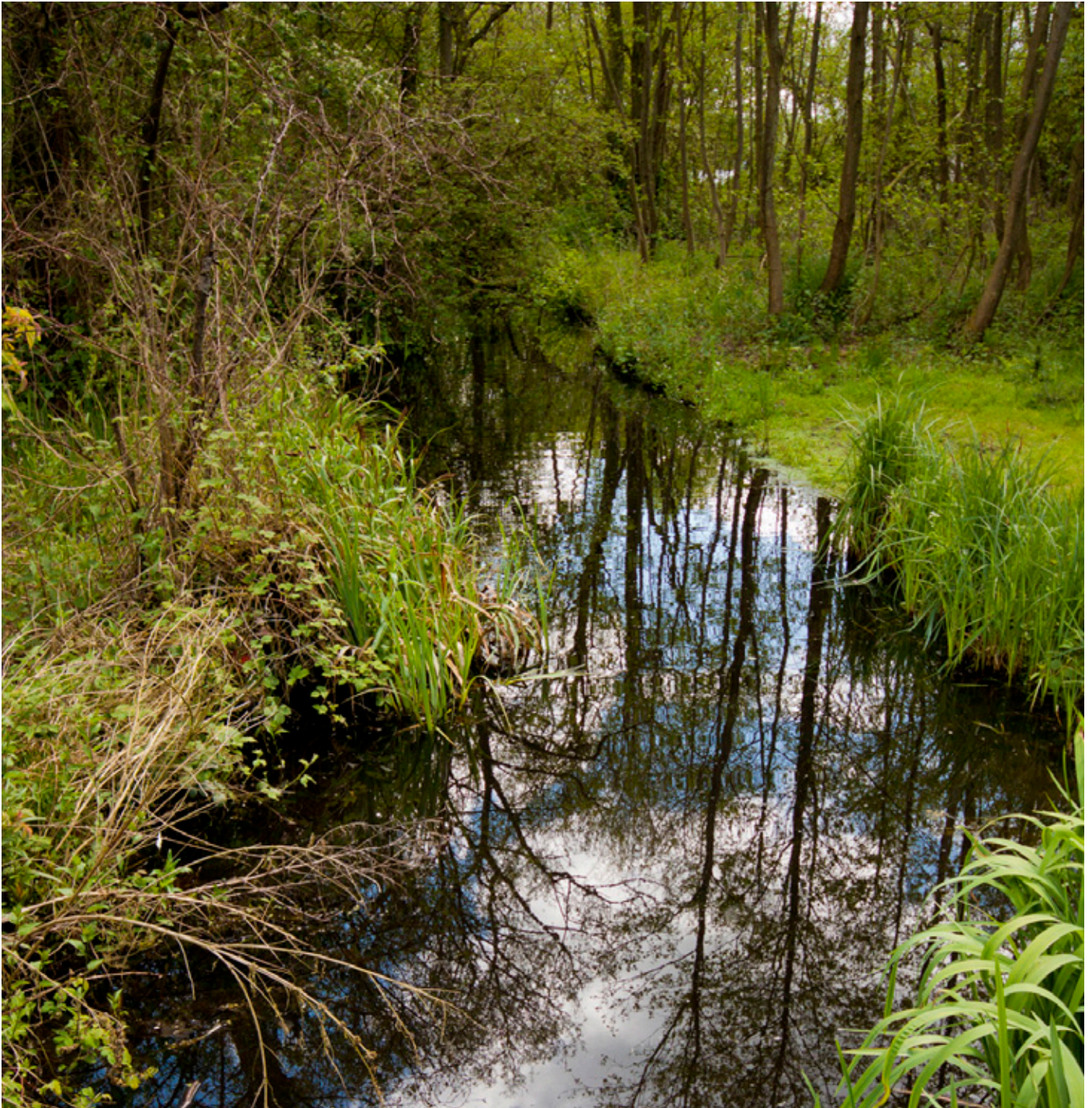


23 December 2011

An Exploratory Survey of Invertebrates of Wet Woodland in the Bure Valley and the Muckfleet Valley



Prepared by

P Lee and C M Drake

Prepared for

Broads Authority

ARACHNE

Invertebrate Information Services

33 Lawford Place, Lawford, Manningtree CO11 2PT

Tel / Fax: 01206 394538

email: paulatarchne@aol.com

©Broads Authority

Terms and Conditions for use of maps in this document

i) You are granted a non-exclusive, royalty free, revocable licence solely to view the licensed data for non-commercial purposes for the period during which the Broads Authority makes it available. ii) You are not permitted to copy, sub licence, distribute, sell or otherwise make available the Licensed Data to third parties in any form iii) Third party rights to enforce the terms of this licence shall be reserved to Ordnance Survey

CONTENTS

SUMMARY	3
INTRODUCTION	4
METHODS	5
<i>Sampling of invertebrates</i>	5
<i>Selection of wet woodland compartments</i>	6
<i>Analysis</i>	6
RESULTS	8
<i>Species recorded</i>	8
<i>Species richness</i>	9
<i>Analysis of Similarity (ANOSIM)</i>	12
<i>Principal Components Analysis (PCA)</i>	13
<i>Analysis using ISIS</i>	15
CONCLUSIONS	18
<i>Invertebrate conservation value of areas of wet woodlands in the Broads</i>	18
<i>NVC wet woodland invertebrate communities</i>	18
<i>Future work programmes</i>	18
ACKNOWLEDGMENTS	19
REFERENCES	20
APPENDIX 1: MAPS OF ALL SAMPLE SITES	22
APPENDIX 2: LIST OF ALL SPECIES RECORDED	23
APPENDIX 3: LIST OF ALL SPECIES RECORDED BY SITE	33

SUMMARY

1. A range of invertebrate groups were sampled in 12 wet woodland compartments equally divided between the Bure and Muckfleet river catchments in the Norfolk Broads. Three woodlands classified as NVC community W2 and three classified as W5 were sampled in each valley. 423 species were recorded including 3 of Red Data Book status or equivalent.
2. The results were analysed by exploring the relationships between species richness and firstly the NVC community type and secondly the river catchment. Analysis of similarity and multivariate analysis was used to explore the response of assemblage species composition to the NVC community type and the river catchment. ISIS, a computer application being developed by Natural England for assessing invertebrate assemblages, was essential in identifying the invertebrate conservation interest of the woodland compartments.
3. The data show no significant differences in the diversity, the composition or the conservation value of the invertebrate communities between the woodland NVC types other than when the species richness of individual taxonomic groups was investigated there was a significantly higher diversity of Diptera in W5 than in W2 woodland.
4. Although there was no difference in species richness, the composition of the invertebrate assemblages of the Bure and Muckfleet valley woodlands did differ significantly. The conservation value of the Bure valley woodlands, especially of the ISIS “permanent wet mire” assemblage type, appeared to be considerably greater. On current evidence this assemblage type appears to be of higher quality in open fen habitats. The Bure valley woodlands were also important for an assemblage type comprising mainly Diptera associated with seepages. Sampling of arboreal assemblages proved inadequate to draw conclusions.
5. It is advised that data from a larger number of woodlands are required to increase the robustness of the analysis of the conservation value of wet woodlands in general and the comparison of NVC communities in particular. If NVC communities are considered important to the aims of future work, ground truthing of the vegetation type should form part of the sampling site selection process.
6. It is recommended that any future monitoring programme dealing with the conservation interest of wet woodland invertebrates in the Broads is based on a protocol adapted to include the sampling of arboreal assemblages using specialist techniques such as vane traps.

INTRODUCTION

The high conservation value of the wetland invertebrate fauna of many sites in the Broads National Park is well documented (e.g. Lott *et al.*, 2002; Lott *et al.*, 2010). However, most field studies have sampled invertebrates associated with open water, reed bed and fen and much less information is available on the importance to invertebrates of the various types of wet woodland in the Norfolk and Suffolk Broads.

It is often assumed that natural succession of fen is detrimental to conservation but the few field studies that have been undertaken suggest that wet woodland can be a rich invertebrate habitat. Moderation of temperatures, a reduction in insolation, increased habitat structure, increased shelter and more subtle variations in microclimate could all in theory contribute to a greater range of ecological niches supporting a large number of species including a number of rarities with very specialised ecological requirements. Some wet woodland invertebrates are associated with the living alder, birch and willow trees such as the weevil *Melanapion minimum*, a Biodiversity Action Plan Priority species whose larvae live in bean galls on the leaves of various types of willow (Morris, 1990). Others include saproxylic flies and beetles dependant on dead and decaying wood e.g. the larvae of *Lipsothrix nervosa*, a BAP Priority species of crane fly, develop around in saturated timber around seepages (Boardman, 2007).

Buglife (2011a) lists 129 species of scarce and rare invertebrates known to be associated with wet woodland although it should be noted that this list includes a number of general woodland and general wetland species as well as wet woodland specialists and by no means all these species are found in East Anglia. More specific to the Broads, Panter *et al.* (2011) report 62 and 59 invertebrate species of conservation concern having primary associations with fen carr and wet woodland respectively. They also suggest that on current evidence the importance of closed, shaded wetland to key invertebrate diversity is lower than that of open wetland habitats (e.g. fen, reedbed, wet grassland, standing waterbodies) but accept that this may to some extent be influenced by the low sampling effort in wooded habitats to date.

The Broads Authority recognised a need to improve the availability of information on invertebrate assemblages in wet woodlands for management planning purposes. The current field study arose from this recognition. The objectives of the project were:

- To assess the invertebrate conservation value of areas of previously unsurveyed wet woodland in the Broads, specifically in the Muckfleet valley (Trinty Broads) and in the Bure valley (Woodbastwick Fen).
- To compare the invertebrate conservation value of wet woodlands classified as W2 and W5 type NVC communities.

Assessment of invertebrate conservation value, or more precisely, assessment of invertebrate assemblage conservation value, is not only of value for selecting sites for conservation action, but also for monitoring their protection, restoration and creation. Species rarity has traditionally been an important parameter for evaluating conservation quality. An alternative approach is to evaluate an assemblage according

to how typical it is of an intrinsically interesting assemblage type or habitat. The fieldwork was designed to collect the data required to evaluate the type and conservation value of the invertebrate assemblages sampled.

METHODS

Sampling of invertebrates

Each of the target groups was sampled at least once in 12 seasonally wet woodland compartments between May and October 2011. The invertebrate groups targeted are listed in tables 1 and 2.

Table 1. Schedule of invertebrate groups sampled in 2011

<i>Group</i>	<i>Sampling method</i>	<i>Time of visits</i>
Araneae & Opiliones (spiders & harvestmen)	beating & ground-searching	May, June & October
Carabidae, Scirtidae & Staphylinidae (ground, marsh & rove beetles)	beating & ground-searching	May, June & October
Diptera (two-winged flies)	sweep-netting & suction-sampling	June
Trichoptera (caddis flies)	sweep-netting & suction-sampling	June

Time-standardised methods of ground-searching, beating, sweep-netting and suction sampling were used for sampling assemblages of each of the target groups (for details of techniques see Drake *et al.*, 2007). Adoption of these fieldwork methods yielded the comparable samples required for statistical analysis. The use of these methods is summarised in table 1. Data from all sampling methods used on all visits to one sampling compartment were pooled for analysis.

Table 2. Target Diptera families

Anisopodidae	Diastatidae	Limoniidae	Scathophagidae
Anthomyzidae	Dixidae	Lonchopteridae	Sciomyzidae
Asilidae	Dolichopodidae	Micropezidae	Sepsidae
Aulacigastridae	Drosophilidae	Muscidae	Stratiomyidae
Calliphoridae	Dryomyzidae	Opomyzidae	Syrphidae
Camillidae	Empididae	Pediciidae	Tabanidae
Chamaemyiidae	Ephydriidae	Periscelididae	Tachinidae
Chaoboridae	Fanniidae	Psilidae	Tephritidae
Chloropidae	Heleomyzidae	Ptychopteridae	Therevidae
Chyromyidae	Hybotidae	Rhagionidae	Tipulidae
Clusiidae	Lauxaniidae	Rhinophoridae	Ulidiidae
Culicidae			

Selection of wet woodland compartments

Eight potential sampling compartments, four approximating to NVC category W2 and four to NVC category W5, were identified from Woodbastwick Fen, part of the Bure Marshes NNR, by Rick Southwood of Natural England. Twelve potential sampling compartments, six classified as NVC category W2 and six classified as NVC category W5 in a 1990 botanical survey, were identified around the Trinity Broads in the Muckfleet valley by Hannah Grey, Broads Authority Conservation Officer (Trinity Broads & Lound). From these 20 potential sites twelve were selected for survey. These twelve sites were equally divided between the Bure Marshes NNR and the Trinity Broads and comprised three examples of each NVC woodland type from each location. Details of the twelve woodland compartments selected are given in table 3 and maps showing the location of each compartment can be found in appendix 1.

Table 3: Details of the woodland compartments sampled during 2011

<i>Woodland</i>	<i>Grid reference</i>	<i>NVC type</i>	<i>Description</i>
Bure 1	TG332167	W5	alder & willow carr, ferns, reed, <i>Carex paniculata</i> , <i>Urtica</i> , dry soil
Bure 2	TG334166	W2	young alder & willow carr, <i>Carex paniculata</i> , sparse reed, dry soil
Bure 3	TG335167	W2	young willow carr, ferns, <i>Eupatorium</i> , <i>Urtica</i>
Bure 4	TG337167	W2	alder carr, pool, <i>Carex paniculata</i> , ferns, sparse reed
Bure 5	TG334164	W5	willow & alder carr, pool, ferns, <i>Carex paniculata</i> , dry soil
Bure 6	TG336164	W5	alder, willow, birch & ash carr, <i>Carex acutiformis</i> , <i>Carex paniculata</i> , ferns, Iris, reed, damp soil
Trinity 5	TG462149	W2	secondary oak & birch woodland, buckler fern, bramble, dry soil
Trinity 6	TG455143	W5	alder, ash & sycamore carr, <i>Ribes</i> , <i>Carex 'riparia'</i>
Trinity 7	TG458143	W2	tall alder carr & young ash, buckler fern, dry soil
Trinity 8	TG459140	W5	alder carr, dry soil
Trinity 9	TG461139	W2	deciduous woodland by lake, dry soil
Trinity 10	TG460143	W5	alder, willow & ash carr, buckler fern, Iris seepage, damp soil

Analysis

Four types of analysis were carried out on the species lists generated.

For each of the twelve samples, a series of **species richness** values were counted as the total number of species recorded in each target group. Relationships with NVC classification and geographical location were explored with the non-parametric Mann-Whitney method.

Species richness is notoriously sensitive to inequalities in sampling effort, but this factor has been minimised in this project by the adoption of standardised sampling protocols. Species richness is a simple, but effective species diversity measure. It can be a powerful tool for interpreting how invertebrate assemblages respond to

environmental factors, but it should be recognised that it is not a straightforward measure of conservation value. An assemblage may contain a large number of widespread species that do not necessarily represent conservation priorities.

