LNHS

THE LONDON NATURALIST

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 77 1998

LON :Y 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

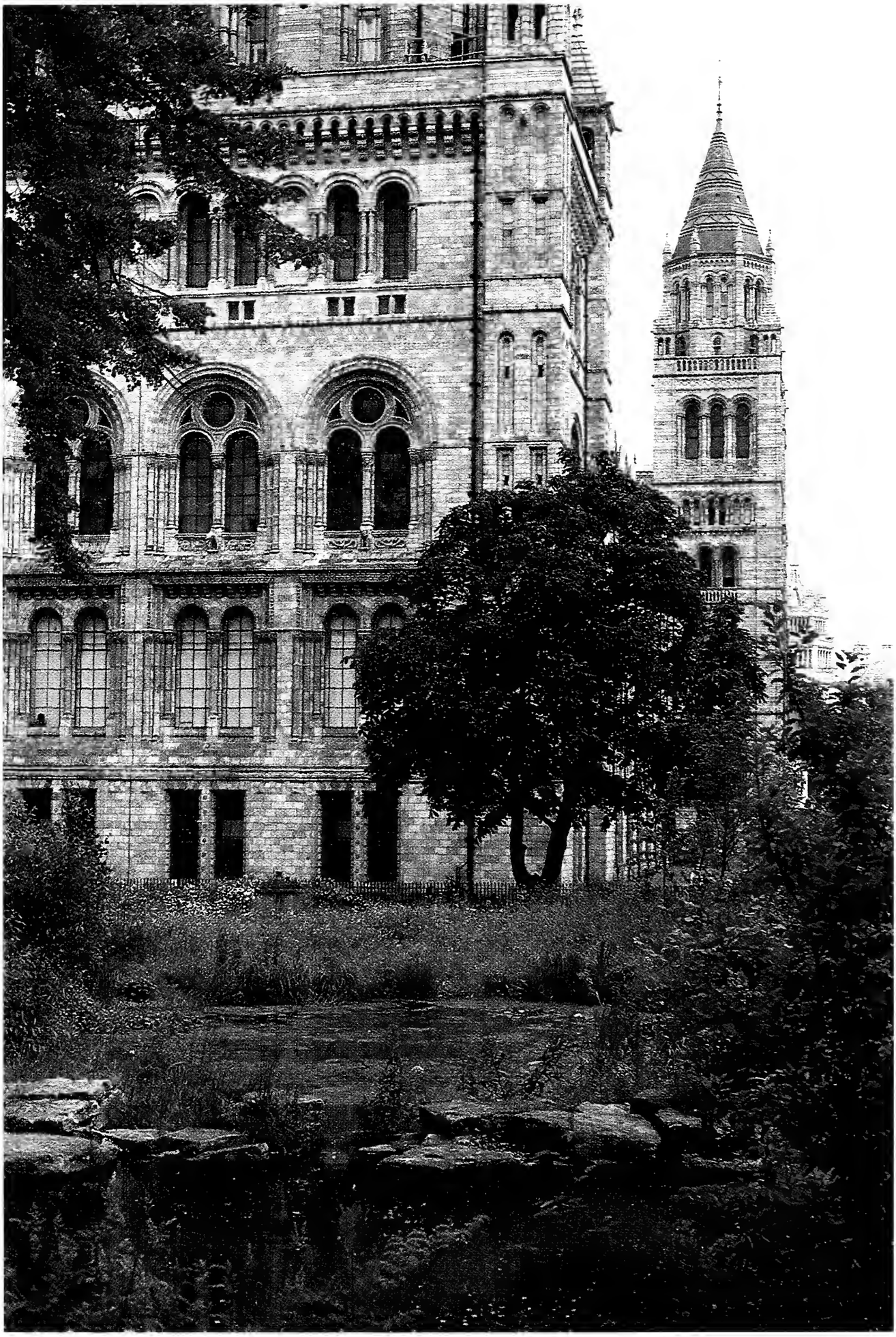
ORDINARY MEMBERS	£15.00
JUNIOR MEMBERS	£5.00
SENIOR MEMBERS	£8.00
FAMILY MEMBERS	£3.00
AFFILIATED SUBSCRIBERS	£15.00

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 Membership Secretary, LNHS, P. C. Holland,
Flat 9, Pinewood Court, 23 Clarence Avenue,
London SW4 8LB

THE LONDON NATURALIST

Further copies of this issue of *The London Naturalist* may be obtained (price £6 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.



The Wildlife Garden at The Natural History Museum, South Kensington.

THE LONDON NATURALIST

Journal of the LONDON NATURAL HISTORY SOCIETY

No. 77

for the year 1997

Edited by K. H. Hyatt

ISSN 0076 0579
ISBN 0 901009 09 1
World List abbreviation: *Lond. Nat.*

Published October 1998

Printed by bezier journals,
Thames View, Abingdon, Oxfordshire OX14 3LE

LONDON NATURAL HISTORY SOCIETY

Founded 1858

President

P. J. SELLAR, B.SC. (ENG.), FRGS, MBOU,
89 Riddlesdown Road, Purley, Surrey CR8 1DH

Honorary Vice-Presidents

E. B. Bangerter, FLS, Miss E. P. Brown, R. M. Burton, MA, FLS, R. E. Butler, B.SC., FGS, R. S. R. Fitter, FLS, FZS, MBOU, R. W. Hale, V. F. Hancock, MBOU, P. C. Holland, K. H. Hyatt, Miss M. E. Kennedy, E. M. Nicholson, CB, CVO, LL D, MBOU, R. M. Payne, FRES, FLS, R. A. Softly.

Officers for 1998

Vice-Presidents: A. J. Barrett, K. F. Betton, MBOU, D. Bevan, C. Bowlt, B.SC., PH.D., FLS, Ms R. Day, D. J. Montier, C. W. Plant, B.SC., FRES, H. M. V. Wilsdon, MBOU.

Secretary: A. J. Barrett, 21 Green Way, Frinton-on-Sea, Essex CO13 9AL.

Treasurer: M. J. West, 52 Trinity Road, Ware, Hertfordshire SG12 7DD.

Membership Secretary: P. C. Holland, Flat 9, Pinewood Court, 23 Clarence Avenue, London SW4 8LB.

Librarian: Mrs L. Hewitt, 106 Hatherley Court, London W2 5RF.

Editor, *The London Naturalist*: K. H. Hyatt, c/o Dept of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD.

Editor, *London Bird Report*: A. V. Moon, 46 Highfield Way, Rickmansworth, Hertfordshire WD3 2PR.

Editor, *Newsletter*: Miss J. Dorr, Brynsifi, Sandy Lane, Parkmill, Gower, Swansea SA3 2EN.

Editor, *Ornithological Bulletin*: D. J. Montier, Eyebrook, Oldfield Road, Bickley, Bromley, Kent BR1 2LF.

Elected Members of Council: N. Anderson, J. F. P. Bennett, Mrs D. L. Brookman, Dr J. F. Hewlett, A. J. Leppard, J. M. W. Topp.

Representative Members of Council: BOOKHAM COMMON SURVEY — Dr I. S. Menzies; BOTANY — Dr M. C. Sheahan; ECOLOGY AND ENTOMOLOGY — G. W. Loveland; HAMPSTEAD HEATH SURVEY — Dr C. Bowlt; ORNITHOLOGY — Miss N. Duckworth; RAMBLERS, ARCHAEOLOGY AND GEOLOGY — Mrs J. R. Lord.

The Society's Recorders

Botany

Bryophytes: Dr K. J. Adams, 63 Wroths Path, Baldwins Hill, Loughton, Essex IG10 1SH.

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

Ecology and Entomology

Mammals: C. Herbert, 67a Ridgeway Avenue, East Barnet, Hertfordshire EN4 8TL (0181-440 6314).

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

Fishes: Dr Ruth Kirk, Crucian, PO Box 1051, Kingston on Thames, Surrey KT2 5WX.

Arachnida: J. E. D. Milner, B.SC., 80 Weston Park, London N8 9TB (0181-341 2158).

Coleoptera (Carabidae): P. R. Mabbott, B.SC., 49 Endowood Road, Sheffield S7 2LY.

Coleoptera (Lucanidae and Buprestidae): Dr D. S. Hackett, 3 Bryanstone Road, London N8 8TN (0181-292 6134).

Coleoptera (families not otherwise listed): M. Barclay, 47 Tynemouth Street, London SW6 2QS (0171-371 9095).

Lepidoptera, Syrphidae, and invertebrates not otherwise listed: C. W. Plant, B.SC., FRES, 14 West Road, Bishop's Stortford, Hertfordshire CM23 3QP (01279 507697).

Orthoptera: Vacant.

Heteroptera: E. W. Groves, 143 Westleigh Avenue, Coulsdon, Surrey CR5 3AF.

Odonata: Ms Ruth Day, B.SC., 18 Zenoria Street, London SE22 8HP (0181-693 4259).

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

Mollusca: Ms Jane Reynolds, DIP. HORT. (Kew), 21c Loraine Road, London N7 6EZ (0171-700 6258).

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.

Ornithology

Inner London: D. McKenzie, 26 Cuthbert House, Hall Place, London W2 1LT.

Kent and Lower Thames (London Bridge to Tilbury): A. J. Morris, 134 Station Road, Crayford, Kent DA1 3QQ.

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

Middlesex: C. Lamsdell, 4 Hardings Close, Iver Heath, Buckinghamshire SL0 0HL.

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

Hertfordshire: A. D. Wilson, c/o A. V. Moon, 46 Highfield Way, Rickmansworth, Hertfordshire WD3 2PR.

Essex: D. Lambert, 109 Gloucester Road, London E17 6AF.

Requests for information should be made to the appropriate recorder.

Contents

Report of Council for 1997

Approved at the Annual General Meeting on 10 December 1997

The year 1997 will go down in the history of the Society as one of consolidation, but with one or two real highlights. The Society seems to be achieving its core aims of issuing publications, holding meetings, stimulating naturalists both young and old, inexperienced and experienced. Our Society is very broadly based and the economic and social patterns of today must have an effect on our membership and above all on the ability of hard-working people to give their spare time to voluntary activities. The greatest problem facing the Society is the number of vacancies for the various jobs which have to be undertaken if we are to continue to progress. The Council has recognized the difficulty and asked John Bennett to prepare a paper on the future shape of the Society. Debate has already begun on his report (for which we all should be very grateful) and your Council will be considering the future structure of the Society together with any necessary rule changes in the next year or so.

Membership

We have to record the deaths of K. P. Byrne, J. W. Coles, Mrs J. W. Milner and D. Roberts. Total membership of the Society at 1,266 is virtually unchanged as follows:

Ordinary	959
Family	113
Junior	3
Senior	134
Honorary	20
Life	7

Thirty organizations are affiliated to the Society.

Subscriptions have had to be increased for the first time since 1988.

Indoor activities

In October the Society held a conference on 'London's Urban Woodlands'. Colin Bowlt and Tony Barrett organized it for us and we are grateful to them and other helpers without whom the Conference would not have been such a success. Some hundred members and friends attended at the Swedenborg Hall; six papers were presented and a lively 'question and answer' session concluded the proceedings. There can be no doubt that the day was appreciated by all — it would be splendid to repeat the exercise in a year or two, but more members will need to be involved in the preparation.

The showing of the film 'London's Birds', made by Bill Park and Raymond Cordero in the early 1960s, will be on 29 April 1998 at the Linnean Society rooms. The intention is to re-create the style of an LNHS meeting of that period and it is to be hoped that members and friends will support the occasion.

Sectional meetings have been well received by the members.

Full reports of the activities of Working Groups, Sections and the Study Centres will be published in *The London Naturalist.*

Conservation

The Nature Conservation Working Group has greatly expanded its activities in the past year. Indoors the highlight was the talk on 'Biodiversity in London' in March. Building on her previous year's field activities, Jacqueline Shane organized a varied series of monthly surveys at which subjects as diverse as amphibians on Mitcham Common, bumblebees in Wimbledon and fungi at Perivale Wood were considered. In May the Group visited the meadow near

Longford threatened by the proposed Heathrow Terminal 5 spur road. This was incorporated into a detailed 'Proof of Evidence' which included much recent survey work by a wide range of Society members. This was subsequently presented at the Public Inquiry by the Conservation Officer. The 'Proof of Evidence' was very much a joint endeavour demonstrating how the Society's expertise can be put into effective use in the defence of a site of ecological importance in London.

Threats to Sites of Nature Conservation Importance continue in many parts of London and the group continues to liaise with the London Wildlife Trust and other like-minded organizations.

Sections

February 1998 will see the winding-up of the South-West Middlesex Section — a sad day for all, but support has been declining for some years and the Council has reluctantly accepted that the Section is no longer viable. It is grateful to all those hard-working officers who have given local supporters so much entertainment and education over the years.

The Society again took an 'Information and Sales' table at the annual exhibition of the Amateur Entomologists' Society. In April an aerial plankton trap, designed by our spider recorder Edward Milner, was installed on the seventeenth floor of a building in the City of London — some specimens have already been obtained and analysed.

Botanists have continued to support the local recording programme in connection with the BSBI's Atlas 2000 project. Ornithologists continue to support the national Breeding Bird Society — another paper on this subject is in course of preparation for later publication in the *London Bird Report.* Helen Baker's work on the monitoring of the house sparrow (our logo, remember!) is continuing and she now has the support of thirty-five people who are monitoring sparrows in their own gardens.

Study Centres

The Open Day at Hampstead Heath was ruined by the weather, but the Centre, having completed its first full year, continues to be well supported. A computer system for records has been set up which is Semi-Recorder-compatible and contains over a thousand botanical records as well as other taxa. On average some twenty workers and helpers visit on survey days and a number of projects have been started.

The Centre at Bookham Common is over fifty years older than that at Hampstead; quiet steady progress can be reported with the survey days being well supported. It is hoped that a new secretary for the Centre can soon be found. It is likely that in 1998 some modest expenditure on equipment will be required.

Library

The building works at Imperial College have left our Library housed in brand new surroundings, in a space which is more compact. A big 'Thank You' to Imperial College for moving the Library for us!

After many years as Life Sciences Librarian, Janice Yeadon has now moved to another department. The Society is very grateful to Janice for all her help and support over the years and we wish her well in her new post.

The Library Committee welcomed a new secretary, Shirley Gear, and many new members, which means that most sections of the Society are now represented and can contribute their suggestions. The scope of the Library has been discussed at length and guidelines established for rationalizing the stock. Following this, a major review of journal holdings is now under way, and long

overdue weeding of the book stock has begun, made more urgent by the smaller space now available.

Without the support of Mrs Czigány and her team none of this would be possible; we are grateful to them for their continuing help and support.

Archives

The Society's Archives continue to be housed securely at Imperial College in basement room 03. Long-term thought should be given to the inadvisability of our housing any archives in a basement, due to obvious vulnerability to flooding.

There is a steady trickle of new material. Probably the major acquisition during the year was photographic and other material from the late Brad Ashby, relating mainly to Bookham Common. Members are urged to be alert to new material that might be added. Deciding what is relevant is an almost impossible task, and it is better to err on the side of wide acquisition rather than attempting to predict what users in future decades might wish to have had preserved. Members of several decades standing, whose experience and personal records span much of the post-war period, are especially urged to consider if they might wish to deposit appropriate material in the archive.

Although a list of material in the archive exists, this needs to be computerized. So far lack of convenient assistance has prevented this task from being carried out. Should the mooted sesquicentenary history of the Society (in 2008) ever be undertaken, then proper prior computerization would be essential.

Publications

Sales of published books continue (but slowly); it is expected, however, that the rate of sales will improve in 1998. The Publications Working Group is considering how best to publish the results of the survey of the gardens at Buckingham Palace. Work on the new *Atlas of breeding birds* continues, but progress is still slow.

Our journals as ever were well received by the scientific community, but sales were well down. The Society has been without a Publications Sales Officer for the whole year. It is essential that this post be filled, and quickly.

Other matters

The Society is conscious of the financial difficulties being experienced by libraries and centres of learning at this time. It therefore took pleasure in being able to donate to some thirty institutions, copies of Colin Plant's books on the moths and butterflies of London. Mrs Czigány gave us great help in arranging the distribution — it is intended that this programme will be continued and extended in the coming year.

The European Bird Atlas has been published — the Society sponsored the page on the house sparrow; those fortunate enough to have seen a copy will easily recognize our motif which looks well in print.

Grants have been awarded to assist with insect recording on Wimbledon Common and to help the London Amphibian and Reptile Group purchase equipment for use in general pond management in London.

It can be seen that the Society is flourishing, financially secure and engaged in many worthwhile activities. As a matter of urgency, however, the existing hard-working officers, who are all voluntary and without whom few of these activities would be possible, must be given some relief. The burden of running the Society can never be equally shared, but the day-to-day tasks must be more widely distributed. It is right therefore that this report should end by offering the thanks of all members to those officers presently undertaking the many complex and time-consuming operations which ensure the successful running of our Society.

Treasurer's report for 1996/7

At the end of the financial year on 30 June 1997, the total net assets of the Society were £436,812, compared with £415,023 the previous year, representing an increase of 5.3 per cent.

Incoming resources during the year totalled £34,812, compared with £35,958 in 1995/6. This reduction, of 3.2 per cent, was largely due to a fall in sales of the Society's journals and publications, offset to some extent by higher investment income. Net income from investments, at £21,480, was 6.4 per cent higher than the previous year, but still below the exceptional level achieved in 1994/5. Subscription income, at £11,579 (including tax recovered on covenanted subscriptions), remained steady. Further efforts are being made to encourage more members to covenant their subscriptions. Income from sales of journals and books was considerably lower than the figure for 1995/6, which had included initial sales of *Bird-Watching in London.*

Overall expenditure during the year amounted to £38,181, compared with the previous year's figure of £40,945, which had included printing costs for *Bird-Watching in London.* Production costs for *The London Naturalist* and *London Bird Report* totalled £9,725, the lowest figure for several years. Meetings costs, sectional and general expenditure rose by £1,182; and management and administrative expenses were £1,488 higher, largely because of extraordinary accountancy support in connection with the requirements of the Charities Act 1993, and subsequent regulations.

Statement of trustees' responsibilities

Charity law requires the Council as trustees to prepare financial statements for each financial year which give a true and fair view of the state of affairs of the charity and of its financial activities for that period. 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 have been followed subject to any material departures disclosed and explained in the financial statements; and
- to prepare the financial statements on the going concern basis unless it is inappropriate to presume that the charity will continue in business.

The trustees are responsible for keeping proper accounting records which disclose with reasonable accuracy at any time the financial position of the charity and to 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 for taking reasonable steps for the prevention and detection of fraud or other irregularities.

Summarized accounts for the year ended 30 June 1997

These summarized accounts have been extracted from the Society's annual accounts for 1996/7. 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' annual 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 22 November 1997.

Summarized statement of financial activities for the year ended 30 June 1997

	Unrestricted funds 1997 £	1996 £
Incoming resources		
Subscriptions received from members	11,579	11,613
Interest receivable	200	223
Investment income	21,480	20,179
Publications/journals income	1,246	3,514
Other sundry income (including donations and bequests)	307	429
Total incoming resources	34,812	35,958
Resources expended		
Direct charitable expenditure	27,542	31,794
Management and administrative expenses	10,639	9,151
Total resources expended	38,181	40,945
Net (outgoing)/incoming resources for the year	(3,369)	(4,987)
Gains and losses on investments		
Realized gains on sale of investments	21,226	11,265
Unrealized gains/(losses) on revaluation of investments	3,932	15,783
Net movement in funds	21,789	22,061
Fund balance brought forward at 1 July 1997	415,023	392,962
Fund balance carried forward at 30 June 1997	£436,812	£415,023

Balance Sheet as at 30 June 1997

	1997 £	1996 £
Fixed assets		
Tangible fixed assets for use by charity	791	1,588
Investments at market value: listed	410,179	396,565
cash	26,021	12,103
	436,991	410,256
Net current assets/(liabilities)	(179)	4,767
Total net assets	£436,812	£415,023
Represented by:		
Unrestricted funds	£436,812	£415,023

Report of the auditors to the members of the London Natural History Society

We have audited the summary financial statements set out on page 10.

Respective responsibilities of trustees and auditors

The summary financial statements are the responsibility of the trustees. Our responsibility is to report to you our opinion on their preparation and consistency with the full financial statements and Annual Report.

Basis of opinion

We conducted our audit in accordance with Auditing Guideline, *The auditor's statement on the summary financial statement*, adopted by the Auditing Practices Board.

Opinion

In our opinion the summary financial statement is consistent with the full financial statements and Annual Report of the Society for the year ended 30 June 1997.

4 London Wall Buildings
LONDON EC2M 5NT
22 November 1997

FRASER RUSSELL
Chartered Accountants
and Registered Auditors

Official and sectional reports for 1997

CONSERVATION

The Nature Conservation Working Group has greatly expanded its activities in the past year. Indoors, the highlight was a talk in March on 'Biodiversity in London', jointly presented by Paul Sinnadurai of English Nature and Alistair Kirk, Biological Recording Officer of the London Wildlife Trust. Building on her previous year's field activities, Jacqueline Shane, assisted by Freda Turtle and Elizabeth Cheeseman, organized a series of monthly midweek events to study and survey subjects as diverse as amphibians on Mitcham Common, bumblebees in Wimbledon and fungi at Perivale Wood. These meetings were run jointly with the London Wildlife Trust. In May the group visited the meadow near Longford threatened by the proposed Heathrow Terminal 5 spur road. Plants were surveyed along a transect which crossed the land that would disappear under the proposed road, and the threatened populations of water avens, adder's-tongue fern and ragged-robin were all mapped in detail. These data were incorporated into a Proof of Evidence which included much other recent survey work by a wide range of Society members. This Proof of Evidence, setting out the Society's objections to the chosen route of the spur road, was presented to the Public Inquiry by the Conservation Officer on 5 August. A copy is available for inspection at the Society's library. This undertaking was very much a joint endeavour and demonstrates well how the Society's expertise can be put to effective use in the defence of a site of ecological importance in London.

DAVID BEVAN, *Conservation Officer*

BOTANY

The Section continues to organize a varied programme of talks and field outings. There were four formal meetings: in February Roy Vickery spoke about plant folklore, in March Paul Bartlett gave an illustrated account of his botanizing in the Picos de Europa, and in April Barbara Last spoke about the conservation and plants of chalk downland in Wiltshire. At the AGM in November Professor Bradbeer, who has visited us before, spoke on some interesting aspects of seed biology. There were three informal meetings: the usual 'Best Botanical Slides' evening, and two useful general identification sessions with Rodney Burton.

There were field trips to the River Wandle, the Thames towpath and Hampton Court Park, Old Park Wood Harefield, Barnes Common, Ditchling Common, Brookwood Cemetery and Basingstoke Canal, Shepherd's Meadows, Railway Fields, Box Hill and Headley, Hayesden, Coldfall Wood, Gutteridge Wood and Yeading Meadows, Ranmore and White Down, Tottenham Marsh, Denham, and finally the popular urban fungus foray in Haringey, a joint meeting with the London Wildlife Trust. Reading the accounts of some of these meetings in the *Newsletter* gives an idea of the variety of plants seen and interesting places visited.

Recording has also continued during the season and is carried out with enthusiasm by many members, who were asked this year to hunt for old plant records. During the year Rodney Burton, our flowering plant recorder, entered no fewer than 8,933 records to the LNHS plant records database — a remarkable achievement.

We are pleased to welcome two new members to the committee, Robin Blades and John Swindells, and we thank everyone who has given talks and led walks for us.

RODNEY BURTON, *Chairman*, MARY CLARE SHEAHAN, *Secretary*

ECOLOGY AND ENTOMOLOGY

The Section arranged a number of interesting meetings, both indoors and in the field for members of all Sections. In March Dr Jim Harris of the University of East London presented his view of the practice and philosophy of ecological restoration, and in April Dr John Langley of Middlesex University illustrated how rotifers were useful as environmental indicators. June saw our Mollusca recorder, Jane Reynolds addressing us on 'A Wider View of Slugs and Snails'. In September we were hosts to members of BENHS for the third Brad Ashby Memorial Lecture: Dr Ian Menzies, who is chairman of the Society's Bookham Common Survey, spoke on 'Half a Century of Insect Encounters in South-West London', illustrating the species which have declined, disappeared or increased during his lifetime of observation. Two informal meetings were held during the year, one in February and one in November, where members displayed their photographic skill and delight in a wide range of invertebrates and faraway habitats.

Field trips were arranged to the London Zoo for a behind-the-scenes look at the Aquarium, to the Middlesex Filter Beds in Lee Valley Park, Lesnes Abbey Woods, Totteridge Fields, and Langham Pond and Bury Wood in Epping Forest in search of a variety of invertebrates.

Our Section covers a wide variety of taxa — everything except plants and birds — and our recorders continue to make fresh discoveries and to share their enthusiasm with the Society's members. The sectional AGM in October was particularly successful, featuring the reports from ten recorders. The main speaker was Tom Langton, recorder of reptiles and amphibians, on the topic of exotic herpetofauna in London and the South-East. These included a crocodilian spotted in the River Lea and a breeding population of Aesculapian snakes on a central London canal bank. The mammal recorder, Clive Herbert, noted of particular interest the report of Leisler's bat in Greenwich. A number of interesting finds were reported by members to the Arachnida recorder, Edward Milner, including a substantial colony of the spectacular jumping spider *Marpissa muscosa*, a colony of *Araneus quadratus* on willow-herb on the Hampstead Heath Extension, and *Nigma walckenaeri* from Greenwich. For Jane Reynolds, Mollusca recorder, a notable find on Hampstead Heath was *Boettgerilla pallens*, the worm slug which arrived in Britain around 1975. Reports were also received from recorders of fish, Carabidae, Lucanidae and Buprestidae, Lepidoptera, Odonata and plant galls. A number of the Section's recorders are involved in the Society's Hampstead Heath Survey.

In April, an aerial plankton trap, designed by our spider recorder, Edward Milner, was installed on the seventeenth floor of a building in the City of London. Some specimens have already been caught.

During the year the committee has accepted with regret the resignation of the Orthoptera recorder, David Martin.

Once again members of the Section represented the Society at the annual exhibition of the Amateur Entomologists' Society in October.

JOHN A. THOMPSON, *Chairman*, CATHERINE SCHMITT, *Secretary*

ORNITHOLOGY

The Ornithology Section has again been engaged in many activities during 1997. A further expansion of the field meeting programme has meant that there was at least one outing on almost every weekend, with about fifty local ones and eight coach trips to places further afield. These latter continue to be particularly well supported, but the meetings in and around London are the core of the programme and serve a valuable purpose in introducing members to local sites and to the interesting bird life to be found there. Our thanks go to the increasing number of members willing to lead these as well as to Neil Anderson

for organizing the programme. Speakers at the Section's lecture meetings covered places as far away as Madagascar, Bhutan, Australia and Lesbos, while closer to home we heard about the birds of Berkshire and East Anglia and the current state of declining populations of farmland birds, a cause of increasing conservation concern. An excellent talk on 'Art in Nature' and accounts of such appropriately familiar species to Londoners as the starling and house sparrow completed a full programme of ten indoor meetings.

Talking of familiar urban species, members participated in the continuing house sparrow and house martin surveys. There was a commendable further increase to 47 in the number of squares covered for the Breeding Bird Survey, and the organizer, BTO rep. Derek Coleman, contributed a survey of the 1996 results to the *London Bird Report.* It was most unfortunate that the publication of that journal was delayed until after the end of the year, but we owe a huge debt to Andrew Moon who stepped into the editorial breach and produced a splendid issue which was worth waiting for. The two-monthly *Ornithological Bulletin* continued to be well supported, records being contributed by a large number of observers covering many parts of the London Area, and was expertly compiled by the indefatigable David Montier. Disappointingly, the new *Atlas of breeding birds of the London Area* had not yet been completed, but real progress was being made by the end of the year.

The Section was unfortunately without a chairman during 1997, but this has now been remedied. Thanks are due to all the officers and committee members who kept the Section running so well.

RON KETTLE, *Chairman*

RAMBLERS, ARCHAEOLOGY AND GEOLOGY

During the year the Section held seven indoor meetings with subjects ranging from Warley Place to gemstones. The former was presented by John Court whose slides showed Warley Place at its best. One advertised lecture, that on the Channel Tunnel, could not be given. However, we were fortunate in obtaining the services of Diana Hawkes, the curator of Haslemere Museum, who gave an interesting account of the Museum's history and collections. Other subjects covered were archaeological discoveries in London, the national parks of the USA, 'Industrial Archaeology in Europe' and 'Gateways to South Wales'. Seventeen field meetings were also held during the year. Attendance figures for those held on weekdays were quite good. The venues were very varied and not very far afield. They ranged from St James's Park and the City gardens in central London to places a little further out such as Ashtead Common and Caterham. The Ashtead Common meeting, which featured butterflies, was very popular. Thanks are especially due to Helen Hartley, Rosa Davis and Bert Wright, each of whom organized two or more field meetings. Other venues included Ranelagh Gardens, Battersea Park, Pinner, Ealing Museums, Tradescant Museum, River Beane, Chiswick House, West Ham Park, Greenwich Park and Kew Gardens. The visits to Bromley and Keston Ponds has a distinct geological flavour. During July Rotherhithe was visited under the leadership of Ruth Day for the study of dragonflies and some of the buildings.

We were very pleased to welcome John Thompson to the Committee in October. The section has to provide a very varied programme to satisfy a considerable number of interests and thanks are due to all those speakers and leaders who have made this possible.

RICHARD E. BUTLER, *Chairman*, DOREEN E. WOODS, *Secretary*

SOUTH-WEST MIDDLESEX

Falling attendances and the difficulty in getting new members willing to serve on the Committee have led to the decision to wind up the South-West

Middlesex Section. Our two final meetings were held in February 1998 — an indoor meeting on the 5th when the speaker was Laura Ponsonby, formerly an education officer from Kew, who gave a superb illustrated talk on 'The Amazing Travels of Marianne North', and a field meeting on the 15th when David Harris led a walk around Osterley Park.

The Section was founded at a public meeting in the Council House, Hounslow on 25 February 1952, and Alderman J. E. Dillingham, who arranged the meeting, was appointed chairman and a provisional committee was elected. Over the years a full programme of field meetings and indoor lectures has been arranged and these have proved to be a valuable source of activity in the Hounslow area and beyond. During 1997 we held seven indoor meetings and twelve field meetings. The indoor meetings covered a wide variety of topics from members' slides, the Lee Valley Park, the Andes, Bedfont Lakes, London's Green Belt, the AGM and quiz, and the Seychelles. The field meetings were mainly in our general area and included Wraysbury Gravel Pits, Windsor Great Park, Bushy Park, Hounslow Heath, Brent Reservoir, Thursley Common, Penton Hook, Runnymede, Ham riverlands, Oxshott Heath, and Kew Gardens.

Our indoor meetings have attracted, on average, about fourteen members, but the field meetings, though not attended by large numbers, have been sufficiently well attended to be worth while. The problem has been the difficulty in recruiting new people onto the Committee, and it was realized that when the key officers had eventually to give up it would be highly unlikely that there would be anyone to take their place. It is with regret that at the last AGM it was agreed that the Section should recommend to Council that it be wound up.

As I was a founder member of the Section in 1952 and have since served on the Committee and been programme secretary, minuting secretary and reporter of field meetings for the Society's *Newsletter*, it has fallen on me to pay tribute to those members who have served on our Committee so loyally over the years. Following Alderman Dillingham, our chairmen have been C. W. Pierce, Dr A. Anderson, Edward Everitt, George Parker, David Harris, Tony Leppard, Ray Bowden and Mark Radford. Most of them had served previously as secretary. Programme secretaries (always mainstays of the committee) included R. J. Parsons, Mrs P. J. Gray, Mrs M. F. Everitt, B. J. Bedell, D. Harris, the late Frances Murphy (the spider expert), myself under my previous name of Bickerstaff, Ellen Nickless, and Gordon Freeman. Our longest-serving secretary was Margaret Smith who took a devoted interest in the Society for twenty-five years until her death in 1988. After this long period of stability we found difficulty in recruiting a secretary for any length of time, but we overcame this by splitting the secretarial duties, and committee member Peter Williams became treasurer and I became minuting secretary. In recent years several long-standing officers have resigned and it became more difficult to fill their posts.

At the time the Section was wound up the Committee was as follows: Chairman, Ray Bowden, Vice-Chairman, Tony Leppard, Secretary, Mark Radford, Minuting Secretary, Marjorie Shattock, Treasurer, Peter Williams, and Auditor, Audrey Thorne. All the above led regular field meetings and were only too pleased to impart their profound knowledge and experience to all. The Section has always been proud of its 'layman-friendly' attitude and had continually encouraged beginners. Nearly half a century is a long time, and many people, of whom only a few have been mentioned above, have contributed to our well-being, but I must finally single out Dr Brian Spooner from Kew Gardens who has led our fungus forays each year and has patiently named all our collections. We are sad to be going, but we know that the South-West Middlesex Section has served a useful purpose, both within the LNHS and in its own corner of Middlesex.

MARJORIE SHATTOCK

Book review

Field guide to the dragonflies and damselflies of Great Britain and Ireland. General editor Steve Brooks, illustrated by Richard Lewington. British Wildlife Publishing. 1997. 160 pp. £18.95 post free from British Wildlife Publishing, Lower Barn, Rooks Farm, Rotherwick, Hook, Hampshire RG27 9BG. Tel. 01256 760663. Fax 01256 760501. ISBN 0 9531399 0 5.

Anyone who is seriously interested in dragonflies should get this book. A great many of them already have it. Indeed, I was quite surprised, during a field trip in August 1998, to see how misshapen a book can become during the course of a wet summer, when it has been soaked and dried out several times. I can, however, testify that the binding stood up to the strain and neither the print nor the illustrations had become blurred. (No, the copy in question does not belong to me.) This book is the latest in a succession of field guides which have appeared since Harley Books published Hammond's guide in the early 1980s. Before that, there was nothing, unless you could manage to get hold of a copy of Longfield's long-out-of-print guide in Warne's Wayside and Woodland series. By now, however, most naturalists have at least one dragonfly book, so why buy another?

There is a great deal of extra information. For many species there is a drawing of the side view as well as the back. One of the problems of dragonfly recording in the London Area is sorting out the little blue damselflies. *Coenagrion puella* the azure damselfly and *Enallagma cyathigerum* the common blue damselfly are equally common, equally abundant and equally blue. Moreover, they may both be present at the same pond. The received wisdom is that *C. puella* has a U-shaped black mark at the top of the abdomen and *E. cyathigerum* has one shaped like the Ace of Spades. Fine, if you can see them, but a lot of dragonfly people are not entomologists and use binoculars rather than a hand net. What do you do if the wretched insect is covering the top of its abdomen with its wings? Brooks and Lewington come to the rescue. *E. cyathigerum* has broader blue shoulder straps (antehumeral stripes) than *C. puella* and only a single black stripe on the side of the thorax where *C. puella* has two. What do you do if you are out on a windy Rainham Marsh and can only see the emerald damselfly you haven't managed to net as a silhouette against the light? Is it *Lestes dryas* or only *Lestes sponsa*? Both species have been recorded from this site. The male *L. dryas* has a square pterostigma, and once you get your eye in, it is quite distinct. In addition to our native species, there are drawings and text showing the migrants likely to occur in Britain.

The introductory chapters on life history, distribution and habitats contain a wealth of interesting detail. For instance, why are some species found only in acid waters whereas others occur in neutral pH? There are new keys for both adults and larvae, a regional guide to the best sites and what can be seen there and even a note of where you can buy a net. The only criticism I have of this excellent book is that the beautifully clear drawings are rather small. If they were not, however, the book would be less portable and even more expensive. The more I use it, the more I am getting accustomed to the size of the drawings and the less I mind it. This book is definitely the best yet!

RUTH DAY

The fauna and flora of the newly created Wildlife Garden in the grounds of The Natural History Museum, London

MARTIN R. HONEY, CERI LEIGH and STEPHEN J. BROOKS
The Natural History Museum, Cromwell Road, London SW7 5BD

Contents

Abstract

This paper presents the initial results from what is intended to be a long-term study of an unusual educational and research opportunity in central London. Details are given of the creation of the Wildlife Garden in the grounds of The Natural History Museum, South Kensington, from a formal garden into a series of interconnecting habitat areas typical of southern England. Records are presented from a survey that has been initiated to monitor most of the major plant and animal groups that are present in the garden with some comments on both their current and historical status.

Background

The Wildlife Garden in the grounds of The Natural History Museum (NHM) occupies an area of about one acre (*c.*4,000 sq. metres) at the western end of the South Kensington site (Grid Ref. TQ27U) (Frontispiece). It was previously part of a formal garden with ornamental shrubs and short-mown grass. To create the Wildlife Garden, the west gardens were completely relandscaped and a large number of the existing plants removed, the exceptions being a boundary hedge of privet *Ligustrum* and ornamental shrubs and several mature trees, including London plane *Platanus* × *hispanicus*, Lombardy poplar *Populus nigra* 'Italica' and a lime *Tilia* sp. (possibly × *europaea*). Plans for the garden were started in 1990/91 and construction work commenced in 1993. It was officially opened on 10 July 1995 by the then Secretary of State for the Environment, the Right Honourable John Gummer MP and the actress Susan Hampshire. The Wildlife Garden now consists of a mosaic of different habitat examples typical of lowland England, including water features which were absent from the Museum grounds before 1993. The Wildlife Garden was developed by the Museum in collaboration with London Conservation Services (an arm of the London Wildlife Trust) and was designed by Mark Loxton, landscape architect of the Adams Loxton Partnership Ltd. Much of the planting was undertaken by Countryside Wildflowers, a firm of landscape gardeners who have, along with many other companies and organizations, sponsored the garden. The chief functions of the garden are

i to illustrate the potential for habitat creation and wildlife conservation in the inner city;
ii to provide an educational resource to promote an understanding of the

balance and relationships between plants and animals, both for children and adult visitors to the Museum; and

iii to provide facilities for the life-sciences departments of the Museum to conduct ecological projects and to train staff in ecological monitoring work.

The garden includes examples of several semi-natural vegetation types and other features which are linked by meandering paths. During the planning stage these paths were designed especially to provide access for people with special needs. The central focus of the garden is formed around three ponds. Water from an upper, shaded pond cascades over a limestone waterfall with a 1.2 m drop and feeds into the main pond. This pond was envisaged as a more-eutrophic lake. It has a surface area of 225 m^2 and a maximum depth of 1.2 m and is fully open to the sun. Water from the large pond is then circulated through a series of three small reed-beds holding *Phragmites*, donated by Merton Ponds Ltd, which simulate commercial filter beds that are designed to absorb heavy metals and nutrients from effluent. Adjacent to the reed-beds is an area of marshland constructed with the aid of a sample of Norfolk fenland donated by the RSPB. A third, small, pond is situated alongside a mound of chalk grassland and the water in this pond is circulated via a trickling chalk stream. One concept of the initial design was that the water levels in the ponds should be maintained from a 40,000-gallon (*c.*182,000-litre) underground water storage tank that was installed to collect rain water from the roofs of the Museum buildings. However, rainfall to date has proved to be insufficient for this purpose and a 150 m-deep borehole was drilled during the summer of 1997. Tests have been carried out on the water quality and rate of supply from this, and it is hoped that after the installation of a pump and water treatment equipment, the borehole will provide a constant water supply, both for the garden ponds and for the Museum.

The National Vegetation Classification (NVC) (e.g., Rodwell 1991) was used when selecting the plant assemblages for the garden. Habitat types represented include typical woodland sub-community (NVC code W10a), wood anemone sub-community (code W10b), ivy sub-community (code W10c), hedgerow (code W21), mesotrophic grassland (code MG4) and calcareous grassland (codes CG2 and CG3). A fire access road crosses the southern part of the garden from Queen's Gate to the front lawn of the Museum, and this has been adapted to represent an ancient lane, modelled on an actual green lane deep in the Essex countryside (Mapletree Lane, Writtle Forest), which is of Saxon or earlier origin. Walking round the garden there is a transition of habitats from marshland, through oak woodland typical of acidic soils and heathland, to woodland typical of more basic soils and, finally, to calcareous grassland. A plan, derived from one of those in the garden database, showing the location of the various habitat types is shown in Figure 1. Throughout the garden, large tree stumps and logs have been left or introduced to encourage the growth of fungi and the colonization by dead-wood fauna. Boulders and rocks, providing ornamental examples of geological formations, are also dispersed around the garden.

The original concept was developed by a Museum Working Party set up by the Director, Dr Neil Chalmers, with advice from the garden's designer, Mark Loxton and ecologist, Denis Vickers. The intention was to renew the Museum's role in nature conservation. This group, together with the Museum Development Trust, raised the £120,000 necessary for its construction and development. A large proportion of this sum came from donations by sponsors. Responsibility for the further development, maintenance and monitoring of the garden is now undertaken by members of the West Gallery Management team, Violet Mareck (initial installation), Christina Aston (maintenance), Ceri Leigh (monitoring co-ordination) and the new part-time gardener, Caroline Ware, as well as part of the Museum's Department of Exhibitions and Education in close

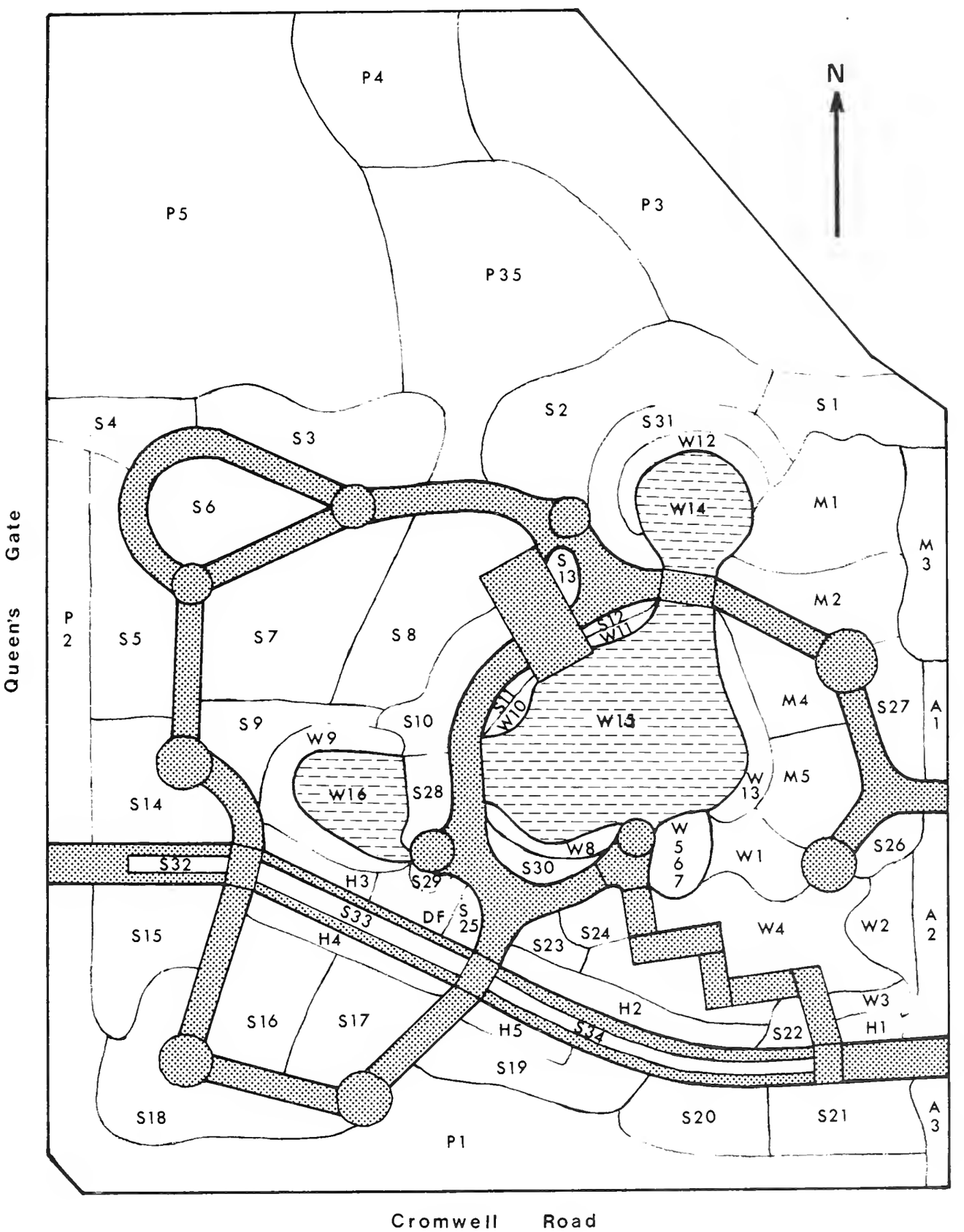


FIGURE 1. A diagram showing the layout of the Wildlife Garden with the various habitat areas and their codes.

consultation with the garden's Scientific Advisory Group of Mary Gibby and Clive Jermy (Botany), Steve Brooks (Entomology) and Peter Mordan (Zoology). A management plan has been commissioned from the Adams Loxton Partnership which details the maintenance necessary to preserve the character of each of the habitats. The garden in regularly monitored by Museum staff and outside volunteers to provide a database of the garden's fauna and flora and to document the colonization by animals and the ecological changes affecting the plants. Special tasks are often undertaken at weekends by current and retired members of staff who have volunteered to be members of the Garden Club (e.g., the removal of part of the boundary hedge ornamentals and their subsequent replacement with native hedging plants and trees). During initial construction, attempts were made to ensure that only native plants and seeds were introduced. These were donated by accredited nurseries who were to provide evidence of British provenance of the specimens supplied. Any non-native plant species, or cultivated varieties, that are found to have been inadvertently planted are removed and replaced. Other plants and seeds were collected in the wild from locations in south-east England, with the landowners' permission, from sites under threat of destruction or following conservation management work. A policy decision was originally made that no animal species should be intentionally introduced, but it is inevitable that some species will have arrived with introduced plants. However, four adult common frogs, a toad and two adult smooth newts that had been rescued from a site where they would otherwise have perished, were introduced to the main pond just after the garden opened in July 1995. Although that policy still stands, a decision to adopt the recommendations resulting from the amphibian survey (Atkins and Herbert 1997) has been taken so their populations will be artificially maintained through 'toping up'. Frog and toad spawn were put into the main pond in the spring of 1998.

Monitoring

Flora

All three ponds, the upper pond (W16), the lower or main pond (W15) and the chalk pond (W14) were surveyed for freshwater algae between May and August 1997. Also, within the lower pond area, the series of three small reed-beds (W05/06/07) was occasionally sampled as a separate site, as was the outflow area between the upper and lower ponds (S28 and the area adjacent to it). However, both of these sites were frequently dry when the pump was off and rainfall was low. There was also some sporadic sampling of the chalk pond in February 1997. Sample methods were 'squeezes' of the filamentous algae, plankton hauls and stone scrapes. The remaining flora (vascular plants, lichens, etc.) were monitored and identified by field observation in the garden itself, by current and ex members of staff of the Department of Botany and other departments of the NHM and specialists from outside bodies (e.g., J. E. M. Mordue of the International Mycological Institute).

Water chemistry

The ponds were initially filled in 1994 with borehole water, low in nutrients, that was supplied by Anglia Water. During 1997 the water chemistry of each of the three ponds and that of the reservoir tank was monitored by Vic Din and Gary Jones. Their initial results revealed that all the ponds were remarkably alkaline with a pH ranging from 9.2 to 10.2, but these have now stabilized. The main pond now has a pH of 8.8, the upper pond 7.5 and the chalk pond 9.0. During the hot summers of 1995 and 1996 the rainwater in the reservoir tank was exhausted and mains water was used to top up the tank and to maintain the water levels in the ponds. An analysis of the water chemistry of the tank in 1997 has revealed that this was the source of the high levels of phosphate and

nitrate which caused large blooms of filamentous algae. Clumps of these algae are periodically raked out to try to reduce nutrient levels and to prevent the algae inhibiting the growth of macrophytes by excessive shading. Despite their aesthetic disadvantages, these algal growths can, in newly created ponds where macrophyte growth is limited, provide an important substrate for macro- and, more especially, microinvertebrates. Data from the water chemistry analysis are available from Ceri Leigh at The Natural History Museum.

Air quality

Air quality analysis was, until recently, carried out in the area by the Department of the Environment (now Department of the Environment, Transport and the Regions — DETR) from the roof of Baden Powell House which overlooks the Wildlife Garden. This ceased in 1996 but, following successful discussions between the Museum and the DETR, a hut has been installed by the DETR in the south-west corner of the garden to house the equipment to monitor levels of sulphur dioxide, etc. Results from monitoring at this site may be made available to the public. Magnox Electric plc sponsored a recently installed system to collect rainwater which will be analysed to assess the extent of acid precipitation and for the results of the water analysis to be databased. Data on the air quality levels at the Cromwell Road site are available on the World Wide Web via the DETR's homepage (http://www.detr.gov.uk) and some are also published by the Royal Borough of Kensington and Chelsea in their *Pollution Information Bulletin.*

Aquatic invertebrates

Standardized sweep samples for macroinvertebrates are taken at irregular intervals using a 250 μm-mesh pond net, from each of the three ponds. Samples are taken from open water and from a variety of different substrates including gravel, mud and plant detritus, and from among living macrophytes. The samples are transferred into 80 per cent alcohol and identified in the laboratory under a $\times 50$ binocular microscope, mainly with reference to Fitter and Manual (1986). Samples for microinvertebrates are also taken using nets with a mesh size between 40 and 65 μm and identified by members of the Quekett Microscopical Club. The invertebrates collected in these samples are identified whilst alive before being preserved in 2–4 per cent formalin. Other samples are occasionally taken and their contents identified and recorded by colleagues from the Museum and by members of other organizations. All records of adult dragonflies are of field identifications.

Terrestrial invertebrates

A programme of insect monitoring was instigated in May 1995, primarily concentrating on the Lepidoptera. The butterflies are monitored by casual observations at lunchtime or in the late afternoon, a technique that has also resulted in some moth records, but the majority of these are the results of light-trapping. The trap used most often is a Robinson type (for details see Fry and Waring 1996) fitted with a 125-watt mercury vapour bulb, but a battery-operated actinic trap (similar to a Heath trap, but manufactured by EntoTech) fitted with an 8-watt black-light bulb has also been used. Attempts have been made to run the trap at least once a week, usually on a day that coincides with a similar trap being operated in the grounds of Buckingham Palace. However, this has not always been possible due to forecasts of adverse weather conditions (e.g., rain or strong wind), availability of staff, etc. Both types of trap are portable and can be sited in almost any of the habitat areas, but the Robinson trap has the advantage of attracting specimens from a much wider area. The traps are operated from dusk to dawn, either via a timer switch or a photoelectric cell. The trap contents are examined shortly after 6.30 a.m. Most of the macrolepidoptera are sorted and identified in the garden and the specimens

released into dense vegetation, but the microlepidoptera are brought into the Museum for later identification, along with problem macros and certain other orders (Trichoptera, Neuroptera, etc.). A few voucher specimens are retained for a small reference collection that is being assembled which will also be available for use as an educational resource.

Later in 1995 the programme was extended to include the monitoring of spiders. A series of eighteen pitfall traps, consisting of small plastic beakers set into the ground and containing a mixture of antifreeze and detergent, set in groups of three, was placed in various habitat types around the garden. The traps are emptied once every two weeks and the spider samples are extracted for identification. Any remaining specimens of other orders are handed over to the relevant specialist for identification.

Beetles are also being monitored from light-trap and pitfall-trap samples, casual observation and searches conducted by colleagues from the Museum's Department of Entomology, as well as from two underground traps installed by Richard Thompson to obtain records of subterranean beetles. Following a recent request for additional volunteers, most of the remaining major orders that were originally selected for the monitoring programme are now being covered.

Vertebrates

Several people are involved in monitoring vertebrates. William Atkins and Clive Herbert (on behalf of the London Amphibian and Reptile Group) conducted a night-time survey of the garden ponds on 25–26 March 1997. Until recently Fiona Rowan (Central London RSPB Members' Group) visited the garden on alternate weeks, early in the morning, to monitor the birds. Three Museum staff also record birds on an irregular basis. Ceri Leigh (West Gallery Management Team, NHM), Frank Greenaway (Photographic Unit, NHM), and John Tovey and other members of the London Bat Group have monitored bats, and Richard Harbord (Mammal Section, NHM) has set up a number of hair traps and Longworth traps to monitor small mammals. As with other groups, these records are supplemented by casual observations by other members of staff.

Databasing

In 1995 the Museum received sponsorship from Compaq Computers Ltd in the form of computer hardware and software that has been used to create the Wildlife Garden database. The system, an AutoCAD system originally based on *FoxPro* and *PaintShopPro*, but which has recently been transferred to *Delphi*, was set up by Richard Cartwright, of Cartwright James Consultants Limited, and has now been networked to one member of staff in each of the Life Sciences Departments and the Department of Mineralogy who are primarily involved with the monitoring process. Every species recorded in the garden is entered onto one of three Wildlife Garden database lookup files: one for insects, a separate one for other animals and one for plants which, for convenience, also includes the fungi. Textual data about a particular species can then be added to the appropriate database and the information can be linked to specific co-ordinates on the garden plan, a feature that is more appropriate when recording plant species. The database will continue to be expanded as species become established or disappear, building up a picture of the actual fauna and flora of the garden and how it develops over time as the garden itself becomes established. Data on disappearances are automatically stored on separate archive databases. The database will eventually include not only lists of plant species that were originally introduced to the garden, but also those that have been recorded subsequently. It is also capable of storing, as bitmap files, photographs of the garden and a representative selection of the species that have been recorded there.

FIGURE 2. Marginal and emergent plants around the main pond (W08).

FIGURE 3. The main pond (W15) towards Queen's Gate, showing the waterfall (S28).

Discussion of results

For a number of reasons it was not possible to conduct a comprehensive survey of the garden site before redevelopment started. A few old records do exist for some groups (e.g., Lepidoptera) but most of these are of casual observations only and do not specifically relate to the area now forming the Wildlife Garden, just the Museum grounds in general. Some lists of species have been provided for historical comparison and the most recent of these is the birds seen around the Museum grounds, based on casual observation by Michael Shaffer (recently retired from the Department of Entomology, NHM) which date back to 1958 (see below under vertebrates).

Freshwater algae (Mandy Holloway, NHM)

Sporadic sampling of the chalk pond from February 1997 showed a surprising degree of activity and an early spring, possibly aided by the high phosphate and nitrate levels, produced an abundance of *Clostrium*, *Cosmarium* and the common green alga *Scenedesmus quadricauda*. To date, the survey of the three ponds (the upper pond (W16), the main pond (W15) and the chalk pond (W14)) and the reed-bed area (W05/06/07), which was undertaken between May and August 1997, has produced a list of thirty species of freshwater algae. Peter York made extensive photographic records of the algae throughout the summer, and Dr David John (both of the Department of Botany, NHM) checked the identifications.

Identification manual references:

CARTER-LUND, H. and LUND, J. W. G. 1995. *Freshwater algae. Their microscopic world explored.* Biopress Ltd.
PENTECOST, A. 1984. *Introduction to freshwater algae.* Richmond Publishing.
PRESCOTT, G. W. 1983. *How to know the freshwater algae.* Brown WC Iowa.

Vascular plants (A. Roy Vickery and Alison M. Paul, NHM)

Unlike other groups, some vascular plants were deliberately introduced when the garden was laid out. Thus the garden in its present state contains three categories of plants: remnants of the previous garden on the site, plants which were introduced because they were considered to be appropriate to the various wildlife habitats in the garden, and plants which have come in unaided since the garden was established.

Remnant plants include all the large trees such as London plane *Platanus* × *hispanica* in areas S05, S15, S21, P01 and P05, two poplars *Populus* in area P03, a large lime tree *Tilia* in S08, a horse-chestnut *Aesculus hippocastanum* in area S27, plus other mixed ornamentals including holly *Ilex aquifolium*, privets *Ligustrum*, mock orange *Philadelphus* and ornamental hawthorn *Crataegus* at the corner with Queen's Gate and previously along the side of Cromwell Road. The latter has now been replaced with hawthorn *Crataegus monogyna*, hazel *Corylus avellana*, dog rose *Rosa canina*, blackthorn *Prunus spinosa*, elder *Sambucus nigra* and field maple *Acer campestre* shrubs with some standards.

Introduced species consist of a long list of plants which were planted in their appropriate habitat areas, for example flowering rush *Butomus umbellatus* at the margin of the main pond, and ferns, e.g., *Dryopteris* in the woodland area. Some of these have flourished, e.g., teasel *Dipsacus fullonum*, which seeded itself to such an extent that it was considered to be a pest in 1997, but others have since disappeared or are finding it difficult to survive.

A wide range of plants has also colonized the garden. These include many fleshy-fruited trees and shrubs (a variety of *Prunus* seedlings, for example, has been observed), butterfly bush *Buddleja davidii*, which colonized the chalk grassland but has since been removed, and a large number of more ephemeral plants, including willowherbs *Epilobium* and a fine example of tobacco plant *Nicotiana tabacum* which arrived in 1996 but was soon killed by frost.

FIGURE 4. The meadow (P35).

FIGURE 5. The hedge (H04) bordering the ancient lane (S32–34).

The vascular plants in the garden are regularly monitored but, due to the large number of species present, more monitoring is required before a list of any significance is possible. The initial planting lists and information subsequent to this report are available from Ceri Leigh at The Natural History Museum.

Identification manual reference:

STACE, C. 1991. *New flora of the British Isles.* Cambridge University Press.

Microfungi (J. E. M. Mordue, International Mycological Institute)

A very preliminary investigation has revealed an overwhelming preponderance of powdery mildews (Erysiphales) within the microfungi recorded. This is not surprising as powdery mildews are often visible quite early in the vegetative period of their hosts and continue to sporulate, even through dry periods, until the onset of cold weather in the autumn. Although some are highly host specific, and occur on a single host genus or even host species, others are less so. The cleistocarps with their asci and ascospores, usually needed for identification, are less frequently formed than the hyphae and conidia of the 'powdery' appearance. There is some very interesting recent work (Cook et al. 1997) which suggests that it may be possible to identify genera of powdery mildews from minute details of the surface ornamentation of the conidia as seen under a scanning electron microscope, but this, even if developed, is a very long way from practical field identification. Among the species recorded, birch mildew is interesting because neither *Microsphaera betulae*, which is specific to birch, nor *Phyllactina guttata*, which is found on birch and a number of other woody hosts, is frequently recorded.

The rust fungi (Uredinales), like the powdery mildews, often continue to sporulate throughout much of the summer. Those recorded so far are common and widely distributed species. Possibly the greatest interest with this group is the absence of very common species such as *Phragmidium violaceum* on blackberry, *Puccinia lagenophorae* on groundsel, *Melampsoridium betulinum* on birch, or species of *Melampsora* on willows. Have they not yet arrived from the nearest reservoir of infection, or are they unable to grow because of pollution levels or other unfavourable conditions? Continued observation is required before these questions can be answered.

No smut fungi (Ustilaginales) have yet been recorded despite some good smut hosts being present in the garden. Anther smut of red and white campion, and other species of Caryophyllaceae, is a particularly common and widespread species and it will be interesting to see whether this, or other smuts, develop in future years.

A few species of Ascomycetes (other than powdery mildews), Coelomycetes and Hyphomycetes have been recorded, but they are too few for any comment other than that more collecting is needed. Several additional collections were made (e.g., leaf spots of *Achillea* and *Primula*, fallen leaves of *Ilex* and a sooty mould of *Tilia* leaves) that were undoubtedly of fungal origin, but the microfungi involved were insufficiently developed for identification.

The microfungi recorded in the garden so far are all plant pathogens which are active during the growing season of their host. No attempt has yet been made to search for endophytes, which may be present within leaves or other plant tissues in a symptomless form until senescence of the tissues when fructifications develop. It should eventually be possible to record some of these. Many other substrates await examination. For example, dead herbaceous stems (nettle is particularly good) and dead twigs attached to woody plants should yield many records. However, some ecological systems are unlikely ever to be explored and chief among these is soil. It is impracticable to record soil microfungi, even though their importance is acknowledged, because laboratory facilities would be required.

FIGURE 6. The chalk pond (W14) and chalk mound (M01).

Identification manual references:

ELLIS, M. B. and ELLIS, J. P. 1997. *Microfungi on land plants: an identification handbook.* Ed. 2. Richmond Publishing Company.

INTERNATIONAL MYCOLOGICAL INSTITUTE. 1967; 1968; 1970. *Descriptions of pathogenic fungi and bacteria.* Nos 138, 157, 190; 265, 478; 1165.

Bryophytes (Len Ellis, NHM)

The bryophyte flora of the Wildlife Garden mostly includes species of common occurrence in the parks and gardens of London. Some species (e.g., *Eurhynchium praelongum* and *Brachythecium rutabulum*) persist throughout the year; others are ephemeral (e.g., *Bryum rubens*, *Pottia truncata* and *Phascum cuspidatum*) and may seem to disappear, or show dramatic changes in relative abundance, over long periods. A few less usual species were imported with the substrates used in some of the specialized habitats of the garden. For example, the leafy liverwort *Lefocolea turbinata*, common only in basic lowland habitats, survived for a time in the chalk grassland area (M01) but was not found during a survey in summer 1997. A thallose liverwort *Marchantia polymorpha* recorded from the wet reed-bed area (W07) has also disappeared.

Identification manual references:

SMITH, A. J. E. 1978. *The moss flora of Britain and Ireland.* Cambridge University Press.

SMITH, A. J. E. 1990. *The liverworts of Britain and Ireland.* Cambridge University Press.

Lichens (Pat Wolseley, NHM)

Twenty-six species of lichen have been recorded in the Wildlife Garden between 1995 and 1997. From casual observation beforehand we know that few of these were present prior to the major landscaping that created the wetland, woodland and chalk downland habitats in June 1995, and none was deliberately

introduced. Lichens grow slowly and are rarely rapid colonizers, so many will have been accidentally introduced on trees and shrubs from nurseries in more rural areas and subsequent recording has followed their demise from this polluted environment on Cromwell Road. The only epiphytic lichens recorded throughout all surveys have been the pollution-tolerant lichen *Lecanora conizaeoides*, which was already on the existing lime tree, and *Scoliciosporum umbrinum*, a scurfy brown lichen of twigs, that is ubiquitous and tolerant of atmospheric pollution.

Atmospheric pollutants at this site are high and particulates have exceeded the European Union standards many times, while nitrous oxide and sulphur dioxide are frequently above the standards. In dry conditions these may have little effect on lichens, but in moist conditions when lichens are actively photosynthesizing, the effect can be marked. This is especially noticeable on the foliose species, such as *Parmelia sulcata* and *P. subaurifera.* These foliose species are normally rapid colonizers of twigs in clean environments, but have not survived their introduction into the Wildlife Garden. In 1997 the acid-tolerant *Hypogymnia physodes* was recorded on twigs in the garden. This species has been gradually recolonizing London since the 1956 Clean Air Act caused a reduction of sulphur dioxide levels (Hawksworth and McManus 1989). Crustose epiphytic species vary in their sensitivity. *Opegrapha vulgata* and *Cliostomum griffithii* had disappeared by 1996, but others, such as *Lecanora chlarotera* and *Buellia punctata*, which are part of a lichen community characteristic of nutrient-enriched sites of agricultural Britain, have remained.

Other species of this community that have been found include *Candelariella vitellina*, *Phaeophyscia orbicularis*, *Physcia tenella* and *Xanthoria parietina.* These species are encouraged by the nutrients from the high levels of particulates in the Wildlife Garden, but restricted by the occasional high levels of sulphur and nitrous oxides. *Xanthoria parietina*, the foliose lichen that forms characteristic orange patches on farm roofs in agricultural areas, was recorded from 1995 to 1997, but has not been recorded recently.

The perimeter wall supports species that are characteristic of urban conditions, such as *Lecidella stigmatea* and *Lecanora dispersa*, but newly created terricolous habitats, such as the chalk mound, may take some time to acquire a lichen community, being dependent on the weathering of the substrate and the availability of propagules. The chalk will neutralize acid atmospheric conditions, but also carries its own flora on chalk pebbles, such as *Verrucaria muralis* which was recorded in 1995 and 1996. *Steinia geophana*, a species characteristic of urban wasteland (Gilbert 1990), has appeared in association with mosses on the chalk mound. Atmospheric conditions appear to be the major factor controlling the lichens of this wildlife garden. With time we should expect an increase in lichens that are tolerant of conditions characteristic of an urban site.

Identification manual reference:

PURVIS, O. W., COPPING, B. J., HAWKSWORTH, D. L., JAMES P. D. and MOORE, D. M. 1992. *The lichen flora of Great Britain and Ireland.* Natural History Museum Publications in association with The British Lichen Society.

Pond life

Cladocerans and chironomid larvae were present in the pond only a few weeks after rainwater had begun to collect in the excavated and newly lined hole. The appearance of Cladocera coincided with the first sighting of mallard ducks on the pond, so it seems likely that they were introduced by the ducks themselves (this would seem to give lie to the observation that water fleas are unable to fly!). Water boatmen *Corixa*, back swimmers *Notonecta*, pond skaters *Gerris*, and the mayfly *Cloeon dipterum* were also quick to colonize. The large expanse of open water particularly favours these bugs and water fleas, but as macrophytes begin to develop and fill the open space, these invertebrates might be expected to decline in abundance. The larvae of *C. dipterum* are equally at

home on bare gravel or amongst algae and submerged macrophytes so this species will probably remain abundant. Mayfly larvae form an important food source for predatory insects. At present, the Chironomidae have not been identified beyond family level, but future work is planned in which they will be identified to species. Any changes in the chironomid assemblages will be recorded and will form the subject of a future report.

The sudden appearance in September 1995 of several molluscan species, of which *Physa fontinalis* is the most abundant, is probably related to the introduction of submerged and marginal macrophytes into the pond during the summer of 1995. Prior to this, macrophytes were absent. All the aquatic plants added to the ponds were obtained from nurseries or were collected in the wild and it is likely that the molluscs were brought into the pond attached to their leaves and roots. The appearance of large numbers of the leech *Helobdella stagnalis* may also be linked to the arrival of molluscs, since snails form an important component in the diet of this leech.

Eight species of dragonfly have been recorded from the pond, all of which commonly occur in central London (Brooks 1989). However, we have proof that only five species, *Coenagrion puella*, *Enallagma cyathigerum*, *Anax imperator*, *Sympetrum striolatum* and *Libellula depressa*, have bred in the ponds. During 1996, large numbers of the first two mentioned anisopteran species emerged from the pond and many females were seen ovipositing. Several female *A. imperator* settled on floating clumps of filamentous algae in order to oviposit, but were then unable to take off again because their tarsal claws became ensnared in the strands of algae. Most *A. imperator* larvae emerged on emergent vegetation surrounding the ponds, but on 24 June 1996, in addition to thirty-four exuviae found on vegetation around the largest pond, one was found about 2 m up on the north facing trunk of a poplar tree about 30 m from the edge of the pond. This larva must have walked past the marginal vegetation surrounding the pond and crossed the meadow and a tarmac path before climbing the tree to emerge. The pond continues to support large numbers of dragonflies with nineteen exuviae of *A. imperator* counted on the emergent vegetation around the main pond (W15) on 22 May 1997. During late May 1997 several teneral *E. cyathigerum* and larval exuviae and large numbers of mating pairs and ovipositing females of *C. puella* were present at the ponds. On 3 June 1997 two female *L. depressa* were observed ovipositing on clumps of filamentous green algae in the chalk pond (W14).

Water lice *Asellus* and the water shrimp *Crangonyx pseudogracilis* are among the most recent colonists and were also probably introduced with aquatic plants. These crustaceans are predominantly detritivores, so may not have been able to build up numbers before a significant amount of rotting plant material had accumulated in the pond.

Despite the pond being well-filled for only two summers, a diverse range of macroinvertebrates has already become established. Some of these have been inadvertently introduced with water plants, but many will have found their own way. Most of the major groups of invertebrates with aquatic larvae are already represented in the fauna with the notable exception of Trichoptera which do not appear to have bred, although adults of several species have been recorded from the light-trap samples. It will be of interest to record future changes in the macroinvertebrate assemblages, to monitor the arrival of new species, fluctuations in abundance of species that are already present, and to link this with development of the plant communities.

Coleoptera

A full list of the species of beetles recorded from the garden is available, but will be published separately by Peter Hammond (Department of Entomology, NHM). In this the garden fauna, 208 species to date (P. Hammond pers. comm.), will be compared with that of other areas of London. The list includes

several exotic species that are now established in Britain, but which are considered rare, and several *Red Data Book* species. Possibly one of the most interesting was a specimen of *Polystichus connexus*, recorded at light on the night of 17–18 August 1995, along with the first specimens recorded in the garden of the migrant silver Y moth *Autographa gamma*, which seems to support the theory put forward by Allen (1996: 40, and the subsequent editorial note by Jones) that records of *P. connexus* may be of immigrant, not native, examples of this scarce beetle. Also of interest are the records from the underground traps of the two blind, subterranean beetles, *Anommatus duodecimstriatus* and *Langelandia anophthalma*. Listed below are just a few records from pond samples and the first records from the underground traps.

Lepidoptera

The garden is certainly not an area that would immediately spring to mind as a recording site for Lepidoptera, especially as the light-traps have to cope with competition from the street lighting in Cromwell Road and Queen's Gate and from the Museum's own floodlighting. Plant (1993: xi) indicated that fewer than forty species of larger moths had been recorded during the period 1980 to 1991 from the tetrad in which the Museum is situated; a check of the distribution maps actually shows this figure to be just three species, the peppered moth *Biston betularia*, the red-belted clearwing *Synanthedon myopaeformis* and the cinnabar *Tyria jacobaeae*. Of these, only the first has been recorded during the current monitoring. The apple tree near the main entrance of the Museum that supported a clearwing colony died several years ago, but some logs from the tree were placed in the Wildlife Garden in the hope that the colony would be able to transfer to one of the remaining old apple trees. Several searches have been carried out and, although there do appear to be a number of likely holes in the trunks, it remains to be seen if this has happened. However, despite the problems mentioned above, 286 species of Lepidoptera have now been identified and recorded from the Wildlife Garden since it was opened in 1995, with a possible twenty additional species of microlepidoptera that need to be examined in more detail (either compared with the Museum collection or dissected) in order to confirm their identification. As has been stated, it was not possible to survey the garden before it was landscaped, but there are a few old records of species recorded from the Museum grounds. These include a specimen of the six-spot burnet *Zygaena filipendulae* that was found on 10 July 1989 on the outside ledge of a basement window of the Entomology block which overlooks the garden. Two species of microlepidoptera, *Archips xylosteana* and *Gyposonoma aceriana*, were known to occur as their larval spinnings are figured in the literature (Bradley et al. 1973: pl. 12, fig. 3, and 1979: pl. 9, fig. 1, respectively) based on specimens found in the Museum gardens (W. G. Tremewan pers. comm.). Some have been found during recent recuration of parts of the British (Rothschild–Cockayne–Kettlewell) collection, such as a specimen of the white ermine *Spilosoma lubricipeda*, that was collected on 12 June 1924 by O. G. Heath, and of a pair of poplar hawk-moths *Lathoe populi*, found *in cop.* on 8 July 1916. We know that both species of microlepidoptera and the poplar hawk-moth are still present, having been recorded during the current trapping sessions, and all three probably still breed in the garden, even though the original host plant for *G. aceriana*, one of several large black poplars, has been lost: it was felled when the Queen's Gate car park was built.

A separate, more detailed, paper on the Lepidoptera recorded in the garden is in preparation (by MRH) and will be published in one of the entomological journals, but there are a few general comments that can be made. At least three species of microlepidoptera that are normally only associated with *Pinus* were recorded early on in the monitoring programme. As no further specimens had been recorded it was assumed that these had been introduced with a group

of small pines that were planted in the lowland heath area (S14). However, single specimens of two of them, *Rhyacionia buoliana* and *Lozotaeniodes formosanus*, came to light on 9 July 1997 and 23 July 1997 respectively, so it is possible that both species could have originated from more-mature trees in one of the well-established gardens in one of the surrounding squares. The early part of June 1996 was notable nationally as the start of a quite spectacular invasion of migrant Lepidoptera, and the Wildlife Garden certainly did not miss out. A humming-bird hawk-moth *Macroglossum stellatarum* was seen on 4 June 1996, painted lady *Cynthia cardui* and red admiral *Vanessa atalanta* butterflies were seen regularly, and over one hundred silver Y moths *Autographa gamma* were in the light-trap on 6 June 1996. It is clear that some species have been accidentally introduced with the plants (e.g., a single specimen of the beautiful yellow underwing *Anarta myrtilli* on 19 July 1995), but with continued monitoring it will soon be apparent which species are able to maintain a resident population. Virtually all the records presented here add to our knowledge of the distribution of Lepidoptera within the London area. Some, such as the red-green carpet *Chloroclysta siterata*, considered to be an 'extremely local and scarce resident' (Plant 1993: 48), are now known to be expanding their range in London (Plant 1997: 160), others represent new 10-km records for TQ27 and several, including at least six species of microlepidoptera (Plant pers. comm.) are completely new records for Middlesex (vice-county 21). New species are continually being added to the list, from both light-trap samples and casual observation, including specimens attracted to security lights on the wall of the Museum adjacent to the garden itself. In 1996 there were 90 additions to the list, and in 1997, when it was possible to run the light-trap earlier and later in the year, there were a further 53 additions including pale brindled beauty *Apocheima pilosaria* and March moth *Alsophila aescularia*, whose males are on the wing in January and February, and the tortricid *Epiphyas postvittana* which was first recorded in October. Records are also received from other colleagues and groups visiting the Wildlife Garden, such as members of the Amateur Entomologists' Society's Bug Club who visited the garden on 20 August 1997 and found a mature larva of the lime hawk-moth *Mimas tiliae* (Masters 1997).

Vertebrates

As mentioned above, birds are one of the few groups of species for which records exist prior to the redevelopment. The most noticeable feature of the list of species formerly recorded is how similar it is to the present one, given below. Almost all the common species mentioned in that report have also been recorded during the present survey. Perhaps the most noticeable difference on the negative side, as noticed elsewhere in Inner London (Moon 1997: 207), is the apparent reduction in the numbers of house sparrows *Passer domesticus*. They probably used to breed in the garden and were often seen, even on the front drive of the Museum, whereas there has been only one sighting during this recording period. On the plus side, an addition to the fauna since the old list is the sparrowhawk *Accipiter nisus*, which is now fairly frequently seen. The number of breeding pairs in the London area has increased dramatically since the late 1980s (Paice and Glaves 1997: 137, Table 1) and it now breeds in nearby Kensington Palace (Moon 1997: 60). In contrast, the kestrel *Falco tinnunculus* seems to have been a regular visitor to the gardens since it was first observed in the early 1970s when it nested on one of the two towers at the rear of the Museum. It has since been a regular breeder, either in the Museum grounds or at suitable sites nearby. Several other species are listed for the former period that have not been recorded recently. The dunnock *Prunella modularis* used to be an occasional visitor to the garden, as were jackdaws *Corvus monedula*. The latter species certainly used to breed in Hyde Park and Kensington Gardens, but not since 1969 (Moon 1997: 206).

The nearest site where one is certain to see this species is probably Richmond Park, but it has been seen more frequently around London over the last few years and is hopefully on the increase. The house martin *Delichon urbica* used to be seen around the grounds during the summer months, but not recently, despite an apparent increase in Inner London records in recent years (Moon 1997: 199), this species is currently the subject of a detailed survey. Two other species that were fairly regularly seen are the greenfinch *Carduelis chloris* and the pied wagtail *Motacilla alba*, but neither has been recorded from the Wildlife Garden since it was opened. As with the recent record of a woodcock *Scolopax rusticola*, a number of 'rarities' have also been recorded over the years. These include a female pheasant *Phasianus colchicus* in 1978 (probably an 'escape' from Holland Park), a male ring ouzel *Turdus torquatus* seen in 1952 (whose identity was confirmed by staff of the Bird Section which was, at the time, housed in the Entomology block), a spotted flycatcher *Muscicapa striata* in 1986 and a singing male reed warbler *Acrocephalus scirpaceus* in 1993. One of the highlights recorded on the old list must have been the Museum's resident tawny owl *Strix aluco*, which used to roost in a gap in the brickwork of the main Waterhouse building opposite the Entomology block well over twenty years ago. As the Wildlife Garden develops it will be interesting to see if it can attract back some of the old resident species, or even add some new ones. The introduction of the water features has already altered the status of one species, the grey heron *Ardea cinerea*, from a species only seen flying over to one actually recorded in the garden.

Species lists

The Wildlife Garden is situated within the boundary of the London Natural History Society's Inner London recording area and copies of the lists have been sent to the appropriate LNHS recorders. The location of a particular garden habitat can be found by comparing the habitat codes with the plan of the garden (Figure 1).

Any species included solely on the basis of a historic record is enclosed in square brackets [ ].

FLORAL RECORDS

Freshwater algae (all dates refer to 1997 only)

Anabaena sp.: area W14 on 6 June, 3 July, 22 July, 9 August, 22 August; W15 on 6 June, 22 July, 9 August; W16 on 23 May, 22 July and 9 August.

Ankistrodesmus falcatus: areas W05/06/07 on 23 May; W15 on 6 June.

Botryococcuss braunii: area W15 on 6 June.

Cladophora glomerata: area W14 on 6 June, 3 July, 22 July, 9 August; W15 on 22 July; W16 on 22 July and 9 August.

Closterium ehrenbergiana: areas W05/06/07 on 23 May; W14 on 6 June, 3 July, 22 July, 9 August, 22 August; W15 on 6 June, 22 July, 9 August; W16 on 23 May, 22 July and 9 August.

Coelastrum micropofrum: areas W05/06/07 on 23 May; W14 on 6 June, 3 July, 22 July, 9 August and 22 August.

Cosmarium subcrenatum: areas W05/06/07 on 23 May; W16 on 23 May, 9 August; W15 on 6 June.

Crucigeniella rectangularis: area W14 on 6 June, 8 August and 22 August.

Dictyosphaerium ehrenbergianum: area W14 on 22 July.

Eudorina sp.: area W14 on 22 July; W15 on 6 June.

Euglena sp.: areas W05/06/07 on 23 May; W14 on 9 August, 22 August; W15 on 6 June and 9 August.

Golenkinia radiata: area W14 on 3 July.

Gongrosira sp.: area W14 on 3 July.

Gonium sp.: area W14 on 22 July.

Micractinium pusillum: area W14 on 22 July.

Oedogonium sp.: area W14 on 22 July, 9 August; W15 on 22 July; W16 on 9 August.

Oocystis solitaria: area W14 on 3 July.
Pediastrum boryanum: areas W05/06/07 on 23 May; W15 on 6 May, 22 July, 9 August; W16 on 23 May and 22 July.
Pediastrum duplex: areas W05/06/07 on 23 May.
Pediastrum tetras: areas W05/06/07 on 23 May.
Phacotus lenticularis: area W14 on 6 June, 3 July, 22 July, 9 August, 22 August; W15 on 6 June; W16 on 23 May and 22 July.
Phacus caudatus: area W14 on 6 June and 3 July.
Phacus pleuronectes: area W14 on 6 June and 3 July.
Scenedesmus pecsensis: area W15 on 6 June.
Scenedesmus quadricauda: areas W05/06/07 on 23 May; W14 on 22 July, 9 August, 22 August; W15 on 6 June, 9 August; W16 on 9 August.
Sphaerocystis shroeteri: area W14 on 3 July.
Spirogyra sp.: area W15 on 22 July; W16 on 22 July and 9 August.
Staurastrum ophiura: area W14 on 6 June and 3 July.
Staurastrum planktonica: area W14 on 6 June.
Tetraedron minimum: areas W05/06/07 on 23 May; W15 on 6 June.

Microfungi (all dates refer to 8 October 1997, unless otherwise stated)

Erysiphe galeopsidis powdery mildew of black horehound: area W12 on host *Ballota nigra.*
Erysiphe ranunculi powdery mildew of buttercup: area W09 on host *Ranunculus repens.*
Septoria leucanthemi leaf spot of ox-eye daisy: area M02 on host *Leucanthemum vulgare.*
Microsphaera alphitoides powdery mildew of oak: area S21 on host *Quercus robur.*
Oidium sp. powdery mildew of mullein: area W08 on host *Verbascum* sp.
Oidium sp. powdery mildew of tansy: area M01 on host *Tanacetum vulgare.*
Oidium sp. powdery mildew of smooth sow-thistle: area S35 on host *Sonchus oleraceus.*
Oidium sp. powdery mildew of red campion: area S21 on host *Silene dioica.*
Oidium sp. powdery mildew of groundsel: area M02 on host *Senecio vulgaris.*
Oidium sp. powdery mildew of selfheal: area W09 on host *Prunella vulgaris.*
Oidium sp. powdery mildew of evening primrose: area DF on host *Oenothera biennis.*
Oidium sp. powdery mildew of water mint: area W08 on host *Mentha aquatica.*
Oidium sp. powdery mildew of crab-apple: area S08 on host *Malus sylvestris.*
Oidium sp. powdery mildew of willowherb: area S17 on host *Epilobium* sp.
Oidium sp. powdery mildew of viper's bugloss: area S14 on host *Echium vulgare.*
Phoma hedericola leaf spot of ivy: area S21 on host *Hedera helix.*
Phyllactinia guttata powdery mildew of birch: area S03 on host *Betula pendula.*
Podosphaera clandestina powdery mildew of hawthorn: area S19 on host *Crataegus monogyna.*
Podosphaera leucotricha, a mildew: area W09 on 4 April 1997.
Puccinia coronata rust of Yorkshire fog: area W09 on host *Holcus lanatus*; in area W08 on *Lolium perenne.*
Puccinia malvacearum hollyhock rust: area W09 on host *Malva sylvestris.*
Puccinia variabilis dandelion rust: area W12 on host *Taraxacum officinale.*
Septoria leucanthemi leaf spot of ox-eye daisy: area M02 on host *Leucanthemum vulgare.*
Sphaerotheca plantaginis powdery mildew of ribwort plantain: area W09 on host *Plantago lanceolata.*
Uncinula bicornis powdery mildew of field maple: area W04 on host *Acer campestre.*
Uromyces rumicis dock rust: area W12 on host *Rumex hydrolapathum.*

Fungi

Boletus chrysenteron: area S08 on 4 September 1996.
Clitocybe dealbata: in area S08 on 7 November 1997.
Hypholoma fasciculare sulphur tuft: area H02 on 4 April 1997; on 7 November 1997 on tree stump in hedge.
Inocybe sp.: area S08 on 7 November 1997.
Nectria cinnabarina coral spot: area H01 on 4 April 1997.
Nectria sp.: area H02 on 4 April 1997.
Trametes versicolor bracket fungus: area H02 on 4 April 1997.

Lichens (all species marked * have now disappeared)

Arthopyrenia punctiformis: area S21 on 20 June 1996 (corticolous).

Bacidea umbrina: area S21 on 20 June 1996 (corticolous).

Buellia punctata: area S06 on 10 November 1995 and 4 April 1997; S21 on 16 August 1996 (corticolous).

Candelariella vitellina: area P02 on 4 April 1997; P01 on 15 April 1997 (saxicolous) on perimeter wall.

Candelariella sp.: area S05 on 16 August 1996 (corticolous).

Cliostomum grifithii: area S06 on 10 November 1995 (corticolous).

**Hypogymnia physodes*: area S16 on 4 April 1997 (corticolous).

Lecanora chlarotera: area S21 on 10 November 1995 and 20 June 1996; S05 on 20 June 1996 on a new tree; H01 on 16 August 1996, also on new tree; S06 on 4 April 1997 (all corticolous).

Lecanora conizaeoides: area H01 on 31 August 1995; S16 on 4 April 1997 (corticolous), both on new trees; S08 on 16 August 1996 on established lime tree.

Lecanora dispersa: area S21 on 10 November 1995 (corticolous); P01 on 15 April 1997 (saxicolous) on perimeter wall.

Lecanora erysibe: area P01 on 15 April 1997 (saxicolous) on perimeter wall.

Lecidella stigmatea: area H01 on 31 August 1995; H04 on 16 August 1996 (corticolous).

Mycoporum quercus: area S21 on 10 November 1995; S05 on 20 June 1996; H04 on 16 August 1996 and 4 April 1997 (corticolous).

**Opegrapha vulgata*: area A03 on 12 July 1965 (corticolous).

Opegrapha sp.: area S18 on 16 August 1996 (corticolous).

**Parmelia subaurifera*: area H01 on 31 August 1995; H04 on 20 June 1996 (corticolous).

**Parmelia sulcata*: area H05 on 16 August 1996; S16 on 4 April 1997 (corticolous).

**Phaeophyscia* sp.: area H01 on 31 August 1995; H05 on 16 August 1996 (corticolous).

Phaeophyscia orbicularis: area P01 on 15 April 1997 (saxicolous) on perimeter wall.

**Physcia* sp.: area S05 on 20 June 1996; S20 on 31 August 1995; H04 on 16 August 1996 (corticolous).

**Physcia tenella*: area H01 on 22 August 1995; S21 on 16 August 1996 (corticolous).

Porina chlorotica: area S21 on 10 November 1995 (corticolous).

Scaletum sp.: area H01 on 16 August 1996 (corticolous).

Scoliciosporum umbrinum: area H01 on 31 August 1995; H05 on 16 August 1996 (corticolous); P01 on 15 April 1997 on perimeter wall.

Steinia geophana: area M03 on 4 April 1997 (saxicolous) on chalk brought in from Hampshire.

Thelidium minutulum: area M01 on 4 April 1997 (saxicolous) on chalk brought in from Hampshire.

Verrucaria muralis: area M01 on 10 July 1995; S01 on 20 June 1996; M03 on 4 April 1997 (saxicolous), all on chalk brought in from Hampshire.

**Xanthoria parietina*: area H01 on 31 August 1995 and 16 August 1996 (corticolous); P01 on 15 April 1997 (saxicolous) on perimeter wall.

Bryophytes (all records from 8 December 1995)

LIVERWORTS

Leiocolea turbinata: area M01.

Marchantia polymorpha: area W07.

Pellia endiviifolia: area M01.

MOSSES

Amblystegium serpens: areas P01 and P03.

Barbula convoluta: areas S01 and P03.

Barbula cylindrica: area P03.

