

# Riverside Energy Park

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## Environmental Statement Technical Appendices

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# **Riverside Energy Park Terrestrial Invertebrate Survey Report**

**Presented to Peter Brett Associates LLP**

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## **Declaration**

We confirm that the information provided in this document is truthful and accurate at the time of completion.

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**Date:** 21 September 2018

## 1. Introduction

- 1.1.1. Biocensus Ltd was commissioned by Peter Brett Associates LLP, on behalf of Cory Environmental Holdings Ltd, to undertake terrestrial invertebrate surveys in relation to the proposed Riverside Energy Park (REP) project. This report presents the findings of these surveys, which were undertaken in 2018.
- 1.1.2. As part of the ecological assessment of REP, a desktop study identified a number of areas either on the REP site or in adjacent areas that should be surveyed for their invertebrate interest. This survey was commissioned to investigate the terrestrial invertebrate fauna of these areas.
- 1.1.3. A full description of REP can be found in **Chapter 3** of the Environmental Statement (**Document Reference 6.1**), and in **Schedule 1** to the draft Development Consent Order (**Document Reference 3.1**).
- 1.1.4. A full description of habitats within REP can be found in **Chapter 11** of the Environmental Statement.

## 2. Method

- 2.1.1. Preliminary desktop studies identified a number of areas for survey (**Figure 11.8**). There were:
  - (1) "Brownfield Habitat". Various referred to on site maps or interpretation boards as an area of Open Mosaic Habitat or Wasteland Habitat, this area was deliberately created at the time of the construction of the existing RRRF plant as partial mitigation for the loss of some existing brownfield habitat to be occupied by the plant and also as a potential visitor interpretation and nature area. This small area occupies approximately 0.5ha and was designed to replicate some of the typical features found on post-industrial site. These include soil and hardcore mounds with south facing slopes, sparse soils and a range of substrate sizes.
  - (2) Thames Wall. Part of the River Thames flood defences, the Thames Wall section is primarily a south facing slope seeded with a varied mix of flowers and some tree and shrub plantings on the upper parts. It extends along the northern boundary of the site and would remain in place after the construction of the new plant. For survey purposes, this area also includes the grassy areas around the pond on the east side of the plant and also the adjacent footpath as these were found on inspection to be holding almost identical types of habitat.

- (3) Data Centre Fields. Two fields to the south of the REP site. Previously grazed, with extant planning permission for the construction of a new data centres on this area.
- (4) Survey Area 4. An area of developing open-mosaic brownfield habitat in 3rd party ownership.
- (5) Crossness Footpath. The footpath and verges of a public footpath running through the Crossness Local Nature Reserve (LNR) to the west of the proposed development site.



Figure 1 REP Invertebrate survey areas

- 2.1.2. A scoping visit was made to the survey areas on 11 April 2018, with survey visits being made on 23 May, 13 July, 17 August and 7 September 2018. Survey visits took place during warm, sunny weather when invertebrates were likely to be most active. Approximately 6-7 hours were spent on site at each visit.
- 2.1.3. Terrestrial invertebrate samples were collected using a variety of methods. Specimens were collected using both a butterfly net and sweep net. Beating was used to sample invertebrates visiting hedgerow flowers and foliage, and direct searching was used to look for invertebrates under debris or associated with dead wood.
- 2.1.4. As Area 1 was presumed to be an important part of the site for invertebrates, three pitfall traps were installed in this area, with traps being filled with a glycol based anti-freeze to act as a preservative. The pitfall traps were operated between 23 May and 7 September, with samples being collected on 13 July and 7 September.
- 2.1.5. Where possible, species identifiable in the field were recorded and released. Voucher specimens were killed with ethyl-acetate for subsequent identification, with specimens being identified to species. A collection of voucher specimens has been retained for the majority of the scarce and local species identified, the exceptions being Lepidoptera and Odonata where field identification was used in all cases.

### **3. Conservation Status Categories**

- 3.1.1. For the purposes of determining priorities for conservation action, invertebrates are assigned a conservation status. The rarest or most threatened species are usually included in a 'Red List' or 'Red Data Book'. These Red Lists may operate at an International, National or Regional level (e.g. County Red Data Books).
- 3.1.2. In the UK, the British Red Data Book for Insects was published in 1987 (Shirt, 1987). This marked the first attempt to produce a comprehensive statement on the status of the most threatened insects in the UK and introduced the various 'Red Data Book' categories (e.g. RDB 1, RDB 2) into UK insect conservation. The publication by the Joint Nature Conservation Committee (JNCC) of a series of reviews covering various groups of insects such as bees, wasps and ants (Falk, 1992) or some of the beetle families (Hyman & Parsons, 1992) extended the use of conservation statuses to the next tier of uncommon insects (Nationally Notable/Nationally Scarce species). All of these publications based their criteria for assigning conservation statuses on work produced by the International Union for Conservation of Nature (IUCN).
- 3.1.3. In 1994 the IUCN produced revised criteria for assessing the conservation status of invertebrates and other animals. This system was adopted by the JNCC in 1995 as the new standard for Red Lists in Britain. Although broadly similar to the old system,

some of the selection criteria have been amended and a revised set of conservation categories have been introduced, though classifications such as Nationally Scarce (Nationally Notable) are retained. However, the statuses used in the new and old systems are not directly comparable as they use differing criteria from each other when assigning a status to a species.

- 3.1.4. The first JNCC publication to make use of the revised status system is the review of water beetle species (Foster, 2000). This has since been revised and republished (Foster, 2010). It is planned that previously published reviews will be revised and republished using the new system. Publication of these reviews is ongoing and at the time of writing additional reviews for Odonata (dragonflies and damselflies) and some parts of the Hemiptera (true bugs) and Coleoptera (beetles) have also been published. Accordingly, this report uses the new status categories and most recent status assessments for groups where new reviews have been published and the older status categories for all other invertebrates recorded during the survey.
- 3.1.5. Unfortunately, the revised system does not discriminate between those species that were previously included in the old Local or Common categories, and many of the new status categories are somewhat cryptic (e.g. LRnsB). In order to allow comparison between various invertebrate groups, for those species where the new status is used an equivalent 'old' status follows in parentheses. Criteria for the various revised categories are included in the report appendices.

## 4. Results

- 4.1.1. A total of 152 species of invertebrate were recorded during the survey. One Red Data Book species was recorded together with 11 Nationally Notable (Nationally Scarce) species and 36 species with Local distributions. Three BAP/Section 41 Priority species were also noted during the survey.
- 4.1.2. Assessment of the results is slightly complicated due to the fact that the most recent review of the conservation status of dragonfly species has undertaken using the new IUCN criteria-based system, while the remaining invertebrate groups noted during the survey are awaiting review and are still currently assessed under the old "Red Data Book" criteria.
- 4.1.3. Table 1 gives a summary of the various species of invertebrate recorded during the survey by Order and conservation status where the groups are currently assessed using the older "RDB" criteria. Table 2 provides a summary of the dragonflies and damselflies based on the most recent reviews using the IUCN categories. Details of the criteria for the various conservation status categories are included in the report appendices. An overall species list, sample site species lists and short notes for all of the Rare, Notable and Local species are provided in the Appendices.

Table 1 Number of invertebrate species recorded from groups assessed using “RDB” criteria.

Order	Total species	RDB species	Notable species	Local species
Araneae – Spiders	1	-	-	-
Isopoda – Woodlice	3	-	-	-
Orthoptera – Crickets and grasshoppers	4	-	1	1
Hemiptera – True vugs	9	-	-	2
Lepidoptera – Butterflies and moths	22	-	-	5
Diptera – Flies	37	1	2	8
Hymenoptera – Bees, wasps and ants	46	-	6	16
Coleoptera – Beetles	21	-	2	4
<b>Total</b>	<b>143</b>	<b>1</b>	<b>11</b>	<b>36</b>

Table 2 Number of invertebrate species recorded from groups assessed using IUCN criteria

Order	Total	LRlc species
Odonata – Dragonflies and damselflies	10	10

4.1.4. The number of invertebrate species recorded from each of the sample areas ranged from 42 to 71 species. These results are summarised in Table 3.