Species richness provides no information on the individual species present. Two sites may well share the same species richness but have none of these species in common. To assess the structure of the invertebrate communities further the similarities of the species lists obtained from the woodlands were investigated using the Bray-Curtis measure of similarity. This index provides a simple measure of the number of species in common between two lists of species. The statistical significance of the similarities was tested for two groupings of woodlands, firstly W2 versus W5 type woodlands and secondly the Bure valley versus the Muckfleet valley woodlands, by Analysis of Similarities (ANOSIM) using the CAP software package distributed by Pisces Conservation Ltd.

A Principal Components Analysis (PCA) was carried out on the species lists in order to explore relationships between the species assemblages present in each woodland compartment in an attempt to gain further insight into underlying factors influencing community structures. This is a method for reducing the complex, multidimensional community data collected in the field to a simpler, two dimensional plot where the most similar assemblages will appear closest together. Rare species occurring in only a single sample were removed from the data before analysis. The analysis used the covariance matrix.

PCA makes no assessment of the conservation value of the species assemblages. For assessing conservation value, scores are usually assigned to individual species within an assemblage and aggregated in some way to produce a score for the whole assemblage. ISIS (Invertebrate Species-habitat Information System) is a computer application developed by Natural England for assessing invertebrate assemblages in this way. It interprets species lists by recognising assemblage types and scoring each assemblage type according to its conservation value. ISIS assemblage types are defined by species composition but labelled according to their favoured habitat in terms that are meaningful to non-specialists. For example, although many invertebrate species are found in woodlands, it is the nature of the arboreal canopy, the supply of dead wood or the presence of shaded conditions that most of these species ultimately rely upon. Therefore ISIS defines the assemblage types in terms of these factors.

Two hierarchical levels of assemblage type are recognised:

Broad Assemblage Types (BATs) are characterised by more widespread species. They can be expressed in lists from a wide range of sites. Their classification reflects environmental factors such as hydrology and disturbance-succession cycles that have an important effect on invertebrate assemblages. ISIS summarises the relative representation of each BAT within the sampled assemblage and evaluates the conservation value of each BAT using a rarity score calculated according to individual rarity values of its constituent species. A rarity score is only calculated if there are sufficient (15) species assigned to a BAT in order that the effects of sampling effort on the score are reduced.

The most narrowly defined level, Specific Assemblage Types (SATs), are characterised by species found within a narrower range of habitats and are considered to have intrinsic conservation value. In general, they are only well expressed in lists from sites with conservation value.

ISIS analyses were carried out on the pooled samples from within each woodland using data for all target groups together. The version used was ISIS 2010.

RESULTS

Species recorded

The species recorded are listed in appendix 2. A total of 361 species from the target groups were recorded in standardised samples. An additional 62 species from non target groups were recorded casually. These additional species are listed in appendix 2 also but were not included in the analysis. A few taxa were represented by female specimens only and the precise species could not be determined. These taxa were not included in the ISIS analysis. However, where the taxa were clearly distinct from those already identified in a sample, they were included in species lists for the purposes of further analysis of species richness and community data.

The list of target species includes three species of true fly with a provisional Red Data Book 3 status and a further 17 nationally scarce species (13 flies, three beetles and one spider). The presence of these species of conservation concern will have a direct impact on the assessment of the conservation value of the assemblages using ISIS. However, the survey produced a number of other records that add significantly to the conservation importance of specific woodland areas but will not be reflected in the ISIS analysis as the species concerned are too recently discovered to be included in the latest update of the software.

The dolichopodid fly *Thrypticus atomus* collected from W2 woodland at Woodbastwick Fen (Bure2) appears to be correctly identified but is not yet included on the British list. The same species was recorded from Woodbastwick, Sutton and Catfield Great Fens in previous surveys (Lott *et al.*, 2010). If confirmed, a crane fly that appears to be *Pilaria nigropunctata* would be new to the British list also. This species was collected from W5 woodland at Woodbastwick Fen (Bure5). As with the female specimens noted above, as the two flies were clearly distinct from those already identified in the survey, they were included in species lists for the purposes of further analysis of species richness and community similarity. However, both identifications will be subject to further checking. Meanwhile, the collection of the anthomyzid fly *Paranthomyza caricis* provides what is probably one of the few records for this species that was described recently from Greywell Fen, Hampshire (Roháček, 1999). A single male was collected from W5 woodland at Woodbastwick Fen (Bure6).

The crane flies *Dicranophragma nemorale* and *D. separatum* were identified correctly for the first time from the Norfolk Broads. A paper by Starý & Reusch (2009) has only recently made the distinction clear through the use of details of genital structure. Previous records of *D. nemorale* (and *D. 'minuscula'*) from the Broads fens probably include both species.

Two species of fly were found in uncharacteristic habitats. The nationally scarce (Nb) fly *Periscelis annulata* was an unexpected find in dry, secondary, oak and birch woodland by Rollesby Sailing Club (Trinity5). This fly is a dead-wood species normally associated with parkland and old woodland where its larvae are reported to develop in sap runs. The common diuid fly *Dixa nebulosa* is a stream species and was unexpected in W5 woodland further to the south of the Sailing Club (Trinity10).

A separate document has been provided to the Broads Authority ecologists giving full details of all species records from the survey. This includes records of non-target species recorded casually.

Species richness

Summary statistics for numbers of species recorded are given below in table 4. The average number of Trichoptera species recorded in each sample was very low and this compromised the suitability of the results for some of the analyses carried out. By contrast, two individual families or family groups of Diptera were recorded in sufficient numbers to enable their responses to be individually analysed. Values for between sample diversity, calculated by Whittaker's measure, were low corresponding with the observation made in the field that there was little difference between the sites in either area.

Table 4. Species richness statistics for whole data set of 12 samples

<i>Target group</i>	<i>total S (γ-diversity)</i>	<i>mean sample S (α-diversity)</i>	<i>between sample (β-diversity)</i>
Araneae & Opiliones	49	10.3	4.8
Carabidae, Scirtidae & Staphylinidae	44	9.8	4.5
Diptera	259	70.6	3.7
Craneflies	49	14.3	3.4
Dolichopodidae	40	11.5	3.8
Trichoptera	9	2.8	3.2

Variations in species richness between samples collected from the two wet woodland types are shown in figure 1. Variations in species richness between samples collected from the Bure valley and the Muckfleet valley woodlands are shown in figure 2. The statistical significance of these variations of species richness can be assessed using the non-parametric Mann-Whitney U Test. This is a test that compares the rankings of values of sample species richness between classes of samples. The test generates a test statistic and a figure for the probability that the observed difference in rankings could be generated by chance.

For most of the target groups there was no significant difference in species richness between the woodland types (see table 5) or between the Bure valley and the Muckfleet valley woodlands (see table 6). The exception was the Diptera where the species richness was significantly higher in W5 than in W2 woodland. Interestingly there was no significant difference apparent in the species richness of the individual families or family groups of Diptera with sufficient data to be analysed. For the other

groups, the diversity of vegetation structure provided by the woodland can be supposed to attract a wider range of ecological groups, each linked to a particular height of vegetation or combination of different vegetation heights. This diversity of structure is likely to be more important than vegetation type for generalist predators such as Araneae, Carabidae and Staphylinidae and hence there is less likelihood of a difference in species richness between the two woodland types.

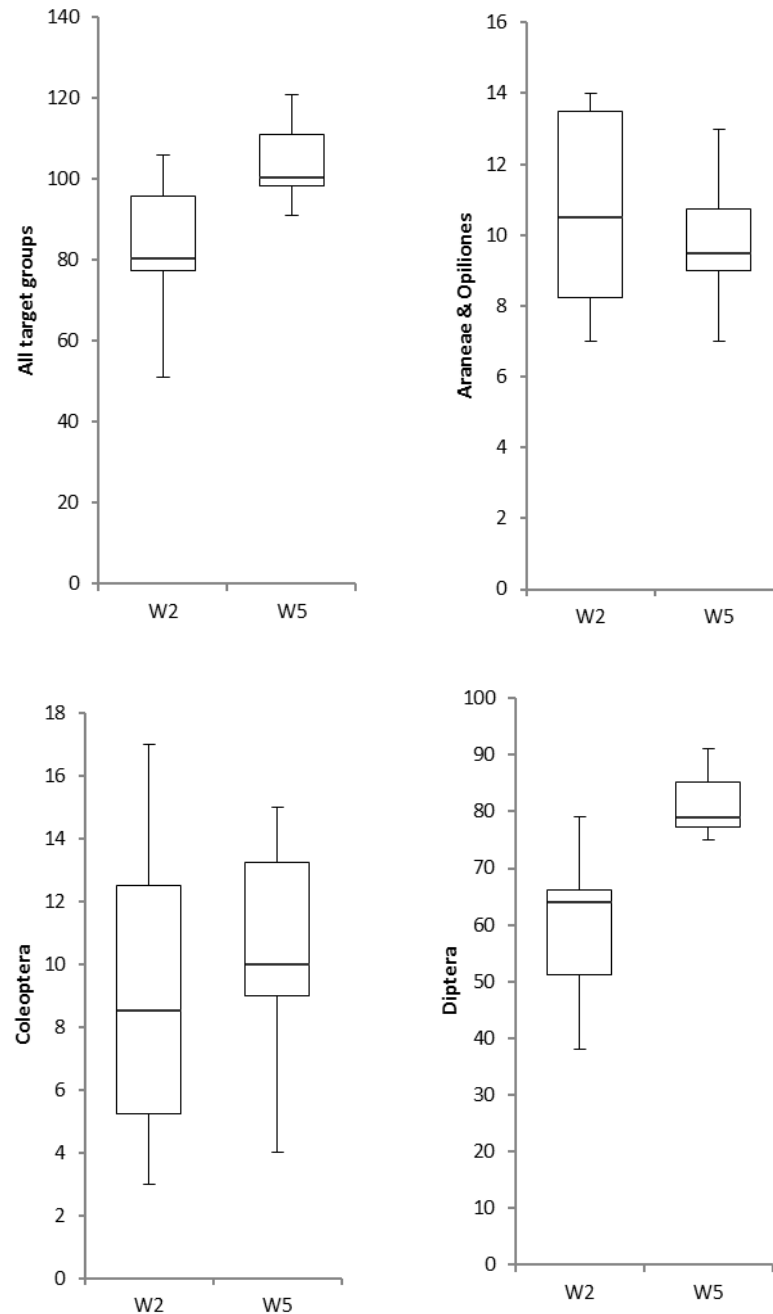


Figure 1: Box plots for numbers of species in samples of various target groups according to NVC classification of habitat (W2 = grey willow - downy birch – common reed woodland, W5 = alder - greater tussock sedge woodland; in box plots the central line represents the median value; the box contains the two middle 25% quartiles representing half of all the values recorded; the whiskers represent the spread between minimum and maximum values)

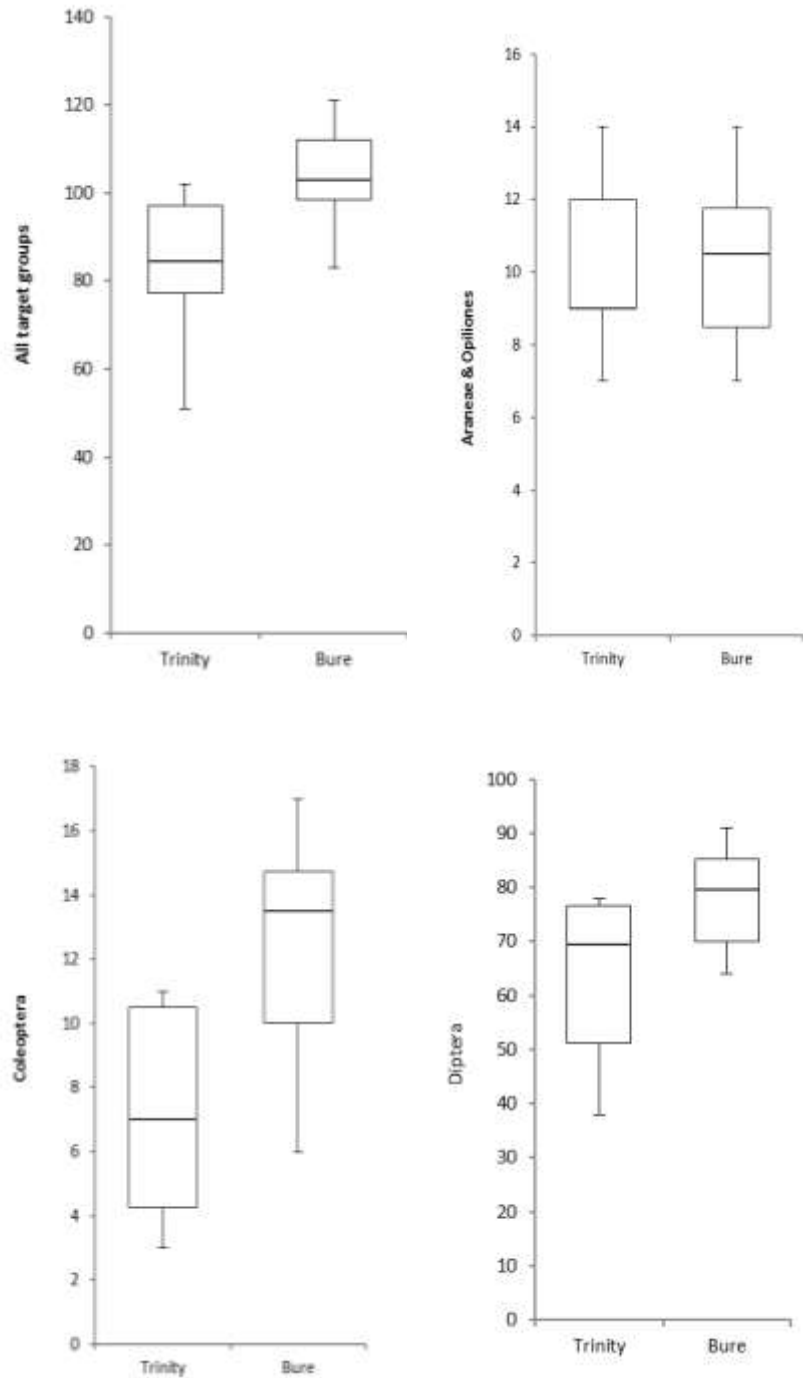


Figure 2: Box plots for numbers of species in samples of various target groups according to river valley (Trinity = woodlands around Trinity Broads in Muckfleet Valley, Bure = woodlands on Woodbastwick Fen in Bure Valley; in box plots the central line represents the median value; the box contains the two middle 25% quartiles representing half of all the values recorded; the whiskers represent the spread between minimum and maximum values)

