiphonia heteroclita (L.)									×			×	×			×	×	×	×	
Helobdella stagnalis (L.)	×	×						×	×	×	×			×		×	×	×		
Haemopis sanguisuga (L.)										×					×	×		×	×	
Erpobdella testacea (Savigny)												×						×		
Erpobdella octoculata (L.)	×	×	×	×				×	×	×	×	×	×	×	×	×	×	×	×	
Trocheta sp.		×																		
Trocheta bykowskii Gedroyc								×									×			
Trocheta subviridis Dutrochet											×					×	×			×
Oligochaeta	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Naididae	×							×	×		×	×	×	×			×	×	×	
Lumbricidae		×		×			×	×			×	×				×	×	×		
Lumbriculidae	×	×						×	×		×	×	×			×	×	×	×	
Hydracarina	×	×						×	×	×	×	×	×		×		×	×	×	
Cladocera	×						×	×	×		×		×				×	×		
Copepoda							×	×	×			×								
Ostracoda	×							×		×	×	×	×				×	×		
Chinese mitten crab																	×			
Argulus foliaceus (L.)	×							×									×	×		
Asellus aquaticus (L.)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Asellus meridianus Racovitza						×					×							×		
Corophium curvispinum Sars	×							×	×											
Crangonyx pseudogracilis Bousfield	×				×		×	×	×	×	×	×	×				×	×		
Gammarus pulex (L.)		×	×	×				×		×	×	×	×	×	×	×	×	×	×	×
Gammarus zaddachi Sexton																	×			
Collembola							×				×									
Baetis fuscatus (L.)												?								
Baetis rhodani (Pictet)		×						×			×	×					×	×	×	
Baetis scambus Eaton								×			×	×					×			
Baetis vernus Curtis								×	×	×	×	×					×	×	×	
Centroptilum luteolum (Muller)													×					×		
Cloeon dipterum (L.)	×					×	×	×	×	×							×	×		
Cloeon simile Eaton																		×		
Ephemera danica Muller											×	×	×					×		
Ephemerella ignita (Poda)								×			×	×	×					×		
Caenis luctuosa (Burmeister)	×	×						×		×	×	×	×		×	×	×	×	×	
Caenis robusta Eaton	?																			
Caenis horaria (L.)										×								×		
Calopteryx splendens (Harris)	×	×						×	×	×	×	×	×			×	×	×	×	
Coenagrion puella (L.)	×							×			×							×		
Erythromma najas (Hansemann)								×												
Enallagma cyathigerum (Charpentier)													×							
Ischnura elegans (Van der Linden)	×	×						×	×	×	×	×	×	×		×	×	×	×	
Aeshna sp.								×			×									
Sympetrum sp.		×																		

	Grand Union Canal	River Pinn	Northwood Hills Stream	Cannon Brook	Copse Wood Stream	Mad Bess Brook	Bigley Diteh	River Colne	River Colne/GUC	New Years Green Bourne	Frays River	Wraysbury River	Longford River	Yeading Brook East	Yeading Brook West	Yeading Brook	Crane	Duke of Northumberland's River (Upper)	Duke of Northumberland's River (Lower)	Frogs Diteh
Hydrometra stagnorum (L.)		×						×				×					×			
Velia sp.	×	×			×	×		×			×				×	×	×	×	×	
Velia caprai Tamanini																			×	
Microvelia sp.	×																			
Gerris sp.	×				×							×	×				×			×
Gerris (Gerris) lacustris (L.)								×			×			×				×		
Nepa cinerea L.								×		×	×						×	×		
Ilyocoris cimicoides (L.)	×																			
Aphelocheirus aestivalis (Fab.)								×			×									
Notonecta sp.	×					×														
Notonecta glauca L.							×	×									×			
Plea minutissima Leach																		×		
Micronecta sp.	×							×					×				×			
Cymatia coleoptrata (Fab.)								×												
Corixidae (Corixinae)													×				×	×		
Hesperocorixa linnaei (Fieber)																	×			
Hesperocorixa sahlbergi (Fieber)													×			×				×
Sigara (Sigara) dorsalis (Leach)	×	×						×		×		×	×				×	×		
Sigara (Subsigara) falleni (Fieber)				×				×		×		×	×					×		
Sigara (Subsigara) fossarum (Leach)								×												
Sialis lutaria (L.)	×	×						×	×	×	×	×					×	×		
Sisyra sp.								×		×									×	
Gyrinidae																		×		
Orectochilus villosus (Muller)								×			×	×								
Gyrinus sp.																				×
Haliplus sp.															×					
Haliplus (Neohaliplus) lineatocollis (Marsham)						×		×									×			×
Haliplus (Liaphlus) flavicollis Sturm								×				×								
Haliplus (Haliplus) laminatus (Schaller)		×						×									×			
Haliplus (Haliplus) ruficollis group	×							×										×		
Haliplus (Haliplus) ruficollis (De Geer)																	×			
Haliplus (Haliplus) immaculatus Gerhardt	×							×												
Haliplus (Haliplus) fluviatilis Aube								×				×				×				
Hygrobia hermanni (Fab.)								×												
Noterus clavicornis (De Geer)																		×		
Laccophilus sp. (larvae)										×										
Laccophilus hyalinus (Degeer)												×						×		
Hyphydrus ovatus (L.)								×										×		
Hydroporinae						×							×							
Hydroporus discretus Fairmaire						×														
Hydroporus palustris (L.)							×													
Hydroporus planus (Fab.)							×													
Graptodytes pictus (Fab.)										×										
Nebrioporus elegans (Panzer)		×						×			×	×			×	×		×		
Stictotarsus duodecimpustulatus (Fab.)		×						×												
Dytiscidae	×									×										
Colymbetinae											×									
Agabus sp.								×												
Agabus bipustulatus (L.)						×	×													×
Agabus didymus (Olivier)														×						
Agabus guttatus (Paykull)					×															
Colymbetes fuscus (L.)								×												

	Grand Union Canal	River Pinn	Northwood Hills Stream	Cannon Brook	Copse Wood Stream	Mad Bess Brook	Bigley Ditch	River Colne	River Colne/GUC	New Years Green Bourne	Frays River	Wraysbury River	Longford River	Yeading Brook East	Yeading Brook West	Yeading Brook	Crane	Duke of Northumberland's River (Upper)	Duke of Northumberland's River (Lower)	Frogs Ditch
Rhantus suturalis (Macleay)							×													
Helophorus (Meghelophorus) aequalis Thomson						×												×		
Helophorus (Meghelophorus) grandis Illiger						×	×													
Helophorus (Atrachelophorus) brevipalpis Bedel	×					×						×								
Helophorus (Helophorus) obscurus Mulsant							×													
Helophorus (Helophorus) minutus Fab.												×								
Anacaena globulus (Paykull)					×	×	×													
Anacaena limbata (Fab.)							×	×												
Laccobius sp.												×								
Helochares lividus (Forster)																		×		
Cercyon (Dicyrocercyon) ustulatus (Preyssler)																		×		
Hydraena nigrita Germar					×															
Microcara testacea (L.)							×													
Cyphon sp. (larvae)							×													
Scirtes sp.																		×		
Elmis aenea (Muller)		×						×			×	×		×			×	×		
Limnius volckmari (Panzer)								×			×	×								
Oulimnius sp.								×					×					×		
Oulimnius major (Rey)												×								
Oulimnius tuberculatus (Muller)										×	×	×								
Phaedon sp.																				×
Pyralidae																		×		
Rhyacophila dorsalis (Curtis)								×		×	×	×								
Agraylea multipunctata Curtis	×																×	×		
Hydroptila sp.								×	×		×	×	×				×	×	×	
Lype sp.											×	×					×	×		
Tinodes waeneri (L.)	×	×						×			×	×					×	×	×	
Ecnomus tenellus (Rambur)	×																			
Cyrnus flavidus McLachlan										×										
Cyrnus trimaculatus (Curtis)	×										×						×	×		
Polycentropus flavomaculatus (Pictet)								×		×	×	×	×					×		
Neureclipsis bimaculata (L.)								×		×	×									
Plectrocnemia conspersa (Curtis)					×															
Hydropsyche sp.										×										
Hydropsyche angustipennis (Curtis)		×						×			×	×	×				×	×	×	
Hydropsyche contubernalis McLachlan								×				×						×		
Hydropsyche pellucidula (Curtis)								×			×	×					×	×	×	
Hydropsyche siltalai Dohler		×						×			×	×								
Phryganea grandis L.	×																	×		
Limnephilidae												×		×						
Halesus sp.											×									
Halesus radiatus (Curtis)								×		×										
Micropterna lateralis (Stephens)		×																		
Potamophylax group										×										
Chaetopteryx villosa (Fab.)								×												
Glyphotaelius pellucidus (Retzius)		×					×											×		
Limnephilus flavicornis (Fab.)																		×		
Limnephilus lunatus Curtis								×		×	×		×					×		
Limnephilus rhombicus (L.)								×			×							×		
Limnephilus sparsus Curtis						×														
Goera pilosa (Fab.)												×								
Molanna angustata Curtis	×							×	×	×	×	×	×					×		

	Grand Union Canal	River Pinn	Northwood Hills Stream	Cannon Brook	Copse Wood Stream	Mad Bess Brook	Bigley Ditch	River Colne	River Colne/GUC	New Years Green Bourne	Frays River	Wraysbury River	Longford River	Yeading Brook East	Yeading Brook West	Yeading Brook	Crane	Duke of Northumberland's River (Upper)	Duke of Northumberland's River (Lower)	Frogs Ditch
Athripsodes albifrons (L.)								×												
Athripsodes aterrimus (Stephens)										×		×	×					×		
Athripsodes cinereus (Curtis)		×						×		×	×						×	×	×	
Ceraclea sp.										×										
Ceraclea dissimilis (Stephens)								×			×									
Ceraclea fulva (Rambur)												×					×			
Ceraclea nigroniversa (Retzius)								×												
Ceraclea senilis (Burmeister)										×										
Mystacides azurea (L.)	×	×						×		×	×	×	×				×	×		
Mystacides longicornis (L.)		×								×	×		×				×	×		
Mystacides nigra (L.)												×								
Tipulidae	×																			
Tipula (Yamatotipula) montium group		×		×						×				×		×	×	×		
Dicranota sp.										×										
Ormosia/Helius sp.							×	×										×		
Psychodidae				×																
Pericoma trivialis group					×	×	×	×			×							×		
Psychoda sp.												×						×		
Chaoborus (Chaoborus) flavicans (Meigen)										×										
Culicidae	×	×																		
Anopheles (Anopheles) sp.							×											×		
Anopheles (Anopheles) claviger (Meigen)						×														
Aedes (Ochlerotatus) rusticus (Rossi)							×													
Culex sp.			×																	
Culiseta (Culicella) litorea/morsitans							×													
Culiseta (Culiseta) annulata group						×	×													
Dixella sp.																		×		
Dixella autumnalis (Meigen)													×							
Simulium sp.													×							
Simulium (Nevermannia) angustitarse group								×	×											
Simulium (Eusimulium) aureum group										×										
Simulium (Wilhelmia) sp.									×											
Simulium (Wilhelmia) equinum (L.)								×		×	×	×								
Simulium (Boophthora) erythrocephalum (De Geer)								×	×	×	×	×								
Simulium (Simulium) ornatum group		×		×				×		×	×							×		
Simulium (Simulium) noelleri Friederichs										×										
Chironomidae	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Ceratopogonidae	×	×		×	×		×	×		×	×	×	×				×	×	×	
Pychoptera sp.																		×		
Chloromyia formosa (Scopoli)								×											×	
Oxycera sp.							×													
Clinocera sp.	×							×				×								
Hemerodromia sp.								×										×		
Dolichopodidae										×							×			
Syrphidae					×															
Eristalis sp.			×																	
Tetanocera sp.								×												
Limnophora riparia (Fallen)		×						×		×	×	×			×	×		×	×	
Bibio sp.							×													
Lonchoptera sp.							×											×		

APPENDIX B

Macroinvertebrate occurrences in the River Brent catchment.

	River Brent	River Brent/GUC	Wembley Brook	Wealdstone Brook	Folly Brook	Edgware Brook	Edgeware Brook Tributary	Watling Ditch	Edgewarebury Brook	Costons Brook	Clitterhouse Brook	Mutton Brook	Dollis Brook	Deans Brook	Silk Stream
Polycelis nigra group	×			×		×			×	×			×	×	×
Dugesia tigrina (Girard)	×					×									
Dugesia polychroa group	×	×				×		×					×		×
Dendrocoelum lacteum (Muller)	×	×	×			×							×		×
Valvata piscinalis (Muller)	×	×											×		
Valvata cristata Muller		×													
Potamopyrgus antipodarum (Gray)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Bithynia tentaculata (L.)	×	×				×							×		
Lymnaea palustris (Muller)							×	×	×						
Lymnaea peregra (Muller)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Physa fontinalis (L.)		×						×					×		
Physa acuta group	×	×	×	×		×		×	×	×			×		×
Planorbis carinatus Muller		×													
Bathyomphalus contortus (L.)	×				×	×							×		×
Anisus vortex (L.)	×	×				×							×		×
Gyraulus albus (Muller)	×	×				×									×
Gyraulus (=Armiger) crista (L.)													×		
Hippeutis complanatus (L.)		×				×							×		
Planorbarius corneus (L.)		×											×		
Ancylus fluviatilis Muller	×												×		×
Acroloxus lacustris (L.)	×	×			×	×							×		×
Zonitidae	×														
Sphaerium corneum (L.)	×	×		×	×	×				×			×	×	×
Sphaerium lacustre (Muller)						×			×						
Pisidium sp.		×		×	×						×	×			×
Pisidium casertanum (Poli)	×					×		×		×			×		
Pisidium milium Held	×					×							×		
Pisidium nitidum Jenyns						×							×	×	
Pisidium personatum Malm						×	×	×	×						
Pisidium subtruncatum Malm	×					×		×	×					×	
Hemiclepsis marginata (Muller)		×											×		
Glossiphonia complanata (L.)	×	×		×	×	×	×						×		×
Glossiphonia heteroclita (L.)	×														
Helobdella stagnalis (L.)	×			×	×	×		×		×			×	×	×
Haemopis sanguisuga (L.)	×									×					×
Erpobdella octoculata (L.)	×	×	×	×	×	×					×		×		×
Trocheta sp.															×
Trocheta bykowskii Gedroyc	×									×					
Trocheta subviridis Dutrochet	×						×	×	×			×	×		
Oligochaeta	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Naididae					×					×			×	×	×
Lumbricidae	×					×		×				×			×
Lumbriculidae	×												×		×
Hydracarina	×	×			×								×		×
Cladocera	×	×				×									
Ostracoda	×	×													
Pacifastacus leniusculus Dana	×														
Asellus aquaticus (L.)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Corophium curvispinum Sars		×													
Crangonyx pseudogracilis Bousfield								×	×			×	×		×
Gammarus pulex (L.)	×	×			×	×	×	×	×	×			×	×	×
Collembola				×					×						
Baetis rhodani (Pictet)	×				×	×		×		×			×		
Cloeon dipterum (L.)	×	×													

	River Brent	River Brent/GUC	Wembley Brook	Wealdstone Brook	Folly Brook	Edgware Brook	Edgeware Brook Tributary	Watling Ditch	Edgewarebury Brook	Costons Brook	Clitterhouse Brook	Mutton Brook	Dollis Brook	Deans Brook	Silk Stream
Habrophlebia fusca (Curtis)													×		
Nemoura cinerea (Retzius)					×								×		
Ischnura elegans (Van der Linden)	×	×								×					
Hydrometra stagnorum (L.)						×									
Velia sp.					×				×	×			×	×	
Velia caprai Tamanini							×								
Gerris (Gerris) lacustris (L.)														×	
Nepa cinerea L.						×								×	
Notonecta glauca L.								×						×	
Sigara (Sigara) dorsalis (Leach)	×														
Sigara (Subsigara) distincta (Fieber)		×													
Sigara (Pseudovermicorixa) nigrolineata (Fieber)										×					
Haliplus sp.	×														
Haliplus (Neohaliplus) lineatocollis (Marsham)									×						
Hydroporus planus (Fab.)														×	
Dytiscidae															×
Agabus bipustulatus (L.)									×						
Agabus didymus (Olivier)									×						
Agabus paludosus (Fab.)									×						
Agabus sturmii (Gyllenhal)								×	×						
Ilybius fuliginosus (Fab.)									×						
Helophorus (Atrachelophorus) brevipalpis Bedel	×										×				
Helophorus (Helophorus) obscurus Mulsant									×						
Anacaena globulus (Paykull)									×						
Anacaena limbata (Fab.)									×						
Elmis aenea (Muller)	×														
Phaedon sp.	×														
Curculionidae									×						
Nymphula nymphaeata (L.)									×						
Hydroptila sp.	×														
Hydropsyche angustipennis (Curtis)	×				×	×				×					
Phryganea grandis L.		×													
Micropterna lateralis (Stephens)							×								
Limnephilus centralis Curtis					×										
Limnephilus lunatus Curtis					×	×	×		×				×		
Tipula (Tipula) oleracea L.															×
Tipula (Yamatotipula) montium group	×					×		×						×	×
Pericoma sp.							×								
Psychoda cinerea Banks	×												×		
Psychoda severini Tonnoir	×														
Culex sp.	×							×							
Culiseta (Culiseta) annulata group								×							
Dixa submaculata Edwards									×						
Simulium sp.	×													×	
Simulium (Simulium) ornatum group						×		×					×		
Chironomidae	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Ceratopogonidae					×				×					×	×
Sargus bipunctatus (Scopoli)									×						
Chloromyia formosa (Scopoli)								×	×						
Beris vallata (Forster)								×							
Oxycera morrisii Curtis														×	
Stratiomys sp.									×						
Dolichopodidae										×					
Tetanocera sp.								×							
Limnophora riparia (Fallen)	×					×								×	

APPENDIX C

Macroinvertebrate occurrences in the Lee, Roding, Ingrebourne and Rom/Beam river catchments.

	River Lee (Enfield-Pymmes Brook)	River Lee (Pymmes Brook-Thames)	River Lee Flood Relief Channel	Small River Lee	Ching Brook	Turkey Brook	Cuffley Brook	Salmon Brook	Hounsden Gutter	Merryhills Brook	Pymmes Brook	Green Brook	Monken Mead Brook	Moselle River	Friary Park Stream	Ingrebourne	Berwick Pond Stream	Weald Brook	Rom/Beam	Wantz Stream	River Roding	Seven Kings Water
Spongillidae								×								×					×	
Hydra sp.											×					×						
Microturbellaria																				×		
Polycelis nigra group	×	×	×	×		×		×						×	×	×	×	×	×		×	×
Polycelis felina (Dalyell)																×						
Dugesia tigrina (Girard)	×	×	×					×	×		×				×	×			×		×	
Dugesia polychroa group	×	×		×		×		×			×				×	×	×		×		×	
Dendrocoelum lacteum (Muller)	×	×	×	×		×	×	×			×				×	×	×	×	×	×	×	
Nematoda	×						×	×	×							×	×	×				
Chordodidae						×									×							
Viviparus viviparus (L.)	×																					
Theodoxus fluviatilis (L.)	×		×	×																		
Valvata piscinalis (Muller)	×	×	×	×																	×	
Valvata cristata Muller	×	×					×										×		×		×	
Potamopyrgus antipodarum (Gray)	×	×		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Bithynia tentaculata (L.)	×	×		×	×	×	×	×			×						×		×	×	×	
Bithynia leachii (Sheppard)	×																					
Lymnaea truncatula (Muller)																×			×			
Lymnaea palustris (Muller)				×		×												×				
Lymnaea stagnalis (L.)	×	×		×												×	×		×	×	×	
Lymnaea auricularia (L.)	×	×																				
Lymnaea peregra (Muller)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
Physa fontinalis (L.)	×	×		×				×					×								×	
Physa acuta group	×	×		×				×	×		×					×	×		×	×		
Planorbis carinatus Muller				×																	×	
Planorbis planorbis (L.)		×						×							×		×				×	×
Bathyomphalus contortus (L.)	×					×	×									×		×	×	×	×	
Anisus vortex (L.)	×	×		×		×	×	×			×						×		×	×	×	×
Gyraulus albus (Muller)	×	×		×		×	×	×								×			×		×	
Gyraulus (=Armiger) crista (L.)			×			×	×									×				×		
Hippeutis complanatus (L.)						×	×	×														
Planorbarius corneus (L.)		×		×		×	×	×									×			×	×	
Ancylus fluviatilis Muller	×	×		×	×	×	×	×			×					×	×	×	×		×	×
Acroloxus lacustris (L.)	×	×		×		×	×	×			×					×	×					
Succineidae								×											×		×	
Anodonta sp.	×																					
Anodonta anatina (L.)							×				×											
Sphaerium corneum (L.)	×	×	×	×	×	×	×	×			×				×	×	×	×	×	×	×	×
Sphaerium lacustre (Muller)	×	×					×									×	×	×	×		×	
Pisidium sp.										×												
Pisidium amnicum (Muller)																					×	
Pisidium casertanum (Poli)		×				×	×	×	×		×	×	×	×	×	×		×		×	×	
Pisidium henslowanum (Sheppard)	×	×					×				×					×						
Pisidium hibernicum Westerlund	×	×		×																		
Pisidium milium Held	×	×	×	×	×	×	×	×								×	×	×	×	×	×	
Pisidium nitidum Jenyns	×	×	×	×	×	×	×	×			×					×	×	×	×	×	×	

	River Lee (Enfield-Pymmes Brook)	River Lee (Pymmes Brook-Thames)	River Lee Flood Relief Channel	Small River Lee	Ching Brook	Turkey Brook	Cuffley Brook	Salmon Brook	Hounsden Gutter	Merryhills Brook	Pymmes Brook	Green Brook	Monken Mead Brook	Moselle River	Friary Park Stream	Ingrebourne	Berwick Pond Stream	Weald Brook	Rom/Beam	Wantz Stream	River Roding	Seven Kings Water
Pisidium personatum Malm									×				×	×	×			×	×		×	
Pisidium subtruncatum Malm	×	×	×	×	×	×	×	×			×			×		×	×	×	×	×	×	×
Piscicola geometra (L.)	×	×	×	×			×	×			×					×	×				×	
Theromyzon tessulatum (Muller)	×							×								×	×		×		×	
Hemiclepsis marginata (Muller)	×					×	×												×		×	
Glossiphonia complanata (L.)	×	×	×	×	×	×	×	×		×	×	×	×	×		×	×	×	×	×	×	×
Glossiphonia heteroclita (L.)	×	×		×		×	×												×			
Helobdella stagnalis (L.)	×	×				×	×	×	×		×					×	×		×	×	×	×
Haemopis sanguisuga (L.)				×		×	×	×			×		×		×	×				×	×	
Erpobdella octoculata (L.)	×	×	×	×	×	×	×	×	×	×	×		×	×	×	×	×	×	×	×	×	×
Trocheta bykowskii Gedroyc	×							×			×					×					×	
Trocheta subviridis Dutrochet		×				×	×	×			×	×	×		×	×	×	×	×	×		
Oligochaeta	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Naididae		×				×	×	×	×	×	×	×	×	×	×	×	×	×		×	×	×
Lumbricidae	×	×		×		×		×	×	×	×			×		×	×	×	×	×	×	×
Lumbriculidae	×	×	×			×		×			×			×	×	×			×	×	×	
Hydracarina	×	×	×	×	×	×	×	×		×	×		×		×	×	×	×	×	×	×	×
Cladocera	×	×		×				×			×			×			×					
Copepoda								×			×			×		×	×			×		
Ostracoda	×		×			×	×	×			×	×	×		×	×	×				×	
Asellus aquaticus (L.)	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Asellus meridianus Racovitza															×			×				
Corophium curvispinum Sars	×		×																			
Crangonyx pseudogracilis Bousfield	×	×				×	×	×	×							×	×		×			
Gammarus pulex (L.)	×	×	×	×	×	×	×	×		×	×	×	×		×	×	×	×	×	×	×	×
Gammarus zaddachi Sexton																					×	
Collembola								×				×										
Baetidae																	×					
Baetis rhodani (Pictet)	×		×	×	×	×	×	×		×	×	×	×		×	×		×	×		×	×
Baetis scambus Eaton	×		×			×																
Baetis vernus Curtis	×		×			×																
Centroptilum luteolum (Muller)						×																
Centroptilum pennulatum Eaton	×																					
Cloeon dipterum (L.)						×		×								×						
Habrophlebia fusca (Curtis)													×					×				
Ephemera danica Muller	×		×																			
Caenis luctuosa (Burmeister)	×		×			×		×			×										×	×
Caenis horaria (L.)	×																					
Leuctra fusca (L.)													×									
Nemoura cinerea (Retzius)													×					×				
Calopteryx splendens (Harris)	×			×			×									×		×	×		×	×
Coenagrion puella (L.)	×	×														×	×					
Enallagma cyathigerum (Charpentier)	×																			×		
Ischnura elegans (Van der Linden)	×	×	×	×				×			×					×			×	×	×	
Aeshna sp.																				×		
Aeshna cyanea (Muller)								×								×						
Aeshna mixta Latreille																					×	
Sympetrum striolatum(Charpentier)																				×		
Hydrometra stagnorum (L.)						×		×			×				×			×	×			
Velia sp.				×		×	×			×	×	×			×	×	×	×				×

	River Lee (Enfield-Pymmes Brook)	River Lee (Pymmes Brook-Thames)	River Lee Flood Relief Channel	Small River Lee	Ching Brook	Turkey Brook	Cuffley Brook	Salmon Brook	Hounsden Gutter	Merryhills Brook	Pymmes Brook	Green Brook	Monken Mead Brook	Moselle River	Friary Park Stream	Ingrebourne	Berwick Pond Stream	Weald Brook	Rom/Beam	Wantz Stream	River Roding	Seven Kings Water
Velia caprai Tamanini					×			×					×						×			
Gerris sp.		×					×															
Gerris (Aquarius) najas (De Geer)						×																
Gerris (Gerris) lacustris (L.)								×			×	×	×							×		
Nepa cinerea L.								×			×	×			×		×		×	×	×	
Ranatra linearis (L.)																	×					
Ilyocoris cimicoides (L.)		×															×					
Aphelocheirus aestivalis (Fab.)	×		×																			
Notonecta glauca L.								×			×					×	×			×		
Plea minutissima Leach																			×			
Micronecta sp.	×																×					
Cymatia coleoptrata (Fab.)					×																	
Corixidae (Corixinae)			×									×							×	×		
Corixa punctata (Illiger)					×												×					
Hesperocorixa linnaei (Fieber)							×															
Hesperocorixa sahlbergi (Fieber)						×										×	×					
Sigara (Sigara) dorsalis (Leach)	×	×		×		×	×	×								×		×			×	×
Sigara (Subsigara) distincta (Fieber)																×		×			×	
Sigara (Subsigara) falleni (Fieber)	×																					
Sigara (Vermicorixa) lateralis (Leach)											×					×						
Sialis lutaria (L.)	×	×		×		×	×	×			×		×			×	×	×			×	
Gyrinidae											×											
Gyrinus sp.																					×	
Gyrinus substriatus Stephens								×								×						
Haliplus sp.		×		×		×							×							×	×	
Haliplus (Neohaliplus) lineatocollis (Marsham)							×	×														
Haliplus (Haliplus) laminatus (Schaller)							×												×		×	
Haliplus (Haliplus) ruficollis group																					×	
Haliplus (Haliplus) immaculatus Gerhardt																×		×				
Haliplus (Haliplus) fluviatilis Aube																					×	
Haliplus (Haliplus) wehnckei Gerhardt	×															×			×		×	
Hygrobia hermanni (Fab)																					×	
Noterus clavicornis (De Geer)																×	×					
Hyphydrus ovatus (L.)		×																				
Hygrotus inaequalis (Fab.)		×																				
Nebrioporus elegans (Panzer)		×	×			×		×			×					×		×		×	×	×
Dytiscidae									×			×	×									
Platambus maculatus (L.)						×										×		×				
Agabus bipustulatus (L.)																	×	×				
Agabus didymus (Olivier)						×		×												×		
Agabus guttatus (Paykull)																		×				
Agabus nebulosus (Forster)																	×					
Agabus paludosus (Fab.)								×														
Ilybius ater (De Geer)																	×					
Ilybius fuliginosus (Fab.)							×	×								×		×	×			
Colymbetes fuscus (L.)							×															
Helophorus sp.																				×		
Helophorus (Atrachelophorus) brevipalpis Bedel								×			×					×		×				

	River Lee (Enfield-Pymmes Brook)	River Lee (Pymmes Brook-Thames)	River Lee Flood Relief Channel	Small River Lee	Ching Brook	Turkey Brook	Cuffley Brook	Salmon Brook	Hounsden Gutter	Merryhills Brook	Pymmes Brook	Green Brook	Monken Mead Brook	Moselle River	Friary Park Stream	Ingrebourne	Berwick Pond Stream	Weald Brook	Rom/Beam	Wantz Stream	River Roding	Seven Kings Water
Hydrophilidae												×	×									
Anacaena globulus (Paykull)								×	×													
Anacaena limbata (Fab.)																×						
Laccobius (Macrolaccobius) striatulus (Fab.)						×																
Helochares lividus (Forster)						×											×					
Hydrobius fuscipes L.																×	×		×	×		
Ochthebius minimus (Fab.)																×						
Elodes sp.								×					×					×				
Scirtes sp.																	×					
Dryops sp.																×						
Elmis aenea (Muller)	×					×		×		×								×				
Oulimnius sp.	×					×																
Oulimnius tuberculatus (Muller)																					×	
Phaedon sp.																			×			
Curculionidae								×			×											
Cataclysta lemnata (L.)																	×					
Agapetus fuscipes Curtis			×																			
Hydroptila sp.	×		×			×		×								×					×	
Lype sp.						×																
Tinodes waeneri (L.)	×		×			×		×													×	
Cyrnus flavidus McLachlan	×																					
Polycentropus flavomaculatus (Pictet)	×	×				×																
Neureclipsis bimaculata (L.)	×																					
Plectrocnemia conspersa (Curtis)								×		×	×	×										
Hydropsyche sp.																		×				
Hydropsyche angustipennis (Curtis)	×					×	×	×			×				×	×						×
Hydropsyche pellucidula (Curtis)	×					×													×		×	
Hydropsyche siltalai Dohler						×																
Phryganea grandis L.	×																				×	
Limnephilidae										×												
Halesus radiatus (Curtis)	×		×				×									×						
Micropterna sequax McLachlan								×				×	×		×	×		×				
Potamophylax group																		?				
Stenophylax permistus McLachlan													×									
Glyphotaelius pellucidus (Retzius)	×															×	×	×				
Limnephilus extricatus McLachlan						×											?					
Limnephilus lunatus Curtis	×		×					×			×		×				×	×				
Goera pilosa (Fab.)						×																
Beraeodes minutus (L.)																		×				
Molanna angustata Curtis	×																				×	
Athripsodes aterrimus (Stephens)						×																
Athripsodes cinereus (Curtis)						×		×								×					×	
Ceraclea dissimilis (Stephens)	×		×																			
Ceraclea senilis (Burmeister)	×																					
Mystacides azurea (L.)	×		×	×		×	×	×													×	
Mystacides longicornis (L.)			×				×															
Mystacides nigra (L.)						×																
Tipula (Tipula) paludosa Meigen																		×				
Tipula (Yamatotipula) montium group				×	×	×		×	×	×	×		×		×	×		×	×	×	×	

	River Lee (Enfield-Pymmes Brook)	River Lee (Pymmes Brook-Thames)	River Lee Flood Relief Channel	Small River Lee	Ching Brook	Turkey Brook	Cuffley Brook	Salmon Brook	Hounsden Gutter	Merryhills Brook	Pymmes Brook	Green Brook	Monken Mead Brook	Moselle River	Friary Park Stream	Ingrebourne	Berwick Pond Stream	Weald Brook	Rom/Beam	Wantz Stream	River Roding	Seven Kings Water
Nephrotoma sp.						×																
Nephrotoma analis Schummel															×			×				
Dicranota sp.								×								×		×				
Limnophila (Eloeophila) sp.																		×				
Pseudolimnophila sp.																	×					
Pilaria (Pilaria) discicollis group																	×	×				
Pilaria filata group							×															
Ormosia/Helius sp.																×	×					
Pericoma sp.											×											
Pericoma cognata Eaton																		×				
Pericoma trivialis group							×	×							×	×	×	×	×			
Pericoma fallax Eaton						×																
Psychoda sp.											×				×							
Psychoda cinerea Banks																			×			
Peripsychoda fusca Macquart													×					×				
Chaoborus sp.							×															
Culicidae		×						×					×				×					
Dixidae		×						×														
Dixa nubilipennis Curtis															×							
Simulium sp.										×		×					×					
Simulium (Nevermannia) vernum group													×									
Simulium (Eusimulium) aureum group			×										×			×		×				
Simulium (Wilhelmia) sp.			×																			
Simulium (Wilhelmia) equinum (L.)	×																					
Simulium (Boophthora) erythrocephalum (De Geer)	×																					
Simulium (Simulium) ornatum group	×			×		×	×	×					×			×		×			×	×
Chironomidae	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Ceratopogonidae	×		×			×	×	×		×		×	×		×	×	×	×	×		×	×
Pychoptera albimana (Fab.)																		×				
Tabanidae							×															
Tabanus sp.																				×		
Stratiomyidae						×		×													×	
Chloromyia formosa (Scopoli)													×						×			
Beris sp.															×			×				
Oxycera morrisii Curtis																×			×			
Stratiomys sp.																	×		×			
Vanoyia tenuicornis (Macquart)																			×			
Hemerodromia sp.	×																					
Chelifera sp.																×						
Dolichopodidae																×			×			
Syrphidae																	×		×			
Chrysogaster group																×						
Ephydridae																			×			
Hydrellia sp.	×																					
Tetanocera sp.				×																	×	
Limnophora riparia (Fallen)	×			×		×	×	×			×					×		×	×			
Bibio sp.							×															
Calliphoridae											×											
Chloripidae																			×			
Fannia sp.							×															

APPENDIX D

Macroinvertebrate occurrences in the River Ravensbourne, River Wandle, Beverley Brook and Hogsmill River catchments.

	River Ravensbourne	Ravensbourne — Downham Branch	Kyd Brook	River Pool	River Quaggy	River Beck	River Wandle	River Wandle — Carshalton Arm	River Wandle — Beddington Arm	Agfa Ditch	Beverley Brook	Cannizaro Park Stream	Coombe Brook	Pyl Brook	Pen Ponds Overflow Stream	Keswich Avenue Ditch	Surbiton Stream	Bonesgate Stream	Hogsmill River
Spongillidae						×	×												
Hydra sp.	×																		
Planaria torva (Muller)	×																		
Polycelis nigra group	×	×		×		×	×	×	×		×	×		×	×	×	×	×	×
Polycelis felina (Dalyell)	×	×	×		×		×		×										
Dugesia tigrina (Girard)	×	×				×	×		×		×								×
Dugesia polychroa group	×	×		×	×	×	×	×	×		×			×			×		×
Dendrocoelum lacteum (Muller)	×		×	×	×	×	×	×	×		×			×		×	×	×	×
Bdellocephala punctata (Pallas)					×		×												
Nematoda	×	×	×				×		×		×			×		×			×
Chordodidae																×			
Valvata piscinalis (Muller)							×	×											×
Valvata cristata Muller	×			×			×		×									×	×
Potamopyrgus antipodarum (Gray)	×	×	×	×	×	×	×	×	×		×		×	×	×	×	×	×	×
Bithynia tentaculata (L.)	×			×		×	×	×											×
Lymnaea truncatula (Muller)		×																	
Lymnaea palustris (Muller)							×			×								×	×
Lymnaea stagnalis (L.)							×	×											×
Lymnaea peregra (Muller)	×	×		×	×	×	×	×	×		×		×	×	×	×	×	×	×
Physa fontinalis (L.)					×		×	×	×									×	×
Physa acuta group	×	×		×		×				×	×		×	×	×	×			×
Planorbis (*Planorbis*) sp.									×										
Planorbis carinatus Muller							×	×											×
Planorbis planorbis (L.)	×			×				×											×
Bathyomphalus contortus (L.)	×			×		×	×	×	×										×
Anisus vortex (L.)							×	×											×
Gyraulus albus (Muller)	×			×		×	×											×	×
Gyraulus (=Armiger) crista (L.)				×	×		×												
Hippeutis complanatus (L.)	×			×	×	×					×								
Planorbarius corneus (L.)							×										×	×	×
Ancylus fluviatilis Muller	×	×		×	×	×	×	×	×		×			×				×	×
Acroloxus lacustris (L.)	×	×		×		×	×				×		×						×
Sphaerium corneum (L.)		×		×		×	×											×	×
Sphaerium lacustre (Muller)											×								
Pisidium sp.								×	×								×	×	
Pisidium casertanum (Poli)				×	×	×	×				×		×	×	×				×
Pisidium milium Held				×		×	×				×								×
Pisidium nitidum Jenyns				×	×	×					×								
Pisidium personatum Malm										×	×		×	×	×				×
Pisidium subtruncatum Malm	×	×		×							×								×
Piscicola geometra (L.)							×	×	×										
Theromyzon tessulatum (Muller)				×			×	×											×
Hemiclepsis marginata (Muller)							×				×								
Glossiphonia complanata (L.)	×	×	×	×	×	×	×	×	×		×	×		×		×	×	×	×

	River Ravensbourne	Ravensbourne — Downham Branch	Kyd Brook	River Pool	River Quaggy	River Beck	River Wandle	River Wandle — Carshalton Arm	River Wandle — Beddington Arm	Agfa Ditch	Beverley Brook	Cannizaro Park Stream	Coombe Brook	Pyl Brook	Pen Ponds Overflow Stream	Keswich Avenue Ditch	Surbiton Stream	Bonesgate Stream	Hogsmill River
Glossiphonia heteroclita (L.)						×													
Helobdella stagnalis (L.)	×	×	×	×	×	×		×			×			×			×	×	×
Haemopis sanguisuga (L.)	×			×			×	×	×										×
Erpobdella testacea (Savigny)								?			?		?	?		?			
Erpobdella octoculata (L.)	×			×	×	×	×	×	×		×							×	×
Trocheta bykowskii Gedroyc	×			×															
Trocheta subviridis Dutrochet		×	×	×	×	×					×	×	×	×	×	×	×	×	×
Oligochaeta	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Naididae	×	×		×	×	×		×	×		×			×	×	×			×
Lumbricidae	×			×	×		×	×	×		×	×		×	×	×	×	×	×
Lumbriculidae	×	×		×	×	×	×	×	×	×	×	×		×	×	×	×	×	×
Hydracarina	×	×	×	×	×	×	×	×	×		×			×			×	×	×
Cladocera																			×
Copepoda					×		×	×	×						×			×	×
Ostracoda	×				×	×		×			×				×				×
Asellus aquaticus (L.)	×	×	×	×	×	×	×	×	×	×	×		×	×	×	×	×	×	×
Asellus meridianus Racovitza	×		×													×			
Crangonyx pseudogracilis Bousfield									×			×		×	×	×		×	×
Gammarus pulex (L.)	×	×	×	×	×	×	×	×	×		×	×			×	×	×	×	×
Collembola	×								×										
Baetis rhodani (Pictet)	×	×	×	×	×		×	×	×	×	×	×				×	×	×	×
Baetis vernus Curtis			×																
Cloeon dipterum (L.)															×				×
Ephemerella ignita (Poda)							×	×											
Caenis sp.															×				
Caenis luctuosa (Burmeister)				×														×	×
Nemouridae															×				
Nemurella picteti Klapalek	×																		
Isoperla grammatica (Poda)			×																
Calopteryx splendens (Harris)											×								×
Coenagriidae							×		×						×				
Ischnura elegans (Van der Linden)											×								×
Sympetrum striolatum(Charpentier)															×				×
Hydrometra stagnorum (L.)	×			×				×										×	×
Velia sp.	×	×			×	×	×		×					×		×			
Velia caprai Tamanini																	×	×	×
Gerris sp.				×													×		×
Gerris (Gerris) lacustris (L.)	×																	×	
Nepa cinerea L.	×				×		×										×	×	×
Notonecta glauca L.																	×	×	×
Plea minutissima Leach																			×
Micronecta (Micronecta) poweri (Douglas & Scott)					×														
Corixidae (Corixinae)					×			×	×		×								
Corixa punctata (Illiger)																			×
Hesperocorixa sahlbergi (Fieber)													×				×		×
Sigara (Sigara) dorsalis (Leach)																			×
Sigara (Subsigara) falleni (Fieber)															×				
Sialis lutaria (L.)															×			×	×

	River Ravensbourne	Ravensbourne — Downham Branch	Kyd Brook	River Pool	River Quaggy	River Beck	River Wandle	River Wandle — Carshalton Arm	River Wandle — Beddington Arm	Agfa Ditch	Beverley Brook	Cannizaro Park Stream	Coombe Brook	Pyl Brook	Pen Ponds Overflow Stream	Keswich Avenue Ditch	Surbiton Stream	Bonesgate Stream	Hogsmill River
Gyrinus substriatus Stephens	×																		×
Haliplus sp.				×				×	×		×								
Haliplus (Neohaliplus) lineatocollis (Marsham)																	×		×
Haliplus (Haliplus) laminatus (Schaller)																			×
Haliplus (Haliplus) immaculatus Gerhardt																			×
Haliplus (Haliplus) fluviatilis Aube							×												×
Noterus clavicornis (De Geer)															×				
Laccophilus minutus (L.)																			×
Hygrotus impressopunctus (Schaller)																			×
Nebrioporus elegans (Panzer)					×													×	×
Stictotarsus duodecimpustulatus (Fab.)						×													×
Dytiscidae								×	×		×								
Dytiscus marginalis L.							×												
Colymbetinae							×												
Agabus bipustulatus (L.)																		×	
Agabus chalconatus (Panzer)	×																		
Agabus didymus (Olivier)					×										×		×	×	×
Agabus paludosus (Fab.)																			×
Ilybius sp.	×									×									
Ilybius fuliginosus (Fab.)																		×	×
Colymbetes fuscus (L.)	×																		×
Helophorus (Atrachelophorus) brevipalpis Bedel	×																	×	
Hydrophilidae							×		×										
Anacaena globulus (Paykull)															×			×	×
Anacaena lutescens (Stephens)																		×	
Hydrobius fuscipes L.																			×
Limnebius truncatellus (Thunberg)	×																		
Elodes sp.	×							×										×	
Dryops sp.															×				
Elmis aenea (Muller)	×						×	×			×					×			
Oulimnius sp.	×																		
Curculionidae							×												
Rhyacophila sp.	×		×																
Agapetus fuscipes Curtis							×	×	×										
Hydroptila sp.	×							×											
Tinodes waeneri (L.)	×						×												
Plectrocnemia conspersa (Curtis)												×				×			
Hydropsyche sp.								×											
Hydropsyche angustipennis (Curtis)	×			×		×	×												
Hydropsyche siltalai Dohler					×														
Limnephilidae											×								
Micropterna lateralis (Stephens)						×											×	×	×
Micropterna sequax McLachlan	×	×	×									×				×	×	×	×
Potamophylax cingulatus (Stephens)																		×	
Potamophylax latipennis Curtis							×	×										×	
Chaetopteryx villosa (Fab.)	×																		
Glyphotaelius pellucidus (Retzius)										×		×							
Limnephilus centralis Curtis															×				

	River Ravensbourne	Ravensbourne — Downham Branch	Kyd Brook	River Pool	River Quaggy	River Beck	River Wandle	River Wandle — Carshalton Arm	River Wandle — Beddington Arm	Agfa Ditch	Beverley Brook	Cannizaro Park Stream	Coombe Brook	Pyl Brook	Pen Ponds Overflow Stream	Keswick Avenue Ditch	Surbiton Stream	Bonesgate Stream	Hogsmill River
Limnephilus lunatus Curtis								×							×				
Sericostoma personatum (Spence)								×											
Athripsodes aterrimus (Stephens)	×																		
Mystacides azurea (L.)				×			×	×											×
Mystacides longicornis (L.)																			×
Tipulidae							×	×	×										
Tipula sp.																×			
Tipula (Yamatotipula) montium group	×	×	×	×	×	×					×			×	×		×	×	×
Dicranota sp.	×																		
Limnophila (Eloeophila) sp.	×																		×
Pilaria (Pilaria) discicollis group	×																		
Psychodidae						×	×	×											
Pericoma cognata Eaton	×																		
Pericoma trivialis group	×	×	×	×															
Psychoda sp.			×		×														
Psychoda alternata Say	×																		
Psychoda cinerea Banks	×																		
Chaoborus sp.															×				
Culicidae														×	×			×	
Aedes sp.											×								
Culex sp.	×																		
Culex (Culex) pipiens L.											×		×						
Culiseta (Culicella) litorea/morsitans										×									
Culiseta (Culiseta) annulata group										×									
Simulium sp.		×					×	×						×			×	×	×
Simulium (Eusimulium) aureum group	×			×											×				
Simulium (Wilhelmia) equinum (L.)	?																		
Simulium (Simulium) ornatum group			×	×	×						×	×			×	×			
Chironomidae	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Ceratopogonidae	×	×	×		×		×	×	×			×		×	×	×			×
Tabanidae	×							×	×										
Stratiomyidae	×	×			×				×					×					
Chloromyia formosa (Scopoli)					×														
Oxycera sp.	×																		
Oxycera morrisii Curtis				×															
Stratiomys sp.																			×
Oplodontha viridula (Fab.)							×												
Clinocera sp.					×														
Dolichopodidae	×					×													
Syrphidae									×										
Eristalis sp.																		×	
Chrysogaster group	×																		
Scathophagidae																		×	
Tetanocera sp.	×												×			×			
Limnophora riparia (Fallen)	×		×	×	×		×	×	×								×	×	×
Scatopse sp.				×															
Fannia sp.											×								

Book reviews

Vice-county census catalogue of the vascular plants of Great Britain, the Isle of Man and the Channel Islands. Edited by C. A. Stace, R. G. Ellis, D. H. Kent, D. J. McCosh. 2003. 405 pages, paperback. Botanical Society of the British Isles. £10. ISBN 0 901158 30 5.

