RSPB/NE Countdown 2010: Bringing Reedbeds to Life Project

CHAPTER 3: Invertebrate results overview

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Contents

This overview summarises the invertebrate species sampled using four sampling techniques at three reedbed reserves in 2009/2010. For details on sampling methods see individual invertebrate chapters.

Background information

Reedbeds are known to support a diverse array of invertebrates, and are home to a number of species of significant conservation importance. There is some debate over the consequences of different reedbed management practices on invertebrates. A number of studies that have investigated the relationship between reedbed invertebrates and habitat conditions/management practices are summarised here.

As an invertebrate habitat, reedbeds are essentially detritus based ecotonal ecosystems with water levels that fluctuate annually. A range of habitats exist within reedbed-wetlands including reedbeds, ditches, open water bodies, fen areas, carr woodland, and more. A range of invertebrate niches occur that include a range of dependencies on reed. There are invertebrates that inhabit the reed litter, plus those associated with other aquatic/fen plants and more generalist species. It is estimated that 700 invertebrate species are associated with reedbeds (Hawke and Jose 1996). The Invertebrate Species-habitat Information System (ISIS) classifies 130 species as a specific “reedfen and pool” invertebrate assemblage type.

Pollet (2001) found that reed marsh habitat in Belgium contained a larger number of rare and Red Data Book species than grassland habitats. The reed marsh habitat did not only house typical reed-marsh species, but also high abundances of species with other ecological affinities.

Impact of water levels

There is some debate over the optimal hydrological management for promoting invertebrate diversity in reedbeds. Kirby (2001) considers summer flooding to be detrimental for terrestrial invertebrates while Burgess et al (1995) state that summer drying leads to invertebrate impoverishment.

Sneyd (1997) looked at invertebrates sampled by reed harvesting, beating and the use of light traps, in areas of reedbed under different water regimes. Species richness was greater in dry reedbed and abundance greater in wet reedbed. Aphids were more abundant in wet areas. Abundance and species richness of macro Lepidoptera was highest in dry reedbed, though proximity to other habitats may be part of the reason for this.

A study at Minsmere RSPB reserve (Ausden, Lyons & Telfer, 2006, Ismay & Schulten 2006) looked at the Diptera fauna of different successional stages of reedbed. This work aimed to investigate whether flooding the litter was detrimental to litter-dwelling invertebrates. Three different successional stages of reedbed were sampled. These zones were pioneer reed (newly established over water), wet (permanently wet, but well established) and dry (seasonally dry). Thirty samples were collected by water and light trapping along 4 transects in August and September 2004. In addition, 64 samples were collected by water and light trapping along 8 transects in June and July 2005.

The wettest areas of reedbed supported a distinctly different Diptera fauna to that of the driest areas of reedbed sampled. A number of Diptera species of high conservation value were caught in the wetter areas of reedbed sampled, but not in the drier area. Overall, there were no significant differences in measures of the conservation value of the Diptera fauna, between the three successional stages. The results therefore provided no evidence that the wettest areas of reedbed supported a Diptera fauna of lower conservation value than that of the driest areas of reedbed sampled. However, there was limited statistical power to determine differences in the fauna of the three successional stages of reedbed sampled. Also, the methods did not sample invertebrates that inhabit litter. Nevertheless, the results still suggest that where management of reedbed for birds increases the range of successional stages present, then this has the potential to also increase the range of Diptera species of high conservation value present within a reedbed.

A study by Bedford and Powell (2005) looked at the changes in litter-dwelling invertebrates over six years of water-fluctuations in the reedbeds of Leighton Moss RSPB reserve. Bi-monthly surveys revealed two distinct invertebrate communities, a “wet” aquatic community (submersion invertebrates) and a “dry” terrestrial and semi-aquatic community (exposure invertebrates). Therefore they concluded reedbeds are ecotonal communities, being transitional zones between two communities and still containing characteristics of each. When the overall species diversity was calculated (measured by Simpson’s Index and Margalef’s Index) there was no consistent response to change in immersion levels.