Table 5. Total species richness of target groups in W2 and W5 wet woodland sites and Mann-Whitney U test statistic for differences in median species richness of samples (probabilities of such values being generated by chance are represented by asterisks where ** = $p < 0.01$; * = $p < 0.05$; values in italics represent no significant difference)

<i>Target group</i>	W2	W5	<i>U</i>
All groups	264	279	7
Araneae & Opiliones	42	30	<i>15.5</i>
Coleoptera	31	32	<i>15.5</i>
Diptera	182	210	3*
Craneflies	36	39	<i>9.5</i>
Dolichopodidae	31	30	<i>14</i>

Table 6. Total species richness of target groups in Bure valley and Muckfleet valley wet woodland sites and Mann-Whitney U test statistic for differences in median species richness of samples (probabilities of such values being generated by chance are represented by asterisks where ** = $p < 0.01$; * = $p < 0.05$; values in italics represent no significant difference)

<i>Target group</i>	<i>Bure</i>	<i>Muckfleet</i>	<i>U</i>
All groups	245	242	6
Araneae & Opiliones	31	36	<i>17</i>
Coleoptera	28	30	<i>5.5</i>
Diptera	180	171	<i>6.5</i>
Craneflies	34	30	<i>12</i>
Dolichopodidae	28	25	<i>8</i>

Analysis of Similarity (ANOSIM)

Similarity values between the different woodland samples are shown in table 7. Values closer to unity indicate samples with the highest level of similarity. Most of the invertebrate communities appear to have relatively low similarities with those from the other woodland samples. The exception to this is the community of sample Trinity5 which shows high similarity with the other sample woodland communities in

Table 7. Bray-Curtis similarity values for pairwise comparisons invertebrate communities wet woodland on Woodbastwick Fen in the Bure valley and around the Trinity Broads in the Muckfleet valley

	Bure Marshes					Trinity Broads					
	2	3	4	5	6	5	6	7	8	9	10
Bure	0.426	0.475	0.530	0.435	0.454	0.798	0.631	0.624	0.571	0.701	0.608
Bure2		0.552	0.500	0.429	0.520	0.811	0.685	0.705	0.638	0.736	0.630
Bure3			0.459	0.526	0.433	0.830	0.644	0.669	0.598	0.743	0.557
Bure4				0.557	0.478	0.803	0.746	0.738	0.694	0.835	0.676
Bure5					0.476	0.765	0.668	0.705	0.568	0.702	0.547
Bure6						0.811	0.665	0.761	0.598	0.724	0.524
Trinity5							0.705	0.688	0.656	0.714	0.660
Trinity6								0.593	0.590	0.589	0.526
Trinity7									0.520	0.610	0.562
Trinity8										0.537	0.500
Trinity9											0.569

general and those of the Bure Marshes in particular. Closer inspection suggests that this results from the invertebrate community at woodland Trinity5 comprising mainly eurytopic species requiring environmental conditions likely to be present in all of the sampled woodlands. More surprising is the low level of similarity between the Bure valley woodlands. Despite their physical proximity on Woodbastwick Fen, each of these woodlands seems to be providing a specific set of conditions favouring a different set of stenotopic invertebrate species. If this is indeed the case it has important implications for the level of detail required in producing management plans for the NNR.

The Bray-Curtis values shown in table 7 were used to test the statistical significance of placing the woodland invertebrate communities into two groups depending on whether they were present in W2 or in W5 type woodlands. The global ANOSIM test statistic of $R = -0.029$ ($p = 0.79$, 1000 randomisations) indicated that the communities were no more similar than if they had been collected randomly from wet woodlands.

The Bray-Curtis values shown in table 7 were used also to test the statistical significance of placing the woodland invertebrate communities into two groups depending on whether they were present in Bure valley or in Muckfleet valley woodlands. The global ANOSIM test statistic of $R = 0.764$ ($p = 0.001$, 1000 randomisations) indicated that the communities in each valley were significantly more similar than would be expected by random chance. The Bure valley and the Muckfleet valley communities were significantly different from each other.

Principal Components Analysis (PCA)

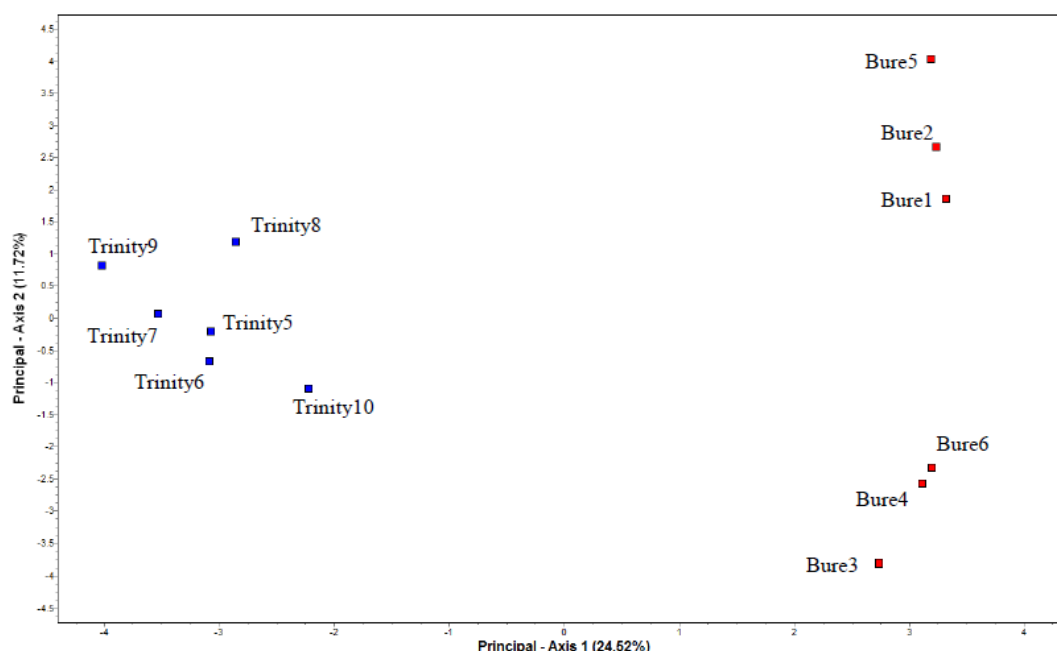


Figure 3: Principal Components Analysis (PCA) plot of samples from woodland invertebrate communities at Woodbastwick Fen in the Bure valley and around the Trinity Broads in the Muckfleet valley. (The proximity of data points indicates similarity of communities)

Ordination of the community data from each of the woodland samples clearly separates the Bure valley and the Muckfleet valley samples but shows no evidence of groupings based on NVC classification (see figure 3). This supports the results of the community similarity analysis above. The first two axes of the ordination explain more than a third of the variability in the data collected (see table 8).

Principal axis 1 shows the geographical separation of the woodland communities evident in the analysis of similarity. The underlying environmental cause of the distribution is less obvious. One possibility is that the axis may reflect the impacts of human disturbance. Buglife (2011b) warn that wet woodland habitats are very fragile and easily damaged by trampling of moss, ground litter and ground surfaces. The use of several of the sites around the Trinity Broads for game bird rearing combined with generally easier public access than to the Woodbastwick Fen sites would support such an interpretation. If this were the case it might be expected that clear differences in the conservation value of the invertebrate assemblages would be apparent between the Trinity Broads and the Woodbastwick Fen woodlands. PCA is not able to make such an assessment but analysis using ISIS (see table 9) suggests that conservation value, at least of the wetland assemblage types, is indeed greater on Woodbastwick Fen.

Principal axis 2 clearly separates the Bure valley woodlands into two groups. Although, the recording of environmental variables did not form part of the study, examination of casual observations on the habitats sampled (see table 3) suggests that the axis may be related to hydrological conditions, those sites with drier substrate being in a more positive direction along the axis. However, examination of the PCA plot of the invertebrate species Eigenvectors (see figure 4) provides less clear evidence supporting this interpretation. The nine species named in figure 4 are associated with the samples from the Bure valley only and are clearly divided into two groups associated with the two groups of woodlands. However, all of these species are recognised as being associated with wetland habitats and there is limited evidence that species in each of the two groups are found preferentially in different conditions of soil moisture / humidity. For example, a study of the marsh beetle *Cyphon padi* in Lithuania (Dapkus, 2008) showed that the beetle was one of just eight species from a total of 80 that occurred in all three habitats sampled (open bog, pine bog and pine forest) and although it was able to cope with the drier forest conditions *C. padi* showed a preference for bog, especially shaded pine bog, supporting its location along principal axis 2. On the other hand, the rove beetle *Stenus juno* is widespread in almost any kind of wetland habitat (Lott and Anderson, 2011) and the spider *Oedothorax gibbosus* is associated with a wide range of wetland habitats in Britain (Bell, 2002) although it is considered an inhabitant of oligotrophic alder carr in some European countries (Maelfait *et al.*, 1995; Stańska *et al.*, 2000).

Table 8. Eigenvalues for the first three axes of the PCA undertaken on the invertebrate community data from the Bure valley and Muckfleet valley woodlands

<i>Principal Axis</i>	<i>Eigenvalue</i>	<i>Cumulative % of total variance</i>
1	120	24.52
2	57	36.24
3	50	46.49

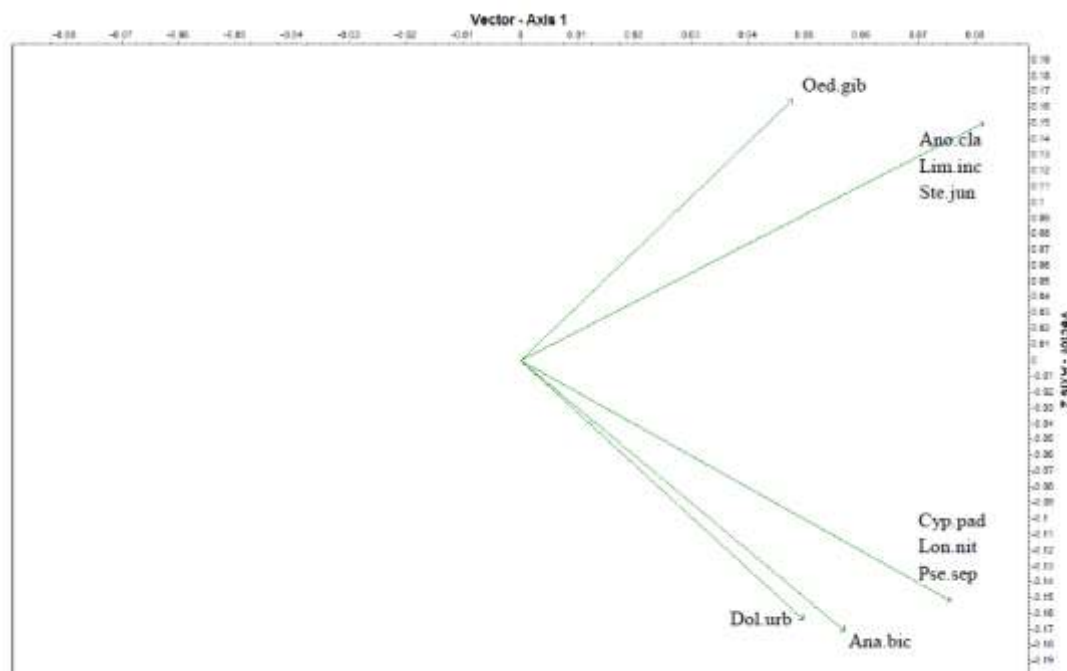


Figure 4: The 9 largest Eigenvectors for the invertebrate species variables calculated by PCA. (Ana.bic = *Anagnota bicolor*; Ano.cla = *Anopheles claviger*; Cyp.pad = *Cyphon padi*; Dol.urb = *Dolichopus urbanus*; Lim.inc = *Limnephilus incisus*; Lon.nit = *Lonchoptera nitidifrons*; Oed.gib = *Oedothorax gibbosus*; Pse.sep = *Pseudolimnophila sepium*; Ste.jun = *Stenus junco*)

Analysis using ISIS

Broad assemblage types (BATs)

Lott *et al.* (2010) recommended that the W3 permanent wet mire assemblage type should be counted as the priority assemblage type in fens. The present survey sampled later successional stages of the hydrosere than the earlier study but it is evident from table 9 that the wetland assemblages of the invertebrate community are important also in the carr woodlands of the Broads. No single assemblage type was dominant, based on representation scores, in all of the woodlands sampled but the W3 permanent wet mire assemblage was the most important in the Bure valley woodlands and in two of the Muckfleet valley woodlands. The shaded field layer assemblage F3 had greater importance in the Muckfleet valley woodlands in general but only at Trinity5 was it truly the dominant assemblage. This site was an area of dry, secondary oak and birch woodland on the edge of Rollesby Broad where felling had opened up much of the area. It was quite different in nature to the other woodlands sampled and produced the lowest species richness of just 50. The presence of the scarce saproxylic fly *Periscelis annulata* within a small species list skewed the analysis of the fauna producing an unexpectedly high representation of the A2 wood decay assemblage.

Despite the nature of the habitats surveyed there was limited evidence of arboreal assemblages in the invertebrate samples. In part at least this was due to the difficulty of adequately sampling these assemblages without the use of resource intensive techniques. However, the species of the A2 wood decay assemblage that were detected without the use of specialist techniques suggests that more effort to detect these saproxylic invertebrates would be worthwhile.

A simple measure of the conservation value of the broad assemblage types is provided by the BAT rarity scores given in table 9. At most of the Bure valley sites the scores for the W3 permanent wet mire assemblage exceeded the threshold for a nationally important assemblage but did not match the values reported for open fen communities by Lott *et al.* (*ibid.*). It should also be remembered that conservation value is best assessed using information on specific assemblage types. It was interesting to note that the W1 flowing water assemblage was highlighted as being of national importance at the Bure3 and Bure6 sites. The species, mainly Diptera, within these

Table 9: Scores for ISIS broad assemblage types by woodland

(A1 = arboreal canopy, A2 = wood decay, F1 = unshaded early successional mosaic, F2 = grassland & scrub matrix, F3 = shaded field & ground layer, W1 = flowing water, W2 = mineral marsh & open water, W3 = permanent wet mire; representation score = percentage of species that are characteristic of BAT; rarity score = average species rarity score for species characteristic of BAT; * = assemblage exceeding threshold of national importance)

	A1	A2	F1	F2	F3	
Woodland	Represent. (1-100)	Represent. (1-100)	Represent. (1-100)	Represent. (1-100)	Represent. (1-100)	Rarity score
Bure 1	2	4	1	8	15	106
Bure 2	2	4	0	10	12	
Bure 3	1	3	0	10	14	
Bure 4	3	3	0	5	11	
Bure 5	2	8	0	6	14	
Bure 6	1	2	1	4	7	
Trinity 5	2	11	0	18	33	
Trinity 6	0	2	0	14	22	100
Trinity 7	0	8	0	11	28	100
Trinity 8	2	4	0	14	22	110
Trinity 9	0	1	1	15	15	
Trinity 10	1	9	0	8	14	

	W1		W2		W3	
Woodland	Represent. (1-100)	Rarity score	Represent. (1-100)	Rarity score	Represent. (1-100)	Rarity score
Bure 1	10		16	131	32	188*
Bure 2	6		19	106	33	168
Bure 3	20	170*	9		31	226*
Bure 4	16		8		43	214*
Bure 5	12		13		27	189*
Bure 6	17	156*	11		43	223*
Trinity 5	9		4		7	
Trinity 6	20	150	9		14	
Trinity 7	14		10		14	
Trinity 8	13		12		18	129
Trinity 9	17		14		23	144
Trinity 10	18	144	8		18	

assemblages are mostly associated with seepages rather than moving water in channels, ditches and streams.

