PART I No 665

# INVERTEBRATE SITE REGISTER

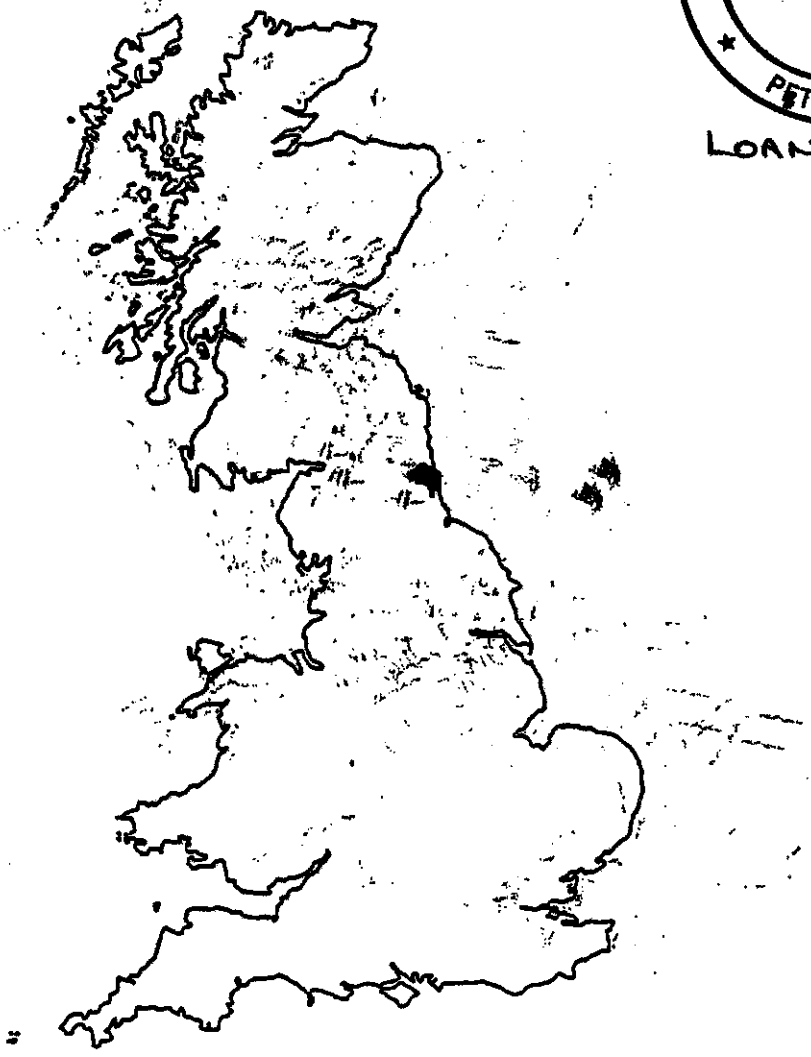
Report number 70 Part I
In confidence

September 1986

## Review of the Invertebrate sites in England
## Tyne and Wear

Stuart G. Ball





NATURE CONSERVANCY COUNCIL
Chief Scientist Directorate
Northminster House, Peterborough PE1 1UA