Table 3 Number of invertebrate species recorded from each sample area

Survey site	Total species	RDB species	Notable species	Local species
Area 1	71	-	5	19
Area 2	72	1	4	16
Area 3	49	1	3	9
Area 4	42	1	4	12
Area 5	66	-	4	9

## 5. Discussion

5.1.1. A total of 152 species of invertebrate were recorded during the five visits made to the site in 2018. These included one Red Data Book and 11 Nationally Notable (Nationally Scarce) species. The conservation status of many invertebrate species

was assigned over 20 years ago (e.g. Shirt 1987, Falk 1991) and an assessment of the conservation status of some of the species recorded during the survey based on more modern records would suggest that the status of some is in need of revision. As an example, the small fly parasitic *Cistogaster globosa* was recorded during the survey and is currently accorded RDB 1 status, but based on the increasing number of recent record this species is now probably best considered as Nationally Scarce.

- 5.1.2. Similar arguments can be advanced for some of the Notable species such as the solitary bee *Hylaeus cornutus* (Na) and the bush-cricket *Conocephalus discolor* (Na). A more realistic assessment of the various species recorded from the survey would suggest the species list would contain no Red Data Book species and around 6 Nationally Notable species. However, until the publication of a revised Red Data Book the current published statuses are those generally used for site assessment and comparisons between sites.
- 5.1.3. Invertebrates from a range of Orders were recorded, with Hymenoptera (bees, wasps and ants) making the biggest contribution to the species list. A number of uncommon species typically associated with the "Thames Gateway" area were recorded, including the Shril Carder Bee *Bombus sylvarum* and the Brown Banded Carder Bee *Bombus humilis*, both BAP species. The overall species list was also influenced by the aquatic habitats of the nearby Crossness Nature Reserve, as evidenced by the range of dragonfly and damselfly species recorded and the presence of species such as the large Soldierfly *Stratiomys singularior* (Nb). The majority of the uncommon species recorded during the survey were mobile species recorded across several or all of the survey sections.
- 5.1.4. Weather conditions in 2018 were more extreme than usual. A very cold spell in late spring was followed by a very hot and dry summer, with very little rain falling between May and the end of August. The long dry spell meant that many plants were stressed by the lack of rain or flowered quickly before much of the top growth desiccated and died. This was particularly noticeable in the Thames Wall section of the site, which was very dry and brown by mid-summer, though there were signs of recovery and a late flush of flowers on some of the more drought-resistant plants by the September visit. Possibly, if weather conditions had been less extreme, a greater number of species might have been recorded from the survey.
- 5.1.5. In order to see if some of the specialist ground dwelling invertebrate species one might hope to see on a well-established, high quality open habitat mosaic site were resident here, in addition to the survey methods employed elsewhere in other areas, pitfall trapping was used in Area 1 over the duration of the survey. While this did bolster the overall number of species recorded compared to other survey sites with no pitfall trapping, only one of these was uncommon. The catch was dominated by woodlice such as *Armadillidium vulgare* and the majority of species

recorded by pitfall trapping were common species that might reasonably be expected to be present across most of the survey area.

- 5.1.6. Although designed to replicate an area of post-industrial open-mosaic habitat, very few fossorial species of bee and wasp were recorded, and very little in the way of nesting or nest sites of this group of invertebrates was observed. This is probably due to the materials employed to create the various low mounds across the site. While these had south facing slopes, the size of the aggregate used to construct the mounds was far too large. Ground nesting bees and wasps require areas of sand or soils with a small particle size in order to excavate their nest burrows, and the mounds appeared to have been mostly constructed from hardcore and large diameter aggregates. Similarly, the woodcrete "bee-hotels" attached to the various upright sleepers were noted as being ineffective. Although they provide the appropriate sized holes needed for cavity nesting bee and wasp species, the internal plastic tubes used for this purpose are prone to condensation and nest success rates are very low. Almost every occupied tube in these woodcrete boxes was found to contain dead nests.
- 5.1.7. When compared to Area 1, similar numbers of invertebrate species, and similar numbers of uncommon invertebrate species were recorded from Area 2. As already noted, fewer beetle species were recorded as no pitfall traps were operated in this area. The Thames Wall is a south facing bank containing a mixture of planted scrub and is sown with a varied wildflower mix. When visited in May, good amounts of vetch and clover were in flower. Long tongued bumblebees such as the Brown-banded Carder Bee *Bombus humilis* and Shril Carder Bee *Bombus sylvarum* preferentially forage on leguminous plants such as clovers and vetches, and a good number of *Bombus humilis* queens were noted collecting nectar and pollen from various patches of vetch along the wall. Bumblebees require a continuity of floral resources across their long flight season, and early season forage such as that seen on the Thames Wall is particularly valuable for queens when establishing their nests.
- 5.1.8. Area 3 and Area 4 are situated next to each other to the south of the main REP site. Area 3 has been ungrazed for a number of seasons and has developed a rather limited flora compared to that seen in Area 2. Area 4 are a very early stage open mosaic habitat, with areas of concrete and hardcore occupying most of the site. Similar numbers of species were recorded from these sites, but the overall number of species recorded was less than those seen in Area 1 or Area 2.
- 5.1.9. Area 5 is a narrow linear feature running north-south through the Crossness LNR to the west of the REP site. The habitats here are essentially tall hedgerow along the west side of the path and either reed-beds or ruderal habitats along the east side. Due to the influence of the surround aquatic habitats at the reserve, a slightly

different range of invertebrate species were recorded from here compared to those seen elsewhere on the survey.

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## Appendix 1 Invertebrate species list

The invertebrate species recorded during the survey are listed below. The current conservation status for each species is shown further details for each of the Notable and Local species are provided in the Species Notes section of the report.

Table 4 Invertebrate species list

Order / Family / Species	Common Name	Status
<b>Araneae</b> <u>Dysderidae</u> <i>Dysdera crocata</i>	Woodlouse Spider	Common
<b>Isopoda</b> <u>Oniscidae</u> <i>Oniscus asellus</i> <u>Porcellionidae</u> <i>Porcellio scaber</i>		Common Common
<b>Odonata</b> <u>Aeshnidae</u> <i>Aeshna cyanea</i> <i>Aeshna mixta</i> <i>Anax imperator</i> <u>Coenagriidae</u> <i>Enallagma cyathigerum</i> <i>Ischnura elegans</i> <u>Lestidae</u> <i>Lestes sponsa</i> <u>Libellulidae</u> <i>Libellula quadrimaculata</i> <i>Orthetrum cancellatum</i> <i>Sympetrum sanguineum</i> <i>Sympetrum striolatum</i>	Southern Hawker Migrant Hawker Emperor Dragonfly  Common Blue Damselfly Blue-tailed Damselfly  Emerald Damselfly  Four-spotted Chaser Black-tailed Skimmer Ruddy Darter Common Darter	LRlc (Common) LRlc (Local) LRlc (Common)  LRlc (Common) LRlc (Common)  LRlc (Common)  LRlc (Common) LRlc (Local) LRlc (Notable B) LRlc (Common)
<b>Orthoptera</b> <u>Acrididae</u> <i>Chorthippus albomarginatus</i> <i>Chorthippus brunneus</i> <i>Chorthippus parallelus</i> <u>Tettigoniidae</u> <i>Conocephalus discolor</i>	Lesser Marsh Grasshopper Common Field Grasshopper Meadow Grasshopper  Long-winged Conehead	Local Common Common  Notable A