This publication describes in a handy format the distribution of native and alien plants in the British Isles, excluding Ireland. It is intended as a successor to Druce's *Comital flora of the British Isles* (1932), but is certainly far more accurate, having been compiled from data supplied by the BSBI's recorders, a network of correspondents far better than what was available to Druce. Another advantage over the earlier work is that it is possible to see the source of each record, by consulting the Society's database on its website. The presence on the title page of the name of Duggie Kent, who died in 1998, is an indication of the long period of planning and preparation of this catalogue. It has been overtaken by the *New atlas of the British and Irish flora* (2002) which gives a much more precise and graphic representation of plant distributions. Its advantages in terms of content over the *Atlas,* which of course is much heavier in the hand and dearer, are (1) that alien occurrences are distinguished as naturalized or casual (some of the tree species shown as casual in the catalogue are said to be planted only in the *Atlas*), and (2) it has distributional data for bramble, dandelion and hawkweed agamospecies not dealt with in the *Atlas.*

The Introduction to the 'VCCC', by Stace alone, gives a comprehensive account of the historical use of the vice-county system as a basis for describing natural distributions, claiming that '. . . it cannot be denied that [vice-counties] have stood the test of time and are still very widely used for recording and preparing Floras. These are the units that are allocated to a Recorder by the BSBI and to which most field botanists demonstrate some chauvinistic allegiance; a species discovered new to Leicestershire will always be greeted with more interest than one discovered new to hectad 42/58, or to 100×100 km square 42.' That may be true in v.-c. 55, which has boundaries not very different from those of the modern Leicestershire (including Rutland), but it is not true in London, where allegiance to old boundaries creates considerable nuisance, and the future organization of recording appears more likely to be based on local records centres matching current administrative units.

RODNEY BURTON

Wild animals. Tiger. Lionel Bender. Chrysalis Children's Books. 2004. 32 pp., hardback, fully illustrated. £10.99. ISBN 1 84458 170 5.

This excellent children's book was received at the end of November, and there is just time to bring it to our readers' attention now.

Tiger is one of a series (other titles are *Crocodile, Elephant, Gorilla* and *Polar Bear*) that looks at how animals live in their natural homes and shows how their lives are in danger. Where do tigers live? What does a tiger eat? Does a tiger have weapons? At what age does a tiger reach full size? The large colour photographs are superbly sharp and are fine images in the situations described — stalking, feeding, adult males fighting, mother and cubs, threats, like cutting down forests and the fur trade, and care, like setting up wildlife reserves.

The captions are printed in large clear bold type and coupled with the fine photographs should make for interest from the intended young readership.

K. H. HYATT

Diel patterns of drift by macroinvertebrates in the River Lee (Hertfordshire) during low discharge

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KEYWORDS: drift density, high nutrient loading, macroinvertebrates, diel periodicity.

Summary

The present study aimed to determine the periodicity of invertebrate drift and its relation to environmental factors. Macroinvertebrate drift samples from Woolmer's Park on the River Lee were collected every three hours over twenty-four-hour periods, once a week between 10 May and 13 July 1995 inclusive. Samples were collected every three hours along with measurements of water velocity, luminosity and water temperature. The most abundant taxa recorded in the drift samples were the Ephemeroptera, *Caenis robusta*, *Baetis rhodani*, *Ephemerella ignita*, *Asellus aquaticus* and Chironomidae. *C. robusta* and *B. rhodani* exhibited night-time maxima, *E. ignita* and Chironomidae had diel patterns of drift during daylight hours. Chironomid drift was significantly, positively correlated with discharge, whereas *E. ignita* was inversely correlated with discharge. *A. aquaticus* peaks in drifting densities occurred at 12.00 and 03.00 hours indicating that for this species, light was not a factor. No correlation between numbers of *A. aquaticus* drifting and discharge and water temperature were found. Note is made of the fact that correlations between drift densities, which are often reported in ecological studies, are spurious in that the drift densities are derived from water velocity measurements at the net's entrance.

Introduction

Immature stages of most rheophilous species of invertebrates, as well as some adults, are known to drift downstream with the current at some stage of their lives (Waters 1972). Drift behaviour of benthic stream organisms has been well documented, in particular with reference to diel periodicity (e.g. Müller 1965, Elliott 1968). Many of these early investigations highlighted both biotic and abiotic influences on drift. The 'types' of drift have been investigated extensively (e.g. Corkum and Clifford 1980, Lancaster 1990), exhibiting several intriguing patterns (Kohler 1984). The following groups of drift are recognized: behavioural, distributional, background and catastrophic (Minckley 1964, Waters 1965). Also, Müller (1982) endeavoured to explain drift behaviour within a life cycle context and proposed the term 'colonization cycle' for downstream drift of insect larvae and nymphs with a compensatory upstream

flight by adult female insects that lay eggs in the headwaters. The concept was later refined to include seasonal movement into more favourable habitats.

Until the 1970s, most studies suggested that macroinvertebrates drifted passively, either as a result of accidental dislodgement during periods of high activity (often with pronounced diel rhythms), or due to increased discharge rates. Although accidental dislodgement undoubtedly accounts for a portion of invertebrate drift, more recent work indicates that other factors are also responsible. Increases in discharge will lead to increased drift, however, water velocity may influence other abiotic factors such as temperature and water chemistry, which may also influence drift (e.g. Brittan and Eikeland 1988). A review of invertebrate drift by Greenwood and Richardot-Coulet (1996) agreed that drift might be a response to environmental constraints and also influenced by resource partitioning.

Invertebrate drift certainly occurs as a response to predation pressure (e.g. Peckarsky and Penton 1989, Lancaster 1990). Questions have arisen as to prey responses to predation. Is prey activity nocturnal in the presence of predators? Does this nocturnal shift occur because of reduced daytime activity rather than increased nocturnal activity? (Douglas et al. 1994). The nocturnal drift of *Baetis rhodani* was due to the presence of trout *Salmo trutta* (Malmquist 1988), whereas higher ratios of night:day drift density of several Ephemeroptera have been reported in streams containing drift-feeding fishes (Flecker 1992, Douglas et al. 1994). Drift periodicity is thought to be genetically fixed, occurring both in the presence and absence of chemical cues (Forrester 1994). Nonetheless, most studies agree that invertebrates exhibit diel periodicity in their drift rates, with the most commonly observed patterns having nocturnal maxima (Barnes and Mann 1991). Indeed, total drift densities may be three times greater at night than during the day. Possible explanations include the effect of light levels and changes in oxygen concentrations (oxygen levels typically reach late-night minima).

Conflicting views exist regarding the factors that induce drift and the reasoning behind drift for different invertebrate components, so no single hypothesis is likely to explain the drift of all taxa at all times (Wiley and Kohler 1981). Changes in ambient light intensity may not be the ultimate reason for drift behaviour, and they do not seem to serve as the trigger or phase-setting agent for drift (Smock 1996). Studies on the threshold level below which drift commences include levels of 0.1-1 lux (Tanaka 1960), 1 lux (Holt and Waters 1967) and 1.57 lux (Chaston 1971). No definitive threshold level has been established, but there is general agreement that light levels of approximately 1 lux and above will reduce drift sufficiently. The majority of drift studies having been carried out in either clean upland streams (e.g. Malmquist 1988, Peckarsky and Cowan 1995) or artificial streams systems (e.g. Hildebrand 1974, Lancaster 1990), with few addressing nutrient-enriched water courses. So the potential impact of elevated nutrients and suspended solids levels on invertebrate activity has received insufficient study. The aim of the present study was to determine whether the drift of invertebrates in the River Lee, a nutrient-rich chalk stream with elevated levels of suspended matter (Faulkner and Copp 2001), follows the similar diel periodicity as reported in other streams. We examine invertebrate drift densities in relation to water temperature, water velocity and light intensity, thus complementing related research of fish drift (Copp et al. 2002) and diel fish distributions (Copp 2004, Copp et al. 2004). The River Lee is of particular interest because the majority of its flow emanates from treated sewage outfalls, especially in periods of reduced discharge (Pilcher and Copp 1997).

Study site, material and methods

The River Lee, with a catchment area of 1,420 km^2 and a human population of two million, is one of the most heavily impacted river systems in the UK. A major tributary of the River Thames in south-eastern England, the River Lee is

of chalk origin (north-west of Luton: Nat. Grid Ref. TL058248), but receives a majority of its discharge as treated sewage effluent, especially during low flow. Water quality in the reach from Essendonbury Farm (TL272098) to Bayfordbury (TL314111) has been designated as 1B (NRA 1994). Sampling was undertaken in a private estate, Woolmer's Park (TL 288 100), which is near the village of Essendon. The study site at Woolmer's Park (Figure 1) has received limited river channel management, mainly the removal of overhanging or fallen trees and bushes (see Copp and Bennetts 1996). The channel varied between 3 and 12 metres wide, in places depth exceeded 2 m, and the width of the riparian border varied from 2 to > 40 m. The river contains riffle, pool and run sequences (for greater detail, see Copp and Bennetts 1996 and Copp et al. 2002).

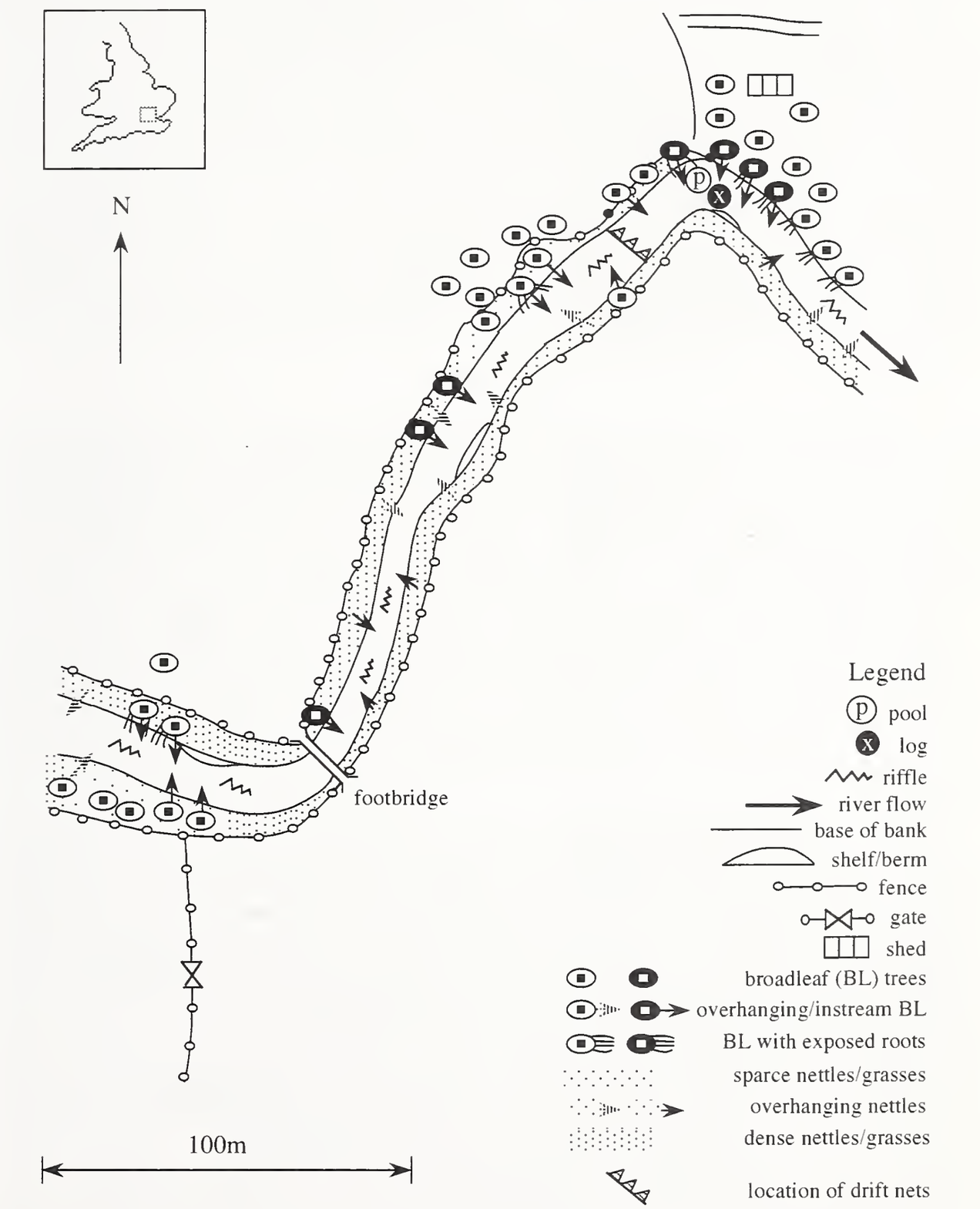

FIGURE 1. Study site on the River Lee at Woolmer's Park, Hertfordshire (UK), with location of drift nets and riparian vegetation indicated.

Drift samples were collected each third hour over twenty-four-hour periods once each week from 10 May to 13 July 1995 using the drift nets and methods described in Copp et al. (2002). The nets (square-to-conical shaped: 0.5 m in total length and 50 μm mesh) were set at 09:00 and the following variables were measured at each sampling time: water temperature, light intensity (lux) and water velocity at the mouth of each net. The drift nets were situated on the left and right banks and centre channel to collect across a range of flow types (for details, see Faulkner and Copp 2001). Invertebrates were sorted from each sample within one to six hours after sampling. Samples of fish and invertebrates were separated and preserved in vials with 4 per cent formaldehyde. Owing to the elevated amounts of debris captured in the nets, the sorting of each samples was limited to thirty minutes to provide an equal unit of effort (see Copp et al. 2002).

The invertebrates collected were counted and identified to order, family, genus or species where possible, using a binocular microscope (10× or 30× magnification) and a variety of identification keys (e.g. Edington and Hildrew 1981, Wallace et al. 1990, Tachet et al. 1991). Drift densities were calculated using the volumes of water filtered estimated for each sample interval using the model presented by Faulkner and Copp (2001), which accounts for the decreased filtering efficiency encountered due to the high amounts of suspended matter carried by the River Lee. We tested for correlations (using Spearman's *r*) calculated between the densities of taxonomic groups with respect to three variables and the position of the nets in the channel (significance at 95 per cent), as well as for differences between sampling times using StatView SE© on Apple Macintosh© and CSS Statistica© on PC.

Results

The most abundant taxonomic group of invertebrates in the drift was arthropods; they comprised 97.5 per cent of the animals collected (Table 1) of which 84 per cent were insects, with Ephemeroptera and Diptera being the most important groups and Isopoda being the third largest order. The remaining invertebrates consisted of Tricladida and Oligochaeta. We concentrated our analysis on the most abundant species (Table 1): *Ephemerella ignita*, *Caenis robusta*, *Baetis rhodani* (Ephemeroptera), *Chironomus* sp. larvae and *Asellus aquaticus*.

From May to July, there were large differences in the numbers of animals collected. *Caenis robusta* had highest densities in late May, whereas *E. ignita* exhibited greatest densities throughout June, declining towards the end of the month. *B. rhodani* had low densities throughout the sampling period, but displayed a small peak in early June (Figure 2). The variation over this period could be explained by individual species' life cycles (emergence and early instar dispersal).

Over a twenty-four-hour period, peak densities for *C. robusta* and *B. rhodani* occurred at night (Figure 3). *Asellus aquaticus* and Chironomidae (Figure 4) and *E. ignita* (Figure 5) also displayed two peaks in density, at 12.00 and 03.00 for *A. aquaticus* (Figure 4) and at 12.00-15.00 and 06.00 hours for Chironomidae and *E. ignita* (Figures 4 and 5). Overall invertebrate drift density was not correlated with water temperature, but certain species were significantly correlated with water temperature and light intensity with regard to specific net locations within the stream (Table 2). On the left bank, *E. ignita* was inversely correlated with discharge, the Chironomidae and *Hydropsyche siltalai* were inversely correlated with temperature and the Ephemeroptera and *H. siltalai* with light levels. On the right bank, all significant correlations with discharge were positive, apart from *E. ignita*, for which it was negative. For the mid-channel net, *E. ignita*, and *H. angustipennis* were inversely correlated with discharge, whereas all Chironomidae, all Diptera and *H. siltalai* were positively correlated. All Trichoptera and Chironomidae were inversely correlated with water temperature, whereas *E. ignita* was positively so. All correlations with light levels were positive in all species except for *Caenis robusta* in the centre net.

TABLE 1. Percentage contribution of taxa (**PHYLUM**, CLASS, ORDER, SUBORDER, Family, *Genus*, *species*) in drift samples collected in the River Lee (England) during May, June and July in 1995.

Taxon				%
ARTHROPODA				
INSECTA	EPHEMEROPTERA	*Ephemerella ignita*		32.0
	(48.5 %)	*Caenis robusta*		11.0
		Baetis rhodani		5.5
	DIPTERA	Chironomidae (24 %)	larvae	21.5
	(29.5 %)		pupae	2.5
		Simuliidae		4.5
		Ceratopogonidae		<1.0
		Chaoboridae		<0.5
		Tipulidae		<0.1
		Empipidae		<0.1
	TRICHOPTERA	*Hydropsyche siltalai*		2.5
	(3.5 %)	*Hydropsyche angustipennis*		<1.0
		Hydroptilidae		<0.1
		Agapetus fuscipes		<0.1
	COLEOPTERA	Coleoptera sp.		1.5
	(2.5 %)	*Elmis aena*		1.0
		Haliplus sp.		<0.1
	HEMIPTERA	*Sigara* sp.	larvae	<0.5
			adults	<0.5
	ODONATA (<0.1 %)			
	ZYGOPTERA	Calopterygidae		<0.1
	ANISOPTERA			<0.1
CRUSTACEA (10.5 %)				
	ISOPODA (10 %)	*Asellus aquaticus*		10.0
		Asellus meridianus		<0.1
	AMPHIPODA	*Gammarus pulex*		<0.5
	BRANCHIURA	*Argulus coregoni*		<0.1
CHELICERATA (3 %)				
	HYDRACARINA			2.5
	ARANEAE	*Argyroneta aquatica*		<0.5
PLATYHELMINTHES				
	TRICLADIDA			1.5
ANNELIDA				
OLIGOCHAETA				1.0
MOLLUSCA				
BIVALVIA				<0.1

TABLE 2. Correlations (Spearman's *r* corrected for ties) and probabilities (*P*) between invertebrate drift densities collected in three nets (left bank, centre, right bank) and environmental factors in the River Lee during May to July 1995. Comparisons of all nets combined for all taxa combined and the most abundant taxa only (*Ephemerella ignita*, *Caenis robusta*, *Baetis rhodani*, all Chironomidae, Simuliidae). *Hy.* = *Hydropsyche*.

Variable versus net:	left		centre		right		combined	
Taxa	*r*	*P*	*r*	*P*	*r*	*P*	*r*	*P*
Discharge								
Ephemerella ignita	-0.363	0.005	-0.378	0.001	-0.258	0.050	-0.370	0.001
Baetis rhodani			0.291	0.010			0.293	0.010
All Ephemeroptera			-0.263	0.050				
Chironomidae larvae	0.360	0.005	0.458	0.001	0.352	0.005		
Chironomidae nymphs	0.386	0.001	0.329	0.005				
All Chironomidae	0.444	0.001	0.481	0.001	0.365	0.005	0.539	0.001
Simuliidae					0.227	0.050		
All Diptera	0.332	0.005	0.483	0.001	0.385	0.001		
Hy. angustipennis			-0.230	0.050				
Hy. siltalai			0.578	0.001	0.373	0.005		
All Trichoptera			0.394	0.001	0.301	0.010		
Coleoptera larvae	0.249	0.050			0.241	0.050		
Elmis aena	0.235	0.050	0.245	0.050	0.303	0.010		
All Coleoptera	0.261	0.050			0.227	0.050		
Hydracarina					0.264	0.030		
Oligochaeta	0.263	0.050			0.255	0.050		
Tricladida	-0.302	0.010						
All invertebrates			0.213	(0.06)	0.270	0.050	0.229	0.050
Water temperature								
Ephemerella ignita	0.235	0.050	0.325	0.005			0.228	0.050
Baetis rhodani			-0.293	0.050	-0.271	0.020	-0.222	0.050
All Ephemeroptera			0.378	0.001				
Chironomidae nymphs	-0.342	0.005	-0.237	0.050	-0.237	0.050		
All Chironomidae	-0.235	0.050	-0.227	0.050	-0.254	0.050	-0.307	0.010
All Diptera			-0.225	0.050				
Hy. siltalai	-0.263	0.050	-0.496	0.001	-0.348	0.005		
All Trichoptera			-0.338	0.003	-0.363	0.005		
Elmis aena					-0.364	0.005		
Gammarus pulex					-0.241	0.050		
Tricladida	0.223	0.050	0.229	0.050				
Light level								
Caenis robusta	-0.449	0.001	-0.212	(0.06)	-0.378	0.001	-0.363	0.002
Baetis rhodani	-0.429	0.001			-0.275	0.050	-0.247	0.030
All Ephemeroptera	-0.260	0.050						
Chironomidae larvae	0.259	0.050	0.377	0.001	0.286	0.050		
All Chironomidae	0.231	0.050	0.349	0.005	0.29	0.050	0.380	0.001
All Diptera			0.338	0.005	0.254	0.050		
Hy. siltalai	-0.358	0.005			-0.244	0.050		
All Trichoptera	-0.296	0.010			-0.258	0.050		
Coleoptera larvae			0.330	0.005				
Elmis aena					-0.300	0.010		
Asellus aquaticus	-0.326	0.005			-0.321	0.010		
All invertebrates	-0.243	0.050			-0.237	0.050		

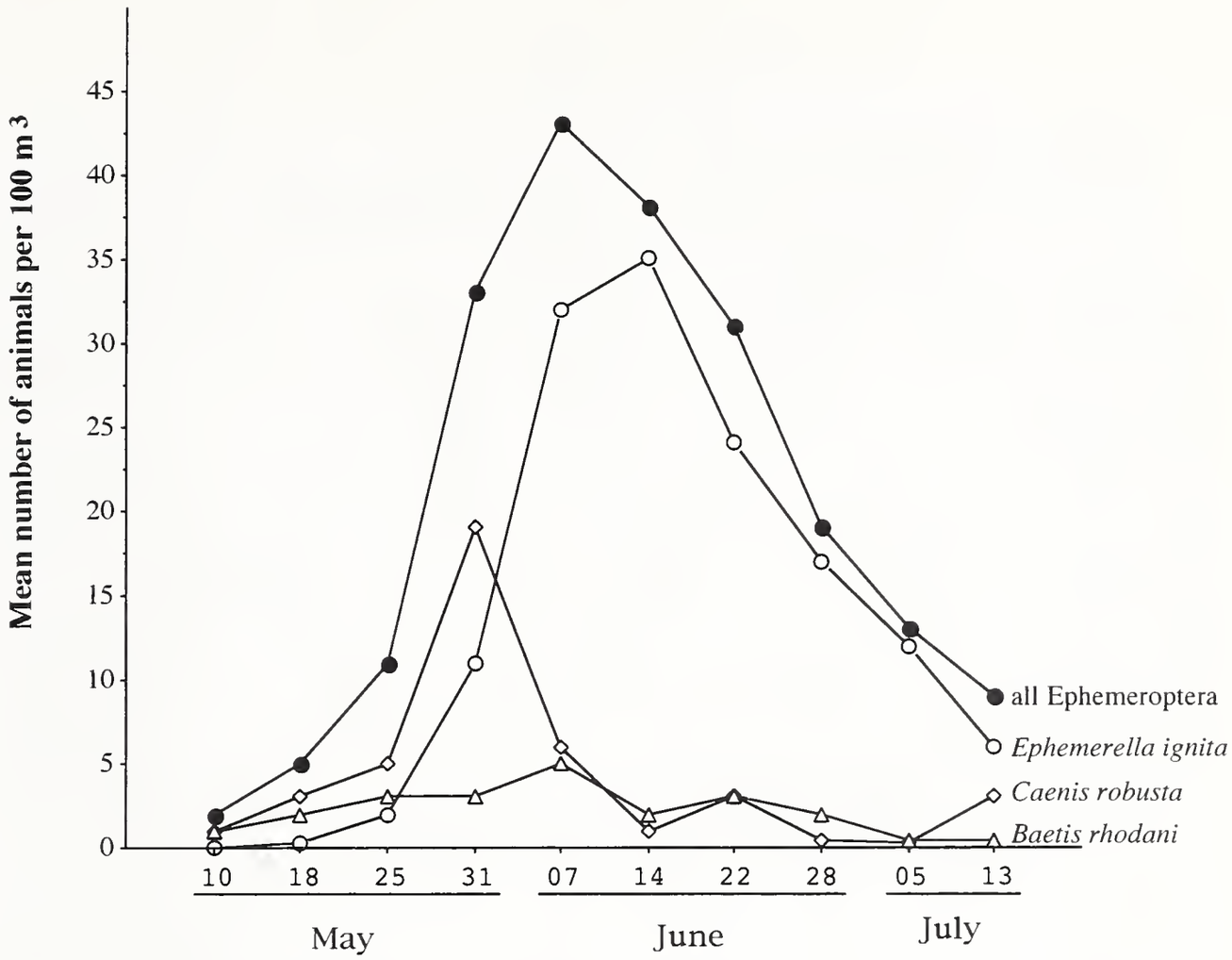

FIGURE 2. Mean density of *Ephemerella ignita*, *Caenis robusta* and *Baetis rhodani*, separately and combined (all Ephemeroptera), at each sampling occasion in the River Lee.

With all samples combined, *E. ignita* and Chironomidae densities were inversely and positively correlated with discharge, respectively. *C. robusta* and *B. rhodani* appeared to drift in a manner inversely correlated with light, as their densities decreased as light levels increased. The opposite was true for Chironomidae, which had densities inversely correlated with water temperature.

Discussion

The asymmetrical gradient of drift density across the channel observed in the River Lee has been reported in large rivers (e.g. Obi and Connor 1986, Grzybkowska 1992). The high proportion (43 per cent) of mayfly nymphs, particularly *E. ignita* and *C. robusta*, observed in drift samples from the River Lee (Table 1) may reflect the fact that the early instars of many Ephemeroptera are recorded drifting in large numbers from early spring until well into the autumn, with some species being plentiful right through the year (Harker 1989: 27–34). The presence of *E. ignita* in such high densities is not unusual; Elliott (1968) reported that they had the highest mean activity of the five species he studied.

Manipulative field experiments of the effects of water temperature, discharge and the presence of predatory fish in relation to drift density have revealed that amongst the various factors (different invertebrate groups, different times of the day), light intensity was the most important factor conditioning the distribution of activity (Williams 1990). Mayfly nymphs in particular appear to adhere closely to light intensity (Greenwood and Richardot-Coulet 1996), demonstrating in some cases (e.g. *E. ignita*) strong negative phototaxis from 5 to 500 lux as well as increased movement at night up onto the upper surface of stones (Elliott 1968).

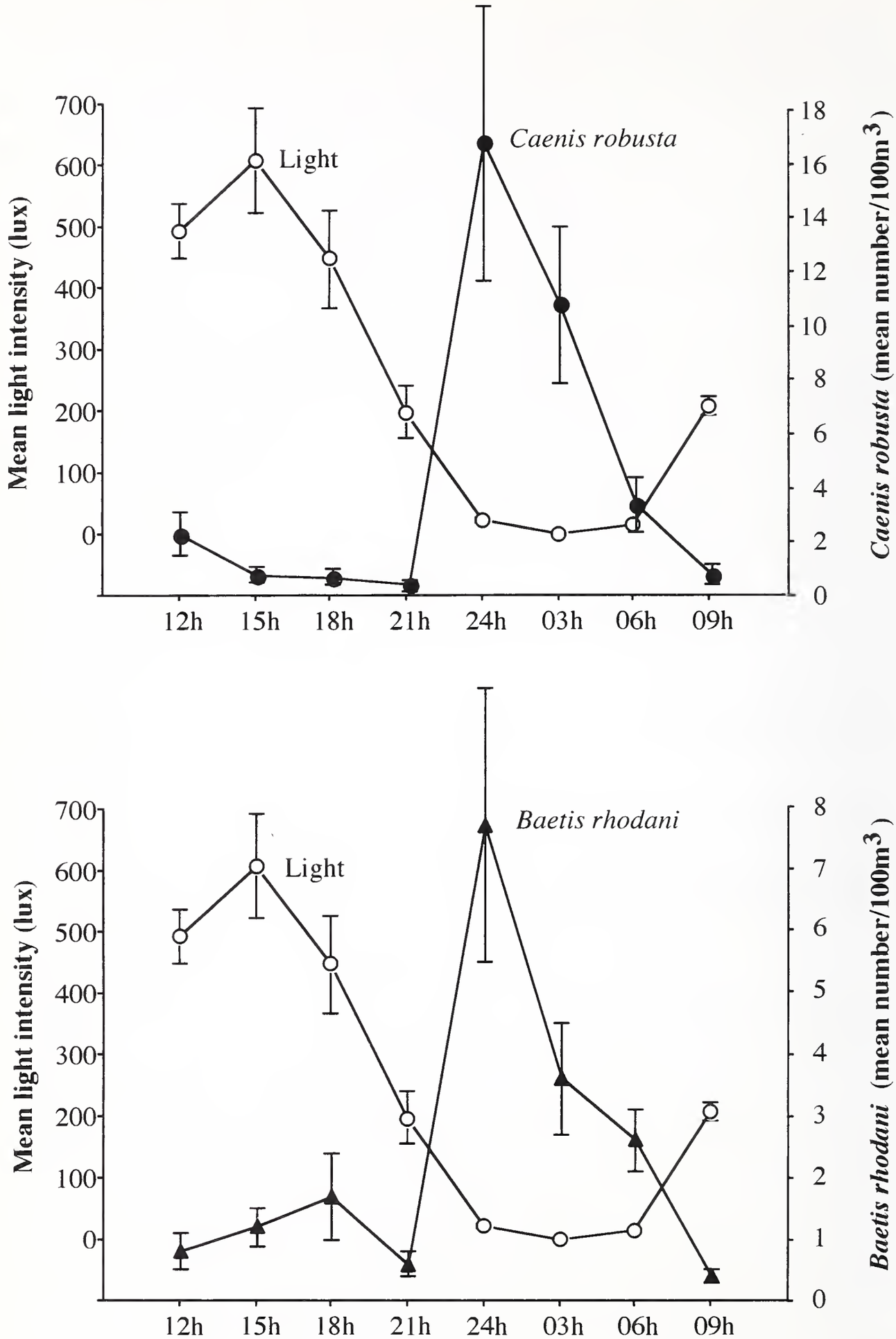

FIGURE 3. Mean light intensity and mean density (note different scales), with standard error, of *Caenis robusta* and *Baetis rhodani* recorded at each sampling occasion over ten 24-hour periods from 10 May to 13 July 1995 in the River Lee.

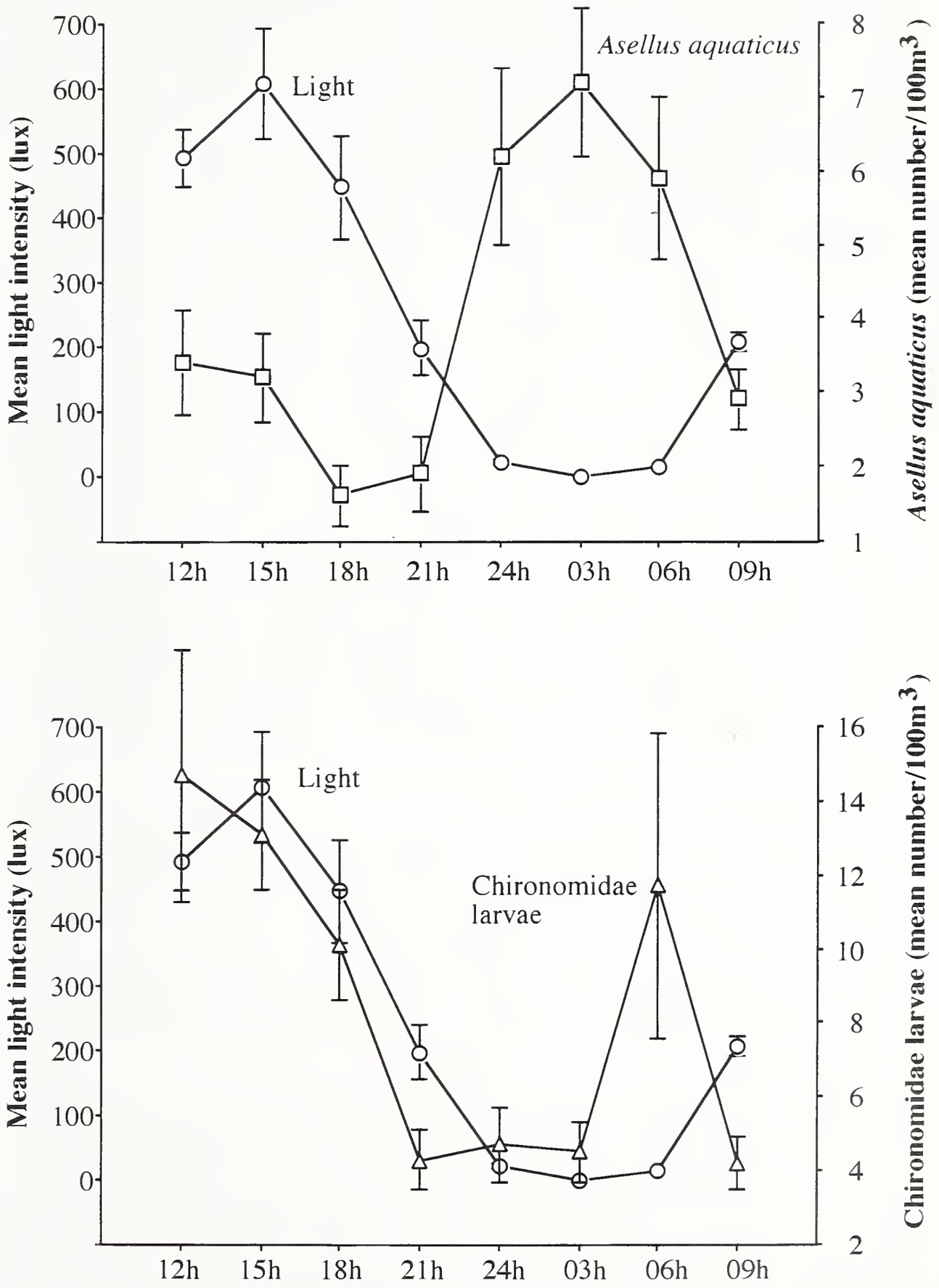

FIGURE 4. Mean light intensity and mean density (note different scales), with standard error, of *Asellus aquaticus* and Chironomidae larvae recorded at each sampling occasion over ten 24-hour periods from 10 May to 13 July 1995 in the River Lee.