## CONTRACT REPORTS

**Report number** 665

**File number** 55 / 05 / 60

**Contract number** -

**Date received** 2 Oct 1986

**Report title** ISR 70: Review of Invertebrate Sites in England: Tyne & Wear
Part I + II

**Contract title** Invertebrate Site Register

**Contractor** Stuart G Ball

**Comments**

**Restrictions** In Confidence

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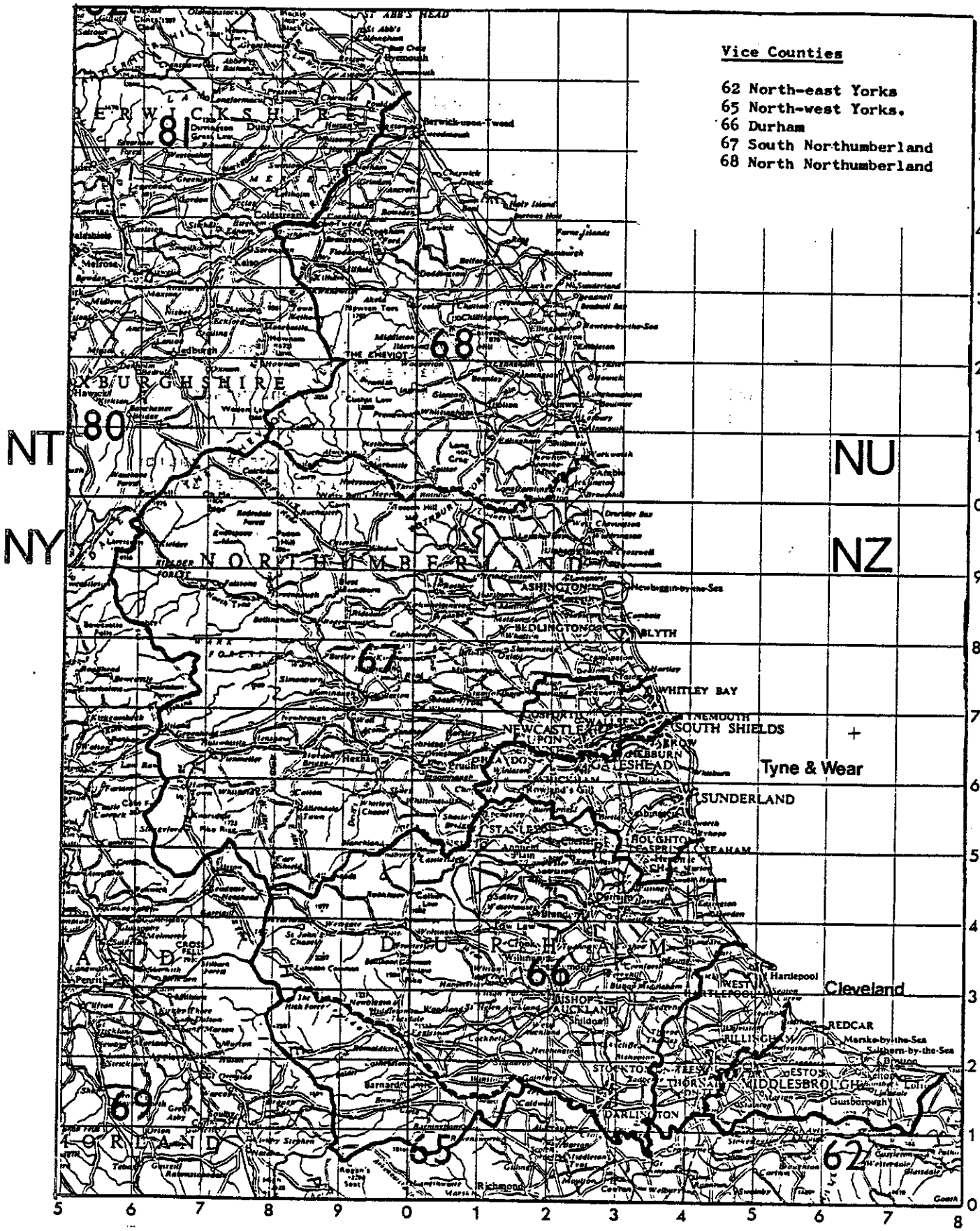
Sandy Collinge - for the file

## CONTENTS



**Note:** A summary of the rare, notable and local species included in this report and the sites at which they have been recorded will appear in a separate report (ISR report number 72) which will cover the whole North-east (ie counties Cleveland, Durham, Tyne & Wear and Northumberland).




Relationship between the Watsonian Vice-counties and the post 1974 County boundaries in North-east England.

## Aims of the Invertebrate Site Register

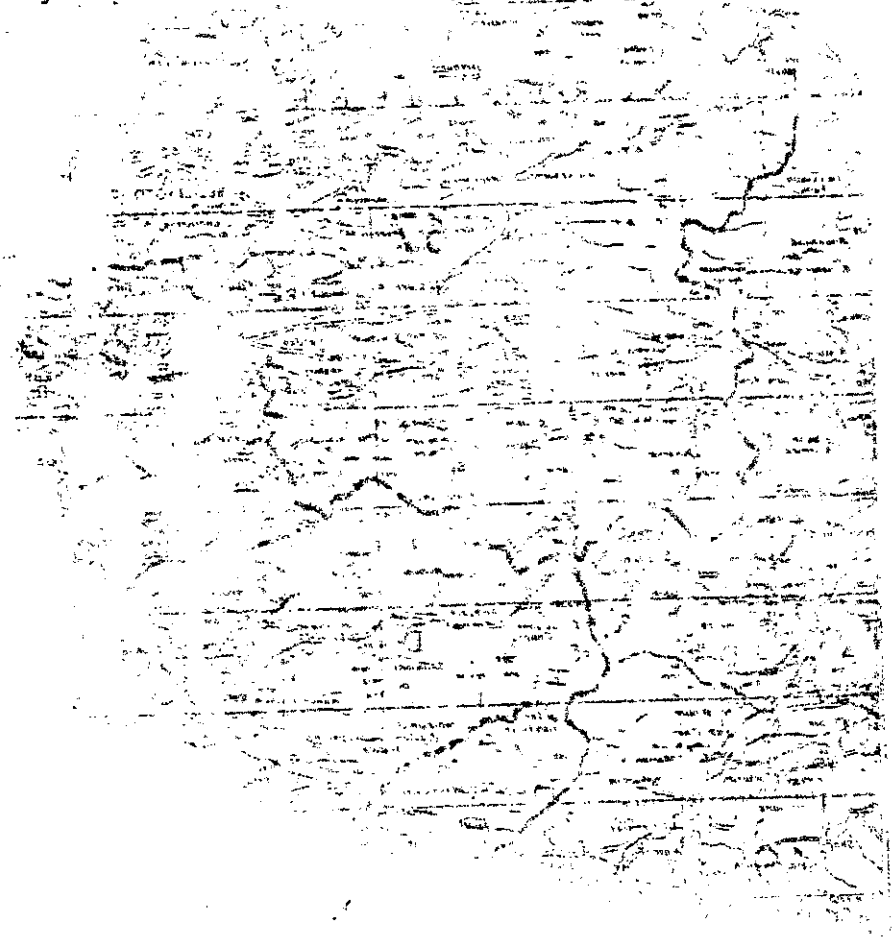
i. To identify, document and evaluate sites of importance for the conservation of invertebrates in Great Britain.

