Natural England Commissioned Report NECR186

# A review of the millipedes (Diplopoda), centipedes (Chilopoda) and woodlice (Isopoda) of Great Britain

Species Status No.23

First published 20 November 2015

www.gov.uk/natural-england

NATURAL ENGLAND

# Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

## Background

Decisions about the priority to be attached to the conservation of species should be based upon objective assessments of the degree of threat to species. The internationally-recognised approach to undertaking this is by assigning species to one of the IUCN threat categories using the IUCN guidelines.

This report was commissioned to update the national threat status of millipedes, centipedes and woodlice. It covers all millipedes, centipedes and woodlice, identifying those that are rare and/or under threat as well as non-threatened and non-native species. Reviews for other invertebrate groups will follow.



**Natural England Project Manager** - Jon Webb, **jon.webb@naturalengland.org.uk**

**Contractor** - Paul Lee, British Myriapod & Isopod Group

**Keywords** - millipedes, Diplopoda, centipedes, Chilopoda, woodlice, Isopoda, invertebrates, red list, IUCN, status reviews

**Further information**
This report can be downloaded from the Natural England website: **www.gov.uk/government/organisations/natural-england**. For information on Natural England publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail **enquiries@naturalengland.org.uk**.



ISBN 978-1-78354-234-5

# CONTENTS

# 1 Introduction to the Species Status project

## 1.1 The Species Status project

The Species Status project is a recent initiative, providing up-to-date assessments of the threat status of taxa using the internationally accepted Red List guidelines developed by the International Union for Conservation of Nature (IUCN) (IUCN, 2012a; 2012b; IUCN Standards and Petitions Subcommittee, 2013, 2014). It is the successor to the JNCC's Species Status Assessment project (http://jncc.defra.gov.uk/page-3352) which ended in 2008. This publication is one in a series of reviews to be produced under the auspices of the new project.

Under the Species Status project, the UK's statutory nature conservation agencies, specialist societies and NGOs will initiate, resource and publish Red Lists and other status reviews of selected taxonomic groups for Great Britain which will then be submitted to JNCC for accreditation (http://jncc.defra.gov.uk/page-1773). This means that the UK's statutory nature conservation agencies and JNCC will be able to publish red lists. All publications will explain the rationale for the assessments made. The approved threat statuses will be entered into the JNCC spreadsheet of species conservation designations (http://jncc.defra.gov.uk/page-3408).

## 1.2 The status assessments

This review adopts the procedures recommended for the regional application of the IUCN threat assessment guidelines which can be viewed at http://cmsdocs.s3.amazonaws.com/keydocuments/Reg_Guidelines_en_web%2Bcover%2Bbackcover.pdf. Section 3 and Appendix 1 provide further details. This is a two-step process, the first identifying the taxa threatened in the region of interest using information on the status of the taxa of interest in that region (IUCN, 2001), the second amending the assessments where necessary to take into account interaction with populations of the taxon in neighbouring regions (IUCN Standards and Petitions Subcommittee, 2013). In addition, but as a separate exercise, the standard GB system of assessing rarity, based solely on distribution, is used alongside the IUCN system.

## 1.3 Species status and conservation action

Sound decisions about the priority to attach to conservation action for any species should primarily be based upon objective assessments of the degree of threat to the survival of a species. This is conventionally done by assigning the species to one of the IUCN threat categories. However, the assessment of threats to survival should be separate and distinct from the subsequent process of deciding which species require action and what activities and resources should be allocated.

## 1.4 References and Further Reading

AINSWORTH, A.M., SMITH, J.H., BODDY, L., DENTINGER, B.T.M., JORDAN, M., PARFIITT, D., ROGERS, H.J. & SKEATES, S.J. 2013. Red List of Fungi for Great Britain: Boletaceae. A pilot conservation assessment based on national database records, fruit body morphology and DNA barcoding. *Species Status Assessment* No 14, ISSN 1473-0154, Joint Nature Conservation Committee, Peterborough.

ALEXANDER, K.N.A. 2014. *A review of the beetles of Great Britain: The Soldier Beetles and Their Allies.* Species Status No.16 Natural England Commissioned Reports, Number 134.

ALEXANDER, K.N.A, DODD, S. & DENTON, J.S. 2014. *A review of the beetles of Great Britain: The Darkling Beetles and Their Allies* Species Status No. 18. Natural England Commissioned Reports, Number 148.

BRATTON, J.H. (ed.). 1991. *British Red Data Books: 3. Invertebrates other than Insects*. Nature Conservancy Council, Peterborough.

CHEFFINGS, C. & FARRELL, L. (eds). 2005. The Vascular Plant Red Data List for Great Britain. *Species Status Assessment* No **7**, ISSN 1473-0154, Joint Nature Conservation Committee, Peterborough.

DAGUET, C., FRENCH, G. & TAYLOR, P. (eds.). 2008. The Odonata Red Data List for Great Britain. *Species Status Assessment* No 11, ISSN 1470-0154, Joint Nature Conservation Committee, Peterborough.

FALK, S.J. & CHANDLER, P.J. 2005. A review of the scarce and threatened flies of Great Britain. Part 2: Nematocera and Aschiza not dealt with by Falk (1991). *Species Status Assessment* No 2, ISSN 1473-0154, Joint Nature Conservation Committee, Peterborough.

FALK, S.J. & CROSSLEY, R. 2005. A review of the scarce and threatened flies of Great Britain. Part 3: Empidoidea. *Species Status Assessment* No 3, ISSN 1473-0154, Joint Nature Conservation Committee, Peterborough.

FOSTER, G.N. 2010. A review of the scarce and threatened Coleoptera of Great Britain Part (3): Water beetles of Great Britain. *Species Status* 1. Joint Nature Conservation Committee, Peterborough.

FOX, R., WARREN, M.S. and BRERETON, T.M. 2010. A new Red List of British Butterflies, *Species Status* 12; 1-32. Joint Nature Conservation Committee, Peterborough.

HUBBLE, D.S. 2014. *A review of the scarce and threatened beetles of Britain. The leaf beetles and their allies. Chrysomelidae, Megalopodidae and Orsodacnidae.* Species Status No.19. Natural England Commissioned Reports, Number 161.

HYMAN, P.S. (revised PARSONS, M.S.). 1992. A review of the scarce and threatened Coleoptera of Great Britain. Part 1. UK Nature Conservation: 3. Joint Nature Conservation Committee, Peterborough.