Barbula tophacea: areas M01 and S01.

Barbula unguiculata: areas M01, M03, S28, S29.

Brachythecium rutabulum: areas M04, P01, P05, S05, S26, S34.

Bryum argenteum: areas S01, S13.

Bryum bicolor: areas M01, S01.

Bryum caespiticium: area M01.
Bryum capillare: area P03.
Bryum gemmiferum: areas M01, M03, S28.
Bryum sp.: area S10.
Bryum sp.: area W02.
Bryum sp.: area W03.
Dicranella varia: area M01.
Eurynchium praelongum: areas M04, P03, P05, S01, S05, S26.
Funaria hygrometrica: area M01.
Grimmia pulvinata: area P03.
Hypnum cupressiforme: area S18.
Phascum cuspidatum: area S13.
Pottia truncata: areas M03, M04, S26, S28, W03.
Schistidium apocarpum: area P03.
Tortula muralis: areas P02, S29, W01, W07.
Tortula ruralis: area P03.

FAUNAL RECORDS

INVERTEBRATES

Rotifers

Brachionus angularis: 8 April 1997 in area W16.
Brachionus urceolaris: 20 August and 12 November 1996 in area W15.
Cephalodella catellina: 13 May 1997 in area W16.
Cephalodella gibba: 8 April 1997 in area W16.
Colurella colorus: 20 August in area W15; 12 November 1996 in areas W14 and W15.
Euchlanis dilatata: 20 August and 12 November 1996 in area W14.
Keratella brevispina: 8 April 1997 in areas W16 and W14.
Keratella cochlearis: 10 December 1996 in area W15.
Keratella quadrata: 8 April 1997 in area W16.
Lecane bulla: 20 August 1996 in areas W14 and W15; 12 November 1996 in areas W14, W15 and W16.
Lecane closterocerca: 20 August and 12 November 1996 in area W14.
Lecane quadridenata: 20 August 1996 in area W15; 12 November 1996 in areas W15 and W16.
Lepadella ovalis: 20 August 1996 in areas W14 and W15; 12 November 1996 in areas W15 and W16.
Lepadella patella: 12 November 1996 in area W15; 8 April 1997 in area W15.
Mytilina mucronata: 20 August 1996 in areas W14 and W16; 12 November 1996 in areas W14, W15 and W16; 8 April and 13 May in area W16.
Mytilina ventralis: 20 August 1996 in area W14; 12 November 1996 in areas W14 and W15.
Pleurotrocha petromyzon: 20 August 1996 in area W15; 12 November 1996 in areas W15 and W16.
Polyartha sp. (*dolichoptera*): 21 January 1997 in area W14; 18 February 1997 in area W14; 8 April 1997 in area W14.
Squatinella lamellaris: 20 August 1996 in area W14; 12 November 1996 in areas W14, W15 and W16.
Synchaeta tremula: 18 February 1997 in area W14; 8 April 1997 in areas W14 and W16.
Trichocerca rattus: 20 August 1996 in areas W14 and W15; 12 November 1996 in areas W14, W15 and W16; 13 May 1997 in area W16.
Testudinella patina: 20 August 1996 in area W15; 12 November 1996 in areas W14 and W15; 8 April 1997 in area W14; 13 May 1997 in area W15.

Turbellaria

PLATYHELMINTHES

Dugesia polychroa or *lugubris*, a planarian: one seen on 30 May 1997 in area W16.
Dugesia polychroa, a planarian: 20 October 1997 in area W15.

Dugesia sp.: several seen on 20 August 1997.
Polycelis nigra, a planarian: 20 October 1997 in area W15.

Crustacea

Acanthocyclops robustus: area W15.
Acanthocyclops viridis: area W14.
Alona quadrangula: 12 November 1996 in area W16.
Asellus aquaticus: September 1996.
Asellus meridianus: 30 April 1996, 20 June 1996, September 1996.
Asellus sp.: seen on 20 August 1997.
Bosmina longirostris: 20 August and 12 November 1996 in area W15; 8 April 1997 in areas W14, W15 and W16; 13 May 1997 in areas W15 and W16.
Ceriodaphnia quadrangula: 20 August and 12 November 1996 in area W15.
Chydorus sphaericus: 20 August and 12 November 1996 in areas W14 and W15.
Crangonyx pseudogracilis: September 1996.
Cyclops sp.: July 1994, May 1995 and on 27 April 1997 in areas S31, W8 and W11.
Cyclops strenuus: area W16.
Daphnia sp.: July 1994, September 1994, May 1995, October 1995 and on 27 April 1997 in areas S31, W8 and W11; also on 20 August 1997.
Daphnia sp. (possibly *D. atkinsoni* or *D. carinata*): 8 April 1997 in area W16.
Eucyclops serrulatus: areas W14 and W15.
Graptoleberis testudinaria: 20 August and 12 November 1996 in area W14.
Macrocyclops albidus: areas W15 and W16.
Megacyclops viridis: area W15.
Mesocyclops leuckarti: area W14.
Ostracoda: July 1994, May 1995, October 1995; 27 April 1997 in areas S31 and W11.
Simocephalus vetulus: 20 August and 12 November 1996 in area W14; 8 April 1997 in areas W15 and W16.

Annelida

Stylaria sp.: May 1995.
Helobdella stagnalis: October 1995 and September 1996.
Erpobdella testacea: September 1994.

Mollusca

Arion distinctus Mabille's garden slug: 12 October 1995 in area S16.
Arion hortensis garden slug: 12 October 1995 in area S18; 8 August 1996 in area S16.
Arion intermedius: 8 August 1996 in area S16.
Arion subfuscus: 8 August 1996 in area S16.
Bithynia sp.: 30 April 1996.
Bithynia leachii: October 1995.
Candidula intersecta: 8 August 1996 in area H03.
Clausilia bidentata: 8 August 1996 in area S16.
Deroceras caruanae Caruana's field slug: 12 October 1995 in area S11; 8 August 1996 in areas S03 and S16.
Deroceras reticulatum grey field slug: 12 October 1995 in area S16; 8 August 1996 in areas M01, S03, S08, S16 and S18.
Discus rotundatus: 8 August 1996 in area S16.
Lymnaea peregra wandering snail: October 1995, 20 June 1996, September 1996 and 8 August 1996 in area W16.
Lymnaea stagnalis great pond snail: 30 April 1996, 20 June 1996 and 8 August 1996 in areas W14 and W15.
Milax sowerbyi Sowerby's keeled slug: 12 October 1995 in area P01.
Oxychilus draparnaudi Draparnaud's glass snail: 12 January 1995 in areas P01 and S05; 8 August 1996 in area S16.
Physa fontinalis bladder snail: October 1995, September 1996.
Physa sp.: 8 August 1996 in areas W15 and W16.
Planobarius corneus great ramshorn snail: October 1995, 30 April 1996, 20 June 1996, 8 August 1996 and September 1996 in area W14.
Planorbis carinatus keeled ramshorn: 8 August 1996 and September 1996 in area W16.

Succinea pfeifferi: 8 August 1996 in areas M04 and W15.
Trichia striolata strawberry snail: 12 October 1995 in area S18.
Vallonia eccentrica eccentric glass snail: 12 October 1995 in area P01.
Zonitoides nitidus: 8 August 1996 in areas M04 and W15.

Arachnida. The sequence and nomenclature for the spiders follow Merrett et al. (1985) with amendments from Merrett and Millidge (1992). The list concludes with two harvestmen and two mites.

SPIDERS

Tibellus sp. one immature, probably of *T. maritimus* in the light trap on 9 April 1997.
Tegenaria sp.: 1♀ in nest-box on poplar tree in area P03.
Pachygnatha degeeri: 1♀ on 12 March 1997 in area P35.
Dicymbium nigrum: 1♂ on 11 February 1997 in area P35.
Erigone dentipalpis: 5 June 1996 and 10 July 1996 in area S05; 1♂ on 27 September 1996 in area M04; 3♂♂ 1♀ on 9 January 1997 in area P35; 2♂♂ in area P35, and 1♂ in area S16 on 11 February 1997; 18♂♂ 1♀ on 12 March 1997 in area P35; 5♂♂ in area M04 on 12 March 1997.
Erigone atra: 1♂ on 9 January 1997 in area P35.
Meioneta rurestris: 5 June 1996 in area M03; 1♂ on 11 February 1997 in area M01; 1♂ 1♀ on 12 March 1997 in area M04.
Centromerita bicolor: 10 July 1996 in area M02; 1♂ in area M04 and 22♂♂ 9♀♀ in area P35 on 9 January 1997; 12♂♂ 14♀♀ on 11 February 1997 in area P35; 4♂ and 1♀ in area P35 and 1♀ in area M04 on 12 March 1997.
Diplostyla concolor: 10 July 1996 on area M02; 1♀ on 9 January 1997 in area M04; 1♀ in area M01 and 1♂ in area S15 on 11 February 1997.
Bathyphantes gracilis: 1♂ on 11 February 1997 in area M01.
Lepthyphantes tenuis: 5 June 1996 in area S16; 10 July 1996 in area M02; 2♂♂ in area M01 and 1♂ in area S16 on 11 February 1997.
Lepthyphantes zimmermani: 1♂ on 27 September 1996 in area M04.

HARVESTMEN

Odiellus spinosus: 5 June 1996 in area S05; 10 July 1996 in area M02.
Opilio saxatilis: 5 June 1996 in area M02.

MITES

Arrenurus sp., a water-mite: 8 April 1997 in area W14.
Piona coccinea stjordalensis, a water-mite: 1♀ on 10 December 1996 in area W15.

Insecta

EPHEMEROPTERA

Caenis sp.: first recorded from the garden on 3 August 1995.
Cloeon dipterum: July 1994, September 1994, May 1995, October 1995, September 1996, 30 April 1996, 29 May 1996, 20 June 1996, September 1996, 2 June 1997.
Mayfly larvae were found on 27 April 1997 in areas S31, W08 and W11.

ODONATA

Enallagma cyathigerum common blue damselfly: adults on 10 July 1995, 5 June 1996 and 27 May 1997.
Ischnura elegans blue-tailed damselfly: adult on 30 May 1997.
Coenagrion puella azure damselfly: adults on 22 May 1997; larval exuviae and adult females ovipositing on 30 May 1997.
Anax imperator emperor dragonfly: larvae in October 1995 and September 1996; adults on 21 July 1994, 10 July 1995, 2 August 1995 with females ovipositing in water-lily stems; 1♂ on 13 September 1995; throughout the summer 1996; numerous larval exuviae on 24 June 1996 and 22 May 1997.
Aeshna cyanea southern hawker: adults in 1995 and 1996.
Aeshna grandis brown hawker: adults in 1995 and 1996.
Libellula depressa broad-bodied chaser: adults on 10 July 1995; in 1996; 1♀ on 28 May 1997 in area W04; 2♀♀ ovipositing on 3 June 1997 in area W14.

Sympetrum striolatum common darter: larvae on 30 August 1994; in October 1995; on 10 July 1995, 30 April 1996 and 20 June 1996; adults in 1995; good numbers of adults on 13 September 1995 and in 1996.

HEMIPTERA

Corixa sp.: in July 1994, September 1994, nymphs and adults on 30 April 1996 and 20 June 1996. Recorded on 27 April 1997 from areas S31, W08 and W11.

Gerris sp.: in September 1994 and September 1996 and on 20 August 1997.

Hydrometra sp.: quite numerous on 30 May 1997 in areas W14 and W15.

Notonecta sp.: in September 1994, May 1995, October 1995, September 1996 and on 20 August 1997.

COLEOPTERA

Acilius sulcatus: adult in October 1995; larvae on 30 May 1997.

Coelambus confluens: October 1995.

Hydroglyphus pusillus: 21 July 1994 and in October 1995.

Hydroporus planus: 21 July 1994.

Hygrotus inaequalis: October 1995 and 17 September 1996.

Hyphydrus ovatus: 17 September 1996.

Laccophilus minutus: October 1995; 30 April 1996 and 17 September 1996.

Cerylonidae

Anommatus duodecimstriatus: 1 specimen in trap 2 (at southern end of garden).

Colydiidae

Langelandia anophthalma: 3 specimens in trap 1 (at northern end of garden) and 1 in trap 2.

Curculionidae

Barypeithes pellucidus: 3 specimens in trap 1.

HYMENOPTERA

The identification of the following two species of wasp was based on the discovery, by the gardener Caroline Ware, of a heavy infestation of the characteristic galls produced by these wasps on the underside of oak leaves in the garden in mid October 1997. *N. nimismalis* produces the silk button spangle gall and *N. quercusbaccarum* the common spangle gall. Both galls are produced in the late summer by grubs that emerge as parthenogenetic females the following spring. Eggs are then laid in oak buds and the resulting grubs produce a different type of gall on either the leaves or the flowers, from which emerge males and females of a sexual generation.

Cynipidae

Neuroterus nimismalis

Neuroterus quercusbaccarum

DIPTERA

Although quite a large number of species occur in the garden, the flies have only recently been covered. Some of the initial data were from pond samples, but all the data are very limited.

Chaoborus sp.: July 1994, September 1994, May 1995.

Chironomidae, unidentified: September 1994, October 1995, 30 April 1996, 20 June 1996.

Culex sp.: September 1994.

Epistrophe eligans: males recorded in April 1996.

Liancalus virens.

Lasiomma seminitidus: males.

Paraphytomyza sp., a leaf-mining fly: 6 November 1997 (ex light-trap).

Scaptomyza (Parascaptomyza) pallida: 6 November 1997 (ex light-trap).

Tipula sp.: September 1996.

Trichocera annulata, a winter gnat: 6 November 1997 (ex light-trap).

Trichocera hiemalis, a winter gnat: 6 November 1997 (ex light-trap).

Volucella zonaria, hornet mimic hoverfly: 10 July 1997.

SIPHONAPTERA

Only one species of this group has so far been reported.

Ceratophyllidae

Ceratophyllus vagabondus ssp. *insularis*, a bird flea: 1 ♀ from a nest in one of the poplar trees in area P03 on 13 November 1997.

LEPIDOPTERA

The following is a complete list of the species so far identified from the Wildlife Garden, including the record of a meadow brown *Maniola jurtina* that was seen during a visit to the garden by members of the LNHS on 27 July 1996. The list follows the numbered sequence given in Bradley and Fletcher (1979, 1986). The nomenclature has been up-dated to follow the latest European checklist (Karsholt and Razowski 1996), but for each amended species entry the previously used generic combination or specific name is also given, enclosed in parentheses.

0017 *Korscheltellus lupulinus* (*Hepialus*) common swift
0020 *Ectoedemia decentella* (*Etainia*)
0021 *Ectoedemia sericopeza* (*Etainia*)
0083 *Stigmella atricapitella*
0112 *Stigmella luteella*
0161 *Zeuzera pyrina* leopard moth
[0169 *Zygaena filipendulae* six-spot burnet]
0218 *Nemapogon variatella*
0236 *Tineola bisselliella* common clothes moth
0247 *Tinea trinotella*
0263 *Lyonetia clerkella* apple leaf miner
0273 *Bucculatrix thoracella*
0274 *Bucculatrix ulmella*
0284 *Caloptilia rufipennella*
0286 *Caloptilia alchimiella*
0288 *Caloptilia stigmatella*
0294 *Aspilapteryx tringipennella*
0301 *Parornix betulae*
0315 *Phyllonorycter harrisella*
0321a *Phyllonorycter platani*
0361 *Phyllonorycter trifasciella*
[0379 *Synanthedon myopaeformis* red-belted clearwing]
0396 *Glyphipterix fuscoviridella*
0411 *Argyresthia goedartella*
0414 *Argyresthia curvella*
0417 *Argyresthia spinosella*
0420 *Argyresthia pruniella* cherry-fruit moth
0424 *Yponomeuta evonymella* bird-cherry ermine
0425 *Yponomeuta padella* orchard ermine
0426 *Yponomeuta malinellus* apple ermine
0427 *Yponomeuta cagnagella* spindle ermine
0428 *Yponomeuta rorrella* willow ermine
0435 *Zellaria hepariella*
0438 *Swammerdamia pyrella*
0450 *Scythropia crategalla* hawthorn moth
0455 *Ypsolopha scabrella*
0464 *Plutella xylostella* diamond-back moth
0490 *Coleophora lutipennella*
0493 *Coleophora serratella*
0494 *Coleophora coracipennella*
0517 *Coleophora frischella*
0518 *Coleophora mayrella*
0552 *Coleophora lassella*
0561 *Coleophora therinella*
0563 *Coleophora argentula*
0568 *Coleophora versurella*
0577 *Coleophora artemisicolella*
0587 *Coleophora caespititiella*
0588 *Coleophora salicorniae*
0632 *Cosmiotes consortella*
0638a *Denisia albimaculea*
0640 *Batia lunaris*
0642 *Crassa unitella* (*Batia*)
0644 *Borkhausenia fuscescens*
0647 *Hofmannophila pseudospretella* brown house-moth
0648 *Endrosis sarcitrella* white-shouldered house-moth
0649 *Esperia sulphurella*
0656 *Tachystola acroxantha*
0658 *Carcina quercana*
0663 *Diurnea fagella*
0695 *Agonopterix alstroemeriana*
0729 *Isophrictis striatella*
0746 *Chrysoesthia drurella*
0748 *Ptocheuusa paupella*
0757 *Recurvaria nanella*
0765 *Teleiodes vulgella*
0772 *Teleiodes fugitivella*
0774 *Teleiodes luculella*
0776 *Teleiopsis diffinis*
0779 *Bryotropha affinis*
0787 *Bryotropha terrella*
0789 *Bryotropha domestica*
0802a *Gelechia sororculella*
0807 *Gelechia turpella*
0815 *Scrobipalpa nitentella*
0819 *Scrobipalpa costella*
0831 *Caryocolum proximum*
0853 *Anacampsis populella*
0870 *Oegoconia quadripuncta*
0873 *Blastobasis lignea*
0874 *Blastobasis decolorella*
0878 *Batrachedra praeangusta*
0886 *Mompha ochraceella*
0892 *Mompha subbistrigella*
0893 *Mompha epilobiella*
0898 *Limnaecia phragmitella*

0903 *Chrysoclista linneella* (*Glyphipterix*)
0904 *Spuleria flavicaput*
0906 *Blastodacna atra* apple pith moth
0927 *Gynnidomorpha minimana* (*Phalonidia*)
0930 *Gynnidomorpha alismana* (*Phalonidia*)
0937 *Agapeta hamana*
0945 *Aethes cnicana*
0947 *Aethes smeathmanniana*
0965 *Cochylis hybridella*
0968 *Cochylis nana*
0969 *Pandemis corylana* chequered fruit-tree tortrix
0970 *Pandemis cerasana* barred fruit-tree tortrix
0974 *Argyrotaenia ljungiana*
0977 *Archips podana* large fruit-tree tortrix
0980 *Archips xylosteana* variegated golden tortrix
0994 *Clepsis consimilana*
0998 *Epiphyas postvittana* light brown apple moth
1000 *Ptycholoma lecheana*
1001 *Lozotaeniodes formosanus*
1010 *Ditula angustiorana* red-barred tortrix
1011 *Pseudargyrotoza conwagana*
1021 *Cnephasia asseclana* flax tortrix
1032 *Aleimma loeflingiana*
1033 *Tortrix viridana* green oak tortrix
1036 *Acleris forsskaleana*
1043 *Acleris aspersana*
1054 *Acleris cristana*
1076 *Celypha lacunana* (*Olethreutes*)
1097 *Endothenia gentianaeana*
1108 *Lobesia abscisana*
1113 *Eudemis profundana*
1133 *Epinotia bilunana*
1138 *Epinotia nisella*
1165 *Zeiraphera isertana*
1167 *Gypsonoma aceriana*
1169 *Gypsonoma dealbana*
1171 *Gypsonoma minutana*
1174 *Notocelia cynosbatella* (*Epiblema*)
1205 *Spilonota ocellana* bud moth
1207 *Clavigesta purdeyi* pine leaf-mining moth
1210 *Rhyacionia buoliana* pine shoot moth
1212 *Rhyacionia pinivorana* spotted shoot moth
1219 *Lathronympha strigana*
1233 *Pammene aurita* (*aurantiana* preocc.)
1234 *Pammene regiana*
1260 *Cydia splendana*
1261 *Cydia pomonella* codling moth
1293 *Chrysoteuchia culmella*
1294 *Crambus pascuella*
1301 *Crambus lathoniellus*
1302 *Crambus perella*
1303 *Agriphila selasella*
1304 *Agriphila straminella*
1305 *Agriphila tristella*
1309 *Agriphila geniculea*
1323 *Pediasia contaminella*
1331 *Acentria ephemerella* water veneer
1338 *Dipleurina lacustrata*
1344 *Eudonia mercurella*
1361 *Pyrausta aurata*
1376 *Eurryhpara hortulata* small magpie
1380 *Phlyctaenia perlucidalis*
1398 *Nomophila noctuella* rush veneer
1405 *Pleuroptya ruralis* mother of pearl
1413 *Hypsopygia costalis* gold triangle
1415 *Orthopygia glaucinalis*
1417 *Pyralis farinalis* meal moth
1424 *Endotricha flammealis*
1425 *Galleria mellonella* wax moth
1428 *Aphomia sociella* bee moth
1436 *Conobathra repandana* (*Acrobasis*)
1452 *Phycita roborella*
1457 *Hypochalcia ahenella*
1470 *Euzophera pinguis*
1481 *Homoeosoma sinuella*
1484 *Phycitodes saxicola*
1524 *Emmelina monodactyla*
1526 *Thymelicus sylvestris* small skipper
1531 *Ochlodes venata* large skipper
1546 *Gonepteryx rhamni* brimstone
1549 *Pieris brassicae* large white
1550 *Pieris rapae* small white
1551 *Pieris napi* green-veined white
1580 *Celastrina argiolus* holly blue
1590 *Vanessa atalanta* red admiral
1591 *Vanessa cardui* (*Cynthia*) painted lady
1593 *Aglais urticae* small tortoiseshell
1597 *Inachis io* peacock
1598 *Polygonia c-album* comma
1614 *Pararge aegeria* speckled wood
1625 *Pyronia tithonus* gatekeeper
1626 *Maniola jurtina* meadow brown
1646 *Watsonalla binaria* (*Drepana*) oak hook-tip
1654 *Tethea ocularis* figure of eighty
1663 *Alsophila aescularia* March moth
1680 *Cyclophora punctaria* maiden's blush
1699 *Idaea vulpinaria* least carpet
1705 *Idaea fuscovenosa* dwarf cream wave
1707 *Idaea seriata* small dusty wave
1711 *Idaea trigeminata* treble brown spot
1713 *Idaea aversata* riband wave
1728 *Xanthorhoe fluctuata* garden carpet
1742 *Camptogramma bilineata* yellow shell
1760 *Chloroclysta siterata* red-green carpet
1764 *Chloroclysta truncata* common marbled carpet
1766 *Plemyria rubiginata* blue-bordered carpet
1795 *Epirrita dilutata* November moth
1811 *Eupithecia tenuiata* slender pug
1816 *Eupithecia linariata* toadflax pug

1825 *Eupithecia centaureata* lime-speck pug
1827 *Eupithecia intricata* Freyer's pug
1834 *Eupithecia vulgata* common pug
1837 *Eupithecia subfuscata* grey pug
1846 *Eupithecia nanata* narrow-winged pug
1852 *Eupithecia abbreviata* brindled pug
1856 *Eupithecia lariciata* larch pug
1860 *Eupithecia rectangulata* green pug
1862 *Gymnoscelis rufifasciata* double-striped pug
1876 *Asthena flammeolaria* small yellow wave
1893 *Macaria liturata* (*Semiothisa*) tawny barred-angle
1902 *Petrophora chlorosata* brown silver-line
1906 *Opisthograptis luteolata* brimstone moth
1915 *Ennomos erosaria* September thorn
1921 *Crocallis elinguaria* scalloped oak
1926 *Apocheima pilosaria* pale brindled beauty
1927 *Lycia hirtaria* brindled beauty
1930 *Biston strataria* oak beauty
1931 *Biston betularia* peppered moth
1935 *Erranis defoliaria* mottled umber
1937 *Peribatodes rhomboidaria* willow beauty
1958 *Lomographa temerata* clouded silver
1979 *Mimas tiliae* lime hawk-moth
1981 *Laothoe populi* poplar hawk-moth
1984 *Macroglossum stellatarum* humming-bird hawk-moth
1991 *Deilephila elpenor* elephant hawk-moth
2026 *Orgyia antiqua* vapourer
2029 *Euproctis chrysorrhoea* brown tail
[2060 *Spilosoma lubricipeda* white ermine]
2064 *Phragmatobia fuliginosa* ruby tiger
[2069 *Tyria jacobaeae* cinnabar]
2087 *Agrotis segetum* turnip moth
2088 *Agrotis clavis* heart and club
2089 *Agrotis exclamationis* heart and dart
2092 *Agrotis puta* shuttle-shaped dart
2107 *Noctua pronuba* large yellow underwing
2109 *Noctua comes* lesser yellow underwing
2110 *Noctua fimbriata* broad-bordered yellow underwing
2111 *Noctua janthe* lesser broad-bordered yellow underwing
2119 *Peridroma saucia* pearly underwing
2123 *Diarsia rubi* small square-spot
2126 *Xestia c-nigrum* setaceous Hebrew character
2134 *Xestia xanthographa* square-spot rustic
2142 *Anarta myrtilli* beautiful yellow underwing
2154 *Mamestra brassicae* cabbage moth
2157 *Lacanobia w-latinum* light brocade
2160 *Lacanobia oleracea* bright-line brown-eye
2164 *Hecatera bicolorata* broad-barred white (incorrectly under *Aetheria* in K & R 1996)
2166 *Hadena rivularis* campion
2173 *Hadena bicruris* lychnis
2182 *Orthosia cruda* small quaker
2187 *Orthosia cerasi* common quaker
2188 *Orthosia incerta* clouded drab
2190 *Orthosia gothica* Hebrew character
2193 *Mythimna ferrago* clay
2198 *Mythimna impura* smoky wainscot
2199 *Mythimna pallens* common wainscot
2232 *Aporophyla nigra* black rustic
2240 *Lithophane leautieri* Blair's shoulder-knot
2243 *Xylocampa areola* early grey
2252 *Polymixis flavicincta* large ranunculus
2256 *Eupsilia transversa* the satellite
2258 *Conistra vaccinii* the chestnut
2262 *Agrochola circellaris* the brick
2263 *Agrochola lota* red-line quaker
2270 *Omphaloscelis lunosa* lunar underwing
2272 *Xanthia aurago* barred sallow
2279 *Acronicta aceris* sycamore
2284 *Acronicta psi* grey dagger
2289 *Acronicta rumicis* knot grass
2293 *Cryphia domestica* marbled beauty
2297 *Amphipyra pyramidea* copper underwing
2299 *Amphipyra tragopogonis* mouse moth
2300 *Mormo maura* old lady
2306 *Phlogophora meticulosa* angle shades
2312 *Ipimorpha subtusa* olive
2314 *Parastichtis ypsillon* (*Enargia*) dingy shears
2318 *Cosmia trapezina* dun-bar
2321 *Apamea monoglypha* dark arches
2330 *Apamea remissa* dusky brocade
2336 *Apamea ophiogramma* double lobed
2337 *Oligia strigilis* marbled minor
2339 *Oligia latruncula* tawny marbled minor
2341 *Mesoligia furuncula* cloaked minor
2343 *Mesapamea secalis* common rustic
2343a *Mesapamea didyma* lesser common rustic
2380 *Charanyca trigrammica* treble lines
2381 *Hoplodrina octogenaria* (*alsines*) uncertain
2384 *Hoplodrina ambigua* Vine's rustic
2387 *Caradrina morpheus* mottled rustic
2389 *Paradrina clavipalpis* (*Caradrina*) pale mottled willow
2441 *Autographa gamma* silver Y
2452 *Catocala nupta* red underwing
2469 *Scoliopteryx libatrix* herald
2474 *Rivula sericealis* straw dot

MEGALOPTERA. The nomenclature follows Plant (1992).

Sialus lutaria: listed by Plant (1992: 120) as the commonest British species. 1 ♀ in area S31 on 29 May 1996 was thought to represent the first record for the 10 km square TQ27, but an old record exists of a specimen dated 22 May 1926 from Wimbledon (Plant pers. comm.). Further records of 1 ♂ on 12 May 1997 and 1 ♀ on 13 May 1997, both from exactly the same location, would suggest that this species is breeding in the garden.

NEUROPTERA. The nomenclature and sequence follow Plant (1992).

Coniopterygidae

Conwentzia psociformis: listed by Plant (1992: 121) as a widespread species, 1 ♂ on 28 July 1997.

Coniopteryx esbenpeterseni: although only recently discovered as a British species, it is now quite common in southern England (P. Barnard pers. comm.). Previously, the only known London examples, which are some of the earliest known British specimens, were found among Museum specimens (Plant 1992: 121). 1 ♂ on 28 July 1997 confirms Plant's assumption that it is present within the London boundary and represents the first and only record for TQ27.

Parasemidialis fuscipennis: Plant (1992: 121) states 'Probably widespread, but at present known only in our area from four records'. 4 ♂♂ on 19 July 1995, 2 ♂♂ on 5 June 1996, 3 ♂♂ and 1 ♀ on 6 June 1996, 2 ♂♂ on 23 July 1997 and 4 ♂♂ on 28 July 1997 would seem to show that it is more widespread and are the first records for TQ27.

Sisyridae

Sisyra fuscata: 3 ♀♀ on 19 July 1995 were originally assumed to be a one-off introduction, which agrees with the comment by Plant (1992: 122) about central London records, until the capture of 1 ♂ on 14 July 1997. This species has also been recorded from Buckingham Palace Garden (Plant pers. comm.).

Hemerobiidae

Psectra diptera: a female specimen of the macropterous form of this species was found in the light-trap on 3 August 1995. It is only the fourth specimen of this form in the NHM collection. Plant (1992: 122) lists just two other London records of this species, but states that this form is 'often taken in lepidopterists' light-traps'. Probably the first record for TQ27.

Micromus variegatus: stated by Plant (1992: 122) to be widespread and locally common, recorded on 3 August 1995 and thought to be the first record for TQ27 and the first Inner London area record, but there are unpublished records of one from the NHM in 1970 and one from Shepherd's Bush in 1997 (P. Barnard pers. comm.).

Hemerobius humulinus: listed by Plant (1992: 123) as widespread and quite common, even from suburban gardens. Recorded on 3 August 1995, probably the first record for TQ27, and in 1997.

[*Hemerobius simulans*: normally associated with *Larix* spp. or *Pinus* spp., Plant (1992: 122) records this London rarity from the roof of The Natural History Museum in 1987. It has yet to be taken in the Wildlife Garden.]

Hemerobius stigma: first recorded from the garden on 3 August 1995. Considered by Plant (1992: 122) to be associated with *Pinus* plantations and therefore not widespread in the London area, but several species of microlepidoptera that have a similar preference for *Pinus* have also been recorded from the garden (see under Lepidoptera above). The distribution map given by Plant does show this species to have been recorded previously from TQ27, and it is interesting to note that this was also from the NHM, inside the Entomology Department on 25 January 1991 (Plant pers. comm.).

Hemerobius micans: 1 ♀ on 19 July 1995 appears to represent the first record for TQ27. Originally assumed to be another one-off introduction as there were no further records from the garden until a specimen was swept from vegetation on 7 July 1997 and 1 ♂ came to light on 28 July 1997.

Hemerobius lutescens: listed by Plant (1992: 123) as widespread and quite common, even from suburban gardens. First recorded on 3 August 1995 and then 1 ♂ on 5 June 1996, 1 ♂ and 1 ♀ on 6 June 1996, a specimen in April 1997 and 1 ♂ and 1 ♀ on 28 July 1997. Apparently the first central area records and the first records for TQ27.

Wesmaelius betulinus: although listed by Plant (1992: 123) as widespread and quite common, 1 ♀ on 28 July 1997 probably represents the first record for TQ27.

Wesmaelius subnebulosus: 1 ♂ and 1 ♀ on 9 June 1997, 2 ♀♀ on 14 July 1997 and 1 ♂ on 28

July 1997. Rather surprisingly, although regarded by Plant (1992: 123) as a widespread species regularly recorded from suburban gardens, it is not recorded by Plant for TQ27. These specimens and an earlier, unpublished, record of a specimen caught in 1977 from the NHM (P. Barnard pers. comm.) are the first records for TQ27.

Sympherobius pygmaeus: Plant (1992: 123) considers this species to be the most widespread of the four British *Sympherobius* species in the London area. First recorded on 3 August 1995, then 3♂♂ and 2♀♀ on 5 June 1996, 2♂♂ and 2♀♀ on 6 June 1996 and 1♀ on 28 July 1997.

Chrysopidae

Chrysopa perla: widespread according to Plant (1992: 124), first recorded on 3 August 1995, often attracted to light, 1♂ on 28 July 1997.

(*Chrysopa pallens*: strangely, this apparently widespread species has yet to be recorded from the garden. Plant (1992: 124) does record this species in TQ27, but only as a pre-1970 record, actually from Clapham in June 1894 (Plant pers. comm.)).

Cunctochrysa albolineata: listed by Plant (1992: 124) as widespread and quite common, recorded on 3 August 1995, probably the first record for TQ27.

Chrysoperla carnea: Plant (1992: 124) states that *C. carnea* [aggregate] is very common, but this taxon is now recognized (Henry et al. 1996) as including at least two other sibling species, including *C. carnea* (Stephens) *sensu stricto* and *C. lucasina*. Records from 3 August 1995, 29 May 1996, 1♀ on 6 June 1996, and post-hibernation specimens, retaining their brownish markings, on 10 March 1997, show *C. carnea* to be the more common of the two species.

Chrysoperla lucasina: this species is not listed by Plant as it has only recently been reconfirmed as being distinct from *C. carnea* (Henry et al. 1996). Recorded from the garden on 3 August 1995.

TRICHOPTERA. The nomenclature and sequence follow Barnard (1985).

With the exception of the two Hydropsychidae, all the Trichoptera recorded are common and widespread species that could be expected from any garden pond. The male *Hydropsyche siltalai*, recorded at light on 23 July 1997, is surprising as this species is normally only associated with fast-flowing water and may not have been recorded previously from central London. The only flowing waters present in the garden are the waterfall and chalk stream and neither is permanently flowing, hardly what could be considered ideal habitat for this species. Wallace (1991: 7), based on a knowledge of habitat requirements, suggests that perhaps 25 per cent of species recorded at light-traps are not from the site under investigation, but, in this instance, it is difficult to imagine a site close enough to the Wildlife Garden from which this specimen could have originated.

Hydroptilidae

Agraylea multipunctata: 1♀ on 14 July 1997.

Agraylea sexmaculata: 3♂♂ and 2♀♀ on 19 July 1995; 1♂ on 10 July 1996; 1♂ on 23 June 1997; 1♂ and 3♀♀ on 22 July 1997; 1♀ on 23 July 1997.

Hydroptila sparsa: 2♂♂ and 3♀♀ on 19 July 1995; 1♀ on 29 May 1996; 1♀ on 6 June 1996; 3♀♀ on 14 July 1997; 1♂ and 3♀♀ on 22 July 1997; 1♀ on 28 July 1997.

Psychomyiidae

Tinodes waeneri: 1♂ on 21 September 1995.

Polycentropodidae

Cyrnus flavidus: 1♂ on 19 July 1995.

Cyrnus trimaculatus: 1♀ on 9 June 1997.

Polycentropus flavomaculatus: 2♀♀ on 23 July 1997.

Hydropsychidae

Hydropsyche angustipennis: 1♀ on 19 July 1995; 1♀ on 23 July 1997.

Hydropsyche siltalai: 1♂ on 23 July 1997.

Limnephilidae

Limnephilus affinis: 1♂ on 21 September 1995.

Limnephilus vittatus: 1♂ on 16 October 1997.

Lepterocidae
Athripsodes sp.: 1♀ on 6 June 1996.
Ceraclea dissimilis: 1♀ on 2 June 1997; 1♀ on 9 June 1997.
Leptocerus tineiformis: 1♂ and 4♀♀ on 19 July 1995; 1♂ and 3♀♀ on 10 July 1996; 1♂ on 14 July 1997; 1♀ on 28 July 1997.
Mystacides azurea: 1♂ on 19 July 1995; 1♀ on 28 July 1997.
Mystacides longicornis: 1♀ on 6 June 1996; 1♀ on 10 July 1996; 1♀ on 28 May 1997; 1♂ and 1♀ on 9 July 1997; 1♀ on 14 July 1997.
Oecetis lacustris: 1♀ on 10 July 1996; 3♂♂ and 1♀ on 23 June 1997; 2♂♂ on 4 July 1997; 2♂♂ and 2♀♀ on 9 July 1997.
Oecetis ochracea: 1♂ on 19 July 1995.

ORTHOPTERA. The nomenclature and sequence follow Marshall and Haes (1988).
Meconema thalassinum oak bush-cricket: a young nymph found on the trunk of the lime tree in area S10 on 13 May 1997 and an older nymph in the same location on 9 July 1997.
Tetrix subulata slender ground-hopper: a nymph on 28 August 1996 in area M01 and an adult on 14 May 1997 in area S10.
Tetrix undulata common ground-hopper: a nymph on 16 September 1996 in area M01.
Omocetus viridulus common green grasshopper: one adult male stridulating in the lowland heath area on 25 July 1995.
Chorthippus brunneus field grasshopper: one stridulating male on 30 August 1995 (actually on the window sill on the second floor of the Entomology block, overlooking the garden).
Chorthippus albomarginatus lesser marsh grasshopper: several nymphs were found in area P35 in late June and early July 1997. Several adults, of both sexes, were found in the same area on 30 July 1997 and the males were stridulating.

VERTEBRATES

Amphibians

Rana temporaria common frog: two adults were introduced into area W13 on 3 July 1995. An adult male was seen subsequently in the main pond (W15) on 25 March 1997, with spawn having been seen earlier in the year.
Bufo bufo common toad: introduced into area W13 on 3 July 1995, an adult male was seen in the main pond W15 on 25 March 1997, and a large specimen was seen in area S31 on 22 July 1997.
Triturus vulgaris smooth newt: two adults were introduced into area W13 on 3 July 1995. On 25 March 1997 five males and two females were reported from area W15 and ova were observed on the aquatic vegetation there. Several others have subsequently been recorded, one in area S18 on 9 October 1996 and one in S16 on 31 October 1996. Unfortunately, a few juveniles have been found dead in the pitfall traps and one adult in one of the traps on the chalk mound M01 on 20 December 1996, but several adults have been active during the day in the main pond W15 on 22 May 1997, and one male in area S28 on 17 June 1997.

Birds

Ardea cinerea grey heron: occasionally seen flying over the garden. An adult was disturbed from the main pond (W15) at 6.30 a.m. on 18 July 1996.
Branta canadensis Canada goose: regularly seen flying over the garden end of the Museum, often in parties of twenty or more, as they move between the Thames at Chelsea and the lakes in Hyde Park and Kensington Gardens.
Anas platyrhynchos mallard: numerous records of up to five birds from all the ponds, including one pair that bred in 1995, prior to the official opening, and hatched 11 ducklings.
Accipiter nisus sparrowhawk: one bathing on the western edge of the chalk pond (W14) on 31 July 1995, one bathing on the northern edge of the chalk pond (W14) on 20 March 1997, one on 1 April 1997, and a pair on 28 May 1997 being chased around the garden by a pair of mistle thrushes.
Falco tinnunculus kestrel: single males and females occasionally seen over the garden, this species has bred previously on the Museum buildings.
[*Phasianus colchicus* pheasant: a female in 1978 was assumed to be an 'escape' from Holland Park.]
Scolopax rusticola woodcock: one record of this bird which is rarely seen in central London.

On 9 January 1997, during a very cold spell when several other woodcock were reported in London, one was unfortunately found dead. It was assumed to have collided with one of the Entomology Department windows.

Larus ridibundus black-headed gull: often seen in or over the garden during the winter months (November to March).

[*Larus canus* common gull: first recorded in 1979, but not recorded during the current monitoring.]

[*Larus argentatus* herring gull: first recorded in 1979, but not recorded during the current monitoring.]

Columba livia feral pigeon: regularly present, breeds on ledges around the Museum buildings.

Columba palumbus woodpigeon: regularly seen bathing and feeding, especially in spring when the poplar buds first break.

[*Strix aluco* tawny owl: resident over twenty-five years ago adjacent to the garden.]

Apus apus swift: regularly seen over the garden throughout the summer, the first sighting for 1997 was on 15 May.

Dendrocopos major great spotted woodpecker: seen on various dates in 1996 and spring 1997, mainly feeding in either of the poplars or the lime tree.

[*Hirundo rustica* swallow: first recorded in 1980, but not reported during the current monitoring.]

[*Delichon urbica* house martin: occasional visitor, but not recorded during the current monitoring.]

Motacilla cinerea grey wagtail: occasionally seen feeding around the ponds in 1995, 1996 and 1997.

[*Motacilla alba* pied wagtail: first recorded in 1975, an occasional visitor, but not recorded during the current monitoring.]

Troglodytes troglodytes wren: certainly resident, but not often seen.

Erithacus rubecula robin: seen throughout the garden at all times of the year, possibly four males holding territory in spring 1997 and evidence of breeding success in juvenile birds have been seen.

[*Prunella modularis* dunnock: used to be seen regularly, but not recorded during the current monitoring.]

[*Turdus torquatus* ring ouzel: a male on 2 October 1952 (*London Bird Report* **17**: 28)]

Turdus merula blackbird: seen thoughout the garden at all times of the year, with at least three resident pairs; juveniles also seen so assumed to have bred in or around the garden.

Turdus pilaris fieldfare: first recorded in 1983, occasionally seen flying over the garden in the winter months.

Turdus philomelos song thrush: a pair is resident and nested successfully in 1997 in the privet hedge that forms the northern boundary of the garden.

Turdus iliacus redwing: first recorded in 1979, occasionally seen in the winter months flying over the garden.

Turdus viscivorus mistle thrush: regularly seen feeding in the garden, a pair bred in 1996 adjacent to the garden on a building in Queen's Gate. Two adults on 28 May 1997 were seen chasing a pair of sparrowhawks.

[*Acrocephalus scirpaceus* reed warbler: one heard singing in the garden in 1993.]

[*Muscicapa striata* spotted flycatcher: the first, and only, record was in 1986.]

Aegithalos caudatus long-tailed tit: seen occasionally, usually in small flocks, e.g., seven in the lime tree in area S08 on 7 November 1997.

Parus caeruleus blue tit: seen regularly, mainly around the more wooded perimeter; one pair seen all through spring 1997 may have nested.

Parus major great tit: seen regularly, mainly around the more wooded perimeter; one pair nested successfully in the bird-box in area P05 in spring 1997.

Garrulus glandarius jay: seen regularly, usually in pairs, but up to seven have been recorded at one time.

Pica pica magpie: as the jay, this species is seen regularly, usually in pairs, but sometimes more numerous.

[*Corvus monedula* jackdaw: used to occur in small numbers over twenty-five years ago.]

Corvus corone carrion crow: seen regularly and has nested previously in the plane trees surrounding the garden.

Sturnus vulgaris starling: seen regularly and has bred in the garden.

Passer domesticus house sparrow: rather surprisingly, only one sighting on 28 September 1995 in area S21.

[*Carduelis chloris* greenfinch: first recorded in 1975 and used to be a regular visitor, but not recorded during the current monitoring.]

Carduelis carduelis goldfinch: one seen on 9 December 1997 in area W15.

Mammals

Sciurus carolinensis grey squirrel: casual records and the finding of a drey on 13 November 1997 indicate that there is at least one pair resident; two young seen in October 1997 indicate probable breeding, almost certainly in one of the poplars at the edge of the meadow (S35).

Mus domesticus house mouse: recorded in areas W04, H02 and S16 on 1 August 1996.

Apodemus sylvaticus wood mouse: recorded in areas W04, H02 and S16 on 1 August 1996 and an adult male in area H09 on 5 August 1997.

Vulpes vulpes red fox: a large adult was observed and reported by a number of people on 13 January 1997. It was seen for about an hour from 9.30 a.m. before departing northwards, around the back of the Spirit Building and was seen later crossing the site of the old Discovery huts. Another was recorded on 12 December 1997 in area W04, disturbed from under the boardwalk.

Pipistrellus pipistrellus pipistrelle: bats were recorded flying over the main pond W15 on 9 October 1996, but none was recorded during a survey on 29 August 1997.

Concluding remark — a plea

Volunteers are still needed to help with the long-term monitoring of species in the Wildlife Garden. Despite the recent number of volunteers, people are still needed to record and monitor the following groups of organisms: thrips, ticks, mites, worms, amoeba and hairybacks. A recorder for birds is also needed as well as one for larger mammals, especially squirrels.

If you feel you would like to become involved in this interesting project or are able to assist with recording and monitoring any of the above groups, please contact Ceri Leigh, Wildlife Garden Monitoring Co-ordinator on 0171-938 8789 (or on e-mail at cl@nhm.ac.uk).

Acknowledgements

The Wildlife Garden would not have been possible without the generous support of numerous individuals and organizations and the Museum particularly appreciates the kind support of English Nature, Esso UK plc, Cadogan Estates Ltd, Ibstock Building Products Ltd and Magnox Electric plc. The authors are extremely grateful to all the recorders and to many colleagues for giving freely of their time and expertise in recording and identifying numerous specimens from the garden samples. Faunal records: Mark Parsons, Kevin Tuck, Mrs Judith Marshall, Mrs Sharon Shute, Peter Hammond, Nigel Wyatt, Dr Peter Barnard, Paul Hillyard, Dr Chris Lyal, Theresa Howard, Emma DeBoise, George Else, Susanne Lewis, Paul Brown, Paul Jenkins, Lee Rogers and Richard Thompson (Department of Entomology, NHM), Dr Peter Mordan, Suphan Karaytug, Dr Rod Bray, Richard Harbord, Fred Naggs, Clare Valentine, Mary Spencer-Jones and Eileen Harris (Department of Zoology, NHM), Paul Lund (Photographic Unit) and Rosabel Richards (both Department of Exhibitions and Education, NHM), also Roy Wiles (Buckingham University), Dr David Agassiz and Pauline Entwistle. Botanical identification and recording were undertaken by Alison Paul, Roy Vickery, Len Ellis, Pat Wolseley, Ian Tittley, Emma Watson, Marion Short, Rob Huxley, Mary Gibby, Alan Harrington, Alan Eddy, Elliott Schubert, Dave John, Peter York and William Purvis (Department of Botany, NHM), Mandy Holloway (Department of Visitor Services, NHM), Caroline Ware (Department of Exhibitions and Education, NHM), J. E. M. Mordue (International Mycological Institute, Egham), also John Alder, Joan Bovarnick, Roddi Wood, Amanda Waterfield, Geoff Kibby, Clive Jermy and Oliver Gilbert. We are also grateful to John Tovey and other members of the London Bat Group for surveying and identifying bats, David Nellist (British Arachnological Society) for identifying the spiders, and Eric D. Hollowday, Brian Tabor and Phil Greaves of the Quekett Microscopical Club for sampling and identifying rotifers, etc. We also thank Derek Adams (Photographic Unit, NHM) for the photographs from which the plate figures were reproduced, and Vic Din and Gary Jones (Department of Mineralogy, NHM) for undertaking, and providing results of, the water chemistry analysis. Our thanks also go to

the numerous colleagues who read early drafts of this paper and provided many helpful comments and criticisms.

References

ALLEN, A. A. 1996. The recurrence of *Polystichus connexus* (Fourc.) (Col.: Carabidae) at light in the London suburbs, with a few thoughts on the question of origin. *Entomologist's Rec. J. Var.* **108:** 40.

ATKINS, W. and HERBERT, C. 1997. *Amphibian survey of the Wildlife Garden ponds, Natural History Museum.* Unpublished report. Amphibian, Reptile and Mammal Conservation Limited.

BARNARD, P. C. 1985. An annotated check-list of the Trichoptera of Britain and Ireland. *Entomologist's Gaz.* **36:** 31–45.

BRADLEY, J. D. and FLETCHER, D. S. 1979. *A recorder's log book or label list of British butterflies and moths.* Curwen Books, London.

BRADLEY, J. D. and FLETCHER, D. S. 1986. *An indexed list of British butterflies and moths.* Kedleston Press, Orpington.

BRADLEY, J. D., TREMEWAN, W. G. and SMITH, A. 1973. *British tortricoid moths. Cochylidae and Tortricidae: Tortricinae.* The Ray Society, London.

BRADLEY, J. D., TREMEWAN, W. G. and SMITH, A. 1979. *British tortricoid moths. Tortricidae: Olethreutinae.* The Ray Society, London.

BROOKS, S. J. 1989. The dragonflies (Odonata) of London: the current status. *Lond. Nat.* **68:** 109–131.

COOK, R. T. A., INMAN, A. J. and BILLINGS, C. 1997. Identification and classification of powdery mildew anamorphs using light and scanning electron microscopy and host range data. *Mycol. Res.* **101**(8): 975–1002.

FITTER, R. and MANUAL, R. 1986. *Collins field guide to freshwater life.* Collins, London.

FRY, R. and WARING, P. 1996. *A guide to moth traps and their use.* Amateur Entomologists' Society, Colchester.

GILBERT, O. L. 1990. The lichen flora of urban wasteland. *Lichenologist* **22:** 87–101.

HAWKSWORTH, D. L. and MCMANUS, P. 1989. Lichens that tell a tale. *Country Life* **183:** 144–145.

HENRY, C. S., BROOKS, S. J., JOHNSON, J. B. and DUELLI, P. 1996. *Chrysoperla lucasina* (Lacroix): a distinct species of green lacewing, confirmed by acoustical analysis (Neuroptera: Chrysopidae). *Syst. Ent.* **21:** 205–218.

KARSHOLT, O. and RAZOWSKI, J. 1996. *The Lepidoptera of Europe. A distributional checklist.* Apollo Books, Stenstrup.

MARSHALL, J. A. and HAES, E. C. M. 1988. *The grasshoppers and allied insects of Great Britain and Ireland.* Harley Books, Colchester.

MASTERS, Z. 1997. The AES Bug Club visit to the Natural History Museum. *Amateur Ent. Soc. Bug Club* **5:** 6–7.

MERRETT, P., LOCKET, G. H. and MILLIDGE, A. F. 1985. A check list of British spiders. *Bull. Br. arachnol. Soc.* **6:** 381–403.

MERRETT, P. and MILLIDGE, A. F. 1992. Amendments to the check list of British spiders. *Bull. Br. arachnol. Soc.* **9:** 4–9.

MOON, A. V. (ed.) 1997. *London Bird Report* **61**. London Natural History Society, London.

PAICE, M. R. and GLAVES, P. 1997. A study of the sparrowhawk *Accipiter nisus* and the kestrel *Falco tinnunculus* in an urban environment. *Lond. Nat.* **76:** 133–152.

PLANT, C. W. 1992. A working list of the lacewings of the London Area. *Lond. Nat.* **71:** 117–136.

PLANT, C. W. 1993. *Larger moths of the London Area.* London Natural History Society, London.

PLANT, C. W. 1997. A review of the butterflies and moths (Lepidoptera) of the London Area for 1995 and 1996. *Lond. Nat.* **76:** 157–174.

RODWELL, J. 1991. *British plants communities* **1**. *Woodlands and scrub.* Cambridge University Press, Cambridge.

WALLACE, I. D. 1991. A review of the Trichoptera of Great Britain. *Res. Surv. Nature Conserv.* **52:** 55 pp. Nature Conservancy Council [now Joint Nature Conservation Committee], Peterborough.

Book review

Butterflies on British and Irish offshore islands. Roger Dennis and Tim Shreeve. Gem Publishing Company, Wallingford. 1996. 132 pp., 11 text figures and 9 tables of data. £16 (papers). ISBN 0 906802 06 7.

For the ecologist and general entomologist alike, islands hold a particular fascination. Here, in splendid isolation, may be found races, forms, subspecies (call them what you like) of a variety of insects that occur nowhere else. This fascinating book draws together data on the butterfly species from no less than 219 British and Irish offshore islands and analyses them in a most thorough manner which sets out an excellent baseline for further ecological studies. As such, the work is long overdue and the two authors are to be congratulated on a most excellent piece of research, accurately and thoroughly conducted and very well presented in a very readable form that will surely stimulate the further researches which they themselves aim to encourage.

The book falls into two sections. Collectors will doubtless only be interested in the second, which is essentially a complete species listing for each of the islands from which data are available, together with a bibliography complete to 1 August 1996. Islands from where no data are available are listed and it is hoped that this will stimulate further recording work on these. However, more-serious entomologists will hopefully find the first section, which forms the bulk of the book, a more serious proposition, though in fairness to potential purchasers it has to be said that some working knowledge of ecological mathematics will greatly ease passage through some of the pages. The ecology of island butterflies is introduced, as far as it is known, and then in different chapters the authors discuss the analysis of island records, factors affecting species richness on islands, relationship among islands, butterfly associations on islands, predicting butterfly records on island migration, ecological basis for island butterflies, variation and historical considerations, before ending with suggestions for future work and some conclusions, which take the form of an eight-point summary. The bibliography which follows is well researched.

At £16 the book may be a little overpriced, though this may reflect a potentially small reader-audience and a consequently restricted sales potential. On the other hand, this book has a far wider appeal than just amongst British entomologists. It is a model ecological study that will be of great interest to other ecologists, to academics and others, not only in Britain but also elsewhere in the world.

COLIN W. PLANT

An update on geological conservation in the London Area

RICHARD BUTLER
205 Barnett Wood Lane, Ashtead, Surrey KT21 2DF

Summary

Since the launch of the Regionally Important Geological Sites (RIGS) plans by English Nature, progress in London had been almost non existent until 1997. Things have now changed. The counties outside London have forged ahead and a national network of sites is beginning to take shape. However, once a site has been declared problems can arise as has been shown recently at Norbury Park.

In order to deal with RIGS for London a group was set up by Greenwich University in 1992 (Butler 1994). Two meetings were held at which the London Natural History Society was represented. At the second meeting a list of proposed sites was drawn up and it appeared that everything was on course for producing results. However, everything was put on hold and nothing further happened. Eventually the situation became clearer when it was admitted that the University had suspended all action on RIGS. This may have in part be due to the removal of its Geological Department to Kent. In 1997 the Ravensbourne Geological Society was asked to take over responsibility for RIGS in London south of the Thames. Here two sites have been declared. The situation in London north of the Thames is still unclear, but nevertheless one site has been notified.

Sites which are registered or being considered are as follows:

ROSE AND CROWN QUARRY, RIDDLESDOWN, London Borough of Croydon

This is a very old chalk quarry with a very large exposure of Upper and Middle Chalk. Unlike many other chalk quarries in the district it has escaped development. A good reason for this could be the railway viaduct which crosses the quarry. However the roadside entrance is now occupied by warehouses. The quarry came to the notice of the Surrey RIGS group before the advent of the London RIGS group as it was a denotified SSSI. Documentations in preparation for registration were prepared, but the final stages could not be carried out because the quarry was up for sale. Protracted negotiations were going on between the vendors and the Corporation of London who wished to add the quarry to their Riddlesdown Common holdings. South London RIGS group have now taken over responsibility for the site. The quarry is important in that it shows the junction between the Upper Chalk, recognized by the presence of flints, and the Middle Chalk which has no flints. Some minor solution effects are visible at the top of the quarry.

CROHAM HURST RIGS, SOUTH CROYDON, London Borough of Croydon

This is an insular hill and is a public open space owned by the London Borough of Croydon. It is capped by the Blackheath Pebble Bed resting on Thanet Sands, which in turn rest on Upper Chalk. The scientific importance lies in the exposure of the Blackheath Pebble Bed at TQ338630 at the south-eastern end. The flint pebbles are naturally cemented into a conglomerate and form a densely packed assemblage. The matrix is a silt mixed with ferruginous material. The presence of the conglomerate no doubt explains the actual existence of the hill and the bed probably extends beneath the surface to

the north-west side. Its presence probably explains why many of the oak trees on the hill are stunted.

On no account should hammers be used on this exposure. Croham Hurst also has some archaeological features in that outlines of Bronze Age huts are visible in the open space at the top.

KESTON PONDS RIGS, London Borough of Bromley

Here is an extensive area of the Blackheath Pebble Beds. Where cementation into a conglomerate does occur it is much weaker than at Croham Hurst. Below the pebble bed is the Woolwich Bed. Water draining down through the pebbles is thrown out as springs at the junction and these feed the ponds which form the main headwaters of the Ravensbourne River.

SPRINGFIELD PARK, London Borough of Hackney

Springfield Park is both a Local Nature Reserve and a RIGS. The name suggests springs or spring line. In fact there are two spring lines which account for the geological importance. Permeable brick earths and terrace gravels form the upper level of the park and end half way down a slope overlooking the River Lee and the Walthamstow Marshes. The upper spring line is at the base of the gravels. Making up the lower levels of the park is the impermeable London Clay which is responsible for a lower spring line. In wet weather seepages along both lines are clearly visible. In dry weather a study of the plants will reveal them.

Registration of this RIGS is largely due to the efforts of the former Borough Nature Conservation Officer, Vivienne Aylmer.

NORBURY PARK, SURREY. Abandoned meander of the River Mole

This is a Surrey RIGS site on the borders of this Society's area. When the railway was constructed between Leatherhead and Dorking there was a problem because the River Mole in Norbury Park tended to flood during wet weather. As the railway embankment skirted part of the east side of the park it was felt some precautionary measures should be taken. These were in the form of a cut-off which isolated a meander of the river. The cut-off encouraged the river to flow faster. It took some time before the meander became completely abandoned except on rare occasions of severe flooding. The Environment Agency, which has incorporated the National Rivers Authority, put forward plans to rejoin the meander to the river. Since the Agency is outside the normal planning procedures, matters could not be referred to the local planning office. The plans were opposed by the Surrey RIGS group on the grounds of educational importance and the fact that the meander was visited by large numbers of school parties. Opposition also came from the park ranger and the local farmer who used the park to graze sheep and cattle.

The Agency made a number of modifications to the plans, but were determined to carry out the basic part of the plans. It is known that there is a swallow hole in the bed of the meander which at some time in the past had been active. At the moment it does not appear to be active but they are unpredictable so maybe something might happen in the future.

All the sites mentioned in this list are freely open to the public except the Rose and Crown Quarry at Riddlesdown. Information on this can be obtained from the Corporation of London's Commons Office at Ninehams Road, Caterham.

As far as north London is concerned some action is needed on Hampstead Heath and the Pinner Chalk Mines. Hampstead Heath has lost its protection from the geological point of view yet is still a geologically important area since it is the main area of the Bagshot Beds within the London Area and the source of a number of streams.

Reference

BUTLER, R. 1994. Geological conservation in the London Area. *Lond. Nat.* **73:** 23–25.

London's urban woodlands — ancient and modern

COLIN BOWLT

7 Croft Gardens, Ruislip, Middlesex HA4 8EY

Contents

Abstract

Archaeological evidence provides limited information about woodland in London during prehistoric and Roman times. Great changes seem to have occurred during the Saxon period so that in Middlesex, for instance, by the time of the Domesday Survey in 1086, only about 20 per cent of the area was covered by woodland. From about that time woodland was protected from animals and managed, either by pollards coupled with grazing, or by enclosed coppice. This provided the wood for fuel, fencing, tool hafts, etc. Timber trees for larger constructions were often grown amongst the coppice, but felled at longer intervals. Strip woodland around the edges of fields is often shown on early maps. A few examples still exist in our area and contain features of ancient woodland. By the nineteenth century, small woods were being planted as coverts, and later came larger plantations of conifers for timber. More recently, natural regeneration has turned the Surrey commons and even derelict sites close to the centre of London into woodland.

Introduction

This was the introductory paper at the London Natural History Society's Conference on 'London's Urban Woodlands' held on 11 October 1997. It attempted briefly to cover the chronological changes of woodland in London from prehistoric times as far as current thoughts and the known evidence allow. These changes concern mainly the areas and structures of the woods, which have mostly been produced by human action in using them as part of the local economy. I have therefore here regarded woods simply as areas with trees and shrubs growing in semi-natural conditions, but with very little reference to their specific make-up of plants, the so-called plant communities. These aspects have been dealt with most recently by Rackham (1980), Peterken (1981), and Rodwell (1991). Many such communities have been described, but not always with agreement between investigators. This is hardly surprising since the concept of a community suggests a fairly distinct grouping of species. In practice certain species do often occur (but not exclusively) together. Such communities can have blurred edges with one community running into another. A single wood can be a mosaic of such communities, both large and small (the area dominated by the shade and fallen leaves of a single beech tree in an essentially oak wood can be considered a separate community). The examples of woods are mainly from north of the River Thames which I know best, but I believe my general statements apply equally to woodlands in London south of the Thames.

Prehistoric Period

Tangible evidence about London's woodlands in the prehistoric period is rather limited, but tantalizingly interesting. The famous West Heath Bog, Hampstead, provided a pollen diagram, dating from about 5000 BC onwards (Girling and

Greig 1977) indicating that at the earliest period oak, lime, hazel were common with birch, elm, pine (presumably *Pinus sylvestris*) and alder also present. Lime trees decreased dramatically after about 1000 BC. A similar decrease has been noted at many other sites elsewhere in England. A pollen diagram going back to about 2000 BC from a bog in Epping Forest with associated carbon-14 dating evidence (Baker et al. 1978) also showed limes to be common, but unusually they here seem to have continued so until Saxon times *c.*AD 700.

In 1986 a Bronze-age spearhead dated on stylistic grounds to *c.*800 BC was found with a metal detector in Park Wood, Ruislip. Fortunately the find was reported and an archaeological excavation took place on the site (Figure 1), discovering a feature containing a remaining piece of the spearhead, two small pieces of pottery and some charcoal (Cotton 1986). The charcoal was identified as coming from beech, oak, hornbeam, poplar/willow, holly, hawthorn, hazel and alder, in decreasing order of abundance. The tip of the wooden spear shaft was still in the socket and was identified as *mature* ash (rings with large radii) and not coming from coppice. Interestingly, the feature was at no great depth with only a thin humus layer illustrating that dead leaves are recycled quite quickly and do not build up to a great thickness with time. (Archaeological layers are many metres underground in the City due to the accumulation of *human* rubbish).

FIGURE 1. The site of the bronze-age spear head in Park Wood, Ruislip.

Perhaps the most remarkable find of prehistoric trees has been that of bog yews at Beckton Sewage Works in Essex (Ian Tyers pers. comm., Greenwood and Malony 1995). Seventeen were dug out of the waterlogged ground, along with bog oaks, and have been C-14 dated to *c.*2000 BC. More examples have since been found at other sites close to the Thames in Essex. Nowadays we think of yews as trees of the chalk, so it is salutary to realize that they once flourished on the flood plain of the Thames.

The Roman and Saxon periods

Some evidence about woodlands in the Roman period comes from the very heart of London. Recent excavations along the waterlogged Thames-side has revealed the Roman waterfronts. An example was the first-century quay north of present-day Thames Street, beside Pudding Lane (Milne 1985). The substantial wooden structure was made of massive squared oak timbers from trees up to more than 200 years old (Figure 2). We do not know where these were grown, but it would seem likely that it was locally, indicating that at this period there were plenty of large oaks growing in London.

This should be contrasted with the medieval waterfronts that have also been excavated (Milne and Milne 1982). These were closer to the river due to land reclamation with successive waterfronts. Typically they were constructed of oak timbers of which more than 80 per cent were from trees 40 to 80 years old, in

FIGURE 2. Excavation of the first-century Roman waterfront, Pudding Lane, City of London.

addition to including much reused timber. All this suggests that by late Saxon times most of the large, available trees had gone.

Medieval woodland

In the Domesday Survey in 1086, woodland in London is listed in terms of pannage for so many pigs. There has been much debate as to how much woodland this represents, but it is clear that if these entries represent the full extent of the woodlands then very little was present close to the City of London by then (Figure 3). All the large pig/pannage totals, bar two, are in the north of Middlesex, and it has been suggested that those two, the estates of Fulham and Stepney, owned by the Bishop of London, really referred to his estates in north Middlesex at Finchley and Hornsey respectively (Silvertown 1978). Rackham (1980) has plotted pannages against the woodland areas at this time where these are known. Using the best-fit curve to this I have estimated the areas of Middlesex woodlands referred to in the Survey. This gives the total area of woodland in Middlesex in 1086 as about 20 per cent of the area of the county (it is now about a tenth of this, with Middlesex being one of the least-wooded English counties). Presumably this was the 'Great North Wood of Middlesex' which is often postulated, encouraged by a reference in FitzStephen's enthusiastic account of London in the twelfth century: 'Close by lies an immense forest, in which are densely wooded thickets, the coverts of game, stags, fallow-deer, boars, and wild bulls'. Rackham (1980) has shown similar areas of woodland for other English counties at this period.

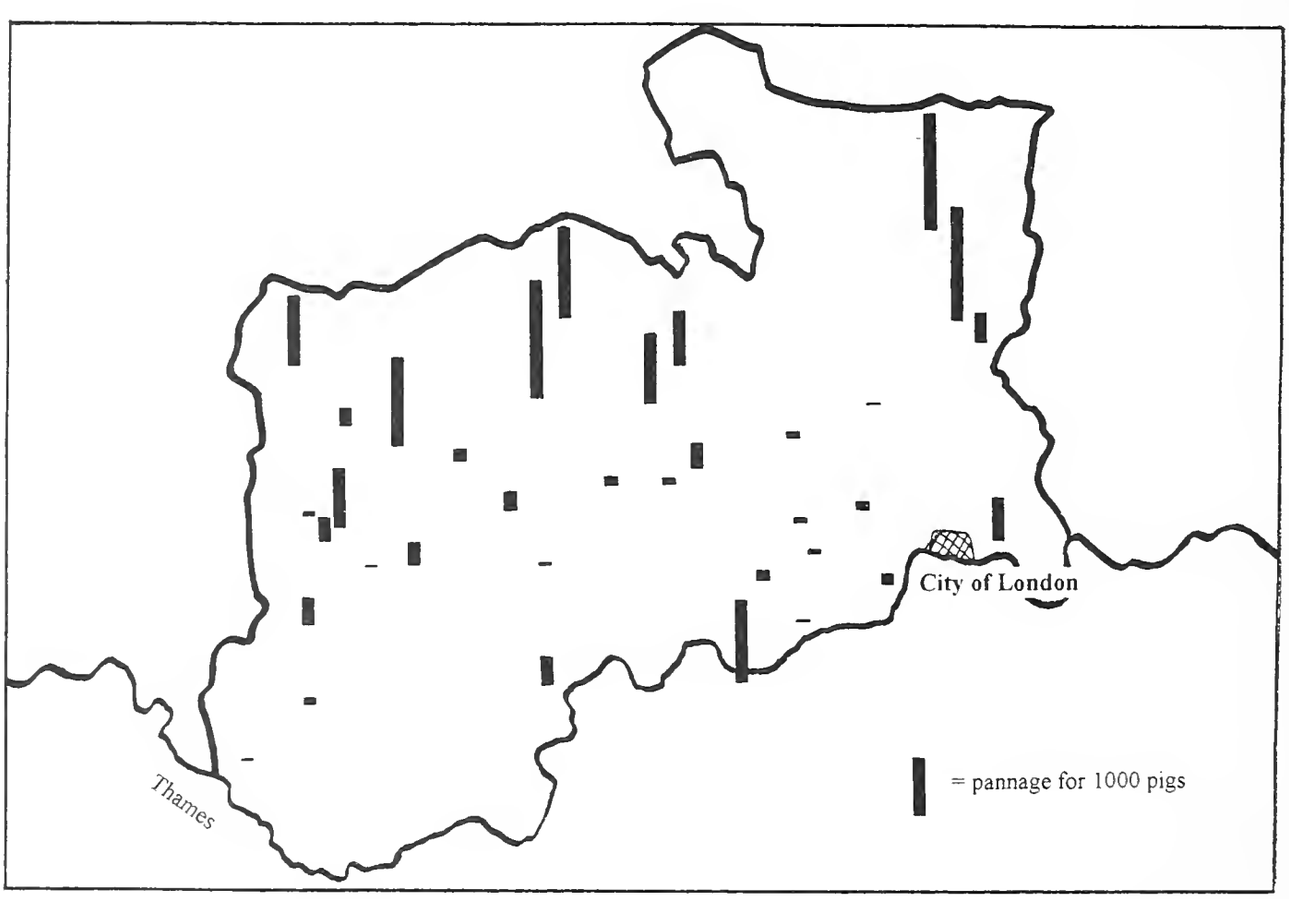


FIGURE 3. Distribution of Middlesex woodland, in pig totals, from the Domesday Survey of 1086.

Woodland by this time was clearly a valuable commodity which needed to be defined. An example of this is seen in the remains of a massive boundary bank in Mad Bess Wood, Ruislip (Figure 4), probably dating from the late eleventh century (Bowlt 1989), and separating the manors of the Abbey of Bec and the

FIGURE 4. Remains of medieval boundary bank topped by stubbed hornbeams separating two manors within the parish of Ruislip.

Abbey of St Catherine, both within the parish of Ruislip. This indicates that the considerable effort of construction of such a boundary was worth it. The boundary bank is topped by 'stubbed' hornbeams (cut periodically to produce branching at *c.*2 m above ground level); a typical feature of such boundary banks.

It is presumed that much of the woodland at this time was unenclosed with many activities taking place in it, such as animal grazing, gravel digging, and bracken gathering, in addition to cutting timber and wood (timber is the big stuff used in large constructions, wood is used for fuel, fencing, tool hafts, etc.). Such multi-use woodland is now termed 'wood pasture'. Grazing of the lower branches of trees would prevent growth below about 3 m and periodically cutting the branches above this produced 'pollard' trees. Hainault Forest, Essex, has relict pollard hornbeams indicating that it was once grazed. At Hatfield Forest, Essex, cows still graze under pollard hornbeams (Figure 5).

This situation could carry on satisfactorily whilst population pressure was small and animal grazing allowed some regeneration to succeed, but ultimately animal grazing had to be excluded from areas specifically set aside for wood and timber production. This was done by enclosing with a bank and ditch (presumably with a fence on top of the bank). Such enclosure can often still be traced today, particularly when it was done in a piecemeal fashion, leaving former boundary banks inside a wood now serving no useful purpose. This allowed the practice of coppicing, with trees for wood being periodically cut close to the ground. The regrowth from the resultant stools, and any regenerating seedlings, were not now eaten off. In the north London area the coppice in ancient woodland is frequently dominated by hornbeam (for example in Highgate, Queen's and Coldfall Woods, Haringey), but hazel and chestnut also occur elsewhere. Whether this reflects the medieval situation is not known. Oak was also coppiced, and relict examples, usually growing in a rather contorted

FIGURE 5. Relict wood-pasture with pollard hornbeams and cattle grazing, Hatfield Forest, Essex.

fashion, can frequently be found (for example in Oxhey Woods, near Watford). It seems to have been important for the bark for tanning, so perhaps the twisted wood did not matter (if it also grew that way in the past).

Rates of growth after coppicing vary depending on species, site, and probably genetic variability within a species. In the Ruislip Woods, chestnut can sprout two metres in a season, whereas hornbeam usually shoots only about a third as high. Coppiced hornbeam sometimes does not grow at all in the first season after cutting (probably when cut late), or one stool can grow five feet adjacent to one with half that growth. It seems likely that trees and coppice do not grow as fast, or as well, now as they did in the past if the woodland is ancient or primary. Ancient woodland is generally taken to have existed since at least AD 1600. Woods until recently were a very important economic resource, providing things which nowadays are replaced by oil and gas, bricks and cement, plastic and metal. As such, woods were continually cropped. No scrap of wood and timber was wasted. Even the twigs were bundled into faggots and no dead trees would be left standing for beetles. It was a one-way traffic with everything coming out of the wood. One would expect this to have gradually depleted the fertility of the woodland soils. Evidence for this might be the fast growth rates indicated by wide tree-rings frequently found in wooden structures in London dating from the medieval period (Tyers 1992).

Frequently trees for timber were grown interspersed amongst the coppice — this was termed 'coppice with standards' (Figure 6). In London, oak is, and presumably was, the most common standard tree, but other species occur and are locally prominent. Ancient woods did not contain large, old trees (Rackham 1980). They were working woods and there was no point in growing timber trees larger than necessary — they would have required the labour of cutting them up for use. The implications of this for wildlife can only be guessed, but must surely have affected breeding of hole-nesting birds and invertebrate and

FIGURE 6. Coppiced hornbeam stools with new growth and standard oaks. The two tall hornbeam poles (back left) had been left for seed in case the coppiced stools did not grow after a gap of forty-five years in the coppicing cycle. Mad Bess Wood, Ruislip.

lichen populations. There is evidence suggesting that timber trees remained small until the beginning of the nineteenth century in some parts of London (Bowlt and Bowlt 1984). Ancient woodland today does not usually contain very old trees, though many are probably bigger, and older, than in the medieval period due to lack of felling in recent times. Ken Wood, Hampstead, is an ancient wood and presumably was coppiced prior to it becoming part of a gentleman's estate more than 250 years ago when it appears to have ceased to be a traditional working wood. It now contains some large standard trees, mainly oaks and beeches, with some holly underwood, but sparse ground vegetation. This well illustrates how ceasing to cut and coppice trees suppresses vegetation under their canopy.

A form of ancient woodland of which I have found examples in London is what could be referred to as 'strip woodland'. Examples are to be found, for instance, at Uxbridge and Trent Park, Middlesex (Figure 7). Jones (1961) also described some on the Downs at Coulsdon, Surrey. They occur down the side of fields but are not simply overgrown hedges. They contain the features of ancient woods: coppice with standards, boundary banks and plants such as bluebell indicative of ancient woods. They appear to have been once quite common. Many early maps indicate such woods, sometimes along more than one side of a field as shown in the *c.*1587 estate map of Clitterhouse Farm, Hendon (Figure 8), where they are called 'shaws'. What was their origin? Were they left-overs from fields carved (assarted) out of woodland? They must have been valued at one time, but most were gradually grubbed up. On the Clitterhouse Farm estate the two groves and most of the shaws had gone by 1715 and only one remained by 1753. The effect of the greater woodland edge to area ratio on the growth of plants and wildlife would be worth investigating. Hunter (1996) has discussed such strips in Essex, Sussex and Kent, but outside

FIGURE 7. Looking through a 'strip wood', Trent Park, Cockfosters. Note the relict hornbeam coppice, plashed hedge and ditch, and standard oaks.

our area. He notes that in north and central Essex they appeared to have been termed 'springs', but in southern Essex and south of the Thames they were called 'shaws'.

There seems to have been surprising variability in the sizes and survival times of woods, even between adjoining parishes. In the parish of Harefield, in north-west Middlesex, research has found (Kiddle 1974) that over the last seven hundred years or so in addition to two larger woods, there have been many small ones, widely scattered, which seem to have come and gone. Some of these may have been secondary woods, but we cannot be certain about this with historical records so few. By contrast, the woods in the adjoining parish of Ruislip have consisted mainly of three large, ancient woods, closely contiguous, whose boundaries have hardly altered until this century. In other areas, some woods have existed for a long time, but have changed their boundaries and shape during that period. Oxhey Woods are a mosaic of ancient and secondary woodland. One part called Abbots Wood, once owned by the Abbey of St Alban's, is ancient woodland, but other parts have not been continuously woodland, even during the last 250 years. For instance, a part called Hill Field was indeed a field in 1822, but by 1871 it was woodland. Inside the wood today the former boundary of this piece is clearly delineated with planted coppiced chestnuts. One wonders what have been the implications for wildlife of such chopping and changing between woodland and fields.

Written records indicate just how many woods have disappeared over the centuries. There was probably always economic pressure to grub them up and cultivate the land. John Middleton (1798), commenting about Finchley Common, wrote 'On this common there are several thousand pollards, of hornbeam and oak [wood pasture], which never can produce a shilling to the lord of the manor, so long as they are allowed to occupy their present situation. Their numbers must annually decrease, as no new ones are permitted to rise, and I observed that several had been grubbed up. By taking the whole down at once,

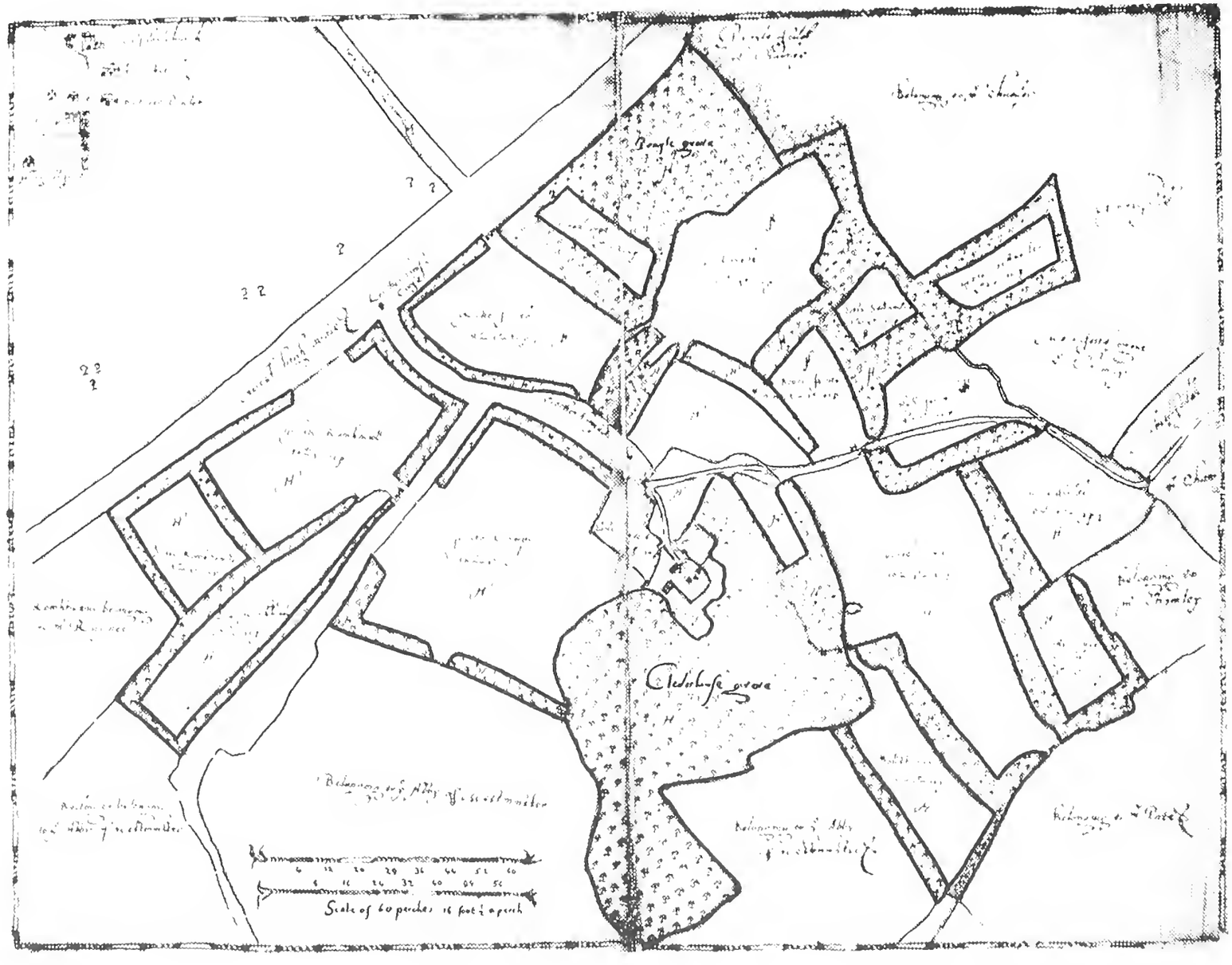


FIGURE 8. Map of Clitterhouse Farm estate, Hendon, *c.*1587, showing Prayle Grove (upper) and Clederhowse Grove (lower) with fields surrounded by strip woods. (By kind permission of St Bartholomew's Hospital Archive and Museum; HC 19, folio 70).

the proprietor might unquestionably put several hundred pounds into his pocket.' A curious case of pressure on a wood being so great as to lead to its rapid disappearance is that of St John's Wood. It is recorded that in 1664 the Scots invaded Newcastle and interrupted the shipment of sea-coal to London. The scarcity (and presumably the price) of coal drove the poor people to cut and carry off the entire wood. It seems to have disappeared as a wood about this time, so the poor must have taken even the roots otherwise it would have grown again, but it was not unknown for owners to take advantage of a situation like this to plough up woodland if they thought they could get a bigger return.

Woods today

Nowadays woods are no longer considered an economic asset. They are generally classed as amenities for leisure activities. Increasingly over the last ten to twenty years some form of management has been reinstated in many of them, but any wood or timber cut and sold hardly pays for itself. Woods are no longer an economic asset, but a liability. This frequently puts them under threat. A sad example is, or was, Bishop's Wood, just to the north of Ken Wood. Once part of the Bishop of London's Park of Haringey, it was built over in 1920. Many of the oak trees are still there in the gardens, but all the other things that go to make a wood are no more. The street name Bishop's Grove (Figure 9) is its 'tombstone'.

FIGURE 9. Site of Bishop's Wood, London Borough of Barnet. Note the standard oaks still growing in the gardens.

It seems doubtful if extensive planting of trees occurred in ancient woodlands. Planting trees is an expensive business and unless the ground is prepared they are inclined to die. Native (and some non-native) deciduous species usually regenerate themselves sufficiently to fill in any gaps. Plantations are a relatively new thing and are now usually associated with what is called 'forestry', but which has nothing to do with what went on in medieval forests. Black Park, Bucks., in the extreme west of our area, is a splendid example of a

FIGURE 10. Conifer plantation, Black Park, Buckinghamshire.

modern plantation (Figure 10), where the regular lines of even-aged conifers are treated like a farm crop: clear-cut when they have grown to the required size and the area replanted. There has been a tendency for naturalists to despise plantations, and it has to be said that the close planting does make them rather poor habitats until they have been thinned out. However, conifer plantations do provide some different niches for London wildlife which deserve to be better known.

In the nineteenth century some small woods of native trees were planted on gentlemen's estates. These seem to have been for both scenic attraction and coverts for game. A typical example is Ten Acre Wood near Northolt Airport. An estate sales map of 1864 shows the site of the wood as a field, but by the time of the 1870 Ordnance Survey map it was a wood with exactly the same boundaries as the former field. The trees today are practically all oaks and there is no coppice. The shrub layer is largely of hawthorn with some hazel. Current wisdom says that secondary woods like this should be poor in species of most groups of wildlife. Ten Acre Wood does seem to have a limited ground flora, but more recording needs to be carried out, not only here, but in a whole range of secondary woods, to find the full extent of differences between ancient and secondary woodlands.

The secondary woods discussed so far have been planted. In many ungrazed, and unmanaged places, woodland has arisen by natural regeneration, usually from the seed of local trees. Former grassland is often indicated by abandoned anthills which can persist for years under the developing scrub, as, for instance, in the one-time fields just to the north of Stanmore Underground Station. At many sites scrub of hawthorn and oak has developed. Both of these are bird sown and therefore can appear at considerable distances from a parent tree. In contrast hornbeam appears to be limited to the distance its winged seeds can be carried by the wind, about three times the height of the tree. Hawthorn can develop into very thick scrub, shading out most other plants. This can exist for

many years, but where oaks have managed also to get established these will ultimately begin to overtop and shade out the thorn, with a gradual opening up of the woodland. Eastern Wood on Bookham Common, Surrey, appears to have had this sort of history. However, many of the Surrey Commons have developed into birch woods, particularly on the gravelly soils. Birch seed is also wind dispersed, but being small and light can travel farther than that of hornbeam.

The process of natural regeneration of secondary woodland starts on any piece of ground left undisturbed for a few years. The LNHS bomb-site survey after the last war showed the first stages of this happening even in the centre of the City of London (Jones 1957). Here, away from the countryside, some exotic species also appeared. A more-recent example, further out from the City centre next to Chiswick Park Station, is the famous Gunnersbury Triangle, a Local Nature Reserve since 1987. This piece of secondary woodland is developing on a derelict piece of land last used for surface gravel extraction. At the moment it is largely a mixture of willow and birch with sycamore, Turkey and holm oaks, but rather few native oaks. This is presumably reflecting available seed coupled with chance conditions.

There is probably a greater range of types of woodland in London today than ever before. These include surviving ancient woodland; with coppice being managed again in some places in a more or less traditional manner, relict grazed woodland and strip woods. In addition there are more recently created coverts for sporting purposes, conifer plantations for timber, and areas naturally regenerating into woodland often containing some exotic species. In what form all these survive into the future will depend on the interference (management) they receive. Since this is so subject to fashion and finance we can expect a good deal of change in the years ahead, and plenty of interest for naturalists.

References

BAKER, C. A., MOXEY, P. A. and OXFORD, P. 1978. Woodland continuity and change in Epping Forest. *Fld. Stud.* **4:** 645–669.

BOWLT, E. M. and BOWLT, C. 1984. Size distribution of timber trees in Ruislip Woods in the seventeenth and nineteenth centuries. *Lond. Nat.* **63:** 71–78.

BOWLT, E. M. 1989. *The goodliest place in Middlesex.* Hillingdon Borough Libraries.

COTTON, J. 1986. A late bronze age spearhead and associated finds from Park Wood, Ruislip. *Trans. Lond. Middx. archaeol. Soc.* **37:** 1–16.

FITZSTEPHEN, W. 12th c. *Description of London. In* Stow, J. 1598, *A survey of London.*

GIRLING, M. and GREIG, J. 1977. Palaeoecological investigations of a site at Hampstead Heath, London. *Nature* **268:** 45–47.

GREENWOOD, P. and MALONEY, C. 1995. London fieldwork and publication round-up 1994. *Lond. Archaeologist* **7:** 345.

HUNTER, J. 1996. Essex springs and shaws. *In* Neale, K. (ed.), *Essex, full of profitable things*: 283–294. Leopard's Head Press.

JONES, A. W. 1957. The flora of the City of London bombed sites. *Lond. Nat.* **37:** 189–210.

JONES, A. W. 1961. The vegetation of Devilsden Wood and nearby Downs, Coulsdon, Surrey. *Lond. Nat.* **41:** 77–86.