Order / Family / Species	Common Name	Status
<b>Hemiptera</b>		
<u>Aphrophoridae</u> <i>Philaenus spumarius</i>	Cuckoo-spit Insect	Common
<u>Coreidae</u> <i>Coreus marginatus</i>		Common
<u>Miridae</u> <i>Calocoris norvegicus</i> <i>Miris striatus</i>		Common Common
<u>Pentatomidae</u> <i>Aelia acuminata</i> <i>Dolycoris baccarum</i> <i>Palomena prasina</i>	Bishop's Mitre Sloe Bug Common Green Shieldbug	Local Common Common
<u>Rhopalidae</u> <i>Rhopalus subrufus</i>		Local
<u>Veliidae</u> <i>Velia caprai</i>	Water Cricket	Common
<b>Lepidoptera</b>		
<u>Arctiidae</u> <i>Tyria jacobaeae</i>	The Cinnabar	Common
<u>Hesperiidae</u> <i>Thymelicus lineola</i>	Essex Skipper	Local
<u>Lycaenidae</u> <i>Aricia agestis</i> <i>Callophrys rubi</i> <i>Celastrina argiolus</i> <i>Lycaena phlaeas</i> <i>Polyommatus icarus</i>	Brown Argus Green Hairstreak Holly Blue Small Copper Common Blue	Local Local Local Common Common
<u>Lymantriidae</u> <i>Orgyia antiqua</i>	Vapourer	Common
<u>Noctuidae</u> <i>Callisteges mi</i> <i>Euclidea glyphica</i>	Mother Shipton Burnet Companion	Common Local
<u>Nymphalidae</u> <i>Aglais urticae</i> <i>Inachis io</i> <i>Polygonia c-album</i> <i>Vanessa atalanta</i>	Small Tortoiseshell Peacock Comma Red Admiral	Common Common Common Migrant
<u>Pieridae</u> <i>Gonepteryx rhamni</i> <i>Pieris brassicae</i> <i>Pieris napi</i>	Brimstone Large White Green-veined White	Common Common Common

Order / Family / Species	Common Name	Status
<i>Pieris rapae</i>	Small White	Common
<u>Satyridae</u>		
<i>Maniola jurtina</i>	Meadow Brown	Common
<i>Pararge aegeria</i>	Speckled Wood	Common
<i>Pyronia tithonus</i>	Gatekeeper	Common
<u>Zygaenidae</u>		
<i>Zygaena filipendulae</i>	Six-spot Burnet Moth	Common
<b>Diptera</b>		
<u>Calliphoridae</u>		
<i>Calliphora vomitoria</i>	Bluebottle	Common
<i>Lucilia caesar</i>	Greenbottle	Common
<u>Conopidae</u>		
<i>Sicus ferrugineus</i>		Local
<i>Thecophora atra</i>		Local
<u>Muscidae</u>		
<i>Musca autumnalis</i>	Face Fly	Common
<u>Ptychopteraidae</u>		
<i>Ptychoptera contaminata</i>		Local
<u>Sarcophagidae</u>		
<i>Nyctia halterata</i>		Local
<i>Sarcophaga carnaria</i>		Common
<u>Scathophagidae</u>		
<i>Scathophaga stercoraria</i>	Yellow Dung Fly	Common
<u>Stratiomyidae</u>		
<i>Chloromyia formosa</i>		Common
<i>Stratiomys singularior</i>		Notable B
<u>Syrphidae</u>		
<i>Baccha elongata</i>		Common
<i>Cheilosia impressa</i>		Local
<i>Cheilosia proxima</i>		Common
<i>Epistrophe eligans</i>		Common
<i>Episyrphus balteatus</i>		Common
<i>Eristalinus sepulchralis</i>		Local
<i>Eristalis arbustorum</i>		Common
<i>Eristalis pertinax</i>		Common
<i>Eristalis tenax</i>	Drone Fly	Common
<i>Eupeodes corollae</i>		Common
<i>Helophilus pendulus</i>		Common
<i>Helophilus trivittatus</i>		Local
<i>Melanostoma mellinum</i>		Common
<i>Melanostoma scalare</i>		Common
<i>Myathropa florea</i>		Common
<i>Platycheirus granditarsa</i>		Common

Order / Family / Species	Common Name	Status
<i>Scaeva pyrastris</i>		Common
<i>Sphaerophoria scripta</i>		Common
<i>Syrpitta pipiens</i>		Common
<i>Syrphus ribesii</i>		Common
<i>Volucella zonaria</i>		Notable B
<i>Xanthogramma pedissequum</i>		Local
<b>Tachinidae</b>		
<i>Cistogaster globosa</i>		RDB 1
<i>Eriothrix rufomaculata</i>		Common
<i>Tachina fera</i>		Common
<b>Tipulidae</b>		
<i>Tipula oleracea</i>		Common
<b>Hymenoptera</b>		
<b>Andrenidae</b>		
<i>Andrena chrysoceles</i>		Local
<i>Andrena denticulata</i>		Local
<i>Andrena dorsata</i>		Local
<i>Andrena flavipes</i>	Yellow Legged Mining Bee	Local
<i>Andrena haemorrhoa</i>	Early Mining Bee	Common
<i>Andrena humilis</i>		Notable B
<i>Andrena nitida</i>		Common
<i>Andrena scotica</i>		Common
<i>Panurgus calcaratus</i>		Local
<b>Anthophoridae</b>		
<i>Anthophora bimaculata</i>		Local
<i>Nomada flava</i>		Common
<i>Nomada goodeniana</i>	Gooden's Nomad Bee	Common
<i>Nomada marshamella</i>	Marsham's Nomad Bee	Common
<b>Apidae</b>		
<i>Bombus hortorum</i>	Small Garden Bumblebee	Common
<i>Bombus humilis</i>	Brown-banded Carder-bee	Local
<i>Bombus lapidarius</i>	Large Red-tailed Bumblebee	Common
<i>Bombus pascuorum</i>	Common Carder Bee	Common
<i>Bombus pratorum</i>	Early-nesting Bumblebee	Common
<i>Bombus sylvarum</i>	Shrill Carder Bee	Notable B
<i>Bombus terrestris</i>	Buff-tailed Bumblebee	Common
<b>Chrysididae</b>		
<i>Trichrysis cyanea</i>		Common
<b>Colletidae</b>		
<i>Hylaeus communis</i>	Common Yellow Face Bee	Local
<i>Hylaeus cornutus</i>		Notable A
<i>Hylaeus dilatatus</i>		Local

Order / Family / Species	Common Name	Status
<u>Eumenidae</u> <i>Ancistrocerus parietum</i>	Wall Mason Wasp	Common
<u>Formicidae</u> <i>Formica cunicularia</i> <i>Formica fusca</i>		Local Common
<u>Formicidae</u> <i>Lasius niger</i>	Small Black Ant	Common
<u>Halictidae</u> <i>Lasioglossum calceatum</i> <i>Lasioglossum leucozonium</i> <i>Lasioglossum morio</i> <i>Lasioglossum pauxillum</i>	Slender Mining Bee  Brassy Mining Bee	Common Common Common Notable A
<u>Ichneumonidae</u> <i>Amblyteles armatorius</i>		
<u>Megachilidae</u> <i>Anthidium manicatum</i> <i>Hoplitis spinulosa</i> <i>Megachile willughbiella</i> <i>Osmia bicornis</i>	Wool-carder Bee  Willughby's Leaf-cutter Bee Red Mason Bee	Common Local Common Common
<u>Melittidae</u> <i>Dasypoda altercator</i> <i>Melitta leporina</i>	Hairy Legged Mining Bee	Notable B Local
<u>Pompilidae</u> <i>Anoplius nigerrimus</i>		Local
<u>Sphecidae</u> <i>Ammophila sabulosa</i> <i>Astata boops</i> <i>Cerceris rybyensis</i>	Red Banded Sand Wasp  Ornate Tailed Digger Wasp	Local Local Local
<u>Tenthredinidae</u> <i>Macrophya annulata</i>		Common
<u>Vespidae</u> <i>Dolichovespula media</i> <i>Vespula vulgaris</i>	Common Wasp	Notable A Common
<b>Coleoptera</b>		
<u>Cantharidae</u> <i>Cantharis rustica</i> <i>Rhagonycha fulva</i>	Red soldier beetle	Common Common
<u>Carabidae</u> <i>Amara aenea</i> <i>Badister bullatus</i> <i>Calathus fuscipes</i>	Common Sun Beetle	Common Common Common