IUCN. 1994. *IUCN Red List Categories and Criteria: Version 2.3*, IUCN Species Survival Commission. IUCN, Gland.

IUCN. 2001. *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland and Cambridge.

IUCN. 2003. Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0. IUCN Species Survival Commission IUCN, Gland and Cambridge.

IUCN. 2012a. *IUCN Red List Categories and Criteria*. Version 3.1. 2nd Edition, IUCN Species Survival Commission. IUCN, Gland.

IUCN. 2012b. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels. Version 4.0, IUCN Species Survival Commission. IUCN, Gland.

IUCN. 2013. *Guidelines for Using the IUCN Red List Categories and Criteria*. Version 10, IUCN Species Survival Commission. IUCN, Gland.

PERRING, F.H. & FARRELL, L. 1977. *British Red Data Books: 1. Vascular Plants*. Society for Nature Conservation, Lincoln.

PERRING, F.H. & FARRELL, L. 1983. *British Red Data Books: 1. Vascular Plants, edn 2*. Royal Society for Nature Conservation, Lincoln.

SHIRT, D.B. 1987. *British Red Data Books: 2. Insects*. Nature Conservancy Council, Peterborough.

STEWART, N.F. & CHURCH, J.M. 1992. *Red Data Books of Britain and Ireland: Stoneworts*. Joint Nature Conservation Committee, Peterborough.

WIGGINTON, M.J. (ed.). 1999. *British Red Data Books.* 1. Vascular Plants. 3rd edition. Joint Nature Conservation Committee, Peterborough.

WOODS, R.G. & COPPINS, B.J. 2012. A Conservation Evaluation of British Lichens and Lichenicolous Fungi. *Species Status Assessment* No 13, ISSN 1473-0154, Joint Nature Conservation Committee, Peterborough.

# 2 Introduction to the Myriapoda and Isopoda review

Myriapoda and Isopoda, in common with other arthropod groups such as the insects, share the characteristics of a segmented body with a hard exoskeleton and jointed legs. The Myriapoda includes four Classes but only two, the centipedes (Chilopoda) and millipedes (Diplopoda), have been sufficiently well studied in Britain to be considered in this review. The Order Isopoda belongs within the mainly marine Subphylum Crustacea (crabs, lobsters, shrimps etc.) but includes within it the most successful of the crustaceans in making the transition from a marine to a terrestrial existence, the woodlice (Suborder Oniscidea). This review considers the woodlice and the small number of waterlice (Suborder Asellota) found in British freshwaters.

It is not the taxonomic relationship between the groups but the more pragmatic issues of field research that leads to them being considered together in this volume. In general centipedes, millipedes and woodlice share the same ecological niches and thus are easily recorded at the same time.

Although the oldest confirmed fossil woodlice date from the early Cretaceous (Alonso *et al*., 2000), Broly *et al*. (2013) argue that the ancestral Oniscidea are much older and probably emerged onto land in the shady swamp forests at around the boundary of the Carboniferous and Permian periods 299 million years ago. The oldest confirmed fossil centipedes date from around 418 million years ago (Shear *et al*., 1998) and fossil millipedes are known from the mid Silurian (Wilson & Anderson, 2004) 423 million years ago. Rota-Stabelli *et al*. (2013) present evidence that the first myriapods probably emerged from the sea onto land in the late Cambrian period over 500 million years ago. The current global fauna includes more than 3,500 described species of woodlice (Schmalfuss, 2004), 3,100 described species of centipede (Minelli, 2011) and approximately 12,000 described species of millipede (Sierwald & Bond, 2007). Brewer *et al*. (2012) estimate that there are probably about 15-20,000 extant species of millipede alone.

Almost every habitat in Britain from sea-shore to upland moor will support some species of Isopoda and Myriapoda but despite a long evolutionary history as terrestrial organisms most species remain tied to microsites with high humidity and will be found in habitats that provide these conditions. For this reason the greatest diversity of species in Britain is to be found within woodlands in the upper soil layers and in surface plant litter. Some species can survive in drier environments, even deserts, through a combination of behavioural and morphological adaptation, e.g. in Britain the Striped Millipede *Ommatoiulus sabulosus* can often be found wandering in sand dunes. Temperature is also important in determining where species can survive. Several species such as the White-striped Centipede *Henia vesuviana* are on the very northern edge of their range in Britain and even in southern England it is usually to be found in warm microsites such as south-facing banks. Vertical migrations within the

soil column have been demonstrated for some species as a method of avoiding unfavourable conditions. A few species within each group have become adapted to the littoral zone (the Sea Slater *Ligia oceanica* never fully made the transition to land) and a notable proportion of the geophilomorph centipedes are capable of surviving intertidally. Millipedes, centipedes and woodlice are often found in synanthropic habitats. Some of our native fauna have been able to make use of the resources provided by agriculture and horticulture and may now be found more frequently in association with man than in the wider countryside e.g. the woodlouse *Porcellionides pruinosus*. Other species that have been introduced to Britain may only have become established in synanthropic habitats, glasshouses especially, and are not assessed in this review.

Centipedes are usually recognised as active predators on other invertebrates although various species have been proposed as vegetarian on the basis of plant material found in the gut. The validity of such evidence remains disputed. Millipedes and woodlice are mainly detritivores but at least one tropical millipede is an earthworm predator and other species including *Blaniulus guttulatus* have been observed feeding on carrion and another live millipede (Morgan, 1988). Millipedes and woodlice make a vital contribution to decomposition as an ecosystem service. Their main importance appears to be in the fragmentation of leaves that increases the rate of chemical breakdown by micro-organisms (Anderson *et al*., 1985). Many species will also eat soft, living vegetation such as seedlings and as a result some species have become known as pests. The bristly millipede *Polyxenus lagurus* is a specialist algal grazer.

Unlike many insects, isopods and myriapods show a very low tendency to disperse resulting in a high level of endemism. The groups are considered good subjects for biogeographical studies (Voigtländer *et al*., 2011) and for the ecological appraisal of habitats and monitoring the rehabilitation of disturbed habitats (Dunger & Voigtländer, 2005, 2009; Tuf & Tufová, 2008). Whilst this has parallels with work on other invertebrates in Britain (e.g. Alexander, 2004; Webb & Lott, 2006) the potential for the use of myriapods and isopods in habitat evaluation here is limited by the restricted diversity of the fauna.