KIDDLE, D. F. A. 1974. *The changing landscape of north west Middlesex.* Manuscript; Uxbridge Library.

MIDDLETON, J. 1798. *View of the agriculture of Middlesex.*

MILNE, G. and MILNE, C. 1982. Medieval waterfront development at Trig Lane, London. *Lond. Middx. archaeol. Soc.* Special paper No. 5.

MILNE, G. 1985. *The port of Roman London.* Batsford, London.

PETERKEN, G. 1981. *Woodland conservation and management.* Chapman and Hall.

RACKHAM, O. 1980. *Ancient woodland.* Edward Arnold, London.

RODWELL, J. S. (ed.) 1991. *British plant communities.* **1**. Cambridge University Press, Cambridge.

TYERS, I. 1992. New dendrochronology work. *In* Milne, G., Timber building techniques in London *c.*900–1400. *Lond. Middx. archaeol. Soc.* Special paper No. 15.

SILVERTOWN, J. 1978. The history of woodlands in Hornsey. *Lond. Nat.* **57:** 11–25.

Holland Park: a bramble oasis

D. E. ALLEN

Lesney Cottage, Middle Road, Winchester, Hampshire SO22 5EJ

Abstract

None of London's central parks has hitherto been thought to harbour more than three bramble microspecies (other than escapes from cultivation). Holland Park, however, proves to have nine, four of them in plenty. Two are particularly unexpected.

Introduction

Most British brambles normally reproduce asexually. What Linnaeus classified as just a single species, *Rubus fruticosus*, is now known to consist of many hundreds of true-breeding entities, each the product of a fertile cross in the past — in the case of those which reproduce asexually, a cross on one of the rare occasions when a reversion to sexuality has occurred. There are so many of these entities that it has become accepted practice among present-day *Rubus* specialists to privilege with a scientific binomial only those which have come to occupy a reasonably extensive tract of country. Even with this self-denying ordinance, however, there are at least a hundred recognized microspecies in each of the southernmost counties of England (except the Isle of Wight) that the respective local students of the group have to become familiar with.

Rubus in London

C. Avery, C. E. Britton, and W. C. R. Watson, who between them (Watson 1952) were largely responsible for our knowledge of the distribution of *Rubus* microspecies in the London Area, appear to have ignored the central parks completely, assuming that they were all too bereft of natural vegetation, as well as too efficiently weeded, to be capable of yielding any brambles of interest — or even any at all (other than the one or two liable to escape from cultivation). And on the whole that assumption was correct: St James's Park and Green Park can boast not a single one, Regent's Park has but a solitary bush of *R. surrejanus* Barton & Riddelsd., while the two main 'wooded' enclosures of Hyde Park and Kensington Gardens, although similarly harbouring one bush of the latter, otherwise contain just a uniform mass of *R. cissburiensis* Barton & Riddelsd. (Allen 1965, Kent 1965). An indeterminate member of Section *Corylifolii* has also been found in one of the non-public areas of Kensington Gardens. Even Buckingham Palace Garden, with its rich wild flora and fauna, has produced only *R. polyanthemus* Lindeb.

Holland Park

Compared to the above, Holland Park, however, has turned out to be a startling exception. The northern half of that has presumably kept its covering of plantations ever since the gardens of Holland House were laid out in the seventeenth century, for nothing else could account for the impressive species diversity of their wild *Rubus* flora. A thorough search of these one afternoon in mid June 1997 (an unusually advanced season) produced a total of nine species. Four of these (in addition to the escaped cultivated species, *R. armeniacus* Focke) proved both plentiful and widespread: *R. rudis* Weihe, a bramble characteristic of the North Downs woods, *R. moylei* Barton & Riddelsd., *R. dasyphyllus* (Rogers) E. S. Marshall and, as in Kensington Gardens, 1 km away, *R. cissburiensis*. The others were all rare. Three members of Section *Corylifolii*, namely *R. britannicus* Rogers, *R. nemorosus* Hayne ex Willd. and *R. tuberculatus* Bab., were not particularly surprising finds, but that was anything but the case with the two remaining species: *R. trichodes* W. C. R. Wats., of which respect-

ively a bush and a clump were encountered in two widely separate parts, has apparently been recorded previously in vice-county 21 (Middlesex) only from the ancient belt of woodland on London's north-west fringe; while *R. norvicensis* A. L. Bull & Edees, a patch of which was found on the margin of an enclosure by the north-east gate, is otherwise unknown in south-east England nearer than the Hampshire–Berkshire border at Silchester and the farthermost part of Essex round Colchester. This last, predominantly a bramble of the Norwich district (whence its name), has lately been turning up in areas as distant as Cardiganshire and Guernsey, and is under increasing suspicion of being accidentally dispersed with plants brought from nurseries. That is probably the source in this particular case too.

It seems unlikely that the Holland Park plantations are species-rich in this one group alone, and it may well be that investigation of their flora and fauna in further directions will prove no less rewarding.

References

ALLEN, D. E. 1965. The flora of Hyde Park and Kensington Gardens, 1958–1962. *Proc. bot. Soc. Br. Isl.* **6:** 1–20.

KENT, D. H. 1965. Further additions and corrections to the flora of central London. *Lond. Nat.* **44:** 18–28.

WATSON, W. C. R. 1952. *Rubus* L. *In* Kent, D. H. and Lousley, J. E., A hand list of the plants of the London Area. *Lond. Nat.* **31**, Suppl.: 74–100.

Book review

The atlas flora of Somerset. Compiled, edited and published by Paul R. Green, Ian P. Green and Geraldine A. Crouch. Crewkerne and Yeovil. 1997. xxiv + 292 pp. £25. ISBN 0 9531324 0 4.

This publication would hardly have been possible a mere ten years ago. Quoting from the authors' own description of themselves, 'Both Ian and Paul suffer from dyslexia and have great difficulty with spelling, grammar and pronunciation thus making the use of Latin names very difficult and attempting to write a book of any kind quite an achievement.' The meaning of that sentence, and of every other sentence in the book, is perfectly clear; the plant names are correctly spelled and the pages properly numbered in two sequences. This can be put down to intelligent use of the computer.

The book presents the records accumulated by the authors and many collaborators during 1987–97. It is noteworthy that the last records appearing both in the text and on the maps were added to the database only a few months before publication. The area covered is the modern county of Somerset, and although the exclusion of Avon, which includes a lot of the most interesting sites in the Watsonian vice-county 6, North Somerset, is fully justified on page vi, nothing is said about the effects of modern boundary changes on the border with Dorset. The species accounts show a good understanding of the importance of indicating the status of aliens. Another modern feature is the alphabetical list of 'A few of our favourite sites for botanising in Somerset', which assumes that the reader will want to go to them by car.

RODNEY BURTON

Readers may purchase this book for £20 post free direct from Ian P. Green, Farwells, Wayford, Crewkerne, Somerset TA18 8QG. Ed.

The natural history of Hounslow Heath Local Nature Reserve — vascular plants

MARTIN HOLT

London Borough of Hounslow, Hounslow Heath Local Nature Reserve, 450 Staines Road, Hounslow, Middlesex TW4 5AB

Contents

Summary

This article aims to provide an overview of the current state of the vegetation at Hounslow Heath Local Nature Reserve (LNR). Historical information necessary to understand the current vegetation distribution is provided, followed by a description and discussion of the plant life on the site. It is intended that other aspects of the natural history of the reserve, including fungi, lichens and bryophytes, birds, and invertebrates will be covered in future articles.

The author has been acquainted with the reserve for twelve years, from 1986 to 1997, in a monitoring and management capacity.

Introduction

Hounslow Heath LNR (Figure 1) is located between Hounslow and Feltham in west London, Grid reference TQ121748 (car park). It forms part of the Crane Valley chain which also includes Cranford Park to the north, Donkey Wood to the west and Crane Park, Feltham Marshalling Yard and Pevensey Road LNR (The Peter Cribb Memorial Reserve) to the south-west. The London Borough of Hounslow in responsible for the management of the reserve and most of the above sites. The area of the reserve is 197 acres (82 hectares) of which some 20 acres (8 hectares) has a heath-type vegetation, the rest being mesotrophic grassland over infill, and woodland. Due to previous disturbance, it is often difficult to categorize the vegetation neatly to National Vegetation Classification, however, it is fairly straightforward to compare the 'old' heathland with the 'new' post-activity vegetation, and that is what I have done.

A historical perspective

The nature reserve at Hounslow Heath is the last remnant of a huge expanse of heathland which once covered much of west Middlesex. Over the years the area has come under pressure first of all from agriculture, then industry, transport, the airport at Heathrow (the name itself having been derived from the Heath) and for housing. The reserve, and a few other areas, now mostly urban parks, were remnants left behind in the rush to develop the west London area. The history of the Heath is documented in a number of publications and maps of the area, including Roque's map of 1754 and subsequent Ordnance Survey maps which show the increase of man's activities at the expense of the wild landscape.

The survival of the site to the present day is due to a number of historical factors. The Forest of Staines, which occupied the whole area to the north of the loop of the River Thames from Staines to Richmond was declared royal hunting forest (Henry VIII's hunting lodge survives at Hanworth Park). Later,

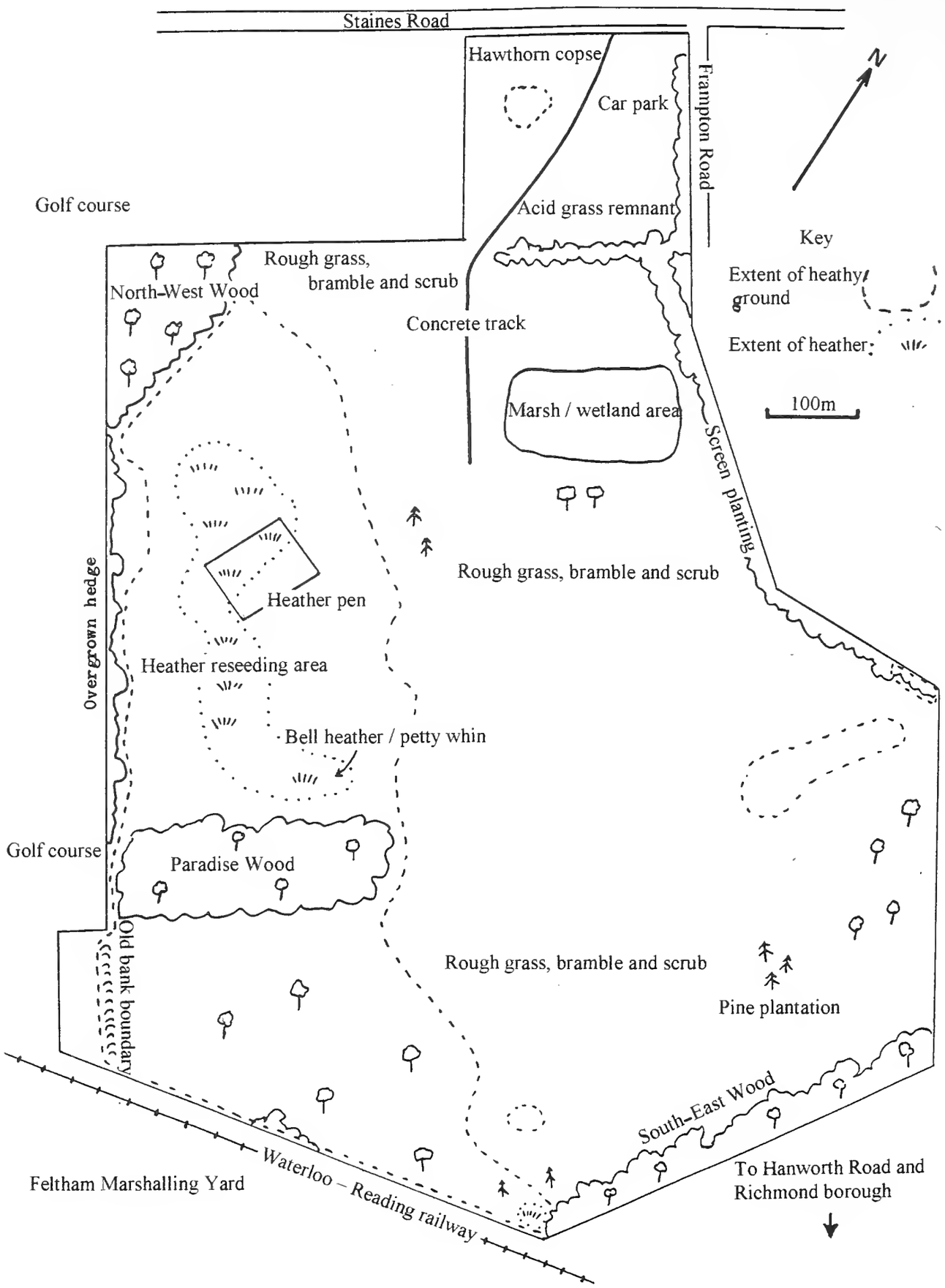


FIGURE 1. Hounslow Heath Local Nature Reserve.

the area was procured by the army as a parade and training ground. One way or another this military association continued right up to the 1970s, and although the army no longer has control of the area, there are still manned barracks to the north of the Heath at the further end of Barrack Road. The Hussar pub, opposite the reserve entrance, is another reminder of previous

military association with the site. In 1919 the present-day heath became the first international civilian airport in the country, and air command for the First World War was stationed there. The ministry land on which the command buildings stood was only finally sold off for housing in the late 1980s.

After the war the army maintained a presence on the Heath, but by then the surrounding areas were rapidly being developed. From the 1950s gravel extraction started on what is now the reserve and the neighbouring golf course. Plans and photographs held at the civic centre show the scale of the old pits, with the sites being worked in a rotation. The vast majority of the area of the reserve was excavated at this time. The domestic refuse of the burgeoning population of the area, industrial refuse, and probably building rubbish, replaced the gravels taken out of the pits, and this was then capped off (or not!) with a mixture of clay, gravel, topsoil and other materials. When the gravel companies finished with the site very little of the original soil or vegetation remained. The site was for all intents abandoned and reverted to wasteland. Fly-tipping was rife, and motorcycle scrambling, joyriding and shooting were commonplace. Nevertheless wildlife began to return, in the form of the native plants and animals which had had a tenuous hold during the quarrying period, and new species which were adapted to the changed face of the landscape.

In the 1960s the Greater London Council (GLC), who at the time owned the site, proposed building on the entire area, but the proposals had to be abandoned due to the subsidence of the landfill, and methane generation. At the beginning of the 1980s the wildlife value of the site came to the attention of the planning authorities, due in large part to the lobbying of the London Wildlife Trust (LWT), and resources were allocated to manage the site as a nature reserve. In 1992 the site was granted Local Nature Reserve status.

My own involvement with the Heath goes back to 1986 when I worked firstly for LWT, then as a Hounslow Council employee.

Heathland survivors

Over a limited area of the reserve the soil has remained suitable for a heathland flora to survive. Here the soil is of a neutral to acidic nature. The ground is stony or gravelly clay rather than sandy, and flat and well drained. Any bog plants which may have existed have long gone, yet there is still a good dry heath flora. Grass heath occurs in a number of places on the west of the reserve. The vegetation is maintained by occasional mowing and scrub removal. Brown top *Agrostis capillaris*, and red and sheep's fescue *Festuca rubra* and *F. ovina* are found, and heath rush *Juncus squarrosus*, heath grass *Sieglinia decumbens*, and mat grass *Nardus stricta*, are present. Mat grass appears unpalatable to rabbits and this must help it to survive here. Occasional patches of heath bedstraw *Galium saxatile* and tormentil *Potentilla erecta* are found in amongst the grass. *Cladonia* lichens and *Polytrichum* moss are also found.

Early hair-grass *Aira praecox* is a common component of the flora of a dry bank in the south-west corner adjacent to the railway line. This bank is an old feature which has survived the gravel extraction activities which occurred either side of it. It possibly dates back to the time of the enclosures and its survival is remarkable considering the disturbance which has gone on all around. The entire west boundary line is delineated by the bank, which for the most part is overgrown by hawthorn *Crataegus monogyna* (possibly the remnants of a hedge), sycamore *Acer pseudoplatanus*, oak *Quercus robur*, and various fruit trees. However, in the south-west corner of the reserve the bank is more open and here it supports the most interesting flora. Being dry, the vegetation is stunted. In addition to the hair-grass there is a fine glaucous form of sheep's fescue, bird's-foot *Ornithopus perpusillus*, wood sage *Teucrium scorodonia* and sheep's sorrel *Rumex acetosella.*

Sheep's sorrel is found commonly throughout the grass heath areas. It flowers

so profusely in some years that entire areas turn red. In other years hardly any plants can be seen at all. Another interesting plant which shares this tendency to come and go is the hemiparasitic red bartsia *Odontites verna*, which favours path-edge situations. Hare's-foot clover *Trifolium arvense*, which has been recorded several times in recent years, also favours gravelly path edges, whilst red spurry *Spergularia rubra*, favours the well-trodden path centre.

Of all the heathland plants which are hanging on by their fingernails, possibly that with the most tenuous hold is the petty whin *Genista anglica*. In recent years only a single plant has been found on the reserve. A further two plants did exist until 1995 near the railway, one outside the reserve boundary by the railway line, but in recent years fires appear to have killed these off. However, the species is easily overlooked and could yet be found in other localities. Another uncommon survivor is dwarf gorse *Ulex minor*. There are isolated plants scattered over the remnant gravel areas. Once again the railway side is an important area for this plant, but this time the regular fires resulting from sparks from passing trains seem to assist in the survival of the species by burning off competing taller vegetation. Another plant which warrants a mention as I have not seen it elsewhere in the area is the harebell *Campanula rotundifolia*, which has a very limited distribution by the railway.

I can remember one of my first visits to the Heath in 1985 was with Bob Kenyon who was then an active member of the London Wildlife Trust. LWT were lobbying for the Heath to have greater protection against development. At the time a few small and inconspicuous tufts of heather or ling *Calluna vulgaris* were all that could be seen. Today the area of heather, though not huge, has increased considerably, and is a conspicuous element of the vegetation, especially in and to the north of the 'heather pen'. This is so called as it was built to take some translocated heather from the adjacent ministry site before it was redeveloped for housing. Other isolated outposts of heather have also managed to hang on where the substrate is right. What is interesting about the regeneration of the species here is its distribution. A pattern can be seen in one or two areas correlating with the position of old tracks, especially an old motorbike circuit. These tracks can be verified by looking at the aerial photographs taken in the early 1980s. The seeds produced from the few surviving plants, and possibly some from the seed bank, have found conditions in these tracks more suitable for growth than elsewhere, maybe due to lack of competition from grasses. In an area to the south of the heather pen we reproduced this situation on a larger scale, by getting a mechanical excavator to remove all the topsoil following a fire, thereby exposing the gravel below the humus layer. This area was then sowed with heather seed harvested from the larger area of heather to the north. To date, about four years on, there are numerous small plants to be seen on this area. Rabbit grazing has kept many of the plants stunted, although a few flowers were found in 1996 and 1997. The summers of 1995 and 1996 were very dry, and the scrape area felt as hot as a desert for days on end. Even so, most of the young heather plants managed to survive the drought.

The other representative of the Ericaceae found on the reserve is bell heather *Erica cinerea*. A few plants are found in the heather pen, survivors from the transplanting experiments from the adjacent housing estate. Prior to the development of the housing estate the bell heather had been regenerating vigorously on some clinkery ground with dyer's greenweed *Genista tinctoria* and ling. The area was also an excellent area for slow-worms and common lizards, which found some piles of fly-tipped rubble ideal habitat. Sadly the authority overlooked our objections to development here and the whole lot was bulldozed to make way for a road. Two or three refugee plants of bell heather in the heather pen are all that survived. The summer of 1997 saw the discovery of another nine plants of bell heather in another location on the reserve, growing amongst gorse *Ulex europaeus*, broom *Cytisus scoparius*, and ling. Although grazed, they were flowering well. This area had been roughly rotavated several years

previously and it must be assumed that the activity had brought long-dormant seed to the surface.

Gorse and broom grow well in the areas with an acid soil which are not maintained for heather or grass. The occasional fires which sweep through the stands provide the ideal conditions for regrowth, and indeed the accumulation of dead dry material on the moribund gorse plants appears to invite burning as a kind of parental sacrifice for the seed scattered underneath. A number of colour variants crop up in the gorse and broom flowers, occasional plants having entirely red or pale lemon flowers. These are more likely to be dug up by the more stupid residents of the borough in the futile expectation of a free garden plant.

The dominant tree type on the gravel beds is oak, which has a low and branched growth form maybe due to lack of nutrients in the soil and possibly as a response to fires and vandalism. Overall however there does seem to be some phenotypic consistency, with the older trees having a gnarled and stunted appearance, often with considerable epicormic growth. Even though the biggest trees are not particularly large, they may be older than their size suggests. In any case they represent the remnant of a natural population. The introduction of oaks from external sources in recent years will in time have implications for the integrity of the population. Any further planting which is done should be from local seed. There are very few other tree species which grow on the gravel. Hawthorn has established here and there, as has an occasional sycamore. These do not appear to be invasive here, and in the last couple of years many local trees and saplings have been killed by sooty-bark disease, caused by the fungus *Cryptostroma cauticaule.* (This is particularly so in the Donkey Wood, where the disease has killed even some quite large trees. With the death of elm regrowth as well, due to Dutch elm disease, the canopy in the wood is now quite open.)

The introduction of pines *Pinus sylvestris* and *Pinus nigra*(?) onto the heathland area by the GLC was surely just a bad mistake. Most have subsequently died due to fire, and no seedlings have appeared. (Elsewhere, away from the heathland, a couple of pine plantations have been maintained to provide some variety.)

Fire plays a role in maintaining the area as heathland. The last large fire, in 1995, burned off a large area of gorse and broom in the heathy south-west corner of the reserve. Many of the smaller of the regenerating oaks were also burned off at that time. This was a large fire, which burned off all top growth and provided conditions for opportunists such as heath groundsel *Senecio sylvaticus*, which occurs regularly after burning. Tall rocket *Sisymbrium altissimum* and thale cress *Arabidopsis thaliana* also took advantage of the open areas, before succession by grasses and sheep's sorrel began again. A small amount of dame's violet *Hesperis matronalis* was seen in 1996. Rosebay willowherb *Chamerion angustifolium* is more persistent and may survive for three to four years after a fire. In 1991 a white-flowered plant occurred.

Some other small areas of heathy vegetation occur away from the main western area of heath. A small strip survives on the eastern edge of the reserve. This was previously planted up with screen planting, some of which has recently been removed to encourage regeneration of heath flora. Some areas of gorse and broom occur, and a little dyer's greenweed is found in the northern part of this strip. These plants are from seed collected from the adjacent site prior to development, and are considered to be a cultivar rather than a persisting local population (R. M. Burton pers. comm.). Fencing protects the area from disturbance and provides a refuge where slow-worms and grass snakes can still be found.

Recent colonizers

The heathy remnants occupy only a small area of the site. Over the majority of the area the vegetation shows little indication that it was once heathland. The

soil has been so modified by gravel extraction and dumping that heathland regeneration has been impossible. Here the vegetation reflects the variable clayey nature of the capping over the rubbish dump. By far the commonest grass is false oat grass *Arrhenatherum elatius* which occurs in dense swathes across the central and eastern sections of the reserve. Other grasses such as *Holcus lanatus* and *Agrostis tenuis* indicate local variations in the underlying substrate.

This mesotrophic grassland is at first glance a bit monotonous, however, inspection reveals a large number of associated species. Many of these are aliens, remnants of cultivation which probably arrived with refuse which was dumped in the pits. Some, such as Japanese knotweed *Fallopia japonica*, horse radish *Armoracia rusticana* and hoary cress *Lepidium draba* are overly common. Intensive efforts to control the knotweed over the last few years have been successful, and it is now much less expansive than formerly. Mopping up operations over the next couple of years should see it eradicated from the site. Other aliens occur in discrete areas, and show little inclination to spread. Lupins *Lupinus polyphyllus*, goat's-rue *Galega officinalis*, soapwort *Saponaria officinalis*, star of Bethlehem *Ornithogalum umbellatum*, a large Duke of Argyll's teaplant *Lycium barbarum*, bladder senna *Colutea arborescens*, and Spanish broom *Spartium junceum* are long-term alien survivors which do not seem to have been deliberately introduced.

Native herb species are also numerous. Cow parsley *Anthriscus sylvestris* agg. is abundant. The following, and many others, are all seen regularly, but in varying amount depending on the year: wild carrot *Daucus carota*, bristly ox-tongue *Picris echioides*, great prickly lettuce *Lactuca virosa*, tufted vetch *Vicia cracca*, grass vetchling *Lathyrus nissolia*, meadow vetchling *Lathyrus pratensis*, hairy and smooth tares *Vicia hirsuta* and *V. tetrasperma*, common mallow *Malva sylvestris*, cut-leaved geranium *Geranium dissectum*, dove's-foot cranesbill *Geranium molle*, germander speedwell *Veronica chamaedrys*, white and yellow melilot *Melilotus alba* and *M. officinalis*, meadow and bulbous buttercup *Ranunculus acris* and *R. bulbosus*, and ox-eye daisy *Chrysanthemum leucanthemum.*

In 1988, three bee orchid *Ophrys apifera* plants were found on the reserve, the first orchid recorded. In subsequent years numbers have ranged from none in 1995 and 1996 (drought) to several hundred in 1993. A single pyramidal orchid *Anacamptis pyramidalis*, was found in 1993, curiously very near to a specimen of the mainly maritime yellow vetch *Vicia lutea.*

Although succession to scrub has been slow in many areas, elsewhere dense bramble occurs, and hawthorn is now encroaching. This provides an excellent scrub/grassland habitat. Additionally there has been a great deal of tree planting, especially along the eastern perimeter by the school, and here a wide range of species is becoming established.

Over the last six years I have been planting hedges along the major footpaths in an attempt to restrict access. To date the effects have been fairly negligible. Fire, drought, trampling and deliberate vandalism have conspired to keep top growth down. However, the hawthorn, which is now planted almost exclusively, shows remarkable tenacity in the face of adversity. The roots are becoming established and once well down produce good strong shoots. Where one shoot is burned off, dozens of shoots reappear from the base. Currently the 'hedges' comprise rows of such shoots, maybe a foot tall. We try and get a row of 200–400 metres planted every year.

Fires are commonplace in the rank grass areas in the summer. Where thatch from the grass builds up the heat kills all shrubby growth and the grassland is to an extent self perpetuating. However, here and there larger shrubs and trees have survived and are now well enough established to be able to survive the periodic fires. A number of larger oak, cherry and hawthorn are closing canopy in some areas. The bramble survives burning very well, shooting back from underground stems and roots. An assemblage of quick-growing species some-

times occurs where the brambles have been burned off. These include sun spurge *Euphorbia helioscopia*, fumitory *Fumaria officinalis* agg., rape *Brassica napus* and wild radish *Raphanus raphanistrum*. Interestingly, in 1997 a large patch of wild arum *Arum maculatum* was found under an oak in one of these burned areas. This is the first natural occurrence of the species to the reserve. Steve Jones introduced some arum seed from the Donkey Wood into the Hawthorn Copse behind the yard in 1988 and the plants are still there.

Towards the flats at Edgar Road a small population of *Pinus sylvestris* was planted in 1985, and about a dozen of these have survived. These have been supplemented with another couple of dozen plants in 1997. The grove provides variety from the surrounding grassland. Locals also view them as a source of Christmas trees, and inevitably one or two get decapitated each year.

Woods

Woodland occurs in a number of areas on the reserve, generally around the margins of the site. The three main areas are the imaginatively named Paradise Wood, and the much less imaginatively titled North-West and South-East Woods. Elsewhere there are small clumps or isolated trees and some of the screen plantings of the 1980s are almost woodland belts now. The three main woods are predominantly pedunculate oak, with some ash *Fraxinus excelsior*, birch *Betula pendula*, hawthorn and other singles. Early Ordnance Survey maps show no mature wood on the site, but it appears almost impossible that there has not been some continuity of tree presence in these areas. Invertebrate surveys by John Herbert are turning up many ancient woodland indicator species, suggestive of continuity of cover. Also, I suspect that the frequent vandalism may replicate to a degree 'ancientness' by providing niches not normally encountered in young, vigorous secondary woodland, by encouraging rot holes, etc. It would indeed by an irony if this were the case.

The South-East Wood shows some good structure, with a field layer of ivy *Hedera helix*, garlic mustard *Alliaria petiolata* and ground ivy *Glechoma hederacea*, and dense shrub layer of blackberry *Rubus fruticosus* agg., raspberry *Rubus ideus*, whitebeam *Sorbus aria* agg., rowan *Sorbus aucuparia*, yew *Taxus baccata*, honeysuckle *Lonicera periclymenum* and holly *Ilex aquifolium*, mostly fairly recently established. In the extreme west of the wood there is regenerating elm *Ulmus procera* suckering, and the decaying remains of the original elm trunks. Here the ground flora includes a small area of small yellow balsam *Impatiens parviflora*.

Paradise Wood also has a poor ground flora, with some creeping soft grass *Holcus mollis* and straggling honeysuckle. Birch, sallow *Salix atrocinerea*, and wild cherry *Prunus avium* accompany the oak here. A small old gravel-pit is located in the wood. Previously this was rather optimistically referred to as a pond. It still has a little sweet grass *Glyceria fluitans* and lesser spearwort *Ranunculus flammula* in the bottom, but is fairly dry now.

The North-West Wood is mostly young oak with some open areas and damp depressions. The area was once the location of a firing range, and the remains of the wall can still be seen. At the base of the wall is a small seasonal pond. The ground here is gravel, and the banks are bare of vegetation, nevertheless a small colony of sweet grass *Glyceria declinata* survives in the middle. A ditch runs along the northern flank of the wood. Here pendulous sedge *Carex pendula* occurs with some yellow flag *Iris pseudacorus*, reedmace *Typha angustifolium*, and water pepper *Polygonum aviculare*. Male fern *Dryopteris filix-mas* occurs in the vicinity here. A three-spiked clump of broad-leaved helleborine *Epipactis helleborine* was seen here from 1993 to 1995 and may well still be present, although it was not seen in the drought year of 1996, or in 1997.

The marginal screen-planting belts provide interest in the variety of cultivars and non-natives which were supplied as whips by commercial growers to the GLC who undertook most of this planting. This is a constant danger when

ordering so-called 'natives' as clearly many nurseries have a fairly broad view of what constitutes native. Red oaks *Quercus rubra*, double flowered pink hawthorn *Crataegus monogyna* 'Paul's scarlet'(?), grey alder *Alnus incana*, and various fruiting *Prunus* cultivars were all planted, presumably in good faith. Some of these have been left as they are part of the much-needed screening. Bird cherry *Prunus padus*, white poplar *Populus alba*, and (possibly) Italian poplar *P.* × *canadensis* are other inappropriate choices which have made the best of the opportunity presented to them. Ground flora at present under the screen planting is negligible.

The wetland area

This is an area of marshy ground and some small ponds formed by localized collapse of underlying fill and by mechanical excavation. The area is fenced to provide a refuge from dogs. The vegetation is of a fen type. Common reed *Phragmites australis*, has been introduced into the area from rhizome cuttings, and provides some screening for the central scrape area. Reedmace *Typha latifolia*, is common, whilst willow and sallow seedlings are rapidly colonizing bare earth areas. The marginal and herbaceous vegetation includes a number of species with limited local distribution. Trifid bur marigold *Bidens tripartita* appears in variable quantity from year to year. Bur-reed *Sparganium erectum*, water mint *Mentha aquatica*, water plantain *Alisma plantago-aquatica* and brooklime *Veronica beccabunga* are all seen here. A small patch of fleabane *Pulicaria dysentrica* was found in 1988 and has since produced a number of satellite colonies. Lesser spearwort *Ranunculus flammula* was recorded in 1997. Greater spearwort *Ranunculus lingua* occurs in a couple of places. A previous 'ecologist' employed by the borough introduced this and a number of other plants of unknown provenance into the area. A rather fetching pink water lily appeared briefly about this time. A number of alien species are of note. Floating water fern *Azolla filiculoides* occurred in great quantity after digging operations, but there is no trace of it now. Similarly, New Zealand stonecrop *Crassula helmsii* was found in 1996, but encouragingly seems to have failed to survive to 1997. Michaelmas daisy *Aster novi-belgii* is on the march in the dryer parts of the wetland area, and in other areas of the reserve. It appears to have some competitive advantage in drought-hit wetland habitats. On the positive side, a single tall spike of common spotted orchid *Dactylorhiza fuchsii*, was found in the middle of a dense patch of the daisy in the centre of the wetland area in 1995. The reappearance of such plants is encouraging, as they are indicative of the continued development and recolonization of the reserve.

References

The following were consulted during the survey:

BURTON, R. M. 1983. *Flora of the London Area.* LNHS, London.
FITTER, R. 1985. *The wild flowers of Britain and northern Europe.* Ed. 2. HarperCollins.
ROSE, F. 1981. *The wild flower key.* Warne.

The flora of Croydon's ponds

J. McLAUCHLIN
33 Norman Avenue, Sanderstead, Surrey CR2 0QH

M. JENNINGS
106 Langdale Road, Thornton Heath, Surrey CR7 7PQ

Contents

Summary

Plants growing in and around ponds in the London Borough of Croydon have been surveyed. Cluster analysis, used to put the ponds into groups, shows how diverse the ponds are in terms of their plants.

Introduction

The London Borough of Croydon is rather deficient in wet areas. Formerly there were extensive ponds and other bodies of water derived from the River Wandle (Thornhill 1987), but these are no longer open. Only a few small stretches of the Bourne, which becomes the Wandle, remain unculverted in Whyteleafe and Coulsdon. The Wandle emerges at Waddon Ponds, but the outflow leaves Croydon and passes into the London Borough of Sutton. However, there are some thirty permanent ponds in Croydon, excluding those in private gardens. Most of these are owned by the London Borough of Croydon, and most are accessible to the public. There are also some short lengths of small streams and some damp patches which may hold water in wet weather (ACCS 1993). The ponds are mostly man-made, but vary considerably in size and construction, and whether they have 'natural' banks or concrete sides. Their situations range from ornamental ponds in parks to natural stream-fed ponds in woods to historic village ponds. These ponds and damp patches are the only habitat in Croydon for submerged and marginal water plants.

The pond survey

The survey was instigated by the ACCS (Association of Croydon Conservation Societies) to add detail to the Water Map of the London Borough of Croydon (ACCS 1993).

Each pond was visited twice during 1994 and 1995. The size and physical character of the ponds were recorded using criteria based on those of Fookes (1993) (Table 1). All the marginal and submerged plants were recorded (Table 2). In the case of the starworts *Callitriche*, plants with leaves like an open-ended bicycle spanner (Stace 1997: 580, 582) were recorded as *C. intermedia.* Otherwise, *Callitriche hamulata* and *C. brutia* were not separated as not all the ponds were visited in late summer when the plants are identifiable by their fruits. Invertebrates were sampled by dipping with a net, and the number of species recorded. The presence of fish, amphibians and waterfowl was also noted (Table 1).

The similarities between the plant communities in the ponds was calculated using cluster analysis (Jacobsen and Gunderson 1986). This technique can be

TABLE 1. Ponds in Croydon.

	Location (north to south)	Grid reference	Approx. size m.	Bed	Depth	Stream in	Tree shade	Fish	Amphibians	Water-fowl	Invertebrate species
1	Beulah Hill	TQ318706	30 × 15	N	3		2	Y	Y	Y	12
2	Beaulieu Heights in wood	TQ333697	10 × 4	N	2	S	2		Y		4
3	Beaulieu Heights by mast	TQ323696	4 × 2	N	1	S	2		Y		5
4	Beaulieu Heights springs	TQ323695	10 × 2	N	1	S	1		Y		5
5	South Norwood Lake	TQ341692	200 × 120	C	3	S	1	Y		Y	6
6	South Norwood Country Park	TQ356684	100 × 80	N	3	S	1	Y		Y	13
7	Brickfield Meadows	TQ342677	30 × 30	N	3	S	1	Y	Y	Y	12
8	Millers Pond 1	TQ369656	30 × 30	C	3	S	2	Y		Y	15
9	Millers Pond 2	TQ369657	20 × 15	N	2	S	2	Y	Y	Y	11
10	Whitgift	TQ345654	10 × 8	N	3	S	2	Y			9
11	Waddon Ponds	TQ309651	200 × 20	N	2	S	2	Y		Y	10
12	Lloyd Park	TQ339649	6 × 4	N	1	S	4		Y		4
13	Pinewood Lake	TQ361649	80 × 20	N	3	S	2	Y	Y	Y	6
14	Addington Hills	TQ353647	4 × 4	N	2		3				6
15	Three Halfpenny Wood	TQ376646	12 × 8	N	2	S	2				11
16	Coombe Wood	TQ346644	15 × 10	N	2	S	2	Y		Y	6
17	Spout Hill	TQ371642	10 × 5	N	2	S	2	Y	Y		6
18	Heathfield large	TQ354638	20 × 15	C	2		1	Y	Y		4
19	Heathfield Rockery	TQ354638	8 × 4	C	2	S	2	Y	Y		8
20	Bramley Bank	TQ352637	10 × 10	N	3		2	Y	Y		11
21	Littleheath Wood	TQ354629	8 × 8	N	1		3		Y		2
22	Sanderstead	TQ341614	12 × 10	N	2	R	1		Y		16
23	Hamsey Green	TQ350595	8 × 6	N	2	S	2	Y	Y	Y	19
24	Bradmore Green	TQ309583	25 × 25	N	3	R	1	Y	Y		14
25	Coulsdon Common	TQ322571	10 × 8	N	2		3		Y		17
26	Ditches Lane	TQ305564	10 × 10	N	2		2		Y		11

Not surveyed

TQ322623 Purley Balancing Pond
TQ363613 Selsdon Wood Pond
TQ338594 Riddlesdown Chalkpit Pond
TQ369657 Millers Pond 3

BED

N natural: mud, clay, silt, etc.
C concrete

DEPTH

1 less than 30 cm
2 30–60 cm
3 more than 60 cm

STREAMS

S stream or spring-fed
R road wash
Y present

TREE SHADE

1 0%
2 1–33%
3 34–66%
4 >67%

TABLE 2. Plants in Croydon ponds.

	Pond (see Table 1)																									Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	ponds
Agrostis stolonifera		×	×	×		×				×																	5
Alisma plantago-aquatica						×														×				×			3
Alopecurus aequalis																		×									1
Alopecurus geniculatus				×																				×			2
Apium nodiflorum						×						×															2
Aponogeton distachyos																		×									1
Azolla filiculoides																						×		×			2
Blechnum spicant															×												1
Callitriche ham./brut.										×							×		×			×				×	5
Callitriche intermedia										×			×														2
Callitriche stagnalis							×		×								×					×	×	×	×		7
Caltha palustris						×										×	×		×	×							5
Cardamine flexuosa														×			×										2
Cardamine pratensis									×							×											2
Carex acuta																			×								1
Carex acutiformis														×													1
Carex otrubae						×																					1
Carex sylvatica														×				×		×							3
Carex pendula	×							×	×	×		×				×				×			×	×			9
Carex remota														×													1
Ceratophyllum demersum										×										×		×		×		×	5
Chamerion angustifolium						×								×	×	×											4
Chara globularis var. *globularis*	×																										1
Chara vulgaris var. *vulgaris*	×												×			×											3
Cirsium arvense	×	×	×	×		×				×																	6
Cotula coronopifolia						×																×					2
Crassula helmsii										×												×		×	×		4
Cyperus longus	×	×										×												×			4
Eleocharis palustris																						×		×			2
Elodea canadensis	×												×				×		×	×		×	×	×	×		9
Elodea nuttallii							×												×								2
Epilobium hirsutum	×	×	×	×		×	×	×	×	×							×					×	×				12
Filipendula ulmaria																×											1
Galium aparine										×						×											2
Glyceria declinata															×												1
Glyceria fluitans		×								×		×		×						×			×	×	×	×	9
Glyceria maxima			×		×																					×	3
Glyceria maxima 'variegata'										×						×					×	×					4
Glyceria plicata																						×					1
Hippuris vulgaris							×																				1

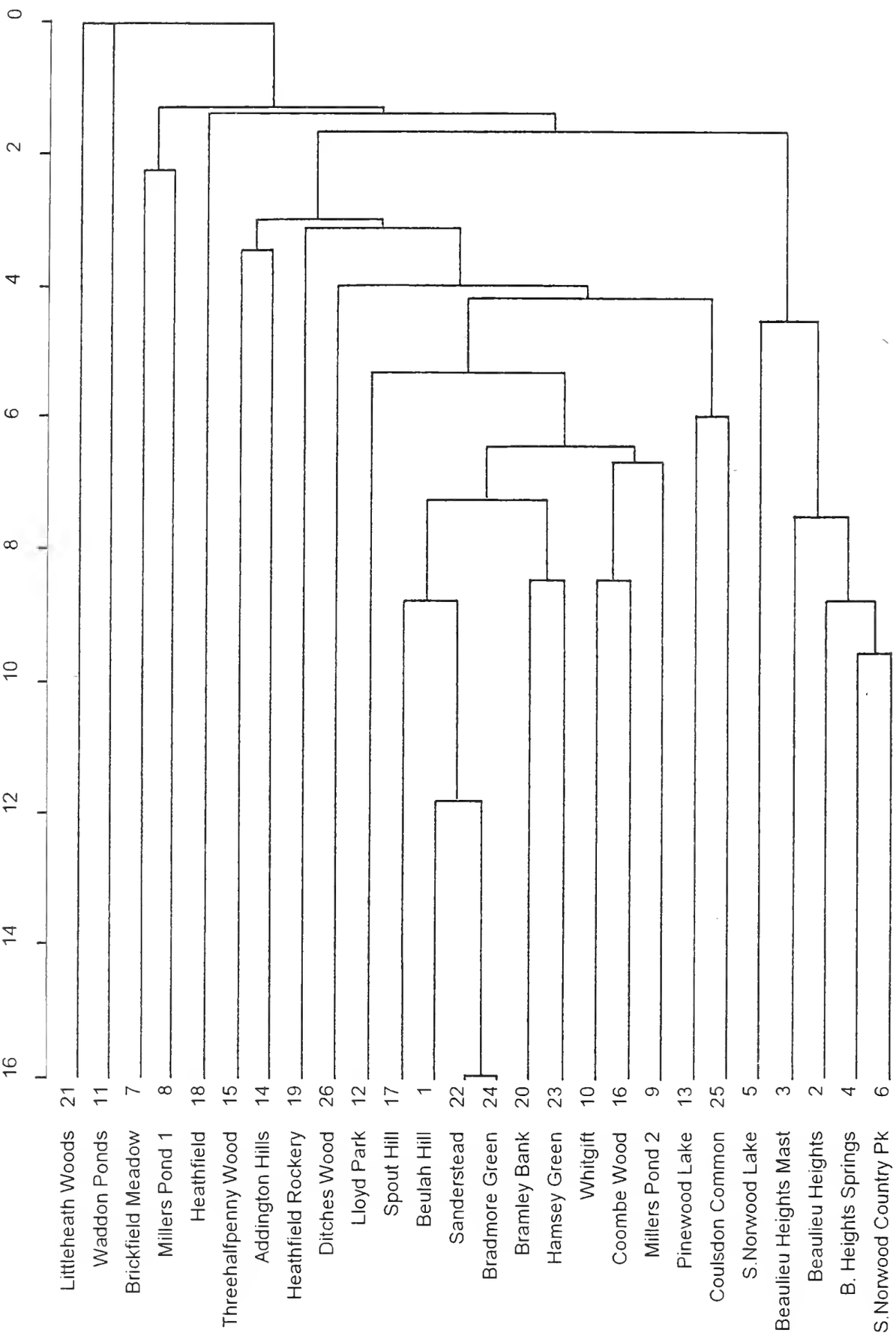
TABLE 2. — *continued*

	Pond (see Table 1)																									Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	ponds
Hydrocharis morsus-ranae																				×							1
Ilex aquifolium	×																										1
Iris pseudacorus	×	×			×	×		×	×	×		×		×	×	×	×	×	×	×		×	×	×	×	×	20
Isolepis setacea						×																					1
Juncus articulatus																						×					1
Juncus bufonius						×																		×			2
Juncus compressus																	×										1
Juncus effusus	×	×				×			×				×	×	×					×		×	×	×	×	×	13
Juncus inflexus		×				×	×													×							4
Juncus tenuis		×											×														2
Lagarosiphon major	×											×	×					×				×		×	×		7
Lemna minor	×	×	×	×		×	×		×	×		×	×		×				×	×		×		×	×	×	17
Lemna minuta																						×				×	2
Lemna polyrhiza																				×		×		×		×	4
Lemna trisulca										×										×		×				×	4
Lotus uliginosus													×														1
Lycopus europaeus	×	×							×								×					×					5
Lysichiton americanum																×											1
Lythrum salicaria						×																					1
Mentha aquatica				×		×			×	×			×									×		×			7
Menyanthes trifoliata																								×			1
Myosotis scorpioides	×			×						×							×					×			×		6
Myriophyllum aquaticum	×																×					×		×			4
Myriophyllum spicatum	×																									×	2
Nymphaea alba									×	×						×		×	×	×		×					7
Nymphoides peltata																						×	×	×			3
Osmunda regalis																×			×								2
Persicaria amphibia						×									×												2
Persicaria maculosa	×		×			×																		×			4
Phalaris arundinacea						×																					1
Phyllitis scolopendrium																×											1
Plantago major	×	×	×	×		×																					5
Polygonatum multiflorum									×																		1
Potamogeton crispus	×							×					×											×			4
Potamogeton natans													×							×					×		3
Ranunculus flammula		×																									1
Ranunculus lingua	×			×		×									×	×						×					6
Ranunculus peltatus																						×				×	2
Ranunculus repens		×	×	×																							3
Ranunculus sceleratus	×																										1

TABLE 2. — *continued*

	Pond (see Table 1)																									Total
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**ponds**
Rorippa nasturtium-aquaticum						×				×						×						×					4
Rumex obtusifolius	×	×	×	×						×		×				×	×			×							9
Scirpus lacustris						×										×											2
Scrophularia auriculata										×																	1
Solanum dulcamara	×		×										×														3
Sparganium erectum	×																										1
Sphagnum sp.															×												1
Stratiotes aloides								×																			1
Trifolium repens	×			×																							2
Typha angustifolia						×	×																				2
Typha latifolia	×					×	×	×								×	×			×		×	×	×			10
Urtica dioica		×		×					×	×		×	×			×						×					8
Veronica beccabunga				×		×					×									×							4
Veronica catenata											×																1
Total species	26	16	9	15	1	28	8	6	12	21	2	9	13	8	8	19	14	6	8	20	0	29	11	24	10	12	

TABLE 3. Dendrogram of relations between ponds.



used to find internal groupings within a data set without comparison to any external classifications. Cluster analysis is available as part of multivariate statistics computer programs.

However, for a data set this size, it is practicable to do the calculations with the aid of any computer spreadsheet. The ponds were compared on the basis of which plants were recorded in common, and the 'average neighbour distances' calculated. From the results, a dendrogram is drawn in which ponds joined by the shortest 'legs' are most closely related (Table 3). This can then be used to place the ponds in groups. Results from clustering methods are descriptive; the relative closeness of the relationships but not the absolute numbers are important.

Results

The ponds in Croydon are diverse in their vegetation. Ninety-five plant species were recorded in total, but no pond had more than 29 (30 per cent of the total). However, some groups emerge which can be related to the characteristics of the ponds.

Two ponds are not related either to each other or to any other ponds. The Littleheath Woods Pond (Number 21) was densely shaded and had no vegetation at the time of the survey. Waddon Ponds (Number 11) is a different pond physically from the others in the Borough. It is one of the largest and has a high water flow from the River Wandle. It is in a public park with surroundings which are attractively managed horticulturally, and it also has a very large population of water birds, especially coots *Fulica atra* which cause considerable water disturbance.

All the ponds in the north of the Borough (Numbers 2 to 6), except 1 (Beulah Hill Pond) form a group. The three Beaulieu Heights ponds are close together, and are small ponds or damp patches where the London Clay and High Level Terraces meet (British Geological Survey 1981). South Norwood Country Park and South Norwood Lake are also on the London Clay. These two ponds do not seem to make a very homogeneous group with the Beaulieu Heights ponds. They are both artificial; the former has been created recently as part of the transformation of the former sewage works into the South Norwood Country Park, with gently sloping banks planted with emergent plants. South Norwood Lake is a large concrete lake which was formerly a feeder reservoir for the Croydon Canal (Anon. 1986), and is now used for sailing and fishing. Only one plant species was recorded, and the relation of this pond to the others in the group is very low, but the entire group is very distant from the rest of the ponds in Croydon. This group of ponds is characterized not by true aquatic plants, but by marginals which are not restricted to ponds, but also grow in other places of varying degrees of dampness, such as creeping bent *Agrostis stolonifera*, creeping thistle *Cirsium arvense*, great willowherb *Epilobium hirsutum*, greater plantain *Plantago major* and broad-leaved dock *Rumex obtusifolius*. These reflect the gently sloping banks, the fluctuating extent of the water and the heavy soil.

Sanderstead (22) and Bradmore Green (24) ponds are the most similar. These are both medium-sized old village ponds, shallow-edged, surrounded by grass and adjacent to busy roads. Beulah Hill Pond (1) is also related: it is of similar size and also adjacent to a main road, which will make it subject to pollution from road run-off. The ponds in this group have some of the highest plant species counts. These ponds are conspicuous, well-known to the public, and are therefore likely to have their plant and animal life complement added to when garden ponds are cleared out. The variegated forms of reed sweet-grass *Glyceria maxima* in Sanderstead Pond is an obvious example. Other plants, which are native in some situations, could also have come from garden ponds, particularly large rapidly spreading species such as fringed water-lily *Nymphoides*

peltata, yellow iris *Iris pseudacorus* and bulrush *Typha latifola*. Less closely related to this group is Spout Hill Pond (17), although physically it is unlike the rest of this group.

Whitgift (10), Coombe Wood (16) and Millers Pond 2 (9) make up a rather loose group. (The Millers Ponds system, in Shirley, is a sequence of three ponds, pond 1 in a public park of mown grass and shrubs, and ponds 2 and 3 (3 was not visited) on private land). These ponds emerge from the boundaries between the Blackheath Pebble Beds and the impermeable London Clay, but so do most of the other ponds in the east of the Borough (ponds 8, 9, 12 to 20). This group is then more loosely related to the Sanderstead–Bradmore Green group.

The remaining ponds do not fall into well-defined groups, showing how diverse in character they are.

The plants which occur in the largest number of ponds are aquatics (common duckweed *Lemna minor* and Canadian waterweed *Elodea canadensis*) and marginal plants. Although soft-rush *Juncus effusus*, great willowherb, floating sweet-grass *Glyceria fluitans* and broad-leaved dock are likely to occur naturally at these sites, the remainder of the list could either grow naturally or come from deliberate introduction (Table 4).

TABLE 4. Commonest plant species and ponds with most plant species.

Commonest species	**Number of ponds**
Iris pseudacorus	20
Lemna minor	17
Juncus effusus	13
Epilobium hirsutum	12
Typha latifolia	10
Carex pendula	9
Elodea canadensis	9
Glyceria fluitans	9
Rumex obtusifolius	9

Ponds with most species	**Number of species**
Sanderstead Pond	29
South Norwood Country Park	28
Beulah Hill Pond	26
Bradmore Green Pond	24
Whitgift Pond	21
Bramley Bank Pond	20

Six ponds had twenty or more species of plants. The pond in South Norwood Country Park is recently created and was artificially although naturalistically planted with a large number of plants. The high counts for Sanderstead, Bradmore Green and Beulah Hill ponds are probably a combination of native plants in old ponds and deliberate introductions because these ponds are near roads and therefore well-known to the public. The ponds with concrete beds (Table 1) have rather low species counts, but so do some ponds with natural beds. The number of species is not dependent on the size or depth of the pond, or to the amount of shading by trees (Tables 1 and 2). Ponds with the largest number of plant species had high invertebrate species counts, but the converse is not true; some ponds also with many invertebrates did not have a large number of plant species (for example 23, Hamsey Green Pond). This may be a reflection of the sampling for animals rather than a real relation.

Discussion

It is not the obvious physical features which determine either the flora in these ponds or their similarities. The survey shows that there is no single or simple

predominating factor which determines the flora of the ponds, such as geographical proximity, pond size, or physical features of the pond or of its surroundings. It might be expected that ponds in a restricted area of one London borough might be quite similar, but actually they are rather diverse. No pond had more than 30 per cent of the total species recorded (29 out of 95). Thirty-one species, almost one-third of the total, were only recorded from one pond, and a further twenty from two ponds.

Ponds are some of the most rapidly changing habitats. Fluctuating water levels are natural and should not be seen as undesirable (Biggs et al. 1994). Although ponds which dry out give rise to great public concern, this does not seem detrimental to floral diversity. Sanderstead Pond dries out regularly during the summer, yet had the highest number of plant species recorded in this survey, and among the highest invertebrate species counts. The group Pond Action encourages the acceptance of ponds drying out as creating further diversity of habitats of no less conservation value such as marshes and wet woods, as long as new ponds can also be established (Biggs et al. 1994). In an urban area like Croydon, however, opportunities for creating new ponds are rare (the large pond in South Norwood Country Park was a notable exception), and existing ponds need to be managed to maintain their conservation and historic value.

Great efforts have been made, especially by volunteer groups, to maintain ponds, trying to prevent drying out by removing large rapidly spreading plants such as bulrush in Sanderstead, Bradmore Green and Beulah Hill ponds. Total elimination of these species is impossible and undesirable because of the cover the stands provide for invertebrates and vertebrates, even quite large ones such as ducks.

It is important to monitor the effects of management. Any survey is only a snapshot in time of a habitat, and it is especially difficult to establish what changes are the effects of management and which are due to other causes. Management should aim at maintaining variety within the pond, and not to change the habitat to the detriment of the existing flora and fauna. This is especially important with such a diverse group of ponds, with so many plant species in only one or two of them. Even though none of the species is rare, they are important in a local context because of the scarcity of wet habitats, and inappropriate management of the ponds could result in loss of some of these plants from the Borough. Ponds are dynamic habitats, and management strategies should aim for diversity.

References

ACCS (Association of Croydon Conservation Societies). 1993. *Croydon water map.* Unpublished.

ANON. 1986. *Retracing canals to Croydon and Camberwell.* Living History Publications and Environment Bromley, Local Guide No. 7.

BIGGS, J., CORFIELD, A., WALKER, D., WHITFIELD, M. and WILLIAMS, P. 1994. New approaches to the management of ponds. *Br. Wildlife* **5:** 273–287.

BRITISH GEOLOGICAL SURVEY. 1981. 1:50,000 Series Map, Sheet 270, *South London.*

FOOKES, G. 1993. *Survey of Tandridge ponds.* Personal communication, unpublished.

JACOBSEN, T. and GUNDERSON, R. W. 1986. Applied cluster analysis. In *Statistical procedures in food research.* Ed. J. R. Piggott. Elsevier Applied Science.

STACE, C. 1997. *New flora of the British Isles.* Ed. 2. Cambridge University Press.

THORNHILL, L. 1987. From palace to washhouse. *Proc. Croydon nat. Hist. scient. Soc.* **17:** 209–248.

Book review

Larger moths of Surrey. Graham A. Collins. Surrey Wildlife Trust, 1997. 333 pp., 16 colour plates. £18 plus £3 p. & p. ISBN 0 9526065 2 6.

Surrey is perhaps regarded by many as one of the better English counties in terms of the number of species of Lepidoptera present, yet surprisingly this book is the first attempt at a summary of the available knowledge of that county's lepidopteran fauna since the publication of the *Victoria county history* — almost a hundred years ago. In this task, the author Graham Collins achieves total success.

An initial chapter places Surrey in context geographically and there follow brief and very readable chapters on geology, collecting and conservation, methods of studying moths and a valuable account of species that have become extinct, decreased or increased in Surrey. As is normal in such publications, the bulk of the work which follows is given over to the accounts of individual species recorded.

Distribution maps accompany all species other than immigrants and very scarce species. Records are shown on these maps for the past twenty-year period which makes comparison with maps in *Larger moths of the London Area* (covering the years 1980 to 1991) entirely practical. Whether this is deliberate or by default I am not sure, but it is certainly a positive step when two adjacent county faunas, especially where there is a geographical overlap, are compatible with each other.

There is little in the book that can really be criticized. I find Graham's sliding scale of frequency from common through fairly common, uncommon and scarce to rare a little bit vague and not always absolutely adhered to in the species accounts, but readers will doubtless be able to place their own interpretations on the data which are presented in a most comprehensive and accurate manner. The set of sixteen colour plates in the centre of the book adds little to the scientific content and could perhaps better have been devoted to more text or even a list of the micro moths so far known from the county.

The book joins similar works in the same series on butterflies (by the same author), dragonflies (by Peter Follett) and — in the gap between publication of the book and publication of this review — hoverflies* (by Roger Morris). Anyone at all interested in insects in the London Area is positively advised of the importance of all these books which are available from the Surrey Wildlife Trust headquarters.

COLIN W. PLANT

**Hoverflies of Surrey*, by Roger K. A. Morris has just been published, price £15 plus £2.70 p. & p. and is available from Surrey Wildlife Trust, School Lane, Pirbright, Woking, Surrey GU24 0JN. Ed.

Corticolous myxomycetes from central London

BRUCE ING

Department of Biology, University College, Chester CH1 4BJ

Contents

Abstract

Thirty-nine species of myxomycetes have been recorded on the bark of living trees within a radius of ten kilometres from Charing Cross. Many are new records for the London area and suggest an improvement in acid pollution of bark, the importance of guano from roosting birds as a neutralizing agent on bark and the value of non-native ornamental trees as a substrate for epiphytic myxomycetes.

Introduction

The majority of myxomycete species are associated with dead fallen trunks and branches or leaf-litter on the forest floor. Others occur on fallen plant remains in other habitats, including the margins of melting snow patches on mountains in spring, and in *Sphagnum* bogs. A significant number of species are found primarily on the bark of living trees, often associated with epiphytic algae, bryophytes or lichens. These species are rarely if ever found in other habitats and may be thought of as obligate corticoles — (A) in the list below. Several other species are of frequent occurrence on tree bark, but may also be found on recently fallen branches and trunks, completing their life cycles after the fall of the limb; these may be thought of as facultative corticoles — (B). Finally, a number of species more usually found on decaying wood and in leaf-litter occasionally appear in cultures of tree bark, usually after several weeks of moist chamber culture. These have probably developed from spores accidentally trapped on bark which later find the culture conditions, especially the constant moisture and availability of bacterial food, suitable for their development. These may be termed casual corticoles — (C).

Corticolous myxomycetes are nowadays studied using the moist chamber culture technique. Small pieces of bark are carefully removed from living trees, without removing phloem or cambium if possible, and carried in sterile, labelled envelopes. As soon as possible the bark is placed on filter paper in 9-cm petri dishes and soaked with deionized or distilled water for twenty-four hours. The excess water is then pipetted off and the bark examined under a stereomicroscope (at least $\times 20$ magnification is required and preferably the ability to magnify to $\times 40$). Myxomycete sporangia are visible after as little as twelve hours and for the first week it is advisable to examine the bark daily, after that less frequent observation is acceptable. Cultures should be kept for at least three months to allow casual corticoles to produce identifiable sporangia. If the bark is not kept sufficiently moist filamentous moulds, especially *Mucor*, *Aspergillus*, *Penicillium*, etc. may overgrow the bark and this prevents the development of myxomycetes. If the bark is kept too wet bacteria dominate and any plasmodia that materialize may disintegrate before they are ready to sporulate. Thus a careful watch on the dishes is necessary. Sporangia may be removed

with a fine needle, scalpel tip or ultra-fine forceps and examined microscopically in the usual ways.

It has been assumed in the past that city centres are too heavily contaminated with airborne pollutants for corticolous myxomycetes to survive. A few especially 'tolerant' species, such as *Arcyria pomiformis*, *Enerthenema papillatum* and *Paradiacheopsis fimbriata*, together with the acrasian *Pocheina rosea*, are characteristic of naturally acid-barked trees such as pines, and are usually the first species to appear in cultures of bark from polluted areas. There is some, so far unpublished, evidence that experimental acidification of bark reduces the diversity of the myxomycota and may also inhibit the development of the commoner species at extreme levels. This has given rise to the idea that urban trees are less rich in myxomycetes than those from rural areas (Härkönen 1977). If, as is widely suggested, the levels of sulphur dioxide pollution in the London area have reduced in recent years, then the bark myxomycete population should reflect this with an increase in diversity. In order to assess the evidence, this paper brings together all that is known about the occurrence of corticolous myxomycetes within ten kilometres of Charing Cross. Records from the author's own studies are supplemented by data from David Mitchell and Alick Henrici and thus allow rather more sites to be included.

The first work was carried out in 1963 in Hampstead and Highgate, both at the edge of the 10-km circle. A few samples were made in the 1960s closer to central London but no myxomycetes were then recorded. During the last twenty years more samples have been taken, approaching closer to the centre, and during early 1997 it was possible to study trees in the garden of Buckingham Palace, which proved to be exceptionally rich. During the winter of 1997/8 several more sites, notably central London parks, were studied. In addition, a few samples from just outside the study area were collected for comparison.

Sites

(with 1-km grid squares, all in TQ)

BMY — Bermondsey, 3380, bark cultured by D. W. Mitchell, 1985.
BPE — Battersea Park East, 2877, bark collected February 1998.
BPG — Buckingham Palace Garden, 2879, bark collected January 1997.
BPW — Battersea Park West, 2277, bark collected February 1998.
CHC — Clapham Common, 2874, bark collected in 1983.
CHP — Clapham Park, 3074, bark collected February 1998.
CSP — Clissold Park, 3286, bark collected February 1998.
ESQ — Euston Square, 2982, bark collected December 1997.
FBP — Finsbury Park, 3187, bark collected February 1998.
GPE — Green Park East, 2980, bark collected December 1997.
GPW — Green Park West, 2880, bark collected December 1997.
HBF — Highbury Fields, 3185, bark collected February 1998.
HHH — Hampstead Heath, 2686, bark collected in 1963 and 1965.
HLP — Holland Park, 2479, bark cultured by A. Henrici, 1988.
HPN — Hyde Park North, bark collected February 1998.
HPS — Hyde Park South, 2779, bark collected February 1998.
KGN — Kew Green, 1877, bark collected February 1998.
KGS — Kew Gardens Station, 1976, bark collected February 1998.
KTP — Kennington Park, 3177, bark collected February 1998.
NHL — Notting Hill, 2480, bark collected in 1983.
QWH — Queen's Wood, Highgate, 2888, bark collected in 1981.
RCP — Ravenscourt Park, 2278, bark collected February 1998.
RGP — Regent's Park, 2883, bark collected in 1988.
SJP — St James's Park, 2979, bark collected December 1997.
SKN — South Kensington, 2679, bark collected January 1997.
SNB — Snaresbook, Eagle Pond, 3988, bark collected June 1997.

TBC — Tooting Bec Common, 2872, bark collected February 1998.
TGC — Tooting Graveney Common, 2891, bark collected February 1998.
TGN — Turnham Green, 2178, bark collected February 1998.
VEG — Victoria Embankment Gardens, 3080, bark collected February 1998.
WPX — Whipp's Cross, Hollow Pond, 3988, bark collected 1971.

Myxomycetes

A number of the species records are new for vice-counties 17 Surrey, 18 South Essex, and 21 Middlesex.

Arcyria cinerea (Bull.)Pers. (B)
On *Aesculus*, *Platanus*, *Robinia* and *Taxus*.
BPG, BPW, HPS, QWH, WPX.
Widespread and common on dead wood and bark; one of the typical bark species in native oakwoods.

A. pomiformis (Leers)Rostaf. (B)
On *Acer*, *Crataegus*, *Malus*, *Platanus*, *Taxus* and *Tilia*.
BPG, BPW, CHC, CSP, FBP, HBF, HHH, KGN, QWH, RCP, RGP.
Widespread and common on dead wood and bark; one of the typical bark species in native oakwoods, often on more-acid substrates that *A. cinerea*.

Badhamia foliicola Lister (B)
On *Aesculus* and *Platanus*.
BPG, HBF, KTP.
Widespread and frequent on grass, occasionally a temporary 'problem' on lawns, and not uncommon on bark.

Calomyxa metallica (Berk.)Niewland (A)
On *Crataegus* and *Platanus*.
BMY, BPG, GPE.
Widespread but not common on bark, usually of mature trees.

Comatricha ellae Härkönen (A)
On *Populus*.
BPG.
A very rare species with only three previous British records; this may have been overlooked for the very small developments of *C. nigra* which are occasionally found on bark. New to v.c. 21.

Comatricha laxa Rostaf. (B)
On *Platanus*, *Quercus* and *Tilia*.
BMY, BPG.
A common and widespread species on fallen branches, but frequent on bark. Surprisingly, new to v.c. 21.

Comatricha nigra (Pers.)Schröt. (C)
On *Pinus*.
BPG.
One of the commonest myxomycetes on fallen wood of all kinds, but not uncommon in bark cultures after several weeks.

Comatricha rigidireta Nann.-Bremek. (A)
On *Aesculus*, *Platanus*, *Quercus* and *Tilia*.
BPE, BPG, CSP, HPN, HPS, RCP, SKN.
An uncommon species which often forms large developments on bark. New to v.c. 17 and 21 and the London area.

Diderma effusum (Schw.)Morg.
On *Aesculus*.
ESQ.
A frequent species of leaf-litter and not infrequently found in long-maintained bark cultures.

Didymium clavus (Alb. & Schw.)Rab. (C)
On *Platanus.*
BPG.
A common and widespread litter species, typical of oak litter, but quite often found on bark.

Echinostelium apitectum Whitney (*vanderpoelii* Nann.-Brem., Mitchell, Lakhanpal & Chopra) (A)
On *Pinus* and *Robinia.*
BPG.
Widespread and frequent in Europe, Asia and north Africa. New to v.c. 21, but known from Kent, Surrey and Sussex..

Echinostelium brooksii Whitney (A)
On *Aesculus* and *Platanus.*
BPG, BPW, CHP, ESQ, FBP, GPW, HPN, KGN, KTP, SJP, VEG.
A widespread and frequent species which develops rapidly in culture and may have disappeared after the first week: characteristic of bark on isolated trees and therefore typical of parkland. New to v.c. 21.

Echinostelium colliculosum Whitney & Keller (A)
On *Acer*, *Aesculus*, *Platanus*, *Populus*, *Quercus* and *Salix.*
BPG, CHP, GPW, HBF, SNB.
A common and widespread species which develops after one or two weeks in culture. New to v.c. 18 and 21; elsewhere in the London area known only from Surrey.

Echinostelium corynophorum Whitney (A)
On *Acer*, *Eucalyptus*, *Quercus*, *Taxus* and *Tilia.*
BPE, BPG, CSP.
One of the 'expected' species on *Eucalyptus*, but not yet recorded from Australia, although widespread in Europe, including the British Isles, and North America. New to v.c. 21, but known from Kent and Surrey.

Echinostelium fragile Nann.-Bremek. (A)
On *Platanus*, *Robinia* and *Salix.*
BMY, BPE, BPG, RCP, RGP, SNB.
Another species characteristic of isolated trees. New to v.c. 18 and 21.

Echinostelium minutum de Bary (A)
On *Acer*, *Aesculus*, *Fraxinus*, *Platanus* and *Taxus.*
BMY, BPG, CHP, GPW, HBF, HHH, HPS.
The largest and perhaps commonest species of the genus, widespread in the London area.

Enerthenema papillatum (Pers.)Rostaf. (B)
On *Platanus.*
BMY, CSP.
A common species on fallen branches of oak and pine in woodlands of many kinds and a common myxomycete on oak bark. It is therefore surprising that there are so few records from bark in central London, although recorded on Hampstead Heath on fallen branches in 1963 and in Buckingham Palace Garden in autumn 1997.

Licea belmontiana Nann.-Bremek. (A)
On *Aesculus.*
KGS.
Widespread but not common; new to v.c. 17 and the London area.

Licea biforis Morgan (A)
On *Aesculus*, *Platanus* and *Salix.*
BPG, ESQ, GPW, HBF, SNB.
An uncommon, usually southern species, rare in the London area — Kent, Surrey and Sussex — but also known from Perivale Wood (1988, A. Henrici on *Sorbus torminalis*). New to v.c. 18.

Licea denudescens Keller & Brooks (A)
On *Aesculus*, *Platanus* and *Salix.*
BPG, CSP, GPE, GPW, HPN, KGS, SNB.
A minute and inconspicuous myxomycete, often found on bark lichens, but here associated with cyanobacteria. This species is commoner in the western areas of the British Isles and is new to v.c. 18 and 21.

Licea inconspicua Keller & Brooks (A)
On *Platanus* and *Salix*.
RGP, SNB.
Another very inconspicuous species and thus rarely reported; new to v.c. 18 and 21 and to south-east England.

Licea kleistobolus Martin (A)
On *Acer*, *Aesculus*, *Crataegus*, *Malus*, *Pinus*, *Platanus*, *Populus*, *Pterocarya*, *Quercus*, *Salix* and *Taxus*.
BPE, BPG, CSP, FBP, GPW, HBF, HPN, HPS, KGS.
A common but often overlooked species, usually on thin-barked trees and vines, widespread and known from Kent, Surrey and Sussex in the London area and also from Perivale Wood, which is in an urbanized area of Ealing 15 km west of Charing Cross, where it grew with *L. biforis*.

Licea marginata Nann.-Bremek. (A)
On *Aesculus*, *Castanea*, *Fraxinus*, *Platanus*, *Populus* and *Salix*.
BPG, BPW, CHP, ESQ, FBP, GPW, HPN, SNB, TGN.
Another minute species, but not uncommon on neutral to base-rich bark, especially where enriched by nitrogenous bases from bird droppings. Recorded from several sites in the south-east of England; new to v.c. 18.

Licea minima Fr. (B)
On *Aesculus*, *Quercus* and *Salix*.
BPG, CHC, ESQ, TBC.
Widespread and frequent on thick, moist bark, on fallen conifer trunks and even on decaying bracket-fungi. Recorded throughout the London area, but older records may have included some closely related, and more recently described, species.

Licea operculata (Wingate)Martin (A)
On *Aesculus*, *Platanus* and *Salix*.
BPE, BPG, CHP, KGN.
Uncommon, but very distinctive, one of the few species of the genus that may be identified in the field. Known from Kent and Surrey, but new to v.c. 17 and 21.

Licea parasitica (Zukal)Martin (A)
On *Acer*, *Aesculus*, *Fraxinus*, *Platanus*, *Salix*, *Sophora* and *Tilia*.
BPE, BPG, BPW, CSP, FBP, GPW, HBF, HPS, KGS, RCP, SNB, TGC.
The commonest *Licea* and often so abundant that the whole bark surface is covered with the distinctive 'pork pie'-shaped sporangia. Previously known from all other parts of the London area, but new to v.c. 21.

Licea pusilla Schrad. (B)
On *Platanus*.
BMY.
As common on fallen pine wood as on tree bark, this species has been found in Essex, Kent, Surrey and Sussex.

Licea pygmaea (Meylan)B. Ing (A)
On *Platanus*.
BPG, FBP, HBF, KGN, KTP.
A minute relative of the previous species, this appears to be restricted to bark, where it is uncommon. New to v.c. 17 and 21 and the southern half of England.

Licea scyphoides Keller & Brooks (A)
On *Salix*.
BPG.
Commonest in moister, Atlantic woodlands and known only previously in south-east England from Sussex; new to v.c. 21.

Licea tenera Jahn (A)
On *Taxus*.
BPG.
A rare and poorly understood species, perhaps confused with minute forms of *Perichaena* which have no capillitium. The American concept was of a dung dweller (Martin and Alexopoulos 1969), and this would agree with some *Perichaena* taxa. This gathering appears to be the typical bark species which has five previous British records, including Essex and Surrey, and is thus new to v.c. 21.

Licea testudinacea Nann.-Bremek. (A)
On *Aesculus* and *Platanus*.
BPG, ESQ.
Similar to *L. minima*, but readily distinguished under the microscope, this is a far less common species. Known from Kent, but new to v.c. 21.

Paradiacheopsis cribrata (Nann.-Brem.)Nann.-Brem. (A)
On *Acer*, *Aesculus*, *Platanus*, *Quercus*, *Salix* and *Tilia*.
BPE, BPG, CSP, HPS, RCP, SNB, TGC.
Widespread and frequent, known from Kent and Sussex, but new to v.c. 17, 18 and 21.

Paradiacheopsis fimbriata (G. Lister & Cran)Hertel (A)
On *Acer*, *Aesculus*, *Castanea*, *Fraxinus*, *Pinus*, *Platanus*, *Populus*, *Pterocarya*, *Quercus*, *Robinia*, *Salix*, *Sophora* and *Tilia*.
BMY, BPE, BPG, BPW, CHC, CSP, FBP, GPW, HBF, HLP, HPN, HPS, KGS, KTP, NHL, QWH, RCP, RGP, SNB, TBC, TGC, TGN.
The typical urban bark myxomycete, but also characteristic of bark in pine forests throughout Europe; widespread and common in south-east England.

Paradiacheopsis microcarpa (Meylan)Mitchell (A)
On *Aesculus* and *Pinus*.
BPG, CSP.
A rare species on acid-barked oaks and pines, known previously in Britain from Cheshire, north Wales and southern England, thus new to v.c. 21 and the south of England.

Paradiacheopsis solitaria (Nann.-Bremek.)Nann.-Bremek (A)
On *Acer*, *Aesculus*, *Castanea*, *Platanus*, *Populus*, *Quercus*, *Salix* and *Tilia*.
BPG, CSP, HPS, KGN, KTP, SNB.
This species is usually regarded as being typical of semi-native woodland and is by no means common in south-east England, except in ancient woodland. Its presence on mature trees in the gardens at Buckingham Palace and the London parks is of considerable interest in terms of possible ecological continuity. New to v.c. 18.

Perichaena chrysosperma (Currey)Lister (B)
On *Platanus*.
BPG, GPE, HPS, KTP.
A widespread and common bark species in western areas, but much less common in the drier east. Its presence in central London is as interesting as the last species, for the same reasons.

Perichaena depressa Libert (B)
On *Platanus*.
BPG.
A widespread and fairly common species on bark on fallen trunks, especially of *Fraxinus*, in southern Britain, this species is rarely found on bark of living trees.

Physarum compressum Alb. & Schw. (C)
On *Castanea*.
BPG.
A common myxomycete of vegetable refuse and grass-based plant litter, this soil species is occasionally developed in bark cultures after several weeks.

Pocheina rosea (Cienk.)Loeblich & Tappin (A)
On *Aesculus*, *Castanea*, *Pinus*, *Populus*, *Quercus* and *Salix*.
BPG, CSP, HLP, HPN, HPS.
This acrasian is common on acid bark, especially of conifers and oaks and is typical of polluted areas. It is widely distributed in southern Britain.

Discussion

This list of thirty-nine species includes several additions to the myxomycetes of the London Area (Ing 1965) and indicates the value of the moist chamber technique in contributing new data. More importantly it suggests a major amelioration of the atmospheric conditions in central London. The most intriguing data come from the results of culturing *Platanus* bark. The thin peeling bark of the London plane and its eastern European parent, *P. orientalis*,

has hitherto been regarded as of little value as a substrate for myxomycetes. However, the bark selected for culture in this study consisted mainly of the thick plates between one and two metres above the ground. Here the accumulation of nitrogenous bases from bird droppings has produced a natural source of neutralizing or at least buffering the impact of acid deposition and, moreover, provides a valuable source of bacteria and other micro-organisms for myxomonad and plasmodial feeding. The value of non-native park trees as a substrate for corticoles has been shown by studies in Switzerland (Ing 1997) where amenity plantings are as important as native woodlands for bark myxomycetes. Central London is well endowed with parks, commons, cemeteries and relict ancient woodlands and further studies are planned so that better comparisons may be made between inner and outer London, and between semi-natural and artificial sites, linked to studies on pollution effects on other organisms.

Acknowledgements

I am grateful to David Mitchell and Alick Henrici for supplying details of their bark cultures and to Peter Holland for his companionship and kind hospitality on many occasions over the period of this study.

References

HÄRKÖNEN, M. 1977. Corticolous myxomycetes in three different habitats in southern Finland. *Karstenia* **17:** 19–32.

ING, B. 1965. A hand list of the plants of the London Area. Myxomycetes. *Lond. Nat.* **44:** 30–42.

ING, B. 1997. Corticolous myxomycetes from Switzerland. *Mycologia helvetica* **9:** 3–19.

MARTIN, G. W. and ALEXOPOULOS, C. J. 1969. *The myxomycetes.* University of Iowa Press, Iowa.

Book review

A key to the adults of British lacewings and their allies. Colin W. Plant. *Field Studies* **9:** 179–269. Field Studies Council, 1997. £6.95. ISBN 1 85153 201 3.

The study of lacewings (Neuroptera and related orders) in Britain has had a somewhat chequered history. Killington's excellent two-volume monograph, which appeared in 1936–7, was an inspiration to many workers, but Fraser's handbook published in 1959 contained several errors and inaccuracies, and undoubtedly deterred many people from studying the group. Ten years ago Colin Plant set up a recording scheme for the group with an associated newsletter and published a provisional atlas in 1994; now, this AIDGAP key is the next stage in the new wave of interest in this fascinating group of over seventy species.

The key begins with an introduction to the current classification and nomenclature of the British species, although there is one error in Table 1 where the current name of *Chrysopa ventralis* should be *Dichochrysa ventralis*, not *prasina*. There are notes on how to use the key, and useful sections on finding, catching and studying lacewings, with a table summarizing the preferred habitats of each species. The series of keys begins with one to separate lacewings from similar groups of insects, and then each main order (Mecoptera, Raphidioptera, Megaloptera and Neuroptera) has its own key. It should be noted that the keys cover only adults, and there is no mention of identifying larvae. Many species of lacewings are not easy to identify, as the wing venation and patterns are often variable, and one often has to examine the genitalia to be certain of a determination. Therefore the keys have relatively long couplets, with detailed descriptions and alternative characters, and each is accompanied by thumbnail drawings of relevant features. Finally there are four appendices and a short list of references, although these sections are not noted in the Contents list on the first page. The appendices include notes on the distribution and ecology of each species, a section on collecting and preserving specimens, an account of how to prepare genitalia for examination, and some comments on nomenclature of the British species.

There are a few minor problems with the keys: that to the genera of Hemerobiidae uses the terms radial vein and radial sector interchangeably, and in the first figure accompanying couplet 7 of the same key the arrow supposedly pointing to a crossvein actually points to thin air as the crossvein has been omitted. It is a pity that arbitrary names for some veins appear here, as they do not correspond with terms that will be found in other standard works. However, these are minor points which do not detract from the fact that this is an important work that will open up the lacewings to a new range of interested naturalists. It is excellent value for money, and armed with this book plus Colin's earlier atlas, one can now confidently make good progress with this attractive group of insects.

PETER BARNARD

Monitoring butterflies at four open spaces in north-west London

L. R. WILLIAMS

Brent Parks Service, Brent Council, c/o Brent Town Hall, Forty Lane, Wembley, Middlesex HA9 9HD

ANN RIX

31 Norfolk Road, Uxbridge, Middlesex UB8 1BL

I. GREENWOOD

Corporation of London, 432 Archway Road, London N6 4JH

Contents

Abstract

Monitoring of butterfly populations was undertaken at four open spaces in north-west London. The four sites had various proportions of woodland, grassland and other habitats. Transects were walked weekly from April to September and annual collated indices were estimated for each species for the years 1986 to 1997. Variations in the populations of butterflies appeared to be due to habitat management at the individual sites and to London-wide changes in abundance. Of particular note were the increase in range and population size of *Pararge aegeria* speckled wood and *Pyronia tithonis* gatekeeper during the period, whilst *Lasiommata megera* wall brown and *Coenonympha pamphilus* small heath declined. At Fryent Country Park there was a large population of *Maniola jurtina* meadow brown which was associated with the high proportion of hay meadow habitat at that site.

Introduction

The distribution of butterfly species in the London Area during the period 1980 to 1986 was plotted by Plant (1987), who also gave information on their historical status. For data on fluctuations in the abundance of butterflies, it is necessary to use some form of monitoring. At Hampstead Heath a butterfly transect was established by Ray Softly in 1976 as part of a national scheme of about 80–100 butterfly transects organized by the then Nature Conservancy Council and the Natural Environment Research Council. The national scheme used the combined data from the individual sites to produce collated indices for each species nationally (Pollard et al. 1986). Collated indices provide an overview of the changing abundance of each species from year to year. Whether the changes in abundance are due to regional trends or to habitat management at individual sites, or to a combination of both, has to be interpreted from a more-detailed analysis of the data and from a knowledge of the individual species.

Further transects were established in north-west London at Fryent Country Park (Brent) in 1986 (Williams et al. 1991), at Beane Hill (Brent) in 1988 and at Gutteridge Wood (Hillingdon) in 1990. Other new transects were established elsewhere in Britain, and the national scheme was unable to cope with the

quantity of data generated. Furthermore, there was a realization that regional indices would be useful, together with indices based on particular habitats. For example, chalk downland sites in southern England now have their own collated indices. Monitoring has continued at the four north-west London transects annually. Whilst they represented four different sites (Beane Hill is located within Fryent Country Park), the transects are all on public open space, with an underlying London Clay and/or gravel geology. The four sites contain various quantities of woodland. Gutteridge Wood had the most mature canopy, though part of the transect is through open habitat. The Hampstead Heath transect was largely through scrub and woodland, while the woodland cover has increased at Fryent Country Park, and in particular at Beane Hill since the mid 1980s.

At present there are few long-running butterfly transects in London. The object of this paper is to establish a butterfly index for north-west London.

Methods

Butterflies were surveyed at four sites using the transect walk method. This is a standard method and is not detailed here as it is well documented elsewhere, as are its limitations (Hall 1981, Pollard et al. 1986, Pollard 1991, Williams et al. 1991). Basically, at each site, a walk is undertaken along the same route, each week, from April to September inclusive, within a standard range of weather conditions conducive to butterfly flight. Transects were walked if the following conditions were satisfied:

a — Temperature: the shade temperature exceeded 13°C providing that there was at least 60 per cent sunshine, (or 17°C with less sunshine), where sunshine was defined as the percentage of transect sections in which shadows were cast.
b — Windspeed: a windspeed on the Beaufort scale not exceeding 3.
c — Time: between 10.45 and 15.45 British Summer Time.
d — Transects were not walked if it was raining.

The number of adults of each butterfly species along the transect were counted. This provided a count for the year at that site. (Recorders can divide the counts into flights and/or generations, or subdivide their transect into sections, if required). The totals used in this paper include estimates for weeks missed due to poor weather or the unavailability of the recorder(s), using averages for the two weeks on either side.

Compilation of regional indices required calculations, since transects varied in length, joined the index in different years, and provision had been made for the possibility that recording may cease at a site in the future. Standardization of the data from different sites is relatively straightforward, and for details reference should be made to Pollard et al. (1986) and Crawford (1991).

It should be emphasized that the original site counts and the resultant indices are not absolute counts of the populations, but indices of abundance. The indices are relative from year to year, not from species to species. The distribution of the four sites in London is shown in Figure 1.

Sites

Hampstead Heath

Transect established in 1976. Grid reference near to centre: TQ264870. The site is in the London Borough of Camden and is managed by the Corporation of London. For a map of the transect route and for species data for the years 1976–85 see Pollard et al. (1986). The transect is largely through scrub with rough grassland. It has been walked by Ray Softly, and more recently by Ian Greenwood and a team from the Corporation of London. As this paper covers the period when there have been at least two (and generally four) transects in

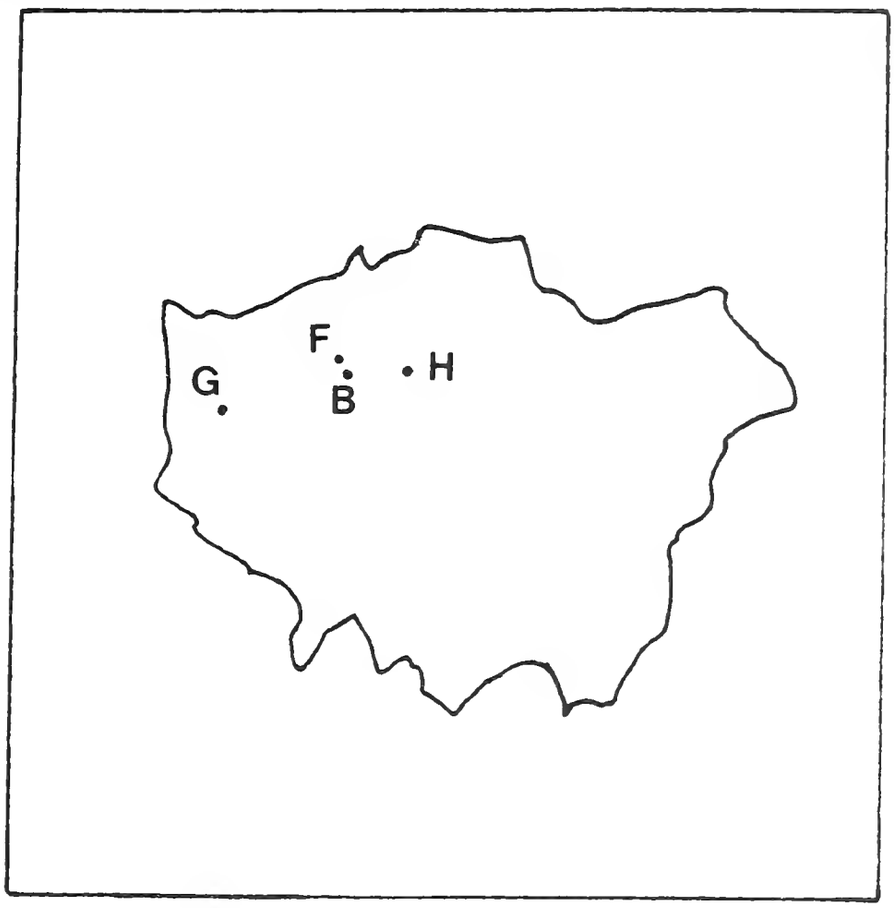


FIGURE 1. Butterfly transect sites in London: B — Beane Hill, F — Fryent Country Park, G — Gutteridge Wood, H — Hampstead Heath. The boundary line represents the outer boundary of London's boroughs.