The authors describe the species diversity of the reedbeds at Leighton Moss to be low, although they do not indicate what this is relative to. The fluctuations in water levels did not seem to favour either the submersion or exposure communities. Colonisation from aquatic refugia during flooding is relatively slow. When water levels are raised in spring, terrestrial litter-dwelling invertebrates are likely to be drowned. Invertebrates will either survive the change, migrate (up reed stems or to the reedbed margins), or drown. During drying, the typical exposure invertebrates will colonise the litter (Tipulids, Psychodids and Carabids). For the submersion fauna, (e.g. *Lumbriculus variegates, Asellus aquaticus, Limnephilus* sp., Chironomidae and Helodidae), during periods of the reedbed drying out, they must avoid desiccation. The timing and duration of the hydroperiod dictates when particular species are present. For example a species may only be present if there is water available at a certain critical point in the life cycle.

The conclusions of this six year study would have been different if sampling had only continued for 1-2 years. These trends were only evident because it was a long term sampling programme. Our study, being of just one year will not incorporate these inter-annual variations, which in the Leighton Moss study were as large as 150 – 750 species per 100 grams of litter between years.

Management

The findings of these surveys in 2009 and 2010 are likely to provide new evidence with which to evaluate our current thinking on reedbed management for invertebrates, summarised by Kirby (2001). Kirby states that all stages in the development and disappearance of a reedbed support important invertebrate communities, but reed standing in open water is the least interesting habitat within reedbeds for invertebrates. He suggests that most species found in wet reed areas are likely to be in greater abundance in dry reed areas. The invertebrate fauna of heavily scrubbed-over reed and wetland scrub is considerable, so Kirby proposes if reed bed is already scrubbed over it would be best to leave it this way. When scrub removal is used to arrest succession the aim should be to keep reed dominant not to remove all scrub. Cutting should be on as long a rotation as possible. Commercial management of reed is not considered ideal for invertebrate conservation by Kirby, so if part of a site is commercially managed, parts of the site should be un-managed to provide habitat and a source of colonists.

The response of reedbed invertebrates to management is highly variable between invertebrate taxonomic groups. A meta-analysis by Valkamaa et al (2008) found certain groups to be lower in number in managed sites compared to unmanaged sites (Mollusca, Coleoptera, Lepidoptera and Hymenoptera), whereas Acarina, Oligochaeta, Isopoda and Homoptera tend to be in higher numbers in managed sites. No effect of management on Trichoptera, Diptera, Heteroptera, Araneae, Collembola and Mysidacea was seen.

A study by Ditlhogo et al (1992) used experimental plots to investigate the effects of cutting, burning and no management on invertebrates in reedbeds. The sampling techniques differed somewhat from ours, since soil invertebrates were sampled by heat-extraction, and reed stem dissection and hand-counting was used in addition to water traps for above ground invertebrates. Overall the results showed management had little impact on invertebrates.

This is in contrast to Schmidt et al (2005) whose study in southern France found reed cutting at a large-scale does alter arthropod communities, which may have detrimental consequences for passerines if major food components are missing. However reed cutting at a small scale was thought to increase habitat heterogeneity and species richness at a landscape level. To maximise recolonisation after cutting, uncut patches should be left near cut patches.

New and old reedbeds compared

A study at Lakenheath Fen looked at the invertebrate populations of created reedbed compared to old, established reedbed (Booth and Ausden 2009). Fifteen water traps were set in the new reedbed (New Fen North) and the older reedbed (Botany Bay). The created reedbed in New Fen North supported abundant invertebrate populations, with a higher total number of invertebrates per sample than the old reedbed. In particular, numbers of Diptera, Hymenoptera, Araneae and Thysanoptera were higher in the created reedbed than in the old reedbed. Numbers of Hemiptera and Coleoptera were similar in both reedbeds and Neuroptera, Acari, Collembola, Mollusca and Trichoptera were also present in small numbers.

Bringing Reedbeds to Life Invertebrate Results

What invertebrate species were found on the three reedbed reserves in Bringing Reedbeds to Life surveys?

Identifying to species level

Taxa were included in the 'species' totals if they were identified to species level, or if they were the only member of a higher taxa, e.g. the only record of a particular genus or family. The genus or family will contain one or more species but the number is not known. Therefore the totals presented here are a minimum. This survey did not encompass all invertebrate niches since soil/litter cores were not examined.

Over all surveys at the three sites, at least 1147 invertebrate 'species' were counted, including 39 reedbed specialist species and 606 wetland specialist species. Over all sites the taxa with the most species identified were the Coleoptera (356), Diptera (316) and Lepidoptera (202). At least 184 073 individual invertebrates were trapped.

