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Cleve Farm – Preliminary Invertebrate Survey Report



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For AECOM Ltd

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Summary

AECOM was commissioned by Hive Energy in July 2015 to undertake an Extended Phase 1 Habitat Survey of all areas within the boundary of Cleve Farm, Graveney, Kent (hereafter referred to as the Site). The approximate Ordnance Survey National Grid Reference for the centre of the Site is TR 034 640. The Site is located approximately 1km to the northeast of Graveney village and is approximately 359ha in size.

The Site contains a mosaic of drainage ditches and marginal habitats that were considered to represent good quality habitat for species groups such as *Odonata* (dragonflies and damselflies). Additionally the location of the Site, on the North Sea coast, increases the likelihood of uncommon species, more frequently found in continental Europe being present. Both terrestrial and aquatic habitats are suitable for notable invertebrates. The Site is mainly composed of arable fields surrounded by a network of drainage ditches.

Due to the presence of suitable habitats, a series of invertebrate surveys of the ditch habitats be undertaken when species are most likely to be active, namely May to September.

1 Introduction

In North Kent, on the banks of the Swale, where Faversham Creek flows in, a large parcel of farmland sits inside the tidal flood defence walls. Originally saltmarsh, reclaimed long ago for grazing, this land is now mostly given over to arable farming, with crops of wheat and beans planted in very large featureless fields. The only available wildlife habitat of note now resides in and along the banks of the drainage ditches that criss-cross the area. This invertebrate survey provides an assessment of the invertebrate interest to be found in these narrow linear features.

AECOM commissioned Richard A. Jones, Consultant Entomologist, to survey and produce this report, to assess the invertebrate interest of the small interstices of land (field margins, ditches and dykes), which stretch across the flat arable landscape.

visits and also it is anticipated that the nature of the scheme, a solar park, would likely have little impact on the ditch networks and associated habitat on Site and surrounding the Site.

2 Methods

2.1 Site visits

The Site was visited on three occasions: 2 August, 8 September and 10 September 2015.

2.2 Site compartments

This large Site (359 ha) is moderately uniform and can usefully be divided into three approximately equal-sized areas. These are:

- Nagden Marshes, the western-most sector, approximately centred on TR031 642;
- Graveney Marshes, the centre sector, approximately centred on TR043 637; and
- Cleve Marshes, the eastern sector, approximately centred on TR049 643.

The three zones are contiguous, undifferentiated, more or less uniform in soil, landscape, aspect and farming use. The ditches and field margins form an interlinked grid across the entire area, so invertebrates occurring in any one part of the Site are likely to occur almost anywhere else in the field margins, ditches and dykes across the Site too.

2.3 Location and collection of specimens

Invertebrates were located and collected by general methods using sweep net, beating tray and a stout trowel. Flowers, leaf surfaces, rocks, bare ground, logs and tree trunks were examined by visual searching. Others were found by finger-tip grubbing in loose soil and plant roots. Some water-dipping was carried out in the drainage ditches using a pond net. Voucher specimens of all but the most common and characteristic species have been kept.

2.4 Taxonomic coverage

The survey concentrated on the following major groups: *Coleoptera* (beetles), *Diptera* (flies), *Hemiptera* (bugs, froghoppers, etc.), *Hymenoptera* (bees, wasps and ants) and *Lepidoptera* (butterflies and moths). Some examples of other groups were noted if seen.

These groups are highly numerous and diverse orders of insects, and identification is not always possible, especially in many of the microscopically small species. Consequently there is much subjective selection of which families or genera are worth taking as sample specimens, for later study. This is often influenced by a personal knowledge of the groups for which useable identification keys are available, and for which the individual entomologist has a particular competence. Nevertheless, a wide coverage or assemblage of insect orders provides an assessment of how important any given Site may or may not be for its invertebrate biodiversity and value.

2.5 Survey Limitations

Due to the commissioning date, the survey visits were carried out in the later part of the survey season, in August and September. Therefore survey visits in spring (May-June) may record different species occurring at the Site. However, this is not considered to be a major constraint to this scheme, as an extensive species list was established from the later season

3 Survey Results

3.1 General

A total of 172 invertebrate species was found during the survey (Table 1), and these are listed, together with various comments on status, habitats and distributions, in Appendix A.

Table 1. Summary of the number of invertebrate species found at the Cleve Farm site, August-September 2015

Family	Number of species
Coleoptera (beetles)	83
Dermaptera (earwigs)	1
Diptera (flies)	23
Hemiptera (bugs)	31
Hymenoptera (bees, wasps etc.)	6
Lepidoptera (butterflies & moths)	14
Odontata (dragonflies)	3
Orthoptera (grasshoppers etc.)	4
Aranaea (spiders)	3
Opiliones (harvestmen)	1
Isopoda (woodlice)	2
Mollusca (snails)	1
Total	172

One hundred and seventy-two species is a relatively low number for such a large Site. However, since most of the land area was given over to intensive arable farming, and true wildlife habitat probably amounts to just a few hectares, this low number is not a surprise. Although most of the species found are common and widespread, expected to be found in almost any part of the wider countryside, a number of unusual or uncommon species were also recorded. It is these more uncommon species that tell us in more detail about the habitat quality of the Site.

3.2 Noteworthy species

The following species are picked out as being especially noteworthy. Most are uncommon nationally. Criteria for allocation of accepted 'nationally rare' (red data book) and 'nationally scarce' (notable) statuses are varied and. However, those that are relevant to this report are listed in summary here.

- **Endangered** (RDB-1). The rarest taxa. Taxa in danger of extinction in Great Britain; species with very few recorded localities or living in especially vulnerable habitats.
- **Vulnerable** (RDB-2). Very rare species. Taxa likely to move into the RDB1 category; species declining in their range.
- **Rare** (RDB-3). Rare species. Taxa with small populations and which are at risk; species estimated to occur in 15 or fewer of the 10-km squares in the national Ordnance Survey grid since 1970.
- **Insufficiently known** (RDB-K). Species thought to be very rare in Britain, recorded from less than 15 of the 10-km squares of the national Ordnance Survey grid since 1970, and which warrant RDB classification of some sort, but for which there is a recognized lack of accurate information.