London, the pre-1986 (1976–1985) data from Hampstead Hill only has not been included in this paper.

Fryent Country Park

Transect established in 1986. Grid reference near to centre: TQ195876. The site is in the London Borough of Brent and is managed by Brent Council with assistance from the volunteer Barn Hill Conservation Group. For a map of the transect route see Williams et al. (1991). The transect includes a range of farmland habitats including hay meadows, hedgerows, woodland, and scrub. It has been walked by Anthony Kwissa, Julianne and David Brown of Barn Hill Conservation Group, and by Leslie Williams of Brent Council Parks Service with assistance from Paul Hutchinson.

Beane Hill

Transect established in 1988. Grid reference near to centre: TQ199873. The site is in the south-east of Fryent Country Park in the London Borough of Brent and is managed by Brent Council with assistance from the volunteer Barn Hill Conservation Group. For a map of the transect route see Williams (1994*a*). The transect is largely through growing woodland which was planted in the mid to late 1980s. It has been walked by Leslie Williams.

Gutteridge Wood

Transect established in 1990. Grid reference at centre: TQ091843. The site is in the London Borough of Hillingdon and managed by the London Wildlife Trust in association with the Borough Council. The transect includes a high proportion of mature oak woodland with a hazel understorey, grassland with

TABLE 1. Collated indices for butterfly transects in north-west London: Hampstead Heath (from 1986), Fryent Country Park (from 1986). Beane Hill (from 1988), and Cutteridge Wood (from 1990). Note therefore the smaller sample sizes prior to 1990. Indices set at 100 in 1990, or first year of record.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Small and Essex skippers	52	82	128	118	100	277	274	78	107	88	61	110
Large skipper	53	123	63	204	100	56	204	179	200	120	72	66
Clouded yellow											100	0
Brimstone					100	133	217	150	82	280	115	328
Large white	142	39	142	321	100	128	1,331	172	183	279	100	321
Small white	568	122	171	248	100	155	264	71	118	289	84	240
Green-veined white	65	34	140	162	100	51	238	71	78	115	75	173
Orange-tip	2	18	10	35	100	63	90	68	27	69	27	60
Purple hairstreak							100	100	200	100	0	500
White-letter hairstreak							100	50	0	0	150	50
Small copper	3	19	10	55	100	48	17	4	38	15	50	27
Common blue	8	8	0	54	100	7	70	15	155	144	48	200
Chalkhill blue												100
Holly blue				105	100	15	6	0	2	23	67	2
Red admiral			100	25	100	40	400	140	120	613	416	138
Painted lady			100	0	100	10	20	0	0	10	1,040	0
Small tortoiseshell	239	342	461	257	100	120	1,055	412	151	276	174	210
Peacock	131	192	161	121	100	173	334	346	259	311	458	380
Comma	79	135	140	185	100	73	473	170	145	194	176	197
Speckled wood		18	59	139	100	75	172	213	321	174	96	168
Wall brown	27	21	0	89	100	13	3	3	3	0	0	0
Marbled white											100	0
Gatekeeper					100	86	108	57	57	73	98	102
Meadow brown	33	110	155	162	100	209	100	25	51	79	140	116
Small heath	42	57	11	37	100	40	32	2	1	1	0	0

scrub, boundary ditches and flowing water in the Yeading Brook. The transect is walked by Ann Rix.

Results

Collated indices for each species are given in Table 1. The relative changes in abundance for individual species from year to year are given by the numerical figures, e.g., a butterfly with an index of 50 in one year and 25 in the following year would have been approximately half as abundant on the four transects in the second year, as compared with the first year. The indices do not provide a guide to the relative population sizes of different species in any given year. Indices have been set at 100 in 1990 or the first year of record: for a technical discussion see Crawford (1991). Indices in the table have been rounded to the nearest whole number. Note that the initial two transects were joined by Beane Hill in 1988 and by Gutteridge Wood in 1990. The order of species and their nomenclature is taken from Thomas (1986). A graphical interpretation of the data is provided for some species in Figures 2–21, in which the left-hand axis denotes the size of the collated indices.

Small skipper *Thymelicus sylvestris*

The small and the Essex skippers (Figure 2) are generally counted together by the transect recorders, due to the difficulty of separating these species in flight. Both species have, however, been identified at all four transects. The two species prefer long grassland, and in the case of the small skipper, the grass *Holcus lanatus* Yorkshire fog in particular. Both species are often found where long grass grows in the vicinity of shrubs and along woodland paths. All four transect sites contain suitable habitat. Results for these two species were influenced by the relatively high population size at Gutteridge Wood. Relatively large numbers were recorded in 1991 and 1992.

Essex skipper *Thymelicus lineola*

The Essex skipper (Figure 2) is generally counted together with the small skipper. The notes above apply to both species.

Large skipper *Ochlodes venata*

Areas of uncut grass containing the foodplant *Dactylis glomerata* cocks-foot are preferred by this species, a habitat present at all four transect sites. Relatively large numbers were recorded in 1989, and 1992–4 (Figure 3).

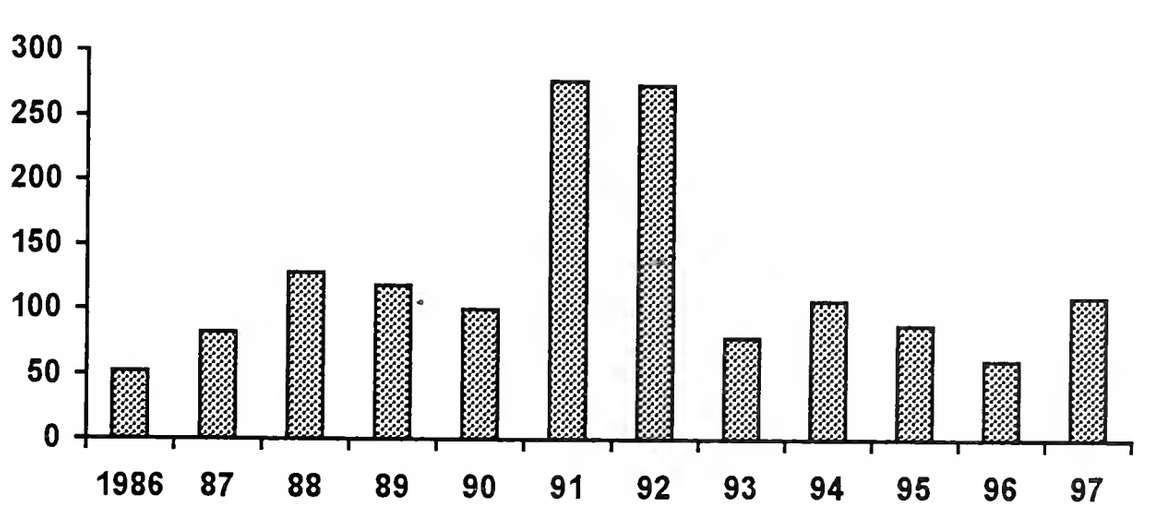


Figure 2. **Small** and **Essex skippers**: collated indices at four transect sites in north-west London for the years 1986–1997.

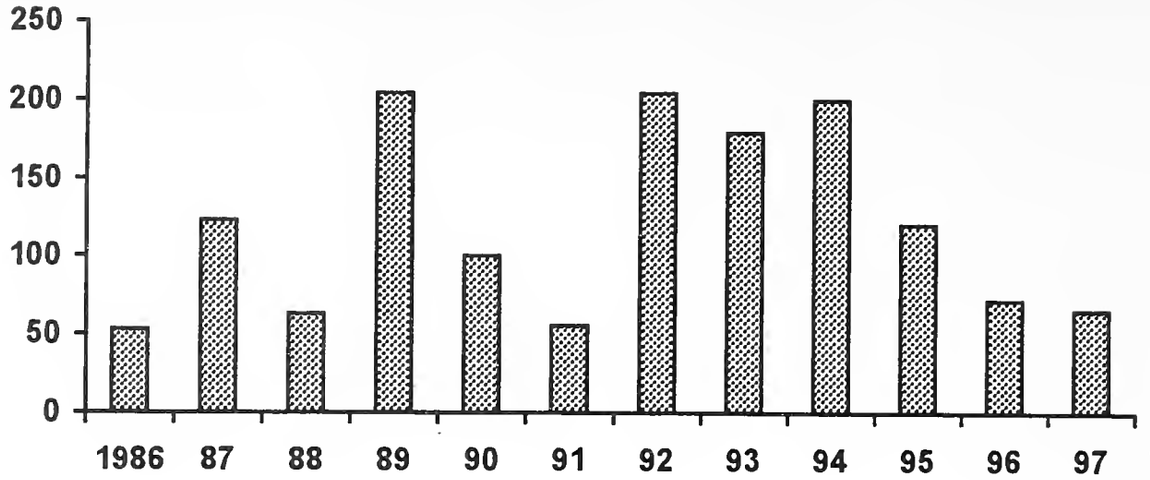


FIGURE 3. **Large skipper**: collated indices at four transect sites in north-west London for the years 1986–1997.

CLOUDED YELLOW *Colias croceus*

The only transect record was at Gutteridge Wood in 1996 — the year of a large migration into Britain from the Continent, and during which it probably bred in Britain (Murray 1997).

BRIMSTONE *Gonepteryx rhamni*

North-west London lacks the ideal habitat for the brimstone: wooded areas with either of the two foodplants, buckthorn *Rhamnus cathartica* or alder buckthorn *Frangula alnus*. Brimstones do however travel long distances to seek out their food plants. It is occasionally seen in London gardens. Gutteridge Woods is the best of the four transect sites for the brimstone with presumably a breeding population. There is some evidence that it is increasing at the other three sites, being first recorded on the transect at Hampstead Heath in 1993, and at Fryent Country Park and Beane Hill in 1995 (Figure 4). It is not known if these represent travelling individuals only, or the start of breeding populations. A clump of alder buckthorn was planted at Fryent Country Park in the 1980s and is now well established.

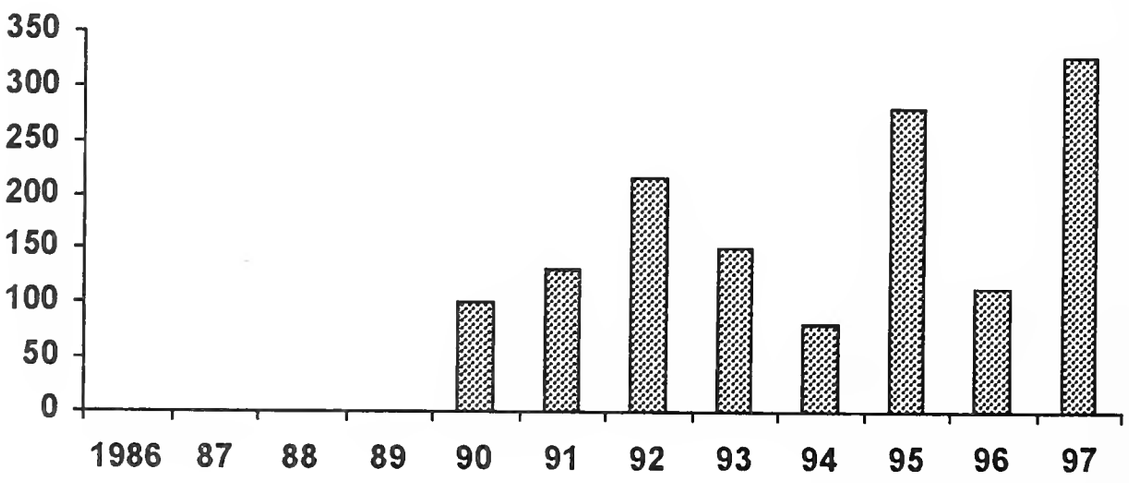


FIGURE 4. **Brimstone**: collated indices at four transect sits in north-west London for the years 1986–1997.

LARGE WHITE *Pieris brassicae*

The large white, like the small and green-veined whites, is usually recorded on all four transects each year. The annual variations possibly reflect the London-wide fluctuations in numbers: 1992 was the best of the years 1986–97 for the large white (Figure 5).

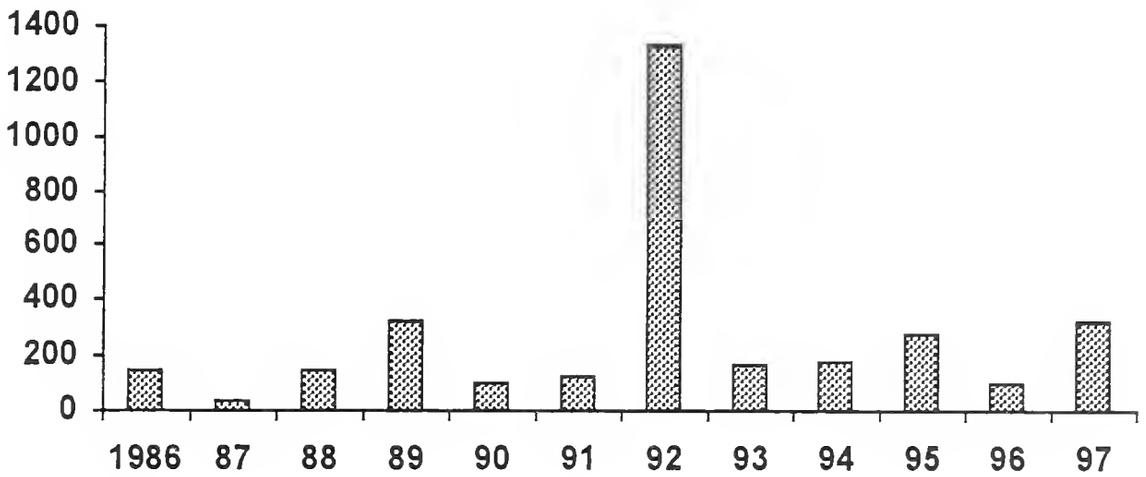


FIGURE 5. **Large white**: collated indices at four transect sites in north-west London for the years 1986–1997.

SMALL WHITE *Pieris rapae*

Increases or decreases in the number of small whites recorded broadly followed a similar pattern to those for the large white (Figure 6), though 1986 was a particularly good year for the small white. Both species range over considerable distances and may be more associated with gardens than with wooded countryside.

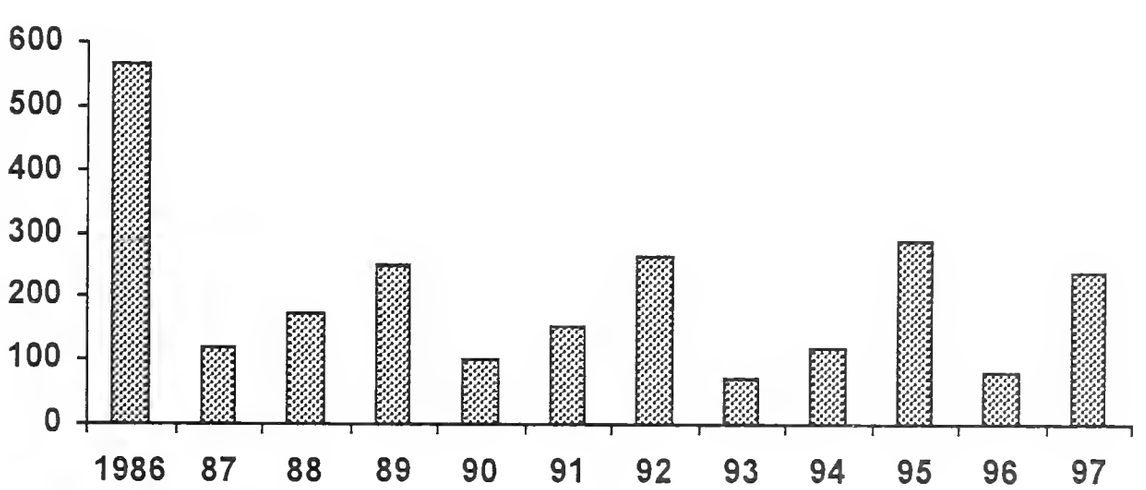


FIGURE 6. **Small white**: collated indices at four transect sites in north-west London for the years 1986–1997.

GREEN-VEINED WHITE *Pieris napi*

During the period 1986–97, the best of the years for the green-veined white was 1992 (Figure 7). In terms of the numbers of individuals recorded, the green-veined white is the most numerous of the white butterflies.

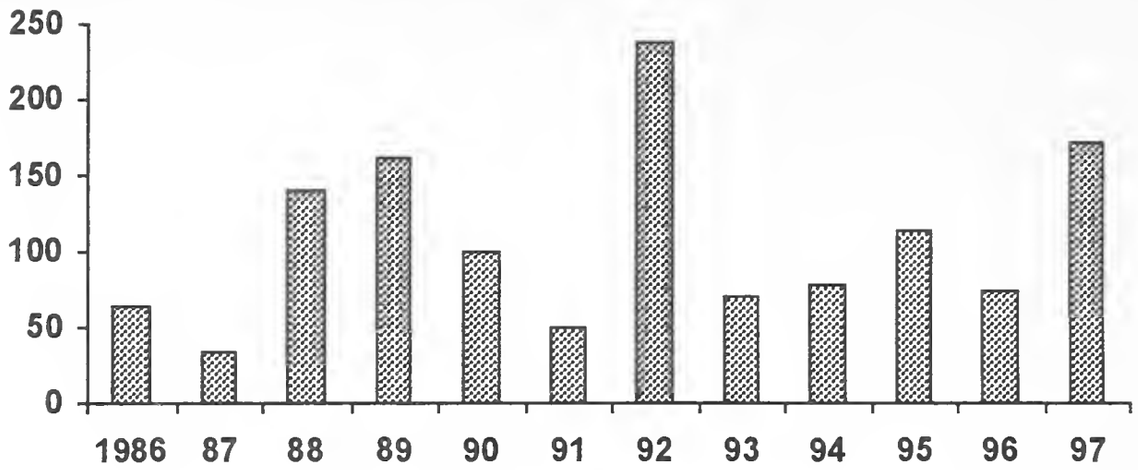


FIGURE 7. **Green-veined white**: collated indices at four transect sites in north-west London for the years 1986–1997.

ORANGE-TIP *Anthocharis cardamines*

The orange-tip was more abundant at Fryent Country Park and at Beane Hill. The high proportions of hedgerow habitat there, and hence of a foodplant, *Alliaria petiolata* garlic mustard, may be a reason. Figure 8 shows that the orange-tip was recorded in relatively high numbers in 1990 and 1992.

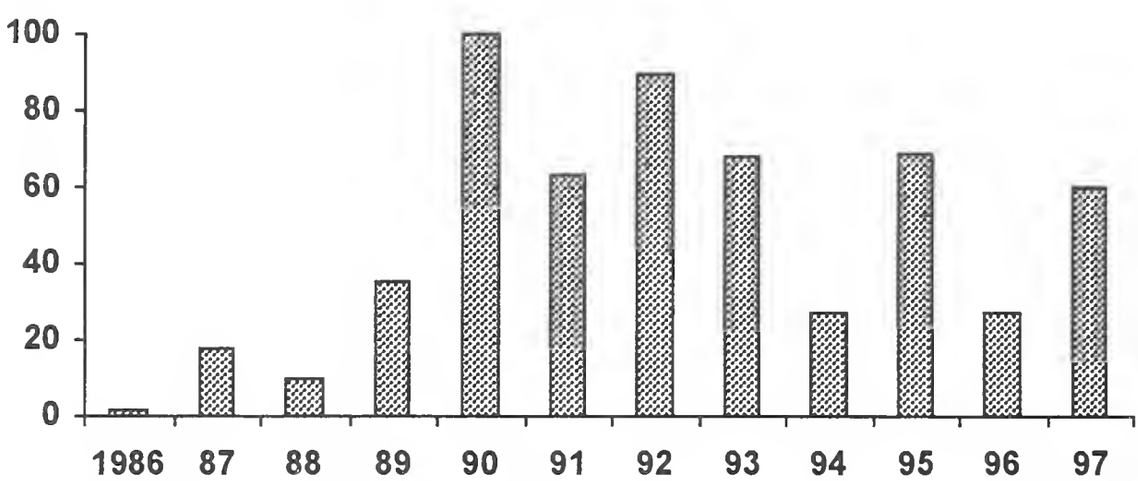


FIGURE 8. **Orange-tip**: collated indices at four transect sites in north-west London for the years 1986–1997.

PURPLE HAIRSTREAK *Quercusia quercus*

One of the few butterflies for which transect recording is inappropriate, as this species is generally on the wing in the evening only. The occasional daytime flyer has been recorded on the Hampstead Heath, Fryent Country Park and Beane Hill transects. The species may be increasing, and if so, this may reflect the increase in the quantity of its foodplants and habitat, oak *Quercus*, oak scrub and mature oak, at some of the transect sites.

WHITE-LETTER HAIRSTREAK *Strymondia w-album*

Two on the transect at Gutteridge Wood in 1992, one in 1993 and three in 1996. One at Hampstead Heath in 1997.

SMALL COPPER *Lycaena phlaeas*

Numbers fluctuate greatly from year to year. There were high numbers in 1990 (Figure 9); in contrast the small copper was recorded on only two of the transects in 1993 when just two individuals were recorded.

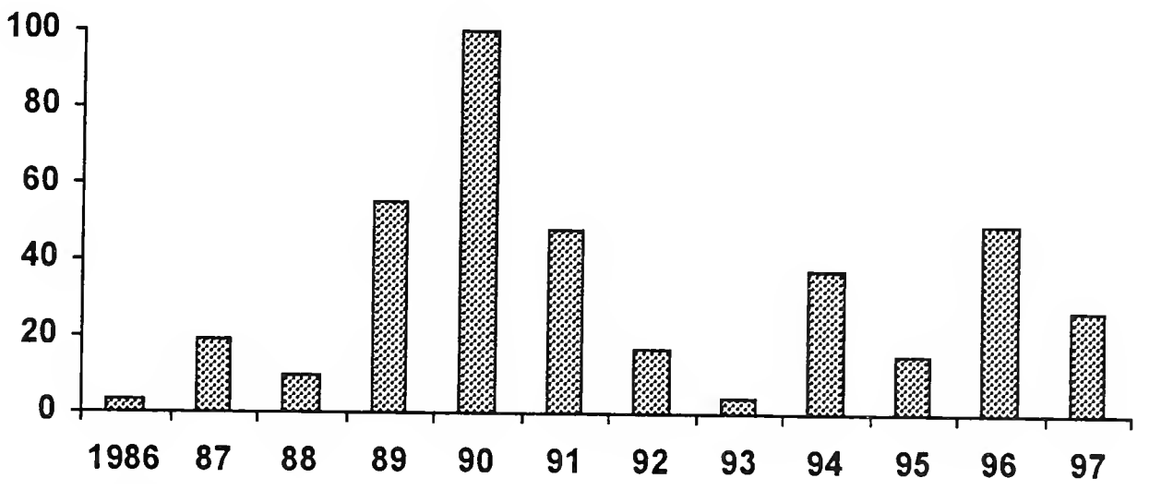


FIGURE 9. **Small copper**: collated indices at four transect sites in north-west London for the years 1986–1997.

COMMON BLUE *Polyommatus icarus*

There were large variations in the index from year to year (Figure 10). Relatively higher at Gutteridge Wood in most years, and a particularly high count there in 1997, largely accounts for the high collated index for that year. It was rarely recorded on the Hampstead Heath transect.

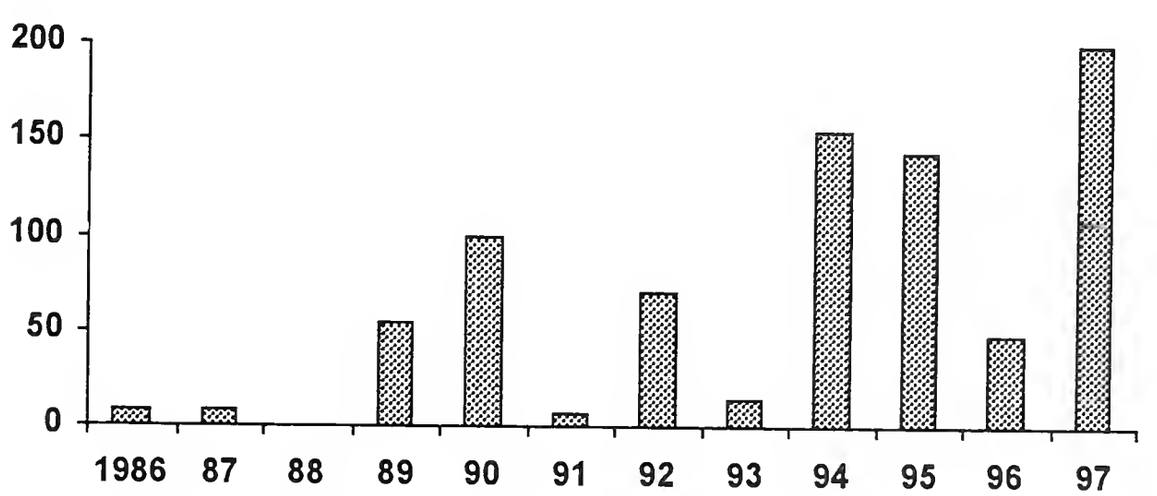


FIGURE 10. **Common blue**: collated indices at four transect sites in north-west London for the years 1986–1997.

CHALKHILL BLUE *Lysandra coridon*

One male at Gutteridge Wood on 6 August 1997. Ann Rix was able to observe it while it was at rest for several minutes and made a sketch to check the identification. The origin of this individual is not known. None of the four transect sites provides suitable habitat or supports the caterpillar's foodplant, nor does suitable habitat occur elsewhere in north-west London.

HOLLY BLUE *Celastrina argiolus*

The holly blue, whose foodplants include holly and ivy, is often found by hedges, in woodlands and throughout London. In some years it is more frequently seen than the common blue. It is however, erratic in numbers from year to year, with the highest index on the transects recorded in 1989 and 1990 (Figure 11).

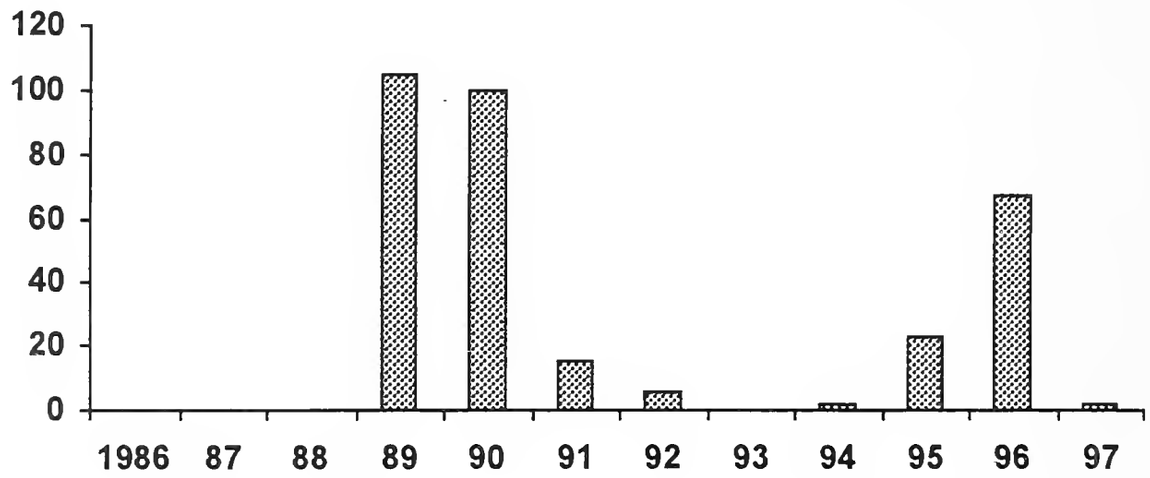


FIGURE 11. **Holly blue**: collated indices at four transect sites in north-west London for the years 1986–1997.

RED ADMIRAL *Vanessa atalanta*

Numbers of this migratory butterfly varied widely from year to year (Figure 12), and the transect indices probably reflected the general variation for London as a whole.

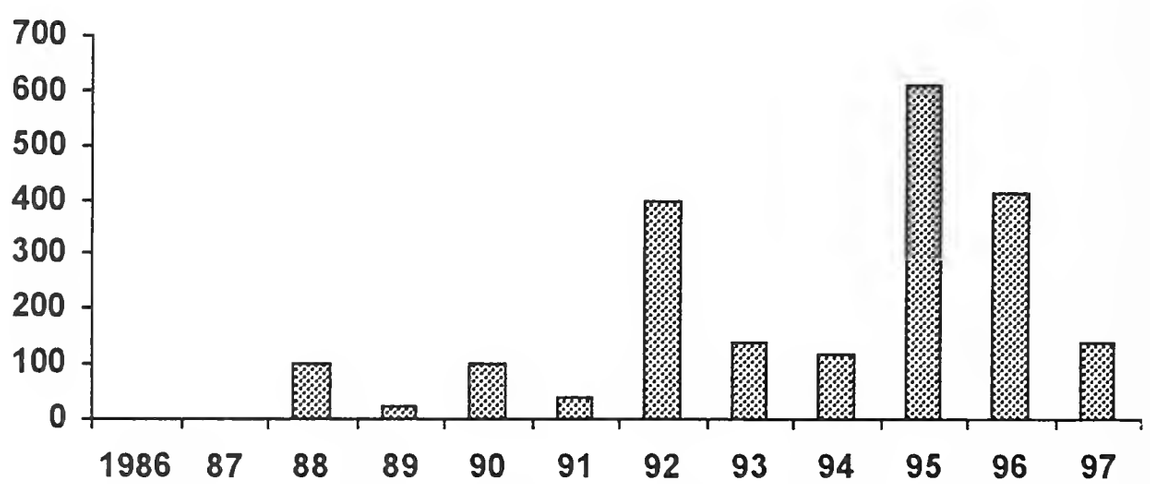


FIGURE 12. **Red admiral**: collated indices at four transect sites in north-west London for the years 1986–1997.

PAINTED LADY *Cynthia cardui*

A conspicuous butterfly for which the transect indices (Figure 13) probably reflect the year-to-year variations in abundance in London. Indeed, the absence of this butterfly from the transects in some years has made it difficult to estimate index ratios. The species is migratory from Continental Europe. The painted lady was recorded in exceptional numbers in 1996. Details of that

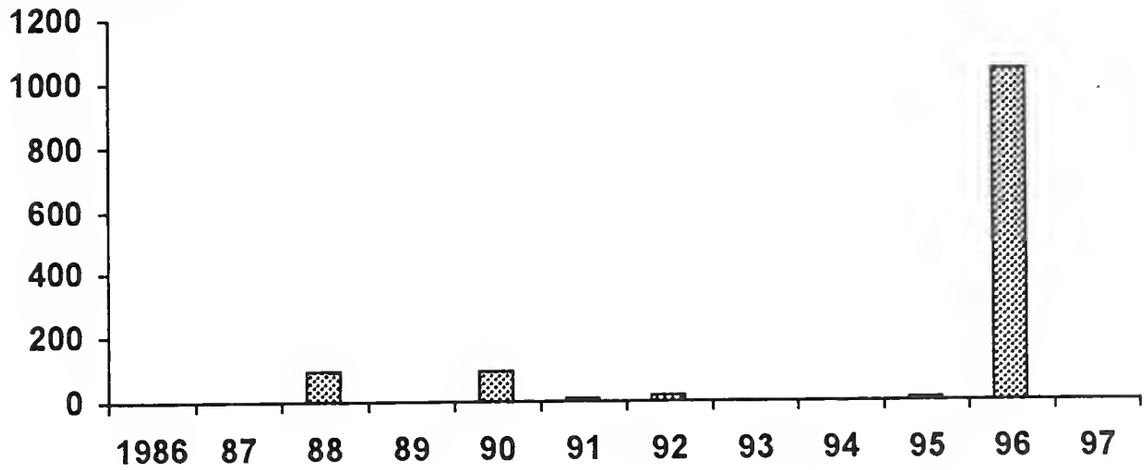


FIGURE 13. **Painted lady**: collated indices at four transect sites in north-west London for the years 1986–1997.

migration through London and Hertfordshire are given in Murray (1997) who commented that it was difficult to know how 1996 compared with previous good migration years, the most recent of which was given as 1988. Collated indices have a use in answering that question. Table 1 shows that whilst 1998 was a good year, as was 1990, the 1996 index value was over ten times higher than for either 1988 or 1990. The actual number of individuals recorded on the three transects walked in both 1988 and 1996, were 6 in 1988, 6 in 1990 and 79 in 1996.

SMALL TORTOISESHELL *Aglais urticae*

Figure 14 shows that 1992 was the best year for this species within the period covered by this paper. Comparatively few were recorded at Gutteridge Wood.

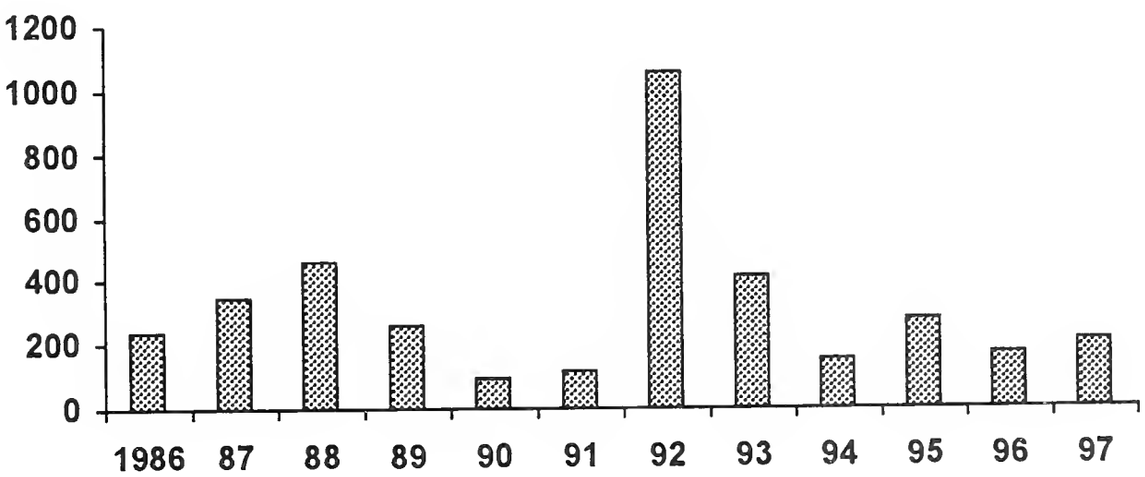


FIGURE 14. **Small tortoiseshell**: collated indices at four transect sites in north-west London for the years 1986–1997.

PEACOCK *Inachis io*

While this species also ranges widely, it is more closely associated with woodland habitats than the small tortoiseshell. The collated indices were higher in 1992–7 than in 1986–91 (Figure 15).

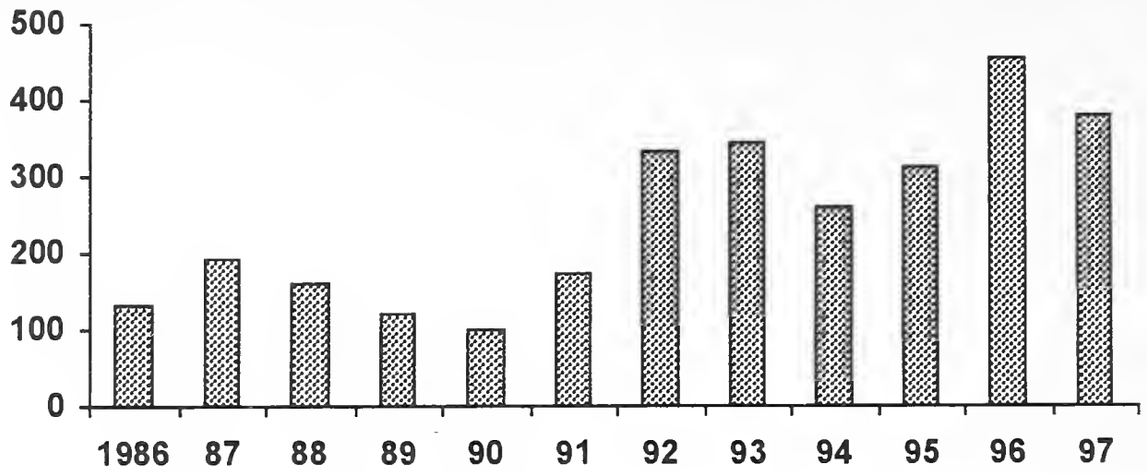


FIGURE 15. **Peacock**: collated indices at four transect sites in north-west London for the years 1986–1997.

COMMA *Polygonia c-album*

The comma is associated with hedgerows and woodland edges. The highest collated index was in 1992 (Figure 16).

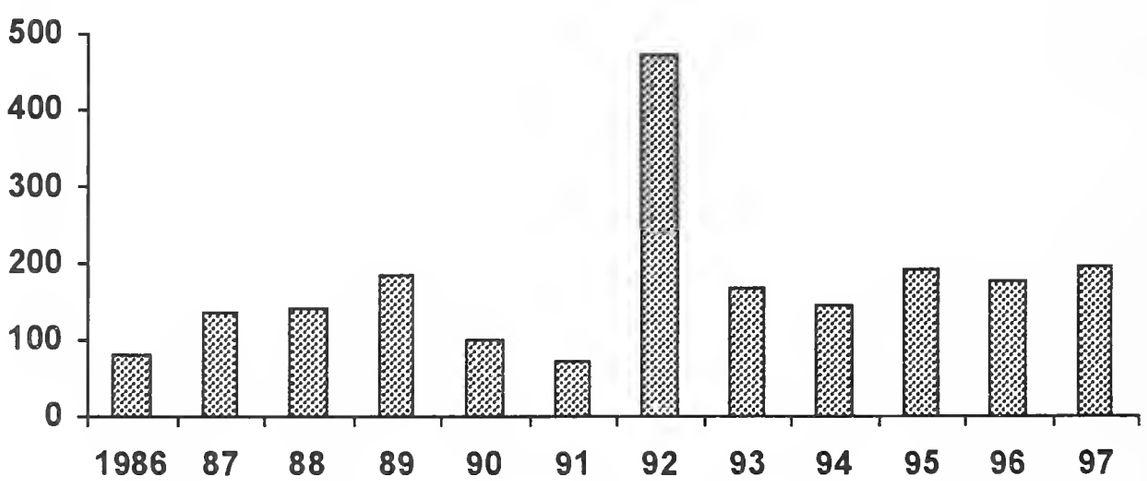


FIGURE 16. **Comma**: collated indices at four transect sites in north-west London for the years 1986–1997.

SPECKLED WOOD *Pararge aegeria*

The speckled wood has increased in range and number since 1986 (Figure 17). At Hampstead Heath it was first recorded in recent times in June 1976 (Ray Softly pers. comm.), and first recorded on the transect in 1981, yet it was the most frequently recorded species in 1997. Colonies established at Fryent Country Park in the early 1980s, and at Beane Hill, spreading throughout the transect sections to become one of the most common butterflies in 1997. Gutteridge Wood already had an established population when the transect was established in 1990. The speckled wood has benefited from both an extension of its range into London, and an increase in the scrub and open woodland at the transect sites. Once established, the speckled wood appears to increase and decrease at the four transects in synchrony, suggesting external factors. The species often declines following dry summers. The highest collated index was in 1994.

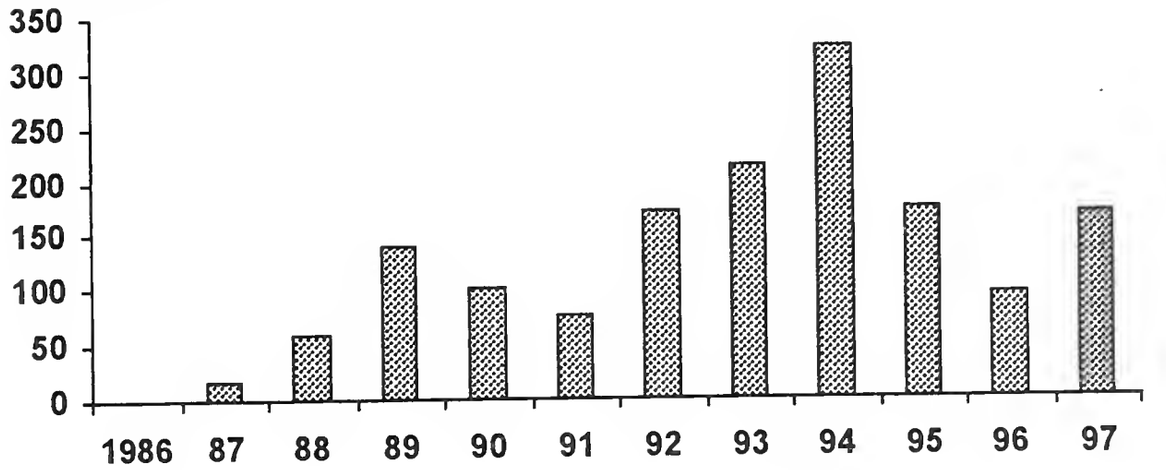


FIGURE 17. **Speckled wood**: collated indices at four transect sites in north-west London for the years 1986–1997.

WALL BROWN *Lasiommata megera*

The wall brown appears to be heading for local extinction. Despite a high in 1990 (Figure 18), it was last seen on the transects at Hampstead Heath in 1990, Beane Hill in 1991, Fryent Country Park in 1993 and at Gutteridge Wood in 1994. Murray (1997) presents maps and data to illustrate the decline from that of a widespread distribution in Middlesex and Hertfordshire in the mid 1980s to virtual extinction in the two counties by 1996. Nationally, this trend appears to be working from the south to the north.

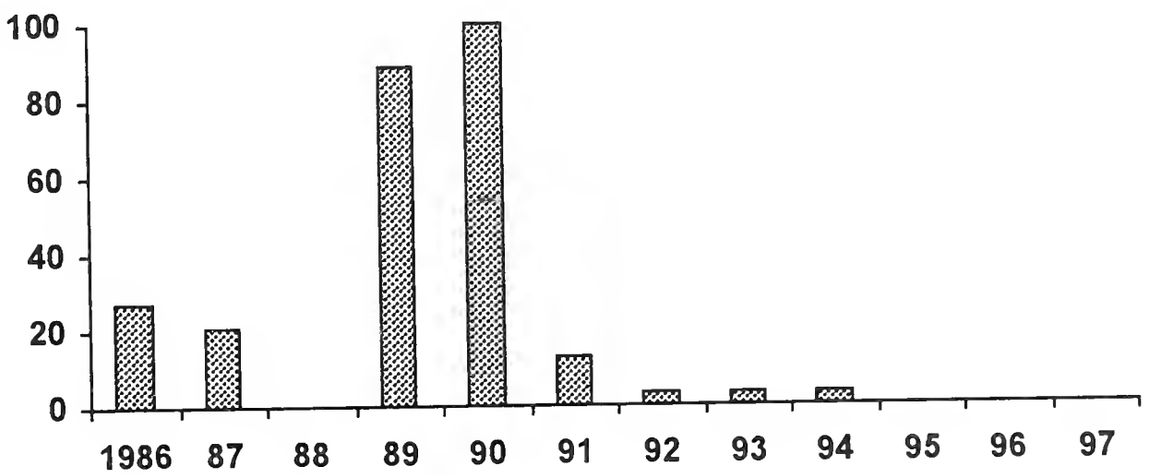


FIGURE 18. **Wall brown**: collated indices at four transect sites in north-west London for the years 1986–1997.

MARBLED WHITE *Melanargia galathea*

Two individuals have been recorded, both in 1996. One was at Fryent Country Park and the first record of marbled white at that site; and the other at Gutteridge Wood.

GATEKEEPER/HEDGE BROWN *Pyronia tithonus*

This species has increased in range and abundance. The two commonly used English names for this species aptly describe the habitat of this butterfly: shrubs with adjacent tall/wild grass. While there was a large population at Gutteridge

Wood since the start of transect recording there, the gatekeeper has colonized the three other sites during the study and has increased in population at each. The gatekeeper was first recorded on the transect at Hampstead Heath in 1990, at Fryent Country Park in 1991 and at Beane Hill in 1994. The increase in counts at these three sites was from a total of one individual gatekeeper in 1990 to 168 butterflies in 1997, though this is not obvious from the collated indices (Figure 19), which are still dominated by the relatively large population at Gutteridge Wood.

The increase in range and population appears to be due to two main trends. Firstly, there has been an extension of the range of this species into London during recent years. The gatekeeper was almost absent from much of London as recently as 1986 (Plant 1987) but present in the surrounding counties. Its movement into London has also been noted by Murray (1996, 1997). Secondly, the three sites that it has colonized, Hampstead Heath, Fryent Country Park and Beane Hill, have suitable and probably increasing habitat for this species. At Fryent Country Park the increase in hedgerow has been noted by Williams (1994*b*), and the area of open woodland has also increased there, while a new woodland has been planted at Beane Hill since 1986. At Fryent Country Park almost two-thirds of the 1997 records of the gatekeeper were from one section of the transect through open scrub with glades. The remainder were from areas with thick hedges/scrub with grassland. The species was largely absent from hedgerows alongside hay meadows on the east of the transect. No gatekeepers were recorded from a section through mature woodland, even though this was adjacent to the main colony.

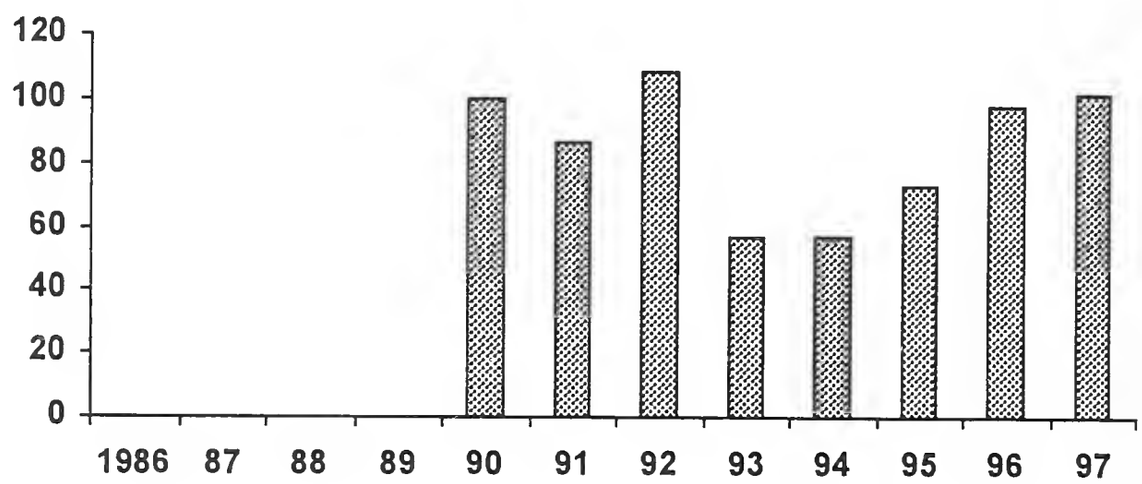


FIGURE 19. **Gatekeeper**: collated indices at four transect sites in north-west London for the years 1986–1997.

MEADOW BROWN *Maniola jurtina*

The index is dominated by the large population at Fryent Country Park where it was the most numerous butterfly: a reflection on the hay meadow habitat. It was also abundant on the Beane Hill transect which is part of the Fryent Country Park site. The highest index value was in 1991 (Figure 20), during the peak of which over a thousand meadow browns were recorded during one transect walk. The species appears to be increasing at Hampstead Heath.

SMALL HEATH *Coenonympha pamphilus*

The small heath appears to be heading for extinction at some of the transect sites (Figure 21). Whilst dominated by the figures from Gutteridge Wood once that site joined the index in 1990/1, the species was the last recorded on

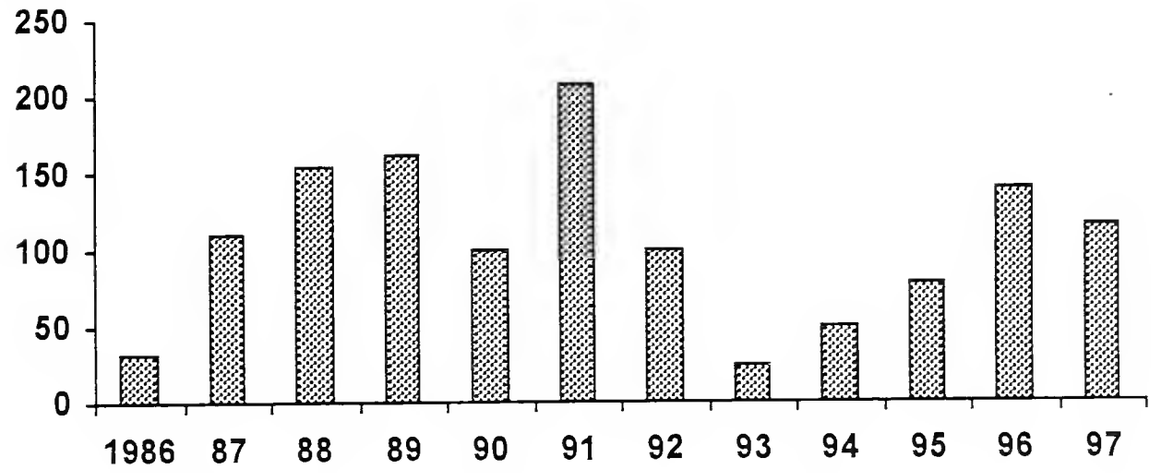


FIGURE 20. **Meadow brown**: collated indices at four transect sites in north-west London for the years 1986–1997.

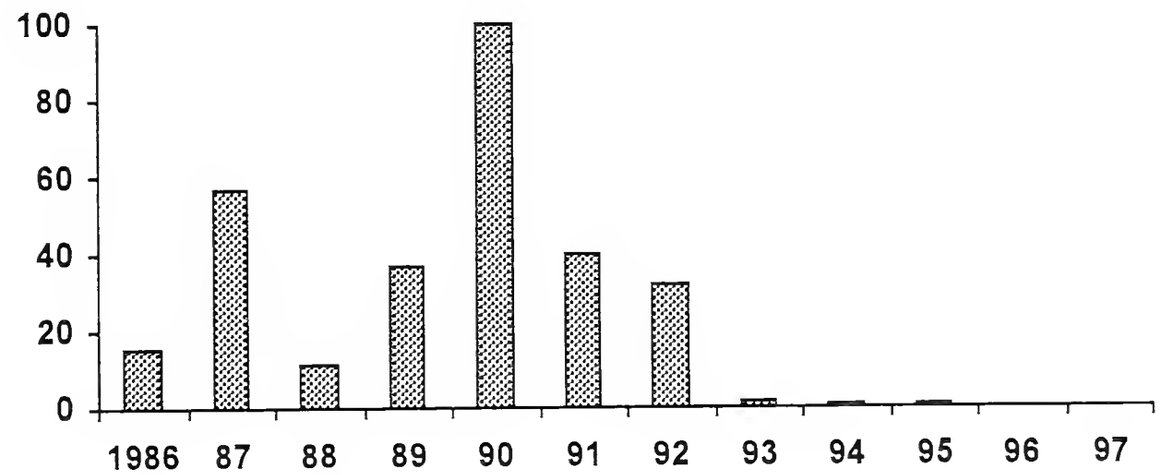


FIGURE 21. **Small heath**: collated indices at four transect sites in north-west London for the years 1986–1997.

transects at Beane Hill in 1992 and Fryent Country Park in 1995. There has only been one record from the transect at Hampstead Heath, in 1978, predating the period of this paper. However, at Gutteridge Wood where it was last recorded on the transect in 1994, a colony was present in 1997 in a meadow approximately 100 m from the transect. It has survived at some other sites in London and Hertfordshire (Murray 1997).

Discussion

Indices, such as those in Table 1, provide information on both changes in the butterfly populations at the sites from which the index was collated, and on changes of abundance in the general area. Obviously there are limitations, not least of which is that the four transect sites are largely semi-natural areas surrounded by the conurbation of north-west London. Nevertheless, many species displayed similar fluctuations in abundance from site to site, and quite often these would reflect the situation in north-west London as a whole.

These indices may be of use beyond the interests of butterfly conservation. Local authorities and the 'Local Agenda 21' process are seeking indicators of the environmental health and sustainability of their areas, and to provide information on which to base their local Biodiversity Action Plans (UK Local

Issues Advisory Group (1997)). Butterfly indices could be made available on an annual basis.

We would add that the major drawback of the collated indices in this paper is the small number of transects that are included, particularly during the earlier years. The calculation of collated indices does permit the recruitment of new sites to the index (and the retirement of sites from the index). The index complements the collated indices produced for the Hertfordshire and Middlesex area of the Butterfly Conservation charity (Murray 1997).

Monitoring is a long-term exercise and the value of the data increases with the increase in the period over which the data have been collected. Every effort should therefore be made to continue the existing transects. The statistical method does allow for some loss and recruitment of sites, but it is continuity at the longer-running sites that is most valuable. The recorders of all four sites always welcome committed local people who have a wish to train as butterfly transect recorders.

Acknowledgements

We acknowledge the earlier and other members of the recording teams at each site, in particular, Ray Softly at Hampstead Heath, and Anthony Kwissa, Julianne and David Brown, and Paul Hutchinson at Fryent Country Park. We thank the landowners and local authorities: the Corporation of London, and the London Borough Councils of Brent, Camden and Hillingdon; and where these share site management, the Barn Hill Conservation Group and the London Wildlife Trust. We should also like to thank Catherine Warren of the Brent Ecology Unit, Brent Council Parks, and Caroline Williams for their help during the preparation of this paper. Colin Plant made useful comments.

References

CRAWFORD, T. J. 1991. The calculation of index numbers from wildlife monitoring data. *In* Goldsmith, B. (ed.), *Monitoring for conservation and ecology*: 225–248. Chapman and Hall, London.

HALL, M. L. 1981. *Butterfly Monitoring Scheme. Instructions for independent recorders.* Institute of Terrestrial Ecology.

MURRAY, J. B. 1996. *Hertfordshire and Middlesex Butterfly Report for 1995.* Hertfordshire and Middlesex Branch, Butterfly Conservation.

MURRAY, J. B. 1997. *Hertfordshire and Middlesex Butterfly and Moth Report for 1996.* Hertfordshire and Middlesex Branch, Butterfly Conservation.

PLANT, C. W. 1987. *The butterflies of the London Area.* London Natural History Society.

POLLARD, E. 1991. Monitoring butterfly numbers. *In* Goldsmith, B. (ed.), *Monitoring for conservation and ecology*: 87–111. Chapman and Hall, London.

POLLARD, E., HALL, M. L. and BIBBY, T. J. 1986. *Monitoring the abundance of butterflies 1976–1985.* Nature Conservancy Council.

THOMAS, J. A. 1986. *Butterflies of the British Isles.* Country Life Books, Twickenham.

UK LOCAL ISSUES ADVISORY GROUP. 1997. *Guidance for Local Biodiversity Action Plans.* UK Local Issues Advisory Group.

WILLIAMS, L. R., KWISSA, A., BROWN, D. and BROWN, J. 1991. Butterfly monitoring at Fryent Country Park, Middlesex, 1986–90. *Lond. Nat.* **70:** 73–80.

WILLIAMS, L. R. 1994*a*. An adaptation of butterfly transect monitoring to survey human park visitors. *Lond. Nat.* **73:** 143–148.

WILLIAMS, L. R. 1994*b*. Changes in the hedgerow landscape of Fryent Country Park, 1983–1993. *Lond. Nat.* **73:** 73–76.

Ponds and fishes in Epping Forest, Essex

ALWYNE WHEELER

Department of Zoology, The Natural History Museum, London SW7 5BD

Contents

Abstract

Between 1992 and 1997 a study of fishes in the still waters of Epping Forest, Essex was made. Eighteen species of fish have been recorded. This faunistic assemblage is mostly due to human interference, but the ponds, which are the major habitat for fishes, are all man-made although some are of considerable antiquity and two incorporate parts of river beds, and thus possibly native fishes. Each pond in which fishes are known to occur is discussed with relevant notes on its origin and past management (where known) and the species present listed with notes on abundance. A general discussion addresses the interactions of fishes with other aquatic vertebrates. The options for management of fish populations which are appropriate for Epping Forest (most of which has SSSI status), while offering recreational angling, are discussed.

Introduction

Epping Forest lies in south-west Essex, at its southern end bordering the conurbation of London, while to the north it marches with the farmlands of Essex. It is well known to naturalists for its status as ancient woodland, formerly managed as woodland pasture. It contains large numbers of old pollarded trees, extensive areas of secondary woodland and grassland and about eighty ponds of various sizes. It comprises about 6,000 acres (2,430 hectares) of land and is administered by the Corporation of London as Conservators of Epping Forest. A further 1,805 acres (731 hectares) of land, mainly bordering the northern part of the Forest, also belongs to the Corporation of London and is managed as bufferland to protect the Forest from development and thus maintain its integrity. This bufferland also contains ponds, but these are not included in this report. Much of Epping Forest is scheduled as a Site of Special Scientific Interest (SSSI) under the Wildlife and Countryside Act 1981.

The ponds in the Forest are an important habitat for aquatic plants, invertebrates, amphibians and fishes as well as providing a visual amenity. Many provide a recreational amenity for anglers; most of the smaller ponds are available for informal angling and several of the larger ponds are licensed to angling clubs who appoint baliffs to issue day tickets to non-member anglers, supervise the angling and clear bankside litter. Angling is forbidden on some ponds where there is potential conflict with water birds or in ponds where bankside vegetation is vulnerable to damage. Angling can be suspended by the Conservators in parts of ponds or for whole ponds in the interest of the conservation status of wildlife or for management reasons. The use of ponds for

other forms of recreation, e.g., swimming or boating, is no longer permitted, although one pond (the Hollow Pond) still has rowing boats available from a licensee in summer (formerly licensees kept boats for hire on Connaught Water, Highams Park Lake, Bulrush Pond and the Perch Pond; most of these were used for rowing until the 1939–45 war, although some continued until the mid 1950s).

The number of ponds in Epping Forest is a matter of disagreement largely stemming from the indefinite meaning of the word pond. Thus, Qvist (1958) stated 'there are 150 ponds, of various sizes . . .' in the Forest, while Hanson (1992) wrote 'there are some 80 bodies of water marked on the 1983 Ordnance Survey map of Epping Forest ranging in surface area from a few square metres to many hectares'. This discrepancy is undoubtedly due to the inclusion as ponds by Qvist of small pits in the ground (most being the aftermath of gravel digging or even small bombs from the 1939–45 war) which hold water only seasonally and have ephemeral populations of plants and insects. Hanson's figure of eighty water-bodies is more realistic, but even then includes a number of small ponds which have an established flora and invertebrate fauna, but which are not capable of sustaining a fish population.

Material and methods

All ponds which were known to contain fish were visited and fished using various methods commensurate with the size of the pond and its physical condition. Ponds which had areas of clear water or submerged macrophytes were netted, the nets varying from a simple hand-net with a stout metal frame and a strong wooden pole, to a 100-m seine net (in several a 60-ft long sand-eel net with fine mesh in the central panel was used). Most Forest ponds, however, have large quantities of timber on the bottom and many have a moderate amount of non-biodegradable rubbish. These hazards prevent the wide use of seine nets and decrease their efficiency. Most fishing was therefore conducted with an electric stunner connected via a fishing box to a petrol-powered generator. Some of the small ponds were fished with a modified back-pack electric stunner powered by rechargeable batteries and used by an operator wading in the pond, or from a rowing boat.

Fish caught were identified and, depending on the conditions, measured and weighed, or assessed for numbers visually before being returned to the water. A small series of each species caught was taken for parasite examination and/or age determination.

Some ponds not known to contain fish were dip-netted and later electro-fished to establish the presence and identity of fish.

Results

The thirty-six ponds in which fish have been caught are listed in a north to south order, under the name of the pond (with alternative names where any). The ponds are numbered sequentially; this is solely for cross reference within this paper. A note is given on the date of construction of the pond (if known) and its history, very brief notes on major vegetation and its condition in the 1990s, and a list of the fishes found. Quantitative assessments of the fish populations were not possible on account of the differing fishing methods employed, the varied vegetation, type of pond bed and amount of rubbish in some ponds. In general the efficiency of the gear used was not high because of these factors, but the electric stunners used by contractors were the most efficient although biased towards large fish. The numbers of fish caught in each pond were biased by a number of factors; amongst them the amount of effort (i.e., time spent fishing) and often by the difficulty encountered with the depth of silt or timber in the water. Results for one pond cannot be directly

compared with those from another pond. There are also differences in the effect of mesh size or electric current from species to species. For example, the number of eels caught in a pond with deep silt will be less than in a silt-free pond (eels are always difficult to catch). Also the use of an electric stunner gives poor results for small fish when compared with large fish. Thus the captures of sticklebacks do not give a true picture of their real abundance in many cases. (Nevertheless the three-spined stickleback is now much less common that it was in the 1950s in many Forest ponds.) The total lengths of the fish caught are given in cm, when estimated preceded by *c.*

Alphabetic list of ponds surveyed

The numbers given are those allocated to the ponds in the north to south sequence of the text.

Alexandra Lake	36	Johnson's Pond	25
Baldwin's Pond	12	Knighton Woods Pond	21
Bell Common Pond (North)	2	Lake, The	1
Bell Common Pond (South)	3	Leighs Pond	27
Blackweir Pond	11	Lost Pond	11
Bulrush Pond	28	Ornamental Water	32
Butler's Pond	18	Perch Pond	35
Connaught Water	17	Pizzle Pits	4
Dell Pond, The	22	Potato Pond	24
Eagle Pond	30	St John's Pond	20
Earl's Path Pond	14	Shoulder of Mutton Pond	33
Fairmead Pond	15	Staples Pond	13
Frying Pan Pond	29	Strawberry Hill Pond	16
Golding's Pond	10	Theydon Green Pond	6
Gravels, The	23	Wake Valley Pond	7
Hawcock Pond	5	(Little) Wake Ponds	8
Heronry Pond	34	Wake Valley Bomb Crater	9
Highams Park Lake	26	Warren Pond	19
Hollow Ponds	31		

Alphabetic list of fishes found in Epping Forest

Scientific names follow Wheeler (1992*a*).

Bleak	*Alburnus alburnus*
Bream	*Abramis brama*
Bullhead	*Cottus gobio*
Carp	*Cyprinus carpio*
Chub	*Leuciscus cephalus*
Clicker barb	*Pseudorasbora parva* (Temminck & Schlegel)
Crucian carp	*Carassius carassius*
Eel	*Anguilla anguilla*
Goldfish (brown goldfish)	*Carassius auratus*
Gudgeon	*Gobio gobio*
Loach, stone	*Barbatula barbatula*
Perch	*Perca fluviatilis*
Pike	*Esox lucius*
Roach	*Rutilus rutilus*
Rudd	*Scardinius erythrophthalmus*
Stickleback, nine-spined	*Pungitius pungitius*
Stickleback, three-spined	*Gasterosteus aculeatus*
Tench	*Tinca tinca*

The ponds

1. **The Lake,** Lower Forest TL472033

(Wintry Wood Pond, Epping Plain Pond, Lower Forest Pond)

Origin. Constructed in 1893/4 with the dual objectives of providing work for the unemployed during an exceptionally cold winter, and creating a swimming-pool. Funds were collected at the instigation of Mr H. B. Yarburgh, owner of Epping Brewery in Lindsey Street, Epping (Ramsey and Fowkes 1986: 468). A diving board was built near the northern end and a changing shed below the level of the bank there (its remains survived until the 1950s), a lifebelt was provided after the drowning of a fourteen-year-old, George Edward Blatch, in 1899.

Later history. The pond was used for swimming and winter skating until the 1950s. It had been stocked with fish. By the 1980s it was heavily overgrown with emergent vegetation and was deeply silted; in 1990 it was dredged out. The fish were removed by Thames Water Authority at the request of the Conservators to be subsequently replaced. This is a medium-sized pond, surface area 0.409 ha.

Fishes. This pond was surveyed in March 1997 and again in September 1997; a summary of the fish caught and their abundance is given below.

BROWN GOLDFISH. *March*: thirty-eight fish (not measured); *September*: 230 fish, a weight of 22.297 kg. All goldfish were removed.

CRUCIAN CARP. *March*: nineteen fish of 8–19 cm; *September*: sixty-three fish of 4–18 cm. At the time of the March survey, the critical identifying features of goldfish and crucian carp were not resolved and some misidentification may have taken place. This was not so in September. The latter sample contained six year classes and it seems that this species had quickly become established after the pond was restocked.

CARP. *March*: four fish of 3–49 cm; *September*: forty-nine fish, a weight of 12.1 kg. These fish had probably been stocked during the current summer.

GOLDFISH × CARP HYBRID. *March*: three fish, not measured; *September*: two fish. All five were removed.

GUDGEON. *March*: seventy-seven fish of 4–9 cm; *September*: very numerous, mostly about 10 cm. This is the only pond in Epping Forest with a substantial population of this species.

ROACH. *March*: one fish of 16 cm; *September*: a small number, up to 25 cm.

RUDD. *March*: thirty-seven fish from 6–13 cm; *September*: very large numbers, the largest 20 cm long.

TENCH. *March*: seventy-five fish from 6–25 cm; *September*: large numbers of small fish; others up to 35 cm.

THREE-SPINED STICKLEBACK. *March*: nineteen fish, 4.5–5.0 cm; September: not recorded.

Note on the fish population. It is obvious that when this pond was restocked by the Thames Water Authority in 1991, the fish were a mixed bag taken from a stock or a holding pond. The number of gudgeon here is unique throughout the Forest, and although the carp were probably illegally released by anglers, the presence of a brown goldfish (frequently confused with crucian carp) suggests a sample was taken out of a stockpond containing a miscellaneous collection of fish and without much regard for the suitability of the species for a small woodland pond. Some of the goldfish were coloured, some of the rudd were highly coloured, both suggest contamination from released garden pond fish.

2. **Bell Common Pond (North)** TL455016

Origin. A small pond which lies just to the south of Epping on the northern end of Bell Common. I have no information as to when it was dug. It was in existence in the 1890s and it is shown in Ramsey and Fowkes (1986: 430) as

shallow with considerable emergent vegetation in 1915 when it was said to have 'received a facelift'. A second picture taken 'sometime later' showed it with its banks clear. The picture suggests that it was very much larger than it was in the 1970s. (See discussion on Bell Common Pond (South) (3)).

Later history. In 1987 or 1988 an attempt to clear the dense vegetation and willow carr by a group of local conservation volunteers succeeded in removing vegetation, but left 25 cm of silt in the pond bed. The drought in 1989 caused the water level of the pond to fall severely by June. Goldfish were visible swimming in the very shallow muddy water.

Fishes. A rescue attempt was made on 26 June 1989 and four goldfish of 12 cm length and 600 sticklebacks of 1–6 cm were caught. These fish were caught in two small pools of 4 and 2^2 m. Several smooth newts *Triturus vulgaris* were caught at the same time. An analysis of the lengths was given by Wheeler (1990).

3. Bell Common Pond (South) (Mill Pond, Epping) TL448012

Origin. A small pond which lies opposite the present road entrance to Copped Hall estate and beside the old A11 road (now B1393). Its position close to the main road which was formerly the London to Newmarket turnpike via Woodford, Loughton and Epping suggests it was probably important for watering cattle and horse traffic, and its proximity to the Epping windmill would have also provided water for the carthorses bringing grain from the farmland at Epping Upland. The pond served a later generation for topping-up steam traction engines. This pond is of considerable antiquity, probably of seventeenth-century construction.

Later history. It is possible that this pond was the one referred to as being deepened in 1899. (See Bell Common Pond (North) (2), although the latter is more likely).

A fence was erected parallel to the road, but offset so that horses could both drink and draw the cart through the shallow margin. Earlier, chained posts had been driven into the pond bed to prevent horse-drawn vehicles getting into deep water (Superintendent's Report, 14 July 1884). These, or replacement posts, are still visible. This pond was deepened and substantially dredged out in 1990.

Fishes

TENCH. Fifty fish were transferred here in 1996 following a fish rescue at Bulrush Pond.
THREE-SPINED STICKLEBACK. Twenty fish caught dip-netting.

Note on the fish. The stickleback is abundant; mostly they live in the small areas of clear water adjacent to patches of *Potamogeton* and other plants. They are uncommon in the dense *Typha* patches. They co-exist successfully with smooth newts *Triturus vulgaris* which keep within the dense vegetation.

4. Pizzle Pits TL441006

Origin. Uncertain. Possibly created by the extraction of gravel used for the nearby turnpike. This suggests a date in the late eighteenth century. It is shown on Buxton's (1897) map of Epping Forest first produced in 1885.

Later history. This small complex of pits forming one water body in conditions of high rainfall lies on the margin of open grassland known as Kemp's Lawn which is now heavily encroached on by secondary woodland. In 1992 an ineffectual attempt was made to open up part of the pond by removing emergent vegetation (chiefly *Typha*) and the pond is now badly silted up with about 1.5 m of silt and timber on the bottom. There is very little submerged vegetation in it. Pond life is minimal.

FIGURE 1. Wake Valley Pond (7), viewed from the east bank, looking south-west. The dense bed of *Phragmites australis* is the dominant marginal plant in this pond and has led to considerable loss of submerged marginal vegetation. (June 1988).

FIGURE 2. Blackweir or Lost Pond (11), viewed from the east bank. This was dug as a gravel pit between 1895 and 1914. This pond contains one of the largest populations of crucian carp in the Forest. (June 1988).

FIGURE 3. Fairmead Pond (15), viewed from the south, looking north-west. This pond was dredged and deepened in 1990. Within five years, at least seven species of fish (with their parasites) had been illegally introduced into it by anglers. (September 1996).

FIGURE 4. Connaught Water (17). This was created in 1880 as an ornamental pond which drained the Forest between Fairmead and High Beach. It is now silted up and very shallow. (June 1988).

Fish

RUDD. Fifty fish of 5–10 cm. They represented two year classes (0-group 5–7 cm and 1-group 8–9 cm) (sampled in March 1997). They were exceptionally brightly coloured with golden head and body, and bright scarlet fins. They were certainly introduced from a garden pond (possibly within a year of sampling). With the poor quality of water and living conditions in this pond, this population is unlikely to survive for long.

5. Hawcock Pond TL443007

Origin. Uncertain. Possibly created by the extraction of gravel for the creation of the adjacent turnpike from Loughton to Epping which suggests it may date from the late eighteenth century. It appears not to be shown on Chapman and André's map of 1777. It is clearly shown on the map in Buxton (1897) which was first produced in 1885.

Later history. This small pond lies on the edge of Kemp's Lawn which has been considerably encroached on by secondary woodland. The pond has a considerable bank of *Typha* and a great deal of silt and timber in the open parts, the silt being about 1.5 m deep. There seems to be no submerged vegetation and dissolved oxygen levels must be low. Survival for any vertebrates must be low.

Fish. This pond was electrofished in March 1997.

CRUCIAN CARP. Forty-seven fish, length range 4–15 cm. This is one of the few populations of crucian carp left in the Forest which has not been affected by the introduction of goldfish or carp. Possibly it has survived unaltered because of the secluded position of the pond and because it looks stagnant (as it is). Equally, only crucian carp could survive in such a poor pond.

6. Theydon Green Pond TQ453991

Origin. A small pond which lies outside the limits of the SSSI. It is embanked on the eastern side and excavated inside the other two sides of its triangular shape. Its early history is uncertain. It is possibly shown on Chapman and André's map of Essex (1777), but the engraving is not distinct. It is clearly shown on the OS map of 1874 and the 1885 map in Buxton (1897).

Later history. This pond was dredged in the 1930s, the 1950s and in 1995/6. Its shape was modified slightly on these occasions and in the 1950s two small islands were created; in the 1990s it was dredged deeper in the centre than on previous occasions to compensate for the decreased rainfall in this decade. It has a shallow sill; some of the bankside vegetation was left.

Fishes. As the water level had dropped dramatically prior to the 1995/6 dredging, all the fish were removed by netting on 25 October 1995. The fish caught were:

EEL	1 fish *c.*40 cm
BROWN GOLDFISH	9 fish (15–20 cm), 1 coloured fish (9 cm)
CARP	19 fish up to 50 cm
GUDGEON	6 fish (10–12 cm)
ROACH	40 fish (6–8 cm), many small fish
TENCH	1 fish *c.*30 cm
THREE-SPINED STICKLEBACK	12 fish, 5–6 cm

Many of these fish were in poor condition due to the low water levels in the pond as a result of the drought.

As this pond lies outside the SSSI and is an important amenity pond which attracts anglers (particularly young anglers), it was stocked soon after it had refilled. The Corporation of London purchased from a fish farm 20 carp and 150 tench which were released into this pond. About 1,000 roach of 15 cm were transferred from the Connaught Water feeder stream to this pond in March 1996. The stocks of fish which were released were known to be free of

diseases and pathological parasites. Unfortunately, within two months larger carp were seen in the pond. Evidently illegal introductions had been made to the pond within weeks of the official stocking. Twenty sticklebacks were introduced in 1996; they have bred and young fish of the year were abundant in May 1998.

7. **Wake Valley Pond** (Figure 1) TQ421987

Origin. This moderately large pond (surface area 0.806 ha) was made about 1882 following the Superintendent's Report to the Epping Forest Committee 'to make this hollow into a pond at a cost of £120.00' (14 November 1881), and the supplementary report of 12 December 'that the Surveyor of Highways for Loughton had assured him that the Local Authority would not oppose the Embankment of the Epping New Road being used as one side for the proposed new Pond near Monk Wood'. The Epping New Road was built by John McAdam in 1830–1834 under contract to the Epping and Ongar Highways Trust (Powell 1956: 114). The road was built on the embankment across the Wake Valley which was constructed with soil (mostly clay) cut from the tops of the ridges and out of three roadside ponds (now known as the Little Wake Ponds — see later) and the south-east end of the present Wake Valley Pond. Various authors (e.g., Addison 1945, Hanson 1992) have assumed that this pond was created by damming during road building, but this is not true.

Later history. This is a very deep pond, measured as up to 3.8 m deep in 1995 near the road embankment. It is, however, showing signs of senescence with dense marginal vegetation (*Phragmites* mostly) and increasing *Potamogeton* in the open water. Coloured water-lily *Nymphaea alba* has been introduced. There is also a lot of timber in the bottom mud. The surface area has decreased considerably during the last fifty years. Although dredging was attempted along the east bank in 1990 to halt the encroachment by Norfolk reed, this was not successful.

Fishes. For many years there has been a substantial head of fish of several species which are popular with anglers. In the 1960s it was stocked with bream taken from Abberton Reservoir and carp which possibly came from D. F. Leney of Haslemere; no numbers are known to me. The bream appear to have died out after 1970, but the carp are still present and are probably the introduced stock now grown large and old. Neither was an inspired choice for stocking a pond which had important dragonfly and amphibian populations because carp in particular destabilize the pond and eat submerged plants.

The present population of fish was assessed in 1995 to comprise six species, as follows:

CARP. Frequent, mostly large fish of 8.2–12.7 kg (18–28 lb). No small carp were caught during electrofishing or netting operations and it it probable that this species does not breed successfully in this cold deep pond.

ROACH. Frequent, mostly small fish up to 20 cm.

RUDD. Abundant, some up to 20 cm, but most are young fish of about 5 cm.

TENCH. Abundant, large numbers of tench have been caught, the largest was 2.5 kg (5 lb 8 oz).

PIKE. Frequent; nineteen fish were caught and removed in November 1995 and March 1996, most were between 20 and 50 cm, the largest was 75 cm.

PERCH. Frequent. Most caught have been relatively small, the largest seen was about 20 cm (8 in).

A pike cull was carried out on 21 April 1998. Only two fish were caught, a female 57 cm long, 1.076 kg with ripe eggs, and a smaller fish. Other fish caught included two carp, one 74 cm (weight 9.53 kg) and a mirror carp of 63 cm (weight 4.09 kg). This was the smallest carp caught during surveying and from its different coloration and general appearance it is believed to have been recently (and illegally) introduced to the pond. This fish was removed. Other

fish caught on this day included a few roach, a very large number of rudd, many tench and one perch (an estimate of the rudd was about 3,000 small fish).

8. Little Wake Ponds (East and West) TQ 419984 TQ418984

Origin. The Little Wake Ponds were dug adjacent to the line of McAdam's road built for the Epping and Ongar Highways Trust in 1830/4. They lie either side of the Epping New Road (A104, formerly the A11). They were dug to provide soil (mostly clay) for the embankment across the Wake Valley. Unlike the Wake Valley Pond, they date from the original roadworks; both are deep (in excess of 1.5 m away from the margins) for such small ponds.

Later history. Both ponds are now heavily silted and there is in excess of 1 m of silt and leaf-litter and quantities of timber in them. The East Pond became very overgrown with willow carr and dense silt and in 1992/3 it was partially cleared. As usual the dredging involved the removal of some of the willow carr and a little emergent vegetation, but most of the silt was left in the pond. Since that year there has been some growth of emergent vegetation. In general neither pond is suited to fish life and they are poor habitats for amphibians and the larger invertebrates which have seriously deteriorated in numerical richness since the 1950s.

Fishes. Little Wake Pond (East):

Brown goldfish	1 fish (10 cm)
Crucian carp	5 fish (small 7.5–10 cm)
Rudd	33 fish (all small 7.5–15 cm)

The small size of these fish shows that although they can survive in the conditions of this pond, they stay small in the food-poor environment. The presence of the brown goldfish shows that illegal stocking has taken place in this small pond which is isolated from the other ponds in this area by the major road.

Fishes. Little Wake Pond (West):

Crucian carp	16 fish (all small, around 10 cm)
Roach	12 fish (15–20 cm)
Rudd	10 fish (7–12.5 cm)
Tench	4 fish (small fish 10–15 cm)
Perch	1 fish (28 cm)

The small size of most of these fish indicates the poor living conditions in this pond. The presence of a single perch suggests that illegal stocking has occurred; this might also apply to the presence of roach, rudd and tench, all of which occur commonly in the neighbouring Wake Valley Pond. However, as one of the crucian carp was infested with the parasitic copepod *Ergasilus briani*, it might be suggested that there had been introduction from a more distant site. (Ponds with fish infested with this parasite are known from a pond on local authority land in Epping and also from a Forest pond to the south — see Fairmead Pond (15)).

9. Wake Valley Bomb Crater TQ419985

Origin. Although this pond is always referred to as a bomb crater, it is actually the crater caused by a German V-2 rocket which fell in early 1945. It lies only a few metres from Little Wake Pond (West). The crater lies in clay and for a year or two after its formation, was steep-sided, deep and bare of vegetation. The surrounding trees were destroyed by the explosion although the crater is now ringed with secondary woodland.

Later history. Since the 1950s the banks have slowly worn and have been partly overgrown by bramble and birch saplings. Some pond plants have invaded (or been introduced) including *Phragmites*. It is not a rich pond for

vegetation because it is now shaded by surrounding trees and its depth/surface area ratio limits its productivity. It is still deep and steep-sided.

Fishes. The following have been recorded:

CRUCIAN CARP	17 fish (mostly 11–15 cm)
CRUCIAN CARP × CARP HYBRID	3 fish (*c.*20 cm)
CARP	1 fish (*c.*38 cm)
RUDD	2 fish (8–20 cm)

Most of these fish have been introduced in the last twenty years. This crater was well-known for its large stock of small crucian carp in the 1960s and 1970s. It, and the adjacent Little Wake Pond (West) were often fished by young anglers. I have seen young anglers transferring fish between the two ponds on several occasions. The carp were probably introduced by adult anglers. Because of its low productivity this pond is suitable only for crucian carp (although rudd can just survive), but the fish will remain stunted and in poor condition.

No angling has been allowed on this and the two Little Wake Ponds since 1992. This will reduce the level of interference with their fauna.

10. **Goldings Pond** (Outer Goldings Hill Pond) TQ429981

Origin. This pond lies beside the Wake Arms–Loughton road (A121) which was constructed between 1611 and 1622 (Powell 1956). Much of its banking is gravel which was probably used for levelling the roadway when it was dug out. It was a 'horse pond' with a shallow incline into and out of the water on the south-eastern side which allowed horses to drag coaches or carts into the water, thus wetting the wooden wheels and tightening the iron-banded running surfaces (a necessary precaution before descending or ascending the steep road). The road was remade between 1770 and 1774 by the Epping and Ongar Highways Trust, to reduce the gradient, but it was still a formidable hill for horse-drawn vehicles.

The hill (and the pond) takes its name from Goldings Hill House, at one time in the possession of John Goldyng (1320), which lay opposite the pond at the junction with Clays Lane.

The incline into the pond was marked as a 'Ford' in the 1915 edition of the six-inch OS map. It was still visible until the 1980s when loads of hoggin were dumped on it by the Corporation of London staff in making up paths in the area. The ford, with its guide railings of about 1875, is illustrated in Ramsey and Fowkes (1986: 45).

Later history. This small pond is 0.380 ha in surface area. It is shallow, probably its maximum depth was about 1.5 m, but due to dense vegetation in it and the mass of silt and dead leaves there are few places where the water is as deep as 20 cm (and then mostly on the north side where it was dredged in 1990). By this date it was heavily overgrown with emergent vegetation and the dredging attempted then was ineffectual due to competing demands for the retention of rare plants, insects and for 'teaching' succession of vegetation in ponds, with the result that it has now lost its value at least for amphibians and fishes and is an unsightly swamp.

Fishes. This pond was fished twice; 9 August 1995 and 22 October 1997. The following fish were caught:

BREAM	4 fish (14–20 cm)
BROWN GOLDFISH	11 fish (14–23 cm)
CRUCIAN CARP	8 fish (12–16 cm)
CARP	1 fish (58 cm)
ROACH	10 + fish (4.5–18 cm + smaller fish)
RUDD	9 fish (7–19 cm)
TENCH	4 fish (2.5–25 cm)
Pseudorasbora parva	1 fish (4 cm)

PIKE	1 fish (80 cm)
THREE-SPINED STICKLEBACK	numerous (3–4 cm)
PERCH	1 fish (31 cm)

This pond was at one time known for the numbers of crucian carp, tench, roach and three-spined stickleback that it contained. The extent to which its fauna has been enriched by illegal release of fish is shown by the occurrence of *Pseudorasbora* (known as the clicker-barb in the pet fish trade), bream, brown goldfish and carp, which are all unsuited for a small silted pond. Two exotic pond plants have also been introduced to this pond. Releasing pike and perch in a pond which was known for its rich amphibian life was also an act of folly.

11. **Blackweir Pond** (Lost Pond) (Figure 2) TQ424978

Origin. A small pond (0.275 ha) lying almost at the crest of Blackweir Hill. It was dug as a gravel-pit on the application of Epping District Council in May 1895 and successive years, and in 1901 by Loughton District Council. Some digging may have continued until 1914. The name Lost Pond, which is more used by the public than the official name, arose from the use of this name by Brimble (1950) in his book *London's Epping Forest.*

Later history. The weeds in this pond were cut and dragged out in 1931 (Minutes of Superintendent of Epping Forest, 24 July 1931). It has silted up severely (a process accelerated by some horse riders encouraging their horses to enter the water). In an attempt to prevent this several large tree branches were felled into the shallow margins, but in time they have rotted and this pond is now very dangerous to wade in. This rotting timber also impeded circulation of the water and has led to a decline in dissolved oxygen in the water.

Fishes. Work in this pond has shown that it contains one of the largest populations of crucian carp in the Forest. The pond was fished twice — 25 September 1996 and 22 October 1997.

	1996	1997	Cumulative total
CRUCIAN CARP	49	91	140
CARP	3	4	7
CRUCIAN CARP × CARP	3	5	8
STICKLEBACK	6	—	6

During January 1997 this pond was frozen over and several carp and crucian carp × carp hybrids died after being frozen in the ice. The fishing in October 1997 was part of the management of this pond to remove carp (and hybrids) to reduce the pressure on the crucian carp.

Sticklebacks were very abundant in this pond in the period 1955 to 1975, but they have become rare. When abundant there was a virtual 100 per cent infestation by the cestode worm *Schistocephalus solidus*, but none was found in a sample of four small fish in 1996. The stickleback seems to become scarce as the pond succession proceeds.

12. **Baldwin's Pond** (Baldwin's Hill Pond) TQ425975

Origin. This pond lies in the valley below Baldwin's Hill and forms the northern major arm of the Loughton Brook. The valley was dammed by the construction of the Clay Road by J. W. Maitland in 1865/6. The pond does not appear on the six-inch OS map of the area surveyed in 1872, but it is drawn in by hand on the archival copy in the Corporation of London's offices at The Warren. It is shown in Buxton's *Epping Forest* (1897), the maps of which date to 1885. The date of construction of the pond must therefore lie between 1872 and 1885. This is a little later than I estimated earlier (Wheeler 1991).

Later history. Since the stream was dammed to form the pond very large quantities of silt and organic debris have formed an extensive delta in the

northern end, now overgrown with willow carr and encroaching into open water by 100 m. It is also seriously overgrown by *Typha latifolia* and other emergent plants. Although it has been claimed that the pond was cleaned out (Speakman 1965) in *c.*1950, the extent of clearance was superficial. The slope of the banks on all sides of the pond is such that heavy machinery cannot be used near the water and the dam is unsafe for such machinery to operate from it.

Fishes. A survey was made on 2 May 1995 when the following species were caught:

CHUB	1 fish (42 cm)
ROACH	17 fish (4.4–11.2 cm)
TENCH	27 fish (8.5–40 cm)
PIKE	4 fish (48–74 cm)
PERCH	7 fish (7–36 cm)

The chub is normally confined to rivers, but the single fish caught was in fine condition (it weighed 2.043 kg). It is assumed that it was brought to the pond by an angler as live bait for pike fishing although this is not certain. The roach represented at least two age classes (probably spawned in 1992 (9–10 cm) and 1994 (4.5–5.9 cm), with the intervening year class poorly represented. Tench were common, but were from three main length classes (8–12 cm, 33–35 cm, 37–40 cm) with a conspicuous gap in the region of 12 to 32 cm where several year classes were not represented. Perch were relatively scarce but there are a few large fish there (one of 36 cm was caught).

It is thought that rudd will be more successful in this pond in the long term and several hundred small fish were stocked into it in October 1997.