Table 3.1: number of individuals identified to different taxonomic levels

Level of identification	**Number of individuals**
Identified to unique species	49 569
Identified to unique genus	2 135
Identified to unique family	121 330
Identified to other unique taxonomic level able to be used in analysis	2 378
Total identified to a level able to be used in analysis	175 412
Not identified to a level able to be used in analysis	8 661
Total individuals	184 073

The key groups where individuals were not all identified to species level were Acari, Copepoda, Crustacea, Nematoda, Platyhelminthes and Parasitica. Note the habitat specialisation and conservation status of these groups was not assessed.

Table 3.3: Number of species, grouped by higher taxa, at each site, over the three survey techniques. Full species lists for each site are given in the appendix. This table shows totals used in analysis, for example in Nematoda we know there was at least one species, so it is counted as one, but there could have been more as this group was not identified to species level. Cases such as this where individuals were not identified to species level were not included in species lists.

Higher Taxon			**Common names**	**Minimum number of species**			**Total individuals**
				HB	**HW**	**SM**	
Insecta	Coleoptera	Order	Beetles	182	144	243	9414
	Diptera	Order	True flies	178	195	184	135765
	Lepidoptera	Order	Moths, butterflies	135	78	128	5524
	Hymenoptera	Order	Ants, bees wasps	29	22	71	1014
	Hemiptera	Order	True bugs	18	19	27	4100

	Odonata	Order	Dragonflies, damselflies	9	4	6	251
	Trichoptera	Order	Caddis flies	6	2	3	165
	Ephemeroptera	Order	Mayflies	1	2	2	918
	Megaloptera	Order	Alderflies, dobsonflies, fishflies	1	1	0	27
	Orthoptera	Order	Grasshoppers, crickets, locusts	0	1	1	2
Arachnida	Araneae	Order	Spiders	38	27	42	4439
	Acari	Order	Mites and ticks	3	3	1	134
	Opiliones	Order	Harvestmen	2	0	3	53
Crustacea	Isopoda	Order	Crustaceans	3	4	7	3516
	Amphipoda	Order	Crustaceans	1	1	1	3718
	Cladocera	Order	Water fleas	2	2	1	2964
	Copepoda	Subclass	Crustaceans	1	1	1	19
	Crustacea	Class	Crustaceans	1	1	1	178
Mollusca	Basommatophora	Order	Gastropod molluscs	7	18	8	8563
	Stylommatophora	Order	Gastropod molluscs	8	6	7	521
	Mesogastropoda	Order	Gastropod molluscs	4	3	1	1622
	Veneroida	Order	Bivalve molluscs	0	3	3	747
Hirudinea	Rhynchobdellae	Order	Leeches	1	5	5	118
	Pharyngobdellae	Order	Leeches	0	2	2	57
Nematoda		Phylum	Roundworms	1	1	0	3
Platyhelminthes		Phylum	Flatworms	4	4	3	31
Annelida		Phylum	Segmented worms	1	2	2	236
Bryozoa		Phylum	Moss animals	0	1	0	1
Total				636	552	753	184073

Each site was important for a different invertebrate order: Coleoptera (beetle) diversity was highest at Stodmarsh, Diptera (true fly) diversity was highest at Ham Wall and Lepidoptera (specifically moths) was highest at Hickling Broad. This highlights the distinct value of reedbeds with different geographical and historical attributes.

Setting these results in context

Estimates of the number of invertebrate species in the UK vary between 25 000 and 40 000 species (Buglife 2011, Ismay, J and B, Pers. Comm.). We sampled over 1 000 invertebrates, when sampling at three reedbed sites with each survey being only done in one year.

Comparing totals to other habitats is difficult without having matched sampling studies from other habitats. However we can use ISIS (Invertebrate Species-habitat Information System, Webb and Lott 2006) to make comparisons. In ISIS, Specific Assemblage Types (SATs) are invertebrate assemblages of intrinsic value for nature conservation. The closest SAT to a "reedbed" assemblage is called "reedfen and pools" and has 130 species. This is mid-range compared to other SATs, the highest being bark & sapwood decay with 594 species. For the Broad Assemblage Types (BATs), W3 permenant wet mire contains 633 species and W2 mineral marsh and open water contains 1134 species. Grassland and scrub matrix is the most species rich BAT with 2294 species. Arboreal canopy contains 981 species. Therefore in context, our samples collected 44 of the 130 species associated with the reedfen and pools specific assemblage type and 404 of the 1767 species in the W2 and W3 broad assemblage types.