ii. To provide a clear statement on the invertebrate fauna of individual sites which can be used to strengthen the scientific basis of site defence and for planning site management compatible with retaining the fauna.

iii. To maintain up-to-date statements on the national and regional status, ecology and conservation of British invertebrate species.

iv. To increase liaison between invertebrate zoologists and NCC staff at all levels and facilitate the interchange of advice and information, particularly so that future survey effort can be encouraged where it is most needed.

v. To supply progress reports on invertebrate conservation to invertebrate zoologists and other interested individuals and bodies.



## Invertebrate recording in Tyne & Wear and sources of information

### History of recording in Tyne & Wear

The county of Tyne and Wear was created by local government reorganisation in 1974 and includes the south-east corner of the old county of Northumberland and the north-east corner of old Durham. This area is rather well recorded because most naturalists who have lived in the north-east of England in the last 150 years have been based in or around Newcastle for at least some of their career.

G Wailes was one of the earliest workers in the area (1830s) and some of his specimens still exist although the localities are vague (eg. 'Newcastle'). His collection was auctioned after his death and a large portion was bought by P B Mason and, following his death, ended up in Bolton Museum. Other specimens have found their way to the Hope Department, Oxford and to York Museum.

In 1846 the Tyneside Naturalist Field Club was formed, but fairly quickly amalgamated with the Natural History Society of Northumberland and Durham. This was the mainstay of local recording until the early 20th century.

During this period J Hardy and T J Bold were amongst the most active local recorders and published a great deal culminating in a three part catalogue of the Coleoptera of Northumberland and Durham published in 1850 and 1852. Hardy was a school teacher in Gateshead in the 1840s, but in later life returned to his native Berwick. In the 1870s he revised the Coleoptera catalogue and published a series of county lists for the Heteroptera, Homoptera and Hymenoptera.

Bold was a clerk in a corn merchants in the Bigg Market, Newcastle. From the mid 1850s he lived in Long Benton and most of his recording was carried out in the area of Benton and the Ouseburn (probably the lower part which is now culverted), and he also produced many records from Prestwick Carr and Gosforth.

In the later part of the 19th century, recording was continued by G B Walsh who lived in Jarrow and published most of his records in the newly established journal of the Northern Naturalist Union: 'Vasculum'.

The 19th century records of Lepidoptera were catalogued by J E Robson of Hartlepool. He died in 1907 before the project was completed, by which time two parts covering the macro-Lepidoptera had been published in 1898 and 1902 (Trans. Nat. Hist. Soc. of Nthmblnd. and Durham, Old Series). The final two parts, covering the micro-lepidoptera, were completed by J Gardner, a timber merchant in Hartlepool, and were published in 1913.

The leading local Dipterist of the late 19th century was Rev J W Wingate who lived in Bishop Auckland, but clearly visited Tyneside quite frequently since he had many records from Gibside. His 'Durham Diptera' (Wingate, 1906) was a mammoth work including not only all his local records, but also a key to most of the British Diptera known at the time. Wingate's collection is in the Hancock Museum and, given that there are nearly three times more species known currently, appear to be correctly determined.

D Rosie gave two small collections of Diptera to the Hancock Museum in 1915 and 1921. None of the material is identified and most bears no data labels, but from the few locality labels that are present it seems that

most of his collecting was done in the west end of Newcastle and around Winlaton Mill in the Derwent Valley.

