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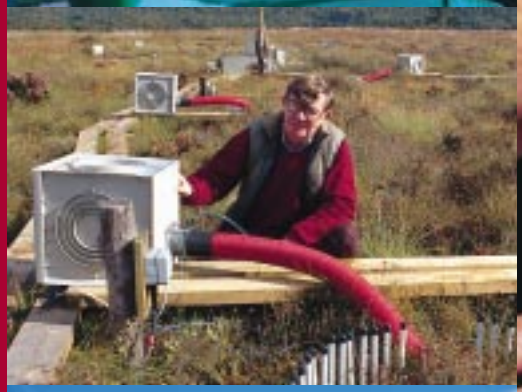
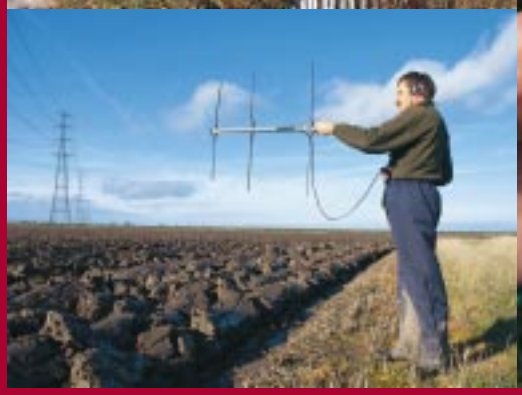
Invertebrate assemblages on English SSSIs

English Nature Research Reports





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English Nature Research Reports

Number 618

Invertebrate assemblages on English SSSIs

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Summary

1. Data from English Nature's Invertebrate Site Register, SSSI citations and the English Nature Site Information System (ENSIS) were used to identify assemblages of invertebrates on SSSI for which invertebrate interest had been recognised in the citations or ENSIS.

2. Assemblages were defined using predominantly well recognised habitat terms. These terms were organised into a hierarchy of three levels. A total of 133 terms were used at the second and third levels, and the number of assemblages recognised exceeds this when the terms were used in combinations. The importance of assemblages was assessed as national / international, regional or county / local.

3. Of the 1028 sites investigated, 885 had sufficient data to allow at least one assemblage to be identified. The average number of assemblages per site was 3.1, ranging from 1 to 10.

4. Assemblages with a high representation in the results were those associated with grasslands, mature woodland, fen and marsh (the latter two mainly represented in features such as ponds and ditches). A few assemblages appeared to be particularly poorly represented, notably shingle and dune assemblages. There appeared to be a strong bias towards habitats that are well represented in the SSSI series, and this probably skews the real distribution of invertebrate assemblages, particularly those regarded as important by entomologists.

5. Owing to differences in the approach taken by the four authors and to the sparseness of the data, it was not possible to rank counties or English regions.

6. Despite shortcomings, this approach is regarded as an important step forward in assessing the invertebrate interest on SSSI, especially in moving away from taxonomic assemblages (eg an assemblage of hoverflies) with low ecological meaning.

Contents

1. Introduction

One of the key responsibilities of the statutory nature conservation agencies in the UK is the identification and protection of a series of sites intended to conserve important wildlife and earth science features. In England these are called Sites of Special Scientific Interest (SSSIs). The statutory nature conservation agency's responsibilities now also include the monitoring of such to assess condition and inform management. In England this agency is English Nature. The Government has set a Public Service Agreement (PSA) target to have 95% of England's SSSI area in favourable or recovering condition by 2010.

The UK's statutory nature conservation agencies and the Joint Nature Conservation Committee are developing Common Standards Monitoring guidance for the nature conservation features of designated sites, including SSSIs (www.jncc.gov.uk/csm/default.htm). Within the framework of Common Standards Monitoring English Nature is currently developing site specific conservation objectives to monitor the condition of sites and their features.

Invertebrates often form part of the notified interest of SSSIs. The current Guidelines for selection of biological SSSIs (NCC 1989) give site selection requirements for invertebrates as:

- representation of rare and scarce invertebrate species (Schedule 5 invertebrate species, Red Data Book invertebrate species and Natonally scarce and regionally scarce invertebrate species);
- invertebrate species assemblages;
- nationally rare butterfly species;
- endemic butterfly races (Red Data Book category 5);
- natonally scarce butterfly species;
- butterflies which have experienced substantial local declines; Nationally rare and scarce *Odonata* (dragonflies and damselflies);
- outstanding *Odonata* assemblages.

Perhaps owing largely to the stress laid on rarity in assessing sites for their invertebrate interest, it is unusual to find assemblages of invertebrates mentioned in SSSI citations in the ecological sense with which plant ecologists are familiar. Taxonomic 'assemblages' are sometimes mentioned, especially those of butterflies and dragonflies, but not ecological groups of species sharing the same environmental conditions. Or the species may have become high-profile through programmes such as the BAP. In other cases, the species mentioned on citations are selected as representatives from long lists, and in themselves may not be worth monitoring. This provides a few problems when monitoring the interest. For example, once-rare species may become genuinely more common due to climate change, or extinct over large areas, thus their presence or absence has nothing to do with how well the SSSI is managed.