Order / Family / Species	Common Name	Status
<i>Harpalus affinis</i>	Strawberry Seed Beetle	Common
<i>Harpalus rufipes</i>		Common
<u>Cerambycidae</u>		
<i>Leptura maculata</i>		Common
<u>Coccinellidae</u>		
<i>Coccinella 7-punctata</i>	Seven-spot Ladybird	Common
<i>Harmonia axyridis</i>	Harlequin Ladybird	Naturalised
<i>Hippodamia variegata</i>	Adonis' Ladybird	Notable B
<u>Curculionidae</u>		
<i>Hypera meles</i>	Strawberry Root Weevil	Notable A
<i>Otiorhynchus ovatus</i>		Local
<u>Melyridae</u>		
<i>Anthocomus rufus</i>	Malachite Beetle	Local
<i>Malachius bipustulatus</i>		Common
<u>Nitidulidae</u>		
<i>Meligethes aeneus</i>	Common Pollen Beetle	Common
<u>Oedemeridae</u>		
<i>Oedemera lurida</i>		Local
<i>Oedemera nobilis</i>		Common
<u>Silphidae</u>		
<i>Silpha laevigata</i>		Local
<u>Staphylinidae</u>		
<i>Creophilus maxillosus</i>	Devil's Coach-horse Beetle	Common
<i>Ocypus olens</i>		Common

## Appendix 2 Invertebrate species by sample site

Invertebrate species recorded from each of the various sites sampled during the survey. Invertebrates are listed alphabetically by sample site

Table 5 Invertebrate species by sample site

Order / Species	Status	Area 1	Area 2	Area 3	Area 4	Area 5
<b>Araneae</b>						
<i>Dysdera crocata</i>		●				
<b>Isopoda</b>						
<i>Armadillidium vulgare</i>		●				
<i>Oniscus asellus</i>		●	·	·	·	·
<i>Porcellio scaber</i>		●	·	·	·	·
<b>Odonata</b>			·	·	·	·
<i>Aeshna cyanea</i>			●			
<i>Aeshna mixta</i>		●	●	●	●	●
<i>Anax imperator</i>				●		
<i>Enallagma cyathigerum</i>	·		●	●		●
<i>Ischnura elegans</i>	·					●
<i>Lestes sponsa</i>	·					●
<i>Libellula quadrimaculata</i>	·		●	●		●
<i>Orthetrum cancellatum</i>					●	
<i>Sympetrum sanguineum</i>						●
<i>Sympetrum striolatum</i>	·				●	●
<b>Orthoptera</b>						
<i>Chorthippus albomarginatus</i>	Local	●				
<i>Chorthippus brunneus</i>		●	●	●	●	
<i>Chorthippus parallelus</i>		●	●	●	●	
<i>Conocephalus discolor</i>	Notable A					●
<b>Hemiptera</b>						
<i>Aelia acuminata</i>	Local	●				
<i>Calocoris norvegicus</i>				●		
<i>Coreus marginatus</i>						●
<i>Dolycoris baccarum</i>		●	●			●
<i>Miris striatus</i>						●
<i>Palomena prasina</i>						●

Order / Species	Status	Area 1	Area 2	Area 3	Area 4	Area 5
<i>Philaenus spumarius</i>		●	●	●		
<i>Rhopalus subrufus</i>	Local	●				
<i>Velia caprai</i>				●		
<b>Lepidoptera</b>						
<i>Aglais urticae</i>		●			●	
<i>Aricia agestis</i>	Local	●	●	●	●	
<i>Callistege mi</i>			●			
<i>Callophrys rubi</i>	Local		●	●		●
<i>Celastrina argiolus</i>	Local					●
<i>Euclidea glyphica</i>	Local		●			
<i>Gonepteryx rhamni</i>						●
<i>Inachis io</i>				●	●	●
<i>Lycaena phlaeas</i>			●			
<i>Maniola jurtina</i>		●	●			●
<i>Orgyia antiqua</i>						●
<i>Pararge aegeria</i>						●
<i>Pieris brassicae</i>		●	●	●	●	·
<i>Pieris napi</i>		●	●	●	●	●
<i>Pieris rapae</i>		●	●	●	●	●
<i>Polygonia c-album</i>			●		●	●
<i>Polyommatus icarus</i>		●	●	●	●	●
<i>Pyronia tithonus</i>		●	●	●		●
<i>Thymelicus lineola</i>	Local	●	●	●	●	●
<i>Tyria jacobaeae</i>				●		●
<i>Vanessa atalanta</i>						●
<i>Zygaena filipendulae</i>		●	●	●		
<b>Diptera</b>						
<i>Baccha elongata</i>						●
<i>Calliphora vomitoria</i>			●			
<i>Cheilosia impressa</i>	Local		●			
<i>Cheilosia proxima</i>			●			
<i>Chloromyia formosa</i>			●	●		
<i>Cistogaster globosa</i>	RDB 1		●	●	●	
<i>Epistrophe eligans</i>						●
<i>Episyrphus balteatus</i>			●		●	
<i>Eriothrix rufomaculata</i>		●	●	●		

Order / Species	Status	Area 1	Area 2	Area 3	Area 4	Area 5
<i>Eristalinus sepulchralis</i>	Local	●	●	●		●
<i>Eristalis arbustorum</i>		●	●			●
<i>Eristalis pertinax</i>			●			●
<i>Eristalis tenax</i>		●	●	●	●	●
<i>Eupeodes corollae</i>			●			
<i>Helophilus pendulus</i>				●		
<i>Helophilus trivittatus</i>	Local		●			
<i>Lucilia caesar</i>		●	●	●	●	●
<i>Melanostoma mellinum</i>				●		
<i>Melanostoma scalare</i>			●			
<i>Musca autumnalis</i>						●
<i>Myathropa florea</i>						●
<i>Nyctia halterata</i>	Local			●		.
<i>Platycheirus granditarsa</i>						●
<i>Ptychoptera contaminata</i>	Local					●
<i>Sarcophaga carnaria</i>		●	●			●
<i>Scaeva pyrastris</i>		●				
<i>Scathophaga stercoraria</i>						●
<i>Sicus ferrugineus</i>	Local				●	
<i>Sphaerophoria scripta</i>		●	●	●		●
<i>Stratiomys singularior</i>	Notable B			●		●
<i>Syrirta pipiens</i>		●	●	●	●	●
<i>Syrphus ribesii</i>			●			
<i>Tachina fera</i>						●
<i>Thecophora atra</i>	Local		●			
<i>Tipula oleracea</i>				●		●
<i>Volucella zonaria</i>	Notable B	●				
<i>Xanthogramma pedissequum</i>	Local		●			
<b>Hymenoptera</b>						
<i>Amblyteles armatorius</i>			●			
<i>Ammophila sabulosa</i>	Local	●				
<i>Ancistrocerus parietum</i>		●				●
<i>Andrena chrysoseles</i>	Local				●	
<i>Andrena denticulata</i>		●				
<i>Andrena dorsata</i>	Local		●			
<i>Andrena flavipes</i>	Local	●	●	●	●	●
<i>Andrena haemorrhhoa</i>						●