Note that 2009 and 2010 have generally been poor years for inverts, due to some untimely droughts, therefore these results may be atypical.

ISIS categories

We can also use ISIS to classify the species we did find according to what invertebrate assemblage they would typically be associated with. The numbers of invertebrates that we sampled in each BAT and SAT are shown in the table below.

Table 3.4: Number of invertebrate individuals in each BAT category found on the reedbed reserves

BAT categories

Number of species		HB	HW	SM
W2	**mineral marsh & open water**	**94**	**117**	**123**
W3	**permanent wet mire**	**152**	**113**	**126**
F2	grassland & scrub matrix	78	51	100
W1	flowing water	13	23	15
M3	saltmarsh, estuary & mud flat	9	3	6
A2	wood decay	7	2	6
F1	unshaded early successional mosaic	7	3	36
A1	arboreal canopy	21	9	28
F3	shaded field & ground layer	10	8	12
Total categorised		*391*	*329*	*452*
Uncategorised		*245*	*223*	*301*
Total species identified		*636*	*552*	*753*

Table 3.5: Number of invertebrate individuals in each SAT category found on the reedbed reserves

SAT categories

Number of		HB	HW	SM

species				
A212	bark & sapwood decay	5	0	2
A213	fungal fruiting bodies	0	0	1
A215	epiphyte fauna	1	1	1
F111	bare sand & chalk	1	0	4
F112	open short sward	0	0	1
F211	herb-rich dense sward	3	2	2
F212	scrub edge	1	0	2
F221	montane & upland	1	0	0
M311	saltmarsh and transitional brackish marsh	3	2	3
W114	sandy river margin	0	1	0
W122	riparian sand	1	0	0
W125	slow-flowing rivers	1	1	0
W211	open water on disturbed mineral sediments	6	4	11
W212	northern lakes & lochs	0	1	0
W221	litter-rich fluctuating marsh	4	2	8
W312	Sphagnum bog	2	0	2
W313	moss and tussock fen	10	4	6
W314	**reedfen and pools**	**30**	**22**	**28**
Total		69	40	71

As expected, the most numerous SAT was reedfen and pools, and the most numerous BATs were wetland categories not associated with flowing water. However a large number of other assemblage types were sampled and this reflect the diversity of habitats found within reedbed-wetland ecosystems.

Reedbed specialists

As part of our analysis, we asked entomological consultants to identify which species from the samples were reedbed specialists (species that is dependent on reed, reared from reed, or only found in reedbed habitats). The reedbed specialists list included 2 Araneae, 6 Coleoptera, 12 Diptera, 2 Hymenoptera and 18 Lepidoptera. These species are of high conservation importance since they depend on reedbed habitat for their survival. Expert entomologists also categorised species as wetland specialists if they were generally associated with wetlands. The total number of species identified by site is given in Table 3.2.

Table 3.2: Number of species and specialists at each of three sites over all survey methods

Minimum number of species	HB	HW	SM
Total	636	552	753
Number of wetland specialists	246	230	249
Number of reedbed specialists	30	22	28

Stodmarsh had the greatest number of species overall, with Ham Wall having the fewest of the three sites. Number of wetland specialists and reedbed specialists were very similar for Hickling Broad and Stodmarsh, and slightly lower for Ham Wall.

Buglife list of species associated with reedbeds

Of the species found at all sites, there were 28 species which Buglife lists as notable invertebrates associated with reedbeds (19 at Hickling Broad, 14 Ham Wall and 18 at Stodmarsh).

Table 3.6: List of species found in surveys that are classed by Buglife as notable invertebrates associated with reedbeds

Higher taxa	Species	Total individuals
Araneae	Clubiona juvenis	9
	Donacochara speciosa	6
	Entelecara omissa	2
	Gongylidiellum murcidum	2
	Hypomma fulvum	13
	Marpissa radiata	1
	Tetragnatha striata	3
Coleoptera	Alianta incana	17
	Aloconota languida	2
	Cypha discoidea	6
	Dacrila fallax	68
	Demetrias imperialis	2
	Erichsonius cinerascens	8
	Myllaena intermedia	3
	Myllaena minuta	4
	Ocyusa picina	64
	Odacantha melanura	1
	Pachnida nigella	17

	Paederus riparius	23
Diptera	Anagnota bicolor	11
	Cryptonevra nigritarsis	15
	Elachiptera austriaca	7
	Molophilus pleuralis	159
	Sphaerophoria loewi	1
Hemiptera	Microvelia pygmaea	3
Hymenoptera	Hylaeus pectoralis	3
	Passaloecus clypealis	1
Stylommatophora	Oxyloma sarsi	2
Grand Total		**453**

Possible new species to Britain

A beetle species was discovered at Stodmarsh which could be *Malthodes hexacanthus* (in which case it would be new to Britain), however this seems unlikely and it could be an extreme variation of *Malthodes lobatus.* The identification cannot be confirmed from the specimen caught, so further surveys are planned at Stodmarsh by Mark Telfer.