A more robust basis for monitoring is provided by ecologically based assemblages, since these will include the entire spectrum of species from rare to common, and can include species from

all ecologically well understood taxonomic groups. This approach is hardly free of its own problems, but is a step forward in monitoring invertebrates on SSSIs.

The report was commissioned to identify invertebrate interests on SSSI. The scope was confined to 876 SSSI where invertebrates were listed in the English Nature Site Information System (ENSIS, the SSSI database). They include most sites where invertebrate interest is mentioned in the SSSI citations. This is a small proportion of the 4112 SSSI in England.

The aims of this report are to devise a list of habitat-based assemblages and to populate a spreadsheet indicating the occurrence and importance of assemblages on each SSSI. The results are provided in an Excel spreadsheet.

The work was undertaken by the authors in conjunction with Jon Webb, one of English Nature's entomological specialists. Keith Alexander was the principal contractor for the bulk of the project, and the final report was written by Martin Drake who also completed an accompanying spreadsheet housed with English Nature. An example of this database is outlined in Appendix 2.

2. Methods

2.1 Identification of assemblages

An initial list of habitats was obtained from Kirby (1994), and after considerable discussion of different approaches to defining assemblages, the final list used in the spreadsheet bears strong comparison with Kirby's types, and uses terms familiar to all ecologists. However, different labels and modifications were used throughout the process of allocating species to assemblages, and altogether about 400 variations were used. This needed *post hoc* rationalisation to make the system usable and searchable. Some nuances have therefore been lost in the tidying-up process.

The final classification is hierarchical, using three levels. The highest level, called the Broad Type, groups habitats with the least structural features in common, resulting in six almost exclusive groups (wetland, flowing water, herb, tree, coast, bare rock). The next level (Assemblage) includes familiar terms, for example river, stream, headwater and waterfall within the Broad Type flowing water. The final level (Sub-types) qualifies each of these, again using familiar terms although with less consistency. For example, the Assemblage 'heathland' may be wet or dry, but could also have scrub, so the term 'heathland / dry, scrub' means dry heathland with scrub (not completely scrubbed-up dry heathland). Where several terms are used in the Sub-type, they are ordered by geology then by hydrology (for example, 'acid, freely-draining'). No attempt was made to order terms used for different woodland types (often named tree species).

For grasslands, a fourth level is included to cover structural variation which is strongly dependent upon management, so may change rapidly and does not have equivalent status to other terms used for Sub-types. This fourth level has the terms short, long and tussocky.

All terms used are given in Appendix 1, Table 1.

2.2 Information sources

Three main sources of information were used: the SSSI citations, ENSIS and the Invertebrate Site Register (ISR), which is English Nature's database of uncommon invertebrates, based on the biological recording package Recorder. These are readily accessible sources covering the widest range of taxonomic groups. While local records centres and national recording schemes could have added useful data, this was beyond the scope of this project. Additional information was sometimes included from personal knowledge of sites or from readily available reports.

There are problems with the reliability and utility of the sources used. The citations and ENSIS of necessity mention very few species, and the choice is sometimes idiosyncratic. Species listed in ENSIS often appear under a wide range of habitats on a site, owing to the exact location of the records being unknown. The feature data in ENSIS had not been validated at the time of this project but is now underway. Information in the ISR varies in quantity from site to site, and in the age of records. Most sites in the ISR can be linked directly to SSSIs, but some sites within extensive SSSIs probably escaped the search if they are known by different names; this happened especially with clusters of SSSIs that had been recently amalgamated under a new single title.

2.3 Procedure

Each citation was read to determine the site's range of habitats to be envisaged. Information on invertebrates was extracted and placed on the spreadsheet. This information was divided into text that described the important aspects of the interest (which was either transferred verbatim or summarised), and any species mentioned, including common as well as rare species.

Data from the ISR was extracted for the site, and two types of information were obtained from the lists generated. The first was an idea of the assemblages present, made by judging the use of the habitats described in the citation that each species was likely to make. For sites with plenty of information (say, at least 40 uncommon species recorded), this proved relatively straightforward, even for species which were not the authors' specialisms, since the ecological pen-pictures in the ISR usually provided reasonably accurate information on the preferred habitats. Where the species accounts appeared thin, other literature was consulted, especially the national reviews of rare and scarce species and distribution atlases. Old records of species known to be in strong decline were checked using distribution atlases; a number of these species appear in citations long after they have become locally extinct. Difficulties were found with sites with little information, or with sites with vast recording effort, where any number of habitat associations could be envisaged. The four authors also differed in their approach to interpreting the data, ranging from the cautious (finding no clear assemblage discernible) to the bold (perhaps the listed species is only a sample of what is really on the site).