### 2.1 Taxa selected for this review

Table 1 summarises the taxa included in this review. Nomenclature follows the World Catalog of Terrestrial Isopods (Isopoda: Oniscidea) (Schmalfuss, 2004) and the Fauna Europaea checklists of Chilopoda and Diplopoda. These taxa have each been the subject of one of three British national recording schemes, coordinated by the Biological Records Centre in association with the British Isopod Study Group or the British Myriapod Group prior to 2000 but in association with the merged British Myriapod & Isopod Group since that date. The work of these schemes includes the collation of information from the following data sources:

- Historic records
    - As published in the national journals (and in some cases also local journals);
    - Published county reviews;
    - Voucher specimens in national and local museums.
- Modern records, arising from the recording activity of the field recording community, especially members of the British Isopod Study Group and the British Myriapod Group and, more recently, the British Myriapod & Isopod Group.

**Table 1**. Distribution across taxonomic groupings of taxa selected for review

| **CLASS** | **ORDER** | **SPECIES** |
|---|---|---|
| Diplopoda | Polyxenida | *Polyxenus lagurus* (Linnaeus, 1758) |
| | Glomerida | *Adenomeris gibbosa* Mauriès, 1960 |
| | | *Geoglomeris subterranea* Verhoeff, 1908 |
| | | *Glomeris marginata* (Villers, 1789) |
| | | *Trachysphaera lobata* (Ribaut, 1954) |
| | Polyzoniida | *Polyzonium germanicum* Brandt, 1837 |
| | Chordeumatida | *Anthogona britannica* Gregory, Jones & Mauriès, 1993 |
| | | *Brachychaeteuma bagnalli* Verhoeff, 1911 |
| | | *Brachychaeteuma bradeae* (Brolemann & Brade-Birks, 1917) |
| | | *Brachychaeteuma melanops* (Brade-Birks & Brade-Birks, 1918) |
| | | *Chordeuma proximum* Ribaut, 1913 |
| | | *Chordeuma sylvestre* C.L. Koch, 1847 |
| | | *Ceratosphys amoena confusa* Ribaut, 1955 |
| | | *Craspedosoma rawlinsii* Leach, 1814 |
| | | *Hylebainosoma nontronensis* Mauriès & Kime, 1999 |
| | | *Melogona gallica* (Latzel, 1884) |
| | | *Melogona scutellaris* Ribaut, 1913 |
| | | *Melogona voigtii* (Verhoeff, 1899) |
| | | *Nanogona polydesmoides* (Leach, 1814) |
| | Polydesmida | *Brachydesmus superus* Latzel, 1884 |
| | | *Macrosternodesmus palicola* Brölemann, 1908 |
| | | *Ophiodesmus albonanus* (Latzel, 1895) |
| | | *Polydesmus angustus* Latzel, 1884 |
| | | *Polydesmus coriaceus* Porat, 1873 |
| | | *Polydesmus denticulatus* C.L. Koch, 1847 |
| | | *Polydesmus inconstans* Latzel, 1884 |
| | | *Propolydesmus testaceus* (C.L. Koch, 1847) |
| | | *Stosatea italica* (Latzel, 1886) |

| CLASS | ORDER | SPECIES |
|---|---|---|
| | Julida | *Allajulus nitidus* (Verhoeff, 1891) |
| | | *Archiboreoiulus pallidus* (Brade-Birks, 1920) |
| | | *Blaniulus guttulatus* (Fabricius, 1798) |
| | | *Boreoiulus tenuis* (Bigler, 1913) |
| | | *Brachyiulus pusillus* (Leach, 1814) |
| | | *Choneiulus palmatus* (Nemec, 1895) |
| | | *Cylindroiulus britannicus* (Verhoeff, 1891) |
| | | *Cylindroiulus caeruleocinctus* (Wood, 1864) |
| | | *Cylindroiulus latestriatus* (Curtis, 1845) |
| | | *Cylindroiulus londinensis* (Leach, 1814) |
| | | *Cylindroiulus parisiorum* (Brölemann & Verhoeff, 1896) |
| | | *Cylindroiulus punctatus* (Leach, 1815) |
| | | *Enantiulus armatus* (Ribaut, 1909) |
| | | *Julus scandinavius* Latzel, 1884 |
| | | *Leptoiulus belgicus* (Latzel, 1884) |
| | | *Leptoiulus kervillei* (Brölemann, 1896) |
| | | *Metaiulus pratensis* Blower & Rolfe, 1956 |
| | | *Nemasoma varicorne* C.L. Koch, 1847 |
| | | *Nopoiulus kochi* (Gervais, 1847) |
| | | *Ommatoiulus sabulosus* (Linnaeus, 1758) |
| | | *Ophyiulus pilosus* (Newport, 1842) |
| | | *Proteroiulus fuscus* (Am Stein, 1857) |
| | | *Tachypodoiulus niger* (Leach, 1814) |
| | | *Thalassisobates littoralis* (Silvestri, 1903) |
| Chilopoda | Geophilomorpha | *Arenophilus peregrinus* Jones, 1989 |
| | | *Eurygeophilus pinguis* (Brölemann, 1898) |
| | | *Geophilus alpinus* Meinert, 1870 |
| | | *Geophilus carpophagus* Leach, 1815 |
| | | *Geophilus easoni* Arthur, Foddai, Kettle, Lewis, Luczinsky & Minelli, 2001 |
| | | *Gephilus electricus* (Linnaeus, 1758) |
| | | *Geophilus flavus* (De Geer, 1778) |
| | | *Geophilus fucorum seurati* Brolemann, 1924 |
| | | *Geophilus osquidatum* Brölemann, 1909 |
| | | *Geophilus proximus* C.L. Koch, 1847 |
| | | *Geophilus pusillifrater* Verhoeff, 1898 |
| | | *Geophilus truncorum* Bergsöe & Meinert, 1866 |
| | | *Haplophilus souletinus* Brölemann, 1907 |
| | | *Haplophilus subterraneus* Shaw, 1789 |
| | | *Henia brevis* (Silvestri, 1896) |
| | | *Henia vesuviana* (Newport, 1845) |
| | | *Hydroschendyla submarina* (Grube, 1872) |
| | | *Nothogeophilus turki* Lewis, Jones & Keay, 1988 |
| | | *Pachymerium ferrugineum* (C.L. Koch, 1835) |