Species with conservation status

Species of high conservation importance are described in more detail in the sections on each sampling method. All species and their conservation statuses are listed by site in the appendix. In total 17 Red List species including 4 Endangered, 10 Vulnerable were recorded. 113 species which are Rare or Nationally Scarce and 21 UK BAP species were sampled.

UK BAP species

The UK BAP priority list in 2007 led to the identification of 1,150 species that are conservation priorities because of their international importance, level of threat and rate of decline. Twenty one UK BAP species were encountered over the three sites over all surveys. This included one mollusc, the shining ram's horn snail (*Segmentina nitida* 27 individuals found at Stodmarsh). Twenty of the BAP species were moths (13 at Hickling Broad, eight at Ham Wall and nine at Stodmarsh). Further details are given in the moth results section.

UK Red List

17 species with a red list status were trapped.

Table 3.7: Number of individuals and their status on the UK Red List.

UK Red List status	Higher taxa	Species	Common name	Total specimens
Endangered	Coleoptera	Quedius balticus	A rove beetle	31
	Lepidoptera	Clostera anachoreta	Scarce Chocolate Tip moth	1
		Pelosia obtusa	Small dotted footman	17

	Basommatophora	Segmentina nitida	Shining ram's horn snail	27
Near Threatened	Diptera	Poecilobothrus ducalis	A small dance fly	21
Vulnerable	Araneae	Clubiona juvenis	A spider	9
	Diptera	Erioptera meijerei	A true fly	47
		Lejops vittatus	A true fly	4
		Odontomyia ornata	A true fly	106
		Pteromicra leucopeza	A true fly	3
		Sphaerophoria loewi	A true fly	1
	Lepidoptera	Cnephasia genitalana	A micromoth	1
		Monochroa divisella	A micromoth	7
		Phragmataecia castaneae	Reed Leopard Moth	58
	Stylommatophora	Oxyloma sarsi	A snail	2
Data Deficient	Coleoptera	Philhygra terminalis	A rove beetle	3
		Telmatophilus schonherrii	A beetle	15
New record in Britain?	Coleoptera	Malthodes hexacanthus?	A solider beetle	1

Table 3.8 Number of individuals that were Rare or Nationally Scarce

				Number of specimens		
Order	**Family**	**Species**	**Conservation Status**	**Hickling Broad**	**Ham Wall**	**Stodmarsh**
Araneae	Linyphiidae	Donacochara speciosa	Nationally Notable A	2		4
Araneae	Linyphiidae	Entelecara omissa	Nationally Notable A	0	0	2
Araneae	Linyphiidae	Gongylidiellum murcidum	Nationally Notable B	0	2	0
Araneae	Linyphiidae	Hypomma fulvum	Nationally Notable A	7	0	6
Araneae	Salticidae	Marpissa radiata	Nationally Notable A	1		
Araneae	Tetragnathidae	Tetragnatha striata	Nationally Notable B	3	0	0