Order / Species	Status	Area 1	Area 2	Area 3	Area 4	Area 5
<i>Andrena humilis</i>	Notable B					●
<i>Andrena nitida</i>			●			
<i>Andrena scotica</i>			●	●		●
<i>Anoplius nigerrimus</i>	Local				●	
<i>Anthidium manicatum</i>		●				●
<i>Anthophora bimaculata</i>	Local				●	
<i>Astata boops</i>	Local	●				
<i>Bombus hortorum</i>			●		●	
<i>Bombus humilis</i>	Local	●	●	●	●	●
<i>Bombus lapidarius</i>		●	●	●	●	●
<i>Bombus pascuorum</i>		●	●	●	●	●
<i>Bombus pratorum</i>			●	●		●
<i>Bombus sylvarum</i>	Notable B	●	●	●	●	
<i>Bombus terrestris</i>		●	●	●	●	●
<i>Cerceris rybyensis</i>	Local	●				
<i>Dasypoda altercator</i>	Notable B					●
<i>Dolichovespula media</i>	Notable A			●		
<i>Formica cunicularia</i>	Local	●	●	●		
<i>Formica fusca</i>			●			
<i>Hoplitis spinulosa</i>	Local	●	●		●	
<i>Hylaeus communis</i>	Local		●		●	
<i>Hylaeus cornutus</i>	Notable A		●		●	
<i>Hylaeus dilatatus</i>	Local				●	
<i>Lasioglossum calceatum</i>		●	●		●	
<i>Lasioglossum leucozonium</i>		●				
<i>Lasioglossum morio</i>		●				
<i>Lasioglossum pauxillum</i>	Notable A	●	●		●	
<i>Lasius niger</i>		●	●			
<i>Macrophya annulata</i>			●			
<i>Megachile willughbiella</i>			●			
<i>Melitta leporina</i>	Local	●				
<i>Nomada flava</i>					●	
<i>Nomada goodeniana</i>				●	●	
<i>Nomada marshamella</i>						●
<i>Osmia bicornis</i>		●				
<i>Panurgus calcaratus</i>	Local	●				
<i>Trichrysis cyanea</i>						●

Order / Species	Status	Area 1	Area 2	Area 3	Area 4	Area 5
<i>Vespula vulgaris</i>		●	●	●	●	●
<b>Coleoptera</b>						
<i>Amara aenea</i>		●				
<i>Anthocomus rufus</i>	Local					●
<i>Badister bullatus</i>		●				
<i>Calathus fuscipes</i>		●				
<i>Cantharis rustica</i>			●			
<i>Coccinella 7-punctata</i>		●	●	●		●
<i>Creophilus maxillosus</i>		●				
<i>Harmonia axyridis</i>		●				
<i>Harpalus affinis</i>		●				
<i>Harpalus rufipes</i>		●				
<i>Hippodamia variegata</i>	Notable B	●	●		●	
<i>Hypera meles</i>	Notable A	●				
<i>Leptura maculata</i>						●
<i>Malachius bipustulatus</i>		●				●
<i>Meligethes aeneus</i>		●				
<i>Ocypus olens</i>		●				
<i>Oedemera lurida</i>	Local	●	●	●	●	●
<i>Oedemera nobilis</i>		●	●	●	●	●
<i>Otiorhynchus ovatus</i>	Local	●				
<i>Rhagonycha fulva</i>				●		
<i>Silpha laevigata</i>	Local	●				
<b>Total</b>		<b>71</b>	<b>71</b>	<b>49</b>	<b>42</b>	<b>66</b>

### Appendix 3 Notes for Rare or Notable invertebrate species

Short notes for the Rare, Notable and Local species recorded from the survey are given below. Species are listed alphabetically within each order.

#### Odonata - Dragonflies & Damselflies

*Aeshna mixta*. Local. The Migrant Hawker. A medium sized hawk dragonfly that prefers ponds and lakes with well-vegetated margins. May also breed in canals and ditches. This species has extended its range throughout southern England since 1900.

*Orthetrum cancellatum*. Local. The Black-tailed Skimmer. A large skimmer dragonfly, the males have a powdery blue bloom on the abdomen. Prefers larger ponds and lakes with open, sandy areas of bank. It is often one of the first species to colonise newly created bodies of water. Mostly found south of the line from the Severn Estuary to the Wash.

*Sympetrum sanguineum*. Lower Risk (least concern) [Notable B]. The Ruddy Darter. A medium sized bright red dragonfly with a club tailed abdomen. Larvae develop in stagnant water at the margins of ponds, lakes, canals and rivers where there is abundant tall emergent vegetation. Mostly restricted to the south-east of England.

#### Orthoptera - Crickets & Grasshoppers

*Chorthippus albomarginatus*. Local. Lesser Marsh Grasshopper. A medium sized grasshopper, found in moist low lying coastal grasslands and associated with estuaries and tidal flood plains. Largely southern and eastern in distribution.

*Conocephalus discolor*. Notable A. Long-winged Conehead. A small brown and green bush cricket which inhabits areas of long grass, reeds or rushes in wet places. Previously categorised as Notable A and confined to the south coastal area, it has recently undergone a population explosion and has been expanding its range in southern England. It has now been recorded from more than 150 10km squares, of which 100 are new 10km square records since 1990. As such, the species is probably best classed as a Local species at present, though the status of this species awaits official review.

#### Hemiptera - True Bugs

*Aelia acuminata*. Local. The Bishop's Mitre. A large plant feeding bug, usually found on dry grassland in a range of habitats. Most frequent in the south and east of England, largely coastal in the west.

*Rhopalus subrufus*. Local. A small bug confined to southern England and Wales. Most commonly associated with common St.Johns-wort *Hypericum perforatum*. It is perhaps most frequent in woodland rides and clearings but often occurs in other habitats and can be abundant where it does occur.

## Lepidoptera - Butterflies and Moths

*Aricia agestis*. The Brown Argus. Local. A small brown butterfly with a row of orange spots along the margins of the wings favouring open, grassy sites. Double brooded, the larva feeds on Common Rock-rose (*Helianthemum*) on chalky soils or Common Storks-bill (*Erodium*) on sandy soils. Predominantly a species of southern calcareous grassland, recorded in south-eastern Britain north to Yorkshire, with additional records from the North Wales coast. Appears to be expanding its range in Britain.

*Collophrys rubi*. Local. The Green Hairstreak. A small bright green butterfly flying in spring. The caterpillars feed on a variety of plants, with Gorse being the preferred foodplant on southern heaths and Common Rock-rose and Bird's-foot-trefoil being used on calcareous sites. Widely distributed throughout the UK but local in occurrence.

*Celastrina argiolus*. Local. The Holly Blue. A small powder blue butterfly with two generations per year. The spring brood usually lay on holly, the summer brood on ivy. This butterfly is known to go through periodic fluctuations in abundance. Found throughout southern Britain.

*Euclidea glyphica*. Local. The Burnet Companion. A day flying moth found in rough grassy places. The larvae feed on clovers, trefoils and other legumes.

*Thymelicus lineola*. The Essex Skipper. A small brown butterfly whose larvae feed on grasses. Told from the very similar Small Skipper (*T. sylvestris*) by the black underside to the tip of the antenna. Frequents unimproved grassland, hedgerows, verges, etc., the larvae feeding on *Dactylis glomerata*, and *Holcus mollis*. Mainly recorded from south-east England and East Anglia though currently increasing its range.

## Diptera - Flies

*Cheilosia impressa*. Local. A small hoverfly of alder carr and wet woodlands, usually found in association with water dropwort other umbellifers which are the likely larval foodplants. Widespread in England and Wales.

*Cistogaster globosa*. RDB1. A small parasitic fly, females are black and males are black and gold. The larvae are internal parasites of shieldbugs of the genus *Aelia*. Originally known from a very few sites in Britain, the species appears to have benefited from the recent series of warmer summers and there are a good number of modern records for this species. To date it has only been recorded from sites in England and Wales but is increasing its range. Status provisionally revised to RDB 2 in the species review currently in preparation (Falk, in prep.) but the number of recent records suggest that the species would probably be best classified as 'Notable'.