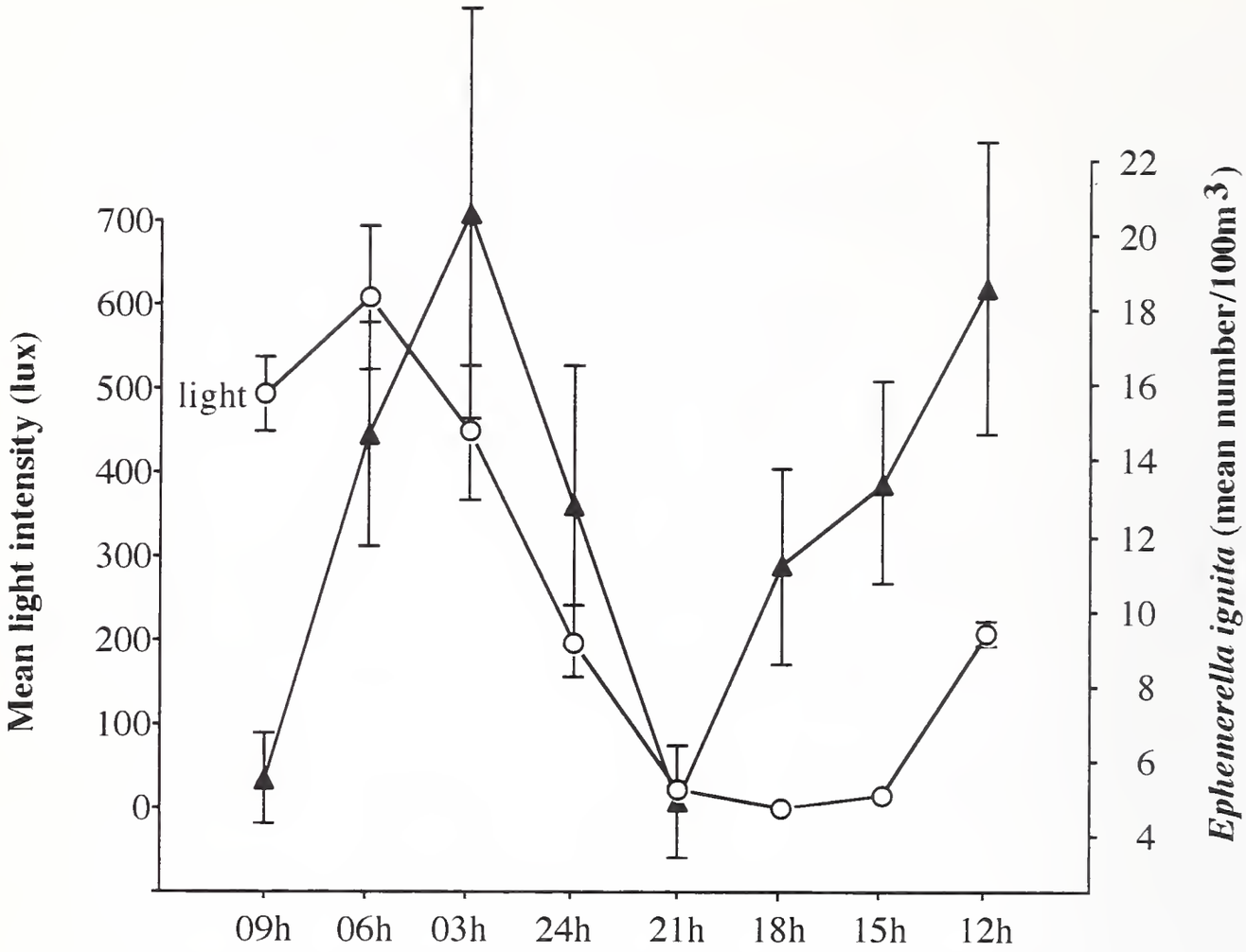

FIGURE 5. Mean light intensity and mean number of *Ephemerella ignita* (with standard error) recorded at each sampling occasion over ten 24-hour periods from 10 May to 13 July 1995 in the River Lee. Densities increase with a decrease in lux.

Traditionally, this increase in the nocturnal use of stone surfaces was believed to lead to an increase in accidental dislodgement and an associated increase in drift density. Whereas several studies have highlighted that light intensity is an important factor, few studies have produced statistically significant evidence to demonstrate that a single factor is responsible for the initiation of mayfly drift. Harker (1953) suggested that mayfly activity cycles were controlled not by one, but a number of factors acting simultaneously and, despite the numerous studies on mayfly activity that followed, this suggestion generally appears to hold true. For example, Allen et al. (1986) acknowledged that light intensity is a contributing factor, but disagreed with the passive entry theory and proposed instead that other factors (such as water velocity) may induce behavioural drift. This concept was strengthened by work carried out by Koetsier and Bryan (1995), which demonstrated that mayfly nymph densities were inversely related to discharge and positively related to water conductivity and water velocity. Note, however, that correlations between drift densities and water velocity are spurious because the drift densities are calculated using water velocity measurements taken at the net's entrance.

With regard to *E. ignita* (Figure 5), the peak densities we observed at 12.00 and 06.00 hours in the River Lee are contrary to the drift patterns recorded by Elliott (1968); the patterns we observed may well reflect fish predation pressures (McIntosh and Peckarsky 1996), and initial results from subsequent studies of diel fish predation activity support this assumption (Copp et al. 2004). The night time drift patterns of *C. robusta* and *B. rhodani* may also be indicative of the presence of fish, coupled with night-time foraging movements.

This explanation does not, however, account for the high densities of Chironomidae drifting during daylight hours. In the Lee, we also observed a positive correlation between drift densities and increases in discharge and an inverse correlation with water temperature. As the Chironomidae were generally small individuals, there may well be additional size/weight associations (as yet unexplored) related to the physical entrainment of the organisms. Because Chironomidae larvae are abundant and taxonomically diverse in most freshwater benthic communities, these dipterans are also the major macroinvertebrate groups found drifting in rivers, especially during summer. But the high density of drifting chironomids is usually dominated by first and second instars, which are the major dispersive agents in all taxa, independent of the life mode of older instars, including pelophilous *Chironomini* (Soponis and Russell 1984, Williams 1989). The behaviour of early instars enables them to seek suitable habitats for further development or/and recolonization of areas of stream bed after a spate (Grzybkowska et al. 1996), drought or heavy pollution (Brittan and Eikeland 1988). It is difficult to add anything to the knowledge of chironomid propensity to drift when these midges are identified to family level, as in our investigations, because drift patterns of chironomid species and genera vary spatially and temporally. As shown by Ferrington (1984) and Grzybkowska (1992), some chironomid taxa exhibited diel drift patterns and they may vary with hydrologic and geomorphic conditions.

An alternative explanation might be prey selection by invertebrate predators. Predator invertebrate species are few and include Zygoptera, Coleoptera and Hemiptera in low numbers, with less than one per cent of the drift consisting of predatory species. Similarly, the densities of benthic predators at the same site (though sampled in the subsequent year), were also low (Copp et al. 2004). Thus, the impact of invertebrate predation at this location is probably negligible compared to that of fish. The classic diel pattern was not exhibited in our study for the most abundant taxonomic groups, but there is some evidence of a bigeminus pattern for *C. robusta* and *B. rhodani* as (Figure 3). As a complement to the ongoing fish-invertebrate interactions studies in nutrient-rich streams, the present study has provided important baseline information. However, future work on invertebrate drift in nutrient-rich streams needs to address the difficulties of sampling invertebrate drift in the face of high levels of suspended matter (Faulkner and Copp 2001), as well as invertebrate size relationship patterns, particularly those of the Chironomidae.

Acknowledgements

We are grateful to the late Mrs Lucas for permission to access the river via her land for this study. We thank S. Doherty, G. Levebre, P. Mortlock, Grant Perry, C. Wadoux and M. Watkins for field and laboratory assistance, and M. Grzybkowska for comments on the text.

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Book reviews

Indices of ecological continuity for woodland epiphytic lichen habitats in the British Isles. A.M. Coppins & B.J. Coppins. 2002. 36 pp. £6 (£3.50 members), British Lichen Society. ISBN 0 9540418 4 4.

A conservation evaluation of British lichens. R.G. Woods & B.J. Coppins. 2003. 59 pp. £6 (£4 members), British Lichen Society. ISBN 0 999540418 5 2.

A field key to common churchyard lichens. Frank S. Dobson. 2003. 38 pp. £6.50 + £1.50 p.& p. Frank S. Dobson, 57 Acacia Grove, New Malden, Surrey, KT3 3BU. ISBN 0 9542324 2 9.

The 1970s was a dynamic time for British lichenology with the James, Hawksworth and Rose paper on lichen communities in *Lichen Ecology* (1977) and Hawksworth and Rose (1970) publishing their scale for estimating mean winter SO_2 in England and Wales. Air pollution was to become the driving force behind many lichen publications, but during this period Francis Rose (1976) was also developing his Indices of Ecological Continuity for the specialized habitat of old woodland. Further work lead to more publications (1992, 2002) and now the Coppinses have just published a compilation of Indices updating Rose's work, which has stood up well to the test of time. Thanks to a team of dedicated field lichenologists, a revision of 'Bonus' species has also been made. Two new Indices, for Scotland (pinewoods) and Ireland (broadleaf), emphasize not only the regionality of these Indices but also where our richest lichenological areas are. As one surveys the depleted lichen biodiversity of London woodlands it is good to think that these rich sites still exist. However global warming and long-distance pollution are threats to even the most remote areas. The authors acknowledge the limitation of these Indices due to the effects of pollution and management. It should be noted that the British Lichen Society published their groundbreaking *Habitat Management Handbook* (Fletcher et al.) in 2001, which gives guidance on management of different habitats from woodland to churchyard.

The second publication is an update of the *Red Data Book* (Church et al. 1997). This covers 1,800 taxa following the new *Checklist* (Coppins 2002) and also includes some lichenicolous fungi. Again the London lichenologist becomes aware of the impoverishment of their lichen flora. There are less than a dozen important species recorded in London in the past, all now no longer there. This is a hugely valuable work compiled by Ray Woods, a professional conservationist working for the Countryside Council for Wales, and Brian Coppins, the leading British lichen taxonomist. The need to track important conservation species is emphasized by the changing status of species on which more work has been done thanks to funding from the Biodiversity Action Plan (BAP) process. The dynamic nature of species composition is emphasized by this tracking, for example *Anaptychia ciliaris* has shown a dramatic decline. Two thirds of the species are Nationally Rare or Nationally Scarce, the critical species have increased from 177 to 208 and we have international responsibility for many species — especially in the western oceanic areas. A vital reference work.

Finally a publication that can be used by the amateur in London — a field key to lichens in churchyards. Through looking at lichens in churchyards the amateur naturalist can become aware of the importance of geology, climate, aspect and even social change. Frank Dobson is a past President of the BLS and has taught many Field Studies Council (FSC) courses on lichens. This is his latest offering to the amateur. It is divided into three parts — photographs covering 54 species; a tabular format for a small subset of species; and a proper dichotomous key, with many marginal sketches to help with interpreting specialist terms that are kept to a minimum. This is a field key that uses field characters, although it does point out that some species can only be truly identified microscopically. It is divided into four growth forms and acid or basic substrates. A list of all the species covered (190) is useful and it is pointed out that more illustrations are available on the FSC cards — 45 on the air pollution one, 45 on rocky shores and 60 on twigs (because this key does not cover trees). The scope is good but almost a fifth of the species recorded in seven London cemeteries are not there, mainly because they are difficult to identify. A lignin key is useful for benches but I was surprised *Lecanora saligna* and *Buellia griseovirens* were not included as they are frequently found. One small addition I think would enhance it is short lists of likely species found in particular habitats. This is a good way to start looking at lichens and with the help of other Dobson publications — such as his *Lichens* or his multiaccess *CD Lichen-Identifier*, that covers all the species in the Flora as well as including many illustrations and distribution maps — opens up a whole new world.

For the amateur lichenologist there is now a plethora of books to encourage their interest, including Oliver Gilbert's New Naturalist *Lichens* (2000). We are indeed lucky to benefit from this small enthusiastic group of field workers.

All three publications are available through the BLS — look on their website: www.theBLS.org.uk for more information.

AMANDA WATERFIELD

The larger Brachycera, Syrphidae and Conopidae (Diptera) of Mitcham Common — some corrections and revisions

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Further to my note on the Diptera of Mitcham Common (Morris 2003), Mr M.W. Hanson has brought to my attention a number of errors in relation to the data quoted for Epping Forest in Table 1 (p.181). Firstly, he advises that I must have overlooked records from the wider Epping Forest area that bring the species count for hoverflies to 126 in his paper (Hanson 1985). I am unsure how this discrepancy arose, but unreservedly withdraw the qualifying note in Table 1 referring to species counts.

In addition, Mr Hanson has drawn my attention to three further accounts of the Diptera of Epping Forest that substantially increase the overall species list. Hanson (1991) updates the original species lists and draws attention to a number of new records. Further details are provided by Ismay (2001*a*, *b*) whose work expands the range of Diptera reported from Epping Forest. As a result, the comparative list of family representation at various London sites quoted in my note can be revised to read:

Family	Number of spp. (UK)	Mitcham Common	Epping Forest *	Great Bookham Common**	Limpsfield Common**
Xylophagidae	3	0	1	0	1
Rhagionidae	15	3	4	5	4
Tabanidae	30	1	3	9	1
Xylomyiidae	3	1	2	0	0
Stratiomyidae	48	16	16	13	5
Acroceridae	3	2	3	2	0
Bombyliidae	9	1	1	1	0
Therevidae	14	2	1	1	0
Scenopinidae	2	0	0	0	0
Asilidae	29	8	10	8	5
Syrphidae	272	100	136	133	58
Conopidae	24	7	6	8	0
Totals	**451**	**141**	**183**	**180**	**74**

* List for Epping Forest *sensu stricto.*
** Includes species on database recorded subsequent to published account.

This table clearly shows the differences in overall species richness at the various sites and the relative proportions of the British fauna represented. Additional alterations to the subsequent tables could be computed, but in broad terms these would not substantially change the analysis. As I highlighted in my original note, the size of both the faunas at Epping Forest and Great Bookham Common reflects the nature of the geology of these sites, and the presence of more extensive wetland and especially the dead wood resources. The list for

Epping Forest used in my original note also included species from the broader Epping Forest area and as such included a number of additional species such as *Scenopinus fenestralis* and *Leopoldius signatus*, neither of which are listed for Epping Forest *sensu stricto* in Hanson (1992).

Acknowledgements

I thank Mr Hanson for forwarding the relevant information and for suggesting the scope for this revision, and Jeremy Dagley of the Corporation of London for forwarding a copy of John Ismay's unpublished report.

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Book review

British bats. John D. Altringham. New Naturalist 93, HarperCollins, London. 2003. 218 pp. Softback, £20.00, ISBN 0 00 220147 X; hardback, £35, ISBN 0 00 220140 2.

A welcome addition to this classic and long-established series of publications. It is written by a leading bat researcher in the UK and forms one of the best all-round texts to this declining taxon. I have heard criticisms from other people that the layout is old fashioned but that is surely one of the attractions of any New Naturalist book — I would have been disappointed if I had opened the cover and found a modern-style publication!

There is certainly nothing old fashioned about the content and it contains all the latest research results on topics from sound analysis and echolocation through to bat conservation. The latter receives a most welcome full chapter and you do not get the feeling, unlike many other books, that it has simply been added on for completeness. There are introductory sections on bat evolution, biology and ecology, followed by a lengthy chapter covering each individual species that accurately brings together what we know — or don't know — about each animal to form detailed accounts.

In summary, this book is to be thoroughly recommended to anyone with an interest in British mammals — it is an easy read but at the same time full of the latest information available.

CLIVE HERBERT

Spider records for 2003 for the counties of London and Middlesex, including the correction of a record for 2002

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Abstract

New and interesting spider records for the counties of London and Middlesex in 2003 are detailed. There were four new records for London and four new records for Middlesex, while one new record for London in 2002 has been rejected.

Introduction

In 2003, altogether 213 species were recorded in the two counties of London and Middlesex (compared with 218 in 2002), of which four were new to London and four were new to Middlesex. One new record reported from London in 2002, *Pseudeuophrys erratica*, has been found to be incorrect (Milner 2003).

During the year pitfall trapping has continued at Regent's Park, Greenwich Park, Blackheath and Hampstead Heath (London), at Harmondsworth Moor and at several sites near Heathrow Airport (Middlesex). Collecting trips have been made to a number of sites including forays for the Open Days at Bedfont Lakes Nature Reserve and Abney Park Cemetery, and another foray for the Friends of Greenwich Park. The Society's spider forays to Nunhead Cemetery in May and the Osterley Park area in December were also very successful although no spiders new to Britain were found this year!

A second site for the tube-web spider, *Atypus affinis* was found; at Vanbrugh Hollows (locally known as 'The Pits') situated at the north-eastern corner of Blackheath, several males were taken in pitfall traps, in May, October and November. The colony on Hampstead Heath also appears to be thriving and males were taken in a set of pitfall traps during 2003 in both November and December. There were fewer sightings of *Argiope bruennichi* this year but these did include two individuals on South Meadow and Pryors Field on Hampstead Heath, but no specimens on the Ladies' Swimming Pool Meadow.

In the list below those marked * are new to London and those marked ** new to Middlesex. All records are by the writer unless indicated. Trapped means pitfall-trapped unless otherwise stated. Nomenclature and the new order in the list of families are according to Merrett and Murphy (2000).

MIMETIDAE

(*Ero aphana***). A single subadult female *Ero* sp., probably *aphana*, was found in long grass at Osterley Park on the Society's spider foray in December. The specimen had four tubercles, but could have been *E. tuberculata*; Dr Peter Merrett's opinion was that it was probably *E. aphana*. Obviously adult specimens are sought. This spider has been taken previously only from the Hampshire/Dorset area and Chobham Common, so this would be an interesting extension of its known distribution but for now it cannot be accepted as a new county record.

LINYPHIIDAE

Erigone aletris. This new record for London was reported in 2002 from some roof gardens at Canary Wharf and Greenwich Reach (Milner 2003: 194). In 2003 several specimens of both sexes were taken in pitfall traps in grassland inside the deer enclosure in Greenwich Park.

Oedothorax apicatus. Altogether eleven specimens of both sexes of this scarce linyphiid were taken in pitfall traps and by sweeping undisturbed neutral grassland near the Heathrow Constructed Wetland adjacent to Heathrow Airport. The species was previously recorded for Middlesex but no specific localities were known.

*Mioxena blanda*** (Nationally Notable B). A single female of this rare winter-active linyphiid was trapped in grass at the Causeway Nature Reserve near Heathrow in October. It has been found by the author not far away at Richmond Park across the Thames, but this is the first record for Middlesex.

Lessertia dentichelis. The only known site for this pale linyphiid in London was Greenwich Marshes (now obliterated by the Dome and other developments) so the trapping of a single male at Leafyard Wood, Regent's Park in November was very satisfactory. However this is an unusual time for an adult male to be found.

*Porrhomma convexum**. The first records in London for this small spider were two adult males trapped in woodland at Abney Park Cemetery in May.

P. errans (Nationally Notable B). Previously only recorded in London from Buckingham Palace Garden, a single female was trapped in woodland at Abney Park Cemetery in June.

Agyneta conigera. Two males of this small linyphiid were trapped at Causeway Nature Reserve near Heathrow in May. This is only the second known locality in Middlesex; it was previously taken by D.R. Nellist at Pond Wood near Trent Park.

TETRAGNATHIDAE

*Pachygnatha listeri***. Two females of this woodland species were trapped in ancient woodland at French Grove Wood, Hillingdon, both in March.

LYCOSIDAE

*Arctosa leopardus***. A single female of this handsome spider was trapped in grassland at Harmondsworth Moor Nature Reserve in July.

HAHNIIDAE

*Hahnia pusilla***. A single male of this diminutive and uncommon spider was trapped in grass at Harmondsworth Moor Nature Reserve in June.

DICTYNIDAE

*Nigma puella** (Nationally Notable B). This is a beautiful green spider with a characteristic red mark in the centre of the abdomen. During a spider foray in Greenwich Park for the Friends of Greenwich Park on 17 May, a single female was beaten from bushes. This was particularly unusual as all previous records had been at or near the coast. Subsequently, on 1 June, two further females were beaten from bushes in Regent's Park on the slope above the Regent's Canal.

*Argenna subnigra**. There are several known sites for this diminutive grassland spider to the west of London in Hillingdon and around Heathrow Airport, but in May several specimens of both sexes were trapped in semi-natural acidic

grassland at Vanbrugh Hollows, Blackheath, London, a new county record. This, and the presence of other grassland specialists such as *Pelecopsis parallela* and *Ozyptila sanctuaria*, as well as *Atypus affinis*, suggests the existence of a relic grassland community around the old gravel pits.

CLUBIONIDAE

Clubiona pallidula. Both sexes of this fairly scarce clubionid were beaten from bushes at Abney Park Cemetery in May. The female was parasitized by an ichneumonid but unfortunately neither survived and so the identity of the ichneumonid was not possible to determine.

PHILODROMIDAE

Philodromus albidus (Nationally Notable B). Last year (Milner 2003: 192), it was reported that a single male had been found by Dr Richard Jones on the roof of Tower Hamlets Cemetery Visitor's Centre in September; this should have read a single female.

SALTICIDAE

*Marpissa muscosa** (Nationally Notable B). A single male specimen was taken in a pitfall trap under the pine trees at the Tumulus on Hampstead Heath; it is assumed that there is a colony living on the bark of these trees.

(*Pseudeuophrys erratica*). Re-examination of the specimens provided by Dr Richard Jones and reported last year (Milner 2003: 193) shows that they were not after all *Pseudeuophrys erratica* but *P. lanigera*, and not a new record for London.

Acknowledgements

I wish to thank Peter Merrett for identifying or confirming the identity of most of the species referred to. Thanks are also due to the London Borough of Hillingdon, Corporation of London, British Airways and British Airports Authority for supporting the spider surveys in areas within their spheres of influence.

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Book reviews

Studying invertebrates. C. Philip Wheater and Penny A. Cook. Naturalists' Handbooks 28. Richmond Publishing Co. Ltd. 2003. 120pp. paperback, £9.95. ISBN 0 85546 313 9.

This latest edition of the Naturalists' Handbooks differs from earlier volumes which specialized in a particular group of invertebrates, either a taxon, e.g. 'Dragonflies' or 'Bumblebees', or an ecologically related assemblage of species such as 'Insects on thistles' or 'Animals of sandy shores', in that it complements the earlier titles by providing an overview of techniques and methods of statistical analysis employed in ecological sampling.

After an introductory chapter on the aims of a survey, and setting up an experiment, the second chapter introduces us to the means of surveying invertebrates, including topics such as vegetation survey, environmental properties such as microclimate and substrate analysis as well as various sampling methods of the invertebrates themselves. This is followed by a basic chapter on identification which provides some sources to keys on the various taxa of marine, freshwater and terrestrial environments. Included in this section are four plates illustrating invertebrates which to me seem totally superfluous, giving such basic ID as butterfly, crab or hoverfly. They just don't serve any useful purpose other than providing a few pretty pictures of invertebrate diversity!

The remaining chapters cover a comprehensive review of describing data, statistical testing and finally presenting results using tables and graphs. Appendices covering statistics are provided as well as useful references to further reading and addresses.

As an aid to serious scientific study of invertebrates this book is a very useful tool and I am sure it will be much thumbed by M.Sc. and Ph.D. students as well as the serious amateur. It certainly took me back to my student days!

NEIL ANDERSON

Field guide to the moths of Great Britain and Ireland. Paul Waring and Martin Townsend. Illustrated by Richard Lewington. British Wildlife Publishing. 2003. 432 pp., paperback, £29.95, ISBN 0 9531399 2 1.

The third identification guide brought to us from British Wildlife Publishing following the highly acclaimed dragonflies (now in its third edition) and more recently butterflies (with a few day-flying moths included). There was much anticipation amongst both the general naturalist and the more specialist mothing communities about the publication of this volume. Did it match the hype?

The common denominator amongst all three BWP field guides is the services of Britain's pre-eminent insect illustrator, Richard Lewington. It is thus no surprise that the plates are a sheer joy to behold — they are both artistically exquisite and of the highest scientific accuracy — important when trying to identify that 'grey job' in the moth trap! For me the great advantage of this guide over Skinner's seminal guide to macro-moths is that all the species are depicted in their natural resting posture, which is a very useful feature, particularly for the less experienced moth-er. Though not replacing Skinner's classic, the two guides are in fact perfectly complementary. The Lewington plates often show several individuals for species exhibiting sexual dimorphism, races and polymorphic forms.

In the introduction we are given the basics to identification, anatomy, life-cycles, distinguishing moths from butterflies and other insects, as well as the importance of recording and conservation. Two and half pages are devoted to finding moths using such techniques as baiting and light-traps. The bulk of the text is dedicated to the species accounts of the families from the Hepialidae (swift moths) to the Noctuidae. For each species this account includes useful information on status, field characters and distinguishing them from similar species, flight season, life-cycle, larval foodplants and habitat. Interspersed amongst the text are numerous small photographs of larvae.

So was the hype justified? For this reviewer at least it has not only matched, but exceeded the anticipated delights. As an obsessive natural history book collector, this was for me the book of 2003; a joy to browse through and thoroughly practical in the field. If you only want one moth guide, it has to be this. Indispensable for any naturalist.

NEIL ANDERSON

London butterfly monitoring report for 2003

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Abstract

Butterflies were monitored by the use of transect walks at twenty-seven sites in London during 2003. Data from these transects were used in the calculation of collated indices.

Introduction

Changes in the abundance of butterflies in London in 2003 as compared with previous years are reported in this paper, primarily using data from sites where butterflies were monitored. London is defined for the purposes of this paper as Greater London or the area encompassed by the London boroughs, though additional records from the wider London Natural History Society (LNHS) recording area are noted.

Methods

Monitoring was undertaken by the transect walk method, a standard method adopted throughout the United Kingdom. Details of the method have not been repeated here as they are described elsewhere (see Pollard and Yates 1993, and Williams 2000 and the references cited there). At each site a walk was undertaken along the same route, each week, between April and September inclusive, within a standard range of weather conditions conducive to butterfly flight. Counts were made of the number of adult butterflies observed to provide a total for each species for the year at each transect. Totals used for this paper include calculated estimates for weeks missed due to poor weather or the unavailability of the recorders. However, for inclusion in the index, data needs to have been obtained by walking the transect with good coverage during the recording season, with the minimum of missed weeks. Collated indices were calculated from the data as described by Williams (2000), but see also Crawford (1991) for an introduction to the use of collated indices in wildlife monitoring; and also Pollard and Yates (1993) and Roy and Rothery (2002). Note that neither the original site counts nor the collated indices are absolute counts of the population, but indices of abundance. The indices are relative from year to year, not from species to species. Indices were collated from transects for which there was suitable data available for at least two years.

Twenty-seven of these transects were walked in London with sufficient coverage in 2003. Transects and the years for which they contributed data are listed below; the recorders are listed in the Acknowledgements, and the Borough in which the transect is located is given in parentheses: **Hampstead Heath** (Camden) 1978–2003; **Fryent Country Park** (Brent) 1986–2003; **Beane Hill** (Brent) 1988–2003; **Gutteridge Wood** (Hillingdon) 1990–2003; four transects managed by the Corporation of London (located in the London Borough of Croydon): **Coulsdon Common** 1990–2003, **Farthing Downs** 1990–2003, **Kenley Common** 1990–2003, **Riddlesdown** 1990–2003; **Clifford Road Allotments/New Barnet Allotments** (Barnet) 1994–1995, 1997–2003;

Mitcham Common 'route A' (Merton) 1994–2001, 2003; **Mitcham Common 'route B'** (Merton) 1995–2003; **Forty Hill** (Enfield) 1996–2002; **Wandsworth Common Woodland** (Wandsworth) 1996–2003; **Wildflowl and Wetlands Trust Wetland Centre at Barn Elms** (Richmond upon Thames) 1996–2003; **Railway Fields** (Haringey) 1997–2003; **Cranford Park** (Hounslow) 1997–2003; **Hutchinson's Bank Nature Reserve** (Croydon) 1997–2003; **South Norwood Country Park** (Croydon/Bromley) 1998–2003; **Trent Country Park** (Enfield) 1998–2003; **Tower Hamlets Cemetery Park** (Tower Hamlets) 1999–2003; **Abney Park Cemetery** (Hackney) 1999–2002; **Gunnersbury Triangle** (Hounslow) 1999–2003; **Roxborough Rough** (Harrow) 1999, 2001–2003; **Brent Reservoir** (Barnet/Brent) 2000–2003; **Elthorne Waterside** (Ealing) 2000–2003; **Featherbed Lane Verge/The Gallops** (Croydon) 2000–2003; **Hounslow Heath** (Hounslow) 2001–2002; **Cranebank** (Hounslow) 2001–2002; **Regent's Canal towpath from Mile End Road to Mare Street** (Tower Hamlets/Hackney) 2001–2003; **Highgate Cemetery** (Camden) 2002–2003; and **Minet Country Park** (Hillingdon) 2002–2003.

Limited transect data for 2003 was also received from Cranebank, Hounslow Heath, Donkey Wood, Riddlesdown Quarry and Happy Valley. Records from these transects and from casual records by LNHS observers have been included in the species accounts where appropriate. Records also contribute towards the county and national databases maintained by Butterfly Conservation.

Results

The species accounts below are based on the collated indices. Indices for 1993 to 2003 are presented in Table 1. The order and nomenclature follow Asher et al. 2001. Estimates of the relative changes in the populations of each species from year to year are given by the difference in the indices. For example, a species with an index of 50 in one year and 25 in the following year would have had approximately half the adult population in the second year as compared with the first year. Indices have been rounded to the nearest whole number and have usually been set at 100 in 1990 or the first year of record: for a technical discussion see Crawford (1991). Reliability of the indices increases with the number of transects: one transect was walked in 1978, two in 1986, three in 1988, eight in 1990, and 27 in 2003. Reliability of the indices may be lower for species with low counts. The 'Total count on transects' provides an indication of the size of the count from which the analysis was made in that year. In previous reports all, or virtually all, of the transects used in the index had been walked in that year, but in 2003 four of the index transects were not walked. The 'Total count on transects' below includes only those transects that were walked in 2003, including estimated counts for missing weeks. The computed estimated counts for transects that were not walked in 2003, have been excluded.

Small skipper *Thymelicus sylvestris* and Essex skipper *Thymelicus lineola*

Small and Essex skippers are generally counted together by transect walkers due to the difficulty of separating these species in flight. Small and / or Essex skippers were recorded on almost all of the transects and results from other observers confirmed that the species were widely distributed in London. Habitats include grasslands on acid, neutral and chalk soils. Wildlife areas in formal parks can support populations, as at Alexandra Park, where both species were present. The index suggested that the combined populations have been relatively stable since 1998, but lower than the average for the period 1988–1997. The highest transect count was at Mitcham Common route B. At eleven transects, attempts were made to identify a sample of the two species separately. Of a combined sample of 322, 59 per cent were small skippers and 41 per cent were Essex skippers. Proportions varied however; the sample at the Brent Reservoir was predominately of small skippers, whereas the sample at Minet Country Park was predominately of Essex skippers. Total count on transects: 2,040.

TABLE 1. Collated indices for butterfly species in London, 1993–2003. Indices have been rounded to the nearest whole number and have usually been set at 100 in 1990 or the first year of record, though indices may be set at 100 in other years or at a different figure where this aids interpretation. A blank indicates no transect records for that species in that year. A zero implies that that species was not observed on transects in that year. A question mark indicates that a species was present in that year, but that data for subsequent years and/or for more transect sites is required before the calculations can be completed. See the text for further information.

	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Small and Essex skippers	78	253	117	182	170	96	110	94	111	86	91
Large skipper	211	211	142	70	63	42	65	60	44	77	107
Dingy skipper	?	?	?	?	100	58	51	63	33	46	124
Grizzled skipper	?	?	?	?	100	25	63	27	16	47	43
Clouded yellow	0	0	0	100	0	111	0	2,272	0	63	105
Brimstone	118	74	125	107	97	86	85	134	102	101	90
Large white	83	115	136	46	140	272	128	135	115	182	124
Small white	73	121	253	114	322	169	99	146	132	168	187
Green-veined white	83	72	145	58	141	186	95	103	68	107	83
Orange tip	87	36	72	36	78	62	48	75	63	74	41
Green hairstreak	100	0	91	45	81	40	20	18	72	48	84
Purple hairstreak	200	147	206	124	340	553	490	477	331	507	326
White-letter hairstreak	50	0	40	115	78	35	20	19	41	24	29
Small copper	10	42	65	65	69	58	34	19	5	3	52
Small blue		?	?	?	100	225	175	188	338	0	38
Brown argus	18	61	98	79	99	11	12	20	6	7	47
Common blue	24	91	145	60	79	40	74	61	37	37	125
Chalkhill blue	12	91	109	109	288	75	180	90	80	41	41
Holly blue	4	4	84	98	20	65	39	45	53	41	45
White admiral						100	0	0	0	0	0
Red admiral	93	124	316	221	109	147	138	282	206	221	450
Painted lady	0	8	11	747	12	8	12	70	9	85	429
Small tortoiseshell	474	181	298	115	291	176	144	68	35	20	65
Peacock	1,124	484	568	787	780	1,108	1,100	1,488	1,061	632	397
Comma	107	107	143	105	126	131	121	212	158	139	214
Dark green fritillary					100	148	181	63	7	11	85
Silver-washed fritillary							100	300	100	0	0
Speckled wood	171	227	152	74	126	148	168	182	153	212	238
Wall brown	3	2	1	0	0	0	0	0	0	0	0
Marbled white				?	100	61	54	39	14	18	39
Gatekeeper	79	86	122	146	150	118	177	196	172	163	209
Meadow brown	54	91	105	136	116	164	153	150	96	70	145
Ringlet	180	310	194	64	211	279	332	454	229	278	373
Small heath	9	5	6	21	28	21	4	2	1	1	12

LARGE SKIPPER *Ochlodes venata*

Large skippers prefer grassland habitat with a higher proportion of shrubs than small and Essex skippers. Widely distributed in London including at suitable sites in urban areas, the large skipper was present on most of the transects. Of the transects in London, that at Wandsworth Common reported the highest count. The London index was the highest since that of 1995 but below the peak years since transect monitoring for butterflies commenced in London in 1978. Total count on transects: 867.

DINGY SKIPPER *Erynnis tages*

The dingy skipper was present at two of the chalk grassland sites in south London. All but one of the butterflies recorded were from Hutchinson's Bank Nature Reserve where the count was the highest since transect monitoring commenced there in 1997. Total count on transects: 100.

GRIZZLED SKIPPER *Pyrgus malvae*

The grizzled skipper has a distribution in London restricted to chalk downland on the southern edge of the area where it was recorded at two transect sites. Total count on transects: 11.

CLOUDED YELLOW *Colias croceus*

The clouded yellow was recorded in low numbers at three transects (Mitcham Common route B, London Wetland Centre and Gunnersbury Triangle). There were a number of other observations, usually of singletons, and though widely dispersed, there was a predominance of records from wetland locations. London records were from Walthamstow Reservoirs, Trent Park, Park Farm at Enfield and Riddlesdown Quarry, while records from the wider LNHS recording area included Walton Reservoir, Swanscombe Marshes, Greenhithe where eight were observed on 24 August 2003, and Molesey Gravel Pits. Records covered the period from late July with the majority of records in August, a male nectaring on Michaelmas daisies *Aster* spp. on 9 October 2003 and a female observed on 30 October 2003. Total count on transects: 5.

BRIMSTONE *Gonepteryx rhamni*

Recorded on most of the transects, the brimstone was widely distributed throughout London. Though the highest transect count was at Hutchinson's Bank, a chalk downland site on the southern edge of London, the second highest transect count was from Tower Hamlets Cemetery Park. Other observations include records from Alexandra Palace on 27 January 2003 and 26 February 2003, Kensington Gardens and St James's Park on 17 March 2003, a range of locations in late March through to early May, and then on 19 July and 2 August 2003. Total count on transects: 417.

LARGE WHITE *Pieris brassicae*

The large white was widely distributed in London and recorded on all the transects except that at the Regent's Canal in the vicinity of Mile End. However, the highest count was at the nearby Tower Hamlets Cemetery Park. The index was lower than in 2002. Total count on transects: 784.

SMALL WHITE *Pieris rapae*

Recorded at all of the transect sites, the small white occurred in larger numbers at urban rather than green-belt sites. Total count on transects: 2,071.

GREEN-VEINED WHITE *Pieris napi*

Green-veined whites were widely distributed throughout London and recorded at almost all transect sites. The index was lower than in 2002. Total count on transects: 1,540.

ORANGE TIP *Anthocharis cardamines*

Orange tips have a preference for damp habitats, and were recorded at most transects sites. There was a reduction in the index compared with that of the years 2000–2002. Total count on transects: 209.

GREEN HAIRSTREAK *Callophrys rubi*

In 2003, green hairstreaks were recorded at four transects, all at sites on chalk soils except for a singleton at Mitcham Common route B. Total count on transects: 14.

PURPLE HAIRSTREAK *Neozephyrus quercus*

Purple hairstreaks generally fly in the evening and therefore were probably more frequent than suggested by the daytime transects. There were records from ten transects, though fourteen of the total count were from the transect at the Brent Reservoir. Records were also received from Covert Way in Enfield, Cannon Hill Common, Wimbledon Common and Cranebank. Total count on transects: 33.

WHITE-LETTER HAIRSTREAK *Satyrium w-album*

Though not recorded on the transect at Trent Park in 2003, the white-letter hairstreak appeared to be well established in the Trent Park area with records from 16 June 2003 when it was seen on wych elm *Ulmus glabra*, until 26 July 2003. The species was recorded at two transect sites, Coulsdon Common and Mitcham Common route A. David Bevan reported a population at Alexandra Park. White-letter hairstreaks are possibly widely distributed at suitable sites in London but in low numbers, as the species has now been recorded from approximately a third of the transects. Total count on transects: 3.

SMALL COPPER *Lycaena phlaeas*

A partial recovery of the small copper was evident in 2003, particularly noted for the second generation in the late summer. Though the index was the highest since 1998, small coppers were recorded from only eighteen of the twenty-seven transects. At half of the eighteen transects the count was less than five, though there were off-transect records at some transect sites. The index was dominated by counts from Trent Park (270) and Farthing Downs (64). The flight periods were chronicled by Robert Callf in the Enfield area and ranged from the first on 5 May, rising to a peak on 13 September, and with the last record on 24 October 2003. In London, the population of small coppers appears to be susceptible to weather-related factors and to the loss of suitable semi-natural grassland habitats, though adults may travel some distance for nectaring (Asher et al. 2001). Total count on transects: 462.

SMALL BLUE *Cupido minimus*

Three small blues recorded on the transect at Hutchinson's Bank Nature Reserve represented an increase on the nil count of 2002, but numbers remain low compared with the average of the years since recording commenced there in 1997. One was also observed at Riddlesdown Quarry. Total count on transects: 3.

BROWN ARGUS *Aricia agestis*

The index was the highest since 1997. The brown argus was recorded on five transects, primarily on chalk sites on the southern edge of London, though two were recorded at Trent Country Park and others away from that transect. The brown argus was also observed at Riddlesdown Quarry, Cranebank, and at South Lodge Farm at Enfield from 2 August to 3 October 2003. Steve Spooner reported a singleton at Walton Reservoir (TQ122685) within the wider LNHS area on 2 August 2003. Total count on transects: 38.

