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East Anglian Fen Invertebrate Survey

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D.A. Lott, D A Procter & A.P. Foster

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Summary

1. The East Anglian Fenland Invertebrate Survey (EAFIS) was carried out between 1988 and 1990 and produced 165 standardised samples from 87 sampling stations at 43 sites containing 26,723 records of 1,676 species. 2,636 additional records were collected casually and these included a further 511 species.

2. In total, 215 nationally scarce species and 90 national red data book species were recorded confirming the national importance of East Anglian fens for invertebrate conservation. The available literature suggests that 43% of wetland invertebrate species, listed as endangered or vulnerable in Britain, have been recorded in East Anglia.

3. A variety of species new to science or new to Britain were also recorded during the study, most are from some of the lesser known families of Diptera and Hymenoptera, though a few are from groups with a wider recording base. Whilst some of these are still only known from East Anglia, others are now known to occur elsewhere.

4. Nine taxonomic groups (Auchenorrhyncha, Dolichopodidae, Sciomyzidae, Sphaeroceridae, Syrphidae, Tipuloidea and Ptychopteroidea, Carabidae and Staphylinidae, water beetles, spiders) were selected for further analysis of standardised samples. Direct comparison of species richness and beta-diversity between these groups could not be carried out, because of differences in sampling periods and the number of samples processed for each group, although trends in variation of species diversity between sites were investigated.

5. Pitfall trapping is considered to be an unsuitable method for sampling beetles in habitats with high water tables. It is suggested that hand-collecting by experienced workers is preferable for beetles and other ground-living taxa in fens and related habitats. The efficiency of water traps for Syrphidae was found to be affected by vegetation height. However, this effect was not detected for other groups investigated and water traps are recommended for flying insects in sites not managed by grazing.

6. Significant annual differences in species diversity were observed for Syrphidae and spiders. These groups contain a large number of species with good dispersal powers

and these mobile species probably represent an important component of many samples.

7. Comparison of species diversity and Species Quality Indices between Broadland, Breckland and other areas suggests that the Breckland area may have a larger regional species pool than other areas, whereas the Broads support a significantly higher proportion of more threatened species in three groups.

8. There was a clear trend for samples taken from NVC community S24 to support assemblages with a high proportion of threatened species. Pingo sites and sites succeeding to carr were also associated with assemblages of high conservation value in several groups.

9. Multivariate analysis showed that vegetation control had an important influence on species assemblage composition in six groups. Cutting was identified as having the biggest impact within the EAFIS dataset. However, despite the small number of grazed sites in the dataset, grazing was also found to affect species composition in several groups. Burning was not identified as a major influence, perhaps because of a combination of the small number of burnt sites sampled and variations in the timing of the burn at different sites.

10. Several red data book and nationally scarce species were found to be sensitive to cutting and a small-scale rotational approach to management is recommended. A mosaic of recently cut areas and areas in an advanced stage of succession will both meet invertebrate conservation objectives and diversify habitat. A single cut on unmanaged sites was found to have an impact on fewer groups than regular cutting in cycles of up to four years. It is therefore recommended that longer cutting cycles are introduced to reduce the impact of cutting on rare invertebrates.

11. Hydrology was found to have an even more comprehensive influence than vegetation control, although the poor definition of recorded environmental variables prevented the identification of clear prescriptions for water level management. Seasonal fluctuations in water level were important in several groups.

12. A methodology for monitoring the effects of site management is recommended, based on species indicator scores calculated for three or more target groups.

It is recommended that further research be carried out on the effects of flooding and ecological succession on selected invertebrate assemblages at around fifty sites ranging from marsh on mineral substrates through fen to carr.

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1. Introduction

Fen is an important semi-natural habitat in Britain with distinctive communities of plants and animals. Examples of different types of fen are distributed across Britain often in small, isolated habitat patches, but the Norfolk and Suffolk Broads contain 3,000 ha of calcareous rich fen, the largest remaining continuous area of this type of fen in Britain (Fojt 1994a). East Anglia is also important for valley fens and other spring-fed systems (Wheeler & Shaw 1992). Historically, the great Fenland area of Cambridgeshire and Lincolnshire was the largest area of rich-fen in Britain, but centuries of drainage have reduced the area of fen to just 500 ha mainly concentrated in two nature reserves, Wicken Fen and Woodwalton Fen. Even in the Broads, only one third of the original area is semi-natural, the remainder having been converted to arable cultivation and improved pasture (Fuller 1986).

Apart from habitat loss, fens are also considered to be suffering a decline in quality. A recent study of fens in English SSSIs found that only 32.5% of the area surveyed was in favourable condition (Solly 2000). Fojt (1994a) identified three main causes of loss of quality in fens:

1. ecological succession to carr,
2. change in hydrological regime,
3. eutrophication.

Hydrological changes include ditching and river-straightening, which have led to dryer conditions in the Broads, while ground-water abstraction has caused problems in fens fed by springs (Fojt 1994b). Apart from the damage to botanical interest, long term dehydration of Redgrave and Lopham Fens due to groundwater abstraction also led to declines in populations of red data book invertebrates, particularly the fen raft spider, *Dolomedes plantarius,* which became confined to just one remnant pool (Harding 1993). This species is only known from one other site in Britain (Merrett & Bratton in Bratton 1991).

Fojt (1994a) listed mowing, grazing, burning, scrub management and peat cutting as management options suitable for the control of vegetation and maintenance of open fen. Essentially, they can all be viewed as anthropogenic disturbances that arrest ecological succession, although some of the recognised fen vegetation community types appear to be products of specific management systems (Fojt 1993) and it would be simplistic to consider succession as a single linear axis of change. Flooding also reverses ecological succession in wetlands (Kangas 1990), but, as with direct vegetation control, the severity and periodicity of the flooding disturbance dictates the precise successional pathway (Bravard *et al* 1992).

East Anglia is a nationally important region for threatened wetland invertebrates. 43% of endangered and vulnerable wetland species in Britain are recorded from here (see table 1). Several threatened insects are not known from any other part of country including high profile species such as the swallowtail butterfly, *Papilio machaon*, and the Norfolk hawker dragonfly, *Aeshna isosceles,* both of which are now confined to the Broads and adjacent areas. In west Norfolk, several series of pingo pools, formed in periglacial features, are of national importance for water beetles (Foster 1993).

Several important fen sites are now being returned to active management in order to conserve rare and valuable vegetation communities and birds. The East Anglian Fen Invertebrate Survey (EAFIS) was initiated in 1988 in order to investigate the effects of these reintroduced management systems on fenland assemblages of terrestrial invertebrates.

Table 1. Number of species of endangered and vulnerable wetland invertebrates recorded from East Anglia (Bratton 1991, Shirt 1987). Figures for Lepidoptera include subspecies. Species were identified as characteristic of wetland by reference to red data book species accounts supplemented by Falk (1991).

	UK	East Anglia	Percentage
Mollusca	14	6	43
Crustacea	3	0	0
Araneae	12	8	67
Odonata	6	3	50
Orthoptera	2	1	50
Heteroptera	1	1	100
Trichoptera	13	4	31
Lepidoptera	9	6	67
Coleoptera	70	32	46
Hymenoptera	4	2	50
Diptera	66	22	33
total	200	85	43

1.1 Invertebrate assemblages as tools for site assessment and monitoring environmental change

The use of species assemblages in invertebrate site conservation complements the more customary approach based on individual species. During initial site assessment, consideration of assemblages in key indicator groups gives a broader picture of the interest of a site than can be gained by concentrating on one or two high profile species. In addition, assemblages are affected by stochastic factors or specific pathogens to a lesser degree than individual species and that makes them useful for monitoring change, especially the introduction of new management regimes.

In recent decades, site assessment methods based on invertebrate species assemblages have developed in two main directions. Firstly, species diversity and variations in species composition have been used to classify invertebrate habitats or otherwise characterise the influence of environmental variables on invertebrate communities. Secondly, a variety of assemblage parameters have been used to evaluate site quality for invertebrate conservation.

1.1.1 The identification of important environmental factors

Species composition has been widely used to explore the response of invertebrate assemblages to environmental variables in both wetland and terrestrial systems. There is now a considerable body of literature dealing with classifications of site-based species lists of various invertebrate groups, often performed using the computer programme, TWINSPAN. The consequent end-groups of sites are usually characterised by reference to biotopes, vegetation types and management regimes. This approach has been applied to freshwater macroinvertebrates in rivers and streams (eg Wright *et al* 1984), upland invertebrates (Coulson & Butterfield 1985), ground beetles (eg Eyre & Luff 1990a, Luff, Eyre & Rushton 1989, Turin *et al* 1991), water beetles (eg Foster & Eyre 1992), grassland weevils (Luff & Eyre 1988), water bugs (Eyre & Foster 1989), Auchenorrhyncha (Eyre, Woodward & Luff 2001), dolichopodid flies (Pollet 1992) and spiders (Rushton & Eyre 1992). One limitation of this approach is that the resulting habitat classifications are not generally applicable outside the dataset from which they were derived. They vary between taxonomic groups (Cherrill *et al* 1997) and between geographic regions (Foster & Eyre 1992). Comparison of various grassland carabid classifications (Eyre *et al* 1989, Eyre & Luff 1990a, 1990b) suggests that they can be sensitive to changes in scale. Their specificity to sampling technique and classification method also needs investigation. Such classifications of invertebrate habitats have not yet been generally adopted by practitioners of nature conservation, except by the invertebrate specialists who devised them. They have generally proved most useful as a way of grouping equivalent sites so that their conservation value can be meaningfully compared (eg Foster *et al* 1990).

TWINSPAN uses reciprocal averaging to ordinate samples and species prior to division into end groups. Raw ordination scores have proved to be effective in comparing the influence of different environmental gradients on species composition, either indirectly after Detrended Correspondence Analysis (DCA) or directly through Canonical Correspondence Analysis (CCA) (ter Braak & Prentice 1988). These methods have been successful in detecting effects of grassland management variables on a variety of invertebrate assemblages including spiders (Rushton, Luff & Eyre 1989, Rushton, Topping & Eyre 1987), ground beetles (Blake *et al* 1996, Eyre *et al* 1989, Rushton, Eyre & Luff 1990), weevils (Eyre *et al* 1989) and Auchenorrhyncha (Brown, Gibson & Kathririthamby 1992, Gibson, Hambler & Brown 1992). There is, of course, a wealth of literature describing changes in species composition following management events without recourse to computerised ordination techniques. For example, Merrett (1976) characterised species turn-over in spiders over a ten year period following the burning of a Dorset heathland site, while changes in grassland Hemiptera assemblages have been described according to different grazing and cutting regimes (Morris 1973, 1981a, 1981b).

In addition to species composition, species diversity is also commonly used to study invertebrate community responses to environmental variables. Sensitivity of species diversity to management variables has been described in ground beetles (Luff 1996), upland rove beetles (Buse & Good 1988), heathland spiders (Usher & Smart 1988) and grassland Hemiptera (Morris 1973, 1975, Morris & Lakhani 1979).

Southwood, Brown & Reader (1979) investigated changes in species diversity of Heteroptera and Coleoptera in secondary succession from fallow field to birch woodland. They found that insect diversity increased together with plant species diversity through the early stages of succession, but declined much less sharply than plant species diversity in later successional stages. The maintenance of a comparatively high insect diversity in later seres was ascribed to the greater structural diversity in the vegetation. The identification of response patterns in species assemblage parameters to fundamental processes in the ecosystem, such as vegetational succession, has great potential for building models to predict the effects of different management options.

Many different diversity indices have been formulated, but in general they are composed of two elements, species richness or number of species, and equitability, often termed evenness, which relates to the distribution of abundances between species. Species richness is the simplest measure of diversity, but it is very sensitive to sampling effort (Southwood 1978). This means that it is difficult to compare results from more than one sample, unless they have all been collected in the same way. Further problems in the comparison of non-synchronous samples are likely to arise from temporal variations in assemblages. Lott (1999b) found significant annual and seasonal variations in the species richness of floodplain beetle assemblages, even with standard sampling techniques, and species richness proved to be a less robust measure of environmental influences than DCA axis scores.

1.1.2 The evaluation of site quality

World-wide, species diversity is one of the most popular criteria used to assess conservation value (Margules & Usher 1981). However, there are major problems in its application. There is no generally accepted method of measuring diversity for conservation value, although Usher (1986) recommended species richness with values adjusted by rarefaction to compensate for variations in sampling effort. Unfortunately, rarefaction does not address problems due to the inflation of species richness values by vagrant species (Shmida & Wilson 1985) or the intrinsically low species richness of climax communities (Southwood, Brown & Reader 1979). Vaisanen, Bistrom & Heliovaara (1993) found that the species richness of saproxylic beetle assemblages in primary boreal forests was lower than in managed forests where the primary forest specialists had disappeared after logging.

Species rarity has been more widely used for site quality evaluation in Britain, because it is tacitly believed to be a good measure of threat of extinction. However, its use has attracted some criticism, either because many threatened organisms are not perceived as rare (McIntyre 1992) or, because current baseline data is inadequate to confidently assign a rarity status to many invertebrate species (Eyre, Luff & Lott 1998). Gaston (1994) also pointed out that the scale of precision in measuring the range size of a species can affect its rarity status.

Site comparisons using the numbers of rare species recorded will be affected by inconsistent sampling effort in the same way as species richness. Eyre & Rushton (1989) developed a system for scoring ground beetle and water beetle assemblages by weighting all of their constituent species according to their recorded range sizes on a geometric scale and calculating the average species score. The result, which has been variously termed SQF, SQI or SQS, is claimed to be independent of sampling effort. This approach has been applied to aculeate bees and wasps (Archer 1995), saproxylic beetles (Fowles, Alexander & Key 1999) and dolichopodid flies (Pollet 2001) using species scores based on national conservation status such as red data book listing instead of recorded range size. SQIs for saproxylic beetle sites are influenced by sampling method (Lott 1995) and area (Lott 1999a). Like species richness, they will be affected by vagrant species (Gaston 1994), though if these are common species, site scores will be depressed rather than inflated. Williams (2000) found that the SQS for bumble bees was an unreliable measure of site quality when based on short species lists, but this may not be such a problem for more species-rich groups.

Levels of habitat occupancy have seldom been used in site quality assessment for invertebrates outside running water systems. Moss *et al* (1987) used five environmental variables measured at 21 running water sites to predict a high proportion of the macro-invertebrate species present at each site. The difference between predicted and observed fauna at any site can then be used to measure the loss of biological quality from current or past pollution events or from river regulation (Armitage *et al* 1986). More recently, Speight and Castella (2001) have demonstrated a predictive system based on a consideration of regional species pools and microhabitats of hoverflies. Essentially this can be used to identify which guilds are poorly represented at a site. A common problem for all evaluation systems that rely on differences between a predicted and an observed fauna is the practical difficulty of producing a complete inventory of species at any one site (see Disney *et al* 1982).

1.2 Wetland invertebrate communities

2,773 species of freshwater aquatic macroinvertebrates occur in Britain (RSPB, NRA & RSNC 1994). Most of them are arthropods and most of the rest are molluscs, but a large proportion of higher taxa within these phyla contain aquatic species. In fact, aquatic species are present in eleven of the 24 orders of insects occurring in Britain. In evolutionary history, the evolution of terrestrial invertebrate into freshwater aquatic invertebrate has occurred many times and in many different groups. Consequently, freshwater aquatic invertebrates exhibit an amazing variety of physiological and life history adaptations to their environment (Dillon 2000, Williams & Feltmate 1992) and it is no surprise that their responses to environmental variables are diverse.

Many aquatic insects undergo a terrestrial phase in their life cycle. The nature of nearby terrestrial habitats could therefore have an important influence on wetland assemblages, although very little work appears to have been done in this area. There are also a large number of specialist wetland species in groups that are traditionally regarded as purely terrestrial. Lott (2001) found more species of wetland Carabidae and Staphylinidae than water beetles during a survey of 30 ponds in Leicestershire. Eyre & Lott (1996) listed 441 terrestrial invertebrate species as characteristic of riparian habitats along British rivers and if static water biotopes, such as siltmarsh, fen and carr were taken into consideration, the species richness of terrestrial species found in wetlands would be in the same order of magnitude as that of aquatic species. Wetland terrestrial species live in the riparian zone or on emergent vegetation, and they may be just as dependent as aquatic species on wetland hydrology through requirements for high soil moisture content or through the disturbance provided by flooding. Consequently, they should be considered as an integral component of wetland invertebrate communities, even though they have generally been neglected in wetland conservation strategies.

Foster (1991) quantified the threat to aquatic insects in terms of numbers of species included in the UK red data book (Shirt 1987). As soon as other invertebrate groups are considered, together with terrestrial groups associated with wetlands, the importance of wetlands for invertebrate conservation becomes very evident. Approximately 34% of all species listed as endangered or vulnerable by Shirt (1987) and Bratton (1991) are associated with freshwater wetlands (see table 2). This amounts to 200 species, but because several groups are not covered in the red data books, the true number of threatened wetland invertebrates is higher than this.

1.2.1 The effects of site management on wetland assemblages

Compared to grassland, relatively little work has been done on wetland invertebrate assemblages, especially with regard to the effects of site management. Pollet (1992, 2001) identified light intensity at ground level, soil moisture content and litter depth as important factors affecting the species composition of reedmarsh and wet grassland dolichopodid assemblages in Belgium. Consequently, site management operations that affect vegetation cover, hydrology and turn over of litter can be expected to affect the dolichopodid fauna. Holmes, Boyce & Reed (1993) identified nutrient status, substrate saturation and grazing as important factors affecting the species composition of Welsh peatland ground beetle assemblages, so site management operations that affect water quality or water levels should have an impact on the ground beetle fauna. In a preliminary analysis of spider data from the

EAFIS dataset, Procter & Foster (1992) identified flooding and vegetation height as important determinants of species composition. As with Dolichopodidae and Carabidae, site management that impacts on hydrology will affect the spider fauna.

Table 2. Percentage of freshwater wetland species in red data book lists of endangered and vulnerable species (Bratton 1991, Shirt 1987). Figures for Lepidoptera include subspecies. Wetland species were identified from red data book species accounts supplemented by Falk (1991). 354 listed species of Diptera are not included in the analysis because they lack published species accounts.

	No species (all habitats)	**No species (freshwater wetland)**	**Percentage**
Coelenterata	1	0	0
Mollusca	17	14	82
Crustacea	3	3	100
Araneae	53	12	23
Odonata	6	6	100
Orthoptera	5	2	40
Heteroptera	20	1	5
Trichoptera	13	13	100
Lepidoptera	49	9	18
Coleoptera	226	70	31
Hymenoptera	49	4	8
Diptera	142	66	46
total	584	200	34

Foster *et al*(1990) and Painter (1999) both found big differences in aquatic invertebrate species composition between large and small fenland ditches. Ditch profile and vegetation were also important factors that both affect species composition and could be affected by management (Painter 1999). However, while the conservation value of larger ditches for water beetles was maintained by regular management, cleaning out of small ditches reduced site quality (Foster *et al*1990).

Several studies have explored the impact of reedbed management on invertebrate assemblages directly. Ditlhogo *et al* (1992) detected no long term change in the numbers of several families after the introduction of either burning or cutting to experimental plots at Hickling in the Norfolk Broads and suggested that both burning and cutting were suitable site management methods for conservation purposes. However, Foster & Procter (1995) compared a recently cut section of a reedbed at Hickling with an uncut section and found that there was a long term decrease in species quality score and a decline in numbers of all but one of the red data book species on the site. In Belgium, spider species richness was found to be similar in regularly cut reedmarsh to uncut marsh, but rare wetland species were sensitive to cutting and the spider assemblages of cut areas were characterised by assemblages with more widespread wetland species and ubiquitous species with good dispersal powers (Decleer 1990). Further details provided by Laurence *et al* (1992) on the first Hickling study makes it apparent that insect numbers in cut and burnt plots may have been distorted by vagrant species, and their conclusions cannot be accepted. Both Decleer (1990) and Foster & Procter (1995) concluded that a more cautious approach to cutting was needed in order to conserve rare fenland invertebrates and recommended leaving a mosaic of unmanaged areas of reed.

1.2.2 The effects of hydrology on wetland assemblages

Many of the studies cited above identify soil moisture and water level as factors influencing the species composition of wetland invertebrates assemblages. However, a single measurement at one point in time is probably inadequate for an understanding of the complex responses of invertebrate assemblages to fluctuations in water level. Eyre *et al* (1992) found that site-water duration was an important determinant of water beetle species composition in 77 silt-ponds in north east England. Given the range of adaptations to drying out found in aquatic invertebrates (see eg Hinton 1953), it is likely that similar responses would be found in some other aquatic invertebrate assemblages. However, Lott (2001) suggested that riparian beetles characteristic of temporary ponds were actually dependent on seasonal fluctuations in water level that exposed bare sediment suitable for breeding, rather than the impermanence of the water body.

Winter flooding has been found to reduce numbers and biomass of soil invertebrates in reedbeds (Ditlhogo *et al* 1992) and wet grassland (Ausden, Sutherland & James 2001). In a study of terrestrial and wetland ground beetle assemblages from 26 sites in floodplains in Moravia and Slovakia, Šustek (1994) detected important variations in species composition between assemblages from dry sites and damp sites subject to flooding and also between assemblages from oligotrophic sites flooded by fast-flowing water and eutrophic sites flooded by stagnant water. There were also significant differences between assemblages in sites flooded only in early spring and those in sites flooded more frequently. Similarly, in a Leicestershire river valley, more severe flooding at sites close to the main channel affects the species composition of ground beetle and rove beetle assemblages quite differently from less severe, seasonal flooding in remoter floodplain sites (Lott 1999b). Aquatic invertebrate assemblages in Rhône floodplain water bodies vary in species composition along a gradient of connectivity with the main channel (Castella *et al* 1984).

1.3 Objectives of this report

This report aims to use the EAFIS dataset as it currently stands to advise on suitable management systems for invertebrate conservation. Therefore, the following objectives have been set:

1. assessment of current dataset and selection of groups for analysis,

2. quantification of site management and relevant environmental variables and exploration of now they influence site quality, species diversity and species composition,

3. identification of management operations that may be favourable to invertebrate conservation,

4. selection of taxonomic groups suitable for monitoring the effects of site management,

5. review of sampling methods,

6. recommendations for further research.

2. The EAFIS dataset

2.1 Sites

Systematic sampling was carried out at 87 stations in 43 sites across East Anglia between 1988 and 1990. The locations of these sites in relation to Natural Areas are shown in map 1. Some sampling stations were operated in more than one year giving a total of 165 samples. Most of the study sites can be characterised as extensive tall-herb fen, but a small number of flushes and acidic mires were also sampled. Descriptions of each sampling station are given in appendix 1.

2.2 Sampling methods

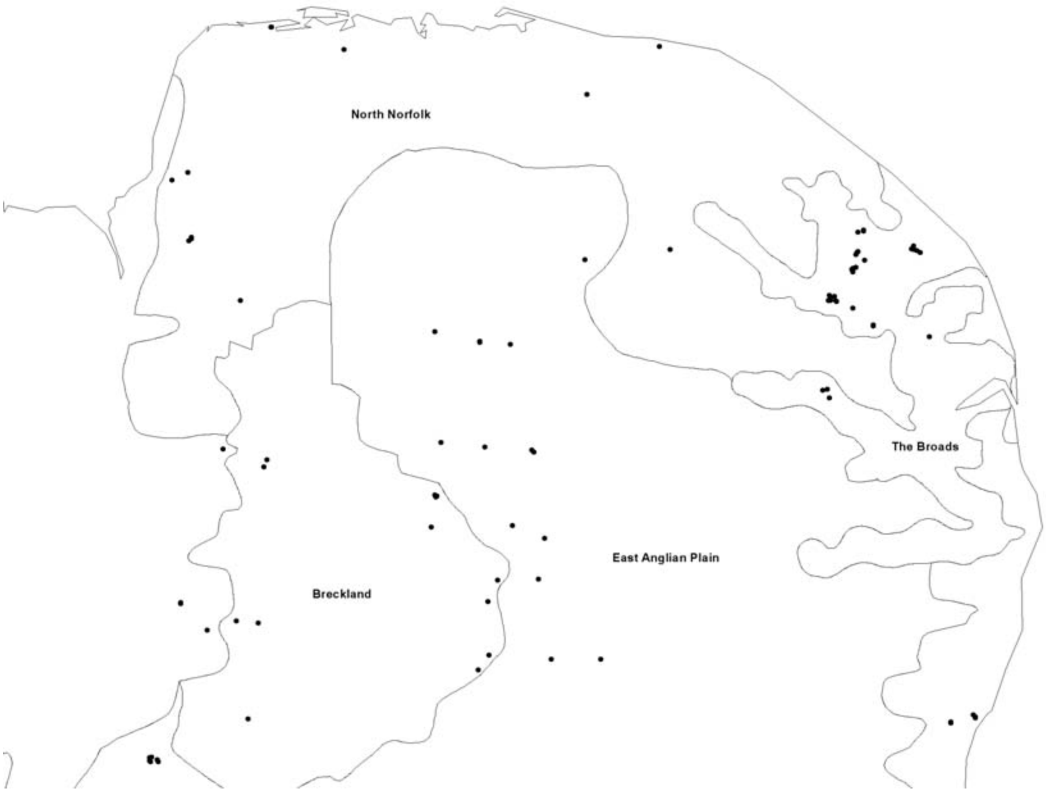
The standard sampling method used at each sampling station consisted of a line of five pitfall traps (white plastic vending machine cups of 87 mm diameter) distributed at one metre intervals between two water traps (white plastic bulb bowls of 200 mm diameter), one placed at ground level and one mounted on a 0.5m stake. All traps contained a 30% solution of ethylene glycol to act as a preservative together with a wetting agent. Traps were usually run at each sampling station for several two-week periods throughout the season. Appendix 3 lists the trapping schedules from each sampling station.

At a few sites, additional sampling methods were also used. These included the collection of litter samples and mercury vapour light trapping. Casual field records were also gathered at many sites. However, these records are not used in the main part of the analysis.

Trap contents were sorted into major taxonomic groups and then identified to species. Specialists used to identify species in groups well represented in the dataset are listed in table 3.

Table 3. Personnel employed to identify species from trap samples. For each group, the bulk of specimens was determined by the first-named specialist. Names in brackets identified less than five specimens.

Taxonomic group	Specialists
Mollusca	Dr I.J. Killeen (+D. Procter, A.P. Foster)
Isopoda	D. Procter
Diplopoda	R.E. Jones (+D. Procter)
Auchenorrhyncha	Dr P. Kirby, A.P. Foster
Dolichopodidae	Dr B.R. Laurence, D. Procter (+P.J. Chandler, A.P. Foster, R.K.A. Morris)
Larger Brachycera	A.P. Foster, A.E. Stubbs (+R.K.A. Morris)
Scathophagidae	S.J. Falk, A.P. Foster
Sciomyzidae	A.P. Foster (+Dr C.M. Drake, S.J. Falk, Dr I.F.G. McLean)
Sphaeroceridae	J. Valentine
Syrphidae	A.P. Foster, R.K.A. Morris (+ Dr M. Morris, D. Procter, A.E. Stubbs, J. Valentine)
Tipuloidea	A.E. Stubbs (+A.P. Foster, P.J. Chandler)
Carabidae	A.P. Foster (+Dr M.L. Luff)
Water beetles	A.P. Foster (+Dr G.N. Foster)
Staphylinidae	A.P. Foster (+P.J. Chandler, Prof. J.A. Owen)
Phytophagous beetles	A.P. Foster
Araneae	D. Procter
Opiliones	D. Procter



Map 1. Locations of sampling sites used in relation to Natural Areas

2.3 Species recorded

The EAFIS dataset currently contains 29,359 records referring to 2,187 species. It includes 214 casual records from Great Cressingham Fen, a site that was not sampled with standard traps. Records from this site will not be considered further. When restricted to samples taken from the standard programme of pitfall and water traps the totals are reduced to 26,723 records of 1,676 species. The full species list can be found in appendix 4. Descriptions of chief features of invertebrate interest for sevceral sites were included in the surveyor's log and these are reproduced in appendix 5.

The processing of standardised samples is not complete. Specimens from some samples remain unsorted into taxonomic groups and sorted samples vary considerably in the degree to which different taxonomic groups have been identified to species. Some of the taxonomic groups that have been processed from each sampling station for each year of operation are listed in the surveyors' notes. In some cases records of groups listed as being processed from a sample are absent from the dataset. It is not clear whether these were negative hits, ie they were genuinely absent from the sample. There are also occasional records of groups from samples, which were not listed as being processed. It is difficult to decide in every case whether this is due to results being received after the list was last updated, or whether the records are casual identifications outside the systematic process of comprehensive sorting and identification of samples. These questions introduce an element of uncertainty to the integrity of the dataset, which must be borne in mind when interpreting the results of any analysis.

Araneae, Opiliones, Isoptera, Hemiptera and some families of Diptera have been processed from a large proportion of sampling stations. Mollusca, Diplopoda, Coleoptera and

Dolichopodidae are less comprehensive in their treatment both in terms of the number of sampling stations represented in the dataset and in the number of sampling periods processed at each station. Some non-target groups, such as Lepidoptera and Hymenoptera, appear not to have been processed in a consistent manner and these are not included in the main part of the analysis. 91 fungus gnat specimens (Diptera, Sciaroidea, Mycetophilidae), one specimen of Sphaeroceridae (Diptera) and one harvestman (Arachnida, Opiliones) could not be identified to species. In addition, it is apparent from the species list in the current dataset that specimens of Aleocharinae (Coleoptera, Staphylinidae) have not been processed, apart from those belonging to the more easily identified genera *Myllaena, Cypha, Gyrophaena* and *Drusilla*. These omissions should not compromise the results of any between-site analyses, as long as they are taxonomically consistent across different samples.

2.4 Red data book and nationally scarce species

215 nationally scarce species and 90 red data book species were recorded. Of these 177 nationally scarce species and 77 red data book species were taken in the standard sampling programme. All species are listed in appendices 6 to 8 together with the sites from where they were recorded. A high proportion of red data book and nationally scarce species records came from the Norfolk Broads, but this partly reflects the greater recording effort at sites in this area.

2.5 Species new to science or Britain

Some species previously undescribed were detected amongst material distributed to specialists. Most were fungus gnats determined by P. Chandler, Sciarid flies identified by B. Laurence, or members of the smaller parasitic Hymenoptera worked on by D. Notton. Chandler (1994) described two new fungus gnats from the genus *Rymosia* from material collected during the study, with the Holotype material for *R. fosteri* from Catfield Fens. Laurence (1994) described five new species of Sciarid fly from the survey with Holotype material of *Plastosciara taractica* collected from Thompson Common, *Corynoptera echinocordyla* and *Bradysia semantica,* two new species from the Brancaster reed beds, *Bradysia dolosa* from Catfield fens, and *Scatopsciara subdivida* from Stallode wash. Notton (1993) described two new Diapriidae (small parasitic Hymenoptera), *Trichopria striata* from Brancaster reed beds, and *Diapria luteipes* from Middle Harling Fen. Some of these taxa are already known elsewhere and may prove to be widespread, others may be scarcer and confined to wetland habitats.

A number of species were also added to the British list, some from the groups previously mentioned. For example Laurence (*loc. cit.*) also recorded six Sciarids new to Britain and Chandler (1992) reported the fungus gnat *Mycomya branderi* as the dominant fungus gnat at Old Buckenham Fen, which is otherwise only recorded from the Stumpshaw RSPB reserve, again within the current study.

Further additions to the British list were detected in other groups, for example the meniscus midge *Dixella graeca* from Walberswick (Disney, 1992), and two snail-killing flies: *Antichaeta atriseta* (Foster & Procter, 1997) and *Sciomyza testacea* (unpublished), the former only recorded from Stallode Wash, the latter widely in the Broadland sample stations but not elsewhere. Both are considered scarce in continental Europe.

2.6 Selection of taxonomic groups for analysis

Taxonomic groups that have been processed from a wide range of sampling stations are listed in table 4 together with statistical information relating to the EAFIS dataset.

Mollusca are represented in the dataset by freshwater and terrestrial snails and freshwater bivalves. Like the Mollusca, the Isopoda (Crustacea) also include freshwater species (water slaters) and terrestrial species (woodlice). Millipedes (Diplopoda), harvestmen (Arachnida, Opiliones) and spiders (Arachnida, Araneae) are other well defined groups represented in the dataset. The first two groups contain exclusively terrestrial species, while the spiders are predominantly terrestrial.

Auchenorrhyncha (Insecta, Hemiptera, Homoptera) include froghoppers and leafhoppers in the families Cercopidae, Cicadellidae, Cixiidae and Delphacidae. They comprise the bulk of Hemiptera records within the dataset and form a homogeneous ecological group that has been used previously in grassland studies. The remaining hemipteran groups (Heteroptera and Psylloidea) include both terrestrial and aquatic groups but are represented by too few records to be considered for the main part of the analysis.

Ground beetles of the family Carabidae (Insecta, Coleoptera) are mostly ground-living predators (at least in wetlands) and have been widely used in community studies, but they are surprisingly poorly represented in this dataset. They are often found together with rove beetles (Staphylinidae), but this latter group has not received as much attention in community studies, despite the large number of species in this family. The previously separate Pselaphinae are included in the figures for Staphylinidae. Water beetles have also been widely used in community studies, though not previously from pitfall trap samples. They are here taken to include the families Haliplidae, Dytiscidae, Hydrophilidae (*sensu lato*), Hydraenidae, Dryopidae and Scirtidae, the latter family being unusually highly represented in this dataset compared to those collected by more traditional methods. The Apionidae, Curculionidae, Chrysomelidae, Nitidulidae (excluding the genus *Epuraea*), Byturidae, Mordellidae and Oedemeridae form a phylogenetically mixed group of phytophagous beetle families. Further beetle families are included in the dataset, but many of them are predominantly terrestrial groups containing few species characteristic of wetlands.

Wetland species assemblages of Dolichopodidae (Insecta, Diptera) have previously been the subject of limited study, but the undoubted potential of other dipteran families for wetland community studies remains largely unexplored. The various families of Diptera mentioned below form separate subsets of the data in that they have been processed from differing sets of samples. The superfamily Tipuloidea or crane-flies contain the families Tipulidae, Cylindrotomidae, Pediciidae and Limoniidae, all previously united in one family. The Ptychopteridae, a family of wetland species are currently placed in a separate superfamily, but they are often recorded together with Tipuloidea and they are united for the purposes of this analysis. The Sciaroidea include the families Mycetophilidae and Sciaridae and are mostly, though not exclusively, associates with fungi (Smith 1989). The larger Brachycera are a heterogeneous group of families which are united in one national recording scheme. In this dataset they are represented by the families Asilidae, Bombyliidae, Rhagionidae, Stratiomyidae, Tabanidae and Therevidae. The hoverflies (Syrphidae) and the dipteran families Sciomyzidae, Scathophagidae and Sphaeroceridae also form substantial subsets of data.

The Sciaroidea are the only group investigated which did not respond significantly to any of the recorded environmental variables and they were discounted from further analysis. The Diplopoda, larger Brachycera, Scathophagidae, Isopoda and Opiliones are all represented by relatively few species both across the entire dataset and within individual samples. They appeared to be entirely absent from some samples, so they too were omitted from the dataset for further analysis. Although Mollusca, phytophagous Coleoptera, Carabidae and Tipuloidea were represented by large numbers of species across the entire dataset, their recorded species richness at individual sampling stations was low. However, the Tipuloidea were retained for further analysis because of their potential for future monitoring programmes.

Consequently, nine groups listed in table 5 were selected for further analysis.

Table 4 . Taxonomic groups well represented in the EAFIS dataset together with data relating to their suitability for analysis. Samples are taken to include all records taken from one sampling station in a single year. Zero scores were not used in the calculation of average number of species recorded from each sample.

Group	No samples containing group	% specimens unidentified to species	No species recorded from whole dataset	Ave no of species recorded from each sample	No significant environmental variables detected by CCA
Mollusca	44		37	4.84	3
Diplopoda	20		13	2.85	3
Auchenorrhyncha	163		117	7.31	9
Tipuloidea	150		83	4.92	6
Sciaroidea	132	3.89	169	11.05	0
Larger Brachycera	93		28	2.20	5
Sphaeroceridae	102	<0.01	55	5.74	5
Dolichopodidae	64		59	6.06	7
Sciomyzidae	155		45	7.15	8
Syrphidae	149		86	8.95	6
Scathophagidae	112		18	1.63	7
Carabidae	95		55	4.96	6
Staphylinidae	98	?	133	8.60	9
Carabidae + Staphylinidae	99	?	188	13.27	9
Water beetles	97		74	6.68	5
Phytophagous beetles	96		78	4.65	5
Isopoda	94		8	1.71	2
Opiliones	105	0.29	12	3.25	9
Araneae	146		182	23.13	10

Table 5. Taxonomic groups selected for analysis

Group	Ecology
Auchenorrhyncha	Phytophagous
Dolichopodidae	Larvae predaceous in soil, mature trees and dung – sometimes aquatic (Smith 1989)
Sciomyzidae	Parasitoids of snails (Berg & Knutson, 1978)
Sphaeroceridae	Saprophagous in dung, litter and mud (Pitkin 1988)
Syrphidae	Varied – many species with aphidophagous larvae; other species are phytophagous, saproxylic or aquatic (Smith 1989)
Tipuloidea	Varied - most species develop in soil, but some larvae are aquatic (Smith 1989)
Carabidae and Staphylinidae	Mostly ground-living predators
Water beetles	Larvae aquatic; pupae terrestrial; adults aquatic, semi-aquatic or terrestrial
Araneae	Predators in a wide range of habitats

2.7 Recorded environmental variables

At each sampling station. nine environmental variables were measured by the surveyors together with the NVC plant community:

- VEGHT was measured as the average height in centimetres of the herbaceous vegetation on the first visit of each year.
- LITCOV was estimated as the percentage of the ground surface covered by surface litter. 11 samples in the project record had missing values for this variable.
- MCYCLE applies to sampling stations managed by cutting and equates to the number of years between each cut.
- MANAGE is a nominal variable based on management by cutting. The value 0 was given to unmanaged stations (78 samples), the value 1 was given to stations where management had been recently reinstated (29 samples) and the value 2 was given to stations which had been managed for many years (58 samples). Some of the original values listed in the project record were revised using information contained in site descriptions.
- GRAZINT is an ordinal variable based on grazing intensity on a scale of 1 to 4. The value 1 was given to stations with no history of grazing (147 samples), the value 2 denotes light grazing (13 samples), the value 3 denotes moderate grazing (4 samples) and the value 4 denotes heavy grazing (1 sample).
- TBURN is an ordinal variable based on management by burning on a scale of 1 to 4. The value 1 was given to stations with no recorded history of burning (148 samples), the value 2 was given to stations burnt in the previous four to six years (6 samples), the value 3 was given to stations burnt in the previous two to three years (8 samples) and the value 4 was given to stations burnt in the previous year (3 samples).
- LITDEP is an ordinal variable based on litter depth on a scale of 1 to 5. The value 1 was given to 90 samples, the value 2 was given to 45 samples and the value 3 was given to 17 samples, value 4 was given 4 samples and the value 5 was given to 5 samples. Four samples in the dataset had missing values for this variable.
- FLOOD is an ordinal value on a scale of 0 to 5. The value 0 was given to stations that never flood (18 samples), the value 1 was given to stations that rarely flood (44 samples), the value 2 was given to stations that occasionally flood (58 samples), the

value 3 was given to stations that frequently flood (26 samples), value 4 was given to stations that are mostly flooded (9 samples) and the value 5 was given to stations that are always flooded (10 samples).

- WTABLE is an ordinal value on a scale of 0 to 5. The value 0 indicates that the water table was below the bottom of the cup when setting pitfall traps (5 samples), the value 1 indicates that the water table was level with the bottom of cup (23 samples), the value 2 indicates that the water table was between the bottom of the cup and one third of the cup height (47 samples), the value 3 indicates that the water table was between one third of the cup height and two thirds of the cup height (53 samples), value 4 indicates that the water table was between two thirds of the cup height and the top of the cup (20 samples) and the value 5 indicates surface flooding (17 samples).
- NVC is a nominal variable. Four classes were recognised: M22 (19 samples), S4 (26 samples), S24 (54 samples) and S25 (19 samples). The remaining 47 samples were grouped into a miscellaneous class.

Further environmental variables for analysis were elicited from the site descriptions in appendix 1:

- TCUT is based on the number of years elapsed since the most recent vegetation cut. This variable was used for analysis in place of MCYCLE whose utility was considered to be reduced by recent changes to the cutting regime at several sites. Cutting cycles ranged from one year to four years, so the value 1 was given to stations with no recent cuts (78 samples), 2 to stations cut four years previously (3 samples), 3 to stations cut three years previously (6 samples), 4 to stations cut four years previously (16 samples) and 5 to samples cut in the previous year (52 samples). Information was missing on the precise cutting times for 10 samples from stations on a two-year cutting cycle and these were assigned a value of 4.5.
- DWATER measures seasonal variations in water levels. The value 0 was given to sampling stations whose description contained references to permanently high water levels or features associated with permanently high water levels such as springs and floating rafts of vegetation (34 samples). The value 2 was assigned to sampling stations whose description contained references to drying out in the summer or to features associated with seasonal fluctuations in water levels such as location in a floodplain (21 samples). A default value of 1 was applied to the remaining 110 samples.
- DOMV is a nominal variable based on the dominant plant species at each sampling station. Five classes were recognised: *Phragmites australis* (64 samples), *Cladium mariscus* (32 samples), co-dominant herb-rich swards (26 samples) and *Carex elata* (11 samples). The remaining 32 samples were grouped into a miscellaneous class.
- HABST is a nominal variable based on habitat. Six classes were recognised: tall-herb fen (120 samples), transitional stage between fen and carr (4 samples), meadow (17 sites), pingo pond (6 sites) and flush (5 sites). The remaining 14 samples were grouped into a miscellaneous class.
- AREA is a nominal variable based on the geographical location of the site. Four classes were recognised: Broadland (88 samples), Breckland and Breckland fringes (24 samples), North Norfolk (12 samples). The remaining 41 samples were grouped into a miscellaneous class.

- YEAR is a nominal variable based on the year of sampling. 70 samples were taken in 1988. 53 samples were taken in 1989. 42 samples were taken in 1990.

Values of all variables for each sampling station are given in appendix 2.

Examination of the correlation matrix in table 6 shows that LITDEP and LITCOV, not surprisingly, are highly correlated and that WTABLE is highly correlated with FLOOD.

The suite of variables can be characterised according to their utility for understanding relationships between species assemblage parameters and management regimes. MANAGE, TCUT, GRAZINT and TBURN are directly related to management operations and can be used to measure their effects directly. LITDEP, LITCOV and VEGHT, which quantify resources used by invertebrates , are products of ecosystem functioning. However, they can be modified by management, so their influence on species assemblage parameters could be used to predict the outcome of management proposals. According to table 6, LITDEP is more sensitive to TCUT and GRAZINT than LITCOV. As would be expected, VEGHT decreases with high values of GRAZINT and TCUT, but it also increases with higher values of FLOOD.

FLOOD and DWATER are hydrological variables that relate to how the ecosystem functions. These variables can be modified by management, so their influence on species assemblage parameters could be used to predict the outcome of management proposals. There are, however, some difficulties in the interpretation of responses to FLOOD, because this variable relates both to hydroperiod (the length of time under water) and to frequency of flooding, which is more of a disturbance factor. The influence of FLOOD on VEGHT suggests that it might also be linked to a productivity gradient. WTABLE is a measure taken at one point in time and is more difficult to relate to ecosystem functioning than FLOOD or DWATER.

HABSTR is loosely associated with ecosystem functioning in that several classes correspond to stages of the classic ecological succession in wetland. However, hydrological variations linked to springs, pingo systems and traditional fen-meadow management have resulted in several heterogeneous classes that are difficult to fit into a linear scale of numerical values. Furthermore, around three quarters of the samples are in one class, tall-herb fen.

YEAR and AREA are large scale factors which may aid interpretation of results. In this respect, it is worth noting that study sites in Breckland are more likely to have seasonal fluctuations in water level (see table 7). Furthermore, there are regional differences in management practices. Study sites in Breckland and North Norfolk were more likely to be uncut than elsewhere (see table 8). NVC and DOMV may also aid interpretation of results, but they are products of ecosystem functioning and management, rather than causative elements.

Table 6. Correlation matrix of continuous and ordinal environmental variables

TCUT	1.00								
TBURN	-.042	1.00							
GRAZINT	.058	-.110	1.00						
LITCOV	-.145	-.168	-.248	1.00					
LITDEP	-.312	-.010	-.220	.656	1.00				
FLOOD	-.136	.187	-.353	-.071	.119	1.00			
DWATER	-.104	.042	.187	.002	-.011	-.182	1.00		
WTABLE	-.117	.023	-.368	-.105	.106	.738	-.416	1.00	
VEGHT	-.254	.139	-.285	.403	.459	.366	-.001	.217	1.00
	TCUT	TBURN	GRAZINT	LITCOV	LITDEP	FLOOD	DWATER	WTABLE	VEGHT

Table 7. Contingency table for distribution of DWATER scores between areas (X^2 statistic = 15.62, p <0.01). Unbracketed figures refer to the observed number of samples; bracketed figures refer to the expected number of samples.

	DWATER		
AREA	0	2	Total
Breck	4 (9.9)	12 (6.1)	16
Broad	17 (11.7)	2 (7.3)	18
Misc	8 (8.0)	5 (5.0)	28
NN	5 (4.3)	2 (2.7)	6
Total	34	21	68

Table 8. Contingency table for distribution of MANAGE scores between areas (X^2 statistic = 32.55, p <0.0001). Unbracketed figures refer to the observed number of samples; bracketed figures refer to the expected number of samples.

	MANAGE			
AREA	0	1	2	Total
Breck	19 (11.3)	3 (4.2)	2 (8.4)	24
Broad	32 (41.6)	22 (15.5)	34 (30.9)	88
Misc	16 (19.4)	3 (7.2)	22 (14.4)	41
NN	11 (5.7)	1 (2.1)	0 (4.2)	12
Total	78	29	58	165

3. Species diversity

3.1 Methods

Variations in sampling effort due to disruption by flooding, variable trapping schedules and incomplete processing mean that species richness cannot be meaningfully compared between sampling stations and between taxonomic groups without extensive manipulation of the data. Consequently, it was decided to use two species diversity indices that are independent of sampling effort. The Shannon-Weaver index (H) is a non-parametric function widely used in community studies. Fisher's alpha is a parametric index that assumes that the abundances of species follows a log series distribution.

Samples from different trapping periods were aggregated for each sampling station within each year and values of each diversity index calculated using PISCES software. Samples containing a single species or a single abundance class were excluded from the analysis. The response of each index to environmental variables was explored using non-parametric statistics on Analyse-it software. Spearman's rank correlation was used for continuous variables. The Mann-Whitney and Kruskal-Wallis tests were used to test the significance of differences in median index values between classes of ordinal and nominal variables.

3.2 Results

Some differences were discovered in the responses of the two indices. Fisher's alpha was found to be slightly more responsive to management variables, while the Shannon-Weaver index was more sensitive to vegetation community type. However, the results for both indices were very noisy. Samples containing only one species or one abundance class were found in all taxonomic subsets of data except for spiders. Even after their removal, several outliers remained in each subset. Nevertheless, the results exhibited some interesting patterns. The responses of species diversity to various environmental factors and variables are shown in tables 9 to 12.

Geographical location was found to have an influence on species diversity. Only the Dolichopodidae showed no significant response in at least one of the diversity indices analysed. For all other groups, samples from the Breckland area and its fringes had relatively high diversities, suggesting either that sites in this area have a high within-site habitat diversity or that most groups have a larger regional species pool in this area. For spiders, water beetles, Auchenorrhyncha, Sciomyzidae and ground-living beetles, samples from the Broads were more diverse than samples from other areas outside Breckland.

For over half the groups, plant community type also affected species diversity. For most groups, NVC proved to be a better predictor in this respect than the single most dominant plant species. However, the community type that produced the highest diversity varied from group to group. M22 fen meadow communities are comparatively species rich in herbs and were associated with high diversity in Auchenorrhyncha, Sphaeroceridae, Syrphidae and spiders. S25 tall-herb fen communities are found in late-successional seres resulting from cessation of management (Fojt 1993) and were associated with high diversity in spiders and Sphaeroceridae. Sciomyzidae were the only group whose diversity peaked in S24 tall-herb communities, which are found in managed fen. S4 type species-poor reedbeds often have high water tables and were associated with high water beetle diversity , but low species diversity in all other groups.

3.2.1 Sensitivity to vegetation control

Species diversity was sensitive to management by cutting (MANAGE and TCUT) in several groups. Spiders, Tipuloidea and Sphaeroceridae tended to be most diverse in unmanaged sites and their diversity dropped whenever cutting was carried out. Sciomyzidae, water beetles and Carabidae and Staphylinidae were most diverse at sites where cutting had recently been introduced, but this increase in diversity was not normally sustained in sites with a regular cutting regime (see tables 13 and 14). No groups were most diverse in sites which had been managed by cutting for some time. The sensitivity of species diversity to burning (TBURN) and grazing (GRAZINT) was less evident and varied between groups and the index employed. Similarly, VEGHT, LITDEP and LITCOV produced few responses that were repeated in both indices. The two exceptions were the positive response of spider diversity to vegetation height and the highly significant negative response of syrphid diversity to the same variable. The negative response of syrphid diversity to LITDEP and LITCOV may be linked to their covariance with VEGHT.