*Eristalinus sepulchralis*. Local. A stout black hoverfly with spotted eyes. Generally seen around ponds and marshes where there is a large amount of decaying vegetation or where cattle trampling and dung have resulted in enrichment. Widely distributed but local, most often found in lowland or coastal districts.

*Helophilus trivittatus*. Local. A large black and yellow hoverfly with aquatic larvae, usually encountered as a single individual. Most often recorded by grassy ponds in meadows and by ditches on coastal flats but with records from across England. Widespread but uncommon.

*Nyctia halterata*. Local. A small sarcophagid fly with dark, shaded wings. The larvae are parasites of weevils. Not uncommon in southern England, rare in the north.

*Ptychoptera contaminata*. Local. A spotted-winged crane fly found at rich water margins beside ditches ponds, lakes, canals and sluggish rivers. The larvae are aquatic. Locally distributed in England (mainly southern) and Wales.

*Sicus ferrugineus*. Local. A medium sized reddish-brown Conopid fly whose larvae are solitary internal parasites of bumblebees (*Bombus* sp.). Widely distributed in the UK but uncommon.

*Stratiomys singularioa* (Synonym *S. furcata*). Notable B. A large soldier fly, black with yellow-white markings. Larvae are found feeding in shallow, sometimes temporary, pools in estuarine and coastal grazing marshes and other brackish situations. They are resistant to desiccation. Originally given RDB 3 status, the status of this species has been revised to Notable B. Recorded mainly from coastal sites, but with a scattering of inland records.

*Thecophora atra*. Local. A small black Conopid fly. The larvae are internal parasites of *Halictus* sp. bees. Uncommon but widely distributed.

*Volucella zonaria*. Notable B. Britain's largest hoverfly, a large, spectacular brown and yellow insect that mimics a hornet. The larvae are predators and scavengers in the nests of social wasps. Formerly only frequent in the London and with a few scattered records from along the south coast and the Bristol area, this species now seems to be expanding its range in southern Britain. This species has been recorded as far north as the Sheffield area, though the majority of records still come from the south of the Severn Estuary to Wash line.

*Xanthogramma pedissequum*. Local. A distinctive black and yellow hoverfly. Scarce but widespread in grassland and in open woodland rides, especially where the turf is short and some bare ground is present. Larvae may be predatory on root aphids.

### **Hymenoptera - Bees, Wasps and Ants**

*Ammophila sabulosa*. Local. Red Banded Sand Wasp. A large (14-24 mm), elongate solitary wasp with a very slender abdomen. Found on sandy heaths and coastal cliffs and dunes where they excavate a short burrow ending in a single cell in sandy soil. An egg is laid and then the cell is stocked with paralysed caterpillars. Widespread in suitable habitats in southern Britain north to Yorkshire

*Andrena chrysoceles*. Local. A small double-brooded solitary bee, ground nesting in a variety of habitats. Can be locally abundant where it does occur. Found throughout much of England and Wales north to Yorkshire.

*Andrena denticulata*. Local. A medium sized solitary bee found in mostly on sandy sites. Appears to have a preference for yellow composite flowers such as ragwort. Recorded across Britain but with a very patchy and intermittent distribution.

*Andrena dorsata*. Local. A small solitary bee found both at the coast and inland. A double brooded species visiting a wide range of flowers. Widespread in southern England north to Lincolnshire.

*Andrena flavipes*. Local. A large, conspicuously banded solitary bee nesting in large compact colonies. Widely distributed but local throughout southern England and Wales but becoming rarer in the north.

*Andrena humilis*. Notable B. A ground nesting solitary bee, nesting burrows are dug in hard sand or stiff soil in sunny situations. This species seems to exhibit a preference for foraging at flowers of yellow composites such as *Hieracium* and *Crepis*. Widely recorded from across the UK north to Lancashire but very local in occurrence.

*Anoplius nigerrimus*. Local. A small spider-hunting wasp, 5-8mm in length, found in a fairly wide range of habitats and nesting in a variety of situations including under stones, in dry plant stems, in deserted burrows of other aculeates and in snail shells. Stocks its nest with paralysed spiders.

*Anthophora bimaculata*. Local. A small ground nesting solitary bee nesting in small colonies in bare ground. Widespread but local in southern England south of a line from the Wash to the Severn. Most records are either coastal or from sandy sites inland.

*Astata boops*. Local. A largish (9-13 mm) solitary wasp which builds an underground nest with multiple cells stocked with the nymphs of shieldbugs. Adults are often seen at umbellifer flowers. Confined to sandy localities in southern England and East Anglia.

*Bombus humilis*. Local. Brown Banded Carder Bee. An uncommon bumblebee whose range has declined markedly in the UK in recent decades. Nesting occurs on the surface of the ground, most modern populations are found on areas of coastal grassland. A BAP species, nowadays mostly recorded from coastal areas in southern England and Wales.

*Bombus sylvarum*. Notable B. The Shrill Carder Bee. BAP Priority Species. A small bumblebee nesting at or just below the surface of the ground in rough vegetation, often in the shelter of a bush. Its shrill hum in flight is distinctive. Historically, widely recorded from a variety of open, flower-rich habitats but has declined substantially. Currently only 7 centres of population for this bee are known in the UK.

*Cerceris rybyensis*. Local. A medium sized (8-12 mm), yellow and black solitary wasp which makes a deep nest burrow in flat, bare and often rather hard ground such as the edges of well trodden paths. Females of this species often nest in dense aggregations. Preys on solitary bees especially those of the genera *Hylaeus* and *Halictus*. Confined to southern Britain.

*Dasypoda altercator*. Notable B. Hairy Legged Mining Bee. A mining bee occurring mainly in sandy coastal habitats such as the mid and hind dune areas of sand dune systems. Inland it is recorded rather more sparingly from sandy locations such as heaths and sandpits. The majority of inland records are from south-east England. Nesting burrows are dug in aggregations in bare areas including footpaths. Adults are on the wing from June to September and the females gather pollen exclusively from yellow composites such as *Senecio* (Ragwort).

*Dolichovespula media*. Notable A. A large social wasp, first recorded from Britain from a site in East Sussex in 1980. Since then, the species has spread rapidly throughout southern Britain and can be found almost anywhere. Originally accorded RDB status, this species was redesignated as a Notable species in Falk (1991). Since then, the dramatic increase in the UK range of this species suggest that this species should be redesignated as a 'Common' species.

*Formica cunicularia*. Local. A large reddish member of the 'Wood Ant' group. It is shade intolerant and is usually found nesting under stones and in dry turf banks. Recorded from across southern England, with most records coming from coastal sites

*Hoplitis spinulosa*. Local. A small black solitary bee, females have orange pollen carrying hairs on the underside of the abdomen. The females nest in empty snail shells and partition the cells with dung or masticated leaves. Widespread but local.

*Hylaeus communis*. Local. A minute yellow faced solitary bee. Females nest in dead stems of bramble and dock and are often found foraging at bramble.

*Hylaeus cornutus*. Notable A. A small black solitary bee collecting pollen from a range of flowers. Females are unusual in that the collected pollen is carried back to the nest on the lower part of the face. Nests in the dead stems of herbaceous plants.

*Hylaeus annularis*. Local. A small yellow-faced bee nesting in hollow stems and twigs. Adults forage at a range of plants and are on the wing in early and mid-summer.

*Lasioglossum pauxillum*. Notable A. A mining bee recorded from a wide variety of situations from scattered locations in southern England including sandy heathland, calcareous grassland, coastal locations such as soft rock cliffs and probably other disturbed spots such as sand pits and chalk quarries. Nesting occurs in light soil. Scarce and very local in occurrence, but the most recent distribution map suggests that this species should no longer be accorded Notable status.