- **Nationally scarce** (notable A). Very local species, thought to occur in 16 to 30 of the 10-km squares of the national Ordnance Survey grid since 1970.
- **Nationally scarce** (notable B). Very local species, thought to occur in 31 to 100 of the 10-km squares of the national Ordnance Survey grid since 1970.
- **Nationally scarce** status is sometimes not subdivided into categories A and B, (notable, occurring in 16 to 100 10-km squares).
- **Very local** status is a much more subjective, but nevertheless useful, measure of scarcity and is based on personal experience, published and unpublished records. It is applied to species that are very limited in distribution or confined to very limited specialist habitats.

The following is a list of some of the more interesting and noteworthy species taken in the area.

Nationally rare (red data book) species

- *Atylotus latistriatus* (Brauer), a large grey horsefly (family Tabanidae). Status: nationally rare (red data book category 3, Falk, 1991). This large distinctive horsefly is more or less confined to the coastal marshes and salt marshes of East Anglia, the Thames Estuary, and around the Solent (Drake, 1991). The larvae are soil-dwelling predators. Female adults suck mammalian blood, usually of grazing stock animals, but also of humans. Two females were found visiting flowers at the very western edge of Nagden Marshes, 2 August 2015.

Nationally scarce (notable) species

- *Agabus conspersus* (Marshall), a medium-sized brown water beetle, Coleoptera: Dytiscidae. Status: nationally scarce (notable, Hyman & Parsons, 1992, Foster, 2010). This scarce water beetle is primarily associated with brackish grazing marshes near the coast. One specimen was found by water-netting in a ditch in Graveney Marshes, 10 September 2015.
- *Brachinus crepitans* L., a small red and blue ground beetle, the bombardier beetle (family Carabidae). Status: nationally scarce (notable B, Hyman & Parsons, 1992). A declining species mainly recorded in southern England. Once it was found fairly widely in inland sites on chalk or sandy soils, but recently it has become more usually associated with coastal undercliffs (Luff, 1998), and brownfield sites in the Thames Gateway. Single specimens were found at various times, across Nagden, Graveney and Cleve Marshes, in drier locations, usually under rocks, stones, pieces of wood, or discarded rubbish, 2 August, 8 September and 10 September 2015.
- *Drymus pilicornis* (Mulsant), a small dark ground bug (family Lygaeidae). Status: nationally scarce (notable, Kirby, 1992). Records for this bug are widely scattered, and its habitat requirements are poorly understood. Most sites are on calcareous grassland. A single specimen was swept from rough grassland in Graveney Marshes, 10 September 2015.
- *Harpalus ardosiacus* Luts., a medium-sized dark blue ground beetle (family Carabidae). Status: nationally scarce (notable B, Hyman & Parsons, 1992). This is mainly a species of southern England, and most localities are coastal or estuarine, with a large series of localities on the north Kent coast (Luff, 1998). One specimen was found under stones and detritus, Nagden Marshes, 8 September 2015.
- *Hippodamia* (formerly *Adonia*) *variegata* Goeze, the Adonis ladybird, (family Coccinellidae). Status: nationally scarce (notable B, Hyman & Parsons, 1992), but status may need revision. Until about 15 years ago, this species was always regarded as having a coastal distribution, occurring in warm sheltered locations such as chalk downs, dunes, undercliffs and other disturbed areas (Majerus *et al.*, 1997). However, it is now known to be fairly widespread in England, especially in the London area and Thames Estuary, where it is associated with sparsely vegetated post-industrial brownfield sites (Roy *et al.*, 2011). Numerous specimens were found by general sweeping rough vegetation in the Nagden Marshes, 2 August, 8 September 2015.
- *Hygrotus parallelogrammus* Ahrens, a small black and orange water beetle (family Dytiscidae). Status: nationally scarce (notable, Hyman & Parsons, 1992, Foster, 2010). This scarce water beetle occurs in England and parts of southern Wales. It is mostly coastal, particularly occurring in Eastern England (especially the Thames Estuary), and Severn Estuary. Several specimens were found by water-netting in ditches in Nagden Marshes, 8 September 2015.

- *Ilybius subaeneus* Erichson, a medium-sized dark water beetle (family Dytiscidae). Status: nationally scarce (notable, Hyman & Parsons, 1992, Foster, 2010). Although widely recorded across England and parts of Wales, this is a decidedly scarce water beetle. It seems to have a distinctly north-eastern distribution in Britain. Several specimens were found by water-netting in Nagden Marshes, 8 September 2015.
- *Pelodytes caesus* Duftschmid, a small pale water beetle (family Haliplidae). Status: nationally scarce (notable, Hyman & Parsons, 1992, Foster, 2010). This is mainly a south-eastern species, occurring in ponds and lakes south of a line from the Humber to the Severn. Two specimens were found by water-netting in Nagden Marshes, 8 September 2015.
- *Reptalus* (formerly *Oliarus*) *panzeri* Low, a small brown plant hopper (family Cixiidae). Status: nationally scarce (notable, Kirby, 1992). This scarce bug has a very restricted south-eastern distribution and is thought to have declined dramatically in the last 50 years (Kirby, 1992). It has recently only been found in the extreme south-east, London, Sussex and Kent (Jones & Hodge, 1999). It seems to be associated with areas of rough ground, particularly where there are areas of bare soil, or where there is regular cracking in the ground during periods of drought. A single specimen was swept from rough grassland in Cleve Marshes, 2 August 2015.
- *Rhantus frontalis* Marsham, a medium-sized black water beetle (family Dytiscidae). Status: nationally scarce (Hyman & Parsons, 1992, Foster, 2010). This scarce water beetle occurs mainly in eastern England (especially the Thames Estuary), and the Severn Estuary. Several specimens were found by water-netting in Nagden Marshes, 2 August, 8 September 2015.