3.2.2 Sensitivity to hydrology

Auchenorrhyncha, Dolichopodidae and Carabidae and Staphylinidae were less diverse in wet and permanently flooded sites, as represented by FLOOD, WTABLE or DWATER. The Tipuloidea were anomalous in that they were less diverse at sites with intermediate scores. The Shannon-Weaver index in spiders and Sciomyzidae also exhibited a non-linear response to different classes of FLOOD reflecting the hybrid nature of this variable.

3.2.3 Variations between taxonomic groups

The sensitivity of species diversity to the environmental variables recorded in this project varied markedly from group to group, but this may be a function of the different extents to which groups have been processed and identified to species level. The Dolichopodidae exhibited the lowest sensitivity of any group. However, as a non-target group, there is some question as to whether this family was recorded systematically from sample to sample and whether diversities from different samples are directly comparable in this dataset.

The species diversity of Syrphidae was found to be extremely sensitive to certain variables. It declined with increasing vegetation height and was low in samples taken from tall-herb fen and plant communities dominated by *Cladium.* This was probably due to the relative height of water traps compared to the surrounding vegetation. A number of both wetland and eurytopic syrphid species are strong fliers with good dispersal powers, but these species are less likely to be caught by water traps obscured by tall vegetation.

3.3 Discussion

The observed variations in species diversity can be interpreted in two ways: artefacts produced by the sampling method and responses to environmental factors that can be explained by the ecology of each group.

3.3.1 Artefacts

Several of the groups in this study contain mobile terrestrial species that end up in traps away from their breeding habitat and lead to noise in the data that obscures rather than distorts meaningful relationships between environmental variables and species assemblage parameters. Syrphid and spider diversity varied significantly from year to year reflecting the strong dispersive powers of these two groups. In the EAFIS dataset, it is apparent that mobile species of Syrphidae have been more easily caught in certain habitats, so that they dramatically affect the response of species diversity to environmental variables. Consequently, some caution must be applied to the interpretation of variations in other syrphid species assemblage parameters.

Evidence for other trapping artefacts are less clear cut. The project record contains frequent references to the disruption of traps by flooding, and this may have responsible for the observed reduction of species diversity from the wetter sites in Carabidae and Staphylinidae. Results for this group are likely to be affected by disruptions specific to pitfall traps. Results from managed sites whose traps were damaged by cutting machinery or grazing stock may also have been affected.

3.3.2 Environmental factors

De Bruyn *et al* (2001) suggested that the direct effect of vegetation composition or structure on species richness should be most evident for phytophagous insects which exhibit an intimate relationship with their hosts. A positive relationship for Auchenorrhyncha diversity with plant species richness is supported in this study by their high diversity in herb-rich plant communities. However, the Shannon-Weaver index for Auchenorrhyncha exhibited a negative response to vegetation height, a result contrary to what would be expected from the vertical stratification of Auchenorrhyncha assemblages found in moorland (Cherrill & Sanderson 1994) and grassland (Payne 1982). Similarly, Auchenorrhyncha diversity exhibited no significant response to management operations that reduce the structural complexity of vegetation, in contrast to the depression of diversity caused by burning and cutting in terrestrial grassland (Morris 1975, Morris & Lakhani 1979). It is possible that Auchenorrhyncha assemblages behave differently in wetlands. However, the insensitivity of species diversity to vegetation cutting observed in this study is probably due to the customary early cutting time in fens. Morris & Lakhani (1979) found that species diversity in dry grasslands was less affected by mowing in May than mowing in July.

Unlike Auchenorrhyncha, spider diversity exhibited a positive response to vegetation height and a negative response to cutting. This may be associated with the dependency of many species on vegetational structures for web building (Rushton, Topping & Eyre 1987). Removal of vegetation may also affect soil invertebrates by reducing soil moisture content and this may explain the negative responses of sphaerocerid and tipulid diversities to cutting. De Bruyn *et al* (2001) found a unimodal relationship between heathland sphaerocerid species diversity and soil moisture content, but this was not directly detected for the coarser ordinal variables used in this study. The positive response of the Shannon-Weaver index in Sphaeroceridae to both litter cover and grazing intensity observed in this study may be connected to their saprophagous habits and does not conflict with the positive correlation between soil organic content and sphaerocerid species diversity found by de Bruyn *et al* (2001).

Table 9. Significant variations in species diversity (Shannon-Wiener Index) between samples classified by habitat, geographical location and year of sampling. Significance tested by the Kruskal Wallace test (KW) * = p < 0.05; ** = p < 0.01; *** = p < 0.001; **** = p < 0.0001.

Classification	**Auchenorrhyncha**	**Dolichopodidae**	**Sciomyzidae**	**Sphaeroceridae**	**Syrphidae**	**Tipuloidea**	**Carabidae & Staphylinidae**	**Water beetles**	**Araneae**
MANAGE			**	*		*	*	*	
NVC	***		*	*	**			**	
DOMV	*			*	****				
HABST					****				
AREA	*		*		**	**	**	*	**
YEAR					*	**			**

Table 10. Significant variations in species diversity (Fisher's alpha) between samples classified by habitat, geographical location and year of sampling. Significance tested by the Kruskal Wallace test (KW) * = p < 0.05; ** = p < 0.01; *** = p < 0.001; **** = p < 0.0001.

Classification	**Auchenorrhyncha**	**Dolichopodidae**	**Sciomyzidae**	**Sphaeroceridae**	**Syrphidae**	**Tipuloidea**	**Carabidae & Staphylinidae**	**Water beetles**	**Araneae**
MANAGE			**	*		**	**		**
NVC	*		*		**			*	*
DOMV				*	****				
HABST					****				
AREA	*			*	*	*	**	*	*
YEAR					*				*

Table 11. Significant responses of species diversity (Shannon-Wiener Index) to recorded environmental variables tested by Spearman's rho (rs) for variables with continuous values, the Kruskal Wallace test (KW) for variables represented by ordinal classes and the Mann-Whitney test (U) for variables reduced to two classes by the aggregation of poorly populated ordinal classes. + indicates a positive response; - indicates a negative response; * indicates a non-linear response. + = p < 0.05; ++ = p < 0.01; +++ = p < 0.001; ++++ = p < 0.0001.

Environmental variable	Significance test	Auchenorrhyncha	Dolichopodidae	Sciomyzidae	Sphaeroceridae	Syrphidae	Tipuloidea	Carabidae & Staphylinidae	Water beetles	Araneae
TCUT	U				--		-			
TBURN	U									++
GRAZINT	U				+					
LITDEP	KW						*			
LITCOV	rs				+	-				
FLOOD	KW			*						*
WTABLE	KW						**	--		
DWATER	U	++						+		
VEGHT	rs	-				----				+

Table 12. Significant responses of Species diversity (Fisher's alpha) to recorded environmental variables tested by Spearman's rho (rs) for variables with continuous values, the Kruskal Wallace test (KW) for variables represented by ordinal classes and the Mann-Whitney test (U) for variables reduced to two classes by the aggregation of poorly populated ordinal classes. + indicates a positive response; - indicates a negative response; * indicates a non-linear response. + = p < 0.05; ++ = p < 0.01; +++ = p < 0.001; ++++ = p < 0.0001.

Environmental variable	Significance test	Auchenorrhyncha	Dolichopodidae	Sciomyzidae	Sphaeroceridae	Syrphidae	Tipuloidea	Carabidae & Staphylinidae	Water beetles	Araneae
TCUT	U				-		--	+		--
TBURN	U	-						++		
GRAZINT	U									
LITDEP	KW					-			+	
LITCOV	rs					--				
FLOOD	KW		-				*			
WTABLE	KW						***	-		
DWATER	U	+	+							
VEGHT	rs			-		----				+

Table 13. Median values of species diversity (Shannon-Wiener Index) within each class of the variable MANAGE for each taxonomic group exhibiting significant between-class variation according to the Kruskal-Wallace test.

MANAGE class	Sciomyzidae	Sphaeroceridae	Tipuloidea	Carabidae & Staphylinidae	Water beetles
0	1.45	1.27	1.39	1.84	1.29
1	1.77	0.91	1.29	2.39	1.71
2	1.44	0.90	1.10	1.96	1.50

Table 14. Median values of Species diversity (Fisher's alpha) within each class of the variable MANAGE for each taxonomic group exhibiting significant between-class variation according to the Kruskal-Wallace test.

MANAGE class	Sciomyzidae	Sphaeroceridae	Tipuloidea	Carabidae & Staphylinidae	Araneae
0	2.96	2.98	3.95	6.94	8.20
1	3.68	2.05	3.17	10.90	6.70
2	2.92	2.39	2.55	7.83	6.35

4. Species composition

4.1 Methods

Samples from different trapping periods were aggregated for each sampling station within each year and the resulting species lists were subjected to Canonical Correspondence Analysis (CCA) using CANOCO software. Eight environmental variables were selected according to their utility in detecting sensitivity to site management. The variables used were MANAGE, TCUT, TBURN, GRAZINT, LITDEP, FLOOD and DWATER. MANAGE was split into two nominal variables. MANAGE1 differentiated between sites where cutting had just been introduced and all other sites. MANAGE2 differentiated between sites with established cutting regimes and all other sites.

4.2 Results

Adequate results were obtained for Carabidae and Staphylinidae without any transformation of the data. For most groups, however, results were easier to interpret after raw abundances were converted into proportion of the total catch from each sample station. This procedure reduces bias due to variations in trapping efficiency between different species. For Sciomyzidae, spiders and water beetles, best results were obtained by converting raw abundances into the proportion of the total catch for that species in the entire dataset and excluding species with less than 10 individuals. This procedure reduces bias due to variations in trapping efficiency between different sampling stations. Neither of these procedures succeeded in producing easily interpretable results for hoverflies, and these results were left untransformed.

Results are presented in biplots showing species and environmental variables. All environmental variables, whether continuous or not, are represented by arrows, the longer the arrow, the more important the variable. Species are labelled using abbreviations. Species that are close together are likely to occur in the same samples. The response of a species to an environmental variable, whether positive or negative, can be gauged from its position along the arrow representing the variable. Axis 1 is the most important axis of variation followed by axes 2 and 3. The relative importance of each axis is related to the magnitude of its eigenvalue (e).

4.2.1 Auchenorrhyncha

Two species-poor samples (one from Chippenham Fen and one from Bure Marshes) were found to be heavily influenced by singletons of non-wetland species and these samples were excluded from the analysis. Figures 1 and 2 show the CCA ordination of species and environmental variables plotted on axes 1 to 3. Only the 42 species with the highest weighting after transformation are shown. Figure 1 indicates that management by cutting and hydrology are the two most important factors affecting the species composition of Auchenorrhyncha assemblages represented in the dataset.

MANAGE2 and TCUT are colinear, but orthogonal to MANAGE1, which is also close to the origin. This suggests that the impact of cutting on Auchenorrhyncha species composition is mainly confined to sites where cutting has been established for some time and that species assemblages characteristic of unmanaged sites can persist beyond the initial reintroduction of management. *Phragmites* feeders are split between those that favour sites managed by cutting (*Chloriona glaucescens, C. unicolor* and *C. smaragdinus*) and those that favour unmanaged sites (*Chloriona dorsata* and *Paralimnus phragmitis*). Other species that favour cutting are all widespread grass-feeders, whereas species favouring a lack of management have a wide range of host plants including *Myrica, Calamagrostis, Carex, Mentha* and *Urtica* and include several nationally scarce species (Kirby 1992, Le Quesne 1960, 1965, 1969, Le Quesne & Payne 1981).

Burning appears to have a similar effect to cutting, grazing much less so, but the number of burnt and grazed sites form a very small proportion of the dataset and Monte Carlo permutation tests found that these variables did not explain a significant proportion of the variation. Litter depth, however, does have a significant influence ($p = 0.01$). Some species possibly rely on litter for hibernation sites. Figure 1 suggests that depth of litter has an opposite effect to cutting, suggesting that the removal of litter is one of the mechanisms, by which management affects Auchenorrhyncha assemblages. Figure 3 indicates that litter depth is also an important variable along axis 3, this time in opposition to grazing.

The importance of the FLOOD variable indicates that hydrology has an important influence on Auchenorrhyncha assemblages. However seasonal fluctuations (DWATER) could not be shown to be important. Table 15 lists species indicator scores based on the position of each species in ordination space along two gradients based on FLOOD and TCUT.

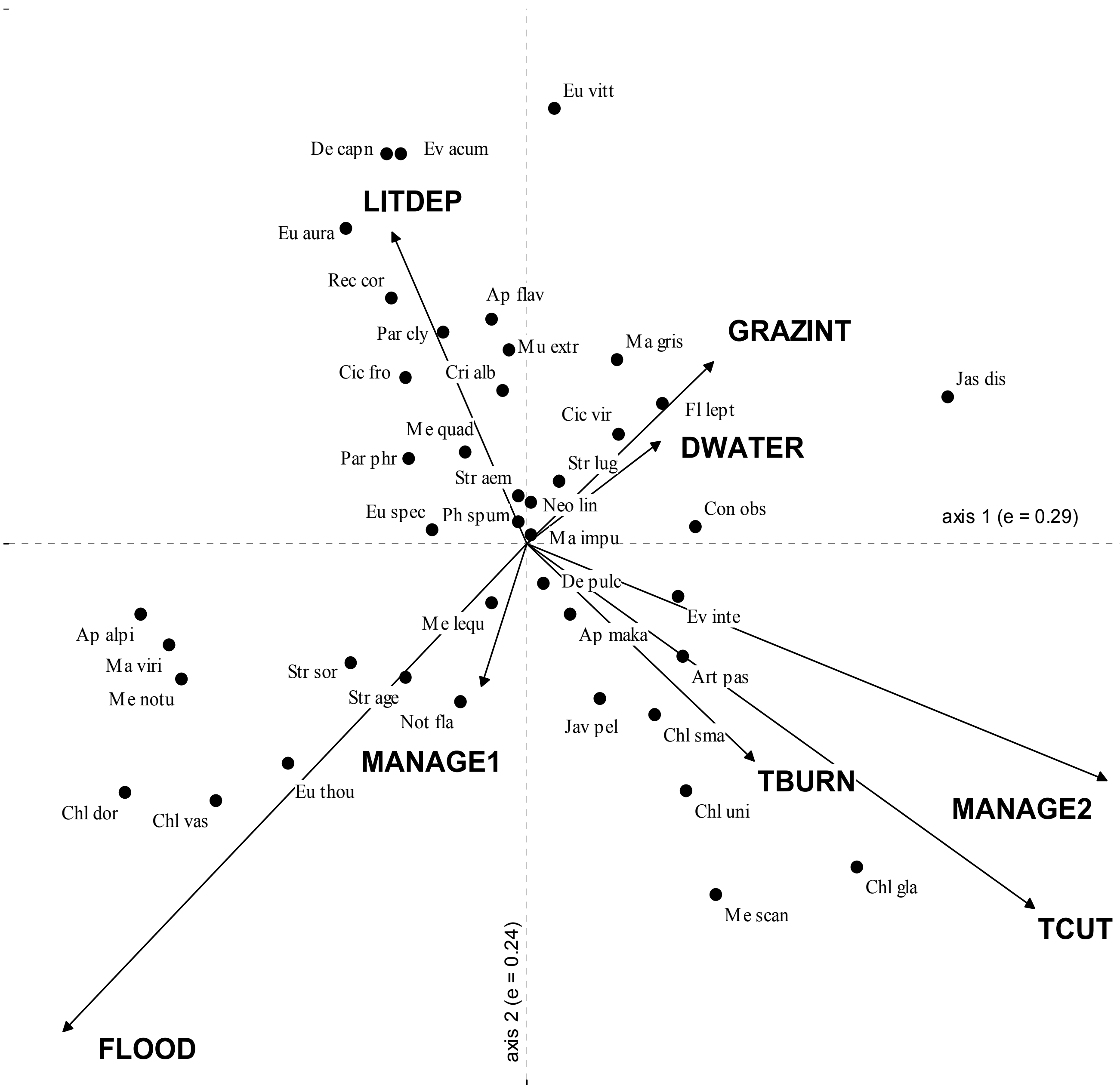


Figure 1. CCA ordination plot of Auchenorrhyncha species

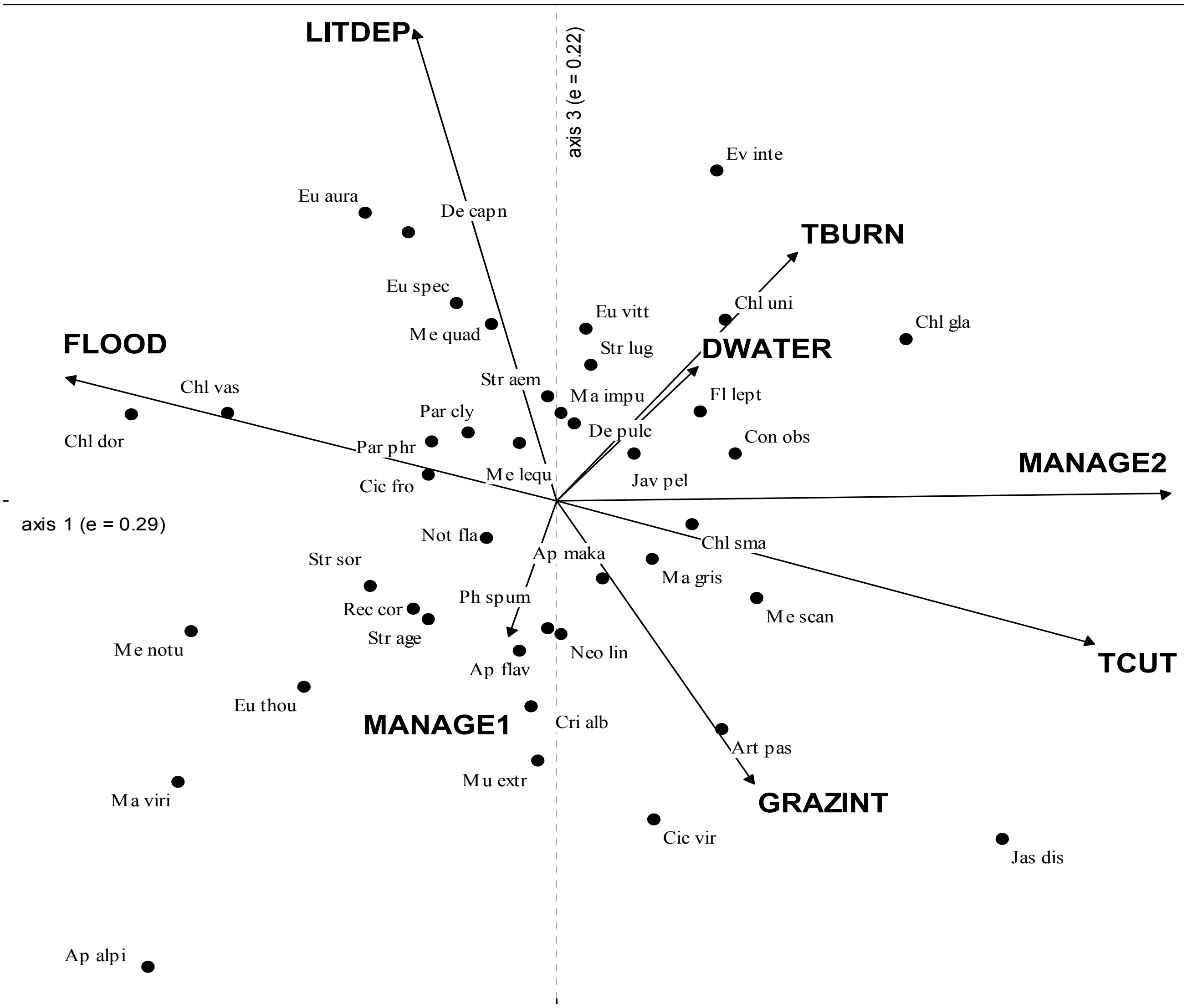


Figure 2. CCA ordination plot of Auchenorrhyncha species

Table 15. Species scores along flooding and management gradients based on CCA ordination (see figure 1). Negative scores indicate a negative response. The scale is arbitrary.

	Sensitivity to flooding	**Sensitivity to management (cutting)**
Aphrodes flavostriatus	-22	-26
Aphrodes makarovi	5	13
Aphrophora alpina	54	-48
Arthaldeus pascuellus	-5	33
Chloriona dorsata	76	-33
Chloriona glaucescens	-1	76
Chloriona smaragdula	3	34
Chloriona unicolor	10	45
Chloriona vasconica	67	-19
Cicadella viridis	-24	3
Cicadula frontalis	-4	-32
Conosanus obsoletus	-22	22
Criomorphus albomarginatus	-15	-18
Delphacodes capnodes	-29	-56
Euides speciosa	9	-15
Eupteryx aurata	-15	-55
Eupteryx thoulessi	54	-13
Eupteryx vittata	-55	-36
Evacanthus acuminatus	-15	-54
Evacanthus interruptus	-11	26
Florodelphax leptosoma	-33	2
Jassargus distinguendus	-68	45
Javesella pellucida	10	25
Macropsis impura	-1	-1
Macrosteles viridigriseus	54	-40
Macustus grisescens	-32	-5
Megamelodes lequesnei	11	1
Megamelodes quadrimaculatus	-2	-18
Megamelus notula	56	-36
Megophthalmus scanicus	19	61
Muellerianella extrusa	-21	-22
Neophilaenus lineatus	-5	-4
Notus flavipennis	21	6
Paraliburnia clypealis	-14	-31
Paralimnus phragmitis	4	-24
Philaenus spumarius	-1	-4
Recilia coronifera	-12	-41
Streptanus aemulans	-5	-6
Streptanus sordidus	35	-13
Stroggylocephalus agrestis	30	-4
Struebingianella lugubrina	-11	-1

4.2.2 Dolichopodidae

Syntormon tarsatus was found to have an undue influence on the ordination and was excluded from the analysis Figures 3 and 4 show the CCA ordination of species and environmental variables plotted on axes 1 to 3. Only the 37 species with the highest weighting after transformation are shown.

Axis 1 is difficult to interpret in that grazing, burning and flooding all seem to have a major influence. Axis 2, however, can be confidently linked to seasonal water level fluctuations and axis 3 can be linked to management by cutting. More than in any other group, sites where management has been recently reintroduced have a very different species composition from sites with long-established cutting regimes.

Seasonal fluctuations in water level adversely affect to varying degrees species with national conservation status that are represented in figure3, such as *Campsicnemus compeditus, Hercostomus chalybeus* and *Telmaturgus tumidulus.* In contrast to Auchenorrhyncha, several species of conservation interest, especially *Dolichopus laticola* and *Argyra elongata* appear to benefit from regular cutting.

Table 16 lists species indicator scores based on the position of each species in ordination space along two gradients based on DWATER and MANAGE2.

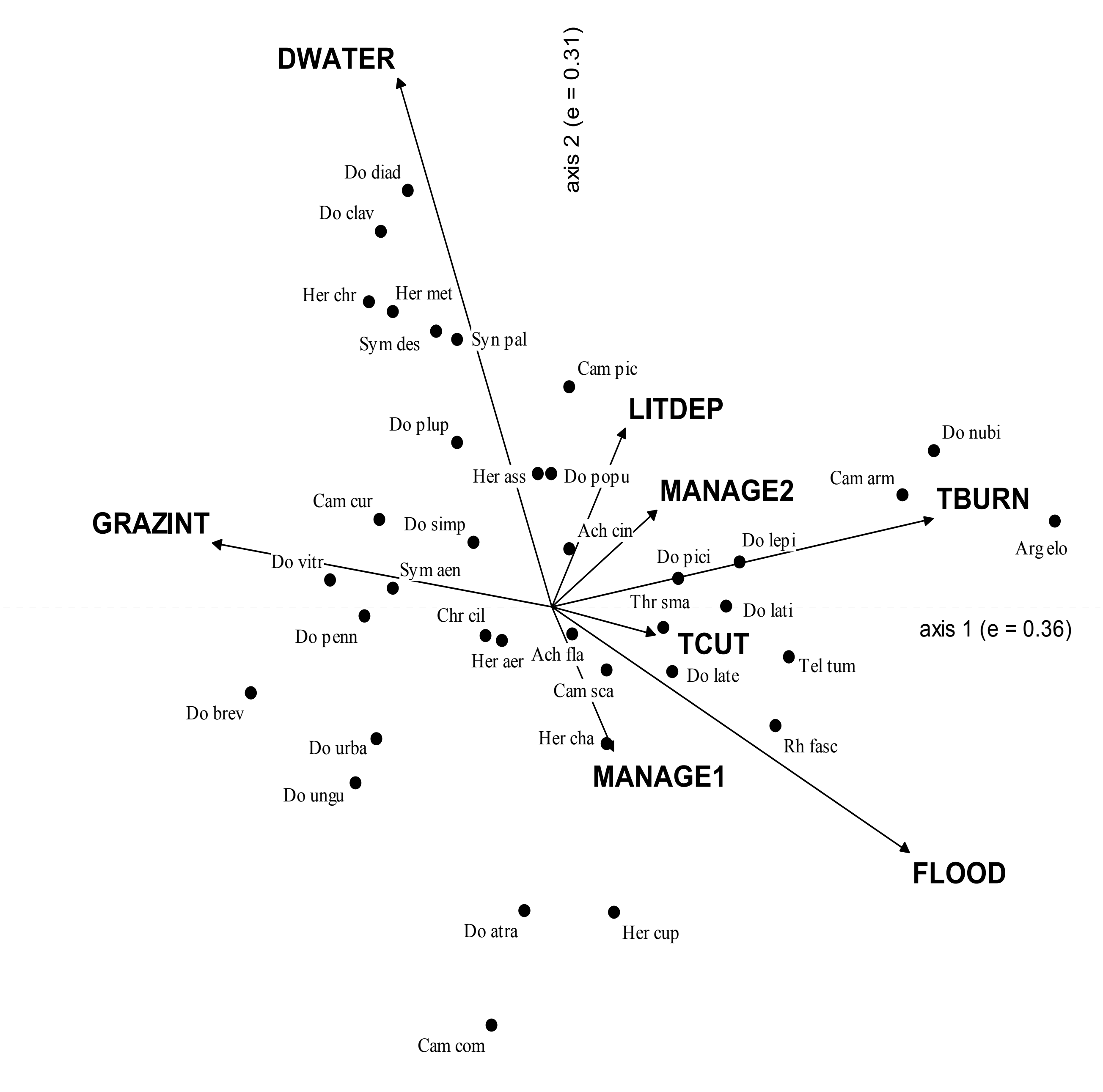


Figure 3. CCA ordination plot of Dolichopodidae species

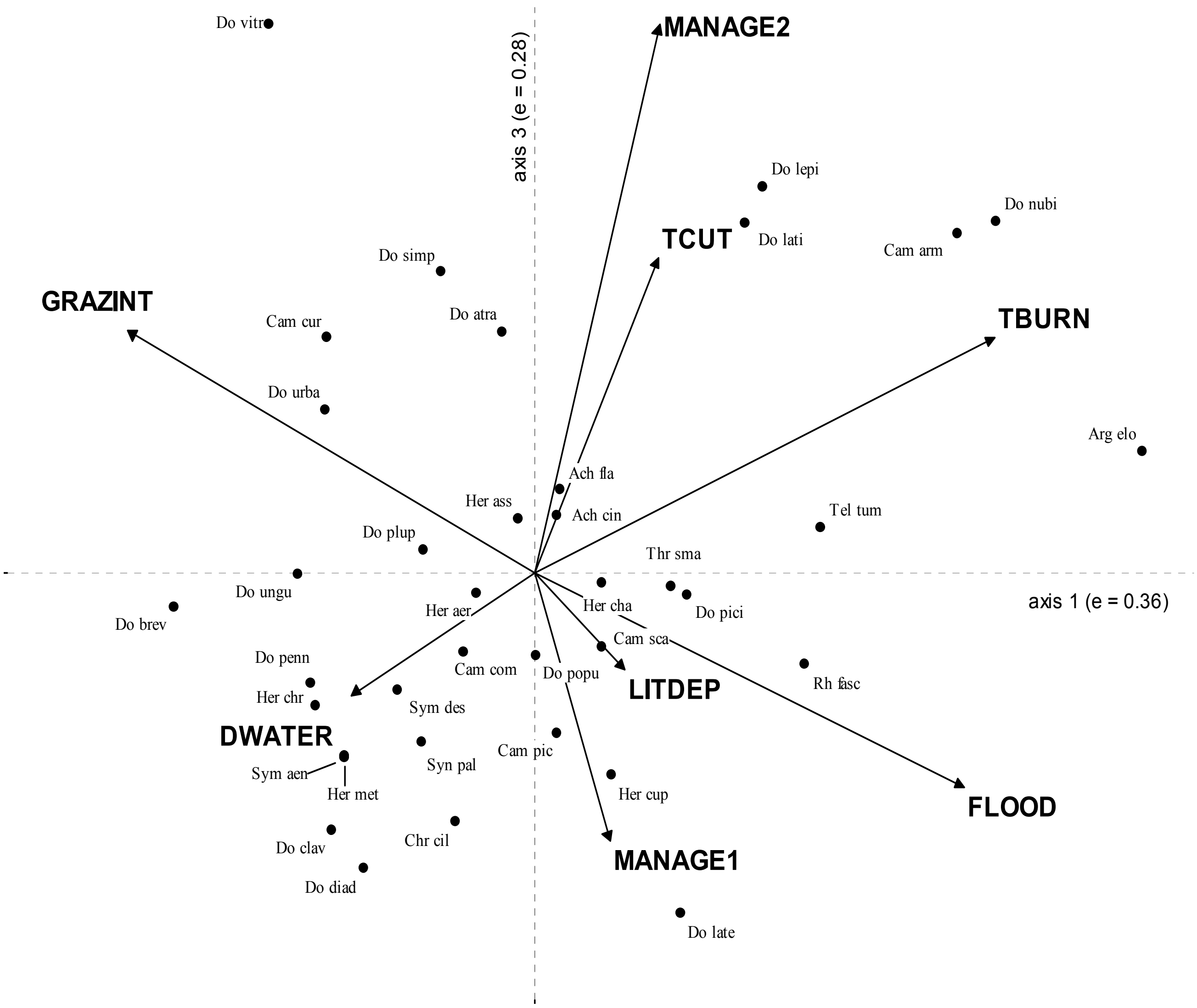


Figure 4. CCA ordination plot of Dolichopodidae species

Table 16. Dolichopodid species scores along environmental gradients based on CCA ordination (see figure 1). Negative scores indicate a negative response. The scale is arbitrary.

	Sensitivity to seasonal water fluctuations	**Sensitivity to regular management (cutting)**
Achalcus cinereus	7	10
Achalcus flavicollis	-5	14
Argyra elongata	-15	40
Campsicnemus armatus	-2	71
Campsicnemus compeditus	-58	-15
Campsicnemus curvipes	22	28
Campsicnemus picticornis	31	-24
Campsicnemus scambus	-12	-9
Chrysotus cilipes	-1	-42
Dolichopus atratus	-43	37
Dolichopus brevipennis	3	-20
Dolichopus claviger	64	-49
Dolichopus diadema	69	-54
Dolichopus latelimbatus	-16	-48
Dolichopus laticola	-9	65
Dolichopus lepidus	-3	71
Dolichopus nubilus	3	75
Dolichopus pennatus	8	-27
Dolichopus picipes	-3	2
Dolichopus plumipes	29	-1
Dolichopus popularis	19	-13
Dolichopus simplex	13	43
Dolichopus ungulatus	-15	-10
Dolichopus urbanus	-10	17
Dolichopus vitripennis	16	75
Hercostomus aerosus	-2	-6
Hercostomus assimilis	20	8
Hercostomus chalybeus	-23	1
Hercostomus chrysozygus	54	-30
Hercostomus cupreus	-48	-29
Hercostomus metallicus	51	-37
Rhaphium fasciatum	-30	-3
Sympycnus aenicoxa	11	-37
Sympycnus desoutteri	46	-24
Syntormon pallipes	44	-31
Telmaturgus tumidulus	-19	19
Thrypticus smaragdinus	-9	3

4.2.3 Sciomyzidae

Figure 5 shows axes 1 and 2 of the CCA ordination of species and environmental variables. All 34 species used in the analysis are shown. Despite the observed increase in species diversity at sites where reed or sedge cutting had recently been introduced, management variables do not feature prominently on any of the main axes of variation. Indeed MANAGE1 is one of the least important variables along either of the two main axes. Axis 2 is dominated by the responses of just two species, *Antichaeta brevipennis* and *Pteromicra pectorosa,* the latter species being recorded in large numbers from just two samples at Stallode Marsh. *Antichaeta brevipennis* has reduced wings and is probably more of a crawler than a flyer. Its position as an outlier may be due to a dependence on litter or to a trapping artefact. Consequently, only axis 1 can be interpreted with any confidence.

Axis 1 is related to hydrology and, in particular, seasonal fluctuations in water levels. Species scores along axis one are listed in table 17. Most of the species with negative scores have aquatic larvae which are predators of aquatic snails or mussels (*Ilione lineata*), while species with positive scores are more varied in their history and include predators of succineid snails (eg *Limnia unguicornis, Pherbellia schoenherri*) and parasitoids of terrestrial slugs (*Tetanocera elata*) and snails (eg *Pherbellia albocostata*, *P. cinerella*) (Falk 1991, Rozkosný 1984). As on axis 2, *Antichaeta brevipennis* is somewhat anomalous, in that unlike other species associated with vernal pools, its axis 1 score is very low. Species of conservation concern are distributed along most of the length of axis 1.

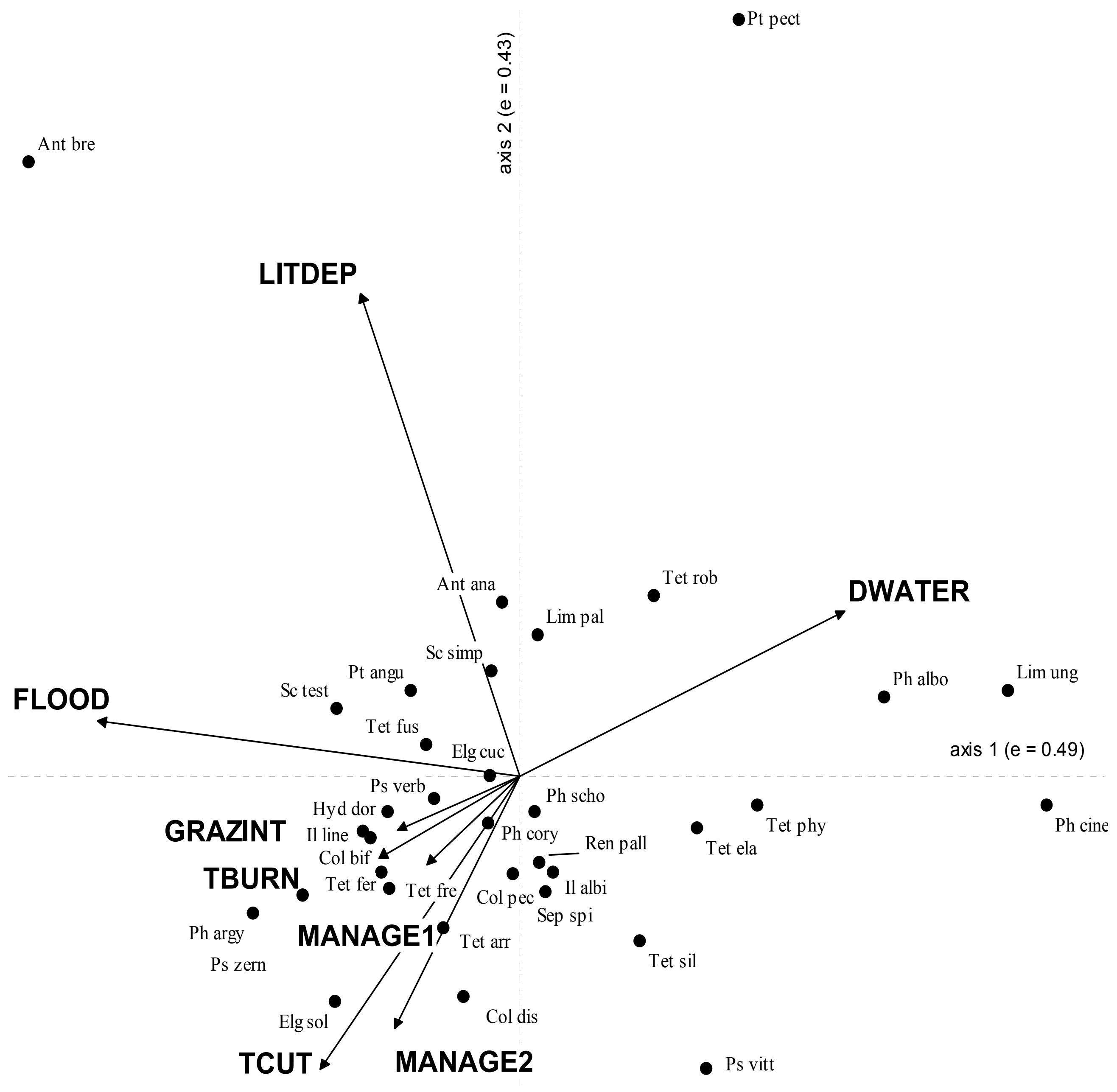


Figure 5. CCA ordination plot of Sciomyzidae species

Table 17. Sciomyzid species scores along gradients based on FLOOD and DWATER scores on axes 1 and 2 of the CCA ordination (see figure 5). Negative scores indicate a negative response.

	Sensitivity to flooding	**Sensitivity to seasonal water level fluctuations**
Antichaeta analis	1	9
Antichaeta brevipennis	34	-31
Colobaea bifasciella	10	-26
Colobaea distincta	4	-23
Colobaea pectoralis	0.5	-8
Elgiva cucularia	2	-4
Elgiva solicita	13	-43
Hydromya dorsalis	9	-22
Ilione albiseta	-2	-1
Ilione lineata	11	-27
Limnia paludicola	-1	12
Limnia unguicornis	-33	78
Pherbellia albocostata	-25	59
Pherbellia argyra	18	-49
Pherbellia cinerella	-36	76
Pherbellia schoenherri	-1	-0.3
Pherbina coryleti	2	-8
Psacadina verbekei	6	-14
Psacadina vittigera	-1	8
Psacadina zernyir	2	-40
Pteromicra angustipennis	7	-10
Pteromicra pectorosa	-15	83
Renocera pallida	-1	-2
Sciomyza simplex	2	3
Sciomyza testacea	13	-22
Sepedon spinipes	-2	-4
Tetanocera arrogans	5	-22
Tetanocera elata	-12	22
Tetanocera ferruginea	9	-27
Tetanocera freyi	9	-27
Tetanocera fuscinervis	6	-12
Tetanocera phyllophora	-16	33
Tetanocera robusta	-9	32
Tetanocera silvatica	-8	7

4.2.4 Sphaeroceridae

Leptocera cryptocha and *L. vagans* were found to have undue influence on the ordination and they were excluded from the analysis. The resulting ordination plot of axis 1 versus axis 2 is shown in figure 6. Only the 24 species with the highest weighting after transformation are shown. The eigenvalues of axes 1 and 2 are low indicating little variation in species composition along the main axes. Nevertheless, variation along the first two axes can be interpreted using the measured environmental variables.

Axis 1 is related to management by cutting and also to litter depth, suggesting that cutting may influence sphaerocerid assemblages through the removal of litter. Sphaerocerid assemblages appear to respond to the introduction of cutting immediately. As with species diversity, the composition of sphaerocerid assemblages in sites where management had been recently introduced was more similar to sites with established management than unmanaged sites. Grazing has similar effects to cutting, but the effects of burning appear to be quite different. Species favoured by management included dung species, such as *Leptocera mirabilis* and *L. lugubris,* and damp mud species, such *as Leptocera finalis* and *L. lutosa,* while species associated with litter, such as *Leptocera ochripes* or *Copromyza pedestris,* or grass tussocks, such as *Leptocera moesta* or *L. fenestralis,* preferred unmanaged sites. Axis 2 was related to seasonal fluctuations in water level. Most of the species in the dataset characterised as marsh species by Pitkin (1988) were associated with sites with high DWATER scores and possibly rely on seasonally exposed substrates for breeding.

Table 18 lists species indicator scores based on the position of each species along axes 1 and 2 which can be related to management by cutting and seasonal fluctuations in water level respectively.

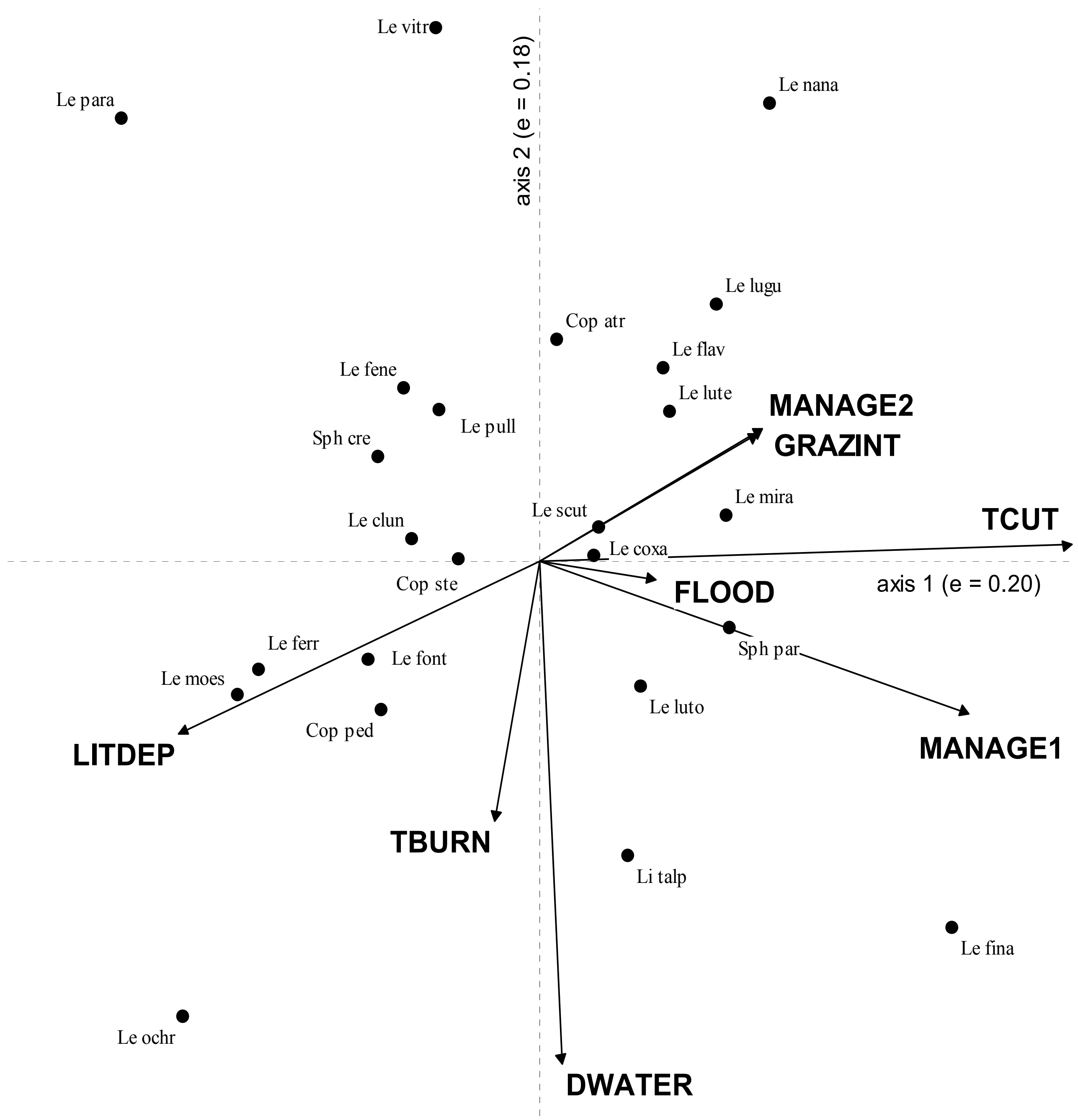


Figure 6. CCA ordination plot of Sphaeroceridae species

Table 18. Sphaerocerid species scores along axes 1 and 2 of the CCA ordination which can be related to management by cutting and seasonal water level fluctuations (see figure 6). Negative scores indicate a negative response.

	Sensitivity to management (cutting)	**Sensitivity to seasonal water fluctuations**
Copromyza atra	1	-16
Copromyza pedestris	-12	11
Copromyza stercoraria	-6	-0.1
Leptocera clunipes	-10	-2
Leptocera coxata	4	-0.4
Leptocera fenestralis	-10	-12
Leptocera ferruginata	-21	8
Leptocera finalis	31	26
Leptocera flavipes	9	-14
Leptocera fontinalis	-13	7
Leptocera lugubris	13	-18
Leptocera luteilabris	10	-11
Leptocera lutosa	8	9
Leptocera mirabilis	14	-3
Leptocera moesta	-22	10
Leptocera nana	17	-33
Leptocera ochripes	-27	33
Leptocera parapusio	-31	-32
Leptocera pullula	-8	-11
Leptocera scutellaris	5	-2
Leptocera talparum	7	21
Leptocera vitripennis	-8	-39
Sphaerocera crenata	-12	-7
Sphaerocera paracrenata	14	5

4.2.5 Syrphidae

Figure 7 shows the first two axes of the ordination of Syrphidae. Only the 33 most abundant species in the dataset are shown. The eigenvalues of axes 1 and 2 are very low indicating very little variation in species composition along the main axes. Furthermore, neither of these axes are easy to interpret using the measured environmental variables, although it is clear that hydrological factors have more influence than management factors. The trapping artefacts evident in syrphid diversity scores may be a factor militating against a robust ordination using his dataset.

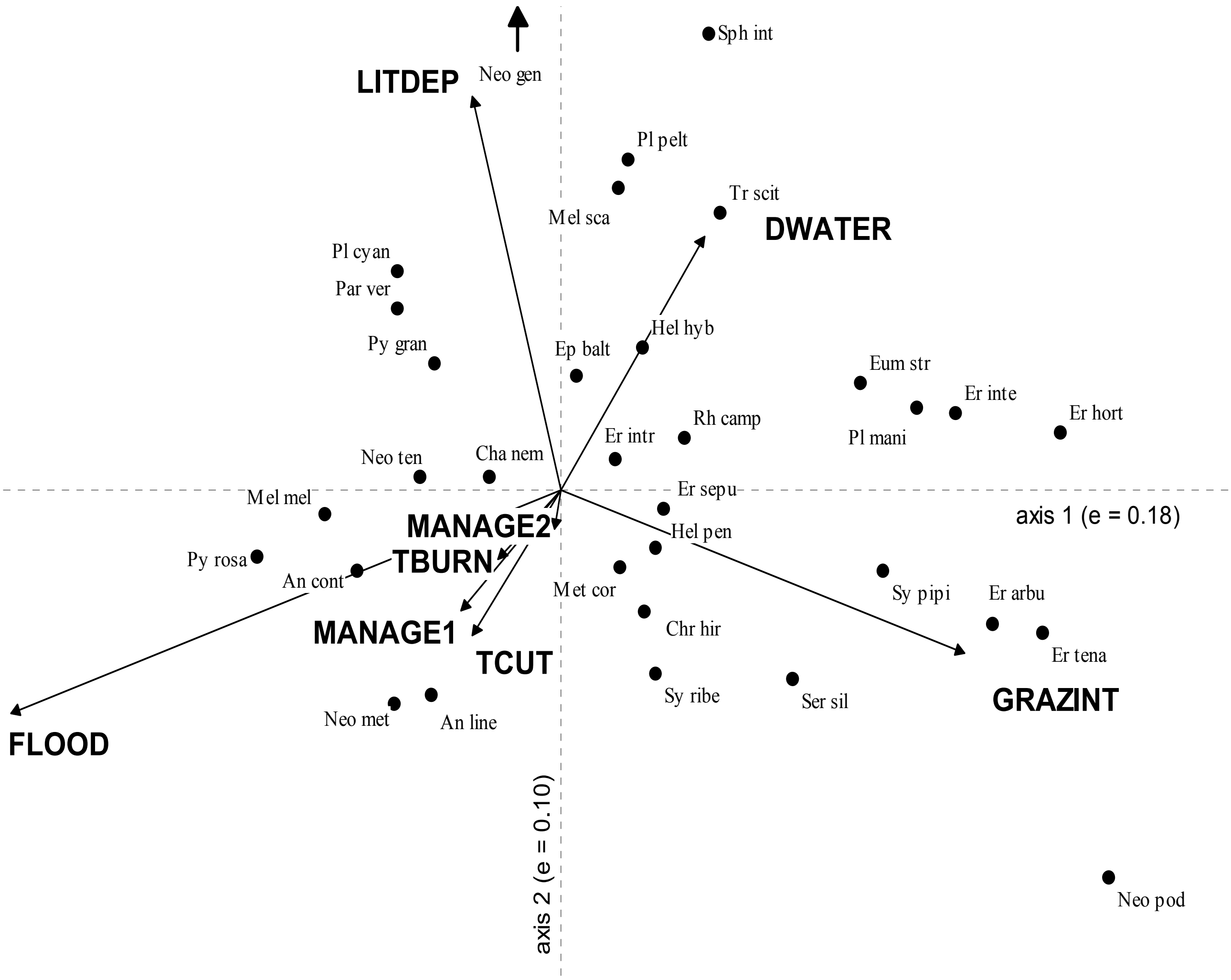


Figure 7. CCA ordination plot of Syrphidae species

4.2.6 Tipuloidea

The ubiquitous species, *Tipula palustris,* was found to have undue influence on the ordination and was excluded from the analysis. The resulting ordination plot of axis 1 versus axis 2 is shown in figure 7. Only the 39 species with the highest weighting after transformation are shown. Axis 1 is related to hydrology, but seasonal fluctuations in water level appear not to have a major influence.