*Melitta leporina*. Local. A solitary bee which makes nest burrows in sandy ground. Adults are on the wing during July and August and appear to have a preference for legumes such as clover and melilot.

*Panurgus calcaratus*. Local. A small black solitary bee nesting in burrows in the ground. Collects pollen from a range of yellow composites.

## **Coleoptera - Beetles**

*Anthocomus rufus*. Local. A small (4mm long) red and black beetle usually, but not always, found in marshes and fens. Common in the south but very local in northern England.

*Hippodamia variegata*. Notable B. Adonis' Ladybird. A red and black ladybird, predatory on aphids. Scarce and restricted mainly to dry sandy places, in particular heathlands, brownfield sites and the coast.

*Hypera meles*. Notable A. A medium sized brown weevil. The beetle has a mainly southern distribution and is associated with members of the Leguminosae such as clovers and vetches. Formerly considered very rare, the species seems to be increasing its range at present (Morris 2002).

*Oedemera lurida*. Local. An elongate, dull metallic-green beetle. The larvae develop in plant stems and the adults frequent flowers, particularly hawthorn and umbellifers. Widely distributed and can be locally common in the south of England.

*Otiorhynchus ovatus*. Local. Strawberry Root Weevil. A slow moving, ground living black weevil between 4.5 to 5.5mm long. Found at the roots the roots of various plant species in dry habitats. Widely distributed across the UK.

*Silpha laevigata*. Local. A small black beetle up to 15mm long, feeding either on snails or carrion. Recorded from scattered localities across southern England.

## Appendix 4 Red Data Book status category definitions and criteria

The methodology used for the for the selection of species for inclusion in various Red Data Book categories are based on criteria developed by the IUCN. In the UK, these follow the examples of Shirt (1987) and Hyman & Parsons (1992). Criteria for the selection of Nationally Notable species generally follow Eversham (1983). For the purposes of site evaluation for the selection of SSSIs, the term Nationally Notable is replaced by the term Nationally Scarce, but the selection criteria remain unchanged. These criteria have been superseded by the 1994 revisions to the IUCN system but are still used for species or groups of species where a review of the status has yet to be carried out using the new criteria.

Table 6 Red Data Book status category definitions and criteria

<b>Red Data Book Category 1 (RDB 1) – ENDANGERED</b>	
<i>Definition:</i>	<p>Taxa in danger of extinction in Great Britain and whose survival is unlikely if casual factors continue operating.</p> <p>Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so dramatically reduced that they are deemed to be in immediate danger of extinction. Also included are some taxa that are possibly extinct.</p>
<i>Criteria:</i>	<p>Species which are known or believed to occur as only a single population within one 10km square of the National Grid.</p> <p>Species which only occur in habitats known to be especially vulnerable.</p> <p>Species which have shown a rapid or continuous decline over the last twenty years and are now estimated to exist in five or fewer 10km squares.</p> <p>Species which are possibly extinct but have been recorded this century and if rediscovered would need protection.</p>
<b>Red Data Book Category 2 (RDB 2) – VULNERABLE</b>	
<i>Definition:</i>	<p>Taxa believed likely to move into the Endangered category in the near future if the casual factors continue operating.</p> <p>Included are taxa of which most or all of the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; taxa with populations that are still abundant but are under threat from serious adverse factors throughout their range.</p>
<i>Criteria:</i>	<p>Species declining throughout their range or whose populations are low.</p> <p>Species in vulnerable habitats.</p>
<b>Red Data Book Category 3 (RDB3) – RARE</b>	
<i>Definition:</i>	<p>Taxa with small populations that are not at present Endangered or Vulnerable, but are at risk.</p> <p>These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.</p>
<i>Criteria:</i>	<p>Species which exist in only fifteen or fewer 10km squares.</p>

<b>Red Data Book Category K (RDB K) – INSUFFICIENTLY KNOWN</b>	
<i>Definition:</i>	<p>Taxa that are suspected but not definitely known to belong to any of the above categories because of lack of information.</p> <p>Species with very few or perhaps only a single known locality and of questionable native status, but not clearly falling into the category of recent colonists, vagrant or introduction,</p>
<i>Criteria:</i>	<p>Taxa recently discovered or recognised in Britain which may prove to belong to be more widespread in the future (although some recent discoveries may be placed in other categories if the group to which they belong is though not to be under-recorded.)</p> <p>Taxa with very few or perhaps only a single known locality, but which belong to poorly recorded or taxonomically difficult groups.</p> <p>Species with very few or perhaps only a single known locality, inhabiting inaccessible or infrequently sampled but widespread habitats. Examples include some northern moorland species, ones associated with agricultural situations and ones which are adult only during the winter.</p>
<b>Nationally Scarce (Notable) Category A (Na) – Notable A</b>	
<i>Definition:</i>	<p>Taxa which do not fall within RDB categories but which are none-the-less uncommon in Great Britain and thought to occur in 30 or fewer 10km squares of the National Grid.</p>
<b>Nationally Scarce (Notable) Category B (Nb) – Notable B</b>	
<i>Definition:</i>	<p>Taxa which do not fall within RDB categories but which are none-the-less uncommon in Great Britain and thought to occur in between 31 and 100 10km squares of the National Grid.</p>
<b>Local</b>	
	<p>The term local is not rigidly defined, but loosely means species confined to a particular habitat type (usually associated with better quality examples of that habitat), a particular geographic area, or species that are too widespread to warrant Nationally Scarce (Notable) status but are nevertheless infrequently encountered.</p>
<b>Common</b>	
	<p>Common or very widespread species, frequently recorded.</p>

Note: Abstracted from Shirt (1987), Hyman & Parsons (1992) & Key (1994).

### **The 1994 Revised IUCN Red List Categories and the revised status system**

The relationships between the various revised conservation categories are summarised in the dendrogram below (Figure 2). They have the advantage that the criteria are more rigorous than for the original system and are measures of threat rather than simply of localisation. This system was adopted in 1995 by the Joint Nature Conservation Committee as the new standard for Red Lists in Britain. These criteria can be applied both globally and nationally. Some of the criteria used to define the status of a taxa are inappropriate when considering most invertebrates, being based on estimates of decline or on predictions that assume a

regular, detailed census. Those that are appropriate to invertebrates are listed in Table 7, below.