COMMON BLUE *Polyommatus icarus*

The index was the highest since 1995 (Figure 1). The common blue was widely distributed throughout London in low numbers, but generally with higher counts from transects on chalk grassland. Given suitable habitat, large populations establish at green spaces in urban London, for example at Tower Hamlets Cemetery Park. Total count on transects: 1,482.

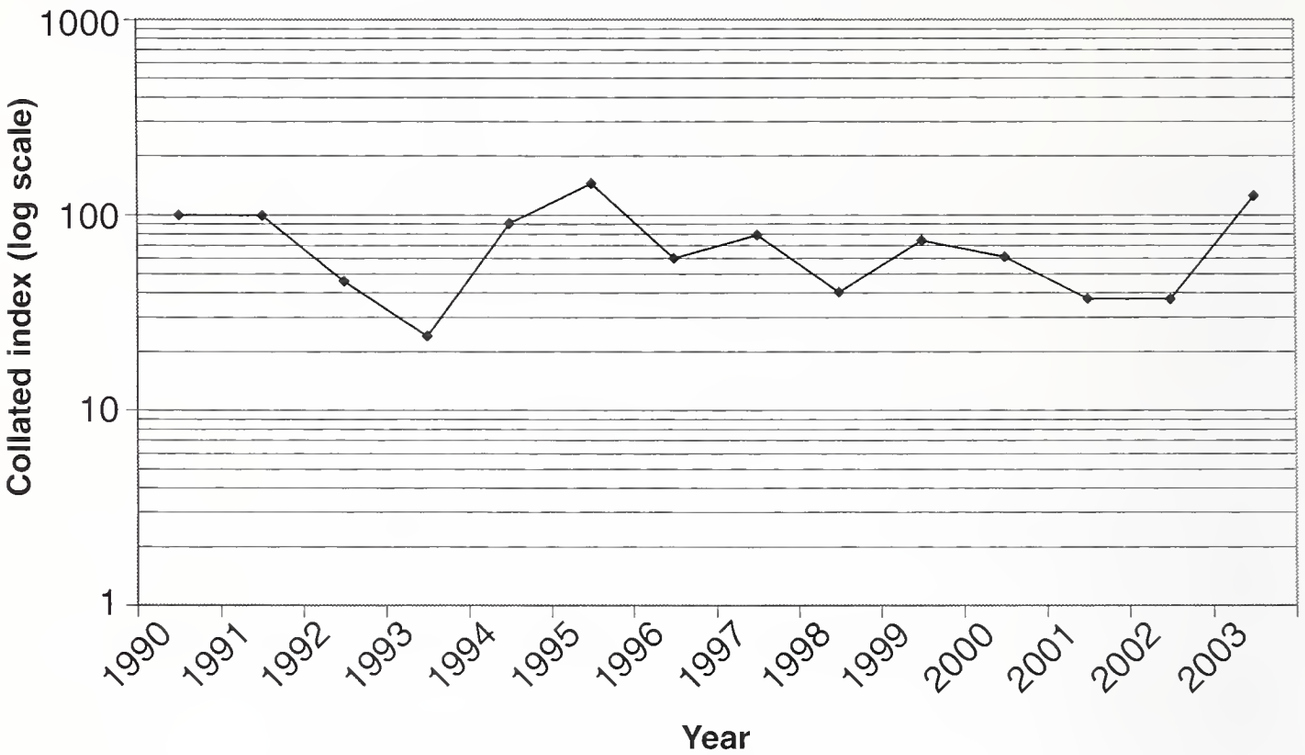

FIGURE 1. **Common blue**: collated indices for London for the years 1990–2003.

CHALKHILL BLUE *Polyommatus coridon*

In London, the chalkhill blue was recorded from one transect site on chalk downland (Riddlesdown) and with the same count as in 2002, which was low compared with the average for the years since 1990. Total count on transects: 28.

HOLLY BLUE *Celastrina argiolus*

In London the holly blue was more common at green spaces in urban areas than at sites in outer London. Of the transect sites, the highest count was again at Tower Hamlets Cemetery Park. Total count on transects: 367.

WHITE ADMIRAL *Limenitis camilla*

A white admiral was reported at Stanmore Common, Harrow (TQ1593) on 25 June 2003 by John Dobson and others; and another was recorded on 14 July 2003 by Gay Carr at Wimbledon Common where the butterfly was observed on brambles under oak trees to the north of The Windmill. In the wider LNHS recording area, Diane Andrews reported two white admirals at Broxbourne Wood on 9 July 2003, (see Murray and Wood 2003 for information of the distribution of this species in Hertfordshire). Total count on transects: 0.

RED ADMIRAL *Vanessa atalanta*

The red admiral was recorded on all transects in 2003 and there were other records throughout London. The index was the highest since 1988; and appeared also to be at the highest since transect monitoring commenced in London in 1978. Records of red admirals were received from 24 January 2003 at Alexandra Palace to 15 November 2003 at Trent Park. Total count on transects: 410.

PAINTED LADY *Vanessa cardui*

The index for the painted lady was the highest since 1996, though at slightly over half that of 1996. Recorded at all of the transect sites, the highest counts were from the London Wetland Centre and the Brent Reservoir. The last record at the Brent Reservoir was on 5 October 2003. The species was widely distributed in gardens and throughout London. Total count on transects: 347.

SMALL TORTOISESHELL *Aglais urticae*

There was a modest recovery of the small tortoiseshell in 2003 following a reduction in numbers for five consecutive years. Numbers were approximately treble that of 2002 and the small tortoiseshell was recorded on all but two of the transects. Total count on transects: 308.

PEACOCK *Inachis io*

The index for the Peacock was the lowest since 1991 though the species remained widely distributed. Total count on transects: 460.

COMMA *Polygonia c-album*

Commas were widespread in London and recorded on all but one of the transects. The index was similar to that of 2000 and the highest since 1992. A comma was also recorded at Alexandra Palace on 24 February 2003. Total count on transects: 676.

DARK GREEN FRITILLARY *Argynnis aglaja*

Recorded from one transect site on the southern edge of London, with an increased count following two years of low counts. Total count on transects: 23.

SPECKLED WOOD *Pararge aegeria*

The index for this widespread species was slightly higher than in 1994, the year of the previous highest index since the monitoring of butterflies on transects commenced in London in 1978. In the early 1980s the speckled wood was relatively uncommon in the urban areas of central, northern and eastern London, though Plant (1987) suggested that the species was colonizing urban London from the countryside south of London. In 2003 the highest counts were from urban woodland sites such as Wandsworth Common and Tower Hamlets Cemetery Park. Total count on transects: 4,411.

MARBLED WHITE *Melanargia galathea*

Recorded from seven transects in 2003, the marbled white in London is primarily a butterfly of chalk downland as at Hutchinson's Bank Nature Reserve and Featherbed Lane Roadside Verge. However, the third highest transect count was from the Brent Reservoir where the population continued to increase. The other transects on which marbled whites were recorded were at Mitcham Common route B, Riddlesdown, Gutteridge Wood and Cranford Park. Records were also received from Riddlesdown Quarry and Trent Park. The index was approximately double that of 2002. Total count on transects: 383.

GATEKEEPER *Pyronia tithonus*

No longer is there the circum-London distribution as evident from the map in Plant (1987). In 2003 the gatekeeper was distributed throughout London including the green belt, suburban and urban areas. For example, one was observed by Torben Larsen in Coldharbour Lane opposite Lambeth Town Hall,

a location that would have been unexpected in the 1980s. Colonies of the gatekeeper have established throughout London where there is suitable habitat particularly of semi-natural grasslands and shrubs. Many of the transects are located at green space sites in London, and hence there were established populations of the gatekeeper at most transect sites. Total count on transects: 2,858.

MEADOW BROWN *Maniola jurtina*

Recorded on all the transects, the meadow brown would appear to be London's most common butterfly. Primarily a species of semi-natural grasslands, colonies establish wherever there is suitable grassland or meadow habitats. The index doubled from that of 2002. Populations recovered at Fryent Country Park following two years of relatively low counts, and there was also a large increase at Trent Country Park. Total count on transects: 11,663.

RINGLET *Aphantopus hyperantus*

In London the ringlet is primarily a butterfly of the chalk downland sites at the southern edge of London. As in 2002, ringlets were also recorded at Trent Country Park, South Norwood Country Park and Mitcham Common route B, suggesting established populations. In 2003, a singleton was recorded from Tower Hamlets Cemetery Park. The index was higher than in 2002. A ringlet was recorded at Alexandra Palace. Total count on transects: 1,434.

SMALL HEATH *Coenonympha pamphilus*

A recovery was evident in 2003 from the low numbers of recent years. However, though the index was the highest since 1998, it was still relatively low compared with the average of the years since 1978. Small heaths were recorded at eight of the transect sites in London, though the count was dominated by that from Trent Country Park which accounted for approximately nine-tenths of the total. The second highest count was from Cranford Park. Andrew Self reported that at the Brent Reservoir the 2003 records of the small heath were the first since 1997. Observations were also made of the small heath at sites elsewhere in London. Much remains to be learned about the ecology and requirements of the small heath (Asher et al. 2001), and the data suggests that the population variations in London reflect in some respects the national situation. While the increase in 2003 compared with 2002 was possibly related to weather conditions, the longer-term pattern in London since the late 1980s / early 1990s has been one of population decline, possibly as a result of habitat loss. Independently of the transect at Trent Park, the flight period was chronicled by Robert Callf with the first three recorded on 5 May 2003, rising to a peak on 4 August and the last three on 25 September 2003. Total count on transects: 1,117.

For details of species that were recorded beyond Greater London but within the wider LNHS recording area, reference should be made to the respective county reports produced by Butterfly Conservation and other organizations. The following 2003 records were received of species recorded in the wider LNHS recording area but not from within Greater London:

SILVER-WASHED FRITILLARY *Argynnis paphia*, recorded from just beyond the Greater London area by Neil Anderson near to Cheshunt Station TL370017 on 14 June 2003.

WALL BROWN *Lasiommata megera*, recorded at East Tilbury on 2 August 2003 (LNHS *Newsletter* **180**: 17).

Discussion

Though the transects of the London index are located throughout London including the green belt, suburban and urban areas, most of the transects are sited within green spaces. The Regent's Canal Towpath transect in the vicinity of Mile End and Victoria Park provides a useful contrast in recording the butterfly fauna of an urban open space. In the few years that the transect has been walked by Donald Rooum, relatively few species and low numbers of butterflies have been recorded compared with other transect sites. Indeed, in 2003 it was 29 June before a butterfly was observed on that transect. Yet, nearby at Tower Hamlets Cemetery Park, many butterflies were observed as early as 27 April 2003. The monitoring of butterflies on such contrasting sites is valuable in highlighting the potential for improving the wildlife of urban areas in London.

The purple emperor *Apatura iris* in Hertfordshire was the subject of a study by Goodyear and Middleton (2003) that covered the historical records, current status and conservation requirements. The purple emperor prefers woodlands in close proximity and within a landscape of other woodlands. Many of the Hertfordshire populations are located in large broadleaved woodlands or clusters of small woodlands in the south of the county on the borders with the north of Middlesex and London. The authors emphasize the need for managing the woodlands to maintain the larval food plants of the species: sallows of *Salix caprea, Salix cinerea* and their hybrids. As sallows are seldom grown for their timber, the trees need to be positively encouraged during management work in woodlands, and for example in woodland glades and rides.

Acknowledgements

In 2003 the transect walkers were Aaron Beat and Bob Gillam at Hampstead Heath, Michael Berthoud, Simon Mercer and Leslie Williams at Fryent Country Park and Beane Hill, and Ann Rix at Gutteridge Wood; at the Corporation of London sites on the southern edge of London (Coulsdon, Farthing Downs, Kenley Common, and Riddlesdown) the team comprised Mike Enfield and colleagues; Diane Furley and Lorna Arnold at New Barnet Allotments, Martin Boyle at Mitcham Common (and in 2002: correction to 2002 report), Ian R. Cunningham at Wandsworth Common Woodland, R.J. Bullock at WWT Wetland Centre at Barn Elms, David Bevan at Railway Fields, John Grayley at Cranford Park, Martin Wills at Hutchinson's Bank Nature Reserve, Malcolm Bridge at South Norwood Country Park, John Whiteman and Robert Callf at Trent Country Park, T. Lyle at Tower Hamlets Cemetery Park, David Rear, Caroline Servaes and Brian Prior at Gunnersbury Triangle, Paul Jeffery at Roxborough Rough, Andrew Self and Roy Beddard at Brent Reservoir, John Whiteman and Richard Kane at Elthorne Waterside, Joan Lowe at Featherbed Lane Verge/The Gallops, C. Slack at Cranebank, Hounslow Heath and Donkey Wood, Donald Rooum at Regent's Canal towpath, Colleen Milligan and K. Madaniah at Highgate Cemetery, and Colin Conroy at Minet Country Park. Records were also received from some of the transect walkers listed above and from Diane Andrews, R.M. Callf, Gay Carr, Tom Clarke, John Dobson and others, Mrs G.E. Flynn, Liz Forbes, Marie Gill, Stephen Harris, Ron Kettle, Torben Larsen, Catherine Schmitt, Paul Sellers, Steve J. Spooner, N.D. Willits, and from London Natural History Society field meetings / LNHS *Newsletter*, and the Butterfly Conservation Hertfordshire and Middlesex Branch *Newsletter*. Landowners and land managers of the sites have an important role in undertaking habitat management and supporting monitoring. These include a significant number of the London boroughs (see the Methods), the Corporation of London, other public authorities, the London Wildlife Trust, the Mitcham Common Conservators, the Friends of Tower Hamlets Cemetery Park, Abney Park Cemetery Trust, Barn Hill Conservation Group and the Welsh Harp Conservation Group. The co-operation with the county co-ordinators for Butterfly Conservation is noted, particularly Mike Enfield (Surrey), and John Murray and Andrew Wood (Hertfordshire and Middlesex), and also Emily Funnell, Regional Officer for Butterfly Conservation. Dr Dave Dawson advised on the statistical method for the collations and the programming of the spreadsheets. Simon Mercer helped develop the series of linked spreadsheets. I would also like to thank Colin Plant, the Greater London Authority, the Millennium Awards, British Trust for Conservation Volunteers, and Caroline Williams.

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Book reviews

Close-up. Chris Jones & Alex Ball. Natural History Museum, London. 2004. 64 pp., small format, colour throughout. Hardback, £5.95. ISBN 0 565 09172 7.

Wildife Garden at the Natural History Museum. Roy Vickery. Natural History Museum, London. 2004. 64 pp., small format, colour throughout. Hardback, £5.95. ISBN 0 565 09185 9.

Here are two further publications in the Natural History Museum's series bringing to the public's attention various aspects of the Museum's work. The series, aimed at the general readership, portrays the topics in a clear and delightful way and the authors are all specialists in their fields.

Close-ups is full of outstanding photographic images created using scanning electron microscopy. Animals and plants (some microscopic) and minerals are dramatically portrayed to show intriguing details of the sculpture of eyes, mouthparts and feeding organs, scales, claws, pollen grains, egg cuticle, crystals, and much more.

The Museum's ***Wildlife Garden*** in its present form will already be familiar to readers of this journal through the three in-depth reviews of its transformation and its present fauna and flora. Here we have a pictorial guide to its development and habitats to the present. Close-ups of a selection of the garden's flora and fauna through the seasons bring the text to life. The garden is an inspiration for anyone who wants to create a space for wild plants and animals. In season it is buzzing with insects, packed with plants and home to birds, mammals and amphibians. It is enjoyed by young and old and is valuable from serious monitoring of its flora and fauna to teaching at all levels, especially London children.

K. H. HYATT

Survey of Bookham Common

SIXTY-SECOND YEAR

Progress Report for 2003

General (Ian Menzies, Chairman, Bookham Common Survey)

Apart from a snowfall followed by heavy frost, which reduced attendance on 11 January to a single botanist, the weather during 2003 has favoured the Survey. In fact we experienced one of the hottest periods on record between August and October, sufficient to completely dry out the Lower Eastern Pond which last happened in September 1995 towards the end of several years of low rainfall. Field meetings have continued to be well attended, usually between eight and fifteen members appearing to follow their various interests on the 'Bookham Saturdays'. Towards the end of the summer we welcomed Alison Fure to take up the study of small mammals which has lapsed for many years at Bookham. Alison has already prepared an account of trapping by her team using a hundred Longworth traps in Hundred Pound Wood during August, which is given below together with the reports of botanical, ornithological and invertebrate studies for 2003.

Rather disturbing news came during the summer that The National Trust wished to have the LNHS Survey hut moved as part of an exercise to tidy up the area adjacent to Merritt's Cottage. However, this offered an opportunity to solve the long-standing problem of overcrowding by replacing the present hut (16 × 8 ft) with a somewhat larger hut (18 × 10 ft). After recommendation by the A & F Committee this proposal was passed by the LNHS Council, with the suggestion that it should be financed by subscriptions raised in commemoration of the late Ruth Day. Ruth contributed excellent studies of Odonata at Bookham (Day 1987, 1988–1994, 1996), and her unexpected death in 2002 has been a sad loss to the Society. The new hut, which is to be named in memory of Ruth, is to be installed early in 2004.

Exchange of information between The National Trust and LNHS Bookham Survey team has suffered since management became centralized at Landbarn Farm, Westcott, some nine road miles from Bookham, and it was decided to see whether organization of regular field meetings between the two groups might help to close this gap. The first of these, held on 21 October 2003, was attended by John Cranham and Ian Swinney (Head Regional and Bookham Common National Trust Wardens), together with three of the LNHS Survey Team — Ken Page, Alan Prowse and Ian Menzies (representing botany, ornithology and invertebrates respectively). During the morning the party made a wide circuit of Bookham Common, and many matters were discussed. The meeting was thought to be an excellent way of exchanging detailed up-to-date information of importance to management, and especially of avoiding the delay that often (or perhaps usually) blights more formal channels of recording and communication. It was decided to arrange another such

meeting in the spring of 2004 to exchange ideas before the next summer management programme starts.

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Vegetation — snowdrops and snowflakes (Ken Page)

Galanthus nivalis snowdrop and *Leucojum aestivum* snowflake are closely related. The most obvious botanical difference is that *Galanthus* has three inner perianth segments smaller than the outer three, whereas *Leucojum* has all segments the same size. When seen in the field the differences are plainly apparent.

Snowdrops have been present on the Common during the three surveys of the past fifty years. The major site is in Division Q where the plants have increased dramatically in the half century. Unfortunately the population in this area was not recorded during the third survey, but it has been seen since in quantity. It is also known in Divisions D, M and P.

Despite its abundance in the British Isles (millions of bulbs) it is not considered to be a native plant. It is invariably found near human habitation, which is apparently quite different from its native environment. Its native range extends from the Pyrenees in the west to the Ukraine in the east, encompassing most of southern Europe and European Turkey but extending north only as far as Paris.

Galanthus plicatus pleated snowdrop was recently found in Division D on the edge of the road leading to Hillhouse Farm. This more robust and larger-flowered snowdrop has its leaves folded in bud. This folding becomes apparent when the leaves develop, with their edges turned down and under: they are also distinctly keeled.

Our plants are subspecies *plicatus* which have green markings only at the apex of the inner segments, found principally in the area west of the Black Sea. Its near relative ssp. *byzantinus* has green markings both at base and apex of the inner segments and hails from Turkey.

Snowflakes were first seen in Division Q alongside the roadway to Manor Cottage, perhaps deliberately planted rather than discarded. This was during the second survey begun in 1977. During the third survey a fine clump was seen in woodland in Division C, in an area less frequently visited. We regarded this as a good find as it had clearly been established for many years. Also during this survey a site was discovered in Division S, next to our only location for *Allium ursinum* ramsons.

There are two subspecies: *Leucojum aestivum* ssp. *aestivum* which is a rare native of southern England and *L. a.* ssp. *pulchellum* from the western Mediterranean. Both have two membranous wings on the flowering stems, which in ssp. *aestivum* are minutely and obscurely denticulate. In ssp. *pulchellum* the wings are smooth (a lens is required to observe the toothing). All our plants are the introduced ssp. *pulchellum*.

An inexpensive instrument to measure tree heights by triangulation (Bryan Radcliffe)

There is no record of *Sorbus torminalis* wild service tree occurring as a native on Bookham Common, although it is present in adjacent woodlands. Nigel Davies, the former National Trust Warden, decided, in 1977, to introduce a

small locally obtained sapling to the Common. In response we were pleased to take the opportunity of monitoring its progress over a period of years. The tree now appears to have achieved its maximum height consistent with the particular environmental conditions locally, and we plan next year to submit a brief account of its development in this period.

Initially, while the tree was small with a clearly defined apex, there was no difficulty in measuring its height with the aid of a carpenter's simple angle tool. However, as the tree gained height (and equally relevant, spread) we were obliged to make observations at greater distances in order to see the top. The consequence of this was that angular measurement became increasingly critical, and the simple tool proved to be unsatisfactory.

Sophisticated equipment such as a theodolite is employed to measure angles with precision, but obtaining accuracy to within a few minutes of arc (60 minutes to the degree) calls for telescopic sights, micrometer scales, and unavoidable tight manufacturing tolerances as well as a support tripod. The full set-up is very expensive. We did not consider such expense could be justified so an alternative answer was sought.

It was concluded that instead of attempting to read the angle directly, a viable solution might be to generate an equivalent triangle and thereafter derive the angle by calculation. If a triangle could be produced with its shortest side no smaller than one hundred millimetres then a acceptable degree of accuracy would be possible. Reading of dimensions would be facilitated by the provision of cm/mm scales on the mating edges of the triangle. Almost invariably the triangle would be of scalene form, but this would be no problem with the aid of simple trigonometry.

One of the standard equations for the solution of triangles can be stated as:

$$\text{Cosine A} = \frac{b^2 + c^2. - a^2}{2bc}$$

where a,b and c are the lengths of the three sides and A is the included angle between sides b and c.

The required parameter for height calculation is actually the tangent of A. Having obtained cosine A by the foregoing equation it is a simple matter to back-read a cosine table to obtain angle A and then read off tangent A in a tangent table. Alternatively, a cosine/tangent conversion table can be used, with a slight diminution in accuracy.

Assuming tree and observer are on level ground the height of the tree is obtained by multiplying observer distance by tangent A and adding observer eye height. In the event of the ground not being level then two sightings are required and the calculation differs slightly, but remains simple. A useful spin-off is that the mean slope of the ground is immediately available if of interest.

The instrument we made (Figure 1) consisted essentially of three inexpensive items:

1. A base unit comprising a 60-cm spirit level, with centrally located bubble tube and cm/mm graduated scale (as widely available). A hole was drilled at one end and another beyond the bubble tube.
2. A rigid sighting bar of similar length and with holes in similar positions. A cm/mm scale was glued to one face (we actually used a piece of a domestic tape measure).
3. A section of a clear plastic ruler with a hole drilled at one end and an extended blind slot cut out at the other.

To form the assembly, the ends of base unit and sighting bar were connected by a small bolt and locknuts. The hole in the ruler and the second hole in the sighting bar were similarly connected. Both joints were tightened sufficiently to

allow angular rotation only. A bolt through the second hole in the base and the ruler slot completed the triangular form and this joint was provided with a wingnut. To allow for accuracy in reading the items were oriented to maintain sliding contact with each other.

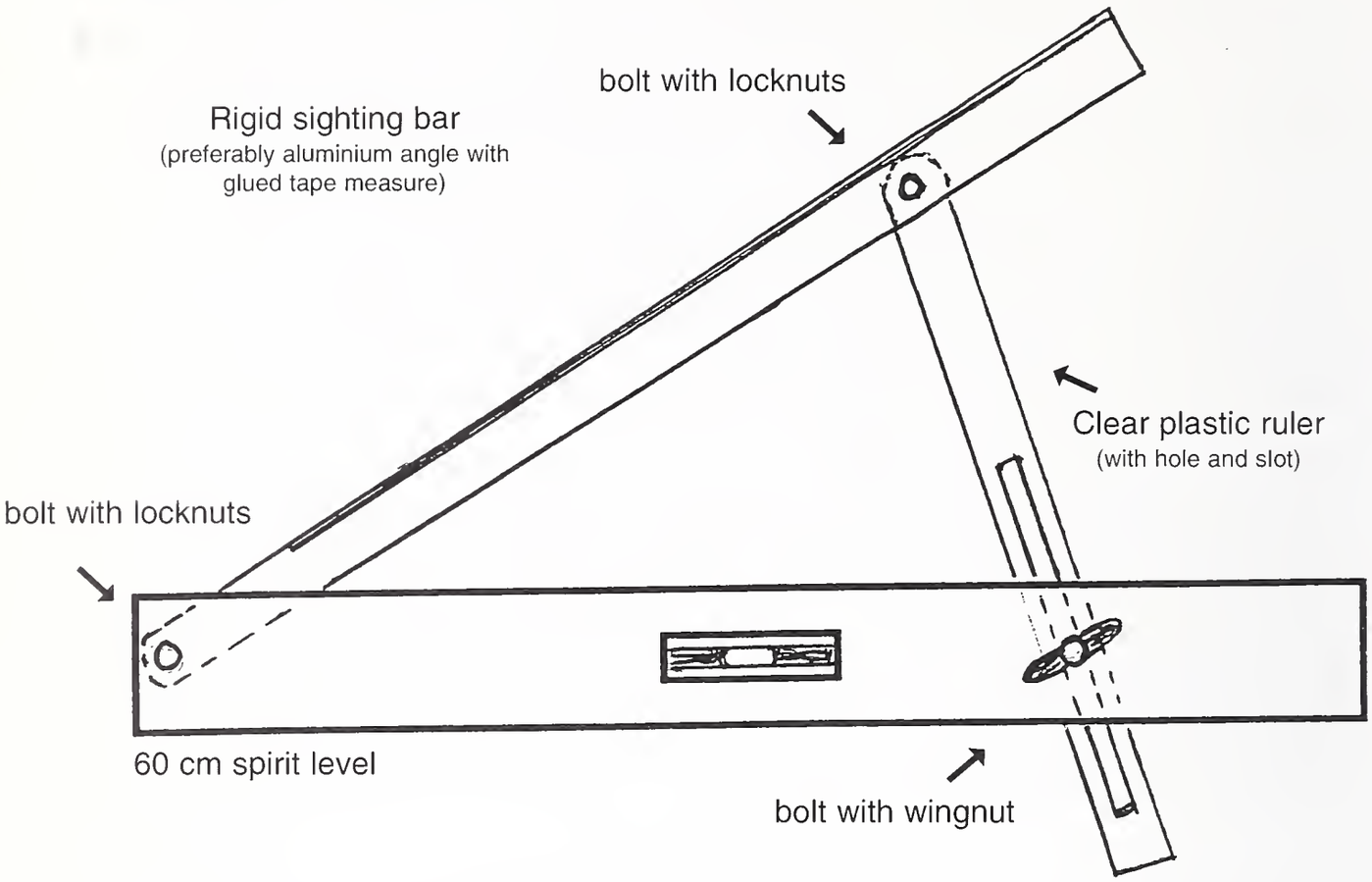

FIGURE 1. An inexpensive instrument to measure tree heights by triangulation.

Slackening of the wingnut allowed the sighting bar to be raised or lowered as desired and all dimensions of the triangle adjusted automatically in response. The system could be securely locked in position by tightening the wingnut.

As originally constructed the instrument required two operators — one to align the sighting bar on the tree — the other to ensure that the base remained level. A later refinement was to mount a small mirror close to the bubble tube, angled backwards at 45 degrees, allowing a single operator to perform both tasks simultaneously.

The scope of the instrument would not of course be confined to measuring trees. It would function equally well in measuring total or partial heights of other structures or depths of quarries. Additionally, it could provide mean gradients on sloping ground. Using other equations it could measure the size of a pond, and even determine the size of an inaccessible structure or tree providing the base and apex were visible.

We would not claim that our unit would equal the precision of a theodolite. However, it would compare favourably with many instruments measuring angle directly. It is instructive to compare errors of equal probability. An error of 1 mm in dimension 'a' of our triangle and 1° in the angle instrument are considered to be in this category. Calculation shows that our unit would be in error by +/– 1 per cent while the angle instrument error would be considerably greater, at +/– 4.2 per cent.

If any reader feels inclined to make an instrument like ours the writer would be happy to supply full details and relevant tips to facilitate construction. The unit is kept in the Bookham hut where it can be examined at leisure any 'Bookham Saturday'. It is light in weight and easily portable. As indicated, the cost would be very modest involving little more than that of the spirit level.

Birds (Alan Prowse)

Weather. There was a benign start to 2003, but there were severe night frosts in April, and again in May. June favoured second broods, but the unusual heat and dryness of July and August would have affected the survival of later chicks. The demography unit of the British Trust for Ornithology reports that breeding results for the 2003 in the UK were much below the long-term average, on the results of constant effort ringing (*BTO News* **251**). After the hot summer came a dry and fairly mild autumn and early winter.

The year. Winter thrushes were still finding plentiful food in the new year with seventy-two redwings on 1 January. A kingfisher was recorded on 22 January. A new bird for the Common was a red kite on 25 February (ADP, DWo), with grey wagtail and five snipe the same day. Larger gulls usually are birds flying over, but this year three lesser black-backed gulls were recorded on the Common on 13 January, with another on 14 April with a herring gull. The first displaying common buzzards were on 20 March, when three tufted ducks were on Eastern Hollow Pond, and ten snipe, the maximum for the year, were on Bayfield Plain. Reports of a possible goshawk on 2 April, and another on 18 October, were not followed by written accounts. The first cuckoo on 4 April was followed by two grey wagtails on 7 April. A willow tit was singing on Western Plain on 17 April (ADP), and the same bird was heard and seen on 22 April, when it was again singing on Western Plain, wandering over a large area and then into a nearby wood. Presumably this was a bird failing to find a mate and it was not seen subsequently. A non-avian was a weasel in SE Wood on 24 April.

Among other migrants was a sedge warbler singing on Bayfield Plain on 26 April (CP). A reed warbler on Western Plain on 28 May (DWs) was the first for many years (I cannot trace a previous record). David Wills on 28 May also had the only spotted flycatcher for some years, the only hobby for the year, and two of the scarce records of turtle dove — a good day out!

Another new species for the Common was a very confiding juvenile greenshank at the almost empty IoW Pond from 3 to 5 September (AP, GP, ADP). The long hot summer produced abundant fruit in the shrubs. There were twenty-four fieldfares on 30 October, and thirty on 31 December with many redwings on each occasion. A large cleared area on Central Plain attracted goldfinches, greenfinches and chaffinches in the early winter. Bullfinches were seen quite commonly with the largest flock of seven on 30 October. On 31 December the year was rounded off by hawfinches on Central Plain — a single bird, then two, then three, perhaps the same three in different combinations. This is one of the very few sites in Surrey where the species is now recorded.

Starlings are now scarce at all times on the Common. In 1995 large flocks of adults and juveniles came to the wood for the hatch of moth caterpillars in mid to late May, with hundreds of jackdaws, carrion crows, and occasional rooks. The starling numbers then were estimated by me at about 2,000. The starlings at this grubfeast shrank rapidly, with an estimated 600 in 1997. Although the grubfeats for corvids continues, the maximum recorded numbers of starlings seen on the Common during the year was eight on 23 May. The birds in 1995 must have been from the local population, the species being still common at that time, but this is an appalling decline. Raven et al. (2003) record a drop in the UK starling population of 13 per cent from 1994 to 2002, with a regional drop in south-east England of 41 per cent in that time.

Breeding season. There were three adult little grebes on 31 March on Eastern Hollow Pond, with two chasing one and rippling. This pair had small downy young on 22 May, and again on 22 July. The third adult was seen on Western Hollow Pond at least until 22 July. Grey herons had twenty-six nests in five groups but one group failed, the other twenty-one being successful at least to

hatching. Mandarin ducks were seen occasionally around the ponds, but also throughout the season along the stream at Hundred Pound Bridge, a new site, where there are a number of old pollarded willows.

A sparrowhawk pair again hatched young near the tunnel car park, though only one young was thought to have hatched. From March to the latter half of May a pair of common buzzards was seen regularly over Hill House and Eastern Woods. A second pair was known on Chasemore Farm just to the north of the Common, though no young were seen from either pair. Reputedly, a pair was successful at Cobham Park, a short distance away, so the species is now becoming established in the area. A male and female kestrel were recorded on the plains at least from February to the end of April, with single birds in the autumn, though no evidence of breeding was recorded. The bird of prey records were completed by a hobby seen by David Wills on 28 May.

Coot nested on four of the main ponds, with moorhen common along the streams, nesting on most of the ten ponds. Stock doves were recorded singing at six places, five of them in SE Wood. Turtle doves were scarce, with single birds on 29 April, 25 May, and two, one singing, on 28 May. Collared doves had four known territories on the edge of the plains, with further birds in the residential area to the south-east of the Common. Two male cuckoos were recorded on the plains with a female heard on 19 May.

Both green and great spotted woodpeckers are common, the former recorded as having thirteen territories or part, and the latter twenty-eight. Four territories of the lesser spotted woodpecker were known. These had a rather linear relationship, and each was approximately 300 metres from the next.

At least one pair of barn swallows nested at houses at the west end of Banks Path, the first nesting recorded in recent years. Also there were at least three pairs of house martins. The other known house martin breeding site just beyond the western edge of the Common was not investigated, but swallows and house martins occur on Chasemore Farm, though their breeding status there is unknown.

The first nightingale appeared on 14 April. Only five pairs were known this year, a severe drop from the twelve of the previous year. Song thrushes had thirteen territories recorded on the thirty-nine hectares of the plains with at least nine others known elsewhere.

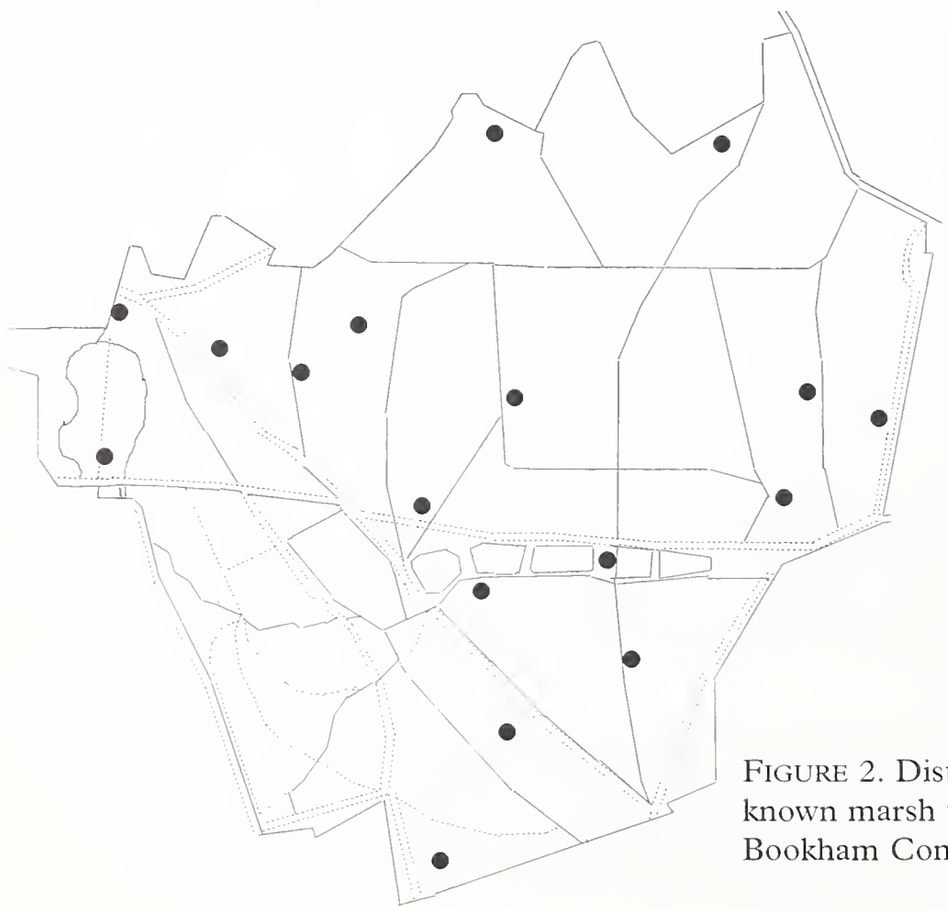

FIGURE 2. Distribution of seventeen known marsh tit territories at Bookham Common, 2003.

Among less common breeders over the whole Common the following numbers of territories were recorded: goldcrest two; long-tailed tit five; marsh tit seventeen; coal tit two. The marsh tit is a bird of conservation concern nationally, so its known distribution on the Common in 2003 is shown in Figure 2. Full censuses were not made but fifteen nuthatch and fourteen treecreeper territories were known. On the plains finch surveys showed chaffinch thirty territories; greenfinch one; goldfinch three; bullfinch seven; and a pair of linnets was seen on one occasion. Buntings continued their poor representation with two records only — a yellowhammer on the northern edge of the Common on 14 April, and a reed bunting singing on the island at the Isle of Wight Pond on 30 May.

The warbler populations of the plains continue to be studied. Table 1 shows the results of this survey since 1997. Four pairs of lesser whitethroats bred this year, the first for two years. Whitethroat numbers dropped by a third in 2003.

TABLE 1. Warbler populations on the thirty-nine hectares of plains on Bookham Common from 1997 to 2003.

Key: WH whitethroat; GW garden warbler; BC blackcap; WW willow warbler; CC chiffchaff; LW lesser whitethroat.

	WH	GW	BC	WW	CC	LW	Total
1997	28	14	12	36	7		97
1998	35	19	27	29	10		120
1999	33	24	23	26	10		116
2000	30	23	25	15	11		104
2001	35	29	28	14	19	4	129
2002	36	22	28	5	28		119
2003	24	24	29	6	27	4	114

Willow warblers. There has been a huge drop since 1997 in willow warbler numbers: 1997 was a peak year. The following two years showed drops of 19.5 per cent and 10 per cent, but then a crash of 40 per cent in 1999–2000. Near stability in 2000–2001 was followed by a 64 per cent drop in 2002, with one extra territory in 2003. The total drop 1997–2003 is 83.3 per cent, and the species dropped from 37.1 per cent of the total warblers in 1997 to a mere 5.3 per cent in 2003.

According to the BTO's Breeding Bird Survey (Raven et al. 2003), willow warblers decreased in the UK between 1994 and 2002 by 13 per cent in England, but dropped by 51 per cent in the South-East, and the decline continues.

A further point of interest happened in 2003 at Bookham, and is shown in Figure 3. The first waves of willow warblers took up territories. Then those established over ten days or so in the northern part of the area were abandoned, leaving only the central area occupied. Perhaps not enough females arrived to pair in areas which may not have been prime habitat, though they appeared so.

The only other species of warbler to show a large decrease at Bookham was the drop by one third in whitethroat numbers in 2003. There was a well-documented whitethroat crash in the UK between 1969 and 1974 of 75 per cent. The cause of that was found retrospectively to have been a sub-Saharan drought (Winstanley et al. 1974). Both British willow warblers and whitethroats winter south of the Sahara in West Africa, and the nightingale is thought to do so (Wernham et al. 2002). The last drought lasted from 1966 to 1986, causing

a marked increase in desertification in the area, aggravated by the subsistence farming of the area. This was a natural disaster worsened to a large degree by human intervention (Berthold 2001). The present results at Bookham may indicate further problems in the winter quarters of these species.