13. **Staples Pond** (Staples Road Pond) TQ419966

Origin. This pond lies at the downstream end of Loughton Brook where it leaves Epping Forest and runs through the built-up parts of Loughton. It is now recognized as being part of the Loughton flood prevention system, its role being to store flood water from summer storms flowing down the eastern streams in the Forest. Much of this problem is a result of urban development up to the very edge of the Brook.

This pond was created by damming the Loughton Brook by the Corporation of London about 1874. It is referred to in the Minutes of the Epping Forest Committee of 17 October 1878 as the 'pond recently formed by us at Staple's Hill', and at a meeting of 18 January 1885 as a 'Pond at the foot of Staples Hill constructed by the City (before we were appointed)'. (The Corporation of London became the Conservators of Epping Forest in 1878).

The pond is drawn by hand in the archival copy of the six-inch OS map which was surveyed in 1877. (This copy is kept in the Superintendent's Office at The Warren).

Later history. This pond appears to have been very extensive (see illustration in Ramsey and Fowkes (1986: 41)), with wooden rails along the Staples Road side. It is said by these authors to have been drained in the 1930s. However, it held water in the 1940s and was drained again soon after that. The whole pond was rebuilt on a grand scale as part of the new flood water retention scheme in 1995/6.

Fishes. Fish removal was attempted in July 1995 before work started, but few were caught in the very deep silt and the swampy conditions. Only five roach (9–21 cm) and one perch (14 cm) were caught. In the conditions prevailing the backpack stunner proved to be ineffective.

Surveyed on 11 August 1997, and after the pond had refilled, the following species were caught:

Brown goldfish	3 fish (10–16 cm)
Crucian carp	1 fish (16 cm)
Carp	16 fish (16–28 cm)
Rudd	7 fish (12–16 cm); many younger fish of the year were seen in the water
Tench	1 fish (16 cm)
Stickleback	2 fish (4–4.5 cm)

This is a striking example of the determination of some individuals to stock carp in defiance of the law. These fish were relatively small and were highly coloured, suggesting that they had been purchased from a garden centre and released. All were removed in accordance with the fish management policy of the Forest.

14. Earl's Path Pond TQ415967

Origin. This pond was made relatively recently by the extraction of gravel in 1892 (Wilson 1893*a*: 74). The excavation was described as having 'a depth of about 15 feet from the surface'. The Epping Forest Committee visited the 'gravel pit dug by the Surveyors to Essex County Council' (E.F. Committee Minutes, 3 April 1893), and at their meeting on 11 June 1894 the Committee resolved that no more gravel digging was to be permitted at that spot. This pond lies on the edge of the Earl's Path, the road from The Robin Hood public house on the Epping New Road to Loughton, and thus was well sited for removing the gravel from the Forest.

Later history. This is a relatively shallow pond and small (area 0.194 ha). It quickly silted up due partly to the run-off from its sandy sides caused by rain and with windblown leaves from trees. By the 1940s it had considerable growth of pond plants and emergent vegetation and in the 1960s it was partially dredged, although ineffectively as the bottom silt was untouched. It is now heavily silted, particularly on the south side.

Because of the ease of access from the road this pond is frequently chosen to dump unwanted pond fish, frogspawn and exotic plants. This pond contained populations of perch and golden orfe *Leuciscus idus* in 1954, and koi carp *Cyprinus carpio* in 1996 (this fish died when the pond froze in January 1997).

Fishes. This pond was fished on 25 July 1996 and 23 September 1997. The following fish were caught:

	July 1996	**September 1997**
Brown goldfish	2 fish (17, 22 cm)	250 fish (4–8 cm)
Crucian carp	2 fish (8, 14.5 cm)	4 fish (4–14.7 cm)
Carp	—	1 fish (51 cm)
Rudd	2 fish (4, 7 cm)	Many (*c.*6 cm)
Tench	2 fish (7, 15 cm)	61 fish (3.1–21.7 cm)
Stickleback	*c.*50 fish (3.3 cm)	*c.*25 fish (3.5 cm)

The second visit (September 1997) was made with the object of removing brown goldfish and carp which are regarded as undesirable species in a pond within the SSSI.

The stickleback, which was at one time abundant in this pond, is now much less common than in the 1950s.

15. Fairmead Pond (Figure 3) TQ409966

Origin. A small pond (surface area 0.097 ha) which lies in the grassland of Fairmead Bottom. It is banked on the south-eastern edge. It is of considerable antiquity, being shown on the Chapman and André (1777) map of Essex which was surveyed in 1772/3 and 1774. It lies about 300 m to the south-east of the site of Fairmead Lodge (demolished in 1898) which was built around the medieval New Lodge (Rackham 1992). This lodge was one of three Forest

Lodges which guarded the extensive area south of High Beach down to Chingford. It is entirely possible that this pond was dug originally as a watering place for Forest deer and the keeper's horses sometime in the sixteenth century. It was filled by a stream which the Chapman and André map shows flowing across Fairmead, but which was diverted southwards to feed Connaught Water in the 1890s. The pond is now isolated from any stream.

Later history. As this pond is more than two hundred years old it must have been cleaned out of silt and vegetation on several occasions before the most recent clearing in 1990 when large amounts of reed mace and other emergent plants, and silt, were dredged out. A water depth of 1–1.5 m was attained after dredging, but care was taken to leave the area in which flowering rush *Butomus umbellatus* grew on the southern bank. This had been in decline since the 1970s and seems now to have disappeared, but in the period of 1955–70 it covered the greater part of the pond.

An earlier dredging out of this pond may have been referred to in the Epping Forest Committee's Minutes for 8 May 1905 which record that a pond near Mr Bartholomew's house be cleared out. This may however refer to the small Alder Pond which lay nearer to Fairmead Lodge. (Mr Bartholomew was resident at Fairmead Lodge until its demolition in 1898). The Committee's Minutes of 30 April 1952 also referred to cleaning Fairmead Pond, deepening the south side and building up the east side to strengthen the bank.

This pond is important for its amphibian species which includes frog, toad, great crested newt and smooth newt (Wheeler et al. 1959). Until 1990 it also contained introduced edible frog *Rana* cf. *esculenta.*

Fishes. This pond has for many years held numerous fishes. It was well known for its crucian carp, tench, stone loach and stickleback in the late 1980s (Wheeler 1992*b*) and the first named seemed to be very abundant in the late 1940s. A survey of the fish population was made in May 1995 (within five years of its being dredged out) and it was found to contain several species of fish (Table 1). Examination of a sample of fish by Bernice Brewster (Aquatic Consultancy Service) resulted in the discovery of the copepod gill parasite *Ergasilus briani* on the gills of the carp hybrids, crucian carp and rudd. The carp were also infested with the blood fluke *Sanguinicola inermis* and the thorny-headed worm, *Pomphorhynchus laevis.*

The presence of these parasites was evidence that the pond had been illegally stocked by anglers transferring fish from an infested source as was the presence

TABLE 1. Fish removed from Fairmead Pond. Superscript letters represent: a. Carp hybrids were not determined to parental species; those that were checked carefully (5 fish) were carp × goldfish, but it is possible that carp × crucian carp were also involved. b. Small cyprinids were not identified to species due to shortage of time; a small sample of 20 fish showed that most were young rudd.

	May 1995	**June 1995**	**July 1996**	**October 1996**	**Total**
Bleak	—	1	—	—	1
Goldfish	—	—	4	4	8
Brown goldfish	—	*c.*150	224	38	412 +
Crucian carp	47	*c.*50	89	6	192 +
Carp	1	3	1	161	166
Carp hybrids	44	*c.*100[a]	44	2	190
Chub	—	1	1	—	2
Roach	2	—	182	457	641
Rudd	42	*c.*200	259	361	862
0-group cyprinids	—	—	—	95[b]	95
Stone loach	1	7	4	100	112
Stickleback	*c.*4	*c.*100	75	565	744 +

of stone loach (and the later discovery of bleak and chub here, all three being riverine fish).

As this pond is popular with anglers, it was feared that infested fish might be further redistributed to neighbouring ponds so, with the consent of the Conservators, English Nature and the National Rivers Authority, it was decided to remove the fish from the pond. On 30 June 1995 more than 600 fish were electrofished out. The numbers of fish are given in Table 1. Two of the goldfish caught were golden shubunkins with ornate tails showing that they had come from a pet-fish source and were thus also illegal introductions. Further electrofishing operations were mounted on 16 July 1996, and 883 fish were removed from the pond (Table 1). These included chub and stone loach, both riverine species. On 25 October 1996 the pond was treated with a liquid piscicide. Between that date and 28 October, 1,671 fish were collected from the water (Table 1). These included a large number of small fish, mostly sticklebacks and small cyprinids, which were too small to be affected by the electric stunner, and stone loach which, being bottom-living fish that burrow into the algae and other vegetation on the lake bed, had not responded to the electric current.

The success of the work to remove all the fish, and with them their parasites, was established on 26 June 1998 when the pond was both netted and electrofished. Sticklebacks had been seen in the pond earlier in 1998 and are thought to have been progeny of the survivors from the use of piscicide, having taken refuge in the dense mass of filamentous algae which had hindered the complete dispersal of the toxins. Two thirty-minute sweeps were made in open water with the stunner, adjusted to affect small fish, and two hauls were made with a fine-meshed (5 mm mesh cod-end) seine net in open water. The only fish caught were forty-six sticklebacks (length 20–57 mm, $\bar{x}$ 37.5). These were free from the copepod parasite *Ergasilus briani* (B. Brewster, Aquatic Consultancy Service, 2 July 1998).

The options thereafter are to leave the pond fishless or to stock it with suitable species. The difficulty in either case is how to prevent further illegal introductions which would certainly include unsuitable species.

It should be emphasized that in attempting to control the spread of this fish parasite more than 2,500 fish were killed, which is a high price to pay for the cynical and illegal introduction of fish to this small pond. It was not possible to weigh all the fish that were removed, but the catch from the July operation weighed a total of 27.90 kg (48 lb 10 oz).

16. Strawberry Hill Pond TQ414965

Origin. This gravel digging dates from the 1880s or just earlier. It is referred to in the Minutes of the Epping Forest Committee for 3 April 1893 when the Committee viewed the gravel pit dug by the surveyors to Essex County Council at Earl's Path (i.e., Earl's Path Pond) and visited 'the old gravel pit at Strawberry Hill'. A similar conclusion is evident from the report in *The Essex Naturalist* (Wilson 1893*b*: 129) 'On Strawberry Hill about 500 yards north of the well-worked pits adjoining the Earl's Path a new section has been opened this summer' (except that the report should read 'south' for 'north').

Later history. In the 1940s to 1970s this was one of the most beautiful small ponds in Epping Forest with a rich flora (including water violet *Hottonia palustris*, water crowfoot *Ranunculus* sp., and white water-lily *Nymphaea*) and large breeding colonies of frog and smooth newt (Wheeler et al. 1959). However, an area of willow carr and dense *Typha* growth developed in the northern bay and obliterated the open water by the 1970s, while willow carr developed along the eastern bank and the island and emergent vegetation developed in the south-west corner. By 1993 the submerged vegetation was greatly diminished and most of the pond bed was covered with fine silt. The

amphibians had become very scarce and none was found in 1996. An attempt to clear the pond of emergent vegetation including willow stumps was made in 1995 but was totally ineffectual.

Fishes. In the 1940s to 1970s this pond had large populations of stickleback and specimens of pike, perch and roach and (golden) goldfish were present. In the 1980s carp were introduced. With the worsening environmental conditions in this pond the fish died out. Only carp were seen in 1996, and in 1997 the pond dried up. So far as is known no fish survived.

17. **Connaught Water** (Figure 4) TQ404953

Origin. This pond was created by the Conservators of Epping Forest in 1880 (Committee Minutes 8 March 1880, and later). Mr William D'Oyley proposed initially making a pond of fourteen acres at Fairmead, later increasing the size to sixteen acres, but by 13 September 1880 it was reduced to seven acres. These reports and discussions tend to be confusing as the site referred to is Fairmead. However, the site of the proposed pond was then known as Chingford Fairmead, an area covering the north-eastern part of the present Chingford Plain (see the one-inch OS map of 1843–4) and described as very boggy and wet due to the drainage of the Cuckoo Brook (Ching Brook) and more importantly the stream through Fairmead itself which lay to the north. The main motive for making Connaught Water was to drain this wet ground.

The Superintendent's plan was to excavate the soil from the low ground and embank the southern side, so creating the pond. The earliest pond enclosed two islands, but in 1893 it was extended to the north-east and gained two more islands (Addison 1997). The original islands were said to be ready for planting (with trees) in 1881. The pond overflowed into the River Ching on the south-western side. Connaught Water has a present surface area of 9 acres (3.65 ha).

Later history. The pond so made was always shallow, about 1 to 1.5 m close to the overflow, but possibly deeper in the centre in 1940/5. The main water source entered at the north by the Fairmead feeder stream with a lesser tributary at the north-west corner. The western bank has greatly eroded and several mature oaks, which stood with their roots close to the water, have now fallen in and been removed. The western bank is now very shallowly shelving. This erosion, and the silt which has washed down the tributary streams, has led to a build-up of silt. As a result the average depth of water is now about 40 cm with about 50–60 cm of silt on the bed. The build-up of silt is very severe in the south-east corner where beds of *Typha* and other vegetation have become established since the early 1950s.

Vegetation has always been sparse in this pond. This is probably due to the suspended solids decreasing light below the surface. The suspended solids in this pond were increased by the presence of hire rowing boats and canoes during the summer months until about the 1950s.

In the 1970s and 1980s submerged vegetation had become established in considerable quantities and there were extensive beds of water-milfoil and *Elodea* in this pond.

Fishes. There seems to be no record of nineteenth-century stocking with fish here. In view of its size it was probably stocked from the 1880s. In the 1940s it contained three-spined stickleback, roach, gudgeon, perch and pike (Wheeler 1958). No doubt anglers stocked further fish on a small scale, but in the 1970s, when the London Anglers Association held the licence to manage this pond, it was stocked with large bream purchased from Abberton Reservoir in Essex; some carp were introduced about the same time. In 1990 the Hollow Angling Society were granted a licence to manage this pond. This club introduced carp

in 1991, 1992 and 1993 in the region of 350 fish, and crucian carp (but see later discussion) about 500 in number. These numbers are impossible to confirm for certain as the HAS figures differ from the numbers in the permits that were granted, and in one case (1991) the supplier is believed to have substituted 150 small carp for 150 crucian carp pleading that the latter were in short supply.

The effects of such a massive injection of carp were quickly apparent. The submerged macrophytes which had been abundant were no longer present in 1994 and the water was turbid with a greenish tinge in early summer. By mid August the phytoplankton was reduced and the water contained large numbers of zooplankton (mostly the copepod *Megacyclops gigas*, and cladocerans *Bosmina* and *Daphnia*). Comparison of the numbers of birds on the pond over the years 1989–94 showed that there had been a considerable decrease in winter numbers of Canada goose *Branta canadensis*, gadwall *Anas strepera*, coot *Fulica atra*, and a small decline in tufted duck *Aythya fuligula*. Numbers of these species have remained low until 1996 when my regular bird counts ceased.

From 1994 the fish population has contained very large numbers of young roach, bream and perch which is attributed to increased survival of fish in their first two years due to the abundant zooplankton during summer and early autumn. In the winter and spring of 1995/6 several hundred 10–15 cm roach were seen regularly in the feeder stream to the north of Connaught Water (an estimated 3,000 fish were dip-netted out of a 100 m length in one day). This stream is 50 cm wide and averages 15 cm deep in this area. Some young fish were seen there in the spring of 1997, but their numbers were much less.

Subsequent management. The decline in the numbers of waterfowl and macrophytes led to active management to re-establish a balance between the fish population and other biota. The Conservators agreed that the solution lay in drastically reducing the number of carp in the pond. This was strongly opposed by the Hollow Angling Society. In a series of operations between March 1995 and November 1997, 220 carp weighing 636 kg were removed. Undoubtedly the stock has not been totally depleted, but it has been reduced both in numbers of fish and in biomass sufficiently no longer to cause a threat to the wildlife of this pond.

Other fishes. In the course of the culling operations and in the initial surveys, the following other fish species were caught. With the exception of pike, all the fish were returned:

EEL. Present in small numbers (four were caught in March 1995; another was seen in November 1996)

BREAM. Common, but caught in variable numbers. In October 1994 thousands were netted of lengths of 5–22 cm (year classes 1–4). In March 1995, about a hundred fish up to 22 cm were caught. In October 1996, twenty fish of 30–40 cm were caught, but very few small fish, and in November 1997, eight fish of 45–58 cm and three of 5–8 cm were caught.

BROWN GOLDFISH. Present in small numbers in October 1994, March 1995 and October 1996. As the angling club had purchased and stocked 'crucian carp' in this water it is probable that these were in fact brown goldfish. Such misidentifications by fish suppliers have been known elsewhere. No true crucian carp have been caught.

ROACH. Present in small numbers at the outset of fishery work in 1994 when a number of young fish (less than four years old), and only one larger fish (25 cm) were caught. In the winter of 1995/6 there were very large numbers of fish of 10–15 cm length, especially along the feeder stream (where in the mornings up to ten herons could be found in the secondary woodland that bordered this stream). In October–November 1996 there were a considerable number of roach up to 20 cm and very large numbers of fish about 10 cm. In the next year roach were much fewer although 0-group and 1-group were present again. It is clear that over the years 1994–7 the removal of large numbers of carp has changed the dynamic balance of the fish population and that young fish in their first four years of life have become extremely abundant in some years, although they have not grown on into similar numbers of larger fish. The cause

is probably the abundance of zooplankton leading to strong survival for the first two years of life, but the virtual absence of macrophytes, which were eaten by carp, means that there is little available food for roach later in life. The scarcity of roach of all ages in 1997 may have been due to the cool, sunless spring weather suppressing the phytoplankton and in turn the zooplankton, but could be due to increased predation on young breeding roach by pike and cormorants and other birds (such as goosander *Mergus merganser*) during the winter.

TENCH. Present in small numbers as it was in the 1940s. Some of them are large-sized fish (heaviest 1.8 kg in 1994), but most are about 0.5 kg. In 1995 they were noted as common and of good size, in 1996 about twenty large fish were caught and released, and in November 1997 a number of large fish were caught. Because tench tend to burrow in the bottom silt it is frequently difficult to assess their population. Moreover, tench always decline in numbers in the presence of carp, so as most carp have been removed now there is a good prospect that the tench stock will continue to thrive.

PIKE. There is a moderate population of pike in this water although in the 1950s it was larger as were the fish than today. While this water was recovering from overstocking with carp, other more suitable species are being introduced and the numbers of pike are being reduced. The numbers removed were, March 1995, thirty-two fish (1.8–3.2 kg) caught, seven large fish removed; November 1996, ten fish removed; November 1997, nine fish removed (0.9–2.5 kg). Once adequate macrophyte growth is re-established and because there are few amphibians in the pond, pike control may be relaxed.

PERCH. Relatively common, but its numbers have fluctuated during the period 1994–7. In October 1994 it was extremely abundant, particularly those of around 10 cm (there were a number of larger fish of 20 cm). The same situation applied in March 1995, and in November 1996 when the small fish were on average 12 cm in length. Again in November 1997 a lot of small fish were caught, mostly around 10 cm (probably 1 + years old) but some were 35 cm in length and in their eighth or ninth year.

Conclusion. The recent history of the fishery of Connaught Water is a classic case of mismanagement of the water and its fish, leading to disruption of the balanced ecology of the pond. Although this is a moderately large pond (3.64 hectares, 9 acres) it is extremely shallow. During the summer of 1997 there was less than 50 cm of water overlying the silt. This pond has always been shallow and nowhere was it more than 1 m (including silt). For many years it contained a moderate stock of mixed fish, but macrophytes were scarce due to the disturbance of summertime boating. The decision by the London Anglers Association to stock large bream was ill advised, indeed it was seriously ill judged and led to a deterioration in the quality of the water, but it was a minor blunder compared with the Hollow Angling Society stocking with large numbers of carp. At introduction these were relatively small, but they grew quickly. By 1994 all macrophytic vegetation had been eaten and there had been a severe dimunition in the winter population of plant-eating birds. These environmentally harmful acts by the two angling clubs were motivated by the temporary availability of large bream and the popularity of carp amongst a section of the angling public. No informed opinion as to the suitability of these introductions had been sought. Although permits to stock the carp had been issued by the appropriate fishery authority, it was not accompanied by any assessment of the impact on the pond and its fauna or flora.

18. **Butler's Pond** (Butler's Retreat Pond) TQ399948

Origin. This is a small, shallow pond, situated close to Butler's Retreat which itself lies just to the east of Queen Elizabeth's Hunting Lodge. It appears to be a relatively recently dug pond as it is not shown in Buxton's (1897) map of the Forest, which was drawn prior to 1885, although so small a pond may have been omitted by the engraver. Butler's Retreat is a converted barn that was used to provide teas from 1887 (Ward 1978). The pond may have been dug for gravel to surface the surrounds of the Retreat at about this time. Gravel from this pond may have been used to mix concrete by Mr Egan who built the Royal Forest Hotel in 1878 (Committee Minutes, 9 December 1878) although Mr

Egan's application seems to have been rejected (Committee Minutes, 30 December 1878).

This pond was enlarged, cleaned out and improved in 1882 (Superintendent of Epping Forest Report, 18 January 1883, para. 88) and was adapted for paddling in the winter of 1910/1 and the summer of 1911.

Later history. A German V-2 rocket fell just beside the eastern edge of this pond in 1945. The point of impact was just on the extremity of the gravel and the crater was in clay. This filled up with water quickly. Since then the water level in this pond has been unstable and the maximum depth of water is rarely more than 50–60 cm.

Fishes. In September 1996 the water level was very low and the fish had to be rescued. The catch was varied and was dominated in biomass terms by carp (twenty fish 27–50 cm, eight fish 4–7.5 cm) and numerically by stickleback (*c.*100 fish, all *c.*3 cm). Other fish caught were goldfish (one fish, gold-coloured, 16 cm) roach (eleven fish 5–12.5 cm), tench (fifteen fish, 13–21 cm), pike (one fish, 57 cm).

This pond was known for its tench and sticklebacks for many years. The presence of so many carp and the pike is probably due to its proximity to the Warren Pond, 200 m on the other side of Ranger's Road, which was popular with anglers. The goldfish could either be a liberated pet fish, or an unwanted prize from the bank holiday fair held close by on Chingford Plain. Ponds close to roads and car parking are usually sites for the introduction of fish (compare Goldings Pond (10).)

19. Warren Pond TQ398946

Origin. This is a moderately large pond sited on the crown of the hill on which Queen Elizabeth's Lodge stands. I have no record of the date it was dug, although it was in existence when the Epping Forest Act was passed in 1878. It does not appear on the Chapman and André map of 1776, but it is shown on Buxton's map engraved before 1885 (Buxton 1897). This pond is said to have been enlarged (actually 'major work was carried out . . . [at] Old Warren Pond' around 1893) (Addison 1977). The purpose of the pond is conjectural, but the existence of Queen Elizabeth's Lodge, which was a dwelling used by keepers of the Forest called the High Standing in the map of *c.*1641 (Rackham 1992), suggests that it may have been a watering place for deer (and cattle). At the same time the gravel banks of the pond at the northern side and the clay banks at the southern side could have served as sources for gravel and for clay for brick making.

Later history. Other than the report of enlargement in about 1893, I know of no later changes to this pond. There was formerly (*c.*1942) a brick wellhead at water level at the northern end of the pond which may have supplied water for the crowds who walked up from Chingford Station, but at this date it was full of mud. It is no longer visible. In the 1940s the central area of the pond had become heavily overgrown with *Typha*, the small island in the middle of the pond serving as a focus for the spread of *Typha*, while the willow growing on this island resulted in willow carr forming. In the 1950s, the willow was wind-blown into the pond leading to the mass of willow carr which has replaced much of the open water of the 1940s (and makes fisheries work there difficult and even dangerous). The water over most of the pond's surface is about 25 cm in depth, underlying it is approximately 1 to 1.5 m of silt and small timber. In places a probe will not find a firm bottom in under 2.5 m.

Fishes. Between the wars this pond was a well-known angling lake with large carp caught from time to time. A list of large carp caught between 1739 and 1952 compiled by Kevin Clifford (1992) records three from Warren Pond

(19.5 lb by J. T. Fisher in July 1919; 21 lb 10 oz by A. E. Wyatt in August 1926; 21 lb found dead in December 1933). Two large carp were on exhibition in the Museum at Queen Elizabeth's Hunting Lodge until recently; they are now in store. Clifford (1992) reported that this pond was stocked with 'king carp' imported from Germany in about 1904, and the three photographs he published are all of partially scaled 'mirror carp' (a variety of carp).

Moderately large carp are still present in this pond (three fish weighing 2.9, 7.4 and 7.4 kg were caught in May 1995). Other fish recorded included eel (a large fish seen but not captured), roach (eleven fish, 9–11 cm in length), tench (fourteen fish, 27–44 cm), pike (eight fish, 14–50 cm) and perch (one fish, 15 cm). This survey was conducted by electrofishing.

In 1989 the pond was netted when 200 roach and ten pike were caught; they were mostly small fish. In 1989 there was sufficient open water to use a seine net effectively, but this was not possible in 1995 due to the excessive growth of macrophytes.

Because Warren Pond was an important pond for amphibians (particularly frogs and smooth newts) all pike caught were removed in May 1995. The importance of pike as predators on amphibians was demonstrated by this sample. Three of the pike had been feeding on amphibians and five smooth newts were removed from their guts. The remaining pike had been feeding on insect larvae (unidentified) and the isopod crustacean *Asellus*.

20. **St John's Pond,** Buckhurst Hill TQ408941

Origin. This small pond lies close to St John's Church in Buckhurst Hill and is isolated on three sides by roads while the fourth side is fenced from a neighbouring garden. It is separated from St John's Church by a narrow road and the churchyard. The ground in which it is dug is gravel and the pond may have been formed by extracting gravel, but it is more likely to have served a secondary function as a 'horse pond' as it lies beside the old road from Woodford to Loughton less than 500 m to the south of the formidably steep Buckhurst Hill, and the pond banks are gently inclined which would allow horse-powered carriages to drive into the water (a pond serving the same purpose lies at the foot of the hill where until the 1950s the trackway was separated from the pond by wooden railings). The size of the pond suggests that the amount of gravel excavated would have been relatively small, probably sufficient for local use, or even in the construction of the church in 1837.

Its date of construction is uncertain. It is shown on Buxton's (1897) map, the plates for which were engraved before 1885. It is also shown on the OS six-inch archival map in the Superintendent's Office which was engraved in 1872.

Later history. A complaint that this pond was silted up was reported in the Epping Forest Committee Minutes in October 1883. This suggests that the pond was at least fifty years old then.

It is now severely silted up and has a band of emergent vegetation fringing the western and southern sides. A small island near the middle of the pond serves as a focus for the growth of *Typha* and other emergent plants. The large oaks which overhang the pond on the northern and southern banks prevent plant growth by shading the water in their vicinity and their fallen leaves contribute to the detritus in the water.

This pond had a very large population of frogs and toads, and each spring many were killed by cars on St John's Road. Both have become scarce here since the vegetation in the pond was partly cleared out with a digger in November 1994. Unfortunately, this clearing removed large numbers of frogs with the vegetation.

Fishes. Work was undertaken on three occasions, November 1994 to rescue fish and frogs during the weed removal, June 1995 and July 1995 to rescue distressed fish due to drought. The fishes caught are listed below:

	November 1994	June 1995	July 1995
GOLDFISH	—	—	1
BROWN GOLDFISH	10	12	—
CARP	9	71	45*
CARP × GOLDFISH hybrid	—	—	3
RUDD	150	18 +	*c.*90
TENCH	—	1	—
PIKE	1	—	—
STICKLEBACK	1	—	—

*Includes an ornamental variety of *c.*30 cm.

This pond shows very clearly the level of irresponsible stocking with carp that can occur, in this case by a local resident who claimed to be an angler.

21. Knighton Woods Pond TQ408934

Origin. Knighton Woods Pond was created as an ornamental water for the Buxtons' estate in the 1870s. The land remained in private ownership until 1930 when most of it was transferred to Epping Forest including the two ponds. (The second pond is smaller and until recently was severely overgrown.) Both ponds are shown on the archival OS map in the Superintendent's Office, which was surveyed in 1872.

Later history. Knighton Woods with its planted rhododendrons and trees, together with this pond was a very popular picnic and walking area in the 1930s. The banks are mostly gravel, but one side has what appeared to be rock face, which age now reveals to be concreted. The island in the middle is surrounded by dense *Phragmites* beds and the pond bed is 1.5 to 2 m deep in silt with masses of small timber in it. If it is to survive as a pond it must be cleaned out. This pond had a large population of amphibians in the 1960s when frog, toad, palmate and smooth newt were all abundant. A small number of frog tadpoles, palmate newts and smooth newts were found in June 1994.

Fishes. Relatively few fishes are found in this pond now. It was surveyed in September 1996 when the folowing fish were caught:

CRUCIAN CARP	8 fish (25–29 cm in length)
CARP	3 fish (all *c.*60 cm)
ROACH	29 fish (mostly *c.*6 cm)
TENCH	5 fish (all 39–41 cm)
PIKE	3 fish (all 22–35 cm)

The structure of the crucian carp, carp and tench populations was curious in that no young fish were caught and the fish caught were mostly large. On the other hand, the roach were mostly small. It could be argued that the presence of pike was engendering the loss of roach, resulting in few larger fish, and may have been controlling the numbers of crucian carp. However, the condition of the pond led to depleted oxygen levels in the summers of 1995–7 and few young fish would have survived, although initial survival of roach fry could have been high due to abundant zooplankton in the pond in the first half of the year.

22. The Dell Pond, Woodford Green (Woodford Green Golf Course) TQ398927

Origin. This small pond lies in a small copse of oak trees at the edge of the golf course. It lies just below the hill and appears to be a small gravel working. A similar shallow pit lies nearby but is now dry. I am unaware of the early history of this pond, but it may be the gravel digging referred to in The Lopps at Woodford in the Committee Minutes on 5 October and 18 November 1889.

Later history. This pond is now almost completely filled with silt and dead leaves which fall into the water directly from the oaks and are wind blown from the surrounding copse. The silt is in excess of 1 m in depth; there is a small *Typha* bed at the northern end and the surface of the water is covered with duckweed *Lemna.* The presence of much fallen timber added to the silt makes this pond dangerous to wade in and impossible to net.

Fishes. A survey conducted on 19 September 1996 produced carp (2 fish), tench (2), perch (1) and an eel (which escaped). In view of the poor state of the pond it was surprising that perch had survived. An earlier survey (14 September 1995) produced a number of perch (seventeen fish, 9–16 cm); carp were seen but were not caught. On 30 September 1997 the first stage of fish population management was undertaken when fish were removed by electrofishing. The following species were caught:

CARP. Twenty fish (one of 14 cm, the remainder between 33 and 46 cm. Total weight 20.88 kg.)
RUDD. Seven fish (one of 18 cm, six between 6 and 10 cm)
TENCH. Five fish (between 19 and 26 cm)
PERCH. Four fish (between 7 and 9 cm)

The tench were returned to the pond, the rudd transferred to the neighbouring The Gravels pond. All the carp and perch were removed. This pond once had a thriving amphibian population which is now greatly diminished. (See the discussion under The Gravels for further details of management.)

23. **The Gravels,** Woodford Green (The Newt Pond, The Dew Pond) TQ397925

Origin. This pond lies on the edge of the fairway at Woodford Green Golf Course with a tee close to its edge. It is of relatively recent construction, although I do not know when it was dug. Its position suggests it was a hazard introduced by the golf club, and its recent construction is also suggested by the raised bank on the south-east side. Golf has been played at Woodford since 1890 (Addison 1977), but I suspect this pond is much later than that, possibly even post 1939/45 war.

Later history. This is a small pond dug out of clay, but there is gravel on the bottom in places, which may be natural. There is now heavy growth of reed mace and other emergent plants including white water lily *Nymphaea*, and *Nymphoides*, planted to beautify the pond. It is shallow, mostly less than 40 cm although near the northern bank one can sink into the water and silt to a depth of 1 m.

This pond is widely known in the area as 'The Newt Pond', and middle-aged inhabitants speak of the large numbers of common newts in it. It is said to contain crested newts also. This pond lies about 150 m to the south-west of The Dell.

Fishes. The pond has been electrofished on three occasions and netted once. The details of the catches are set out below:

	CARP	RUDD	PERCH
11 September 1995	Nil	*c.*20 fish, 13–18 cm	*c.*15 fish, 8–10; 20–25 cm
19 September 1996	Nil	30 fish, 4–20 cm	50 fish, 6–14 cm
30 September 1997	1 fish, 35 cm	Several, 15–19 cm, hundreds *c.*6 cm	11 fish, 11–20 cm
Netting			
1 October 1997		*c.*200 fish, *c.*6 cm	12 fish

Discussion. The recognition that this pond had a newt population, possibly of some importance, and it was also shallow and liable to dry up during the extensive drought of 1995–7 left no alternative but to manipulate the fish

population. The first objective was to remove the perch which were numerous as they were potential predators on the newts. It was then discovered that anglers had been transferring perch and carp from the neighbouring pond (The Dell) so control of both species was extended to that pond also. This decision was justified when a carp, possibly recently introduced, was discovered on the third electrofishing operation in September 1997. Had nothing intervened, this pond would have been left with rudd in it, which provided food for visiting kingfisher *Alcedo atthis* and grey heron *Ardea cinerea*, both of which were seen regularly visiting the pond. Unfortunately the drought continued into October and distressed fish were seen at the surface so as many as possible were caught in a small, fine-meshed seine net and the rudd were transferred to Baldwin's Hill Pond (12) (the perch were killed). Sufficient rudd were left in the pond to form a breeding stock providing the condition of the pond does not worsen.

24. **Potato Pond,** Woodford Green TQ401922

Origin. I have been unable to trace the origin of this pond which lies on the west side of the Woodford Green–Epping road. On its northern side it is overlooked by the (dilapidated) building of the Men's Club which was converted from the Wesleyan Chapel in 1904. It is possible that it was constructed to supply domestic water to the houses on this side of the Green, but on the east side in wet weather it fills up to the paved path alongside the road, which suggests that horses and other livestock might have benefited from it also. This pond is shown on the map (engraved in 1885) in Buxton (1897). It is also shown on the archival map in the Superintendent's Office which was surveyed before 1881, but seems to be shown larger than its present size.

There seems to be no confirmation for its name that locals washed their potatoes here on their way to market.

Later history. This very small pond is usually unnoticed. In the 1990s it has had a considerable growth of *Typha* at its margins which results in it drying out early in the summer due to increased transpiration. It was 'cleared out' by a team from the Manpower Services Commission in 1983, which is reported to have found a well close to the island in the pond. The island is now overgrown with vegetation and the whole pond is silting up. (The surface vegetation was removed by volunteers in early 1998.)

Fishes. This pond was electrofished on 25 February 1997: the following fishes were caught:

Brown goldfish	7 fish (16–19 cm in length)
Crucian carp	2 fish (both 13 cm fish)
Carp	1 fish (52 cm)
Stickleback	2 fish (both 4.5 cm)

The carp and the brown goldfish were removed; all others were returned to the pond.

Later in the year twenty small rudd and fifteen small tench were stocked in this pond with the double objectives of suppressing mosquitoes and providing angling targets for juvenile anglers.

25. **Johnson's Pond,** Woodford Green TQ401920

Origin. The pond lies at the junction of Woodford High Road and Snake's Lane in the heart of the shopping centre of Woodford Green. The western and southern sides are retained by concreted walls; that on the northern side is overgrown with emergent vegetation as is the eastern side although less so. There are two small islands on which live domestic ducks and a number of brown rats. The pond is very muddy and rather shallow.

The presence of a hand pump by the south-west corner of the pond suggests

that it may lead to a buried spring and have supplied water to nearby houses. This pond is not shown on the engraved maps from 1885 in Buxton (1897), but it is shown on the archival map in the Superintendent's Office on a map surveyed in 1881. If the pump and the pond are contemporary then they are post 1885. It is possible that the pond was dug much later as a visual amenity to the village while the pump was a working pump supplying water to the local community.

Later history. I have no information on alterations to, or management of, the pond.

Fishes. In February 1997, following two weeks' severe frost, a number of dead fish were found. Electrofishing revealed a number of small fish still living.

BROWN GOLDFISH	1 fish (28 cm) which was removed.
CARP	6–8 dead fish of 4–5 lb weight; 1 live carp (15 cm) was removed.
TENCH	2 fish (15 and 20 cm)

Later in the year this pond was stocked with twenty rudd and twenty tench to provide fishing interest for young anglers in the centre of the village.

26. Highams Park Lake TQ393922

Origin. This lake lies in the middle of the valley of the River Ching which rises at Connaught Water, Chingford, and flows southwards before turning west at Hale End to flow into the River Lee. It was created by digging out the sides of the Ching and dumping the spoil at the southern end to create a dam. The design was by Humphry Repton and the *Red Book* he produced is dated 7 February 1794 (copy in the Vestry Museum, Walthamstow). It was part of a major redesign of the house (Higham Hills) and the estate for Thomas Courtenay Theydon Warner. The lake follows the course of the original river bed, the river entering from the north beside a planned boathouse and cottage and an overflow at the south-east (the boathouse may never have been built).

At construction (or possibly at a later date) a new channel was cut for the River Ching parallel to the lake and along its western bank. This was a departure from Repton's plan. In the 1930s a weir with a diversion channel existed so that part (or all) of the flow could be diverted into the northern end of the lake. Today this diversion channel no longer exists, although its concreted walls are still visible in the river bank.

The Highams Park estate was purchased in 1890 from Mr Courtenay Warner by the Corporation of London and a number of local landowners. It was opened to the public in June 1891.

Later history. In the 1930s the lake was already silting up at the northern end where it is very narrow. Possibly because of this the flow of the river was no longer diverted into it. However, by then the river's natural flow had been seriously changed from Repton's time by the construction of the Western Sewage Treatment Works at Chingford Hatch (upstream of the lake) at the beginning of the twentieth century. This continued in use until the early 1960s when the sewage was diverted to Deepham's Sewage Treatment Works at Edmonton once this was rebuilt and extended. There seem to be no records of the amount of sewage treated in the filter beds of the Western Sewage Treatment Works, nor the quality of the effluent discharged. It is probable that the quality of effluent was not high at times when economic and social changes affected the works and the volume of sewage was enormously increased by the inter- and post-war developments of housing estates in North Chingford and Woodford Green. Much of the silt which covers the bed of the lake in large areas of the northern half, to a depth of 1.5 to 2 m, was probably deposited after the construction of the Sewage Treatment Works. Surveys of the chemical state of the lake water show that it has very high phosphate levels (B. Brewster pers.

comm.) which would account for the dense growths of filamentous algae observed every year since 1990 (and by verbal accounts earlier). High phosphate levels were particularly noted in sewage effluents in the post-1939/45 war period when early detergents came into use.

The discharge of the treated sewage effluent into the River Ching, part of which was diverted into the lake, was responsible for many of its siltation problems today. The long-term future of the lake is very uncertain because of the enormous volume of silt and the very restricted access to the lake side. Dredging of the lake would be very expensive, not least because the silt would need to be removed to a distant site.

Fishes. As planned by Repton, the lake was primarily intended as a visual amenity to the Highams Hill estate, but it was also regarded as a fishery. Plate I of his *Red Book* contains the note 'necessary to have a cottage near the water to protect the boats and the fishing tackle . . .'. There seems to be no information available on the kinds of fish that were stocked into the lake.

To my knowledge in the 1930s and 1940s the lake contained tench, roach and sticklebacks (but these were the results of occasional records). In the early 1990s the Hollow Angling Society was licensed to administer the fishery and in March 1994 it was given permission to introduce 300 carp of 4–6 inches to the water (when they were delivered the fish were 10–12 inches in length — thereby approximately quadrupling the biomass introduced). The angling club also was given permission to remove forty pike from the lake in 1993 (and transfer them to the Hollow Ponds (31) which was regarded as having too many small fish in it). Both of these faunal manipulations were undertaken without professional surveys or advice.

A fish survey was conducted in February 1995 by the National Rivers Authority who caught a large number of pike (25), tench (35) and roach (33). Most of the pike were small (16–23 cm) but six were between 43 and 56 cm, and one was 68 cm. The tench were mostly small (3–18 cm) but eleven were between 23 and 48 cm. The roach were mostly small, thirty between 6 and 9 cm, although three were 21–23 cm in length.

Later work was aimed at controlling the number of pike while assessing the abundance of other fish. The results are given below:

Pike lengths

	Total length (cm)									
	10–19	**20–29**	**30–39**	**40–49**	**50–59**	**60–69**	**70–79**	**80–89**	**90–99**	**No.**
1.ii.1995	11	6	—	4	2	1	—	—	—	24
1.iii.1996	1	1	1	10	20	6	5	—	—	44
18.iii.1996	20	—	3	1	2	—	—	—	—	26
11.xi.1997	1	45	2	—	—	1	—	—	1	50
18.xi.1997	—	36	6	4	2	2	1	—	—	51
									Total	195

Other fishes

EEL. Several large eels between 62 and 72 cm.

ROACH. Large numbers caught: most were less than 10 cm; larger fish (23–26 cm) were caught. Visual observations from a boat in June 1996 and 1997 reported schools of young roach in excess of 3,000 fish.

TENCH. Large numbers of small fish (10–23 cm) were caught. Two larger fish (45–46 cm were measured). In summer 1997 up to twenty-five large tench were observed swimming near the surface in still conditions. Most of these were about 50 cm in length.

PERCH. Large numbers of fish of 6–10 cm were caught; one larger fish (24 cm) was measured.

CARP. There are large carp in this lake. Anglers report catching fish of up to 9 kg, but all the netting and electric fishing have failed to catch one. Probably this is due to the depth of silt and the dense vegetation in which these fish can hide. It is possible that the 300 carp introduced in 1994, which had been reared in heated effluent and kept

in tanks before release, mostly died when exposed to predators, parasites and disease because few have been recognized in later catches. Large carp are also vulnerable to theft because of their high monetary value.

Further discussion. This lake was notable for the large numbers of sticklebacks and gudgeon in the 1930s and 1940s. None has been caught during the surveys. A small number of gudgeon and crucian carp were released here in November 1997.

27. Leighs Pond TQ395912

Origin. This small pond lies just to the north of the Napier Arms. It is steep-sided on the eastern side, but embanked on the western edge. I know nothing of its origin, but have been told it was excavated for gravel when the road to Hale End (Oak Hill) was being surfaced.

The pond is shown on the archival copy of the OS map surveyed in 1862 and 1863 (Superintendent's Office at The Warren). I cannot discern it on the map in Buxton's *Epping Forest* (1897), but that is possibly because the pond was too small to be engraved to scale.

Later history. This pond had accumulated about 1.5 m of soft silt in its bottom which is in places compacted by dense growth of *Phragmites* reed. There is very little open water except where trees overhang the pond edges and where there is considerable leaf litter. This pond has very low conductivity and there is little dissolved oxygen in the water; only a very limited range of aquatic life could survive in this pond.

Fishes. This pond was surveyed for fishes on 25 February 1997 and the results checked on 23 September 1997. The results are given below:

	February	September	Total
Brown goldfish	5 (13–26 cm)	9 (14–24 cm)	14*
Crucian carp	72 (11–17 cm)	87 (3–17 cm)	159†
Tench	5 (22–30 cm)	2 (23–25 cm)	7

*All fish removed from the pond. †All fish returned to the pond, some fish may therefore have been counted twice to make a cumulative total.

This is the most important pond in Epping Forest for the size of the stock of crucian carp. Its condition is such that only crucian carp could survive in such low oxygen levels and such a habitat choked with emergent vegetation. Possibly as a result of the poor conditions, there are relatively few young crucian carp in the pond.

The presence of brown goldfish in this pond is a matter for concern because of the risk of hybridization, but it is thought that they may have been recently released here from Bulrush Pond during 'unofficial' fish rescues by children.

28. Bulrush Pond (Rising Sun Pond) TQ391897

Origin. The date this pond was created is uncertain. Possibly it was a gravel digging, but it is more likely that it was a swampy area which was drained by digging a pond. It is shown in Buxton (1897) as Bulrush Pond in his map engraved in 1885, but the size and shape of the pond does not agree with its present-day outline. In October 1923, what was described as the swamp was made into an ornamental pond and this may date when the pond was deepened and enlarged to its present outline (Minutes of the Epping Forest Committee, Corporation of London).

In September 1877, the East London Water Works Company constructed a reservoir in Forest Road about 400 m to the north of the pond. Extensions to the reservoir were made in 1881 and 1895 (Ramsey and Fowkes 1986: 62). A connecting ditch running southwards linked the reservoirs to Bulrush Pond and carried surplus water away after the reservoirs had been pumped full. As a result

the pond was full all year round and in the summer months it was used for boating mostly by children in paddle boats (the pilings which supported the landing stage close to the roadside were visible, although much decayed until 1996).

Parenthetically, it might be noted that this discharge and the connections of this pond with the Eagle Pond, and the Hollow Ponds and others, provided a direct route for the dispersal of the amphipod crustacean *Eucrangonyx gracilis* (S. I. Smith) which is now widely distributed in almost all ponds in Epping Forest (Ingle 1959; and personal observation). This amphipod occurred in the filter beds at the Lea Bridge Waterworks (Crawford (1937), quoted in Ingle (1959)) which were part of the Metropolitan Water Board system which fed the reservoirs.

Later history. The reservoirs were reconstructed in the 1970s and the regular supply to the pond ceased although water is occasionally pumped into the ditch leading to the pond. Over the years this pond had silted up so that there was between 45 and 50 cm of silt above the original clay bed. Dense beds of emergent vegetation, including *Typha*, had formed on the north-western side and in the southern bay by the 1980s whereas in the 1930s the pond was mostly open water. Several ineffectual attempts were made to reduce the vegetation in the early 1990s, but these, as usual, removed plant material, not the cause of the problem which was the huge quantity of silt. With the declining rainfall during the 1990s the pond became increasingly shallow. A major attempt to remove the silt took place in 1997.

The drought of 1996 caused the water level to drop severely and parts of the pond dried out. In August 1996 a fish rescue was mounted using seine nets and a backpack stunner.

Fishes. The following species were caught:

EEL. One of 60 cm was temporarily stunned, but escaped into the silt.
BROWN GOLDFISH. Numerous.
CRUCIAN CARP. Numerous.
CARP. Very common, including young fish. This pond was one of the few in which carp had successfully bred.
ROACH. Very large numbers.
RUDD. Many.
TENCH. Numerous.
STICKLEBACK. Large numbers.

This fish rescue produced so many fish (estimated at around 5,000 individuals) that exact counts of abundance were impossible to obtain. An attempt at quantification was made by half-filling a large bucket with water adding fish until it was full, then identifying and counting the fish. This gave a count of brown goldfish plus crucian carp 15, carp 56, roach 51, rudd 19, stickleback 29. The number of buckets emptied into holding tanks during two days amounted to more than 4,000 fish. All the fish were removed to a pond on Corporation land at Woodredon Farm. It is believed that the larger fish were removed by unofficial action.

This pond was an important amphibian habitat with large populations of frogs, smooth and palmate newts.

29. **Frying Pan Pond** (Round Pond, Buxton Pond) TQ393891

Origin. No information is available on the origin of this pond. It lies on the green in front of Forest School, but is very close (*c.*100 m) to Snaresbrook Road. It may have been dug as a watering pond for cattle grazing in the nearby Forest, but the proximity of the much larger Eagle Pond makes this unlikely. It is very small (about 50 m across) and almost circular in shape. Its bed is gravel. It pre-dates the maps in Buxton's *Epping Forest* which were engraved in 1885.

Later history. This pond is shallow with about 15 cm of silt on its gravel bed and about 45 cm of water (in winter). There is a substantial stand of club-rush near the north bank and much of the surface area is covered with fringed water lily. The droughts of 1994–7 reduced the water level severely.

Fishes. In August 1996 the pond was electrofished with a seine net in place to stop the fish from hiding in the vegetation. The following species were caught:

Eel	1 fish (85 cm)
Brown goldfish	7 fish (21–33 cm)
Crucian carp	1 fish (18 cm)
Carp	4 fish (31–61 cm)
Tench	34 fish (10–35 cm)
Pike	1 fish (46 cm)
Stickleback	*c.*100 fish (4–5 cm)
Perch	1 fish (19 cm)

This pond is an example of the level of uninformed interference in the fish fauna. Pike, perch and carp are quite unsuited to a pond of this size.

The eel, pike and perch were removed from the pond as were the carp and goldfish.

30. Eagle Pond TQ399890

Origin. The Eagle Pond is of considerable age as it is shown much in its present shape in the map of Chapman and André of 1777 (surveyed from 1772 to 1774). Its present shape and size are also shown in the archival copy of the OS map in the Epping Forest office which was surveyed in 1862/3. According to Addison (1977: 78) the pond had been enlarged from the ancient spring known as Birch Well by the 1870s, but there seems to be some doubt whether this was the spring in Wanstead which for a short while was well-known for its health-giving properties (Christy and Thresh 1910: 11). Addison also refers to the Eagle Pond as receiving 'special treatment' after the Conservators had been shown the example of 'Caesar's Well on Wimbledon Common', but neglects to say what the 'treatment' was or exactly when it was done. Possibly this was the period when the eastern end was embanked and the northern side was confined by a deep concrete wall as it is today.

Later history. The Eagle Pond is bordered on the south side by the grounds of Snaresbrook Crown Court. Originally the site was enclosed in the 1840s and the building was erected by the Infant Orphan Charity as an orphanage, later to become the Royal Wanstead School in 1938. Because of the irregular nature of the original enclosure, the Eagle Pond (but not its south or east banks) was vested in the Conservators of Epping Forest, but the land on these banks is Crown property. In its days as a school the pond was used as a recreation area with boating and swimming; later it was used as a fishery with an angling club licensed to control the fishery. Inevitably it was stocked with carp and bream by the club in the 1970s. However, fishing was only possible from the footway of Snaresbrook Road which was hazardous to pedestrians, and when long 'poles' were in use, the hazard extended into the roadway. The pond also attracted large numbers of wildfowl, particularly in winter, and there was conflict between birds and fishing. The Corporation withdrew the license and banned angling on this pond in about 1989.

Because of the presence of large carp and other fish and the clear access on to the pond on its northern bank from Snaresbrook Road, night-time poaching quickly developed and it was mainly to curb this that the decision was taken to remove as many of the fish as possible.

The pond is now heavily silted with up to 1.5 m of silt in places, particularly in the south-east corner and at the western end around the islands. In summer

a heavy filamentous algal bloom caused difficulty in netting. There is also an enormous amount of rubbish (e.g., plastic bags) in the pond.

Fishes. Fishing was by use of both electric stunner and seine net and in August 1997 using fyke nets. A summary of the catches is given here:

EEL. Numerous: 101 eels (35 kg) were caught in fyke nets set for forty-eight hours in August 1997.

BREAM. Numerous: a few moderately large fish and many small ones in November 1994; a total of seventy large fish between 1.3 and 1.8 kg in January 1995; many small fish October 1997.

CARP. A small number of large fish are still present, e.g., six up to 6 kg, November 1994; 2.7, 4.5, 2.7, 4.1, 9.5 kg caught in January 1995 and on 31 October 1997. Carp of this size are difficult to catch; there were certainly more than these in the pond. Three small fish (6 cm) were caught in fyke nets.

ROACH. This species was common in the 1970s; a few were caught in November 1994, but none was caught later during our work.

TENCH. This species was very common in this pond in the 1970s and later, but only two small fish (*c.*15 cm long) were caught in October 1997.

PIKE. Moderately common. A total of nine fish netted in January 1995 and October 1997, ranged in weight from 0.02 to 4.5 kg.

PERCH. Numerous but small; about 100 fish up to 25 cm, but most were about 9 cm on each occasion when nets were used.

From being a richly stocked pond in the 1970s, the Eagle Pond is now not notable for fish. Two factors have probably contributed to this. Firstly, the introduction of large carp by angling interests in the 1980s has altered the ecological balance of this lake, notably by eating the vegetation and stirring up the silt on the bed. Secondly, the presence of cormorants *Phalacrocorax carbo* all year round which have certainly reduced the number of 'silver fish', e.g., roach, in this and other lakes. In combination, the removal of protecting vegetation and the presence of comorants would make it difficult to re-establish this as a fishery.

31. Hollow Ponds TQ393887

Origin. This large and irregular-shaped pond with eight islands of various sizes lies on the south-western side of Leyton Flats opposite Whipps Cross Hospital. Leyton Flats lie on a very extensive area of sandy gravel of the Thames terraces. This area had had gravel extracted over a long period leaving the surface pitted and uneven, an 'open space, much broken by old gravel pits, and covered with patches of gorse and broom' (Buxton 1897: 26). The Conservators of Epping Forest in their early enthusiasm for drainage and tidying-up the Forest further excavated and joined up the small gravel diggings in 1883 to form a large pond (Superintendent's Report, 18 January 1883). The pond was enlarged in 1897 at a cost of £1,209, and a further extension to the east was created in 1903 to 1904 (Archival OS Map 1880 in Epping Forest office; MS additions). It was probably this occasion that was referred to by Layton (1986) when the local authority employed a hundred men for three months to enlarge the pond (although Layton dated this to 1905).

Later history. This pond is relatively shallow and is very vulnerable to drought, so that in times of low rainfall it is only 10 to 15 cm deep in places, where, with the winter's rain, it may be nearly 1 m. A moderate amount of silt has accumulated, but it is only a problem in the eastern and northern bays. Marginal vegetation is not dense although there is a small bed of *Typha* in an area on the eastern bay. Submerged vegetation is variable, but in the northern bay there is a certain amount of milfoil *Elodea canadensis*, and *Potamogeton crispa*; on the southern side of the pond there are extensive beds of *Potamogeton friesi* (1995 observations). For a decade before that the pond was virtually bare of bottom vegetation following an enormous growth of *Lagarosiphon major*

which blocked the pond and prevented the hire rowing boats from being used in summer. Much of this pond weed was dragged out using tractors and a steel hawser — but this also removed large numbers of aquatic insects and young fish trapped in the weed.

This pond is managed by the Hollow Angling Society and has been since 1986. In an attempt to encourage plant growth, this club treated the water with limestone chippings in about 1986 (with permission). The restoration of vegetation noted above in 1995 may have been attributable to this.

Fishes. Not surprisingly, the fish fauna of this pond was found to be poor when first surveyed. The following fish were caught:

14 February 1995
EEL. Several moderate to large specimens, most about 70 cm long.
BREAM. Several large fish, 35–51 cm long, and a large number of 5 cm fish.
CARP. One about 40 cm, seen but not caught.
ROACH. One large specimen of 25 cm disgorged by a pike; a number of 4–5 cm fish.
TENCH. Ten large fish, 40–46 cm.
PIKE. Twenty fish, 20–120 cm long. All were removed.
PERCH. Thirty fish, 5–7 cm and one of 12 cm were caught.

10 April 1995
EEL. Three, all about 1 m long (weights 1.8, 1.8 and 2.4 kg).
BREAM. Fifty fish of 35–51 cm, but very few young fish.
GUDGEON. About twenty on the eastern edge of the pond.
ROACH. About twenty fish, to 25 cm caught, and a small number of younger fish.
TENCH. Fifty to sixty large fish.
PIKE. Fifty-four caught and removed, a total weight of 39.018 kg.
PERCH. Small numbers caught.

In the survey of February 1995, it was noted that the pike were excessively thin and their gall bladders were enlarged (showing that they had not eaten). One of them contained a moorhen chick. They were in poor condition and had heavy external parasite loads of the fish louse *Argulus foliaceus* and the fish leech *Piscicola geometrica.* The sparsity of small fish, particularly roach and bream, in both surveys showed that they had been heavily predated by piscivores. This clearly was a result of the introduction of forty pike from Highams Park Lake (26) in late 1993 by the angling club, an act perpetrated because there were 'too many small fish'. In all, sixty-two pike were taken from this pond in an attempt to restore the balance of predators/prey fish.

32–35. Ponds of Wanstead Park

Wanstead Park is the remains of a large estate belonging to Sir Josiah Child (1630–1699), Governor of the East India Company, and later Sir Richard Child (d.1784) which comprised 300 acres (122 ha), much of the land of present-day Wanstead, Leytonstone and Snaresbrook. In addition to the building and lavish tree planting that took place, a series of extensive fish ponds was created during the ownership of the two Childs, some of which are discernible on the map of Rocque of 1745.

Wanstead Park was purchased by the Corporation of London in 1881 and, although it is administered together with Epping Forest, it is distinct from the Forest with its own by-laws. It is not included within the SSSI, being a wholly man-made habitat. Because of this a certain amount of latitude is possible in fishery management proposals, although nature conservation issues are still important in its management.

32. Ornamental Water TQ418876

Origin and later history. This is the largest of the lakes in Wanstead Park, but it forms an elaborate meandering channel which formed the original bed of the River Roding with narrow channels dug on the eastern side to create

Lincoln Island (the largest island) and Rook Island, while a series of very small islands forming a ring are known as the Fortifications. The maze of islands was spanned by bridges and is said to have been used to stage mock sea battles, the Fortifications being central to these 'war games'. A long straight channel ('The Canal'), running to the east, is part of the planned visual landscape permitting long views down the lake at its widest part and across the lawns to Wanstead House (demolished in the 1820s).

The islands are all heavily wooded, as the banks of the lake have been for many years, and there is a large volume of leaves dropping and blowing into the lake each year. The narrowness of the channels also reduces wind ruffle and the considerable volume of timber in the water from the windblown trees further limits the uptake of oxygen by the water. As a result, oxygen levels around these narrow meanders are very low in the warmer months of the year. The water is also very shallow and very few fish live in this area of the lake. Most of the lake is heavily silted with up to 1 m of mud.

It seems that the planned water supply to this and other ponds in the Park was designed to flow from The Basin (within the Wanstead Golf Club) by pumping to the Shoulder of Mutton Pond, the Heronry Pond, to the Perch Pond and thence into the Ornamental Water and being discharged into the River Roding. However, this sequence was reversed in the past and continues now with water being pumped from the Roding into the Ornamental Water and from there into the Perch Pond. The Heronry Pond is dry most of the year and the Shoulder of Mutton Pond is filled by rainfall and some water from The Basin. It is unfortunate that the water intake from the river requires flow through a poor quality area of this pond before it is pumped to a higher pond.

The condition of the Ornamental Water caused problems in the past when sewage entered from the River Roding in 1883; the pond was cleaned out (Report 1883) and in 1908/9 when 400 unemployed men from West Ham were directed to clean it out by the Distress Committee (Superintendent's Reports 1909).

The herony in Wanstead Park was originally on an island in Heronry Pond, but in the nineteenth century moved to Lincoln Island in the Ornamental Water. As the trees matured on the island at Walthamstow Reservoirs in 1914, the heronry transferred there (Christy 1890, Cox 1984).

Fishes. There must have been fish in this pond ever since it was made because it was part of the River Roding, although I have no information on the species present. There are records of the presence of carp, roach and pike from 'Wanstead Park Lake' in Wheeler (1958), but these were culled from angling literature.

Fishery surveys here showed that the population is dominated in terms of weight by eels and pike. In June 1994 approximately 90 kg of eels and 45 kg of pike were caught by Mid-Kent Fisheries by arrangement with the angling club (Redbridge & District Association of Anglers) and the Corporation.

A general survey took place on 29 November 1994 and produced eel, bream (a large number between 6 and 16 cm), goldfish × carp hybrids (two large fish), carp (several, the largest 9.0 kg), roach (a large number up to 10 cm), tench (several), pike (several, the largest 9 kg), perch (1). The same species were caught on 2 November 1996, but roach were more numerous and larger (seventy-two fish up to 20 cm). A small 18-cm carp caught this day contained three specimens of the imported tapeworm *Kahwia sinensis*, a parasite which had not been recorded before in Epping Forest ponds (B. Brewster pers. comm.). From the condition and size of the host fish, it is suggested that this fish had been recently introduced to the pond.

Observations made on four fish surveys suggest that there are very few fish of any kind in the north-western arm of the lake or around the Fortifications (in which area the water was only 0.5 m deep).

33. Shoulder of Mutton Pond TQ409873

Origin and history. This small pond is a relatively shallow basin at the western end of Wanstead Park. Its bottom is entirely gravel. There is an inflow stream running southward from The Basin (Wanstead Golf Course property) but it flows only in conditions of high rainfall. However, this pond does not dry up even in conditions of drought, so there may be seepage through the gravel from the golf course. The outflow is on the eastern edge of the pond and the flow is in a conduit to The Heronry Pond. Angling is banned in this Pond.

Fishes. In the 1990s, the pond was dense with Canadian pondweed *Elodea canadensis*. It was netted on 24 November 1994. The only fishes that were caught were three-spined and nine-spined sticklebacks. The proportion between the species was 10 to 1 in a sample of over 1,000 fish. Reports have it that there are carp in this pond (and anglers are known to have been seen 'poaching' it), but attempts to bring them to the surface with electric fishing gear were unsuccessful. (The fact that anglers are fishing in a pond is not evidence that fish are present.)

In 1994, about 30 per cent of the *Gasterosteus aculeatus* population was infested with the cestode worm, *Schistocephalus solidus*.

This pond has a rich invertebrate fauna. It attracts a large number of birds in the winter, numerous coots, tufted ducks, Canada goose and many gadwall. Dabchicks bred on it in 1994 to 1996. Unidentified newt larvae were caught in some numbers.

34. Heronry Pond TQ413872

Origin and history. This large pond is one of the series of 'fish ponds' constructed in the eighteenth century. It was enlarged after the Corporation of London purchased the Park as is shown by the archival copy of the OS map surveyed in 1862/3, and printed in 1879 (Superintendent's Office at The Warren). It extends west as far as the edge of the present-day western 'island' (GR 413873). The Pond is shown with its present shape in Buxton's (1897) map, which was engraved for the 1885 edition, so the extension must have taken place in the 1880s. It was said to have been deepened and altered in 1906/7 (Ramsey and Fowkes 1986: 19).

At some time the pond was found to leak and its bed was concreted, the slabs being separated by wooden battens. These have now rotted. Being built on the flood plain gravels (as are the other ponds in the Park) only a pond with a puddled clay bottom would have been watertight and concrete slabs would only have held water if their joints had been made watertight. During the 1939–45 war bombs dropped into the Pond, further damaging the bed.

In the 1980s and 1990s, this pond has partially filled up when there has been heavy rainfall, and the water stands in the eastern end for several months. During the drought years of the mid 1990s the pond dried up completely from about August.

There is little aquatic vegetation in this pond (although in 1995–6 water crowfoot *Ranunculus* and sparse *Elodea* appeared, and there was a lot of filamentous algae in the water). A rather poor invertebrate fauna appears during the early summer.

Fishes. An attempt to rescue the fish that were present in the summer of 1995 showed that there were large numbers of three-spined sticklebacks (several hundred were caught), and twenty-five perch (15–20 cm in length) were caught. These fish were removed, but others that were present would not have survived the frost in January 1997 when the water froze solid.

35. Perch Pond TQ417872

Origin and history. This moderately large pond lies within the chain of fish/ornamental ponds made within Wanstead Park. During the Corporation's ownership it was used for boating with hire rowing boats available, but no boating is allowed now. The pond is now kept topped-up by pumping water from the Ornamental Water, although considerable surface water must drain into it from the grassland of the Park.

This pond has a gravel bed with a considerable accumulation of silt, but the depth of silt is not serious except around the islands at the western end (where it exceeds 1 m in places) and in the south-eastern corner where wind-drift deposits leaves and floating rubbish.

Since 1994 this pond has been administered as a fishery by the Wanstead Park Angling Association.

Fishes. A survey was conducted by netting in November 1994 and showed that there were large numbers of small bream (7–10 cm), roach, tench, pike and perch in the pond.

After discussions with the Association it was felt that there were too many pike in the water (and pike were relatively unpopular with the anglers fishing here). A pike cull was held in November 1995 from which thirty-four pike of 29–64 cm length were removed. The majority of these fish were from 50–60 cm in length. During this netting the following other fish were caught and returned to the water:

BREAM. Sixty-five large fish (45–60 cm), fifty of which were transferred to the Ornamental Water. An estimated 2,000 young-of-the-year fish were caught.

BROWN GOLDFISH. One specimen, about 35 cm. Others may have been present, but many have been regarded as young carp by the large numbers of helpers from the Association.

CARP. At least sixty fish were caught, mostly in the 50–100 cm length range.

ROACH. An estimated fifty fish 15–25 cm and 600 to 700 small fish of 5–8 cm.

TENCH. Up to twenty-five large tench (<50 cm), but very few small fish.

PERCH. Twenty-five fish 15–25 cm and *c.*100 fish of 7–9 cm.

The second stage of the management of the fish took place in May 1997 when it was netted to remove the small carp ('small' being defined by the Angling Association as 12 lb (5.5 kg) or less). Fifteen fish were removed from the water, the remainder were released.

Other fish caught during this operation included fifteen pike (average weight 1.27 kg), one eel (1.8 kg), one tench (1.36 kg), twenty-two bream (1.1–1.8 kg), and several roach. In contrast with the previous nettings, there were very few young bream or roach; the reasons for this are uncertain.

Eels are known to be common in this pond, but only one was captured in the three nettings. It is assumed that they avoided the net or electric stunner by burrowing in the mud.

36. Alexandra Lake TQ415862

Origin. This large pond was created from plans published in 1878 and the pond was made near a 'disused brickfield' on the north side of Wanstead Flats (Epping Forest Reports, 18 January 1883). However, there is a discrepancy with the map in Buxton (1897) which shows a Brick Field Pond at least 0.5 mile (0.8 km) WNW of the present Alexandra Lake. It is also surprising that the surface geology where the lake lies seems to be Thames terrace gravel and not brick clay. It is possible that the gravel on the site of the present pond was used to fill in the old 'brickfield' excavation. The present pond is at least twice the size of the pond shown on Buxton's map and the map lacks the two conspicuous islands that are present in the lake.

This is a very shallow pond. In normal conditions of rainfall it has at most

1 m depth of water and silt, but during droughts it dries out with the exception of a narrow channel which was dredged in 1991 on the Wanstead Park side of the islands. Even then it is less than 1.5 m deep.

There is no deep silt (in comparison with the other large ponds), but the bed, particularly in the north-east and north-west bays, has about 30 cm of silt and in these shallow bays it is deeper. Some of this is accumulation of leaves from the trees in the vicinity, but a substantial input comes from the very large numbers of waterfowl that are attracted to the pond and are fed by the public; flocks of Canada geese numbering over 200 at times are attracted to the grass in the vicinity of the pond and take refuge on it. In season there are large numbers of mallard, tufted duck and shoveller, mute swan, Egyptian goose and coot. More shovellers occur here than on any other Forest pond; this may be a result of very abundant zooplankton (in December 1994, plankton samples contained huge numbers of the copepod *Cyclops vicinus* and cladocerans *Daphnia hyalina* and *Bosminia longirostris* (det. Dr G. Boxshall)).

Later history. This pond has been used for angling for many years, but following the drought of 1991/2, the level of this pond fell very low and many of the fish became distressed and were transferred to the Perch Pond in Wanstead Park. This pond lies outside the SSSI. No angling has been permitted since 1992.

Fishes. A fish survey on 20 December 1994 showed that the lake contained:

EEL. Fifteen fish, average length 60 cm.
CARP. One large fish seen, but not captured.
TENCH. One small tench about 8 cm.
PIKE. Thirteen fish mostly about 30 cm, but one was 60 cm long.
PERCH. Forty-five perch, mostly about 7 cm, but ten fish were around 30 cm.

This survey showed a serious imbalance between predatory species (eel, pike and perch) and non-predators (carp and tench).

On 26 July 1995 an attempt was made to redress the imbalance by removing predators in the hope of introducing more-suitable fish which could later be used to stock other ponds. The catch on this day was:

EEL. Fourteen fish, 56–71 cm in length.
CARP. One fish of 5.562 kg.
TENCH. Nine fish; two at 4 cm, seven of 41–50 cm.
PIKE. Fifteen fish 20–100 cm in length; the two largest fish weighed 7.4 and 9.2 kg.
PERCH. About 1,500 fish, length groups of 5–7, 11–13, 22–24 and 27 cm possibly represented four year classes. The number of fish in each length group *c.*1,500, 16, 4 and 1, supported this.

A further cull of fish was made on 5 December 1995:

CARP. Three large fish of 69, 70 and 78 cm (7.2, 10.4 and 11 kg).
TENCH. Five fish (one of 45 cm, and four of 7 cm).
BREAM. One fish 54 cm (2.6 kg).
PIKE. Thirteen fish (35–94 cm).
PERCH. About 1,000 of 7–8 cm, eight of 13–16 cm, six of 26–31 cm.

Unfortunately, in the summer of 1997 the water level continued to fall through to September and fish were visible in the very shallow water (which was more of the nature of liquid silt) — a further thirteen eels, seven tench, eleven pike and fifteen perch. Most of the perch died in the course of capture.

An outbreak of avian botulism in the wildfowl of the lake caused the Conservators to discourage public access, and much of the silt had to be removed by contractors. So far as is known, there were no fish in this pond from the winter of 1997/8.

Discussion

The prime reason for undertaking this survey was to discover what species of fish were found in the ponds of Epping Forest and what ecological impact fishes

had on the ecology of small woodland ponds and the larger lakes of this area. Most of Epping Forest is designated as a SSSI, most particularly for the flora and fauna of this ancient woodland site. The aquatic fauna is poorly known by comparison, with the exception of the amphibians and dragonflies of a few ponds which have been studied. Although a number of papers have been published concerning fishes, none is in any sense complete and most reported fishes caught by anglers, thus concentrating on the larger species.

As all the ponds in Epping Forest (in this context Wanstead Park is included in the Forest) are man-made, there are no profound biogeographical conclusions to be drawn from the study. However, there is some interest in discovering what species are present and in conjecturing how organisms became established in these ponds. A feature of this paper is the collection of information on the history of the ponds which sheds light on the methods of distribution of some of the animals.

The origins of the ponds are varied. Some are ornamental, being created as part of great estates established by landowners (e.g., Highams Park Lake (26)). Others were excavated to drain swampy areas of Forest (e.g., Connaught Water (17)), while others were seen as a means of making a visual amenity (e.g., Wake Valley Pond (7)), many of the smaller ponds are simply flooded gravel-pits (e.g., Strawberry Hill Pond (16) and the Earl's Path Pond (14), Loughton), and a few are bomb craters from the Second World War. Despite their varied origins, all are habitats of interest to the naturalist and places into which fishes can be introduced.

Introductions and translocations

With a few possible exceptions, all the fishes in the Forest ponds have been introduced deliberately by man. Most seem to have been introduced in the past by anglers or angling clubs who presumed to enhance the opportunities for anglers. In a few cases these introductions may have been made by the nineteenth-century owners of the estates which later became part of Epping Forest. Such lakes existed in Wanstead Park and Highams Park and were created as 'fish ponds' as well as ornamental amenity ponds for the estate. If the descendants of the fish introduced still survive they have been inhabitants of these lakes for two centuries or more. Few other ponds are more than a century old and the fish in them have been introduced by man in that time. Such introductions are mostly undocumented or are only known about by word of mouth and rumour many years after the event, one such being the introduction of bream to Connaught Water (17) by the London Anglers' Association (who were also probably involved in bream being released in the Wake Valley Pond (7)). The former case is known to me by verbal report of the principals involved, most of whom are now dead, but there is no record of it in the minute books or archives of the LAA today (A. E. Hodges pers. comm.).

Introductions of this kind are rarely recorded and often happened in the past at the whim of the introducee. In one case known to me from the 1960s, fish were being transported between two waters outside the Forest when the individuals involved, concerned at the apparently distressed state of some of the fish, simply off-loaded some of them into a Forest pond beside which their vehicle could park. The fish concerned were bream and the pond Goldings Pond (10).

The carp is a popular fish with anglers and was so in the 1930s; this is partly because of its size (it commonly grows to a weight of 20 kg today, but in the 1920s it was exceptional to catch fish over *c.*9.8 kg (20 lb). From the 1920s, Donald Leney of the Surrey Trout Farm, Haslemere, began importing large numbers of carp from Europe and large good-quality carp became more commonly available. Although I have no evidence that Mr Leney supplied carp to any Forest ponds, it was at about that time that large fish began to be caught

in Warren Pond (19) (Clifford 1992) and these may have originated directly or indirectly from Leney. Very large carp were frequently caught in Dagenham Lake in the period 1949–50 and in Cheshunt Reservoir earlier. Both lakes are close to the Forest and transport of live carp is simple as the fish survive for a long time out of water if kept damp. I consider it possible that fish from either, or both lakes found their way unofficially to Warren Pond (19) and perhaps in the 1950s to the Wake Pond (7).

Such introductions were made commonly in pre-SSSI days. There was no mechanism for curbing introductions of animals to the Forest. Even since Epping Forest has been given such recognition, stocking with fish has been frequent. Some individuals consider they have the right (if not the obligation) to introduce carp in particular to ponds without any reference to the Corporation of London or English Nature. Known illegal stocking has occurred in the last decade at St John's Pond (20), Buckhurst Hill; Staples Road Pond (13), Loughton; Theydon Green Pond (6), Theydon Bois; and at the Lake (1) in the Lower Forest.

Carp have also been introduced with the consent of the Conservators and the National Rivers Authority into large ponds by angling clubs, in one case (Connaught Water (17)) with disastrous consequences. The club involved in this was also given permission to transfer pike from one pond (Highams Park Lake (26)) into another (Hollow Ponds (31)) solely for the reason that there were too many small fish in the latter and too many pike in the former. The result was that the small fish in Hollow Ponds were reduced in numbers to a very low level and the introduced pike were clinically starving within a year. The larger pike were then forced to prey in spring on waterfowl chicks, and the perch in that water were feeding on the (illegally) introduced Turkish crayfish *Astacus leptodactylus* in their young stages. These introductions and translocations were undertaken without any consultation with a fishery adviser, and the statutory authority (then the NRA) gave permission without any enquiry.

Small-scale translocations of fish have been numerous over the years. They comprise the introduction of a single specimen of a native species to a pond often hopelessly unsuitable for it. The most striking cases involve single pike found in very small ponds (Frying Pan Pond (29), Butler's Pond (18) and St John's Pond (20)). The case of off-loading stressed bream in transit into Golding's Hill Pond (10) has already been mentioned. In this category of introduction on a small scale is the unexpected and puzzling discovery of a clicker barb in Golding's Hill Pond (10). This species is an Asiatic fish which was introduced to eastern Europe in consignments of small carp and grass carp purchased by fish farmers in Romania. By the translocation of unscreened fish to fish farms first in eastern Europe and later in western Europe, it has spread to cover most of Europe. So far it has only been reported in five localities in southern England and the source of these in the two cases where the source could be traced has proved to be an ornamental fish supplier who has supplied clients with golden orfe contaminated with clicker barbs for garden ponds.

Possibly the most frequently found introduced fish in Forest ponds is the golden form of the goldfish which has been caught in a number of ponds during the survey and which I have seen in a dozen ponds over fifty years. They are highly visible because of their coloration and may not survive long in ponds which herons visit (which is most in the course of a year).

The goldfish in its brown form has been found to be abundant in some ponds (over 250 brown goldfish were caught in Earl's Path Pond (14)). Its abundance is difficult to explain convincingly. It seems unlikely that in such a pond it has been deliberately stocked (although this has been the case elsewhere). The explanation may be that these brown goldfish are the offspring of goldfish released from garden ponds which have failed to colour and stayed brown due to the environmental conditions in the pond. The selective pressure of predators such as pike, heron and cormorant may, however, have removed the easily

visible gold-coloured fish and left the brown specimens. The situation is complex and requires further study because it is possible that the brown goldfish are gynogenetic progeny which are female fish only.

Conservation problems produced by translations and introductions

Within the SSSI area there is every reason for critically scrutinizing all proposals to introduce fish to a pond. Such scrutiny must be made bearing in mind the impact of the introduced fish on all aspects of the habitat, not just the perceived benefit of providing more fish for anglers to catch. In the past, permissions have been granted without any apparent appreciation of the indirect effects of introductions. This is an important principle. Too often in the past only the impact on the fishery has been considered. However, this is in keeping with the historic culture of coarse fish angling in which the addition of more fish is considered to be the solution to any problem in a fishery.

There are several examples in Epping Forest that demonstrate this. The most striking is the case of Connaught Water (17) in which a considerable number of carp were introduced. At the time of introduction, this pond had plentiful vegetation in the water and a rich invertebrate fauna. Within four years of the introduction of carp, there was a visible decline in the macrophytes and winter counts of plant-eating birds, notably coot, gadwall and Canada goose, had been seriously reduced. The water became greenish and turbid, as a result zooplankton was seasonally abundant. Eventually, most of the submerged macrophytes disappeared. The invertebrates were not seriously studied, but had decreased, although bottom-living forms (e.g., freshwater mussels *Anodonta*) remained common. The introduction of so many carp, which eventually became a very large fish biomass by annual growth, caused a serious degradation in the plant-eating birds of which the gadwall was an important loss to this water.

The Wake Valley Pond (7) also has a stock of carp which is long-established but small. This pond has a very good growth of macrophytes which are important to the maintenance of its dragonfly fauna. Eighteen species have been recorded from this pond, amongst them the downy emerald *Cordulia aenea*, a nationally scarce species, and the red-eyed damselfly *Erythromma najas* which is also rare (J. Dagley pers. comm.). The introduction of more carp, which would be popular with carp anglers, on the scale of the carp in Connaught Water, could completely destroy this important fauna. Fortunately, the club controlling the fishing at this pond is very responsible and appreciates that it is essential to keep the carp population at a low level.

Many of the ponds in Epping Forest had large numbers of amphibians in the survey conducted by Wheeler et al. (1959) (and later unpublished data). In the context of the reported national decline in numbers of amphibians (which has also been noted in ponds in the Forest) the introduction of pike into ponds in which amphibians occur is contraindicated. Pike are known to eat newts during their aquatic stages (see Warren Pond (19) in this survey), they also eat frogs (Wheeler 1998). This being so, it is inadvisable to permit the introduction of pike into ponds of importance as amphibian habitats. The present work in Epping Forest has shown that pike are often introduced to quite unsuitable ponds. It is difficult to understand the motive of persons doing such a thing and it is quite unauthorized. As with the illegal introduction of other fish into small ponds (e.g., carp into St John's Pond (20)), it is impossible to control without vigilant policing, and the only remedy the managers of a SSSI have are regular surveys of sensitive ponds with the object of removing unwanted species.

Policy for managing fish stocks within an SSSI

A policy for managing fish populations has been evolved within Epping Forest which lays emphasis on sharing the resource between its conservation interest

and recreational use for angling. Sensitive ponds which have importance because of significant populations of invertebrates, such as dragonflies, or of amphibians for which vegetation must be preserved, should not have carp introduced and, if they are present in any numbers already, consideration should be given to reducing the carp population. Neither pike nor perch should be introduced to ponds in which amphibians are an important part of the fauna, and eels should be controlled if they are present in numbers. Where ponds have a tradition of use for angling, the introduction of fish species which are in agreement with the conservation value of the pond should be considered. Thus, roach, rudd, tench and crucian carp are not known to be injurious and can be introduced and angled for (although the current obsession with carp in the angling world means that anglers will clamour for their introduction).

For ponds outside the SSSI (effectively in Wanstead Park in this study) such stringent restrictions on the fish can be relaxed. Here, carp, perch, and pike can be permitted within reason and even introduced if it can be proved beyond doubt that the stock is low. However, experience has shown that anglers' records are quite inadequate for judging fish stocks in a pond and stocking proposals will make no allowance for changes in the biomass attributable to growth, breeding or mortality. Angling culture demands stocking of more fish irrespective of any evidence.

This policy has been brought into practice in Epping Forest with the agreement of the Conservators. In routine surveying, pike are controlled in all ponds and removed from very small ponds where they have been callously introduced. Carp are removed from small sensitive ponds, and in the case of Connaught Water (17), almost totally in response to its gross overstocking and the environmental damage that it caused. Goldfish are also removed when found because there is reason to believe that, by interbreeding with crucian carp, the native species has become very rare by comparison with its status forty years ago. The serious decline in the status of the crucian carp is a national issue and has been drawn to the attention of English Nature.

Acknowledgements

I am grateful to Mr J. I. Besent, OBE, FRICS, for permission to conduct this study in Epping Forest and to his staff for their support. In particular, I am grateful to the late Peter Burman and to Jeremy Wisenfeld, successively the Superintendent's Deputies and Conservation Officers, and Jeremy Dagley, Forest Ecologist, for help and interest.

During feld-work Graham Rawlings has been a tower of support, and from time to time Chris Reynolds, Tom O'Leary and Dave Cheadle have all got wet and muddy in helping me catch fish. I am also grateful to Keith Wesley, Bedwell Fish Farm and Fisheries, for netting and electric fishing in the larger lakes.

My thanks are also due to Bernice Brewster (Aquatic Consultancy Service) for reporting on fish parasites, and Geoff Boxshall, FRS (The Natural History Museum) for identifying cladoceran crustaceans.

Environment Agency staff in the Thames Region have been very supportive of my work and I have to thank Mark Pilcher, Fisheries and Conservation Manager, NE Area of Thames Region, and Steve Coates, Fisheries Offcer in the Epping Forest area for their interest.

Sharon Cooper typed this paper, and all the preceding reports, with great competence: I am grateful for her help.

Opinions and statements in this paper are the responsibility of the author and do not necessarily represent Corporation of London policy.

References

ADDISON, W. 1945. *Epping Forest its literary and historical associations.* J. M. Dent and Sons Ltd, London.

ADDISON, W. 1997. *Portrait of Epping Forest.* R. Hale, London.

BRIMBLE, J. A. 1950. *London's Epping Forest.* Country Life Ltd, London.

BUXTON, E. N. 1897. *Epping Forest.* (Ed. 4). Edward Stamford, London.

CHAPMAN, J. and ANDRÉ, P. 1777. *A map of the county of Essex.*

CHRISTY, M. 1890. The birds of Essex: a contribution to the natural history of the county. *Essex Fld Club spec. Mem.* **2**.
CHRISTY, M. and THRESH, M. 1910. *A history of the mineral waters and medicinal springs of the county of Essex.* Essex Field Club, London.
CLIFFORD, K. 1992. *A history of carp fishing.* Sandholme Publishing, Newport, North Humberside.
COX, S. 1984. *A new guide to the birds of Essex.* Essex Bird Watching and Preservation Society.
HANSON, M. W. (ed.) 1992. Epping Forest through the eyes of the naturalist. *Essex Nat.* **11** (N.S.).
INGLE, R. W. 1959. On the occurrence of the amphipod crustacean, *Eucrangonyx gracilis* (S. I. Smith), in Epping Forest. *Essex. Nat.* **30:** 199–201.
LAYTON, R. L. 1986. Gravel workings — a landscape feature in Epping Forest. *Lond. Nat.* **65:** 31–33.
POWELL, W. R. 1956. Loughton. Extract from the *Victoria county history of Essex* **4**.
QVIST, A. 1958. *Epping Forest.* Corporation of London, London.
RACKHAM, O. 1992. Lodges and standings. *In* Hanson, M. W. (ed.), Epping Forest through the eyes of the naturalist. *Essex Nat.* **11** (N.S.): 8–16.
RAMSEY, W. G. and FOWKES, R. L. 1986. *Epping Forest then and now.* Battle of Britain Prints International Ltd, London.
SPEAKMAN, F. J. 1965. *A forest by night.* G. Bell and Sons, Ltd, London.
WARD, B. n.d. [1978]. *The retreats of Epping Forest.* Conservators of Epping Forest (Corporation of the City of London).
WHEELER, A. C. 1958. The fishes of the London Area. *Lond. Nat.* **37:** 80–101.
WHEELER, A. 1990. The population of three-spined sticklebacks *Gasterosteus aculeatus* in an Epping Forest pond. *Lond. Nat.* **69:** 77–78.
WHEELER, A. 1991. Carr formation and vegetation zones at Baldwin's Pond, Epping Forest. *Lond. Nat.* **70:** 35–46.
WHEELER, A. 1992*a*. *A list of the common and scientific names of fishes of the British Isles.* Fisheries Society of the British Isles, Academic Press, London.
WHEELER, A. 1992*b*. Fishes. *In* Hanson, M. W. (ed.), Epping Forest through the eyes of the naturalist. *Essex Nat.* **11** (N.S.): 150–154.
WHEELER, A. 1998. Fishes on floodplains. *In* Bailey, R. G., Jose, Paul V. and Sherwood, B. R. (eds), *United Kingdom floodplains.* Westbury Academic and Scientific Publishing, Otley, West Yorkshire.
WHEELER, A. C., MALENOIR, G. and DAVIDSON, J. 1959. A first report on the reptiles and amphibians in Epping Forest. *Essex Nat.* **30:** 179–188.
WILSON, T. H. 1893*a*. Notes on the gravel in Epping Forest. *Essex Nat.* **7:** 74–75.
WILSON, T. H. 1893*b*. Drift rocks in Epping Forest. *Essex Nat.* **7:** 129.

Spider records for the London Area in 1997

J. EDWARD MILNER
80 Weston Park, London N8 9TB

Abstract

Records of interesting spiders recorded in London and Middlesex in 1997 are noted. There were just two new records for London and one for Middlesex in the course of the year.

Introduction

Compared with previous years, 1997 was disappointing with only two new London records and one for Middlesex, well below the average for the past few years. (This was due to at least in part to the absence abroad of the author for much of the year.) Most of the records are from pitfall-traps at four sites: Queen's Wood, Highgate Wood, Hampstead Heath, and Buckingham Palace Garden.

Unless otherwise indicated all records are by the author.

In the list below new records are indicated as follows: * = new record for Middlesex, ** = new record for London. London (county) is taken as the old LCC area, and Middlesex its traditional area irrespective of changes in political or postal boundaries since 1974. The reason for this is that many spider records dating from before this date would otherwise have to be abandoned as they are not associated with specific localities, but only exist as 'county records'.