Very local species

- *Anthocomus rufus* Herbst, a small bright red malachite beetle (family Malachiidae). Status: very local. This uncommon beetle is almost entirely confined to fens and marshes, where reed beds occur. It is mainly a southern and eastern species. Several specimens were swept from common reed, *Phragmites australis*, across all areas of the marshes, 2 August, 8 September, 10 September 2015.
- *Bombus muscorum* (Linnaeus), a large brown carder bumblebee (family Apidae). Status: very local. This once very common bumblebee has declined dramatically in the last 50 years until it is now restricted mainly to coastal sites in southern England (it is slightly more widespread still in Scotland). A male was found visiting flowers in Nagden Marshes, 2 August 2015.
- *Bruchus atomarius* (Linnaeus), a small seed beetle (family Chrysomelidae). Status: very local. This species was originally accorded nationally scarce (notable B) status by Hyman & Parsons (1992), but this was not confirmed by Hubble (2014). Although widespread in southern England, this is a very local insect. It is associated with rough flower-rich grassland, where it breeds in the seed pods of various vetches, *Vicia* and *Lathyrus* species (Cox, 2007). One specimen was found by general sweeping of rough grassland at the north-west end of the Site, 21.v.2010.
- *Camarota curvipennis* Latreille, a minute black 'frit' fly (family Chloropidae). Status: very local. Once more widespread, breeding the heads of wheat, rye and barley, this species has declined dramatically in the last 50 years following 'advances' in agriculture. Although not accorded notable status by Falk (), the decline of this fly has alerted Ismay (in preparation) to suggest that this species be monitored for possible future nationally scarce notification. One specimen was swept in rough grassland, Cleve Marshes, 2 August 2015.
- *Corixa affinis* Leach, a small dark water boatman (family Corixidae). Status: very local. This scarce bug occurs in ponds, ditches and drainage dykes, usually in grazing levels, and is most often found near the coast. Several specimens were found by water-dipping in ditches in Nagden Marshes, 8 September 2015.
- *Corizus hyoscyami* (Linnaeus), a large black and red ground bug (family Rhopalidae). Status: very local. This scarce bug occurs on dry sandy soils, like dunes, cliffs and undercliffs, mainly in southern and western Britain. Until recently it was not known from any inland sites other than the Norfolk Breckland, but over the last 10 years has occurred in more areas of inland England. Several specimens were found by sweeping in Nagden Marshes, 2 August 2015.
- *Dictyla convergens* (H.-S.), a minute lace-bug (family Tingidae). Status: very local. Usually found in rough grassy places and damp meadows where its foodplants *Myosotis* species grow. A single specimen was found by sweeping in Nagden Marshes, 2 August 2015.

- *Dyschirius salinus* Schaum, a small dark metallic bronze ground beetle (family Carabidae). Status: very local. This scarce ground beetle occurs in mud at the edge of ponds, ditches and marshy areas. It is almost exclusively coastal, and often occurs in saltmarshes. It occurs around the coasts of southern Scotland, England and Wales (Luff, 1998). A single specimen was found on the muddy bank of a drainage ditch in Cleve Marshes, 2 August 2015.
- *Hypera pollux* (Fabricius), a small mottled weevil (family Curculionidae). Status: very local. This scarce weevil usually occurs on river, stream and ditch banks, where it feeds on species of *Apium*, *Peucedenum* and *Oenanthe*. It occurs widely, but scattered, across England and Wales. A single specimen was found by sweeping ditch-side vegetation in Nagden Marshes, 2 August 2015.
- *Liorhysus hyalinus* (Fabricius), a small reddish ground bug (family Rhopalidae). Status: very local. This bug was long thought to be an occasional vagrant, but it has now, perhaps, colonized Britain. A single specimen was found by sweeping in Cleve Marshes, 2 August 2015.
- *Lobrathium multipunctum* (Gravenhorst), a small brown rove beetle (family Staphylinidae). Status: very local. Although widely recorded, this is a scarce beetle which occurs in a variety of wetland habitats, including ditch banks, clay banks, cliff seepages. A single specimen was found by finger-tip searching at the edge of a drainage ditch in Nagden Marshes, 2 August 2015.
- *Machaerium maritimae* Haliday, a very small metallic green long-footed fly (family Dolichopodidae). Status: very local. As its name suggests this is a coastal species, occurring in a variety of wet habitats like ponds, ditches, wet woods and hedgerows, near the coast. A single specimen was found resting on vegetation in Cleve Marshes, 2 August 2015.
- *Nysius senecionis* (Schilling), a small pale plant bug (family Lygaeidae). Status: very local. First found in Britain in 1992, the London area and Thames Estuary seem to be the headquarters for this bug. Although nominally recorded on various ragwort species, the bug has been found on the newcomer composite Guernsey fleabane, *Conyza sumatrensis*, often in large numbers. Several specimens were swept from rough grassland in Cleve Marshes, 2 August 2015.
- *Ochthebius marinus* Paykull, a minute brown water beetle (family Hydraenidae). Status: very local. This beetle occurs in the muddy water amongst thick vegetation at the edge of ponds, lakes and ditches. As its name suggests it is almost exclusively coastal in the UK, mostly occurring in the brackish dykes and ditches across coastal grazing meadows. Several specimens were found by water-netting in Nagden Marshes, 8 September 2015.
- *Paroxyna plantaginis* Haliday, a small grey picture-winged fly (family Tephritidae). Status: very local. This scarce fly breeds in the flower heads of sea aster, and consequently is more or less confined to coastal sites (Clemmons 1997, 2004). Several specimens were swept from rough grassy areas in Nagden and Graveney Marshes, 2 August 2015.
- *Pentastiridius leporinus* Linnaeus, a small grey plant hopper (family Cixiidae). Status: very local. Although widespread, this distinctive bug is almost exclusively coastal, occurring in reed beds, grazing marshes and salt marshes. Several specimens were swept in Graveney and Cleve Marshes 2 August 2015.
- *Philonthus spinipes* Sharp, a large black and red rove beetle (family Staphylinidae). Status: very local. This large distinctive beetle is a native of the Far East, but has been introduced into Europe and has recently occurred in England. It occurs in compost heaps, manure, dung and other decaying organic matter. One specimen was found in horse dung just outside the survey area in Nagden Marshes, 8 September 2015.
- *Rhinusa* (formerly *Gymnetron*) *antirrhini* (Paykull), a tiny black weevil (family Curculionidae). Status: very local. This beetle feeds solely on common yellow toadflax, *Linaria vulgaris*, a plant of dry grassy places, and although its foodplant occurs throughout England, Scotland and Wales it is far from being ubiquitous, and the weevil occurs in widely scattered localities. Several specimens were swept from the foodplant in Nagden Marshes, 2 August 2015.
- *Tephritis divisa* Rondani, a very small grey and pink picture-winged fly (family Tephritidae). Status: very local, seemingly a new colonist to the UK. On the continent this fly has been reared from the flower heads of bristly ox-tongue, *Picris echinoides*, a widespread and common plant of disturbed ground such as brownfield sites. It was first found in Britain, on the Sussex Coast, in 2005 and is likely to be a new arrival to the country. It is recorded