Another major Dipterist, W J Fordham, lived at Whinney Park House, Low Fell, Gateshead where he was TB control officer, and published local records during the 1930s. He updated Wingate's list in 1945 at about the time he moved to Yorkshire. His collection was destroyed in the last war but some of his diaries and record cards exist and are held by P Skidmore (YNU Diptera recorder) at Doncaster Museum.

At around the same time an extensive collection of Aculeate Hymenoptera was made by J E Ruxton who lived at Shotley Bridge in the Derwent Valley and collected throughout the valley and also in the lower Tyne. Ruxton's collection is also in the Hancock Museum and has been recently checked by D A Sheppard.

The arachnologist Rev. Dr J E Hull lived in the Chopwell area and was active from the end of the 19th century until his death in 1960 at the advanced age of 96. He wrote a book on British Spiders which was never published because there was considerable doubt about the characters he used to recognise species, and many of the new species he described were not accepted by other workers in the field (although a number have subsequently been re-discovered and are now accepted). A substantial part of his collections are in the Hancock Museum. (See notes by G A Fenwick and J R Parker in Br. Arachnol. Soc Newsletter 6:2-4, March 1973)

From the 1920s to the 1960s local recording was dominated by Prof. J W Heslop-Harrison and R S Bagnall. Heslop-Harrison started his professional career as a science master in Middlesborough and was eventually professor of Botany at Durham University. He lived in Birtley for most of his life. He recorded most groups and travelled very widely in the area, but published a great many records for the Team Valley around his home. Most of the sites he knew have now gone. He was editor of the Vasculum until the mid 1960s and published a great deal of local material in its pages, but also in national journals. His collection has been broken up and is now widely dispersed in museums and private hands. Most of his diaries and records were destroyed.

R S Bagnall, a man of private means, was a leading recorder in the Tyneside Field Club in the 1910s covering many obscure groups such as mites and Pseudoscorpiones. In later years Bagnall and Harrison became interested in the Cecidomyiidae (gall midges) and published a huge tome on this group in 1934. Rather little has been done on these obscure flies since, making these records difficult to interpret. Bagnall left the area in the 1940s and subsequently worked at the Hope Department.

Care is needed when dealing with Bagnall and Harrison's publications because doubt has been expressed about the authenticity of some of their records.

G C Varley was a reader at Kings College (later to become Newcastle University) in the 1940s and, although he published very little in the way of local records, there is a certain amount of material he collected in the Hope Department, Oxford.

There was little activity in the period between 1956 and 1965 until the University of Newcastle set up a field station for its Agricultural Biology Department at Close House on the Tyne. A succession of staff and students have passed through this department, notable Dr M L Luff, who has been a lecturer there since 1966, Dr G N Foster (late 1960s early 1970s), Dr M Cox (early 1970s), Dr D A Sheppard (1970-1980), Dr S G Ball

(1975-1985) and currently M D Eyre, Dr S J Rushton and Dr G R Port. A small number of entomologists have also been based at the Zoology Department at the University - notably Dr I J Wallace.

Dr M L Luff is the national recorder for ground beetles (Carabidae) and did a considerable amount of local recording in the late 1960s and early 1970s. Currently, with M D Eyre and S J Rushton, he is carrying out a widespread pitfalling survey of Carabidae and spiders which includes several sites in Tyne & wear.

Dr G N Foster in the national recorder for waterbeetles and during his time at Close House did a great deal of local recording, especially in the west of Northumberland, but also locally including Ryton Willows and sites in the Derwent Valley.

Dr M Cox is the national recorder for leaf beetles (Chrysomelidae) and did a certain amount of local recording.

Dr D A Sheppard was one of the most active recorders in the area in the 1970s, initially with a special interest in Lepidoptera and later Hymenoptera, especially sawflies and ants. In the late 1970s he carried out an extensive survey of sites in the Derwent Valley with M D Eyre.

Dr S G Ball recorded Diptera at a restricted number of sites in the late 1970s and early 1980s and identified material from other workers, notably D A Sheppard and M D Eyre. In 1976-78 he was involved in a survey of Thornley Wood and in 1984 of Shibdon Pond.

M D Eyre initially went 'mothing' with D A Sheppard and later developed interests in other groups, notably the lacewings (Neuroptera) and booklice (Psocoptera). Consequently these groups were very well recorded during Sheppard and Eyre's Derwent Valley survey. The local Neuroptera were reviewed by Eyre(1983) and his Neuroptera collection is now in the Hancock Museum. In the early 1980s he carried out a series of surveys, mainly of Coleoptera, with M Walker which included Gibside, Thornley Wood and Gosforth Park. From about 1982 he became interested in waterbeetles and carried out a very extensive survey in the eastern part of the region which complimented G N Foster's work in the west. This led to several publications including a review of the North-east fauna (Eyre and Foster, 1984) and an atlas (Eyre, Ball and Foster,1985). Recently he became interested in analysis of the data provided by such surveys and is currently involved in the pitfalling survey of ground beetles and spiders mentioned above. Most recently, in collaboration with Luff, he has produced an atlas of the ground beetles (Carabidae) (Eyre, Luff and Ball, 1986).