The second type of information obtained from the ISR and ENSIS was a list of species of particular interest because of their listing in the EU Habitats & Species Directive, Schedule 5 (for full protection) of the Wildlife & Countryside Act 1981, the UK Biodiversity Action Plan, or the Red Data Books. These species are given in the spreadsheet, although without the reason for their inclusion.

The range of major taxa, for example, insect orders, known to have been recorded was listed, as this gives a crude indication of the level of recording (although also at times misleading since only a few orders account for most of the records).

A subjective judgement was made of the importance of each assemblage at a site. Five levels were suggested: international, national, regional, county and local. This proved the least satisfactory aspect of the project since there are no guidelines for such an assessment and no definitions of each level of importance. The judgement had to be made using uncomparable data. Personal knowledge of a site, or its reputation, often resulted in an assessment based not purely on the data available. In well recorded sites where more than average number of assemblages could be discerned, an artefact in this assessment sometimes arose whereby each assemblage on its own could not be highly regarded (since it would be represented by only a few species), yet the site's overall quality was clearly high.

Additionally to identifying the main habitat assemblages, it was sometimes possible to discern microhabitats of particular interest, which were listed separately. Where no or inadequate information was found, this was indicated in the spreadsheet. Free-text notes were occasionally included.

3. Results

An Excel spreadsheet is lodged with English Nature. An example has been extracted and is listed in Appendix 2. The whole list covers 876 SSSI and lists 2756 assemblage features, another 286 with insufficient data to make a decision, and 12 with marine interest which is outside the scope of this project (Table 2). There appear to be some sites where invertebrates are notified features but which are not yet included in ENSIS. The minimum number of assemblages recognised to the sub-type level is 133 (Appendix 1,Table 1), and somewhat more than this are listed in the spreadsheet as different combinations of terms are used at the sub-type level.

3.1 Breakdown of Assemblages

Table 2 shows the number of records of Assemblages (that is, the second level of the hierarchy). A few assemblages account for a large proportion of the total recognised: grassland assemblages form 21%, mature woodland nearly 11%, fen and marsh (which actually are mainly pond and ditch assemblages), both with around 7-8%. There is no way of telling whether these values reflect the actual distribution of assemblages in the countryside, or just the predominance of these habitats in the SSSI series. Grassland is divided into calcareous and all other types (using a sub-type division) in Table 2. The prevalence of sites with assemblages associated with calcareous grassland strongly suggests that the data are skewed by the selection of sites in the SSSI series, and by chalkland butterflies appearing in most calcareous grassland SSSI citations. Rather than reflecting these butterflies' importance in the British fauna, it supports long-standing claims by entomologists for more rigour in assessing the conservation needs of our invertebrate fauna.

Some assemblages regarded as particularly important in the British invertebrate fauna are apparently fairly well represented. These are early successional assemblages (c. 4%) and those

associated with old tree growth, some of which has been inextricably incorporated into the mature woodland category (so well over 7%). Scrubland assemblages are also significant in the table.

Assemblages that may be less well represented are those associated with coastal shingle and dunes, which are two habitats with particularly valuable faunas. Perhaps these low values merely reflect the available habitat.

Even without a finer breakdown to the Sub-type third level, it is apparent that this second level needs refinement. For example, hardly any assemblages were recognised for hard cliff and rocky seashore, waterfall and headwater. It is likely that these apparently under-represented habitats have no associated assemblages, rather that the citation and accompanying data did not represent them.

3.2 Geographic variation

There is wide variation across England in the number of SSSI with recognised invertebrate interest (Table 3). Some of the variation is due to the size of counties, and to some having a greater wealth of natural conditions, especially the southern counties. The high number of sites with interest in Cambridgeshire, compared with neighbouring Lincolnshire, Bedfordshire and Northamptonshire, probably reflects the proximity to NCC and English Nature head office with its entomological specialists. However, a source of variation comes from the wording of citations. Those for some counties are consistently outstanding in their recognition of invertebrates whereas other barely mention their presence. Without this recognition, invertebrates usually fail to be mentioned in ENSIS and hence have been omitted from the present analysis, despite records being present in the ISR. It is clear that most omissions relate to sites notified shortly after the 1981 Wildlife and Countryside Act when there was intense pressure for re-notification. Lack of time and resources therefore lead to some detail (e.g invertebrate interest) being somewhat eschewed for a greater focus on habitats.

Most of the variation in the number of assemblages recognised on a site derives from the authors (Table 3). This reflects different approaches to interpreting the data, from the cautious to the cavalier. These data will be validated by the monitoring programme, with initial surveys providing proof or otherwise of the data collected for this report. Taking the results of each author separately, there is no obvious reason for the differences between counties in the average number of assemblages recognised. Counties perhaps unfairly condemned as dull often appear as well endowed as those with a greater reputation. The high scoring Yorkshire and Humberside sites appears to reflect an unconscious change in approach to interpretation since these were analysed several months later than the remaining counties. Attempts to rank counties or regions using these data are therefore not meaningful.