Araneae	Theridiosomatidae	Theridiosoma gemmosum	Nationally Notable B	0	1	0
Coleoptera	Cantharidae	Silis ruficollis	Nationally Notable B	5	33	38
Coleoptera	Carabidae	Acupalpus exiguus	Nationally Notable B			1
Coleoptera	Carabidae	Badister dilatatus	Nationally Notable B	2		
Coleoptera	Carabidae	Bembidion fumigatum	Nationally Notable B	1		55
Coleoptera	Carabidae	Blemus discus	Nationally Notable B		1	
Coleoptera	Carabidae	Demetrias imperialis	Nationally Notable B	1	1	
Coleoptera	Carabidae	Odacantha melanura	Nationally Notable B	1		
Coleoptera	Carabidae	Oodes helopioides	Nationally Notable B	5	1	131
Coleoptera	Carabidae	Paradromius longiceps	Nationally Notable A	1		
Coleoptera	Carabidae	Pterostichus anthracinus	Nationally Notable B			9
Coleoptera	Carabidae	Pterostichus gracilis	Nationally Notable B		12	13
Coleoptera	Chrysomelidae	Longitarsus parvulus	Nationally Notable A			1
Coleoptera	Cryptophagidae	Telmatophilus brevicollis	Rare		1	
Coleoptera	Curculionidae	Bagous subcarinatus	Nationally Notable A		1	
Coleoptera	Curculionidae	Eubrychius velutus	Nationally Notable B	2		4
Coleoptera	Curculionidae	Gymnetron villosulum	Nationally Notable B			1
Coleoptera	Dytiscidae	Hydaticus seminiger	Nationally Notable B	1		
Coleoptera	Dytiscidae	Hydaticus transversalis	Rare		2	
Coleoptera	Dytiscidae	Hydroglyphus geminus	Nationally Notable B			3

Coleoptera	Dytiscidae	Hygrotus decoratus	Nationally Notable B	8		1
Coleoptera	Dytiscidae	Rhantus frontalis	Nationally Notable B	7	1	1
Coleoptera	Dytiscidae	Rhantus grapii	Nationally Notable B		1	
Coleoptera	Dytiscidae	Rhantus suturalis	Nationally Notable B	2	1	5
Coleoptera	Gyrinidae	Gyrinus aeratus	Nationally Notable B		1	
Coleoptera	Gyrinidae	Gyrinus paykulli	Nationally Notable A	47		2
Coleoptera	Haliplidae	Peltodytes caesus	Nationally Notable B			4
Coleoptera	Helophoridae	Helophorus strigifrons	Nationally Notable B	2		
Coleoptera	Hydraenidae	Hydraena testacea	Nationally Notable B	4	3	32
Coleoptera	Hydrochidae	Hydrochus angustatus	Nationally Notable B	1		
Coleoptera	Hydrophilidae	Cercyon sternalis	Nationally Notable B	16	1	10
Coleoptera	Hydrophilidae	Cercyon tristis	Nationally Notable B	6	14	3
Coleoptera	Hydrophilidae	Cercyon ustulatus	Nationally Notable B		2	1
Coleoptera	Hydrophilidae	Helochares lividus	Nationally Notable B		5	1
Coleoptera	Hydrophilidae	Hydrophilus piceus	Rare			1
Coleoptera	Malachiidae	Cerapheles terminatus	Nationally Notable A			15
Coleoptera	Nitidulidae	Meligethes fulvipes	Nationally Notable			7
Coleoptera	Nitidulidae	Meligethes rotundicollis	Nationally Notable			4
Coleoptera	Noteridae	Noterus crassicornis	Nationally Notable B			15
Coleoptera	Scirtidae	Cyphon pubescens	Nationally Notable B	1		
Coleoptera	Scirtidae	Scirtes orbicularis	Nationally		1	

			Notable A			
Coleoptera	Staphylinidae	Aloconota languida	Nationally Notable			2
Coleoptera	Staphylinidae	Calodera riparia	Nationally Notable			1
Coleoptera	Staphylinidae	Carpelimus lindrothi	Nationally Notable		2	
Coleoptera	Staphylinidae	Cypha discoidea	Nationally Notable B	1	2	3
Coleoptera	Staphylinidae	Dacrila fallax	Nationally Notable	6		62
Coleoptera	Staphylinidae	Gabrius bishopi	Nationally Notable B		5	2
Coleoptera	Staphylinidae	Philonthus fumarius	Nationally Notable B			18
Coleoptera	Staphylinidae	Pselaphaulax dresdensis	Nationally Notable	1		
Coleoptera	Staphylinidae	Stenus carbonarius	Nationally Notable B	9		
Coleoptera	Staphylinidae	Stenus palustris	Nationally Notable B	6	1	24
Diptera	Anthomyzidae	Anagnota bicolor	Nationally Notable	3	6	2
Diptera	Anthomyzidae	Typhamyza bifasciata	Nationally Notable			1
Diptera	Chloropidae	Cryptonevra nigritarsis	Nationally Notable	5	3	3
Diptera	Chloropidae	Dicraeus scibilis	Nationally Notable			1
Diptera	Chloropidae	Elachiptera austriaca	Nationally Notable	1	4	1
Diptera	Chloropidae	Melanochaeta pubescens	Nationally Notable			1
Diptera	Chloropidae	Oscinisoma gilvipes	Nationally Notable		1	
Diptera	Chloropidae	Speccafrons halophila	Nationally Notable	15	1	5
Diptera	Chloropidae	Trachysiphonella scutellata	Nationally Notable			1
Diptera	Dolichopodidae	Poecilobothrus	Near	5	4	