BAT rarity scores could not be compared across all assemblage types and sites as sample size was insufficient to generate the scores in many cases. Examination of the rarity scores for the W3 permanent wet mire assemblage suggest there was no significant difference in the invertebrate conservation value between W2 and W5 NVC type woodlands but that the Bure valley woodlands were of significantly higher conservation value than the Muckfleet valley woodlands. If further data were available the conclusions may differ for the conservation value of other assemblage types.

Specific assemblage types (SATs)

The SATs recorded for each compartment are listed in table 10. The most widely recorded SATs were W314 (reed fen and pools), W313 (moss and tussock fen) and W126 (seepage). SATs recorded at much lower levels of representation included W312 (Sphagnum bog), W221 (undisturbed fluctuating marsh), A213 (fungal fruiting bodies) and A212 (bark & sapwood decay). None of these assemblages were identified as being of national importance.

Table 10: Recorded species numbers for ISIS specific assemblage types by woodland

(W314 = reed-fen and pools, W313 = moss & tussock fen, W221 = undisturbed fluctuating marsh, W126 = seepage, A213 = fungal fruiting bodies, A212 = bark & sapwood decay, F003 = scrub-heath & moorland, F111 = bare sand & chalk)

<i>Woodland</i>	<i>W314</i>	<i>W313</i>	<i>W221</i>	<i>W126</i>	<i>A213</i>	<i>A212</i>	<i>F003</i>	<i>F111</i>
Bure1	3	3	1	1	1		1	
Bure2	4	1		1			1	
Bure3	5	2		4			1	
Bure4	7	2		1				
Bure5	2	2	1	1	1	1	1	
Bure6	8	2		1				
Trinity5								
Trinity6		1		2			1	
Trinity7				1				
Trinity8				1		1	1	
Trinity9			1					1
Trinity10	1	1		1				

The SAT scores are simple species richness values covering a small range of integers. In addition, there is still some imprecision in the definition of W314 and W313 assemblage types especially as expressed in the coding of Diptera species. The faunas of the Muckfleet valley woodlands were comparatively poor in numbers of stenotopic species associated with any of these specific assemblage types. The sparse data from the Muckfleet valley prevents robust analysis but again there is no evidence of a difference in the invertebrate conservation value between W2 and W5 NVC type woodlands.

CONCLUSIONS

Invertebrate conservation value of areas of wet woodlands in the Broads

There was no evidence of differences in species richness between wet woodlands in the Bure valley and wet woodlands in the Muckfleet valley but the quality of the invertebrate assemblages was in general higher in the Bure valley. This difference was reflected not only in the presence of more species of conservation concern but also in the higher rarity scores for most of the broad assemblage types for which sufficient data was available to make the assessment. None of the assemblages from the Muckfleet valley woodlands appeared to be of national importance but there were several such high quality communities identified in the Bure valley woodlands. Most of the Bure valley woodlands supported a W1 flowing water assemblage and / or a W3 permanent wet mire assemblage of national importance. The W1 assemblage was dominated by Diptera including BAP Priority species of crane fly associated with seepages. On present evidence the W3 assemblage in particular is better represented in open fen compartments.

NVC wet woodland invertebrate communities

There was no evidence of any differences in the invertebrate communities found in W2 and W5 woodland. These communities were shown to be similar in species richness, community structure and conservation value. This was not entirely unexpected as one of reasons for the development of ISIS was the recognition of the inability of vegetation defined communities to describe adequately invertebrate communities (Webb & Lott, 2006).

Future work programmes

This exploratory survey has identified differences in the conservation value of wet woodland compartments in the Bure valley and Muckfleet valley but has not been able to link these differences with woodland type or with environmental variables. It is difficult to assess whether these links truly do not exist or simply were not detected due to the limitations of the survey. It is recommended that any future monitoring programme dealing with the conservation interest of wet woodland invertebrates in the Broads is based on a new protocol better adapted to woodland habitats than that used by Lott *et al.* (2010). In particular there is a need to give more attention to the sampling of arboreal assemblages which will require the use of specialist techniques including trapping e.g. vane traps. Other suggested extensions / improvements include measurement of environmental variables, the sampling of a greater number of woodlands to increase the robustness of the analysis and ground truthing of NVC communities if these are considered important to the aims of the work.

ACKNOWLEDGMENTS

Andrea Kelly (Broads Authority) acted as project officer. Hannah Gray (Broads Authority) and Rick Southwood (Natural England) selected the compartments to be surveyed and provided landowner contact details and environmental information.

Terrestrial beetles were sampled and identified by Paul Lee. Diptera and caddis flies were sampled and identified by Martin Drake. Spiders and other taxa were sampled and identified by Paul Lee. Hannah Gray (BA), Des Hunt, Rick Southwood (NE) and Ed Wharton gave permission for access.

REFERENCES

- Bell, J.R. 2002. *Oedothorax gibbosus* species account. In Harvey, P.R., Nellist, D.R. and Telfer, M.G. (eds.) *Provisional atlas of British spiders (Arachnida, Araneae), Volumes 1 & 2*. Biological Records Centre, Huntingdon.
- Boardman, P. 2007. *A provisional account and atlas of The Craneflies of Shropshire*. Privately published.
- Buglife. 2011a. *Notable invertebrates associated with wet woodland*. [online]. [www.buglife.org.uk/Resources/Buglife/Migrated%20Resources/Documents/3220 Notable%20invertebrates%20associated%20with%20wet%20woodland.pdf](http://www.buglife.org.uk/Resources/Buglife/Migrated%20Resources/Documents/3220%20Notable%20invertebrates%20associated%20with%20wet%20woodland.pdf). [Accessed December 12th 2011]
- Buglife. 2011b. *Wet woodland. Managing Priority Habitats for Invertebrates*. [online]. [www.buglife.org.uk/conservation/adviceonmanagingbaphabitats/wet woodland](http://www.buglife.org.uk/conservation/adviceonmanagingbaphabitats/wet%20woodland). [Accessed December 12th 2011]
- Dapkus, D. and Tamutis, V. 2008. Assemblages of beetles (Coleoptera) in a peatbog and surrounding pine forest. *Baltic Journal of Coleopterology*, 8 (1), 31 - 40.
- Drake, C.M., Lott, D.A., Alexander, K.N.A. and Webb, J. 2007. *Surveying terrestrial and freshwater invertebrates for conservation evaluation*. Natural England Research Report NERR005. Natural England, Peterborough.
- Hawke, C.J. and José, P.V. 1996. *Reedbed Management for Commercial and Wildlife Interests*. RSPB, Sandy.
- Kirby, P. 1992. *Habitat Management for Invertebrates: A practical handbook*. RSPB, Sandy.
- Lott, D.A. and Anderson, R. 2011. *The Staphylinidae (rove beetles) of Britain and Ireland. Parts 7 & 8: Oxyporinae, Steninae, Euaesthetinae, Pseudopsinae, Paederinae, Staphylininae*. Handbooks for the identification of British insects, 12(7). Royal Entomological Society, St Albans.
- Lott, D.A., Drake, C.M. and Lee, P. 2010. *Broads Fen Invertebrate Survey. Project 1: Assemblage responses to local factors. Project 4: Evaluation of invertebrate assemblages. Final Report*. Unpublished report for Broads Authority.
- Lott, D.A., Procter, D.A. and Foster, A.P. 2002. *East Anglian Fen Invertebrate Survey. English Nature Research Reports Number 477*. English Nature, Peterborough.
- Maelfait, J.P., De Keer, R., De Becker, P. and Huybrechts, W. 1995. Analysis of the spider fauna of the riverine forest nature reserve 'Walenbos' (Flanders, Belgium) in relation to hydrology and vegetation. In Ruzicka, V. (ed.) *Proceedings of the 15th European Colloquium of Arachnology*. Institute of Entomology, Ceske Budejovice.
- Morris, M.G. 1990. *Orthocerous Weevils: Coleoptera: Curculionoidea (Nemonychidae, Anthribidae, Urodontidae, Attelabidae and Apionidae)*. Handbooks

for the identification of British insects, 5(16). Royal Entomological Society, St Albans.

Panter, C., Mossman, H. and Dolman, P. M. 2011. *Biodiversity Audit and Tolerance Sensitivity Mapping for the Broads. Broads Authority Report*. University of East Anglia, Norwich.

Stańska, M., Hajdamowicz, I. and Zabka, M. 2000. Epigeic spiders of alder swamp forests in Eastern Poland. In Toft, S. and Scharff, N. (eds.) *Proceedings of the 19th European Colloquium of Arachnology*. Aarhus University Press, Aarhus.

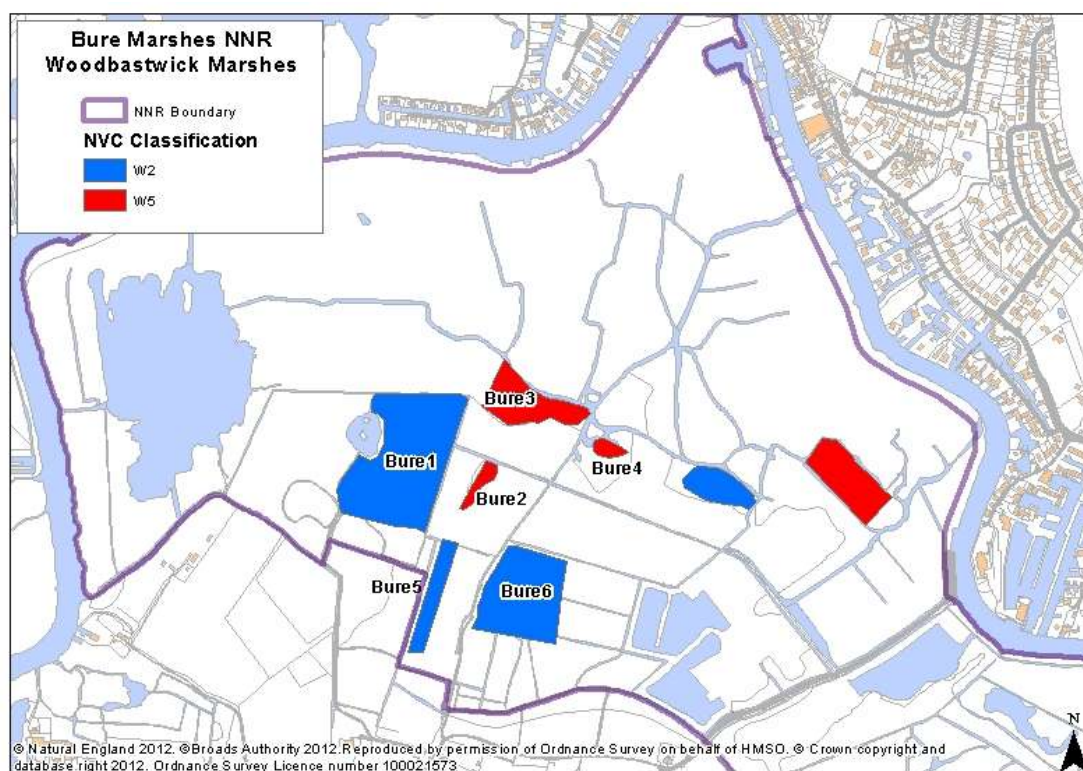
Roháček, J. 1999. A revision and re-classification of the genus *Paranthomyza* Czerny, with description of a new genus of *Anthomyzidae* (Diptera). *Studia dipterologica* 6, 373-404.

Starý, J. & Reusch, H. 2009. European species of the subgenus *Brachylimnophila* (Diptera: Limoniidae). *Entomologica Fennica* 19, 207-217.

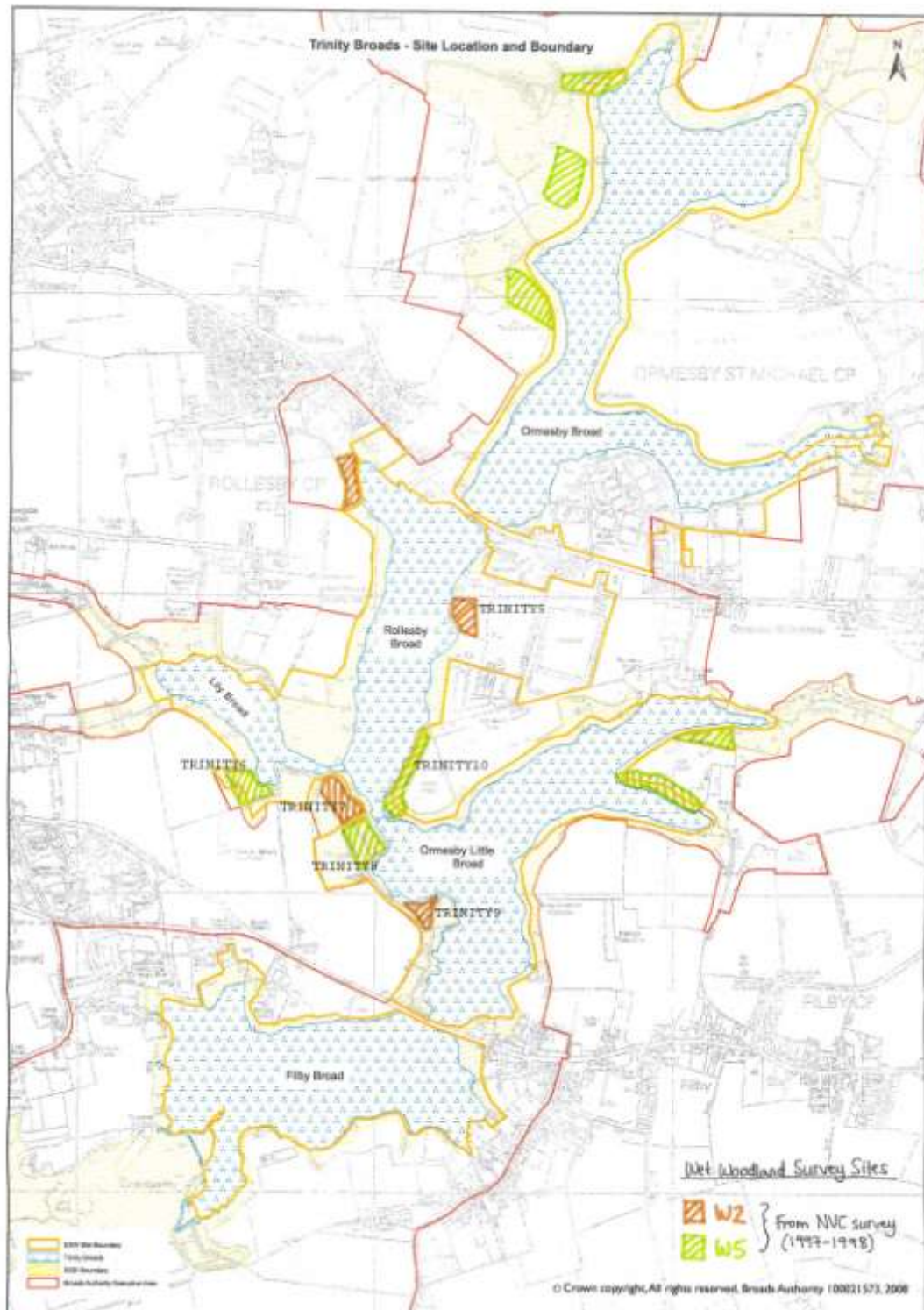
Webb, J. and Lott, D.A. 2006. The Development of ISIS: A Habitat-based Invertebrate Assemblage Classification System for Assessing Conservation Interest in England. *Journal of Insect Conservation* 10(2), 179-188.