GNAPHOSIDAE

Two species of *Zelotes* have been recorded from a small number of sites from London and Middlesex: *Z. latreillei* and *Z. apricorum*. They are both associated with ants, especially the meadow ant *Formica rubra*. Records on Hampstead Heath have been very hard to come by, although the first two records for the genus on the Heath were reported by the author last year (Milner 1997). Until the last few years, the mowing regime on the Heath was fairly hostile to both the ants and these spiders, but this has now changed and anthills are now reappearing in several parts of the Heath. A single male *Z. latreillei* was taken in a pitfall-trap on the lower '*Atypus* slopes' above the Vale of Health, and an immature male, probably *Z. apricorum*, was taken in a trap on the Hampstead Heath Extension. These are both new areas of the Heath for *Zelotes* and can be taken as most encouraging finds, and possibly evidence of the generally improving conditions for invertebrates on the Heath.

THOMISIDAE

Last year a small crab spider *Ozyptila sanctuaria* was reported for the first time from London (on the '*Atypus* slopes' of Hampstead Heath). This year a second specimen (a female) was taken on the opposite side of the Heath on Upper Cohen's Field.

PHILODROMIDAE

A single male *Philodromus praedatus* (Notable B) was taken in Queen's Wood: this is only the third site in Middlesex for this uncommon crab-spider.

SALTICIDAE

The first London record of *Sitticus pubescens* since the 1950s was the discovery of a small colony on a south-facing wall in Buckingham Palace Garden.

A single female *Neon reticulatus* was trapped on a sunny bank in Highgate Wood. This is only the fourth record for the two counties, and would appear to add evidence of the relic ancient woodland fauna of Highgate Wood.

LYCOSIDAE

Further specimens of *Pirata latitans* (first recorded for London last year) were taken in June and July from the reedbed fringing the pond in the Bird Sanctuary on Hampstead Heath. A single male *P. uliginosus* was trapped on the Hampstead Heath Extension (Middlesex), a new locality for this uncommon species (one London record and now four Middlesex records).

TETRAGNATHIDAE

The previously unrecorded *Tetragnatha obtusa***/* was found at three separate sites in the course of 1997. These were the Bird Sanctuary at Hampstead Heath and Buckingham Palace Garden (both London) and the vegetation fringing the pond in the conservation area at Alexandra Park (Middlesex). How such an apparently widespread species has been overlooked before is not known.

LINYPHIIDAE

*Trichopterna thorelli***, an extraordinary money spider, with the head of the male elevated into a sort of wide periscope, was collected in leaf-litter at Buckingham Palace Garden.

Another small money spider, *Ceratinopsis stativa*, which occurs only on the 'best' (oldest, least disturbed, etc.) grassland habitats in the London Area has been taken on Pryors Field, Hampstead Heath, only the third site in the county of London.

Queen's Wood

As readers of the author's notes in the *Newsletter* will know, ground-active spiders in Queen's Wood have been monitored continuously by pitfall-trapping for the last nine years: the author intends to report on the first ten years' records in a subsequent issue of *The London Naturalist.* In the last few years few new records for the wood have been noted, but, unusually, in 1997 several species were found there for the first time in the trap catches. These were *Oonops domesticus*, *Zora spinimana*, *Philodromus praedatus*, and *Porrhomma microphthalmum.*

Acknowledgement

I would like to thank Dr Peter Merrett for identifying several species and confirming the identifies of others.

Reference

MILNER, J. E. 1997. Spider records for the London Area in 1996. *Lond. Nat.* **76:** 153–156.

Plant gall records for 1996 and 1997

K. HILL

93 Elmhurst Drive, Hornchurch, Essex RM11 1NZ

Preamble

As readers will be aware, 1996 was my first year as recorder of plant galls for the London Natural History Society, and although I had been interested in the subject for a few years previously, only a few records have come to me from the membership during this time. However, as so many of our members enter London during the course of the year, I am sure that even the most casual observers will be able to find something 'strange' in their travels. Material gathered from town streets, recreation grounds, parks, and commons, such as Wandsworth Common, Battersea Park, Alexandra Palace, Richmond Park, Victoria Park, Hackney Marshes, and especially from the older cemeteries, would prove interesting and useful to our purpose — to record the various changes in the natural history of the London Area.

Records to date

Catherine Schmitt sent me three records in 1996:

i A leaf of herb bennet *Geum urbanum* (L.) galled by the mite *Cecidophyes nudus* (Nalepa), which she found in an allotment site in Gordon Road, London N3.

ii A leaf of the lime *Tilia* × *vulgaris* galled by the mite *Eriophyes tiliae* ssp. *tiliae* (Pagenstecher), gathered in July from a pollarded tree in the N3 area of London.

iii A bud on the oak *Quercus robur*, galled by the wasp *Andricus kollari* (Hartig). This is known as the oak marble gall, and was found in December in Regent's Park.

Also sent to me in 1996 were an inflorescence appearing like a miniature 'witch's broom' on *Salix fragilis*, which is a gall by the mite *Phytoptus triradiatus* (Nalepa), found by Jane Reynolds in December in Camden, and fallen leaves of the elm *Ulmus carpinifolia* (Gleditsch), galled by the mite *Aceria campestricola* (von Frauenfeld), gathered by Peter Holland from a tree in Buckingham Palace grounds in December.

A visit I made to the Middlesex Filter Beds in July 1996 produced the gall of the aphid *Tetraneura ulmi* (L.) on *Ulmus glabra* (Huds.) which was almost covered in this red and white gall and looked quite spectacular (Figure 1). Also found here was *Acer pseudoplatanus* (L.) galled by the mite *Aceria macrorhyncha macrorhyncha* (Nalepa), and *Populus nigra* var. *italica* (Münchh.), galled by the spores of the fungus *Taphrina populina* (Fr.).

The Ecology and Entomology Section's visit to the London Wildlife Trust's nature reserve in Camley Street on 20 July 1996 gave me *Pontania proxima* (Lepeletier) a sawfly, on *Salix alba*; *Rabdophaga heterobia* (Löw) a gall midge, the mite *Aculops tetanothrix* (Nalepa) on *Salix caprea*; *Eriophyes inangulis* (Nalepa) (formerly *Phytoptus laevis inangulis* (Nalepa)) on *Alnus glutinosa*, and on *Fraxinus excelsior* the gall from the psyllid *Psyllopsis fraxini* (L.).

During August 1996, further collections were made including *Neuroterus quercusbaccarum* (L.) on *Quercus robur* along Hornchurch Road, in Hornchurch. On 4 September *Andricus quercuscalicis* (Burgsdorf), also on *Quercus robur*, from a small tree alongside a footpath in Hornchurch, and the final gathering for the year was the mite gall *Eriophyes lateannulatus* (Schulze) on *Tilia vulgaris*.

Perhaps not a very lengthy list, but interesting nevertheless. The most eye-catching had to be *Tetraneura ulmi* (L.) at Middlesex Filter Beds in July 1996, when almost every leaf had at least one, sometimes several, of these spectacular galls on it.

FIGURE 1. Galls caused by the aphid *Tetraneura ulmi* on wych elm *Ulmus glabra*, Middlesex Filter Beds, Hackney, July 1996. *Photo: K. Hill*

Those who take note of galls, will notice how some years seem to provide a number of growths in large quantities, whilst other years may only reveal a few or none at all of some species. I am unsure of the whole reason for this behaviour, but it is apparent that weather conditions must play a large part, some causers succumbing to particularly bleak and cold conditions, some being preyed upon more heavily than usually by birds such as blue tits, in the absence of a wider variety of prey. Again, it is possible that like so many other patterns in nature (biennial fruiting in trees such as plums), a good year may lead to one or two poor years because of the drain on nutrients available to the host species.

I am pleased to say 1997 was rather more productive of records/specimens. More are, of course, quite common, as might be expected, since they are the most obvious. Never be discouraged: there is always the possibility of finding an uncommon specimen, or even a rarity. Plant galls can occur in the top of the foliage, to down on the roots below earth level, on buds, shoots, leaves, inflorescences, twigs, bark, petioles, or even a combination of these. Most causers are highly specific to the part of the plant on which they live and feed, and to the species of plant on which they are found, and as such, are found to be different species in themselves. If there is interest in breeding out the particular causer, one of the books in the Naturalists' Handbook series (No. 17) will give details of how this may be done. As with all branches of natural history, involvement can be as deep as the individual wishes; there is *always* something else to learn.

In February 1997, on *Forsythia intermedia* in the front garden of a neighbour's house, I found *Corynebacterium fascians*. *Viburnum farreri* in my own front garden was showing fresh infestation by *Agrobacterium radiobacter* ssp. *tumefasciens* in March, a woolly gall reminiscent of cotton wool.

Jane Reynolds sent two specimens from Athlone House, Hampstead, during early spring, *Aceria genistae* (Nalepa) on a *Cytisus/Sarothamnus* sp. and *Diplolepis rosae* (L.) on *Rosa* sp.

FIGURE 2. Galls caused by the gall-midge *Euura amerinae* on introduced *Salix melanostachys*, South London Botanical Institute, Tulse Hill, February 1997. *Photo: K. Hill*

In March, *Andricus kollari* (Hartig) was again found on *Quercus robur* on the small tree beside the footpath in Hornchurch, and collected this time. There is a patch of green surrounded by ornamental shrubs at Roneo Corner, Romford, where an elderly *Salix alba* revealed numerous *Eriophyes triradiatus* (Nalepa) in March.

Two specimens were sent to me by Florence Frost which she had gathered in Norwood Park during April 1997, *Biorhiza pallida* (Olivier) on *Quercus robur*, and *Rabdophaga rosaria* (Löw) on *Salix* sp.

Catherine Schmitt reported that *Cecidophyes nudus* (Nalepa) was present again on *Geum urbanum*. As remarked already, galls don't *have* to be present each year, and nil returns are also valuable, since over the course of many years, patterns may reveal themselves, and later researchers may be assisted in their work by what we find out today.

In February 1997, in the garden of the South London Botanical Institute, at Tulse Hill, I was intrigued to find *Euura amerinae* (L.) on a tree believed to be an introduction from Japan, *Salix melanostachys* (Mak.) (Figure 2).

A hedge near Gidea Park Station in August produced *Eriophyes macrochelus* (Nalepa), *Artachris macrorhynchus* (Nalepa) and *Aceria macrorhyncha cephalonea* (Nalepa) all on *Acer pseudoplatanus*, with close by *Aceria campestricola* (von Frauenfeld) on *Ulmus procera*.

At the junction of Billet Lane and the side road to Langtons Gardens, Hornchurch, also in August, *Psyllopsis fraxini* (L.) was on *Fraxinus excelsior* (L.), and *Artacris macrorhynchus* (Nalepa) was found on *Acer pseudoplatanus*.

A further visit to the green at Roneo Corner, Romford, in late July allowed the gathering of *Andricus quercuscalicis* (Burgsdorf), *Macrodiplosis dryobia* (Löw), *Neuroterus quercusbaccarum* (L.), *Cynips divisa* (Hartig), and *Neuroterus numismalis* (Fourcroy) (sexual generation) off *Quercus robur*. On the *Salix alba* nearby were many specimens of *Phytoptus triradiatus* (Nalepa) again, together with *Pontania proxima* (Lepeletier).

In my own back garden I found *Puccinia caricina* (DC) on *Urtica dioica* in August, not at all plentiful and the first time I had seen it there.

In Heath Park in Hornchurch at the end of August, I found *Pemphigus spyrothecae* (Passerini) on *Populus nigra* var. *italica.*

A visit to the Hospice in Lawrie Park Road, Sydenham, in October, was followed by a look around the perimeter of the tennis courts opposite. *Andricus kollari* (Hartig), *Neuroterus quercusbaccarum* (L.), *Andricus quercuscalicis* (Burgsdorf), and *Neuroterus numismalis* (Fourcroy) (sexual generation), were all found on *Quercus robur.* On *Quercus cerris* (L.) *Andricus quercusradicis* (Fabricius) (sexual generation), *Neuroterus quercusbaccarum* (L.), and *Neuroterus numismalis* (Fourcroy) (sexual generation), were all found. *Pemphigus spyrothecae* (Passerini) on *Populus nigra* var. *italica* was found. *Phytomyza ilicis* (Curt.) was collected on leaves of *Ilex* × *altaclarensis* (Dallim) cult. *Hodginsii*; very interesting because of the identity of the tree on which it occurred. *Phytomyza ilicis* (Curt.) is a leaf miner, working in the soft interior tissues of the holly leaf, and there is some dispute as to whether or not it should be counted as a gall. It is widespread and common, and because of the dispute over classification of gall or not, will not be referred to again.

A morning visit to Eastbrookend, Dagenham, alongside the District Railway line in late October, produced *Phytoptus triradiatus* (Nalepa) in some numbers, and *Pontania proxima* (Lepeletier), both on *Salix alba.*

A surprise package turned up in late October. George Newbigging sent five specimens from Alexandra Park, north London. *Andricus fecundator* (Hartig) the artichoke gall, *Neuroterus numismalis* (Fourcroy) the silk button spangle, *Neuroterus quercusbaccarum* (L.) the common spangle, *Andricus anthracina* (Curtis) the oyster gall (sexual generation), and *Cynips divisa* (Hartig) (sexual generation) were all on leaves of *Quercus robur.* The asexual generation of *Cynips divisa* (Hartig) occurs on the buds. The question was also posed about the gall *Diastrophus rubi* (Bouché) — was it common or not? Peter Holland gave me a specimen a few years ago, but I have rarely seen it myself. It is said to be uncommon on the raspberry *Rubus idaeus*, but common on the bramble *Rubus fruticosus* agg. This gall affects the stem, causing small swellings which may aggregate into a rather longer swelling, from which later on in the year emergent holes of the mature cynipid wasp may be seen. This damage can only be done during the green stage of growth as later on the stems turn brown and harden, the colony of wasps may be of 80 to 100 animals. The galls persist in the plant and may be found at any season. The imagines are said to be particularly difficult to rear, as once the stems are cut out of the plant, they harden quickly, emergence not then being possible.

The last specimen of the year was provided by Rodney Burton. He had *Petroselinum segetum* (L.) Koch, corn parsley, at Eynsford, West Kent, in November, where some of the plants had been invaded by an unnamed mite, causing what resembled a camellia type of rosette (bearing in mind the small size of the flower). This is referred to in *Gallenboek*, but I have not been able to find it elsewhere. The specimen was sent for confirmation, and the reply is still awaited.

I look forward to receiving further records (and specimens) of plant galls. The following two publications provide good introductory information:

Naturalists' Handbook 17, *Plant galls*, by Margaret Redfern and R. R. Askew, obtainable from The Richmond Publishing Co. Ltd, PO Box 963, Slough, SL2 3RS.

Gallenboek, by W. M. Docters van Leeuwen (in Dutch), published by B.V. W.J. Thieme & Cie, Zutphen.

Blackheath in the 1950s and 1960s Addenda and corrigenda

W. G. TEAGLE

41 Bell Street, Herston, Swanage, Dorset BH19 2RY

I must confess to having made two errors in my paper in the last issue of *The London Naturalist* (Teagle 1997). The redstarts mentioned on p. 95 were seen at The Paragon on **14** April **1953** and not on 13 April 1963 as stated. The second error concerns The Paragon's Tuscan colonnade (p. 86). Pevsner (1952) stated that the columns 'are said to have been taken from Sir Gregory Page's mansion', i.e., Wricklemarsh. I should have noticed that he was cautious when mentioning them and should not have said that the Wricklemarsh columns *were* used in the construction of the crescent. Neil Rhind (*in litt.*) has kindly pointed out that the Wricklemarsh columns, dating from the 1720s, were certainly not used at The Paragon. They were larger than those that form the colonnade. Some were removed to Beckenham Place Park, where they can still be seen. He tells me that the columns at The Paragon are of Coade stone, not in use until the 1760s. I knew that Coade stone had been used at The Paragon, but did not know to what extent. Pevsner's comment — 'what little decoration there is, is of Coade stone' — is not very helpful.

K. H. Hyatt (*in litt.*) has added two species to the list of birds seen in the area during the period under review:

Tufted duck *Aythya fuligula*: A female was seen by him on the Prince of Wales Pond at 07.35 hours on 12 March 1954.

Kingfisher *Alcedo atthis*: One was seen perched on the sundial by the pond in his garden at 3 Kidbrooke Gardens at 07.20 hours on 15 September 1952.

Since the paper appeared, John F. Burton has sent me extracts from his journal which contain much unpublished information on the birds and invertebrates of Blackheath which I might have used had I contacted him. I regret that I did not do this, but I am glad that he will be submitting an in-depth paper on the vertebrates to *The London Naturalist.*

References

PEVSNER, N. 1952. *London except the Cities of London and Westminster.* Penguin Books, Harmondsworth.

TEAGLE, W. G. 1997. Blackheath in the 1950s and 1960s. *Lond. Nat.* **76:** 83–103.

Book review

Plant Crib 1998. T. G. R. Rich and A. C. Jermy. Botanical Society of the British Isles. 1998. 392 pp., A4 softback. £20.50. ISBN 0 901158 28 3.

Prepared to provide guidance with the recording and identification of difficult plants for the Atlas 2000 Project, this book is far more than simply a second edition of the original *Plant Crib* published in 1988. The coverage has been greatly expanded and brought up to date and now includes a valuable section on ferns and allied plants by Clive Jermy. A total of around 325 taxonomic groups is covered compared with the 200 groups treated in the original. The aim has been to augment rather than to duplicate the coverage of other recent publications, notably Stace's *New flora of the British Isles* (1991, 1997) and the BSBI Handbooks.

It is difficult in a short review to do full justice to the scope of this book, and I have only been able to try out a few of the many new keys available. I particularly liked some of the illustrated vegetative keys. These cover, for example, the subtle variations in the subspecies of the common vetch *Vicia sativa*, and the even trickier differences in the leaf shapes of the small-flowered annual *Geranium* species. There is a very full and helpful account of the water crowfeet (*Ranunculus* subgenus *Batrachium*), useful leaf outlines of the more problematic whitebeams, and a new dichotomous key for identifying conifers. I shall be looking more carefully at bindweeds (*Calystegia* spp.) in the future, to discover which of the several illustrated subspecies occur locally, and I shall feel more confident in tackling willowherb (*Epilobium*) and dock (*Rumex*) hybrids in future. I have found only two minor errors. The illustrations showing the stipules of annual *Medicago* species (p. 187) do not match the accompanying text, and couplet 5 in the key (p. 288), which separates *Hypochaeris glabra* from its relatives, has been reversed.

Apart from its relevance to Atlas 2000 recording, *Plant Crib 1998* contains a huge amount of information that will be of use to ecologists and surveyors, and although it is rather bulky for use in the field I have no doubt that it will become an indispensable companion for serious field botanists for many years to come. My copy is already becoming dog-eared!

DAVID BEVAN

Survey of Bookham Common

FIFTY-SIXTH YEAR

Progress Report for 1997

Contents

General (Ian Menzies, Chairman, Bookham Common Survey)

Although there was some increase in rainfall, the weather for 1997 has followed a somewhat similar course to that of 1996 and the Common has remained somewhat dehydrated. The unusually warm sunny weather in March and April, however, produced an early start to the natural history calendar, hawthorn blossom being virtually finished by the middle of May instead of just commencing as in 1996. But the intervention of May, which was again cold, had a complex impact on the appearance of flowers and insects during the summer.

Matters of note include appearance of the long-eared owl, hawfinch (regular sightings near Bookham Station!), and of goosander, little grebe and tufted duck on the ponds (see Alan Prowse's report). With regard to invertebrates, a further increase in the numbers of the silver-washed fritillary, and appearance of the brown argus and grizzled skipper butterflies is good news (see Ken Willmott's report), and Neil Anderson reports the appearance of the white-legged damselfly in the IoW and Western Hollow Ponds, representing the spread of a Mediterranean species which is at the edge of its natural tolerance range in the south of England. The aggressive growth of *Typha* in and around Lower Eastern Pond now threatening other waterside plants presents a problem calling for careful management to maintain optimal biodiversity. Neil Anderson reminds us that the *Typha* favours our thriving colony of the ruddy darter dragonfly *Sympetrum sanguineum*, but at the same time this plant has become a threat to other local insects by crowding out foodplants such as *Sparganium*, *Scutellaria* and *Mentha*. The aggressive potential of alien plants reported from the Common in recent years (see Ken Page's report) also needs to be borne in mind. These include Guernsey fleabane and fringecups (both from America), and Japanese honeysuckle. To this list New Zealand stonecrop, which is growing vigorously in the South-East Pond, should be added.

Support for organized field days has been variable; a complete lack of attendance at one carefully prepared botanical 'study day' was most discouraging. These are now arranged to coincide, where possible, with Bookham Saturday meetings when the organizers would plan to be at Bookham anyway: knowledge of persons proposing to attend is helpful, although the numbers accepted remains flexible. These meetings remain informal, priority being given

to the observation of habits, ecology and demonstration of methods of detection in the field, with respect to species available at the time.

Reports presented for 1997 include: management (Ian Swinney, The National Trust warden); vegetation (Ken Page), with a study about the migration of species by Bryan Radcliffe; fungi (Audrey Thomas); mammals (William N. Landells); birds (Alan Prowse); butterflies and moths (Ken Willmott); beetles, bugs, bush crickets and miscellaneous insects (Ian Menzies). The National Trust Biological Survey Team (Keith Alexander) present a brief but interesting report. Important contributions to the knowledge of coleopterous fauna have also been made by Maxwell Barclay and John Owen and, as a result of these efforts, no fewer than fifty-four new species have been added to the Bookham list.

Management (Ian Swinney, Warden, The National Trust)

Traditionally, the north-east aspect of the Bookham Commons has been heavily wooded, the more open grassland areas lying to the south-west. For some years, however, the wooded area has not only become more dense, but has extended into the open areas with vigorous growth of rose, bramble, hawthorn and blackthorn scrub together with seeding birch, willows and oak, and there has been a corresponding disappearance of grassland and associated ground flora. This advance of woody species towards the south-west, accompanied by retraction of herbaceous ground flora from the north-east, is consistent with the relative drift of plant species towards the south-west of the Common recorded by Bryan Radcliffe in his section on 'Further considerations on the migration of species', also included in this annual report.

The unimproved, neutral grassland of the Central, Bayfield, Isle of Wight and Western Plains, together with the more acidic Eastern Plain, are representative of the species-rich ecologies that are undergoing a progressive and irreversible loss due to the demands of agriculture and building, especially in the south-eastern parts of the country. Besides protection from the pressures of commerce and population, such limited areas that remain require careful attention, particularly to control excessive growth and spread of scrub which has been generally neglected for many years. On Bookham Commons, rotational clearance of scrub and secondary woodland has been undertaken on all the grassland areas, but, it must be stressed, with careful restraint concerning preservation of important bird nesting sites, leaving sufficient stands of mature thorn for refuge, feeding and roosting. Retention of sufficient young scrub to ensure succession, also of specific foodplant species such as old hawthorn for the jewel beetle *Agrilus sinuatus*, aspen for phytophagous beetles such as *Zeugophora flavicollis*, and the wide range of Lepidoptera associated with poplar species, and other locally relevant details that have been reported. Disturbance of overall soil structure has been minimized to preserve any seed bank that may have survived under recently established scrub.

Grazing, a regular practice prior to 1949, has been reintroduced for scrub control on the Central Plain from 1989. Evaluation of the effects on vegetation undertaken by the LNHS Survey has been of value in deciding whether grazing of more grassland is justified, and it is now proposed to extend grazing to parts of the Bayfield and Isle of Wight Plains. At the present time fifty acres have been fenced for this purpose, and cattle are due to be reintroduced for a short period before the main flowering season in March 1998 and again in later summer and autumn until ground and weather conditions call a halt to proceedings. The intensity of grazing is adjusted to avoid undue damage to perennial plants and ensure the retention of tall grass tussocks which provide a valuable refuge for insects and small vertebrates, in order to achieve optimal diversity.

Our fine oak woodland, in excess of 300 acres, has been neglected with

respect to the degree of in-filling by younger trees that has been allowed to take place. Although this might favour certain species, the resulting dense woodland impairs optimal growth of timber and discourages the ground flora and associated animal species. These provide good reasons for light thinning, and perhaps heavy thinning in some areas, to produce 'pasture woodland'. A strong case for some old-fashioned forestry therefore exists, to reduce the gloom and improve the appearance and variety of the ground flora in the woodland areas, also to increase the number of sunny glades and rides. Implementation of this policy has already been accompanied by a return of the silver-washed fritillary butterfly with the increased growth of its foodplant, violet, and also appears to favour the white admiral, purple emperor, comma, ringlet, gatekeeper and speckled wood butterflies which also need the right balance of light and shade.

There has been a worrying loss of some old oaks in recent years, fine trees in their prime suffering from progressive loss of foliage with no sign of that vigorous growth from main branches usually seen in old trees that are dying back. This may be due to the recent progressive lowering of the water table, delayed effects of storm damage, acid rain, repeated insect attack, oak wilt and fungal attack. The National Trust is currently consulting experts in tree care from the Alice Holt Research Station about this matter, and Ted Green from Windsor Great Forest, a founder member of the Ancient Tree Forum.

Removal of fish from the Isle of Wight Pond on 7 July 1995, which was grossly overstocked (97 per cent common carp, 2 per cent silver bream and about 1 per cent of crucian carp and pike) can now be claimed to have been of benefit to the other forms of pond life: during 1997 there has been a notable increase in the numbers of invertebrates and a return of aquatic plants. There has also been an increase in the number and diversity of waterfowl seen on the pond.

The National Trust North Downs Management, Bookham Local Committee, would like to emphasize the importance of specialist information provided by the London Natural History Society's Study Group, for which they are most grateful.

The National Trust Biological Survey (Keith Alexander)

The National Trust Biological Survey Team spent two days at Bookham Common in July 1997, as part of a wider programme of work locally. The aim of the short visit was to up-date the Trust's assessment of the nature conservation importance of the property and to draw out the key management issues for the property management team. The report is currently being written and it is hoped that extracts will be available for *The London Naturalist* No. 78 in 1999. However, in the meantime I would like to take the opportunity of reporting on some of the more interesting invertebrates found during the visit.

One of Bookham's former glories has been the specialist invertebrates of wood-decay, but recent recording has detected only a relatively few significant species and I had been beginning to suspect that there had been some major disaster with the older trees or the dead wood which they produce. Fortunately, my fears proved groundless, and I was able to find a good variety of wood-decay insects and even some additions to the LNHS lists. Amongst the beetles found were the rare **Dorcatoma dresdensis* Herbst, as well as the uncommon *Ctesias serra* (Fab.), *Agrilus pannonicus* (Pill. & Mitt.), *A. laticornis* (Illiger), **Mycetophagus piceus* (Fab.), *Platypus cylindrus* (Fab.), *Phymatodes testaceus* (Linn.), **Triplax aenea* (Schaller), *Bitoma crenata* (Fab.), and **Triphyllus bicolor* (Fab.). Amongst other orders were: brown tree ant *Lasius brunneus* (Latreille), the false scorpion *Chernes cimicoides* (Fab.), the moth *Morophaga choragella* (Denis & Schiffermüller) and the bug *Xylocoris cursitans* (Fallén). The most important area for this fauna occupies a triangle, from around the main series

(Note: the three species marked *appear to be new records for Bookham — I.S.M.)

of ponds southwards to just beyond the railway track. This is the main concentration of old, open-grown, former pasture-woodland oaks.

Little time was spent around the main ponds as these have been well surveyed in recent years. Skullcap leaf-beetle *Phyllobrotica quadrimaculata* (Linn.) was noted in passing, as was the deer fly *Chrysops relictus* Meigen. The open damp grasslands of Little Bookham Common were given some close attention as a major restoration grazing project is now well under way here. Invertebrates noted here include the rare barkfly *Caecilius atricornis* McLachlan, a speciality of tall marshy vegetation and a good indication that this area has retained some of its former interest through the relatively recent history of neglect.

Vegetation: hybrids and aliens (Ken Page)

In the Progress Report for 1990 (*Lond. Nat.* **70**) we listed nineteen hybrid combinations that had been determined for the Common. Since then, a further six have been noted. Two of these, *Agrimonia eupatoria* × *A. procera* and *Rosa arvensis* × *R. stylosa* have been mentioned in recent reports.

Last year, on a newly cleared area in division P, a moderate quantity of *Potentilla* × *mixta* was discovered. Confusingly, this taxon can be derived from *P. erecta* × *reptans* and *P. anglica* × *reptans*! All the plants examined appeared to be sterile which is characteristic of this hybrid. Other characters which may aid identification are the number of leaflets — three to five, and the number of petals — four to five. The lengths of leaf stalks (roughly equal) should be observed.

The recently published BSBI Handbook *Roses of Great Britain and Ireland*, has stimulated interest in this genus. The groups that make up *Rosa canina* have been identified and the hybrid *R.* × *andegavensis* was found in division N. It is vigorous, with stems reaching four metres and has the general appearance of *R. canina*. However, a clearly discernible difference can be seen with the narrower, more widely-spaced pairs of leaflets indicating the influence of *R. stylosa*. Also, the lowest pair of leaflets are reflexed towards the junction of petiole and stem. Investigations by Surrey botanists have indicated that this cross may be more widespread in the county than records show.

Saxifraga × *urbium* is the London pride of many cottage gardens. It has been found on a ditch bank in division N where it has spread from a nearby garden, and an increasing area on the Common appears likely. This dainty-flowered hybrid has distant geographical parents: the Pyrenean saxifrage *S. umbrosa*, which has been naturalized in Britain for more than a century, and St Patrick's cabbage *S. spathularis*, a rare Irish species. It is of garden origin.

A clump of the garden Solomon's seal *Polygonatum* × *hybridum* is slowly increasing in size in a wooded area in division S. This semi-shaded habitat is similar to that which the two native species making up this hybrid enjoy. *P. multiflorum* is found locally in our area, whereas *P. odoratum* is mainly from northern England. Distinguishing the hybrid from the two species is not easy, but slightly ridged and angled stems and flowers somewhat contracted in the middle are helpful aids. It rarely sets fruit.

Many new aliens have appeared on the Common since the last flora was published (Radcliffe and Page 1981). Some have been noted in subsequent Progress Reports. The present report aims to bring the list up to date.

In 1985, Bryan Radcliffe speculated that a *Prunus* sapling in division C might be the rum cherry *P. serotina*, and this proved to be correct. It is now a thriving tree three metres high. In the same division the perennial cornflower *Centaurea montana* is established and nearby is another herbaceous plant, fringecups *Tellima grandiflora*. This American plant, favoured by flower arrangers, produces seed freely, and may increase if conditions are favourable.

Japanese honeysuckle *Lonicera japonica* is becoming widely naturalized and

was recently discovered in division N. This is a vigorous semi-evergreen climber frequently used by gardeners for screening. It spreads rapidly when introduced into the wild and the spread is assisted by the facility of trailing stems to root at the nodes creating, vegetatively, new plants. It could ultimately cover a large area.

Well known in the London area, Guernsey fleabane *Conyza sumatrensis* is extending its range. We found our first plant last summer after the clearance of some scrub in division S. Despite the specific and vernacular names, it is a native plant of South America!

Reference

RADCLIFFE, B. and PAGE, K. 1981. Vascular plants of Bookham Common: a new survey. *Lond. Nat.* **60:** 68–84.

Further considerations on the migration of species (Bryan Radcliffe)

Major surveys in 1953 (Jones 1954) and in 1977–9 (Radcliffe and Page 1981) in addition to listing all vascular plants, allowed for a quantitative assessment of positional data, which led to the conclusion that a substantial migration of species was taking place, with a definite bias in direction.

Since 1981 two events have occurred that render a reassessment desirable. Firstly, the centres of area of individual divisions have now been determined with a reasonable degree of accuracy. In earlier years visual inspection of a map was used to estimate centres. Owing to the marked irregularity of divisional shape this was very difficult, and gave results of questionable reliability.

Secondly, our views on the identification of birches have recently altered. What we earlier accepted as *Betula pubescens* is now thought to be the hybrid *B.* × *aurata*. We believe that *B. pubescens* is either very rare or absent from the Common.

Betula pubescens was one of the species that featured in the quantitative assessment. It would not be correct simply to change the name and let the calculations stand. While this might have been appropriate in the case of the later survey, we have no way of knowing what the situation was concerning the birches in 1953. The only acceptable way out of this difficulty was to delete *B. pubescens* from the list of species used.

In order to study migration in a quantitative manner it is essential to have data relating periods and positions of species. The two surveys noted above were about twenty-five years apart, which adequately satisfies one of the requirements. When it comes to considering position however, the situation is not so straightforward. Before it could be accepted that the centre of area of a division was a valid measure of the centre of distribution of a species, it would be necessary to be satisfied that individuals of the species were evenly distributed through the division.

At one extreme, a single or a few individuals would be particularly unlikely to be evenly distributed. On the other hand a superabundant species such as honeysuckle would be expected to qualify with ease. In the oakwoods of Bookham it would be difficult to turn in any direction and fail to see the plant. However, its very abundance serves to disqualify it from acceptance. It is no doubt migrating here and there all the time, but as a consequence of its presence (together with ten other species) in all divisions all of the time, any movement cannot be detected in our study.

The ideal of strictly uniform distribution is probably never met in nature; perhaps even by a species like honeysuckle. Nevertheless, if a species is very common and widespread in a locality the probability is that an acceptable approximation to uniformity exists so it becomes possible to consider the centres as coincident.

The selection of species for calculations was strictly on the following criteria:

a. The species was not present in all twenty divisions in both surveys.
b. Inclusive of both surveys, the species was present and widespread in at least seventeen divisions.

Of the 451 species recorded in the second survey, 400 were rejected. Eleven of these were ubiquitous in both surveys and the remainder were not sufficiently common. Fifty-one species qualified on the above criteria and were used for the calculations for the 1981 paper. The subsequent deletion of *Betula pubescens* now reduces the number qualifying to fifty.

The calculations were performed in accordance with the following technique:

1. The coordinates of one particular species in the first survey were summed, and divided by the number of divisions occupied, thus giving the coordinates of the centre of distribution of that species in that survey (E1, N1).
2. A similar summation and division of the same species in the second survey gave centre coordinates E2, N2.
3. The differences of the two pairs, i.e., (E2 − E1) and (N2 − N1) represented the movement of the centre of distribution. The linear distance moved by the centre was $D = \sqrt{(E2 - E1)^2 + (N2 - N1)^2}$ metres.
4. The direction of movement was derived from the angle $\alpha = \tan^{-1}$ (N2 − N1/ E2 − E1) followed by application of the 'butterfly diagram' concept to get the bearing, thus:

   if N2 > N1 and E2 > E1, direction is in NE quadrant. Bearing $= 90 - \alpha$ degrees
   if N2 < N1 and E2 > E1, direction is in SE quadrant. Bearing $= 90 + \alpha$ degrees
   if N2 < N1 and E2 < E1, direction is in SW quadrant. Bearing $= 270 - \alpha$ degrees
   if N2 > N1 and E2 < E1, direction is in NW quadrant. Bearing $= 270 + \alpha$ degrees
5. The same procedure was repeated for each species under consideration.

It is obligatory to deal with each species separately until movements of centres are established, as in the first part of step 3. Thereafter it is permissible, and can be useful, to treat the species in combination. For instance, if the centre movements are all pooled the result is a pair of distances Er and Nr that represents the nett combined movements of all the species. It is of course necessary to work with algebraic summation, taking due account of positive and negative values.

Alternatively, a more detailed representation can be obtained by considering the effect of combining species sharing the same quadrant of movement. In this case normal summation is appropriate because the species movements share the same sign whether positive or negative.

Having performed the calculations on the species selected by the criteria mentioned earlier, it was decided to extend the investigation by considering the behaviour of a different group of species, somewhat less abundant though still very common. In this case the criterion adopted was 'occurrence in at least fourteen and not more than sixteen divisions'.

Individual movements for both groups of species are given in Table 1. For clarity and economy of space the bearings (in degrees) and the distances (in metres) are rounded to the nearest integer, although a higher level of precision had emerged in the actual calculations. Both lists are arranged in ascending order of bearings, which allows for simple visualization of the relevant quadrants. The predominance of species moving in the SW quadrant is very marked.

Both groups of species included some that had gained divisions, some that had lost, and just a few where losses were equalled by gains. The one significant exception was *Oxalis acetosella* (already commented on in the 1981 account.)

TABLE 1. Movements of common species in the period 1953–1979.

Species occupying 17–20 divisions	Bearing	Distance		Species occupying 14–16 divisions	Bearing	Distance
Veronica chamaedrys	21	31		*Taxus baccata*	1	69
Poa annua	27	18		*Epilobium montanum*	14	59
Stellaria graminea	43	48		*Alisma plantago-aquat.*	27	166
Prunus spinosa	48	38	**NE**	*Rosa arvensis*	39	33
Ajuga reptans	50	28	**quadrant**	*Cerastium fontanum*	63	26
Anthoxanthum odoratum	60	50		*Veronica officinalis*	68	188
Prunella vulgaris	71	43		*Lapsana communis*	80	54
Potentilla sterilis	72	31		*Lolium perenne*	90	133
Plantago major	77	17		*Ranunculus acris*	98	120
Betonica officinalis	95	107		*Agrostis canina*	127	40
Fagus sylvatica	103	40		*Stellaria media*	135	97
Geum urbanum	107	32		*Stachys sylvatica*	138	32
Geranium robertianum	110	58	**SE**	*Plantago lanceolata*	140	134
Callitriche stagnalis	112	16	**quadrant**	*Urtica dioica*	142	3
Arrhenatherum elatius	122	74		*Poa trivialis*	143	84
Ranunculus flammula	140	22		*Juncus conglomeratus*	150	34
Acer campestre	140	58		*Acer pseudoplatanus*	152	138
Sambucus nigra	146	31		*Bromopsis ramosa*	177	83
Juncus bufonius	155	85		*Rumex obtusifolius*	182	117
Rumex sanguineus	165	59		*Angelica sylvestris*	183	108
Fraxinus excelsior	166	85		*Persicaria hydropiper*	188	10
Potentilla reptans	171	41		*Lotus corniculatus*	190	123
Dactylis glomerata	173	29		*Dryopteris carthusiana*	192	285
Glechoma hederacea	177	25		*Alopecurus pratensis*	194	100
Juncus effusus	183	3		*Hypericum pulchrum*	195	130
Quercus cerris	188	179		*Centaurea nigra*	204	180
Lotus pedunculatus	190	108		*Trifolium repens*	205	122
Dryopteris dilatata	191	175		*Hypochaeris radicata*	213	35
Galium saxatile	196	74		*Carex hirta*	214	25
Rumex acetosa	202	110		*Hypericum humifusum*	216	177
Cirsium palustre	207	142	**SW**	*Achillea millefolium*	216	195
Chamerion angustifolium	212	68	**quadrant**	*Veronica serpyllifolia*	217	94
Circaea lutetiana	219	81		*Heracleum sphondylium*	218	91
Tamus communis	223	93		*Galium uliginosum*	219	62
Taraxacum officinale	224	62		*Juncus inflexus*	227	196
Ranunculs ficaria	240	20		*Salix caprea*	235	58
Potentilla anserina	240	233		*Vicia sepium*	241	93
Viola riviniana	240	23		*Festuca rubra*	244	58
Corylus avellana	244	93		*Solanum dulcamara*	246	112
Ilex aquifolium	244	93		*Cardamine flexuosa*	247	212
Ruscus aculeatus	249	39		*Carex ovalis*	250	26
Moehringia trinervia	252	71		*Epilobium ciliatum*	281	26
Malus sylvestris	253	55		*Populus tremula*	299	76
Brachypodium sylvaticum	260	62		*Agrostis capillaris*	322	68
Galium aparine	267	10		*Primula vulgaris*	324	39
Betula pendula	267	68		*Epilobium obscurum*	324	174
Hedera helix	278	38		*Succisa pratensis*	334	8
Dryopteris filix-mas	282	82	**NW**	*Arum maculatum*	335	72
Cornus sanguinea	285	73	**quadrant**	*Ribes rubrum*	345	183
Gnaphalium uliginosum	357	6		*Epilobium hirsutum*	359	19
				Luzula campestris	360	81

This is an abundant constituent of most of the woodlands. However, although woods have increased in number and extent in the last forty years, forming in previously open divisions, this species has shown no inclination to move and remains in the original fourteen divisions. Accordingly, it does not appear in the second list.

In the case of the 17–20 division group of species, the ratio of species with nett gains to those with nett losses was 62 to 38. In the 14–16 group the same ratio was 47 to 53.

It could be claimed that there is a qualitative difference between species that gained divisions and those that lost, such that those showing a loss were undergoing a 'contraction of range' rather than 'migration'. Against this it may be mentioned that in about half of the instances of nett loss the species had appeared in new divisions, so positive 'migration' was occurring in a majority of the species considered.

Illustration of the movements by diagrams is no simple matter. If the centres of distribution for the two surveys are connected by lines on a map of the Common the result is a tangled mass of criss-crossing lines that defies interpretation. If the simplifying expedient is adopted of treating the first survey results as the 'zero condition', such that all lines to the second survey position radiate from a common centre, the picture is a little less baffling, but still too crowded for clarity owing to the large number of lines in close proximity. The eventual decision was to simplify still further, using combinations of species that broadly moved in the same directions, i.e., in the same quadrants. The movements of the two groups of species are shown thus in Figures 1 and 2. These are referred to as 'virtual' because the species do not really radiate out from a common

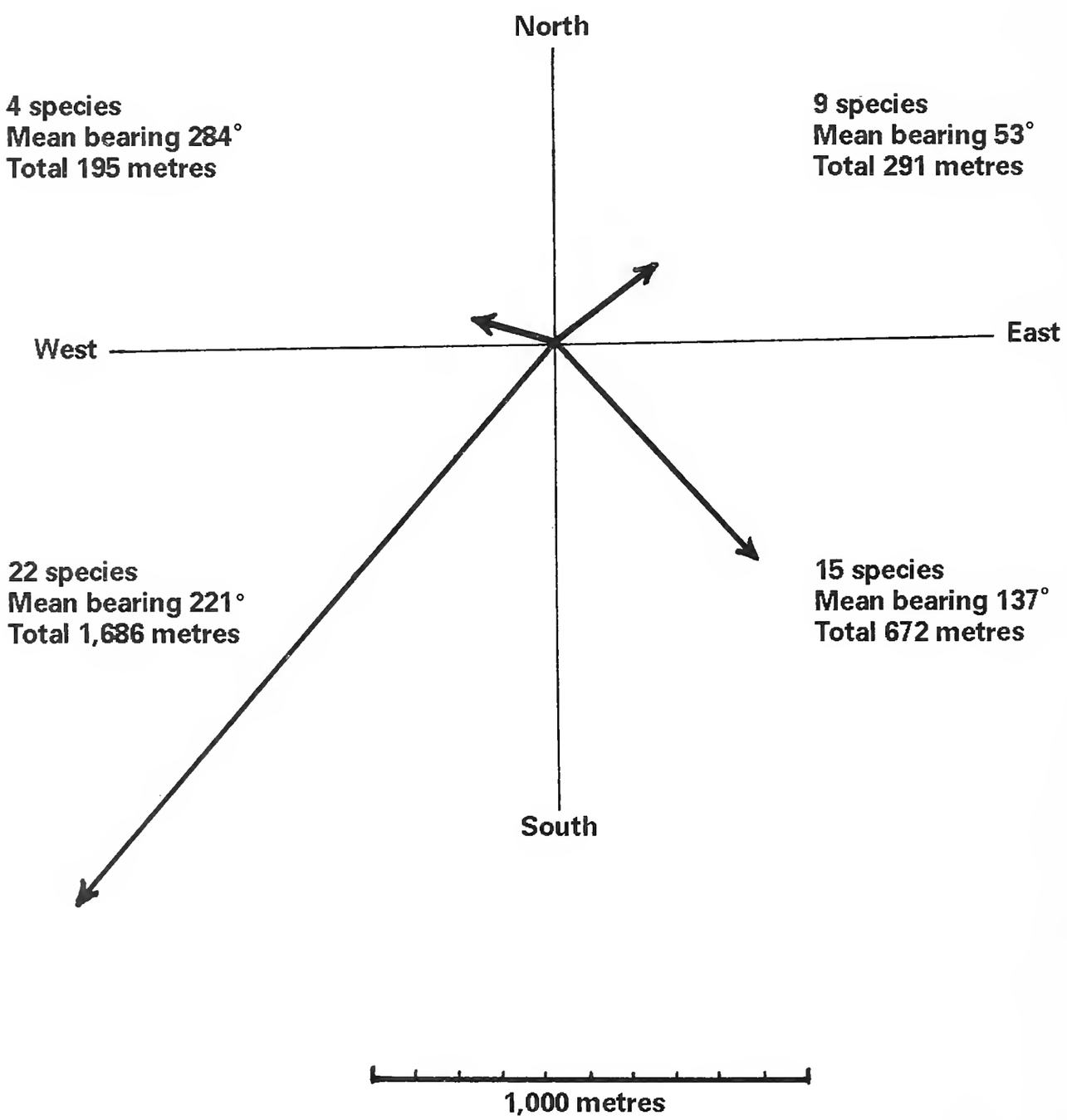


FIGURE 1. Virtual vector diagram. Movements of species occupying 17–20 divisions. All values are rounded to nearest integer.

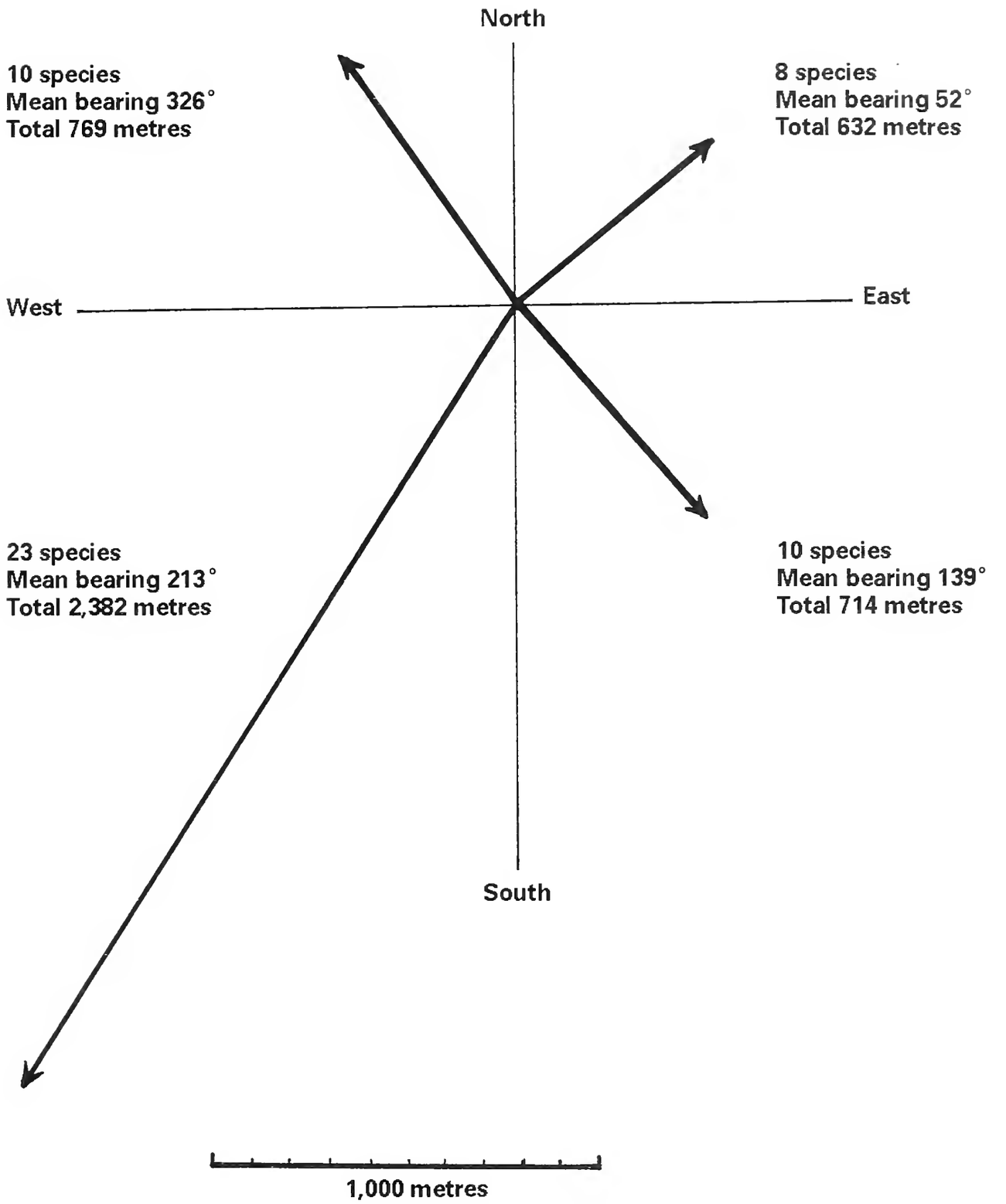


FIGURE 2. Virtual vector diagram. Movements of species occupying 14–16 divisions. All values are rounded to nearest integer.

centre and no one species moves on the bearing depicted. However, the diagrams are realistic in showing the mean bearings of the groups and the combined shifts of centres.

Complete summation gives the following overall values:

17–20 division group (including *Betula pubescens*)	Bearing 218°, total move 1,485 m
17–20 division group (excluding *Betula pubescens*)	Bearing 201°, total move 1,658 m
14–16 division group	Bearing 206°, total move 1,696 m

When *Betula pubescens* was included in the 1981 calculations its direction of movement had been in the NW quadrant. Subsequent recalculation after discounting this species produces an increased trend to the south and a reduction in the westerly component.

In view of the totally different species makeup of the two groups subject to the recent calculations, the similarity of overall results is very surprising. It may be entirely fortuitous and at this time no more credible explanation can be proposed. Alternative ideas from anyone would be most welcome.

The feature that does emerge clearly from the investigation is that it amply supports the conclusions of the 1981 account, to the effect that in the period 1953 to 1979 a very significant migration of species was occurring, from the more-wooded north and east to the more-open south and west.

A new major plant survey is scheduled to commence in the year 2002. It is timed to start twenty-five years after the second survey, which was about twenty-five years after the first. We fully expect that some interesting results will emerge.

References

JONES, A. W. 1954. The flora of Bookham Common. *Lond. Nat.* **33:** 25–47.

RADCLIFFE, B. and PAGE, K. 1981. Vascular plants of Bookham Common: a new survey. *Lond. Nat.* **60:** 68–84.

Fungi (Audrey Thomas)

The following fungi were identified on Bookham Common during 1997:

1. Species seen during the 'Bookham Fungus foray' on 18 October, led by Brian Ferry.

The area covered included Bayfield and Isle of Wight Plains, and the Common road.

AGARICS and BOLETI

Amanita muscaria
Amanita citrina var. *alba*
Clitocybe mellea
Clitocybe clavipes
Clitocybe infundibuliformis
Clitocybe nebularis
Clitocybe odora
Clitocybe vibecina
Clitopilus prunulus
Collybia butyracea
Collybia dryophila
Coprinus plicatilis
Cortinarius pseudosalor (under birch)
Crepidotus mollus
Entoloma porphyrophaeum
Gymnopilus junonius
Hypholoma fasciculare
Laccaria amethystea
Laccaria laccata
Lactarius tabidus (under birch)
Lactarius turpis
Lepista nuda
Mycena galericulata
Mycena pura (rose and lilac forms)
Oudemansiella radicata
Panellus stipticus (on oak)
Pholiota carbonaria
Pluteus cervinus
Psathyrella hydrophila (two colours)
Russula grisea
Russula mairei (pink, usually red)
Russula nigricans
Russula ochroleuca
Tricholoma ustale

POLYPORES and RESUPINATE FUNGI

Coriolus versicolor
Daedaleopsis confragosa
Phellinus igniarius
Stereum hirsutum
Stereum rugosum

GASTROMYCETES: PUFFBALLS and their allies

Lycoperdon perlatum
Lycoperdon pyriforme
Mutinus caninus
Scleroderma citrinum

JELLY FUNGI

Tremella mesenterica

ASCOMYCETES: CUP FUNGI and their allies

Aleuria aurantia
Bulgaria inquinans
Chlorosplenium aeruginascens
Clavipes purpurea
Diatrype disciformis
Nectria cinnabarina
Xylaria hypoxylon

2. Other species also seen at Bookham during 1997.

AGARICS and BOLETI

Amanita fulva
Amanita rubescens
Boletus chrysenteron
Boletus impolitus
Boletus edulis
Clitocybe geotropa
Coprinus micaceus
Lacrymaria velutina
Marasmius oreades
Mycena galopus
Russula atropurpurea
Russula claroflava
Paxillus involutus
Pleurotus ostreatus
Russula emetica
Tricholoma terreum
Tubaria furfuracea

POLYPORE and RESUPINATE FUNGI

Daedalea quercina
Fistulina hepatica
Laetiporous sulphureus
Lenzites betulina
Pseudotrametes gibbosa

Mammals (William N. Landells)

Systematic observation of mammals on the Common is currently at a low ebb, apart from a series of night visits throughout the summer months for bats by myself. Perhaps unsurprisingly there are also few records in either the LNHS database or with the Surrey Wildlife Trust. However it is hoped to extend coverage through 1998, particularly directed at those species of conservation concern which have been recorded previously on the Common. Three of these are small mammals unlikely to be encountered on incidental visits, but any sightings of brown hare would be gratefully received. There are several records for 1997 of brown hare in the fields around the north and east boundaries of the Common and juveniles were seen. Ian Swinney, to whom I am most grateful for several fruitful discussions and his day-to-day observations, has observed individuals in the adjacent woods on the Common itself, and on 8 February 1997 an adult was noticed making its way through the undergrowth of Central Wood in the triangle bounded by Rydall, Woodland and High Point Paths, well away from any open ground (I.S.M.). Unfortunately the most recent record of dormouse is one brought in by a cat, still alive, which was rescued and subsequently returned to a suitable area of the Common.

With regard to bats on the Common, a series of ten visits was made, mainly in the evenings, throughout the summer of 1997. These visits largely confirmed the previous findings (see Progress Report for 1996), and no new species were added. Pipistrelles are frequent and feed widely over the Common. Virtually all have been of the 55 kHz variety. No roosts were found though these undoubtedly exist, probably in buildings on or adjacent to the Common. Occasional noctules feed over the Common and particularly the larger ponds, but as often they simply commute overhead. There are a small number of Daubenton's feeding over the open water of the larger ponds. The numbers are perhaps lower than in the previous year, but no trend is yet discernible. A single serotine was found on several occasions feeding in a different area from previous years. This probably represents a solitary non-breeding male. It has not been possible to identity other *Myotis* bats on the Common. The conservation measures being practised on the Common with regard to old trees, tree-holes and dead wood are to be recommended and supported. All sightings of bats, particularly large bats in the early evening, would be gratefully received.

Roe deer are seen frequently in many parts of the Common. All records

including area, sex, age and number of individuals would be welcome and thus an attempt at an accurate census could be made. The deer remain susceptible to harassment by dogs and all instances should be reported to the Common warden. Badgers are active on the Common and adjacent lands, though the degree of interchange is not known. Both rabbits and moles are distributed over most of the Common. Foxes roam widely.

Birds (Alan Prowse)

In January a long-eared owl was flushed and remained for three weeks. They have been recorded often enough in the past to suggest they could be regular in winter, though elusive. Winter redwings and fieldfares were numerous, feeding on the plentiful berries, and attended by sparrowhawks. Hawfinches were regular near Bookham Station, with a maximum of nine in March.

The breeding season is reported in detail elsewhere (see p. 177). A lesser redpoll called and gave an abbreviated song flight on 10 March, but did not stay to fulfil that early promise. The warm spring brought migrants in earlier than usual. It was astonishing to find blackcaps on 8 April, not only paired, but scolding one through their territory. Highlights of the season were little grebes and tufted ducks nesting on the ponds, a large population of warblers, eight nightingales and fourteen turtle dove pairs. Hobby and goshawk visited during the season.

In autumn mandarin ducks reached a total of nine, with six males. The improvement in the ponds saw a maximum of eighteen tufted ducks, and a family of five mute swans. On the plains a poor crop of berries saw minimum numbers of redwings and fieldfares. A hawfinch was seen on 14 December. Three small parties of siskins on 1 December in the northern wood, and seven redpolls at the Arboreteum on 3 December were the first records in winter for some years. A melanistic sparrowhawk on 20 November was an identification puzzle at first. The highlight of the early winter was a female goosander, which appeared on the Isle of Wight Pond on 30 November and stayed at least until the first week of January.

Dragonflies (Neil Anderson)

Four visits to the Common were undertaken during the year. Only imagines were recorded, with no larval sampling.

On the first date, 14 June, the sun disappeared after visiting the first pond — Kelsey's, producing cool and overcast conditions which were far from optimal for recording Odonata. At Kelsey's Pond, three pairs of azure damselflies *Coenagrion puella* were in cop. with oviposition occurring. Several other males were discovered in emergent vegetation. With the sun's disappearance, a few common blue *Enallagma cyathigerum* and blue-tailed damselflies *Ischnura elegans* were found perched in the surrounding vegetation. The most notable event of the day was the number of emerald damselflies *Lestes sponsa* which were disturbed as we walked through *Juncus*-dominated vegetation around the Lower Eastern Pond. Over a hundred individuals were counted suggesting a recent mass emergence. A few were also observed at Upper Eastern Pond.

Weather conditions were ideal on 12 July when it was warm, humid and mainly sunny with variable cloud cover. The maximum number of *Coenagrion puella* recorded, 50+, was at Kelsey, with much breeding activity. Also here were a male emperor *Anax imperator*, a brown hawker *Aeshna grandis* and at least four male ruddy darters *Sympetrum sanguineum*. Over ten black-tailed skimmers *Orthetrum cancellatum* were found at the Isle of Wight Pond, favouring the bare banks for basking. Many territorial skirmishes were witnessed over the water. Two male banded demoiselles *Calopteryx splendens* were probably

wanderers from the nearby River Mole, as this is typically a species of slow-flowing rivers with a muddy substrate. A patrolling broad-bodied chaser *Libellula depressa*, a female *S. sanguineum* and ovipositing *Enallagma cyathigerum* were also noted at IoW Pond. Despite previous fish removal in 1995, shoals of unidentified small fish were very much in evidence.

Notable for being the first records for Bookham were at least three white-legged damselflies *Platycnemis pennipes* in the IoW and Western Hollow Ponds area. This species is found in southern England on slow-moving, well-vegetated riverine habitats, such as the nearby River Mole, where it is quite common. Basically a Mediterranean species at the edge of its range in Britain, it, along with numerous other insects, appears to be benefiting from recent climatic conditions. There are increasing records of this species turning up at lakes and at least one proven breeding record in this habitat (see references). With this in mind it will pay to scrutinize this species for breeding behaviour on the Common in future seasons. R. Kettle had further sightings of this species in the same area on 9 August.

Other records on 12 July included a pair of *Sympetrum sanguineum* copulating on Eastern Hollow and several others on Lower Eastern. Bayfield Pond yielded a male *Libellula depressa*, two male common darters *Sympetrum striolatum* and about ten *Coenagrion puella.*

The visit on 23 August started off overcast, but became hot, sunny and humid. No *Anax imperator* were recorded on this visit, but various *Aeshna* hawkers were well represented with at least one *A. grandis* at most ponds and southern hawker *A. cyanea* represented by two to four individuals on Upper Eastern, Kelsey's and Bayfield Ponds. Occasional migrant hawkers *A. mixta* were encountered. Most striking was the large population of *Sympetrum sanguineum*, especially on those ponds which are heavily vegetated with dense stands of *Typha*, *Sparganium*, etc., such as Lower Eastern Pond where over forty were counted. Ovipositing was observed at Upper Hollows, Lower and Upper Eastern Ponds. Though present on all ponds examined, it was only outnumbered by *S. striolatum* on IoW Pond which is the largest, most open water body here, lacking the dense stands of emergent vegetation favoured by the former species. Any future management to control the *Typha* on Lower Eastern needs to be conducted with great care, so as not to affect adversely the healthy *S. sanguineum* population there.

Peak numbers of zygopterans on this visit were over forty *Enallagma cyathigerum*, including several ovipositing pairs, on IoW Pond. Small numbers of *Ischnura elegans* and *Lestes sponsa* were seen at most ponds, whilst a few *Coenagrion puella* were ovipositing through the now *Lemna*-dominated surface.

The final visit was on 27 September, a day of mainly hazy cloud with brief sunny intervals, when most of the observations were made. *Aeshna mixta* and *Sympetrum striolatum* were the only anisopterans recorded and seen in small numbers at most ponds.

References

CHAM, S. 1997. Dragonfly Reports. *Br. Wildlife* **9:** 49.
FOLLET, P. 1996. *Dragonflies of Surrey.* Surrey Wildlife Trust.
MERRIT, R., MOORE, N. W. and EVERSHAM, B. C. 1996. *Atlas of the dragonflies of Britain and Ireland.* HMSO.

Butterflies (Ken Willmott)

A long-awaited and most-welcome fine spring heralded the start of the season for Lepidoptera. Early in the second week of March saw some sunny days with temperatures above 55°F, easily tempting out good numbers of brimstones *Gonepteryx rhamni*, and a very early red admiral *Vanessa atalanta* was defending a territory at the northern end of the Broadway, on the eastern side of the

Common. This may have been a successful hibernator after the relatively mild winter of 1996/7, surviving the only exceptional cold spell of the late December/ early January period. During the latter part of March a female red admiral was seen showing interest in stinging nettles on the western side of the Common.

The orange underwing *Brephos parthenias* was around the birches in small numbers on 15 March, with the occasional individual being found at ground level on moisture from one of the rapidly drying paths along Broadway.

The last day of March was an exceptional day with both small tortoiseshell *Aglais urticae* and commas *Polygonia c-album* seen depositing eggs, singly in the case of the latter and a large batch in the case of the former, on the stinging nettles near Tunnel Car Park. Temperatures were just above 60°F for the fifth time in March. Six orange-tips *Anthocharis cardamines* were seen, together with two speckled woods *Pararge aegeria*, thus being the first non-hibernating butterflies seen on the Common in 1997. March is an early month for such an event. The peacock *Inachis io* was particularly common in all suitable sunny spots for territory establishment, far outnumbering the comma, which establishes its territory and successfully pairs before the peacock comes onto the spring scene.

On 2 May a successful evening search for the grizzled skipper *Pyrgus malvae* was undertaken. At this time of day they can be found settled for overnight roosting on the old seed-heads of plants like the knapweeds *Centaurea*. The area on the Bayfield Plain where they were found has been lightly grazed by cattle in recent years, and The National Trust warden, Ian Swinney, has undertaken extensive scrub clearance, both of which bode well for this species and for the persistence of its larval foodplants (*Fragaria*, *Potentilla*, etc.) and its accessibility to egg-laying females, which is a most important factor. On the same date three small coppers *Lycaena phlaeas* were seen, and three batches of small tortoiseshell larvae were located on various nettle beds. Two more small coppers were seen on 17 May (Ron Kettle).

The 26 May was a red-letter day on the Common, with the discovery of a small colony of the brown argus *Aricia agestis*, a species which I have not encountered on the Common before and a recently nationally successful and increasing species, being recorded from a number of sites in the south of England and beyond for the first time. On the Bayfield Plain site where I discovered it, I searched for likely larval foodplants and successfully located several prostrate growths of the cut-leaved geranium *Geranium dissectum*. On the same day six grizzled skippers were counted, with the same numbers of common blues *Polyommatus icarus*. A single white-letter hairstreak *Strymonidia w-album* larva was found on wych elm *Ulmus glabra*, and a female orange-tip seen busily depositing eggs on dame's violet *Hesperis matronalis*. The day-flying moths, Mother Shipton *Callistege mi* and burnet campanion *Euclidia glyphica* were also on the wing.

On a poor day, 1 July, only a couple of white admirals *Ladoga camilla* were seen together with very small numbers of the usually common species, small skipper *Thymelicus sylvestris*, meadow brown *Maniola jurtina* and ringlet *Aphantopus hyperantus*. The next day was drier and brighter although temperatures remained in the mid sixties, reminiscent of the latter part of the disappointing June. There was much more on the wing, with over fifty white admirals being seen and for the first time in many years of observation on the Common, three copulating pairs of silver-washed fritillary *Argynnis paphia* were recorded. They had obviously bred successfully on the Common during 1996(!), and on 13 July and again 21 July, a female was observed depositing eggs on the trunk of an oak in Central Wood West, as further confirmation of breeding. They were still on the wing in moderate numbers on 9 August (Ron Kettle). Both sexes of the large skipper *Ochlodes venata* were still on the wing on 2 July, together with the sighting of a high-flying purple hairstreak *Quercusia quercus* and a white-letter hairstreak feeding on wild angelica *Angelica sylvestris*. Both meadow brown and

ringlet were in good numbers and a fresh female *hutchinsoni* comma was seen depositing eggs.

On 4 July, an estimated six different purple emperors *Apatura iris* were seen on their two main territories at Mark Oak and Hillhouse Farm. Once again the odd individual marbled whites *Melanargia galathea* were seen on the Common (I. Menzies; K. Page, 12 July). Perhaps a tiny population persists in a suitable grassland area, unless some irresponsible individual is annually shifting specimens from another site.

On 8 July a white admiral was observed depositing eggs on suitable growths of honeysuckle *Lonicera*, and by 21 July the first larva was located. On 12 July two *seminigrina* white admirals were recorded by Ian Menzies. Bookham Common is host to both *nigrina* (very rare), and *seminigrina* (rare) forms of the white admiral, where an excess of the melanin pigment totally or partially obscures the white bands of this well-known Bookham speciality. The purple hairstreak had a notably poor year, the second successive, in comparison with the 1995 year of plenty.

In general 1997 was a mixed year on the Common, with the spring species prospering in the fine weather in contrast to the often poor weather experienced by those with summer flight periods. Hopefully, 1998 will be another year of great interest with the continued maintenance and expansion in ranges of unusual species that inhabit Bookham Common.

Beetles (Ian Menzies)

During May the following interesting attelabid weevils were noted: *Apoderus coryli* was seen again on several occasions (2 on 10th and 1 on 18th) resting on the leaves of hazel in the vicinity of the Isle of Wight and Hollows Ponds, several *Caenorhinus interpunctatus* were beaten from oak in the same area (3 on 10th), and a single *Byctiscus betulae* on aspen, Eastern Plain (19th). Weevils of the genus *Magdalis* were also noted in the vicinity of Merritt's Cottage, *M. carbonaria* (one from birch on 10th), *M. cerasi* (singles on 10th and 19th from oak) and *M. ruficornis* (one on 19th from rose).

This year the numbers of longicorn beetles (Cerambycidae) attracted to the hawthorn blossom was, as in 1995 and 1996, disappointingly low. On 19 May, for instance, only single examples of *Rhagium mordax*, *Anaglyptus mysticus*, and *Clytus arietis* could be found; *Rhagium bifasciatum* was absent and the ubiquitous *Grammoptera ruficornis* very scarce. However it was reassuring to find the longicorn *Saperda populnea* in some numbers again (two on 10 May and four of 19 May), resting in the sun on the leaves of sapling aspen in the glade, although this seems to be a local resurgence as the species remains scarce on the Eastern Plain where sapling aspens are also abundant. The local longicorn *Phymatodes alni* appeared in large numbers (eight on 19 May) on an oak branch which had fallen the previous October (1996) in the vicinity of the Isle of Wight Pond. The cockchafer (or maybug) *Melolontha melolontha*, not noticed at Bookham for many years, was seen on 18 May (two) and again on the 19th (one) when beating hawthorn blossom, and the spectacular beetles *Phyllobrotica quadrimaculata*, *Chrysolina menthastri* and *C. polita* continue to thrive in the marshy area adjacent to the Lower Eastern Pond. The two *Chrysolina* were present in large numbers on 22 July and 9 and 18 August, mainly resting on the water mint, while *Phyllobrotica* was seen on the skullcap, at first abundantly (9 July 1997), but later in diminished numbers (9 August 1997), having disappeared by 18 August 1997.

During the period 1995 to 1997, Maxwell Barclay made regular visits to Bookham and has contributed a long annotated list of his findings of which the following species of Coleoptera have a restricted status and/or are not listed for the Common. Among them, the following, being Red Data species new to the Common, are of particular interest: *Uleiota planata* Latreille, *Notolaemus*

unifasciatus (Latreille) and *Silvanus bidentatus* (Fab.), which were found under the bark of dead branches in the Arboretum on 10 May 1997; *Cicones undatus* Guérin-Méneville discovered at night under elm bark in *Scolytus* workings by the Common Road, also on 10 May 1997, and *Colydium elongatum* (Fab.) obtained from *Platypus* workings in oak in the Arboretum, 2 November 1997:

	Date and comments	Status	New to Bookham
CARABIDAE			
Cychrus caraboides (Linn.)	6.xii.1996, under bark		+
Bembidion obliquum Sturm.	6.i.1996, IoW Pond	NT2	
Agonum assimile (Paykull)	3.iii.1996, in rotten log		+
Bradycellus verbasci (Dufts)	6.i.1996, E Hollow Pond		+
DYTISCIDAE			
Hydroporus gyllenhali Schiodte	2.xi.1997, by IoW Pond		+
Acilius sulcatus (Linn.)	2.xi.1997, by IoW Pond		+
HYDROPHILIDAE			
Enochrus melanocephalus (Ol.)	25.x.1996, E Hollow Pond	NT2	
HISTERIDAE			
Paromalus flavicornis (Herbst)	26.x.1996, under bark	NT2/AW3	+
SILPHIDAE			
Nicrophorus humator (Gleditsch)	8.vi.1996, at actinic light		+
Nicrophorus vespilloides Herbst	8.vi.1996, at carrion trap		+
Silpha atrata Linn.	6.xii.1996, under bark		+
STAPHYLINIDAE			
Staphylinus olens Müller	9.ix.1995, drowned in stream		+
LUCANIDAE			
Lucanus cervus (Linn.)	8.vi.1996, dead on path	?	
BUPRESTIDAE			
Agrilus angustulus (Illiger)	24.vi.1996, from oak, 10.v.1997, in stick	NT2	
DERMESTIDAE			
Ctesias serra (Fab.)	10.v.1997, under bark, IoW Pond	NT2/AW3	
CLERIDAE			
Tillus elongatus (Linn.)	24.vi.1996, sweeping in Arboretum	NT2/AW3	+
Thanasimus formicarius (Linn.)	10.v.1997, under bark in Arboretum	AW3	+
MELYRIDAE			
Axinotarsus marginalis (L. de C.)	24.vi.1996, sweeping	introduction	+
NITIDULIDAE			
Carpophilus sexpustulatus (Fab.)	26.x & 6.xii.1996, 10.v.1997, E Hollow Pond and Arboretum	AW3	+

	Date and comments	Status	New to Bookham
CUCUJIDAE			
Uleiota planata Latreille	10.v.1997, under bark in Arboretum	RD2/AW1	+
Cryptolestes duplicatus (Waltl.)	10.v.1997, under bark in Arboretum		+
Notolaemus unifasciatus (Latreille)	10.v.1997, under bark in Arboretum	RD3/AW2	+
SILVANIDAE			
Silvanus bidentatus (Fab.)	10.v.1997, under bark in Arboretum	RD3/AW2	+
BIPHYLLIDAE			
Biphyllus lunatus (Fab.)	10.v.1997, under bark in Common Road	AW3	+
BYTURIDAE			
Byturus ochraceus (Degeer)	8.vi & 24.vi.1996, 10.v.1997, beating in Arboretum		+
EROTYLIDAE			
Dacne rufifrons (Fab.)	10.v.1997, in fungus by Common Road		+
CERYLONIDAE			
Cerylon ferrugineum Stephens	26.x.1996, 10.v.1997, under bark in Arboretum		+
COCCINELLIDAE			
Subcoccinella 24-punctata (Linn.)	9.ix, 14.ix & 14.x.1995, on *Rumex*		+
Clitostethus arcuatus (Rossi)	8.vi.1996, from ivy, Common Road	RD1	
Coccinella heiroglyphica Linn.	14.x.1995, from heather, E Plain		+
LATHRIDIIDAE			
Aridius bifasciatus (Reiter)	6.i & 3.iii.1996, in *Typha* litter		+
MYCETOPHAGIDAE			
Mycetophagus 4-pustulatus (Linn.)	14.x.1995, 8.vi.1996, 10.v.1997, from ivy		+
Mycetophagus piceus (Fab.)	10.v.1997, in fungus by Common Road	NT2/AW3	+
COLYDIIDAE			
Cicones undatus Guérin-Méneville	10.v.1997, in *Scolytus* workings, at night	NT1	+
Bitoma crenata (Fab.)	3.iii.1996, under bark	AW3	+
Colydium elongatum (Fab.)	2.xi.1997, in *Platypus* workings, Arboretum	RD3/AW1	+
SALPINGIDAE			
Rhinosimus ruficollis (Linn.)	10.v.1997, under bark, E Hollow Pond		+
OEDEMERIDAE			
Ischnomera cyanea (Fab.)	10.v.1997, hawthorn blossom, Common Road	RD2/AW3	+

	Date and comments	Status	New to Bookham
CERAMBYCIDAE			
Phymatodes testaceus (Linn.)	8.vi.1996, 10.v.1997, on log pile	AW3	+
Grammoptera variegata (Germar)	10.v.1997, hawthorn blossom, Common Road	NT1/AW3	
Phymatodes alni (Linn.)	8.vi.1996, on fallen oak, Arboretum	NT2	
CHRYSOMELIDAE			
Orsodacne lineola (Panzer)	8.vi.1996, 10.v.1997, by Station and in Arboretum	NT2	
CURCULIONIDAE			
Strophosomus sus Stephens	14.x.1995, 26.x.1996, on heather		+
Liophloeus tessulatus (Müller)	10.v.1997, on ivy by Common Road		+
Sitona cambricus Stephens	2.xi.1997, suction sampler, E Hollow Pond	NT2	
Euphryum confine (Broun)	8.vi.1996, 10.v.1997, under bark		+
PLATYPODIDAE			
Platypus cylindrus (Fab.)	26.x.1996, 10.v.1997, oak logs, Arboretum, IoW Pond	RD3/AW3	

A further interesting study of Bookham was undertaken during 1997 by Professor J. A. Owen using two deep pitfall-traps sited by old oak trees, one by the side of Hollow Path near East Hollow Pond, the other, which was dead, at the junction of Tunnel and Rydall Paths. These traps were inserted to a depth of eleven inches, constructed to receive small insects active at depths of between two and eight inches below ground level, the top being closed off. During the course of the year he obtained 362 beetles of thirty-five species, of which fifteen do not appear to have been previously recorded from the Common:

Species	No.	Status	?new	Species	No.	Status	?new
Stomis pumicatus (Panzer)	1			*Tachyporus nitidulus* (Fab.)	1		
Abraeus globosus (Hoffman)	3		+	*Tachinus signatus* Gravenhorst	1		
Ptenidium pusillum (Gyllenhal)	1		+	*Geostiba circellaris* (Gravenhorst)	2		
Nargus velox (Spence)	18			*Atheta sodalis* (Erichson)	2		+
Nargus wilkini (Spence)	4			*Atheta trinotata* (Kraatz)	3		+
Choleva spadicea (Sturm)	2		+	*Atheta pilicornis* (Thomson)	16		
Catops fuliginosus Erichson	2		+	*Dimetrota marcida* (Erichson)	1		+
Catops nigricans (Spence)	2			*Oxypoda lividipennis* Mannerheim	26		
Neuraphes plicicollis Reitter	1	NT1	+	*Bryaxis bulbifer* (Reichenbach)	2		
Proteinus ovalis Stephens	1			*Dalopius marginatus* (Linn.)	1		
Anotylus sculpturatus (Grav.)	7			*Rhizophagus cribratus* Gyllenhal	226		+
Rugilus rufipes Germar	2			*Rhizophagus dispar* (Paykull)	2		+
Othius myrmecophilus Kiesenwet.	3		+	*Rhizophagus parallelocollis* Gyll.	1		+
Othius punctulatus (Goeze)	6			*Rhizophagus perforatus* Erichson	4		+
Philonthus decorus (Gravenhorst)	1		+	*Cerylon fagi* Brisout	5	NT1/AW3	
Quedius fumatus (Stephens)	2			*Cerylon histeroides* (Fab.)	2		
Quedius maurus (Sahlberg)	1	AW3		*Dienerella separanda* (Reitter)	6	AW3	+
Habrocerus capillaricornis (Grav.)	1						

Status NT2 = Notable B or Local; NT1 = Notable A or Very Local; RD3 = Rare; RD2 = Rare and Vulnerable; RD1 = Very Rare and Endangered; AW1, AW2, AW3 = Ancient woodland categories

Contributions such as these emphasize the extent to which insect records depend upon the distribution of experienced entomologists as well as that of the species themselves!

Bugs (Ian Menzies)

The brassica bug, *Eurydema oleraceum* (Linn.) — a handsome shield-bug — continues to thrive on the Common: it was present in unusually large numbers

on white garlic mustard growing alongside the Isle of Wight enclosure near Central Ditch: as many as three pairs per plant were noted on 18 May. The sloe bug *Dolycoris baccarum* (Linn.) was also seen in unusually large numbers this summer, for instance as many as twenty and thirty could be counted on the tray, especially when beating aspen in The Glade during August. Single examples of the blue bug *Zicrona caerulea* (Linn.) were seen on skullcap growing at the margin of Lower Eastern Pond on 9 and 18 August. This brilliant metallic-blue shield-bug is known to predate phytophagous beetles. Several years ago one was photographed with its proboscis firmly implanted between the abdominal segments of the beetle *Lochmaea caprea* (Linn.), swarming on Bayfield Plain sallows at that time (I.S.M.). It seems that this bug may also be interested in the beetle *Phyllobrotica quadrimaculata* present on the skullcap.

Bush-crickets (Ian Menzies)

Two of our three British tetrigids, *Tetrix subulata* (Linn.) the slender ground-hopper, and *Tetrix undulata* (Sowerby) the common ground-hopper, were seen in some numbers on recently cleared ground alongside the Isle of Wight enclosure by Central Ditch on 18 May 1997. Unlike grasshoppers and bush-crickets, ground-hoppers, which look like miniature grasshoppers, mature in the spring and early summer. Both the above species are common and widely distributed, but inconspicuous and easily overlooked: *T. subulata* tends to favour a marshy environment.

During the course of the 'bush-cricket' field day on 9 August, it was noted that the distribution of both Roesel's and the long-winged cone-head bush-crickets *Metrioptera roeselii* and *Concephalus discolor* had now expanded to occupy almost every grassy part of the Central, IoW, Bayfield and Western

FIGURES 1 and 2. Great prominent moth *Peridea anceps* — fully grown larva (left) feeding on an oak leaf, and adult (right) at rest on oak trunk. Both from Bookham Common.
Photos: I. S. Menzies

FIGURE 3. Elephant hawk-moth *Dielephila elpenor* — fully grown larva, Bookham Common, 18 August 1997. *Photo: I. S. Menzies*

Plains. By contrast, the short-winged conehead *C. dorsalis* was, as last year, detected in only one small area of the Western Plain. In 1996 the oak bush-cricket *Meconema thalassina* was plentiful and the speckled bush-cricket *Leptophyes punctatissma* scarce, but this year it was the other way around, large numbers of *Leptophyes* being seen at rest on a variety of herbaceous plants, while not a single *Meconema* could be obtained by beating the branches of oak and other trees. Although the dusky bush-cricket *Pholidoptera griseoaptera*, a retiring species that is difficult to detect despite its large size, was heard stridulating towards the end of the Banks Path, it was not detected along the path across Western Plain where it appeared to be well established in 1996.

Miscellaneous insects (Ian Menzies)

Two fully-grown larvae of the great prominent moth *Peridea anceps* (Goeze) were found on 12 July, one crawling along the ground by Broadway South and the other beaten from oak in The Glade (Figure 1). These large spectacular caterpillars look somewhat similar to those of the privet hawk-moth, but with oblique lateral stripes reversed and no hawk-moth 'tail'. This species inhabits well-established oak woodland, but the adult (Figure 2) is seldom seen unless attracted to light. A fully-grown larva of the elephant hawk-moth was found feeding on marsh bedstraw at the margin of Lower Eastern Pond on 18 August (Figure 3).

Contributors' addresses

Keith Alexander, The National Trust, 33 Sheep Street, Cirencester, Gloucestershire GL7 1RQ.
Neil Anderson, 32 Rowan Close, London W5 4YH.
Maxwell Barclay, 47 Tynemouth Street, London SW6 2QS.
William N. Landells, Department of Histopathology, St Helier Hospital, Wrythe Lane, Carshalton, Surrey SM5 1AA.

Ian S. Menzies, Villiers Lodge, 1 Cranes Park, Surbiton, Surrey KT5 8AB.
Ken Page, 10 Cannonside, Fetcham, Leatherhead, Surrey KT22 9LE.
Alan Prowse, 46 Badingham Drive, Leatherhead, Surrey KT22 9HA.
John A. Owen, 8 Kingsdown Road, Epsom, Surrey KT17 3PO.
Bryan Radcliffe, 14 Manor Close, Burgess Hill, West Sussex RH15 0NN.
Ian Swinney, Merritt's Cottage, Great Bookham Common, Leatherhead, Surrey KT23 3HZ.
Audrey Thomas, Badgers Hollow, Peperharrow Road, Goldaming, Surrey GU7 2PX.
Ken J. Willmott, 3 Yarm Court, Leatherhead, Surrey KT22 8NY.

Book review

A history of Sussex wild plants. *An account of the origins of the wild plants of Sussex from the time of the retreat of the ice sheets to the present day.* Ursula Smith & Eileen Howard. Edited by Gerald Legg. Brighton Borough Council – The Booth Museum of Natural History, Brighton. 1997. 46 pp., A4. £4.50 post free. ISBN 0 948723 33 5.

This is a disappointment after some of the other publications of the Booth Museum of Natural History. Not only is it riddled with spelling errors, only a few of which are dealt with in the inserted 'Corrigendum' (which adds to the number by wrongly asking for a second 'd' at the end of the name 'Wolley-Dod'); it also does very little to help the reader understand why the plants in Sussex now are there in their present proportions. The archaeological and historical data from available sources are there, often undigested in tables which are not well related to the text, but there could have been a lot more, for instance, about twentieth-century changes in agricultural practice which have radically altered the ratio of rough grazing to arable land, with consequences for the flora. The county is dotted with clues to its past vegetation, like the relict fly honeysuckle and large-leaved lime in the west of the county, which, with a great deal of research no doubt, could have been assembled into a series of reconstructions to be compared with the present situation.

RODNEY BURTON

Book review

The moths and butterflies of Cornwall and the Isles of Scilly. F. H. N. Smith. Gem Publishing Co., Wallingford. 1997. 434 pp., 32 pp. of coloured plates, hardbound. £44, plus £3 UK p. & p. ISBN 0 906802 07 5.

Surprisingly, it appears that the last published list of the Lepidoptera of the County of Cornwall was issued in 1906 within the pages of the *Victoria county history*; the publication of Frank Smith's book is, therefore, somewhat overdue and very welcome. However, if one is expecting to see the now almost obligatory tetrad distribution maps for the species recorded one will be disappointed — there are none at all! The author explains that the technology for mapping was not easily available to him and that he considers named localities to be more interesting and of more practical use than dots on a map. With the former, the reviewer sympathizes, but with the latter he disagrees, though this is largely a personal opinion and I am sure it is not shared by everyone. I for one do not have an intimate knowledge of Cornwall and I have never been to the Scillies, so the names mean rather less to me than they will to entomologists regularly working within the county, though in fairness there is a relatively extensive gazetteer (of names mentioned in the text?) in the rear of the book which may solve the problem. Localities are no doubt important to collectors, but to those of us wishing to study the objects of our desire in more detail, especially when it comes to monitoring range expansions and contractions, maps are a valuable tool.

On the positive side, the species accounts are comprehensive and evidently accurate and the records have clearly been properly vetted prior to inclusion. Two very valuable inclusions take the form of appendices — first a list of species added to the county list since the 1906 publication in *VCH* and second, a list of the species not seen since that publication, accompanied by the names of their alleged foodplants as a stimulus to further recording.

This is, overall, a very valuable work of reference on the Lepidoptera of Cornwall and the Isles of Scilly and it is enhanced by the inclusion of 152 superb colour photographs of moths and their habitats (although these may perhaps be partly responsible for the relatively high price of the work). The photographs of the micro-moths are better than many illustrations I have seen in expensive identification guides and I can't help feeling that Mr Smith might turn his attention next to a micro companion volume to 'Skinner'. If he does, then I recommend its purchase, as indeed I do for the present volume.

COLIN W. PLANT

Birds of Bookham Common in the breeding season

ALAN D. PROWSE

46 Badingham Drive, Leatherhead, Surrey KT22 9HA

Contents

Summary

Although the annual survey of birds in the oakwood of Eastern Wood has continued at Bookham Common, other bird records have been casual since the survey on the Plains was discontinued in 1985. In 1996 and 1997 the whole of Bookham Common was surveyed to determine the distribution of various bird species and to gain some idea of abundance. In addition, more detailed studies were made on the plains, and the oakwood survey was maintained.

This paper sets out the present status of the avifauna at Bookham at a time of active management, so that future changes and the effects of conservation measures can be assessed.

Introduction

The surveys of birds on Bookham Common are a valuable archive. They pre-date the Common Birds Census (CBC) of the British Trust for Ornithology (BTO), and are of national importance. The figures were most recently used by Newton et al. (1997) in a study of sparrowhawk predation on common species in woodland before, during and after the DDT problems of the 1960s.

Beven (1976) summarized the records until 1975 for the oak woodland plot (16.2 hectares). Newton et al. were unaware that recording had continued after the 1970s. Published results for the oak woodland in the 1980s referred to a few common species only. Surveys of the plains (39 hectares) by Melhuish and Merritt continued to 1985, but publication of the results was sparse (Beven 1989). The CBC study of oak woodland has continued in the 1990s, but records elsewhere on the Common have been casual, apart from documentation of the heronry. For example, it was not known in 1995 if jackdaws, a common species, nested on the Common.