Axis 2 is related to management by cutting. The colinearity of TCUT, MANAGE1 and MANAGE2 indicates that, when sites are introduced to cutting their tipulid fauna changes to become similar to sites with established cutting regimes. However, their respective scores suggest that a complete transition to an assemblage characteristic of managed sites requires more than one cut. Burning and grazing appear to have different effects on species composition, but they were not found to have a significant influence in the EAFIS dataset.

Table 19 lists species indicator scores based on the position of each species along axes 1 and 2 which can be related to management by cutting and seasonal fluctuations in water level respectively. Species favoured by flooding include several species of designated conservation status, such as *Erioptera nielseni, Paradelphomyia nielseni*, *Pilaria fuscipennis, Thaumastoptera calceata* and *Tipula melanoceros* (Falk 1992). Several species with conservation status are sensitive to cutting(*Paradelphomyia nielseni*, *Molophilus bihamatus, Thaumastoptera calceata* and *Tipula melanoceros*), but *Erioptera nielseni* and *E. meijeri* appear to be favoured by management of vegetation.

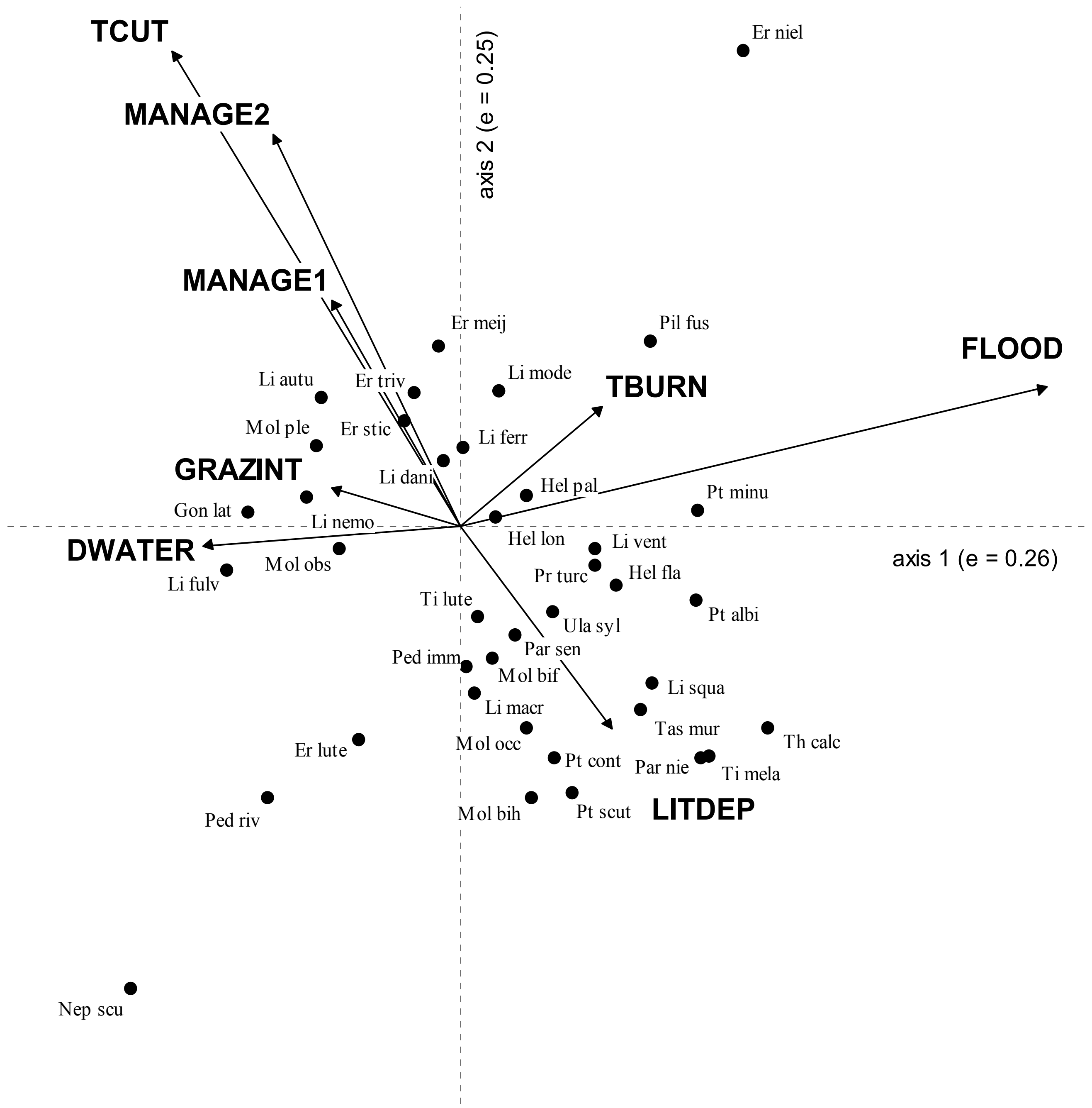


Figure 8. CCA ordination plot of Tipuloidea species

Table 19. Tipulid species scores along axis 1 (which is related to flooding) and a gradient based on TCUT scores on axes 1 and 2 of the CCA ordination (see figure 8). Negative scores indicate a negative response.

	Sensitivity to flooding	**Sensitivity to management (cutting)**
Erioptera lutea f. taenionota	-9	-20
Erioptera meijerei	-2	25
Erioptera nielseni	25	38
Erioptera stictica	-5	18
Erioptera trivialis	-4	21
Gonomyia lateralis	-19	19
Helius flavus	14	-20
Helius longirostris	3	-2
Helius pallirostris	6	-2
Limnophila ferruginea	0.3	10
Limnophila fulvonervosa	-21	13
Limnophila nemoralis agg.	-13	16
Limnophila squalens	17	-36
Limonia autumnalis	-12	28
Limonia danica	-1	10
Limonia macrostigma	1	-23
Limonia modesta	3	14
Limonia ventralis	12	-14
Molophilus bifidus	3	-20
Molophilus bihamatus	6	-41
Molophilus occultus	6	-31
Molophilus pleuralis	-13	22
Nephrotoma scurra	-29	-33
Paradelphomyia nielseni	21	-50
Paradelphomyia senilis	5	-19
Pedicia immaculata	1	-19
Pedicia rivosa	-17	-20
Pilaria fuscipennis	17	8
Prionocera turcica	12	-16
Ptychoptera albimana	21	-29
Ptychoptera contaminata	8	-38
Ptychoptera minuta	21	-17
Ptychoptera scutellaris	10	-44
Tasiocera murina	16	-38
Thaumastoptera calceata	27	-52
Tipula luteipennis	2	-13
Tipula melanoceros	22	-51
Ula sylvatica	8	-19

4.2.7 Carabidae and Staphylinidae

Ordination plots of axis 1 versus axis 2 and axis 3 are shown in figures 9 and 10 respectively. Only the 50 most abundant species across the whole dataset are shown. Axis 1 and axis 2 are related to different management regimes. Cutting and grazing have quite different effects on these beetle families. In both cases, however, the reduction of litter depth may be a contributory factor to the impact of each type of management. The colinearity of TCUT, MANAGE1 and MANAGE2 indicates that sites, where cutting has been recently introduced, have similar assemblages to sites with established cutting regimes.

Table 20 lists species indicator scores based on the position of each species in ordination space along two gradients based on GRAZINT and TCUT. *Pterostichus* species in the table all respond positively to both types of management, whereas most other species are sensitive to at least one type of management. Two national red data book species, *Dromius longiceps* and *Quedius balticus,* and most species of the rove beetle genus, *Stenus,* are adversely affected by both types of management.

Axis 3 is related to flooding. *Odacantha melanura, Trissemus impressus* and *Stenus latifrons* are three specialist species associated with high water levels that have high scores on axis 3. However, species with similar habitats are distributed all along axis 3 and some, such as *Quedius maurorufus,* have very low scores. Furthermore, other high scorers on axis 3 include species often found at sites with fluctuating water levels such as *Elaphrus cupreus* and *Philonthus micans,* and two dry-land species, *Proteinus ovalis* and *Anotylus nitidulus*, which could be vagrants from nearby terrestrial biotopes. Consequently, the identification of axis 3 with flooding does not concur with the known ecologies of individual species. This could be related to the hybrid nature of the variable FLOOD or a trapping artefact caused by an inefficiency of pitfall traps in catching species adapted to living in permanently wet habitats.

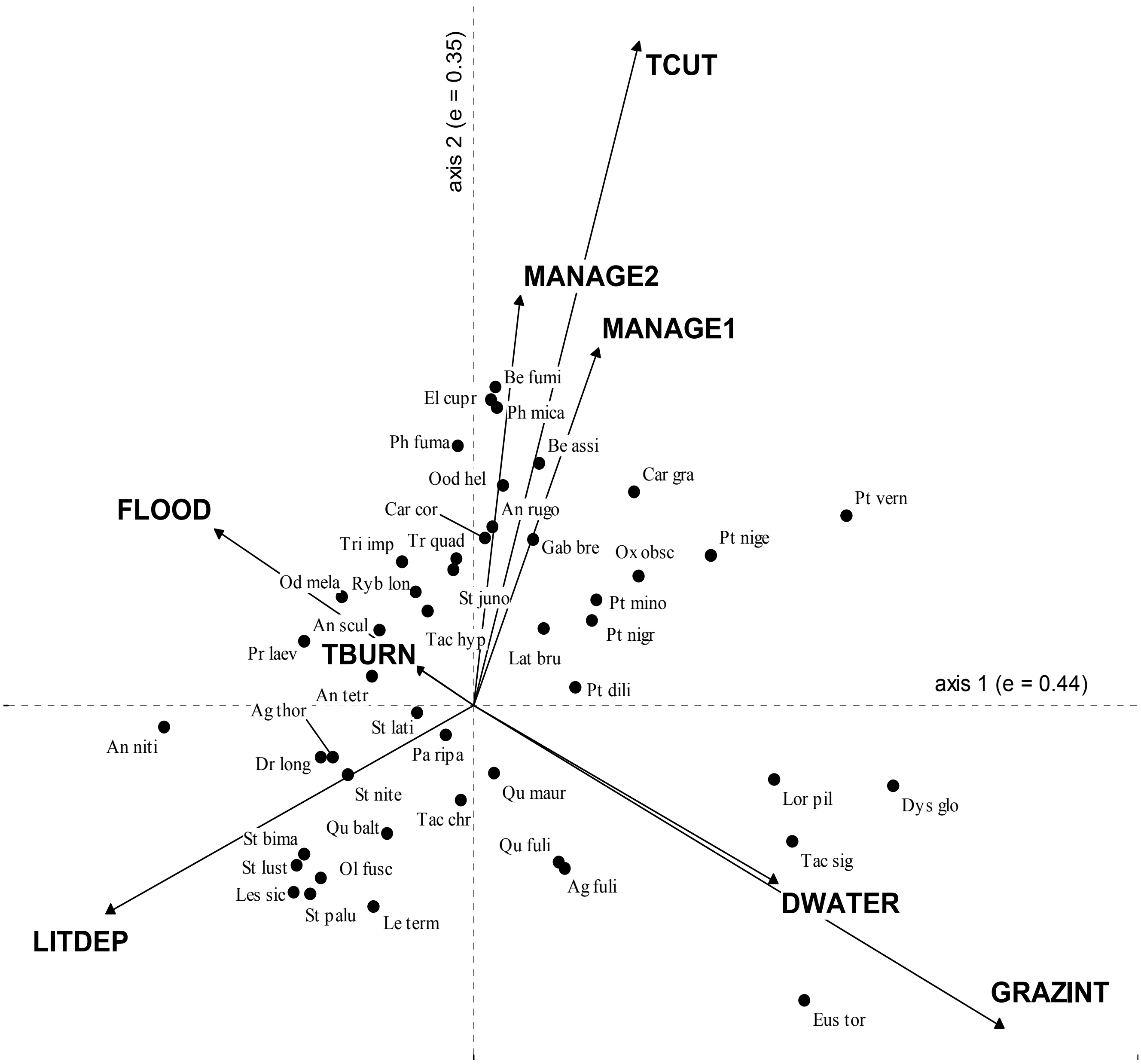


Figure 9. CCA ordination plot of Carabidae and Staphylinidae species

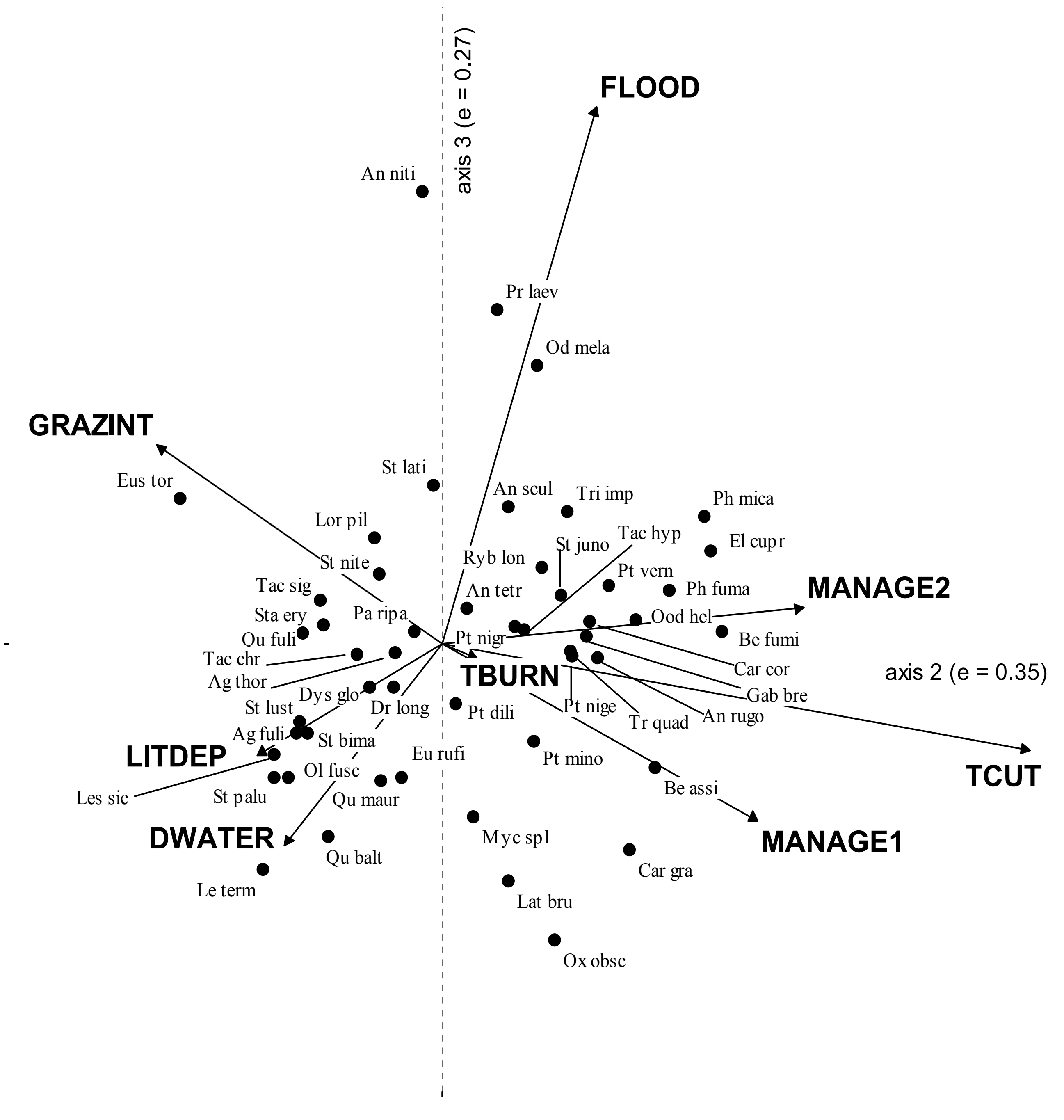


Figure 10. CCA ordination plot of Carabidae and Staphylinidae species

Table 20. Carabid and staphylinid species scores along environmental gradients based on CCA ordination (see figure 9). Negative scores indicate a negative response.

	Sensitivity to management (grazing)	**Sensitivity to management (cutting)**
Agonum fuliginosum	-26	-21
Agonum thoreyi	-16	-14
Anotylus nitidulus	-43	-16
Anotylus rugosus	-11	28
Anotylus sculpturatus	-19	7
Anotylus tetracarinatus	-17	1
Bembidion assimile	-9	40
Bembidion fumigatum	-21	50
Carpelimus corticinus	-11	26
Carabus granulatus	7	40
Dromius longiceps	-18	-15
Dyschirius globosus	68	6
Elaphrus cupreus	-21	48
Eusphalerum torquatum	-71	-31
Gabrius breviventer	-4	28
Lathrobium brunnipes	4	15
Leistus terminatus	2	-35
Lesteva sicula	-11	-36
Loricera pilicornis	50	1
Odacantha melanura	-28	10
Olophrum fuscum	-8	-33
Oodes helopioides	-12	35
Oxypselaphus obscurus	14	27
Paederus riparius	-2	-6
Philonthus fumarius	-22	39
Philonthus micans	-19	47
Proteinus laevigatus	-30	3
Pterostichus diligens	14	7
Pterostichus minor	10	21
Pterostichus niger	23	33
Pterostichus nigrita	11	18
Pterostichus vernalis	39	45
Quedius balticus	-2	-24
Quedius fuliginosus	-25	-20
Quedius maurorufus	-9	-10
Rybaxis longicornis	-17	15
Stenus bimaculatus	-13	-30
Stenus juno	-13	20
Stenus latifrons	-8	-3
Stenus lustrator	-13	-32
Stenus nitens	-13	-16
Stenus palustris	-8	-36
Tachinus signatus	57	-7
Tachyporus chrysomelinus	6	-15
Tachyporus hypnorum	-13	12
Trechus quadristriatus	-13	22
Trissemus impressus	-21	19

4.2.8 Water beetles

The ordination plots of axis 1 versus axis 2 is shown in figures 11. Axis 1 is difficult to interpret. Axis 2 is related to seasonal fluctuations in water level and separates hydrophilids of the riparian zone, such as *Anacaena globulus* and various *Cercyon* species, from scirtids, such as *Scirtes hemisphericus* and *Cyphon* species. Diving beetles of the Dytiscidae and related families have little influence on the ordination, in stark contrast to their importance in analyses based on samples collected with a D-frame pond net.

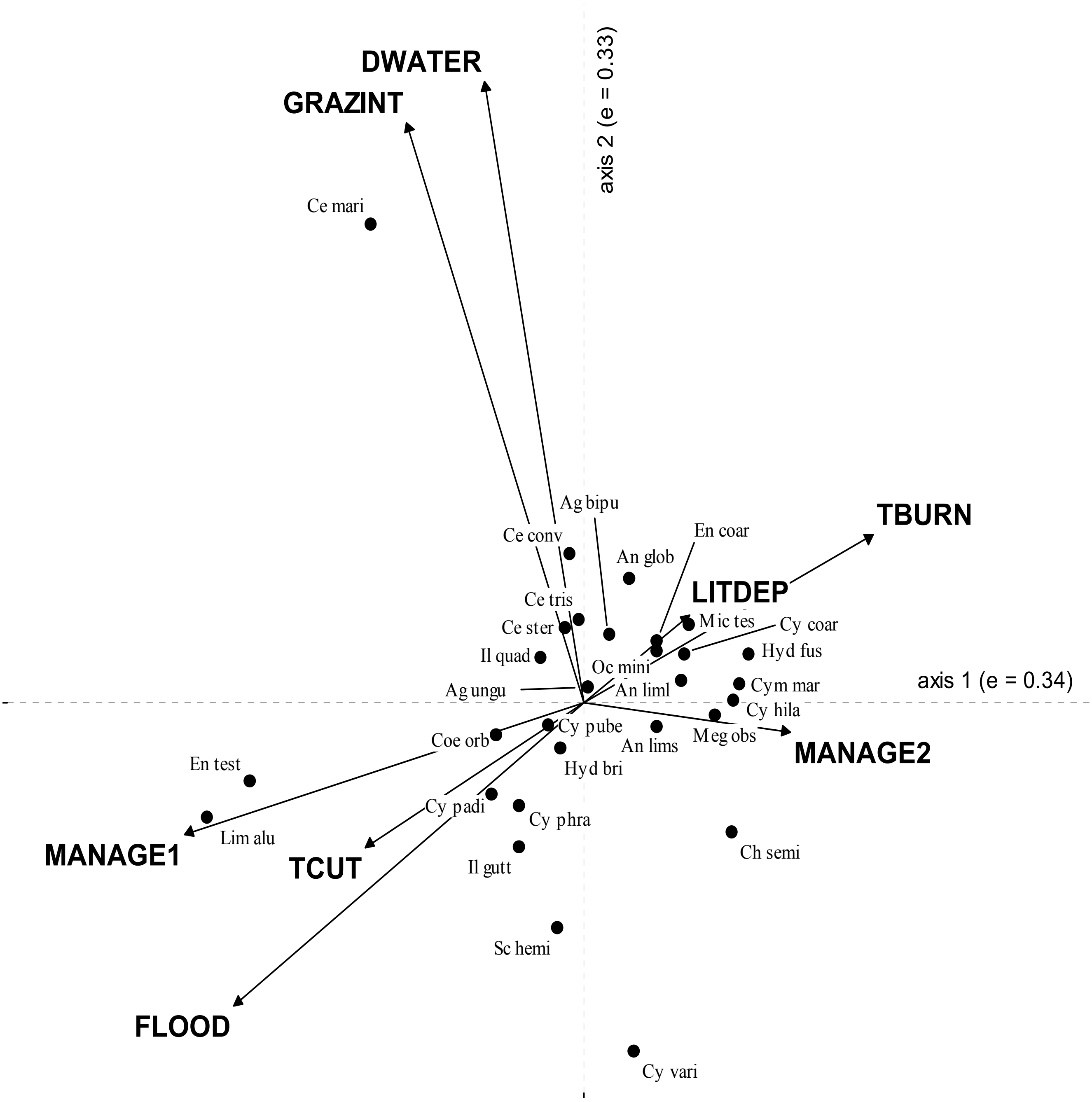


Figure 11. CCA ordination plot of water beetle species

4.2.9 Spiders

The ordination plot of axis 1 versus axis 2 is shown in figure 12. Management and hydrology both feature as important influences on species composition. Regular cutting and grazing are the most influential management variables and, unlike in Carabidae and Staphylinidae, they have roughly similar effects on species composition. MANAGE1 is unimportant and it appears that the spider fauna of unmanaged fen appears to be relatively little affected by a single cut.

A large proportion of the species in the ordination diagram are generalists, not particularly associated with wetlands. As in Carabidae and Staphylinidae, these are unexpectedly distributed all along the axis related to hydrology. The water spider, *Argyroneta aquatica,* is favoured by flooding and management. Other wetland species that were found in sites with high water levels include the wolf spider, *Pirata tenuitarsis,* and the linyphiids, *Hypomma fulvum* and *Donacochara speciosa*. The wolf spider, *Hygrolycosa rubrofasciata,* the clubionid, *Clubiona lutescens,* and the linyphiid, *Agyneta ramosa,* are all wetland species that are both associated with low summer water levels and sensitive to management. Species strongly favoured by regular management are dominated by wolf spiders, of which *Arctosa leopardus, Trochosa spinipalpis, Pirata piscatorius* can be characterised as wetland species, or, at least, hygrophilous. The ordination suggests that the national red data book species, *Clubiona juvenis* is not favoured by management, but is more affected by hydrology.

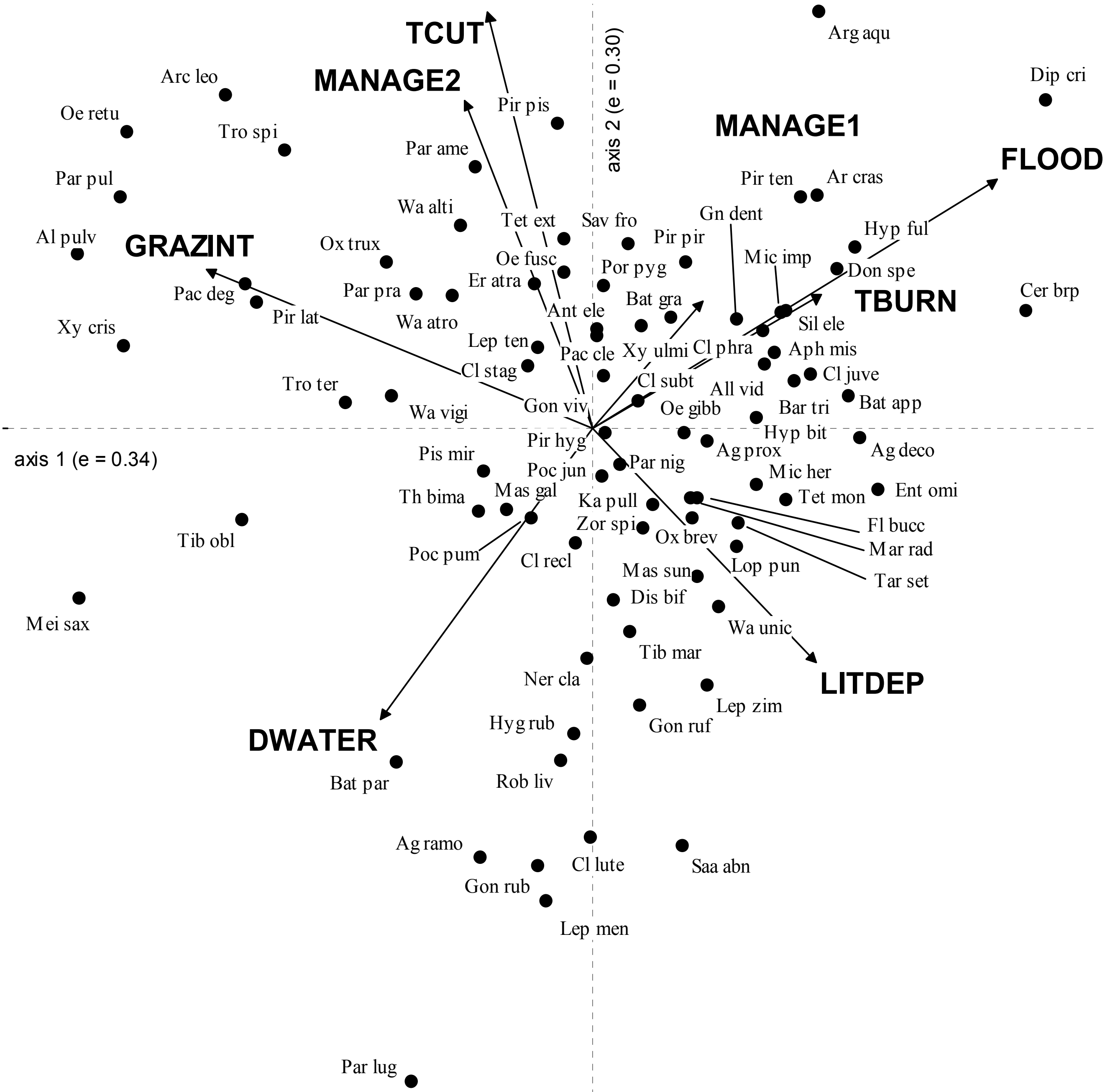


Figure 12. CCA ordination plot of spider species

4.3 Discussion

The lack of any interpretable results for the Syrphidae was possibly connected with high proportion of vagrants in the dataset that disrupted the results for species diversity.

Turning to the other eight groups, at least one major axis could be related to hydrological factors in every case. In several groups, these hydrological factors could be at least partly linked to seasonal fluctuations in water level.

Management factors could be related to major axes in six of the eight groups. Cutting was an important factor in all these groups, but the first cut of a newly introduced regime usually had a much weaker, if not divergent impact from regular cutting. Grazing was important in at least two groups (terrestrial beetles and spiders), but burning featured much less prominently. Often, grazing and cutting were associated with different axes of variation, although their effects were both frequently opposite to the gradient related to litter depth. Holmes *et al* (1993) also found that grazing affected carabid beetle assemblages on Welsh peatland sites. Rushton *et al* (1987) attributed the influence of cutting and grazing on grassland spider assemblages to changes in vegetation structure.

5. Site Quality

5.1 Methods

Samples from different trapping periods were aggregated for each sampling station within each year. Their SQI was calculated by allotting scores to species according to their conservation status, as in table 21, and taking the mean for the sample as a whole with no weighting for abundance.

The response of SQI to environmental variables was explored using non-parametric statistics on Analyse-it software. Spearman's rank correlation was used for continuous variables. The Mann-Whitney and Kruskal-Wallis tests were used to test the significance of differences in median index values between classes of ordinal and nominal variables.

5.2 Results

The distribution of red data book and nationally scarce species between groups used in the main part of the analysis is summarised in table 22. Within the dataset, some groups are much richer in species of high conservation status than others.

The responses of SQI to various environmental factors and variables are shown in tables 23 and 24. As with species diversity, there were significant annual changes in SQI in spiders and Tipuloidea. There were also significant annual changes in SQI for Sphaeroceridae.

Geographical location influenced SQIs in five groups suggesting that they have regional hot spots for rarer species. The hotspot for spiders, Syrphidae and Sciomyzidae was located in the Broads, whereas Breckland and its fringes contained water beetle assemblages with the greatest proportion of species with a high conservation status.

NVC, dominant plant species and habitat structure also affected the SQI of all groups except for Dolichopodidae and Sphaeroceridae. NVC proved to be a better predictor in this respect than the single most dominant plant species or habitat structure. High SQIs were associated with S24 communities in most groups, but high SQIs also occurred in other NVCs within some groups (see table 25). Amongst habitat structures, the transitional stage between fen and carr was only represented at four sampling stations, but produced high SQIs for spiders, Auchenorrhyncha, Dolichopodidae and Carabidae and Staphylinidae. Pingo systems also scored highly in several groups (see table 26).

SQI for Auchenorrhyncha, Sciomyzidae and spiders exhibited more sensitivity to management than other groups. In this respect, hydrological factors had a greater influence than direct vegetation control. The wetter the site, the higher the SQI. However, grazing was found to have a negative impact on the SQI of four groups. Burning was found to have a significant impact on the SQI of three groups, but the direction varied. Only Auchenorrhyncha exhibited a significantly negative response to cutting.

5.3 Discussion

The geometric scoring system leads to SQI being heavily influenced by the small proportion of the species in each group that populate the classes with the highest conservation status. These species are generally restricted in their distribution, both geographically and ecologically, and it is no surprise that the SQIs of several groups are responsive to a wide range of factors. The responsive SQIs of spiders, Auchenorrhyncha and Sciomyzidae indicate that the most threatened species in these groups have similar habitats, whereas threatened species in the Dolichopodidae, Tipuloidea and beetles are more evenly distributed along environmental gradients.

The lack of response of SQI by most groups to cutting obscures the finding from CCA ordination that many individual species of conservation concern were adversely sensitive to cutting. Similar findings for reedbed spiders were reported by Decleer (1990) and Foster & Procter (1995).

Table 21. Derivation of species scores used to calculate SQI.

Conservation status	Species score
Red Data Book (endangered) (RDB1)	64
Red Data Book (vulnerable) (RDB2)	32
Red Data Book (rare) (RDB3)	16
Red Data Book (indeterminate) (RDBI)	16
Red Data Book (insufficiently known) (RDBK)	8
nationally scarce grade a (Na)	8
nationally scarce grade b (Nb)	4
nationally scarce (ungraded) (N-)	4
local	2
common	1
naturalised	1
unknown	1

Table 22. Number of species in each conservation status class where C = common, N = naturalised, U = unknown, L = local, N- = nationally scarce, Nb = nationally scarce grade b, Na = nationally scarce grade a, RK = Red Data Book (insufficiently known), RI = Red Data Book (indeterminate), R3 = Red Data Book (rare), R2 = Red Data Book (vulnerable), R1 = Red Data Book (endangered). Average score is calculated from the scores allocated to each conservation status for the purpose of calculating the Species Quality Index (see table 21).

	C/N/U	**L**	**N-/Nb**	**Na/RK**	**R3/RI**	**R2**	**R1**	**Ave score**
Araneae	98	66	6	6	1	3	2	2.98
Auchenorrhyncha	73	25	12	6				1.89
Carabidae + Staphylinidae	114	47	22	5	1		1	2.19
Water beetles	35	16	15	4	3			2.84
Dolichopodidae	24	24	5		2	1	3	5.90
Sciomyzidae	17	9	8		3	8		8.24
Sphaeroceridae	41	14						1.25
Syrphidae	42	35	7		1	1		2.19
Tipuloidea	40	22	22		3	2		3.19

Table 23. Significant variations in SQI (Species Quality Index) between samples classified by habitat, geographical location and year of sampling. Significance tested by the Kruskal Wallace test (KW) where * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; **** = $p < 0.0001$.

Classification	**Auchenorrhyncha**	**Dolichopodidae**	**Sciomyzidae**	**Sphaeroceridae**	**Syrphidae**	**Tipuloidea**	**Carabidae & Staphylinidae**	**Water beetles**	**Araneae**
MANAGE	**			*					
NVC	****		**		****	****	***	*	****
DOMV	**		*		*	*	*	*	****
HABST	****				*	*	***		****
AREA			***	**	***			**	****
YEAR				**		*			**

Table 24. Significant responses of SQI (Species Quality Index) to recorded environmental variables tested by Spearman's rho (rs) for variables with continuous values, the Kruskal Wallace test (KW) for variables represented by ordinal classes and the Mann-Whitney test (U) for variables reduced to two classes by the aggregation of poorly populated ordinal classes. + indicates a positive response; - indicates a negative response; * indicates a non-linear response. + = p < 0.05; ++ = p < 0.01; +++ = p < 0.001; ++++ = p < 0.0001.

Environmental variable	**Significance test**	**Auchenorrhyncha**	**Dolichopodidae**	**Sciomyzidae**	**Sphaeroceridae**	**Syrphidae**	**Tipuloidea**	**Carabidae & Staphylinidae**	**Water beetles**	**Araneae**
TCUT	KW	---								
GRAZINT	U	--	--					-		----
TBURN	U	-		++						+
LITDEP	KW	++								+
LITCOV	rs								---	++
FLOODS	KW	+++		+++		+				++++
WTABLE	KW	+++		++++		+				+++
DWATER	U			--						-
VEGHT	rs	++++				+++		+		++++

Table 25. Means of SQI (Species Quality Index) within each NVC class for each taxonomic group exhibiting significant between-class variation according to the Kruskal-Wallace test.

NVC class	**Auchenorrhyncha**	**Sciomyzidae**	**Syrphidae**	**Tipuloidea**	**Carabidae & Staphylinidae**	**water beetles**	**Araneae**
M22	1.31	3.62	1.40	1.68	1.47	2.17	1.69
S4	1.51	4.10	1.58	2.48	1.86	2.55	2.26
S24	**1.94**	**4.76**	**1.60**	**3.64**	2.30	**2.59**	**2.97**
S25	1.71	3.59	1.40	1.51	**3.56**	1.72	2.27
misc.	1.60	3.23	1.40	1.97	1.46	2.11	1.61

Table 26. Means of SQI (Species Quality Index) within each class of the variable HABSTR for each taxonomic group exhibiting significant between-class variation according to the Kruskal-Wallace test.

HABSTR class	**Auchenorrhyncha**	**Syrphidae**	**Tipuloidea**	**Carabidae & Staphylinidae**	**Araneae**
tall-herb fen	1.78	1.53	**2.90**	2.41	2.49
fen/carr transition	1.90	1.43	1.63	**2.76**	**2.89**
flush	1.31	1.24	1.40	1.21	1.38
fen meadow	1.18	1.47	1.25	1.60	1.53
pingo	**1.93**	**1.56**	2.70	1.38	1.84
misc.	1.45	1.36	1.69	1.30	1.42

6. Conclusions and recommendations

6.1 Effects of management

6.1.1 Vegetation control

Only 2.4% of samples in the EAFIS dataset came from carr with a further 2.4% coming from fen-carr transitional habitats. It would be useful to study further the invertebrate assemblages of these biotopes, because sites that were transitional between open fen and carr had relatively high SQIs across several groups, suggesting that several species of high conservation value may be associated with advanced stages of ecological succession. This would appear to conflict with the generally held perception that the succession of open fen to carr diminishes its conservation value (Fojt 1994a). It may also conflict with the view that established carr is of greater conservation value than carr which has recently succeeded from open fen (Fuller 1986).

Vegetation control effectively arrests or reverses succession. A general prescription to manage fen by mowing, grazing, peat-cutting and scrub clearance (see eg Anon 1997) could therefore be damaging to invertebrate conservation. Analysis of the EAFIS dataset certainly provides plenty of evidence that cutting affects invertebrate assemblages in a number of ways. Species diversity showed significant responses in six groups, while major axes of variation in species composition could be related to cutting also in six groups. Although, only Auchenorrhyncha showed a decline in SQI at regularly cut sites, several species of conservation value in other groups appeared to be adversely sensitive to cutting, while other species appeared to benefit.

Morris (1981a) found that cutting of dry grassland in May had a weaker and less persistent impact on Auchenorrhyncha than cutting in July, because of seasonal variations in the vulnerability of different life cycle stages of the species affected. Species that occupied higher positions on vegetation in the summer were adversely affected by a summer cut. Species that overwintered in the egg stage were positively affected (Morris 1981b). It would be reasonable to assume that the timing of cutting in fens is critical in determining its impact, not only on Auchenorrhyncha, but also other groups that are vertically stratified in the vegetation, or that depend on a litter layer for hibernation. In the Broads, *Phragmites* beds are traditionally cut in the winter between December and April, while *Cladium* beds are cut in the summer between May and September. Furthermore, *Cladium* beds are traditionally cut on a four year cycle, whereas *Phragmites* beds are cut on a shorter one to two year cycle. In fact the negative response of Auchenorrhyncha SQI is confined to Phragmites beds and not observed in Cladium beds, suggesting that frequency of cutting may be more important than timing.

One of the more interesting results of the EAFIS analyses was the finding that invertebrate assemblages can be very different in sites with long-established cutting regimes from those where cutting has only recently been introduced. This calls into question the legitimacy of predictions of the impact of regular cutting, when they are based on studies using experimental plots on previously unmanaged sites (see eg Ditlhogo *et al* 1992). It also suggests that cutting carried out at longer intervals could be effective both in arresting ecological succession and reducing adverse impacts on some invertebrate groups. Long period rotational mowing and scrub clearance of small plots could benefit the conservation of invertebrates and other types of interest through:

- the retention on site of areas of relatively advanced stages of ecological succession,
- the arrest of long term succession to mature carr,
- an increase in habitat diversity.

The proportion of samples from grazed (11%) or burnt (10%) sites in the EAFIS dataset was low compared to sites managed by cutting (52%). Despite this, grazing was found to have an important influence relative to other variables on species composition in beetles, spiders and possibly Dolichopodidae. Morris (1973) suggested that grazing was a relatively benign management regime for grassland Hemiptera, because it did not involve single catastrophic events as in mowing or burning. However, all three types of management had a significantly negative effect on Auchenorrhyncha SQI in the EAFIS dataset, while grazing was also identified as having a negative impact on SQI for beetles, spiders and Dolichopodidae. Trampling by stock with repeated disturbance of a soft substrate may have a larger impact in wetlands than in terrestrial biotopes. Differences in periodicity and disturbance of the substrate between grazing and cutting could account for the fact that these two types of management had quite different influences on species composition in all but two groups (spiders and Sphaeroceridae).

The effects of fire on grasslands are known to vary considerably according to several factors including timing, severity and weather both during the fire event and afterwards (Daubenmire 1968). Variations in the season at which burning was carried out on sites represented in the EAFIS dataset could account for the lack of any clear pattern emerging from the analyses.

6.1.2 Hydrology

In general, hydrological factors were found to have an even greater effect on invertebrate assemblages than vegetation control. Unfortunately, the environmental measurements in the EAFIS dataset do not allow assemblage responses to be easily interpreted in terms that can be translated into management prescriptions. Given the importance of hydrology for invertebrates, further research into the effects of water level fluctuations should identify critical factors that can be used to set management objectives suitable for nature conservation. Even though the variable DWATER could only be estimated for part of the dataset, it, nevertheless, explained variations in the species composition of several invertebrate assemblages.

6.2 Review of sampling methods

Pitfall trapping is widely used for sampling terrestrial ground-living invertebrates and has even been found to give more representative results than sweeping for grassland Auchenorrhyncha whose species are vertically stratified in the vegetation (Payne 1982). However, the use of pitfall traps in wetlands is liable to produce sampling artefacts in three ways:

- reduced efficiency caused by damage to traps by flooding,
- reduced efficiency caused by damage to traps by grazing stock,

- inherent bias caused by low efficiency in catching species adapted to waterlogged habitats.

Problems caused by flooding of trap sites are recorded in the project log and these may have been partly responsible for variations in species diversity along the flooding and water table gradients. Results from standard pitfall traps set in wet mud are often unusable because of damage due to trampling by cattle (Lott 1999b).

One line of eight pitfall traps set on a floating mat of vegetation in Leicestershire for one month yielded just 61 specimens of Carabidae and Staphylinidae from 22 species, several of which were vagrants from adjacent terrestrial biotopes. By contrast a nearby line of traps set in exposed substrate in an abandoned river channel yielded 1,239 specimens from 75 species. This difference, which was not repeated to anything like the same extent in hand-collected samples, was attributed to the ability of species adapted to waterlogged habitats to avoid capture by pitfall traps (Lott 1999b). Even though a wetting agent was added to the trap preservative in the EAFIS project, examination of the ordination plot for Carabidae and Staphylinidae suggests that a similar artefact is present in the EAFIS dataset. Specialist species of waterlogged habitats are barely present in the set of species with high scores on axes associated with high water levels, although several vagrant species are represented. Table 27 suggests that many beetle species characteristic of waterlogged habitats are relatively poorly represented in the EAFIS dataset compared to hand-collected samples, although it is interesting to note that the representation of vagrant species is roughly equivalent (see table 28).

The advantages of pitfall trapping as a repeatable sampling method for terrestrial beetles clearly do not apply in a waterlogged environment. However, high population densities of wetland beetles mean that hand-collecting is relatively efficient. The robustness of ordination techniques used on hand-collected samples of Carabidae and Staphylinidae (Lott 1999b and unpublished) mean that simple presence and absence data can be used for monitoring single sites or comparing different sites. Hand-collecting by an experienced fieldworker is also cheaper in wetlands than pitfall trapping, because only one site visit per sample is needed. Also there is no need for time-consuming sorting preliminary to identification and hand-collected specimens tend to be more intact and easier to identify.

It is unclear whether the artefacts described above are present in the EAFIS dataset for other groups. Similar problems appear to be manifest in the spider results, but the clear separation of wetland species of Auchenorrhyncha and Sciomyzidae along appropriate ordination axes suggests that water traps may not suffer from the same drawbacks as pitfall traps set in waterlogged ground. Hand-collecting of a representative sample of Diptera would take longer than for other groups and water trapping probably represents a more feasible option. The EAFIS results suggest that water traps have an inherent bias in samples of Syrphidae, but similar problems could not be detected for other groups. Their main deficiency is that they are liable to be damage by grazing stock as reported in the EAFIS project log. As in pitfall traps, variations in design can affect the catch (Blackshaw 1983, Pollet & Grootaert 1994). Consequently a standard trapping protocol needs to be developed for monitoring purposes.

Table 27. Representation of the more widespread Carabidae and Staphylinidae associated with waterlogged habitats in 22 hand-collected samples from fen sites in Norfolk (Lott, unpublished) and 99 standard EAFIS samples.

Species	Percentage of hand-collected samples containing species	Percentage of EAFIS samples containing species
Agonum fuliginosum	27	27
Agonum thoreyi	23	56
Bembidion doris	45	5
Erichsonius cinerascens	95	9
Lathrobium terminatum	18	11
Lesteva sicula	18	9
Myllaena dubia	50	3
Myllaena intermedia	41	1
Odacantha melanura	9	13
Oodes helopioides	5	24
Paederus riparius	73	49
Philonthus fumarius	45	13
Pterostichus minor	55	36
Stenus bifoveolatus	23	1
Stenus cicindeloides	36	5
Stenus latifrons	45	20
Stenus melanarius	18	0
Stenus nitens	23	35
Stenus nitidiusculus	18	1
Trissemus impressus	14	14

Table 28. Representation of some vagrant terrestrial beetle in 22 hand-collected samples from fen sites in Norfolk (Lott, unpublished) and 99 standard EAFIS samples.

Species	Percentage of hand-collected samples containing species	Percentage of EAFIS samples containing species
Amara plebeja	5	1
Anotylus nitidulus	0	7
Anotylus tetracarinatus	0	19
Anthobium atrocephalum	5	0
Dromius linearis	0	7
Dromius melanocephalus	5	0
Gyrohypnus angustatus	5	1
Leistus rufescens	0	11
Metabletus foveatus	5	0
Mycetoporus clavicornis	5	2
Mycetoporus splendidus	5	16
Omalium rivulare	5	1
Pterostichus niger	0	7
Tachinus signatus	0	16
Tachyporus chrysomelinus	18	13
Tachyporus hypnorum	41	42
Trechus quadristriatus	0	23

6.3 Selection of taxa suitable for monitoring the effects of management

The use of physical indicators to measure the favourability of fens for invertebrates is not yet possible, because too little is known about the habitat requirements of wetland invertebrates. However, analysis of the EAFIS database demonstrates that there are several groups sensitive to ecological change that could serve to monitor ecological change and the effects of management.

Tables 15 to 20 list species indicator values that could be used to measure ecological change at intervals of multiples of one year. An annual site score can be derived by calculating the mean of all the species scores represented in a sample for that year. It may be necessary to calibrate individual species scores against datasets derived from other sampling methods, where these are considered to be deficient in the EAFIS project. For example, a national dataset held by the author could be used to generate hydrological scores for Carabidae and Staphylinidae.

It might be considered redundant to use indicators of management to detect whether a site is cut, grazed or burnt. However, these indicators could be used to assess the scale of impact of management. They would be even more useful if they could be related to ecological succession and its disturbance, but this would need further work on sites at earlier and later stages of succession than are represented in the EAFIS dataset.

Monitoring of site quality is more problematic. SQI is becoming accepted as a standard measure of site quality, but there are questions about its robustness and the baseline data on which it is calculated. SQI was originally developed for ranking sites in order of their importance. Its use for monitoring site quality is compromised by the fact that a priority species can disappear without affecting the SQI, if it is replaced by an immigrant species with a similar conservation status. Furthermore, there are many species of conservation interest outside the main groups analysed in this report, and they will inevitably form the subject of individual monitoring projects as part of species recovery programmes. Monitoring of individual priority species would therefore appear to remain the most effective approach, until suitable non-biotic indicators can be identified.

Gibson, Hambler & Brown (1992) pointed out the dangers of designing land management plans on the basis of single taxonomic assemblages. However, it is doubtful that resources would be available for a monitoring programme that involved the complete taxonomic range of invertebrate assemblages. It is therefore necessary to select representative groups that will efficiently detect important habitat changes. The minimum requirement would be for a predominantly aquatic group, a predominantly ground-living group and a group dependent on vegetation structure. Luff & Woiwod (1995) listed desirable attributes that would qualify an insect group for monitoring land use change. These can be adapted for site monitoring as follows:

- Diversity. The group must have enough species to show measurable responses along the environmental gradients targeted for monitoring.
- Ease of identification. The group must be readily identifiable down to species and taxonomically stable so that the nomenclature is not seriously confused.

- Efficient sampling methods. Cost-effective and repeatable sampling methods must be established for the group.
- Sensitivity to ecological change. The group must exhibit measurable responses to ecological changes resulting from site management.

Table 29 evaluates the suitability of groups investigated in this report, drawing on experience from other studies as well the EAFIS project.

The only predominantly aquatic group analysed in this report are the water beetles. Comparatively weak relationships with environmental gradients were detected in the EAFIS dataset, but few would argue that pitfall trapping is a suitable sampling method for any aquatic group and their value for environmental studies has been amply demonstrated using more traditional sampling methods.

Carabidae and Staphylinidae meet all the criteria for the ground-living group, except for ease of identification. Sphaerocerids present fewer identification problems, in that a published key is available, even if there are few entomologists with very much experience in the group. However their relatively low diversity would lead to a higher proportion of samples containing too few species for a robust site assessment.

The selection of a group dependent on vegetation structure rests between Auchenorrhyncha and spiders. The high proportion of vagrant species in any spider sample could lead to appreciable noise when averaging species indicator scores.