Dr I J Wallace is the national recorder for caddis flies (Trichoptera) and was a PhD student in the Zoology Department at Newcastle University in the 1960s and early 1970s. His family live in Northumberland and he continues to take an active interest in the area. His local recording included the ponds in the Tyne valley such as Shibdon, Ryton Willows and Sled Lane.

C Reid was a student in the Agricultural Biology Deptartment from 1981 to 1984 and was a very good field entomologist specialising in beetles, especially Staphylinidae. He did a great deal of local recording and determined material collected by others. He is currently in Australia carrying out research for a PhD thesis.

## Collections of records held by local entomologists

Extensive sets of data are held by individuals who have collated information on various groups, usually for the whole of North-east England (Watsonian Vice-counties 66, 67 and 68). The following were the main sources of records included in this report:

Lepidoptera: Dr J D Parrack (for Northumberland), T C Dunn (for the whole area including most of J D Parrack's records). The records for the old county of Northumberland, including Tyne & Wear north of the Tyne, have been computerised by the Hancock Museum in a system called 'Lepsite' on the University's mainframe computer using the database 'Spires'. Unfortunately, because of design and implementation problems this is not very useful.

Coleoptera: M D Eyre. Includes records from literature and collections and the local records from M L Luff, G N Foster and M Cox's national recording scheme and also C Reid and M Walker's records.

Neuroptera, Psocoptera, Hemiptera-Heteroptera: M D Eyre. Includes his own and literature records. These records have been computerised by S G Ball on an Apple IIe system.

Hemiptera- Auchenorhyncha: M D Eyre. Includes records from D A Sheppard and G Forester. (Some records from G R Port are not incorporated.) These records have been computerised by S G Ball on an Apple IIe system.

Hymenoptera: D A Sheppard. Includes his own records and those from collections and the literature. Not updated in the past few years. These records have been computerised by S G Ball on an Apple IIe system.

Diptera: S G Ball. Includes his own records and those from the literature, also the Trechman Collection at Sunderland museum in part, recent material from T C Dunn, J D Parrack and G Simpson (mostly det SGB), the Castle Eden Dene collection (mostly det P Skidmore), extensive collections of Tipulids made by D A Sheppard (det A E Stubbs) and records from J Robinson, W A Ely and J H Cole. These records have been computerised by S G Ball on an Apple IIe system.

Odonata: S G Ball. His own records and those from the literature and collections. Also records from many others including H Church, P Corkhill, J Durkin, D McCutcheon, M Rebane, N Jackson, J D Parrack, J Richards and T C Dunn. These records have been computerised by S G Ball on an Apple IIe system.

Mollusca: R H Lowe. Mainly VC66 records.

## NCC files

Invertebrate information was extracted from the site files in the NCC's regional office in Newcastle.

## County Conservation Trust

The modern county is covered by two trusts: Durham County Conservation Trust south of the River Tyne and the Northumberland Wildlife Trust north of the river.

Invertebrate information was extracted from the site files held by both trusts covering their own reserves and other sites in which they have an interest.

Both trusts have embarked upon invertebrate surveys using Manpower Services Commission funding in recent years. The NWT had a pitfalling scheme to look at fauna on some of their reserves in 1977, but the only site in Tyne & Wear was Gosforth Park. The Coleoptera were determined by M L Luff, the few Hymenoptera by D A Sheppard and the Diptera by S G Ball.

The DCCT's insect survey was carried out in 1981 and 1982 and covered a very large number of sites in VC66 including several in Tyne & Wear. The material collected in 1981 was sorted and distributed to experts nationwide and most of it has now been returned. A report was published by DCCT in 1983, but a good deal of material has been returned since so this is now out of date. S G Ball produced an update on the Diptera in 1986. The 1982 material has been sorted to major groups and distributed to M D Eyre (Coleoptera and minor orders), D A Sheppard (Hymenoptera) and S G Ball (Diptera) for further sorting and distribution to experts but, it will be some years before the task is completed.

The material is held at Sunderland Museum (in spirit). Some of the determinations (mainly Coleoptera) undertaken by C Bruce and D A Woodfall have proved to be unreliable, but some of the material has been checked by M L Luff who has re-done the Carabidae.