from several brownfield localities in the Thames Estuary area (Jones, 2008) and has started to spread along the south coast. Several specimens were swept in rough grassy areas across the Site, 2 August 2015.

4 Conclusion and Discussions

Almost all of the Site was given over to intensive arable farming, with crops of wheat or bean planted in very large monotonous fields. The only available areas of anything similar to natural or semi-natural habitat were in and along the drainage ditches that intersect the area. Adjacent offsite to the north and west, larger dykes fringe the Site, demarcating the edge of the farmland area where it changes into a reedbed and a grazing strip on the immediate landward side of the estuarine flood defence walls. The management of these is more sympathetic to biodiversity. Beyond the raised flood walls are mudflats and saltmarsh.

Within the survey area, useful invertebrate habitat was limited to the linear ditches and field margins. Although no evidence was apparent, these are likely influenced by agricultural chemicals drifting on the wind, or running off in water after rain. Based on the low number of invertebrate species found, the Site appeared to have a low biodiversity value.

However, several scarce and unusual insects were found. These are mostly species with particular associations with coastal grazing meadows, brackish ditches, saltmarsh and boggy fenland. Despite the agricultural intensity, they have managed to sustain themselves in the tiny pockets that now remain, perhaps boosted by influx from the slightly less intensively managed borderland between the arable fields and the flood defence walls of the Swale and Faversham Creek.

Several scarce and unusual water insects, including water beetles (*Agabus conspersus*, *Rhantus frontalis* and *Ochthebius marinus*) and boatmen bugs (*Corixa affinis*), occurred in the water filled ditches. Many of these are found almost exclusively in coastal areas in the UK. This may be because slow-flowing ditches which retain water all year round, across grazing and arable fields mostly occur for drainage purposes in coastal flood-plain areas, or it may be linked to these species' ability to live in the slightly brackish water which occurs near the coast. Whatever the reason, these species are so adapted, they give the ditch habitat a biodiversity value which is significant at the local level.

Other unusual species occur here at the coast because of subtle seasonal temperature gradients near the sea (e.g. bombardier beetle *Brachinus crepitans*, ground beetle *Harpalus ardosiacus*, planthopper *Reptalus panzeri* and bumblebee *Bombus muscorum*). Others are associated with coastal or wetland plants (e.g. red malachite beetle *Anthocomus rufus*, lacebug *Dictyla convergens*, weevil *Hypera pollux*, picture-winged fly *Paroxyna plantaginis* and planthopper *Pentastiridius leporinus*) or because they are saltmarsh-tolerant specialists (e.g. horsefly *Atylotus latistriatus*, ground beetle *Dyschirius salinus*, predatory fly *Machaerium maritimae*). Conclusion

The diversity of the terrestrial and aquatic invertebrates of the Site was concentrated in the field margins, ditches and dykes bordering the arable fields. The initial evaluation of these invertebrates, based on the total number found, 172 species. On closer examination a number of unusual and scarce insects were found, particularly those associated with the coast, brackish water, grazing marshes and salt-marshes.

5 References

Clemons, L. 1997. A provisional atlas of the Tephritidae (Diptera) of Britain and Ireland. *British Tephritidae Newsletter* **6**: 1-42.

Clemons, L. 2004. A provisional atlas of the Tephritidae (Diptera) of Britain and Ireland. Version 2. *British Tephritidae Newsletter* **8**: 1-25.

Cox, M.L. 2007. Atlas of the seed and leaf beetles of Britain and Ireland. Newbury: Pisces Publications.

Drake, C.M. 1991. *Provisional atlas of the larger Brachycera (Diptera) of Britain and Ireland*. Abbots Ripton: Biological Records Centre.

Falk, S. 1991. *A review of the scarce and threatened flies of Great Britain (part 1)*. Peterborough: Nature Conservancy Council.

Foster, G.N. 2010. *A review of the scarce and threatened Coleoptera of Great Britain. Part 3: water beetles of Great Britain*. Peterborough: JNCC.

Hubble, D.S. 2014. *A review of the scarce and threatened beetles of Great Britain. The leaf beetles and their allies: Chrysomelidae, Megalopodidae, Orsodacnidae*. Species Status Number 19. JNCC/ Natural England.