Under the guidance of the recorder Ron Kettle, ADP in 1996 mapped and surveyed a limited number of species on the Plains in the breeding season. He also surveyed the whole Common, recording which species could be found in each of the twenty defined recording areas (Figure 1). This information had not been collected previously. In 1997, the Plains survey was repeated for an increased number of species. The qualitative survey for the whole Common was also repeated by ADP, and the CBC woodland and heronry surveys were undertaken by Roger Suckling. The birds on the Common in the breeding

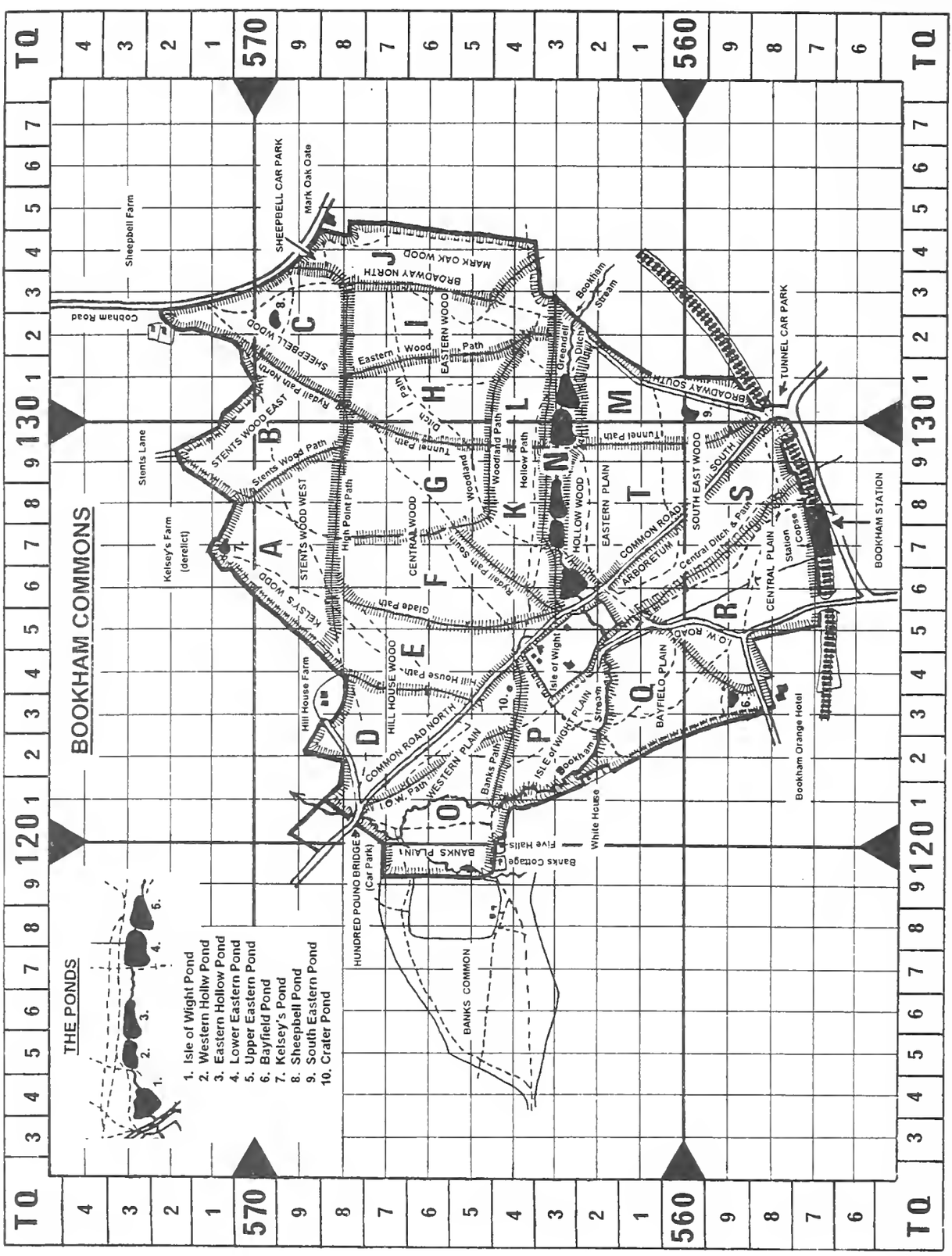


FIGURE 1. Map of Bookham Common, showing recording areas, paths, roads, woods, plains and ponds.

season are, therefore, better known at the present time than for more than a decade. The management of the Plains is active. For some years there has been annual scrub clearance mechanically of multiple small areas. An extension of the area of fenced stock grazing is taking place, to cover Bayfield and Isle of Wight Plains as well as the existing Central Plain.

The present paper sets out to report the present status in the breeding season of many bird species. This will make the assessment of future changes possible, quantifying the effects of current management. It is my intention to update the past archive, enabling comparison with the past.

Methods

The CBC survey of oak woodland was undertaken jointly in 1996 by Ron Kettle and Roger Suckling. RS continued the survey in 1997, and his conclusions have been confirmed by the BTO.

The qualitative survey of the whole Common (ADP) was by random repeat visits to all areas, mapping the birds contacted, with transfer to species maps. On the plains, visits were frequent to each area, often several times weekly, with mapping of all bird contacts, and transfer to species maps. Much valuable help came from other observers. If, halfway through the season, a species map on the Plains showed gaps in distribution, that area would be further investigated. In this way, for example, three extra whitethroat territories were found when nestlings were being fed. Willow warblers were extremely common in some areas, especially on Bayfield Plain, where mechanical clearance had taken place eighteen months before. The species was surveyed on two additional occasions by plotting each singing male against at least two others, to get greater accuracy. Thus, techniques were adapted to individual species to get as close to the true picture as possible.

Results

The distribution of the birds throughout the Common is shown in Table 1; the results of the CBC survey with appropriate densities in Table 2; and the selected species counts on the Plains and elsewhere in Table 3. The final column in Table 3 shows densities taken from Cramp et al. (1977), *The birds of the western Palearctic* (*BWP*), for comparison. Many of these statistics are rather poorly edited in that publication, but, where possible, comparable figures are taken for southern England. Reference to that authority is recommended if fuller details are required, but their presence here will be helpful in interpreting the table. The present status of each species is summarized in the Appendix.

At a time when common birds are no longer common, Bookham Common is a delight. On the Plains in May it is possible to hear seven species of warblers with a background of nightingales and turtle doves. Nineteen species of conservation concern occur among the sixty-nine species recorded in the breeding season in 1996 and 1997. Nightingales reached their highest recorded total ever on the Plains, and there was a good population of turtle doves. Song thrushes on the Plains equalled their numbers of the 1970s, which is surprising in view of their present national decline.

Seed eaters have low numbers, but it has always been so. Linnets do not breed, though they do so on the allotments within a hundred metres of the Common. Greenfinches are absent, though they are in gardens immediately to the south-west, but chaffinches are common. Hawfinches are present throughout the year, as are bullfinches. Redpolls and yellowhammers no longer breed, though reed buntings do.

Insectivores and other invertebrate eaters are present in abundance. There is one phenomenon, which ADP has termed the 'grubfeast' (see below) which vastly increases the bird biomass using the Common in late May and early June. It creates some problems in census work at an important time of year.

It will be obvious from this account that the results have three levels of accuracy. The CBC is a fairly good indicator for population and population change (Bibby et al. 1992, O'Connor and Shrubb 1986). The figures for the Plains probably approach the CBC in reliability. The figures for the Common as a whole are indicative only. Nevertheless, in many species there is a reasonable correlation. For example, densities of blackcaps on the Plains, the entire Common, and the CBC area are 31, 31, and 37 pairs/km^2 respectively. This is a difference of one pair only in the 16.2 hectares of the CBC area.

The 'grubfeast'

In late May and early June large numbers of starlings and corvids appear. The corvids are carrion crows and jackdaws (with some rooks in 1996). They form many noisy parties of forty birds or more feeding on a massive insect hatch in the oak trees throughout the wooded area. The starlings, adult and juvenile, number many hundreds, at times thousands, on the plains and in the woodland, and feed voraciously in the oaks. These flocks can cause great agitation to local nesting birds. The invasion obviously increases the biomass of birds feeding on the Common at that time. There was a smaller second wave involving jackdaws near Bookham Grange Hotel on 16 June 1997.

Other birds benefit from this plenty. For example, the male reed bunting fed his nestlings almost entirely from two oaks growing as standards in his territory.

Heronry

There were twenty successful nests of grey herons in 1997. This was the highest total since the heronry was established in 1988. It is now divided into two groups. The first group is near a much-used public path. It had ten nests in 1996, but only two were successful in 1997. More nests were built in the second group, which is in a less-disturbed part of Central Wood. However, more paths have appeared in 1997 through this part of the Wood. At least one of a pair of herons is constantly at the nest from egg laying until the young are hatched and growing, unless disturbed. Predation by corvids results from disturbance. The adjacent Eastern Wood CBC shows a density of carrion crows of 19 pairs/km^2, and jays of 31 pairs/km^2.

Suckling (1997) found that 70 per cent of Surrey heronries are on land with no public access. This figure rose to 90 per cent in his control area immediately adjacent to the Surrey border. Herons need to be relatively undisturbed in the breeding season, and there is urgent need for new paths in the second area of the heronry to be actively discouraged.

Ponds

Little grebes returned in 1997, after an absence of some years. Two pairs bred, though no young survived, and a third pair was present on Pond 2 in early April. Tufted ducks were frequent visitors in 1996, and a pair bred in 1997 for the first time for many years, hatching nine young, six of which survived to independence. A pair of Canada geese bred successfully. Pairs of mandarin ducks were present, with three adult males together in mid season (the best indication of pair numbers according to Bibby et al. (1992)). Many broods of mallards (the largest of fourteen ducklings), coots and moorhens were reared. Despite the drought, moorhens nested on three peripheral ponds as well as the central series.

The success of the breeding season on the ponds can be attributed directly to the removal of carp, pike and other species in 1994 and 1995. Their presence was keeping the water murky and slowing normal biological succession.

The Plains

Clearance of localized areas of scrub each year has produced numerous open spaces of differing ages. In 1997 this resulted in apparently ideal habitat for some warblers. High numbers of willow warblers and whitethroats in particular were present. Nightingales at eight pairs were at their highest known level on the plains, and they were recorded singing at twelve locations. Several males sang at their traditional sites on arrival, but moved to damper sites near streams in their first week, persisting there. If present droughts were to continue, it would be important that some scrub thickets are left around and over the streams.

The varied age of the ground flora must have benefited turtle doves. This species is increasingly uncommon in most habitats, and had not been counted at Bookham for some years, though present. It was surprising to find, after several early evening surveys, that about fourteen pairs were present, some in small groups, and others as lone pairs. The few observations on feeding were on first-year and second-year clearance areas.

The national decline of the song thrush has received much attention in the media and literature. The ten pairs on the Plains are similar to the levels in the 1970s.

Woodland census CBC

The CBC results show:

a. High numbers of robins and blue tits.
b. A continued decline in wrens, in line with the national trend after two bad breeding seasons.
c. A continued poor population of the song thrush.

Lack (1966) pointed out that the density of the song thrush was higher on Bookham Common than any density in woodland reported elsewhere, though higher levels at Bookham were subsequently reported. The density is now much lower than in those days, though the blackbird population is much the same. The ten pairs of song thrushes in 1966 in the CBC area are a distant memory; none was present in 1987 and 1988, with poor numbers since.

Other species in the woodland near the CBC area, but not actually in it, were grey heron, woodcock, lesser spotted woodpecker, wood warbler in 1996, goldcrest, jackdaw, bullfinch and hawfinch.

Birds of Conservation Concern (BOCC)

The following species occurring on the Common are of red BOCC status, i.e., have had a decline of more than 50 per cent in the last twenty-five years:

Turtle dove, song thrush, spotted flycatcher, linnet, bullfinch, and reed bunting.

There were fourteen pairs of turtle doves and sixteen pairs of bullfinches. Of two pairs of reed buntings at least one pair was successful to fledging. Linnets have always been uncommon, and do not now breed. Spotted flycatchers have been occasional migrants only, and retain this status.

The following species are of amber BOCC status, with a 25–50 per cent decline in the same period:

Kestrel (1 pair present and another visits the northern area), stock dove (2), green woodpecker (9), swallow (present), dunnock (37), nightingale (8), blackbird (28 pairs on the plains and 10 in the CBC area), grasshopper warbler (present 1996 and 1997, probably one pair nesting in each year), marsh tit (7 pairs, but probably under recorded), willow tit (no longer breeding, but a singing male in 1996), starling (thought to be no longer nesting in the woodland), goldfinch (several pairs in 1996 on the Plains, but not breeding 1997), and hawfinch (present in several areas of the woodland and thought to breed).

Conservation

Birds are often clear indicators of the health of an environment, with examples ranging from the miner's canary to the food chain effects of DDT. Common birds are no longer common because of changes in agricultural practices (O'Connor and Shrubb 1986). Less-common birds, with their more demanding ecological requirements, are even more at risk.

It is encouraging to find such healthy populations at Bookham. In secondary environments, e.g., song thrushes and starlings in woodland, there have been declines in line with national trends, as birds leave to take over primary habitat available elsewhere. In primary habitats a population can continue to maintain itself. It is important to maintain this range of habitats. No adverse agricultural chemicals are used on the Common, except for herbicides on a paddock by one of the residents on the Isle of Wight.

The management by The National Trust warden, Ian Swinney, has produced many beneficial changes. The clearing of introduced fish from the ponds, including a 15-lb pike, has improved the ponds. Little grebes and tufted ducks have returned, and other species in winter also demonstrate the improvement.

The decision to clear multiple small areas of the Plains was made for botanical reasons. The mosaic of small environments of differing ages has produced high populations of warblers, and may be of national importance as a technique for conservation of turtle doves and nightingales. The extension of the grazing area will produce further changes, not least in the control of large dogs on walks.

The future

The changes on the Plains will be monitored, with emphasis on matters which can help conservation. The team is, at present, an extremely small one. In 1998 Roger Suckling will be unable to do the CBC census of oak woodland because of university commitments, though an overview of that area should be possible.

Acknowledgements

My thanks are due to the following observers who submitted records: D. Couzens, P. Crook, J. Gale, G. Ibbitson, W. Ingram, R. Kettle, N. Murphy, J. Owens, C. Pettigrew, Anna and Andrew Stribley, and Ian Swinney. Dr W. Landells produced some wonderful plotted maps of the birds of the Plains, while he was surveying the bats, and contributed much knowledge on the present status of the owls. To Ron Kettle goes the credit for continuing recording at Bookham Common after 1989, but unfortunately, he had to relinquish this following an accident in 1996. I would like to pay tribute to his work here. Above all, I would like to thank Roger Suckling for the CBC and heronry censuses, his company, unfailing good humour and encouragement, and his many helpful suggestions on the first draft of this paper.

References

BEVEN, G. 1976. Changes in breeding bird populations of an oak-wood on Bookham Common, Surrey, over twenty-seven years. *Lond. Nat.* **55:** 23–42.

BEVEN, G. 1989. Survey of Bookham Common. Forty-seventh year. Progress report for 1988. Birds. *Lond. Nat.* **68:** 136–140.

BIBBY, C. J., BURGESS, N. D. and HILL, D. A. 1992. *Bird census techniques.* Academic Press, London.

CRAMP, S. et al. (eds) 1977. *The birds of the western Palearctic.* **1–9.** Oxford University Press.

LACK, D. 1966. *Population studies of birds.* Clarendon, Oxford.

NEWTON, I., DALE, D. and ROTHERY, P. 1997. Apparent lack of impact of sparrowhawks on the breeding densities of some woodland songbirds. *Bird Study* **44:** 129–135.

O'CONNOR, R. J. and SHRUBB, M. 1986. *Farming and birds.* Cambridge University Press.

SUCKLING, R. 1997. *Grey herons in Surrey 1986 to 1997.* Unpublished. Prepared for the University of Birmingham and the BTO. Copy with the BTO.

TABLE 1. Distribution of bird species in the twenty recording areas of Bookham Common in the breeding seasons 1996 and 1997.

Species	Recording areas	Score
Little grebe	N	1
Grey heron	F G	2
Mute swan	N	1
Canada goose	N	1
Mandarin	M N	2
Mallard	N	1
Pochard	n	1
Tufted duck	N	1
Goshawk	Recorded once. See Appendix.	1
Sparrowhawk	E F G H I J L M O P T	11
Kestrel*	B D E F O P Q S T	9
Hobby	r	1
Pheasant	A B C D E F G H I J K L M O P Q R S T	19
Moorhen	A C N P Q	5
Coot	N	1
Stock dove*	B I J K	4
Woodpigeon	A B C D E F G H I J K L M N O P Q R S T	20
Collared dove	I J M N Q R	6
Turtle dove**	D E O P Q R	6
Cuckoo	A B D E F K M O P Q R S	12
Little owl	B O	2
Tawny owl	E H I J K M N Q	8
Swift	Feeding above all areas, May–August.	
Green woodpecker	A D F H I M O P Q R S T	12
Gt sp. woodpecker	A B C D E F G H I J K L M N P Q R S T	19
Lr sp. woodpecker	B D F I J	5
Swallow*	P Q	2
House martin	P Q R	3
Pied wagtail	N O Q S	4
Wren	A B C D E F G H I J K L M N O P Q R S T	20
Dunnock*	A D E F H J M N O P Q R S T	14
Robin	A B C D E F G H I J K L M N O P Q R S T	20
Nightingale*	O P Q R S	5
Blackbird*	A B C D E F G H I J K L M N O P Q R S T	20
Song thrush*	A B D E F G H I J K L M O P Q R S T	18
Mistle thrush	A B D E F I J K L M N P Q R S T	16
Grasshopper warbler*	F Q R	3
Lesser whitethroat	o p r	3
Whitethroat	E F K N O P Q R	8
Garden warbler	E F K L M N O P Q R S T	12
Blackcap	A B C D E F G H I J K L M N O P Q R S T	20
Wood warbler	1996 (E) M	2
Chiffchaff	A C D E F H I J K L M N O P Q R S T	18
Willow warbler	A B D E I J k l M N O P Q R S T	16
Goldcrest	C D E F I J N O S T	11
Spotted flycatcher**	1996 e	1
Long-tailed tit	A B C E F G H I J K M N O P Q R T	17
Marsh tit*	A B D E G H I K	8
Willow tit	1996 q	1
Coal tit	A B C D G H J L M P Q S T	13
Blue tit	A B C D E F G H I J K L M N O P Q R S T	20
Great tit	A B C D E F G H I J K L M N O P Q R S T	20
Nuthatch	A B C D E F G H I J K L M N Q R S T	18
Treecreeper	A C D E G H I J K L M N S T	14
Jay	A B C D E F G H I J K L M N O P Q R S T	20
Magpie	Common in all areas. Not censused.	
Jackdaw	A B C J M O S T	8
Rook	l n	2
Carrion crow	A B C E F H I J L M N O R S T	15
Starling*	Present. No detailed records.	

TABLE 1. — *continued.*

Species	Recording areas	Score
House sparrow	P Q R	3
Chaffinch	A B C D E F G H I J K L M N O P Q R S T	20
Greenfinch	None.	
Goldfinch*	E n O R t	5
Linnet**	(Q)r	2
Redpoll	s t	2
Bullfinch**	B C D E F K M O P Q R S	12
Hawfinch*	C E F G H R T	7
Reed bunting**	Q R	2

Key:
A–T — present in areas indicated, usually showing signs of breeding.
(E), (Q) — present for a time, but did not breed.
e, k, l, n, o, p, r, s, t — seen on one occasion; no suggestion of breeding.
** — BOCC red alert = 50 per cent decline in last twenty-five years.
* — BOCC amber alert = 25 per cent decline in last twenty-five years.
Score — number of recording areas (out of 20) where species occurred.

TABLE 2. Analysis of oak woodland survey (Common Bird Census), 1995–1997.

Species	Numbers (pairs) 1995	1996	1997	Density prs/km^2
Sparrowhawk	p	1	1	
Pheasant	1	3	1	6–19
Stock dove	p	1	1	
Woodpigeon	nc	nc	nc	
Collared dove		p		
Cuckoo	1	p		
Tawny owl	1		p	
Green woodpecker	1	1	p	
Gt sp. woodpecker	3	3	3	19
Lr sp. woodpecker		p		
Wren	19	15	10	62–117
Dunnock	p	1	1	
Robin	48	43	44	265–296
Blackbird	10	13	10	62–80
Song thrush	1	2	1	6–12
Mistle thrush	1	1	1	
Blackcap	3	6	6	19–37
Chiffchaff	2	3	5	12–31
Willow warbler	p		1	
Goldcrest	1			
Long-tailed tit	2	5	3	12–31
Marsh tit	p	2	2	12
Coal tit	2	3	1	6–19
Blue tit	20	26	31	123–191
Great tit	10	13	11	62–80
Nuthatch	2	2	4	12–25
Treecreeper	1	1	2	6–12
Jay	4	5	5	25–31
Magpie	2	2		0–12
Jackdaw	p			
Carrion crow	2	2	3	12–19
Starling	nc	nc	nc	
Chaffinch	4	7	7	25–43
Bullfinch		p		
Hawfinch			p	

Key: p — present, but below standard BTO require for one pair.
nc — not counted.

TABLE 3. Counts of selected species in 1997, with totals for the whole Common, Plains and CBC areas, with densities.

Species	Total for Common	Plains number	Plains prs/sq km	CBC number	CBC prs/sq km	*BWP** prs/sq km
Turtle dove	14	14	36			
Cuckoo (males)		4	10	1	6	m < 5/hectare
Tawny owl	6			1	6	to 11
Green woodpecker	9	3	8	1	6	to 12
Gt sp. woodpecker	nc			3	19	tc 51
Wren	nc			10	62	to 380
Dunnock	37	22	56	1	6	to 230
Robin	nc	31	80	44	272	to 300
Nightingale		8	20			to 30
Blackbird	nc	28	72	10	62	to 300
Song thrush	24	10	26	1	6	43
Mistle thrush	4	1	2.6	1	6	< 10
Whitethroat	31	28	72			to 100
Garden warbler	23	14	36			to 60
Blackcap	49	12	31	6	37	80 (wood)
Chiffchaff	29	7	18	5	31	to 200
Willow warbler	51	36	92	1	6	to 200
Goldcrest	6			1	6	to 70
Long-tailed tit	20	5	12	3	19	to 34
Marsh tit	7			2	12	to 28
Coal tit	9	2	5	1	6	to 27
Blue tit	nc			31	191	to 290
Great-tit	nc			11	68	to 320
Nuthatch	18	1	2.6	4	25	to 108
Treecreeper	10			2	12	
Jay	nc			5	31	to 15
Carrion crow	11			3	19	to 36
Chaffinch	nc	17	43	7	43	58 (wood)
Bullfinch	16	12	31			to 21
Reed bunting	2	2	5			

**BWP* (*The birds of the western Palearctic*) — see Results, p. 179.

APPENDIX

Status of bird species in breeding season 1997 on Bookham Common

Little grebe	2–3 pairs.
Grey heron	20 successful nests.
Canada goose	1 pair.
Mandarin	3 pairs.
Mallard	many pairs.
Pochard	male and female present in March 1997.
Tufted duck	1 pair bred.
Goshawk	1 seen, 18 June 1997 (AS). Subject to ratification.
Sparrowhawk	1 pair bred and others visit.
Kestrel	1 pair on Plains and another to north.
Hobby	1 adult, 6 June 1997 (ADP).
Moorhen	nests on central and peripheral Ponds.
Coot	breeds on Ponds 1 to 4.
Woodcock	roding and pair seen.
Stock dove	minimum of 2 pairs.
Woodpigeon	common.
Collared dove	*c.*8 pairs at periphery, especially near Bookham Station.
Turtle dove	*c.*14 pairs on Plains.
Cuckoo	*c.*4 males on Plains; also elsewhere.
Little owl	seen on Plains and farmland to north.
Tawny owl	minimum of 6 pairs.
Swift	many feed over the Common.
Green woodpecker	probably 9 pairs.
Gt spotted woodpecker	common.
Lr spotted woodpecker	recorded in two areas (ADP).
Swallow	regular on Plains; may nest in buildings on IoW.
House martin	nests on houses by allotments in Bookham Grange area.
Pied wagtail	2 pairs reported (IS).
Wren	common.
Dunnock	widespread.
Robin	common.
Nightingale	8 pairs.
Blackbird	common.
Song thrush	24 territories, low numbers in woodland.
Mistle thrush	4 pairs.
Grasshopper warbler	male singing in previously unexplored area, 30 May 1997 (JO).
Lesser whitethroat	males heard in two areas temporarily to 6 June 1997 (RK, CP).
Whitethroat	31 pairs.
Garden warbler	23 pairs.
Blackcap	49 pairs.
Wood warbler	1 pair bred 1996; no 1997 records.
Chiffchaff	29 pairs.
Willow warbler	51 pairs.
Goldcrest	6 pairs.
Spotted flycatcher	1 bird seen 1996 (ADP); none in 1997.
Long-tailed tit	20 pairs.
Marsh tit	7 pairs, but may well have been under recorded.
Willow tit	no longer breeds; 1 singing male in 1996 (ADP).
Coal tit	9 pairs.

Blue tit	common in all areas.
Great tit	common in all areas.
Nuthatch	18 pairs, but may be under recorded.
Treecreeper	10 pairs found.
Jay	common.
Magpie	common; a Larsen trap is operated within 100 metres of the Common
Jackdaw	nests in several areas.
Carrion crow	at least 11 pairs.
Starling	whether it still breeds on the Common is uncertain.
House sparrow	uncommon on IoW and at Bookham Grange.
Chaffinch	common.
Greenfinch	absent from the Common; nests in gardens at south-west edge.
Goldfinch	2–3 pairs in 1996; none between 23 April and 30 June 1997.
Linnet	1 singing male, 22 April 1997; breeds on allotments to west.
Redpoll	no longer breeds; one heard and seen, 10 March 1997 (ADP).
Bullfinch	16 territories.
Reed bunting	2 pairs, one nesting successfully.
Yellowhammer	no records.

Key to observers

ADP	A. D. Prowse	IS	I. Swinney
AS	Andrew Stribley	JO	J. Owens
CP	C. Pettigrew	RK	R. Kettle

Book review

Urban flora of Belfast. Stan Beesley and John Wilde. The Institute of Irish Studies, The Queen's University of Belfast, 1997. x + 196 pp. £8.50. ISBN 0 85389 695 X.

This is the product of a survey carried out in the three years 1993 to 1995. It looks like a mapping scheme, yet only the base map is provided, and for each species recorded a list of squares is supplied so that the reader who wants to has the data allowing him to visualize a species map for himself. The decision to survey the urban flora of Belfast was made before it was decided what the boundary of the urban area should be, and the decision reached was to cover an irregular area which would include all the contiguous urban area and define it by 1-km grid lines, so some rural habitats have been caught up in it. The area consists of seventy-six 1-km squares only, and a most unusual and interesting feature of the book is a description of each square as a botanical habitat. Many surprising discoveries were made during the survey.

The London botanist reading about the flora of Belfast will be struck by the good variety of ferns, but there are no native Ericaceae. Other surprising absences are *Lamium amplexicaule*, *Plantago coronopus*, *Reseda lutea* and *Urtica urens*. The seven records of *Polygonatum multiflorum* and two of *P. odoratum* as garden escapes all look suspiciously like the hybrid of the two species to me, and I wonder about the 'very hairy variety' of *Epilobium palustre* 'occasionally found on dry open ground'. As there were problems distinguishing *Crepis biennis* and *C. capillaris*, it seems likely that when *C. vesicaria* finds its way to Belfast, as *Conyza canadensis* has done quite recently, it will be overlooked.

RODNEY BURTON

Hampstead Heath Survey Progress Report for 1997

Contents

General (Colin Bowlt, Chairman)

Survey days have been well supported with ten to twenty members turning up on the last Sundays of each month. About forty members were involved during the year, and a number of studies have taken place, some of which are detailed in this report. Others, including surveys of amphibians, birds, algae, and fungi, are part of longer-term projects. Ruth Day has developed a computer programme specifically for the recording needs of our Survey, but which is compatible with the more general, and, currently less user-friendly, Recorder programme.

The Heath is a very 'public' public open space and receives much attention, both official and unofficial. The Corporation of London, who own it, have put in a lot of conservation effort. Because of the long history of botanizing on the Heath, the Corporation is only too well aware of the many lost plants, and they are endeavouring to reintroduce species. This has posed some interesting problems for the Survey since in some instances it is not clear whether a plant is reintroduced or relict. There are strong arguments both for and against reintroductions. However, it is the policy of the LNHS not to express opinions on matters of conservation in connection with the Heath — there are plenty of other groups and individuals doing that already. Nonetheless, our records and findings are available on request to all concerned with the management of the Heath. Monitoring the success, or otherwise, of the reintroduced species and the effect of other management work we see as an important part of the Survey. In addition, I suspect that some members of the public have also been doing their own little bits of plant introduction. To separate these from bird-sown introductions can be difficult. How the indigenous species cope with the invaders (with the help of management) in this semi-natural piece of London environment is going to make for fascinating recording.

We have been keen to let the public know what we are doing. Our notice-board outside the Centre, by which we endeavour to keep the public informed of our work and what is to be seen on the Heath, has had much attention from passers-by. We also put on a Public Open Day at the Centre in June, but heavy rain kept practically everyone away. More successfully we celebrated our first anniversary with wine and nibbles (rather more actually) at the Centre on an evening in July, at which we were delighted to entertain management staff of both the Heath and Kenwood.

Vegetation (Barbara Villiers)

Hampstead Heath, despite its comparatively small area, *c.*320 hectares (790 acres), contains a diversity of habitats: woodland, scrub, recreational areas such as playing fields, ponds, the landscaped areas of Kenwood, sandy areas where gravel was once extracted, etc., thus providing ample scope for botanical recorders. Although this was only the first full year of the survey, over 400

plants, including additions to the GLC (1986) *Hampstead Heath Flora*, have been recorded. Details of plant records are held on the Heath Survey computer programme developed by Ruth Day. Recording has covered most areas except Golders Hill Park.

Notable plants found included three species of bur-marigold: *Bidens cernua* nodding bur-marigold, *B. tripartita* trifid bur-marigold, and *B. connata* London bur-marigold, found mostly near the ponds on Sandy Heath and occasionally elsewhere. *B. connata* is an introduced species usually seen naturalized near some of London's canals.

Two orchid species were recorded. Four or five plants of *Epipactis helleborine* broad-leaved helleborine were found in long grass beside the riding track on the Heath Extension, and one tall plant was seen on South Meadow outside the Ladies Pond. A single *Anacamptis pyramidalis* pyramidal orchid was found on Sandy Heath. Whether or not they will survive in their unusual habitats remains doubtful.

As well as the more common *Symphytum* × *uplandicum* Russian comfrey, four species of comfrey have been recorded: two native, *S. officinale* common comfrey, *S. tuberosum* tuberous comfrey, and two introduced (naturalized garden escapes), *S. grandiflorum* creeping comfrey and *S. orientale* white comfrey. *Stachys palustris* marsh woundwort and *Lotus pedunculatus* greater bird's-foot trefoil have been found near the Seven Sisters ponds. *Mycelis muralis* wall lettuce, another uncommon London plant, appears to be increasing in two or three areas. *Hieracium sabaudum,* the commonest many-leaved hawkweed, was found by Johnnie Slattery and Anthony Vaughan (determined by Rodney Burton) on West Heath, Sandy Heath and the Extension. There is also a recent record of the similar *H. salticola* from Sandy Heath by Ken Adams and reported by Rodney Burton. *Plantago coronopus* buck's-horn plantain, of which we have no recent record, was found by Johnnie Slattery on the fairground site near Hampstead Ponds.

We intend to survey the bluebell population. The native English bluebell *Hyacinthoides non-scripta* is not abundant, but the hybrid with the Spanish bluebell, *H. non-scripta* × *H. hispanica* is fairly frequent.

As might be expected, casual birdseed and similar introductions appear from time to time, particularly on Parliament Hill fields. George Hounsome found *Ambrosia artemisiifolia* ragweed, a common North American weed which is apparently spreading in this country where it may be semi-naturalized. Its pollen is said to cause hay fever. A single plant of *Cannabis sativa* hemp was seen growing in the middle of a chicory plant *Cichorium intybus. Ammi majus* bullwort, another birdseed alien, has been recorded on the railway embankment at Gospel Oak and on the Viaduct Bridge.

Alien grasses found include *Ceratochloa carinata* California brome which is becoming invasive in some areas, especially on East Heath near Hampstead ponds. A few spikes of *Setaria viridis* green bristle-grass, a wool or birdseed casual, were found in two places on Parliament Hill Fields. The rediscovery of the native *Danthonia decumbens* heath-grass in Pryors Field was encouraging as, according to Rodney Burton's records, it has not been seen since 1978.

Two recent finds of ferns, rare on the heath, was gratifying. Sue Adshead found *Blechnum spicant* hard fern near the Vale of Health. It was last recorded in this locality in 1949 (Kent 1975: 146), but 'grubbed-up a few days after its discovery'. *Phyllitis scolopendrium* hart's-tongue, which has not been recorded on the Heath since 1910 in Kenwood (Kent 1975: 143), was found in a ditch near the Stock Pond by Rose Pride and determined by Johnnie Slattery.

The SSSIs on the Kenwood Estate were also visited. They are managed by English Heritage in conjunction with English Nature. North Wood is important for its many ancient beeches, but the scarcity of their regeneration is apparently giving some cause for concern. *Scirpus sylvaticus* wood club-rush is fairly abundant in and near the ancient Ken Wood. Westfield Bog is drying out due

to the recent drought, but small amounts of *Sphagnum* moss (*S. palustre, S. fimbriatum* and *S. squarrosum*) may still be present.

We have not yet undertaken a tree survey, but some interesting and unusual examples are noteworthy. Fifteen wild service trees *Sorbus torminalis* have been mapped by Jeremy Wright. A fine specimen of *Aesculus flava* yellow or sweet buckeye, an infrequent tree from south-east America, is to be found on Parliament Hill Fields. Others of interest include the semi-deciduous *Quercus* × *crenata* Lucombe oak, *Ginkgo biloba* maidenhair tree, *Liquidambar styraciflua* sweet gum, *Taxodium distichum* swamp cypress, *Metasequoia glyptostroboides* dawn redwood, and *Liriodendron tulipifera* tulip tree.

Finally, we are keeping in contact with the Corporation of London, the owners and managers of the Heath since 1989, apart from the Kenwood Estate, and try to monitor some of their experimental areas, e.g., where they have made attempts to control invasive species such as *Fallopia japonica* Japanese knotweed, *Pteridium aquilinum* bracken and *Heracleum mantegazzianum* giant hogweed. It will also be interesting to monitor the success, or otherwise, of some of their recent plantings. *Salix repens* creeping willow, *Menyanthes trifoliata* bogbean, *Myrica gale* bog-myrtle, and *Calluna vulgaris* ling appear to be naturalizing well.

Acknowledgements

David Bevan, Rodney Burton, George Hounsome, Margo Nagle, and Anthony Vaughan have given assistance in recording and identification. I am especially grateful for the kind support of Johnnie Slattery.

References

GLC. 1986. *Hampstead Heath flora.* Habitat Handbook No. 1. Greater London Council.
KENT, D. H. 1975. *The historical flora of Middlesex.* The Ray Society, London.

Mosses and liverworts (Christine Rieser)

A study of the bryophytes of Hampstead Heath was begun in 1989 and species recorded in arbitrarily allocated areas.

It will be seen that ninety-one species have been found and of these six are first recordings for Middlesex (or first for over sixty years). This is unexpectedly high for an area so close to central London and must indicate a variety of habitats and a recently improved air quality.

The heights of Hampstead Heath are capped by the Bagshot Sands which occur in the areas at the top of Parliament Hill, West Heath, Sandy Heath, North Wood, and Kenwood South Woods and West Meadows. Heath mosses such as *Polytrichum juniperinum, Campylopus pyriformis* and *Pohlia nutans* occur in these areas, and in wooded parts *Tetraphis pellucida* and the liverworts *Lepidozia reptans* and *Calypogeia muelleriana* can be found.

Where the Bagshot Sands layer has been eroded and the underlying Claygate Beds are exposed, springs occur which give support to the hydrophilic mosses such as *Sphagnum* and *Drepanocladus* species present in the bogs on West Heath and Kenwood West Meadows.

Lower down, streams lead to the ponds on the London Clay and a damp microclimate encourages the growth of bryophytes. The presence of willows and elders gives opportunity to some of the epiphytes and a surprising range of these is present:

Dicranoweisia cirrata
Orthotrichum affine
O. lyellii
Ulota crispa var. *norvegica*
U. phyllantha
Cryphaea heteromalla (Figure 1)
Leskea polycarpa
Frullania dilatata
Metzgeria furcata

FIGURE 1. *Cryphaea heteromalla* (with capsules). First record for Middlesex.
Photo: C. Rieser

This is undoubtedly due to an improvement in air quality as most of these epiphytes are notoriously sensitive to air pollution and it seems particularly interesting that *Ulota phyllantha*, which is mostly recorded near coasts, should have found its way here.

In the woodland areas more-common species such as *Atrichum undulatum*, *Dicranella heteromalla* and *Mnium hornum* are present, but where the canopy is very dense, for instance on the lower slopes of Sandy Heath and West Heath, few bryophytes are successful.

Thanks are due to Dr Ken Adams for help with the earlier recordings and for many of the less-common species. A list of species of special interest gives the recorder by initials:

KJA refers to Dr Ken Adams, Dept of Life Sciences, University of East London.
JGD refers to Prof. J G Duckett, Queen Mary and Westfield College, London.
GS refers to Graeme Smith, 59 Tippett Court, Stevenage, Hertfordshire.
CR refers to Christine Rieser, 1 Seymour Avenue, Louth, Lincolnshire.

There is some variation in species recorded season by season, especially where drought has occurred and streams have dried out. For example, *Sphagnum* has not been seen on West Heath since 1995 and is greatly reduced in Kenwood West Meadows, but will doubtless recover in future when humidity improves, provided care is taken that higher plants and trees do not take over the sites.

Other previously unrecorded species may still be found on Hampstead Heath and it is to be hoped that further recording will be undertaken by volunteers to monitor the situation in the future.

Arbitrarily allocated areas of Hampstead Heath where recording has taken place. (Figure 2)

A West Heath includes West Heath Bog, The Hill Garden, Leg of Mutton Pond, but not Golders Hill Park.
B Sandy Heath ('North End') includes wooded slope south of Wildwood Road and static ponds above.
C Vale of Health includes Vale of Health Pond, Viaduct Pond and stream area.
D Hampstead Ponds area includes Pryors Field, but not Preachers Hill. The area of willows situated between the most northerly small fenced pond and the next fenced pond, together with nearby elders, was very productive.
E North Wood is an area of geological interest where the Bagshot Sands at the top, Claygate Beds between, and London Clay below, are exposed, but was not bryologically rich.
F Kenwood includes surrounds to Wood Pond and Thousand Pound Pond, South Woods, and South Meadows with stream area. The site of the leaning oak, which was so productive, is where the path from Highgate Gate crosses the stream.
G Kenwood West Meadow. Recording here is mainly from the *Sphagnum* bog (which is not now easily accessible).
H Parliament Hill includes patches of scrub and elders bordering the Heath by garden wall of Tanza Road, which have since been removed.
J Cohens Fields, east of Kenwood includes willows bordering stream in south-east corner.
K Highgate Ponds area includes Millhouse Lane and wall at exit of lane by Fitzroy Park. Fenced-off areas around ponds have not been looked at.
L Hampstead Heath Extension includes area of ponds and stream banks.

Records of less-common species

MOSSES

Species	Date	Recorder	Grid ref.	Area
Sphagnum palustre	27.ii.1990	KJA	TQ269869	G
S. squarrosum	27.ii.1990	KJA	TQ269869	G
S. fimbriatum	27.ii.1990	KJA	TQ269869	G
	23.vi.1995	CR, GS	TQ259865	A
S. auriculatum	23.vi.1995	CR, GS	TQ259865	A

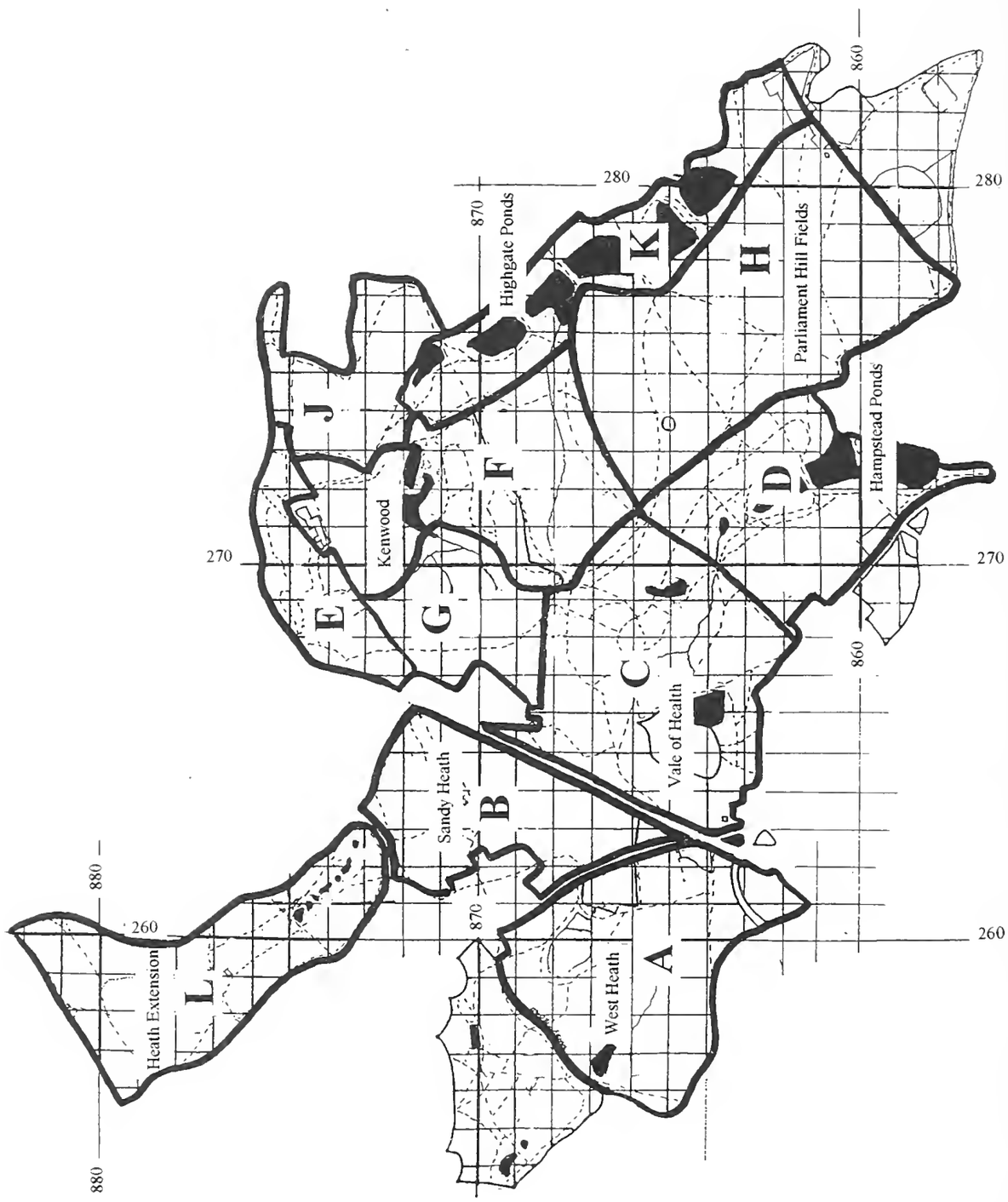


FIGURE 2. Recording areas of the moss and liverwort survey on Hampstead Heath, 1989–1997. (Note: these are not exactly the same areas as currently being used by the Heath Survey).

Species	Date	Recorder	Grid ref.	Area
Dicranella cerviculata	11.vii.1992	KJA	TQ265863	C
	Bank by Vale of Health pond			
	11.ii.1994	CR	TQ259868	A
	Patch, bare vertical banks			
Fissidens exilis	2.v.1989	KJA	TQ271863	D
	On clay			
	17.i.1993	CR	TQ258878	L
	On clay; stream bank with *F. taxifolius*			
Tortula laevipila	28.i.1995	CR	TQ270863	D
	Very small tuft on elder			
Zygodon viridissimus	28.i.1994	CR	TQ277868	K
	Good patch on wall; edge of Heath			
Orthotrichum lyellii	1992	KJA	TQ271863	D
	FIRST Middlesex record; on crack willow			
	31.v.1994	CR	TQ276871	J
	On willow			
	28.i.1995	CR	TQ271863	D
	On elder			
O. anomalum	20.iii.1990	KJA	TQ277868	K
	On wall; edge of Heath			
O. striatum	2.v.1989	KJA	TQ271863	D
	FIRST Middlesex record; on willow			
Ulota crispa var. *norvegica*	2.v.1989	KJA	TQ271863	D
	FIRST Middlesex record; on willow			
	31.v.1994	CR	TQ276872	J
	Single tuft on oak			
U. phyllantha	1991	KJA	TQ276872	J
	FIRST Middlesex record; on crack willow			
	1993	JGD	TQ274868	F
	On leaning oak; (still present 31.v.1994, CR)			
Cryphaea heteromalla	1993	JGD	TQ274868	F
	FIRST Middlesex record; on leaning oak; (still present 31.v.1994, CR)			
	28.i.1995	CR	TQ271863	D
	On elder			
Leskea polycarpa	2.v.1989	KJA	TQ271863	D
	On willow			
Drepanocladus fluitans var. *falcatus*	27.ii.1990	KJA	TQ269869	G
	In *Sphagnum* bog			
var. *fluitans*	23.vi.1995	CR	TQ259865	A
	FIRST Middlesex record; in run-out from bog			
LIVERWORTS				
Metzgeria furcata	14.iii.1995	CR	TQ274861	H
	Small patch on elder			
Gymnocolea inflata	1.vii.1992		TQ265863	C
	Bank of Vale of Health pond			

Species	Date	Recorder	Grid ref.	Area
Calypogeia muelleriana	17.iii.1990 On soil; base of oak	CR	TQ272869	F
Frullania dilatata	2.v.1989 On willow	KJA	TQ271863	D
	1993 On leaning oak; (still present 31.v.1994, CR)	JGD	TQ274868	F

TABLE 1. Bryophyte records for Hampstead Heath, 1989–1997.

Mosses	A	B	C	D	E	F	G	H	J	K	L
Sphagnum auriculatum	×										
Sphagnum palustre							×				
Sphagnum squarrosum							×				
Sphagnum fimbriatum	×						×				
Tetraphis pellucida					×	×					
Polytrichum formosum		×	×			×					
Polytrichum juniperinum	×							×			
Atrichum undulatum	×		×							×	
Pseudephemerum nitidum	×										×
Ceratodon purpureus	×	×	×	×	×	×		×	×	×	×
Dicranella heteromalla	×	×	×	×		×		×			×
Dicranella cerviculata	×		×								
Dicranoweisia cirrata	×	×	×	×	×	×		×	×	×	×
Dicranum scoparium						×					
Campylopus pyriformis	×	×					×				
Campylopus paradoxus	×										
Campylopus introflexus	×	×				×	×			×	
Fissidens bryoides			×			×		×		×	×
Fissidens exilis				×							×
Fissidens taxifolius									×	×	
Tortula muralis	×	×	×		×	×		×		×	×
Tortula laevipila				×							
Pottia truncata	×										×
Barbula convoluta	×			×					×		×
Barbula convoluta var. *commutata*										×	
Barbula unguiculata		×				×				×	×
Barbula hornschuchiana					×						
Barbula rigidula										×	
Barbula trifaria	×	×			×						
Barbula cylindrica	×	×									
Barbula recurvirostra										×	
Schistidium apocarpum										×	
Grimmia pulvinata										×	×
Funaria hygrometrica	×		×		×	×		×	×		×
Physcomitrium pyriformis											×
Orthodontium lineare	×					×					×
Pohlia nutans	×	×	×			×	×	×			×
Pohlia carnea											×
Bryum capillare	×			×				×		×	×
Bryum flaccidum								×			
Bryum pallescens	×										
Bryum caespiticium	×									×	
Bryum bicolor						×			×	×	×
Bryum argenteum	×		×	×		×		×	×	×	×
Bryum rubens										×	×
Mnium hornum		×	×		×	×			×	×	×
Rhizomnium punctatum						×					

Mosses	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**
Plagiomnium undulatum									×	×	
Aulacomnium androgynum	×		×			×				×	×
Aulacomnium palustre						×					
Zygodon viridissimus										×	
Orthotrichim lyellii				×					×		
Orthotrichum affine	×			×				×	×		×
Orthotrichum anomalum										×	
Orthotrichum diaphanum	×			×				×	×		×
Orthotrichum striatum				×							
Ulota crispa var. *norvegica*				×					×		
Ulota phyllantha						×			×		
Cryphaea heteromalla				×		×					
Leskea polycarpa				×							
Amblystegium serpens	×		×		×	×		×	×	×	×
Amblystegium riparium	×		×								
Drepanocladus fluitans	×						×				
Homalothecium sericeum	×									×	
Brachythecium albicans	×	×	×	×		×		×	×		×
Brachythecium rutabulum	×	×	×	×	×	×	×	×		×	×
Brachythecium velutinum										×	
Rhynchostegium confertum	×	×	×	×	×	×		×	×	×	×
Eurhynchium praelongum	×	×	×		×	×	×	×		×	
Eurhynchium swartzii	×									×	
Plagiothecium curvifolium	×	×									
Plagiothecium succulentum							×				
Isopterygium elegans	×	×	×		×	×					×
Hypnum cupressiforme var. *resupinatum*	×		×		×					×	
Hypnum jutlandicum	×	×	×								
Rhytidiadelphus squarrosus	×					×					×
Liverworts											
Lunularia cruciata	×		×			×		×	×	×	×
Metzgeria furcata								×			
Pellia epiphylla	×		×			×	×				
Pellia neesiana							×				
Gymnocolea inflata			×								
Lophocolea bidentata var. *bidentata*	×	×	×						×		
Lophocolea bidentata var. *rivularis*							×				
Lophocolea heterophylla	×	×	×		×	×			×	×	×
Cephaloziella divaricata	×	×									
Cephalozia bicuspidata	×	×	×	×		×					×
Lepidozia reptans	×				×	×					
Calypogeia muellerana						×					
Calypogeia fissa	×	×	×	×		×					×
Frullania dilatata				×							

Snails and slugs (Jane E. Reynolds)

Since January 1997 I have been attending the LNHS Hampstead Heath study days fairly regularly during the winter months and have also led a Conchological Society of Great Britain and Ireland field meeting to the Heath. As a result I have about 200 records representing over forty species of both freshwater and terrestrial molluscs. While some areas have been covered quite extensively, others are still unsurveyed, thus there are still records to be added over the coming months. The list presented here represents only preliminary results, especially as regards the freshwater species since formal surveys of Wood Pond, both Bathing Ponds and other bodies of water have still to be arranged.

Terrestrial snails and slugs

Carychium minimum	herald snail
Carychium tridentatum	tricorn herald snail
Oxyloma pfeifferi	marsh snail
Cochlicopa lubrica	slippery or moss snail
Lauria cylindracea	chrysalis snail
Vallonia costata	ribbed grass snail
Vallonia pulchella	smooth grass snail
Discus rotundatus	discus snail
Arion ater (agg.)	black slug or red skirt
Arion flagellus	
Arion subfuscus	dusky slug
Arion silvaticus	woodland slug
Arion distinctus	Durham slug
Arion hortensis	garden slug
Arion intermedius	hedgehog slug
Vitrina pellucida	pellucid glass snail
Vitrea crystallina	crystal snail
Nesovitrea hammonis	
Aegopinella pura	clear glass snail
Aegopinella nitidula	smooth glass snail
Oxychilus draparnaudi	Draparnaud's glass snail
Oxychilus cellarius	cellar snail
Oxychilus alliarius	garlic snail
Tandonia budapestensis	keeled or Budapest slug
Boettgerilla pallens	worm slug
Limax maximus	great grey slug
Deroceras reticulatum	netted or field slug
Deroceras caruanae	Caruana's slug
Euconulus fulvus	tawny glass snail
Monacha cantiana	Kentish snail
Trichia hispida	hairy snail
Trichia striolata	strawberry snail
Helix aspersa	common snail

Freshwater molluscs

Potamopyrgus jenkinsi	Jenkins' spire snail
Bithynia tentaculata	spire snail
Physa acuta	pointed bladder snail
Lymnaea palustris	marsh snail
Planorbis planorbis	ram's-horn snail
Gyraulus albus	white ram's-horn
Armiger crista	nautilus ram's-horn
Acroloxus lacustris	lake limpet
Anodonta cygnea	swan mussel
Sphaerium lacustre	lake orb mussel
Pisidium personatum	pea mussel

The most commonly recorded species over the areas surveyed (note that these are not necessarily the most abundant species) were *Deroceras reticulatum, Aegopinella nitidula, Arion distinctus, Oxychilus alliarius, Deroceras caruanae* and *Arion intermedius*. Each of these was recorded at an average of ten localities. The species which were next most frequent were *Cochlicopa lubrica, Discus rotundatus, Arion subfuscus, Vitrina pellucida, Tandonia budapestensis, Limax maximus* and *Potamopyrgus jenkinsi;* the remainder were recorded at less than three locations.

Particularly interesting finds include *Boettgerilla pallens,* probably the first London records, and *Acroloxus lacustris.* It should be noted that only half a dead shell of *Anodonta cygnea* was found and may not represent a living population. As yet no specimens of *Testacella scutulum,* the shield slug, have been found although there are reliable records from Fenton House nearby.

Grasshoppers and bush-crickets (Sandi Bain)

The following species of Orthoptera were recorded during August and September 1997:

Grasshoppers

Lesser marsh grasshopper	*Chorthippus albomarginatus*
Common field grasshopper	*Chorthippus brunneus*
Meadow grasshopper	*Chorthippus parallelus*
Common green grasshopper	*Omocestus viridulus*

Bush-crickets

Roesel's bush-cricket	*Metrioptera roeselii*
Long-winged cone-head	*Conocephalus discolor*

The most abundant species was the lesser-marsh grasshopper, found throughout the area in any long grass. Field and meadow grasshoppers were found less frequently, with a more patchy distribution, often on higher ground. The common green was only found in any considerable numbers in South Meadow to the area west of the Ladies' Bathing Pond.

Roesel's bush-cricket was also found commonly throughout the area, in any patch of tall ruderals, e.g., thistles, or in longer grass. Many males were found of the macropterous (long-winged) form, indicating a high density population. The long-winged cone-head was also abundant.

The Parliament Hill Fields and South Meadow areas supported the largest numbers, which could be indicative of the south-facing aspect of these areas.

Recording mostly took place on sunny, warm afternoons and early evenings, using stridulation to locate and identify species. No species were recorded in dense woodland or on short amenity grassland.

Dragonflies (Ruth Day)

In 1996, when I took over from Steve Brooks as LNHS dragonfly recorder, I estimated how common the London species were by counting the number of sites at which each of them had been recorded. The result for the thirty-three boroughs of the former GLC area was as follows:

Species		No. of sites in London
Ischnura elegans	Blue-tailed damselfly	163
Aeshna grandis	Brown hawker	142
Enallagma cyathigerum	Common blue damselfly	132
Sympetrum striolatum	Common darter	132
Aeshna cyanea	Southern hawker	111
Aeshna mixta	Migrant hawker	79
Libellula depressa	Broad-bodied chaser	71
Coenagrion puella	Azure damselfly	61
Anax imperator	Emperor dragonfly	57
Calopteryx splendens	Banded demoiselle	45
Lestes sponsa	Emerald damselfly	32
Orthetrum cancellatum	Black-tailed skimmer	30
Sympetrum sanguineum	Ruddy darter	23
Erythromma najas	Red-eyed damselfly	17
Pyrrhosoma nymphula	Large red damselfly	14

With two exceptions I have seen all of these on Hampstead Heath between 1994 and 1997. The two exceptions are the migrant hawker (which is migrant, but also resident) and the banded demoiselle. I expect the reason I have failed

to see the migrant hawker on the Heath is that I have not been there in the autumn. The main part of its flight period is usually in September, rather later than most of the other London dragonflies. The demoiselle, of course, is primarily a running-water species, which occurs only occasionally in ponds.

I saw a few individuals of two of the damselfly species only on one occasion each. On 4 June 1996 I saw a few large red damselflies on the Heath Extension at the second of the Seven Sisters Ponds and on 3 August 1994 I saw one or two emerald damselflies at one of the Sandy Heath Ponds. I also suspect that the black-tailed skimmer I observed on Sandy Heath on the same day in August 1994 was just visiting. This species really prefers newly dug ponds and gravel-pits, where the terrain is open and there is plenty of bare soil. All the other species may well breed on the Heath, at least some of the time.

The brown hawker certainly breeds in Viaduct Pond. Dan Hackett collected a large number of exuviae there in 1997. Viaduct Pond is also the only site on the Heath where I have seen the red-eyed damselfly. It is a large weedy pond, at which I have also seen emperor, the common darter, the common blue damselfly and the blue-tailed damselfly. In 1997, eight species were seen at the small ponds on the Heath Extension and Sandy Heath. The azure damselfly occurs there rather than the common blue. These two species look very similar and are often confused with each other. The southern hawker breeds at the first of the Seven Sisters Ponds and may well also breed at other ponds in this chain. The other six are the blue-tailed damselfly, the broad-bodied chaser, the emperor, the brown hawker and the ruddy and common darters.

I have also seen brown hawkers patrolling the Hampstead ponds, but in general, the Highgate ponds are less favoured by dragonflies.

Lepidoptera notes (Ray Softly)

Moth trapping has taken place since 1977 on a daily basis all year round, using a Heath actinic trap in monad TQ2785. The trap site is adjacent to the northern verge of a railway and immediately to the east of Hampstead Heath Station.

Two traps are operated: one at second-floor level at the back of Parliament Court, a three-storey block of flats backing onto the railway, with a south-east aspect across the tracks: the other at the base of the flats on the same side. As can be imagined, the strip of land between the flats and the railway is London Clay mixed with building rubble. It has not been landscaped or cultivated since the flats were built in the 1930s, and has acquired the usual ruderal plants, bramble, ash, sycamore, and one large hybrid poplar. More recently, part was greatly disturbed by bulldozing and this was subject to natural colonization and also desultory development as a garden area by a few residents, including the writer. The site is within a hundred metres of the end of a southern tongue of the Hampstead Heath complex of open space, of which most lies within a radius of two kilometres. Thus the site is within close flying range of moths breeding on the various habitats of this open space, as well as along the railway verge to the east, which is backed by allotments, and also in the gardens of varying sizes lying to the south and west in the surrounding urban area.

Examples are given below, and in Table 1, of total annual catches of selected species, illustrating in three cases the colonization of the area, and in one case the reduction of a population to the point of possible extinction locally.

Noctuidae

The black rustic *Aporophyla nigra* has recently expanded its range in the London Area, moving across from the south-west. Nationally recorded as feeding on a disparate variety of low-growing foodplants, followed after hibernation by the opening leaves of deciduous trees, its range expansion may

illustrate specialization by a local population on one particular foodplant, followed by the emergence of a new strain within the population that switches to a new host and is able to move into a different habitat. The figures do suggest the establishment of a local breeding population, but its host plant has yet to be discovered. Certainly it cannot be either petty whin or ling, which up to 1993 had been the only foodplants that Colin Plant had been able to record for the London population (Plant 1993: 172).

Blair's shoulder-knot *Lithophane leautieri* has a subspecies of Atlantico-Mediterranean range which has extended northwards, reaching the British Isles in 1951 and spreading along the south coast. It was first recorded in the London Area in 1972 (Plant 1993: 175) and Hampstead in 1987. The trap figures seem to indicate a now resident population from 1990. It seems to have flourished wherever its foodplants, various cypress cultivars, have been available. These have become increasingly popular as garden boundary hedges. The moth is therefore not to be regarded as a breeding inhabitant of Hampstead Heath as such, but an overflier in its search for its hostplant in peripheral gardens.

Tortricidae

Epiphyas postvittana is another newcomer to the British list. It is an indigenous Australian species that has become known there as the light-brown apple moth or apple leaf-roller, indicating its habits. Having accepted, in its native land, an introduced alien foodplant as a convenient host, it has spread, with the cultivation of the apple, to various parts of Australasia and even as far as Hawaii before tracing the apple back to its source in England, where it was discovered in 1936 in Cornwall as an already established population. This is an interesting example not of the more familiar cases of alien introductions becoming a pest, but of the reverse case of an indigenous species taking advantage of an alien introduction and then actually establishing itself back on the alien's native territory. Happily there is no indication that it has become a serious pest of apples in England. Perhaps the routine control measures applied against our other native pests of apples have been equally effective in controlling *postvittana* and may have accounted for its rather slow spread across the southern counties, to become one of the most recent arrivals in Hampstead, where there are plenty of garden apple trees, as well as a few ancient crabs, and rogue cultivars sprung from discarded apple cores, to be found on Hampstead Heath. By comparison, other tortricoid species that have acquired 'fruit-tree tortrix' as a vernacular name, never appear in great quantity in the area, and their cousin, the notorious codlin moth *Cydia pomonella*, which prefers the fruit to the leaves, turns up in the trap in a steady trickle of only single figures annually.

Arctiidae

The garden tiger *Arctia caja* is a well enough known species, most often noticed as a mature larva lolloping along the ground seeming to want to put as much distance as possible between its final meal and its future pupation site. It is decidedly polyphagous and is (or was?) common throughout London. However, Hampstead statistics show an unexpected and unexplained steady decline in the local population, which has been mirrored across the London Area in recent years (Plant pers. comm.). Figures like these should serve as an early warning of something, but of what? Or is the species subject, as others are known to be, to cyclic variations in numbers caused by parasites or disease? The figures illustrate how rapidly an apparently flourishing population may vanish. But its return will be dependent on how easy or difficult it is for neighbouring populations to fill the gap again. Surely, the aptly named garden tiger should find no difficulty in moving freely through the suburban area?

TABLE 1. Total annual catches of four selected species.

Year	*Aporophyla nigra*	*Lithophane leautieri*	*Epiphyas postvittana*	*Arctia caja*
1980	1	0	0	20
1981	1	0	0	16
1982	1	0	0	27
1983	1	0	0	13
1984	0	0	0	10
1985	0	0	0	19
1986	0	0	0	5
1987	0	1	0	4
1988	0	1	0	10
1989	1	3	0	5
1990	5	20	0	1
1991	3	9	0	3
1992	2	5	0	1
1993	6	17	0	1
1994	9	9	0	1
1995	13	14	1	0
1996	21	28	1	0
1997	41	12	7	0

Reference

PLANT, C. W. 1993. *Larger moths of the London Area.* LNHS.

Contributors' addresses

Sandi Bain, 232 Brecknock Road, London N19 5BQ.
Colin Bowlt, 7 Croft Gardens, Ruislip, Middlesex HA4 8EY.
Ruth Day, 18 Zenoria Street, London SE22 8HP.
Jane E. Reynolds, 21c Loraine Road, London N7 6EZ.
Christine Rieser, 1 Seymour Avenue, Louth, Lincolnshire LN11 9EW.
Ray Softly, 12 Parliament Court, Parliament Hill, London NW3 2TS.
Barbara Villiers, Flat 17, 55 Shepherd's Hill, London N6 5QP.

Old field boundaries and their survival in a public open space — the case of Hampstead Heath

ANTHONY VAUGHAN

108 Cranley Gardens, London N10 3AH

Contents

Summary

A survey was made of surviving hedgerows in the Hampstead Heath open space, and the results compared with the field boundaries existing in the 1790s, in the 1860s, and at the time the land was acquired for the public. Comparisons were also drawn with other hedgerow studies. About a quarter of the hedgerows still exist, with a further half represented by isolated trees or bushes. Reasons for the changes are put forward.

Introduction

Hampstead Heath in north London is one of the best-known open spaces in the London area. Together with Ken Wood, part of which since 1986 has been separately administered, it extends to about 325 hectares (800 acres).

The term 'heath', however, could give rise to misunderstanding. Most of the present open space was never heathland in the ecological sense, nor was it common-land. Of the present open space only about eighty-nine hectares consisted of the heath proper, that is to say unenclosed common. The remainder was farmland, enclosed woodland, or had become part of the ornamental grounds of landed estates.

The present open space was acquired for the public at various times. Table 1 summarizes the main acquisitions, and see also Figure 1.

In 1986, with the abolition of the Greater London Council (GLC), responsibility for the open space was divided. Part of the Kenwood Estate, including the house, ornamental grounds, lakes and woods amounting to forty-five hectares, was taken over by English Heritage. The remainder of the open space was managed for three years by the London Residuary Body, and then entrusted to the Corporation of London.

The aims of the present study are to examine much of the non-heath parts of the present open space in order

1 to establish the existence of old field boundaries,
2 to see to what extent they have survived into the present, and
3 to suggest reasons for any changes that have occurred.

Background

Hedgerows, including the hedgerow bushes, the timber trees and any distinc-

TABLE 1. The development of the Hampstead Heath public open space.

Name of area	Date of acquisition	Approximate size	Land use at time of acquisition
Hampstead Heath proper (East, Sandy and West Heaths)	1871	89 ha	commonland; sand extraction
East Park	1889	25 ha	pastures, brick-works
Parliament Hill	1889	81 ha	meadow and pasture
Golders Hill Park	1898	15 ha	mansion and ornamental grounds
Hampstead Heath Extension	1907	32 ha	farmland
South Ken Wood Estate and Cohens Fields	1923	37 ha	meadow, pasture and ex-golf course
Ken Wood South Wood and Ponds	1924	13 ha	mainly woodland
Ken Wood house, grounds and West Meadow	1928	30 ha	mansion, ornamental grounds, woods and pasture
Various small additions	1872-1996	*c.*5 ha	

tive hedgerow flora have been the subject of much study over the last thirty years. Much of the information collected has been summarized by Pollard et al. (1974) and Rackham (1986). Relatively few studies have been carried out on hedges in the London area, the best known being those done in the London Borough of Brent (e.g., Williams et al. 1987, Williams 1989*a*).

The destruction of farmland hedges in the last fifty years has also been extensively documented (e.g., Muir and Muir 1987). However almost all the field boundaries considered in this paper had become part of a publicly-owned open space by the late 1920s. This study will also see to what extent public ownership has preserved the hedges, and the reasons for any destruction.

The scientific names of trees and bushes in this paper follow Stace (1997).

Scope

Within the present public open space of Hampstead Heath (including Ken Wood), all field boundaries, past and present, were examined, with the exception of the following areas:

1 The surviving parts of the original Hampstead Heath (89 ha), consisting today of the East Heath, the Sandy or North-West Heath and the West Heath. These areas, being unenclosed commonland, had no hedgerows.
2 Golders Hill Park (15 ha), lying north of the West Heath. This area was ordinary farmland down to about 1760, when it became a small ornamental estate. Some hedgerow trees from the farmland period do survive inside the park and on its boundaries, but they were not considered in the present study.
3 The surrounds of Ken Wood House, including the lawns, gardens and the North and South Wood of the Estate (about 26 ha). This area again was developed into a landed estate in the early eighteenth century.

The survey area was about 195 hectares and for the purpose of this analysis was divided into four zones (Figure 2):

A the East Park,
B Parliament Hill Fields,

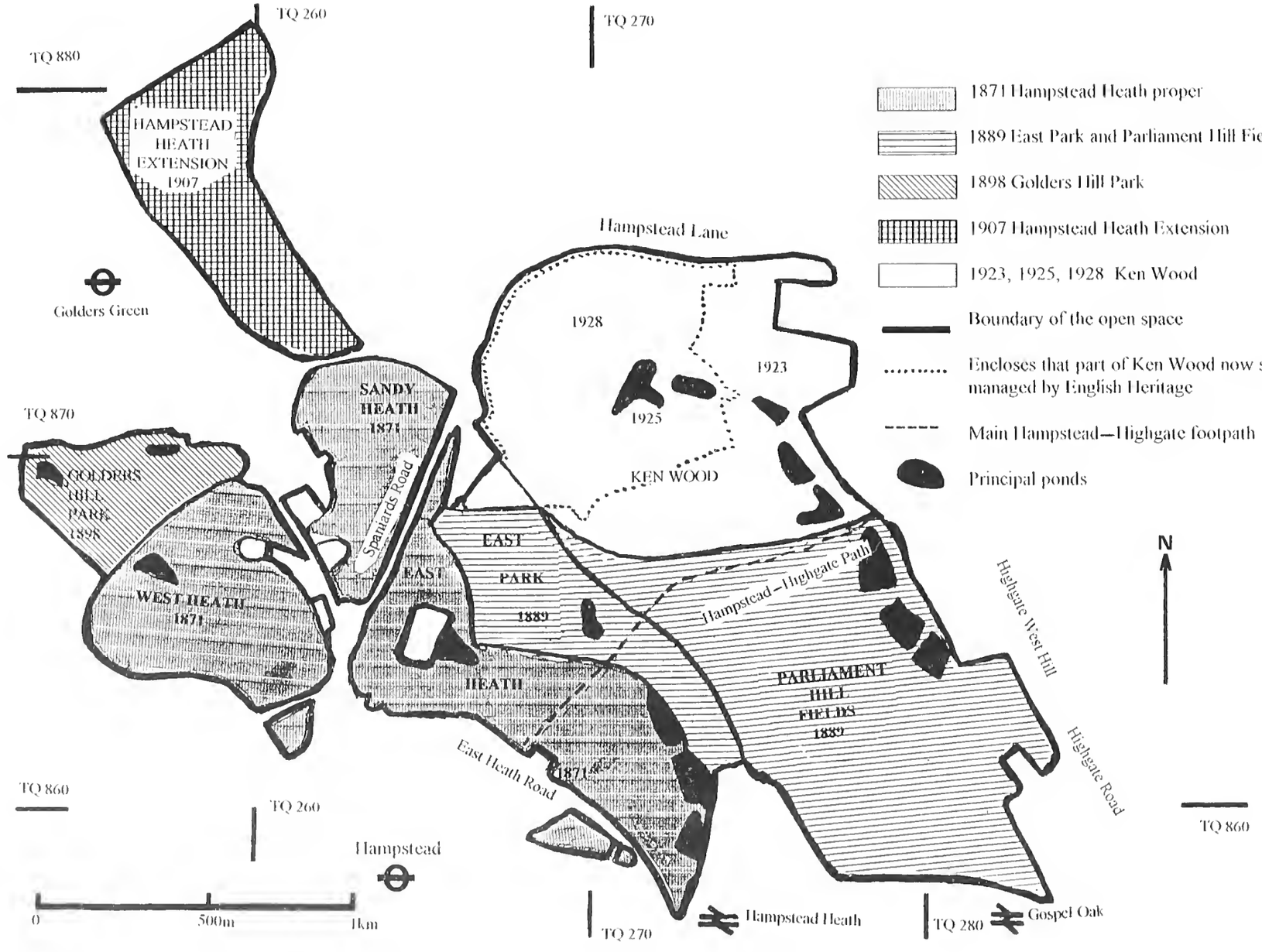


FIGURE 1. Hampstead Heath, showing dates of acquisition by the public.

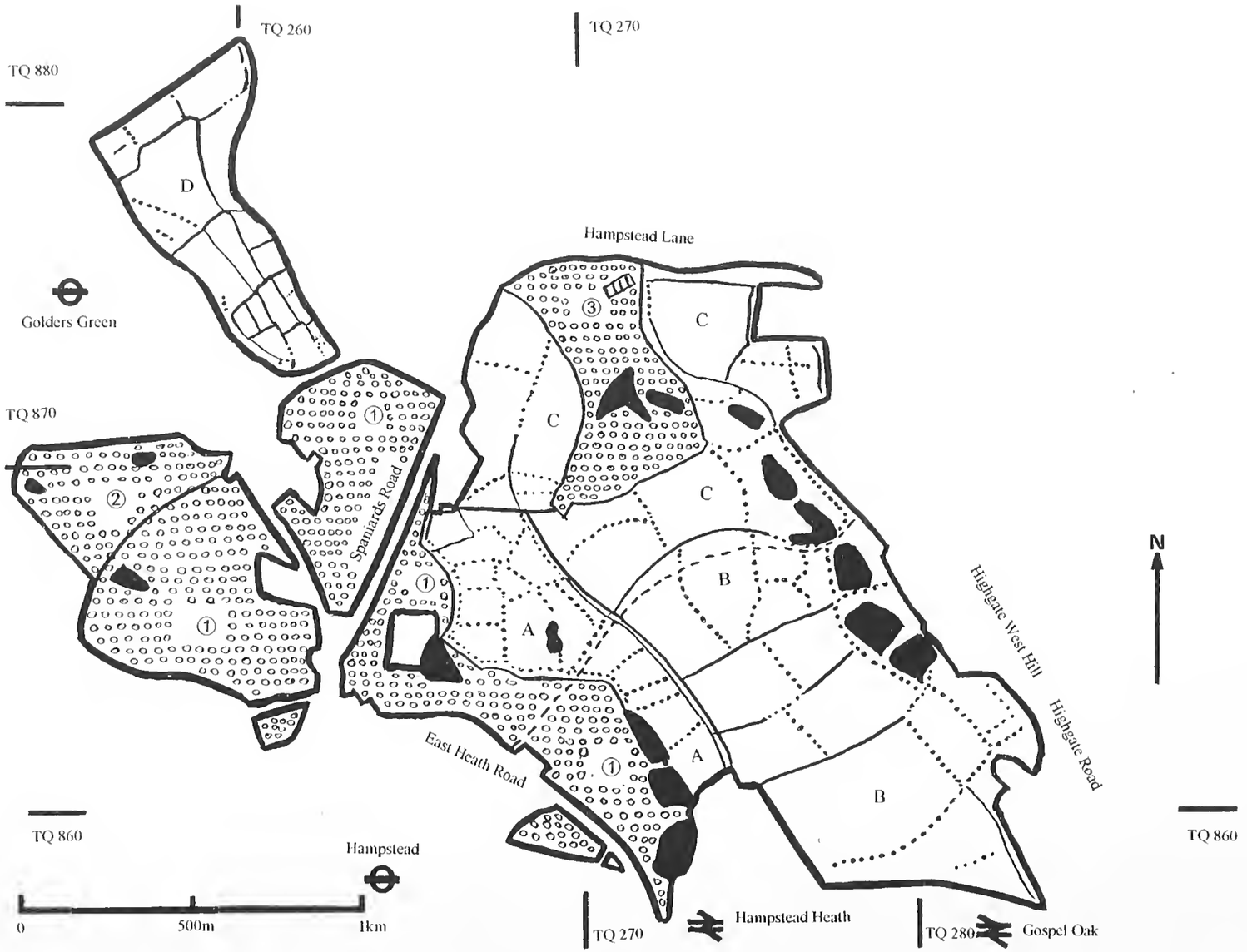


FIGURE 2. Hampstead Heath hedge borders, 1790s to 1990s. **Included areas:** A East Park, B Parliament Hill Fields, C Kenwood Farmland, D Hampstead Heath Extension. Zones B and C are separated by the Hampstead–Highgate main footpath, shown by a dashed line. **Excluded areas:** 1, Hampstead Heath proper, 2, Golders Hill Park, 3, Ken Wood ornamental grounds and woods. **Field boundaries:** — relict or full hedge, 1990s (excluding recent plantings), ... ghost hedge or no boundary at all, 1990s.

C the former farmland round Ken Wood house on the east and west side and immediately south and south-east of the South Wood (called Ken Wood Farmland for brevity),
D Hampstead Heath Extension.

These are pragmatic categories, but correspond roughly to the times that the areas came into public control, and with the earlier patterns of ownership.

Methods

Historical sources

The changes in the field boundaries over the last two hundred years were examined, with particular reference to the 1790s, the 1860s, and to the period during which the area was part of a public open space.

The 1790s were chosen because of the availability of manorial, parish or estate maps at around that time for the three parishes in which the survey area was situated — Hampstead, St Pancras and Hendon. (Very small parts of the open space extend into two other former parishes, Finchley and Hornsey, but the survey area did not include these fragments.)

In the parish of Hampstead was the Heath proper, together with a strip of land to the east of the East Heath (the East Park). Also in Hampstead was the western strip of the Ken Wood Estate. In St Pancras lay all the rest of the Ken Wood Estate, including Parliament Hill Fields. Adjoining this estate on the east, and now forming the north-east corner of the present open space, was another large landed property, the Fitzroy Estate. In Hendon was the whole of Hampstead Heath Extension and most of Golders Hill Park. The sources used are listed in the bibliography.

The 1860s were the years of the publication of the first edition of the Ordnance Survey maps at the scale of twenty-five inches to the mile (1:2,500) for the London area. These maps show field boundaries as they existed in the 1860s, and they also show hedgerow trees, as far as possible within five metres of their exact positions in the hedges (Oliver 1993: 73). (More-recent large-scale editions of the Ordnance Survey indicate field boundaries, and isolated trees in fields, but not usually hedgerow trees). Four different maps covered the survey area, published in different years in the 1860s.

An attempt was made to correlate the types of field boundary shown in these historical sources with the evidence on the ground in the 1990s. In addition, the hedgerow trees shown on the 1860s Ordnance Survey were compared, when possible, with the trees to be found in these same localities today.

For the period when the survey areas became part of a public open space, the archives of the administering bodies were consulted, namely the London County Council from 1889 to 1965 and the Greater London Council from 1965 to 1986. Aerial photographs of the heath and old postcard photos also proved useful.

Types of field boundary

All field boundaries existing in the 1790s, the 1860s or later within the present public open space were examined. Field boundaries were grouped into four categories:

1 No evidence of field boundary. Boundary apparently totally destroyed at some time since the 1790s.
2 Boundary represented by isolated timber trees. No hedge bushes, and usually no ditch or bank; this is termed a 'ghost hedge'.
3 Boundary represented usually by one or more timber trees and by scattered hedgerow bushes, too widely spaced to make a continuous hedge. Traces of a ditch or bank usually present; termed a 'relict hedge'.
4 Hedge present and more or less continous at least throughout most of the length of the original boundary; called a 'full hedge'.

Allocation of field boundaries to categories 2 and 3 in the nineteenth century is admittedly somewhat speculative. Also, for the purposes of the survey the assumption was made that all field boundaries of the 1790s period consisted of ordinary field hedges, and that none were relict hedges or had no hedge at all. In practice, this is unlikely to have been the case. In the 1790s a few field boundaries shown on maps were perhaps represented on the ground only by fences, or had the form of relict hedges as described above.

Composition of hedges: hedgerow bushes

In field-work carried out from July 1996 to March 1998, the hedge bushes present in the hedge were noted and, in the case of full hedges of category 4, their relative frequency was estimated. Bushes were classified according to a simplified scale of abundance, namely **predominant** where a species formed 51 per cent or more of the biomass of the hedge, **frequent** where a species comprised from 11 to 50 per cent of a hedge, and **occasional** where a species was estimated to comprise up to 10 per cent of a hedge. (For a few hedge-lengths which were particularly short, and for all hedges judged to be in category 3, all bush species were recorded, but estimates of abundance were not made).

In the last forty years, management practices have allowed hedge bushes to spread beyond the original hedge line, and in parts of Hampstead Heath there are now hedges which may be 25 metres wide. This practice has benefited the suckering species, especially blackthorn *Prunus spinosa*, and English elm *Ulmus procera*. So what was originally a predominantly hawthorn hedge may appear at first sight to be a blackthorn thicket or a forest of elm suckers. It therefore becomes difficult to establish what exactly is the hedge. For the purpose of the survey only those bushes growing on or adjacent to the original hedge line were listed.

In the last fifteen years the administrators of Hampstead Heath have planted numerous young bushes in the hedgerows, filling in many of the gaps which existed before. These species were not counted for the purposes of this survey, though a brief note is made about them later in this paper.

Hawthorns and oaks

For the hawthorns, Williams (1989*b*) considered that in the London Borough of Brent the hybrid between the two closely related native species, *Crataegus* × *media*, was as widespread as common hawthorn *Crataegus monogyna*, and that the hawthorns in older hedgerows showed a continous range of forms from typical *C. monogyna* through various intermediates to typical woodland hawthorn *C. laevigata*. Similar conclusions could perhaps be drawn for old hawthorns on field boundaries in Hampstead Heath. However, for this survey no records were made of intermediate specimens. Instead, what seemed to be 'pure' *C. laevigata* was scored as such, and all other hawthorns were lumped as *C. monogyna*.

Britain's two closely related native species of oak, the common oak *Quercus robur* and the sessile or durmast oak *Q. petraea*, appear to be interfertile, and intermediate specimens, presumed hybrids, are widely distributed (*Q.* × *rosacea*). For the purpose of this survey, a 'narrow' definition was adopted for the hybrid, and only trees which could not be placed in one or other species were listed as *Q.* × *rosacea*. Fortunately the main survey year (1997) was quite a good acorn year, and both leaf characteristics and fruiting peduncle characteristics were used whenever possible to place the trees in one species or the other.

Composition of hedges: timber trees

In traditional farmland hedges, the woody elements comprised two distinct parts; the hedge bushes and the timber trees (Rackham 1986). Timber trees, as noted above, were recorded on the 1860s series of Ordnance Survey maps.

In the survey the species and number of all mature timber trees were

recorded, equally for 'ghost hedges', 'relict hedges' and 'full hedges'. The number of trees recorded was then compared to the hedgerow trees mapped on the 1860s series of Ordnance Survey maps.

Herbaceous vegetation

A preliminary survey was also made of the herbaceous vegetation associated with Hampstead Heath hedges, but the results obtained so far do not justify particular comment in this paper.

Changes in Hampstead Heath field boundaries, 1790s to 1990s

Field boundaries in the 1790s

From the old maps it has been calculated that the survey area contained about 20.26 km of field boundary, assumed, for the purpose of this survey, to be ordinary farmland hedges. These field boundaries were apportioned as follows: East Park — 5.37 km, Parliament Hill Fields — 5.78 km, Ken Wood Farmland — 4.45 km, and the Hampstead Heath Extension 4.66 km (Figure 2). The earlier history of these areas can be briefly described.

The East Park. In the Middle Ages, the lands known as the East Park appeared to have been a wood called 'Wytebirche' (Farmer 1984). Grubbed out by the lord of the manor of Hampstead probably during the period 1660 to 1680 (Baker 1989: 121), the area had become by the 1790s a series of meadows or pastures separating the East Heath from Parliament Hill Fields, and with ordinary farmland hedges dividing up the land. The fields themselves usually had unimaginative names like 'Three Acre Mead', or 'Six Acre Mead', suggesting relatively late enclosure.

Parliament Hill Fields was owned in the 1790s by the Earls of Mansfield of Ken Wood. Much of it had been woodland until the late sixteenth century (Farmer 1984, LCC 1936). It consisted of a series of pastures running down to Gospel Oak and including the three lower Highgate Ponds.

Ken Wood Farmland. In the 1790s, Humphry Repton was busy landscaping for the Earl of Mansfield the immediate surrounds of Ken Wood House (excluded from this survey). The land to the west and south of these ornamental grounds belonged to the Mansfield Estate while that to the east was part of the Fitzroy Estate. Maps show a group of rather large fields, used as meadows and pastures, together with the three upper Highgate ponds. One of the large fields is shown as subdivided by what appear to be fences.

Hampstead Heath Extension consisted of a network of farmland fields, virtually all owned by Eton College since the sixteenth century (Marcham 1932). Some of the fields, with their rather sinuous outlines and distinctive names, might be of medieval origin, but those in the south-east part of the Extension had been carved out of a wood called 'Weild Wood' or 'Wyldes Wood' early in the eighteenth century, contiguous with the wood surviving today outside the Heath and called Turner's Wood.

Field boundaries in the 1860s

By the 1860s, London was spreading towards Hampstead Heath. Landowners made large sums selling or leasing their estates for building, and the railways, which were criss-crossing London, included one with a station called Hampstead Heath, opened in 1860. These developments were to have their effects on the old field systems. By the 1860s the hedgerows show large differences from their presumed state in the 1790s. A few additional field boundaries are shown, though none has survived. The estimated hedgerow lengths are:

Full hedge:	11.23 km	Ghost hedge:	5.12 km
Relict hedge:	1.80 km	No trace of boundary:	2.56 km

The main causes of destruction seem to be due to the policies of local landowners, their managers or their tenants.

In the **East Park**, the owner of this land, the lord of the manor of Hampstead, Sir Thomas Maryon Wilson, had been engaged in a long battle to develop this estate. In the 1840s he had planned a series of villas on the East Park, linked by a new road which he had constructed and which cut right across the field boundaries. At one point the new road crossed a marshy area which was dug out to become what is now known as the Viaduct Pond. To construct this viaduct, he used bricks made close by in a brick-field established in the East Park. The hedges and, it would seem, the ditches, dividing the fields were destroyed (Farmer 1984: 70; quoting *The Times* of 14 October 1844). However, the timber trees were left, and were still marked on the 1866 Ordnance Survey map.

Thwarted in his attempt to build houses, he let some of the land in 1866 for further brick-making, the soil of the land being extensively excavated, totally destroying a few of the former field boundaries. Four cottages were built for the brickworkers in the East Park. The 1860s Ordnance Survey map shows the beginning of the brick-fields period. By the 1860s, cattle may still have grazed some of the pastures, but the old field system had broken down. Wilson also planted two groves of trees in his fields as well as a few scattered ornamental trees.

About one-third of the field boundaries bordered land beyond the East Park — either the East Heath, Parliament Hill Fields, or private land to the north-west of Wilson's property. Here the hedges and ditches, for the most part, were spared.

In **Parliament Hill Fields**, which remained as hay-meadows and pastures, and which were still part of the Mansfield Estate, many of the fields had been thrown together, but as in the East Park, the old hedgerow timber was usually left standing. The length of 'full hedges', however, had been cut by half.

The **Ken Wood Farmland**, north of Parliament Hill Fields and the East Park, was now entirely within the Mansfield Estate, the lands to the east of the mansion having been added to the estate in 1840 to prevent them being built upon. Here too several field boundaries were removed leaving the timber trees. On the western side, the destruction of the hedge and ditch in 1845 was precisely recorded, as this was a parish boundary (Stokes 1995: 17). In the first half of the nineteenth century a number of 'walks' or 'circuits' were laid out within the estate, to show off the estate to visitors (Bryant and Colson 1990). Perhaps the hedges and ditches immediately to the south and south-west of Ken Wood South Wood were destroyed at the same time, though these seem to lie outside these circuits. The hedges appeared to be still in existence in 1838, according to a pictorial map of the time (Loudon 1838). At all events, by the 1860s only a little over half the 1790s field boundary length was still composed of proper hedgerows.