APPENDIX 1: MAPS OF ALL SAMPLE SITES

Bure valley woodlands



Muckfleet valley woodlands



APPENDIX 2: LIST OF ALL SPECIES RECORDED

ISIS BAT codes: 0 = unclassified, A1 = Arboreal canopy, A2 = wood decay, F1 = unshaded early successional mosaic, F2 = grassland & scrub matrix, F3 = shaded field & ground layer, W1 = flowing water, W2 = mineral marsh & open water, W3 = permanent wet mire, #N/A = not in ISIS database.

ISIS SAT codes: A212 = bark & sapwood decay, A213 = fungal fruiting bodies, F003 = scrub-heath & moorland, F111 = bare sand & chalk, W126 = seepage, W221 = undisturbed fluctuating marsh, W313 = moss and tussock fen, W314 = reed fen and pools.

ISIS rarity scores for target groups are based on recently recorded range size in Britain, where these are accessible. Scores of 8 or 16 are more or less equivalent, as far as they can be, to national red data book status or a nationally scarce grade A designation; a score of 4 is roughly equivalent to a nationally scarce grade B designation.

Group	Species	No. samples	ISIS BAT code	ISIS SAT code	ISIS Rarity Score
Diplopoda (millipedes)	<i>Brachydesmus superus</i>	1	F3		1
	<i>Craspedosoma rawlinsii</i>	6	F3		2
	<i>Cylindroiulus britannicus</i>	2	A2		1
	<i>Cylindroiulus punctatus</i>	7	F3		1
	<i>Julus scandinavicus</i>	5	F3		1
	<i>Ophiulus pilosus</i>	1	F3		1
	<i>Polydesmus angustus</i>	6	0		1
	<i>Polydesmus inconstans</i>	1	F2		1
	<i>Proteroiulus fuscus</i>	2	A2		1
	<i>Tachypodoiulus niger</i>	1	0		1
Chilopoda (centipedes)	<i>Cryptops hortensis</i>	4	0		1
	<i>Geophilus easoni</i>	4	F3		0
	<i>Geophilus truncorum</i>	2	A2		1
	<i>Lithobius crassipes</i>	1	F2		1
	<i>Lithobius forficatus</i>	3	0		1
	<i>Lithobius melanops</i>	1	F1		1
	<i>Lithobius microps</i>	1	F3		1
Isopoda (woodlice)	<i>Ligidium hypnorum</i>	11	F3		2
	<i>Oniscus asellus</i>	8	0		1
	<i>Philoscia muscorum</i>	11	0		1
	<i>Porcellio scaber</i>	9	0		1
	<i>Trichoniscus pusillus</i>	11	0		1
Orthoptera – Tetrigidae	<i>Tetrix subulata</i>	1	W2		2
Hemiptera (bugs)	<i>Cixius nervosus</i>	1	0		1
	<i>Hydrometra stagnorum</i>	1	W2		1
	<i>Kleidocerys resedae</i>	2	A1		1
	<i>Neolygus contaminatus</i>	1	A1		1
	<i>Oncopsis alni</i>	1	A1		1
	<i>Oncopsis flavicollis</i>	2	A1		1
	<i>Scolopostethus puberulus</i>	1	F2		2
	<i>Stygnocoris fuliginus</i>	1	F2		1

Group	Species	No. samples	ISIS BAT code	ISIS SAT code	ISIS Rarity Score
Coleoptera - Carabidae	<i>Acupalpus dubius</i>	2	W3		1
	<i>Agonum fuliginosum</i>	3	W2		1
	<i>Amara eurynota</i>	1	F1	F111	2
	<i>Elaphrus cupreus</i>	1	W2		1
	<i>Notiophilus biguttatus</i>	2	0		1
	<i>Pterostichus diligens</i>	5	W3		1
	<i>Pterostichus madidus</i>	1	F2		1
	<i>Pterostichus melanarius</i>	1	F2		1
	<i>Pterostichus minor</i>	5	W3		1
	<i>Pterostichus nigrita</i>	3	W2		1
Coleoptera – Silphidae	<i>Silpha atrata</i>	1	0		1
Coleoptera - Staphylinidae	<i>Anotylus rugosus</i>	3	W2		1
	<i>Brachygluta fossulata</i>	2	F2		1
	<i>Erichsonius cinerascens</i>	6	W3		2
	<i>Lathrobium brunnipes</i>	6	0		1
	<i>Lathrobium elongatum</i>	1	W3		2
	<i>Lathrobium fovulum</i>	2	W2	W221	2
	<i>Lesteva longoelytrata</i>	1	W1		1
	<i>Mycetoporus splendidus</i>	1	F2		1
	<i>Ocalea badia</i>	1	F2		1
	<i>Oxypoda opaca</i>	1	F2		1
	<i>Paederus riparius</i>	1	W3	W314	2
	<i>Philonthus fumarius</i>	2	W3	W313	4
	<i>Quedius fuliginosus</i>	2	W2		1
	<i>Quedius maurorufus</i>	1	W1		1
	<i>Rugilus erichsoni</i>	1	W3		2
	<i>Rugilus orbiculatus</i>	1	F2		1
	<i>Sepedophilus marshami</i>	1	F2		1
	<i>Stenus argus</i>	1	W2	W221	4
	<i>Stenus bifoveolatus</i>	5	W3		1
	<i>Stenus bimaculatus</i>	5	W2		1
	<i>Stenus carbonarius</i>	1	W3	W314	4
	<i>Stenus flavipes</i>	1	0		1
	<i>Stenus juno</i>	3	W2		1
	<i>Stenus latifrons</i>	1	W3		1
	<i>Stenus nitidiusculus</i>	2	W3		1
	<i>Tachinus rufipes</i>	1	F2		1
	<i>Tachyporus dispar</i>	1	F2		1
	<i>Tachyporus hypnorum</i>	2	F2		1
	<i>Tachyporus pallidus</i>	1	W2		2
Coleoptera - Scirtidae	<i>Microcara testacea</i>	5	W2		1
	<i>Cyphon coarctatus</i>	9	0		1
	<i>Cyphon hilaris</i>	5	W3		2
	<i>Cyphon ochraceus</i>	2	W2		1
	<i>Cyphon padi</i>	3	W3		2
Coleoptera – Elateridae	<i>Athous haemorrhoidalis</i>	2	F2		1
Coleoptera – Phalacridae	<i>Stilbus testaceus</i>	1	#N/A		0
Coleoptera – Cantharidae	<i>Cantharis figurata</i>	1	F2	F211	2
	<i>Malthinus flaveolus</i>	1	A2	A212	1
	<i>Rhagonycha testacea</i>	1	F2		1
	<i>Silis ruficollis</i>	1	F2		4
Coleoptera – Anobiidae	<i>Anobium fulvicorne</i>	1	A2	A212	1
	<i>Ochina ptinoides</i>	1	A2	A212	2
Coleoptera – Lathridiidae	<i>Stephostethus lardarius</i>	1	#N/A		0
Coleoptera – Coccinellidae	<i>Adalia 10-punctata</i>	1	A1		1

Group	Species	No. samples	IS BAT code	IS SAT code	IS Rarity Score
Coleoptera – Coccinellidae	<i>Coccinella 7-punctata</i>	1	0		1
	<i>Philorhizus melanocephalus</i>	1	F1		1
Coleoptera – Chrysomelidae	<i>Phaedon armoraciae</i>	1	W2		1
Coleoptera – Rhynchitidae	<i>Deporaus betulae</i>	2	A1		1
Coleoptera – Eirrhinidae	<i>Thryogenes fiorii</i>	1	F2	F211	0
Coleoptera – Apionidae	<i>Trichapion simile</i>	1	A1		2
Coleoptera - Curculionidae	<i>Phyllobius argentatus</i>	1	A1		1
	<i>Phyllobius glaucus</i>	1	A1		1
	<i>Phyllobius pyri</i>	1	A1		1
	<i>Polydrusus cervinus</i>	2	A1		1
	<i>Strophosoma melanogrammum</i>	1	A1		1
Diptera – craneflies (Limoniidae + Pediciidae + Ptychopteridae + Tipulidae)	<i>Achyrolimonia decemmaculata</i>	2	A2	A212	2
	<i>Atypophthalmus inustus</i>	2	A2	A213	4
	<i>Austrolimnophila ochracea</i>	11	A2		1
	<i>Dicranomyia lucida</i>	6	W1		4
	<i>Dicranomyia modesta</i>	2	W3		1
	<i>Dicranophragma nemorale</i>	5	W1		1
	<i>Dicranophragma separatum</i>	6	W1		1
	<i>Dolichopeza albipes</i>	1	W1		2
	<i>Epiphragma ocellare</i>	6	A2		2
	<i>Euphyllidorea aperta</i>	1	W1		2
	<i>Gonomyia bifida</i>	4	W3	W314	4
	<i>Helius flavus</i>	8	W3		2
	<i>Helius longirostris</i>	10	W2		1
	<i>Limonia macrostigma</i>	10	W1		1
	<i>Limonia nubeculosa</i>	6	F3		1
	<i>Limonia phragmitidis</i>	6	F3		1
	<i>Lipsothrix nervosa</i>	2	W1	W126	2
	<i>Metalimnobia quadrinotata</i>	1	F3		1
	<i>Molophilus appendiculatus</i>	1	W1		1
	<i>Molophilus bihamatus</i>	10	W1	W126	4
	<i>Molophilus medius</i>	7	W1		1
	<i>Molophilus ochraceus</i>	5	W3		1
	<i>Molophilus serpentiger</i>	1	W1		1
	<i>Neolimnomyia batava</i>	2	W2		2
	<i>Neolimonia dumetorum</i>	4	A2		1
	<i>Nephrotoma guestfalica</i>	1	W1		2
	<i>Nephrotoma quadrifaria</i>	3	F3		1
	<i>Ormosia pseudosimilis</i>	2	F2		2
	<i>Paradelphomyia czizekiana</i>	1	#N/A		0
	<i>Phylidorea abdominalis</i>	1	W3		4
	<i>Phylidorea ferruginea</i>	1	W3		1
	<i>Phylidorea fulvonervosa</i>	9	W3		1
	<i>Pilaria decolor</i>	4	W3		0
	<i>Pilaria discicollis</i>	6	W2		1
	<i>Pilaria nigropunctata</i>	1	W3		0
	<i>Pilaria scutellata</i>	2	W3		4
	<i>Pseudolimnophila sepium</i>	3	W1		1
	<i>Rhipidia maculata</i>	1	A2		1
	<i>Tasiocera murina</i>	7	F3		1
	<i>Thaumastoptera calceata</i>	1	W1	W126	4
	<i>Tipula fascipennis</i>	2	F2		1
	<i>Tipula lunata</i>	2	F3		1
	<i>Tipula oleracea</i>	1	W3		1

Group	Species	No. samples	I/S BAT code	I/S SAT code	I/S Rarity Score
Diptera – craneflies	<i>Tipula unca</i>	8	W1		1
	<i>Tipula variicornis</i>	1	F3		1
	<i>Tipula vernalis</i>	1	F2		1
	<i>Tricyphona immaculata</i>	1	W3		1
	<i>Ula sylvatica</i>	1	F3		1
Diptera - Anisopodidae	<i>Sylvicola cinctus</i>	1	0		1
Diptera - Anthomyzidae	<i>Anagnota bicolor</i>	4	W3		4
	<i>Anthomyza neglecta</i>	2	W3		0
	<i>Paranthomyza caricis</i>	1	#N/A		0
Diptera - Asilidae	<i>Dioctria linearis</i>	1	F2	F212	2
Diptera - Aulacigastridae	<i>Stenomicroa cogani</i>	6	W3	W313	8
Diptera - Calliphoridae	<i>Pollenia griseotomentosa</i>	2	0		1
	<i>Pollenia labialis</i>	1	0		2
	<i>Pollenia rudis</i>	1	0		1
Diptera - Camillidae	<i>Camilla glabrata</i>	1	#N/A		0
Diptera - Chaoboridae	<i>Chaoborus flavicans</i>	9	W2		0
	<i>Chaoborus pallidus</i>	1	W3		0
Diptera - Chloropidae	<i>Elachiptera cornuta</i>	1	0		1
	<i>Gaurax dubius</i>	1	0		0
Diptera - Chyromyidae	<i>Gymnochiromyia ?inermis(female)</i>	1	#N/A		0
Diptera - Clusiidae	<i>Clusia flava</i>	1	A2		2
	<i>Clusiodes albimana</i>	2	A2		2
	<i>Clusiodes gentilis</i>	1	A2		2
	<i>Clusiodes verticalis</i>	3	A2		2
	<i>Aedes annulipes</i>	9	W2		2
Diptera - Culicidae	<i>Aedes cantans</i>	2	W2		1
	<i>Anopheles claviger</i>	3	W2		1
	<i>Culex pipiens</i>	2	W2		1
	<i>Culiseta annulata</i>	1	W2		1
	<i>Culiseta fumipennis</i>	1	W2		2
	<i>Culiseta morsitans</i>	7	W2		1
	<i>Campichoeta punctum</i>	3	F2		2
Diptera - Diastatidae	<i>Diastata adusta</i>	3	0		1
	<i>Diastata fuscata</i>	8	F3		1
	<i>Dixa nebulosa</i>	1	W1		1
Diptera - Dixidae	<i>Dixella amphibia</i>	3	W3		1
	<i>Dixella serotina</i>	2	W3	W314	2
Diptera - Dolichopodidae	<i>Achalcus cinereus</i>	7	W3		2
	<i>Achalcus flavicollis</i>	7	W3		2
	<i>Achalcus nigropunctatus</i>	4	#N/A		0
	<i>Achalcus vaillanti</i>	5	W3	W314	0
	<i>Anepsiomyia flaviventris</i>	8	W1		2
	<i>Argyra ?argentina/perplexa (f)</i>	1	#N/A		0
	<i>Argyra diaphana</i>	1	W1		1
	<i>Argyra elongata</i>	4	W3		2
	<i>Argyra leucocephala</i>	1	W1		1
	<i>Argyra vestita</i>	1	W3		2
	<i>Campsicnemus curvipes</i>	4	W1		1
	<i>Campsicnemus loripes</i>	2	W3		1
	<i>Campsicnemus scambus</i>	11	W3		1
	<i>Chrysotus gramineus</i>	1	0		1
	<i>Chrysotus neglectus</i>	1	0		1
	<i>Dolichopus griseipennis</i>	1	0		1
	<i>Dolichopus longitarsis</i>	1	W3		2
	<i>Dolichopus pennatus</i>	2	W1		1