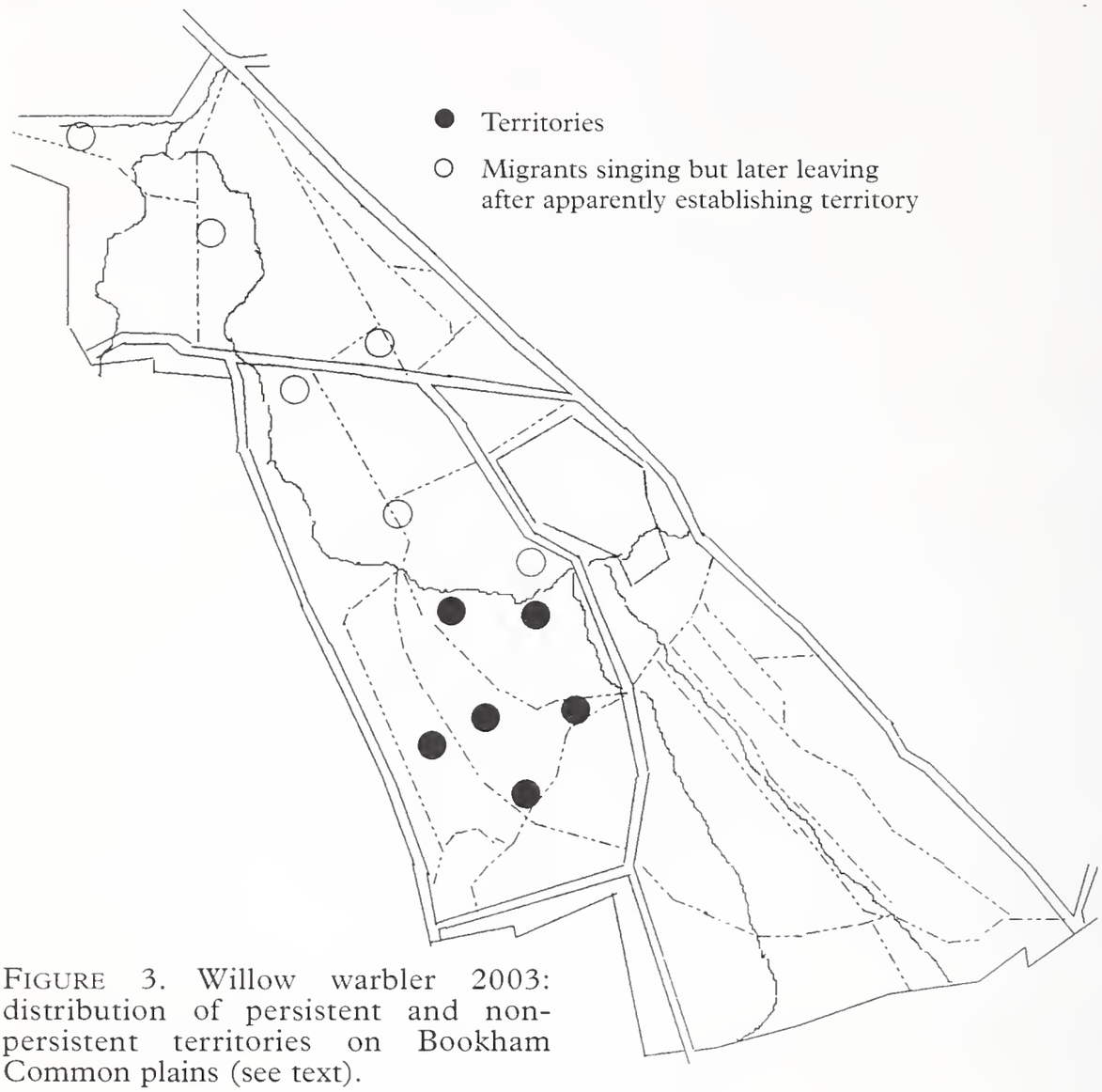

FIGURE 3. Willow warbler 2003: distribution of persistent and non-persistent territories on Bookham Common plains (see text).

Chasemore Farm

This farm is at the northern border of Bookham Common, each side of the road from Hundred Pound Bridge. It is managed partly for game so there are fields of cover, and wide field borders. Skylarks and a yellowhammer sing, there are linnets in the hedges, and swallows and house martins over the fields. A pair of common buzzards has been in one of the woods since 2002. This farm has been an asset to the wildlife of the area, and a contrast to the current farming scene as described by Shrubb (2003). The farmer owner died in 2003 and his widow is continuing the farm at present. It would be a loss to the area if this farm changed its practices.

Acknowledgements

My thanks are due to the following observers: Lance Gibbs, Max Hyslop, Ron Kettle, Anne and Graham Parsons, Colin Pettigrew, Roger Suckling, Anne and Andrew Stribley, Ian Swinney, David Wills and David Wolstenholme.

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ERRATA. In the *London Bird Report* for 2000 and the *Surrey Bird Report* 2000, both recently published, the following records for Bookham Common are incorrect: nightingales are recorded as eight territories, when the correct figure is seven; rooks are recorded as having nineteen nests on Bookham Common; the species has not nested at Bookham at least since the survey began, and the figure refers to the rookery some distance away at Guildford Road, Bookham.

Mammals and reptiles (Alison Fure)

Bookham Common mammal group last published its work in 1995. A new mammal group, convened in August 2003, set out to investigate the small mammals in tracts of Hundred Pound Wood. Three distinct areas were surveyed including the woodland edge, the mature woodland, and an area clear felled of poplars where grassland was regenerating.

On 29 August fourteen volunteers sited a hundred Longworth traps which were divided between the three sites. They were left in situ until 1 September. They were checked (under licence) twice daily and captures were marked by fur clipping.

There were thirty-five captures, six of which were recaptures: common shrew *Sorex araneus* sixteen; pygmy shrew *Sorex minutus* six; wood mouse *Apodemus sylvaticus* four; yellow-necked mouse *Apodemus flavicollis* one; field vole *Microtus agrestis* one; bank vole *Clethrionomys glareolus* seven.

Results showed that each sector held a distinctive mammal community. Animals were restricted in their distribution as follows: woodmouse and field vole were found only in the area clear-felled of poplars in regenerating grassland; the lone yellow-necked mouse was found in the mature part of the wood near the car park; common shrews were common in the mature woodland but rare in the grassland. Pygmy shrews were equally distributed (so we must have identified them correctly); bank vole dominated the catch along the woodland edge (only one was found elsewhere and this was near a grassy path).

Several bat surveys were also carried out during this period in an effort to seek information about the bat interest in this part of the site. Surveys results were as follows:

Date	**Location**	**Species**	**Sunset**	**First bat**
10.viii.2003	Hundred Pound Car Park	*Myotis* sp. *Plecotus auritus* *Pipistrellus pipistrellus*	20.32	21.15
26.viii.2003	M25 nr Bookham Common	*Plecotus auritus* found dead on motorway during another survey and sent for testing		
29.viii.2003	Public footpath on Chasemoor surveying brook	*Pipistrellus pygmaeus* (constant passes) *Myotis daubentonii* (several passes)	19.53	20.21 20.30
31.viii.2003	IoW Pond	*Pipistrellus* sp. feeding for 30 mins		Late evening
31.viii.2003	Hundred Pound Car Park	*Pipistrellus pygmaeus* (two flying constantly) *Plecotus auritus* feeding around oak	19.47	20.30
–.viii.2003	Local house	*Plecotus auritus* found dead in roost		
31.x.2003	IoW Pond	Possible *Pipistrellus* sp. seen by warden		15.00

During 2004 we plan, with English Nature, to erect fifty dormouse boxes in sections of Bookham Common as follows: ten boxes in Hundred Pound Wood, distributed throughout edge, area of clear-felled poplar and hazel near car park; ten boxes on Bayfield Plain, to be distributed in quieter areas on hazel near horseride; five boxes on hazel in Stents Wood, in areas with little public use. The remainder to be sited in the warden's garden (Merritt's Cottage), the Arboretum, and IoW Plain behind the warden's house.

The boxes will be fixed to hazel trees by strong green garden wire. Subsequent supervision will avoid disturbing birds that might select the boxes for nesting, and amend sites according to schedule or in response to disturbance from the public, etc. The project has been registered with the National Dormouse Monitoring Scheme (number 240) and construction of boxes for location in the spring has commenced.

In the course of our field work many badger hairs were found, especially on fallen tree trunks. Fresh latrines were found by Hundred Pound Bridge during May 2003 and the western edge of Hundred Pound Wood in August. Roe deer were frequently seen with young. A mink was trapped by the local gamekeeper. Moles and squirrels were seen, but little evidence of fox — shot and winged birds for instance did not appear to have been 'cleaned up'.

On one occasion a possible sighting and droppings of a hare was noted. No harvest mouse nests were found, but possible evidence of water shrew was seen along Bookham Brook at Chasemoor Farm.

In addition to the above there were many sightings of grass snake and two of common lizard. Both species were found in woodland and grassland, and grass snake eggs were found under rotten logs on a pile of sawdust at the margin of the wood in front of Merritt's Cottage.

Acknowledgements

Thanks are due to Dr I. Menzies, I. Swinney, Dr S. Semple, E. Cheesman, R. and C. Bradshaw, R. Garret, A. Podmore, J. Hatto, M. and M. Richardson, I. Kettle, and U. Sutcliffe.

Invertebrates (Ian Menzies)

Coleoptera

The discovery of an adult male stag beetle *Lucanus cervus* by the warden, Ian Swinney, in a pile of logs and sawdust outside Merritt's Cottage on 3.i.2003 made an appropriate start to the year. A further six adults and grubs at various stages of development were noted on 12.v.2003 when the same log-pile was being moved to a site on the wood border in front of the cottage. In the past stag beetles have only been reported on the Common on three occasions (Easton 1949, Hall 1961, Barclay 1996).

During the year the following species, either new to the Common or not recorded for many years, have been found:

Agonum micans Nicolai: 3 in marshy area at south east end of IoW Plain, 10.v.2003 (R.G. Booth) — not seen since 1942.

Agonum moestum (Duftschmid): 1 in marshy area at south east end of IoW Plain, 10.v.2003 (RGB) — not seen since 1951.

Stenolophus teutonus (Schrank): **Nb** 1 by margin of IoW Pond, 24.vii.2003 (M.V.L. Barclay) — not seen since 1950s.

Stenus similis (Herbst): 1 in marshy area at south east end of IoW Plain, 10.v.2003 (RGB) — not seen since 1945.

Neobisnius villosulus (Stephens): 1 in wet site of former Western Pond, 10.v.2003 (RGB) — new record.

Staphylinus compressus Marsham: 2, first on trunk and second in deep pitfall trap by dead oak, Glade Path, 13.ix.2003 (RGB) — not seen since1947.

Quedius aetolicus Kraatz: **Na** 2 in squirrel's drey on oak, Glade Path, 13.xii.2003 (RGB) — not seen since1941.

Quedius maurorufus (Gravenhorst): 1 on mud by IoW Pond, 30.iv.2003 (RGB) — not seen since 1941.

Quedius scitus (Gravenhorst): **Nb** 1 in DP trap at base of old dead oak, Glade Path, 13.xi.2003 (RGB) — new record.

Deinopsis erosa (Stephens): 1 in wet area between LE and EH Ponds 30.iv.2003 (E. Regan, RGB) — new record.

Oligota apicata Erichson: **N** 3 among small logs with fungi near IoW Pond 30.iv.2003 (RGB) — new record.

Aloconota longicollis (Mulsant & Rey): **N** 1 in wet site of former Western Pond 10.v.2003 (RGB) — not seen since 1947.

Atheta castanoptera (Mannerheim): 1 near IoW Pond, 30.iv.2003, and 3 in DP trap, Hollows Path, 11.x and 1 by sieving fungus, Hollows Path, 11.x.2003 (RGB) — not seen since 1950s.

Atheta pallidicornis (Thomson): 2 among small logs with fungi near IoW Pond, 30.iv.2003 (RGB) — not seen since 1944.

Atheta ravilla (Erichson): 2 in fungi on rotten wood, Glade Path, 13.xii.2003 (RGB) — not seen since 1965.

Atheta taxiceroides Munster: 1 from squirrel's drey, Glade Path, 13.xii.2003 (RGB) — not seen since 1940.

Euplectus kirbyi Denny: **N** 1 in DP trap at base of old dead oak, Glade Path, 13.xi.2003 (RGB) — new record.

Bryaxis puncticollis (Denny): 1 11.x.2003 and 1 13.xii.2003, in DP trap at base of old dead oak, Glade Path (RGB) — new record.

Athous subfuscus (Müller): **RD3** 4 by beating oak near Bayfield Pond, 10.v.2003 (RGB) — new record.

Malthodes marginatus (Latreille): by beating old willow by Bookham Stream on Bayfield Plain, 10.v.2003 (RGB) — not seen since 1944.

Meligethes morosus Erichson: 2 in marshy area on IoW Plain, 10.v.2003 (RGB) — not seen since 1945.

Longitarsus rutilus (Illiger): **Na** 1 in marshy area at south-eastern end of IoW Plain, 10.v.2003 (RGB) — new record.

Acalles roboris Curtis: **Nb** 1 in squirrel's drey, Glade Path, 13.xii.2003 (RGB) — new record.

Rhynchaenus populicola Silverberg: **RDBK** 1 sieved from damp litter at edge of IoW Plain, 10.v.2003 (RGB) — new record.

Tetratoma fungorum Fabricius: from birch bracket-fungus, 8.ii.2003 (I. S. Menzies) — a third record for Bookham.

Gastrophysa viridula (Phytophaga) and *Oedemera nobilis* (Heteromera) are both spectacular metallic green beetles. Although not uncommon in the UK neither was recorded prior to the 1990s but both have now become well established at Bookham, the former abundant on *Rumex* in the marshy areas around the ponds and on IoW Plain (10.v, 12.vii, 26.vii and 9.viii.2003) and the latter seen in large numbers resting conspicuously in the yellow buttercups outside Merritt's Cottage on 3.vi.2003 (ISM).

Infestation of the old hawthorn next to the LNHS Bookham Survey hut by the hawthorn jewel beetle *Agrilus sinuatus* was confirmed by the discovery of an adult beetle on 24.vii.2003, and on 21.x.2003 along High Point Path an oak damaged by high winds a few years ago and now dead was noticed to have many recent D-shaped exit holes of the oak jewel beetle *Agrilus pannonicus*. In several areas of the Common oak stumps left by the great storm of October 1987 became infested with *A. pannonicus*, but after a few years lapse the beetle returned to its more usual state of scarcity.

Lepidoptera

Spring butterflies recorded by Alan Prowse include comma *Polygonia c-album* and orange tip *Anthocaris cardamines*, the latter abundant on the plains on 17 and 23.iv.2003 together with the peacock *Inachis io*, speckled wood *Pararge aegeria*, and brimstone *Gonepteryx rhamni*, and a red admiral *Vanessa atalanta* was seen on 29.iv.2003. Although he saw no sign of post-hibernation small tortoiseshells *Aglais urticae*, they were seen in June and July with summer species such as the meadow brown *Maniola jurtina*, ringlet *Aphantopus hyperantus*, silver-washed fritillary *Argynnis paphia*, white admiral *Limenitis camilla*, small skipper *Thymelicus sylvestris* and large skipper *Ochlodes venata*. A larval nest of the small tortoiseshell found on a nettle patch on the Isle of Wight Plain on 10.v.2003 also signalled recovery of this species from the scarcity of recent years.

The painted lady *Vanessa cardui* appeared during the first half of May, unusually early for this migrant species, possibly indicating hibernation in the UK, and was then seen at intervals throughout the summer. Half-grown larvae of this species were also found on spear thistle outside Merritt's Cottage during the 'dragonflies and other insects' field meeting led by Neil Anderson on 12.vii.2003. On the same day purple hairstreaks and silver-washed fritillaries were seen flying in large numbers, the latter exceeding fifty sightings in an hour and a half, but white admiral numbers appeared less than in recent years (under eight in an hour and a half). A red admiral entertained members having tea by laying its small eggs with remarkable rapidity on nettles just outside the Hut. A single small copper *Lycaena phlaeas* was seen at the south end of Hollows Path, and purple emperors *Apatura iris* were seen twice, first briefly over high trees near Station Copse and later flying above the master oaks of Hill House Wood.

Later, on 24.vii.2003, a female purple emperor was seen flying around and ovipositing on a sallow in the vicinity of Merritt's Cottage. Colonies of the common blue *Polyommatus icarus* were present in areas cleared of scrub around IoW Pond (24.vii.2003) and along Central Ditch Path (26.vii.2003): it seems likely that marsh bird's-foot trefoil *Lotus uliginosus* may serve as foodplant for the lakeside colony. Two second generation white admiral butterflies were seen around Isle of Wight Pond on 13.ix.2003 visiting the flowers of water mint instead of the usual bramble and thistle which had finished flowering. A 'black and white' butterfly, almost certainly a further second generation white admiral, was also seen by Win Booth near IoW Pond on 11.x.2003. A second generation white admiral has been seen before at Bookham, on 5.ix.1976 during another fine summer said to be 'even hotter than 1975' (Beven 1977). September records for the white admiral would seem to be very rare as only two are mentioned by Frohawk (1934: 188) — for the unusually hot summers of 1911 and 1933.

Larvae of the elephant hawkmoth *Deilephila elpenor* were found by IoW Pond on two occasions, the first a green half-grown specimen by sweeping lakeside vegetation (24.vii.2003) and the second, fully grown and black, on great willow herb *Epilobium hirsutum* (9.viii.2003).

Other orders

Most of the regular 'Bookham Common' bush cricket and grasshopper species were seen during the course of the 'Bushcrickets and other insects' Field Study led by Ian Menzies on 9.viii.2003 — an unusually hot sunny day. Long-winged conehead, Roesel's and dark bush crickets (*Conocephalus discolor*, *Metrioptera roeselii* and *Pholidoptera griseoaptera*) were heard stridulating in several areas, but again there was no sign of the short-winged conehead *Conocephalus dorsalis* which has not been seen at Bookham since August 1997. It was interesting to see how quickly the slender and common ground-hoppers (*Tetrix subulata* and *T. undulata*) had managed to colonize the eastern border of the Isle of Wight Pond which was cleared of dense sallow carr last year.

A single example of the blue bug *Zicrona caerulea* was found on vegetation by the IoW Pond (10.v.2003) and a small number of the local shield bug *Stollia fabricii* seen on white deadnettle, Bayfield Plain (5.vi.2003). The 'forest bug' *Pentatoma rufipes* was found in unusually large numbers by beating oak and other shrubs (12.vii.2003). Other observations of note include the hornet *Vespa crabro* of which a huge female was seen near Merritt's Cottage in the late afternoon of 14.vi.2003, and the workers were regularly seen hawking for insects over the banks of flowering water mint at the margin of IoW Pond in September. The rare strawberry spider *Araneus alsine* was again found in both the previously recorded grassy sites along Glade Path and on Eastern Plain (Oliver Crundall, 14.x.2003). Continued hot dry weather reduced the water level in the Isle of Wight Pond and the shells of the swan mussel *Anodonta cygnea*, many more than four inches in length, were left exposed on the mud surface during September and October.

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Book reviews

Bumblebees. Their behaviour and ecology. Dave Goulson. Oxford University Press. 2003. 175 pp. text, 51 pp. references, paperback, £27.50. ISBN 0 19 852607 5.

The volume and range of dates of the references at the end of this book is testimony to the comprehensive research that Dave Goulson has put into this concise update on the expanding interest in bumblebees, both as important pollinators and as dramatically declining flagship indicators of the intensification of agriculture and arboriculture. Divide 175 pages into fifteen chapters and it becomes apparent that this can be no turgid academic work, but a crisp discussion of what we do or do not know about bumblebees today.

The chapter topics are: Introduction, Thermoregulation, Social organization and conflict, Finding a mate, Natural enemies, Parasites and commensals, Foraging economics, Foraging range, Exploitation of patchy resources, Choice of flower species, Intraspecific floral choices, Communication during foraging, Competition in bumblebee communities, Bumblebees and pollinators, Conservation, Bumblebees abroad; effects of introduced bees on native ecosystems. These topics will surely resonate with many of our own observations of bumblebee behaviour and lead us to dip into this book. One dip may well lead to purchase for regular reference.

Travellers' nature guide — Britain. Martin Walters and Bob Gibbons (Scotland text by Kenny Taylor). Oxford University Press. 2003. 376 pp. (pbk) £14.99. ISBN 0 19 850434 9.

One of a continuing series of European country guides, this book begins with a brief overview of British habitats and such matters as maps, conservation organizations and protected site classifications. The bulk of the book is devoted to one to three-page descriptions of 160 well-known nature reserves and associated areas, identified on simple regional maps. The site descriptions include access and grid reference, habitats, mention of characteristic flowers, birds, other vertebrates and sometimes a few butterflies or other conspicuous insects. There are attractive photographs of a habitat for each location and often a particular species is illustrated.

A book to browse to choose sites that may suit your interests to visit on holiday, but you will need to tap other sources to decide how long to stay and how to best use your time.

RAYMOND UFFEN

Hampstead Heath Survey

Progress Report for 2003

General (Colin Bowlt, Chairman, Hampstead Heath Survey)

The number and distribution of flowering plants species is never static in any area, but changes on Hampstead Heath are probably particularly rapid due to the heavy public pressure, and their introducing, deliberate or otherwise, various species, such as parrot's feathers *Myriophyllum aquaticum* and three-angled leek *Allium triquetrum*. Foreign animals have also been introduced, including red-eared terrapins and marsh/edible frogs. These all make for variety but leave one wondering if this is really the best way to increase biodiversity. The Corporation of London, who own and manage Hampstead Heath, have recently employed two part-time ecologists to give them advice on how it should be maintained.

One of their problems is that the many people using the Heath have many different ideas about how it should be managed. Some want the grass cut short, others prefer it long, some think there are too many trees, others would like them thinned. Yet others say they like it as it is now, apparently not realizing that unless the invading scrub is controlled there won't be much Heath left. There are at least twenty local organizations with an interest in the management of the Heath, and being composed of Hampstead residents, are both vocal and vigorous (after all they saved the Heath from development in the nineteenth century).

The LNHS Survey took the decision at the start that it would not enter the management debate. We made it quite clear that we are a purely recording group but that our findings and records were available to all. I have said (tongue-in-cheek) that if the Corporation covered the whole Heath with tarmac we would be very sad, but would simply start recording any wildlife that returned.

Turner's Wood, Hampstead (Colin Bowlt)

Turner's Wood is not part of Hampstead Heath but lies some 200 metres to the east of the Heath Extension. It appears to be relict ancient woodland, formerly falling within the Great Park of the Bishop of London (Silvertown 1978), but is now completely surrounded by houses. The surviving piece is approximately 8 acres (3.24 hectares) in extent and is now privately maintained by a management company in which the owners of the surrounding properties are members.

The Hampstead Survey group visited the wood on the 30 September 2001, 26 May 2002, 25 May 2003 and 13 May 2004 at the kind invitation of the management company. It was thought worthwhile to put our observations of these short visits on record since the wood is not easy of access.

The shade from the many tall trees (particularly oak, hornbeam and sycamore) produce a restricted ground flora, predominantly of bramble and some bracken. A stream flowing across the site has created steep clay banks in places.

The following list of plants recorded makes no pretence to completeness but shows that while the wood still appears to retain some of its ancient woodland flora, in particular its fine sessile oaks *Quercus petraea,* hornbeams *Carpinus betulus,* wild service trees *Sorbus torminalis*, great horsetail *Equisetum telmateia*, it has also acquired non-native garden plants either by invasion from the surrounding gardens or deliberate introduction. In view of this one must recognize the possibility that certain of the native plants for which there are

historical records, such as wood anemone and lily-of-the-valley, may have become extinct and then reintroduced from gardens. Hybrid bluebells are an example of how insidious garden escapes can be to wild plants. The bluebells in Turner's Wood in 1869 were undoubtedly the wild native English bluebell *Hyacinthoides non-scriptus*. Those now present are a mixed population of hybrids between *H. non-scriptus* and the Spanish bluebell *H. hispanicus*, a vigorous garden escape, which was first recorded growing wild in the London area in 1920 (Kent 1975). The situation has recently been discussed by Vaughan (2000).

Several species, such as camellias, polyanthus and Lawson cypress, which had been obviously recently planted, have been ignored.

The flora

Acanthus mollis bears-breeches. Two clumps.
Acer campestris field maple.
Acer platanoides Norway maple. Mature trees and several saplings.
Acer pseudoplatanus sycamore. Many mature trees and regeneration.
Aesculus hippocastanum horse-chestnut.
Alliaria petiolata garlic mustard. Perimeter only.
Allium ursinum ramsons. Large patches in two places.
Anemone nemorosa wood anemone.
Anthriscus sylvestris cow parsley. Perimeter only.
Arum maculatum lords and ladies. Rather scarce.
Aucuba japonica spotted-laurel. Planted by perimeter.
Bergenia crassifolia elephant-ears. Planted by perimeter.
Betula pendula silver birch. A few scattered mature specimens; no regeneration apparent.
Betula pubescens downy birch. Several trees.
Cardamine flexuosa wavy bittercress. Perimeter only.
Carex pendula pendulous sedge. Scattered plants.
Carpinus betulus hornbeam. Many tall trees; no relict coppice seen. Some regeneration.
Castanea sativa sweet chestnut.
Circaea lutetiana enchanter's nightshade.
Conopodium majus pignut.
Convallaria majalis lily of the valley. Over many square metres at northern end.
Corylus avellana hazel. Thinly scattered.
Crataegus laevigata woodland hawthorn. At least one bush, others appear hybrids with next species.
Crataegus monogyna common hawthorn.
Crocosmia × *crocosmiiflora* montbretia.
Dactylis glomerata cocksfoot.
Deschampsia cespitosa tufted hair-grass.
Dryopteris carthusiana narrow buckler fern. One plant by stream.
Dryopteris dilatata broad buckler fern. Frequent.
Dryopteris filix-mas male-fern. Frequent.
Dryopteris filix-femina lady-fern.
Epilobium montanum broad-leaved willowherb.
Equisetum telmateia great horsetail. Along stream.
Euonymus europaeus spindle.
Fagus sylvatica beech. A few scattered trees.
Fallopia japonica Japanese knotweed. Being destroyed; a few remnant plants on perimeter.
Forsythia × *intermedia* forsythia. Planted by perimeter.
Fraxinus excelsior ash. Seedling in a number of places but no trees.
Gaultheria shallon shallon. Two patches.
Geranium robertianum herb Robert.
Geum urbanum wood avens.

Hedera helix ivy. Widespread; mostly covering ground.
Heracleum sphondylium hogweed. Perimeter only.
Holcus mollis creeping soft-grass.
Hyacinthoides non-scripta × *hispanica* bluebell. Hybrid swarm.
Hydrangea sp. hydrangea.
Hypericum androsaemum tutsan. One plant seen.
Ilex aquifolium holly. Frequent as understory; dense on southern side.
Ilex × *altaclerensis* Highclere holly. Scattered individuals.
Impatiens parviflora small balsam. Widespread.
Juncus effusus soft-rush.
Laburnum anagyroides laburnum.
Lamiastrum galeobdolon ssp. *argentatum* yellow archangel. Frequent.
Ligustrum ovalifolium garden privet. In several places.
Mahonia aquifolium Oregon grape. A few plants.
Melissa officinalis lemon balm.
Milium effusum wood millet. Scattered.
Narcissus sp. Obvious plantings in several places.
[*Oreopteris limbosperma* lemon-scented fern. By stream — to be confirmed.]
Oxalis articulata pink sorrel. Along perimeter.
Pachysandra terminalis carpet box. Large patch near stream.
Pentaglottis sempervirens green alkanet.
Phyllitis scolopendrium hart's tongue. Horticultural variety planted on perimeter.
Poa trivialis rough meadow grass.
Polygonatum multiflorum Solomon's seal. A few plants.
Prunus avium cherry. A few with some regeneration.
Prunus domestica wild plum. Single shrub found.
Prunus laurocerasus cherry laurel.
Prunus lusitanica Portugal laurel. Single bush seen.
Pseudosasa japonica arrow bamboo. Several clumps by stream.
Pteridium aquilinum bracken.
Quercus petraea sessile oak. All the oaks appear to be of this species and constitute a remarkable population. Many straight, tall trees, and with the hornbeams and sycamores, dominate the canopy.
Ranunculus repens creeping buttercup. Perimeter only.
Rhododendron luteum yellow azalea.
Rhododendron sp. At least three species.
Rosa canina dog rose.
Rubus fruticosus agg. bramble. Widespread.
Ruscus hypoglossum spineless butcher's broom. Single female clump.
Sambucus nigra elder. Thinly scattered.
Sedum sp. ice plant.
Sisymbrium officinale hedge mustard.
Solanum dulcamara woody nightshade.
Sorbus aria agg. whitebeam. Several saplings, but no mature trees.
Sorbus aucuparia rowan. Spread throughout wood and flowering and regenerating well.
Sorbus latifolia broad-leaved whitebeam. Many young trees of same age.
Sorbus torminalis wild service tree. Saplings but no mature trees seen.
Stellaria media chickweed.
Symphoricarpos albus snowberry.
Taxus baccata yew. Several small specimens.
Tiarella sp. foam flower.
Ulmus procera elm. Suckers on southern boundary.
Urtica dioica nettle.
Veronica hederifolia ivy-leaved speedwell.
Viburnum opulus guelder-rose. Single plant found.
Viola riviniana common dog violet.

The following bryophytes and fungi were also found

Mosses

Amblystegium serpens
Atrichum undulatum
Brachythecium rutabulum
Calliergon cuspidatum
Diacranella heteromalla
Dicranoweisia cirrata
Eurhynchium praelongum
Fissidens bryoides
Fissidens taxifolius
Hypnum cupressiforme
Isoptergium elegans
Mnium hornum
Rhynchostegium confertum

Liverworts

Cephalozia bicuspidata
Lophocolea heterophylla
Pellia epiphylla

Fungi

Auricularia auricula-judae
Boletus badius
Daedaleopsis confragosa
Ganoderma adspersum
Grifola frondosa
Hypholoma fasciculare
Meripulus giganteus
Mycena spp.
Nectria cinnabarina
Russula ochroleuca
Scleroderma citrinum

Historical records of plants in Turner's Wood listed by Kent (1975)

Anemone nemorosa wood anemone, 1869
Betonica officinalis betony, 1869
Cardamine amara large-flowered bittercress, 1830
Chrysosplenium oppositifolium opposite-leaved golden saxifrage, 1830
Claytonia sibirica springbeauty, 1945
Convallaria majalis lily of the valley, 1814
Equisetum sylvaticum wood horsetail, 1861
Equisetum telmateia great horsetail, 1830
Hyacinthoides non-scriptus bluebell, 1869
Hypericum hirsutum hairy St John's wort, 1829
Lamiastrum galeobdolon yellow archangel, 1869
Lythrum portula water-purslane, 1869
Melica uniflora wood melick, 1869
Milium effusum wood millet, 1869
Oxalis acetosella wood-sorrel, 1869
Petasites hybridus butterbur, <1876
Populus tremula aspen, 1869
Quercus petraea sessile oak, 1913
Ribes rubrum redcurrant, 1925
Scirpus sylvaticus wood clubrush, 1830
Sorbus torminalis service tree, 1910
Stellaria alsine bog stitchwort, 1861
Vaccinium myrtillus bilberry,<1876
Valeriana officinalis valerian, 1869
Viburnum opulus guelder rose, 1910
Viola riviniana dog violet, 1869

Acknowledgements

My thanks to those members of the Hampstead Heath Survey who did the recording, and to the members of the management company for allowing us access to the wood.

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A preliminary survey of the Hampstead Heath lichens

(Amanda Waterfield)

Hampstead Heath is a large area, 320 hectares (790 acres), originally old farmland or parkland as well as heathland, and it was only in the nineteenth century that it all became public open space. The geology is Bagshot Sands, Claygate Beds and London Clay. Two lines of iron-rich spring-fed ponds, that meet north of Camden and run into the Thames at Blackfriars, drain it. Hampstead is an interesting area for Londoners because of the continuity of open space in an area so close to the City. However this very fact means that it has taken very heavy usage. I am not here concerned with historical records or air pollution (Crombie 1869, Bates 2002, Gilbert 1992, Hawksworth and McManus 1989, Laundon 1967, 1970, 1973, Purvis et al. 2002, Rose and Hawksworth 1981). The reinvasion of lichens was noted in the 1980s so it seems timely to assess what is there now and this note goes some way towards assessing that. No long-term monitoring projects have yet been set up.

Several visits have been made to Hampstead Heath and Kenwood over the last five years and I am extremely grateful to Chris Hitch for helping me with the more difficult species such as in the genus *Bacidia*. I always look forward to his annual visit to increase my understanding of the lichen flora and cannot emphasize too much the need to have an expert to turn to. The urban flora is notoriously difficult, not only because of its poverty but also because often it is quite stressed and it takes an expert eye to interpret.

Man-made substrates. The built environment is very much a part of the city, and aspect, vertical height, substrate, shade, nutrient enrichment and succession all play their part in the lichen assemblage.

Peter James gave me some records from about 1991 when he looked at the old nursery on the north side. The boundary brick wall had two particularly interesting records, *Acarospora smaragdula* and *Vezdaea leprosa* in fruit. Otherwise there was the ubiquitous *Caloplaca citrina, Lecanora dispersa, Psilolechia lucida, Tephromela atra* and *Cladonia humilis*. Other interesting records were from the old oak surrounds of the garden frames — *Buellia badia* and *Strangospora moriformis*: these were with the commoner *Candelariella vitellina, Lecanora hageni, Lecidella stigmatea, Placynthiella icmalea, Trapelia coarctata, T. obtegens* and *Xanthoria polycarpa*. He also looked at the asbestos roofing and sides of compost bins which yielded *Caloplaca holocarpa, Lecania erysibe, Protoblastenia rupestris, Rinodina gennarii, Verrucaria nigrescens,* and *Xanthoria calcicola* as well as the more common *X. parietina.* Unfortunately these constructions no longer exist. He had the first record for *Dimerella pinetii* in deep shade on oak trees nearby; this is now more often recorded as people get used to its habitat at the base of large trees, especially ash.

The bridges are on the whole too shaded to have a rich lichen flora but some of the concrete posts around the ponds are worth further investigation.

Sculptures yielded common species — *Caloplaca flavescens, Candelariella aurella, Lecanora dispersa, Lecanora muralis, Phaeophyscia orbicularis, Physcia caesia* and *Xanthoria parietina.*

Benches — most of the modern ones are scrubbed and painted and have no lichens but occasionally a few old ones are found which are worth investigation and yield *Marchandiomyces corallinus* on *Lecanora conizaeoides, Amandinea punctata, Hypogymnia physodes, Lecanora sulcata, Xanthoria candelaria, X. polycarpa, Lecania cyrtella.* The benches along the top walk at Kenwood provide a particularly interesting study. *Amandinea punctata, Candelariella vitellina, Flavoparmelia caperata, Hypogymnia physodes, Hypotrachyna revoluta, Lecania cyrtella, L. erysibe, Lecanora conizaeoides, L. muralis, Lecanora saligna, Marchandiomyces corallinus, Melanelia fuliginosa* ssp. *glabrata, M. subaurifera, Parmelia sulcata, Physcia caesia, P. tenella, Punctelia subrudecta, Ramalina*

farinacea, Scoliciosporum umbrinum, Trapeliopsis flexuosa, Usnea subfloridana, Xanthoria parietina, and *X. polycarpa* have been recorded. Each bench has a slightly different suite of species.

Epiphytes. The older trees do not support a rich lichen flora, mostly due to the fact that their bark is probably impregnated with pollutants, but spreading young oaks (*Quercus*) out in the open have an abundant flora on their horizontal branches, although twig flora is poor. The past influence of sulphur dioxide pollution and soot probably explains this. The fact that there are old hedgerows (Vaughan 1998) does not seem to be important for the lichen flora. Lichens are returning but the current story still has not been fully elucidated. Large thalli, over 20 cm. diameter, of *Flavoparmelia caperata* have been recorded and abundant *Parmelia sulcata* and *Melanelia subaurifera*.

Planes (*Acer*) usually have *Lepraria incana* and if near nutrient enriched dust such as in a car park can have a good nitrogenous assemblage. Lime (*Tilia*) has a richer assemblage. Hornbeams (*Carpinus*) have a minimal lichen flora.

Willows (*Salix*) probably have the richest as their bark is basic and they are usually in fairly humid habitats. Interesting records include the newly recognized *Punctelia ulophylla*. Attention was drawn to willow by the late Brian Fox (1999, 2003) but anyone interested in lichens in an urban setting would have probably been aware of this fact. I started a little project with Nick Bertrand at the Welsh Harp in the mid 1980s but it came to nothing due to my ill health and Nick moving from Ealing to Lewisham. We did however record *Usnea* with great excitement. I have not seen *Usnea* on willow on the Heath but it could be there. Now *Usnea* has been recorded on a bench at Kenwood and on oak; however they never grow luxuriantly and appear to drop off after a few years. This might be because they are fruticose and therefore the longer they get the more surface is exposed to the elements and pollutants. Scrub is worth investigating as elder (*Sambucus*) can have *Ramonia interjecta* as well as the usual nitrogenous flora.

Terricolous lichens. Due to trampling there is a nonexistent terricolous flora. A dozen *Cladonia* species have been recorded in the past. Now only two species of *Cladonia* have been recorded on tree stumps and old rotting wood rather than on the ground — *Cladonia coniocraea* and *C. fimbriata*. *Peltigera* has not been found and the little cyanobacterial species in short mossy swards also seem to be missing. There is a theory that some ground-dwelling species survive pollution because of a boundary layer of air that is unaffected but I think this is only true with swiftly moving pollution, and deposition in precipitation cannot be avoided.

Total list

Acarospora smaragdula
Amandinea punctata.
Athelia arachnoidea (LF)
Bacidia arnoldiana
Bacidia chloroticula
Bacidia delicata
Buellia badia
Caloplaca citrina
Caloplaca holocarpa
Caloplaca obscurella
Caloplaca saxicola
Candelariella aurella
Candelariella reflexa
Candelariella vitellina
Cladonia coniocraea
Cladonia fimbriata
Cladonia humilis
Dimerella pineti
Evernia prunastri
Flavoparmelia caperata
Flavoparmelia soredians
Hypotrachyna revoluta
Hypogymnia physodes
Lecania cyrtella
Lecania erysibe
Lecanora chlarotera
Lecanora conizaeoides
Lecanora dispersa agg.
Lecanora hageni
Lecanora muralis
Lecanora persimilis
Lecanora saligna
Lecidella elaeochroma
Lecidella stigmatea
Lecidella scabra
Lepraria incana
Marchandiomyces corallinus (LF)
Melanelia elegantula
Melanelia fuliginosa glabratula
Melanelia subaurifera

Parmelia sulcata
Parmotrema chinense
Phaeophyscia orbicularis
Physcia adscendens
Physcia tenella
Placynthiella dasaea
Placynthiella icmalea
Psilolechia lucida
Punctelia ulophylla
Ramalina farinacea
Ramonia interjecta
Rinodina gennarii
Scoliciosporum umbrinum
Strangospora moriformis
Tephromela atra
Trapelia coarctata
Trapelia obtegens
Trapeliopsis flexuosa
Usnea subfloridana
Verrucaria nigrescens
Vezdaea leprosa
Xanthoria calcicola
Xanthoria parietina
Xanthoria polycarpa

Recording on the Heath

The Heath has been divided into ten areas for recording purposes:

Area 1 is Parliament Hill Fields, which has a few trees by the information centre with a typical smooth bark community, i.e. *Lecanora chlarotera*, *Lecidella eleochroma*, etc. that are worth monitoring.

Area 2 is north of this, the other side of the Lime Avenue below Kenwood and includes willow.

Area 3 is further north, Cohen's Field, adjacent to Kenwood. A fallen willow here allows access to the canopy flora.

Area 4 is Kenwood, which includes many man-made substrates such as benches, statues and walls. The woodland is too shaded and dense to have an interesting lichen flora.

Area 5 East Heath includes some very wooded parts and the spreading oaks.

Area 6 is south of Lime Avenue, running from the Pryors to the Highgate ponds, and includes the Hampstead ponds.

Area 7 is West Heath and includes Hill Garden which is worth further investigation.

Area 8 is Sandy Heath.

Area 9 is the extension.

Area 10 is Golders Park which I have not yet investigated.

I hope that in the years to come more detailed recording can be done by area as well as topic.

What can lichens tell us?