3.3 Importance rating of assemblages

Attempts to rate the importance of assemblage features are not satisfactory (Table 4). Different authors appear to have used the pairs of terms international and national, and regional and county in the same way, so these have been combined in Table 4. A difference of approach between

authors is the biggest source of variation. Some authors rated few assemblages, and usually only when they were of obvious importance; others were more generous. It proved somewhat invidious to provide a rating in most cases since the data were sparse, and often it was not possible to be completely objective if the site was known. Because of these problems comparisons between regions or counties is not robust.

3.4 Coverage of invertebrate interest in citations and ENSIS

The initial raft of 876 SSSI extracted from ENSIS represents about one fifth of English SSSI. The large disparate recognition given to invertebrates in SSSI notification, and hence as notified features worthy of monitoring and including on ENSIS, has been alluded to in 3.2. For example, as part of the initial work in this project, all 165 citations for Cornwall were read; of these 61, mention invertebrates (so rather better than the national average). But ISR data were available for another 30 sites, of which 16 contained assemblages rated as nationally or regionally important, but which are unlikely to be considered in monitoring programmes since they are not notified features. The final third of sites had no data in the sources used here. This paucity of information and lack of transference of readily available information is likely to be a major hindrance to raising the profile of invertebrate conservation within English Nature.

4. Discussion

While recognising that this attempt at allocating lists of species to assemblages clearly has a long way to go, it has made a start on a process that botanists have long accepted as normal practice. Importantly, this approach moves away from lumping invertebrates into taxonomic assemblages which rarely have any ecological basis. For example, an 'assemblage' of butterflies (a relatively tiny group in the British fauna) can include species from a wide range of habitats, and does not really help to define what features may be important at a site. An assemblage of flies (Diptera), a group containing one hundred times as many species as there are butterflies, is completely without ecological meaning.

Despite considerable discussion at the outset of the project about how to define assemblages, the labels used here describe habitats rather than assemblages of species as used, for instance, in the National Vegetation Classification, or attributes of the habitats, for example, the degree of disturbance or its hydrology. For this reason, there is little point in using the terms with new or narrow meanings just to fit with an entomological view. The nomenclature used has the advantage that all ecologists can envisage where each group of species lives, even though the species themselves are not part of the description of the assemblage.

Some assemblage names appear to be missing but these have been subsumed within a higher level. The greatest liberty has been taken with still water which has been mostly abandoned as an invertebrate habitat (except for large lakes and temporary ponds) since most species associated with still water live close to its margin, either as 'terrestrial' species or as true aquatic species for all or part of their life cycle. Ponds and ditches have thus been regarded as part of larger wetlands such as fens, bogs or marshes. To a rough approximation, this places the bulk of wetland species in the right context even if the rather small proportion of completely aquatic

invertebrates appear to have been stranded on wet land. This particular instance may need re-visiting if it fails to highlight hydrological issues.

Woodlands cause a problem in deciding where to allocate groups of species. It was hoped that the term 'woodland' could be avoided by allocating invertebrates to its component features: old growth (saproxylic species), the canopy, the field layer, and the open spaces (rides and glades). This proved difficult with the data available, and a dumping ground called 'mature woodland' has been used, suitably qualified in the sub-type where possible. Post-hoc tidying-up could not remedy the original allocations made by the four authors.

The anastomosing nature of habitat classification has produced some awkward allocations. For instance, is wet woodland foremost a wetland or a woodland? Should the saproxylic component of wet woodlands be classified quite distantly from the species associated with the organic ooze on the ground? In the present project, this issue will probably not affect the usefulness of the results since the quality of the data on which the decisions were based was mostly very scant. The assemblages inferred from the data and the site's description are probably good enough to allow management decisions.

Despite the shortcomings and apparent lack of conclusions that can be drawn from the analysis, this project takes a big step towards being able to better assess the invertebrates on SSSI. Two actions would improve the method. Firstly, it is clear that better data are needed if assemblage features are to be more accurately assessed. This can be addressed through the NBN Gateway. Secondly, each species needs to be allocated to its preferred habitat and microhabitat, using a refined habitat classification that reflects invertebrates' perception of their world rather than the gross features used in the present analysis. Once species' requirements are available on a database, it would be relatively easy to identify the quality of assemblages on a site. This action is being addressed through a current English Nature contract.

It is hoped that the dataset collected in this report will be used to:

- Inform the SSSI notification progress by highlighting both gaps and well-covered assemblage types within the series.
- Provide an initial dataset to lay the grounds for a monitoring programme.
- Provide an initial set of guidance to help work towards a classification of ecological assemblages for invertebrates.

4.1 Further work

- Our assemblage types are as yet untested. There is need to determine whether the terms we have used have real meaning. None of these terms have yet been ground-proofed and there has been no attempt to list those species that occur in each assemblage. It is hoped that this will be achieved over the next few years.