The three best candidate groups for monitoring the effects of site management using a species indicator score methodology are water beetles, Auchenorrhyncha and Carabidae and Staphylinidae. If resources are available, the additional use of Dolichopodidae, Sciomyzidae, Sphaeroceridae, Tipuloidea and spiders would provide valuable data and improve the robustness of the monitoring scheme overall. Several other groups not included in the main analysis also have potential for monitoring, most notably Lepidoptera. Their responses to environmental variables as species assemblages cannot be evaluated at the present time, although it is known that individual species can be very sensitive to different management regimes (eg Waring 2001).

Using hand-collecting techniques, an experienced worker would take up to two days to collect, identify and document five or six samples of one group collected from one site, and produce a simple proforma type report. Consequently, it would cost around £2,000 to monitor five or six management compartments at one site in one year, using three indicator groups. The frequency of sampling would depend on available resources and the review period of the site management plan.

These recommendations use a theoretical model based on species distributions along environmental gradients. In the longer term it may be possible to develop methods based on guild structure either measuring habitat occupancy (Speight & Castella 2001) or species richness (see eg Lott 1999a), but currently there is too little base line data on guilds in wetland invertebrate communities to attempt this approach, except for the Syrphidae.

Table 29. Evaluation of invertebrate groups for their suitability in monitoring site management.

Group	Diversity	Ease of identification	Ease of sampling	Sensitivity to hydrology	Sensitivity to vegetation control
Auchenorrhyncha	High?	Medium	High	High	High
Dolichopodidae	High?	Low	Medium	High	High
Sciomyzidae	Medium	High	Medium	High	Low
Sphaeroceridae	Medium	Medium	Medium	High	High
Syrphidae	Too many vagrants	High	Medium	Low	Low
Tipuloidea	High	Low	Medium	High	High
Carabidae & Staphylinidae	High	High for carabids; low for staphylinids	High	High	High
Water beetles	High	High	High	High	High
Araneae	Too many vagrants	High	High	High	High

6.4 Recommendations for further research

The hydrological variables recorded in the EAFIS dataset are inadequate for an understanding of how hydrology affects invertebrate assemblages of fen. Further work is needed to provide a rationale for developing hydrological management objectives suitable for invertebrate conservation and to identify habitat factors that could be used for simple environmental monitoring programmes. A comprehensive investigation of the influence of water level fluctuations would involve consideration of periodicity, magnitude and flow during inundation. From a perspective based on physiological, behavioural and life history adaptations of wetland invertebrates, water level fluctuations can be classified into four types by their periodicity:

- predictable daily fluctuations influenced by tidal movement,
- predictable seasonal fluctuations,
- unpredictable flooding events occurring at intervals of less than one year,
- unpredictable catastrophic events occurring at intervals of more than one year.

For the investigation, it will necessary to evaluate which of these categories is important in East Anglian fens and select around 30 sites for a stratified study accordingly. At each site, some measure of severity of disturbance by flooding and magnitude of each category of flooding event should be estimated. Severity of disturbance can be deduced from substrate particle size, distribution of litter and vegetation cover. The magnitude of various types of fluctuation can be estimated from factors such as presence or absence of draw-down zone and position of site in relation to floodplain, main river channels, river catchment and tidal influences. This exercise would benefit from the participation of local site managers. For each group, the sampling, analysis and reporting could be carried out by an experienced worker in 20 days which would equate to around £5,000. For three target groups the total costs would be around £15,000.

An understanding of how vegetation control affects invertebrate assemblages in East Anglian fens is handicapped by a lack of knowledge of how these assemblages respond to natural ecological succession. Although a large number of sites were sampled in the EAFIS project, most of them fall into a fairly narrow ecological band, and sites in both early and late successional stages appear to be poorly represented in the dataset, or at least poorly characterised by the environmental variables measured. A smaller stratified study on unmanaged sites in various stages of succession would assist greatly in interpreting the impact of vegetation control on succession in invertebrate communities. Environmental variables that are useful for gauging ecological succession include substrate (organic versus mineral) and a measure of tree or shrub density. As for the hydrological project, the total costs for a project targeting three groups would be £15,000.

Hydrology and succession are interlinked and the two studies described above can be usefully combined, in which case up to forty samples would be needed. The total costs for a project targeting three groups would then be £20,000. Some savings on Dipteran groups could be achieved by using water traps which would reduce sampling costs over several groups.

Such a combined study would result in a more confident general management prescription for conserving fenland invertebrate communities, better interpretation of the biotic monitoring programme and, possibly, a methodology for monitoring site management using more easily measured physical and hydrological factors. It would also provide a context for carrying out more detailed work on the effects of particular management regimes, such as grazing. A study involving SACs and SPAs would be eligible for European Union funding under the LIFE programme.

Table 30: Estimated costs of further research (£).

Project	Three groups targeted	Six groups targeted
Combined study of responses of invertebrate assemblages to hydrology and ecological succession	20,000	35,000
Specific study of responses of invertebrate assemblages to management type eg grazing	15,000	30,000
Monitoring of individual site (five or six compartments)	2,000	4,000

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Appendix 1 Descriptions of sites and sampling stations

Badley Moor

A site comprising spring fed valley fen and grassland alongside the River Tud. Chalk springs emerge from the valley side and are marked by some of the finest tufa formations in Britain which have remained undisturbed.

Sample station 1 (TG012118)

South facing seepage slope of large tufa mound. Fairly short sward dominated by *Schoenus nigricans*, *Juncus subnodulosus* and *Molinia caerulea*. This species rich vegetation also includes *Drosera anglica*, *Pinguicula vulgaris*, *Epipactis palustris*, *Succisa pratensis* and *Menyanthes trifoliata*. An extensive bryophyte carpet is also present. The site has been lightly grazed by donkeys in recent years, though not within the duration of this invertebrate survey. Seepage slope wet throughout sample periods.

Boughton Fen

A small calcareous valley fen on the western edge of the Norfolk Breckland. The few noteworthy invertebrate records known from the site prior to this survey are summarised in Foster (1987).

Sample station 1 (TF718012)

Located towards the southern end of the fen in hollow containing *Carex elata* tussocks, *Filipendula ulmaria*, *Cladium mariscus*, *Phragmites australis*, *Phalaris arundinacea* and *Urtica dioica*. However, this vegetation with *C. mariscus* and *C. elata* is not typical for most of the site. Much of the fen is developing into scrub dominated vegetation. Sample station was dry during the summer of 1988, as were most other areas of the fen visited.

Brancaster

Three sample stations were operated within a block of reed beds near to the north Norfolk coast, located between arable farmland and coastal grazing marsh. Stations 1 and 2 were sampled during 1988 and 1989, the additional station 3 was sampled only during 1989. The reed beds had been unmanaged for many years prior to this survey and remained so during the sample periods. However, a management programme involving the cutting of the separate blocks of reed bed on a rotation, has since been instigated.

No invertebrate records referring specifically to the above reed beds have been traced prior to this survey, though the study site does lie within the `Brancaster' site documented in Foster (1986).

Sample station 1 (TF768443)

Unmanaged, coastal *Phragmites australis* bed with dead standing reed stems dominating the vegetation structure. Other plant species common within the bed are *Epilobium hirsutum*, *Calystegia sepium*, *Solanum dulcamara* and *Galium aparine*. Vegetation litter covers the ground layer. Drier than the nearby stations 2 and 3.

Sample station 2 (TF767443)

Unmanaged, coastal *Phragmites australis* bed. Vegetation overwhelmingly dominated by *Phragmites* both standing dead and living stems, other plant species present are at very low deity, these include *Solanum dulcamara*, *Carex riparia*, *Galium aparine* and *Equisetum*.

Sample station 3 (TF767443)

Unmanaged, coastal *Phragmites australis* bed. Vegetation dominated by living and dead standing stems of *Phragmites*. *Epilobium hirsutum*, *Calystegia sepium* and *Galium aparine* all present but scarce and occurring low down in the sward. This compartment on a slight slope possibly with some spring seepages present.

Bure Marshes NNR (Woodbastwick)

Sample station 1 (TG339163)

Located in compartment 4 of NNR. Botanically a species rich fen meadow cut annually in late summer, when the marsh hay is removed and deposited at the edge of the compartment forming a large stack of fen litter. This type of management has been carried out since 1978. Vegetation dominated by *Juncus subnodulosus* in most areas, though during 1988 the parasitic *Pedicularis palustris* was co-dominant in parts of the compartment. A number of *Carex* spp. present including *C. elata*, *C. lasiocarpa*, *C. lepidocarpa* and *C. panicea*. Other plants present and frequent in the sward are; *Peucedanum palustre*, *Lysimachia vulgaris*, *Lychnis flos-cuculi*, *Cirsium dissectum*, *Myrica gale* and *Molinia caerulea*. *Phragmites australis*, though present, is represented only by short weak plants which are sparsely distributed. Extensive bryophyte carpet also present.

Sample station 2 (TG343167)

Located in compartment 17 of NNR. Area of unmanaged fen vegetation since 1975 (apart from some removal of *Salix* scrub) formerly reed bed, now developing into scrub. Shrub vegetation represented by *Myrica gale*, *Salix repens* and other *Salix* spp., *Rhamnus catharticus* and some *Betula*. *Phragmites australis* and *Juncus subnodulosus* common throughout, and the following also present; *Peucedanum palustre*, *Lysimachis vulgaris*, *Molinia caerulea* and *Cladium mariscus*, though very little of the latter in this section of the compartment.

Sample station 3 (TG339166)

Regularly harvested sedge bed in compartment 16 of NNR. Vegetation dominated by *Cladium mariscus,* with *Myrica gale* common throughout as well, and *Carex elata*, *Juncus subnodulosus*, *Schoenus nigricans* and *Molinia caerulea* frequent. Other flowering plants present, though only in low numbers, include *Peucedanum palustre*, *Lysimachia vulgaris*, *Pedicularis palustris* and *Cirsium dissectum*. Harvested in year prior to invertebrate samples commencing ie 1987.

Sample station 4 (TG338168)

Formerly *Cladium mariscus* vegetation overgrown with dense *Alnus glutinosa* carr, located in compartment 20 of NNR. Unmanaged for at least a hundred years prior carr/woodland being cleared in 1987, this clearing of the carr is continuing in other areas of the compartment. *C. mariscus* overwhelmingly dominates the vegetation in most areas, though the invertebrate traps located in a more open diverse part of the compartment, even so *C. mariscus* still dominates here. *Peucedanum palustre*, *Lysimachia vulgaris*, *Parnassia palustris*, *Galium palustre*, *Juncus subnodulosus* and *Carex elata* all present, though at low frequencies. Tussocks of *Carex appropinquata/paniculata* frequent in other areas of compartment.

Sample station 5 (TG344163)

Commercially harvested bed of *Phragmites australis* in compartment 24 of NNR, with the invertebrate traps were located at the River Bure end of compartment. Cut annually and was also burned in 1985. Dense and very tall growth of reed with some stems exceeding 250 cm in height, other plants present at low frequency and low down in the sward, these include *Caltha palustris*, *Ranunculus lingua*, *Lysimachia vulgaris*, *Peucedanum palustre*, *Calystegia sepium* and *Scutellaria galericulata*, some tussocks of *Carex elata* also present.

Sample station 6 (TG345162)

Phragmites australis bed in compartment 26 of NNR. Harvested frequently thought not annually (unlike the adjacent compartment with station 5), but more often double wale. Not cut in winter of 1987/88, but was so during following winter, then left uncut again in winter of 1989/90. Reed not as tall and dense as at station 5, though still dominant. Flora present includes *Peucedanum palustre*, *Lysimachia vulgaris*, *Lathyrus palustris*, *Rumex hydrolapathum* and *Filipendula ulmaria.*

Sample station 7 (TG337163)

Alnus glutinosa woodland within compartment 3 of NNR. Canopy of *A. glutinosa* approximately 10m tall, some *Fraxinus* in the understorey with saplings reaching a height of 2m or so. Ground vegetation consisting of *Carex riparia*, some *C. elata* tussocks, and *C. remota*, with much of the ground flora dominated by *Dryopteris* ferns, with *Lysimachia vulgaris*, *Galium palustre* and *Filipendula ulmaria* also present but less frequent.

Burgh Common

An important area of unreclaimed wetland in the Norfolk Broadland lying in a shallow valley at the western end of Filby Broad, where traditional mowing and grazing regimes are largely maintained. A wide variety of habitats are represented including fen meadow, tall herb fen, carr and a series of drainage ditches. Much of the site is a Norfolk Naturalists' Trust Reserve.

One sample station was operated in the biennially mown fen meadows. Although unlikely to be the most species rich area of the site for fenland invertebrates, this type of habitat was only sampled at two other localities within this survey; Hickling Broad and Chippenham Fen NNR's.

A site known to be of high entomological value with the voluntary warden, K. Saul, providing an annual report incorporating entomological records principally for Odonata and Lepidoptera.

Sample station 1 (TG440126)

Fen meadow with each half the meadow being mown during late summer in alternate years, also occasionally grazed by cattle. Section with invertebrate traps was not cut during the sample programme, ie cut during the previous year. Relatively short sward of vegetation dominated by *Calamogrostis canescens*, *Carex panicea*, *Juncus subnodulosus*, *Cirsium dissectum* and *Hydroctyle vulgaris*. Other characteristic Broadland plants present include *Peucedanum palustre* and *Lysimachia vulgaris.*

Buxton Heath

A diverse heath and fen area forming one of the best examples of this habitat in Norfolk. The principal nature conservation interest is the valley mire which has developed along the length of a small stream.

Sample station 1 (TG175215)

Narrow band of calcareous fen alongside the stream running through the base of the mire. Vegetation dominated by *Juncus subnodulosus* and *Molinia caerulea* extensive bryophyte carpet also present. Other flowering plants recorded include *Succisa pratensis*, *Valeriana dioica*, *Caltha palustris* and *Lychnis flos-cuculi*. Large area of *Salix* carr nearby (approx. 15m away). Unmanaged.

Catfield Fens

Situated to the east of Barton Broad and on the flood plain of the River Ant this site forms part of the large Ant Valley Marshes SSSI. A complex pattern of vegetation types are present and have been studied in some detail, eg Giller (1978). Many areas of these fens are managed for the commercial harvesting of *Cladium mariscus*. Woodland, scrub and carr are also represented.

Sample station 1 (Rose Fen TG374204)

Area of fen formerly developing into scrub until being burnt during the winter of 1986/87 and again in winter of 1988/89. In summer of 1988 vegetation around invertebrate traps dominated by *Calammogrostis canescens*, with *Cladium mariscus*, *Juncus subnodulosus*, *Myrica gale* and *Peucedanum palustre* all frequent. In the two following summers the *C. canescens* was less common around the traps, though still dominant in some areas of the compartment, with the other aforementioned species becoming more frequent. Other plants species in sward include *Carex elata*, *Galium palustre*, *Lysimachis vulgaris*, *Lythrum salicariae* and *Thelypteris palustris*. Many tussocks and extensive bryophyte carpets present in this compartment, with the areas between the tussocks frequently flooded.

Sample station 2 (TG367213)

Small area of unmanaged vegetation (until 1989) forming a floating mat of bryophytes (mainly *Sphagnum* spp.) and emergents over what appears to be a former ditch. Surrounded by frequently harvested *Cladium mariscus* bed. *Phragmites australis* and *Thelypteris* dominate with *Peucedanum palustre* and *Potentilla palustris* also common. *Typha angustifolia* is a frequent emergent from the wettest areas. Extensive bryophyte carpet throughout. Vegetation was cut together with the surrounding sedge bed in the summer of 1989.

Sample station 3 (TG366212)

Cladium mariscus bed harvested every three years or so and appears to have been burnt during recent years, possibly in the winter of 1986/87. *C. mariscus* dominates the vegetation with *Phragmites australis*, *Juncus subnodulosus*, *Schoenus nigricans*, *Pedicularis palustris*, *Myrica gale* and *Molinia caerulea* among the other plant species recorded. Sedge was harvested in summer of 1989.

Sample station 4 (Catfield Great Fen TG365210)

Cladium mariscus dominated vegetation cut in 1987 prior to invertebrate sampling commencing. Small areas of the vegetation are cut each year forming a mosaic of succession within this large sedge bed. *C. mariscus* dominates the vegetation in the vicinity of the trap run with *Schoenus nigricans* fairly common also. Other plants recorded included *Pedicularis palustris*, *Myrica gale*, *Carex elata*, *C. lepidopcarpa* and *Juncus subnodulosus.* The site was flooded during many of the sample periods and some aquatic plants were present also, eg *Utricularia minor*.

Caudlesprings

This small site is sympathetically managed, single handed, by the owner for nature conservation purposes. The site comprises some recently dug ponds, spring flushes, small areas of carr and annually mown meadow. The single sample station was operated in the meadow area.

The artificially created ponds are known to be of entomological interest for their dragonfly and damselfly fauna; both *Lestes dryas* and *Sympetrum sanguineum* confirmed as breeding here.

Sample station 1 (TF941019)

Herb rich meadow with a number of *Carex* species present including *C. flacca*, *C. otrubae* and *C. hirta*, the area is annually mown during late summer. Orchids and *Lychnis flos-cuculi* are common in the sward, and *Ophioglossum* is present on the site though not in the immediate vicinity of the trap run. Spring flushes and recently created ponds are nearby. The meadow was grazed by ponies some years ago, then left unmanaged for a few years until the current owner instated an annual cutting regime.

Cavenham Heath NNR (Tuddenham Fen)

A small area of fairly fen located adjacent to the River Lark and within Cavenham Heath NNR.

Historically this site, in common with other areas of wetland adjacent to the R. Lark, was studied by entomologists and a number of scarce wetland species were noted, eg the carabid beetle *Dromius longiceps* (Shirt 1987) and the snail killing fly *Dichetophora finlandica* (Withers 1984). Very few modern entomological records are available for this area of fen.

Sample station 1 (TL744736)

Located in compartment 1 of NNR. Vegetation dominated by *Glyceria maxima*, with a few large tussocks of *Carex paniculata* present, also *Phragmites australis*, *Urtica dioica* and *Angelica sylvestris* frequent. Fairly dry during sample periods in 1988. Unmanaged.

Chippenham Fen

A national Nature Reserve on the periphery of the Cambridgeshire fens, supporting herbaceous fen communities, fen carr and woodland. The site is spring fed with calcareous ground water.

Sample station 1 (TL652692)

Species rich tall herb fen in compartment 11. Cut biennially during late summer with marsh hay left in the compartment, formerly mown to retain open fen conditions for shooting and was one of the few areas of the fen to remain scrub free during the years of neglect in the early 1960's. Vegetation dominated by *Juncus subnodulosus* and *Molinia caerulea*, a variety of *Carex* spp. present including *C. lepidocarpa* and *C. panicea*. Other flowering plants recorded are *Succisa pratensis*, *Prunella vulgaris*, *Cirsium palustre*, *Galium palustre*, *Valeriana dioica* and *Selinum carvifolia*.

Sample station 2 (TL651694)

Biennially mown fen meadow in compartment 8, undergoing similar management to station 1 (in compartment 11), though cut in the alternate year. Unlike compartment 11 this meadow was not maintained for shooting and thus became more overgrown. *Juncus subnodulosus* dominates with *Cladium mariscus*, *Phragmites australis* and *Carex lepidocarpa* frequent. Remaining flora includes *Lythrum salicaria*, *Valeriana dioica* and *Selinum carvifolia*.

Sample station 3 (TL643696)

Unmanaged area of tall *Phragmites australis* in compartment 6 adjacent to carr, with some *Cladium mariscus* also present lower down in the sward, *Juncus subnodulosus* and *Solanum dulcamara* frequent. This site flooded for most of the year, consequently pitfall traps were not always set.

Sample station 4 (TL645697)

North meadows in compartment 2. This area is cattle grazed and mown every second year, with each half of the compartment being mown on alternate years. Vegetation dominated by *Molinia caerulea*, with *Carex panicea*, *Cirsium dissectum* and *Succisa pratensis* all frequent in the short sward. The invertebrate traps were often damaged or destroyed by cattle or mowing machinery.

Sample station 5 (TL644692)

Sedge bed in compartment 4, Snailswell Poors Fen, ground with a number of depressions resulting from historic peat cutting. Traps located in an area of sedge cut in 1987, one of four blocks cut in turn on a four year rotation. Vegetation dominated by *Cladium mariscus* with *Phragmites australis* and *Eupatorium cannabinum* frequent.

Sample station 6 (TL643693)

Sedge bed located in compartment 4 in block of sedge cut in 1988, and adjacent to block containing station 5 above. Vegetation similar though the *Cladium mariscus* forms a higher percentage cover here, with *Phragmites australis* and *Eupatorium cannabinum* less common. In addition, *Calystegia sepium* and *Equisetum ? palustris* are frequent. Note that part of this block of vegetation was accidentally burned in the summer of 1989 and is the subject of a separate study, a report of which will appear elsewhere.

Cranberry Rough

A basin mire, with a high and fairly stable water table, which has developed over the site of a former lake. The site consists of swamp woodland, tall fen vegetation, grassland and a network of ditches and ponds. Surrounded by coniferous woodland.

Sample station 1 (TL931932)

Open area dominated by *Carex elata* tussocks, surface water present throughout sampling periods. Pine, Alder and Sallow scrub nearby.

Dersingham Bog

Oligotrophic valley mire with the water table maintained from seepage off the nearby Greensand scarp face. The site consists of acidic grassland dominated by *Molinia caerulea*, carpets of *Sphagnum* spp. with *Narthecium ossifragum* and *Drosera* spp. and areas of *Myrica gale* scrub. Much of the site is surrounded by pine and rhododendron woodland, though some areas of open dry heathland persist.

Entomologically this site renowned as the only recorded British site for two species of micro-moth, neither of which have been seen for some years, and the occurrence of a number of insects which are predominantly northern and western in distribution combined with some species more often associated with the New Forest bogs.

Sample station 1 (TF682294)

Area overwhelmingly dominated by large tussocks of *Molinia caerulea* and *Myrica gale* scrub. Some flooding between tussocks. Area may have been burnt in past years; evidence of charred, dead birch scrub in vicinity. By-pass has since been constructed over, or at least very close to this sample station.

Sample station 2 (TF666286)
Located towards the south western end of the site in Wolferton Fen. Open area of small boggy pools, *Sphagnum* carpets with *Narthecium ossifragum*, *Drosera rotundifolia* and *Vaccinium oxycoccus*. Some pine is encroaching though the trees are in poor health, possibly because of the high water table.

East Harling Common

A site containing a series of approximately twenty pingo pools on the eastern edge of the Norfolk Breckland. Most of these periglacial depressions are surrounded by ramparts of calcareous grassland which is rabbit grazed, though some of the pools border or are within adjacent farmland. Some secondary birch woodland is present and an extensive area of reed swamp occupies much the southern part of the site.

The pingo pools, like those at other West Norfolk sites, are known to contain relict a community of water beetles. Some other scarce wetland insects have also been recorded.

A single sample station was investigated, situated in one of the larger pingo depressions.

Sample station 1 (TL999878)

Pingo pool surrounded by calcareous grassland (Pond number 12 as indicated in file EA/N/275 held at English Nature, Bracondale office). The margin of the pingo is dominated by *Juncus subnodulosus*, with the central area dominated by large tussocks of *Carex elata* and a small patch of *Cladium mariscus*. Pingo depression flooded during first two sample periods, though partially dried out during late summer sample.

East Walton Common

A site containing many pingo depressions, calcareous springs, woodland and calcareous grassland.

A site of high entomological value, noted in particular for the outstanding assemblage of rare aquatic Coleoptera in the pingo pools and a variety of scarce Diptera. Killeen (1991) has recently studied the Mollusca at this site and recorded some rare species including *Vertigo mouliiana*.

Sample station 1 (TF736163)

Traps set in central area of fairly large pingo. No open water; depression covered with mat of vegetation dominated by *Carex elata*, and bryophyte carpet. Some *Salix* bushes and *Cladium mariscus* present in centre. *Menyanthes trifoliata* and *Potentilla palustris* frequent towards edge of depression. Cattle grazed, heavily so in 1989 though this may, in part, have been due to exceptionally low water levels allowing the stock to wander further into the hollows than would normally be the case.

Foulden Common

A large site comprising a variety of different sized pingo pools, neutral and calcareous grassland, woodland and areas of tall herb fen vegetation.

Sample station 1 (TF763001)

Pingo pool dominated by *Carex elata* tussocks, *Cladium mariscus* and a sparse growth of *Phragmites australis*. Flooded during early summer of 1988, though dry during late summer sample period. The surrounding calcareous grassland is grazed by cattle.

Sample station 2 (TL760996)

Large area of *Cladium mariscus* dominated vegetation, with some *Schoenus nigricans* and *Juncus subnodulosus*. Wet during first two sample periods in 1988, though dry by late summer. Surrounded by calcareous grassland. Currently unmanaged, though may have been cut for sedge in the past.

Hickling Broad NNR

Sample station 1 (TG427214)

Whitslea grazing marsh in compartment 5. In the past grazed by ponies and more recently (since 1976) by cattle, in addition the meadows have been cut in late summer. The short sward is dominated by *Eriophorum angustifolium*, *Carex panicea* and *Potentilla erecta* near to the trap line, though in other areas of the meadow *Cirsium dissectum* and *Juncus subnodulosus* are dominant. Since cattle were present during the last trapping period of 1990, the traps were not set at this station during 15-29/8/90.

Sample station 2 (TG424215)

Whitslea sedge beds in compartment 6. Vegetation dominated by *Cladium mariscus*, with *Juncus subnodulosus*, *Phragmites australis*, *Galium palustre*, *Mentha aquatica* and *Iris pseudacorus* all frequent, *Schoenus nigricans* and *Peucedanum palustre* also present. Sedge has been harvested from the vicinity of the trap line during the 1950's, 60's and 70's, and was cut in 1988 with a view to instating a four year cutting cycle.

Sample station 3 (TG422216)

Big Rond sedge bed in compartment 6. Vegetation similar to station 2 with *Cladium mariscus again* dominating, frequent plant species including *Juncus subnodulosus*, *Phragmites australis*, *Iris pseudacorus*, *Galium palustre* and *Oenanthe lachenalii*. Frequently harvested sedge bed most recently cut in 1989 with a four year cutting cycle now the objective.

Sample station 4 (TG431212)

Bygraves Marsh in compartment 7. Commercially harvested reed bed since 1972, vegetation overwhelmingly dominated by *Phragmites australis* with dense growth of *Agrostis ? stolonifera* at ground level. Other plants present in the compartment, though scarce, include *Calammogrostis canescens*, *Epilobium hirsutum* and *Cirsium palustre*. First record of reed being cut was in 1954 and the whole bed was burnt off in 1971 prior to commercial harvesting beginning. Water levels are maintained at artificially high levels during the summer months, though in 1989 and 1990, due to exceptionally low water levels, the bed was fairly dry. Due to these often high water levels, traps were sometimes flooded out and the pitfalls were not set on a number of occasions.

Sample station 5 (TG424219)

Skoyles marsh in compartment 3. Unmanaged bed of *Phragmites australis* with dense stand of dead and living stems and a deep layer of vegetation litter. A few other plant species present including *Peucedanum palustre*, *Dryopteris* sp. and *Rubus* sp.. Some scrub is developing, consisting of *Betula*, *Salix* and *Quercus.* Not managed since 1980 when the vegetation was machine cut, though litter would have been left on the marsh at this time.

Sample station 6 (TG424219)

Area of cut *Phragmites australis* adjacent to station 5 above. Prior to winter of 1989, when cutting took place, the vegetation was similar to that described above in station 5. *P. australis* less common following the cut, with *Calammogrostis canescens* dominating most of this managed area, particularly where litter piles had been burnt off, *Peucedanum palustre* is fairly frequent. This station was sampled for the two seasons following the cut.

Holt Lowes

An area of dry sandy heath that grades into calcareous flushed slopes alongside the River Glaven. These flushed slopes adjacent to the R. Glaven possess a typically rich calcareous fen vegetation over a bryophyte carpet.

The site is noted entomologically, in the East Anglian context, for the occurrence of some species associated with the acidic valley mire, eg the dragonfly *Orthetrum coerulscens*.

A single sample station was operated on one of calcareous the seepage slopes. Carr woodland was present nearby.

Sample station 1 (TG090374)

Small calcareous flush just to the north of the River Glaven. Formerly scrubbed up with *Salix* though much of this shrub vegetation was removed in the year prior to sampling. *Juncus subnodulosus* and *Filipendula ulmaria* dominate the vegetation around the trap line, though some adjacent areas are more open with extensive bryophyte carpets, it is particularly noticeable that the *F. ulmaria* is dominant in the patches where scrub had been cleared. Other flowering plants in the compartment included *Pedicularis palustris*, *Epipactis palustris*, *Lotus uliginosus* and *Cardamine pratense*, One tussock of *Schoenus nigricans* nearby.

Hopton Fen

One of a series of small valley fens spanning the watershed between the headwaters of the River Waveney and Little Ouse. Much of the site is dominated by areas of reed vegetation, some of which is cut for thatching, other sections of the fen have a sward with saw sedge being dominant. Some marginal areas on higher ground contain seepage slopes with Black Bog Rush and Purple Moor Grass. Scrub and woodland is invading many areas of the site.

A single sample station was operated in a section of unmanaged fen dominated by *Cladium mariscus*.

Sample station 1 (TL990801)

Invertebrate traps located in wet hollow dominated by *Cladium mariscus*, drier areas nearby are dominated by *Filipendula ulmaria*. Dense covering of vegetation litter present, the hollow was flooded in the early summer of 1989, though drier during the late summer sample period. Some scrub present in compartment consisting mainly of *Salix* and *Fraxinus*.

Kenninghall Fen (Banham Great Fen)

Sample station 1 (TM041879)

Located in the sedge bed area of Banham Great Fen. *Phragmites australis* and *Molinia caerulea* co-dominant, with *Cladium mariscus* dominating some adjacent areas. Sedge is harvested from the fen, though there was no recent sign of cutting in the sample plot. This part of the fen is also maintained for shooting, and has thus been kept fairly open and scrub free. An extensive area of carr and woodland, dominated by ash, oak and alder lies to the south of the fen.

Lakenheath Poors Fen

A small remnant of once extensive peat fen surrounded by arable fields. Water filled ditches border part of the site with most of the central area of the reserve consisting of a fairly dry meadow. A Suffolk Trust for Nature Conservation reserve.

The few invertebrate records available for the site prior to this survey included some wetland species of noteworthy status.

Sample station 1 (TL702827)

Traps set in damp ditch running through fairly dry meadow. No surface water during sampling in summer of 1988. Vegetation dominated by *Equisetum*, *Carex elata* and *Juncus subnodulosus*. Surrounding meadow containing *Thalictrum flavum* and *Lysimachia vulgaris*. Some areas of the site have been grazed by cattle in previous years, but not during this invertebrate survey. A small length of the ditch, though not the section sampled, was dug out during/reprofiled 1988.

Market Weston Fen

Small calcareous valley fen with a number of springs on sloping ground and containing valuable examples of species-rich fen vegetation, fen grassland and relict heath. The southern section of the site also has a series of wet hollows which contain a number of rare species. Most of the site is a nature reserve owned by The Suffolk Trust for Nature Conservation.

Known to be of high entomological interest, particularly for aquatic Coleoptera (Foster 1984)

Sample station 1 (TL979786)

Compartment annually mown in late summer. Cut for the last four years, formerly dense *Phragmites australis* and scrub. Still surrounded by unmanaged *P. australis* and carr/woodland. Open short sward which is species rich, the wetter shallow depressions dominated by *Juncus subnodulosus* and *Carex panicea* with bryophyte carpets, and the drier areas dominated by *Filipendula ulmaria*. hollows wet throughout sampling in 1989.

Middle Harling Fen

A small calcareous valley fen situated at the head of a small tributary of the River Thet. The site comprises of a number of springs on sloping ground, open fen and some fen carr. Unimproved calcareous grassland surrounds much of the fen, this is no longer grazed but may have been in the past. A single sample station was operated in one of the wettest parts of the fen, even so much this area was dry in the late summer of 1988. Fojt (1990) notes the very low water table and potential threats to the site.

No invertebrate records have been traced for this site prior to the current survey.

Sample station 1 (TL989856)

Transect of traps runs from marginal band of *Carex elata* tussocks, through a zone of *Juncus subnodulosus* dominated vegetation up to the edge *Cladium mariscus* dominated, central, section of the fen. Most areas of fen flooded during the early summer of 1988, though only the *C. elata* band still wet in the late summer.

Mill's Marsh, Ranworth

Area of mowing marsh near to Ranworth Broad in the Bure Marshes SSSI. Privately owned though now managed by the Norfolk Naturalists' Trust. Only accessible by boat.

Sample station 1 (TG362155)

Annually mown herb rich fen. The marsh vegetation is cut in late summer and the hay removed, this regular form management has been carried out almost uninterrupted for many years certainly since the 1940's, and is one of the few sites where these open fen conditions have been maintained almost continuously, principally for duck shooting. The short vegetation is dominated by *Juncus subnodulosus* and *Thelypteris palustris* with various *Carex* spp., *Pedicularis palustris*, *Oenanthe fistulosa*, *Lychnis flos-cuculi* and *Galium palustre* all frequent. An extensive bryophyte carpet covers most areas also. A frequently flooded site where the traps were often vandalised, probably by a fox.

Old Buckenham Fen

A small valley fen with a central area consisting of managed reed beds surrounding a natural mere. Around the margin of the fen basin are areas of scrub, drier fen and cattle grazed meadows containing wet hollows.

Sample station 1 (TM047921)

Reed bed located in the central area of the SSSI. Harvested for thatch and cut during the winter of 1987/1988, and sampled during the summer of 1988. Vegetation dominated with tall growth of reed, understorey consisting of a very sparse and low growth of *Urtica dioica, Valeriana dioica* and *Iris pseudacorus*.

Pashford Poors Fen

Sample station 1 (TL732836)

Damp hollow with *Juncus subnodulosus*, *Filipendula ulmaria*, *Carex elata*, *Caltha palustris* and *Agrostis* sp. dominating the vegetation. Surrounded by dry grassland and arable fields. Wet in early summer visits of 1988, though dry during last sample period. Grazed by cattle, perhaps excessively so in 1988.

Potter and Scarning Fens

A small calcareous valley fen with seepage slopes, areas of cut and unmanaged reed and scrub. Known to be of high entomological value prior to this survey, eg the only East Anglian locality for *Ceriagrion tenellum*, The Small Red Damselfly.

Sample station 1 (TF981121)

Seepage slope on eastern side of Scarning Fen. Vegetation dominated by *Schoenus nigricans*, *Juncus subnodulosus*, also *Carex panicea* and *Molinia caerulea* common. This area of the fen is mown frequently, with small sections at a time are cut each year, consequently although mowing is carried out each year, any particular section of vegetation may only get cut every two or three years.

Sample station 2 (TF981120)

Species poor, *Phragmites australis* dominated vegetation near the valley bottom of Scarning Fen. *Solanum dulcamara* and *Eupatorium cannabinum* also common. This area has remained unmanaged for many years prior to sampling, though has been cut since invertebrate survey was carried out.

Redgrave and Lopham Fens

Sample station 1 (TM054797)

Invertebrate traps located at Middle Fen Lopham, within a shallow hollow (? old turf pond) dominated by *Cladium mariscus* and *Carex elata*. Flooded during winter of 1988/89, though dry throughout sampling periods in summer of 1989. Higher areas of ground in compartment dominated by *Calammogrostis canescens*, *Phragmites australis* and *Molinia caerulea*. Compartment has not been cut in recent years.

Reedham Marshes

A series of species rich reed beds within The Broads Authority reserve at How Hill, forming part of the large Ant Valley Marshes SSSI. Some are cut regularly for thatch, others have been left unmanaged for many years.

Sample station 1 (TG361195)

Reed bed unmanaged in recent years until half the compartment was cut in winter of 1989/90. Vegetation is diverse and has formed a floating hover over what was formerly grazing marsh, surface water nearly always present and deeper flooding frequently occurs. *Phragmites australis* dominates the tall vegetation and *Agrostis stolonifera* forms a dense covering low down. Other plant species frequent in the compartment include *Typha latifolia*, *Carex pseudocyperus*, *Cicuta virosa*, *Peucedanum palustre*, *Rumex hydrolapathum* and *Galium palustre. Sium latifolium* is also present though not common. Invertebrate traps were moved into cut section of reed bed for 1990 samples. Due to frequent floods the pitfall traps, and water trap on the ground were frequently submerged.

Sample station 2 (TG362196)

Reed bed where management has been recently reinstated to follow a two year cutting cycle (double wale) when possible. *Phragmites australis* dominates with *Cicuta virosa* fairly common, other plants present include *Peucedanum palustre*, *Sium latifolium*, *Rumex hydrolapathum*, *Stellaria palustris* and *Lythrum salicaria*, some *Carex elata* tussocks also present. *Salix* scrub had invaded much of the compartment, though most of this has now been manually removed. Reed was harvested in winters of 1987/88 and 1989/90.

Sample station 3 (TG365197)

Regularly harvested reed bed overwhelmingly dominated by *Phragmites australis*. Botanically this reed bed is species poor in comparison to stations 1 & 2 described above. Other plant species present, though at very low frequency and low down in the sward are; *Solanum dulcamara*, *Calystegia sepium*, *Sium latifolium*, *Galium aparine* and *Rumex hydrolapathum*. Though flooded frequently this compartment is not as wet as stations 1,2 and 4.

Sample station 4 (TG362192)

Area of unmanaged fen vegetation dominated by *Phragmites australis* and permanently flooded, some scrub invasion is taking place mainly of *Alnus glutinosa* and *Salix* spp..

Vegetation is diverse and contains a number of nationally scarce plant species, eg *Thelypteris palustris* and *Lysimachia vulgaris*. Among the remaining plant species recorded and frequent here are: *Typha latifolia*, *Sparganium erectum*, *Impatiens capensis*, *Peucedanum palustre*, *Rumex hydrolapathum* and *Carex elata* (large tussocks).

Sample station 5 (TG362193)

Area of cut reed vegetation adjacent to station 4 described above, with the vegetation formerly similar, though less diverse botanically. This section of the reed bed is not permanently waterlogged as in station 4, but does flood frequently. Vegetation cut in winter of 1988/89 and sampled for invertebrates in the two subsequent summers. Dominated by *Phragmites australis* with *Sium latifolium*, *Epilobium hirsutum*, *Solanum dulcamara*, *Cardamine pratensis* and *Apium nodiflorum* all occurring at low frequency. The invertebrate trap line was set running through a small area where a pile of fen litter, following the cut, had been burnt off.

Roydon Common

A lowland mixed valley mire with a complex series of plant communities grading from wet heath through valley mire to calcareous fen. The hydrology and vegetation of the mire area has been studied by Daniels & Pearson (1974). Part of the site is a Norfolk Naturalists' Trust reserve.

In common with the nearby Dersingham Bog this site is noted for the occurrence of a variety of invertebrates predominantly northern and western in distribution coupled with the presence of some species occurring in boggy heaths of southern England.

Sample station 1 (TF686226)

Boggy area with *Sphagnum cuspidatum* carpet together with *Drosera rotundifolia* and *Eriophorum angustifolium*. *Narthecium ossifragum* is common in some nearby pools, though not present in the sample station. Permanently wet.

Sample station 2 (TF686228)

Unmanaged *Cladium mariscus* bed in area of calcareous fen. *C. mariscus* and *Myrica gale* dominate the vegetation, though the presence of *Schoenus nigricans* and *Juncus subnodulosus* probably classifies this vegetation within the *Schoeno-juncetum* community. Historically this sedge bed is likely to have been harvested.

Sample station 3 (TF683224)

Band of *Schoenus nigricans*, *Juncus subnodulosus* and *Myrica gale* dominated vegetation bordering the central watercourse of the site. Other plants present are *Phragmites australis*, *Erica tetralix*, *Calluna vulgaris* and *Succisa pratensis*, with *Sphagnum* spp. fairly common. *Potamogeton natans* is present in some of the small trickles of water nearby. This sample station is within the Norfolk Naturalists' Trust reserve.

Roydon Fen, Diss

Sample station 1 (TM104797)

Compartment partly cleared of scrub in recent years, though shrubs are already regenerating. Some small pools present with dense growth of *Chara* spp., though most of compartment fairly dry. Vegetation dominated by *Eupatorium cannabinum*, *Cladium mariscus* and *Phragmites australis*. Surrounded by dense *Alnus glutinosa* carr/woodland.

Scoulton Fen

Scoulton Heath, where the invertebrate traps were located, is the island in Scoulton Mere, is largely covered by birch woodland, and a dense ground cover of *Sphagnum* has developed over much of the area suggesting the development of a raised bog.

Sample station 1 (TF986014)
Invertebrate traps located on Scoulton Heath (the island in Scoulton Mere). Area of *Carex riparia* dominated vegetation with *Sphagnum* carpets, within *Betula*/*Quercus* woodland. *Phragmites australis* and *Calammogrostis canescens* frequent in some areas of the wood too.

Sea Mere

A large natural lake surrounded by species rich fen, grazing levels and carr woodland.

Sample station 1 (TG034011)

Area of *Carex riparia* or *acutiformis* swamp with some *C. elata* tussocks. Now fairly open fen, though formerly scrubbed over with *Salix*, which was cleared in autumn of 1986. Wet throughout 1988, pitfalls therefore placed on tussocks.

Sample station 2 (TG036009)

Meadow formerly grazed by cattle though not during sample year (1988). Vegetation dominated by *Juncus subnodulosus*, *Carex* ? *disticha*, *Caltha palustris*, *Lotus uliginosus* and *Calammogrostis canescens*. Nearby ditch lined with *Carex elata* and *Cladium mariscus* separates the meadow from a dense area *Salix* carr/swamp.

Sheringham and Beeston Regis Commons

A site known to be of high entomological interest, in particular a number of nationally rare Diptera have been recorded, see Foster (1986). In addition, Mr K. Durrant has studied the site for many years, reporting a range of rare species.

Sample station 1 (TG164423)

Seepage flush area in central are of Common near stream valley. Traps deliberately hidden from public view within dense sward of *Juncus subnodulosus* and *Schoenus nigricans*, this vegetation is not necessarily typical, since many of the adjacent flush areas are more open with *Pinguicula vulgaris* and *Drosera rotundifolia*. Seepages wet throughout sampling during 1989. Area sampled has not been cut or managed in recent years.

Stallode Wash

Area of winter flooded wetland adjacent to the Little Ouse River. The vegetation ranges from seasonally flooded grassland, through a large area of mixed, tall fen to reedswamp, a number of large willows are present, mainly alongside old dykes.

Sample station 1 (TL675855)

Monodominant stand of *Glyceria maxima*. Deep and dense layer of vegetation litter. Floods during winter months, though dry during sample periods in summer of 1988.

Sample station 2 (TL675854)

Area of *Carex riparia* and *Glyceria maxima* dominated vegetation, just south of line of old willow trees. A few small puddles of water during first sample period in 1988, dry for remainder of summer. Unmanaged.

Strumpshaw RSPB Reserve

RSPB reserve situated on the flood plain of the River Yare and within the Yare Valley Marshes SSSI.

Sample station 1 (TG338064)

Herb rich fen meadow in compartment 30, sometimes grazed by cattle, and mown in most years for marsh hay during the late summer. The invertebrate traps were often damaged or destroyed by these forms of management. Sward dominated by various species of grass and the following species among the frequent species of dicots; *Thalictrum flavum, Filipendula ulmaria*, *Rhinanthus minor* and *Lotus uliginosus*.

Sample station 2 (TG331071)

Area of unmown, though some thinning of encroaching scrub has been carried out, species rich fen vegetation in compartment 5. Tussocks of *Carex elata* and *C. paniculata* are common though *Phragmites australis* dominates the tall vegetation. Among the nationally scarce plants in the compartment are; *Lysimachia vulgaris*, *Peucedanum palustre*, *Lathyrus palustris* and *Thelypteris palustris*. Frequently flooded between the tussocks.

Sample station 3 (TG336072)

Unmanaged area of *Glyceria maxima* dominated vegetation towards the southern end of compartment 80. The *G. maxima* dominates the vegetation almost to the total exclusion of other plant species; a few tall *Phragmites australis* stems persist, and low down some seedlings of *Urtica dioica* and *Epilobium hirsutum* are present. Sampled only in 1988 and 1989, since the compartment was inaccessible during 1990.

Sutton Broad Marshes

Sample station 1 (TG373234)

Area of fairly short fen vegetation dominated by *Carex* spp., principally *C. elata* and *C. lasiocarpa*, and *Juncus subnodulosus*. The area is frequently flooded and contains extensive bryophyte carpets throughout, other plant species recorded include; *Pedicularis palustris*, *Menyanthes trifoliata*, *Potentilla palustris* and *Utricularia* spp. Formerly managed by intermittent burning, vegetation was cut in the late summer of 1989 to control scrub invasion.

Sample station 2 (TG373235)

Frequently harvested reed bed which is exceptionally species rich in tall herbs, and located between station 1 & 3 some 30 metres away from Sutton Broad. Though dominated by *Phragmites australis*, the sward contains a number nationally scarce plant species which are of frequent occurrence here, eg *Sium latifolium*, *Cicuta virosa* and *Peucedanum palustre*. Other plants common in this reed bed include *Typha angustifolia*, *Carex pseudocyperus*, *Rumex hydrolapathum*, *Oenanthe fistulosa* and some *Carex elata* tussocks. Wheeler & Shaw (1987) consider this vegetation community as *Cicuto-Phragmitetum*, distinct from *Peucedano-Phragmitetum* which is widespread in the Broadland.

Sample station 3 (TG373235)

Band of tall, dense, unmanaged vegetation adjacent to Sutton Broad. Dominated by ferns (up to 1m tall), *Typha angustifolia*, *Eupatorium cannabinum*, *Impatiens capensis* and *Epilobium hirsutum*, some *Salix* bushes present also. Dense and deep mat of litter covering an almost permanently flooded floating hover vegetation.

Sample station 4 (TG367233)

Area of fen burnt in year prior to survey commencing, with dead and charred bushes of *Rhamnus catharticus* present near to trap line. *Calammogrostis canescens* dominated the vegetation during the first year of sampling, though in the subsequent two years *Phragmites australis*, *Salix repens* and *Myrica gale* became co-dominants. The vegetation was uncut during this invertebrate survey. This sample station is located in Middle Marsh which is some distance away from stations 1,2 and 3 that are much nearer to Sutton Broad.

Swangey Fen (Attleborough Poors Fen)

A detailed botanical survey was carried during 1980 and 1981 (Wheeler, Daglish & Morris 1981), this work also provides some management recommendations. The site contains an area of species rich , spring-fed vegetation of a type, otherwise restricted mainly to the Norfolk Broadland. Little management of the vegetation has been carried out in recent years, except for some scrub clearance during 1987 (MSC team), though historically the fen was cut for peat and mown for sedge (Wheeler & Shaw, 1987).

No invertebrate records, prior to this 1988 survey, have been traced for the site.

Sample station 1 (TM014934)

Until recently sedge bed scrubbed over with *Alnus glutinosa;* most of scrub removed in year prior to sampling. Invertebrate traps located in compartment 9 as given in Wheeler et. al. (1981) in open, scrub free, frequently flooded area between two baulks. Some regeneration of *Alnus* from cut stumps, though vegetation dominated by *Phragmites australis* and *Cladium mariscus*, some nationally scarce plant species also present, eg *Peucedanum palustre*. Drier areas, eg on the baulks, with *Calammogrostis canescens* dominating, *Solanum dulcamara* also frequent.

Thompson Common

Norfolk Naturalists' Trust reserve containing a large number of pingo pools which vary greatly in physical size, depth and vegetation structure. Some are enclosed within woodland others in open situations, some having had the surrounding trees recently cleared. The vegetation of the pools has been studied by Watts & Petch (1986).

Sample station 1 (TL937964)

Large pingo pool `a' located in grid square 63 as given in Watts & Petch 1986. Central area sampled and overwhelmingly dominated by *Phragmites australis*, with *Ranunculus lingua*, *Carex elata*, *Potentilla palustris*, *Galium palustre*, and *Hydrocharis morsus-ranae* also present. Surrounding margins of pingo containing a rich aquatic and emergent vegetation.

Sample station 2 (TL936963)

Large pingo pool. Pond `a' in grid square 62 as given in Watts & Petch 1986. Pond located in wooded area though trees and scrub in immediate vicinity have been cleared to reduce shading. A large pingo with classic zonation of marginal vegetation through to *Carex elata* swamp and *Cladium mariscus* swamp in central area. Traps located in central area of *C. mariscus*. Flooded throughout sample season of 1988.

Sample station 3 (TL935965)

Shallow pingo depression located in pony grazed meadow. Pond `a' in grid square 54 as given in Watts & Petch 1986. Marginal vegetation dominated by *Menyanthes trifoliata* with some *Hottonia palustris*. Central area with large *Carex elata* tussocks, *Eupatorium cannabinum* and *Ranunculus lingua* also present. Marginal areas grazed by ponies.

Upton Fen

A site comprising a spring fed Broad with adjacent areas of species-rich fen vegetation, fen carr and grazing levels. Much of the site is a Norfolk Naturalists' Trust Reserve

Known to be of high entomological interest particularly for Coleoptera and Diptera, eg the only recorded site in Britain for the fly *Platypalpus pygialis*, and one of only a few sites for two rare wetland beetles; *Quedius balticus* and *Lathrobium rufipenne*.