| CLASS | ORDER | SPECIES |
|---|---|---|
| | | *Schendyla nemorensis* (C.L. Koch, 1837) |
| | | *Schendyla peyerimhoffi* Brolemann & Ribaut, 1911 |
| | | *Strigamia acuminata* (Leach, 1815) |
| | | *Strigamia crassipes* (C.L. Koch, 1835) |
| | | *Strigamia maritima* (Leach, 1817) |
| | Scolopendromorpha | *Cryptops hortensis* (Donovan, 1810) |
| | Lithobiomorpha | *Lithobius borealis* Meinert, 1868 |
| | | *Lithobius calcaratus* C.L. Koch, 1844 |
| | | *Lithobius crassipes* L. Koch, 1862 |
| | | *Lithobius curtipes* C.L. Koch, 1847 |
| | | *Lithobius forficatus* (Linnaeus, 1758) |
| | | *Lithobius lapidicola* Meinert, 1872 |
| | | *Lithobius macilentus* L. Koch, 1862 |
| | | *Lithobius melanops* Newport, 1845 |
| | | *Lithobius microps* Meinert, 1868 |
| | | *Lithobius muticus* C.L. Koch, 1847 |
| | | *Lithobius piceus* L. Koch, 1862 |
| | | *Lithobius pilicornis* Newport, 1844 |
| | | *Lithobius tricuspis* Meinert, 1872 |
| | | *Lithobius tenebrosus* Meinert, 1872 |
| | | *Lithobius variegatus* Leach, 1814 |
| Malacostraca | Isopoda | *Androniscus dentiger* Verhoeff, 1908 |
| | | *Armadillidium album* Dolfuss, 1887 |
| | | *Armadillidium depressum* Brandt, 1833 |
| | | *Armadillidium nasatum* Budde-Ludde, 1885 |
| | | *Armadillidium pictum* Brandt, 1833 |
| | | *Armadillidium puchellum* (Zencker, 1798) |
| | | *Armadillidium vulgare* (Latreille, 1804) |
| | | *Asellus aquaticus* (Linnaeus, 1758) |
| | | *Buddelundiella cataractae* Verhoeff, 1930 |
| | | *Cylisticus convexus* (De Geer, 1778) |
| | | *Halophiloscia couchii* (Kinahan, 1858) |
| | | *Haplophthalmus danicus* Budde-Lund, 1880 |
| | | *Haplophthalmus mengei* (Zaddach, 1844) |
| | | *Haplophthalmus montivagus* Verhoeff, 1941 |
| | | *Ligia oceanica* (Linnaeus, 1767) |
| | | *Ligidium hypnorum* (Cuvier, 1792) |
| | | *Metatrichoniscoides celticus* Oliver & Trew, 1981 |
| | | *Metatrichoniscoides leydigii* (Weber, 1880) |
| | | *Miktoniscus patiencei* Vandel, 1946 |
| | | *Oniscus asellus asellus* Linnaeus, 1758 |
| | | *Oniscus asellus occidentalis* Bilton, 1994 |
| | | *Philoscia muscorum* (Scopoli, 1763) |
| | | *Platyarthrus hoffmannseggi* Brandt, 1833 |

| CLASS | ORDER | SPECIES |
|---|---|---|
| | | *Porcellio dilatatus* Brandt, 1833 |
| | | *Porcellio laevis* Latreille, 1804 |
| | | *Porcellio scaber* Latreille, 1804 |
| | | *Porcellio spinicornis* Say, 1818 |
| | | *Porcellionides cinguendus* (Kinahan, 1857) |
| | | *Porcellionides pruinosus* (Brandt, 1833) |
| | | *Proasellus cavaticus* (Leydig, 1871) |
| | | *Proasellus meridianus* (Racovitza, 1919) |
| | | *Stenophiloscia glarearum* Verhoeff, 1908 |
| | | *Trachelipus rathkii* (Brandt, 1833) |
| | | *Trichoniscoides albidus* (Budde-Lund, 1880) |
| | | *Trichoniscoides helveticus* (Carl, 1908) |
| | | *Trichoniscoides saeroeensis* Lohmander, 1923 |
| | | *Trichoniscoides sarsi* Patience, 1908 |
| | | *Trichoniscus provisorius* Racovitza, 1908 |
| | | *Trichoniscus pusillus* Brandt, 1833 |
| | | *Trichoniscus pygmaeus* Sars, 1899 |

The area covered in this review is Great Britain (i.e. England, Scotland and Wales only). While Northern Ireland forms part of the United Kingdom, the recent trend has been for that area working with the Irish Republic over whole Ireland reviews. The Channel Islands and the Isle of Man are also not included.

### 2.2 Previous reviews

#### 2.2.1 Woodlice in Britain and Ireland: distribution and habitat (1985)

In their distribution atlas Harding and Sutton (1985) gave provisional RDB status to four species of woodlouse in Britain (Table 2). *Metatrichoniscoides celticus* was provisionally listed as Vulnerable (RDB2) as the species was considered to be restricted to the supralittoral zone on rocky shores at 7 sites where it was potentially threatened by marine pollution, human disturbance and the development of sites. Further it was considered Endemic (RDB5) to South Wales. *Armadillidium album* and *A. pictum* were both provisionally listed as Rare (RDB3) on the basis of the very restricted number of locations from which they were then known. The fourth species, *Halophiloscia couchii*, was listed as Out of Danger (RDB4) although this was on the basis of further survey in Cornwall and Devon rather than successful conservation measures.

**Table 2.** Provisional Red List categories for woodlice after Harding & Sutton (1985)

| CLASS | SPECIES | CATEGORY |
|---|---|---|
| Isopoda | *Metatrichoniscoides celticus* | RDB 2: Vulnerable, RDB5: Endemic |
| Isopoda | *Armadillidium album* | RDB 3: Rare |
| Isopoda | *Armadillidium pictum* | RDB 3: Rare |
| Isopoda | *Halophiloscia couchii* | RDB 4: Out of Danger |

### 2.2.2 British Red Data Books: 3. Invertebrates other than insects (1991)

The only attempt at a comprehensive account of threatened British myriapods and an update on Harding and Sutton's review of isopods was included in the *British Red Data Books: 3. Invertebrates other than insects* (Bratton, 1991). This listed 7 of the total British fauna at that time (123 species), and only one i.e. 0.8% was given Threatened status (Table 3). Data sheets were given for these Rare (RDB3) and Insufficiently Known (RDBK) species.