**Local museums and record centre**

The area is covered by two local record centres: the Durham Biological Record Centre based at Sunderland Museum and Art Gallery, and the Northumberland Biological Record Centre based at the Hancock Museum. Neither hold a great deal of invertebrate information and what they do have is largely extracted from the local literature and is therefore available elsewhere. The accuracy of identification of the collections has not been examined recently although the Aculeate Hymenoptera at the Hancock have been checked and incorporated into a single sequence by D A Sheppard.

**Literature**

Little effort was put into direct literature searches since most of the work had been done already by the individuals listed above in collating the local records.

## Coverage of various invertebrate groups

**Odonata** (Dragonflies)

The Odonata is a group in which recently published identification guides have provoked increased interest and there has been extensive local recording notably by J Durkin, D McCutcheon and S G Ball. C Bruce is now acting as local recorder for this order.

Five species of damselfly (*Ischnura elegans, Pyrrhosoma nymphula, Lestes sponsa, Coenagrion puella, Enallagma cyathigerum*) and three of dragonfly (*Aeshna cyanea, A. juncea, Sympetrum striolatum*) can be expected to occur at almost any pond in the county.

*Cordulegaster boltonii* is recorded occasionally, probably as wandering individuals. Heslop-Harrison recorded *Brachytron pratense* from Gibside, and *Sympetrum danae* from Birtley and although neither have been found recently in Tyne & Wear both occur in the North-east. He also recorded *Aeshna mixta, Sympetrum sanguineum* and *S. flaveola* as migrants. *Coenagrion pulchellum* has been recorded occasionally throughout the region and there is a 1960s record for Gosforth Park and a recent one for Big Waters. Considerable care is needed in the determination of this species.

**Orthoptera** (Grasshoppers and Crickets)

Very poorly represented locally with only two species of grasshopper being abundant, the common green (*Omocestus viridulus*) and common field (*Chorthippus brunneus*), and the ground hopper (*Tetix undulata*) being found occasionally and overlooked frequently.

**Neuroptera** (Lacewings)

Due to the efforts of M D Eyre, the North East is one of the best recorded areas in the country. Many species are particularly associated with conifers (especially Scots Pine and Larch) where the larvae feed on various soft-bodied insects like aphids. Two species, *Drepanepteryx phalaenoides* and *Sympherobius elegans* are particularly associated with old deciduous woodland and have been recorded at a number of the better woodland sites in the region.

**Heteroptera** (Bugs)

The water bugs and the plant hoppers (Homoptera-Auchenorhyncha) are reasonably well recorded but terrestrial Heteroptera records are rather scanty. Few nationally rare species are likely to occur in Tyne & Wear.

**Lepidoptera** (Butterflies and Moths)

Butterflies are one of the best recorded groups in the area because many naturalists take an interest in them. This also causes problems because a great many mis-identifications occur. A recent publication of Gateshead Education Department, 'The butterflies of Gateshead and North-east England' by S G Ball summarises the local status of butterflies.

The macrolepidoptera are also reasonably well known and there was a considerable amount of recording in the 1970s by D A Sheppard, M D Eyre etc. especially in the Derwent Valley. A moth trap has been operated on occasions for many years at Gosforth Park by the Natural History Society. R Henderson has also had a long standing interest in the Chopwell area. Recently wardens employed by Gateshead MBC based at the Thornley

Woodlands Centre, and employees of the Wildfowl Trust at Washington have been light trapping on their sites.

An up to date summary of the status and distribution of macrolepidoptera in north-east England by T C Dunn and J D Parrack is currently in press. ('The Moths and Butterflies of Northumberland and Durham: Macrolepidoptera', published by NNU, due Nov 1986)

The microlepidoptera are much less well recorded with the majority of information coming from D A Sheppard and M D Eyre's Derwent Valley survey. D A Sheppard also did some recording at Gosforth Park.

Coleoptera (Beetles)

Historically the area is very well worked with extensive lists for some popular sites, notably Gibside, and other areas in the Derwent Valley. More recently the waterbeetles and ground beetles (Carabidae) have been well recorded but other families rather more casually. In recent years records come from M Walker and M D Eyre in the early 1980s who pitfalled at Gosforth Park, Gibside, Thornley Woods etc.; from M D Eyre's waterbeetle survey which covered many sites in 1982-3; from C Reid who visited many sites in the period 1982-4 recording Staphylinids especially, but also other families; from Shibdon Pond in 1984 (det. M L Luff), and from the current pitfalling survey being carried out by staff from Newcastle University.

The distribution of Waterbeetles and ground beetles in the north-east has recently been summarised in two atlases (Eyre, Ball and Foster, 1985; Eyre, Luff and Ball, 1986). These give tetrad maps for all but the rarest species.