Hyman, P.S. & Parsons, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain. Part 1*. Peterborough: Joint Nature Conservation Committee.

Ismay, J. In preparation. *A review of the scarce and threatened flies of Great Britain (part 2)*. Peterborough: Natural England.

Jones, R.A. 2008. *Caught in the greenwash: what future for invertebrate conservation on the brownfields of the Thames Gateway*. Unpublished report for Buglife, the Invertebrate Conservation Trust.

Jones, R.A. & Hodge, P.J. 1999. Notes on the occurrence of the planthoppers *Reptalus panzeri* (Loew) (Hemiptera: Cixiidae) and *Asiraca clavicornis* (Fab.) (Hemiptera: Delphacidae). *British Journal of Entomology and Natural History* **12**: 239-240.

Kirby, P. 1992. *A review of the scarce and threatened Hemiptera of Great Britain*. Peterborough: Joint Nature Conservation Committee.

Luff, M.L. 1998. *Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain*. Abbots Ripton: Biological Records Centre.

Majerus, M.E.N., Majerus, T.O., Bertrand, D. & Walker, L.E. 1997. The geographic distribution of ladybirds (Coleoptera: Coccinellidae) in Britain (1984–1994). *Entomologist's Monthly Magazine* **133**: 181-203.

Roy, H., Brown, R., Frost, R. & Poland, P.. 2011. *The ladybirds (Coccinellidae) of Britain and Ireland*. Biological Recording Centre.

Shirt, D.B. (ed.) 1987. *British red data books: 2. Insects*. Peterborough: Nature Conservancy Council.

Appendix A.
Species List

Appendix A – Species List

Species	Status	Notes	Locality name, nominal grid reference and vice-county		
			Nagden Marshes TR031641; 15, North Kent.	Graveney Marshes, TR043637; 15, North Kent.	Cleve Marshes; TR049643; 15, North Kent.
COLEOPTERA, Beetles					
Apionidae, Minute weevils					
Apion frumentarium (Lin.) (formerly A. miniatum)	local	On docks, Rumex species		2.viii.2015	
Aspidapion radiolus (Mars.)	common	On mallows, Malva species.	2.viii.2015		
Malvapion malvae (Fab.)	common	On mallows, Malva species.	2.viii.2015		
Pseudapion rufirostre (Fab.)	common	On mallows, Malva species.	2.viii.2015		
Cantharidae, Soldier beetles					
Cantharis lateralis (Lin.)	local	Woods, larvae predatory in rotten wood	2.viii.2015		
Rhagonycha fulva (Scop.)	common	Adults on flowers, larvae predators in soil layer	2.viii.2015	2.viii.2015	2.viii.2015
Carabidae, Ground beetles					
Bembidion articulatum Panz.	local	River and stream banks			2.viii.2015
Bembidion assimile Gyll.	local	Marshes, fens and saltmarshes	2.viii.2015		
Bembidion guttula Fab.	common	River and stream banks	2.viii.2015		2.viii, 10.ix.2015
Bembidion illigeri Net. (genei)	local	Bare ground near water	2.viii.2015		2.viii.2015
Bembidion mannerheimi Sahl.	local	Damp grasslands			2.viii.2015
Brachinus crepitans L.	Nb	Coastal cliffs, chalk and sandy areas	8.ix.2015	10.ix.2015	2.viii, 10.ix.2015
Demetrias atricapillus (Lin.)	common	Long grass	8.ix.2015	10.ix.2015	10.ix.2015
Dyschirius salinus Schaum	v.local	Coastal, ditches, marshes, saltmarshes			2.viii.2015
Dromius (Philorhizus) melanocephalus (Dejean)	common	Bare soil, grass roots, under stones	8.ix.2015		
Elaphrus cupreus Duft.	local	Running at edge of ponds and	2.viii.2015		

		streams			
Harpalus ardosiaceus Luts.	Nb	Chalk or limestone, usually coastal	8.ix.2015		
Harpalus rubripes Duft.	common	Open bare ground			2.viii.2015
Metabletus (Syntomus) obscuroguttatus Duft.	local	In moss etc., usually moist areas		10.ix.2015	10.ix.2015
Pterostichus cupreus (Lin.)	common	Open fields, bare ground	8.ix.2015		
Chrysomelidae, Leaf and flea beetles					
Bruchus atomarius (Lin.)	v.local	Various habitats		2.viii.2015	
Bruchus rufimanus Boh.	common	On various leguminous plants	8.ix.2015		
Cryptocephalus fulvus Goeze	local	Dry grassy areas.	2.viii.2015		
Galerucella nymphaea/sagittariae	common	Marshy places, ponds, ditches	2.viii.2015		
Lema melanopus/rufocyanea	common	Grassy places			2.viii.2015
Coccinellidae, Ladybirds					
Adalia decimpunctata (Lin.)	common	10-spot. Wide variety of habitats.	2.viii.2015		2.viii.2015
Coccidula rufa (Herbst)	local	Marshy places, reed and sedge beds		10.ix.2015	
Coccinella 7-punctata Lin.	common	7-spot. Wide variety of habitats.	2.viii.2015		2.viii.2015
Coccinella undecimpunctata (Lin.)	local	11-spot ladybird, wide variety of habitats			2.viii.2015
Harmonia axyridis	common	Recent arrival in Britain	2.viii.2015		2.viii.2015
Hippodamia variegata	Nb	Adonis ladybird. Mainly coastal and London basin	2.viii, 8.ix.2015		
Micraspis 16-punctata (Lin.)	common	16-spot, mildew feeder, grassy places	2.viii, 8.ix.2015	10.ix.2015	2.viii, 10.ix.2015
Propylea 14-punctata (Lin.)	common	14-spot. Wide variety of habitats	2.viii.2015		2.viii.2015
Subcoccinella 24-punctata (Lin.)	common	24-spot. On false-oat grass	2.viii, 8.ix.2015		
Curculionidae (weevils)					
Ceutorhynchus pallidactylus = quadridens (Pz.)	common	On alaria and other crucifers, woods and hedges	2.viii.2015		2.viii.2015
Rhinusa (Gymnetron) antirrhini (Payk.)	v. local	On Linaria vulgaris	2.viii.2015		
Hypera pollux (Fab.)	v.local	Marshy places	2.viii.2015		
Mecinus pyraister (Herbst)	common	On plantains, Plantago species		2.viii.2015	
Sitona hispidulus (Fab.)	common	On clovers and other legumes		10.ix.2015	