**Table 3.** Red List categories for species reviewed by Bratton (1991)

| CLASS | SPECIES | CATEGORY |
|---|---|---|
| Isopoda | *Armadillidium pictum* | RDB 3: Rare |
| Diplopoda | *Trachysphaera lobata* | RDB K: Insufficiently Known |
| Diplopoda | *Chordeuma sylvestre* | RDB K: Insufficiently Known |
| Chilopoda | *Geophilus proximus* | RDB K: Insufficiently Known |
| Chilopoda | *Lithobius lapidicola* | RDB K: Insufficiently Known |
| Chilopoda | *Lithobius tenebrosus* | RDB K: Insufficiently Known |
| Isopoda | *Metatrichoniscoides celticus* | RDB K: Insufficiently Known |

With the exception of *Armadillidium pictum* the species provisionally listed by Harding and Sutton (1985) were placed in a lower category (*Metatrichoniscoides celticus*) or not listed (*Armadillidium album, Halophiloscia couchii*) by Bratton (1991). All three species had been discovered at more sites in the intervening period. The difficulties of collecting the species even at known sites and the low levels of recording along Atlantic coasts in Europe resulted in *M. celticus* being downgraded to Insufficiently Known (RDBK) and a decision taken that the Endemic status was not justified.

### 2.2.3 The new review

The present review has been undertaken to provide an up to date assessment of the status of centipede, millipede and woodlice species in the format now almost universally adopted for the assessment of threat in any taxa. The IUCN Guidelines have been revised (IUCN, 1994) and subsequently updated (IUCN, 2012a), and new information on distribution and trends has become available since the publication of Bratton (1991), making it necessary to revise the status of all centipede, millipede and woodlice species. It should be noted that the IUCN criteria for threat categories

concentrate on imminent danger of regional extinction whereas the older, non-IUCN criteria for Nationally Rare and Nationally Scarce relate to a restricted geographic distribution within Great Britain, without taking any account of trends, whether for increase or decline. Applying the new IUCN criteria results in 6 of the current native fauna (133 species) i.e. 4.5% being identified as Threatened. This higher figure reflects a significant improvement in knowledge since Bratton (1991) and is similar to the 3% of myriapods Red Listed in Norway (Djursvoll, 2010) but is very significantly lower than the 13% of centipedes and 21% of millipedes Red Listed in Germany (Voigtländer *et al*., 2011).

# 3 The IUCN threat categories and selection criteria as adapted for Invertebrates in Great Britain

### 3.1 Summary of the 2001 Threat Categories

A brief outline of the revised IUCN criteria and their application is given below. For a full explanation see Appendix 2, IUCN (2001; 2013) and the IUCN web site (http://www.iucnredlist.org/; www.iucn.org/). The definitions of the categories are given in Figure 1 and the hierarchical relationship of the categories in Figure 2. The categories *Extinct in the wild* and *Regionally Extinct* have not been applied in this review. All categories refer to the status in Great Britain (not globally).

**REGIONALLY EXTINCT (RE)**
A taxon is Extinct when there is no reasonable doubt that the last individual has died. In this review the last date for a record is set at fifty years before publication.

**CRITICALLY ENDANGERED (CR)**
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Table 4).

**ENDANGERED (EN)**
A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Table 4).

**VULNERABLE (VU)**
A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Table 4).

**NEAR THREATENED (NT)**
A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

**LEAST CONCERN (LC)**
A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

**DATA DEFICIENT (DD)**
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 are lacking. Data Deficient is therefore not a category of threat. 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.

**NOT EVALUATED (NE)**
A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

**Figure 1.** Definitions of IUCN threat categories (from IUCN 2001 with a more specific definition for regional extinction)

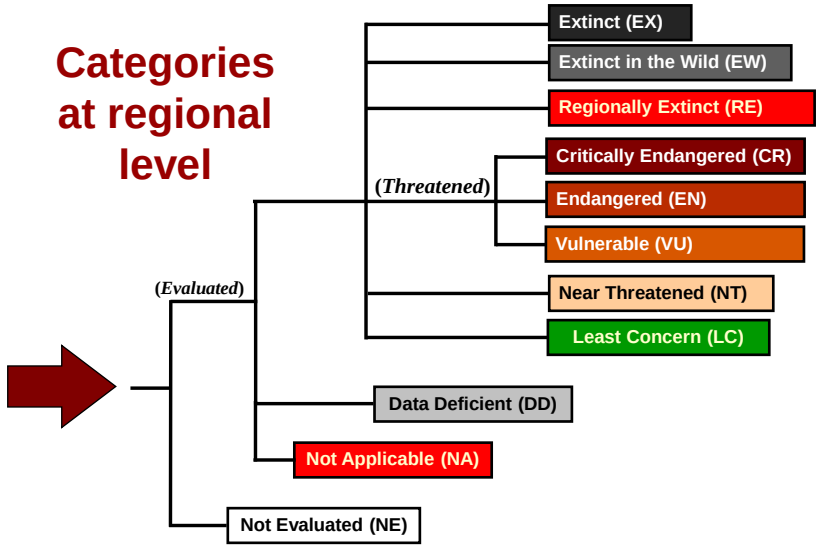


Figure adapted from IUCN (2001)

**Figure 2.** Hierarchical relationships of the categories

Taxa listed as *Critically Endangered*, *Endangered* or *Vulnerable* are defined as Threatened (Red List) species. For each of these threat categories there is a set of five main criteria A-E, with a number of sub-criteria within A, B and C (and an additional sub-criterion in D for the *Vulnerable* category), any one of which qualifies a taxon for listing at that level of threat. The qualifying thresholds within the criteria A-E are detailed in Appendix 2: IUCN Criteria and Categories.