Group	Species	No. samples	I/S BAT code	I/S SAT code	I/S Rarity Score
Diptera - Dolichopodidae	<i>Dolichopus picipes</i>	2	W1		2
	<i>Dolichopus popularis</i>	6	W1		1
	<i>Dolichopus urbanus</i>	4	W1		1
	<i>Dolichopus wahlbergi</i>	1	W1		2
	<i>Ethiomyia chalybeus</i>	4	W3		2
	<i>Gymnopternus aerosus</i>	9	W3		1
	<i>Gymnopternus assimilis</i>	3	W3	W314	2
	<i>Gymnopternus blankaartensis</i>	7	W3	W314	0
	<i>Gymnopternus cupreus</i>	4	W1		2
	<i>Gymnopternus metallicus</i>	12	W1		1
	<i>Gymnopternus ?silvestris</i> (female)	1	W1		2
	<i>Lamprochromus elegans</i>	1	W3		2
	<i>Medetera impigra</i>	1	A2		0
	<i>Medetera muralis</i>	1	A2		2
	<i>Sciapus platypterus</i>	5	F3		1
	<i>Sybistroma obscurellum</i>	4	F3		1
	<i>Sympycnus desoutteri</i>	1	W2		1
	<i>Syntormon bicolorellum</i>	2	W3		2
	<i>Syntormon tarsatum</i>	1	W3		2
	<i>Teuchophorus spinigerellus</i>	1	W3		2
	<i>Thrypticus atomus</i>	1	#N/A		0
	<i>Xanthochlorus ornatus</i>	4	0		2
Diptera - Drosophilidae	<i>Drosophila obscura</i>	1	#N/A		0
	<i>Drosophila phalerata</i>	3	#N/A		0
	<i>Drosophila subobscura</i>	2	#N/A		0
	<i>Lordiphosa andalusiana</i>	2	#N/A		0
	<i>Scaptomyza flava</i>	7	#N/A		0
	<i>Scaptomyza graminum</i>	5	#N/A		0
	<i>Scaptomyza pallida</i>	6	#N/A		0
Diptera – Dryomyzidae	<i>Neuroctena anilis</i>	1	F3		1
Diptera - Empididae	<i>Chelipoda albiseta</i>	6	W1		2
	<i>Dolichocephala oblongoguttata</i>	7	W1		2
	<i>Empis aestiva</i>	3	0		1
	<i>Empis scutellata</i>	1	0		2
	<i>Hilara longifurca</i>	7	0		1
	<i>Hilara rejecta</i>	3	W1		2
	<i>Phyllodromia melanocephala</i>	9	F3		1
	<i>Rhamphomyia caliginosa</i>	3	0		4
	<i>Rhamphomyia nigripennis</i>	2	F3		1
	<i>Rhamphomyia tibiella</i>	3	F3		1
Diptera - Ephydriidae	<i>Axysta cesta</i>	3	W3		2
	<i>Coenia curvicauda</i>	8	W3		1
	<i>Coenia palustris</i>	7	W3		1
	<i>Ditrichophora calceata</i>	4	W1		1
	<i>Ditrichophora fuscella</i>	9	W1		1
	<i>Hydrellia albilabris</i>	1	W3		1
	<i>Hydrellia maura</i>	2	0		1
	<i>Hydrellia thoracica</i>	1	W3		1
	<i>Ilythea spilota</i>	5	0		1
	<i>Limmellia fallax</i>	2	W3		2
	<i>Limmellia surturi</i>	1	0		1
	<i>Notiphila subnigra</i>	3	W3	W314	4
	<i>Notiphila umbrosa</i>	1	W3		0
	<i>Parydra coarctata</i>	5	W1		1
	<i>Parydra fossarum</i>	2	W2		1

Group	Species	No. samples	ISIS BAT code	ISIS SAT code	ISIS Rarity Score
Diptera - Ephydriidae	<i>Parydra littoralis</i>	6	W1		1
	<i>Parydra pusilla</i>	3	W3		2
	<i>Parydra quadripunctata</i>	5	W2		1
	<i>Philotelma nigripenne</i>	4	0		2
	<i>Scatella stagnalis</i>	5	W2		1
	<i>Scatella tenuicosta</i>	7	W3		1
	<i>Scatophila noctula</i>	5	0		0
Diptera - Fanniidae	<i>Fannia armata</i>	1	0		1
	<i>Fannia lustrator</i>	1	F3		1
	<i>Fannia postica</i>	1	F3		1
	<i>Fannia serena</i>	1	F3		1
	<i>Fannia sociella</i>	1	F3		1
Diptera – Heleomyzidae	<i>Suillia atricornis</i>	7	F3		1
	<i>Suillia bicolor</i>	9	F2		1
	<i>Suillia flava</i>	1	F3		2
	<i>Suillia fuscicornis</i>	1	F3		1
	<i>Suillia variegata</i>	1	F3		1
Diptera - Hybotidae	<i>Bicellaria vana</i>	1	0		1
	<i>Drapetis ephippiata</i>	1	0		2
	<i>Hybos femoratus</i>	8	F2		1
	<i>Leptopeza flavipes</i>	9	A2		2
	<i>Ocydromia glabricula</i>	8	F3		1
	<i>Oedalea stigmatella</i>	1	A2		2
	<i>Oedalea tibialis</i>	1	A2		2
	<i>Platypalpus ciliaris</i>	1	F3		1
	<i>Platypalpus cursitans</i>	2	F2		1
	<i>Platypalpus longicornis</i>	2	0		1
	<i>Platypalpus longiseta</i>	2	0		1
	<i>Platypalpus pallidiventris</i>	4	0		1
	<i>Stilpon graminum</i>	1	F2		1
	<i>Tachypeza nubila</i>	1	A2		1
	<i>Trichina clavipes</i>	2	F3		1
	<i>Trichina pallipes</i>	4	F3		2
Diptera - Lauxaniidae	<i>Calliopum simillimum</i>	2	F3		1
	<i>Lyciella affinis</i>	6	F3		1
	<i>Lyciella decipiens</i>	11	0		1
	<i>Lyciella platycephala</i>	3	F3		0
	<i>Lyciella rorida</i>	12	F3		1
	<i>Lyciella stylata</i> group (female)	2	#N/A		0
	<i>Minettia inusta</i>	2	F3		0
	<i>Minettia longipennis</i>	5	F3		1
	<i>Sapromyza sordida</i>	1	0		0
	<i>Tricholauxania praeusta</i>	10	F3		1
Diptera - Lonchopteridae	<i>Lonchoptera bifurcata</i>	1	0		1
	<i>Lonchoptera lutea</i>	10	0		1
	<i>Lonchoptera nitidifrons</i>	3	W3	W314	2
Diptera - Micropezidae	<i>Neria cibaria</i>	2	0		1
Diptera – Muscidae	<i>Azelia cilipes</i>	2	#N/A		0
	<i>Coenosia infantula</i>	1	0		0
	<i>Hebecnema nigra</i>	4	#N/A		0
	<i>Hebecnema nigricolor</i>	3	#N/A		0
	<i>Hebecnema vespertina</i>	1	#N/A		0
	<i>Helina impuncta</i>	2	#N/A		0
	<i>Helina lasiophthalma</i>	1	#N/A		0
	<i>Hydrotaea militaris</i>	1	#N/A		0

Group	Species	No. samples	IS/BAT code	IS/SAT code	IS/S Rarety Score
Diptera – Muscidae	<i>Lispocephala erythrocer</i>	4	0		1
	<i>Lispocephala alma</i>	3	W1		2
	<i>Morellia simplex</i>	1	#N/A		0
	<i>Mydaea humeralis</i>	1	#N/A		0
	<i>Phaonia fuscata</i>	1	#N/A		0
	<i>Phaonia pallida</i>	3	#N/A		0
	<i>Phaonia palpata</i>	1	#N/A		0
	<i>Phaonia subventa</i>	3	#N/A		0
	<i>Polietes lardaria</i>	2	#N/A		0
	<i>Schoenomyza litorella</i>	1	0		1
Diptera - Opomyzidae	<i>Spanochaeta dorsalis</i>	2	0		2
	<i>Geomyza balachowskyi</i>	1	F2		1
	<i>Geomyza tripunctata</i>	1	F2		1
	<i>Opomyza florum</i>	3	F2		1
	<i>Opomyza germinationis</i>	11	F2		1
Diptera - Perisclidae	<i>Perisclis annulata</i>	1	A2		4
Diptera - Psilidae	<i>Chamaepsila rosae</i>	1	#N/A		0
Diptera - Rhagionidae	<i>Chrysopilus cristatus</i>	6	W3		1
	<i>Rhagio scolopaceus</i>	1	F2		1
Diptera – Rhinophoridae	<i>Melanomya nana</i>	1	0		1
Diptera - Scathophagidae	<i>Cordilura ?aemula (female)</i>	1	W3	?W314	8?
	<i>Cordilura albipes</i>	1	W3		2
	<i>Cordilura ciliata</i>	2	W3		2
	<i>Scathophaga furcata</i>	4	F2		1
	<i>Scathophaga stercoraria</i>	4	F2		1
	<i>Scathophaga suilla</i>	1	F2		1
	<i>Trichopalpus fraternus</i>	1	W3		2
	<i>Colobaea bifasciella</i>	1	W3	W314	4
	<i>Ilione lineata</i>	2	W3	W313	2
	<i>Limnia paludicola</i>	8	W3		1
Diptera - Sciomyzidae	<i>Pelidnoptera fuscipennis</i>	2	F3		2
	<i>Pherbellia albocostata</i>	4	F3		1
	<i>Pherbellia dubia</i>	8	F3		1
	<i>Pherbellia schoenherri</i>	1	W3		2
	<i>Pherbina coryleti</i>	1	W2		1
	<i>Pteromicra angustipennis</i>	5	W3		2
	<i>Renocera pallida</i>	3	0		1
	<i>Tetanocera elata</i>	2	F2		1
	<i>Tetanocera ferruginea</i>	2	W3		1
	<i>Tetanocera freyi</i>	4	W3	W313	8
	<i>Tetanocera fuscinervis</i>	4	W3		2
	<i>Tetanocera hyalipennis</i>	6	0		1
	<i>Tetanura pallidiventris</i>	1	F3		2
	<i>Beris vallata</i>	1	F2		1
	<i>Microchrysa cyaneiventris</i>	1	F2		1
Diptera - Syrphidae	<i>Baccha elongata</i>	1	F3		1
	<i>Episyrphus balteatus</i>	1	0		1
	<i>Eupeodes corollae</i>	2	F1		1
Diptera - Tabanidae	<i>Haematopota pluvialis</i>	1	W3		1
Diptera – Tachinidae	<i>Siphona geniculata</i>	1	#N/A		0
Diptera - Tephritidae	<i>Philophylla caesio</i>	1	F2		2

Group	Species	No. samples	I/S BAT code	I/S SAT code	I/S Rarity Score
Hymenoptera (Bees, ants and wasps)	<i>Bombus lapidarius</i>	1	F1		1
	<i>Lasius niger</i>	1	F1		1
	<i>Lasius platythorax</i>	4	F1		0
	<i>Myrmica ruginodis</i>	9	F3		1
Trichoptera – Beraeidae	<i>Beraea pullata</i>	1	W1	W126	1
Trichoptera – Leptoceridae	<i>Mystacides longicornis</i>	6	0		1
Trichoptera - Limnephilidae	<i>Glyphotaenius pellucidus</i>	9	W2		1
	<i>Limnephilus flavicornis</i>	2	W2		1
	<i>Limnephilus incisus</i>	3	W2		1
	<i>Limnephilus luridus</i>	4	W2		1
	<i>Limnephilus sparsus</i>	2	W2		1
	<i>Phryganea grandis</i>	1	W3		2
	<i>Trichostegia minor</i>	5	W2		1
Araneae (spiders)	<i>Agyneta ramosa</i>	2	F3		2
	<i>Antistea elegans</i>	1	W3		2
	<i>Aphileta misera</i>	1	W3		2
	<i>Bathyphantes gracilis</i>	1	0		1
	<i>Centromerus sylvaticus</i>	2	F3		1
	<i>Clubiona lutescens</i>	1	0		1
	<i>Dicymbium nigrum</i>	2	0		2
	<i>Dicymbium tibiale</i>	1	0		2
	<i>Drapetisca socialis</i>	1	A2		1
	<i>Enoplognatha ovata</i>	4	F2		1
	<i>Episinus angulatus</i>	2	F2		2
	<i>Erigone atra</i>	2	0		1
	<i>Erigonella hiemalis</i>	1	F2		1
	<i>Gonatium rubellum</i>	1	F3		1
	<i>Gnathonarium dentatum</i>	1	W3		1
	<i>Gongylidium rufipes</i>	3	F3		1
	<i>Hylyphantes graminicola</i>	1	A1		2
	<i>Kaestneria dorsalis</i>	2	F2		1
	<i>Lepthyphantes obscurus</i>	2	A1		2
	<i>Lepthyphantes tenebricola</i>	1	F3		2
	<i>Lepthyphantes tenuis</i>	2	0		1
	<i>Maso sundevalli</i>	2	F2		1
	<i>Metellina mengei</i>	3	0		1
	<i>Metellina merianae</i>	1	A2		2
	<i>Micrargus herbigradus</i>	1	F3		1
	<i>Microneta viaria</i>	3	F3		1
	<i>Monocephalus fuscipes</i>	1	F3		1
	<i>Neriere clathrata</i>	5	F2		1
	<i>Neriere peltata</i>	4	A1		1
	<i>Oedothorax gibbosus</i>	4	W3		1
	<i>Ozyptila trux</i>	1	F2		1
	<i>Pachygnatha clercki</i>	3	W3		1
	<i>Pardosa saltans</i>	1	F2		1
	<i>Philodromus albidus</i>	5	A1		4
	<i>Pirata hygrophilus</i>	6	W3		1
	<i>Porrhomma pygmaeum</i>	2	0		1
	<i>Rugathodes instabilis</i>	1	W3		2
	<i>Silometopus elegans</i>	1	W3		2
	<i>Tetragnatha montana</i>	9	W3		2

<i>Group</i>	<i>Species</i>	<i>No. samples</i>	<i>I/S BAT code</i>	<i>I/S SAT code</i>	<i>I/S Rarity Score</i>
Araneae (spiders)	<i>Theridion varians</i>	1	A1		1
	<i>Walckenaeria antica</i>	3	0		1
	<i>Walckenaeria cucullata</i>	1	F3		1
Opiliones (harvest spiders)	<i>Dicranopalpus ramosus</i>	1	A1		2
	<i>Mitostoma chrysomelas</i>	4	F2		1
	<i>Nelima gothica</i>	6	F2		2
	<i>Nemastoma bimaculatum</i>	4	F3		1
	<i>Oligolophus tridens</i>	3	F3		1
	<i>Paroligolophus agrestis</i>	7	0		1
	<i>Platybunus triangularis</i>	3	F3		1
Pulmonata (slugs and snails)	<i>Arion ater</i> agg.	1	0		1
	<i>Cochlicopa lubrica</i>	2	F2		1
	<i>Discus rotundatus</i>	3	0		1
	<i>Oxychilus alliarius</i>	4	0		1
	<i>Vitrina pellucida</i>	1	0		1

APPENDIX 3: LIST OF ALL SPECIES RECORDED BY SITE

ISIS rarity scores for target groups are based on recently recorded range size in Britain, where these are accessible. Scores of 8 or 16 are more or less equivalent, as far as they can be, to national red data book status or a nationally scarce grade A designation; a score of 4 is roughly equivalent to a nationally scarce grade B designation.