Diptera (Flies)

Wingate(1906) includes many records for Gibside and some from Axwell Park, Marsden etc. Fordham published extensive lists for the grounds of his house in Gateshead. The works of Bagnall and Harrison include a great many local records, especially for sites in the Team Valley, but since these cover the gall midges (Cecidomyiidae) almost exclusively, they are very difficult to interpret because virtually nothing else, apart from their work, is known about the biology and distribution of these flies. Lewis Davies' collection includes some material from South Shields and Boldon Flats.

Many of the Diptera records are recent ones from S G Ball and come from the Derwent Valley, especially Thornley Wood, and the Tyne Valley ponds, especially Shibdon Pond where an extensive survey was carried out in 1984.

Most of the records of crane flies (Tipulidae) derive from specimens taken at light by D A Sheppard and passed to A E Stubbs for identification.

A large number of records was also generated by the DCCT insect survey. The specimens were examined by many national experts.

There has been an upsurge in interest in the Diptera, particularly the Syrphidae since the publication of an identification guide (Stubbs & Falk, 1983) and a number of new recorders have emerged, notably G Simpson a forest ranger employed by the Forestry Commission. He has started collecting hoverflies on FC land including Gibside and Chopwell.

**Hymenoptera** (Sawflies, Ants, Bees and Wasps)

Apart from the early work by Ruxton which was mainly in the upper part of the Derwent Valley outside Tyne & Wear, virtually all the records come from D A Sheppard who took an especial interest in sawflies (Symphyta), bumblebees and ants, but also recorded other aculeates less intensively. Heslop-Harrison published a great many records of gall forming sawflies, but like the gall midges, these are very difficult to assess because very little is known of their distribution.

**Molluscs** (Slugs and Snails)

R H Lowe has had a long standing interest in this group and has frequently published records in the Vasculum. His data has recently been deposited at the Hancock Museum and an atlas is planned following the same format as those already published for the waterbeetle and ground beetles. There has recently been an upsurge of interest in the slugs organised by N Jackson, and D McCutcheon has been active locally.

**Arachnida** (Spiders, Harvestmen etc.)

Although the area is well worked historically and there are early, published lists for the Derwent Valley in the Transactions of the Tyneside Naturalists Field Club, there has been very little recording since the turn of the century until very recently.

During his time in Cleveland D Horsfield specialised in this group and he visited other sites in the North-east including Shibdon Pond. He also determined material collected by the DCCT survey in 1981.

Spiders are now being actively investigated as part of the pitfalling survey being carried out by staff of the Agricultural Biology Deptartment at Newcastle University. S Rushton is determining the material.

**Other non-insect groups** (Woodlice, Centipedes, Millipedes etc.)

Apart from a little recording by N Jackson at Gibside and Windy Nook and a few records from D McCutcheon there is little information on these groups.

**Aquatic invertebrates**

The dragonflies and waterbeetles have already been mentioned. Other insect groups with aquatic larvae such as mayflies and stoneflies are poorly know. Water bugs have been reasonably well worked but most of the species found locally are very common, and being highly mobile, are likely to be found at any wetland site. Some other information comes from the survey of Great Crested Newt sites carried out by D Green for DCCT.

A survey of the Rivers of Northumberland and Durham was carried out by J D Sadler and T J Booth in 1976/7, but only the Northumberland part was written up (Sadler & Booth, 1978). However part I of their report contains a very useful literature survey and summary of the aquatic invertebrates recorded in the area's rivers.

## ISR Site evaluation criteria

Invertebrate recording is a rather specialised skill which tends to involve few individuals in any one area. Consequently both the groups covered and the quality and quantity of information varies greatly between sites depending very largely on chance factors such as who happens to have visited the site and for how long. Most information collected by the ISR comes from general biological recording carried out for reasons other than nature conservation together with some larger scale surveys some of which are specifically designed for conservation purposes.

The ISR also does not seek to collect full information about a site, but asks for the 'best' species only. Increasingly the best species are being defined in terms of Red Data Book, Nationally and Regionally Notable categories, but local naturalist are left to make the initial selection of data which is passed to NCC.

The information collected by the ISR about a wide range of groups, which varies in quantity and quality, makes any rigorous attempts at site evaluation impossible and the evaluations that are arrived at are largely subjective. The entomologists employed by the ISR must use their knowledge of invertebrates and the county being reviewed to compare different groups of organisms and to correct for different recording intensities, to identify and filter out dubious records, and to assess which sites would make a contribution to the SSSI series in terms of adding or strengthening habitat or rare species representation.

Sites are placed in one of five grades:

A Sites of national importance for invertebrate conservation, equivalent to NCR status on the grounds of invertebrate interest.