The use of lichens to illustrate pollution by suphur dioxide (SO_2) is now well known. Now that it has been noted that the excessive use of nitrogenous fertilizers (Benfield 1994) has an impact in the countryside the urban story still needs teasing out. The rural story has also been looked at by van Herk (1999) who noted the spectacular increase in nitrophyte species in the Netherlands where there is high cattle density, especially on acid-barked trees such as oak. Also there was a corresponding decrease in acidophytes. He created two indexes of nitrophytes and acidophytes:

Nitrophytes: *Caloplaca citrina, C. holocarpa, Candelariella aurella, C. reflexa, C. vitellina, C. xanthostigma, Lecanora muralis, L. dispersa* s.lat. (inc. *L. hagenii*), *Phaeophyscia orbicularis, P. nigricans, Physcia adscendens, P. caesia, P. dubia, P. tenella, Rinodina gennarii, Xanthoria candelaria, X. calcicola, X. paretina, X. polycarpa.*

Acidophytes: *Cetraria chlorophylla, Chaenotheca ferruginea, Cladonia* spp., *Evernia prunastri, Hypocenomce scalris, Hypogymnia physodes, H. tubulosa, Lecanora aitema, L. conizaeoides, L. pulicaris, Lepraria incana, Ochrolechia microstictoides, Parmelia saxatilis, Parmeliopsis ambigua, Placynthiella icmalea, Platismatia glauca, Pseudevernia furfuracea, Trapeliopsis flexuosa, T. granulosa, Usnea* spp.

Ammonia (NH_3) was seen as the chief factor of change, however the primary cause was not increased availability of nitrogen but the rise in bark pH. Ammonia is especially a problem in regions of acid sandy soils. In the

Netherlands it contributes to about 45 per cent of the acidification through nitrification (HNO_3) after deposition, a process that takes place in the soil not on bark. Some ammonia reacts in the atmosphere with acids, leading to the deposition of ammonium sulphate ($(NH_4)2SO_4$) thus part is transformed to ammonium (NH_4+) which does does not affect bark pH, neither does nitrogen oxide. This makes the urban story more complicated as car emmissions are thought to have a major impact on the atmosphere. Slurry spreading on maize fields did not have an effect which points to a continuous source of ammonia being important. Landscape 'roughness' which causes turbulence and dilution does seem to have an effect with higher levels of nitrophytes in open 'windy' landscapes. Tree age is also important with young trees having higher indexes. Nitrophytes and acidophytes seem to have opposing behaviour, the latter being sensitive to ammonium as well. Van Herk also notes that the reaction of nitrophytes to bark pH means there cannot be a comparision with the straight reaction of lichens to SO_2. Other factors influence the correlations such as climate, dust, age of trees, other pollutants, dogs, bark wounds and salt spray.

Van Herk et al. (2002) also looked at lichens as indicators of climate change. Species that like warmth and were scarce before such as *Flavoparmelia soredians* are becoming more common. This is noticeable and quite dramatic. I therefore propose to go on recording lichens on the Heath even though I am not confident that I know the tale that they tell.

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The fungi of Hampstead Heath — notes on the London Fungi Recording Group database

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Introduction

I first began recording the fungi of Hampstead Heath in 1992 but it was not until 1997, following the formation of the 'Fungi to be with Mushroom Club' that species lists were submitted to the Corporation of London at Hampstead Heath. Until very recently I had not calculated how many species had been recorded over the six years since I began producing the lists. This has now been done by the means of an Excel spreadsheet. The number of species recorded currently stands at 306.

The spreadsheet is arranged in years starting with 1997 along with the corresponding dates on which particular fungi were recorded with comment boxes added to the more significant records denoting where they were found. Species recorded before 1997 that have not been recorded since do not appear within the cells of the spreadsheet but have an attached comment box giving the date they were recorded. Species recorded before 1997 which have been recorded since appear within the cells and also have an attached comment box. The scientific names used for the records follow those used in the British Mycological Society Fungi Records Database (BMSFRD) (Kirk 2004), and where applicable the recommended English names from the recently published *Recommended English Names for Fungi in the UK* (Holden 2003).

The bulk of the records are a direct result of the 'Fungi to be with' forays held on the Heath each autumn. In 1997 there was only one autumn foray, but over subsequent years this has risen from two to three and sometimes four forays spread throughout the autumn months.

Additional records on the spreadsheet are those that were made during my own personal visits to the Heath throughout the year. This became more consistent from 2000 when I moved closer to the Heath.

The areas covered during the forays generally start from the South End Green car park taking in East Heath, the Vale of Health, the small woodland running east of South Meadow and Sandy Heath. On returning to the car park we take in the old beech wood and environs left of the Bird Bridge (McDowall and Wolton 1998). My personal visits tend to start on the Heath extension, generally concentrating on the western end of the extension, moving up to Sandy Heath and then in and around the Vale of Health. Both group and personal visits can also include the South Wood opposite Kenwood House depending on which route I decide to take on the day (Figure 1).

In more recent years the forays that are included in the workshop that I hold at the information centre encompass the Parliament Hill area. In covering all of these areas we are able to record fungi from the three soil types of the Heath, starting with clay in the Parliament Hill area onto the Claygate Beds of the Kenwood area and then over to the sandy soils of the aptly named Sandy Heath.

Drawing conclusions from the spreadsheet

By simply selecting a particular species from the spreadsheet one can follow its occurrence during this six-year period and if with a comment box possibly further back (Online only at www.fungitobewith.org).

As the database is added to from year to year it will begin to reveal an even clearer picture of the comings and goings of certain species recorded from Hampstead Heath.

For example, I have seen the arrival of certain species during my period of recording, such as *Sparassis crispa* in August 2001 at the base of *Pinus ponderosa* the Western yellow pine (Cleaver 1981); *S. crispa* has now fruited for three years in succession. Not an uncommon species but the number of old pine trees on Hampstead Heath is quite low, therefore the likelihood of this species occurring on the Heath is also low. *Ganoderma lucidum* (Frontispiece), a rare and unusual looking bracket fungus (Mattock 2001), was recorded for the first time in the summer of 2003. Its reappearance will be sought. A fresh specimen of *G. lucidum* from this site was shipped, along with a prepared culture, to Jean-Marco Moncalvo, curator of fungi at the Royal Ontario Museum in Canada, where it may be used as the epitype for the species. The existing epitype is based upon an illustration.

One record of a species new to Britain is that of *Russula pseudo-affinis* which was discovered in September 2001, close to *Tilius* in Golders Hill Park. Unfortunately this species has not reoccurred during 2002/3. This record was confirmed by Geoffrey Kibby (Editor, *Field Mycology*).

Even though *Boletus badius* appears on the spreadsheet for most years its numbers have definitely dropped, whereas *B. edulis* seems to have grown in numbers even though many mycorrhizal species have dwindled, species of Russulaceae being a good example.

In fact the most striking difference in the last few years has been the rise in lignicolous species and the drop in mycorrhizal fungi. The saprotrophic fungi seem to be faring quite well but are still affected by the dry conditions, a result of the drought-ridden summers we have been experiencing, especially during 2002 and 2003.

I have witnessed during 2002/3 a rise in the localities for species such as *Grifola frondosa* (Figure 2), *Laetiporus sulphureus, Fistulina hepatica, Armillaria mellea,* and *Meripilus giganteus* as well as the arrival of new records such as *Rhodotus palmatus* and *Hemipholiota populnea*.

So we can draw conclusions from the spreadsheet that highlight the proliferation of certain genera and the decline of other genera, as well as those species belonging to a particular genus that may not be as sensitive to climatic changes as others of the same genus may be. *Amanita muscaria* may oscillate in numbers but it is invariably present from year to year as the spreadsheet shows, whereas species such *A. fulva,* and *A. spissa* may not be present at all from one year to the next.

The spreadsheet can be accessed via www.fungitobewith.org where it can be utilized for reference purposes and you will be able to view the comment boxes.

Note. As I refer to species numbers in the text I feel it sensible to comment that numbers of certain species found in a given year do not appear on the spreadsheet.

The identification process for the majority of the fungi on the spreadsheet was carried out by taking notes in the field of the apparent associated plants or trees, substrate and any macro-characteristics belonging to a particular species that may be lost during transportation. Further macro- and microscopic examinations were then carried out at home aided by appropriate literature (see references), if possible within twenty-four hours.

Many of the more difficult and critical species, but not all (due to practical reasons) on the spreadsheet have been determined and confirmed either by mycologists at Kew or by independent authorities on fungi, such as Geoffrey Kibby (Editor, *Field Mycology*) and Nick Legon (Royal Botanic Gardens, Kew). Voucher specimens of rare, uncommon and common species found on Hampstead Heath are housed at the Mycology Department Herbarium, Royal Botanic Gardens, Kew, for future reference.

Key to locations

S.H. Sandy Heath
E.H. East Heath
W.H. West Heath
H. ext. WW rd Heath Extension, Wildwood Road
H. ext. H.W. Heath Extension, Hampstead Way
P.H. Parliament Hill
G.H.P. Golders Hill Park
B.B. Bird bridge
S.M. South Meadow
U.F. Upper Fairground
V.H. Vale of Health Pond
W.H. AV West Heath Avenue
Bnd Pth Boundary Path
N.E.rd North End Road
N.E. rd gdn. North End Road Garden

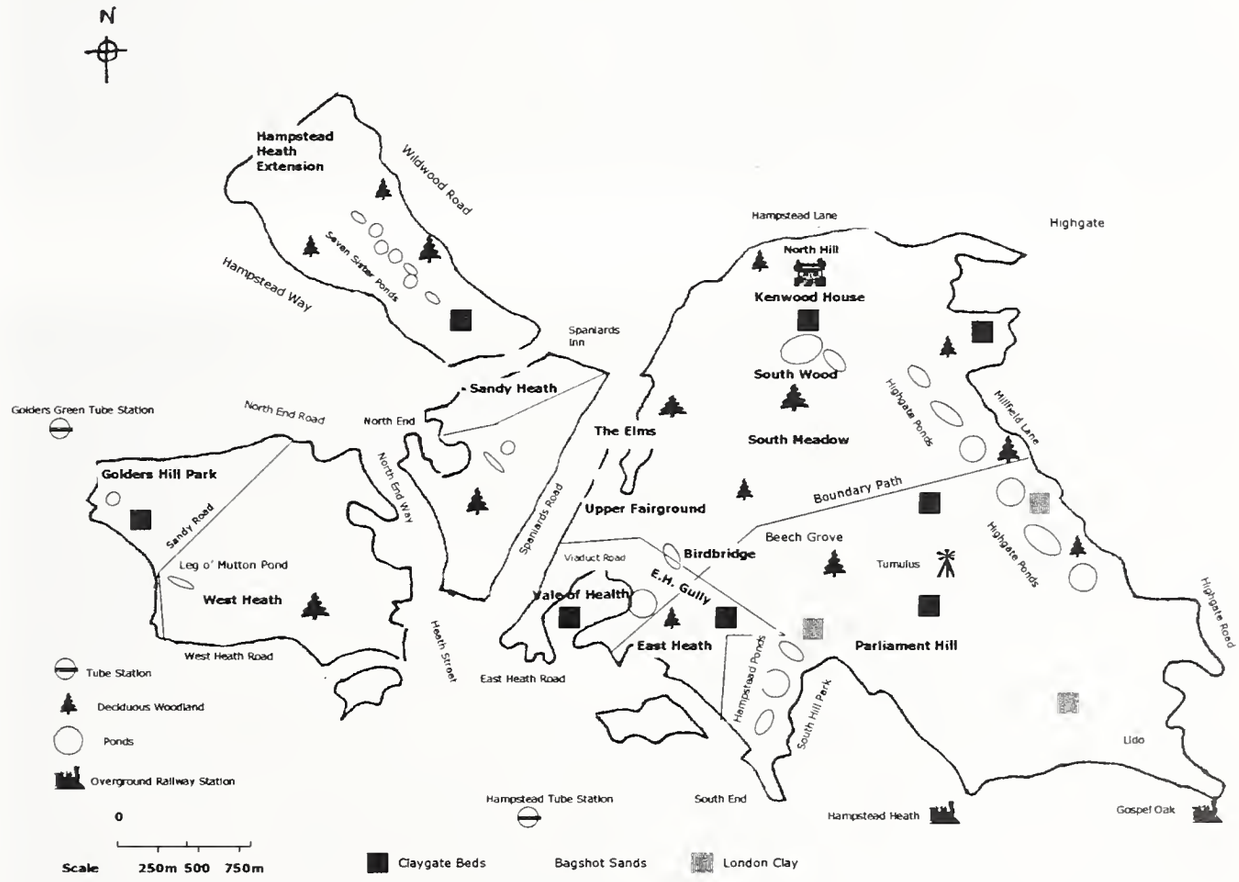

FIGURE 1. Hampstead Heath (TQ 265 865).

Acknowledgements

I would like to thank Geoffrey Kibby and Nick Legon for confirming the identity of collections; Peter Roberts and Brian Spooner at the Mycological Dept, Royal Botanic Gardens, Kew for allowing me to utilize the facilities, and Valerie Barkham the librarian; The Corporation of London for allowing me to carry out organized forays upon Hampstead Heath and all those who have taken part in the forays. Also Yvette Mayn, my partner, whose help during the forays kept the events organized and, with her keen eye, helped to add new records to the database.

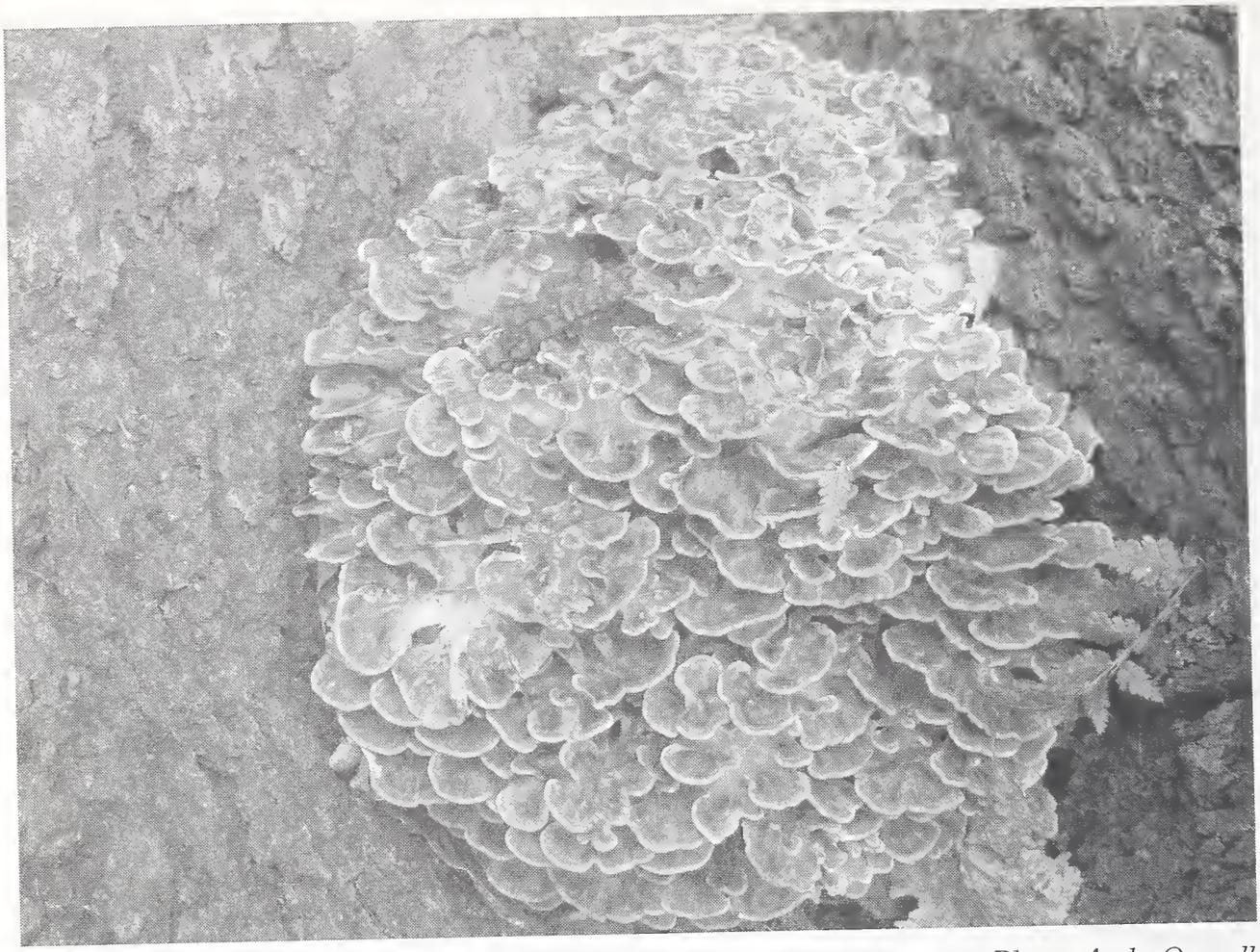

FIGURE 2. *Grifola frondosa*, hen of the woods. *Photo: Andy Overall*

FIGURE 3. *Agaricus impudicus*. *Photo: Andy Overall*

FIGURE 4. *Coprinus lagopus*, hare's-foot inkcap. *Photo: Andy Overall*

FIGURE 5. *Pleurotus dryinus*, veiled oyster. *Photo: Andy Overall*

The London Fungi Recording Group — Hampstead Heath fungi records

Species		Location	1997	1998	1999	2000	2001	2002	2003	2004
Abortiporus biennus	Blushing Rosette	P.H.&HH ext							7-Dec	
Agaricus augustus	The Prince	S.H.								
Agaricus arvensis	Horse Mushroom	H.ext H.W.		17-Oct				Aug/Sep	Aug/Sep 03	
Agaricus bisporus	Cultivated Mushroom			17-Oct		21-Oct				11-Apr
Agaricus bitorquis		S.M. nr S.road								9-Jun
Agaricus campestris	Field Mushroom	H.ext H.W.	11-Oct		21-Aug					20th Aug
Agaricus comtulus		GHP								28th Aug
Agaricus haemorrhoidarius		P.H.				21-Oct				
Agaricus impudicus		H.ext					Dec-01		3-Dec	
Agaricus langei		H.ext H.W.								6-Jun
Agaricus nivescens		H.ext H.W.								17-Jul
Agaricus romagnesii		S.M. the elms						26-Oct		
Agaricus xanthodermus	Yellow Stainer					21-Oct				
Agrocybe cylindracea	Poplar Fieldcap	U.F.willow		17-Oct	16-Oct					
Agrocybe erebia	Dark Fieldcap	E.H.			16-Oct					17-Jul
Agrocybe paludosa		U.F. Grass								23-May
Agrocybe putaminum		G.H.P. wchip								11-Jun
Agrocybe praecox		U.F. wchip								23-May
Agrocybe vervacti		G.H.P.								24-Mar
Aleuria aurantia	Orange Peel Fungus	S.H.& H.ext	14-Oct					5-Oct		11-Jun
Amanita annulosulphurea		S.H.					3-Aug			
Amanita aspera		S.H.					3-Aug			

Amanita citrina	False DeathCap	B.B.nr Beech		17-Oct						
Amanita spissa	Grey Spotted Amanita	S.H.			16-Oct			5-Oct		9-Jun
Amanita fulva	Tawney Grisette	Widespread					13&27 Oct	27-Jun	6-Jul	11-Jun
Amanita muscaria	Fly Agaric	Widespread	11-Oct	17-Oct		21-Oct	13-Oct		27 Sept-11/25/Oct	
Amanita rubescens	The Blusher	Widespread	11-Oct	17-Oct		21-Oct	13-Oct	11 Aug -5 Oct	10 Jun-12 Sept	30-May
Auricularia auricula-judae	Wood Ear	Widespread		17-Oct	16-Oct	21-Oct		19-Oct	27 Sept-11/25/Oct	7-Jan
Auricularia mesenterica	Tripe Fungus	H.ext-H.way								7-Jan
Armillaria gallica	Bulbous Honey	B.B.nr beech						26-Oct	11-Oct	
Armillaria mellea	Honey Fungus	Widespread	11-Oct	17-Oct		21-Oct	13-Oct	26-Oct	11-Oct	
Armillaria tabescens	Ringless Honey	H.ext	11-Oct						27-Sep	
Asocoryne sarcoides	Purple Jelly Disc	Widespread	11-Oct	17-Oct		21-Oct	13-Oct	26-Oct	11-Oct	
Bjerkandera adusta	Smokey Bracket	S.H.		17-Oct						
Boletus badius	Bay Bolete	S.H.& V.H.	11-Oct	17-Oct	16-Oct	11-Sep	13-Oct		Oct-04	9-Jun
Boletus edulis	The Cep	S.H. & V.H.		17-Oct	21Aug-16 Oct	11 Sept-21Oct	13&27 Oct	5-Oct	12-Sep	17-Jul
Boletus erythropus	Scarletina Bolete	H.ext. H.W.	20-Sep		21-Aug			14-Sep		6-Jun
Boletus chrysenteron	Red Cracked Bolete	Widespread	11-Oct	17-Oct	21Aug-16 Oct	21-Oct	13&27 Oct		9 Jul-11Oct	12-Jul
Boletus communis										17th July
Boletus impolitus	Iodine Bolete	S.H.			21-Aug	7-Sep		21-Aug	3/17/27 Sept	20th July
Boletus luridus	Lurid Bolete	W.H. Lime						5-Sep		11-Jun
PseudoBoletus parasiticus	Parasitic Bolete	S.H.				7&21 Sept	13&27 Oct	14-Sep	20-Aug	27th Aug
Boletus pulverulentus		S.H.								12-Jul
Boletus pruinatus	Matt Bolete	S.H.		17-Oct						
Boletus radicans	Rooting Bolete	H.ext south	20-Sep		21-Aug	7-Sep			5-Sep	9-Jun
Boletus rubellus		GHP								28-Aug

Boletus subtomentosus	Suede Bolete	S.H.			16-Oct		5-Sep			
Bolbitius vitellinus	Yellow Fieldcap	H.ext		17-Oct	5-Aug			27-May		
Bolbitius vitellinus var. titubans										2-May
Bulgaria inquinins	Black Bulgar	Widespread	1997	1998	1999	2000	2001	2002	2003	2004
Calocera cornea	Small Stagshorn			17-Oct						
Calocybe gambosa	St Georges Mushroom	H.ext south						6-Apr	15-May	24 Apr-2 May
Cantherellus cibaria								1-Jun		
Chalciporus piperatus	Pepper Bolete	V.H.		17-Oct	16-Oct	21-Oct	27-Oct			
Clavulina cinerea	Grey Coral Fungus							5-Oct	11-Oct	
Clavulina cristata	White Coral	E.H.					25-Sep			
Clavariadelphus fistulosis		E.H.woods				21-Oct				
Clitocybe dealbata	Ivory Funnel	S.H.				21-Oct				
Clitocybe decembris		H.ext				21-Oct				
Clitocybe clavipes	Club Foot	H.ext-H.W.	20-Sep	17-Oct	16-Oct			19/26 Oct		
Clitocybe fragrans	Fragrant Funnel			17-Oct						
Clitocybe geotropa	Trooping Funnel	S.R.				21-Oct				
Clitocybe gibba	Tawny Funnel Cap	Widespread	11-Oct	17-Oct	16-Oct	21-Oct		26-Oct	3-Dec	12th July
Clitocybe nebularis	Clouded Funnel	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	19/26 Oct	3/7 Dec	
Clitocybe odora	Aniseed Funnel	E.H. woods	14-Oct	17-Oct	16-Oct					4th Sept
Clitocybe phaecophthalma	Chicken Run Funnel	E.H.		17-Oct			27-Oct		3-Dec	
Clitocybe rivulosa	Fools Funnel	S.H.							22-Oct	
Clitopilus prunulus	The Miller			17-Oct	16-Oct	21-Oct				
Coboria batshiana							26-Sep			
Collybia butyracea	Buttercap	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct		3-Dec	17th July

Collybia confluens	Clustered Toughshank	Nr Viaduct			16-Oct		13&27 Oct	26-Oct	11-Oct	17th July
Collybia erythropus	Redleg Toughshank				16-Oct	21-Oct				27th Aug
Collybia dryophila	Russet Toughshank	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	19/26 Oct	25/27 Oct	12-Jul
Collybia fusipes	Rooting Tough Shank	E.H.						5/26 Oct	27-Sep	
Collybia peronata	Wood Woolyfoot	S.H.						26-Oct	12-Sep	27th Aug
Conocybe aporos		H.ext south					15-27 Apr			
Conoybe tenera		P.H.					27-Oct			
Coprinus atramentarius	Common Ink Cap	Widespread	14-Oct		16-Oct	21-Oct	13-Oct	26-Oct	11-Oct	6-Apr
Coprinus comatus	Lawyers Wig/Shaggy Ink Cap		11-Oct		16-Oct	21-Oct		26-Oct	17-Dec	6-Apr
Coprinus disseminatus	Fairy Bonnets	E.H.				21-Oct		26-Oct	11-Oct	24-Apr
Coprinus domesticus	Firerug Ink Cap	H.ext & U.F.					28-30 Mar			11 Feb-2 Apr
Coprinus lagopus	Hares's Foot Inkcap	E.H. gully					13-Oct		25 Oct-7 Dec	17th July
Coprinus micaceus	Glistening Ink Cap	Widespread		17-Oct	16-Oct	21-Oct	28-30 Mar	5/26 Oct	20 Sep-11/25 Oct	7 Jan-11 Feb-3 Mar
Coprinus plicatilis	Pleated Inkcap	Widespread	11-Oct	17-Oct	16-Oct	21-Oct		5-Oct	11-Oct	2-May
Cordyceps militaris	Scarlet Caterpillar Club	E.H.nr V.H.					13-Oct			
Cortinarius basililaceus		E.H gully						5-Oct		20-Jul
Cortinarius betuletorum		E.H. gully					13-Oct			
Cortinarius cagei		E.H.gully					27-Oct			
Cortinarius dionysae		E.H. gully						5-Oct		
Cortinarius paleaceus	Pelargonium Webcap	E.H. gully		17-Oct						
Cortinarius purpurascens	Bruising Webcap	E.H. gully					13-Oct	19-Oct		
Crepidotus mollis	Peeling Oysterling	H.ext south							25 Oct-3 Dec	2-May
Crepidotus variabilis	Variable Oysterling	Widespread		17-Oct	16-Oct				27-Sep	3-Mar
Daedalea quercina								26-Oct		
Daedaleopsis confragosa	Blushing Bracket	Widespread				21-Oct	13&27 Oct	5/19/26Oct	27 Sep-11/25 Oct	

Daldinia concentrica	King Alfreds Cakes	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	5/19/26Oct	20 Sep-11/25 Oct	
Enteridium lycoperdon		S.H.								
Entoloma aprile		H.ext. elm					15-27 Apr	2-Apr	29-Apr	24-Apr
Entoloma clypeatum	Shield Pinkgill									15-May
Entoloma rhodopolium		H.ext willow							3-Dec	
Exidia glandulosa	Witches Butter	E.H.							20-Nov	2-May
Fistulina hepatica	Beefsteak fungus	Widespread	11-Oct	17-Oct	21 Aug-16 Oct	11 Sept-21 Oct	13-Oct	5/19/26Oct	22 Jul-5/17/27 Sep	6th Aug
Flammulina velutipes	Velvet Shank	H.ext elm					28-30 Mar		11-Oct	7-Jan
Fomes fomentarius	Tinder Bracket	P.H.& E.H.					13-Oct	26-Oct	9 Jul-3 Nov-8 Dec	
Fuligo septica	Flowers of Tan	S.H.							12-Sep	
Ganoderma applanatum	Artist's Bracket	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13-Oct	5-Oct	11-Oct	
Ganoderma australe	Southern Bracket	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13-Oct	5-Oct	11-Oct	
Ganoderma lucidum	Laquered Bracket	S.M.							5-Sep	
Ganoderma resonaceum	Big Laquered Bracket	Widespread			16-Oct	21-Oct	13-Oct	5-Oct	5-Sep	6th Aug
Grifola frondosa	Hen of the Woods	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	16-Oct	5/19/26Oct	17/20/27 Sep-27 Oct	
Gymnopilus junonius	Spectacular Rustgill	E.H.	11-Oct					5/19/26Oct	21-Sep	
Gyroporus castaneus	Chestnut Bolete	S.H.				21-Oct	25-30 Aug			28-Aug
Handkea excipuliformis		H.ext.ww rd							12-May	
Hebeloma crustuliniforme	Poison Pie	E.H.		17-Oct	16-Oct		25 Sept-13 Oct			
Hebeloma mesophaeum	Veiled Poison pie	E.H.							11-Oct	
Hebeloma pallidoluctuosum	Sweet Poison pie	E.H.					13-Oct	5-Oct		
Hebeloma sacchariolens	Sweet Poison pie	U.F.			16-Oct					
Hemimycena lactea		H.ext							3-Dec	
Hemipholiota populnea		E.H.gully							25-Oct	

Helvella crispa	White Saddle	S.H.woods					27-Oct			
Hericium cirrhatum	Tiered Tooth*	S.H.					13-Oct			
Hygrocybe euroflavescens		P.H.				21-Oct				
Hygrocybe miniata	Vermillion Waxcap	P.H.		17-Oct						
Hygrocybe virginea	Snowy Waxcap	P.H.				21-Oct				
Hygrophoropsis aurantiaca	False Chanterelle								11-Oct	
Hypholoma fasciculare	Sulpher Tuft	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13-Oct	5/19/26Oct	10th June	
Hypholoma udum	Peat Brownie	E.H. gully							25-Oct	
Inocybe bongardii		Sandy.H.								20-Jul
Inocybe flocculosa										28-Aug
Inocybe geophylla var alba	White Fibre Cap			17-Oct				19-Oct	11-Oct	17th July
Inocybe geophylla var lilacina	Lilac Fibre Cap						24-27 Sept			
Inocybe jurana		G.H.P.						28-Sep		
Inocybe lacera var. lacera		V.O.H.								9-Jun
Inocybe lanunigosa		S.H.						27-May		
Inocybe phaeocomis	Collared Fibrecap								31-Jul	
Ionotus dryadeus		G.H.P oak								
Ionotus hispidis	Shaggy Bracket	S.M.bnd pth	11-Oct			21-Oct			27-Sep	
Kuehneromyces mutablis	Sheathed Woodtuft	H.ext & E.H.					13-Oct	19-Oct	25 Oct-20 Nov-7 Dec	3-Mar
Laccaria amethystia	Amethyst Deciever	Widespread		17-Oct	16-Oct	21-Oct	27-Oct			17th July
Laccaria laccata	Common Deciever	Widespread			16-Oct		27-Oct	26-Oct	25-Oct	17th July
Lacrymaria lacrymabunda	Weeping Widow	H.ext. P.H.							3-Dec	9-Jun
Lactarius aurantiacus	Orange Milkcap	V.H.		17-Oct					25-Oct	
Lactarius blennius	Beech Milkcap						27-Oct			

Lactarius blennius	Beech Milkcap						27-Oct			
Lactarius circellatus		HHext w.w. rd								30-May
Lactarius glyciosmus	Coconut Milkcap	V.H.		17-Oct	16-Oct			5/26 Oct		
Lactarius rufus	Rufous Milkcap	V.H.				21-Oct				
Lactarius subumbonatus				17-Oct		21-Oct	13&27 Oct			6th Aug
Lactarius tabidus	Birch Milkcap	V.H.						5-Oct	11-Oct	
Lactarius turpis	Ugly Milk Cap	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	5/19/26Oct	11-Oct	
Lactarius quietus	Oakbug Milkcap	Widespread		17-Oct	16-Oct	21-Oct	13&27 Oct	5-19 Oct		
Lactaius vellereus	Fleecy Milkcap		11-Oct						27-Oct	
Lactarius vietus	Grey Milkcap	V.H.						5-Oct		
Laetiporus sulphureus	Chicken in the Woods	Widespread	Aug-04	19-Sep		7Aug-21 Oct	14-Jun	27 Jun-5 Oct	10 Jun-5 Sep	20th Aug
Leccinum brunneogriseolum		S.H. & V.H.					27-Oct	26-Oct	11-Oct	4th Sept
Leccinum carpini	Hornbeam Bolete	H.ext-WW rd					3-Sep	21-Aug		4th Sept
Leccinum oxydabile		V.H.						5-Oct		
Leccinum scabrum	Brown Birch Bolete	S.H. & V.H.	11-Oct	17-Oct			13-Oct	5-Oct	17 Sep-24 Oct	9-Jun
Leccinum variicolor	Mottled Bolete	S.H. V.H.					13-Oct	5-Oct		
Leccinum versipelle	Orange Birch Bolete	V.O.H.								25th Sept
Lenzites betulinus	Birch Mazegill	Widespread		17-Oct	16-Oct					
Lepiota cristata										17th July
Lepista flaccida								19/26 Oct		
Lepista nuda	Wood Blewit	U.F. H.ext				21-Oct	27-Oct		3/25 Dec	11 Feb -16 Ma
Lepista saeva	Field Blewit	Jack Straws								
Leucoagaricus cepistipes		GHP					3-Aug			
Lycogala epidendron		Widespread		17-Oct	16-Oct			5-Oct	11-Oct	
Lycoperdon perlatum	Puffball	Widespread	20-Sep	17-Oct	16-Oct	21-Oct	13&27 Oct	5/19/26Oct		

Lycoperdon pyriforme	Stump Puffball	Widespread			16-Oct		13&27 Oct	5/19/26Oct	11-Oct	
Lycoperdon umbrinum										4th Sept
Lyophyllum decastes	Clustered Domecap	B.B. & NE rd			16-Oct		15-Sep	26-Oct		11-Jan
Macrolepoita procera	Parasol	H.ext WW rd						19-Oct	20 Nov-3 Dec	6th Aug
Macrolepiota rhacodes	Shaggy Parasol	S.M.the elms						5/19/26Oct	19/27 Sep-3 Dec	
Marasmius epiphyllus									1st Nov	
Marasmius oreades	Fairy Ring Champignon	P.H.		17-Oct	16-Oct		13-Oct			12-Jul
Marasmius rotula	Collared Parachute							Sep-02	Aug-03	
Marasmius wynnei	Pearly Parachute		14-Oct							
Megacollybia platyphylla		S.H.						11-Aug	3rd Sep 03	
Melanoleuca cognata						21-Oct				24-Apr
Melanoleuca grammopodia										17-May
Melanoleuca polioleuca	Common Cavalier	E.H.path						26-Oct		29th Aug
Meripilus giganteus	Giant Polypore	Widespread	11-Oct	17-Oct	16-Oct			5/19/26Oct	8/27 Sep-11 Oct	6th Aug
Morchella elata (complex)		N.E.Rd gdn								1/9/14 April
Mucilago crustacea		H.ext							25-Dec	
Mutinus caninus	Dog Stinkhorn	U.F woods					26-Sep			
Mycena acicula		H.ext.H.W.								12-May
Mycena arcangeliana	Angel's Bonnet	S.H.							22-Oct	
Mycena epipterygia	Yellowleg Bonnet	E.H.							25-Oct	
Mycena filopes	Iodine Bonnet	H.ext							11-Oct	
Mycena flavo-alba		P.H.		17-Oct						
Mycena galericulata	Common Bonnet	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	19/26 Oct	11-Oct	7-Jan
Mycena galopus var.candida	Milking Bonnet	H.ext H.W.							11-Oct	

Mycena galopus var.galopus		Widespread		17-Oct	16-Oct	21-Oct	13&27 Oct	19/26 Oct		
Mycena haematopus	Burgundydrop Bonnet	S.M. woods					13-Oct	26-Oct		
Mycena galopus var.nigra	Black Milking Bonnet							26-Oct		
Mycena leucogala							13&27 Oct	5-Oct		
Mycena inclinata	Clustered Bonnet						13&27 Oct	26-Oct	25-Oct	
Mycena olivaceomarginata	Brownedge Bonnet	E.H. & H.ext							11-Oct	
Mycena polygramma	Grooved Bonnet						27-Oct	5-Oct	27-Sep	
Mycena pura var. rosea	Rosy Bonnet	H.ext.& E.H.				21-Oct		19/26 Oct	20-Nov	
Mycena speirea	Bark Bonnet	H.ext.& E.H.							3/25 Dec	
Mycena vitilis	Snapping Bonnet	H.ext H.W.							27-Sep	
Nectria cinnabarina	Coral Spot	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	19/26 Oct	25-Oct	
Neobulgaria pura	Beech Jellydisc	S.H.				21-Oct				
Neobulgaria pura var. foliacea		S.H.					27-Oct			
Otidea onotica	Hare's Ear	E.H.gully						19-Oct		
Panellus serotinus	Olive Oysterling	S.H.							7-Dec	7-Jan
Panellus stipticus	Bitter Oysterling	S.H.								7-Jan
Paxillus involutus	Brown Roll Rim	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	5-Oct	9th July	11 Jan-17 Ma
Peniphora quercina		S.H.							7-Dec	
Peziza badia	Bay Cup	E.H.gully					24&27 Sept		2-Aug	6th Aug
Peziza vesiculosa	Blistered Cup							26-Oct	29-Apr	11-Apr
Phallus impudicus	Stinkhorn	Widespread	14-Oct			21-Oct	27-Oct	5-19 Oct	3-Sep	12th July
Phlebia tremellosa	Jellyrot								27 Sep-1 Nov	
Pholiota alnicola		E.H gully				21-Oct				
Pholiota aurivella		E.H.gully	11-Oct				13-Oct	5/19/26Oct	11/22 Oct	

Pholiota gummosa	Sticky Scalycap	E.H. gully							11-Oct	
Pholiota squarossa	Shaggy Scalycap	Widespread	11-Oct	17-Oct	16-Oct	21-Oct		5/19/26Oct	11/25 Oct	
Pholiotina brunnea										27th Aug
Piptoporus betulinus	Birch Polypore	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	5/19/26Oct	19/27 Sept	
Pleurotus cornucopiae	Branching Oyster	E.H.gully elm				21-Oct			11/25 Oct	
Pleurotus dryinus	Veiled Oyster	E.H. gully *oak*					13-Oct		27 Sep-22/25 Oct	
Pleurotus lignitalis		E.H.gully							25-Oct	
Pleurotus ostreatus	Oyster	Widespread	11-Oct	17-Oct	18 Aug-16 Oct		26 Aug-27 Oct	5/19/26Oct	27 Sep-11/25 Oct	7 Jan-23 May
Pluteus cervinus	Fawn Pluteus	Widespread	11/14 Oct	17-Oct	16-Oct		13-Oct	5/19/26Oct	27 Sep-11/25 Oct	2-May
Pluteus luteovirens		S.M. (S.R.)								2-May
Pluteus nanus										12th July
Pluteus petastatus		G.H.P.					4-Sep			
Pluteus umbrosus	Velvet Shield	S.M.the elms						26-Oct		
Pluteus salicinus	Willow Shield							26-Oct	11-Oct	
Podoscypha multizonata	Zoned Rosette	EHpth&ghp						5-Oct		28-Aug
Polyporus durus	Bay Polypore	E.H.gully		17-Oct	16-Oct			5-Oct	27 Sep-11/25 Oct	
Polyporus brumalis	Winter Polypore	S.H.&W.H.							25-Dec	20-Mar
Polyporus squamosa	Dryads Saddle	P.H.&H.ext	11-Oct					5-Oct	29 May-8 Sep-11/25 Oct	2/22 May
Polyporus tuberaster	Tuberous Polypore	S.H.							27-Jul	
Polyporus varius var. nummularius		E.H.								23-Mar
Postia stiptica	Bitter Bracket						27-Oct			
Psathyrella conopilus		H.ext H.W.	14-Oct				30-Mar		5-May	6-Jun
Psathyrella gracilis		G.H.P.							Dec-03	
Psathyrella multipedata	Clustered Brittle stem	S.M. woods						5-Oct		
Psathyrella piluliformis	Common Stump Brittlestem	S.M. woods		17-Oct	16-Oct	21-Oct	13-Oct		11-Oct	

Psathyrella pellucidipes										27th Aug
Psathyrella polycystis									1-Nov	
Psathyrella spadicea	Chestnut Brittlestem	W.H.Av						23-Nov	7-Dec	
Psathyrella spadiceogrisea var.		W.H.rd								24-Mar
Pseudotrametes gibosa		S.H.					13-Oct	26-Oct		
Psilocybe cyanascens	Blueleg Brownie	S.M woods							7-Dec	
Psilocybe semilanceata	Liberty Cap	P.H.& S.M.				21-Oct				
Ramaria stricta	Upright Coral						27-Oct			
Rhodotus palmatus	Wrinkled Peach	E.H.gully elm							11-Oct	
Rickenella fibula										17th July
Russula amoenolens		H.ext & GHP		17-Oct	16-Oct	21-Oct	13-Oct			20th Aug
Russula amoenolens var. alba		H.ext WW rd					27 Aug-27 Oct			20th Aug
Russula atropurpurea	Purple Brittlegill	Widespread		17-Oct	21Aug-16 Oct	7 Sept-21 Oct	13th Oct 01	5/19/26Oct		17th July
Russula betularem	Birch Brittlegill			17-Oct			13&27 Oct			
Russula claroflava	Yellow Swamp Brittlegill	S.H.				11-Sep	13&27 Oct			17th July
Russula cyanoxantha	Charcoal Burner	S.H.			18 Aug-16 Oct	11 Sept-21Oct				17th July
Russula delica	Milkwhite Brittlegill	ext s&w.h.			5-Aug					20th July
Russula emetica f. Sylvestris	Sickener							19-Oct		
Russula fragilis	Fragile Brittlegill			17-Oct			13&27 Oct		25-Oct	
Russula foetens	Stinking Brittlegill	S.H.					20-Sep			
Russula grisea		H.ext WW rd		17-Oct				6-Jun		17-Jun
Russual graveolens		S.H.					3-Sep			20th Aug
Russula heterophylla	Greasy Green Brittle gill	W.H. Lime	14-Oct				3-Sep			17th July
Russula nitida							27-Oct			

Russula ochraleuca	Ochre Brittlegill	S.H.		17-Oct	16-Oct	7 Sept-21 Oct	13&27 Oct	5/19/26Oct	27 Sept-25 Oct	6th Aug
Russula nigricans	Blackening Brittlegill	S.H.					27-Aug		Aug-03	28th Aug
Russula risigellina var.										28th Aug
Russula sororia										17th July
Russula subfoetens										28th Aug
Russula vesca		S.H.					3-Sep			
Russula parazurea	Powdery Brittlegill	S.H.	11-Oct	17-Oct	21Aug-16 Oct	21-Oct	13&27 Oct	11 Aug-5/19/26Oct	3/27/Sept-11 Oct	30-May
Russula velenovskii										4th Sept
Russula xerampelina							20-Sep			
Russula pseudo-affinis	Veiled Brittlegill	G.H.P						26-Sep		
Scleroderma aeroelatum	Leopard Earthball	S.H.				21-Oct				27th Aug
Scleroderma citrinum	Common Earthball	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	11 Aug-5/19/26Oct	27 Sept-11 Oct	6th Aug
Scleroderma verrucosus	Scaly Earthball	S.H.		17-Oct	16-Oct			5/19/26Oct		20th Aug
Scutellinia scutellata	Eyelash Fungus									17-May
Simocybe sumptuosa									1-Nov	
Sparassis crispa	Cauliflower Fungus	S.H.		17-Oct			27-Aug	14-Sep	12-Sep	
Stereum hirsutum	Hairy Curtain Crust	Widespread	11-Oct	17-Oct	16-Oct		13-Oct		3-Dec	
Stereum rugosum		Widespread								
Stropharia aurantiaca	Redlead Roundhead	H.ext,BB,PH	14-Oct			21-Oct	15-Sep	19-Oct	1-Nov	
Stropharia aeruginosa	Small Blue Roundhead	P.H. woods				21-Oct			25-Oct	
Stropharia cyanea	Blue Roundhead	S.H.				21-Oct		28-Sep		
Suillus granulatus	Weeping Bolete	G.H.P.								
Taphrina pruni	Pocket Plum	H.ext H.W.							5-May	15-May
Thelephora terrestris			14-Oct							

Tricholoma album					16-Oct					
Trametes versicolor	Turkey Tail	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	5/19/26Oct	11-Oct	
Tricholoma fulvum	Birch Knight	E.H.gully		17-Oct		21-Oct				
Tricholoma sejunctum										
Tricholoma scalpturatum	Yellowing Knight						13&27 Oct			17th July
Tricholoma sulphureum	Sulphur Knight						27-Oct			
Tricholoma ustaloides		E.H.gully					13&27 Oct			
Typhula erythropus	Redleg Club			17-Oct						
Ustulina deusta										16-May
Volvariella bombycina	Silky Rosegill	Beech BB							1-Aug	20th Aug
Volvariella gloiocephala	Stubble Rosegill	G.H.P& U.F		17-Oct	16-Oct			Spring 2002		12th Jun
Xerula radicata	Rooting Shank	E.H.woods						26-Sep		
Xylaria hypoxolon	Candlesnuff Fungus	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	5/19/26Oct	11/25/1st Nov	
Xylaria polymorpha	Deadman's Fingers	Widespread	11-Oct	17-Oct	16-Oct	21-Oct	13&27 Oct	5/19/26Oct	11/25/1st Nov	

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Book review

A catalogue of alien plants in Ireland. Sylvia C. P. Reynolds. Occasional Papers No. 14, National Botanic Gardens, Glasnevin. 2002. 414pp., paperback. A5. ISSN 0792 0422. Available from The Herbarium, National Botanic Gardens, Glasnevin, Dublin 9, Ireland for €30 post free. There are a limited number of hardback copies at €45, also post free to Great Britain.