Sample station 1 (TG383137)

Annually mown fen cut during late summer, and the marsh hay raked off and deposited at the edge of nearby woodland, which surrounds this managed area. Herb rich fen dominated by *Carex elata* (including many large tussocks) and *Thelypteris palustris*. Other *Carex* spp. are present including *C. lasiocarpa*, *C. lepidopcarpa* and *C. panicea*. *Juncus subnodulosus* is also frequent and the herbs present include *Peucedanum palustre*, *Pedicularis palustris*, *Pyrola rotundifolia* and *Hydrocotyle vulgaris*. Bryophyte carpet almost covers the ground layer.

Sample station 2 (TG383138)

Mature *Alnus glutinosa* woodland with trees 10 metres or more in height, understorey vegetation approximately 1 metre tall and consisting mainly of *Dryopteris* ferns, *Eupatorium cannabinum*, *Filipendula ulmaria*, *Solanum dulcamara*, *Rubus* spp. and *Humulus lupulinus*.

Walberswick NNR

A large NNR located on the Suffolk coast comprising a wide variety of habitats including flood-plain mire containing one of the largest areas of reed bed in Britain, mixed carr woodland, acidic heathland, coastal shingle and saltmarsh/mudflats.

A site where invertebrates have been recorded in some detail, particularly the Lepidoptera and Diptera, and is noted for the occurrence of a number of nationally scarce species including many wetland rarities.

Sample station 1 (TM462732)

Small area of annually mown fen where the marsh hay is removed or burned, there is a pond within the compartment located not far from the invertebrate traps and the mown fen is surrounded by birch woodland and unmanaged reed bed. Though *Phragmites australis* is one of the dominant species, the plants are not very tall or vigorous in growth. There is a rich flora present including a varied bryophyte carpet, with the flowering plants present including; *Juncus subnodulosus*, *Apium nodiflorum*, *Lotus uliginosus* (often dominant), *Pedicularis palustris*, *Hydrocotyle vulgaris* and *Galium palustre*. This site is frequently flooded.

Sample station 2 (TM462733)

Unmanaged *Phragmites australis* swamp, permanently flooded. Some scrub development in the form of isolated bushes of *Salix*. The *P. australis* is very tall often in excess of 2.5 metres, with dead standing stems and living plants dominating the vegetation almost to the exclusion of other species. Other plants noted though at low frequency are *Apium nodiflorum*, *Carex pseudocyperus*, *Agrostis stolonifera* and *Lemna minor*. Due to the high water table pitfalls were not always set, though when possible were set in piles of naturally occurring reed litter.

Sample station 3 (TM485740)

Unmanaged bed of *Phragmites australis*, unlike station 2 above not permanently flooded and the reed is not so overwhelmingly dominant. Other plants recorded include *Eupatorium* *cannabinum*, *Rumex hydrolapathum*, *Epilobium hirsutum*, *Lycopus europaeus* and, perhaps the most distinctive feature of the site, a frequent occurrence of *Sonchus palustris*.

Sample station 4 (TM487738)

Commercially harvested reed bed cut annually and located near to the sea front. Vegetation dominated by tall, dense and vigorous growth of *Phragmites australis*, other plants present though usually only as a few scattered individuals include *Solanum dulcamara*, *Agrostis stolonifera* and very small plants of *Eupatorium cannabinum*. Site frequently floods, possibly with brackish water.

Sample station 5 (TM487737)

Phragmites australis bed adjacent to station 4 above, though not cut so frequently, eg was not harvested during winter of 1987/88, and the reed here is not so tall and robust as in station 4. *P. australis* dominates with *Agrostis stolonifera* common at ground level, there is also some *Scirpus maritimus* and *Galium aparine* near to the trap line, though only a few plants. This plot was both cut and burnt in the winter of 1988/89.

Wangford Carr

Sample station 1 (TL754834)

Formerly fen; large dead *Carex* tussocks present, site is now degraded and developing into *Quercus*/*Betula* woodland. Sample station located in small clearing within woodland/carr, *Phragmites australis* is dominant, though the growth is weak, *Calammogrostis canescens* also present. Dry during the sampling in 1988.

Wendling Poors Fen (Holly Farm Meadow)

Sample station 1 (TF935131)

Dry area of south facing meadow, sample station dominated by *Juncus subnodulosus*, *Angelica sylvestris* and *Eupatorium cannabinum*. Other areas of the sites nearer to the spring seepage are wetter and contain species such as *Schoenus nigricans*. Horse grazed (lightly) for at least fourteen years, though year of invertebrate sampling (1988) ungrazed. Hawthorn scrub is invading near to the trap line.

Whitwell Common

Very few invertebrate records known for the site prior to this survey, though the rare snail-killing fly *Antichaeta brevipennis* had been noted previously.

Sample station 1 (TG088205)

Invertebrate traps located in dry meadow just south of SSSI boundary in an area dominated by *Filipendula ulmaria* and *Inula dysenterica*, some adjacent areas are dominated by *Phalaris arundinacea*, there is also a derelict area of tall *Phragmites australis* vegetation nearby. Flora in sample area also includes *Epilobium hirsutum*, *Juncus subnodulosus* and

Equisetum telmateia. Meadow was probably grazed, or cut for hay in past years, though is currently unmanaged

Appendix 2 Values of environmental variables recorded at each sampling station

See EAFIS dataset section for explanation of environmental variables.

sample	YEAR	AREA	NVC	DOMV	HABST	MANAGE	MCYCLE	TCUT	TBURN	GRAZINT	LITDEP	LITCOV	FLOOD	WTABLE	DWATER	VEGHT
Badl1	89	Misc	M13	misc	flush	0	0	1	1	2	1	50	1	3	0	20
Boug1	88	Breck	S26	Car	fen	0	0	1	1	1	2	70	1	0	2	110
Bran1a	88	NN	S26	Phr	fen	0	0	1	1	1	2	100	2	2	2	165
Bran1b	89	NN	S26	Phr	fen	0	0	1	1	1	3	100	2	1	2	185
Bran2a	88	NN	S26	Phr	fen	0	0	1	1	1	2	100	3	2	1	200
Bran2b	89	NN	S26	Phr	fen	0	0	1	1	1	2	100	3	2	1	210
Bran3b	89	NN	S26	Phr	fen	0	0	1	1	1	2	80	2	0	1	210
Bure1a	88	Broad	S24	mixed	meadow	2	1	5	1	1	1	10	3	3	1	45
Bure1b	89	Broad	S24	mixed	meadow	2	1	5	1	1	1	35	3	2	1	40
Bure1c	90	Broad	S24	mixed	meadow	2	1	5	1	1	1	40	2	2	1	40
Bure2a	88	Broad	S24	Phr	fen/carr	0	0	1	1	1	2	90	3	3	1	150
Bure2b	89	Broad	S24	Phr	fen/carr	0	0	1	1	1	2	95	3	2	1	140
Bure2c	90	Broad	S24	Phr	fen/carr	0	0	1	1	1	3	90	2	2	1	135
Bure3a	88	Broad	S24	Clad	fen	1	4	5	1	1	1	70	3	3	1	75
Bure3b	89	Broad	S24	Clad	fen	1	4	4	1	1	1	80	2	2	1	100
Bure3c	90	Broad	S24	Clad	fen	1	4	3	1	1	2	80	2	2	1	105
Bure4a	88	Broad	S24	Clad	fen	1	4	5	1	1	2	80	3	3	1	150
Bure4b	89	Broad	S24	Clad	fen	1	4	4	1	1	3	71	2	2	1	132
Bure4c	90	Broad	S24	Clad	fen	1	4	3	1	1	3	77	2	2	1	137
Bure5a	88	Broad	S4	Phr	fen	2	1	5	3	1	1	5	3	4	1	200
Bure5b	89	Broad	S4	Phr	fen	2	1	5	2	1	1	10	3	3	1	192
Bure5c	90	Broad	S4	Phr	fen	2	1	5	2	1	1	12	3	3	1	165
Bure6a	88	Broad	S4	Phr	fen	1	1	4	1	1	1	60	3	3	1	120
Bure6b	89	Broad	S4	Phr	fen	1	2	5	1	1	1	65	2	2	1	145
Bure6c	90	Broad	S4	Phr	fen	1	1	4	1	1	2	100	2	2	1	90
Bure7c	90	Broad	W5	misc	carr	0	0	1	1	1	1	5	3	2	1	[1000]
Burg1	90	Broad	M22	mixed	meadow	2	2	4	1	2	1	5	2	1	1	40
Buxt1	89	Broad	M22	misc	flush	0	0	1	1	1	1	30	2	3	0	50
Catf1a	88	Broad	S24	Clad	fen	0	0	1	3	1	1		3	3	1	100

sample	YEAR	AREA	NVC	DOMV	HABST	MANAGE	MCYCLE	TCUT	TBURN	GRAZINT	LITDEP	LITCOV	FLOOD	WTABLE	DWATER	VEGHT
Catf1b	89	Broad	S24	Clad	fen	0	0	1	4	1	1	54	3	3	1	119
Catf1c	90	Broad	S24	Clad	fen	0	0	1	3	1	1	70	3	3	1	105
Catf2a	88	Broad	S24	misc	fen	0	3	1	1	1	3	70	3	4	0	155
Catf2b	89	Broad	S24	misc	fen	0	3	1	1	1	3	70	3	4	0	185
Catf2c	90	Broad	S24	misc	fen	1	3	5	1	1	2	75	3	3	0	55
Catf3a	88	Broad	S24	Clad	fen	2	3	4	3	1	2		3	3	1	75
Catf3b	89	Broad	S24	Clad	fen	2	3	3	3	1	2	68	3	3	1	140
Catf3c	90	Broad	S24	Clad	fen	2	3	5	2	1	2	83	3	3	1	82
Catf4a	88	Broad	S24	Clad	fen	2	3	5	1	1	1	10	4	4	0	15
Catf4b	89	Broad	S24	Clad	fen	2	3	4	1	1	1	20	4	4	0	77
Catf4c	90	Broad	S24	Clad	fen	2	3	3	1	1	1	22	3	3	0	97
Caud1	88	Breck	M22	mixed	meadow	1	1	5	1	1	1	5	1	2	1	30
Cave1	88	Breck	S25	misc	river	0	0	1	1	1	2	80	2	1	2	110
Chip1a	88	Misc	M22	mixed	fen	2	2	4.5	1	1	1		3	2	1	30
Chip1b	89	Misc	M22	mixed	fen	2	2	4.5	1	1	1	70	2	2	1	70
Chip1c	90	Misc	M22	mixed	fen	2	2	4.5	1	1	1	60	2	2	1	50
Chip2a	88	Misc	M22	misc	meadow	2	2	4.5	1	1			3	3	1	30
Chip2b	89	Misc	M22	misc	meadow	2	2	4.5	1	1	3	50	3	2	1	160
Chip2c	90	Misc	M22	misc	meadow	2	2	4.5	1	1	2	10	2	2	1	75
Chip3a	88	Misc	S4	Phr	fen	0	0	1	1	1		30	4	5	0	130
Chip3b	89	Misc	S4	Phr	fen	0	0	1	1	1	4	30	3	5	0	200
Chip3c	90	Misc	S4	Phr	fen	0	0	1	1	1	4	45	3	4	0	210
Chip4a	88	Misc	M24	misc	fen	2	2	4.5	1	3	1	10	1	1	1	30
Chip4b	89	Misc	M24	misc	fen	2	2	4.5	1	3	1	10	1	1	1	40
Chip4c	90	Misc	M24	misc	fen	2	2	4.5	1	3	1	10	1	1	1	30
Chip5a	88	Misc	S2	Clad	fen	2	4	5	1	1	2		2	3	1	133
Chip5b	89	Misc	S2	Clad	fen	2	4	4	1	1	2	90	2	2	1	175
Chip5c	90	Misc	S2	Clad	fen	2	4	3	1	1	2	90	1	2	1	180
Chip6a	88	Misc	S2	Clad	fen	2	4	2	1	1	2		2	3	1	95
Chip6b	89	Misc	S2	Clad	fen	2	4	5	1	1	3	99	2	2	1	150
Chip6c	90	Misc	S2	Clad	fen	2	4	4	1	1	2	99	1	2	1	145
Cran1	88	Breck	S1	Car	mire	0	0	1	1	1	1	5	4	5	0	75
Ders1	88	NN	M25	misc	mire	0	0	1	1	1	2	70	3	3	0	20
Ders2	88	NN	M21	misc	mire	0	0	1	1	1	1	0	4	3	0	10
EHar1	88	Breck	S1	Car	pingo	0	0	1	1	1	1	10	3	3	2	40

sample	YEAR	AREA	NVC	DOMV	HABST	MANAGE	MCYCLE	TCUT	TBURN	GRAZINT	LITDEP	LITCOV	FLOOD	WTABLE	DWATER	VEGHT
EWal1	89	Misc	S1	Car	pingo	0	0	1	1	3	1	30	3	3	2	40
Foul1	88	Breck	S1	Car	pingo	0	0	1	1	2	1	20	3	3	2	125
Foul2	88	Breck	S2	Clad	fen	0	0	1	1	2	2	30	3	3	2	190
Hick1a	88	Broad	M24	misc	meadow	2	1	5	1	2	1	30	2	2	1	25
Hick1b	89	Broad	M24	misc	meadow	2	1	5	1	2	1	50	1	1	1	28
Hick1c	90	Broad	M24	misc	meadow	2	1	5	1	2	1	30	1	1	1	20
Hick2a	88	Broad	S24	Clad	fen	0	4	1	1	1	2	85	3	3	1	130
Hick2b	89	Broad	S24	Clad	fen	1	4	5	1	1	2	85	2	2	1	75
Hick2c	90	Broad	S24	Clad	fen	1	4	4	1	1	2	90	2	2	1	105
Hick3a	88	Broad	S24	Clad	fen	2	4	3	1	1	1		3	3	1	130
Hick3b	89	Broad	S24	Clad	fen	2	4	2	1	1	1	65	2	2	1	27
Hick3c	90	Broad	S24	Clad	fen	2	4	5	1	1	1	70	2	2	1	75
Hick4a	88	Broad	S4	Phr	fen	2	1	5	1	1	1	40	3	4	0	130
Hick4b	89	Broad	S4	Phr	fen	2	1	5	1	1	1	30	3	3	1	140
Hick4c	90	Broad	S4	Phr	fen	2	1	5	1	1	1	35	2	3	1	75
Hick5a	88	Broad	S25	Phr	fen	0	0	1	1	1	3	95	2	2	1	160
Hick5b	89	Broad	S25	Phr	fen	0	0	1	1	1	3	95	1	1	1	165
Hick5c	90	Broad	S25	Phr	fen	0	0	1	1	1	4	100	1	1	1	180
Hick6b	89	Broad	S25	Phr	fen	1	2	5	1	1	1	58	1	1	1	43
Hick6c	90	Broad	S25	Phr	fen	1	2	4	1	1	1	28	1	1	1	76
Holt1	89	NN	M13	mixed	flush	1	0	5	1	1	2	50	2	2	0	50
Hopt1	89	Breck	S2	Clad	fen	0	0	1	1	1	3	100	3	2	2	120
Kenn1	88	Breck	S2	Phr	fen	2	4	1	1	1	1	10	2	1	1	75
Lake1	88	Breck	S25	mixed	ditch	0	0	1	1	1	1	0	2	1	2	30
MHar1	88	Breck	S1	misc	fen	0	0	1	1	1	1	1	3	3	2	25
Mill1a	88	Broad	S24	mixed	fen	2	1	5	1	1	1	20	3	4	1	45
Mill1b	89	Broad	S24	mixed	fen	2	1	5	1	1	1	25	3	3	1	25
MWes1	89	Breck	M22	mixed	fen	1	1	5	1	1	1	30	3	3	0	45
OBuc1	88	Breck	S4	Phr	fen	2	1	5	1	1	1	10	2	2	1	120
Pash1	88	Breck	M22	mixed	fen	0	0	1	1	4	1		2	1	2	50
Pott1	88	Misc	M13	mixed	flush	2	2	4.5	1	1	1	20	3	4	0	40
Pott2	88	Misc	S25	Phr	fen	0	0	1	1	1	5	100	3	3	1	175
Redg1	89	Misc	S25	Clad	fen	0	0	1	1	1	2	80	2	0	2	80
Reed1a	88	Broad	S24	Phr	fen	0	0	1	1	1	1	10	6	5	0	120
Reed1b	89	Broad	S24	Phr	fen	0	0	1	1	1	1	15	5	5	0	142

sample	YEAR	AREA	NVC	DOMV	HABST	MANAGE	MCYCLE	TCUT	TBURN	GRAZINT	LITDEP	LITCOV	FLOOD	WTABLE	DWATER	VEGHT
Reed1c	90	Broad	S24	Phr	fen	1	1	5	1	1	1	35	5	4	0	132
Reed2a	88	Broad	S24	Phr	fen	1	2	5	1	1	1	20	5	4	1	95
Reed2b	89	Broad	S24	Phr	fen	1	2	4	1	1	1	70	4	3	1	152
Reed2c	90	Broad	S24	Phr	fen	1	3	5	1	1	2	90	4	3	1	108
Reed3a	88	Broad	S4	Phr	fen	2	1	5	1	1			4	3	1	112
Reed3b	89	Broad	S4	Phr	fen	2	2	4	1	1	2	62	3	2	1	190
Reed3c	90	Broad	S4	Phr	fen	2	1	5	1	1	2	65	2	2	1	110
Reed4a	88	Broad	S24	Phr	fen	0	0	1	1	1			6	5	0	250
Reed4b	89	Broad	S24	Phr	fen	0	0	1	1	1	2	65	6	5	0	230
Reed4c	90	Broad	S24	Phr	fen	0	0	1	1	1	4	92	6	5	0	225
Reed5b	89	Broad	S24	Phr	fen	1	1	5	1	1	2	30	4	3	2	136
Reed5c	90	Broad	S24	Phr	fen	1	2	4	1	1	2	67	3	3	2	192
RoyC1	88	NN	M2	misc	mire	0	0	1	1	1	1	0	4	4	0	10
RoyC2	88	NN	M13	Clad	fen	0	0	1	1	1	3	80	3	3	1	110
RoyC3	88	NN	M13	mixed	mire	0	0	1	1	1	2	30	3	4	1	25
RoyF1	89	Misc	S25	misc	fen/carr	0	0	1	1	1	1		4	2	2	115
Scou1	88	Breck	x	misc	carr	0	0	1	1	1	2	70	3	3	1	75
SeaM1	88	Breck	S1	Car	fen	0	0	1	1	1	1	1	4	4	0	115
SeaM2	88	Breck	M22	mixed	meadow	0	0	1	1	2	1	20	2	1	1	50
Sher1	89	NN	M13	mixed	flush	0	0	1	1	1	1	10	1	2	0	50
Stal1	88	Breck	S5	misc	river	0	0	1	1	1	5	100	2	1	2	35
Stal2	88	Breck	S6	misc	river	0	0	1	1	1	3	100	2	1	2	70
Stru1a	88	Broad	M22	mixed	meadow	2	1	5	1	2	1	1	2	2	1	70
Stru1b	89	Broad	M22	mixed	meadow	2	1	5	1	2	1	5	2	1	1	65
Stru1c	90	Broad	M22	mixed	meadow	2	1	5	1	2	1	1	2	1	1	50
Stru2a	88	Broad	S24	Phr	fen	0	0	1	1	1	2	30	3	4	1	155
Stru2b	89	Broad	S24	Phr	fen	0	0	1	1	1	2	25	3	3	1	165
Stru2c	90	Broad	S24	Phr	fen	0	0	1	1	1	2	35	3	3	1	195
Stru3a	88	Broad	S5	misc	fen	0	0	1	1	1	1	80	3	3	1	100
Stru3b	89	Broad	S5	misc	fen	0	0	1	1	1	2	90	2	2	1	250
Sutt1a	88	Broad	S24	Car	fen	0	0	1	2	1	1	10	5	3	1	70
Sutt1b	89	Broad	S24	Car	fen	1	1	5	2	1	1	5	5	3	1	40
Sutt1c	90	Broad	S24	Car	fen	1	2	4	2	1	1	10	4	3	1	35
Sutt2a	88	Broad	S24	Phr	fen	2	1	5	1	1	1	5	5	4	1	110
Sutt2b	89	Broad	S24	Phr	fen	2	1	5	1	1	1	10	5	4	1	160

sample	YEAR	AREA	NVC	DOMV	HABST	MANAGE	MCYCLE	TCUT	TBURN	GRAZINT	LITDEP	LITCOV	FLOOD	WTABLE	DWATER	VEGHT
Sutt2c	90	Broad	S24	Phr	fen	2	1	5	1	1	1	5	5	2	1	138
Sutt3a	88	Broad	S25	misc	fen	0	0	1	1	1	5	90	6	5	0	155
Sutt3b	89	Broad	S25	misc	fen	0	0	1	1	1	5	80	6	5	0	210
Sutt3c	90	Broad	S25	misc	fen	0	0	1	1	1	5	90	6	5	0	142
Sutt4a	88	Broad	S25	misc	fen	0	0	1	4	1	1	80	5	3	1	160
Sutt4b	89	Broad	S25	Phr	fen	0	0	1	3	1	2	90	4	3	1	135
Sutt4c	90	Broad	S25	Phr	fen	0	0	1	3	1	2	90	3	2	1	150
Swan1	88	Breck	S24	misc	fen	1	4	5	1	1	3	70	3	3	1	100
Thom1	88	Breck	S4	Phr	pingo	0	0	1	1	1	1	0	4	5	1	200
Thom2	88	Breck	S2	Clad	pingo	0	0	1	1	1	1	0	4	5	0	220
Thom3	88	Breck	S1	Car	pingo	0	0	1	1	2	1	0	4	5	1	90
Upto1	90	Broad	S24	Car	fen	2	1	5	1	1	1	23	4	2	1	36
Upto2	90	Broad	W5	misc	carr	0	0	1	1	1	1	21	4	2	1	80
Walb1a	88	Misc	M22	mixed	fen	1	1	5	1	1	1	5	4	4	1	50
Walb1b	89	Misc	M22	mixed	fen	1	1	5	1	1	1	10	4	4	1	43
Walb1c	90	Misc	M22	mixed	fen	1	1	5	1	1	1	10	4	4	1	50
Walb2a	88	Misc	S4	Phr	fen	0	0	1	1	1	3	50	6	5	0	210
Walb2b	89	Misc	S4	Phr	fen	0	0	1	1	1	3	60	6	5	0	250
Walb2c	90	Misc	S4	Phr	fen	0	0	1	1	1	3	60	6	5	0	280
Walb3a	88	Misc	S25	Phr	fen	0	0	1	1	1	1	90	4	3	1	150
Walb3b	89	Misc	S25	Phr	fen	0	0	1	1	1	1	90	3	2	1	163
Walb3c	90	Misc	S25	Phr	fen	0	0	1	1	1	1	85	3	2	1	140
Walb4a	88	Misc	S4	Phr	fen	2	1	5	1	1	1	10	4	3	1	125
Walb4b	89	Misc	S4	Phr	fen	2	1	5	1	1	1	40	4	2	1	250
Walb4c	90	Misc	S4	Phr	fen	2	1	5	1	1	1	10	2	1	1	170
Walb5a	88	Misc	S4	Phr	fen	2	2	4	1	1	2	90	4	3	1	150
Walb5b	89	Misc	S4	Phr	fen	2	1	5	4	1	2	90	3	2	1	130
Walb5c	90	Misc	S4	Phr	fen	2	1	5	3	1	1	76	2	1	1	105
Wang1	88	Breck	S26	Phr	carr	0	0	1	1	1	2	60	1	1	2	90
Wend1	88	Misc	M22	mixed	meadow	0	0	1	1	2	1	20	1	0	2	75
Whit1	89	Misc	M27	mixed	meadow	0	0	1	1	1	1	80	1	0	2	55

Appendix 3 Project records of trapping schedules and sample processing

Badley Moor

Two trapping periods: 31/5-14/6/89, 28/8-7/9/89. All traps sorted. Preservative colour CLEAR.

Species identification from the samples is completed for Mollusca (slugs & snails), Diplopoda (millipedes), Hemiptera (bugs), some families of Diptera (flies); Tipulidae, Stratiomyidae, Sphaeroceridae, Sciomyzidae, Syrphidae and Scathophagidae; Lepidoptera (moths) larvae, Coleoptera (beetles), Isopoda (woodlice), Opiliones (harvestmen) and Araneae (spiders).

Boughton Fen

Two trapping periods: 10/6-8/7/88, 23/8-5/9/88. All traps sorted. Preservative colour YELLOW.

Identification has been completed for the following groups: Mollusca (snails), Hemiptera (bugs), some families of Diptera (flies); Tipulidae, Mycetophilidae, Stratiomyidae, Sciomyzidae, Sphaeroceridae, Syrphidae and Pipunculidae, also Opiliones (harvestmen) and Araneae (spiders).

Brancaster

Stations 1,2 sampled only during 1988; 17/6-1/7/88, 1-15/7/88, 15/7-2/9/88 (station 1 water trap on stake only), 2-16/9/88, 16/9-28/10/88. All 1988 samples sorted. Stations 1,2,3 during 1989; 14-28/6/89 (sorted), 28/6-12/7/89 (not sorted), 24/8-7/9/89 (sorted), 7-21/9/89 (not sorted). Preservative colour YELLOW,BLUE at stations 1,2; CLEAR at station 3.

Identification of specimens from the samples is completed for both years within the following groups; Hemiptera (bugs), some families of Diptera (flies); Tipulidae, Dixidae, Stratiomyidae and Sciomyzidae; Isopoda (woodlice), Opiliones (harvestmen) and Araneae (spiders). Identification for specimens collected in the 1988 samples only is complete within Diplopoda (millipedes), some Diptera (flies) families; Mycetophilidae, Sphaeroceridae, Lonchopteridae, Dolichopodidae and Empidae; Coleoptera (beetles). All hoverflies collected during 1989 have been identified. In addition to the standardised water and pitfall trapping programme, some litter samples were taken on 10/1/89. Mollusca (snails) and Coleoptera (beetles) have been identified from these samples. Light trapping for Lepidoptera was also carried out on 12/7/1989.

Bure Marshes NNR (Woodbastwick)

As one of the long term sites investigated, samples were taken throughout much 1988 and 1989, though the autumn, winter, early spring and some of the summer samples have not yet been sorted or identified. The trapping periods were as follows, with those sample which have sorted marked accordingly. During 1988; 6-20/6/88 (sorted), 20/6-4/7/88 (sorted), 4/7-

5/8/88, 5-19/8/88 (sorted), 19/8-11/10/88, 11/10-5/12/88. During 1989; 5/12/88-12/4/89, 5-19/6/89 (sorted), 19/6-3/7/89, 17-31/8/89 (sorted), 31/8-13/9/89, 13/9-13/10/89, 13/10-9/11/89, 9/11-7/12/89. During 1990; 7/12/89-4/1/90, 4/1-26/4/90, 26/4-7/6/90, 7-21/6/90 (sorted), 21/6-5/7/90, 16-30/8/90 (sorted). Preservative colour YELLOW,BLUE/CLEAR at stations 1 to 6; CLEAR at station 7.

Burgh Common

Three sample periods: 12-26/6/90, 26/6-10/7/90, 23/8-6/9/90. All pitfall traps sorted, though the water traps from the second and third trapping periods are wholly unsorted, and those from the first trapping period only have target groups removed; Hemiptera, Coleoptera, Diptera (Tipulidae, Sciomyzidae), Isopoda, Opiliones and Araneae. Preservative colour CLEAR.

Species identification is complete for Hemiptera (bugs), some Diptera (flies). Isopoda (woodlice), Opiliones (harvestmen) and Araneae (spiders), have been determined from the earliest trapping period. Some Hymenoptera (Sphecidae) have been identified

Buxton Heath

Two trapping periods: 26/5-9/6/89, 27/8-6/9/89. All traps sorted. Preservative colour CLEAR.

Species identification is completed for Hemiptera, Diptera (Tipulidae, Mycetophilidae, Syrphidae, Sciomyzidae), Lepidoptera, Isopoda, Opiliones and Araneae. Coleoptera have been identified from the first trapping period only.

Catfield Fens

Samples were taken throughout most of the latter half of 1988 including the autumn and winter, though sampling was restricted to the summer months in subsequent years. Nearly all samples have been sorted to some degree. 1988 samples, all sorted; 7-21/6/88, 21/6-5/7/88, 5/7-12/8/88, 12-26/8/88 and 26/8/-29/9/88 (station 4 only), 29/9-13/10/88, 13/10-13/12/88. 1989 samples; 13/12/88-22/5/89, 22/5-6/6/89, 6-20/6/89 (sorted), 20/6-4/7/88 (sorted), 16-30/8/89 (sorted0, 30/8-13/9/89. 1990 samples; 6-20/6/90 (sorted), 20/6-4/7/90 (target groups only removed), 17-31/8/90 (target groups only removed). Preservative colour YELLOW,BLUE/CLEAR.

Caudlesprings

Three sample periods: 8-22/6/88, 22/6-6/7/88, 2-16/9/88. Catches from first and third trapping periods sorted, those from 22/6-6/7/88 remain unexamined. Preservative colour YELLOW, BLUE.

Species identification is complete for Diplopoda, Hemiptera, Diptera (Tipulidae, Dixidae, Mycetophilidae, Stratiomyidae, Rhagionidae, Syrphidae, Sciomyzidae, Sphaeroceridae), Lepidoptera, Isopoda, Opiliones and Araneae. Flies in the family Dolichopodidae have been identified from the first trapping period only.

Cavenham Heath NNR (Tuddenham Fen)

Three trapping periods: 10-24/6/88, 24/6-14/7/88, 23/8-5/9/88. Catches from first and third trapping dates are sorted, those from 24/6-14/7/88 remain unexamined. Note that this unsorted trap run exceeds the standard fourteen day period used throughout most of the survey. Preservative colour YELLOW.

Species identification from the sorted samples is complete for Hemiptera, Diptera (Tipulidae, Dixidae, Mycetophilidae, Syrphidae, Sciomyzidae, Sphaeroceridae, Scathophagidae), Hymenoptera (Symphyta), Isopoda, Opiliones and Araneae. Mollusca, Diplopoda, Coleoptera and Diptera (Dolichopodidae) have been identified from the first trapping period only.

Chippenham Fen

Samples were taken throughout the latter half of 1988 including the autumn and winter, though in subsequent years sampling was restricted to the summer months. Only some of the summer samples have been sorted at this stage. 1988 samples; 2-16/6/88 (sorted), 16/6-3/7/88, 3/7-10/8/88, 10-24/8/88 (sorted), 24/8-12/10/88, 12/10-9/12/88. 1989 samples; 2-16/6/89 (sorted), 16-30/6/89 (sorted), 18/8-1/9/89 (sorted), 1-20/9/89. 1990 samples, all sorted; 4-18/6/90, 18/6/-2/7/90, 22/8-5/9/90. Preservative colour YELLOW, BLUE/CLEAR.

Cranberry Rough

Three trapping periods: 14-28/6/88, 28/6-12/6/88, 12-26/9/88. Catches from first and third trapping periods sorted, those from 28/6-12/6/88 remain unexamined. Preservative colour YELLOW, BLUE.

Species identification is complete for Hemiptera, Diptera (Tipulidae, Dixidae, Mycetophilidae, Stratiomyidae,. Syrphidae, Sciomyzidae, Sphaeroceridae, Scathophagidae), Opiliones and Araneae. Dolichopodidae have been identified from the first and Coleoptera from the second trapping period.

Dersingham Bog

Four trapping periods at both stations: 20-30/6/88, 30/6-18/7/88, 18/7-2/9/88 (water trap on stake only at both stations), 2/9-26/10/88. These trapping periods were not of the standard fourteen days used throughout most of the survey, due to restricted access. Catches from first and last trapping periods are sorted, others remain unexamined. Preservative colour YELLOW,BLUE.

Species identification from the samples is complete for Hemiptera, Diptera (Trichoceridae, Tipulidae, Ptychopteridae, Mycetophilidae, Syrphidae, Sciomyzidae, Sphaeroceridae, Scathophagidae), Isopoda, Opiliones and Araneae. Light trapping for Lepidoptera was carried at stations 1 on a number of occasions during 1988 and 1989.

East Harling Common

Three trapping periods: 14-28/6/88, 28/6-12/7/88, 1-15/9/88. Catches from first and third trapping periods sorted, those from 28/6-12/7/88 remain unexamined. Preservative colour YELLOW.

Species identification from the samples is complete for Hemiptera, Diptera (Tipulidae, Mycetophilidae, Syrphidae, Sciomyzidae, Sphaeroceridae, Scathophagidae), Isopoda, Opiliones and Araneae. Coleoptera and flies of the family Dolichopodidae have been identified from the first trapping period only. In addition, Jane Breach and David Feather operated an actinic light trap for Lepidoptera at this site on three separate dates during August and September 1988.

East Walton Common

Two trapping periods: 31/5-14/6/89, 24/8-9/9/89. All trap catches sorted. Preservative colour CLEAR.

Species identification from the samples is complete for Hemiptera, Diptera (Tipulidae, Dixidae, Larger Brachycera, Syrphidae, Sciomyzidae, Sphaeroceridae, Scathophagidae), Isopoda, Opiliones and Araneae. Coleoptera have been identified from the first trapping period only.

Foulden Common

Two trapping periods: 10/6-8/7/88, 23/8-5/9/88. Note first trapping period was of approximately four weeks, exceeding the usual fourteen day period for this survey. All trap catches sorted. Preservative colour YELLOW.

Hickling Broad NNR

As one of the long term sites under investigation, samples were taken throughout most of the 1988 and 1989, though many samples are at this stage unsorted. All sample periods are detailed below with those sorted marked accordingly. 1988 samples; 9-23/6/88 (sorted), 23/6-7/7/88 (sorted), 7/7-8/8/88, 8-22/8/88 (sorted), 22/8-14/10/88, 14/10-8/12/88. 1989 samples; 8/12/88-22/5/89, 22/5-22/6/89, 8-22/6/89 (sorted), 22/6-6/7/89 (sorted), 21/8-4/9/89 (sorted), 4-18/9/89, 18/9-16/10/89, 16/10-13/11/89, 13/11-11/12/89. 1990 samples; 11/12/89-8/1/90, 8/1-30/4/90, 30/4-5/6/90, 5-19/6/90 (sorted), 19/6-3/7/90 (sorted), 15-29/8/90 (sorted), station 1 not sampled during this last trapping period. Preservative colour YELLOW,BLUE/CLEAR.

Species identification from the samples is complete for Hemiptera, Diptera (Tipulidae, Mycetophilidae, Syrphidae, Sciomyzidae, Sphaeroceridae, Scathophagidae), Isopoda, Opiliones and Araneae. Coleoptera have been identified from the early June and August trapping periods for all three years. Dolichopodidae have been identified from 1988 only, and Sphaeroceridae from 1988 and 1989.

Holt Lowes

Two trapping periods: 26/5-9/6/89, 23/8-6/9/89. All trap catches sorted. Preservative colour CLEAR.

Species identification from the samples is complete for Hemiptera, Diptera (Tipulidae, Mycetophilidae, Larger Brachycera, Syrphidae, Sciomyzidae), Isopoda, Opiliones and Araneae.

Hopton Fen

Two trapping periods: 24/5-7/6/89, 25/8-8/9/89. All trap catches sorted. Preservative colour CLEAR.

Species identification from the samples is completed for Hemiptera, Diptera (Tipulidae, Mycetophilidae, Larger Brachycera, Syrphidae, Sciomyzidae, Scathophagidae), Isopoda, Opiliones and Araneae.

Kenninghall Fen (Banham Great Fen)

Three trapping periods: 14-28/6/88, 28/6-12/7/88, 31/8-14/9/88. All trap catches sorted. Preservative colour YELLOW.

Lakenheath Poors Fen

Three trapping periods:10-24/6/88, 24/6-8/7/88, 30/8-13/9/88. All trap catches sorted. Preservative colour YELLOW.

Species identification from the samples is completed for Diplopoda, Hemiptera, Diptera (Tipulidae, Mycetophilidae, Sciaridae, Larger Brachycera, Syrphidae, Sciomyzidae, Sphaeroceridae, Scathophagidae), Hymenoptera (Symphyta, Apidae), Isopoda, Opiliones and Araneae. Flies of the family Dolichopodidae have been identified from the first trapping period only.

Market Weston Fen

Two trapping periods: 24/5-7/6/89, 25/8-8/9/89. To comply with the owners wishes traps were emptied at seven day intervals within the above periods. These catches were later amalgamated to obtain the standard fourteen day trapping periods used throughout most of the survey. All traps sorted. Preservative colour CLEAR.

Species identification from the samples is complete for Hemiptera, Diptera (Tipulidae, Dixidae, Mycetophilidae, Larger Brachycera, Syrphidae, Sciomyzidae, Sphaeroceridae), Isopoda, Opiliones and Araneae. Mollusca have been identified from the first trapping period. No Coleoptera have as yet been identified from the traps.

Middle Harling Fen

Three trapping periods: 14-28/6/88, 28/6-12/7/88, 1-15/9/88. All trap catches sorted. Preservative colour YELLOW.

In addition to the standardised pitfall and water trapping techniques, Jane Breach and David Feather operated a actinic light trap for Lepidoptera at this site during the late summer of 1988.

Mill's Marsh, Ransworth

Four sample periods during 1988: 13-27/6/88, 27/6-13/7/88, 13/7-11/8/88, 11/8-5/9/88 (2 pitfalls missing). All trap catches sorted. Three sample periods during 1989: 12-26/6/89, 26/6-10/7/89 (2 pitfalls missing), 17-31/8/89. All trap catches sorted. Preservative colour YELLOW,BLUE/CLEAR.

Old Buckenham Fen

Three trapping periods: 14-28/6/88, 28/6-12/7/88, 31/8-14/9/88. All trap catches sorted. Preservative colour YELLOW.

Pashford Poors Fen

Three trapping periods: 10-24/6/88, 24/6-8/7/88, 30/8-13/9/88. All trap catches sorted. Preservative colour YELLOW.

Potter and Scarning Fens

Four trapping periods run simultaneously at both stations: 8-22/6/88, 22/6/-6/7/88, 6/7-2/9/88 (two water traps on ground only at station 1, water trap on stake and one on ground at station 2), 1-15/9/88. In order to make station 1 as inconspicuous as possible at this public site, two water traps on the ground were used ie no water trap on a stake. All trap catches sorted. Preservative colour YELLOW.

Redgrave and Lopham Fens

Two trapping periods: 30/5-13/6/89, 25/8-8/9/89. All trap catches sorted. Preservative colour CLEAR.

Reedham Marshes

As one of the long term sites under investigation samples were taken throughout much of 1988, though in subsequent years sampling was restricted to the summer months. Nearly all samples have been sorted to some degree. 1988 samples, all are sorted; 13-27/6/88, 27/6-11/7/88, 11/7-12/8/88, 12-26/8/88, 26/8-27/10/88, 27/10-7/12/88. 1989 samples; 12-26/6/89 (sorted), 26/6-10/7/89 (sorted), 22/8-5/9/89 (sorted), 5-19/9/89. 1990 samples, target groups removed from all samples, but not fully sorted; 11-25/6/90, 25/6-9/7/90, 20/8-3/9/90. Preservative colour YELLOW, BLUE/CLEAR

Roydon Common

Three trapping periods run simultaneously at all three stations: 8-22/6/88, 22/6-6/7/88, 12-26/9/88. Catches from first and third trapping dates are sorted, those taken during 22/6-6/7/88 remain unexamined. Preservative colour YELLOW.

Roydon Fen, Diss

Two trapping periods: 30/5-13/6/89, 25/8-8/9/89. All traps sorted. Preservative colour CLEAR.

Scoulton Mere

Three trapping periods: 8-22/6/88, 22/6-6/7/88, 28/9-12/10/88. traps from first and third trapping periods sorted, those from 22/6-6/7/88 remain unexamined. The autumn trapping period was much later in the year than at most other sites sampled in the project. Preservative colour YELLOW.

Sea Mere

Four trapping periods run simultaneously at both stations: 8-22/6/88, 22/6-6/7/88, 6/7-2/9/88 (water trap on stake only at both stations), 2-16/9/88. All trap catches sorted. Preservative colour YELLOW.

Sheringham and Beeston Regis Commons

Two trapping periods: 26/5-9/6/89, 23/8-6/9/89. All trap catches sorted. Preservative colour CLEAR.

Stallode Wash

Three trapping periods at both stations run simultaneously: 10-24/6/88, 24/6-8/7/88, 13-27/9/88. All trap catches sorted. Preservative colour YELLOW.

Identification is complete for Mollusca, Hemiptera, some Diptera (Tipulidae, Mycetophilidae, Stratiomyidae, Sphaeroceridae, Sciomyzidae, Syrphidae, Scathophagidae), Isopoda, Opiliones and Araneae. Most Dolichopodidae have also been identified.

Strumpshaw RSPB Reserve

As one of the long term sites under investigation samples were taken throughout the latter half of 1988 including the autumn and winter, though in subsequent years sampling was restricted to the summer months. Only summer samples have been sorted. 1988 samples; 13/6-11/7/88 (sorted), 11/7-15/8/88, 15/8-5/9/88 (sorted), 5/9-7/10/88, 7/10-7/12/88. 1989 samples; 7/12/88-23/5/89, 23/5-13/6/89, 13-27/6/89 (sorted), 27/6-11/7/89 (sorted), 22/8-5/9/88 (sorted), 5-19/9/89 (station 2 only sorted). 1990 samples, stations 1 and 2 only; 12-26/6/90 (sorted), 26/6-10/7/90 (sorted), 23/8-6/9/90 (sorted, only station 2 sampled). Preservative colour YELLOW, BLUE/CLEAR.

Sutton Broad Marshes

Samples were taken throughout much of the latter half of 1988 including the autumn and winter, though in subsequent years sampling was restricted to the summer months. Only summer samples have been sorted at this stage. 1988 samples; 9-23/6/88 (sorted), 23/6-7/7/88 (only station 1 sorted), 7/7/-4/8/88, 4-18/8/88 (sorted), 18/8-25/10/88, 25/10-8/12/88. 1989 samples; 8/12/88-22/5/89, 22/5-8/6/89, 8-22/6/89 (sorted), 22/6-6/7/89 (sorted), 21/8-4/9/89 (sorted), 4-18/9/89. 1990 samples; 8-22/6/90 (sorted), 22/6-6/7/90 (sorted), 17-31/8/90 (sorted). Preservative colour YELLOW, BLUE/CLEAR

Swangey Fen (Attleborough Poors Fen)

Three trapping periods: 14-28/6/88, 28/6-14/7/88, 31/8-14/9/88. All traps sorted to Order. Preservative colour YELLOW, BLUE.

Species identification has been completed for Hemiptera (bugs), some families of Diptera (flies); Tipulidae, Ptychopteridae, Dixidae, Mycetophilidae, Stratiomyidae, Syrphidae, Sphaeroceridae, Sciomyzidae and Scathophagidae. All Isopoda (woodlice), Opiliones (harvestmen) and Araneae (spiders) are also identified. Identification is incomplete for some species groups, however, those records available are included in the accompanying species list. For example, Coleoptera (beetles) and Mollusca (snails) have only been identified from the first and last trapping dates whilst flies belonging to the family Dolichopodidae have only been determined from the first trapping period.

Thompson Common

Three trapping periods run simultaneously at all stations: 10-24/6/88, 24/6/-8/7/88, 13-27/9/88. Catches from the first and third trapping periods sorted, those from 24/6-8/7/88 remain unexamined. Preservative colour YELLOW.

Species identification is complete for Hemiptera, Diptera (Tipulidae, Mycetophilidae, Dixidae, Stratiomyidae, Sciomyzidae, Sphaeroceridae, Scathophagidae), Symphyta, Opiliones and Araneae. Mollusca are only determined from stations 2 and 3, and Syrphidae only from stations 1 and 2.

Upton Fen

Three trapping periods run simultaneously at both stations: 7-21/6/90, 21/6-5/7/90, 16-30/8/90. All pitfall traps have been sorted, though water traps from all trapping periods only have target groups removed (Hemiptera, Coleoptera, some Diptera, Isopoda, Opiliones and Araneae). Preservative colour CLEAR.

Species identification from the samples is complete for Hemiptera, Diptera (Tipulidae, larger Brachycera, Sciomyzidae), Hymenoptera (Eumenidae, Sphecidae). Some identification has been carried out for other groups and all available records are included in the species list.

Walberswick NNR

Samples were taken throughout the latter half of 1988 including the autumn and winter, however, sampling was restricted to the summer months in subsequent years. Only some of the summer time samples have been sorted at this stage. 1988 samples; 1-15/6/88 (sorted), 15-29/6/88 (only station 1 sorted), 29/6-27/7/88, 27/7-11/8/88, 11-25/8/88 (sorted), 25/8-10/10/88, 10/10-6/12/88. 1989 samples; 1-15/6/89 (sorted), 15-29/6/89 (sorted), 14-29/8/89 (sorted), 29/8-12/9/89. 1990 samples; 1-15/6/90 (only target groups removed), 15-29/6/90 (sorted), 14-29/8/90 (only target groups removed). Preservative colour YELLOW,BLUE/CLEAR.

Wangford Carr

Three trapping periods: 10-24/6/88, 24/6-8/7/88, 30/8-13/9/88. Trap catches from first and third trapping periods have been sorted, those from 24/6-8/7/88 remain unexamined. Preservative colour YELLOW.

Wendling Poors Fen (Holly Farm Meadow)

Three trapping periods: 8-22/6/88, 22/6-6/7/88, 14-28/9/88. Catches from the first and third trapping dates have been sorted, those from 22/6-6/7/88 remain unexamined. Preservative colour YELLOW.

Whitwell Common

Two sample periods: 26/5-9/6/89, 22/8-6/9/89. All trap catches sorted. Preservative colour CLEAR.

Appendix 4 Full species list recorded during project

The species in this list were identified over ten years ago. Species nomenclature in the beetle families Carabidae, Dytiscidae and Staphylinidae has been updated to conform to modern usage, but this has not been attempted in other families. A small number of species names in the Diptera are in non-standard binomial format, but are as supplied by the relevant taxonomic specialist. The beetle names appearing in square brackets have not been identified by an approptiate taxonomic specialist and require confirmation.

In the following lists, St = number of specimens caught by standard sampling methods (pitfall traps and water traps) and non-St = number of species caught at light, in leaf letter and by casual collecting.