In the main, the status evaluation procedure relies on an objective assessment of the available evidence. In certain cases, however, subjective assessments are acceptable as, for example, in predicting future trends and judging the quality of the habitat and methods involving estimation, inference and projection are acceptable throughout. Inference and projection may be based on extrapolation of current or potential threats into the future (including their rate of change), or of factors related to population abundance or distribution (including dependence on other taxa), so long as these can be reasonably supported. Suspected or inferred patterns in the recent past, present or near future can be based on any of a series of related factors, and these factors should be specified as part of the documentation. Some threats need to be identified particularly early, and appropriate actions taken, because their effects are irreversible or nearly so (IUCN, 2001). Since the criteria have been designed for global application and for a wide range of organisms, it is hardly to be expected that each will be appropriate to every taxonomic group or taxon. Thus a taxon need not meet all the criteria A-E, but is allowed to qualify for a particular threat category on any single criterion.

The guidelines stipulate/advise that a precautionary approach should be adopted when assigning a taxon to a threat category and this should be the arbiter in borderline cases. The threat assessment should be made on the basis of reasonable judgment, and it should be particularly noted that it is not the worst-case scenario that will determine the threat category to which the taxon will be assigned.

The categorization process is only to be applied to wild populations inside their natural range (IUCN, 2001), with a long-term presence (since 1500 AD) in Britain. Taxa deemed to be ineligible for assessment at a regional level were placed in the category of **'Not Applicable (NA)'.** This category is typically used for introduced non-native species whether this results from accidental or deliberate importation. It may also be used for recent colonists (or attempted colonists) responding to the changing conditions available in Britain as a result of human activity and/or climate change.

### 3.2 Application of the Guidelines to Invertebrates

The criteria A, C, D1 and E are rarely appropriate for centipedes, millipedes and woodlice as population data have not been gathered and quantitative analysis has not been undertaken for this group.

In this Review, **Extent of occurrence** (EOO) is not applied to most species of centipedes, millipedes and woodlice as an agreed methodology for its measurement in relation to these species is not available. There are some instances where the known EOO can be measured but these are the exception. These tend to be species known to occur from one or a few sites and where their habitat resource is easily definable, in a restricted area and where intensive survey work has been undertaken to ascertain their distribution. Where EOO has been applied, the terms of this use has been defined within the status sheets on a species by species basis.

**Area of occupancy** (AOO) is another measure that is difficult to apply to invertebrate records and populations as defined by the IUCN guidelines (IUCN, 2012a; 2012b; 2013).

"Area of occupancy is defined as the area within its 'extent of occurrence' that is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases (e.g. irreplaceable colonial nesting sites, crucial feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data. To avoid inconsistencies and bias in assessments caused by estimating area of occupancy at different scales, it may be

necessary to standardize estimates by applying a scale-correction factor. It is difficult to give strict guidance on how standardization should be done because different types of taxa have different scale-area relationships." (IUCN, 2012a).

The IUCN have recommended a scale of $4km^2$ (a tetrad) as the reference scale (IUCN, 2013). This needs to be applied with caution and there will be instances where a different scaling is more applicable, or where attempting to apply any scale is extremely difficult. For common and widespread species applying this rule will lead to under-estimation of their true AOO and a degree of interpretation is required. This highlights the importance of peer review and shared expert opinion for making decisions on scale. For rarer, more restricted, species the tetrad is more applicable, in particular those species which may occur on a few fragmented sites within the UK and/or whom are often restricted to certain, well-defined habitat types that are easily identified. In most instances, the reviewer (and his peers) is best placed to judge which these species are.

### 3.2.1 The two-stage process in relation to developing a Red List

The IUCN regional guidelines (IUCN, 2003) indicate that if a given taxon is known to migrate into or out of the region it should be assessed using a two-stage approach. Populations in the region under review should firstly be assessed as if they were isolated taxa. They should then be reassessed and can be assigned a higher or a lower category if their status within the region is likely to be affected by emigration or immigration. Although recruitment from abroad has clearly accounted for the establishment of some newcomers to the British fauna, migration within Britain and between Britain and the Continent of populations of centipedes, millipedes and woodlice under threat is not considered to be a significant factor.

### 3.2.2 The use of the Near Threatened category

The IUCN guidelines recognise a *Near Threatened* category to identify species that need to be kept under review to ensure that they have not become Threatened. This category is used for species where a potential threat, natural habitat dependency or range change demand frequent review of status.

This category would be best considered for those species that come close to qualifying as CR, EN or VU but not quite; i.e. meets many but not all of the criteria and sub-criteria. For those criteria that are not quite met, there should be sufficient evidence to show that the taxon is close to the relevant threatened thresholds. As such, it is up to the reviewers to provide evidence and methods for discerning this.

The Invertebrate Inter Agency Working Group and JNCC have defined the following for the use of B2bii which is commonly used in reviews. Continuing decline has to be demonstrated – and proven that it isn't an artefact of under-recording. If decline is

demonstrated then the reviewer needs to consider whether or not B2a (and B2c if the data is present) is met:

- If 10 or less current localities then *Critically Endangered*, *Endangered*, *Vulnerable* is applicable;
- If 11 or 12 current localities then *Near Threatened* applies;
- If 13-15 and the taxon can be shown to be vulnerable to a specific and realistic threat, then *Near Threatened* applies;
- If more than 15 locations then *Least Concern* applies.

# 4 GB Rarity Status categories and criteria

At the national level, countries are permitted under the IUCN guidelines to refine the definitions for the non-threatened categories and to define additional ones of their own. The *Nationally Rare* and *Nationally Scarce* categories are unique to Britain. Broadly speaking, the Nationally Rare category is equivalent to the Red Data Book categories used by Bratton (1991), namely: Endangered (RDB1), Vulnerable (RDB2), Rare (RDB3), Insufficiently Known (RDBK) and Extinct. These are not used in this review. The Nationally Scarce category is directly equivalent to the combined Nationally Notable A (Na) and Nationally Notable B (Nb) categories used in the assessment of various taxonomic groups (e.g. by Hyman and Parsons (1992) in assessing the status of beetles) but never used in a published format to assess millipedes, centipedes or woodlice.

For the purposes of this review, the following definitions of Nationally Rare and Nationally Scarce have been applied:

| | |
|---|---|
| Nationally Rare | Native species recorded from 15 or fewer hectads of the Ordnance Survey national grid in Great Britain since 31st December 1989 and where there is reasonable confidence that exhaustive recording would not find them in more than 15 hectads. This category includes species that are probably extinct. |
| Nationally Scarce | Native species which are not regarded as Nationally Rare AND which have not been recorded from more than 100 hectads of the Ordnance Survey national grid in Great Britain since 31st December 1989 and where there is reasonable confidence that exhaustive recording would not find them in more than 100 hectads. |

The choice of 1990 as the start of the modern recording period for millipedes, centipedes and woodlice is discussed in Section 6.2

This national set of definitions is referred to as the GB Rarity Status within this document. Importantly, Nationally Rare and Nationally Scarce are not categories of threat.