		ducalis	Threatened			
Diptera	Dolichopodidae	Syntormon filiger	Nationally Scarce	1		
Diptera	Empididae	Rhamphomyia lamellata	Nationally Scarce			1
Diptera	Ephydridae	Philotelma defectum	Nationally Scarce	3	1	1
Diptera	Ephydridae	Polytrichophora duplosetosa	RDB 3		1	
Diptera	Ephydridae	Scatella silacea	Nationally Scarce		1	
Diptera	Hybotidae	Platypalpus articulatoides	Nationally Scarce	1		
Diptera	Limoniidae	Cheilotrichia imbuta	Nationally Notable			3
Diptera	Limoniidae	Erioptera meijerei	Vulnerable	4		
Diptera	Limoniidae	Erioptera nielseni	Nationally Notable	1		
Diptera	Limoniidae	Helius pallirostris	Nationally Notable	2	1	
Diptera	Limoniidae	Pilaria scutellata	Nationally Notable		1	
Diptera	Lonchopteridae	Lonchoptera scutellata	Nationally Notable		1	
Diptera	Sciomyzidae	Colobaea bifasciella	Nationally Notable	1	1	2
Diptera	Sciomyzidae	Pherbellia griseola	Nationally Notable	2		
Diptera	Sciomyzidae	Pteromicra leucopeza	Vulnerable	3		
Diptera	Sciomyzidae	Sciomyza simplex	Nationally Notable			1
Diptera	Stratiomyidae	Odontomyia ornata	Vulnerable	1		12
Diptera	Stratiomyidae	Odontomyia tigrina	Nationally Notable	1	17	6
Diptera	Stratiomyidae	Stratiomys singularior	Nationally Notable	15		8
Diptera	Stratiomyidae	Vanoyia tenuicornis	Nationally Notable			1
Diptera	Syrphidae	Anasimyia	RDB 3		1	

		interpuncta				
Diptera	Syrphidae	Anasimyia lunulata	Nationally Scarce		2	
Diptera	Syrphidae	Lejops vittatus	Vulnerable	4		
Diptera	Syrphidae	Sphaerophoria loewi	Vulnerable		1	
Diptera	Tephritidae	Orellia falcata	Nationally Notable			1
Hemiptera	Veliidae	Microvelia buenoi	Rare	3		
Hemiptera	Veliidae	Microvelia pygmaea	Nationally Notable B			3
Hymenoptera	Apidae	Lasioglossum malachurum	Nationally Notable B			2
Hymenoptera	Apidae	Lasioglossum puncticolle	Nationally Notable B			6
Hymenoptera	Crabronidae	Passaloecus clypealis	Rare			1
Lepidoptera	Arctiidae	Pelosia muscerda	Rare	4		
Lepidoptera	Arctiidae	Spilosoma urticae	Nationally Notable B	9		1
Lepidoptera	Gelechiidae	Brachmia inornatella	Nationally Notable B			2
Lepidoptera	Gelechiidae	Monochroa palustrella	Nationally Notable B		1	2
Lepidoptera	Geometridae	Itame brunneata	Nationally Notable A			1
Lepidoptera	Noctuidae	Archanara sparganii	Nationally Notable B	2		
Lepidoptera	Noctuidae	Chortodes brevilinea	Rare	5		
Lepidoptera	Noctuidae	Macrochilo cribrumalis	Nationally Notable B	1		38
Lepidoptera	Noctuidae	Mythimna flammea	Nationally Notable A	15		
Lepidoptera	Noctuidae	Simyra albovenosa	Nationally Notable B	58		24
Lepidoptera	Pyralidae	Calamotropha paludella	Nationally Notable B	2	86	14
Lepidoptera	Pyralidae	Nascia cilialis	Nationally Notable A	3		2
Lepidoptera	Pyralidae	Schoenobius gigantella	Nationally Notable B	65		59

Lepidoptera	Tortricidae	Phalonidia manniana	Nationally Notable B	3	1
Lepidoptera	Yponomeutidae	Yponomeuta rorrella	Rare		1
Trichoptera	Hydroptilidae	Tricholeiochiton fagesii	Nationally Notable	7	