B Sites of regional importance for invertebrate conservation, equivalent to SSSI status on grounds of invertebrate interest.

C Sites which might potentially be graded A or B, but lack sufficient information to justify these gradings. Such sites are identified on the grounds of their habitat structure or because interesting species have been found with little recording effort. These are sites which require further survey.

D Sites where sufficient information is available to indicate that they are not of national or regional importance, but which maybe of local importance, especially in otherwise inhospitable areas.

? Ungraded sites. These include sites recommended to the ISR without supporting species information, sites mentioned in the literature which cannot be identified by present day entomologists, sites for which too little information is available to make any sensible grading, and localities with particularly interesting records which for various reasons cannot be considered as sensible sites for invertebrate conservation.

The criteria which are considered when assigning these grades are as follows:

i. The presence of rare species

Currently the British Red Data Book, Part 2, Insects (ed. D B Shirt) is in press. This covers many orders of insects but does not include Microlepidoptera, Sawflies, Mayflies, Stoneflies, Lace wings, Hemiptera-Homoptera and some other small orders. Provisional lists of Red Data Book species for several of these groups and many non-insect Invertebrates have also been prepared. Work on a non-insect invertebrate Red Data Book has recently commenced.

National species reviews, which identify nationally notable species, have been completed for Dragonflies, Butterflies, Molluscs, Macro- and Microlepidoptera and Orthoptera and are underway for Diptera and Coleoptera. Provisional lists of nationally notable species have also been produced for spiders and some other non-insect groups.

When assessing the rarities present on a site, its geographical position must be taken into account. Regionally notable species have been identified for some well-known groups of organisms in northern England and Scotland by specialists working in these areas.

While the presence of rare species should not be the only criterion used in evaluating sites it does give, in the absence of quantifiable information, some measure of the invertebrate interest of the site.

Those rare species whose biology is at least partly understood can be conserved by protecting the sites where they occur and ensuring the continuity of suitable management on these sites.

ii. Species richness and diversity

Species richness is a measure of the number of species present on a site. For many invertebrates it is not, and probably never will be, possible to record all the species present and this will change with time anyway. There are a few of the larger most easily recorded groups such as Butterflies, Dragonflies and Orthoptera for which a total species list can be achieved and for which species richness criteria have been defined. As the number and skill of recorders increases it is probable that some other groups will fall into this category.

Measures of diversity attempt to take into account the distribution of individuals between the species present in a sample, giving the highest value to an even spread, and are only applicable to quantitative data.

Whilst high diversity is intuitively a desirable characteristic of a conservation site, its measurement is fraught with difficulties, especially because of the artificially high diversity which can arise because of 'tourist' elements in the fauna. These can be defined as species which will be found anywhere but which do not breed or are not otherwise dependent upon the site concerned. It must also be borne in mind that some habitats are naturally species poor when undisturbed by man.

iii. Representativeness

The prime consideration in selecting any site for conservation on the grounds of its vegetation is likely to be that it is a good representative of its habitat type - meaning that it contains a full range of the community types and species one would expect to find on that type of site in that area. As yet the application of this concept to invertebrates is poorly developed because the normal fauna of most habitats has yet to be documented and the habitat affinities of a great many species are poorly known. It is also an extremely difficult concept to quantify and the techniques applied to the vegetation have only just started to be used with invertebrates.

iv. Habitat representation

Attempts have been made to include the best examples of each habitat type for invertebrates present in the county. Habitat categories defined for the NCR and NVC do not necessarily conform to the habitat preferences of invertebrates and are rarely used by the local naturalists who are the main contributors of invertebrate information. Particular emphasis is given to microhabitats which are of special importance for invertebrates and to those which are easily damaged and to habitat mosaics.

Emphasis is also given to habitat types which may support very distinctive invertebrate communities of conservation importance (eg. river shingles, soft rock cliffs), but may not have been recognised as being important in surveys carried out by personnel with other biological interests.

v. Area

Area is considered when comparing similar sites. On balance the bigger a site the more likely it is to be able to hold viable populations of rarer species and to offer continuity of scarcer microhabitats and long-term stability of management.

vi. Potential

Many sites have received little more than the most rudimentary coverage for many groups of invertebrates. If interesting species have been found with little effort, suggesting that good populations exist, or a competent field worker has reported that good invertebrate habitat is present, then the site can be regarded as having good potential and will generally have been graded C.

vii History of recording

Sites that have been particularly well worked in the past have been included even if most of the records are very ancient. If the habitats of interest have survived on such sites, even as small remnants, it is not unusual to find that elements of the fauna have also managed to persist and may merit a C grading. Only post 1950 records have been used to calculate the Invertebrate Index (see below).