Sitona lineatus (Lin.)	common	On clovers, and many other legumes	2.viii, 8.ix.2015		
Dytiscidae, water beetles					
Agabus bipustulatus (Lin.)	common	Lakes and ponds		10.ix.2015	
Agabus conspersus (Mars.)	Nb	Ditches and ponds, usually near the coast, brackish water	8.ix.2015		
Agabus sturmi Gyll.	local	Lakes and ponds		10.ix.2015	
Colymbetes fuscus (L.)	common	Ponds and lakes	8.ix.2015	10.ix.2015	
Dytiscus semisulcatus Muller	local	Ponds, ditches, lakes			10.ix.2015
Hydroporus palustris L.	common	Ponds and ditches	8.ix.2015	10.ix.2015	
Hydroporus planus (Fab.)	local	Ponds and ditches	8.ix.2015		
Hygrotus inaequalis (Fab.)	local	Ditches and ponds	8.ix.2015		
Hygrotus parallelogrammus (Ahrens)	Nb	Ditches, ponds, brackish, mostly coastal	8.ix.2015		
Hyphydrus ovatus (Lin.)	common	Ponds, lakes, streams and other water	8.ix.2015	10.ix.2015	10.ix.2015
Ilybius subaeneus Er.	N	Ponds, lakes, ditches, eastern	8.ix.2015		
Laccophilus minutus L.	local	Ponds and lakes	8.ix.2015	10.ix.2015	10.ix.2015
Rhantus frontalis Marsham	Nb	Ponds, lakes, ditches, mostly coastal	2.viii, 8.ix.2015		
Rhantus grapii (Gyl.)	local	Ponds, lakes, ditches, marshes	8.ix.2015		
Geotrupidae, dor beetles					
Geotrupes spiniger (Marsh.)	common	In cow dung	2.viii.2015		
Gyrinidae, whirligig beetles					
Gyrinus caspius Men.	local	Ponds, ditches, lakes, mostly coastal	2.viii, 8.ix.2015		
Gyrinus substriatus Steph.	common	Ponds, lakes, ditches	2.viii.2015		
Halipidae, water beetles					
Halipius lineaticollis (Mars.)	common	Ponds, lakes and ditches	8.ix.2015	10.ix.2015	10.ix.2015
Halipius ruficollis group	common	Ponds and lakes	2.viii, 8.ix.2015		10.ix.2015
Peltodytes caesus Duft.	Nb	Ponds, flooded gravel pits, fens	8.ix.2015		
Hydraenidae, water beetles					
Ochthebius marinus (Paykull)	v. local	Ditches, ponds, lakes, coastal	8.ix.2015		
Ochthebius minimus (Fab.)	common	Ponds and ditches	8.ix.2015		10.ix.2015
Hydrophilidae, water beetles					

Anacaena limbata (Fab.)	local	Ponds, ditches, marshes	8.ix.2015		10.ix.2015
Berosus affinis Brulle	local	Brackish ditches and ponds	8.ix.2015	10.ix.2015	10.ix.2015
Cymbiodyta marginella (Fab.)	local	In stagnant water	8.ix.2015		10.ix.2015
Enochrus testaceus Fab.	local	Ponds, ditches, marshes	8.ix.2015		
Helochares lividus (Forster)	common	Ponds, lakes and other still water		10.ix.2015	
Hydrobius fuscipes (L.)	local	Ponds and lakes	8.ix.2015		10.ix.2015
Laccobius bipunctatus Fab.	common	Ponds and lakes	8.ix.2015		
Sphaeridium bipustulatum Fab.	common	In dung of horses and cows etc.	2.viii, 8.ix.2015		
Sphaeridium scarabaeoides Lin.	common	In dung of horses and cows etc.	2.viii, 8.ix.2015		
Melyridae, False soldier beetles					
Anthrenus rufus Herbst	v.local	Fens, reedbeds, marshes and wet meadows	2.viii, 8.ix.2015	2.viii.2015	2.viii, 10.ix.2015
Malachius viridis Fab.	common	Open grassy areas, on flowers, larvae predatory			2.viii.2015
Noteridae, water beetles					
Noterus clavicornis (Deg.)	common	Ponds, lakes and other still water.	8.ix.2015	10.ix.2015	10.ix.2015
Oedemeridae, Flower beetles					
Oedemera nobilis (Scopoli)	local	On flowers	2.viii.2015		
Scarabaeidae, chafers and dung beetles					
Aphodius fossor (Lin.)	common	In dung of horses, cows etc.	2.viii.2015		
Aphodius haemorrhoidalis (Lin.)	common	In dung of horses, cows etc.	2.viii.2015		
Onthophagus coenobita Herbst	local	In mammalian dung			10.ix.2015
Scirtidae, marsh beetles					
Scirtes hemisphericus (Lin.)	common	Rough grassy places	2.viii.2015		
Staphylinidae, Rove beetles					
Lobrathium multipunctatum (Grav.)	v.local	Wet areas, ditch banks, pond sides, marshes	2.viii.2015		
Paederus riparius L.	local	Marshes, damp meadows			10.ix.2015
Philonthus spinipes Sharp	v. local	In decaying organic matter, recent immigrant	8.ix.2015		
Platydacus stercorarius Ol.	local	Dry grassy places			10.ix.2015
DERMAPTERA, Earwigs					
Forficulidae, earwigs					