# 5 Methods and sources of information

## 5.1 Introduction

The most recent published list of scarce and threatened centipedes, millipedes and woodlice prior to this review was to be found in British Red Data Book 3 (Bratton, 1991). The original IUCN criteria for assigning threat status used in this publication had the categories Extinct, Endangered (RDB1), Vulnerable (RDB2), Rare (RDB3), Out of Danger (RDB4) and Endemic (RDB5) with the addition of the category RDB K (Insufficiently Known) after Wells, Pyle & Collins (1983). The categories were defined rather loosely and without quantitative thresholds. The application of the criteria was largely a matter of judgment, and it was not easy to apply them consistently within a taxonomic group or to make comparisons between groups of different organisms.

## 5.2 Data sources

The present review assessed the status of all selected taxa using the information sources described in this section and the system explained in Sections 3 and 5. During the review process, the views of a number of other specialists (see Acknowledgements) were sought. The bulk of the data however come from the BMIG recording schemes (c. 260,000 records) supplemented by information provided directly by a number of naturalists with experience in particular species and/or locations. It is important to acknowledge the considerable contribution made by all of these recorders.

The key sources were the data compilations used for the Millipede Atlas (Lee, 2006b), the Woodlouse Atlas (Gregory, 2009) and the Centipede Atlas (Barber, in prep.) as summarised and analysed by BRC. This was then supplemented using more recent data gathered by the national recorders but not yet accessible via the NBN Gateway. Time was not spent in checking other data uploaded to the NBN Gateway as a brief inspection demonstrated a high level of records that require further checking and correspondence with original contributors.

For species achieving IUCN or GB Rarity Status, the data was investigated more carefully and records that were judged unreliable were discarded.

# 6 The assessments

## 6.1 The data table

The key outcome of this Review is the generation of a table that lists all of the taxa in the taxonomic groupings covered. The full table has been produced as a spreadsheet that accompanies this text. Appendix 1 provides an extract of the key data. The columns completed in the full accompanying Excel table are as follows:

Species name
Old BRC number
BRC concept
NBN taxon number
Presence in:
- England
- Scotland
- Wales

Area of occupancy:
- Total number of hectads occupied for period from 1970-1989
- Total number of hectads occupied for period from 1990-2013
- Total number of dual hectads where species have been recorded from within the hectad in both date classes (see 6.2 below).
- Total number of tetrads occupied for period from 1990-2013*
- Total number of known locations for period from 1990-2013*

GB IUCN status (2013)
Qualifying criteria
Rationale
Global IUCN status (2012)
GB Rarity status (2013)
Status in Bratton (1991)
Ecological account
Popular synonyms

* These columns are completed only where a taxon has been placed on the Red List or in the Near Threatened category.

## 6.2 Date classes

This Review uses 1990 as the **point of measurement** as this was judged to be the date most applicable to the data concerned. It was roughly the half way date between the instigation of the BMIG recording schemes and the present day or the most recent Atlas publications. It was judged that the adoption of a later date would have resulted in far too many species being found to have fewer than 100 hectads in the modern time period. This would obviously have seriously undermined the value of the assessments made. The use of this date has the consequence that Criterion B2b –

continuing decline – has to rely heavily on estimation, inference and projection. The IUCN criteria assess declines based on data from the last ten years, but this clearly is not feasible for most invertebrate groups. It is rare that any centipede, millipede or woodlouse has been comprehensively surveyed in the past ten years. Even then survey work has been limited in geographical extent, for example, in the case of *Trachysphaera lobata*, (Lee *et al*., 2012). The reviewer has needed to assess whether reductions in the Area of Occupancy represent significant decline or lack of data. This will vary considerably between taxonomic groups and for different species within taxonomic groups depending on survey effort. Use of Criterion B2b for any taxon therefore demands justification by an explanation of confidence in the rate of decline.

Habitat decline values can be used as a proxy for population declines for species that are strongly associated with specific habitat types. However, it should be acknowledged that evidence of habitat fidelity in most centipedes, millipedes and woodlice is generally anecdotal. Even where such fidelity exists quantitative data on habitat declines are rarely available and the reviewer needs to work with very imperfect data.

The IUCN Guidelines state that: "A continuing decline is a recent, current or projected future decline (which may be smooth, irregular or sporadic) which is liable to continue unless remedial measures are taken. Fluctuations will not normally count as continuing declines, but an observed decline should not be considered as a fluctuation unless there is evidence for this." It is clear then that a full review of the evidence is not essential but that it can be projected, much as the 'population reduction' criterion may rely on 'observed, estimated, inferred, projected or suspected' reduction. The objective is to achieve consensus amongst the appropriate experts on the level of evidence available and to apply it pragmatically.

# 7 Downgraded and excluded species

## 7.1 Introduction

The intervening period since the publication of the Red Data Book (Bratton, 1991) has seen an increase in recorder effort in general as well as targeting species with RDB status, and an increased knowledge of the species concerned. The revised statuses presented here more accurately reflect the status of those species. The Red Data Book should – in many ways - be regarded as a first draft, a first attempt at assessing status. The effect of increased recording effort is particularly clear in the few years prior to the publication of 'the millipede atlas' (Lee, 2006b) and to a lesser extent 'the woodlouse atlas' (Gregory, 2009) with a 'spike' of records submitted being followed by a sharp drop-off in subsequent years.

## 7.2 Downgraded species

Down-grading of species should not be seen necessarily as evidence that species status is improving. Two species were graded too highly in the earlier Red Data Book (Bratton, 1991) through lack of availability of supporting data, a situation that has been partially addressed through an increase in the activity of recorders. The species in Table 5 were included in the Red Data Book, but are down-graded here for the reasons stated in the following table.