- Further work is also needed to determine the assemblages present on all notified sites. At present, our information does not provide a full picture of the invertebrate interest throughout all English SSSIs (only 876 of the total of 4112 sites – those with invertebrate interest mentioned in ENSIS - have been looked at).
- Some of the decisions about assemblage type and quality have been made on scant information. Variability was also introduced by the sheer nature of the subjective methods used. Further ground-proofing of many of these sites is therefore essential.
- Links between invertebrate assemblage types and other classification systems would also be beneficial. This would help ecologists except the use of invertebrate assemblage types.

5. References

KIRBY, P. 1994. *Habitat fragmentation; species at risk*. Report to English Nature.

NATURE CONSERVANCY COUNCIL. 1989. *Guidelines for selection of biological SSSIs.*

Appendix 1.

Table 1. Terms used for each level of the assemblage hierarchy

Broad Type	Assemblage	Sub-type
Bare	bare rock	calcareous
Bare	bare rock	scree
Bare	bare rock	upland
Bare	cave	
Coastal	brackish marsh	saltmarsh
Coastal	brackish marsh	lower saltmarsh
Coastal	brackish marsh	upper saltmarsh
Coastal	brackish marsh	pools
Coastal	brackish marsh	lagoon
Coastal	brackish marsh	detritus pond
Coastal	brackish marsh	freshwater springs
Coastal	brackish marsh	grazed
Coastal	brackish marsh	grazing marsh
Coastal	shore	silty
Coastal	shore	sandy
Coastal	shore	vegetated
Coastal	shore	fresh/brackish
Coastal	shingle	beach
Coastal	shingle	vegetated
Coastal	shingle	saline
Coastal	soft rock cliff	
Coastal	hard-rock cliff	rock, bare ground, saline
Coastal	rocky seashore	
Flowing water	river	silty
Flowing water	river	sandy
Flowing water	river	shingle
Flowing water	stream	silty
Flowing water	stream	sandy
Flowing water	stream	shingle
Flowing water	stream	subterranean
Flowing water	waterfall	
Flowing water	headwater	calcareous
Herb	early successional	sandy
Herb	early successional	shingle
Herb	early successional	clay
Herb	early successional	dry
Herb	early successional	scrub
Herb	early successional	coastal
Herb	early successional	cliff
Herb	early successional	hard-rock cliff
Herb	dunes	scrub
Herb	heathland	dry
Herb	heathland	wet
Herb	heathland	scrub
Herb	heathland	moorland
Herb	heathland	montane
Herb	heathland	saproxylic

Broad Type	Assemblage	Sub-type
Herb	heathland	canopy
Herb	grassland	acid
Herb	grassland	neutral
Herb	grassland	calcareous
Herb	grassland	coastal
Herb	grassland	clay
Herb	grassland	sandy
Herb	grassland	peaty
Herb	grassland	scrub
Herb	grassland	dry
Herb	grassland	free-draining
Herb	grassland	damp
Herb	grassland	wet
Herb	glades and rides	scrub
Herb	shaded field layer	acid
Herb	shaded field layer	neutral loam
Herb	shaded field layer	calcareous
Herb	shaded field layer	dry
Herb	shaded field layer	wet
Tree	old growth	acid
Tree	old growth	open canopy
Tree	old growth	closed canopy
Tree	old growth	epiphytic
Tree	old growth	saproxylic
Tree	mature woodland	calcareous
Tree	mature woodland	damp
Tree	mature woodland	wet
Tree	mature woodland	shrub
Tree	mature woodland	deciduous
Tree	mature woodland	mixed
Tree	mature woodland	conifer
Tree	mature woodland	secondary
Tree	mature woodland	named tree species
Tree	mature woodland	litter
Tree	mature woodland	fungi
Tree	mature woodland	saproxylic
Tree	mature woodland	niditicolous
Tree	mature woodland	canopy
Tree	scrubland	calcareous
Tree	scrubland	low bushes
Tree	scrubland	mixed
Tree	scrubland	named species
Tree	scrubland	canopy
Tree	scrubland	epiphytic
Tree	scrubland	saproxylic
Tree	trees and shrubs	open canopy
Tree	trees and shrubs	named species
Tree	trees and shrubs	hedgerow
Tree	trees and shrubs	coastal
Wetland	acid mire	poor fen
Wetland	acid mire	blanket bog
Wetland	acid mire	valley mire