Species	St	non-St
Amphipoda Crangonyctidae		
Crangonyx pseudogracilis Bousfield	6	
Araneae Araneidae		
Araneus diadematus Clerck	4	
A. marmoreus Clerck		1
A. quadratus Clerck	6	
Araniella cucurbitina (Clerck)		2
A. opistographa (Kulczynski)	1	
Larinioides cornutus (Clerck)	3	1
Mangora acalypha (Walckenaer)		1
Araneae Argyronetidae		
Argyroneta aquatica (Clerck)	12	2
Araneae Clubionidae		
Cheiracanthium erraticum (Walckenaer)	2	
C. virescens (Sundevall)	1	
Clubiona brevipes Blackwall	2	
C. compta Koch C.L.	2	
C. diversa O. P.-Cambridge	5	
C. juvenis Simon	158	2
C. lutescens Westring	21	
C. neglecta Cambridge O.P.	2	
C. phragmitis C.L. Koch	1070	4
C. reclusa Cambridge O.P.	82	1
C. rosserae Locket	1	
C. stagnatilis Kulczynski	230	3
C. subtilis L. Koch	80	2
C. trivialis Koch C.L.	3	
Araneae Dictynidae		
Dictyna arundinacea (Linnaeus)		3
Lathys humilis (Blackwall)	1	
Araneae Gnaphosidae		
Drassodes cupreus (Blackwall)	4	
Haplodrassus signifer (Koch C.L.)	7	
Micaria pulicaria (Sundevall)	2	
Zelotes latreillei (Simon)	8	
Araneae Hahniidae		
Antistea elegans (Blackwall)	1256	1
Hahnia helveola Simon	2	
H. montana (Blackwall)	1	

Species	St	non-St
Araneae Linyphiidae		
Agyneta decora (O. P.-Cambridge)	21	1
A. ramosa Jackson	18	
A. subtilis (O. P.-Cambridge)	2	
Allomengea scopigera (Grube)	2	
Allomengea vidua (L. Koch)	482	
Aphileta misera (O. P.-Cambridge)	21	
Araeoncus crassiceps (Westring)	61	
A. humilis (Blackwall)	1	
Baryphyma gowerense (Locket)	7	2
B. trifrons (O. P.-Cambridge)	172	9
Bathyphantes approximatus (O. P.-Cambridge)	489	2
B. gracilis (Blackwall)	1985	6
B. nigrinus (Westring)	1	
B. parvulus (Westring)	94	1
B. setiger O. P.-Cambridge	6	
Carorita paludosa Duffey	3	
Centromerus dilutus (O. P.-Cambridge)	1	
C. incultus Falconer	1	
C. sylvaticus (Blackwall)	1	
Ceratinella brevipes (Westring)	205	
C. brevis (Wider)	9	
C. scabrosa (O. P.-Cambridge)	2	
Cnephalocotes obscurus (Blackwall)	7	
Dicymbium nigrum (Blackwall)	5	
D. tibiale (Blackwall)	1	
Diplocephalus cristatus (Blackwall)	16	
D. permixtus (O. P.-Cambridge)	1	
Diplocephalus picinus (Blackwall)	3	
Diplostyla concolor (Wider)	2	
Dismodicus bifrons (Blackwall)	40	
Donacochara speciosa (Thorell)	275	2
Entelecara errata O. P.-Cambridge	2	
E. erythropus (Westring)	1	
E. omissa O. P.-Cambridge	198	1
Erigone atra (Blackwall)	1045	
E. dentipalpis (Wider)	8	

Species	St	non-St
Erigonella hiemalis (Blackwall)	3	
E. ignobilis (O. P.-Cambridge)	2	
Floronia bucculenta (Clerck)	17	
Gnathonarium dentatum (Wider)	1019	2
Gonatium rubens (Blackwall)	33	
Gongylidiellum murcidum (Simon)	4	
G. vivum (O. P.-Cambridge)	47	1
Gongylidium rufipes (Sundevall)	25	1
Halorates reprobus (O. P.-Cambridge)		1
Hylyphantes graminicola (Sundevall)	2	
Hypomma bituberculatum (Wider)	331	2
H. fulvum (Bosenburg)	404	
Hypselistes jacksoni (O. P.-Cambridge)	2	
Kaestneria dorsalis (Wider)	1	
K. pullata (O. P.-Cambridge)	141	6
Labulla thoracica (Wider)	1	
Lepthyphantes ericaeus (Blackwall)	6	1
L. flavipes (Blackwall)	3	
L. mengei Kulczynski	22	
L. pallidus (O. P.-Cambridge)	4	
L. tenuis (Blackwall)	548	4
L. zimmermanni Bertkau	42	
Leptorhoptrum robustum (Westring)	5	
Linyphia triangularis (Clerck)	5	
Lophomma punctatum (Blackwall)	186	
Maso gallicus Simon	23	
M. sundevalli (Westring)	73	
Meioneta gulosa (L. Koch)	1	
M. rurestris (C.L. Koch)	2	
M. saxatilis (Blackwall)	16	
Metopobactrus prominulus (O. P.-Cambridge)	8	
Micrargus herbigradus (Blackwall)	24	
M. subaequalis (Westring)	2	
Microlinyphia impigra (O. P.-Cambridge)	18	
M. pusilla (Sundevall)	8	2
Microneta viaria (Blackwall)	1	
Neriene clathrata (Sundevall)	14	
Oedothorax apicatus (Blackwall)	1	
O. fuscus (Blackwall)	67	
O. gibbosus (Blackwall)	2107	8
O. retusus (Westring)	58	
Ostearius melanopygius (O. P.-Cambridge)	1	
Pocadicnemis juncea Locket & Millidge	300	
P. pumila (Blackwall)	43	
Poeciloneta globosa (Wider)	1	
Porrhomma convexum (Westring)	2	
P. pygmaeum (Blackwall)	87	
Saaristoa abnormis (Blackwall)	11	
Saloca diceros (O. P.-Cambridge)	1	

Species	St	non-St
Savignya frontata (Blackwall)	15	2
Silometopus elegans (O. P.-Cambridge)	402	1
Tallusia experta (O. P.-Cambridge)	4	1
Tapinocyba insecta (L. Koch)	2	
Tapinopa longidens (Wider)	1	
Taranucnus setosus (O. P.-Cambridge)	31	
Trichopterna thorelli (Westring)	6	
Walckenaeria acuminata Blackwall	5	
W. alticeps (Denis)	20	
W. atrotibialis (O. P.-Cambridge)	92	1
W. kochi (O. P.-Cambridge)	3	
W. nodosa (O. P.-Cambridge)	1	
W. nudipalpis (Westring)	4	1
W. obtusa (Blackwall)	1	
W. unicornis O. P.-Cambridge	28	
W. vigilax (Blackwall)	100	
Araneae Lycosidae		
Agroeca proxima (O.P.-Cambridge)	89	
Alepecosa pulverulenta (Clerck)	18	
Arctosa leopardus (Sundevall)	163	
Hygrolycosa rubrofasciata (Ohlert)	18	
Pardosa amentata (Clerck)	327	1
P. lugubris (Walckenaer)	14	
P. nigriceps (Thorell)	37	
P. palustris (Linnaeus)	7	
P. prativaga (L. Koch)	1483	
P. pullata (Clerck)	965	
Pirata hygrophilus Thorell	4194	2
P. latitans (Blackwall)	857	
P. piraticus (Clerck)	4311	
P. piscatorius (Clerck)	378	1
P. tenuitarsis Simon	498	
Trochosa ruricola (Degeer)	4	
T. spinipalpis (Cambridge F.O.P.)	60	
T. terricola Thorell	21	
Araneae Metidae		
Metellina segmentata (Clerck)	3	
Araneae Mimetidae		
Ero cambridgei Kulczynski	3	
E. furcata (Villers)	1	1
Araneae Philodromidae		
Philodromus cespitum (Walckenaer)	1	1
Thanatus striatus C.L. Koch	8	1
Tibellus maritimus (Menge)	15	4
T. oblongus (Walckenaer)	13	1
Araneae Pisauridae		
Pisaura mirabilis (Clerck)	35	
Araneae Salticidae		
Euophrys frontalis (Walckenaer)	1	
Evarcha falcata (Clerck)	2	
Marpissa radiata (Grube)	10	
Neon reticulatus (Blackwall)	4	
Sitticus caricis (Westring)	1	1
Araneae Tetragnathidae		
Pachygnatha clercki Sundevall	877	1

Species	St	non-St
P. degeeri Sundevall	44	1
Tetragnatha extensa (Linnaeus)	24	10
T. montana Simon	10	
Araneae Theridiidae		
Anelosimus vittatus (C.L. Koch)	1	
Crustulina guttata (Wider)		1
C. sticta (O. P.-Cambridge)	5	
Enoplognatha ovata (Clerck)	3	
Robertus arundineti (O. P.-Cambridge)	2	
R. insignis O. P.-Cambridge	1	
R. lividus (Blackwall)	10	
Theridion bimaculatum (Linnaeus)	13	1
T. impressum L. Koch	2	1
T. instabile O. P.-Cambridge	8	
T. mystaceum L. Koch	1	
T. pallens Blackwall	6	
T. pictum (Walckenaer)	9	
T. simile C.L. Koch	2	1
T. varians Hahn	1	
Araneae Theridiosomatidae		
Theridiosoma gemmosum (L. Koch)	6	
Araneae Thomisidae		
Oxyptila brevipes (Hahn)	13	
O. sanctuaria (O.P.-Cambridge)	3	
O. trux (Blackwall)	262	2
Xysticus cristatus (Clerck)	25	
X. ulmi (Hahn)	59	2
Araneae Zoridae		
Zora spinimana (Sundevall)	122	2
Chilopoda Lithobiidae		
Lithobius crassipes L. Koch	1	
Coleoptera Anobiidae		
Anobium punctatum (Degeer)	1	1
Ochina ptinoides (Marsham)	1	
Coleoptera Anthicidae		
Anthicus floralis (L.)	1	1
Coleoptera Apionidae		
Apion carduorum Kirby		1
A. minimum Herbst		2
A. vicinum Kirby		1
Nanodes marmoratus (Goeze)	3	
Coleoptera Attelabidae		
Rhynchites longiceps Thomson		1
Coleoptera Bruchidae		
Bruchus loti Paykull	1	
Coleoptera Buprestidae		
Trachys troglodytes Gyllenhal	1	1
Coleoptera Byturidae		
Byturus tomentosus (Degeer)	7	
Coleoptera Cantharidae		
Cantharis cryptica Ashe	5	
C. decipiens Baudi	28	2
C. figurata Mannerheim	12	
C. lateralis L.	2	
C. nigra (Degeer)	2	
C. nigricans (Mueller)	1	
C. pallida Goeze	51	2
C. rufa darwiniana L.	1	
C. rufa L.	2	
C. thoracica (Olivier)	195	
Malthodes marginatus (Latreille)	2	
Rhagonycha fulva (Scopoli)		9
R. testacea (L.)	3	
Silis ruficollis (F.)	361	14
Coleoptera Carabidae		
Acupalpus parvulus (Sturm)	1	
Agonum afrum (Duftschmid)	3	
A. fuliginosum (Panzer)	161	2
A. gracile Sturm	3	
Agonum livens (Gyllenhal)	1	
A. muelleri (Herbst)	1	
A. thoreyi Dejean	1022	11
A. viduum (Panzer)	6	
Amara communis (Panzer)	3	
A. convexior Stephens	1	
A. familiaris (Duftschmid)	1	
A. lunicollis Schioedte	1	
A. plebeja (Gyllenhal)	1	
Badister dilatatus Chaudoir	2	1
Bembidion assimile Gyllenhal	22	4
B. biguttatum (F.)	2	
B. doris (Panzer)	5	
B. fumigatum (Duftschmid)	43	
B. guttula (F.)	5	
B. lampros (Herbst)	1	
B. obliquum Sturm		1
B. properans Stephens	1	1
B. quadrimaculatum (L.)	1	
Blethisa multipunctata (L.)	9	1
Bradycellus harpalinus (Serville)	5	
B. ruficollis (Stephens)	1	
Carabus granulatus L.	137	1
Cicindela campestris L.		1
Clivina fossor (L.)	3	
Cychrus caraboides (L.)	5	
Demetrias atricapillus (L.)		2
D. imperialis (Germar)	6	
Dromius linearis (Olivier)	8	1
D. longiceps Dejean	38	1
D. melanocephalus Dejean		1
Dyschirius globosus (Herbst)	23	
D. luedersi Wagner	12	
Elaphrus cupreus Duftschmid	79	5
E. riparius (L.)	4	
Harpalus affinis (Schrank)		1
Leistus terminatus (Hellwig)	45	1
Loricera pilicornis (F.)	173	2
Nebria brevicollis (F.)	2	
Notiophilus biguttatus (F.)	1	
N. palustris (Duftschmid)	2	
Odacantha melanura (L.)	27	4
Oodes helopioides (F.)	185	1
Oxypselaphus obscurus (Herbst)	33	1
Pterostichus diligens (Sturm)	137	3
P. madidus (F.)	6	
P. melanarius (Illiger)	3	

Species	St	non-St
P. minor (Gyllenhal)	170	2
P. niger (Schaller)	20	1
P. nigrita (Paykull)	74	1
P. rhaeticus Heer	13	
P. strenuus (Panzer)	7	4
P. vernalis (Panzer)	25	1
P. versicolor (Sturm)	13	
Stenolophus mixtus (Herbst.)	1	
Trechus quadristriatus (Schrank)	32	
Coleoptera Cerambycidae		
Agapanthia villosoviridescens (Degeer)	2	9
Clytus arietis (L.)		2
Grammoptera ruficornis (F.)	3	5
Pogonocherus hispidus (L.)		1
Strangalia maculata (Poda)	4	7
S. melanura (L.)	2	1
S. quadrifasciata (L.)	1	2
Coleoptera Chrysomelidae		
Altica lythri Aube	33	14
A. pusilla Duftschmid		1
Aphthona lutescens (Gyllenhal)	52	
A. nonstriata (Goeze)	15	2
Cassida flaveola Thunberg	9	
C. rubiginosa Mueller	1	1
C. viridis L.		2
Chaetocnema concinna (Marsham)	8	
C. hortensis (Fourcroy)	11	
Chrysolina brunsvicensis (Gravenhorst)	1	
C. polita (L.)	6	5
C. staphylaea (L.)	1	
Chrysomela populi L.	46	1
Crepidodera transversa (Marsham)	1	1
Cryptocephalus labiatus (L.)		1
Donacia clavipes Fabricius	1	1
Galerucella calmariensis (L.)	19	2
[G. grisescens (Joannis)]	5	
G. lineola (F.)		1
G. pusilla (Duftschmid)	34	
G. sagittariae (Gyllenhal)	1	
G. tenella (L.)	7	1
Gastrophysa polygoni (L.)		3
Lochmaea caprea (L.)	16	5
L. crataegi (Forster)		1
Longitarsus holsaticus (L.)	18	2
L. luridus (Scopoli)	1	1
L. melanocephalus (Degeer)	1	
L. parvulus (Paykull)	1	
Lythraria salicariae (Paykull)	5	
Oulema melanopa (L.)	2	3
Phaedon cochleariae (F.)	5	5
Phyllobrotica quadrimaculata (L.)		3
Phyllodecta vitellinae (L.)	3	
Phyllotreta atra (F.)		1
P. exclamationis (Thunberg)	21	1
P. flexuosa (Illiger)	2	
P. undulata Kutschera	1	
P. vittula (Redtenbacher)	1	

Species	St	non-St
Plateumaris affinis (Kunze)	1	
P. braccata (Scopoli)	10	7
P. discolor (Panzer)		3
P. sericea (L.)	2	
Prasocuris phellandrii (L.)	3	
Psylliodes affinis (Paykull)	1	
P. picina (Marsham)	3	
Pyrrhalta viburni (Paykull)		3
Sphaeroderma testaceum (F.)		1
Coleoptera Clambidae		
Clambus armadillo (Degeer)	7	
C. pubescens Redtenbacher	5	
C. punctulum (Beck)		1
Coleoptera Coccinellidae		
Adalia bipunctata (L.)		2
A. decempunctata (L.)		2
Anisosticta novemdecimpunctata (L.)	1	
Calvia quattuordecimguttata (L.)	1	1
Chilocorus renipustulatus (Scriba)	2	
Coccidula rufa (Herbst)		3
Coccinella septempunctata L.	10	9
Hyperaspis pseudopustulata Mulsant	1	
Propylea quattuordecimpunctata (L.)	4	3
Psyllobora vigintiduopunctata (L.)		1
Scymnus auritus Thunberg	2	
S. frontalis (F.)	1	
Subcoccinella vigintiquattuorpunctata (L.)		2
Coleoptera Corylophidae		
Corylophus cassidoides (Marsham)	19	2
Sericoderus lateralis (Gyllenhal)		1
Coleoptera Cryptophagidae		
Antherophagus nigricornis (F.)	12	
Atomaria basalis Erichson		1
A. fuscicollis Mannerheim		1
Cryptophagus laticollis Lucas		2
Ephistemus globulus (Paykull)		1
Ootypus globosus (Waltl)	3	
Telmatophilus schoenherri (Gyllenhal)	2	
T. typhae (Fallen)	6	
Coleoptera Cucujidae		
Pediacus dermestoides (F.)	1	
Coleoptera Curculionidae		
Amalorrhynchus melanarius (Stephens)	2	
Bagous lutulentus (Gyllenhal)		2
Barypeithes pellucidus (Boheman)	5	
Ceutorhynchus floralis (Paykull)	3	
C. litura (F.)		1
C. melanostictus (Marsham)	1	
Cidnorhinus quadrimaculatus (L.)	2	
Cionus alauda (Herbst)		1
C. scrophulariae (L.)		2
Dorytomus dejeani Faust		1
D. salicinus (Gyllenhal)		1

Species	St	non-St
Drupenatus nasturtii (Germar)		2
Hypera arator (L.)	1	
H. pollux (F.)	5	5
Limnobaris pilistriata (Stephens)	1	
L. t-album (L.)	1	1
Phyllobius pomaceus Gyllenhal	1	2
P. pyri (L.)	1	
Phytobius waltoni Boheman	1	
Poophagus sisymbrii (F.)		2
Ramphus pulicarius (Herbst)	1	
Rhinoncus inconspectus (Herbst)	1	
R. perpendicularis (Reich)	7	
Rhynchaenus foliorum (Mueller)	2	
Sitona lineatus (L.)	251	1
Tanysphyrus lemnae (Paykull)	4	
Tapinotus sellatus (F.)	1	
Thryogenes festucae (Herbst)	11	
T. nereis (Paykull)	14	
Trichosirocalus troglodytes (F.)	1	
Tychius picirostris (F.)	3	
Coleoptera Dascillidae		
Dascillus cervinus (L.)		1
Coleoptera Dermestidae		
Dermestes murinus L.	1	1
Coleoptera Dryopidae		
Dryops anglicanus Edwards		9
D. ernesti des Gozis	4	2
D. luridus (Erichson)	2	
D. nitidulus (Heer)	3	
D. similaris Bollow		1
Coleoptera Dytiscidae		
Agabus bipustulatus (L.)	10	7
A. labiatus (Brahm)	3	
A. paludosus (F.)		1
A. striolatus (Gyllenhal)	5	
A. sturmii (Gyllenhal)	6	2
A. uliginosus (L.)	1	
A. unguicularis (Thomson)	16	3
Colymbetes fuscus (L.)	1	
Copelatus haemorrhoidalis (F.)	1	4
Dytiscus semisulcatus Mueller	2	1
Graptodytes granularis (L.)		1
Hydaticus seminiger (Degeer)		2
Hydroporus angustatus Sturm	2	2
H. erythrocephalus (L.)		1
H. gyllenhalii Schioedte		1
H. longicornis Sharp	1	
H. melanarius Sturm	1	
H. memnonius Nicolai	4	3
H. palustris (L.)	1	
H. pubescens (Gyllenhal)	1	3
H. scalesianus Stephens	1	
H. striola (Gyllenhal)	2	1
H. tessellatus Drapiez		1
H. umbrosus (Gyllenhal)	3	2
Hygrotus decoratus (Gyllenhal)		2
H. impressopunctatus (Schaller)		1
H. versicolor (Schaller)	1	
Ilybius ater (Degeer)	8	

Species	St	non-St
I. fuliginosus (F.)		2
I. guttiger (Gyllenhal)	31	1
I. montanus (Stephens)	1	
I. quadriguttatus (Lacordaire & Boisduval)	52	3
Laccophilus minutus (L.)		1
Laccornis oblongus (Stephens)	4	
Rhantus grapii (Gyllenhal)	1	
Coleoptera Elateridae		
Actenicerus sjaelandicus (Mueller)		1
Adrastus pallens (F.)	1	
Agriotes lineatus (L.)	17	
A. pallidulus (Illiger)	2	
Agrypnus murinus (L.)	1	
Athous haemorrhoidalis (F.)		4
A. hirtus (Herbst)		2
Dalopius marginatus (L.)	2	
Denticollis linearis (L.)	3	2
Hypnoidus riparius (F.)		1
Melanotus villosus (Geoffroy in Fourcroy)		1
Selatosomus incanus (Gyllenhal)	2	
Coleoptera Geotrupidae		
Geotrupes spiniger (Marsham)		1
Typhaeus typhoeus (L.)		1
Coleoptera Haliplidae		
Haliplus confinis Stephens	1	
H. fluviatilis Aube		1
H. lineatocollis (Marsham)		1
H. mucronatus Stephens		1
H. obliquus (F.)		1
H. ruficollis (Degeer)	1	1
Coleoptera Heteroceridae		
Heterocerus marginatus (F.)	1	
Coleoptera Histeridae		
Abraeus globosus (Hoffmann)	1	
Hister unicolor L.	1	
Saprinus semistriatus (Scriba)	1	
Coleoptera Hydraenidae		
Hydraena britteni Joy	38	1
H. palustris Erichson	6	27
H. riparia Kugelann	2	1
Limnebius aluta (Bedel)	78	79
L. nitidus (Marsham)		1
L. papposus Mulsant		1
L. truncatellus (Thunberg)		1
Ochthebius marinus (Paykull)	1	
O. minimus (F.)	69	3
O. viridis Peyron	1	
Coleoptera Hydrochidae		
Hydrochus brevis (Herbst)	9	5
H. carinatus Germar		1
H. megaphallus Berge Henegouwen		24
Coleoptera Hydrophilidae		
Anacaena globulus (Paykull)	36	4
A. limbata s. lat. (F.)	53	40
A. limbata s. str. (F.)	29	
A. lutescens	1	

Species	St	non-St
Cercyon analis (Paykull)	5	
C. atomarius (F.)	3	
C. convexiusculus Stephens	136	47
C. haemorrhoidalis (F.)	7	
C. marinus Thomson	10	
C. melanocephalus (L.)	2	
C. pygmaeus (Illiger)	1	
C. sternalis Sharp	24	2
C. terminatus (Marsham)	3	
C. tristis (Illiger)	121	
Chaetarthria seminulum (Herbst)	10	3
Coelostoma orbiculare (F.)	150	5
Cryptopleurum minutum (F.)		1
Cymbiodyta marginellus (F.)	13	8
Enochrus coarctatus (Gredler)	10	4
E. isotae Hebauer		2
E. ochropterus (Marsham)	2	1
E. quadripunctatus s. lat. (Herbst)	1	1
E. testaceus (F.)	12	1
Helophorus brevipalpis Bedel	2	1
H. minutus F.	2	
H. nanus Sturm		1
H. strigifrons Thomson	2	
Hydrobius fuscipes (L.)	19	11
Laccobius bipunctatus (F.)	4	3
Laccobius striatulus (F.)		1
Megasternum obscurum (Marsham)	42	
Coleoptera Lampyridae		
Lampyris noctiluca (L.)	2	1
Coleoptera Lathridiidae		
Adistemia watsoni (Wollaston)	3	
Aridius bifasciatus (Reitter)	173	1
A. nodifer (Westwood)	22	2
Corticaria impressa (Olivier)		2
C. umbilicata (Beck)	1	
Corticarina fuscula (Gyllenhal)	1	
Cortinicara gibbosa (Herbst)	370	1
Dienerella filum (Aube)	1	
Enicmus histrio Joy & Tomlin	13	
E. testaceus (Stephens)	1	
E. transversus (Olivier)	6	
Lathridius pseudominutus (Strand)	1	
Stephostethus lardarius (Degeer)	15	
Coleoptera Leiodidae		
Agathidium atrum (Paykull)	1	
Amphicyllis globus (F.)	2	
Catops morio (F.)	57	1
C. tristis (Panzer)	2	
Leiodes dubia (Kugelann)	1	
L. polita (Marsham)	3	
L. rufipennis (Paykull)	22	
Nargus wilkini (Spence)	1	
Ptomaphagus subvillosus (Goeze)	2	
Sciodrepoides watsoni (Spence)	29	
Coleoptera Lycidae		
Platycis minuta (F.)	1	
Coleoptera Melyridae		
Anthocomus rufus (Herbst)	589	7
Cerapheles terminatus (Menetries)	305	1
Malachius bipustulatus (L.)	3	1
Coleoptera Mordellidae		
Mordellistena pseudopumila Ermisch	5	
M. pumila (Gyllenhal)	3	
M. variegata (F.)	1	
Coleoptera Nitidulidae		
Brachypterus glaber (Stephens)	10	
B. urticae (F.)	5	
Carpophilus obsoletus Erichson	1	
Epuraea aestiva (L.)	1	
[E. limbata (F.)]	2	
E. pusilla (Illiger)	1	
E. unicolor (Olivier)	1	
Glischrochilus hortensis (Fourcroy)	98	1
G. quadriguttatus (F.)		1
Kateretes pedicularius (L.)	3	
K. rufilabris (Latreille)	7	
Meligethes aeneus (F.)	1027	6
M. erythropus (Marsham)	16	
M. gagathinus Erichson	1	
M. nigrescens Stephens	215	
M. ochropus Sturm	6	
M. ovatus Sturm	1	
M. planiusculus (Heer)	71	
M. viridescens (F.)	58	
Coleoptera Noteridae		
Noterus crassicornis (Mueller)		1
Coleoptera Oedemeridae		
Nacerdes melanura (L.)		1
Oedemera lurida (Marsham)	4	
Coleoptera Phalacridae		
Stilbus atomarius (L.)	9	
S. oblongus (Erichson)	55	
S. testaceus (Panzer)	25	
Coleoptera Ptiliidae		
Acrotrichis atomaria (Degeer)		1
A. cognata (Matthews)		1
A. fascicularis (Herbst)		2
A. henrici (Matthews)		2
A. intermedia (Gillmeister)		1
A. lucidula Rosskothen		1
A. montandoni (Allibert)		2
A. pumila (Erichson)		1
A. sitkaensis (Motschulsky)		2
Ptenidium fuscicorne Erichson		2
P. pusillum (Gyllenhal)		2
Coleoptera Pyrochroidae		
Pyrochroa serraticornis (Scopoli)		5
Coleoptera Rhizophagidae		
Monotoma bicolor Villa		8
M. picipes Herbst	1	1
M. testacea Motschulsky		2
Coleoptera Scarabaeidae		
Aphodius contaminatus (Herbst)	2	
A. fimetarius (L.)	1	
A. fossor (L.)	3	

Species	St	non-St
A. rufipes (L.)		3
A. rufus (Moll)	1	1
Onthophagus similis (Scriba)	7	
Phyllopertha horticola (L.)	1	
Serica brunnea (L.)		1
Coleoptera Scirtidae		
Cyphon coarctatus Paykull	213	
C. hilaris Nyholm	442	
C. ochraceus Stephens	1	
C. padi (L.)	423	2
C. palustris Thomson	2	
C. phragmiteticola Nyholm	196	
C. pubescens (F.)	16	
C. variabilis (Thunberg)	17	
Microcara testacea (L.)	29	
Scirtes hemisphaericus (L.)	16	6
Coleoptera Scolytidae		
Cryphalus abietis (Ratzeburg)	1	
Pityophthorus pubescens (Marsham)	1	
Scolytus multistriatus (Marsham)	1	
Coleoptera Scraptiidae		
Anaspis frontalis (L.)	2	
A. maculata Fourcroy	1	1
A. regimbarti Schilsky	1	
A. rufilabris (Gyllenhal)	1	
Coleoptera Scydmaenidae		
Cephennium gallicum Ganglbauer	3	
Euconnus hirticollis (Illiger)	161	1
Neuraphes elongatulus (Mueller & Kunze)	1	
Stenichnus collaris (Mueller & Kunze)	3	
Coleoptera Silphidae		
Nicrophorus humator (Gleditsch)	4	2
N. investigator Zetterstedt	4	
N. vespillo (L.)	45	
N. vespilloides Herbst	243	
N. vestigator Herschel	7	
Oiceoptoma thoracicum (L.)	5	1
Silpha atrata L.	8	2
S. tristis Illiger	14	
Thanatophilus rugosus (L.)	2	
T. sinuatus (F.)	4	
Coleoptera Silvanidae		
Psammoecus bipunctatus (F.)	19	
Coleoptera Staphylinidae		
[Anotylus nitidulus (Gravenhorst)]	71	
A. rugosus (F.)	106	4
A. sculpturatus (Gravenhorst)	90	
A. tetracarinatus (Block)	56	
Anthobium unicolor (Marsham)	1	
Atheta coriaria (Kraatz)		1
A. graminicola (Gravenhorst)		1
Bibloplectus ambiguus (Reichenbach)	5	6
Bisnius cephalotes (Gravenhorst)		1
B. fimetarius (Gravenhorst)	1	2
Bledius gallicus (Gravenhorst)	1	

Species	St	non-St
Bolitobius castaneus (Stephens)	3	
B. cingulatus (Mannerheim)	6	
Brachygluta fossulata (Reichenbach)	3	
Bryaxis bulbifer (Reichenbach)	17	88
B. curtisi (Leach)		1
[Bryophacis crassicornis (Maeklin)]	1	
Carpelimus corticinus (Gravenhorst)	26	2
C. zealandicus (Sharp)	1	
Cypha discoidea (Erichson)	9	
C. longicornis (Paykull)	1	
Deubelia picina (Aube)		16
Drusilla canaliculata (F.)	3	
Erichsonius cinerascens (Gravenhorst)	15	7
Euaesthetus laeviusculus Mannerheim		1
E. ruficapillus Boisduval & Lacordaire	25	52
Euplectus kirbii Denny		1
Eusphalerum luteum (Marsham)	5	
E. minutum (F.)	2	
E. torquatum (Marsham)	253	
Gabrius breviventer (Sperk)	22	
G. osseticus (Kolenati)	1	
G. trossulus (von Nordmann)	2	3
Gabronthus thermarum (Aube)	1	1
Gyrohypnus angustatus Stephens	1	
Habrocerus capillaricornis (Gravenhorst)		16
Lathrobium brunnipes (F.)	21	5
L. elongatum (L.)	4	
L. fovulum Stephens	1	
L. impressum Heer		2
L. rufipenne Gyllenhal		1
L. terminatum Gravenhorst	16	2
L. volgense Hochhuth	6	
Lesteva longoelytrata (Goeze)	4	
L. punctata Erichson	7	
L. sicula Erichson	30	5
Lithocharis nigriceps Kraatz		1
L. obsoleta (von Nordmann)		1
L. ochracea (Gravenhorst)		1
Lordithon thoracicus (F.)	2	
Medon apicalis (Kraatz)		3
Megalinus glabratus (Gravenhorst)	1	
Megarthrus depressus (Paykull)	1	
Metopsia clypeata (Mueller)	5	
Micropeplus fulvus Erichson		2
M. porcatus (Paykull)	3	
M. staphylinoides (Marsham)	1	
Mocyta amplicollis (Mulsant & Rey)		1
M. fungi (Gravenhorst)		1
Mycetoporus clavicornis (Stephens)	3	
M. punctus (Gravenhorst)	1	

Species	St	non-St
M. splendidus (Gravenhorst)	25	
Mycetota laticollis (Stephens)		1
Myllaena brevicornis (Matthews)		1
M. dubia (Gravenhorst)	3	
M. elongata (Matthews)		1
M. gracilis (Matthews)		22
M. intermedia Erichson	1	
M. minuta (Gravenhorst)	3	
Neobisnius procerulus (Gravenhorst)	1	
Ochthephilum fracticorne (Paykull)		1
Ocypus aeneocephalus (Degeer)	1	
O. ater (Gravenhorst)		2
O. globulifer (Fourcroy)	1	
Oligota punctulata Heer		1
Olophrum fuscum (Gravenhorst)	129	7
Omalium excavatum Stephens		1
O. rivulare (Paykull)	9	
Othius angustus Stephens	1	
O. laeviusculus Stephens	2	
O. punctulatus (Goeze)	1	
Oxypoda opaca (Gravenhorst)		5
Oxytelus fulvipes Erichson	1	
Paederus riparius (L.)	286	2
Philonthus carbonarius (Gravenhorst)	2	
P. cognatus Stephens	1	
P. concinnus (Gravenhorst)	2	
P. fumarius (Gravenhorst)	18	1
P. micans (Gravenhorst)	18	
P. nigrita (Gravenhorst)	5	
[P. nitidicollis (Boisduval & Lacordaire)]	2	
P. politus (L.)	1	
P. quisquiliarius (Gyllenhal)	1	
P. rufipes (Stephens)	1	
P. splendens (F.)	7	
P. varians (Paykull)	7	
Platystethus cornutus (Gravenhorst)	1	
P. nodifrons Mannerheim	10	
Proteinus brachypterus (F.)	1	
P. laevigatus Hochhuth	66	
Pselaphaulax dresdensis (Herbst)	8	
Quedius balticus Korge	22	2
Q. boops (Gravenhorst)	3	
Q. cinctus (Paykull)		1
Q. fuliginosus (Gravenhorst)	46	5
Q. fumatus (Stephens)	3	7
Q. levicollis (Brulle)	7	
Q. maurorufus (Gravenhorst)	42	8
Q. mesomelinus (Marsham)		4
Q. molochinus (Gravenhorst)	2	
Q. nitipennis (Stephens)	7	
Q. picipes (Mannerheim)	1	
Q. umbrinus Erichson		2
Rugilus erichsoni (Fauvel)	1	

Species	St	non-St
R. fragilis (Gravenhorst)		9
R. orbiculatus (Paykull)		4
R. rufipes Germar	1	1
Rybaxis longicornis (Leach)	26	2
Scaphidium quadrimaculatum Olivier		1
Schistoglossa curtipennis (Sharp)		1
Sepedophilus marshami (Stephens)	7	
S. nigripennis (Stephens)	3	
S. testaceus (F.)	1	
Staphylinus erythropterus L.	41	2
Stenus aceris Stephens	1	
S. argus Gravenhorst	8	2
S. bifoveolatus Gyllenhal	1	
S. bimaculatus Gyllenhal	55	3
S. boops Ljungh	10	
S. brunnipes Stephens	1	1
S. canaliculatus Gyllenhal	1	1
S. carbonarius Gyllenhal		1
S. cicindeloides (Schaller)	5	
S. clavicornis (Scopoli)	5	
S. europaeus Puthz	2	
S. flavipes Stephens	2	
S. fulvicornis Stephens	2	1
S. fuscicornis Erichson	1	
S. fuscipes Gravenhorst	1	
S. impressus Germar	13	2
S. incrassatus Erichson		1
S. juno (Paykull)	122	8
S. latifrons Erichson	35	14
S. lustrator Erichson	21	
S. melanarius Stephens		1
S. nitens Stephens	79	56
S. nitidiusculus Stephens	1	8
S. opticus Gravenhorst	11	
S. pallitarsis Stephens	1	
S. palustris Erichson	19	8
S. picipennis Erichson	7	
S. proditor Erichson	4	
S. providus Erichson	8	2
S. similis (Herbst)	1	
S. solutus Erichson	9	6
Sunius propinquus (Brisout)	1	
Tachinus humeralis Gravenhorst	1	
T. laticollis Gravenhorst	2	
T. marginellus (F.)	4	
T. pallipes (Gravenhorst)	2	
T. signatus Gravenhorst	65	1
T. subterraneus (L.)	3	
Tachyporus atriceps Stephens	1	
T. chrysomelinus (L.)	24	
T. dispar (Paykull)	1	
T. hypnorum (F.)	89	7
T. nitidulus (F.)	3	2
T. obtusus (L.)	6	1
T. pallidus Sharp	1	
T. transversalis Gravenhorst	4	
Trissemus impressus (Panzer)	25	16
Xantholinus longiventris Heer	3	

Species	St	non-St
Coleoptera Tenebrionidae		
Lagria hirta (L.)	5	1
Coleoptera Throscidae		
Trixagus dermestoides (L.)	7	
Dermaptera Forficulidae		
Forficula auricularia L.	3	1
Dermaptera Labiidae		
Labia minor (L)	1	
Diplopoda Craspedosomatidae		
Craspedosoma rawlinsi	2	
Nanogona polydesmoides (Leach)	4	
Diplopoda Glomeridae		
Glomeris marginata (Villers)	6	
Diplopoda Julidae		
Brachyiulus pusillus (Leach)	4	
Cylindroiulus latestriatus (Curtis)	2	
C. punctatus (Leach)	3	
Julus scandinavius Latzel	6	
Ommatoiulus sabulosus	14	
Ophyiulus pilosus (Newport)	5	
Tachypodoiulus niger (Leach)	10	
Diplopoda Polydesmidae		
Brachydesmus superus Latzel	3	
Polydesmus angustus Latzel	19	
P. denticulatus	15	
Diptera Anisopodidae		
Sylvicola cinctus (Fabricius)	156	
S. punctatus (Fabricius)	12	
Diptera Anthomyzidae		
Anagnota bicolor (Meigen)	1	
Anthomyza bifasciata Wood	9	
A. neglecta Collin	1	
Diptera Asilidae		
Dysmachus trigonus (Mg)	1	
Machimus atricapillus (Fallen)	9	1
Diptera Bibionidae		
Bibio marci (Linnaeus)		1
Dilophus febrilis (Linnaeus)	3	
Diptera Bombyliidae		
Bombylius major Linnaeus		1
Phthiria pulicaria	2	
Diptera Chloropidae		
Lipara lucens Meigen		2
Platycephala planifrons (Fabricius)	154	
Diptera Clusiidae		
Clusiodes albimana (Meigen)	5	
Diptera Conopidae		
Conops flavipes L.	1	
C. quadrifasciata Degeer	2	
Myopa testacea (Linnaeus)	1	
Sicus ferrugineus (L.)	1	2
Thecophora atra (Fabricius)	1	
Diptera Diastatidae		
Campichoeta obscuripennis (Meigen)	9	1
Diastata adusta Meigen	7	
D. nebulosa (Fallen)		2
Diptera Dixidae		
Dixa dilatata Strobl	3	

Species	St	non-St
D. nebulosa Meigen	1	
D. nubilipennis Curtis	2	
D. submaculata Edwards	2	
Dixella aestivalis Meigen		1
D. amphibia (Degeer)	756	1
D. autumnalis Meigen	2237	1
D. filicornis Edwards		1
D. graeca Pandazis	6	1
D. martinii Peus	36	
D. serotina Meigen	469	
Diptera Dolichopodidae		
Achalcus cinereus (Haliday)	26	
A. flavicollis (Meigen)	19	
A. melanotrichus Mik	2	
Argyra elongata (Zetterstedt)	18	
Bathycranium bicolorellum (Zetterstedt)	2	
Campsicnemus armatus (Zetterstedt)	18	
C. compeditus Loew	1	
C. curvipes (Fallen)	56	
C. picticornis (Zetterstedt)	92	
C. scambus (Fallen)	717	1
Chrysotus cilipes Meigen	11	1
Dolichopus agilis Meigen	2	
D. atratus Meigen	9	
D. brevipennis Meigen	12	
D. campestris Meigen	1	1
D. claviger Stannius	8	
D. diadema Haliday	7	
D. discifer Stannius	6	
D. latelimbatus Macquart	17	
D. laticola Verrall	10	
D. lepidus Staeger	19	
D. longicornis Stannius	2	
D. longitarsis Stannius	2	1
D. nigripes Fallen	5	4
D. notatus Staeger	3	
D. nubilus Meigen	63	
D. pennatus Meigen	84	
D. picipes Meigen	45	1
D. plumipes (Scopoli)	17	
D. plumitarsis Fallen	1	
D. popularis Wiedemann	216	
D. simplex Meigen	32343	
D. ungulatus (Linnaeus)	40	
D. urbanus Meigen	172	
D. vitripennis Meigen	166	
Hercostomus aerosus (Fallen)	117	
H. assimilis (Staeger)	58	
H. blankaartensis Pollet	2	1
H. chalybeus (Wiedemann)	61	1
H. chrysozygus (Wiedemann)	13	4
H. cupreus (Fallen)	55	
H. germanus (Wiedemann)	3	
H. metallicus (Stannius)	2	1
Hydrophorus bipunctatus (Lehmann)	1	
Medetera truncorum Meigen	2	

Species	St	non-St
Micromorphus albipes (Zetterstedt)	2	
Rhaphium fasciatum Meigen	7	
Sciapus longulus (Fallen)	1	
S. platypterus (Fabricius)	1	
Sympycnus aenicoxa (Meigen)	13	
S. desoutteri Parent	5	1
Syntormon monilis (Haliday)	3	
S. pallipes (Fabricius)	7	
S. pumilus (Meigen)	2	
S. tarsatus (Fallen)	4	
Telmaturgus tumidulus (Raddatz)	22	
Teuchophorus spinigerellus (Zetterstedt)	4	
Thrypticus smaragdinus Gest.	14	
Xanthochlorus ornatus (Haliday)	1	
Diptera Drosophilidae		
Drosophila andalusiaca Strobl	1	
Diptera Dryomyzidae		
Dryomyza analis Fallen	75	
Diptera Empididae		
Bicellaria vana Collin		1
Chelifera precatoria (Fallen)	8	
Chelipoda vocatoria (Fallen)	58	
Chersodromia hirta (Walker)	4	
Clinocera stagnalis (Haliday)	9	
Dolichocephala engeli		1
Dolichocephala guttata (Haliday)	3	
Empis aestiva Loew	52	
E. albinervis Meigen	260	
E. livida Linnaeus	19	
E. nigripes Fabricius	10	
E. nuntia Meigen	2	
E. praevia Collin	3	
E. stercorea Linnaeus	1	
E. tessellata Fabricius	4	
Hemerodromia raptoria Meigen	4	
Hilara chorica (Fallen)	229	
H. subpollinosa Collin	8	
Hybos femoratus (Muller)	2	
Ocydromia glabricula (Fallen)		1
Phyllodromia melanocephala (Fabricius)	30	
Platypalpus albiseta (Panzer)	1	
P. minutus (Meigen)	2	
P. pallidicornis (Collin)	24	
P. pallidiventris (Meigen)	32	
P. unicus Collin	1	
Rhamphomyia caliginosa Collin	28	
Stilpon graminum (Fallen)	49	
Tachydromia aemula (Loew)	5	
Trichina clavipes Meigen	1	
Diptera Ephydridae		
Ilythea spilota (Curtis)		1
Ochthera manicata	44	2
Parydra quadripunctata (Meigen)		1
Diptera Heleomyzidae		
Allophyla atricornis (Meigen)	2	
Heteromyza oculata Fallen		1

Species	St	non-St
Suillia affinis Meigen	5	
S. bicolor (Zetterstedt)	12	
S. dumicola (Collin)	4	
S. flava (Meigen)	4	
S. flavifrons	1	
S. notata (Meigen)	4	
S. variegata (Loew)	34	
Diptera Lauxaniidae		
Lyciella decipiens (Loew)	1	
Trigonometopus frontalis (Meigen)	2	
Diptera Lonchopteridae		
Lonchoptera furcata (Fal.)	1	
L. lutea Panzer	416	
L. nitidifrons Strobl	111	
L. scutellata Stein, P.	28	
Diptera Muscidae		
Coenosia tigrina (Fabricius)	4	
Drymeia hamata (Fallen)	2	
Graphomya maculata (Scopoli)	2	
Hydrotaea bimaculata (Meigen)		2
Phaonia pallida (Fabricius)	1	
Spanochaeta dorsalis (von Roser)	2	
Diptera Mycetophilidae		
Acnemia nitidicollis (Meigen)	116	1
Allodia alternans (Zetterstedt)	1	
A. angulata Lundstroem	21	
A. barbata (Lundstroem)	38	
A. embla Hackman	25	
A. lugens (Wiedemann)	14	
A. lundstroemi Edwards	11	
A. ornaticollis (Meigen)	79	
A. pistillata (Lundstroem)	1	
A. silvatica Landrock	1	
A. truncata Edwards	1	
Allodiopsis domestica (Meigen)	1	
A. ingeniosa Kidd	1	
A. rufilatera (Edwards)	2	
Anatella ciliata Winnertz	6	
A. dampfi Landrock	65	
A. flavomaculata Edwards	28	
A. lenis Dziedzicki	4	
A. minuta (Staeger)	21	
A. setigera Edwards	91	
A. simpatica Dziedzicki	1	
A. unguigera Edwards	36	
Asindulum nigrum Latreille	2	1
Boletina dubia (Meigen)	5	
B. gripha Dziedzicki	1	
B. trivittata (Meigen)	6	
Bolitophila dubia Siebke	1	
B. hybrida (Meigen)	2	
Brachycampta grata (Meigen)	3	
Brevicornu arcticum Lundstrom	1	
B. auriculatum (Edwards)	20	
B. boreale (Lundstroem)	2	
B. fissicauda (Lundstroem)	9	
B. griseicolle (Staeger)	8	
B. proximum (Staeger)	6	
B. sericoma (Meigen)	52	

Species	St	non-St
Cordyla brevicornis (Staeger)	1	
C. crassicornis Meigen	7	
C. flaviceps Staeger	2	
Docosia gilvipes (Walker)	2	
Epicypta aterrima (Zetterstedt)	3	
E. limnophila Chandler	197	
Exechia bicincta (Staeger)	2	
E. cincta Winnertz	1	
E. contaminata Winnertz	1	
E. dizona Edwards	1	
E. exigua Lundstroem	7	
E. festiva Winnertz	1	
E. frigida Boheman	1	
E. fusca (Meigen)	46	
E. lucidula (Zetterstedt)	2	
E. nana (Staeger)	17	
E. nigroscutellata Landrock	1	
E. pseudocincta Strobl	1	
E. pseudofestiva	70	
E. repanda Johannsen	100	
E. seriata (Meigen)	1	
E. spinuligera Lundstroem	70	
Exechiopsis crucigera (Lundstroem)	3	
E. fimbriata (Lundstroem)	2	
E. hammi (Edwards)	41	
E. ligulata (Lundstroem)	2	
E. pollicata (Edwards)	1	
E. pulchella (Winnertz)	2	
E. subulata (Winnertz)	8	
Isoneuromyia semirufa (Meigen)	2	
Leia bifasciata Gimmerthal	1	
L. longiseta Barendrecht	172	
Macrocera estonica Landrock	5	
M. fascipennis Staeger	4	
M. nana Macquart	1	
Macrorrhyncha flava Winnertz		1
Megalopelma nigroclavatum (Strobl)	2	
Monocentrota lundstroemi (Edwards)	12	
Monoclona rufilatera (Walker)	6	
Mycetophila blanda Winnertz	9	
M. britannica Lastovka & Kidd	2	
M. cingulum Meigen	1	
M. confusa Dziedzicki	14	
M. fungorum (Degeer)	104	
M. ichneumonea Say	4	
M. luctuosa Meigen	5	
M. mitis Johannsen	1	
M. ocellus Walker	22	
M. ornata Stephens	1	
M. pumila Winnertz	2	
M. signatoides Dziedzicki	10	
M. sordida Wulp	26	
M. stolida Walker	1	
M. strigata Staeger	1	
M. trinotata Staeger	1	
M. unicolor Stannius	17	

Species	St	non-St
M. vittipes Zetterstedt	1	
Mycomya affinis (Staeger)	45	
M. annulata (Meigen)	4	
M. britteni Kidd	7	
M. fimbriata (Meigen)	7	
M. insignis (Winnertz)	1	
M. marginata (Meigen)	8	
M. maura (Walker)	46	
M. neohyalinata Vaisanen	6	
M. nitida (Zetterstedt)	1	
M. sp. A	4	
M. tenuis (Walker)	11	
M. winnertzi (Dziedzicki)	1	
Neuratelia nemoralis (Meigen)	1	
Orfelia nemoralis (Meigen)	2	
Phronia biarcuata Steenburg	4	
P. braueri Dziedzicki	1	
P. conformis (Walker)	2	
P. flavipes Winnertz	5	
P. forcipata Winnertz	2	
P. humeralis Winnertz	1	
P. mutabilis Dziedzicki	18	
P. nigricornis (Zetterstedt)	1	
P. nitidiventris Wulp	7	
P. strenua Winnertz	1	
P. tenuis Winnertz	24	
Platurocypta punctum (Stannius)	8	
P. testata (Edwards)	7	
Polylepta guttiventris (Zetterstedt)	1	
PseudE. parallela (Edwards)	100	
P. trisignata (Edwards)	19	
P. trivittata (Staeger)	34	
Pseudobrachypeza helvetica (Walker)	2	
Rutylapa ruficornis (Zetterstedt)	1	
Rymosia armata Lackschewitz	25	
R. bifida Edwards	1	
R. britteni Edwards	16	
R. fasciata (Meigen)	1	
Sceptonia costata (Wulp)	1	
S. fumipes Edwards	6	
S. nigra (Meigen)	4	
Sciophila lutea Macquart	2	
Symmerus annulatus (Meigen)	2	
Synapha fasciata Meigen	23	
S. vitripennis (Meigen)	1	
Tarnania fenestralis (Meigen)	1	
Tetragoneura sylvatica (Curtis)	7	
Trichonta icenica Edwards	2	
T. melanura (Staeger)	1	
T. nigritula Edwards	9	
T. pulchra Gagne	1	
T. terminalis (Walker)	2	
XenE. leptura (Meigen)	1	
Zogomyia vara (Staeger)	3	
Z. humeralis (Wiedmann)	18	
Z. notata (Stannius)	21	
Z. pictipennis (Staeger)	3	
Z. valida Winnertz	16	