Forficula auricularia L.	common	Hedges, fields, woods	2.viii. 8.ix.2015		2.viii.2015
DIPTERA, True flies					
Asilidae, robberflies					
Leptogaster cylindrica (Deg.)	local	Grassy places in southern England	2.viii.2015		
Chloropidae, frit flies					
Camarota curvipennis Lat.	v.local	Breeds in heads of wheat, rye, barley			2.viii.2015
Dolichopodidae, long-footed flies					
Machaerium maritimae Hal.	v.local	Damp places, grazing marshes, coastal			2.viii.2015
Scathophagidae, dungflies etc.					
Scathophaga stercoraria (Lin.)	common	Develops in the dung of cows, horses, dogs etc.	8.ix.2015	10.ix.2015	
Sciomyzidae, snail-killing flies					
Elgiva sollicita Harr.	common	Parasitoid of snails, marshes	2.viii.2015		
Ilione albiseta (Scop.)	local	Attacks snails, moist places		2.viii.2015	
Hydromya dorsalis (Fab.)	local	Attacks freshwater snails	2.viii.2015		
Pherbellia schoenherri Fall.	local	Damp or marshy places, larvae attack snails	2.viii.2015		
Sepedon spinipes (Scop.)	local	Parasitoid of snails	2.viii.2015		2.viii.2015
Tetanocera ferruginea Fall.	common	Probably predator/parasitoid of land snails	2.viii.2015		
Syrphidae, Hoverflies					
Episyrphus balteatus (Lin.)	common	Wide variety of habitats, gardens etc.			2.viii.2015
Eristalinus aeneus (Scop.)	v.local	Coastal, larvae in decaying seaweed etc.	2.viii.2015		
Eumerus strigatus (Fall.)	local	In dafodill and narcissus bulbs	2.viii.2015		
Scaeva pyrastris (Lin.)	common	Wide variety of grassy habitats			2.viii.2015
Sphaerophoria scripta (Lin.)	common	Wide variety of grassy habitats	2.viii.2015		
Tabanidae, horseflies					
Atylotus latistriatus Brauer	RDB3	Saltmarshes, Essex, Kent, Hampshire, Dorset	2.viii.2015		
Tachinidae, parasitic flies					
Lydella grisescens R.-D.	common	Parasitoid of various moth caterpillars	8.ix.2015		
Tephritidae, picture-winged flies					

Paroxyna plantaginis (Hal.)	v.local	Larvae in heads of Aster tripolium, coastal	2.viii.2015	2.viii.2015	
Sphenella marginata (Fall.)	local	Larvae in the flowering heads of ragworts		2.viii.2015	
Tephritis divisa (Rond.)	v.local	Larva on bristly ox-tongue, recent recolonist, spreading	2.viii.2015	2.viii.2015	2.viii.2015
Urophora cardui (Lin.)	common	Larvae in galls in stems of Cirsium arvense	2.viii.2015		
Urophora quadrifasciata (Meig.)	local	Larvae in galls in knapweed heads		2.viii.2015	2.viii.2015
Ulidiidae					
Ceroxys urticae L.	local	Coastal meadows and saltmarshes	2.viii.2015		
HEMIPTERA, True bugs					
Cercopidae, Frog hoppers					
Philaenus spumarius (Lin.)	common	Nymphs on various herbs, variety of habitats			2.viii.2015
Cixiidae, froghoppers					
Reptalus (Oliarus) panzeri Low	N	Dry grassy places			2.viii.2015
Pentastiridius leporinus (L.)	v.local	Salt marshes and brackish grazing meadows		2.viii.2015	2.viii.2015
Corixidae, water boatmen					
Corixa affinis Leach	v.local	Ditches, ponds, mostly coastal	8.ix.2015		
Corixa punctata Ill.	common	Ponds, lakes, streams and rivers	8.ix.2015		10.ix.2015
Hesperocorixa linnaei Lacz.	common	In ponds, lakes and ditches	2.viii, 8.ix.2015		
Hesperocorixa sahlbergi Fieber	common	In ponds, lakes and ditches			10.ix.2015
Sigara stagnalis (Leach)	local	Ponds and lakes	8.ix.2015		
Cydniidae, shieldbugs					
Legnotus limbatus (Geoff.)	local	Flower places, on bedstraws		10.ix.2015	
Gerridae, water-skaters					
Gerris lacustris L.	common	Ponds and stream edges			10.ix.2015
Lygaeidae, Ground bugs					
Drymus pilicornis Muls.	Nb	Calcareous soils, amongst moss		10.ix.2015	
Heterogaster urticae (Fab.)	common	On stinging nettles	2.viii, 8.ix.2015		
Nysius senecionis (Schill.)	v.local	On Guernsey fleabane and ragworts			2.viii.2015
Scolopostethus affinis	common	Under stones,	2.viii.2015		