Broad Type	Assemblage	Sub-type
Wetland	acid mire	pools
Wetland	acid mire	scrub
Wetland	fen	mesotrophic
Wetland	fen	floodplain
Wetland	fen	vegetated water margins
Wetland	fen	pools
Wetland	fen	ditch
Wetland	fen	reedbed
Wetland	fen	scrub
Wetland	marsh	swamp
Wetland	marsh	vegetated water margins
Wetland	marsh	pond
Wetland	marsh	detritus pond
Wetland	marsh	silt pond
Wetland	marsh	silt pond (pingo)
Wetland	marsh	ditch
Wetland	marsh	grazing marsh
Wetland	marsh	grazing marsh/fen ditches
Wetland	seepage	acid
Wetland	seepage	calcareous
Wetland	seepage	soft-rock cliff
Wetland	seepage	hard-rock cliff
Wetland	seepage	woodland
Wetland	temporary pond	
Wetland	lake	calcareous
Wetland	lake	stony shore
Wetland	lake	stony and vegetated shore
Wetland	wet woodland	floodplain
Wetland	wet woodland	fen carr
Wetland	wet woodland	pools
Wetland	wet woodland	canopy
Wetland	wet woodland	field layer
Wetland	wet woodland	saproxylic

Table 2. Number of occurrences of each assemblage and the percentage of the 2756 assemblages allocated to a habitat type.

Broad Type	Assemblage	Number of occurrences	Percentage of occurrences
Bare	bare rock	8	0.3
Bare	cave	1	0
Coastal	brackish marsh	83	3
Coastal	shore	29	1.1
Coastal	shingle	16	0.6
Coastal	soft cliff	3	0.1
Coastal	hard cliff	1	0
Coastal	rocky seashore	1	0
Flowing water	river	48	1.7
Flowing water	stream	67	2.4
Flowing water	waterfall	2	0.1
Flowing water	headwater	4	0.1
Herb	early successional	106	3.8
Herb	dunes	21	0.8
Herb	heathland	160	5.8
Herb	grassland: calcareous	272	9.9
Herb	grassland: all other types	316	11.5
Herb	glades and rides	157	5.7
Herb	shaded field layer	89	3.2
Tree	old growth	215	7.8
Tree	mature woodland	296	10.7
Tree	scrubland	89	3.2
Tree	trees and shrubs	37	1.3
Wetland	acid mire	75	2.7
Wetland	fen	208	7.5
Wetland	marsh (mainly pond or ditch)	229	8.3
Wetland	seepage	75	2.7
Wetland	ephemeral pond	23	0.8
Wetland	lake	34	1.2
Wetland	wet woodland	89	3.2
Wetland	unspecified	2	0.1
insufficient data		286	
taxa		39	
marine		12	
total analysed		**3093**	

Table 3. Summary by county of the numbers of SSSI with invertebrate information in ENSIS, the sites to which ecological assemblages were allocated, and the average number of assemblages recognised by each author.

Region	County	Number of sites investigated	Number of sites allocated ecological assemblages	Number of assemblages	Assemblages per site	Author	Notes (see below)
South East	Berkshire	12	12	23	1.9	KA	
	Buckinghamshire	26	26	72	2.8	KA	
	East Sussex	24	23	74	3.2	KA	
	Hampshire	48	37	104	2.8	KA	
	Isle of Wight	20	14	32	2.3	KA	
	Kent	36	31	113	3.6	KA	
	Oxfordshire	22	22	69	3.1	KA	
	Surrey	31	28	95	3.4	KA	
	West Sussex	35	32	112	3.5	KA	
South West	Avon	8	8	13	1.6	KA	
	Cornwall	165	24	128	5.3	KA	1
	Devon	60	39	88	2.3	KA	
	Dorset	53	51	118	2.3	KA	
	Gloucestershire	19	15	36	2.4	KA	
	Somerset	41	34	75	2.2	KA	
	Wiltshire	131	79	118	1.5	KA	
East of England	Bedfordshire	17	17	52	3.1	MD	
	Cambridgeshire	36	36	181	5.0	MD	
	Essex	22	22	151	6.9	MD	
	Hertfordshire	11	11	37	3.4	MD	
	Norfolk	33	32	113	3.5	MD	
	Suffolk	30	29	131	4.5	MD	

Region	County	Number of sites investigated	Number of sites allocated ecological assemblages	Number of assemblages	Assemblages per site	Author	Notes (see below)
East Midlands	Derbyshire	16	15	48	3.2	DL	
	Leicestershire	34	31	62	2.0	DL	
	Lincolnshire	16	15	37	2.5	DL	
	Northamptonshire	16	7	18	2.6	DL	
	Nottinghamshire	11	10	17	1.7	DL	
West Midlands	Birmingham	1	0	0	0	JW	
	Hereford & Worcester	33	31	108	3.5	MD	
	Shropshire	6	5	9	1.8	MD, JW	
	Staffordshire	18	16	28	1.8	JW	
	Warwickshire	11	10	16	1.6	JW	
Yorkshire and	North Yorkshire	10	10	61	6.1	MD	2
Humberside	South Yorkshire	10	10	60	6.0	MD	2
	West Yorkshire	2	2	9	4.5	MD	2
North East	Cleveland	4	3	10	3.3	MD	
	Durham	14	14	52	3.7	MD	
	Northumberland	17	17	70	4.1	MD	
	Tyne and Wear	9	9	38	4.2	MD	
North West	Cheshire	10	9	45	5.0	MD	
	Cumbria	41	39	105	2.7	MD	
	Lancashire	9	9	32	3.6	MD	
	Merseyside	1	1	5	5.0	MD	

Notes.
1. Total number of features is high owing to this county being used in the experimental phase, and the number of sites was derived from ENSIS, not as given in the spreadsheet.
2. High numbers of features appears to reflect an unconscious change in approach.