Species	St	non-St
Diptera Opomyzidae		
Geomyza majuscula (Loew)	1	
Opomyza florum (Fabricius)	108	1
O. lineatopunctata von Roser	7	
O. petrei Mesnil	4	
Diptera Otitidae		
Ceroxys urticae (Linnaeus)	14	
Herina frondescentiae (Linnaeus)	64	3
Melieria crassipennis (Fabricius)	1	
M. omissa (Meigen)	2	
Diptera Pallopteridae		
Palloptera trimacula (Meigen)	3	
Diptera Pipunculidae		
Cephalops chlorionae	2	
C. perspicuus (de Meijere)	73	
C. semifumosus (Kowarz)	13	
Dorylomorpha clavifemora Coe	1	
D. confusa (Verrall)	3	
D. infirmata (Collin)	2	
D. xanthopus (Thomson)	21	
Pipunculus campestris Latreille	15	1
Tomosvaryella cilitarsis (Strobl)		1
T. sylvatica (Meigen)	1	
Verrallia aucta (Fallen)	1	
V. setosa Verrall		1
Diptera Platypezidae		
Opetia nigra Meigen	1	
Diptera Ptychopteridae		
Ptychoptera albimana (Fabricius)	24	1
P. contaminata (Linnaeus)	6	2
P. minuta Tonnoir	185	3
P. scutellaris Meigen	135	2
Diptera Rhagionidae		
Chrysopilus cristatus (Fabricius)	386	14
Rhagio lineola Fabricius	2	
R. scolopacea (Linnaeus)	15	
R. tringarius (Linnaeus)		2
Dip*tera Scathophagidae*		
Chaetosa punctipes (Meigen)	2	
Cleigastra apicalis (Meigen)	13	
Cordilura aemula Collin	2	2
C. albipes Fallen	1	
C. ciliata Meigen	5	
C. impudica Rondani	4	
Delina nigrita (Fallen)		1
Gimnomera tarsea (Fallen)	220	4
Norellisoma lituratum (Meigen)	3	
N. opacum (Loew)	1	
N. spinimanum (Fallen)	9	
Scathophaga furcata (Say)	131	3
S. inquinata Meigen	1	
S. lutaria (Fabricius)	1	
S. stercoraria (Linnaeus)	161	4
S. suilla (Fabricius)	5	
S. tinctinervis (Becker)	3	
Spaziphora hydromyzina (Fallen)	4	
Trichopalpus fraternus (Meigen)	1	
Diptera Sciaridae		
Bradysia aprica (Winnertz)	5	
B. brunnipes (Meigen)	1	
B. confinis (Winnertz)	1	
B. funebris (Winnertz)	2	
B. fungicola (Winnertz)	18	
B. hilaris (Winnertz)	14	
B. insignis (Winnertz)	1	
B. subtilis (Lengersdorf)	12	
B. triseriata (Winnertz)	8	
Corynoptera forcipata (Winnertz)	1	
C. perpusilla Winnertz	1	
Ctenosciara hyalipennis (Meigen)	10	
Lycoriella auripila (Winnertz)	7	
L. conspicua (Winnertz)	2	
Phytosciara flavipes (Meigen)	40	
Plastosciara falcifera (Lengersdorf)	2	
Scatopsciara pusilla (Meigen)	2	
S. vivida (Winnertz)	10	
Schwenckfeldina carbonaria (Meigen)	5	
Sciara humeralis Zetterstedt	3	
S. thomae (Linnaeus)	2	
Trichosia pilosa (Staeger)	1	
Zygoneura sciarina Meigen	3	
Diptera Sciomyzidae		
Antichaeta analis (Meigen)	70	1
A. atriseta (Loew)	1	
A. brevipennis (Zetterstedt)	74	
Colobaea bifasciella (Fallen)	300	
C. distincta (Meigen)	21	
C. pectoralis (Zetterstedt)	36	
Coremacera marginata (F.)	2	
Dichetophora finlandica Verbeke	5	
Elgiva cucularia (Linnaeus)	43	2
E. solicita (Harris)	13	1
Hydromya dorsalis (Fabricius)	42	2
Ilione albiseta (Scopoli)	113	19
I. lineata (Fallen)	61	8
Limnia paludicola Elberg	346	4
L. unguicornis (Scopoli)	10	2
Pherbellia albocostata (Fallen)	13	
P. argyra Verbeke	31	
P. cinerella (Fallen)	18	
P. griseola (Fallen)	2	1
P. nana (Fallen)	3	
P. schoenherri (Fallen)	52	9
Pherbina coryleti (Scopoli)	328	6
Psacadina verbekei Rozkonsky	82	8
P. vittigera (Schiner)	10	7
P. zernyi Mayer	63	
Pteromicra angustipennis (Staeger)	1940	
P. leucopeza (Meigen)	5	
P. pectorosa (Hendel)	295	
Renocera pallida (Fallen)	102	6
R. striata (Meigen)	7	
Sciomyza dryomyzina Zetterstedt	3	
S. simplex Fallen	564	
S. testacea Macquart	67	
Sepedon sphegea (Fabricius)	3	
S. spinipes (Scopoli)	107	2

Species	St	non-St
Tetanocera arrogans (Meigen)	391	6
T. elata (Fabricius)	153	6
T. ferruginea Fallen	2467	7
T. freyi Stackelberg	505	
T. fuscinervis (Zetterstedt)	352	5
T. hyalipennis von Roser	9	
T. phyllophora Melander	41	1
T. robusta Loew	211	
T. silvatica Meigen	165	5
Trypetoptera punctulata (Scopoli)	2	
Diptera Sepsidae		
Saltella sphondylii (Schrank)	1	
Sepsis cynipsea (Linnaeus)		1
S. fulgens Meigen		1
Themira annulipes (Meigen)	1	
T. pusilla (Zetterstedt)	4	
Diptera Sphaeroceridae		
Copromyza atra (Meigen)	32	5
C. fimetaria (Meigen)	15	
C. nitida (Meigen)	1	
C. pedestris (Meigen)	559	
C. similis (Collin)	11	
C. stercoraria (Meigen)	159	
C. uncinata (Duda)	1	
Leptocera aterrima (Haliday)	1	
L. b. v. cryptocha (Duda)	2	
L. bifrons (Stenhammar)	1	
L. breviceps (Stenhammar)	1	
L. caenosa (Rondani)	5	
L. claviventris (Strobl)	3	
L. clunipes (Meigen)	93	
L. collini Richards	1	
L. coxata (Stenhammar)	3132	12
L. cribrata (Villeneuve)	1	
L. curvinervis (Stenhammar)	3	
L. fenestralis (Fallen)	79	
L. ferruginata (Stenhammar)	10	
L. finalis (Collin)	169	
L. flavipes (Meigen)	33	
L. fontinalis (Fallen)	871	
L. fungicola (Haliday)	5	
L. fuscipennis (Haliday)	1	
L. heteroneura (Haliday)	4	
L. hirticula (Collin)	2	
L. hirtula (Rondani)	6	
L. humida (Haliday)	12	
L. limosa (Fallen)	5	
L. longiseta (Dahl)	1	
L. lugubris (Haliday)	11	
L. luteilabris (Rondani)	57	
L. lutosa (Stenhammar)	46	
L. mirabilis (Collin)	4	
L. moesta (Villeneuve)	55	
L. nana (Rondani)	11	
L. ochripes (Meigen)	1	
L. palmata (Richards)	11	
L. parapusio (Dahl)	2	
L. pullula (Zetterstedt)	432	
L. rufilabris (Stenhammar)	10	3

Species	St	non-St
L. scutellaris (Haliday)	12	
L. spinipennis Haliday	1	
L. spinosa (Collin)	6	
L. splendens Duda	1	
L. talparum (Richards)	3	
L. v-atrum Villeneuve	3	2
L. vagans (Haliday)	5	
L. vitripennis (Zetterstedt)	15	
Sphaerocera crenata (Meigen)	13	
S. curvipes Latreille	1	
S. denticulata	2	
S. paracrenata Duda	74	
S. pusilla (Fallen)	5	
Diptera Stratiomyidae		
Beris vallata (Forster)	15	2
Chloromyia formosa (Scopoli)	2	2
Nemotelus nigrinus Fallen	24	
N. notatus Zetterstedt	4	
N. pantherinus (Linnaeus)	265	1
N. uliginosus (L)	17	
Odontomyia angulata (Panzer)		2
O. argentata (Fabricius)	6	2
O. tigrina (Fabricius)	24	2
Oplodontha viridula	99	8
Oxycera nigricornis Olivier	102	8
O. rara Scopoli	70	6
O. trilineata Linnaeus	5	2
Pachygaster atra (Panzer)		2
Sargus flavipes Meigen	2	
Stratiomys potamida	4	2
S. singularior (Harris)	26	2
Vanoyia tenuicornis (Macquart)	3	3
Diptera Syrphidae		
Anasimyia contracta Claussen & Torp	400	
A. interpuncta (Harris)	2	
A. lineata (F)	652	7
A. transfuga (L)	21	
Arctophila superabiens (Muller)		1
Baccha obscuripennis Meigen	2	
Brachyopa scutellaris Robineau-Desvoidyi		1
Chalcosyrphus nemorum (Fabricius)	71	2
Cheilosia albipila Mg		1
C. albitarsis Meigen	2	
C. antiqua Mg	1	1
C. bergenstammi Becker	2	
C. fraterna (Meigen)	1	4
C. illustrata (Harris)	1	1
C. impressa Loew		1
C. longula (Zetterstedt)	1	
C. pagana (Meigen)	12	3
C. praecox (Zetterstedt)	1	
C. pubera (Zetterstedt)		4
C. velutina Loew	11	
C. vernalis (Fal.)	15	
Chrysogaster cemiteriorum (L.)	2	4
C. hirtella Loew	99	1

Species	St	non-St
C. solstitialis (Fallen)	2	
C. virescens Loew	22	
Dasysyrphus albostriatus (Fallen)	1	
Epistrophe eligans (Harris)		1
Episyrphus balteatus (Degeer)	81	5
Eristalinus sepulchralis (L)	184	
Eristalis abusivus Collin	13	
E. arbustorum (Linnaeus)	35	
E. horticola (Degeer)	37	
E. interrupta (Poda)	28	1
E. intricarius (Linnaeus)	110	3
E. pertinax (Scopoli)	19	3
E. tenax (Linnaeus)	51	3
Eumerus strigatus (Fallen)	116	
Eumerus tuberculatus Rondani	13	
Ferdinandea cuprea (Scopoli)	6	
Helophilus hybridus Loew	205	
H. pendulus (Linnaeus)	2775	8
H. trivittatus (F.)	16	
Lejogaster metallina (Fabricius)	15	
L. splendida (Meigen)	2	3
Leucozona lucorum (L)		5
Melangyna umbellatarum (F)	2	
Melanostoma mellinum (Linnaeus)	136	
M. scalare (Fabricius)	42	2
Meliscaeva auricollis (Mg)	6	2
M. cinctella (Zetterstedt)	4	
Merodon equestris (Fabricius)	2	
Metasyrphus corollae (Fabricius)	31	
M. latifasciatus (Macq.)	6	
M. luniger (Meigen)	11	
Microdon devius (Linnaeus)		1
Myathropa florea (Linnaeus)	1	
Neoascia geniculata (Meigen)	59	1
N. interrupta (Meigen)	1	
N. meticulosa (Scopoli)	37	4
N. podagrica (Fabricius)	80	
N. tenur (Harris)	2986	12
Neocnemodon vitripennis (Meigen)	1	
Orthonevra geniculata Meigen	18	1
O. nobilis (Fallen)		1
O. splendens (Mg)	5	
Parhelophilus consimilis (Malm)	2	
P. frutetorum (Fabricius)	13	1
P. versicolor (F)	38	1
Pipiza bimaculata Meigen	1	
P. noctiluca (L)	2	
Pipizella virens (Fabricius)		1
Platycheirus clypeatus agg. (Meigen)	10	3
P. cyaneus (Muller)	60	3
P. fulviventris (Macq.)	1	
P. manicatus (Meigen)	100	
P. melanopsis Loew	1	
P. peltatus (Meigen)	2	
P. peltatus agg.	118	
P. scutatus (Meigen)	7	
P. sticticus (Meigen)	1	
P. tarsalis (Schummel)	2	
Pyrophaena granditarsa (Forster)	76	3
P. rosarum (F)	26	1
Rhingia campestris Meigen	77	4
Sericomyia lappona (L)	4	
S. silentis (Harris)	44	2
Sphaerophoria interrupta (Fabricius)	27	2
S. scripta (Linnaeus)	8	3
Sphegina clunipes (Fallen)	1	
Syritta pipiens (Linnaeus)	76	4
Syrphus ribesii (Linnaeus)	35	1
S. vitripennis Meigen	7	
Trichopsomyia flavitarsis (Mg.)	3	
Tropidia scita (Harris)	434	4
Volucella bombylans (Linnaeus)	20	6
V. pellucens (Linnaeus)		2
Xylota abiens Meigen	2	
X. segnis (Linnaeus)	16	1
X. sylvarum (Linnaeus)	1	2
Diptera Tabanidae		
Chrysops caecutiens (L)		3
C. relictus Mg	1	1
C. viduatus Fabricius	3	5
Haematopota crassicornis Wahlberg		1
H. pluvialis (Linnaeus)	7	13
Hybomitra bimaculata (Macquart)	5	8
H. distinguenda (Verrall)		5
H. muhlfeldi (Brauer)	2	7
Diptera Tachinidae		
Alophora hemiptera (Fabricius)		1
Diptera Tephritidae		
Ensina sonchi (Linnaeus)	1	
Orellia falcata (Scopoli)	4	
Paroxyna misella (Loew)	1	1
Terellia ruficauda (Fabricius)		2
Trypeta zoe (Meigen)	1	
Xyphosia miliaria (Schrank)		1
Diptera Therevidae		
Thereva nobilitata (F)	37	1
Diptera Tipulidae		
Austrolimnophila ochracea (Meigen)	3	
Cheilotrichia cinerascens (Meigen)	1	
C. imbuta (Meigen)	1	
Erioptera fuscipennis Meigen	12	2
E. hybrida (Meigen)	7	
E. lutea f. taenionota Meigen	12	
E. maculata Meigen	1	
E. meijerei Edwards	55	
E. nielseni de Meijere	22	
E. squalida Loew	2	
E. stictica (Meigen)	11	
E. trivialis Meigen	22	1
Gonomyia bifida Tonnoir	1	
G. lateralis (Macquart)	30	
Helius flavus (Walker)	47	
H. longirostris (Meigen)	193	

Species	St	non-St
H. pallirostris Edwards	20	
Limnophila abdominalis Staeger	6	
L. adjuncta (Walker)	4	
L. dispar (Meigen)	1	
L. ferruginea (Meigen)	407	3
L. fulvonervosa (Schummel)	22	11
L. maculata (Meigen)	2	
L. meigeni Verrall	4	
L. nemoralis agg. (Meigen)	247	
L. squalens (Zetterstedt)	8	23
Limonia autumnalis (Staeger)	17	4
L. complicata (de Meijere)	6	
L. danica (Kuntze)	48	
L. duplicata (Doane)	3	
L. lucida (de Meijere)	2	
L. macrostigma (Schummel)	35	
L. modesta (Meigen)	71	
L. morio (Fabricius)	1	
L. nubeculosa Meigen	5	
L. tripunctata (Fabricius)	4	
L. trivittata (Schummel)	1	
L. ventralis (Schummel)	17	
Molophilus bifidus Goetghebuer	3	
M. bihamatus de Meijere	139	
M. griseus (Meigen)	4	
M. medius de Meijere	5	
M. obscurus (Meigen)	145	3
M. occultus de Meijere	101	1
M. pleuralis de Meijere	299	
M. propinquus (Egger)	1	
M. serpentiger Edwards	2	
Nephrotoma lunulicornis (Schummel)	1	
N. scurra (Meigen)	1	
Ormosia depilata Edwards	1	
O. hederae (Curtis)	4	
O. pseudosimilis (Lundstroem)	1	
Paradelphomyia dalei (Edwards)	5	
P. nielseni (Kuntze)	6	
P. senilis (Haliday)	129	
Pedicia immaculata (Meigen)	96	1
P. rivosa (Linnaeus)	16	
Phalacrocera replicata (Linnaeus)	2	
Pilaria batava (Edwards)	1	
P. discicollis (Meigen)	8	
P. filata (Walker)	1	
P. fuscipennis (Meigen)	34	
P. meridiana (Staeger)	1	
P. scutellata (Staeger)	15	
Prionocera turcica (Fabricius)	27	3
Pseudolimnophila lucorum (Meigen)	2	
P. sepium (Verrall)	3	
Tasiocera murina (Meigen)	2	
Thaumastoptera calceata Mik	15	
Tipula luna Westhoff	5	2
T. luteipennis Meigen	36	1
T. marginata Meigen	1	
T. maxima Poda		1

Species	St	non-St
T. melanoceros Schummel	12	
T. nigra Linnaeus	2	
T. oleracea Linnaeus	8	1
T. paludosa Meigen	9	
T. staegeri Nielsen	1	
T. variicornis Schummel	1	
T. vittata Meigen		1
Ula sylvatica (Meigen)	10	
Diptera Trichoceridae		
Trichocera annulata Meigen	2	
T. hiemalis (Degeer)	9	
T. parva Meigen	1	
T. regelationis (Linnaeus)	47	
Ephemeroptera Ephemerellidae		
Ephemerella ignita (Poda)		1
Gnathobdellida Hirudinidae		
Haemopis sanguisuga (L.)	8	
Hemiptera Acanthosomatidae		
Elasmostethus interstinctus (Linnaeus)		1
Elasmucha grisea (Linnaeus)		1
Hemiptera Aphalaridae		
Strophingia ericae (Curtis)		10
Hemiptera Berytinidae		
Cymus glandicolor Hahn	4	4
Hemiptera Cercopidae		
Aphrophora alni (Fallen)	8	3
A. alpina Melichar	13	2
Cercopis vulnerata Illiger		1
Neophilaenus lineatus (Linnaeus)	141	23
Philaenus spumarius (Linnaeus)	115	11
Hemiptera Cicadellidae		
Adarrus ocellaris (Fallen)	25	
Agallia brachyptera (Boheman)	5	
A. consobrina Curtis	6	
Allygus mixtus (Fabricius)	1	
Aphrodes albifrons (Linnaeus)	28	
A. albiger (Germar)	8	
A. bifasciatus (Linnaeus)	7	
A. flavostriatus (Donovan)	30	
A. makarovi Zakhvatkin	348	
Arboridia parvula (Boheman)	4	
Arocephalus punctum (Flor)	1	
Arthaldeus pascuellus (Fallen)	122	
Cicadella lasiocarpae Ossiannilsson	1	
C. viridis (Linnaeus)	73	5
Cicadula aurantipes (Herrich-Schaeffer)	2	
C. flori (J.Sahlberg)	2	
C. frontalis (Herrich-Schaeffer)	240	1
C. quadrinotata (Fabricius)	9	3
C. saturata (Edwards)	25	
Conosanus obsoletus (Kirschbaum)	425	2
Cosmotettix costalis (Fallen)	1	
Deltocephalus pulicaris (Fallen)	1	
Dikraneura variata Hardy	1	1

Species	St	non-St
Diplocolenus abdominalis (Fabricius)	1	
Edwardsiana salicicola (Edwards)	1	
Elymana sulphurella (Zetterstedt)	6	
Empoasca decipiens Paoli		1
Eupelix cuspidata (Fabricius)	2	
Eupteryx aurata (Linnaeus)	12	2
E. cyclops Matsumura	2	
E. melissae Curtis	2	
E. signatipennis (Boheman)	13	1
E. thoulessi Edwards	6	
E. urticae (Fabricius)	7	
E. vittata (Linnaeus)	45	
Euscelis incisus (Kirschbaum)	17	1
Evacanthus acuminatus (Fabricius)	41	
E. interruptus (Linnaeus)	69	1
Forcipata citrinella (Zetterstedt)	11	5
Graphocraerus ventralis (Fallen)	1	
Grypotes puncticollis (Herrich-Schaeffer)	1	
Idiocerus confusus Flor	1	1
I. lituratus (Fallen)	1	
Jassargus distinguendus (Flor)	304	
Kybos smaragdulus (Fallen)	1	
Macropsis impura (Bohem.)	23	
M. prasina (Boheman)	3	
Macrosteles laevis (Ribaut)	1	
M. oshanini Razvyaskina	7	
M. septemnotatus (Fallen)	11	
M. sexnotatus (Fallen)	6	3
M. variatus (Fallen)	1	
M. viridigriseus (Edwards)	8	2
Macustus grisescens (Zetterstedt)	581	
Megophthalmus scabripennis Edwards	4	
M. scanicus (Fallen)	25	
Mocuellus metrius (Flor)	1	
Mocydia crocea (Herrich-Schaeffer)	1	
Notus flavipennis (Zetterstedt)	163	2
Oncopsis flavicollis (Linnaeus)		3
O. tristis (Zetterstedt)	2	
Paluda adumbrata (C. Sahlberg)	1	
P. flaveola (Boheman)	2	
Paralimnus phragmitis (Boheman)	197	
Psammotettix confinis (Dahlbom)	12	
Recilia coronifera (Marshall)	119	
Rhytistylus proceps Kirshbaum	3	
Ribautiana tenerrima (Herrich-Schaeffer)	1	
Scleroracus plutonius (Uhler)	2	
Sonronius dahlbomi (Zetterstedt)	3	
Streptanus aemulans (Kirschbaum)	100	
S. marginatus (Kirschbaum)	1	
S. sordidus (Zetterstedt)	66	
Stroggylocephalus agrestis (Fallen)	310	
S. livens (Zetterstedt)	10	
Ulopa reticulata (Fabricius)	1	2
Zyginidia scutellaris (Herrich-Schaeffer)	36	
Hemiptera Cimicidae		
Anthocoris nemoralis (Fabricius)	2	
A. nemorum (Linnaeus)	94	6
Orius laevigatus (Fieber)	10	
O. majusculus (Reuter)	102	
O. niger (Wolff)	8	
Xylocoris galactinus (Fallen)	3	
Hemiptera Cixiidae		
Cixius nervosus (Linnaeus)	3	
C. similis Kirschbaum	1	
Tachycixius pilosus (Olivier)	1	
Hemiptera Corixidae		
Corixa panzeri (Fieber)	1	
C. punctata (Illinger)		1
Hesperocorixa sahlbergi (Fieber)		1
Micronecta scholtzi (Scholtz)		8
Sigara falleni (Fieber)	1	
Hemiptera Delphacidae		
Anakelisia fasciata (Kirschbaum)	1	
Chloriona dorsata Edwards	14	
C. glaucescens Fieber	109	
C. smaragdula (Stal)	165	19
C. unicolor (Herrich-Schaeffer)	19	
C. vasconica Ribaut	145	
Conomelus anceps (Germar)	10	3
Criomorphus albomarginatus Curtis	23	
Delphacodes capnodes (Scott)	40	
D. venosus (Germar)	5	
Delphax pulchellus Curtis	127	6
Euides speciosa (Boheman)	83	
Florodelphax leptosoma (Flor)	30	2
F. paryphasma (Flor)	1	
Hyledelphax elegantulus (Boheman)	2	
Javesella discolor (Boheman)	1	
J. dubia (Kirschbaum)	13	
J. pellucida (Fabricius)	83	6
Kelisia guttula (Germar)	1	
K. pallidula (Boheman)	4	
K. punctulum (Kirschbaum)	3	
K. vittipennis (Sahlberg)	5	
Megamelodes lequesnei Wagner	102	1
M. quadrimaculatus (Signoret)	156	2
Megamelus notula (Germar)	38	1
Muellerianella extrusa (Scott)	47	
M. fairmairei (Perris)	3	
Oncodelphax pullulus (Boheman)	14	
Paradelphacodes paludosus (Flor)	14	
Paraliburnia adela (Flor)	7	
P. clypealis (J.Sahlberg)	37	
Stenocranus fuscovittatus (Stal)	3	
S. longipennis (Curtis)		3
S. major (Kirschbaum)	4	1
Struebingianella lugubrina (Boheman)	5	

Species	St	non-St
Ceratocombus coleoptratus (Zetterstedt)	12	
Hemiptera Gerridae		
Gerris lacustris (Linnaeus)	9	1
G. lateralis Schummel	2	
G. odontogaster (Zetterstedt)	5	
Hemiptera Hebridae		
Hebrus pusillus (Fallen)	10	1
H. ruficeps (Thomson)	59	
Hemiptera Hydrometridae		
Hydrometra gracilenta Horvath	1	
H. stagnorum (Linnaeus)	4	
Hemiptera Liviidae		
Livia crefeldensis (Mink)	5	1
L. juncorum (Latreille)	9	2
Hemiptera Lygaeidae		
Acompus rufipes (Wolff)	1	2
Chilacis typhae (Perris)	2	
Drymus brunneus (Sahlberg)	7	
D. sylvaticus (Fabricius)	3	
Ischnodemus sabuleti (Fallen)	3	2
Kleidocerys truncatulus (Walker)		18
Pachybrachius fracticollis (Schilling)	12	2
Peritrechus geniculatus (Hahn)		1
Scolopostethus decoratus (Hahn)	1	1
S. puberulus Horvath	14	1
S. thomsoni Reuter	3	
Stygnocoris sabulosus (Schilling)	6	
Hemiptera Microphysidae		
Loricula elegantula (Baerensprung)	1	
L. pselaphiformis Curtis	2	
Myrmedobia coleoptrata (Fallen)	1	
M. distinguenda Reuter	1	
M. exilis (Fallen)	2	
Hemiptera Miridae		
Acetropis gimmerthali (Flor)	1	
Adelphocoris ticinensis (Meyer-Dur)	1	1
Blepharidopterus angulatus (Fallen)	1	
Bryocoris pteridis (Fallen)	8	
Calocoris norvegicus (Gmelin)	1	2
Campyloneura virgula (Herrich-Schaeffer)		1
Capsus ater (Linnaeus)	7	1
C. wagneri Remane		3
Dicyphus epilobii Reuter	10	
Globiceps dispar (Boheman)	1	
Halticus apterus (Linnaeus)	1	7
Leptopterna dolabrata (Linnaeus)	4	37
L. ferrugata (Fallen)	1	
Liocoris tripustulatus (Fabricius)		1
Lygocoris contaminatus (Fallen)	1	
L. lucorum (Meyer-Dur)	7	9
L. pabulinus (Linnaeus)	1	
Lygus rugulipennis Poppius	3	2
Mecomma ambulans (Fallen)	4	
Species	**St**	**non-St**
Monalocoris filicis (Linnaeus)	5	
Notostira elongata (Geoffroy in Fourcroy)		2
Orthonotus rufifrons (Fallen)	2	
Orthops campestris (Linnaeus)	1	3
Orthotylus marginalis Reuter	3	1
Pithanus maerkeli (Herrich-Schaeffer)	1	1
Plagiognathus arbustorum (Fabricius)	5	3
P. chrysanthemi (Wolff)	6	4
Polymerus nigritus (Fallen)	1	
P. palustris (Reuter)	5	
Stenodema calcaratum (Fallen)	30	1
S. laevigatum (Linnaeus)	2	1
S. trispinosum Reuter	33	
Teratocoris antennatus (Boheman)	30	6
T. saundersi Douglas & Scott	4	
Trigonotylus ruficornis (Geoffroy)		1
Tytthus geminus (Flor)	1	
Tytthus pygmaeus (Zetterstedt)	9	
Hemiptera Nabidae		
Aptus mirmicoides (Costa)	1	
Nabicula flavomarginata (Scholtz)	1	
N. limbata (Dahlbom)	26	
N. lineata (Dahlbom)	13	
Nabis ericetorum Scholtz	2	
N. ferus (Linnaeus)	61	1
N. rugosus (Linnaeus)		1
Stalia boops (Schiodte)	1	
Hemiptera Nepidae		
Nepa cinerea Linnaeus	61	1
Hemiptera Pentatomidae		
Pentatoma rufipes (Linnaeus)		2
Picromerus bidens (Linnaeus)	1	
Troilus luridus (Fabricius)		1
Zicrona caerulea (Linnaeus)	2	1
Hemiptera Psyllidae		
Psylla hartigi Flor	3	
P. moscovita Andrianova	67	
P. saliceti Forster	12	19
Hemiptera Reduviidae		
Empicoris vagabundus (Linnaeus)	3	
Hemiptera Rhopalidae		
Rhopalus maculatus (Fieber)		1
Hemiptera Saldidae		
Chartoscirta cincta (Herrich-Schaeffer)	275	
C. cocksi (Curtis)	1	
C. elegantula (Fallen)	2	
Saldula opacula (Zetterstedt)	3	
S. saltatoria (Linnaeus)	116	1
Hemiptera Tingidae		
Acalypta carinata (Panzer)	15	
A. parvula (Fallen)	1	
Dictyla convergens (Herrich-Schaeffer)	7	2
Hemiptera Triozidae		
Trioza apicalis Forster		1

Species	St	non-St
T. centranthi (Vallot)		2
T. galii Forster	1	
T. urticae (Linnaeus)	1	1
Hemiptera Veliidae		
Microvelia buenoi umbricola Wroblewski	11	
M. reticulata (Burmeister)	4	
Velia caprai Tamanini	10	
Hymenoptera Andrenidae		
Andrena denticulata (Kirby)	2	
Hymenoptera Apidae		
Apis mellifera Linnaeus	91	
Bombus hortorum (Linnaeus)	41	
B. lapidarius (Linnaeus)	11	2
B. lucorum Linnaeus	73	
B. muscorum (Linnaeus)		2
B. pascuorum (Scopoli)	115	2
B. pratorum (Linnaeus)	32	
B. terrestris (Linnaeus)	12	
Psithyrus bohemicus (Seidl)	6	
P. sylvestris Lepeletier	4	
Hymenoptera Bethylidae		
Bethylus cephalotes Forster	3	
B. fuscicornis (Jurine)	2	
Hymenoptera Cephidae		
Calameuta pallipes (Klug)	3	
Cephus cultratus Eversmann	1	
C. pygmeus (Linnaeus)	1	
Hymenoptera Colletidae		
Hylaeus communis Nylander	1	
Hymenoptera Dryinidae		
Anteon ephippiger Dalman	1	
A. fulviventre Haliday	2	
A. pubicorne Dalman	1	2
Aphelopus melaleucus (Dalman)	1	
Lonchodryinus ruficornis Dalman	2	
Hymenoptera Eumenidae		
Ancistrocerus parietinus (Linnaeus)		1
A. trifasciatus (Muller 1776)	2	
Gymnomerus laevipes (Shuckard)	1	
Odynerus simillimus Morawitz F.	1	
Symmorphus gracilis (Brulle)	2	1
S. mutinensis (Baldini)	1	
Hymenoptera Formicidae		
Myrmica rubra (Linnaeus)	21	
M. ruginodis Nylander		1
M. sulcinodis Nylander	5	
Hymenoptera Halictidae		
Lasioglossum quadrinotatum (Kirby)	1	
Sphecodes rubicundus von Hagens	1	
Hymenoptera Megachilidae		
Megachile circumcincta (Kirby)	2	
Hymenoptera Melittidae		
Macropis europaea Warncke		3
Hymenoptera Pompilidae		
Episyron rufipes (Linnaeus)	1	
Pompilus cinereus (Fabricius)	2	

Species	St	non-St
Hymenoptera Sphecidae		
Crabro cribrarius (Linnaeus)		1
Ectemnius continuus (Fabricius)	10	
E. lapidarius (Panzer)	2	
Passaloecus clypealis Faester	7	
Rhopalum gracile Wesmael	17	
Trypoxylon attenuatum Smith F.	36	2
Hymenoptera Tenthredinidae		
Allantus calceatus (Klug)	2	
Ametastegia glabrata (Fallen)	16	
Athalia bicolor Lepeletier	55	
A. circularis (Klug)	1	
A. cordata Lepeletier	4	
A. liberta (Klug)	1	
A. lugens (Klug)	2	
Birka cinereipes (Klug)	2	
Brachythops flavens (Klug)	1	4
Croesus septentrionalis (Linnaeus)		1
C. varus (Villaret)	2	
Dolerus aericeps Thomson	2	
D. sanguinicollis (Klug)	1	
Empria baltica Conde	6	
Eutomostethus luteiventris (Klug)	1	
Euura mucronata (Hartig)	1	
Macrophya duodecimpunctata (Linnaeus)	1	
Pachynematus kirbyi (Dahlbom)	2	
Pristiphora pallidiventris (Fallen)	1	
Selandria serva (Fabricius)	1	2
Tenthredo arcuata Forster	1	
T. atra Linnaeus	2	
T. ferruginea Schrank	51	
T. livida Linnaeus	1	
Tenthredopsis nassata (Linnaeus)	1	
Hymenoptera Vespidae		
Vespula vulgaris (Linnaeus)	9	
Isopoda Armadillidae		
Armadillidium vulgare	10	
Isopoda Asellidae		
Asellus aquaticus (L.)	196	2
A. meridianus Racovitza	11	
Isopoda Ligiidae		
Ligidium hypnorum	1735	
Isopoda Oniscidae		
Oniscus asellus	3	
Isopoda Philosciidae		
Philoscia muscorum	153	2
Isopoda Porcellionidae		
Porcellio scaber	7	
Isopoda Trichoniscidae		
Trichoniscus pusillus	90	
Lepidoptera Arctiidae		
Arctia caja	1	14
Cybosia mesomella	1	1
Diacrisia sannio	1	1
D. mendica	1	1
Eilema complana		5
E. griseola		5
E. lurideola		2

Species	St	non-St
Miltochrista miniata Forst.		1
Phragmatobia fuliginosa	15	7
Spilosoma lubricipeda	2	1
S. luteum	1	2
S. urticae	3	
Thumatha senex	4	8
Tyria jacobaeae		5
Lepidoptera Cochylidae		
Agapeta hamana		4
Lepidoptera Drepanidae		
Cilix glaucata		3
Drepana binaria		3
D. cultraria		1
D. falcataria		3
Falcaria lacertinaria		3
Lepidoptera Geometridae		
Acasis viretata		1
Aethalura punctulata		1
Alcis repandata		3
Aplocera efformata		1
Biston betularia		3
Cabera exanthemata		2
C. pusaria		4
Campaea margaritata		4
Camptogramma bilineata bilineata L.	1	2
Catarhoe cuculata Hufn.		1
Chloroclysta truncata		1
Cidaria fulvata		1
Cosmorhoe ocellata		2
Crocallis elinguaria		1
Cyclophora albipunctata		1
Ecliptopera silaceata		2
Ematurga atomaria	1	5
Ennomos alniaria		2
E. erosaria		2
E. fuscantaria		1
Epione repandaria	2	1
Epirrhoe alternata	3	16
Euchoeca nebulata		2
Eulithis pyraliata		3
Euphyia unangulata		1
Eupithecia centaureata	1	
E. icterata		1
E. subfuscata	6	
E. subumbrata	1	
E. tripunctaria		3
E. vulgata	3	
Geometra papilionaria		3
Hemithea aestivaria		1
Hydriomena furcata		3
Idaea aversata		5
I. biselata		3
I. dimidiata	4	2
I. emarginata		2
I. muricata		1
I. straminata		1
I. trigeminata		1
Ligdia adustata		1

Species	St	non-St
Lomaspilis marginata		6
Lomographa temerata		1
Opisthograptis luteolata		3
Orthonama vittata		9
Ourapteryx sambucaria		1
Pelurga comitata		1
Peribatodes rhomboidaria		5
Perizoma affinitata		1
Perizoma albulata Denis & Schiffermuller		2
Perizoma alchemillata		2
Petrophora chlorosata	1	
Scopula immutata		4
Scotopteryx chenopodiata		4
Selenia dentaria		2
Semiothisa clathrata		5
Timandra griseata Petersen		4
Xanthorhoe ferrugata		7
X. fluctuata		4
X. montanata	1	5
X. spadicearia	1	4
Lepidoptera Hepialidae		
Hepialus humuli humuli L.		2
H. lupulinus		1
Lepidoptera Hesperiidae		
Ochlodes venata	18	6
Thymelicus sylvestris	7	2
Lepidoptera Incurvariidae		
Adela cuprella (Denis & Schiffermuller)		2
A. rufimitrella		3
Nemophora degeerella		5
Lepidoptera Lasiocampidae		
Lasiocampa quercus	1	1
Philudoria potatoria	17	12
Trichiura crataegi		1
Lepidoptera Limacodidae		
Apoda limacodes		1
Lepidoptera Lycaenidae		
Callophrys rubi		1
Celastrina argiolus		1
Lycaena phlaeas	1	3
Polyommatus icarus	1	3
Lepidoptera Lymantriidae		
Euproctis similis		6
Leucoma salicis		2
Lymantria monacha		1
Orgyia antiqua		3
O. recens	1	
Lepidoptera Micropterigidae		
Micropteryx calthella Linnaeus		1
Lepidoptera Noctuidae		
Abrostola trigemina		1
Acronicta megacephala		1
A. rumicis		1
A. tridens		1
Agrotis clavis		1
A. exclamationis		2
A. puta		3

Species	**St**	**non-St**
A. segetum		1
A. vestigialis		1
Amphipoea fucosa	1	
A. berbera		1
A. pyramidea		1
A. tragopoginis		3
Anarta myrtilli	2	1
Apamea anceps		1
A. crenata	1	
A. epomidion		1
A. monoglypha		6
A. ophiogramma	1	1
A. remissa		2
A. unanimis	2	
Archanara dissoluta	1	
A. geminipuncta	4	2
Arenostola phragmitidis	2	9
Atethmia centrago		1
Autographa gamma	166	11
A. pulchrina	1	1
Axylia putris	1	1
Brachylomia viminalis		1
Callistege mi	1	1
Catocala nupta		1
Celaena haworthii	2	
C. leucostigma	1	5
Cerapteryx graminis		2
Chilodes maritimus	4	1
Coenobia rufa	1	2
Colocasia coryli		3
Cosmia trapezina		5
Cucullia verbasci		1
Diachrysia chrysitis	1	2
Diarsia florida		1
D. mendica mendica Fabricius	1	
D. rubi	2	4
Discestra trifolii		4
Earias clorana (L.)		1
Eclidea glyphica	1	
Enargia ypsillon		1
Eremobia ochroleuca		2
Euplexia lucipara		1
Eustrotia uncula	1	7
Graphiphora augur		2
Hadena bicruris	1	3
Herminea tarsipennalis		1
H. nemoralis	1	
Hoplodrina alsines		1
H. blanda		1
Hydraecia micacea	1	2
Hypena proboscidalis		3
Hypenodes turfosalis		2
Lacanobia oleracea	1	5
L. thalassina		1
Laspeyria flexula		2
Luperina testacea		2
Lycophotia porphyria	3	1
Lygephila pastinum	4	3
Macrochilo cribrumalis	1	2

Species	**St**	**non-St**
Mamestra brassicae		2
Melanchra persicariae		3
Mesapamea secalis		7
Mesoligia furuncula		3
M. literosa		1
Mythimna conigera		1
M. ferrago		2
M. impura	3	9
M. pallens		4
M. pudorina	1	6
M. straminea	1	3
M. unipuncta	1	
Noctua comes		4
N. fimbriata		2
N. interjecta		2
N. janthina		5
N. pronuba	3	9
Nonagria typhae	3	
Ochropleura plecta	2	11
Oligia fasciuncula	1	
O. latruncula		1
Orthosia gracilis	1	1
Panemeria tenebrata	1	
Phlogophora meticulosa		4
Photedes minima		1
P. pygmina	3	13
Phytometra viridaria		2
Plusia festucae	1	1
P. putnami		1
Rhyacia simulans		1
Rivula sericealis		14
Schrankia costaestrigalis		3
Senta flammea	3	1
Simyra albovenosa		7
Xanthia icteritia		1
X. togata	1	
Xestia baja		1
X. c-nigrum		4
X. ditrapezium		2
X. rhomboidea (Esper)		1
X. sexstrigata	2	5
X. triangulum		3
X. xanthographa		6
Lepidoptera Nolidae		
Nola cucullatella		3
Lepidoptera Notodontidae		
Eligmodonta ziczac		6
Furcula furcula		4
Notodonta dromedarius		4
Phalera bucephala	1	
Pheosia gnoma		3
P. tremula		3
Pterostoma palpina		3
Ptilodon capucina		4
Lepidoptera Nymphalidae		
Aglais urticae	11	8
Cynthia cardui	2	3
Inachis io	1	3
Polygonia c-album		1

Species	St	non-St
Vanessa atalanta		1
Lepidoptera Oecophoridae		
Agonopterix alstroemeriana		1
A. angelicella		2
A. ciliella		1
Carcina quercana		1
Lepidoptera Papilionidae		
Papilio machaon	3	7
Lepidoptera Pieridae		
Anthocharis cardamines		2
Gonepteryx rhamni	12	2
Pieris brassicae	4	3
P. napi	15	6
P. rapae	17	1
Lepidoptera Psychidae		
Psyche casta Pallas		1
Lepidoptera Pterophoridae		
Adaina microdactyla		1
Pterophorus pentadactyla		2
Lepidoptera Pyralidae		
Agriphila geniculea Haworth		1
A. straminella		1
A. tristella	1	3
Calamatropha paludella (Hubner)	1	
Cataclysta lemnata Linnaeus		6
Catoptria pinella		1
Chilo phragmitella		5
Chrysoteuchia culmella		5
Crambus pascuella		4
C. perlella		3
Endotricha flammealis Denis & Schiffermuller		1
Eurhodope suavella Zincken		1
Eurrhypara hortulata		1
E. lancealis		1
Evergestis forficalis		1
E. pallidata		2
Hypsopygia costalis		2
Nascia cilialis		2
Nymphula nymphaeata L.		3
Orthopygia glaucinalis		2
Phlyctaenia perlucidalis (Hubner)		3
Phycita roborella Denis & Schiffermuller		1
Pleuroptya ruralis		7
Pyla fusca		1
Pyrausta aurata		1
Schoenobius forficella		10
Udea elutalis		5
U. olivalis		1
U. prunalis		1
Lepidoptera Saturniidae		
Saturnia pavonia		3
Lepidoptera Satyridae		
Aphantopus hyperantus	6	8
Coenonympha pamphilus	4	3
Hipparchia semele	1	
Lasiommata megera	2	3
Maniola jurtina L.	3	10
Parage aegeria L.		4
Pyronia tithonus	1	3
Lepidoptera Sphingidae		
Deilephila elpenor		1
Laothoe populi		1
Mimas tiliae		1
Smerinthus ocellata		1
Sphinx ligustri		1
Lepidoptera Thyatiridae		
Habrosyne pyritoides		3
Thyatira batis		3
Lepidoptera Tortricidae		
Acleris hyemana		1
A. lorquiniana		1
A. notana		1
A. rhombana		1
A. rufana Denis & Schiffermuller		1
A. variegana		1
Apotomis betuletana		1
A. turbidana		1
Argyrotaenia ljungiana Thunberg		1
Clepsis spectrana		1
Cnephasia conspersana Dougl.		2
Cydia succedana		1
Epinotia solandriana		1
Olethreutes lacunana		2
Orthotaenia undulana		2
Pandemis cerasana		1
P. corylana		1
Philedone gerningana		1
Lepidoptera Yponomeutidae		
Plutella xylostella		3
Yponomeuta evonymella		1
Y. rorrella		1
Lepidoptera Zygaenidae		
Zygaena trifolii		1
Mecoptera Panorpidae		
Panorpa cognata Rambur		1
Mollusca Ancylidae		
Acroloxus lacustris (L.)	1	
Arion ater (L. 1758)	25	1
Mollusca Clausiliidae		
Clausilia bidentata (Strom)	2	1
Mollusca Cochlicopidae		
Cochlicopa lubrica (Muller)	8	
Mollusca Ellobiidae		
Carychium minimum agg.	11	
C. minimum seg. Muller		1
Mollusca Endodontidae		
Discus rotundatus (Muller)	7	
Punctum pygmaeum (Draparnaud 1801)	7	
Mollusca Euconulidae		
Euconulus alderi (Gray)	26	2
E. fulvus agg.	7	
Mollusca Helicidae		
Ashfordia granulata (Alder)	32	
Cepaea nemoralis (L.)	74	3
Monacha cantiana (Montagu)	4	

Species	St	non-St
Trichia hispida (L.)	5	
T. plebeia (Draparnaud)	1	
T. striolata (Pfeiffer)	10	
Mollusca Hydrobiidae		
Potamopyrgus jenkinsi (Smith)	2	
Mollusca Lymnaeidae		
Lymnaea palustris (Muller)	290	
L. peregra (Muller)	7	2
L. truncatula (Muller)		1
Mollusca Pisidiidae		
Pisidium obtusale (Lamarck)	3	
P. personatum Malm	13	
Mollusca Planorbidae		
Anisus leucostoma (Millet)	45	
Bathyomphalus contortus (L.)	4	2
Planorbis planorbis (L.)	4	3
Mollusca Succineidae		
Oxyloma pfeifferi (Rossmassler)	56	
Succinea putris (L.)	241	
Mollusca Vallonidae		
Acanthinula aculeata (Muller)	1	
Valvata cristata Muller	155	
Mollusca Vertiginidae		
Columella edentula agg.		1
Vertigo antivertigo (Draparnaud)	2	
V. moulinsiana (Dupuy)	8	1
V. pygmaea (Draparnaud)	1	
V. substriata (Jeffreys)		2
Mollusca Zonitidae		
Aegopinella nitidula (Draparnaud)	10	
A. pura (Alder)	1	
Nesovitrea hammonis (Strom)	13	1
Oxychilus alliarius (Miller)	2	
O. cellarius (Muller)	3	
Vitrea crystallina agg.	1	
Zonitoides excavatus (Alder)		1
Z. nitidus (Muller)	61	
Neuroptera Chrysopidae		
Chrysopa carnea Stephens	2	
Neuroptera Hemerobiidae		
Micromus variegatus (Fabricius)	7	4
Psectra diptera (Burmeister)	10	
Neuroptera Sialidae		
Sialis lutaria Linnaeus	7	
Odonata Aeshnidae		
Aeshna cyanea (Muller)		1
A. grandis (Linnaeus)		2
A. mixta Latreille		1
Odonata Coenagriidae		
Coenagrion puella (Linnaeus)		6
Ischnura elegans (Vander Linden)	19	7
Pyrrhosoma nymphula (Sulzer)	54	5
Odonata Lestidae		
Lestes sponsa (Hansemann)		1
Odonata Libellulidae		
Libellula depressa Linnaeus		2
L. quadrimaculata Linnaeus		2
Sympetrum danae (Sulzer)	1	
S. striolatum (Charpentier)		3

Species	St	non-St
Opiliones Nemastomatidae		
Mitostoma chrysomelas	17	
Nemastoma bimaculatum (Fabricius)	118	1
Opiliones Phalangiidae		
Lacinius ephippiatus	438	
Leiobunum blackwallii	39	
L. rotundum	23	
Lophopilio palpinalis	56	
Mitopus morio	30	
Nelima silvatica	52	
Oligolophus tridens	1325	
Paroligolophus agrestis	511	1
Phalangium opilio	2	
Rilaena triangularis	184	
Orthoptera Conocephalidae		
Conocephalus dorsalis (Latreille)	2	1
Orthoptera Tetrigidae		
Tetrix subulata (Linnaeus)		1
Orthoptera Tettigoniidae		
Platycleis albopunctata (Goeze)		1
Plecoptera Nemouridae		
Nemoura cinerea (Retzius)	20	3
N. dubitans Morton		6
Nemurella pictetii Klapalek	3	3
Trichoptera Limnephilidae		
Glyphotaelius pellucidus (Retzius)	1	
Tricladida Rhynchodemidae		
Microplana terrestris		1

Appendix 5 Descriptions of chief features of invertebrate interest at various sites (by A.P. Foster & D.A. Procter).

Badley Moor

Two Red Data Book species of fly listed in category 2 (vulnerable) were present, a larva of the soldier fly *Odontomyia argentata* was recorded from the pitfall traps during the late summer sample period, and adults of the snail-killing fly *Psacadina vittigera* were taken in the early summer samples and also recorded from field observation. Both of these species were rare within the survey, both occurring only at only four other sites, three of them in common.

Two species of beetle were unique to this site (though many of the beetle samples taken elsewhere are currently unidentified); *Dryops nitidulus* and *Nicrophorus vestigator*, both are regarded as nationally scarce. The former is a water beetle, the latter a carrion feeding species attracted to one of the samples which had decayed. Another scarce species of beetle recorded was *Trachys troglodytes*, a species whose larvae mine the leaves of *Succisa*. A nationally scarce jumping spider was unique to this site; *Sitticus caricis*.

Though unique within this survey as the only tufa formation sampled, the invertebrate fauna recorded at Badley Moor showed some similarities with other types of calcareous seepage habitats investigated. For example, the snail-killing fly *P. vittigera was* recorded from only three other spring fed calcareous fens, and two of these were seepage slopes in calcareous valley fens.The bug *Livia crefeldensis* was present here and at one other calcareous seepage slope within the survey.

Although small, with the whole SSSI only covering 18.1 hectares and the tufa mound only forming a very small proportion of this, the seepage slopes of the main tufa formation are of high invertebrate interest. The low intensity grazing regime seems to be favourable in maintaining the short sward and open structure to the vegetation and also avoiding excessive trampling.

Boughton Fen

The few noteworthy invertebrate records known from the site prior to this survey are summarised in Foster (1987).

Very few scarce wetland species recorded from this fairly dry site, though two Na species were present. Adults of the moth *Eurrhypara perlucidalis* were recorded by field observation flying in late afternoon, this is a newcomer to this country and is spreading through south east England. The larvae feed on *Cirsium* spp. in wetland situations. The wolf spider *Hygrolycosa rubrofasciata* was present in the traps. This species is almost entirely restricted fens in and around the Breckland (it also occurred nearby at Foulden within this survey). Merrett (1990) notes that it is more tolerant to the growth of scrub than most other fenland spiders.

A number of the species noted are more often associated with fen carr rather than open fen situations, eg the snail-killing fly *Tetanocera phyllophora*, reflecting the scrubbing up of much of the site.

Brancaster

No invertebrate records refering specifically to the above reed beds have been traced prior to this survey, though the study site does lie within the `Brancaster' site documented in Foster (1986).

The rare Carabid beetle *Dromius longiceps* occurred in stations 1 and 2, this is a predatory species living in old reed stems and is associated with old fens and coastal reedbeds. Though occurring in a wide geographic spread of sites in this survey, it was scarce and showed a marked preference for old unmanaged areas of reed.

A number of rare Mycetophilidae were present particularly during the 1988 season, most of these, though nationally scarce, were widespread within this survey. *Trichonta icenica*, however, is an exeption in only occurring at one other sample site in the Norfolk Broadland. *Pseudexechia parallela* though listed as extinct, proved to be widespread in East Anglia during this project, it was formerly known only from the holotype female.

The beetle *Mordellistena pseudopumila* has only recently been added to the British list and is difficult to separate from a closely related species, it occurred at only one other site in the survey. It is possible that the larvae live in small fragments of dead wood, adults are attracted to flowers.

The moth *Nascia cilialis*, whose larvae feed on various species of *Carex*, was recorded during the light trapping. Nationally this species is very restricted in distribution with its main stronghold in East Anglia.

Among the Sciarid flies collected at this site there appears to be a species new to science and not yet described, Dr B.R.Laurence (pers. comm.).

Burgh Common

A site known to be of high entomological value with the voluntary warden, K. Saul, providing an annual report incorporating entomological records principally for Odonata and Lepidoptera.

Although only a small proportion of the material collected has been worked, some rare species have been identified. A single specimen of the digger wasp *Passaloecus clypealis* was present in the water trap samples, this is a rarity in Britain and has been reared from cigar galls, formed by the fly *Liparas lucens*, on reed. It was only recorded from this and three other sites in the Broadland during this survey.