In contrast to the considerable changes which had affected the other three areas, the land to become **Hampstead Heath Extension** remained as ordinary farmland, with only slight changes in the field boundaries since the 1790s.

Field boundaries under public ownership, 1889–1986

An effective system of local government was slow to come to London. Before the creation of the London County Council in 1889, some London-wide matters were administered by the Metropolitan Board of Works. Among other activities this Board was responsible for open spaces in London, and had managed Hampstead Heath proper since 1871. With the creation of the London County Council (LCC) in 1889, the work of this board was taken over by the LCC. Immediately the new body found that, with the acquisition of the East Park and Parliament Hill Fields adding a further 106 hectares to the 89

hectares of the original Heath, the Hampstead Heath open space had more than doubled.

Using evidence from maps, old photographs and documents, it is estimated that by the dates that the survey areas became part of Hampstead Heath open space, the field boundaries of the 1790s (including a few created since that time) were as follows:

Full hedge:	7.92 km	Ghost hedge:	5.88 km
Relict hedge:	4.03 km	No trace of boundary:	2.89 km

In the last years of private ownership the hedges in the survey area had declined further, the biggest increase being in the category of relict hedge.

The LCC Parks Department determined on a more active policy in managing this large open space. Its activities were controversial, in that its opponents charged the LCC with managing Hampstead Heath as if it were a city park. Certainly a great deal of tidying-up and ornamental tree planting was carried out in the 1890s. In 1896 the LCC Parks Committee accepted 'a petition of 800 residents objecting to the planting of trees' together with a letter from someone opposing the petition (LCC 1896).

Gradually, greater recognition was given to native species for planting, and as early as 1949 the chairman of the LCC Parks Committee could refer to the 'progressive planting of new trees, with special emphasis on wild service trees and other indigenous species' (LCC 1949).

The East Park from 1889

The East Park was acquired at the same time as Parliament Hill Fields, and administered as part of the Fields. In 1889 some of it presented a picture of devastation, caused by the pits and rubble of the brickworks. There still survived a network of ghost hedgerows, with more substantial hedges on its boundaries.

When the LCC took over, the brick-pits were filled in, and a programme of tree planting started, particularly in the north of the area. Much of the East Park was still grazed by sheep and late nineteenth-century photographs show the old timber trees of the ghost hedges with the lower branches revealing a typical browsing line. An aerial photograph of 1917 shows much of the East Park as still open, and the trees of the ghost hedgerows standing out amongst the grassland, small bushes and young planted trees.

Later, however, secondary woodland quickly developed and by the 1980s occupied three-quarters of the area. The trees of the ghost hedgerows were now being over-topped by younger trees (often their own progeny).

As for the boundary hedges, the Superintendent of the Heath in 1905 could still refer to the old parish boundary hedge dividing the East Park from Parliament Hill Fields as a 'thorn hedge' (LCC 1905), but with tree planting near the hedge, and especially the natural development of scrub and young trees on both sides of the boundary, this hedge became very largely shaded out.

The hedges dividing the East Park from the East Heath also virtually vanished, and in some places the boundary ditch was destroyed as well. The causes of destruction seem varied: extension of the Hampstead upper fair-ground and Dutch elm disease being two of them. The straggling hedge-line in the southern part, with shredded timber trees along a stream, is recorded on photographs of the late nineteenth and early twentieth century, and the trees on an Ordnance Survey map of 1936, but these have now vanished. The trees were probably elms. Possibly the hedgerows delimiting the East Heath from the East Park, and that dividing the East Park from Parliament Hill Fields were deliberately destroyed by the LCC, in order to 'unite' the Hampstead Heath open space. There is no direct evidence for this, except for a remark by Ikin (1971: 17), that the LCC removed hedges 'to some degree' after the opening of Parliament Hill Fields.

Parliament Hill Fields from 1889

The LCC Superintendent of the Heath, in a report on 11 February 1898 stated:

'Parliament Hill, when it was taken over by the Council, consisted mainly of hayfields with a few trees in the hedgerows, many of which were decaying, and of a large brickfield [in the East Park] where vegetation had been destroyed and where contractors had been allowed to deposit some thousands of tons of dustbin refuse'. (LCC 1898).

The Superintendent returned to the subject of the hedges in his report the following year:

'I beg to call attention to the old hedgerow thorns, so grand a feature in their blooming and fruiting periods. [Of] these grand thorns, many [are] in a very serious condition'. (LCC 1899).

He attributed their poor condition to 'children and sheep', and refers, in an effort to revive the hedges, of young trees being planted, and 'old trees, especially elm' requiring lopping.

Before 1889 the land had been used both for livestock and for hay. This supposes at least some functioning hedges, if livestock were to be kept out of the hayfields until the hay was cut. Sheep in large numbers were to remain on Parliament Hill or in parts of the adjacent Ken Wood farmland much of the time until about 1954, and would certainly have made their mark on the internal hedges of the fields. Children would have been a new influence on the hedges, but given the popularity of the open space, the sheer numbers of people tramping across the slopes would certainly have tended to make gappy hedges even more fragmented.

The state of the Parliament Hill hedgerows seems to have been a matter of concern over seventy years. In 1972, long after sheep had been removed from the Fields, an aggrieved visitor to the Heath wrote to the Greater London Council Parks Department to say that:

'We also had two good thick hedges running from the top of the Heath down to the Highgate Ponds, the home of many birds, but these have been so thoroughly cleared out and tidied up as to be almost out of existence'. (GLC 1972).

This complaint was taken up by the local press, through a member of the Heath and Old Hampstead Society:

'The municipal look of Parliament Hill Fields reflects no credit on the GLC for having made it so, or this Society for not having ensured the retention of hedges. Few people are impressed with it, finding in it little more than can be found in other drab parks like Wormwood Scrubs'. (Wade 1972).

But the Society had some influence with the administrators of Hampstead Heath, and by 1975 its *Newsletter* was able to report:

'We have the GLC's agreement . . . that steps should be taken to replant some of the declining hedgerows in Parliament Hill Fields'. (Heath and Old Hampstead Society 1975).

Photographic evidence shows that the main east–west hedgerows across Parliament Hill Fields have had a continuous existence in the twentieth century, although sections of them vanished at certain times.

The hedgerows in the south of Parliament Hill Fields and round the Highgate Ponds fared worst. Aerial photographs as late as 1963 and 1974 showed some relict or ghost hedgerows still in existence. However the south of Parliament Hill Fields had long been given over to sports and athletics, whose needs were considered paramount. With the creation of a new athletics track in 1974, and further tennis courts, the last old field hedges, by then reduced to relict or ghost form, were doomed, though the immediate agent of destruction was perhaps Dutch elm disease, as there is some suggestion in the GLC archives that many, if not all of the hedgerow trees in this area were elms.

Ken Wood farmland from the 1920s

Acquired in three separate parcels in the 1920s, the land became owned by the LCC who retained the existing hedgerows, but left them unmanaged, so those species in them capable of developing into trees, did so. Much of the area was mown, preventing the development of scrub and young woodland, but where left unmown, scrub and secondary woodland resulted in the surviving hedgelines gradually becoming shaded by trees.

Hampstead Heath Extension from 1907

When the London County Council acquired this area in 1907, the field boundaries were virtually identical with those of 1867. The Superintendent of the Heath visited the new acquisition in 1907, but did not seem impressed:

'The old hedgerows should be broken up and in great part removed, leaving trees and best thorns. This would improve the appearance of the place and increase its usefulness.' (LCC 1907).

'Usefulness' here meant conversion of the meadows into playing fields (He asked for, and obtained, money to drain the flatter fields so they could become football and cricket pitches.) However, from the surviving evidence, it would appear that the somewhat drastic recommendations of the Superintendent on the hedges were not fully acted upon. Sections of some hedges were probably cut down, and young oak trees in the hedges promoted. In general however the old hedgerow boundaries of the farmland period survive better in the Extension than anywhere else. Nonetheless, in the southern part of the Extension, the growth of secondary woodland has reduced some of them to relict status.

The field boundaries today

Field boundary survival

The general results are summarized below. Of the 20.72 km of field boundary (presumed to be hedges) which existed in the 1790s, or which were created in the nineteenth century, something over one quarter remain as more or less continuous hedges. The figures are as follows:

Full hedge:	5.43 km	26.18%	Ghost hedge:	5.98 km	28.71%
Relict hedge:	3.18 km	15.34%	No trace of boundary:	6.15 km	29.70%

In addition some 0.4 km of hedgerow has been planted where no hedgerow stood before.

If we compare the hedgerows existing at the times these areas became part of a public open space, we find the following changes:

	Field boundaries in 1889/1907/1920s	**Field boundaries 1990s**	**Percentage 1889 etc./1990s**
Full hedge:	7.92 km	5.43 km	68.56
Relict hedge:	4.03 km	3.18 km	78.91
Ghost hedge:	5.88 km	5.98 km	101.70
No trace of boundary:	2.89 km	6.15 km	212.80

The results seem to show that the hedgerows have survived comparatively well during the period of public ownership, but that the length of former field boundaries of which no trace now remains has more than doubled.

Moreover, by the 1990s it is becoming increasingly academic to list ghost hedgerows, as in many cases they were fast approaching vanishing point. An example will illustrate. The Mansfield Estate acquired a number of fields in 1789 belonging to Millfield Farm, and which are now part of Parliament Hill Fields. The fields were amalgamated into larger fields, but the timber trees of the original hedgeline were left standing. The 1860s Ordnance Survey map still

shows a sinuous line of thirteen trees along one of these former field boundaries. The 1894, 1915 and 1936 maps show six trees along the former boundary, but by 1997 there were just two trees remaining, standing alone in grassland, and hardly recognizable as the remains of a former field boundary.

Hedgerow timber trees, 1860s to 1990s

There is no information as to the precise number of mature timber trees in hedges before the publication of the first edition of the Ordnance Survey maps at a scale of 1:2,500 in the 1860s. As stated earlier, the first edition shows hedgerow trees, as well as individual trees in fields. Along the present and former field boundaries of the survey area, the maps show some 946 individual trees. Rackham (1986: 222), also working with the first edition Ordnance Survey maps, estimated the density of hedgerow trees in terms of number of trees per acre. Out of 550 fifty-acre sample plots he calculated the number of hedgerow trees on the maps at just under one tree per acre. The Hampstead Heath survey areas did slightly better: the average number of trees per acre was 1.95 (4.83 trees per hectare). Alternatively we can say that there was about one tree every 19.6 m of field boundary. These averages conceal some differences among the areas. The land which would become the Hampstead Heath Extension had relatively few hedgerow trees: one tree every 35 m, while the East Park, despite destruction caused by brick-making, the laying down of a road and the creation of ponds, still had a density of one tree every 14.5 m in hedgerows or former hedgerows.

How many of these trees survive into the 1990s? The survey found 430 mature timber trees occurring in full, relict or ghost hedges (45 per cent of the 1860s total). Not all the 1990s trees were the same as those recorded in the 1860s (though many were). Perhaps a half of the existing trees seem to have developed from hedgerow stubs. In the 1860s these would have been managed as hedgerow bushes, and so would not have been counted by the surveyors of the Ordnance Survey. This was particularly the case on Hampstead Heath Extension where the number of trees recorded actually rose between 1863 and 1997, from 125 to 137, an increase possibly connected with the Heath Superintendent's comments of 1907 reported above. The part of Hampstead Heath which has suffered the greatest drop in numbers of old hedgerow trees is Parliament Hill Fields, where 237 trees are shown in the 1860s and only 28 hedgerow or ex-hedgerow trees survive today.

Mature timber tree species in old field boundaries in the 1990s

Table 2 gives the species of mature timber trees recorded in the various types of hedgerow on Hampstead Heath during the survey.

Both common oak *Quercus robur* and sessile oak *Q. petraea* occurred over most of the area, but with a tendency for *Quercus robur* to dominate at the lower levels and *Q. petraea* to be the principal species on the higher, sandy soils.

Ingrouille and Laird (1986) surveyed oak populations in the north London area, and three of these populations were on Hampstead Heath. This is not the place to discuss the oaks of the Heath in general; however, the present hedgerow survey tends to support their view that in north London there are 'two variable species with few hybrids' (Ingrouille and Laird 1986: 44), but not their further contention that there has been an 'aggressive colonisation of Hampstead Heath by *Q. robur.*' (ibid.: 46). This survey found that both species seemed to seed themselves with success in hedges, and if *Q. robur* was slightly more numerous as a hedge bush, then this reflects the distribution of full hedges which have survived better in the clay country of Hampstead Heath than elsewhere — a type of soil in which *Q. robur* normally predominates in the London area. Any 'aggressive colonisation' of the common oak of Hampstead Heath seems more likely to be due to LCC plantings than any natural superiority of *Quercus robur.* However, the hedge survey did support the general

TABLE 2. Old timber trees in Hampstead Heath hedges or hedge remnants, 1997.

Species	Number	
Sessile or durmast oak *Quercus petraea*	210	
Common oak *Quercus robur*	151	All native oaks, 399
Intermediate oaks *Quercus* × *rosacea*	14	
Undetermined native oak *Quercus* sp.*	24	
Ash *Fraxinus excelsior*	14	
Beech *Fagus sylvatica*	7	
Sycamore *Acer pseudoplatanus*	4	
Wild service *Sorbus torminalis*	4	
Turkey oak *Quercus cerris*	1	
Sweet chestnut *Castanea sativa*	1	
Common maple *Acer campestre*	1	
Total	431	

*a number of the 24 unidentified oaks were surveyed out of season, and most will probably be referable to one of the two main taxa in a subsequent season.

thesis of Ingrouille and Laird that the Heath was one of the areas in London containing a mixed population of oaks.

One of the wild service trees *Sorbus torminalis* listed above was in an East Park ghost hedge, and is probably the same tree mentioned by Whiting in 1912 as 'remarkably fine and large' (Whiting 1912: 225). He also states: 'On the Heath many of the Maples [*Acer campestre*] — which were spared when the hedges in which they grew were removed many years ago — have since assumed the rank of trees' (ibid.: 221). If so, none appears to have survived into the 1990s.

Missing from the list are elms, *Ulmus* spp. Elm suckers in the extant hedges were locally frequent and it is estimated that from fifty to a hundred elm timber trees occurred in the survey area in the 1960s.

Pollards and shredded trees

The old oaks on the former field boundaries were examined to see if they had been affected by human activity. Many, perhaps most, trees had been affected in this way. Not for the hedgerow oaks the tall tree with a clean trunk and symmetrical outline. At least one-third of the oaks had once been pollarded, with a further fifty or so probably or possibly pollarded. A much smaller proportion showed signs of having been shredded. Both pollarding and shredding of hedgerow trees were common practices in the past, the cutting being done to provide tenants, rather than landowners, with wood for fuel or other purposes.

Middleton, writing 200 years ago, also noted the abundance of pollards in Middlesex hedges: 'many of the hedge-rows in the county are disfigured by pollard trees' (Middleton 1798: 275), and, expanding on this phenomenon, invoked 'the present appearance of hedge-rows, which almost everywhere disgust us with the sight of rotten pollards, and trees stripped of their side-branches like May-poles' (ibid.: 278). Middleton's disgust seems to have been deepened by the fact that it was the tenant, not the landowner, that derived a benefit from pollarding. His comments about 'trees stripped of their side-branches like May-poles' seems to refer to the practice of shredding, whereby all the lower branches of the tree were cut off on one or more occasions.

Rackham (1986: 229) implies that shredding ceased several centuries ago, but that is not the case. For example Read (1856), writing about nineteenth-century Buckinghamshire, attacks the practice:

'From one end of the county to the other there exists the barbarous custom of lopping off all the branches from the hedge-row timber and leaving only a bunch of leaves at the extreme top, the tree thus presenting the appearance of a household mop.'

Early photographs of the Heath appear to show a number of shredded trees, particularly on the boundary between the East Park and the East Heath. However, pollarding seems to have been the common method of obtaining wood from hedgerow timber trees.

Pollarding and shredding ceased over a century ago, and the trees now exhibit some fascinating forms: huge squat burry trunks, contorted lateral branches, and curious shapes at the point where the tree was once pollarded.

Hedgerow bushes in the 1990s

Some forty-seven hedges comprised the 5.43 km of full hedge on old field boundaries. A further twenty-eight hedges, totalling 3.18 km, were considered to be relict hedges. Over half the full hedges were on Hampstead Heath Extension; the remainder were divided more or less equally in terms of length, between the Ken Wood Farmland and Parliament Hill Fields. No full hedges occurred in or around the East Park.

The distribution of hedge bush species in these seventy-five hedges, *excluding* hedgerow timber trees, is shown in Table 3.

TABLE 3. Distribution of hedgerow bushes in Hampstead Heath 'full' and 'relict' hedgerows, 1997.

Rank	Species	No. of hedges in which found
1	Common hawthorn *Crataegus monogyna*	68
2	Holly *Ilex aquifolium*	48
3	Elder *Sambucus nigra*	40
4	Ash *Fraxinus excelsior*	35
5	Sycamore *Acer pseudoplatanus*	31
6	Woodland hawthorn *Crataegus laevigata*	31
7	Common oak *Quercus robur*	28
8	Maple *Acer campestre*	27
9	Yew *Taxus baccata*	25
10	Sessile oak *Quercus petraea*	23
11	Hazel *Corylus avellana*	21
12	Blackthorn *Prunus spinosa*	21
13	Wild cherry *Prunus avium*	20
14	Elms (mainly, but not entirely, English elm *Ulmus procera*)	18

Other species occurring in three or more hedges: orange-berried whitebeam *Sorbus croceocarpa* (15), silver birch *Betula pendula* (13), dog rose *Rosa canina* agg. (10), mountain ash *Sorbus aucuparia* (9), crack willow *Salix fragilis* (8), Turkey oak *Quercus cerris* (8), horse chestnut *Aesculus hippocastanum* (7), hornbeam *Carpinus betulus* (6), wild service *Sorbus torminalis* (6), grey sallow *Salix cinerea* (6), Norway maple *Acer platanoides* (6), beech *Fagus sylvatica* (5), Oregon grape *Mahonia aquifolium* (4), cherry laurel *Prunus laurocerasus* (4), Swedish whitebeam *Sorbus intermedia* (4), goat willow *Salix caprea* (3), field rose *Rosa arvensis* (3), service tree of Fontainebleau *Sorbus latifolia* (3), honeysuckle *Lonicera periclymenum* (3).

Comparison with other surveys

The figures for the Hampstead Heath survey can be compared with other surveys carried out in other parts of the country over the last thirty years. Table 4 gives some comparisons.

The composition of the Hampstead Heath hedges shows some remarkable differences from other studies of hedgerow composition. The frequency of holly *Ilex aquifolium*, and even more strikingly, of yew *Taxus baccata* does not appear to be paralleled in other studies. During the farming period, yew would probably have been eradicated from any hedges on which livestock might browse, because of its reputation of being poisonous to cattle. In the present survey, the frequency of these two species in the above list might owe something

TABLE 4. Frequency of hedgerow bushes in eight recent studies.

Species	Rank of frequency							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Hawthorn *Crataegus monogyna*	1	1	1	1	1	4	***	1
Blackthorn *Prunus spinosa*	5	2	3	2	2	8	1	11
Elder *Sambucus nigra*	2	13	2	8	3	3	3	3
Ash *Fraxinus excelsior*	5	5	4	10	7	5	7	4
Maple *Acer campestre*		3	5	7	9	11	9	8
Hazel *Corylus avellana*	12	3	8	3	5			11
Elm *Ulmus procera*	3	10*	7*		8**	2	6	14
Common oak *Quercus robur*	4	7	5	5	5	1	2	7
Holly *Ilex aquifolium*	8	22	9	4	4			2

*Wych elm *Ulmus glabra*. **described just as 'elms'. ***hawthorn records were split three ways with hybrid hawthorn *Crataegus* × *media* considered the most widespread, being ranked as 5th.

Key:
A: Maulden Sands, Bedfordshire (Rands and Nau 1976);
B: Maulden Clays, Bedfordshire (Rands and Nau 1976);
C: Church Broughton, Derbyshire (Willmot 1980);
D: Longden, Shropshire (Cameron and Pannett 1980);
E: Montford and Bicton, Shropshire (Cameron and Pannett 1980);
F: Wembley, London (Williams 1989*a* — this study included 'remnants' of hedgerows);
G: rural Kingsbury, London (Williams 1989*a*);
H: present study.

to a winter check on all the hedgerows, where these evergreen species were much more conspicuous than in the summer, as many plants were quite small. It remains to be seen if these two trees will feature prominently in the hedgerows of the future.

As for other species, blackthorn *Prunus spinosa* usually figures in the top four species, and its relatively lowly position in Table 3 awaits an explanation. It is also to be noted that five self-sown species of *Sorbus* occur in the hedgerows, the most widespread being the fairly recently recognized species orange-berried whitebeam *Sorbus croceocarpa* (Sell 1989). The ability of this species to seed itself in the hedges contrasts with that of the native wild service, *Sorbus torminalis* which was found less frequently — including the trees given in Table 2 — it was found in just eight full or relict hedges on the Heath.

Notable absences from the list include those species which have some preference for calcareous soils, but which may occur in the more diverse hedgerows on other soils: dogwood *Cornus sanguinea*, common buckthorn *Rhamnus cathartica*, spindle *Euonymus europaeus*, and wild privet *Ligustrum vulgare*.

Numerous species not normally associated with farmland hedges had established themselves, as can be seen from the list above. The abundance of ornamental trees on the Heath itself and in nearby private properties, and the loose and gappy state of many hedges, means that colonizing species can readily establish themselves. Such 'non-traditional' hedgerow bushes were widespread but not particularly abundant.

Special categories of hedge

Those who have analysed hedges have noted that parish boundary hedges are often more diverse in species because they are often of considerable antiquity and frequently mark ownership boundaries as well. Hedges bordering old roads and tracks may also be species-rich. Finally, old estate boundaries or land ownership boundaries may also be older than the average hedge.

There are about 3.2 km of parish boundary, roadside or estate boundary hedges within or bordering the survey area (Figure 3). They may be summarized as follows:

(Lengths given refer just to the highlighted sections on the map. Historical sources are mainly from Farmer (1984) and LCC (1936)).

1. Parish boundary between Hampstead and St Pancras (1.4 km) running more or less north–south through the centre of the open space. Recorded from the thirteenth century and perhaps existed in Saxon times; also a land ownership boundary from the thirteenth century until the late eighteenth century (in the north), or until 1889 (in the south). Large old ditch with parish boundary stones. In 1998 this boundary was classified in part as a ghost hedge (with no hedgerow bushes at all), or as a relict hedge, where most hedge bushes had been shaded out. It is probable that this boundary ran through woodland until the sixteenth century, so it is unlikely that a hedge existed at all until one or both sides of the boundary had been cleared. In 1998, this boundary had some very large oaks, especially towards the north. Otherwise, a few hornbeams *Carpinus betulus* and maple *Acer campestre* on the hedgebank near the south end of the boundary line, and scattered old woodland hawthorn *Crataegus laevigata* further north suggest that a hundred years ago it might have been of more interest.
2. Parish boundary between St Pancras and Hornsey (460 m). Recorded from the thirteenth century and perhaps older. Also an estate boundary from the thirteenth century or earlier until the late eighteenth century. It had some old oaks, but the hedge–bush layer had no special character. Some ornamental planting had taken place in the nineteenth century.
3. Parish boundary between Hampstead and Hendon (675 m in two separate segments). That between Sandy Heath and the Heath Extension bordered a former road or track, alongside which ornamental trees had been planted long ago, shading out the hedge. A few oaks survive. The section in Golders Hill Park and on the boundary between that Park and the West Heath is outside the survey area for this paper. The hedge has gone, but some impressive old trees are still standing.
4. Old road in Ken Wood Farmland, a north-easterly continuation of Millfield Lane, existing at least since the sixteenth century and an estate boundary until 1840, now a path (540 m). Its hedge, where it exists, has now largely grown into trees, but it does contain an exceptionally large wild service *Sorbus torminalis*.
5. Former track between 'The Spaniards' Inn and the Vale of Health, disused after 1845 and now obliterated except for a short 125-m section bordering the north-west corner of the East Park and the East Heath. Now deep in secondary woodland, this boundary lacks the hedge, but on the high bank above the track is a singularly dense and impressive row of old oaks *Quercus petraea* and *Q. robur* and beeches *Fagus sylvatica*.
6. Estate boundary running east–west just south of Parliament Hill. Attested in the sixteenth century, probably in the thirteenth; a land ownership boundary until the second half of the eighteenth century. Length 540 m. Broad old ditch in places, with old hedge-bushes scattered along the line. However, there has been a great deal of planting in the 1980s and 1990s to thicken the hedge and plug gaps. None of the thirteen trees recorded in the 1860s survives — they were probably elms.

Some of these boundaries are remarkable for their old trees, but the hedge-bushes have either been shaded out or have grown into trees, or much of the hedge-line has been replanted. No old medieval hedge exists on Hampstead Heath today, or if it does, then its characteristic features have been lost.

Abundance of species

For the forty-seven 'full' hedges, the degrees of abundance recorded give

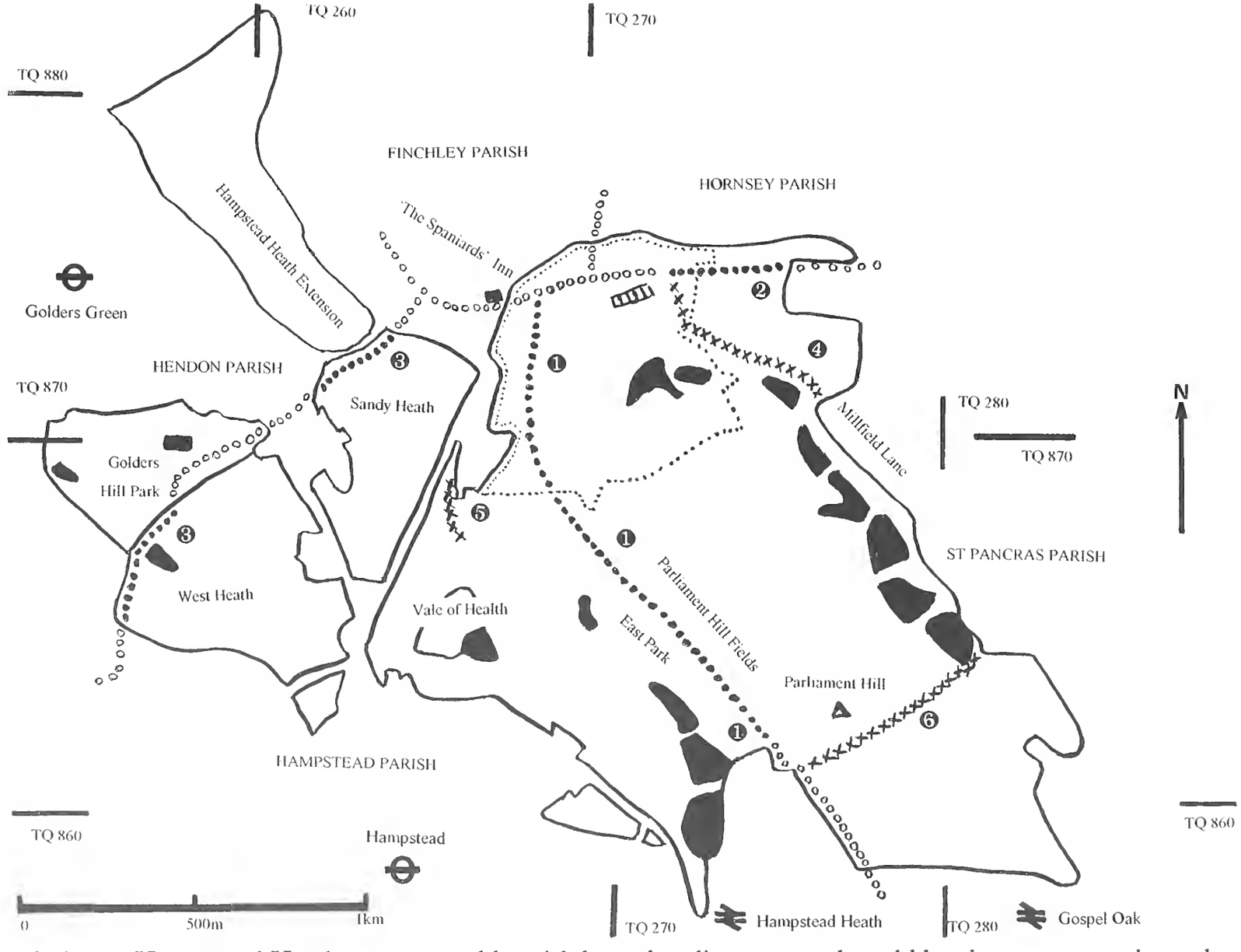


FIGURE 3. Old boundaries on Hampstead Heath. oooo•••• old parish boundary line, **xxxx** other old border, ... encloses that part of Ken Wood now separately managed by English Heritage.

TABLE 5. Abundance of hedgerow bush species, Hampstead Heath 'full' hedges, 1997.

Species	Score	Rank
Common hawthorn *Crataegus monogyna*	2225	1
Elms (mainly *Ulmus procera*)*	385	2
Holly *Ilex aquifolium*	260	3
Common oak *Quercus robur*	205	4
Elder *Sambucus nigra*	205	4
Woodland hawthorn *Crataegus laevigata*	195	6
Maple *Acer campestre*	185	7
Blackthorn *Prunus spinosa*	185	7
Orange-berried whitebeam *Sorbus croceocarpa*	170	9
Ash *Fraxinus excelsior*	165	10
Sessile oak *Quercus petraea*	145	11
Sycamore *Acer pseudoplatanus*	125	12
Hazel *Corylus avellana*	115	13

*Smooth-leaved elm *Ulmus minor* and wych elm *Ulmus glabra* were also recorded from one or two hedgerows.

some idea of the frequency of particular species in the hedges. A simple index was constructed whereby 'predominant' species were scored 75, 'frequent' species 25 and 'occasional' species 5. Mature timber trees were excluded. Using this index we can find the most abundant species in Hampstead Heath hedgerows (Table 5). This shows the overwhelming dominance of the common hawthorn *Crataegus monogyna* (broadly defined) in the Heath hedgerows.

New and thickened hedges

Planting new saplings in the hedges of Hampstead Heath appears to have been the intermittent practice from the late nineteenth century onwards. The older plantings were probably mainly of common hawthorn *Crataegus monogyna*, and they have now merged with the hedge-bushes existing before the land came into public ownership. In the last twenty years there has been a renewed interest in 'thickening' the hedges, and this activity can be seen on the ground. In the 1980s a large number of hedge saplings were planted in various hedges where there were gaps, or where the hedge appeared to be too thin. The species planted were mainly common hawthorn *Crataegus monogyna*, but with plenty of maple *Acer campestre*, hazel *Corylus avellana* and sometimes other species. More recently the planting has been more imaginative. As well as the above species, the following have been planted in Hampstead Heath hedges: alder buckthorn *Frangula alnus*, common buckthorn *Rhamnus cathartica*, dogwood *Cornus sanguinea*, spindle *Euonymus europaeus*, wild privet *Ligustrum vulgare*, guelder rose *Viburnum opulus*, as well as a little hornbeam *Carpinus betulus*, alder *Alnus glutinosa*, wild cherry *Prunus avium*, mountain ash *Sorbus aucuparia* and occasionally other native species.

Discussion

Of the twenty kilometres or so of hedgerow presumed to have existed in the survey area in the 1790s, about a quarter survives in a more or less continuous form. However, the appearance of the hedges and the species within them are probably different from the time two hundred years ago when they bordered meadows or pastures. Middleton (1798: 132), for example, talks of the normal practice in Middlesex at that time of laying hedges every ten to twelve years. Few Hampstead Heath hedges of today have been laid in the last hundred years.

The principal reasons for the changes over the last two hundred years can be summarized as follows:

1. Enlargement of fields for agricultural or ornamental purposes by landowners or their tenants. This usually leads to the total destruction of the hedge, but in the study area the timber trees were often left while the hedge was grubbed up and the ditch filled in — leaving the 'ghost hedges' of this study. The Mansfield Estate destroyed many hedges between the 1790s and the time that the estate came into public ownership (1889–1920s); in contrast the Extension was only slightly affected.
2. Destruction of hedges in preparation for building. The East Park hedges were probably lost in this way, though the timber trees were again mainly allowed to grow on, presumably because such trees were regarded as an embellishment to the estate of large villas which was planned.
3. Destruction of hedges in the interests of the provision of human recreation: playing fields, tennis courts, athletics facilities, fairgrounds and the like. On Hampstead Heath this destruction was carried out by the LCC and GLC, mainly affecting the lower part of Parliament Hill Fields and around the Highgate ponds.
4. Destruction of hedges through industrial activities on the land. In the case of Hampstead Heath the brick-making works in the East Park, especially from 1866 to 1887, were responsible. However, most of the hedgerow bushes had been destroyed twenty years earlier and the brick-making mainly affected the surviving timber trees.
5. Lack of management such as regular laying, resulting in the hedges growing tall, with some species developing into trees and thinning the bush element, the hedge therefore becoming increasingly gappy.
6. Change of land use in the adjoining areas, leading to the development of secondary woodland, the gradual shading out of the hedge, and producing what has been termed in this paper 'relict hedges' — a very common phenomenon on the Heath.
7. Pressure of livestock on hedges no longer used to confine the livestock, again ultimately producing 'relict' hedges.
8. Pressure of human recreation on hedges, resulting in the creation of passageways through the hedge, and sundry destruction.
9. Colonization of hedges by seedlings, often as a result of lack of management. In remote rural areas such seedlings are likely to be of species already present in the hedge. Hampstead Heath, however, has plenty of ornamental trees growing on it, and there are many more in the residential areas around, making colonization by such species easy. The result is a change in the species composition of the hedgerow.
10. Thickening hedges through planting, again often resulting in a change in the species composition of the hedgerow.

The last five causes are interrelated. Lack of management will make it easier for humans or livestock to create passageways through the hedge, and, in the case of human trampling, the resulting gaps may allow species of good colonizing ability to establish themselves. Alternatively the hedge will be partly replanted, perhaps with species not originally part of the hedge.

Conclusion

This study has in effect illustrated how hedges are a product of human management. Hedges were originally created to keep livestock out of corn, to prevent them straying, as a source of wood or timber, or as ownership boundaries. When none of these reasons applies, then the hedge either just becomes a line of bushes and trees, or is browsed or trampled out of existence, or is deliberately destroyed for a human activity which has no use for hedges.

The study has shown that the loss of hedgerows in the survey area was already quite well advanced by the time that the land became part of a public open space, and was the result of actions by the owners or tenants of landed

estates. The further losses up to the present are due partly to deliberate management policies which have destroyed them, but due much more to ecological succession consequent upon the land use changing from farmland to public open space.

Today, of course, there are far more trees and bushes in the survey area than there were in the 1790s. Two hundred years ago, apart from the very occasional tree standing in a field, bushes and trees were confined to the hedgerow. Now, many of the same species are common in scrub and secondary woodland throughout the survey area. The hedges have greatly declined, but the descendants of many of the species once typical of the hedgerows are still to be found in the same area.

Acknowledgements

The writer would like to thank Colin Bowlt for reading the manuscript and for his helpful comments, Mr P. J. M. Nethercott for identifying the writer's *Sorbus* specimens, and Isobel Stokes of Haringey Libraries. He also wishes to thank the staff of the London Metropolitan Archives, the Camden Local History Library, the Barnet Local History and Archives Library, as well as the staff at the University of North London Library for their courtesy and help. Finally, he would like to acknowledge the diligence of the park constables of Hampstead Heath who, accosting someone who was apparently skulking suspiciously in hedgerows, finally accepted the writer's explanation for his behaviour!

References

BAKER, T. F. T. 1989. Woodlands. In *History of the county of Middlesex:* **9.** *Hampstead and Paddington.* Oxford University Press and Institute of Historical Research, Oxford. (Victoria County History).

BRYANT, J. and COLSON, C. 1990. *The landscape of Kenwood.* English Heritage, London.

CAMERON, R. A. D. and PANNETT, D. J. 1980. Hedgerow shrubs and landscape history: some Shropshire examples. *Fld Stud.* **5:** 177–194.

FARMER, A. 1984. *Hampstead Heath.* Historical Publications, London. (1996 reprint).

GREATER LONDON COUNCIL (GLC). 1972. Hampstead Heath: general. London Metropolitan Archives, file GLC/DG/AR/6/32(2).

HEATH AND OLD HAMPSTEAD SOCIETY. 1975. *Newsletter* **6**(7). Autumn.

IKIN, C. W. 1971. *Hampstead Heath.* High Hill Press, London.

INGROUILLE, M. J. and LAIRD, S. M. 1986. A quantitative approach to oak variability in some north London woodlands. *Lond. Nat.* **65:** 35–46.

LONDON COUNTY COUNCIL (LCC). 1896. In *Tree planting on Hampstead Heath, 1875–1899.* London Metropolitan Archives, file LCC/PK/GEN/2/2.

LCC. 1898. In *Tree planting on Hampstead Heath, 1875–1899.* London Metropolitan Archives, file LCC/PK/GEN/2/2.

LCC. 1899. In *Superintendents' half-yearly reports, 1893–1911.* London Metropolitan Archives, file LCC/CL/PK/1/109.

LCC. 1905. In *Superintendents' half-yearly reports, 1893–1911.* London Metropolitan Archives, file LCC/CL/PK/1/109.

LCC. 1907. In *Superintendents' half-yearly reports, 1893–1911.* London Metropolitan Archives, file LCC/CL/PK/1/109.

LCC. 1936. *Survey of London* **17**. London County Council.

LCC. 1949. In *Hampstead Heath general, 1945–51.* London Metropolitan Archives, file LCC/CL/PK/2/46.

LOUDON, J. C. 1838. *The suburban gardener.* London; map reproduced in Bryant, J. and Colson, C., *The landscape of Kenwood.* English Heritage, London.

MARCHAM, F. 1932. Eton College property in Hampstead and adjacent parishes, *Trans Lond. Middlx archaeol. Soc.,* (NS) **6:** 310–313,

MIDDLETON, J. 1798. *View of the agriculture of Middlesex.* G. Nicoll, and Board of Agriculture, London.

MUIR, R. and MUIR, N. 1987. *Hedgerows: their history and wildlife.* Michael Joseph, London.

OLIVER, R. 1993. *Ordnance Survey maps: a concise guide for historians.* Charles Close Society, London.

POLLARD, E., HOOPER, M. D. and MOORE, N. W. 1974. *Hedges.* Collins, London.

RACKHAM, O. 1986. *History of the countryside.* Dent, London.
RANDS, E. B. and NAU, B. S. 1976. A comparative study of hedges on the Boulder Clay and Lower Greensand in the Maulden area. *Beds. Nat.* **30:** 39–52.
READ, C. S. 1856. Report on the farming of Buckinghamshire. *J. Roy. agric. Soc.* **16:** 269–322.
SELL, P. D. 1989. The *Sorbus latifolia* (Lam.) Pers. aggregate in the British Isles. *Watsonia* **17:** 385–399.
STACE, C. 1997. *New flora of the British Isles.* Ed. 2. Cambridge University Press, Cambridge.
STOKES, M. 1995. *A walk along ancient boundaries in Kenwood.* Hornsey Historical Society, London.
WADE, R. 1972. *Hampstead and Highgate Express*, 15 September.
WHITING, J. E. 1912. Trees. *In* Barrett, T. J. *The annals of Hampstead* **3:** 210–234. Lionel Levanthal, London (1972 reprint).
WILLIAMS, L. R. 1989*a*. The survival of rural hedgerows in a London borough. *Lond. Nat.* **68:** 25–33.
WILLIAMS, L. R. 1989*b*. *Crataegus* × *media* in Middlesex hedgerows. *Watsonia* **17:** 364–365.
WILLIAMS, L. R., McLAUGHLIN, J. and HARRISON, T. G. 1987. Hedgerows surviving in suburban Kingsbury. *Lond. Nat.* **66:** 35–39.
WILLMOT, A. 1980. The woody species of hedges with special reference to age in Church Broughton, Derbyshire. *J. Ecol.* **68:** 269–285.

Other manuscript sources

The following additional sources were consulted to establish the existence of field boundaries in the late eighteenth and nineteenth century.

COOKE, John. *The manor and parish of Hendon in the county of Middlesex, drawn and engraved by John Cooke of Hendon.* [with accompanying book]. 1796. London Borough of Barnet Local History and Archives Service.
EYRE, Edward John. *A plan of the manor of Tottenhall alias Tottenham Court with the demesne lands therein belonging to the Hon.ble Charles Fitzroy as taken in the year 1761 by Edward John Eyre.* London Metropolitan Archives, 2471 J. St P. 1761.
MESSEDER, Isaac. *Plan of the manor and parish of Hendon, surveyed and delineated by Isaac Messeder.* [with accompanying manuscript volume.] 1754. London Borough of Barnet Local History and Archives Service.
[MILLFIELD FARM]. *The particulars of Highgate Ponds and Farm, to be sold by auction . . . London 27 Aug. 1789.* [with accompanying map]. London Metropolitan Archives, J. St P. 1726.
*A PLAN of the parish of Saint Pancras in the county of Middlesex . . . 1804. c.*26 inches to the mile. London Metropolitan Archives, SC/PM/SP/01/01.
PHOTOGRAPHS. Aerial photographs and postcard photographs, 1890 onwards. London Borough of Camden Local History Library.
TITHE COMMISSIONERS. *Plan of the parish of Hendon in the county of Middlesex . . . 1840.* London Borough of Barnet Local History and Archive Service.
TITHE COMMISSIONERS. *Tithe apportionment and map, Hampstead St John. 1838–39.* London Metropolitan Archives.

Book review

Hidden jewels. The wildlife of Leatherhead and Fetcham. Jeremy Early. Published by the author, 16 Bridge Court, Bridge Street, Leatherhead, Surrey KT22 8BW. 1997. 96 pp., A4, hardback, profusely illustrated in colour. £14.50 + £2 p. & p. ISBN 09530098 0 7.

This is essentially a book of fine photographs by the author. They concern a millpond and a meadow, and the River Mole as it passes through the town of Leatherhead. The book is, however, important for all those interested in the conservation of the Thames tributaries and river valleys around London.

This small section of the Mole has 15 species of dragonfly, including the white-legged damselfly — one of the least tolerant of all to pollution; 20 species of butterflies and 20 of mammals have occurred in the past ten years, and almost 100 species of birds. Kingfishers, grey wagtails and little grebes nest.

This river has Gatwick Airport and the expanding towns of Crawley and Horley in its catchment area, and more homes with second cars than anywhere else in the country. Seven sewage treatment works discharge into the river above Leatherhead. Surprisingly, there is no bacteriological standard laid down for their clean water discharges, and the river just above Leatherhead has been described as bacteriologically filthy by the local authority's Chief Environmental Health Officer. However, these discharges account for more than 50 per cent of the river's flow in dry summers, and stop it drying out. Agricultural chemicals are less important than rain on built-up areas, for the flash floods after storms destroy the first kingfishers' nests each spring, and have destroyed all swans' nests for ten years. The 21 pages of text detail these facts and many others dispassionately and fairly, but with fear for the future. The threats to the whole river, with their pros and cons, are fully discussed, with official organizations receiving credit where it is due.

The Leatherhead and District Countryside Protection Society work tirelessly on these matters, and the proceeds of this book go to them and the Surrey Wildlife Trust. Representations on all relevant planning applications are made, and some limited protection achieved. This mode of conservation can only be achieved at a local level, and the author is an example of all of us in devoting his skills to this. Tellingly, the foreward is by the vice-chairman of the Mole Valley District Council.

The photographs are beautiful, technically excellent, and show the seeing eye of an artist. They show the area season by season, with atmospheric views of the millpond and river, and shots of the natural inhabitants. The male siskin on the end of a twig against a uniform background is the best I have ever seen of the species; a black-tailed skimmer on an ear of wheat is a masterpiece of close work; the dog rose leaf with hoar frost made a visitor of mine gasp; the group of tufted ducks would surely have needed the brush of a Robert Gillmor or a Michael Warren to compose so well. There are many more worthy of mention, but the best must be the sheer perfection of two kingfishers in territorial dispute.

On a bedside table this beautiful book would convert any overnight guest to conservation. The text is well researched, and makes compulsive reading. I hope this book reaches a wide audience, and stimulates all its readers to greater efforts in their own parishes.

ALAN PROWSE

Botanical records for 1997

RODNEY M. BURTON

Sparepenny Cottage, Sparepenny Lane, Eynsford, Kent DA4 0JJ

Abstract

This annual paper contains records of vascular plants made in a circular area of radius 20 miles, centred on St Paul's Cathedral. This area includes all of the Watsonian county of Middlesex and parts of Kent, Surrey, Essex, Herts. and Bucks. These papers are the only place where new plants for the flora of Middlesex are reported; in 1997 there were the naturalized aliens *Carex arenaria* and *Hydrocotyle ranunculoides*, and casual aliens *Adiantum raddianum*, *Bidens ferulifolia* and *Euphorbia characias*.

This paper also includes some comments on the increasing practice of introducing native plant species to 'wild' situations.

Introduction

The Atlas 2000 project of the Botanical Society of the British Isles has been mentioned in these pages before. Its aim is to produce maps of the distribution of vascular plants like those in the *Atlas of the British flora* (Perring and Walters 1962), but more accurate, covering more taxa and of course more up-to-date. I have been made responsible for the collection of data for this project from the London area, and 1997 was the first year in which I was able to report results from our area to the Project Organizer, and so discover some of the problems. The most time-consuming part of preparing the results proved to have been the compilation of historical records, mostly old records of native species which were present in long-vanished semi-natural habitats. The problem worth going into further here is not the plants which have gone, but the ones which someone has tried to bring back. For the purposes of the project, I have to distinguish as far as the available data will allow, and in this order of preference, between native records, records of naturalized aliens, records of casual aliens, records of plants which may once have been deliberately introduced but are surviving unattended in reasonably natural situations, and recent deliberate introductions. These categories are described in more detail by Macpherson et al. (1996), amplified by Macpherson (1997). I also have to distinguish, again in order of preference, between plants seen since 1987, plants last seen in the years 1970 to 1986, and plants not seen since before 1970. If there is an older record of a plant in one of the squares into which the country is divided for the purpose of this and other mapping projects, and another record of the same plant in the same square, in a more recent date category but of less good status, then both records have to be included in the results. At the time of writing, with the older records investigated for eleven of the seventeen squares I am covering for the project, I have already found over a hundred species for which there will have to be two records from one or more squares. In most cases the older record is a native occurrence and the more recent one a deliberate introduction, not generally in the same locality.

Probably the best documented example is the heathers *Calluna vulgaris* and *Erica cinerea* on Hampstead Heath. The last known native occurrence of these plants there was in 1927 and 1912 respectively (Kent 1975). Barbara Villiers has kindly obtained for me details of the reintroduction in November 1986 of about 13 m^2 of these species, which was successful to the extent that the *Erica* was reported as a relict native plant (Burton 1996: 142). Dodder, presumably *Cusuta epithymum*, was inadvertently introduced as a parasite on the *Calluna*, but did not persist. More recently, Anthony Vaughan informs me, *Calluna* has been planted in much larger quantities in many parts of the Heath, probably including some where it was absent even at the time of Constable's painting. Mr Vaughan also lists many other native species deliberately introduced in very

recent times, not all successfully, and some of which like bog myrtle *Myrica gale* have certainly never been seen there before. Another telling case is that of South Norwood Country Park. John Bedford sent me a list of recent observations there by himself and Mrs Pat Manning, and also a list compiled from records by Jean Byatt in 1980 and Jane McLauchlin, when this was still the site of the long-derelict Elmers End Sewage Works. A description of the site soon after its conversion is provided by Birkett (1992). Although Mr Bedford has not himself listed grasses and trees, the other common species of rough grassland which were present before are present still. Yellow medick *Medicago falcata* which was there cannot now be found, but is still represented by its oddly coloured hybrid with lucerne *M.* × *varia*. It is quite clear from Mr Bedford's list and comments that attempts have been made to create an assortment of habitats here, including waterside and weedy cornfield. For some of the plants which can only have been deliberately introduced here, such as weasel's-snout *Misopates orontium* and corn crowfoot *Ranunculus arvensis*, each seen in one year only, there are much older records from the same square, but definitely not from the same place. The more attractive vanished cornfield weeds, cornflower *Centaurea cyanus*, corncockle *Agrostemma githago* and so on turn up all over the placè; in 1997 I found the two named myself at the foot of Old Father Thames near Coin Street in Southwark.

I can think of three reasons why people should want to cultivate wild flowers, but none of them is at all satisfactory. The first is quite simply for ornament; there has been a reaction against over-bred double flowers in favour of the bolder outlines of the species from which they were derived. This took place a long time ago, and I think it is better understood now that garden races of flowering plants are often artificial hybrids with a much longer flowering season, and therefore greater ornamental value, than the wild species. There is no reason to suppose that plants which happen to be British natives are any more suitable or less demanding of maintenance effort than others; indeed, in the special conditions of London, species native in warmer climates than that of rural Britain can be expected to thrive better. (It should be said that the plants introduced to South Norwood Country Park, perhaps accidentally, also include garden material like Maltese cross *Lychnis chalcedonica* and peach-leaved bellflower *Campanula persicifolia*). The second is for education, and it is certainly the case that a large proportion of the enclosed spaces to which wild plants are introduced consists of school premises. One cannot contest the principle that children should be acquainted with wild flowers, but too often the flowers chosen are ones which they are not likely to be confronted with anywhere else.

More interesting is the idea that introducing or reintroducing native plants should be done in the interests of nature conservation. It would be particularly ignorant if that meant simply trying to expiate the guilt of the human race, which has hitherto worked against the interests of nature conservation, by making good the observable decline of native plants, since it must be merely wasteful to introduce plants to habitats which are not suitable for them now even if they had been in a past age, when there were few dog messes, light grazing and low atmospheric pollution. In the last twenty years or so a new orthodoxy has developed, which rules that native plants should be grown because they are more supportive of animal life than foreign plants. In *The Guardian* Education Supplement of Tuesday April 21 1998, one can read it expressed thus: 'Not surprisingly, the natural habitats and food supplies of Britain's wildlife are associated with our native plants. Exotic and ornamental plants may look good, but they do not provide as rich a habitat and do little or nothing to support the complex life cycles of our native wildlife.' I cannot find any evidence that the assumptions on which the new orthodoxy is based have ever been tested.

The insect species most favoured by the selection of their foodplants for

planting are undoubtedly butterflies; the brimstone butterfly *Gonepteryx rhamni* is an attractive and easily recognized insect the larvae of which feed on buckthorns *Rhamnus cathartica* and *Frangula alnus*, and these plants are in Mr Vaughan's words 'favourites when the Corporation of London and English Heritage want to fill gaps in old hedge-lines' on Hampstead Heath. (I suspect that the *Frangula* which has long been present in a remote corner of Kew Gardens may have been planted for a similar reason). There has never been any monitoring of the success of these or other foodplant introductions. In the case of the brimstone butterfly, individual adults of which are known to wander more widely than those of other species, monitoring would need to be subject to careful statistical controls. Monitoring of natural butterfly populations on nature reserves over a long period has shown that considerable changes of abundance, including the loss of some species and the acquisition of others, is normal (Pollard and Yates 1994). Thomas (1995: 60–61) has shown that re-establishment or reinforcement of butterfly populations by the release of captive-bred adults is only practicable 'when a potential release site is considerably larger than the minimum area required by single local populations', so the small-scale introduction of the foodplant alone is likely to be totally ineffective.

British butterfly species are few in number; the limited diet of their larvae is a familiar feature of popular natural history. Other insects which feed on plants are more varied and numerous, and are more likely themselves to be important in the diet of vertebrates which most readers are likely to understand by 'wildlife'. Emmet and Heath (1991) give an index to the 'foodplants and other food substances and situations' of all British Lepidoptera (i.e., moths as well as butterflies), from which it can be seen that most common perennial and woody plants support these insects. If one examines the detail of Emmet's chart (loc. cit.: 61–303), it becomes apparent that insects which feed on a number of related plant species do not distinguish between them according to their country of natural origin; the lychnis moth *Hadena bicruris* is an example of an insect which has increased in abundance naturally in Britain by feeding on an alien plant, sweet william *Dianthus barbatus*. There are even moths which feed on those alien coniferous plants which are least desirable in gardens in the new orthodoxy. Also many beetles, listed by Philp (1991) with their foodplants, are phytophagous; the plants in question include many trees, native and alien, but there are also common herbaceous plants with no associated beetle, e.g., bugle *Ajuga reptans*, field scabious *Knautia arvensis* and teasel *Dipsacus fullonum*. Another large order of insects, the Hemiptera, feed almost entirely on plants and include many well-known causers of damage to field and garden crops; one might question whether it is proper to encourage the cultivation of native plants in order that they may be injured by native insects.

The most extreme manifestation of the new orthodoxy is the Flora for Fauna local plant index, which can be inspected by Internet users at http://fff.nhm.ac.uk/fff. This provides a list of native plants which have been recorded in an area corresponding approximately to the postcode specified by the user. The data are taken from Perring and Walters (1962), and will no doubt be replaced by the more up-to-date data of Atlas 2000 when it becomes available. Postcodes are a convenient and familiar way in which the user can specify his home area, but they do not match the 100-km^2 squares used by the botanical data. For instance the writer's home postcode DA4 straddles two of the latter, and the plant list offered for it includes estuarine species such as English scurvy-grass *Cochlearia anglica* which I will never be able to grow here. The list provides many examples to illustrate the impracticality of selecting native plant species for cultivation as a means of encouraging insect populations; I will take one. Woolly thistle *Cirsium eriophorum* is a handsome biennial which I would be happy to grow, but I would need a lot of space to have enough of it for it to be able to maintain itself. It is in the list for DA4 on the strength of two nineteenth-century records, and the nearest extant populations, both small, are

twenty kilometres to the west in Surrey and over fifty kilometres to the east in East Kent. Clemons (1998), reviewing tephritid fly species known from Britain but not from Kent, comments that *Terellia longicauda* is unlikely to occur in Kent on the thistle, its main host species, as there may not be enough of it to support a population. It is therefore even less likely that I am going to do anything to encourage this rare insect by growing the woolly thistle. This is only one aspect of the Flora for Fauna database, but I find it difficult to avoid the conclusion that the whole structure has been built because it has been found technically possible to do so, regardless of its real usefulness.

It may be thought that my antipathy to the introduction of native plant species derives from its considerable nuisance value to the plant recorder, who has to try and keep track of the introductions though they only make more difficult the task of trying to understand natural distributions. That may be so, but there is nevertheless the more serious point, which applies particularly strongly in the urban environment, where alien plant species are more likely to thrive than native ones, that the result of inappropriate stress on native species will be to undervalue the naturally occurring aliens, which can be expected amongst the species finding their own way to sites where nothing at all is planted. This point has recently been forcefully expressed by Nick Bertrand (1997).

Mention of Mr Bertrand gives me the opportunity to change the subject (at last, I can hear some readers thinking) and report that he is the first to send me site lists of plants on floppy disk. This has been a source of records, received too late to include in the following paragraphs, which I have been able to incorporate into the database which I described in *Lond. Nat.* **75:** 144–146 (1996). The time it takes me to modify the data on the disk as necessary and paste it into the database averages four or five plants in a list per minute, which can certainly be improved upon.

In the following paragraphs, records are taken in the usual sequence of vice-counties in number order, and within each vice-county records from inner London boroughs, outer London boroughs and parts of the London Natural History Society's recording area outside the London boroughs.

V.C. 16, West Kent

Many of the 1997 records I have from the Kent part of south-east London stem from my own efforts to collect data for the Atlas 2000 project. In Greenwich I spent a day mostly in the east of the borough, finding *inter alia* plenty of hoary plantain *Plantago media*, perhaps introduced with turves, on a grassy bank by Frances Street, Woolwich and an old plant of deadly nightshade *Atropa belladonna* on waste ground west of the Thames Barrier, a habitat of which there used to be much more in this part of London. Much earlier in the year a plant of Oxford ragwort *Senecio squalidus* with undivided leaves at Bell Water Gate had attracted some attention at an ornithological meeting of the Society; such plants are not uncommon and can look very different from the normal ones among which they usually grow. This was in the wrong area to look for the western limit along the Thames in v.c. 16 of saltmarsh plants, as Mr Bertrand had found English scurvy-grass *Cochlearia anglica* and sea-aster *Aster tripolium* at Deptford Creek. This locality is in the Borough of Lewisham, at the other end of which, near Castillon Road, Hither Green, Peter Tymkow reported rocket *Eruca vesicaria*, a rare casual even in London, and at Goldsmiths Community Centre ivy-leaved duckweed *Lemna trisulca*, which is by no means a normal feature of London's artificial ponds.

The largest number of interesting 1997 plant records from Bexley were contributed by John Palmer. They include a bush of tall nightshade *Solanum chenopodioides* 125 cm tall and two metres across east of the river at Barnes Cray; he suggests that this species is widely overlooked. In other places around

Crayford there were a few bee orchids *Ophrys apifera* at the edge of an industrial estate, about a hundred Bithynian vetch *Vicia bithynica* and some greater chickweed *Stellaria neglecta* near the River Cray and a large thicket of burnet rose *Rosa pimpinellifolia* in Biggs Hill Wood. The last was not the native plant but var. *altaica*, very obviously spread from cultivation; the interesting thing about it was the other thicket not far away of the hybrid between this species and the common dog-rose *R. canina*, which is called *R.* × *hibernica*. With Geoffrey Kitchener he found two plants of blue passion-flower *Passiflora caerulea* climbing up the wire fence of what one of them calls a ruined factory west of Barnes Cray and the other an abandoned works between Crayford and Dartford. Margot Godfrey's records include a dense stand of false acacia *Robinia pseudoacacia* on former tennis courts at Barnehurst, and Graham Nicholls told me about the plant of broad-leaved helleborine *Epipactis helleborine* recently arrived in Bexley Park Wood.

He also mentioned bee orchid on the east side of Ruxley Nature Reserve, across the A20 and into the Borough of Bromley and a new paragraph. Rosa Davis reported skullcap *Scutellaria galericulata* under a waterside *Cotoneaster* in Kelsey Park, and I revisited the patch of the flat-leaved var. *setosum* of creeping thistle *Cirsium arvense* on the side of Martin's Hill, Bromley where I had previously seen it more than twenty-five years before. In the more rural part of the borough, Joyce Pitt mentions in her report for the Orpington Field Club the discovery of two bushes of mezereon *Daphne mezereum*, which has not been seen in the borough before; the locality is one where scrub had been cleared every autumn for several years up to 1995 in order to protect the habitat of another equally rare but herbaceous plant, and it seems not unlikely that the mezereon was among the bushes cut.

Problems of status of plants at South Norwood Country Park have already been mentioned, but I still have to point out the problems it causes me in my efforts to sort out localities by vice-county and by London borough. When the sewage works was established by the Metropolitan Board of Health it lay across the county boundary between Kent and Surrey, and the site continued to be divided along the same line when it separated the London Boroughs of Bromley and Croydon. More recent changes have put it all into Croydon, but the area of most natural history interest is at the Elmers End part of the site and I put all its plants into v.c. 16.

As is often the case, and he justly complains about the arbitrariness of it, I am having to be extremely selective in the Kent records from Mr Palmer that I find space for. Bladder ketmia *Hibiscus trionum* came from a roadside in a Dartford industrial estate. Western St Paul's-wort *Sigesbeckia serrata* came from a garden at Sutton-at-Hone where it had also been in 1996, and to which he postulates that it had been brought in from somewhere by flocks of sparrows which are a feature of the place. The plants in calcifuge woodland vegetation by Parkwood House, Swanley included seedlings of the Chinese shrub *Clethra fargesii.* At the very edge of our area near Hartley were a sizeable colony of Mediterranean spurge *Euphorbia characias* on a grassy rural roadside and the native columbine *Aquilegia vulgaris* in dense dark remote thickets. Mr Kitchener, when preparing for a joint meeting of the Wild Flower Society and the Kent Field Club which he led on 13 July, found on rough grassland near Dartford Heath several plants of wild liquorice *Astragalus glycyphyllos* not recorded in this part of our area for many years, and in the same area Italian lords-and-ladies *Arum italicum* subsp. *italicum* abundantly naturalized in shade. He followed up Nadine Smith's report of marshmallow *Althaea officinalis* in the river at Eynsford Castle, but in the same place I saw flowering rush *Butomus umbellatus* and nodding bur-marigold *Bidens cernua*, and as none of these had been there before I have to assume that at least the *Althaea* and *Butomus* were deliberate plantings. He also identified Mrs Godfrey's discovery of hoary cinquefoil *Potentilla argentea* on the west side of Joyce Green Lane north of

Dartford, where it was near to dittander *Lepidium latifolium* which continues to appear in new localities. The only record of my own which I wish to include here is New Zealand bitter-cress *Cardamine corymbosa*, not previously recorded in our area, which was covering a pot containing a magnolia for sale at Cooling's Nurseries, Knockholt. It was fortunate that I did not immediately recommend to anyone else that they should go and see it, because when I went back to it with my camera the following morning the magnolia had been sold.

V.C. 17, Surrey

The Atlas 2000 square TQ37 is mostly in Southwark, and lists from many Southwark sites in this square were supplied to me with the help of Ruth Day; one of them included corky-fruited water-dropwort *Oenanthe pimpinelloides* stranded in the grounds of a block of flats in Dulwich, which has been known for a few years though not mentioned previously in this journal. Tony Hare also helped fill a few gaps in this borough and in Lambeth. In Wandsworth, Elizabeth Norman checked on some earlier records and discovered that the *Ludwigia* reported two years before (Burton 1996: 139) is not Hampshire purslane *L. palustris*, but its hybrid with *L. natans* Elliott; this hybrid, discussed by Clement (1997), is most probably the plant reported from Essex by Adams (1977), which did not survive. She investigated various populations of teaplant *Lycium* and confirmed that only one, in Heathfield Road, is genuine *L. chinense*, other records of that species all being errors for the much commoner *L. barbarum*. John Hodge confirmed for Atlas 2000 a number of records from Wandsworth and elsewhere in the vice-county, including round-leaved mint *Mentha suaveolens* by Scio Pond, also seen by Mary Clare Sheahan and Stella Luce. In Merton, he confirmed the presence of bell heather *Erica cinerea*, spring vetch *Vicia lathyroides* and eared willow *Salix aurita* on Wimbledon Common, the last a different plant from the *S. aurita* × *cinerea* confirmed on the Common by Dr Sheahan and Mrs Luce.

In the small part of the Borough of Bromley in v.c. 17, Mr Bertrand found rough dog's-tail *Cynosurus echinatus* in the caravan park in Crystal Palace Park. Most of the records communicated to me by Graham Medcalf are from Croydon; they include London rocket *Sisymbrium irio* at the corner of Dingwall Road, East Croydon, and American speedwell *Veronica peregrina* at the Davidson Professional Centre, Woodside, found by John Williams, and bitter vetch *Lathyrus linifolius* at the Bethlem Royal Hospital found by Bill Wyatt. Jane McLauchlin confirmed many plants for Atlas 2000 from TQ36, which is mostly in Croydon, such as lily-of-the-valley *Convallaria majalis* at Croham Hurst. At this locality David E. Allen found a single bush of the bramble *Rubus cantianus*, not previously recorded from Surrey. In Sutton, there were gaps in the Atlas 2000 records from TQ26 filled by Peter Coxhead. Ron Parker produced evidence that there are still aliens coming up on the site of Beddington Sewage Farm, including watermelon *Citrullus lanatus*, honeydew and canteloupe melons *Cucumis melo* and, more unexpectedly, sea buckthorn *Hippophae rhamnoides*, and Joyce Smith passed on to me Pete Grainger's record of Mediterranean barley *Hordeum geniculatum* from The Grove, Carshalton. Kingston records, all from Mr Hodge, include keeled-fruited cornsalad *Valerianella carinata* in local gardens, including his own, and many plants from along the Hogsmill River nearby, including sneezewort *Achillea ptarmica* and slender tufted sedge *Carex acuta*.

In Richmond I have first to mention the information supplied to me by Richard Bullock, which is to be contrasted with my opening paragraphs. This concerns the site of the Barn Elms Reservoirs, which during 1996 and 1997 was transformed into the Wetland Centre reserve of The Wildfowl and Wetlands Trust. Here there is a purpose for introducing native plants different from all those already mentioned: to create a habitat which can support a good variety of resident and visiting water birds, based on a thorough knowledge of their

requirements for food, water, space and shelter. One can but envy the thoroughness with which the Trust, in the person of Dr Bullock, has noted all the introductions, not all of them successful, and also not quite all of them deliberate, for there is an admission that the invasive aliens New Zealand pigmyweed *Crassula helmsii* and Nuttall's waterweed *Elodea nuttallii* were introduced accidentally. His data include the results of floristic surveys of the reservoirs and their surrounds done in the working life of the reservoirs in 1991–3, so that it can be seen which species present before the work on the site commenced are being reintroduced. Wild clary *Salvia verbenaca*, which was discovered here by the late Rupert Hastings in 1984, was taken into cultivation at the Trust's Slimbridge site with the intention of re-establishing it at Barn Elms (and there is also a small colony of it planted previously in St Mary's churchyard, Barnes, as a memorial to Rupert). A small colony of needle spike-rush *Eleocharis acicularis*, found on the shore of one of the new water bodies created at the site, was not among the plants deliberately introduced. Also it would appear that somebody had got in and scattered the usual 'wildflower seed' on banks, accounting for the presence of corn marigold *Phacelia tanacetifolia*, which is not a native species but often appears in this company, and other species. Other plants which I should mention from Richmond are Dr Sheahan's confused fescue *Festuca lemanii*, determined by Dr T. A. Cope, honey garlic *Nectaroscordum siculum* and spring starflower *Tristagma uniflorum* found on Barnes Common; hard fern *Blechnum spicant*, bristle club-rush *Isolepis setacea*, hair-like pondweed *Potamogeton trichoides* and other plants confirmed in Richmond Park by Mr Hodge; and Mrs Norman's hairy finger-grass *Digitaria sanguinalis* clearly naturalized near Barnes Station — more usually this species is only casual.

In Surrey the outstanding 1997 record must be Barry Phillips' rediscovery of downy-fruited sedge *Carex filiformis* on Chertsey Meads. Until he discovered this sedge on Thorpe Hay-meadow recently, it had been thought extinct in Surrey, having last been seen by myself in a different place on Chertsey Meads in 1970 (David 1983). Mr Phillips has also done a lot of work for the Atlas 2000 square TQ06; two of the more unusual aliens he has listed were established, Mrs Robb's bonnet *Euphorbia robbiae* at Broadwater Farm and slender vervain *Verbena rigida* for its third season on the pavement near his Chertsey home. Mr Hodge's welcome confirmations in modern Surrey include *Eleocharis acicularis* on Epsom Common, marsh St John's-wort *Hypericum elodes* and lemon-scented fern *Oreopteris limbosperma* on Esher Common and bilberry *Vaccinium myrtillus* on Oxshott Heath. On Reigate Heath, at the edge of our area, John Williams found broad-leaved spurge *Euphorbia platyphyllos* and meadow saffron *Colchicum autumnale*, the latter not native in this locality. George Hounsome found about thirty rosettes of water-lettuce *Pistia stratiotes* in the Wey Navigation north of the junction at New Haw; this floating tropical aroid is an aquarium plant which can multiply in an English summer, propagating by the rosettes breaking into two, but cannot survive an English winter out of doors. Mr Kitchener found a great variety of willow-herb *Epilobium* hybrids around sandpits at Moorhouse and Tandridge and several plants each of Greek dock *Rumes cristatus* and orange mullein *Verbascum phlomoides* by the South-West Water Company's pit at Godstone.

V.C. 18, South Essex

I was asked to look at a piece of waste ground north of the A13 near Plaistow in Newham. Although it did not have the rarity promised, it had good numbers of such typical species for such a place as small-flowered evening primrose *Oenothera cambrica*, water-cabbage *Bunias orientalis* and danewort *Sambucus ebulus*. Across the road in Beckton District Park I noticed large spreads of strawberry clover *Trifolium fragiferum*, which was displaying the greater resist-

ance to drought on account of which it is sown. Ken Adams told me he had found dittander in Stratford. In Redbridge, Paul Ferris sent me his species list for the sewage works site next to Wanstead Park, and other data about plants in the Park and on Wanstead Flats, as a contribution to the Atlas 2000 data for TQ48; the best new record from the sewage works site is soft clover *Trifolium striatum*, a few plants in short grass. The London Ecology Unit sent me a draft of a publication on this borough which included Mike Mullin's survey data; the most useful discoveries, being on ground not normally considered of botanical interest, were spotted medick *Medicago arabica* in St Mary's churchyard, Ilford, and bur chervil *Anthriscus caucalis* in South Park, Ilford. Trying to collect some records from TQ39, which remains our worst-recorded square for Atlas 2000, I confirmed that mat-grass *Nardus stricta* is still on Woodford Golf Course. I went on into Waltham Forest, finding a lot of *Valerianella carinata* on the up platform of Highams Park Station; the upper parts of the plants were covered in scurfy glandular hairs, making them look very different, but the fruit were diagnostic of this species. David Bevan told me that Brian Wurzell had found floating pennywort *Hydrocotyle ranunculoides* in a ditch on Walthamstow Marshes, the first record of this invasive alien from the Lea Valley. Also on the marshes John Archer and Mike Mullin found a patch of French meadow-rue *Thalictrum aquilegiifolium*, surrounded by meadowsweet *Filipendula ulmaria*, and a plant of dense-flowered fumitory *Fumaria densiflora* by a footpath. Both are likely to be new records for the vice-county, though there is a 1957 record of the meadow-rue from very near the border in Middlesex, and the fumitory can only be considered a casual.

The only 1997 records received from that part of the vice-county which is still Essex are Howard Matthews' report from the British Pteridological Society's visit to Warley Place on 14 September. The site was the garden attached to Ellen Willmott's house, and is now a nature reserve, protecting the unusual richness of garden relics there. The only pteridophyte which was new to the site was scaly male-fern *Dryopteris affinis* subsp. *borreri*, found by Tim Pyner.

V.C. 19, North Essex

There are no records this year from North Essex.

V.C. 20, Herts.

Mr Vaughan checked on some of his pre-1987 records for Atlas 2000. Bistort *Persicaria bistorta*, of obscure origin in a very ordinary bit of grassland at Totteridge, was more abundant than it had been in 1986. The other plant to mention from Barnet, though it is in the extreme eastern corner of the borough and so only just in this vice-county, is Robin Blades' sawwort *Serratula tinctoria*, which he first found by Waterfall Walk in 1996.

Only two records from the outer parts of Herts. in our area will be mentioned. Ray Eades' report of summer cypress *Bassia scoparia* by the M25 west of Junction 1 (Eades 1997) certainly refers to a locality in our area. Peter Ellison's records included golden-club *Orontium aquaticum* from a pond at the north-west corner of Chorleywood Common; this North American aroid may have been only planted there, but is surely one to watch.

V.C. 21, Middlesex

John Edgington's records include rustyback *Ceterach officinarum* and maidenhair spleenwort *Asplenium trichomanes* on the stretch of ancient wall in St Alphege's Gardens in the City of London. The curious thing about these records is that in 1980 on the same stretch of wall John Montgomery found two different small ferns, black spleenwort *A. adiantum-nigrum* and wall-rue *A. ruta-muraria* (Burton 1981: 92). Only hartstongue *Phyllitis scolopendrium* is on both lists. Perhaps the authorities responsible have been treating the wall as part

of the garden and growing ferns on it. Further finds at Buckingham Palace by Elinor Wiltshire and David McClintock account for most of the 1997 records from the City of Westminster; most remarkable was a no doubt casual plant of few-flowered fumitory *Fumaria vaillantii*. Mrs Wiltshire added to her list from Kensington Gardens especially by finding a vigorous patch of harebell *Campanula rotundifolia* near Buck Hill, perhaps the same place where it was collected by J. B. L. Warren in 1871 (Kent 197: 443); nearby fiddle dock *Rumex pulcher* reappeared after the cessation of mowing. The most interesting thing about the short-lived appearance of the ornamental fern *Adiantum raddianum* on a wall in Pimlico (Rumsey 1998) is that had been predicted by Kent (1975: 140). I found self-sown *Bidens ferulifolia* on the side of the road (there was no pavement) in St Ann's Street, Westminster, it is surprising that this attractive plant with rays of a good yellow, commonly grown in hanging baskets, has only been recorded as a casual once or twice before.

Most of the London Natural History Society's 1997 plant records from the Borough of Camden and Brent derive from the Society's Hampstead Heath Survey, reported on elsewhere in this issue. The main part of the Heath is in Camden, and surely the most unexpected plant found was a single pyramidal orchid *Anacamptis pyramidalis*, seen first I believe by Colin Bowlt. Mr Vaughan has I think hit on the explanation for this lime-loving species thriving in this and probably other lime-free areas where it has put in an isolated appearance: disused pits on the Sandy Heath were filled with debris from wartime bomb-sites which included a quantity of mortar rubble. Mr Matthews reported to me on ferns, which include scaly male-fern and soft shield-fern *Polystichum setiferum*. The extensive introduction of native species to the Heath has already been mentioned, and this is I think a comprehensive list, scientific names only to save space, and excluding species introduced less recently, such as *Cyperus longus*: *Alnus glutinosa*, *Calluna vulgaris*, *Centaurea nigra*, *Corylus avellana*, *Daucus carota*, *Erica tetralix*, *Euonymus europaeus*, *Frangula alnus*, *Galium verum*, *Ligustrum vulgare*, *Menyanthes trifoliata*, *Myrica gale*, *Rhamnus cathartica*, *Rosa canina* (often in very different forms), *Salix repens* and *Viburnum opulus*. *Arctium lappa*, *Senecio sylvaticus* and *Vulpia myuros* were perhaps introduced accidentally with other plants. Nodding bur-marigold *Bidens cernua* and the related naturalized species *B. connata*, not previously known so far from navigable waterways, were found near ponds on the Sandy Heath, and greater duckweed *Spirodela polyrhiza* and the increasing naturalized alien least duckweed *Lemna minuta* were found in them; as there is no recent history of these species there perhaps they too are a mixture of deliberate and accidental introductions. I am indebted for most of the information about 1997 plant records from the Heath to Mr Vaughan; not far from the Heath and just in Camden he found rustyback and other ferns in the grounds of Athlone House which is now a NHS convalescent hospital. Casual introductions in the area of the Heath, certainly independent of any planting activity, were *Phacelia tanacetifolia* 'probably escaped from a new wildlife garden' near the Information Centre, reported by Barbara Villiers, and an odd mixture of plants reported by Margo Nagle, most of them obviously from birdseed but including corn-salad *Valerianella locusta* and bur chervil, in a gully on Parliament Hill. Miss Villiers also mentioned strawberry clover in a mixture sown after the laying of a gas pipe. Joanne Colthup found pale galingale *Cyperus eragrostis* by the Regent's Canal near the Zoo.

The Hampstead Heath Extension is in Brent. The list of deliberate introductions here is *Campanula trachelium*, *Cornus sanguinea*, *Erica cinerea*, *Galium mollugo*, *Knautia arvensis*, *Lonicera periclymenum*, *Lychnis flos-cuculi*, *Malva moschata*, *Menyanthes trifoliata*, *Ononis repens*, *Potentilla argentea*, *Primula veris*, *P. vulgaris*, *Ranunculus lingua*, *Rhinanthus minor*, *Sanguisorba minor* subsp. *muricata*, *Silene dioica*, *S. latifolia*, *Trifolium campestre* and perhaps also *Ranunculus flammula*. Possibly inadvertent introductions are *Arctium lappa* and *Cardus crispus*. Mr Vaughan comments on the extensive areas of 'wild flower meadow'

created on the Extension, and on the differences between what was listed as having been sown and what actually came up, an observation previously made in a similar situation by Day (1990). Mr Vaughan speculates that *Convallaria majalis*, which he found near an old hedge-bank only about a hundred metres from Turner's Wood, where it was present as a wild plant in the early nineteenth century (Kent 1975: 512), might be a survival from the original population, especially as the wood had previously extended as far west as this point. Also in Brent, Leslie Williams sent me a list of plants from Gibbons Recreation Ground, Neasden, including lesser pondweed *Potamogeton pusillus*.

The occurrence of *Hydrocotyle ranunculoides* in the Lea Valley has already been mentioned. Our field meeting on 29 September found this among duckweed in Stonebridge Lock basin and nearby in the Lea Diversionary Channel, the first records for Middlesex. These localities are in the London Borough of Haringey, whose conservation officer David Bevan led the meeting. He and Brian Wurzell found a piece of stony ground on the east edge of Finsbury Park with characteristic small annuals like lesser chickweed *Stellaria pallida* and whitlow-grass *Erophila verna*. Mr Bevan told me that Mr Wurzell had found a plant of rustyback on old brickwork at Markfield Recreation Ground, South Tottenham. I could not find it when I went there myself later in the year, but did find *Cynosurus echinatus* which Mr Wurzell had listed in a notice on site, and marjoram *Origanum vulgare* on a concrete foundation, self-sown from a nearby herb garden. Two records from Islington should be mentioned, Mr Bevan's Hungarian vetch *Vicia pannonica* subsp. *striata* near Gillespie Park and Prof. Edgington's thorn-apple *Datura stramonium* by the canal at Hoxton.

Mr Allen's bramble discoveries in Holland Park are treated in a separate paper in this issue. The other records from Kensington & Chelsea are by John Latham, who revisited many plants in Kensal Green Cemetery for Atlas 2000, and also found dwarf spurge *Euphorbia exigua* and cut-leaved dead-nettle *Lamium hybridum* in Brompton Cemetery. Moving to Hammersmith & Fulham, Mr Latham reported compact brome *Anisantha madritensis* in its second year as a pavement weed in Hammersmith Broadway, and Dr Sheahan found cypress spurge *Euphorbia cyparissias* in Fulham Palace allotments. By an oversight on my part, the discovery of two plants of green spleenwort *Asplenium viride* at Ravenscourt Park Station two years earlier (Rumsey 1997), was not reported here, but may be mentioned now on the strength of Alison Paul's report that it was still there in 1997. The outstanding record from Hounslow in 1997 was made by Mr Hounsome on a well-known piece of derelict railway property; sand sedge *Carex arenaria* is obviously not native here, but it is certainly well established and it is a new plant for Middlesex. Dr Hare gave me a plant list from the Crane oxbows near Hatton, which included lesser spearwort *Ranunculus flammula* in a pool in a field.

Passing to the outer Middlesex boroughs, with Atlas 2000 in mind in Enfield I relocated still in quantity marsh arrow-grass *Triglochin palustre* and knotted bur-parsley *Torilis nodosa* near the Lea Navigation where they were found by Alan Leslie in 1980 (Burton 1981: 92). On the other side of the canal near the roundabout in Braithwaite Road was my new locality for dittander and near Ponders End I found a nice rural stretch of the old River Lea still with such plants as common club-rush *Schoenoplectus lacustris*. In Barnet, Mr Bevan showed me proof that *Nardus* still occurs on Hadley Green, and communicated to me that lesser marshwort *Apium inundatum* has reappeared on Monken Hadley Common after removal of *Crassula helmsii* from its pond. Mr Hounsome found several plants of Johnson-grass *Sorghum halepense* on the verge of the A1 in Hampstead Garden Suburb. Our only Harrow record this year is Mr Matthews' *Polystichum setiferum* north-east of the Clementine Churchill Hospital.

Moving to the west of the vice-county, Mr Bevan kindly gave me a copy of

his Proof of Evidence to the Heathrow Terminal 5 public enquiry, concerning the site where water avens *Geum rivale* had been found the year before. Additional plants bearing witness to the value of this site include meadow brome *Bromus commutatus*, common sedge *Carex nigra* and crested hair-grass *Koeleria macrantha*, the last-named found by Mr Mullin. Also in Hillingdon, Mr Ellison confirmed for Atlas 2000 that Forster's wood-rush *Luzula fosteri* still occurs in Park Wood (though not in Mad Bess Wood); he found a strange assortment of casuals near Ruislip Lido, including rough marsh-mallow *Althaea hirsuta*, meadow-foam *Limnanthes douglasii* and loose silky-bent *Apera spica-venti*. In the small part of TQ09 in this vice-county and borough Dick Walker found a casual plant of moth mullein *Verbascum blattaria* in a garden in Northwood and *Euphorbia characias* subsp. *wulfenii* seeded out of a garden in Springwell. Our meeting on 4 October found a rather dilapidated clump of Indian rhubarb *Darmera peltata* near a canal bridge at Denham Lock.

Parts of the historical county of Middlesex are not in any London boroughs, but are currently administered from the county towns of Hertfordshire and Surrey. In the Surrey part of Middlesex Mr Tymkow produced a plant list for Stanwell Place as a contribution to the Atlas 2000 records for TQ07; the less-common species are mostly waterside ones like orange balsam *Impatiens capensis* and skullcap. To the same end, Carol and Bill Hawkins confirmed the presence of many plants on Shortwood Common and Staines Moor, and in the latter locality Mr Hounsome found *Anthriscus caucalis*, which seems to be increasing in the area, and *Koeleria macrantha*. The bank near Halliwell Fisheries, Shepperton, which has produced interesting plants before for Mrs Nagle in 1997 had hairy buttercup *Ranunculus sardous*.

V.C. 24, Bucks.

Chad George confirmed the continued presence of toothwort *Lathraea squamaria* and other plants in Chalfont Park and *Luzula forsteri* in Oakend Wood. Mr Ellison found shining and round-leaved cranesbills *Geranium lucidum* and *G. rotundifolium* and bastard cabbage *Rapistrum rugosum* by the road to gasworks off the A413 near Tatling End. I spent a day in the Denham area, finding meadow-rue *Thalictrum flavum*, hemlock water-dropwort *Oenanthe crocata* and purple osier *Salix purpurea* near the River Misbourne, and viper's bugloss *Echium vulgare* of uncertain status by the bridge near Court Farm.

Acknowledgements

Dr Sheahan and Colin Plant provided me with expert help of different kinds, and Tony Barrett helped me with a reference. Many more people have supplied records for Atlas 2000 than those whom it has been possible to acknowledge individually.

References

ADAMS, K. J. 1977. *Ludwigia palustris* in Epping Forest. *Lond. Nat.* **56:** 18–19.
BERTRAND, N. 1997. Putting the wild back into wildflowers. *BSBI News* **77:** 46–48.
BIRKETT, J. 1992. Birds of South Norwood Country Park. *Lond. Bird Rep.* **56:** 136–150.
BURTON, R. M. 1981. Botanical records for 1980. *Lond. Nat.* **60:** 87–93.
BURTON R. M. 1996. Botanical records for 1995, with a note on computerization. *Lond. Nat.* **75:** 137–146.
CLEMENT, E. 1997. *Ludwigia* × *muellertii* Hort. new to Britain. *BSBI News* **77:** 54.
CLEMONS, L. 1998. The Tephritidae of Kent. Part 4: summary. *Newsl. Kent Fld Club* **34:** 5–14.
DAVID, R. W. 1983. The distribution of *Carex tomentosa* L. (*C. filiformis* auct.) in Britain. *Watsonia* **14:** 412–414.
DAY, R. 1990. The Horniman wildflower meadow the year after it was sown: a quantitative study. *Lond. Nat.* **69:** 27–34.
EADES, R. 1997. Has *Bassia scoparia* reached London? *BSBI News* **77:** 52–53.

EMMET, A. M. and HEATH, J. 1991 [1992]. *The moths and butterflies of Great Britain and Ireland.* 7(2). *Lasiocampidae—Thyatiridae, with life history chart of the British Lepidoptera.* Colchester.

KENT, D. H. 1975. *The historical flora of Middlesex.* The Ray Society, London.

MACPHERSON, P. 1997. Plant status nomenclature and Atlas 2000. *BSBI News* **77:** 7–8.

MACPHERSON, P., DICKSON, J. H., ELLIS, R. G., KENT, D. H. and STACE, C. A. 1996. Plant status nomenclature. *BSBI News* **72:** 13–16.

PERRING, F. H. and WALTERS, S. M. 1962. *Atlas of the British flora.* London and Edinburgh.

PHILP, E. G. 1991. Vascular plants and the beetles associated with them. *In* Cribb, P. W., ed., *A coleopterist's handbook,* Ed. 3, by Jonathon Cooter et alii. Feltham.

POLLARD, E. and YATES, T. J. 1994. *Monitoring butterflies for ecology and conservation.* London.

RUMSEY, F. J. 1997. *Asplenium viride* Hudson (Aspleniaceae) in Greater London. *Watsonia* **21:** 376–378.

RUMSEY, F. J. 1998. *Adiantum raddianum* Presl in London. *BSBI News* **78:** 60.

THOMAS, C. D. 1995. Ecology and conservation of butterfly metapopulations in the fragmented British landscape. *In* Pullin, A. S., ed., *Ecology and conservation of butterflies*: 41–63. London.

Book reviews index

The London Naturalist

Instructions to contributors

Submission of papers

Papers should be submitted **in duplicate** to the editor, Mr K. H. Hyatt, at (preferably) his home address, or c/o Department of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD, before the end of January if they are to be considered for publication in the same year. However, the editor may be contacted at any time 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. Manuscripts should be typed **double spaced** 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.** The editor would be pleased to receive contributions as ASCII files on disc (either $3\frac{1}{2}''$ or $5\frac{1}{4}''$) in IBM-compatible format as well as in manuscript as above. 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.

Text

Locality spellings should follow the latest editions of the 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, and **only** Latin names of genera and species must be underlined. 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 under 100 should be in words, except in a strictly numerical context. Dates in the text should follow the logical sequence of day, month, year, i.e., 25 December 1971, but in lists 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, alphabetical or numerical order. **Hyphens should not appear at the end of lines** as the right-hand margins of manuscripts do not need to be justified. **Tables 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. Book titles should also be underlined.

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.

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 or Letraset. 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.

Offprints and reprints

Up to 25 free, unbacked offprints will be supplied on request. Additional copies may be purchased if ordered when the proofs are returned.

Backed and folded, wire-stitched reprints, with or without covers, may be purchased by authors following consultation with the editor.

c/o The Natural History Museum, Cromwell Road,
London SW7 5BD

£6 Published October 1998