Until the publication of this book, our knowledge of the alien plants of Ireland lagged far behind that of the rest of the British Isles. As John Akeroyd points out in his useful preface, 'not all botanists have regarded research on aliens as an entirely reputable occupation'. Even that great Irish botanist, the late Professor David Webb, was suspicious of aliens. Only partly in jest, he scolded both Akeroyd and Sylvia Reynolds for pursuing an interest in aliens that 'would lead Irish botany into disrepute'! Fortunately for us, Ms Reynolds continued with her studies, and this meticulously researched catalogue is the result.

The catalogue is designed to be used in conjunction with *Alien plants of the British Isles* (Clement and Foster 1994) and *Alien grasses of the British Isles* (Ryves et al. 1996). These two standard reference works provide additional information, such as the countries of origin, sources of introduction into the British Isles, and references to plant descriptions and illustrations. Care has also been taken to ensure that the catalogue is compatible with the *New atlas of the British and Irish flora* (Preston et al. 2002) whose maps complement the distribution information given in the *Catalogue*.

In total 920 alien plant taxa have been recorded in Ireland, mainly in the nineteenth and twentieth centuries. Around 200 of these are native to Britain. The current list (1987 – 2001) contains 645 alien taxa, of which 70 per cent are of cultivated origin, 45 per cent are casuals, 55 per cent are rare or found at only one site, and only 18 per cent are common. A very small proportion of the last category are of conservation concern on account of their invasive tendencies. They include the 'usual suspects' — plants like rhododendron *R. ponticum*, cherry laurel *Prunus laurocerasus*, Japanese knotweed *Fallopia japonica*, and giant hogweed *Heracleum mantegazzianum*, all of which cause problems in other parts of the British Isles. It is perhaps more surprising to learn that beech *Fagus sylvatica*, an introduction in Ireland, is also considered a threat to oak woods, and to the yew woods in Killarney. Alarm bells have already been raised about the possible spread of certain invasive aquatic species, such as New Zealand pygmyweed *Crassula helmsii* and parrot's-feather *Myriophyllum aquaticum*, thankfully both still rare in Ireland. The third member of this notorious trio, floating pennywort *Hydrocotyle ranunculoides* was found in Ireland (County Down) for the first time in 2002. They will all need to be carefully monitored.

This excellent book will provide an invaluable baseline against which future changes in Ireland's alien flora may be assessed.

David Bevan

Fungal records for 2003; with a review of records published in *The London Naturalist,* 1934–2003

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Abstract

This paper inaugurates regular fungal recording by the London Natural History Society. As the first designated recorder of fungi for the Society, the author will accept material for identification and gather foray reports, occasional records and notable finds annually. These records will be summarized in this journal and submitted in full to the national database maintained by the British Mycological Society. Foray records for north London sites in 2003 are presented along with a note about previous recording within the LNHS area.

Introduction

The fifth kingdom of life on earth comprises the fungi and consists of some 300,000 described species, which are estimated to be only about 20 per cent of the true number (USDA Research Service 2003). Of the 300,000 species in the literature 14,817 have been recorded from the British Isles (British Mycological Society 2004) amounting to nearly 5 per cent of the world total. For no other group of organisms is the percentage of the world total so high. This reflects two factors; fungi are extremely efficient at dispersing themselves and mycological taxonomic and recording effort in the British Isles has been intensive over the past two hundred years. Almost any fungus can turn up almost anywhere, as one of our records this year illustrates. However recorder effort is patchy and the size of the target dwarfs the number of mycologists active in the field.

Fungus records in *The London Naturalist*, 1934–2003

The London Naturalist (*LN*) has only irregularly reported on fungal diversity in our area as Henry Tribe noted in a historical review of fungi in London (Tribe 1995). Searching the journal for the past seventy years by hand yielded only ten articles devoted to mycology of which five are on myxomycetes (not now considered to be fungi) (Ing 1965, 1998, 1999, 2002; Holland 1973). A study of urban fungi in the London Borough of Haringey, 1983–1991, by Keith Thomas (1992) was based on the annual forays for those years and is the most comprehensive such survey to date. These forays have continued and an update will be published in due course. Plant and Kibby (1984) surveyed the fungi of southern Epping Forest from 1979 to 1983. They remark that the records for the central area of the forest included over 1,100 species at that date, making it one of the richest sites in London. However these records were not included as their article is confined to the southern part of the site. A number of reports are

contained within wider ecological surveys such as the annual Bookham Common and Hampstead Heath Survey progress reports (e.g. Bowlt 1999, Holland 1991, Goldsmith 1986). Castell (1947, 1949) reported lists of the fungi of Bookham Common including 340 species. These lists resulted from three annual visits by the British Mycological Society (dates not stated) and several visits by Dr R.W.G. Dennis (now recently deceased, the doyen of British fungal taxonomy of the twentieth century). Castell pointed out and Holland (1969) repeated that careful recording over successive years would reveal data on succession, distribution and habitat requirements. Other than annual additions to the list this seems not to have happened. Otherwise forays have not been regularly reported in the *LN* and in any case they only provide a snapshot of what was found on a particular day, usually in the autumn. Nevertheless they are important since, when forayers are numerous, one can hope to have obtained a fair proportion of at least the macrofungi present at the sites visited. Individual efforts over longer time spans and throughout the year are also very important, as the article by Andy Overall in this issue demonstrates. Finally back and front garden records can contribute a surprising variety of species from this largely untapped aggregate of sites, which often go unnoticed and are certainly under-recorded. It remains the case that fungal distribution, diversity and status is usually the least known aspect of the ecology of sites within our area, with the exception of a few highly monitored sites such as the Royal Botanic Gardens at Kew (undoubtedly the most intensively forayed patch on the planet), the gardens of Buckingham Palace (Henrici 2001) and the Wildlife Garden at the Natural History Museum (Leigh and Ware 2003). By gathering and publishing any available London records (with the exception of Kew), I hope to promote the inclusion of the fifth kingdom in our regular recording effort.

Methods

Two forays in 2003 were led by the recorder (Haringey and Gillespie Park) from which the days' collections were taken to a central point for sorting and detailed identification using the references sited in the Appendix. Where necessary, microscopic examination of spores and other tissues were also undertaken. In one case material was sent to Kew for confirmation. Some individual records have been supplied to the author via the London Fungi site set up by Keir Mottram at http://uk.groups.yahoo.com/group/londonfungi/ or by post. Records were entered into MycoRec, a fungal recording programme available from the British Mycological Society at http://194.203.77.76/fieldmycology/MycoRec/MycoRec.htm/.

Results

Table 1 lists the species according to taxonomic classification and provides a site index and species list. Each record has a unique accession number and the site, substrate, collector, identifier and literature reference are attached. The total of ninety-two species is quite low. This reflects the fact that the two forays took place in an extremely dry autumn following the hottest summer on record in the UK. Fruiting of ectomycorrhizal species such as Russulas, Lactarii, Amanitas and Boletes failed almost completely. The majority of species found were lignicolous and such species were unusually abundant. As this is the first year of general systematic recording no comment can be made on trends.

Notable finds

The find of the year was undoubtedly *Leucocoprinus birnbaumii* observed fruiting in hundreds of clumps all over a large pile of woodchips in Highgate Woods in early August by Keir Mottram. *L. birnbaumii* (Figure 1, and Frontispiece) is a large handsome bright yellow pan-tropical species, which sometimes appears in

hothouses; hence one of its common names — the stove house agaric. Although there have been previous records of its occurrence outdoors in England, Nick Legon at Kew noted this as the first confirmed record and added it to the UK checklist of agarics which he was compiling at the time. Exsiccata, notes and photographs have been deposited in Herbarium Kew (**K**). News of the find was reported in the local and national press as a global-warming story, which indeed it may reflect. The woodchip pile at Highgate Wood was composed of shredded Christmas trees and discarded houseplants. The latter were most likely the source of the fungus as such plants are originally from the tropics and certainly propagated in greenhouses where *L. birnbaumii* is known to occur.

Figure 2 illustrates the size that a lignicolous fungus, *Laetiporus sulphurous* chicken of the woods, achieved, also in Highgate Wood in early September. The specimen illustrated was growing on a standing dead oak trunk.

Figure 3 shows Keir Mottram measuring the largest fungus found to date in Haringey, a 1.4 metre wide bracket of *Rigidiporus ulmarius* growing on a poplar stump in Avenue Gardens near Alexandra Palace railway station. An even larger specimen of this species found at Kew has been listed in *The Guinness Book of Records*. Figure 4 is of *Boletus crocipodium*, an uncommon species found in Highgate Wood in early autumn.

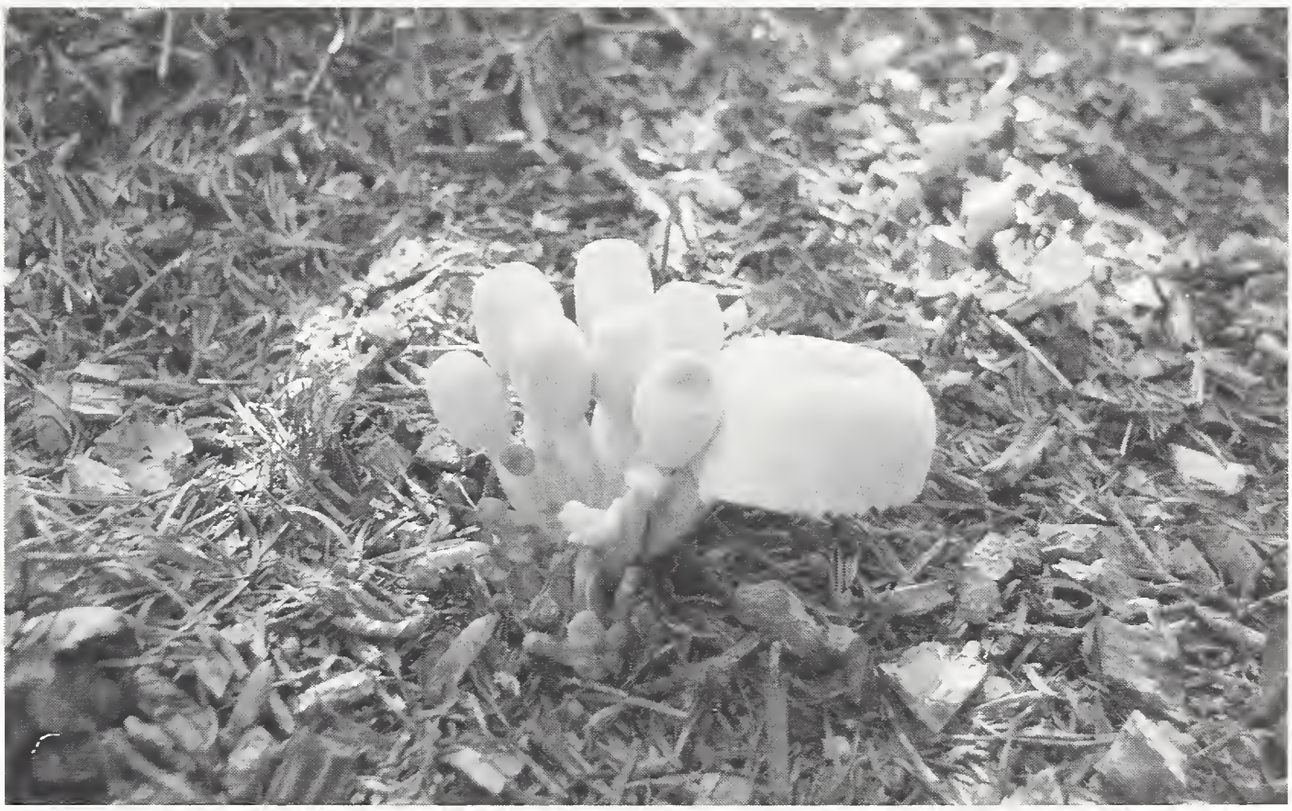

FIGURE 1. *Leucocoprinus birnbaumii,* the stovehouse agaric, 10.viii.2003. See also Frontispiece.

Acknowledgements

Keir Mottram assisted in identifying many collections. David Bevan (Haringey Conservation Officer) has given unfailing support and encouragement towards fungal recording by the author. Peter Holland started the author on regularly recording the Haringey foray.

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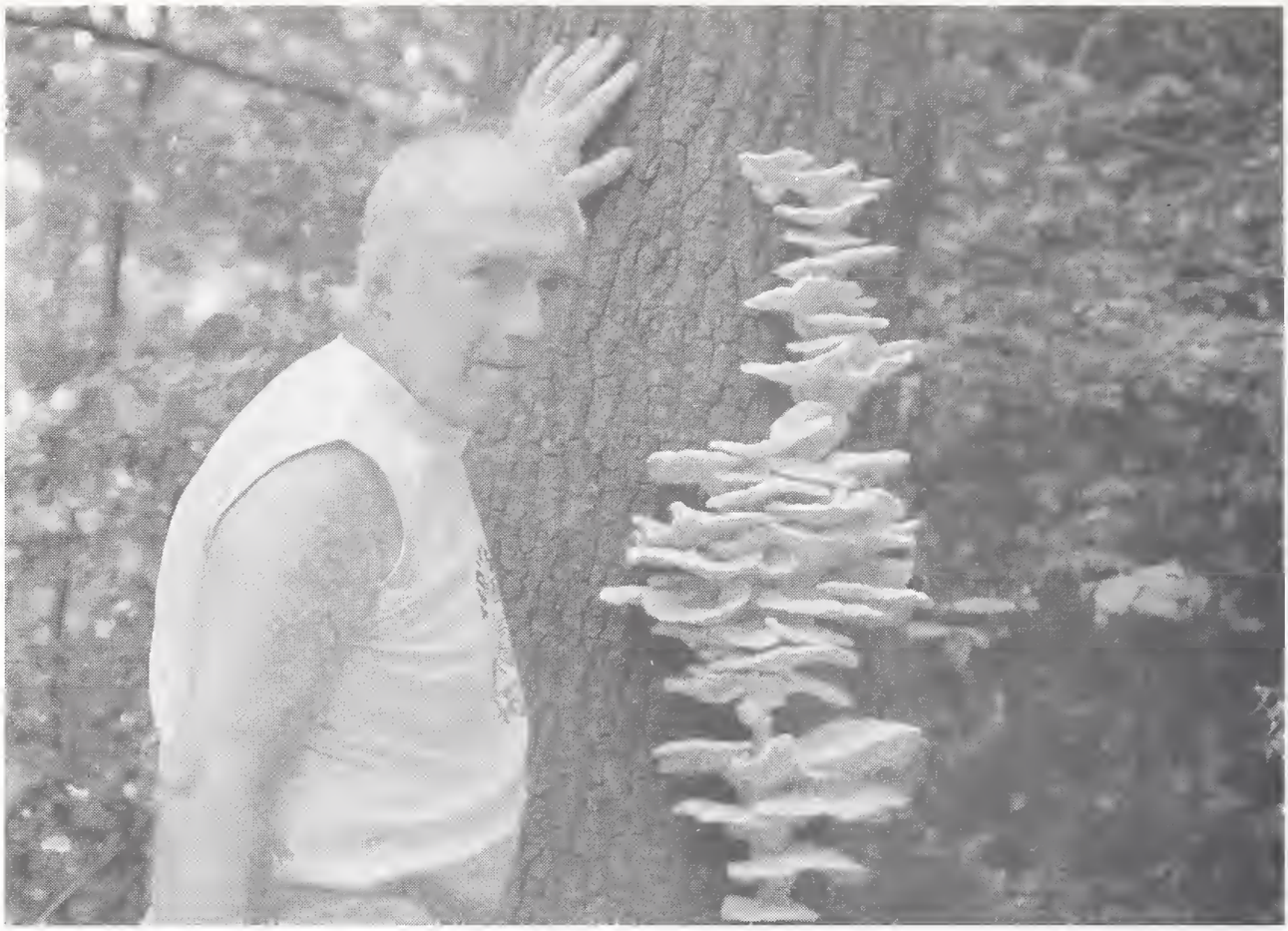

FIGURE 2. *Laetiporus sulphurous,* chicken of the woods, growing on a dead tree trunk, 20.ix.2003. The author adds scale. *Photo: Michelle Tuddenham*

FIGURE 3. *Rigidiporus ulmarius* on a poplar stump is being measured by Kier Mottram, 22.iv.2004.

FIGURE 4. *Boletus crocipodium,* Highgate Wood, 13.viii.2003. Collector, J. Sanders.

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APPENDIX
Fungal records for north London, 2003
Taxonomic index

ANAMORPHIC FUNGI

Hyphomycetous anamorph

Cercospora armoraciae

377, doubtful record, *Armoracia rusticana*, leaf, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: R. Myers, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 25.x.2003, Lit: *Microfungi on land plants*, M.B. Ellis and J.P. Ellis, 1997.

ASCOMYCOTA

Dothideales

Leptosphaeriaceae

Leptosphaeria maculans

375, doubtful record, *Alliaria petiolata*, leaf, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: R. Myers, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 25.x.2003, Lit: *Microfungi on land plants*, M.B. Ellis and J.P. Ellis, 1997.

Erysiphales

Erysiphaceae

Erysiphe cichoracearum

374, Doubtful record, *Achillaea millefolium*, leaf, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: R. Myers, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 25.x.2003, Lit: *Microfungi on land plants*, M.B. Ellis and J.P. Ellis, 1997.

Hypocreales

Hypocreaceae

Nectria cinnabarina

49, wood, dead, woodland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: M. Rawitzer, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

369, branch, dead, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: R. Myers, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Leotiales

Leotiaceae

Ascocoryne sarcoides

312, *Acer platanoides*, trunk, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Bulgaria inquinans

314, branch, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Sordariales

Lasiosphaeriaceae

Lasiosphaeria ovina

92, *Acer platanoides*, bark, dead, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: D. Bevan, Det.: M. Rawitzer, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Encyclopaedia of the fungi of Britain and Europe,* Michael Jordan 1995.

Xylariales

Xylariaceae

Daldinia concentrica

80, wood, dead, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

370, branch, dead, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Hypoxylon fragiforme
373, doubtful record, stump, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Hypoxylon multiforme
372, doubtful record, stump, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

87, wood, dead, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Xylaria hypoxylon
86, wood, dead, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

352, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: M. Rawitzer, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Xylaria polymorpha
47, wood, dead, woodland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

85, wood, dead, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

BASIDIOMYCOTA
BASIDIOMYCETES
AGARICALES
Agaricaceae
Agaricus xanthodermus
56, grassland, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Leucoagaricus leucothites
94, compost, mixed semi-natural woodland, Site: North Bank Estate, TQ284899, Middlesex, Col.: D. Bevan, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 17.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Leucocoprinus birnbaumii
380, wood chips, woodland, Site: Highgate Wood, TQ282887, Middlesex, Col.: K. Mottram, Det.: E.G.D. Tuddenham, Conf.: N. Legon, 5.viii.2003, Herb.: K, Lit: *Fungus flora of Venezuela and adjacent countries*, R.W.G. Dennis, 1970. Notes: First confimed open-air record for UK.

Macrolepiota procera
333, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

332, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Macrolepiota rhacodes
57, garden, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Bolbitiaceae
Bolbitius vitellinus
361, manure, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 06.xii.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Coprinaceae

Coprinus atramentarius

364, wood, buried, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

359, wood, buried, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 6.xii.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Coprinus lagopides

322, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Coprinus micaceus

60, grassland, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: D. Bevan, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

321, stump, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Coprinus romagnesianus

45, wood, rotten, woodland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995, Notes: Also confirmed by spore measurement.

Psathyrella multipedata

61, grassland, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Psathyrella piluliformis

344, wood, base, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Pluteaceae

Pluteus salicinus

48, wood, dead, woodland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: M. Rawitzer, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

365, wood, dead, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Strophariaceae

Hypholoma fasciculare

58, wood, dead, garden, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

74, wood, dead, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: M. Rawitzer, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

328, trunk, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Pholiota aurivella

88, wood, dead, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Stropharia cyanea

as *Stropharia caerulea*, 356, wood chips, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, Conf.: K. Mottram, 6.xii.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Tricholomataceae

Armillaria gallica

310, *Quercus*, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Armillaria mellea

77, wood, dead, woodland & scrub, Site: Alexandra Park, TQ301901, Middlesex, Col.: anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *The mushrooms and toadstools of Britain and North Western Europe*, Marcel Bonn, 1987.

54, wood, dead, grassland & scrub, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

52, wood, dead, woodland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

66, *Quercus robur*, wood,, base, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Clitocybe nebularis

317, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Fungi of Switzerland,* 5, J. Breitenback and F. Kranzlin, 2000.

316, leaf, litter, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Flammulina velutipes

326, stump, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: K. Mottram, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Gymnopus dryophilus

as *Collybia dryophila*, 320, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: K. Mottram, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Gymnopus fusipes

as *Collybia fusipes*, 73, *Quercus robur*, trunk, base, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: M. Rawitzer, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Lepista flaccida

as *Clitocybe flaccida*, 318, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: J. Breitenback and F. Kranzlin, *Fungi of Switzerland*, 5, 2000.

355, leaf, litter, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: K. Mottram, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 6.xii.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe,* Roger Phillips, 1981.

Lepista nuda

363, soil, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

329, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

360, flower bed, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 6.xii.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Mycena

as *Mycena alcalina*, 340, leaf, litter, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Mycena epipterygia

338, leaf, litter, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Mycena filopes
339, leaf, litter, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Mycena galericulata
334, tree, standing, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *The mushrooms and toadstools of Britain and North Western Europe*, Marcel Bonn, 1987.

Mycena galopus
335, leaf, litter, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Mycena haematopus
82, soil, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Mycena leptocephala
336, leaf, litter, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Mycena pura* var. *rosea
as *Mycena rosea*, 337, leaf, litter, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: K. Mottram, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Rhodocollybia butyracea
as *Collybia butyracea*, 319, soil, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: M. Rawitzer, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Fungi of Switzerland*, 5, J. Breitenback and F. Kranzlin, 2000.

as *Collybia butyracea*, 70, soil, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: M. Rawitzer, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Rickenella fibula
371, Doubtful record, branch, dead, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Auriculariales

Auriculariaceae

Auricularia auricula-judae
46, *Sambucus nigra*, branch, woodland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: M. Rawitzer, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

311, *Sambucus nigra*, branch, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Auricularia mesenterica
83, wood, dead, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Boletales

Coniophoraceae

Serpula himantioides
345, *Acer platanoides*, trunk, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

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341, wood, buried, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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53, *Crataegus*, wood, dead, grassland & scrub, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Gymnopilus penetrans

357, wood, buried, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, Conf.: K. Mottram, 6.xii.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Hebeloma crustuliniforme

358, soil, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 6.xii.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

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Crepidotus variabilis

323, branch, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: M. Rawitzer, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Tubaria conspersa

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Tubaria furfuracea

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325, *Quercus*, trunk, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: K. Mottram, Det.: K. Mottram, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

65, *Quercus robur*, wood, attached, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

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90, *Quercus robur*, trunk, attached, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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327, *Acer platanoides*, trunk, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Ganoderma resinaceum

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81, *Quercus robur*, trunk, attached, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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331, stump, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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68, soil, clayey, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

93, *Lolium perenne*, parkland & scattered trees, Site: Scout Park, TQ296914, Middlesex, Col.: M. Rawitzer, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Daedalea quercina

50, wood, dead, woodland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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Daedaleopsis confragosa

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Grifola frondosa

72, *Quercus robur*, trunk, base, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: M. Rawitzer, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

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Laetiporus sulphureus

69, wood, rotten, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Meripilus giganteus

55, wood, dead, grassland & scrub, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Piptoporus betulinus

64, *Betula pubescens*, wood, attached, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: K. Mottram, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Rigidoporus ulmarius

91, *Fraxinus excelsior*, trunk, attached, base, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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Trametes gibbosa

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as *Coriolus versicolor*, 51, wood, dead, woodland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

366, stump, dead, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

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71, *Fagus sylvatica*, branch, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: M. Rawitzer, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

Pleurotus ostreatus

59, wood, dead, garden, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: D.Bevan, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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368, stump, dead, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: R Myers, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

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379, *Sambuccus niger*, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: K. Mottram, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 25.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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315, *Betula*, trunk, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

Phlebia merismoides

343, wood, buried, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Det.: K. Mottram, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

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as *Phlebia radiata*, 353, trunk, attached, parkland & scattered trees, Site: Chiswick House, TQ209775, Middlesex, Col.: Mick Massie, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 28.xii.2003, Lit: *Fungi of Switzerland*, 2, J.Breitenback and F.Kranzlin, 2000.

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378, branch, dead, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: K. Mottram, Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 25.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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79, *Quercus robur*, soil, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 19.x.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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346, branch, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: M. Rawitzer, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

347, *Acer platanoides*, branch, dead, parkland & scattered trees, Site: Hampstead Heath Extension, TQ259876, Middlesex, Col.: M. Rawitzer, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 30.xi.2003, Lit: *Mushrooms and other fungi of Great Britain and Europe*, Roger Phillips, 1981.

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367, stump, dead, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: R. Myers, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 25.x.2003, Lit: *Mushrooms and toadstools of Britain and Europe*, R. Courtecuisse and B.D. Duhem, 1995.

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376, *Urtica dioica*, leaf, grassland & scrub, Site: Gillespie Park, TQ314862, Middlesex, Col.: R. Myers, Det.: E.G.D. Tuddenham, Conf.: E.G.D. Tuddenham, 25.x.2003, Lit: *Microfungi on land plants*, M.B.Ellis and J.P.Ellis, 1997.

120 records, 86 species.

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Alexandra Park, TQ301901, Middlesex.
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Tottenham Cemetery, TQ332909, Middlesex.

People references

Anon.
D.Bevan
E.G.D. Tuddenham
K. Mottram
M. Rawitzer
Mick Massie
N. Legon
R. Myers

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Alliaria petiolata
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Betula
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Betula pubescens
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Crataegus
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Fagus sylvatica
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Fraxinus excelsior
Rigidoporus ulmarius.

Lolium perenne
Abortiporus biennis.

Populus
Rigidoporus ulmarius.

Quercus
Armillaria gallica, Daedalea quercina, Fistulina hepatica.

Quercus robur
Armillaria mellea, Daedaleopsis confragosa, Fistulina hepatica, Ganoderma adspersum, Ganoderma resinaceum, Grifola frondosa, Gymnopus fusipes, Inonotus hispidus, Podoscypha multizonata.

Sambucus nigra
Auricularia auricula-judae, Hyphoderma sambuci.

Urtica dioica
Pseudoperonospora urticae.

Botanical records for 2003

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Abstract

This paper presents a selection of the more interesting records of flowering plants and ferns made in the London Area in 2003. Maps are presented showing the overall distribution in the area of *Crassula helmsii* and *Lepidium latifolium*.

Introduction

This paper is the twenty-ninth in an annual series to be offered by the present author, continuing a sequence started by J. E. Lousley (1945). These papers present a selection of the more interesting plants discovered within twenty miles of St Paul's Cathedral in the previous year. They are arranged according to the system of vice-counties divised by Watson (1873), and within each vice-county by London boroughs, or outside London, by the modern county administrations.

In 2003, members of the London Natural History Society were involved in recording for the Local Change project run by the Botanical Society of the British Isles. This project, which is continuing in 2004, collects records in predetermined square areas which were also surveyed for the BSBI's Monitoring Scheme in 1987 and 1988 and will no doubt be surveyed again at similar intervals of time in the future, with the object of making observations about overall decrease or increase of plant taxa nationally. I have responsibility for assembling records from areas in Bromley and Kent (vice-county 16) and Barnet, Harrow, Richmond upon Thames and Surrey (v.c. 21). A selection of records made in these areas will appear in the appropriate places below. All Local Change records, including those from other parts of the present LNHS area (a circle of twenty miles radius centred on St Paul's Cathedral), are or will be available on the BSBI's web site www.bsbi.org.uk. The BSBI has selected the programme MapMate for handling Local Change records; the consequence for me is that I now have records in two databases, the other being the one I described earlier in the series (Burton 1996: 144–146).

Although many members and non-members go to a great deal of trouble to supply records to me, and I am extremely grateful to them, it must not be supposed that the records in this and previous papers are exhaustive accounts of discoveries in the LNHS area. This circle is an area exceeding 3,000 km^2 and extending well beyond London into five counties which have recording schemes of their own.

V.C. 16, West Kent

Our most remarkable record from **Greenwich** is surely the small vegetative patch of *Juncus subnodulosus* observed on our meeting of 14 May at the Drawdock on the west side of the North Greenwich peninsula. The meeting was led by John Edgington, who had seen the patch at the same site in 2002, but was not then sufficiently confident of its identification, perhaps because the habitat is so different from the calcareous fens with which the plant is normally asssociated. Other plants of this area seen on 14 May and also in 2002 are *Ranunculus sardous* in rough grass at a roadside and *Sagina maritima* already reported here (Burton 2003: 253) and now given much valuable background by its discoverer (Edgington 2004). Going over the same ground as the meeting myself later in the year I found many large seedlings of *Hebe brachysiphon* around the Ballot monument in front of the Royal Naval College, one plant of kidney vetch by the Millennium Dome boundary fence, probably self-sown from

plantings in shingle beds a bit further downstream, and actually in the shingle beds many large plants of *Filago vulgaris*. Could it have been sown there? It has no obvious floral beauty.

Passing to less central London boroughs, Ron Parker's list from South Norwood Country Park includes *Neslia paniculata*, our first record of this bird-seed alien for twenty years. This site is in **Croydon** but the parts of it nearest South Norwood are in v.c. 17, so this may be in the wrong paragraph. The Local Change records from **Bromley** include some good ones. Our meeting of 11 May found eleven plants of man orchid on Saltbox Down, *Lathraea squamaria* in five places and a single plant of *Euphorbia platyphyllos* at a field border where it had previously been seen in 1978–9 and 1987–8, but not otherwise. Later in the same area Clare Coleman and John O'Reilly collected a rose determined by A.L. Primavesi as *Rosa* × *verticillacantha*. Our meeting of 26 April also found the *Lathraea* in a less likely situation by the bridge over the Kyd Brook below the Hawkwood Estate. In the same square Clare and John (as they will be referred to hereinafter) found orpine *Sedum telephium*, not to mention the established *Akebia quinata* already reported by them (Coleman and O'Reilly 2004). Recording further out for Local Change, Geoffrey Kitchener found patches of *Cerastium diffusum* on a close-mown traffic island at the Hewitts Farm roundabout. Mr Kitchener found *Chenopodium murale* on imported soil near the Pratts Bottom roundabout. *Verbascum lychnitis* used to grow both on a roadside bank near here and on the down platform at Elmstead Woods station. It had not been seen in either place for several years but I found two flowering plants and many seedlings at the latter site in 2003. However *Hypericum montanum*, which used to be plentiful on a bank above the station approach, seems genuinely to have gone from there. Some aliens seem to persist better than rare natives: Priscilla Nobbs told me that Russian comfrey is still by a railway footbridge at West Wickham where she knew it forty years earlier. She also gave me the bad news that *Hydrocotyle ranunculoides* is now covering Pickhurst Green pond.

Bexley was one of the boroughs covered in 2003 by the Greater London Authority's survey contractor; the fieldwork was done by Jon Rilley, succeeded by Mark Spencer. The record which gave me most pleasure was of *Carex strigosa* along a stream in Lesnes Abbey Wood, which is where I knew a single plant of it until 1977, since when I had been unable to relocate it; the population of about fifty plants is similar in size to the one in Scadbury Park in Bromley. A single plant of the same species, and also one of the fern *Polystichum setiferum*, were by the Rectory Lane pond at Foots Cray, where they were not known before, although this has been a nature reserve for many years. The other site of interest to mention at this point is a small pond just off Parsonage Lane, North Cray. When we looked at this pond at our meeting of 24 July 1999, it was a very new horse-pond with *Gnaphalium uliginosum* and *Rorippa palustris* as its only vegetation. Now it supports not only *Lythrum portula* but also *Crassula helmsii* occupying all of what would otherwise be open water. This is now a common plant in much of the London Area, as can be seen from the map (Figure 1); in the *Flora of the London Area* (Burton 1983) five sites for it were listed. The species can regenerate from small fragments and multiply. I suppose it is possible that such fragments may be taken from one pond to another on the feet of birds and other creatures, but a more usual explanation is illustrated by an anecdote from Mary Smith. She had actually seen, and tried to remonstrate with, a person who was emptying an aquarium into a pond at Belhus Woods Country Park. The lady told her she could no longer maintain the aquarium and did not want the fish to die. I do not know whether the occupants of the local heronry will recognize the brightly coloured fish as something edible. Although Love Lane Allotments in Bexley was one of the sites surveyed, the *Red Data Book* (Wigginton 1999) species *Chenopodium vulvaria* which has been on the allotments of LNHS member David Nicolle since 1993 was overlooked. At the time its presence there posed a problem for the borough council, which

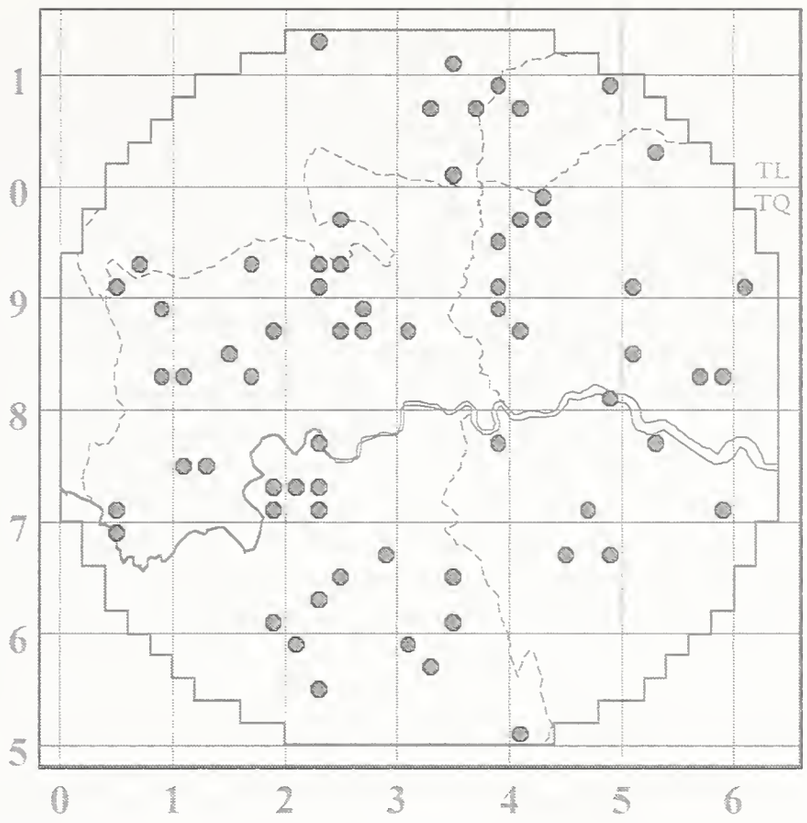

FIGURE 1. Tetrad distribution of New Zealand pigmyweed *Crassula helmsii* in the London Area.

proposed to bulldoze the allotments to allow for the construction of new concrete paths, though this plan has since been dropped. This is probably not the sort of site legislators had in mind when specifying a fine of up to £2,500 for destroying a plant named in Schedule 8 of the Wildlife and Countryside Act 1981. John Palmer continued to find a good variety of exotic plants on Crayford Marshes, on ground which was at last being prepared for agriculture, but his most unusual sightings from Bexley in 2003, were, in my opinion, the hundreds of seedlings of *Artemisia pontica* in a car park in Crayford and the six-foot sapling of the ornamental rowan *Sorbus hupehensis* var. *obtusa* far from any obvious seed parent or house on the Cray River Levels. On the Optima Estate nearby, Mr Kitchener found more *Chenopodium murale* among planted shrubs and *Spergularia marina* in a rut. Margot Godfrey sent me a sketch map of her finds of *Senecio inaequidens* around Barnehurst, Crayford and Erith and a coloured photocopy of a plant of wood anemone which she found in Bursted Wood, with less divided leaves than the usual plant.