The small spider *Hypomma fulvum* was frequent in samples from the Broadland area, though is nationally scarce, it lives in a variety of fenland vegetation types, with the egg cocoons have been recorded from the flower heads of reed.

Colobaea bifasciella is a snail-killing fly which is a parasitoid of snails in the family Succineidae.

Buxton Heath

Two very rare Diptera were recorded; the snail-killing fly *Psacadina vittigera* from both the traps and field collecting, and the soldier fly *Odontomyia argentata*, adults of which were recorded during a field collecting in 1991. The former species has larvae which are predators of aquatic Mollusca, the latter has aquatic larvae which probably inhabit mossy areas of spring flushes. Both of these species are very rare nationally and were scarce within this extensive survey; *P. vittigera* occurring at three and *O. argentata* at only four other localities, at two of these sites both species again occurred together. All of these sample sites were calcareous fens and most set in spring flush areas.

The bug *Livia crefenldensis*, which feeds on varius *Carex* spp., also accompanied the above Diptera here and at one other spring flush site.

In addition to the spring flush fauna above, some heathland species were represented in the samples, eg the hoverfly *Sercomyia lappona* which has an aquatic larva and The Beautiful Yellow Underwing Moth, *Anarta myrtilli* whose larvae feed on *Calluna vulgaris*.

Caudlesprings

The artificially created ponds are known to be of entomological interest for their dragonfly and damselfly fauna; both *Lestes dryas* and *Sympetrum sanguineum* confirmed as breeding here. Some light trapping has been carried out by the owner, the resulting Lepidoptera lists are not included here but have been forwarded to the Norfolk Moth Survey.

Two nationally scarce water beetles were recorded by sampling the ponds, one, *Haliplus mucronatus*, is listed in Shirt (1987) though has been reported from artificially created habitats in the past, the second, *Limnebius papposus*, is fairly widespread in East Anglia.

Some nationally notable Diptera were recorded from the trapping station; two speies of fungus gnat, *Epicypta limnophila* and *Pseudexechia parallela* both of which proved fairly widespread in this survey, the hoverfly ,*Anasimyia contracta*, which has an aquatic larvae and is possibly associated with areas of *Typha*, and the Dolichopodid fly *Micromorphus albipes* which occurred now where else in this extensive survey.

In addition the soldier fly *Stratiomys potamida* was recorded by field obervation. This species has an aquatic larva, and at this site is likely to breed in the spring flush where a freshly emerged adult was recorded.

Cavenham Heath NNR

Historically this site, in common with other areas of wetland adjacent to the R. Lark, was studied by entomologists and a number of scarce wetland species were noted, eg the carabid beetle *Dromius longiceps* (Shirt 1987) and the snail killing fly *Dichetophora finlandica* (Withers 1984). Very few modern entomological records are available for this area of fen.

Two very rare snail-killing flies were present in the samples; *Antichaeta brevipennis* and *Dichetophora finlandica*, both species occurred at a few other sites within the present survey but were scarce. Note that *D. finlandica* had been reported from this site as long ago as 1907 (Withers 1984). In addition two rare fungus gnats were noted; *Anatella dampfi* and *Mycetophila confusa*, though nationally rare both of these species were widespread within the samples taken in this survey. The spider *Hygrolycosa rubrofasciata* is a characteristic Breck fen species, which is extremely rare outside of this area of East Anglia.

Cranberry Rough

Two of the rarest species present were Sciomyzidae (snail-killing flies) both are listed in Shirt (1987); *Colobaea pectoralis* and *Tetanocera freyi*. The former was rare in this survey occurring at only two other localites; East Walton Common (a pingo site) and at one site in the Norfolk Broadland. In the past it has been noted nearby at some of the fluctuating Breckland meres. *T. freyi*, though common in the Broadland samples, was rare outside this area occurring only here and at Thompson Common (pingo site). Both species have larvae feed on aquatic Mollusca.

Three other Diptera formerly given Red Data Book ranking but since had their status revised by Falk (1991) were recorded. *Dixella serotina*, one of the meniscus midges with an aquatic larva, and *Epicypta limnophila,* a fungus gnat, were both widespread in this survey, though the cranefly *Limonia ventralis* was far more resticted occurring at Walberswick, two sites in the Norfolk Broadland, Thompson Common (pingo site) and here at Cranberry.

Dersingham Bog

Entomologically this site renowned as the only recorded British site for two species of micro-moth, neither of which have been seen for some years, and the occurrence of a number of insects which are predominantly northern and western in distribution combined with some species more often associated with the New Forest bogs.

7.1.1 East Harling Common

Some nationally scarce fungus gnats (Mycetophilidae) were present in the samples, however, the species concerned proved to quite widespread within this survey. One such species, *Pseudexechia parallela*, was only known from the holotype female prior to this survey, and is listed as extinct in the ISR database.

East Walton Common

A site of high entomological value, noted in particular for the outstanding assemblage of rare aquatic Coleoptera in the pingo pools and a variety of scarce Diptera. Killeen (1991) has recently studied the Mollusca at this site and recorded some rare species including *Vertigo moulinsiana*.

A number of Red Data Book species were recorded from the pingo trapped. The snail-killing fly *Colobaea pectoralis*, an extremely rare species that was present at only two other localities in this survey, larvae of the soldier fly *Odontomyia argentata* the fly *Cordylura aemula*, which has a larva in the leaf bases of *Carex* spp., and *Cyphon pubescens* a beetle with an aquatic larva.

In addition the very rare soldier fly *Odontomyia angulata* was recorded by field collecting, this species occurred at only one other site in this survey, again by field collecting in a pingo depression at Thompsom Common.

Great Cressingham Fen

A small calcareous spring fed fen located in a small side valley of the River Wissey. Species rich fen occurs on the low-lying ground where the springs emerge with much of the vegetation dominated by *Juncus inflexus* and *Carex panicea*. Tall fen vegetation occurs in the valley bottom and is dominated by *Phragmites australis* and *Juncus effusus*, some large tussocks of *Carex paniculata* are also present. *Salix cinerea* carr woodland is also present on the site.

All the species listed result from a single visit made to this site on 1/8/1988, principally from sweep netting, no pitfall or water traps were operated.

Some of the scarce species noted at this site were not captured elsewhere in the survey by using pitfall or water trapping techniques, though some were noted at a few other sites by field. Such species include the bug *Capsus wagneri* which is likely to feed on *Calammogrostis canescens*, though other grasses may be hosts too, the weevils *Bagous lutulentus* feeding on *Equisetum* spp. and *Drupenatus nasturtii* feeding on *Rorippa* spp., and the lea beetle *Phyllobrotica quadrimaculata* which has adults and larvae feeding on *Scutellaria galericulata*. Larvae of The Reed Dagger Moth were recorded at this site feeding on *Carex paniculata*, though the more usual foodplant is *Phragmites australis*.

The other scarce species noted were mnore widespread within the survey, for example the soldier fly *Stratiomys singularior* which has an aquatic larva and the soldier beetle *Silis ruficollis* which is a predator.

Holt Lowes

The site is noted entomologically, in the East Anglian context, for the occurrence of some species associated with the acidic valley mire, eg the dragonfly *Orthetrum coerulscens*.

Some nationally scarce species were noted from this very small area of open fen, including the bug, *Livia crefeldensis*, which occurred at only one other site within this extensive survey; Badley Moor, also on a calcareous seepage slope.

The stonefly *Nemoura dubitans* has aquatic larvae occurs where water seeps over fen peat and has recently been recorded from a number of sites in East Anglia, though appears to be very local. Present at three other localities in this survey.

Hopton Fen

Five nationally scarce species were recorded, though most of these were widespread within the current survey. *Exechia exigua*, a fungus gnat, was the exeption in occurring at only three other localities, this is a scarce species favouring wooded areas where the larvae probably develop in soft fungi.

Lakenheath Poors Fen

The few invertebrate records available for the site prior to this survey included some wetland species of noteworthy status.

Three species of Diptera considered as nationally scarce were unique to this site within the present survey. *Dolichopus plumitarsis* is extremely rare in Britian with only one previous record, from the Ely ditrict, the detailed biology of this species is not known, but the larvae are likely to live in damp mud and the adults are predators on other small insects. The other two species are widespread, the cranefly *Molophilus propinquus* is primarily northern and western in distribution and associated with ditch and stream sides, and the picture winged fly *Orellia falcata* forms galls on *Tragopogon pratensis*.

Market Weston Fen

Known to be of high entomological interest, particularly for aquatic Coleoptera (Foster 1984)

Many of the scarce species noted are Coleoptera from the water filled hollows at the southern end of the site, i.e not in the trapping station. Some of these are Red Data Book species and the fauna of these hollows shows some similarities with the pingo pools of West Norfolk.

The bug *Paradelphacodes paludosus* was present in the trapping station, this species occurred at only one other site within the present survey (Swangey Fen) and is probably phytophagous on *Carex* spp. and *Molinia*. The hoverfly *Cheilosia velutina* has larvae which feed on *Scrophularia*, this species was also scarce within this survey, occurring at only two other localities, though listed in Shirt (1987) its status has since been revised by Falk (1991).

Middle Harling Fen

No invertebrate records have been traced for this site prior to the current survey.

A number of nationally rare Diptera were present in the samples including the very rare *Dolichopus agilis*, which only occurred at one other site (Old Buckenham Fen) within this extensive survey, and for which there are only a few British records. The fungus gnat, *Mycomya britteni*, was also scarce within the survey though did occur at five other sites, four in the Broadland and one pingo locality.

The spider *Entelecara omissa* though widespread within this survey, being particularly frequent in the fens of the Broadland, is nationally very local and scarceoutside of East Anglia.

One scarce species of bug, *Florodelphax paryphasma*, was unique to this site, the foodplants are unkown though the species is associated with fens and has apparently declined in recent decades.

Field collecting resulted in some rare water beetles being recorded including the Red Data Book listed *Hydrochus brevis*, and the very rare hoverfly, *Microdon devius*, which is associated with calcareous grassland where the larvae develop in ants nests.

Potter & Scarning Fens

Known to be of high entomological value prior to this survey, eg the only East Anglian locality for *Ceriagrion tenellum*, The Small Red Damselfly.

Roydon Common

In common with the nearby Dersingham Bog this site is noted for the occurrence of a variety of invertebrates predominantly northern and western in distribution coupled with the presence of some species occurring in boggy heaths of southern England.

Sheringham & Beeston Regis Commons

A site known to be of high entomological interest, in particular a number of nationally rare Diptera have been recorded (Foster 1986). In addition, Mr K. Durrant has studied the site for many years, reporting a range of rare species.

Stallode Wash

Most remarkable was the occurrence of a number of rare Sciomyzidae (snail-killing flies), including *Antichaeta atriseta* new to the British Isles, a species is considered as very rare throughout its Palearctic range, it has not been found anywhere else in Britain. Prior to this survey there were only two confirmed British records for the very rare *Pteromicra pectorosa*; Wicken Fen and a site in Essex, this species was abundant at Stallode Wash and unique to this site within the survey.

Other rare species present included a number of Mycetophilidae (fungus gnats) and the spider *Donacochara speciosa*, though most of these proved to be fairly widespread within this East Anglian survey. A larvae of the Water Ermine Moth, *Spilosoma urticae*, was captured in a pitfall trap at station 1, this species appears to have undergone a decline in recent years, though East Anglia remains one of its strongholds.

No marked differences were noted between the faunae recorded at the two sample stations.

Swangey Fen

No invertebrate records, prior to this 1988 survey, have been traced for the site.

A good range of wetland species recorded including some nationally rare, though many of these are frequently recorded within East Anglia.

The three Red Data Book species present in the samples are all listed in the vulnerable category; *Hydroporus scalesianus* (a water beetle), *Erioptera meijerei* (a cranefly) and *Psacadina zernyi* (a snail-killing fly). Only females, however, were recorded for two of these species (*E. meijerei* and *P. zernyi*); males are required to confirm these records beyond doubt. One bug allocated to RDB K status (*Paraliburnia clypealis*) was also present.

The fungus gnat *Pseudexechia paralella* is listed as extinct in the data base and until recently known only from the holotype female, has in fact proved to be widespread in East Anglian wetlands during the current survey.

In addition, four species of Diptera listed in Shirt (1987) within RDB 3 category, but subsequently downgraded to Nb status by Falk (1991), were also captured; *Colobaea bifasciella*, *Pherbellia griseola* and *Sciomyza simplex* all snail killing flies, and *Epicypta limnophila* a fungus gnat.

The water beetle *H. scalesianus* is very rare and localised in Britain, with records in southern England formerly confined to the pingo pools of West Norfolk and, less frequently, from the fens of the Norfolk Broadland. Some nationally scarce water beetles were also recorded, including *Hydroporus longicornis* for which Swangey is only the third known Norfolk locality (G N Foster in lit.).

Both *E. mejerei* and *P.zernyi* were rare in the current survey, though both species showed very similar geographic distributions; Swangey Fen, some of the Norfolk Broadland Fens, some pingo sites and Walberswick NNR on the Suffolk coast. Outwith Swangey, *P. clypealis* was only recorded from three Broadland sample stations and the island in Scoulton Mere. This bug is known to feed on *Calammogrostis canescens*.

The invertebrate fauna of Swangey Fen shows some similarities with with both the pingo sites and the Broadland flood plain fens. In addition, species occurring in spring flush habitats are also represented. A site of high invertebrate conservation value, and probably one of the most important small valley fens sampled in this survey.

Thompson Common

Many of the rarer species noted at this site were fungus gnats (Mycetophilidae), with station 1 producing the longest list of species. Though nationally rare most of these species were widespread within the current survey. Two snail-killing flies (Sciomyzidae) listed in the Insect Red Data Book were present; *Psacadina zernyi* and *Tetanocera freyi*. The former was fairly frequent at sites within the Norfolk Broadland and at Walberswick on the Suffolk coast, though scarce outside these areas; occcurring here at Thompson, Foulden Common ,another pingo site, and Swangey Fen. *T. freyi* though common and widespread within the Broadland, and occurred at only two sites outwith this area; here at Thompson and Cranberry Rough.

The scarce snail *Vertigo moulinsiana* has not been recorded from many sites within the survey, though most of the Mollusca remain unidentified at this stage.

Upton Fen

Known to be of high entomological interest particularly for Coleoptera and Diptera, eg the only recorded site in Britain for the fly *Platypalpus pygialis*, and one of only a few sites for two rare wetland beetles; *Quedius balticus* and *Lathrobium rufipenne*.

Two rare solitary wasps were noted; *Rhopalum gracile* and *Passaloecus clypealis*. Both are listed as Red Data Book insects and were present in samples elsewhere within the Norfolk Broadland during this survey, though not recorded in the other areas sampled. These species seem to be associated with fairly open fen situations where the vegetation is cut every few years, although in this instance *R. gracile* occurred at station 2, mature alder woodland. *P. clypealis* is known to nest in the vacated cigar galls on reed, formed by the fly *Lipara lucens*.

Sample station 2 was one of only two trapping stations located within fen woodland during this survey and some typical woodland species were noted; the beetle *Platycis minuta* develops in decaying timber and two of the snail killing flies, *Pherbellia albocostata* and *Tetanocera phyllophora* are most often associated with wooded habitats.

Walberswick NNR

A site where invertebrates have been recorded in some detail, particularly the Lepidoptera and Diptera, and is noted for the occurrence of a number of nationally scarce species including many wetland rarities.

Whitwell Common

Very few invertebrate records known for the site prior to this survey, though the rare snail-killing fly *Antichaeta brevipennis* had been noted previously.

Appendix 6 Red data book and nationally scarce species recorded from sites in the Norfolk Broads.

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
Araneae											
Baryphyma gowerense (Locket)	RDB K	8								1	
Carorita paludosa Duffey	RDB 2									3	
Centromerus incultus Falconer	RDB 2						1				
Clubiona juvenis Simon	RDB 2	47			17	42		35		17	
Donacochara speciosa (Thorell)	Na	30			3	12		62	3	3	
Entelecara errata O. P.-Cambridge	Nb									1	
E. omissa O. P.-Cambridge	Na	27			33	31		2	4	36	
Hypomma fulvum (Bosenburg)	Na	87		2	58	41		77	5	60	
Marpissa radiata (Grube)	Na	2			1						
Robertus insignis O. P.-Cambridge	RDB 1				1						
Theridiosoma gemmosum (L. Koch)	Nb	1						1	1	2	
Coleoptera											
Acrotrichis lucidula Rosskothen	pRDBK	1									
A. pumila (Erichson)	pRDBK	1									
Agabus labiatus (Brahm)	Nb							3			
A. striolatus (Gyllenhal)	RDB 2	5									
A. unguicularis (Thomson)	Nb	11						2		1	
Apion minimum Herbst	pRDB 3	2									
Bembidion fumigatum (Duftschmid)	Nb	4				1		38			

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
Blethisa multipunctata (L.)	Nb	1						9			
Cerapheles terminatus (Menetries)	Na	107			9	70		86		34	
Cercyon convexiusculus Stephens	Nb	35			51	14	1	32		1	
C. sternalis Sharp	Nb	4			1	3		9		1	
C. tristis (Illiger)	Nb	28				5		63		3	
Chaetarthria seminulum (Herbst)	Nb	4	2		1		1				2
Cypha discoidea (Erichson)	Nb					3					
Cyphon pubescens (F.)	Nb	7			5					1	
Demetrias imperialis (Germar)	Nb					2		4			
Donacia clavipes Fabricius	Nb				2						
Dorytomus salicinus (Gyllenhal)	Nb	1									
Dromius longiceps Dejean	Na	3				12		3		1	
Dryops anglicanus Edwards	RDB 3				6						1
D. nitidulus (Heer)	Na	1									
Enochrus coarctatus (Gredler)	Nb				8			2			
Euplectus kirbii Denny	Nb	1									
Helophorus strigifrons Thomson	Nb									2	
Hydraena palustris Erichson	RDB 2				28			5			
Hydrochus brevis (Herbst)	RDB 3	2			6			2		1	1
H. megaphallus Berge Henegouwen	pRDB 3				24						
Ilybius guttiger (Gyllenhal)	Nb	14					3	9		3	
Laccornis oblongus (Stephens)	Na	3								1	
Lathrobium rufipenne Gyllenhal	RDB 2	1									
Limnebius aluta (Bedel)	Na				81		1	69		3	

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
Longitarsus parvulus (Paykull)	Na							1			
Lythraria salicariae (Paykull)	Nb	2			3						
Medon apicalis (Kraatz)	Nb	2									1
Meligethes gagathinus Erichson	Nb				1						
M. ochropus Sturm	Nb				1	4				1	
Mordellistena pseudopumila Ermisch	pRDBK						4				
Myllaena elongata (Matthews)	Nb				1						
Neobisnius procerulus (Gravenhorst)	pRDBK				1						
Ochthebius marinus (Paykull)	Nb					1					
O. viridis Peyron	Nb					1					
Odacantha melanura (L.)	Nb	9			1	1		17		3	
Oodes helopioides (F.)	Nb	101			12		41	10		10	
Oxytelus fulvipes Erichson	Na	1									
Philonthus fumarius (Gravenhorst)	Nb	5			3	1		9		1	
[P. nitidicollis (Boisduval & Lacordaire)]	Nb							2			
Phytobius waltoni Boheman	Nb	1									
Plateumaris braccata (Scopoli)	Na	3			1	1	1	8		3	
Platycis minuta (F.)	Nb										1
Platystethus nodifrons Mannerheim	Nb	4				1		2			
Pselaphaulax dresdensis (Herbst)	Nb	2				1		4		1	
Quedius balticus Korge	RDB 1	5			3	14				1	
Rhynchaenus foliorum (Mueller)	Na									2	
Rhynchites longiceps Thomson	Nb	1									
Rugilus fragilis (Gravenhorst)	Nb	9									

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
Sepedophilus testaceus (F.)	Nb					1					
Silis ruficollis (F.)	Nb	131			6	71	5	106		38	
Stenus argus Gravenhorst	Nb	9								1	
S. carbonarius Gyllenhal	Nb	1									
S. europaeus Puthz	Nb									2	
S. fuscicornis Erichson	Nb	1									
S. nitens Stephens	Nb	19			62	17		15		8	
S. opticus Gravenhorst	Na						3	8			
S. palustris Erichson	Nb				12	13				2	
Stilbus atomarius (L.)	pRDBK					9					
Tapinotus sellatus (F.)	Na									1	
Telmatophilus schoenherri (Gyllenhal)	pRDBK									2	
Diptera											
Achalcus melanotrichus Mik	Nb								1		
Allodia angulata Lundstroem	pRDB 2				4	1		5		3	
A. barbata (Lundstroem)	Nb				5	2		3	4	1	
A. embla Hackman	pRDB 3	3			8			2	1	4	
Allodiopsis rufilatera (Edwards)	pRDB 2									1	
Anagnota bicolor (Meigen)	Nb							1			
Anasimyia interpuncta (Harris)	RDB 3								2		
Anatella dampfi Landrock	pRDB 3	5			8	8		6		2	
A. lenis Dziedzicki	Nb				3						
Anthomyza bifasciata Wood	Nb							7		2	
Antichaeta analis (Meigen)	pRDB 3	2			17	1		10		10	

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
A. brevipennis (Zetterstedt)	RDB 2								3	67	
Argyra elongata (Zetterstedt)	pRDB 3	1			1	4				12	
Asindulum nigrum Latreille	RDB 2	1					2				
Cephalops perspicuus (de Meijere)	RDB 2	11			9	20		12	4	10	
Cheilosia velutina Loew	Nb					1					
Colobaea bifasciella (Fallen)	Nb	111		1	5	7	1	97	13	46	
C. distincta (Meigen)	Nb					12		4	1	4	
C. pectoralis (Zetterstedt)	RDB 2									19	
Cordilura aemula Collin	pRDB 3							1	1		
Dichetophora finlandica Verbeke	pRDB 3									3	
Dixella serotina Meigen	Nb	35			36	16		209	12	24	
Dolichopus laticola Verrall	RDB 1	5			4		1				
D. nigripes Fallen	RDB 1	9									
Dorylomorpha clavifemora Coe	RDB 1					1					
Epicypta limnophila Chandler	Nb	17			24	35	2	26	8	18	
Erioptera meijerei Edwards	RDB 2				9	1	39	1		1	
E. nielseni de Meijere	Nb									15	4
Exechia cincta Winnertz	pRDB 3	1									
E. dizona Edwards	RDB 1				1						
E. exigua Lundstroem	Nb					4					
E. lucidula (Zetterstedt)	pRDB 2						2				
E. pseudofestiva	Nb	4			12	5		10	3	1	
Gimnomera tarsea (Fallen)	Nb	49			92		20			58	1
Gonomyia bifida Tonnoir	Nb							1			

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
Helius pallirostris Edwards	Nb	2			3						
Hercostomus chalybeus (Wiedemann)	Nb	3			19	2		5	8	2	
Hybomitra muhlfeldi (Brauer)	pRDB 3	6					1	1		1	
Leia longiseta Barendrecht	pRDB 2	4			9	31	2	80	10	7	
Lejogaster splendida (Meigen)	Nb					2				1	
Limnophila abdominalis Staeger	Nb	2			3					1	
Limonia complicata (de Meijere)	Nb	1				1					
L. danica (Kuntze)	pRDB 3	1			2	10		12	9	2	
L. trivittata (Schummel)	Nb							1			
L. ventralis (Schummel)	Nb	2			3						
Lonchoptera nitidifrons Strobl	Nb							25		22	
L. scutellata Stein, P.	Nb	1						14	1	1	
Macrocera estonica Landrock	Nb				1			1		3	
Megalopelma nigroclavatum (Strobl)	Nb				1			1			
Molophilus bihamatus de Meijere	Nb	132									7
Mycetophila confusa Dziedzicki	pRDB 3	1			2			3	2		
M. stolida Walker	Nb				1						
Mycomya britteni Kidd	pRDB 2				2		1		1	1	
M. insignis (Winnertz)	pRDB 2							1			
Neoascia geniculata (Meigen)	Nb							9			
Nephrotoma lunulicornis (Schummel)	Nb								1		
Ochthera manicata	pRDB 3	28			6	2	4	1	1	4	
Odontomyia argentata (Fabricius)	RDB 2		1								
O. tigrina (Fabricius)	Nb				3			1			

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
Orthonevra geniculata Meigen	Nb				1	1					
Parhelophilus consimilis (Malm)	RDB 2									2	
Pherbellia argyra Verbeke	RDB 2				8			12		11	
P. nana (Fallen)	Nb								2	1	
Phronia mutabilis Dziedzicki	pRDB 1	2			6			4		6	
Phthiria pulicaria	Nb					1				1	
Pilaria fuscipennis (Meigen)	Nb	12			1					2	
P. meridiana (Staeger)	Nb									1	
P. scutellata (Staeger)	Nb	1						2			
Pipizella virens (Fabricius)	Nb	1									
Platypalpus albiseta (Panzer)	Nb							1			
Psacadina verbekei Rozkonsky	Nb	9	4		5	16		6	4	18	
P. vittigera (Schiner)	RDB 2		7								
P. zernyi Mayer	RDB 2	6			11			10		23	
Pteromicra leucopeza (Meigen)	RDB 2					3		2			
Renocera striata (Meigen)	Nb				5					1	
Rhamphomyia caliginosa Collin	Nb				5	20		1			
Rymosia armata Lackschewitz	pRDB 3	2			7	2		4		4	
R. britteni Edwards	pRDB 2							3		5	
Scathophaga tinctinervis (Becker)	RDB 2					2			1		
Sceptonia costata (Wulp)	Nb								1		
Sciomyza dryomyzina Zetterstedt	RDB 2								3		
S. simplex Fallen	Nb	91			56	6		171	8	64	
Stratiomys potamida	Nb	1				1					

Species	**Status**	**Bure Marshes**	**Buxton Heath**	**Burgh Common**	**Catfield Fens**	**Hickling Broad**	**Mill's Marsh**	**Reedham Marshes**	**Strumpshaw Marsh**	**Sutton Broad Fens**	**Upton Fen**
S. singularior (Harris)	Nb	1			1	5	5		2		
Suillia dumicola (Collin)	Nb					1					
Telmaturgus tumidulus (Raddatz)	pRDB 3				9		3				
Tetanocera freyi Stackelberg	RDB 3	111			105		103	105	1	71	3
T. phyllophora Melander	Nb	2									7
Thaumastoptera calceata Mik	Nb									7	
Tipula marginata Meigen	RDB 3						1				
Trichonta icenica Edwards	pRDB 3								1		
T. nigritula Edwards	RDB 1				3					3	
T. pulchra Gagne	pRDB 1							1			
Xylota abiens Meigen	Nb								1		
Hemiptera											
Adelphocoris ticinensis (Meyer-Dur)	Nb					1				1	
Aphrodes albiger (Germar)	Nb					4	3			1	
Aphrophora alpina Melichar	Nb	1			2	2				1	
Capsus wagneri Remane	Nb				1						
Chloriona dorsata Edwards	Nb							11			
C. vasconica Ribaut	Nb					1		110		9	
Cicadula flori (J.Sahlberg)	Nb	2									
Delphacodes capnodes (Scott)	Nb	2			15	15				3	
Hebrus pusillus (Fallen)	Nb				5						1
Hydrometra gracilenta Horvath	pRDB 3							1			
Macrosteles oshanini Razvyaskina	pRDBK									7	
Megamelodes lequesnei Wagner	Nb	4			3	57				12	

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
Microvelia buenoi umbricola Wroblewski	RDB 3	3			1			7			
Oncodelphax pullulus (Boheman)	Nb									3	
Paradelphacodes paludosus (Flor)	Na	1			2						
Paraliburnia clypealis (J.Sahlberg)	pRDBK				22	7					
Paralimnus phragmitis (Boheman)	Nb	43			41	19		20	16	17	
Saldula opacula (Zetterstedt)	Nb							1	2		
Stroggylocephalus livens (Zetterstedt)	Nb	1							2	1	
Trioza centranthi (Vallot)	Nb						2				
Tytthus geminus (Flor)	Nb	1									
Hymenoptera											
Macropis europaea Warncke	Na	2				1					
Odynerus simillimus Morawitz F.	RDB 1					1					
Passaloecus clypealis Faester	RDB 3	2		1		3					1
Rhopalum gracile Wesmael	RDB 2				8	8					1
Sphecodes rubicundus von Hagens	Na					1					
Lepidoptera											
Acleris lorquiniana	pRDB 3	1									
Archanara dissoluta	Nb					1					
Calamatropha paludella (Hubner)	Nb									1	
Chilodes maritimus	Nb	1						2			
Earias clorana (L.)	Nb	1									
Eustrotia uncula	Nb	2				1		1			1
Macrochilo cribrumalis	Na	1								1	
Nascia cilialis	Na	1									

Species	Status	Bure Marshes	Buxton Heath	Burgh Common	Catfield Fens	Hickling Broad	Mill's Marsh	Reedham Marshes	Strumpshaw Marsh	Sutton Broad Fens	Upton Fen
Orgyia recens	RDB 2								1		
Papilio machaon	RDB 2	4				2		2	1	1	
Phlyctaenia perlucidalis (Hubner)	Na	1									
Senta flammea	RDB 3	2									
Simyra albovenosa	Na	2									
Spilosoma urticae	Nb							1		1	
Mollusca											
Vertigo moulinsiana (Dupuy)	RDB 3	1								3	
Plecoptera											
Nemoura dubitans Morton	Nb	3			1						

Appendix 7 Red data book and nationally scarce species recorded from sites in Breckland.

Species	Status	Boughton Fen	Caudlesprings	Cavenham Heath	Cranberry Rough	East Harling Common	Foulden Common	Hopton Fen	Kenninghall Fen	Lakenheath Poors Fen	Market Weston Fen	Middle Harling Fen	Buckenham	Pashford Poors Fen	Roydon Fen, Diss	Scoulton Mere	Sea Mere	Stallode Wash	Swangey Fen	Thompson Common	Wangford Carr
Araneae																					
Clubiona juvenis Simon	RDB 2						1														
Crustulina sticta (O. P.-Cambridge)	Nb						2		1												
Donacochara speciosa (Thorell)	Na						3						13					3		1	
Entelecara omissa O. P.-Cambridge	Na						21		8			4				2	1				
Gongylidiellum murcidum (Simon)	Nb					1										2				1	
Hygrolycosa rubrofasciata (Ohlert)	Na	4		1			3		4												2
Hypomma fulvum (Bosenburg)	Na												5		1					12	
Marpissa radiata (Grube)	Na						1		1										2		2
Maso gallicus Simon	Na						20														
Theridiosoma gemmosum (L. Koch)	Nb																			1	
Coleoptera																					
Agabus uliginosus (L.)	Na																		1		
A. unguicularis (Thomson)	Nb										3								2		
Agonum livens (Gyllenhal)	Nb						1														
Badister dilatatus Chaudoir	Nb						1				1								1		
Bembidion obliquum Sturm	Nb										1										
Cercyon convexiusculus Stephens	Nb			4			2				1	1	8	27							
C. sternalis Sharp	Nb			2							1		2	2					1		
C. tristis (Illiger)	Nb			2									10	10							
Dryops anglicanus Edwards	RDB 3										2										

Species	Status	Boughton Fen	Caudlesprings	Cavenham Heath	Cranberry Rough	East Harling Common	Foulden Common	Hopton Fen	Kenninghall Fen	Lakenheath Poors Fen	Market Weston Fen	Middle Harling Fen	Old Buckenham Fen	Pashford Poors Fen	Roydon Fen, Diss	Scoulton Mere	Sea Mere	Stallode Wash	Swangey Fen	Thompson Common	Wangford Carr
D. similaris Bollow	Na											1									
Enochrus coarctatus (Gredler)	Nb										2										
E. isotae Hebauer	RDB 3						1				1										
E. ochropterus (Marsham)	Nb										1										
Gabrius osseticus (Kolenati)	Nb																				1
Graptodytes granularis (L.)	Nb										1										
Haliplus mucronatus Stephens	RDB 3		1																		
Helophorus nanus Sturm	Na											1									
Hydaticus seminiger (Degeer)	Nb										1										
Hydrochus brevis (Herbst)	RDB 3				1							1									
H. carinatus Germar	RDB 3						1														
Hydroporus longicornis Sharp	Nb																		1		
H. scalesianus Stephens	RDB 2																		1		
Hygrotus decoratus (Gyllenhal)	Nb										2										
Ilybius guttiger (Gyllenhal)	Nb										1										
Limnebius aluta (Bedel)	Na										2										
L. papposus Mulsant	Nb		1																		
Oodes helopioides (F.)	Nb						5														
Plateumaris affinis (Kunze)	Nb												1								
Platystethus nodifrons Mannerheim	Nb													3							
Silis ruficollis (F.)	Nb			1			1						5			1	1		1		
Stenus nitens Stephens	Nb						7							1							
Diptera																					
Achalcus melanotrichus Mik	Nb																1				

Species	Status	Boughton Fen	Caudlesprings	Cavenham Heath	Cranberry Rough	East Harling Common	Foulden Common	Hopton Fen	Kenninghall Fen	Lakenheath Poors Fen	Market Weston Fen	Middle Harling Fen	Buckenham	Pashford Poors Fen	Roydon Fen, Diss	Scoulton Mere	Sea Mere	Stallode Wash	Swangey Fen	Thompson Common	Wangford Carr
Allodia angulata Lundstroem	pRDB 2						1		1											2	
A. barbata (Lundstroem)	Nb			1			1		1			1	4					1		2	
A. embla Hackman	pRDB 3						1		2											1	
A. silvatica Landrock	Nb			1																	
Allodiopsis ingeniosa Kidd	Nb																				1
A. rufilatera (Edwards)	pRDB 2												1								
Anatella dampfi Landrock	pRDB 3			1		1	2		4			1	2					2		2	
A. lenis Dziedzicki	Nb																			1	
Antichaeta analis (Meigen)	pRDB 3																	20			
A. brevipennis (Zetterstedt)	RDB 2			1														2			
Brevicornu proximum (Staeger)	Nb						1					1									
Cheilosia pubera (Zetterstedt)	Nb																2			1	
C. velutina Loew	Nb										3						7				
Cheilotrichia imbuta (Meigen)	Nb																1				
Colobaea bifasciella (Fallen)	Nb						2						4		1			2	3		
C. pectoralis (Zetterstedt)	RDB 2				12																
Cordilura aemula Collin	pRDB 3															1					
Dichetophora finlandica Verbeke	pRDB 3			1																	
Dixella serotina Meigen	Nb			2	4		2		6			12	1		1		15			8	
Dolichopus agilis Meigen	RDB 2											1	1								
D. notatus Staeger	Nb													3							
D. plumitarsis Fallen	RDB 1									1											
Dorylomorpha infirmata (Collin)	Nb	1																			
Epicypta limnophila Chandler	Nb		1	1	1		6	1	3			4	3		1	1	2	7	1	4	

Species	Status	Boughton Fen	Caudlesprings	Cavenham Heath	Cranberry Rough	East Harling Common	Foulden Common	Hopton Fen	Kenninghall Fen	Lakenheath Poors Fen	Market Weston Fen	Middle Harling Fen	Old Buckenham Fen	Pashford Poors Fen	Roydon Fen, Diss	Scoulton Mere	Sea Mere	Stallode Wash	Swangey Fen	Thompson Common	Wangford Carr
Erioptera meijerei Edwards	RDB 2						1												2		
E. nielseni de Meijere	Nb																			3	
Exechia exigua Lundstroem	Nb							1								1					
E. pseudofestiva	Nb		1	1	1	1	2		3				2	1			2	1		4	
Exechiopsis crucigera (Lundstroem)	Nb																	1			
E. fimbriata (Lundstroem)	Nb																			1	
E. ligulata (Lundstroem)	Nb															1					
Geomyza majuscula (Loew)	Nb																				1
Hercostomus chalybeus (Wiedemann)	Nb				18		1		1												
Leia longiseta Barendrecht	pRDB 2				2								5					12		1	
Limonia ventralis (Schummel)	Nb				1															8	
Lonchoptera nitidifrons Strobl	Nb	2		22					1							21	1				
Lonchoptera scutellata Stein, P.	Nb				1											5		3		2	
Macrocera fascipennis Staeger	pRDB 3								1							2					
Microdon devius (Linnaeus)	RDB 2											1									
Micromorphus albipes (Zetterstedt)	Nb		2																		
Molophilus propinquus (Egger)	Nb									1											
Mycetophila confusa Dziedzicki	pRDB 3			1																1	
M. mitis Johannsen	Nb																			1	
Mycomya britteni Kidd	pRDB 2											1								1	
Neoascia geniculata (Meigen)	Nb													1				46			
N. interrupta (Meigen)	Nb											1									
Odontomyia argentata (Fabricius)	RDB 2								1												
O. tigrina (Fabricius)	Nb																	8		1	

Species	Status	Boughton Fen	Caudlesprings	Cavenham Heath	Cranberry Rough	East Harling Common	Foulden Common	Hopton Fen	Kenninghall Fen	Lakenheath Poors Fen	Market Weston Fen	Middle Harling Fen	Buckenham	Pashford Poors Fen	Roydon Fen, Diss	Scoulton Mere	Sea Mere	Stallode Wash	Swangey Fen	Thompson Common	Wangford Carr
Orellia falcata (Scopoli)	Nb									4											
Phalacrocera replicata (Linnaeus)	Nb																			2	
Pherbellia griseola (Fallen)	Nb														1				1		
Platypalpus unicus Collin	pRDB 2											1									
Psacadina verbekei Rozkonsky	Nb										1	2						1	1	1	
P. zernyi Mayer	RDB 2						1												2	1	
Pteromicra pectorosa (Hendel)	RDB 2																	##			
Renocera striata (Meigen)	Nb																			1	
Rutylapa ruficornis (Zetterstedt)	RDB 1								1												
Rymosia armata Lackschewitz	pRDB 3																1			2	
R. britteni Edwards	pRDB 2						2		1											1	
Sciomyza simplex Fallen	Nb												3					##	6	6	
Stratiomys potamida	Nb		1						1		2										
Suillia dumicola (Collin)	Nb																			2	
Tetanocera freyi Stackelberg	RDB 3				1															5	
T. phyllophora Melander	Nb	8							18								1				
Hemiptera																					
Agallia brachyptera (Boheman)	Nb													1							
Aphrophora alpina Melichar	Nb														3						
Chloriona vasconica Ribaut	Nb						3						2							7	
Cicadella lasiocarpae Ossiannilsson	Na														1						
Cosmotettix costalis (Fallen)	pRDBK																1				
Florodelphax paryphasma (Flor)	Na											1									
Megamelodes lequesnei Wagner	Nb						1		5		1	5							1		

Species	Status	Boughton Fen	Caudlesprings	Cavenham Heath	Cranberry Rough	East Harling Common	Foulden Common	Hopton Fen	Kenninghall Fen	Lakenheath Poors Fen	Market Weston Fen	Middle Harling Fen	Old Buckenham Fen	Pashford Poors Fen	Roydon Fen, Diss	Scoulton Mere	Sea Mere	Stallode Wash	Swangey Fen	Thompson Common	Wangford Carr
Myrmedobia coleoptrata (Fallen)	Nb																				1
Oncodelphax pullulus (Boheman)	Nb						4					1					1			4	
Paradelphacodes paludosus (Flor)	Na						2		1		2										
Paraliburnia clypealis (J.Sahlberg)	pRDBK															7			1		
Paralimnus phragmitis (Boheman)	Nb						1	1							3				2	3	
Stroggylocephalus livens (Zetterstedt)	Nb				1	1	1	1				1									
Hymenoptera																					
Lasioglossum quadrinotatum (Kirby)	Na													1							
Lepidoptera																					
Apoda limacodes	Nb											1									
Archanara geminipuncta	Nb		1												1						
Drepana cultraria	Nb											1									
Eustrotia uncula	Nb						1														
Evergestis pallidata	Nb											1									
Macrochilo cribrumalis	Na								1												
Phlyctaenia perlucidalis (Hubner)	Na	1					1														
Rhyacia simulans	Nb					1															
Simyra albovenosa	Na																		3		
Spilosoma urticae	Nb																	1			
Mollusca																					
Vertigo moulinsiana (Dupuy)	RDB 3																			4	
Plecoptera																					
Nemoura dubitans Morton	Nb										1										

Appendix 8 Red data book and nationally scarce species recorded from other sites

Species	Status	Badley Moor	Brancaster	Chippenham Fen	Dersingham Bog	East Walton Common	Holt Lowes	Potter Fen	Redgrave and Lopham Fens	Roydon Common	Sheringham Common	Walberswick	Wendling Poors Fen	Whitwell Common
Araneae														
Clubiona juvenis Simon	RDB 2			1										
C. rosserae Locket	RDB 1			1										
Crustulina sticta (O. P.-Cambridge)	Nb							1		1				
Donacochara speciosa (Thorell)	Na		45					13				86		
Entelecara omissa O. P.-Cambridge	Na		5	1				5				19		
Hygrolycosa rubrofasciata (Ohlert)	Na			4										
Hypomma fulvum (Bosenburg)	Na			23								33		
Marpissa radiata (Grube)	Na									1				
Maso gallicus Simon	Na			3										
Saloca diceros (O. P.-Cambridge)	Nb			1										
Sitticus caricis (Westring)	Nb	2												
Coleoptera														
Apion vicinum Kirby	Nb					1								
Cercyon convexiusculus Stephens	Nb		4			1	1							
Chaetarthria seminulum (Herbst)	Nb							3						
Cypha discoidea (Erichson)	Nb		5					1						
Cyphon pubescens (F.)	Nb					2						1		
Dromius longiceps Dejean	Na		8	1								11		
Dryops nitidulus (Heer)	Na	2												
Enochrus coarctatus (Gredler)	Nb					2								
E. ochropterus (Marsham)	Nb											2		
Hydaticus seminiger (Degeer)	Nb								1					
Hyperaspis pseudopustulata Mulsant	Nb									1				
Ilybius guttiger (Gyllenhal)	Nb			2										
Limnebius aluta (Bedel)	Na					1								
L. nitidus (Marsham)	Nb										1			

Species	Status	Badley Moor	Brancaster	Chippenham Fen	Dersingham Bog	East Walton Common	Holt Lowes	Potter Fen	Redgrave and Lopham Fens	Roydon Common	Sheringham Common	Walberswick	Wendling Poors Fen	Whitwell Common
Mordellistena pseudopumila Ermisch	pRDBK		1											
Mycetoporus punctus (Gravenhorst)	Nb		1											
Nicrophorus vestigator Herschel	Na	7												
Noterus crassicornis (Mueller)	Nb					1								
Oodes helopioides (F.)	Nb					7								
Quedius balticus Korge	RDB 1											1		
Rhantus grapii (Gyllenhal)	Nb					1								
Silis ruficollis (F.)	Nb		2	1		1						1		1
Stenus nitens Stephens	Nb		4					1				1		
Diptera														
Allodia angulata Lundstroem	pRDB 2			1	1			1				1		
A. barbata (Lundstroem)	Nb		3	2				3				3	1	
A. embla Hackman	pRDB 3									1		2		
A. pistillata (Lundstroem)	Nb							1						
Anatella dampfi Landrock	pRDB 3		9					6				6		
Antichaeta analis (Meigen)	pRDB 3			5								6		
A. brevipennis (Zetterstedt)	RDB 2													1
Brevicornu boreale (Lundstroem)	Nb		2											
B. proximum (Staeger)	Nb		3					1						
Campsicnemus compeditus Loew	Nb				1									
Cephalops perspicuus (de Meijere)	RDB 2			5								2		
Cheilosia pubera (Zetterstedt)	Nb					1								
Colobaea bifasciella (Fallen)	Nb			1								6		
C. pectoralis (Zetterstedt)	RDB 2					5								
Cordilura aemula Collin	pRDB 3					1								
Dichetophora finlandica Verbeke	pRDB 3				1									
Dixella filicornis Edwards	Nb			1										
D. serotina Meigen	Nb		3	22		1						60		
Dorylomorpha infirmata (Collin)	Nb													1
Epicypta limnophila Chandler	Nb		9	5				4		1		12		
Erioptera meijerei Edwards	RDB 2											1		
Exechia exigua Lundstroem	Nb									1				

Species	Status	Badley Moor	Brancaster	Chippenham Fen	Dersingham Bog	East Walton Common	Holt Lowes	Potter Fen	Redgrave and Lopham Fens	Roydon Common	Sheringham Common	Walberswick	Wendling Poors Fen	Whitwell Common
E. pseudofestiva	Nb		6	1				2				6	1	
Exechiopsis crucigera (Lundstroem)	Nb		1									1		
E. fimbriata (Lundstroem)	Nb							1						
E. ligulata (Lundstroem)	Nb									1				
E. pollicata (Edwards)	Nb							1						
Gimnomera tarsea (Fallen)	Nb							4						
Helius pallirostris Edwards	Nb			1								14		
Hercostomus chalybeus (Wiedemann)	Nb		3											
Leia bifasciata Gimmerthal	Nb											1		
L. longiseta Barendrecht	pRDB 2											9		
Lejogaster splendida (Meigen)	Nb					2								
Limonia complicata (de Meijere)	Nb											4		
L. danica (Kuntze)	pRDB 3											12		
L. lucida (de Meijere)	Nb							2						
L. ventralis (Schummel)	Nb											3		
Lonchoptera nitidifrons Strobl	Nb		11					6						
Macrocera fascipennis Staeger	pRDB 3									1				
M. nana Macquart	Nb													1
Mycetophila confusa Dziedzicki	pRDB 3		1	2				1						
M. strigata Staeger	Nb		1											
Neoascia geniculata (Meigen)	Nb		2				1					1		
Odontomyia angulata (Panzer)	RDB 1					2								
O. argentata (Fabricius)	RDB 2	1		1		4								
O. tigrina (Fabricius)	Nb											13		
Opomyza lineatopunctata von Roser	Nb				7									
Orthonevra geniculata Meigen	Nb			2		1				2		12		
Paradelphomyia nielseni (Kuntze)	Nb									6				
Pherbellia griseola (Fallen)	Nb					1								
Pilaria fuscipennis (Meigen)	Nb											19		
P. scutellata (Staeger)	Nb											12		
Platycheirus sticticus (Meigen)	Nb			1										
Psacadina verbekei Rozkonsky	Nb		4	3		2	6	4				3		

Species	Status	Badley Moor	Brancaster	Chippenham Fen	Dersingham Bog	East Walton Common	Holt Lowes	Potter Fen	Redgrave and Lopham Fens	Roydon Common	Sheringham Common	Walberswick	Wendling Poors Fen	Whitwell Common
P. vittigera (Schiner)	RDB 2	5		3				2						
P. zernyi Mayer	RDB 2											9		
Rhamphomyia caliginosa Collin	Nb		2											
Rymosia armata Lackschewitz	pRDB 3							3						
R. britteni Edwards	pRDB 2			1				3						
Sciomyza simplex Fallen	Nb			3								24		
Stratiomys singularior (Harris)	Nb											12		
Suillia dumicola (Collin)	Nb													1
Telmaturgus tumidulus (Raddatz)	pRDB 3											10		
Tetanocera phyllophora Melander	Nb			4	1					1				
Thaumastoptera calceata Mik	Nb	1						7						
Tomosvaryella cilitarsis (Strobl)	Nb				1									
Trichonta icenica Edwards	pRDB 3		1											
T. nigritula Edwards	RDB 1											3		
Vanoyia tenuicornis (Macquart)	Nb		2	1		2						1		
Xylota abiens Meigen	Nb													1
Hemiptera														
Agallia brachyptera (Boheman)	Nb			4										
Aphrophora alpina Melichar	Nb			1		1				4				
Chloriona dorsata Edwards	Nb		1									2		
C. vasconica Ribaut	Nb		9									4		
Delphacodes capnodes (Scott)	Nb			1						4				
Hebrus pusillus (Fallen)	Nb					5								
Megamelodes lequesnei Wagner	Nb		1	4		1		4		4				
Oncodelphax pullulus (Boheman)	Nb					1								
Paradelphacodes paludosus (Flor)	Na					1		3	2					
Paralimnus phragmitis (Boheman)	Nb		5	2								24		
Rhopalus maculatus (Fieber)	Nb					1								
Stenocranus fuscovittatus (Stal)	Nb			2				1						
Stroggylocephalus livens (Zetterstedt)	Nb							1						
Hymenoptera														
Brachythops flavens (Klug)	Nb											1		

Species	Status	Badley Moor	Brancaster	Chippenham Fen	Dersingham Bog	East Walton Common	Holt Lowes	Potter Fen	Redgrave and Lopham Fens	Roydon Common	Sheringham Common	Walberswick	Wendling Poors Fen	Whitwell Common
Lepidoptera														
Archanara geminipuncta	Nb		1		1			1				1		
Chilodes maritimus	Nb							1				1		
Eupithecia subumbrata	Nb	1												
Eustrotia uncula	Nb	1			1									
Evergestis pallidata	Nb		1											
Hypenodes turfosalis	Nb				2									
Idaea muricata	Na				1									
Nascia cilialis	Na		1											
Senta flammea	RDB 3											2		
Xestia rhomboidea (Esper)	Nb				1									
Yponomeuta rorrella	pRDB 3				1									
Mollusca														
Vertigo moulinsiana (Dupuy)	RDB 3					1								
Orthoptera														
Platycleis albopunctata (Goeze)	Nb					1								
Plecoptera														
Nemoura dubitans Morton	Nb						1							

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Bottom left: Radio tracking a hare on Pawlett Hams, Somerset.
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