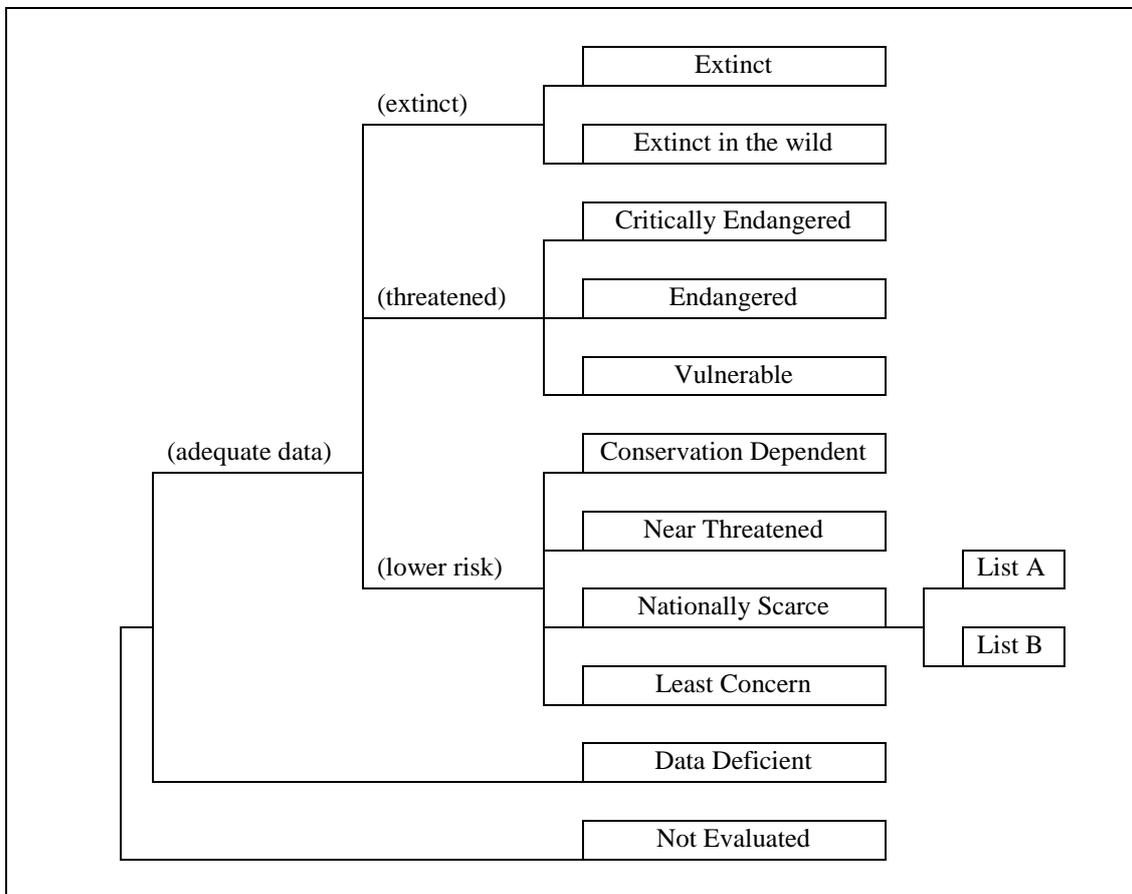


Figure 2 Decision tree for IUCN conservation categories

Table 7 IUCN conservation category definitions

<b>Extinct in the Wild (Ex)</b>	
<i>Definition:</i>	A taxon is considered extinct if there is good reason to believe that the species has become extinct in the wild in Britain. No precise threshold date is specified whereas the past definition was based on lack of records in the 20th Century.
<b>Critically Endangered (CR)</b>	
<i>Definition:</i>	A taxon is critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the following criteria [C-D omitted]:
	A. Population reduction in the form of either of the following:
	1. An observed, estimated, inferred or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer, based on (and specifying) any of the following:
	(a) direct observation

- (b) an index of abundance appropriate for the taxon
  - (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
  - (d) actual or potential levels of exploitation
  - (e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.
2. A reduction of at least 80%, projected or suspected to be met within the next ten years or three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d) or (e) above.
- B. Extent of occurrence estimated to be less than 100 km<sup>2</sup> or area of occupancy estimated to be less than 10 km<sup>2</sup>, and estimates indicating any two of the following:
1. Severely fragmented or known to exist at only a single location.
  2. Continuing decline, observed, inferred or projected, in any of the following:
    - (a) extent of occurrence
    - (b) area of occupancy
    - (c) area, extent and/or quality of habitat
    - (d) number of locations or subpopulations
    - (e) number of mature individuals.
  3. Extreme fluctuations in any of the following:
    - (a) extent of occurrence
    - (b) area of occupancy
    - (c) number of locations or subpopulations
    - (d) number of mature individuals.
- E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or 3 generations, whichever is the longer.

### Endangered (EN)

*Definition:* A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the following criteria [C-D omitted]:

- A. Population reduction in the form of either of the following:
1. An observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is the longer, based on (and specifying) any of the following:
    - (a) direct observation
    - (b) an index of abundance appropriate for the taxon
    - (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
    - (d) actual or potential levels of exploitation
    - (e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.
  2. A reduction of at least 50%, projected or suspected to be met within the next ten years or three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d) or (e) above.

- B. Extent of occurrence estimated to be less than 5000 km<sup>2</sup> or area of occupancy estimated to be less than 500 km<sup>2</sup>, and estimates indicating any two of the following:
  - 1. Severely fragmented or known to exist at no more than five locations.
  - 2. Continuing decline, observed, inferred or projected, in any of the following:
    - (a) extent of occurrence
    - (b) area of occupancy
    - (c) area, extent and/or quality of habitat
    - (d) number of locations or subpopulations
    - (e) number of mature individuals.
  - 3. Extreme fluctuations in any of the following
    - (a) extent of occurrence
    - (b) area of occupancy
    - (c) number of locations or subpopulations
    - (d) number of mature individuals.
- E. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or 5 generations, whichever is the longer.

#### Vulnerable (VU)

*Definition:* A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a very high risk of extinction in the wild in the medium-term future, as defined by any of the following criteria [C and D1 omitted]:

- A. Population reduction in the form of either of the following:
  - 1. An observed, estimated, inferred or suspected reduction of at least 20% over the last 10 years or three generations, whichever is the longer, based on (and specifying) any of the following:
    - (a) direct observation
    - (b) an index of abundance appropriate for the taxon
    - (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
    - (d) actual or potential levels of exploitation
    - (e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.
  - 2. A reduction of at least 20%, projected or suspected to be met within the next ten years or three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d) or (e) above.
- B. Extent of occurrence estimated to be less than 20,000 km<sup>2</sup> or area of occupancy estimated to be less than 2000 km<sup>2</sup>, and estimates indicating any two of the following:
  - 1. Severely fragmented or known to exist at no more than five locations.
  - 2. Continuing decline, observed, inferred or projected, in any of the following:
    - (a) extent of occurrence
    - (b) area of occupancy
    - (c) area, extent and/or quality of habitat
    - (d) number of locations or subpopulations
    - (e) number of mature individuals.

3. Extreme fluctuations in any of the following:
  - (a) extent of occurrence
  - (b) area of occupancy
  - (c) number of locations or subpopulations
  - (d) number of mature individuals.
- D. Population very small or restricted in the form of either of the following [only 2 relevant]:
2. Population is characterised by an acute distribution in its area of occupancy (typically less than 100 km<sup>2</sup>) or in the number of locations (typically less than 5). Such a taxon would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming Critically Endangered or even Extinct in a very short period.
- E. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.

### Lower Risk (LR)

*Definition:* A taxon is Lower Risk where it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the LR category can be separated into four subcategories.

#### **1) Conservation Dependent (LRcd)**

Taxa, which are the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.

#### **2) Near Threatened (LRnt)**

Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable - in Britain, defined as occurring in 15 or fewer hectads but not CR, EN or VU. The absolute count of hectads is, in this review, considered subordinate to evidence of decline on an extent not qualifying the species for CR, EN or VU.

#### **3) Nationally Scarce (LRns)**

Taxa which do not qualify for Conservation Dependent or Near Threatened - in Britain defined as species occurring in 16 to 100 hectads but not CR, EN or VU. Nationally Scarce species are usually divided into lists A (**LRnsA** 16-30 hectads) and B (**LRnsB** 31-100 hectads) as in the previous system. This subcategory associates a level of threat with rarity status, whereas the previous National Scarcity listings were based solely on rarity. Those species, the populations of which occasionally occupy more than 30 or 100 hectads as LRnsA and LRnsB respectively, can still be listed if it is thought that their baseline populations frequently fall below these thresholds, or if the habitats occupied are considered under threat.

#### **4) Least Concern (LRlc)**

Taxa, which do not qualify for Conservation Dependent, Near Threatened or National Scarce subcategories - in Britain, this covers all species found on evaluation not to fit into any of the other categories.

**Data Deficient (DD)**

*Definition:* A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution is lacking. Data Deficient is therefore not a category of threat or Lower Risk. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and threatened status. If the range of a taxon is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

**Not Evaluated (NE)**

*Definition:* A taxon is Not Evaluated when it has not yet been assessed against the criteria.