Table 4. Importance rating of assemblages

Region	County	Number of features					Percentage		
		national and international.	county and regional	local	total of rated features	none and unknown	national and internat.	county and regional	local
South East	Berkshire	2	5	16	23	1	9	22	70
	Buckinghamshire	1	23	47	71	1	1	32	66
	East Sussex	17	23	36	76	1	22	30	47
	Hampshire	28	34	42	104	12	27	33	40
	Isle of Wight	6	6	21	33	6	18	18	64
	Kent	15	41	57	113	5	13	36	50
	Oxfordshire	7	23	37	67	2	10	34	55
	Surrey	12	35	48	95	3	13	37	51
	West Sussex	14	37	54	105	10	13	35	51
South West	Avon	3	9	2	14	1	21	64	14
	Cornwall	23	42	71	136	137	17	31	52
	Devon	16	25	61	102	11	16	25	60
	Dorset	42	38	38	118	2	36	32	32
	Gloucestershire	4	24	9	37	4	11	65	24
	Somerset	4	13	43	60	0	7	22	72
	Wiltshire	10	37	67	114	56	9	32	59
E. England	Bedfordshire	0	11	42	53	0	0	21	79
	Cambridgeshire	7	57	117	181	0	4	31	65
	Essex	9	46	95	150	2	6	31	63
	Hertfordshire	0	6	31	37	0	0	16	84
	Norfolk	19	37	57	113	10	17	33	50
	Suffolk	8	55	67	130	8	6	42	52

Region	County	Number of features					Percentage		
		national and international.	county and regional	local	total of rated features	none and unknown	national and internat.	county and regional	local
E. Midlands	Derbyshire	1	0	1	2	46	50	0	50
	Leicestershire	3	6	10	19	47	16	32	53
	Lincolnshire	1	0	2	3	38	33	0	67
	Northamptonshire	0	1	1	2	27	0	50	50
	Nottinghamshire	3	0	0	3	16	100	0	0
W. Midlands	Birmingham	0	1	0	1	0	0	100	0
	Hereford & Worcs	9	26	71	106	5	8	25	67
	Shropshire	3	4	1	8	3	38	50	13
	Staffordshire	3	6	7	16	14	19	38	44
	Warwickshire	0	4	0	4	13	0	100	0
North East	Cleveland	0	3	7	10	1	0	30	70
	Durham	0	4	48	52	0	0	8	92
	Northumberland	0	17	53	70	0	0	24	76
	Tyne and Wear	0	5	33	38	0	0	13	87
North West	Cheshire	0	15	17	32	0	0	47	53
	Cumbria	11	40	52	103	4	11	39	50
	Lancashire	6	12	14	32	0	19	38	44
	Merseyside	1	1	3	5	0	20	20	60
Yorkshire &	North Yorkshire	1	18	42	61	0	2	30	69
Humberside	South Yorkshire	21	39	21	81	3	26	48	26
	West Yorkshire	0	1	9	10	0	0	10	90

Appendix 2. A Table showing an example of the invertebrate assemblage features spreadsheet (taken from Gloucestershire)

Site	Sources of additional data	Broad type	Assemblage	Sub-type	New species features	Sub-community recorded	Taxonomic groups recorded	Importance
Badgeworth		Insufficient data			none			
Barnsley Warren	ISR	Herb	grassland	calcareous	none		Coleoptera, Lepidoptera, Diptera	local
Coombe Hill Canal & Meadows	ISR	Herb	grassland	wet	*Paraphotistus nigricornis*		Coleoptera, Diptera	regional
Coombe Hill Canal & Meadows	ISR	Tree	old growth	open canopy, saproxylic	none	saproxylic	Coleoptera, Diptera	local
Coombe Hill Canal & Meadows	ISR	Wetland	fen	floodplain	none		Coleoptera, Diptera	regional
Coombe Hill Canal & Meadows	ISR	Wetland	marsh	grazing marsh, ditches	*Agabus undulatus*	ditches	Coleoptera, Diptera, Odonata	regional
Coombe Hill Canal & Meadows	ISR	Wetland	wet woodland		none		Coleoptera, Diptera	local
Cotswold Commons & Beechwoods	ISR	Herb	glades and rides	scrub	none		Lepidoptera, Coleoptera	local
Cotswold Commons & Beechwoods	ISR	Herb	grassland	calcareous	none		Diptera, Coleoptera, Lepidoptera,	regional