(Schill.)		bare ground, sparse vegetation			
Miridae, Leaf bugs					
Capsus ater (Lin.)	common	Various habitats on various plants		2.viii.2015	
Deraeocoris ruber (Lin.)	common	On stinging nettles and various other plants		2.viii.2015	
Heterotoma planicornis (Fab.)	common	On stinging nettles	2.viii.2015		
Nabidae, Damself bugs					
Himacerus apterus (Fab.)	local	On trees	2.viii.2015		
Naucoridae, saucer bugs					
Ilyocoris cimicoides (Lin.)	local	In ponds, lakes and other still water	8.ix.2015	10.ix.2015	10.ix.2015
Nepidae, water scorpions					
Nepa cinerea L.	local	Ponds and ditches		10.ix.2015	10.ix.2015
Ranatra linearis L.	Local	Ponds, lakes, ditches			10.ix.2015
Notonectidae, back-swimmers					
Notonecta maculata (Fab.)	common	Ponds and lakes	8.ix.2015	10.ix.2015	10.ix.2015
Pentatomidae, Shield bugs					
Aelia acuminata (Lin.)	local	Various grassy habitats	8.ix.2015		
Dolycoris baccarum (Lin.)	local	Woodland edges and hedges, on variety of plants	2.viii, 8.ix.2015		2.viii.2015
Podops inuncta (Fab.)	local	Sandy and chalky places, under stones etc.	8.ix.2015	10.ix.2015	2.viii.2015
Pleidae					
Plea minutissima Leach	common	Ditches, ponds, streams	8.ix.2015	10.ix.2015	
Rhopalidae, Leaf bugs					
Corizus hyosclami (L.)	v.local	Dry sandy places	2.viii.2015		
Liorhyssus hyalinus (Fab.)	v.local	Recent arrival in Britain			2.viii.2015
Saldidae, shore bugs					
Saldula orthochila Fieb.	local	In dry places, fields, sandy heaths, dunes	8.ix.2015		
Scutelleridae, tortoise bugs					
Eurygaster testudinaria (Geoff.)	local	Grassy and marshy places	8.ix.2015		
Tingidae, Lace bugs					
Dictyla convergens (H.- S.)	v.local	Marshy places on Myosotis	2.viii.2015		
HYMENOPTERA					
Apidae, bees					

Bombus muscorum L.	v.local	Wide variety of habitats	2.viii.2015		
Eumenidae, Potter wasps					
Ancistrocerus parietum (Lin.)	common	Builds mud nest in cavities in walls, tree trunks, rocks etc.		2.viii.2015	
Formicidae, Ants					
Formica fusca Lin.	common	England and Wales, widespread	2.viii, 8.ix.2015		
Pompilidae, spider- hunting wasps					
Priocnemis parvula Dahl.	common	Sandy soils, preys on ground- dwelling spiders	8.ix.2015		
Sphecidae, Solitary wasps					
Ectemnius lituratus (Panz.)	local	Nests in timber, especially in woods.		2.viii.2015	
Vespidae, social wasps					
Vespula germanica (Fab.)	common	Large underground nests, predators		2.viii.2015	
LEPIDOPTERA, Butterflies & moths					
Arctidae, tiger moths etc.					
Eilema complana (L.)	local	Caterpillar on lichens and algae on rocks	2.viii.2015		
Tyria jacobaeae (Lin.)	common	Cinnabar moth, caterpillars on ragwort			2.viii.2015
Hesperidae, skippers					
Thymelicus lineola (Ochs.)	common	Essex skipper, grassy places, larvae on grasses		2.viii.2015	
Lycaenidae, Blues					
Cellastrina argiolus (L.)	common	Holly blue. On ivy and holly		2.viii.2015	
Polyommatus icarus Rott.	common	Common blue. Grassy places, larvae of trefoils, clovers and medicks.	2.viii.2015		
Nymphalidae					
Coenonympha pamphilus (L.)	common	Small heath, larvae on grasses	8.ix.2015		
Inachis io (Lin.)	common	Peacock, larvae on stinging nettles	2.viii.2015		2.viii.2015
Maniola jurtina (Lin.)	common	Meadow brown. Grassy places, on various grasses.		2.viii.2015	2.viii.2015
Pararge aegeria (Lin.)	common	Speckled wood. Woodland edges and rides, larvae	2.viii.2015		

		on grasses			
Pyronia tithonus (L.)	common	Gatekeeper, hedges and grassy places	2.viii.2015	2.viii.2015	
Vanessa atalanta (Lin.)	common	Red admiral. Larvae on stinging nettles. Migrant.		2.viii.2015	2.viii.2015
Vanessa cardui (Lin.)	common	Painted lady. On thistles, regular migrant.	8.ix.2015		
Pieridae, cabbage whites					
Pieris brassicae (Lin.)	common	Large white, on brassicas, wild and garden species	2.viii.2015		2.viii.2015
Pieris napi (Lin.)	common	Green-veined white, on brassicas	2.viii.2015		
ORTHOPTERA					
Acrididae, grasshoppers					
Chorthippus brunneus (Thunb.)	common	Wide variety of grassy habitats.	2.viii.2015		
Conocephalidae, coneheads					
Conocephalus fuscus (Fab.) = discolor (Thunb.)	local	Grassy places, spreading recently	2.viii.2015		2.viii.2015
Tetrigidae, groundhoppers					
Tetrix undulata (Sow.)	local	Grassy places, woodland edges, damp places	2.viii.2015		
Tettigoniidae					
Metrioptera roeselii (Hag.)	local	Dry grassy places, Essex, Kent, London spreading west	8.ix.2015		
ARANAEA (spiders)					
Araneidae, orb-web spiders					
Araneus diadematus (Cl.)	common	Fields, parks and gardens	8.ix.2015		
Cybaeidae, water spiders					
Argyroneta aquatica Clerck	local	The water spider, ponds, lakes and ditches	8.ix.2015	10.ix.2015	10.ix.2015
Dysderidae, woodlouse spiders					
Dysdera crocata Cl.	common	Wide variety of habitats, under stones	2.viii.2015		
OPILIONES					
Nematostomatidae, harvestmen					
Nemastoma bimaculatum	common	Under logs and stones, in leaf litter		10.ix.2015	

ISOPODA					
Armadillidiidae, pill woodlice					
Armadillidium vulgare (Latr.)	common	Under logs and stones etc., mainly dry places	2.viii.2015		
Platyarthridae					
Platyarthrus hoffmannseggii Brandt	common	Scavenges in ant nests	2.viii.2015		
Mollusca, slugs and snails					
Helicidae, snails					
Monacha cantiana	common	Various roughly vegetated habitats	8.ix.2015		

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