Species	Rarity Score	Bure1	Bure2	Bure3	Bure4	Bure5	Bure6	Trinity5	Trinity6	Trinity7	Trinity8	Trinity9	Trinity10
<i>Brachydesmus superus</i>	1				•								
<i>Craspedosoma rawlinsii</i>	2	•	•	•	•	•	•						
<i>Cylindroiulus britannicus</i>	1		•	•									
<i>Cylindroiulus punctatus</i>	1					•	•		•	•	•	•	•
<i>Julus scandinavicus</i>	1						•			•	•	•	•
<i>Ophiulus pilosus</i>	1				•								
<i>Polydesmus angustus</i>	1	•		•	•					•		•	•
<i>Polydesmus inconstans</i>	1	•											
<i>Proteroiulus fuscus</i>	1								•	•			
<i>Tachypodoiulus niger</i>	1											•	
<i>Cryptops hortensis</i>	1								•	•	•	•	
<i>Geophilus easoni</i>	0							•		•		•	•
<i>Geophilus truncorum</i>	1											•	•
<i>Lithobius crassipes</i>	1							•					
<i>Lithobius forficatus</i>	1					•	•					•	
<i>Lithobius melanops</i>	1									•			
<i>Lithobius microps</i>	1					•							
<i>Ligidium hypnorum</i>	2	•	•	•	•		•	•	•	•	•	•	•
<i>Oniscus asellus</i>	1	•			•	•	•			•	•	•	•
<i>Philoscia muscorum</i>	1	•	•	•	•	•		•	•	•	•	•	•
<i>Porcellio scaber</i>	1	•	•				•	•	•	•	•	•	•
<i>Trichoniscus pusillus</i>	1	•	•	•	•	•	•		•	•	•	•	•
<i>Tetrix subulata</i>	2												•
<i>Cixius nervosus</i>	1	•											
<i>Hydrometra stagnorum</i>	1						•						
<i>Kleidocerys resedae</i>	1		•				•						
<i>Neolygus contaminatus</i>	1						•						
<i>Oncopsis alni</i>	1												•
<i>Oncopsis flavicollis</i>	1							•					•
<i>Scolopostethus puberulus</i>	2	•											
<i>Stygnocoris fuliginus</i>	1									•			
<i>Acupalpus dubius</i>	1							•				•	
<i>Agonum fuliginosum</i>	1		•			•			•				
<i>Amara eurynota</i>	2											•	
<i>Elaphrus cupreus</i>	1								•				
<i>Notiophilus biguttatus</i>	1					•					•		
<i>Pterostichus diligens</i>	1	•	•	•	•		•						
<i>Pterostichus madidus</i>	1											•	
<i>Pterostichus melanarius</i>	1										•		
<i>Pterostichus minor</i>	1	•	•						•	•		•	
<i>Pterostichus nigrita</i>	1		•			•						•	
<i>Silpha atrata</i>	1					•							
<i>Anotylus rugosus</i>	1									•		•	•

Species	Rarity Score	Bure1	Bure2	Bure3	Bure4	Bure5	Bure6	Trinity5	Trinity6	Trinity7	Trinity8	Trinity9	trinity10
<i>Brachygluta fossulata</i>	1		•	•									
<i>Erichsonius cinerascens</i>	2	•	•	•	•		•		•				
<i>Lathrobium brunnipes</i>	1		•	•			•		•			•	•
<i>Lathrobium elongatum</i>	2		•										
<i>Lathrobium foveolum</i>	2					•						•	
<i>Lesteva longoelytrata</i>	1								•				
<i>Mycetoporus splendidus</i>	1									•			
<i>Ocalea badia</i>	1								•				
<i>Oxypoda opaca</i>	1								•				
<i>Paederus riparius</i>	2				•								
<i>Philonthus fumarius</i>	4		•			•							
<i>Quedius fuliginosus</i>	1			•						•			
<i>Quedius maurorufus</i>	1			•									
<i>Rugilus erichsoni</i>	2											•	
<i>Rugilus orbiculatus</i>	1							•					
<i>Sepedophilus marshami</i>	1	•											
<i>Stenus argus</i>	4	•											
<i>Stenus bifoveolatus</i>	1	•	•			•	•				•		
<i>Stenus bimaculatus</i>	1	•	•	•		•			•				
<i>Stenus carbonarius</i>	4						•						
<i>Stenus flavipes</i>	1										•		
<i>Stenus junco</i>	1	•	•			•							
<i>Stenus latifrons</i>	1	•											
<i>Stenus nitidiusculus</i>	1					•					•		
<i>Tachinus rufipes</i>	1												•
<i>Tachyporus dispar</i>	1							•					
<i>Tachyporus hypnorum</i>	1								•			•	
<i>Tachyporus pallidus</i>	2	•											
<i>Microcara testacea</i>	1	•	•			•	•				•		
<i>Cyphon coarctatus</i>	1	•	•	•		•	•		•	•	•		•
<i>Cyphon hilaris</i>	2	•	•	•	•	•	•						
<i>Cyphon ochraceus</i>	1										•	•	
<i>Cyphon padi</i>	2			•	•		•						
<i>Athous haemorrhoidalis</i>	1							•					•
<i>Stilbus testaceus</i>	0												•
<i>Cantharis figurata</i>	2						•						
<i>Malthinus flaveolus</i>	1				•								
<i>Rhagonycha testacea</i>	1			•									
<i>Silis ruficollis</i>	4						•						
<i>Anobium fulvicorne</i>	1												•
<i>Ochina ptinoides</i>	2											•	
<i>Stephostethus lardarius</i>	0			•									
<i>Adalia 10-punctata</i>	1						•						
<i>Coccinella 7-punctata</i>	1					•							
<i>Philorhizus melanocephalus</i>	1	•											
<i>Phaedon armoraciae</i>	1	•											
<i>Deporaus betulae</i>	1							•					•
<i>Thryogenes fiorii</i>	0				•								
<i>Trichapion simile</i>	2							•					
<i>Phyllobius argentatus</i>	1							•					
<i>Phyllobius glaucus</i>	1									•			
<i>Phyllobius pyri</i>	1							•					
<i>Polydrusus cervinus</i>	1							•					•
<i>Strophosoma melanogrammum</i>	1							•					

Species	Rarity Score	Bure1	Bure2	Bure3	Bure4	Bure5	Bure6	Trinity5	Trinity6	Trinity7	Trinity8	Trinity9	Trinity10
<i>Achyrolimonia decemmaculata</i>	2					•					•		
<i>Atypophthalmus inustus</i>	4	•				•							
<i>Austrolimnophila ochracea</i>	1	•		•	•	•	•	•	•	•	•	•	•
<i>Dicranomyia lucida</i>	4	•	•	•	•	•	•						
<i>Dicranomyia modesta</i>	1		•			•							
<i>Dicranophragma nemorale</i>	1			•	•					•	•		•
<i>Dicranophragma separatum</i>	1	•	•	•	•	•	•						
<i>Dolichopeza albipes</i>	2						•						
<i>Epiphragma ocellare</i>	2	•		•		•				•	•		•
<i>Euphyllidorea aperta</i>	2			•									
<i>Gonomyia bifida</i>	4		•	•	•	•							
<i>Helius flavus</i>	2	•	•	•	•	•	•				•		•
<i>Helius longirostris</i>	1	•	•	•	•	•	•	•	•		•		•
<i>Limonia macrostigma</i>	1	•		•	•	•	•		•	•	•	•	•
<i>Limonia nubeculosa</i>	1			•		•		•	•	•	•		
<i>Limonia phragmitidis</i>	1					•		•	•	•	•		•
<i>Lipsothrix nervosa</i>	2			•					•				
<i>Metalimnobia quadrinotata</i>	1					•							
<i>Molophilus appendiculatus</i>	1									•			
<i>Molophilus bihamatus</i>	4	•	•	•	•	•	•		•	•	•		•
<i>Molophilus medius</i>	1		•	•	•	•	•	•			•		
<i>Molophilus ochraceus</i>	1								•	•	•	•	•
<i>Molophilus serpentiger</i>	1			•									
<i>Neolimnomyia batava</i>	2			•							•		
<i>Neolimonia dumetorum</i>	1							•	•		•		•
<i>Nephrotoma guestfalica</i>	2											•	
<i>Nephrotoma quadrifaria</i>	1								•	•	•		
<i>Ormosia pseudosimilis</i>	2										•	•	
<i>Paradelphomyia czizekiana</i>	0			•									
<i>Phylidorea abdominalis</i>	4				•								
<i>Phylidorea ferruginea</i>	1								•				
<i>Phylidorea fulvonervosa</i>	1	•	•	•		•	•		•		•	•	•
<i>Pilaria decolor</i>	0			•			•		•				•
<i>Pilaria discicollis</i>	1			•	•				•	•	•		•
<i>Pilaria nigropunctata</i>	0						•						
<i>Pilaria scutellata</i>	4					•	•						
<i>Pseudolimnophila sepium</i>	1			•	•		•						
<i>Rhipidia maculata</i>	1					•							
<i>Tasiocera murina</i>	1	•	•	•		•	•			•	•		
<i>Thaumastopectera calceata</i>	4			•									
<i>Tipula fascipennis</i>	1								•	•			
<i>Tipula lunata</i>	1								•				•
<i>Tipula oleracea</i>	1								•				
<i>Tipula unca</i>	1	•		•	•	•	•	•	•				•
<i>Tipula variicornis</i>	1								•				
<i>Tipula vernalis</i>	1								•				
<i>Tricyphona immaculata</i>	1				•								
<i>Ula sylvatica</i>	1				•								
<i>Sylvicola cinctus</i>	1												•
<i>Anagnota bicolor</i>	4			•	•		•						•
<i>Anthomyza neglecta</i>	0				•		•						
<i>Paranthomyza caricis</i>	0						•						
<i>Dioctria linearis</i>	2							•					
<i>Stenomicroa cogani</i>	8	•		•		•	•		•				•
<i>Pollenia griseotomentosa</i>	1	•				•							

Species	Rarity Score	Bure1	Bure2	Bure3	Bure4	Bure5	Bure6	Trinity5	Trinity6	Trinity7	Trinity8	Trinity9	Trinity10
<i>Pollenia labialis</i>	2								•				
<i>Pollenia rudis</i>	1										•		
<i>Camilla glabrata</i>	0							•					
<i>Chaoborus flavicans</i>	0	•	•				•	•	•	•	•	•	•
<i>Chaoborus pallidus</i>	0					•							
<i>Elachiptera cornuta</i>	1	•											
<i>Gaurax dubius</i>	0	•											
<i>Gymnochiromyia ?inermis(f)</i>	0								•				
<i>Clusia flava</i>	2												•
<i>Clusiodes albimana</i>	2					•							•
<i>Clusiodes gentilis</i>	2					•							
<i>Clusiodes verticalis</i>	2		•							•			•
<i>Aedes annulipes</i>	2	•	•	•			•		•	•	•	•	•
<i>Aedes cantans</i>	1										•	•	
<i>Anopheles claviger</i>	1	•	•			•							
<i>Culex pipiens</i>	1	•								•			
<i>Culiseta annulata</i>	1		•										
<i>Culiseta fumipennis</i>	2										•		
<i>Culiseta morsitans</i>	1	•	•	•	•	•	•		•				
<i>Campichoeta punctum</i>	2		•	•		•							
<i>Diastata adusta</i>	1			•	•	•							
<i>Diastata fuscata</i>	1	•		•	•		•	•	•		•	•	
<i>Dixa nebulosa</i>	1												•
<i>Dixella amphibia</i>	1			•			•						•
<i>Dixella serotina</i>	2				•		•						
<i>Achalcus cinereus</i>	2	•	•	•	•	•	•				•		
<i>Achalcus flavicollis</i>	2	•		•		•			•	•		•	•
<i>Achalcus nigropunctatus</i>	0	•		•	•		•						
<i>Achalcus vaillanti</i>	0	•	•	•	•		•						
<i>Anepsiomyia flaviventris</i>	2	•				•		•	•	•	•	•	•
<i>Argyra ?argentina/perplexa (f)</i>	0										•		
<i>Argyra diaphana</i>	1								•				
<i>Argyra elongata</i>	2	•		•			•						•
<i>Argyra leucocephala</i>	1										•		
<i>Argyra vestita</i>	2					•							
<i>Campsicnemus curvipes</i>	1			•		•						•	•
<i>Campsicnemus loripes</i>	1									•	•		
<i>Campsicnemus scambus</i>	1	•	•	•	•	•	•		•	•	•	•	•
<i>Chrysotus gramineus</i>	1	•											
<i>Chrysotus neglectus</i>	1											•	
<i>Dolichopus griseipennis</i>	1							•					
<i>Dolichopus longitarsis</i>	2				•								
<i>Dolichopus pennatus</i>	1					•	•						
<i>Dolichopus picipes</i>	2	•		•	•								
<i>Dolichopus popularis</i>	1	•					•		•	•		•	•
<i>Dolichopus urbanus</i>	1			•	•		•		•				
<i>Dolichopus wahlbergi</i>	2									•			
<i>Ethiomyia chalybeus</i>	2	•			•	•	•						
<i>Gymnopternus aerosus</i>	1	•	•		•	•		•	•	•	•	•	
<i>Gymnopternus assimilis</i>	2	•		•			•						
<i>Gymnopternus blankaartensis</i>	0	•	•	•	•	•	•						•
<i>Gymnopternus cupreus</i>	2								•	•	•	•	
<i>Gymnopternus metallicus</i>	1	•	•	•	•	•	•	•	•	•	•	•	•
<i>Gymnopternus ?silvestris (f)</i>	2									•			
<i>Lamprochromus elegans</i>	2						•						