Site	Sources of additional data	Broad type	Assemblage	Sub-type	New species features	Sub-community recorded	Taxonomic groups recorded	Importance
							Mollusca	
Cotswold Commons & Beechwoods	ISR	Herb	shaded field layer	dry	*Ena montana*		Mollusca, Diptera, Coleoptera	regional
Cotswold Commons & Beechwoods	ISR	Tree	old growth	open canopy, saproxylic	*Ctenophora flaveolata*	saproxylic	Diptera, Coleoptera	regional
Cotswold Commons & Beechwoods	ISR	Wetland	seepage	calcareous, woodland	*Acicula fusca*		Mollusca	regional
Crickley Hill & Barrow Wake	ISR	Herb	grassland	calcareous	none		Lepidoptera, Mollusca, Coleoptera, Diptera	regional
Crickley Hill & Barrow Wake	ISR	Tree	old growth	open canopy, saproxylic	none	saproxylic	Lepidoptera, Mollusca, Coleoptera, Diptera	regional
Daneway Banks		insufficient data			none			
Dixton Wood	ISR	Tree	old growth	open canopy, saproxylic	*Limoniscus violaceus, Ampedus rufipennis*	saproxylic	Coleoptera	national
Dymock Woods	ISR	Lepidoptera:butterflies and moths			*Boloria euphrosyne, Minoa murinata*		Lepidoptera	regional
Kingscote & Horsley Woods		insufficient data			none			

Site	Sources of additional data	Broad type	Assemblage	Sub-type	New species features	Sub-community recorded	Taxonomic groups recorded	Importance
Midger	ISR	Flowing water	stream	silty	none		Mollusca, Diptera, Coleoptera, Lepidoptera	regional
Midger	ISR	Herb	grassland	calcareous, scrub	*Bombylius discolor*		Mollusca, Diptera, Coleoptera, Lepidoptera	regional
Midger	ISR	Herb	shaded field layer	dry	*Ena montana*		Mollusca, Diptera, Coleoptera, Lepidoptera	regional
Midger	ISR	Tree	mature woodland	saproxylic	none	saproxylic	Mollusca, Diptera, Coleoptera, Lepidoptera	local
Midger	ISR	Wetland	seepage	calcareous, woodland	none		Mollusca, Diptera, Coleoptera, Lepidoptera	regional
Minchinhampton Common	ISR	Herb	grassland	calcareous	none		Coleoptera, Diptera, Hemiptera, araneae, Mollusca	regional
Minchinhampton Common	ISR	Tree	scrubland	juniper	none		Lepidoptera	local

Site	Sources of additional data	Broad type	Assemblage	Sub-type	New species features	Sub-community recorded	Taxonomic groups recorded	Importance
Rodborough Common	ISR	Herb	grassland	calcareous, scrub	*Macroplax preyssleri*		Coleoptera, Diptera, hemiptera, Hymenoptera, Lepidoptera, Mollusca, Araneae	national
Rough Bank, Miserden	ISR	Herb	grassland	calcareous	none		Lepidoptera, Coleoptera, Orthoptera	regional
Severn Estuary	ISR	Coastal	brackish marsh	upper saltmarsh, pools	none	brackish pools	Coleoptera, Cladocera	regional
Severn Estuary	Sources of Additional Data	marine			none		marine	
Soudley Ponds	ISR	Flowing water	stream	silty	none		Coleoptera, Odonata	regional
Soudley Ponds	ISR	Herb	glades and rides	scrub	none		Coleoptera	local
Soudley Ponds	ISR	Wetland	marsh	silt pond	none		Coleoptera, Odonata	local
Stinchcombe Hill	ISR	Herb	grassland	calcareous, scrub	*Cryptocephalus primarius*		Coleoptera, Lepidoptera	national
Strawberry Banks	ISR	Herb	grassland	calcareous	*Eurodryas aurinia, Meloe rugosus*		Lepidoptera, Coleoptera, Mollusca	regional
Upper Wye Gorge	ISR	Flowing water	river	sandy	none		Diptera	regional

Site	Sources of additional data	Broad type	Assemblage	Sub-type	New species features	Sub-community recorded	Taxonomic groups recorded	Importance
Upper Wye Gorge	ISR	Herb	shaded field layer	dry	*Tipula alpina*		Diptera, Lepidoptera, Hymenoptera, Coleoptera	national
Upper Wye Gorge	ISR	Tree	old growth	open canopy, saproxylic	none	saproxylic	Diptera, Coleoptera	regional
Woodchester Park	ISR	Herb	glades and rides	scrub	none		Mollusca, Diptera, Lepidoptera, Coleoptera, Araneae	regional
Woodchester Park	ISR	Herb	grassland	calcareous, scrub	none		Mollusca, Diptera, Lepidoptera, Coleoptera, Araneae	regional
Woodchester Park	ISR	Herb	shaded field layer	dry	*Ena montana*		Mollusca, Diptera, Lepidoptera, Coleoptera, Araneae	regional
Woodchester Park	ISR	Wetland	marsh	silt pond	none		Diptera, Odonata	local

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