Comparing old and new reedbed areas

The following comparisons try to match old and new reedbed within sites to examine whether the invertebrate fauna of new reedbeds (restored with bittern requirements in mind) is impoverished compared to older reedbed. This section is an overview that compares all invertebrates caught in pitfall, water trap and moth surveys in the old and new areas. In general:

- The restored Hundred Acre reedbed at Hickling has similar species diversity and composition to the older drier reedbed fringing the broad.
- Restored reedbed at Grove Ferry had similar invertebrate diversity and composition to the older reedbed at Stodmarsh
- However abundances and conservation scores were higher in the older reedbeds at both Hickling Broad and Stodmarsh

Hickling Broad and Hundred Acre Reedbed

At Hickling Broad, there are two contrasting areas of reedbed. Hundred Acre reedbed was restored between 1997 and 1999 with a LIFE 1 project grant to provide bittern habitat. This area has been reedbed for 40 years, before which it was arable land. Restoration work involved large scale dyke creation, restoration and management, installation of water control structures and large scale scrub management. In the western section, reed cutting takes place and water levels are lowered accordingly in the winter months. In contrast the reedbed surrounding the broad is unmanaged and water levels are allowed to fluctuate naturally with the level of the broad.

Hundred Acre and the reedbed around the broad had equivalent numbers of species and 213 species were common to both. Total abundance of invertebrates was much higher in the older reedbed surrounding the Broad, however this difference was mainly due to more Chironomids in the area around the broad. Total conservation score was also higher, indicating not only a higher abundance but a higher abundance of species of conservation importance. Species composition was very similar between the two areas when grouped by order.

Table 3.9: Comparisons of invertebrates trapped at Hundred Acre (new reedbed) and older reedbed surrounding the Broad

	Hundred Acre (n=21)	Broad (n=22)
Total number of species	369	370
Total individual abundance	9 287	24 246
Total individual abundance without	4 216	5 630
Total conservation score	390	435

Stodmarsh and Grove Ferry Reedbed

The reedbed at Grove Ferry is younger than that of the rest of Stodmarsh. Establishment of the Grove Ferry reedbeds from grassland took place between 1998 and 2001. There was reed fringing the edges of ditches on this grassland before restoration. Work included landscaping of ditches and pools and the establishment of reed, largely by natural spread with some rhizome transfer.

Total number of species recorded over the water trap, pitfall and moth surveys was slightly higher at Stodmarsh, perhaps because more traps were out over a larger area (25 traps at Stodmarsh compared to 20 at Grove Ferry). The total abundance of individuals was higher at Stodmarsh, and this was not just due to more traps being put out at Stodmarsh, with the average abundance per trap being 365 at Grove Ferry compared to 2 644 at Stodmarsh. Without Chironomidae, however, the differences were less stark. Three traps near the lake in the Stodmarsh reedbed had high abundances of Chironomidae so this was accounting for the large differences in overall abundances. Conservation score was also higher at Stodmarsh than Grove Ferry, indicating more species of conservation concern were trapped in the older reedbed. Considering its age, the Grove Ferry invertebrate diversity was not dramatically poorer than that of the rest of Stodmarsh. When grouped by higher taxa, overall the species composition was remarkably similar.

Table 3.10: Across the moth, water trap and pitfall trap surveys, the total number of species in reedbeds at Grove Ferry and in the rest of Stodmarsh.

	Grove Ferry (n=20)	Rest of Stodmarsh (n=25)
Total number of species	667	674
Total abundance of individuals	7 299	66 106
Total abundance of individuals without Chironomidae	5 130	5 251
Total conservation score	305	625

Since a higher number of traps were surveyed at Stodmarsh compared to Grove Ferry, average number of species per trap was calculated for each of the three surveys. Grove Ferry had on average a higher number of species per trap.

Table 3.11: Comparison of average number of species per trap for each survey in the Grove Ferry reedbed and the rest of Stodmarsh

Survey	**Grove Ferry**		**Rest of Stodmarsh**	
	N	**Mean**	**N**	**Mean**
Pitfall	11	31.18	13	28.08
Water trap	9	58.11	12	53.33
Moth (trap points were a subset of water trap points)	5	39.20	7	35.71

More specific comparisons of reedbed and wetland specialist Diptera and moths are given in the water trap and moth trap results.

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