I do not know of a varietal name for this plant, which I have also seen in Farningham Wood in **Kent**. In a chalk valley in the Stonehouse area in the Local Change tetrad worked by Mr Kitchener, he found dropwort which is extremely rare in this part of our area, bee and pyramidal orchids and masses of yellow rattle. This may be the same site as the 'privately owned chalk slope near Birthday Wood' mentioned by Pitt (2004). Joyce Pitt herself found eighteen plants of *Gentianella anglica* on a slope between Shoreham and Otford recently acquired by the Kent Wildlife Trust; this is now known from three sites from Shoreham to Kemsing, but remains exceedingly rare, requiring a certain amount of disturbance for the maintenance of its populations. Mr Palmer's many Kent records include the very frost-sensitive aquarium plant *Pistia stratiotes* in some quantity in the water and on the mud by the river near South Darenth, which must have enjoyed the year's summer heat, and three plants of an ornamental fern *Pteris tremula* var. *kingiana* on an old brick wall near the 'Orange Tree' at Wilmington.

V.C. 17, Surrey

The only novelty from the Inner London part of v.c.17 in 2003 was the hawkweed *Hieracium scotostictum* found by John Newton on a small wasteland site near St Thomas' Hospital. I identified this from a digital photograph he sent me attached to an e-mail; it was good enough to show the detail of the glandular hairs of the phyllaries and the dark markings of the leaves. At the other end of the borough of **Lambeth**, Roy Vickery found a healthy plant three metres high of *Asparagus setaceus* (Kunth) Jessop on West Norwood High Street. The slender branches of this plant are much used by florists in bouquets.

All the following plants from **Merton** are aliens reported by Ian Kitching. *Ceratochloa cathartica* in four different places is clearly an increasing species of roadsides etc. *Euphorbia oblongata* was an obvious escape from the garden of 183 Hillcrest Avenue, Morden Park, sprouting through cracks in the pavement by the adjacent access to fields. Tarragon *Artemisia dracunculus* was in the middle of the Shannon Corner roundabout. Two plants very seldom seen in London were identified by myself, comparing them carefully with native Continental material preserved at the Natural History Museum; *Geranium reflexum* came from garden waste in a corner of Cottenham Park Recreation Ground and *Sonchus tenerrimus* was at the foot of a low wall near the junction of Claremont Avenue and Burlington Road. The latter is similar to the smooth sow-thistle *S. oleraceus* but always has a wad of white cottony hairs around the base of the capitulum and leaves with segments narrowed towards the base (Figure 2).

FIGURE 2. Leaf and capitulum (in bud) of *Sonchus tenerrimus*.

I now pass to the outermost London boroughs in v.c. 17, but stay with Dr Kitching. By the path at Riverside Drive near Ham River Lands in **Richmond upon Thames** he found the smaller subspecies of strawberrry clover, *Trifolium fragiferum* subsp. *bonannii*. It may be that these subspecies are of little value, but if it could be shown, for instance, that subsp. *bonannii* is mostly a plant of dry places by paths whereas subsp. *fragiferum* is the one in damp grassland, often behind sea walls, then they would be accepted as being worth more. His specimen of *Leycesteria formosa* by the Thames path outside Kew Gardens appears to be the first of this bird-sown shrub from the borough. Dr Kitching found large quantities of *Hypericum hircinum* by the Thames in **Kingston upon Thames**; this alien shrub has increased dramatically in recent years and is now locally abundant near the river from Hampton to Richmond Hill. In the grassy area at the junction of Kingston Road and New Malden High Street, he saw single plants of golden dock *Rumex maritimus* and musk storksbill *Erodium moschatum*; the latter is unconfirmed but likely to be correct, see below. Moving to **Sutton**, the unadopted road south of Ridge Road continues to provide Dr Kitching with unusual aliens which it must be assumed are garden rejects. I was

able to identify *Sedum sarmentosum* Bunge, a distinctive stonecrop with starry yellow flowers and whorled leaves, but failed completely on a small rhizomatous *Euphorbia*. A garden in Ridge Road had *Anthriscus caucalis* and *Fumaria muralis* subsp. *boraei* among its weeds. Many of the plants by a stream alongside the west part of Therapia Lane north of Beddington appeared to have come from a 'wildflower' seed mix, and the marsh marigold could have been part of the mix, but could the marsh dock *Rumex palustris*, or the caraway *Carum carvi*, and could *Salvia sclarea* be a substitute for a native species? The aliens which Mr Parker found in Throwley Road, Sutton by the multi-storey car park are more likely to be from a bird-seed mix; they included both *Sorghum halepense* and *S. bicolor*, and all were huge, *Chenopodium polyspermum* reaching two metres. I have already mentioned South Norwood Country Park under v.c. 16, but am fairly sure that the single plant of pyramidal orchid which John Bedford saw was in the v.c. 17 part of the Park.

Of plants from what is still **Surrey**, it might be appropriate for me to mention first Dr Kitching's carefully checked *Berberis aggregata* at the north corner of Banstead Downs, which might just be in Sutton. He checked the tor-grass on the Downs microscopically and found that it was *Brachypodium pinnatum sensu stricto*, whereas the plants I checked from the Downs on Juniper Hill, Mickleham seemed to me to be the segregate *B. rupestre* (Host) Roemer & Schult. (*B. pinnatum* subsp. *rupestre* (Host) Schübler & Martens). There are a number of possibilities, one of which is that I may have got it wrong. Mr Parker sent me a well detailed list from Nonsuch Park, including the rarity *Epilobium palustre* in a permanently damp spot near the bomb crater at the south-west corner of the Park.

V.C. 18, South Essex

Brian Wurzell made some surprising discoveries in the course of a survey of the Eastway Cycle Circuit north of Stratford in **Newham**. In short drained turf at the top of the camp site were rare clovers *Trifolium ornithopodioides*, *T. fragiferum* and *Medicago polymorpha*. In tall dry secondary grassland on plateau infill was a nationally scarce sedge *Carex divisa*. Along the mown verges of tracks over a wide area was *Erodium moschatum*. In Britain this is considered to be an uncommon casual outside the coastal regions of south-west England and Wales (S.J. Leach in Preston et al. 2002: 450) but in London it is becoming naturalized in many places. I had reports from both Brian and Ken Adams about plants occurring on Walthamstow Marshes in **Waltham Forest**, mostly resulting from the work done to improve the habitat for *Apium repens* discovered there in 2002. *Juncus subnodulosus* was plentiful and very large, an unparallelled sight in London, more like an East Anglian fen and very different from a tidal river-bank in Greenwich. A single plant of *Samolus valerandi*, a rare plant in London, first seen by Dave Miller, was close to the *Apium*. A single plant again, this one of *Catapodium marinum*, as its name suggests a plant normally found by the sea, was on the parapet of High Bridge, a cast-iron structure crossing the River Lea, a weird habitat for any plant. A yard further west and it would have been in Middlesex. Brian showed David Bevan a well established plant of of *Dorycnium hirsutum* at the edge of a car park on the south side of Ferry Lane. Another weird occurrence is the fragrant orchid which David identified on the Chase in **Barking and Dagenham**; it had also been there the year before, wrongly identified as a pyramidal orchid. Near it were several clumps of the alien *Iris spuria*, being avoided by grazing animals.

Eastwards into **Havering**, whence Mary Smith sent me records of her own and Bob Creber's, principally in an effort to add plants from the 10×10 square TQ58 not shown from there in the *New atlas of the British and Irish flora* (Preston et al. 2002). I have already mentioned Mrs Smith's anecdote about *Crassula helmsii*; the same pond in Belhus Woods Country Park produced water-soldier,

which 'must have grown very fast'. When this sort of thing goes on, I am suspicious about ragged robin appearing in a new location in a country park. A group of fifty or more plants of *Ranunculus sardous* some way north of the park is a very good find, and by the Thames shore on Rainham Marshes her little mats of *Festuca rubra* subsp. *littoralis* were the first record of this coastal subspecies as a wild plant in London. The colony of *Gnaphalium luteoalbum* in Harrow Lodge Park had been thought lost, but Mr Creber found five plants there in 2003, and also one in a paved front garden in Upminster a few miles to the east. In a field on highway authority land west of Aveley in **Essex** which I mentioned last year for its rare clovers, Mrs Smith added *Medicago polymorpha*. Dr Adams told me of another single plant of *Samolus* in a garden at Buckhurst Hill.

V.C. 20, Herts.

We have one important record from that part of the London Borough of **Barnet** which was in Hertfordshire continuously until the formation of the borough. Phil Attewell found two old and straggly plants of *Ulex minor* in scrub on Rowley Green. This heathland relic was known from this area to Dony (1967: 67) but has apparently not been seen there since.

Only just outside London in **Hertfordshire**, Mark Spencer came across a very substantial population of *Mentha pulegium* in a valley recently altered by a flood prevention scheme. Dr Spencer's opinion was that this was a native occurrence of pennyroyal, as such a *Red Data Book* species (Wigginton 1999, citing C. Chatters in Stewart et al. 1994). My own opinion would make it a presumably deliberate introduction, like those reported here in Regent's Park (Burton 2003: 258) and on a golf course at Warlingham (Burton 1996: 140). David Bevan found a few plants of *Legousia hybrida* in a field near the M25 which has been known for its cornflowers at least since 1941, when the species was already beginning its continued decline as a cornfield weed; the *Legousia* has not been seen from so far south in Herts. for about ninety years. Howard Matthews found a good range of ferns in Oxhey Woods. Peter Ellison's last collection of records in our area includes about thirty-eight spikes of broad-leaved helleborine in a hedge at the south-east end of Batchworth Lake. Pamela Carr saw a single plant of mousetail at Waterend. This record, Mr Attewell's and those which follow were kindly copied to me by Trevor James. The Herts Flora Group visited Berrygrove Wood in a Local Change square and were able to relocate its special plants *Molinia*, *Juncus bulbosus*, *Carex vesicaria* and *C. pallescens*. On its bramble study day just outside London, a few plants of *Rumex pulcher* were seen near the road on Batchworth Heath and the sterile hybrid *Potentilla* × *suberecta* was in Bishop's Wood, as well as brambles. In Bush Wood near Welham Green, Mr James himself found *Carex strigosa* and Steve Murray saw plentiful *Oenanthe aquatica* in a large pond. Gerald Salisbury made the first Herts. record of the hybrid *Luzula* × *borreri* in Oxhey Woods, with the parent species *L. forsteri* which is much rarer to the north than to the south of London.

V.C. 21, Middlesex

The first London record of the tropical weed *Alternanthera pungens* Kunth was a single plant by a new path in Regent's Park in **Wesminster**, found by Aaron Woods and identified with some difficulty — eventually he found a picture of it on an Australian website. More centrally, Mr Nicolle saw a five-metre strip of *Cyperus eragrostis* in Deans Yard, Westminster, mown down to a height of 15 cm, and Mr Kitchener found three plants of *Verbena bonariensis* at least fifteen metres from the nearest planted specimens in Hyde Park.

To my mind the most exciting botanical discovery in 2003 in the boroughs immediately adjacent to the Cities of London and Westminster was the young plant of lemon-scented fern *Oreopteris limbosperma* found by Mr Matthews by a

path in Ken Wood in **Camden**, near another rarity already known from there, hard-fern *Blechnum spicant*. The probable source of this is a mature plant in Branch Hill Combe about a mile away, seen by Mr Wurzell in 1994 just before the site became inaccessible, but no doubt still extant. From the same borough, Dr Spencer supplied an extraordinary list of plant species introduced to Camley Street Natural Park in top soil, including abundant *Fumaria muralis* and several *Lathyrus annuus*, the second record for London. In **Islington** he found a few isolated male plants of black poplar, all in areas developed in the first half of the nineteenth century. Dr Kitching sent me a comprehensive list of plants seen in **Tower Hamlets** Cemetery and a nearby grassy area between Cantrell Road and the railway arches. They are almost without exception native species which have been deliberately introduced here, some of them, such as *Clinopodium ascendens* and *Dipsacus pilosus*, quite rare as wild plants in London. This kind of horticulture may be thought to give a more 'natural' look, but makes it harder to justify protection of those places where such species occur genuinely wild, and so ultimately leads to a loss of natural diversity. He and I went to the Mudchute on the Isle of Dogs on separate occasions. The flora of this valuable area is well known but I cannot find a previous mention of western gorse *Ulex gallii* below the elevated path in the south-west corner, carefully identified by both of us. My visit was at the Wild Flower Society meeting on 6–7 September led by John Swindells, who knows the flora of his home borough so well. Two aliens we saw which had previously been found by him are naturalized *Vallisneria spiralis* which has extended its range into the Hertford Union Canal, and blatantly casual *Euphorbia prostrata* Aiton in planters with fan-palm *Trachycarpus fortunei* on the east side of the Limehouse Basin. This American spurge, which was identified by Eric Clement and myself independently, is well naturalised in some Mediterranean countries but has not been seen in Britain before. Maybe there is a lot of it on the premises of the supplier of the palms. Prof. Edgington found a single much-damaged plant of southernwood *Artemisia abrotanum* in Arena Fields, **Hackney** Wick, a site which will certainly be lost if the bid to hold the 2012 Olympics in London is successful, and may be if it is not. When they lived on the opposite side of London, Bill and Carol Hawkins had *Cerinthe major* sowing itself in their garden, but I had not heard of it appearing outside gardens; this was changed when I was informed of at least ten plants of it by a public path off Inglesham Walk in the same area, determined at the Edinburgh Botanic Garden from material sent by a local resident for identification. Dr Kitching sent me a specimen of *Mazus reptans* N.E. Br. from Princes Gate Mews, probably derived from plants once in nearby containers although there were none there at the time. When checking its identity in the folder for *Mazus* (next to *Mimulus*) in the herbarium of the Natural History Museum, it struck me that the only *M. reptans* specimen was of a cultivated plant. In the nature conservation area in Holland Park, Jim Blackwood found toothwort under holly; if this was a deliberate introduction, it would surely have been a difficult subject.

Passing to north London boroughs, David Allen sent me the second Middlesex record of an uncommon bramble *Rubus cinerosus*, of which he had found a strong population along the north edge of Queen's Wood in **Haringey**. Dr Adams found a small bush of *Rosa ferruginea* in the hedge with allotments behind, approaching Tottenham Marshes; this is one of the roses which has been called *R. glauca*, a much confused name. Mr Wurzell found *Torilis nodosa* in the Marshes car park, a different approach. Scratch Wood in **Barnet** was another of the sites studied, especially for ferns, by Mr Matthews who led our meeting of 5 September there. The Local Change square in this borough is traversed by Edgware Way, on the north side of which Jill Collar and I independently noticed a large population of dittander which is spreading into the adjacent rough grassland, a known site of *Sanguisorba officinalis*. I included a distribution map of this species in our area in my paper here only four years ago (Burton 2000:

204), but already it is worthwhile offering another (Figure 3). Further north I found a single plant of *Hypericum hirsutum*, a rare plant in north London, clearly suffering in the summer heat of July 2003. On 23 August, the Herts Flora Group visited the north part of Barnet, which was covered by Dony's (1967) flora because this wedge of land had been in Hertfordshire from 1904 to 1965. It includes Hadley Green, where Mr Salisbury found a single plant of *Juncus squarrosus* on this occasion, not previously found at this locality, well known for its heath plants, which still include grasses *Nardus* and *Danthonia decumbens*, and its ponds, where rare plants *Apium inundatum*, *Ranunculus trichophyllus* and even plentiful *Myriophyllum alterniflorum* survive, in spite of the presence of aliens *Hydrocotyle ranunculoides*, which ducks were seen to be eating, and *Sagittaria latifolia*. The two grasses were also seen on Monken Hadley Common further east, which has a small amount of heather, but there the ponds are more infested by aliens. From **Brent**, John Birdsey found a plant of marguerite on a pavement in Charterhouse Avenue, Sudbury, and Dr Kitching pointed out to me a colony of dittander by the Bakerloo line tracks between Wembley Park and Neasden.

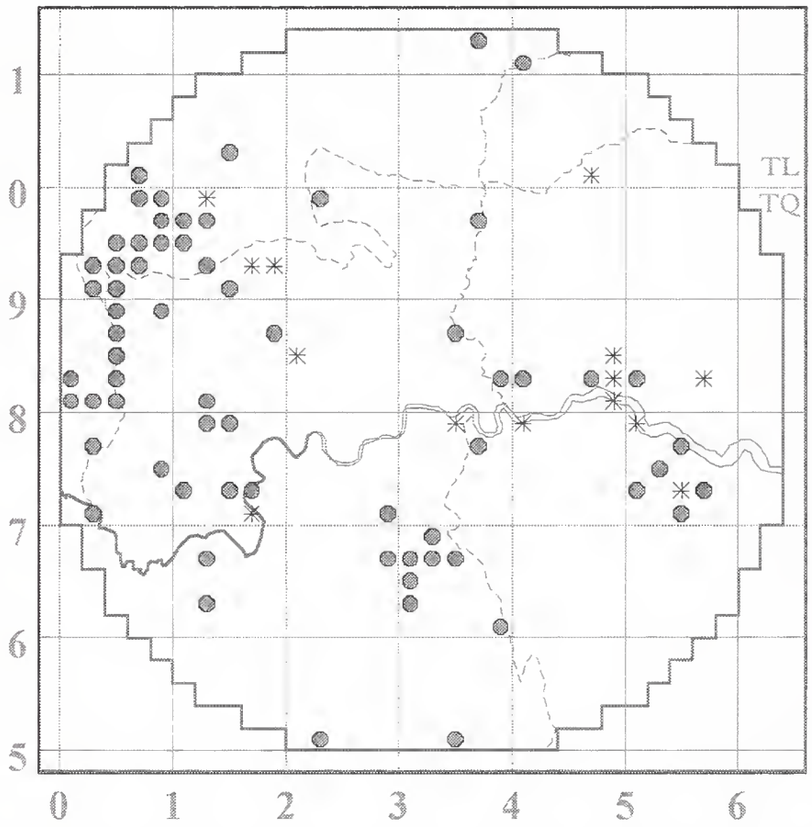

FIGURE 3. Tetrad distribution of dittander *Lepidium latifolium* in the London Area. Asterisks indicate records added in 2000–2003.

Passing to the west of London, Christopher Slack, the **Hounslow** senior ranger, sent me a specimen to confirm the presence of *Carex disticha* in the meadow by the River Crane he showed me in 2001 (Burton 2002: 225). Clare and John found over eighty plants of *Orobanche minor* as a parasite on ivy or *Brachyglottis repanda* by the Brent near Brentford Lock. Further up this river in **Ealing**, Diana Willment found a new locality for adder's-tongue fern in Brent River Park. Reporting from our meeting on 20 July, Dr Kitching identified the rare subspecies *chalepense* of *Lepidium draba* on the north-east side of Paradise Fields, Greenford. In his last communication from **Hillingdon**, Mr Ellison found many plants of *Lythrum portula* in a road gutter in Ruislip and over a hundred spikes of *Epipactis purpurata* near the north-west corner of Stocker's Lake; now that he has moved to Hampshire, he is no longer at hand to check the identification of the latter. Colin Bowlt's dittander record was from the west side of Ruislip Lido. The last Local Change area to be mentioned is west of

Hampton, mostly in **Richmond upon Thames**. John and Clare made a good start to recording there with one visit in October, finding naturalized aliens becoming characteristic of Thames-side west of London, *Ceratochloa carinata* and *Hypericum hircinum*. *Conyza bilbaoana* may be in the same category, but theirs was only the second record from the Middlesex side of the Thames. Dr Kitching's Middlesex Richmond records are also from the neighbourhood of the Thames, including *Buddleja globosa* and *Mimulus guttatus* in Teddington and a sequence along the Barge Walk, starting with naturalized *Tristagma* and a self-sown *Saponaria ocymoides* at the Kingston Bridge end, passing *Erophila verna* var. *praecox* opposite the Kingston House Estate and taking in a recently sprayed plant of *Erodium moschatum* almost in front of the wrought-iron gates of Hampton Court Park.

V.c. 21 also includes parts of two counties outside London. I had an unexpected opportunity for half-an-hour's botanizing in the Potters Bar area in modern **Hertfordshire**, and found a good colony of naturalized *Geranium endressii* in Bridgefoot Lane. The extreme south-west of the vice-county is now administratively in **Surrey**. *Cyperus fuscus* at the edge of the pond on Shortwood Common near Staines is not a new record, but this national rarity had not been seen there for several years. Repeated efforts by the plant conservation charity Plantlife to clear the pond of invasive aliens have at last borne fruit, and in late summer 2003, when the water level was very low, Barry Phillips, Tom Cope and Eric Clement were able to see thousands of plants of it in a dense mass on the less accessible north side of the pond, whilst *Crassula helmsii* and *Myriophyllum aquaticum* continue to be abundant on the south side.

V.C. 24, Bucks.
Paul Bartlett told me of very abundant dittander by the M25 / M40 junction.

Acknowledgements

The maps were produced using Alan Morton's programme Dmap. In addition to support from numerous members of the London Natural History Society, I am grateful for continuing co-operation from BSBI county recorders Ann Sankey, Ken Adams, Trevor James and Roy Maycock.

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Book review

Fungi. Roy Watling. Life series, Natural History Museum Publishing, Natural History Museum, London SW7 5BD. 2003. 96 pp., large quarto, softback, £9.95. ISBN 0 565 09182 4.

Roy Watling is a highly respected and widely published professional mycologist who until he retired in 1998 was head of the Department of Mycology and Plant Pathology at the Royal Botanic Garden, Edinburgh. In this little book he has set out to provide an introduction for the general reader to the world of fungi. Printed on glossy paper with striking colour photographs or illustrations on every page with a clear text and conversational style it certainly is both attractive and informative. The first of seven sections (they are not numbered as chapters) makes the case for the importance of fungi in the web of life, and the second section defines fungi with a simplified classification scheme. A longer section follows which surveys the larger fungi, their habits of life and amazing diversity of form. Oddly this section contains a paragraph on yeasts that seems to have got misplaced. Next comes a section on where and when to look for fungi, effectively making the point that they are everywhere. A section on collecting and studying fungi gives very useful tips on how to start making useful records in the field and later at base camp. Watling's experiences in the tropics come to the fore here. The penultimate section on fungi and humans provides a fascinating glimpse into the many and varied ways that fungi have been used in different cultures over the ages. The last section, entitled conservation, contains the following sentence: 'It is fair to say that, apart from those at a very few sites, the precise range of species of fungi present in any one area and their relative abundance or scarcity is usually unknown and therefore conservation is meaningless'. An observation with which your fungus recorder totally agrees!

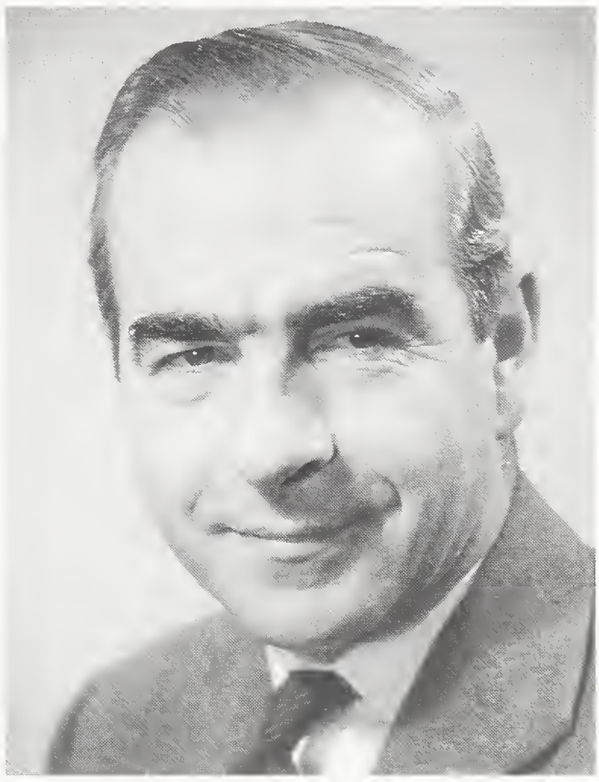
There is a short glossary, website and reading lists to complete a very fine introduction to the fungi, which can be thoroughly recommended to anyone setting out to explore the fifth kingdom or to anyone who wants to widen their appreciation of the natural world. It would make a very suitable gift to a young naturalist.

I have only one critical comment to make, a few of the illustrations seem to have been added at random to break up the text. For example the picture on page 7 captioned 'Many fungi occur in grassland, and some of these have an as yet unexplained association with certain grasses' actually shows some old and unidentifiable *Hygrocybe* caps in a pure sward of thrift *Armeria maritima*.

E. G. D. TUDDENHAM

XX(385416.1)

Obituary



BILL PARK, 1922–2003

Bill Park, who died at Saunderton, Buckinghamshire on 20 September 2003 at the age of 81, joined the London Natural History Society in 1938 when he was sixteen. He is best remembered for his involvement in the Ornithology Section and as the co-cameraman of the Society's full-length film on London's birds.

William Desmond Park was born on 26 January 1922 in Peckham, London. He attended Haberdasher's Aske's School at New Cross from 1931 to 1934. In 1934, the family moved to Epsom and he was offered a place at Wimbledon School of Art, but declined. During the Second World War he served as a bomber pilot, and it was while with the Royal Air Force in Egypt that he met and married Elizabeth. In 1945 he was invited to become James Callaghan's political agent, but he turned the offer down and followed his father into the Board of Trade. Bill and Elizabeth lived initially at Epsom but they moved to Dorking when their daughter Elizabeth was born, and in 1952 they moved to Worcester Park when their son David was born. In 1963 they moved back to Dorking.

Bill was the Society's bird-ringing secretary from 1952 to 1958 (and an active ringer himself, with 206 birds in 1955) and a founder member of the Dungeness Bird Observatory Committee. In 1958 he became secretary of the Ornithology Section (with a membership of 1,100), and later its chairman. He served as chairman of the Society's Mammal Study Group and for some years was a member of Council and its Administration and Finance Committee. He also acted as secretary of the 'Toxic Chemicals' Committee of the BTO and was a member of the joint RSPB/BTO committee serving the same area.

In the late 1950s, when the Society decided to make a full-length film of London's birds, we became the joint cameramen. We mostly filmed separately — there was a lot of ground to cover — but for certain sequences we combined, as in the erection of a pylon hide — lent by Eric Hosking — to film the Walthamstow Reservoir heronry, and when we followed the Swan-uppers for a day. Over four years some seventy species were caught on camera, and now historic scenes, such as the inner London evening flocks of starlings and the City bomb sites, were recorded for posterity.

By the time the film was premiered in 1963 Bill had given up all posts in voluntary societies and had exchanged the relatively placid life in the Board of Trade for the rigours of the Nature Conservancy, then under the Director-Generalship of the incomparable and tireless Max Nicholson. For the next twenty years he was involved with many burning conservation issues ranging from oil pollution (including the *Torrey Canyon* disaster of 1967) to pesticides, toxic waste dumping at sea, offshore oil development, airport expansion and the Channel Tunnel.

Filming gulls at Charlton rubbish tip, early 1960s.

In his role as co-ordinator of advice to ministers he brought his administrative and diplomatic skills, his unflappability and sense of humour, into full play in balancing the differing views of cautious politicians and enthusiastic scientists. He did not seek a high profile but often worked quietly behind the scenes, and can be credited with an important role in some notable Nature Conservancy successes, including changes to the Wildlife and Countryside Bill, allowing for the provision of marine reserves.

Bill had an engagingly dry wit, which made his company very enjoyable both in committee and in the field. He appreciated the quirks of fellow birdwatchers and the little absurdities of life itself. He would often send an irreverent note or cutting. At a time when R.C. 'Dick' Homes, a tall, dignified but rather serious man, was a big name in the Society, Bill sent me a newspaper headline reporting a very bad flood. It read: 'Homes swept out to sea'. On another occasion when I claimed that I seen an isabelline shrike his Christmas card carried a pair of square brackets and the words 'For your shrike'. Yet Bill was always anxious that talent and achievements were recognized, and he lobbied successfully for an RSPB hide to be named as a memorial to Stanley Cramp.

After his retirement in 1982 Bill dabbled in antiques (for he had an eye for beauty, from birds to porcelain), served on the committees of local and district associations and encouraged his three grandsons to become birdwatchers. Sadly his last years were clouded by the long illness and death in 1996 of his wife Elizabeth, whom he had married in Egypt fifty years before, and later by his own declining health.

RAYMOND CORDERO

XX(385417.1)

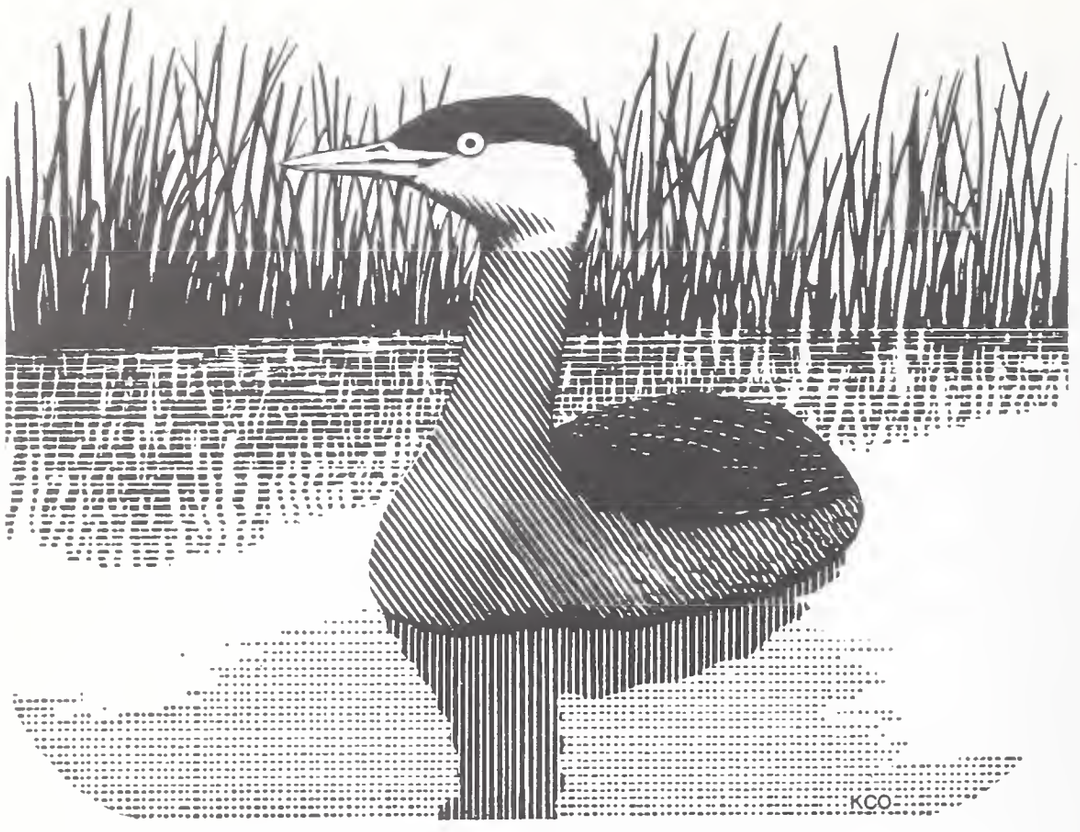
Obituary

Photograph courtesy of Bryan Thomas

KEN OSBORNE, 1930–2003

One would meet Ken cycling along the lanes around Oxted and Limpsfield, probably on his way to Bough Beech Reservoir for a spot of birdwatching. After an exchange of ornithological news the conversation might take the following turn: *'Ken, I was wondering whether you might be able to draw a map for something that is to be published in the London Bird Report?' 'Of course, but can you let me know what you want before I go to the Scillies next month?'* Such an encounter sums up much of Ken's interests and outlook: cycling, birdwatching, Bough Beech, the Isles of Scilly, drawing, a willingness to deploy his artistic and design skills for others. If one adds to that list a close involvement with both his local RSPB Group and the London Natural History Society, one has a pretty fair picture of Ken over the past thirty years or so.

Kenneth Charles Albert Osborne was born in Mitcham on 9 February 1930, the only child of Charles and Ruth Osborne. He showed an early interest in the natural world exploring with his cousin Jean the local common at Tooting Bec and searching for flowers and insects as well as birds' nests. He was evacuated to West Sussex on the outbreak of war in 1939 and this gave him further opportunities to develop his interest in wildlife. He attended the Henry Thornton Grammar School in Chichester, subsequently returning to London with the school in 1943 and around that time becoming a member of the Junior Bird Recorders' Club of the RSPB. In 1946 he joined the Streatham Hill Cycling Club and explored further afield, but always with an eye open for birds. Cycling trips took him all over Britain and he made several trips to Austria with the club. Photography became a particular interest at that time and as well as doing his own black-and-white processing (which he continued to do for many years) he was an early user of colour photography when recording cycle trips. Bird-watching had become his main interest, however, and as well as birding on Wimbledon and other local commons, he was a regular at Beddington Sewage Farm.



Red-necked grebe by Ken Osborne, *London Bird Report* **32**, 1968

Ken joined the LNHS in 1961 and submitted his first records to the *London Bird Report* in that year. He drew the front cover illustration for the 1968 issue. This was the beginning of an association with the *LBR* that lasted for the rest of his life. He edited the Ornithology Section *Bulletin* in 1970 and his name first appeared as a member of the then editorial committee the same year. In 1971 he wrote part of the systematic list for the first time. By the following year he was editor, a post he held for seven years, a longer continuous stint than any other editor in the history of the *LBR*. The map of the London Area that has appeared in each issue since that for 1971 was drawn by Ken and his first text illustrations and maps for the *LBR* appeared in that for 1982. Since then his drawings and maps have appeared regularly and his continuing contributions have involved further writing of the systematic lists, acting as recorder for Inner London from 1988 to 1993 and membership of the Records Committee from 1994 to 1997. In addition to all this he found time to write articles, including one on water pipits, published in the *LBR* for 1970 and to compile a checklist of the birds of the London Area published in 1978.

For much of his life Ken worked for the Civil Service, joining in 1972 the Information Directorate of the then Department of the Environment where he supervised the design and production of many of its publications. This skill was to prove invaluable to the LNHS when the first London breeding-bird atlas was being planned. Ken's design mock-ups were crucial in persuading the publishers to accept the project. He was equally influential in the design and layout of the second breeding-bird atlas published in 2002. As well as designing and drawing, Ken was equally accomplished as a painter in water colours.

In addition to a close involvement with the LNHS, Ken developed a lasting passion for the Isles of Scilly, visiting them every October for at least a quarter of a century and contributing not only his records, but drawings and articles for the Isles of Scilly Bird Reports. In 1983 he was a founder member of the East Surrey RSPB Group with which he remained intimately associated for the rest of his life. He was a regular participant in the Group's field meetings and his

field knowledge was frequently in demand when differences of opinion arose on difficult identifications. He had lived in Oxted since at least 1973 and his knowledge of the birds of Oxted and Limpsfield was extensive.

Ken was a quiet and unassuming man, his contributions to the organizations he was involved with frequently being behind the scenes. On the other hand, he could be very direct in his views, but that was a valuable trait when asked, as he frequently was, to comment on someone's draft article. The author was never left in any doubt about what Ken thought. He was meticulous in all he did and that was reflected in the way he maintained his house and garden, though a visit to his home invariably required the shifting of piles of books from a chair so that the visitor could take a seat. Except when birding he was never known to be seen other than in a grey suit, white shirt and tie, and even when out cycling or birding the tie was never absent. He never learned to drive but was an active cyclist until just a few weeks before he died and was out birdwatching almost to the end. On a Sunday he was on Sheppey with the RSPB Group looking at harriers and buzzards, but died suddenly the following Saturday 20 September 2003 having been looking forward to another visit to the Isles of Scilly. Ken will be missed not just by those who knew him personally but by readers of the *London Bird Report* in particular. He never married and is survived by his mother, to whom we extend our sincere sympathies.

PETER OLIVER

Book reviews index

The London Naturalist

Instructions to contributors

Submission of papers

Papers **must be submitted in duplicate** to the editor, Mr K. H. Hyatt at his home address, 1 Tremcelynog, Rhandirmwyn, Llandovery, Carmarthenshire SA20 0NU. Please contact the editor before the end of January if you wish to contribute to the forthcoming issue. However, the editor may be contacted at any time on 01550 760346 to discuss possible contributions, and will be pleased to send a recent offprint to show our style, and as a guide to preparing the manuscript, **which should be followed as closely as possible in regard to layout and typefaces.** Manuscripts **must be double spaced throughout on one side of the paper only** and with wide (3-cm) margins. **Authors must retain a copy.** Papers should include at the beginning an **abstract, summary** or **synopsis. Sheets must be numbered.** Papers are peer-reviewed as appropriate. After acceptance, the editor would be pleased to receive contributions as Microsoft Word-compatible files together with two matching hard copies of the final text. Papers should be relevant to the natural history and archaeology of the London Area. This includes comparisons between London and its surrounding countryside with other localities, as well as work relating to or comparing species or habitats which occur in the London Area. Contributions of relevance nationally will also be considered.

Text

Locality spellings should follow the latest editions of maps published by the Ordnance Survey. Capitalization should be kept to a minimum. Common names of animals and plants must begin with lower-case initials (except for proper nouns), and **only** Latin names of genera and species must be underlined unless typed in italic. When both common and Latin names are given there should be no brackets or commas separating them. **Genus names should appear in full where first used within each paragraph.** When scientific names are taken from a standard work, which must be cited, authorities should be omitted. In descriptive matter numbers up to a hundred should be in words, except in a strictly numerical context. Dates should follow the logical sequence of day, month, year, i.e., 25 December 1971, but in lists may be as 25.xii.1971. Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs, or St. Lists should be in systematic, alphabetic or numerical order. **Hyphens should not appear at the ends of lines** as the right-hand margins of manuscripts do not need to be justified: **turn off the hyphenation option. Tables and figure legends should be typed on separate sheets at the end of the text. Word-processed text should not use italic, bold or compressed typeface. Paragraphs should be indented. Sentences must not begin with numerals.**

References

Reference citation should be based on the Madison rules (*Bull. Torrey bot. Club* **22:** 130–132 (1895)), except that a colon should always precede a page number. Capitalization in titles of books and papers in journals should be kept to a minimum. Journal titles should be in full, or follow the abbreviations in the *World list of scientific periodicals,* and be underlined or in italics. Book titles should also be underlined or in italics.

Examples are as follows:

In text:

Meadows (1970: 80) or (Meadows 1970).

In references:

MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964–9. *Lond. Nat.* **49:** 76–81.

MELLANBY, K. 1970. *Pesticides and pollution.* Ed.2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* **92:** 39–45.

Authors must ensure that all references are cited accurately: they will not be checked by the editor.

Illustrations

Distribution maps should be submitted in the form of a recording map with symbols in Indian ink and stencilled or by transfers, e.g., 'Letraset'. Solid dots are used to indicate contemporary or recent presence, circles for old records, and crosses (not pluses) for other information, such as introduced species. The caption should be written outside the frame of the map and will be set up by the printer. Scale bars must be included within the frame of the map.

Line drawings should be in Indian ink on white card or tracing paper, larger than the printed size, but no larger than A4. Place names, etc., must be produced with stencils, Letraset, or with sharp typing. Captions should be separate as they will be set up by the printer, but keys that include special characters should be included within the border of the figure.

Photographs should be glossy black-and-white prints, of good contrast, preferably plate or half-plate in size, or, following consultation with the editor, in the form of colour transparencies, either 35 mm or larger. Colour prints are also suitable for reproduction in the text in black and white.

Proofs

Proofs will be sent to authors for scrutiny, but only essential corrections can be made at that stage.

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London SW7 5BD

ISBN 0 901009 16-4

Published December 2004 £8