Species	Rarity Score	Bure1	Bure2	Bure3	Bure4	Bure5	Bure6	Trinity5	Trinity6	Trinity7	Trinity8	Trinity9	Trinity10
<i>Medetera impigra</i>	0							•					
<i>Medetera muralis</i>	2					•							
<i>Sciapus platypterus</i>	1							•		•	•	•	•
<i>Sybistroma obscurellum</i>	1							•		•	•		•
<i>Sympycnus desoutteri</i>	1		•										
<i>Syntormon bicolorellum</i>	2						•			•			
<i>Syntormon tarsatum</i>	2			•									
<i>Teuchophorus spinigerellus</i>	2	•											
<i>Thrypticus atomus</i>	0		•										
<i>Xanthochlorus ornatus</i>	2		•		•			•		•			
<i>Drosophila obscura</i>	0									•			
<i>Drosophila phalerata</i>	0	•							•	•			
<i>Drosophila subobscura</i>	0					•		•					
<i>Lordiphosa andalusiaca</i>	0			•									•
<i>Scaptomyza flava</i>	0	•	•	•	•	•			•	•			
<i>Scaptomyza graminum</i>	0	•		•	•					•	•		
<i>Scaptomyza pallida</i>	0	•	•		•		•		•		•		
<i>Neuroctena anilis</i>	1	•											
<i>Chelipoda albiseta</i>	2	•	•	•	•	•	•						
<i>Dolichocephala oblongoguttata</i>	2			•		•	•		•		•	•	•
<i>Empis aestiva</i>	1							•	•				•
<i>Empis scutellata</i>	2								•				
<i>Hilara longifurca</i>	1	•	•	•		•			•	•			•
<i>Hilara rejecta</i>	2								•			•	•
<i>Phyllodromia melanocephala</i>	1	•	•			•	•	•	•	•	•	•	•
<i>Rhamphomyia caliginosa</i>	4		•		•	•							
<i>Rhamphomyia nigripennis</i>	1					•			•				
<i>Rhamphomyia tibiella</i>	1	•							•	•			
<i>Axysta cesta</i>	2		•		•		•						
<i>Coenia curvicauda</i>	1	•	•	•	•	•	•				•		•
<i>Coenia palustris</i>	1	•	•		•	•	•				•		•
<i>Ditrichophora calceata</i>	1	•							•			•	•
<i>Ditrichophora fuscella</i>	1	•	•	•	•	•	•		•		•		•
<i>Hydrellia albilabris</i>	1						•						
<i>Hydrellia maura</i>	1										•		•
<i>Hydrellia thoracica</i>	1						•						
<i>Ilythea spilota</i>	1					•	•		•		•		•
<i>Limnellia fallax</i>	2									•	•		
<i>Limnellia surturi</i>	1								•				
<i>Notiphila subnigra</i>	4		•		•		•						
<i>Notiphila umbrosa</i>	0		•										
<i>Parydra coarctata</i>	1					•	•		•			•	•
<i>Parydra fossarum</i>	1						•						•
<i>Parydra littoralis</i>	1						•		•	•	•	•	•
<i>Parydra pusilla</i>	2			•			•					•	
<i>Parydra quadripunctata</i>	1			•	•	•	•						•
<i>Philotelma nigripenne</i>	2	•	•			•	•						
<i>Scatella stagnalis</i>	1	•	•			•	•						•
<i>Scatella tenuicosta</i>	1	•	•		•	•	•				•		•
<i>Scatophila noctula</i>	0	•		•		•	•						•
<i>Fannia armata</i>	1											•	
<i>Fannia lustrator</i>	1									•			
<i>Fannia postica</i>	1		•										
<i>Fannia serena</i>	1								•				
<i>Fannia sociella</i>	1					•							

Species	Rarity Score	Bure1	Bure2	Bure3	Bure4	Bure5	Bure6	Trinity5	Trinity6	Trinity7	Trinity8	Trinity9	Trinity10
<i>Suillia atricornis</i>	1	•	•	•	•				•	•	•		
<i>Suillia bicolor</i>	1	•	•	•	•	•		•	•		•	•	
<i>Suillia flava</i>	2				•								
<i>Suillia fuscicornis</i>	1							•					
<i>Suillia variegata</i>	1								•				
<i>Bicellaria vana</i>	1								•				
<i>Drapetis ephippiata</i>	2								•				
<i>Hybos femoratus</i>	1	•	•	•	•	•	•			•	•		
<i>Leptozeza flavipes</i>	2	•	•	•	•	•	•	•		•			•
<i>Ocydromia glabricula</i>	1	•	•	•		•	•		•		•		•
<i>Oedalea stigmatella</i>	2									•			
<i>Oedalea tibialis</i>	2		•										
<i>Platypalpus ciliaris</i>	1	•											
<i>Platypalpus cursitans</i>	1								•	•			
<i>Platypalpus longicornis</i>	1					•	•						
<i>Platypalpus longiseta</i>	1					•					•		
<i>Platypalpus pallidiventris</i>	1	•					•	•			•		
<i>Stilpon graminum</i>	1			•									
<i>Tachypeza nubila</i>	1		•										
<i>Trichina clavipes</i>	1					•					•		
<i>Trichina pallipes</i>	2	•	•		•	•							
<i>Calliopum simillimum</i>	1									•	•		
<i>Lyciella affinis</i>	1							•	•	•	•	•	•
<i>Lyciella decipiens</i>	1	•	•	•	•	•	•		•	•	•	•	•
<i>Lyciella platycephala</i>	0							•			•		•
<i>Lyciella rorida</i>	1	•	•	•	•	•	•	•	•	•	•	•	•
<i>Lyciella stylata</i> group (female)	0		•			•							
<i>Minettia inusta</i>	0									•		•	
<i>Minettia longipennis</i>	1	•		•				•		•			•
<i>Sapromyza sordida</i>	0											•	
<i>Tricholauxania praeusta</i>	1	•	•	•			•	•	•	•	•	•	•
<i>Lonchoptera bifurcata</i>	1					•							
<i>Lonchoptera lutea</i>	1	•	•	•	•	•	•			•	•	•	•
<i>Lonchoptera nitidifrons</i>	2			•	•		•						
<i>Neria cibaria</i>	1		•			•							
<i>Azelia cilipes</i>	0	•				•							
<i>Coenosia infantula</i>	0		•										
<i>Hebecnema nigra</i>	0									•	•	•	•
<i>Hebecnema nigricolor</i>	0								•		•	•	
<i>Hebecnema vespertina</i>	0	•											
<i>Helina impuncta</i>	0	•							•				
<i>Helina lasiophthalma</i>	0							•					
<i>Hydrotaea militaris</i>	0				•								
<i>Lispocephala erythrocerata</i>	1				•	•	•						•
<i>Lispocephala alma</i>	2								•		•		•
<i>Morellia simplex</i>	0	•											
<i>Mydaea humeralis</i>	0				•								
<i>Phaonia fuscata</i>	0											•	
<i>Phaonia pallida</i>	0							•			•	•	
<i>Phaonia palpata</i>	0									•			
<i>Phaonia subventa</i>	0							•	•				•
<i>Polietes lardaria</i>	0											•	•
<i>Schoenomyza litorella</i>	1								•				
<i>Spanochaeta dorsalis</i>	2			•	•								
<i>Geomyza balachowskyi</i>	1										•		

Species	Rarity Score	Bure1	Bure2	Bure3	Bure4	Bure5	Bure6	Trinity5	Trinity6	Trinity7	Trinity8	Trinity9	Trinity10
<i>Geomyza tripunctata</i>	1							•					
<i>Opomyza florum</i>	1									•	•	•	
<i>Opomyza germinationis</i>	1	•	•	•		•	•	•	•	•	•	•	•
<i>Periscelis annulata</i>	4							•					
<i>Chamaepsila rosae</i>	0									•			
<i>Chrysopilus cristatus</i>	1		•	•	•	•			•	•			
<i>Rhagio scolopaceus</i>	1								•				
<i>Melanomya nana</i>	1												•
<i>Cordilura ?aemula</i> (female)	8								•				
<i>Cordilura albipes</i>	2		•										
<i>Cordilura ciliata</i>	2	•									•		
<i>Scathophaga furcata</i>	1	•				•	•					•	
<i>Scathophaga stercoraria</i>	1	•							•		•	•	
<i>Scathophaga suilla</i>	1												•
<i>Trichopalpus fraternus</i>	2											•	
<i>Colobaea bifasciella</i>	4						•						
<i>Ilione lineata</i>	2	•			•								
<i>Limnia paludicola</i>	1	•	•	•	•	•	•				•		•
<i>Pelidnoptera fuscipennis</i>	2							•			•		
<i>Pherbellia albocostata</i>	1	•		•		•				•			
<i>Pherbellia dubia</i>	1	•		•		•			•	•	•	•	•
<i>Pherbellia schoenherri</i>	2	•											
<i>Pherbina coryleti</i>	1	•											
<i>Pteromicra angustipennis</i>	2	•		•	•	•	•						
<i>Renocera pallida</i>	1			•	•								•
<i>Tetanocera elata</i>	1	•							•				
<i>Tetanocera ferruginea</i>	1	•				•							
<i>Tetanocera freyi</i>	8	•		•	•		•						
<i>Tetanocera fuscinervis</i>	2	•	•		•	•							
<i>Tetanocera hyalipennis</i>	1	•	•			•				•	•		•
<i>Tetanura pallidiventris</i>	2										•		
<i>Beris vallata</i>	1	•											
<i>Microchrysa cyaneiventris</i>	1		•										
<i>Baccha elongata</i>	1			•									
<i>Episyrphus balteatus</i>	1										•		
<i>Eupeodes corollae</i>	1	•					•						
<i>Haematopota pluvialis</i>	1						•						
<i>Siphona geniculata</i>	0								•				
<i>Philophylla caesio</i>	2									•			
<i>Bombus lapidarius</i>	1										•		
<i>Lasius niger</i>	1			•									
<i>Lasius platythorax</i>	0			•	•	•	•						
<i>Myrmica ruginodis</i>	1			•		•	•	•	•	•	•	•	•
<i>Beraea pullata</i>	1			•									
<i>Mystacides longicornis</i>	1							•	•	•	•	•	•
<i>Glyphotaelius pellucidus</i>	1	•	•		•	•	•			•	•	•	•
<i>Limnephilus flavicornis</i>	1										•	•	
<i>Limnephilus incisus</i>	1	•	•			•							
<i>Limnephilus luridus</i>	1	•	•	•	•								
<i>Limnephilus sparsus</i>	1	•	•										
<i>Phryganea grandis</i>	2											•	
<i>Trichostegia minor</i>	1		•			•	•					•	•

Species	Rarity Score	Bure1	Bure2	Bure3	Bure4	Bure5	Bure6	Trinity5	Trinity6	Trinity7	Trinity8	Trinity9	Trinity10
<i>Agyneta ramosa</i>	2		•	•									
<i>Antistea elegans</i>	2			•									
<i>Aphileta misera</i>	2			•									
<i>Bathyphantes gracilis</i>	1								•				
<i>Centromerus sylvaticus</i>	1				•					•			
<i>Clubiona lutescens</i>	1			•									
<i>Dicymbium nigrum</i>	2									•	•		
<i>Dicymbium tibiale</i>	2											•	
<i>Drapetisca socialis</i>	1												•
<i>Enoplognatha ovata</i>	1					•		•			•		•
<i>Episinus angulatus</i>	2				•				•				
<i>Erigone atra</i>	1							•		•			
<i>Erigonella hiemalis</i>	1									•			
<i>Gonatium rubellum</i>	1								•				
<i>Gnathonarium dentatum</i>	1	•											
<i>Gongylidium rufipes</i>	1	•		•							•		
<i>Hylyphantes graminicola</i>	2										•		
<i>Kaestneria dorsalis</i>	1										•	•	
<i>Lepthyphantes obscurus</i>	2	•	•										
<i>Lepthyphantes tenebricola</i>	2		•										
<i>Lepthyphantes tenuis</i>	1								•				•
<i>Maso sundevalli</i>	1		•										•
<i>Metellina menzei</i>	1			•			•				•		
<i>Metellina merianae</i>	2									•			
<i>Micrargus herbigradus</i>	1											•	
<i>Microneta viaria</i>	1			•		•						•	
<i>Monocephalus fuscipes</i>	1									•			
<i>Neriere clathrata</i>	1	•	•	•							•	•	
<i>Neriere peltata</i>	1		•		•	•							•
<i>Oedothorax gibbosus</i>	1	•	•			•						•	
<i>Ozyptila trux</i>	1				•								
<i>Pachygnatha clercki</i>	1		•						•			•	
<i>Pardosa saltans</i>	1							•					
<i>Philodromus albidus</i>	4	•		•		•	•				•		
<i>Pirata hygrophilus</i>	1	•		•		•	•				•	•	
<i>Porrhomma pygmaeum</i>	1					•	•						
<i>Rugathodes instabilis</i>	2											•	
<i>Silometopus elegans</i>	2		•										
<i>Tetragnatha montana</i>	2	•	•		•	•		•		•	•	•	•
<i>Theridion varians</i>	1							•					
<i>Walckenaeria antica</i>	1	•	•				•						
<i>Walckenaeria cucullata</i>	1							•					
<i>Dicranopalpus ramosus</i>	2				•								
<i>Mitostoma chrysomelas</i>	1			•							•	•	•
<i>Nelima gothica</i>	2		•	•			•		•		•		•
<i>Nemastoma bimaculatum</i>	1					•	•	•	•				
<i>Oligolophus tridens</i>	1	•	•		•								
<i>Paroligolophus agrestis</i>	1		•		•	•		•	•			•	•
<i>Platybunus triangularis</i>	1								•		•	•	
<i>Arion ater</i> agg.	1					•							
<i>Cochlicopa lubrica</i>	1	•				•							
<i>Discus rotundatus</i>	1									•	•	•	
<i>Oxychilus alliarius</i>	1			•					•	•		•	
<i>Vitrina pellucida</i>	1											•	