**Table 5.** Species included in Bratton (1991) but down-graded in this review.

| Scientific name | Bratton, 1991 | Rationale for down-grading |
|---|---|---|
| *Armadillidium pictum* | RDB3 | Reported from 14 hectads since 1990. Increased understanding of habitat requirements and improved knowledge of identification characters (Gregory & Richards, 2008) resulted in significant increase in records from wider geographical area. Likely to occur in further locations both within current range and possibly in SW England or SW Scotland also. Should be considered Nationally Scarce. |
| *Lithobius lapidicola* | RDBK | Natural habitat appears to be lowland heath / acid grassland in the Brecks and in coastal Kent and Suffolk. No evidence of decline but only reported from four semi-natural locations (plus three glasshouses) since 1990 and two aites are threatened with development. Despite possibility of some under recording (Barber, 2009b) should be considered Near Threatened. |

### 7.3 Excluded species

The status of some species newly recorded in Britain can be very difficult to ascertain. Most problematic are those species that could conceivably be on the edge of their natural range in Britain but only occur in a limited number of locations to which they may equally have been introduced. The geographical position of Britain makes it inevitable that our fauna includes Lusitanian, Western European, Northern European and even Central European species some of which are considered native but others more clearly introduced. It is important that a lack of clear evidence of native status is not automatically taken to mean that a species is introduced. A case in point is that of the centipede *Arenophilus peregrinus*, originally described from the Isles of Scilly and assumed to be an introduction from the Americas but recently discovered in Portugal suggesting its origins may be Lusitanian. Following the recommendation of Voigtländer *et al*. (2011) when reflecting on the Red Listing of myriapods in Germany, where it was unclear whether a species was native or alien it has been evaluated.

Where the presence of a species results from a natural colonisation from the near continent, they may be expected to continue to expand their distribution and records may occur from more than 100 hectads within the next few decades. Their natural range, or 'extent of occurrence' under the IUCN Guidelines expands with them, but they are not long-term residents in Britain and so are excluded from the IUCN categorisation. The precautionary principle suggests that they should not be afforded a regional conservation status unless the source population itself is threatened, which would seem unlikely in most cases, although climate change may impose such a threat.

In many cases there is at least a strong suspicion that the arrival of a species in Britain is actually a chance introduction and the resulting populations are not normally afforded conservation status. This is most commonly the case with taxa associated with horticultural establishments, e.g. botanic gardens, as they usually require heated premises to survive and form established populations. An increased emphasis on recording the fauna of synanthropic habitats, especially heated glasshouses, has led to the discovery of an increasing number of such species in recent years. A number of taxa that are considered chance introductions have been able to survive and form sustainable populations outdoors. These naturalised taxa are most often found in synanthropic settings but do occur more rarely in semi-natural habitat. There is evidence from archaeological remains that unintentional dispersal of woodlice by man has been occurring for centuries (Girling, 1979). The same is almost certainly true for centipedes and millipedes but only those taxa believed by a consensus of expert opinion to have been resident in Britain prior to 1500 AD have been included in the assessments.

Those species that have been excluded from assessment on the basis that they are introduced non-natives, whether this results from accidental or deliberate importation, have been assigned to the category of 'Not Applicable (NA)' as required under the IUCN Guidelines. Even where these species occur in 100 hectads or less, they have not been assessed for scarcity or rarity as they are not considered to be native to Britain. A list of the excluded species and the rationale for their exclusion is given in Table 6.

**Table 6.** Species categorised as 'Not Applicable'

| **Scientific name** | **Post-1990 hectads** | **Rationale for exclusion** |
|---|---|---|
| *Amphitomenus attemsi* | 1 | Probable accidental import with plants. Originates from Andes. Only found in heated glasshouses in Britain. |
| *Anamastigona pulchella* | 3 | Italian species first recorded as accidental import, probably through horticultural trade, in N Ireland (Anderson, 1996). Recorded from RHS Wisley in 2009 and now known from one synanthropic site in Scotland and Wales also. Likely to further expand its range. |
| *Brachyiulus lusitanus* | 1 | European species first recorded outdoors at Eden Project in 2009. Probable accidental import with plants. Possible overlooked native but initial examination of existing collections suggests not. |
| *Cylindrodesmus hirsutus* | 3 | Accidental import, probably with plants. Widespread in tropical regions. Restricted to heated glasshouses in Britain. |
| *Cylindroiulus salicivorus* | 2 | Accidental import from northern Italy, probably with plants. Restricted to glasshouses in Scotland (Read *et al*., 2002). |
| *Cylindroiulus truncorum* | 6 | Accidental import probably with plants from North Africa. Known from glasshouses and outdoors. Apparently naturalised and likely to expand its range. |
| *Cylindroiulus vulnerarius* | 15 | Accidental import probably with plants from Italy but relict populations may exist in cave systems further north. Known from glasshouses and outdoors. Apparently naturalised and likely to expand its range. |

| Scientific name | Post-1990 hectads | Rationale for exclusion |
|---|---|---|
| *Eutrichodesmus* sp. 'Eden A' | 1 | Accidental import, probably with plants. Undescribed species of unknown origin but established in Humid Tropical Biome of Eden Project. |
| *Haplopodoiulus spathifer* | 4 | Accidental import, probably with plants. Originates from western Pyrenees. Recorded from Kew in 1976 (Jones & Corbet, 1996) and 3 other arboreta in S England. Naturalised and likely to spread. |
| *Oxidus gracilis* | 11 | Accidental import, probably with plants from SE Asia. Largely restricted to glasshouses but may establish temporary colonies outdoors. Likely to spread. |
| *Paraspirobolus lucifugus* | 1 | Accidental import, probably with plants. Possibly originates from Indian Ocean islands. Only found in heated glasshouses in Britain (Barber, 2005). |
| *Polydesmus barberii* | 2 | Probable accidental import via port or marina facilities from French or Italian Rivieras. First recorded in 1995 (Bolton, 1996) and now naturalised in Dartmouth and Plymouth areas. Likely to spread. |
| *Poratia digitata* | 3 | Accidental import, probably with plants. Originates from Neotropics. Restricted to heated glasshouses in Britain. |
| *Prosopodesmus panporus* | 1 | Accidental import, probably with plants. Collected in 1975 from heated glasshouse at Kew. Described as new to science by Blower & Rundle (1980). Believed native to Queensland, Australia (Mesibov, 2012) |
| *Pseudospirobolellus avernus* | 1 | Accidental import, probably with plants. Widespread in Tropics. Only found in heated glasshouses in Britain. |
| *Rhinotus purpureus* | 1 | Accidental import, probably with plants. Originates from Neotropics. Only found in heated glasshouses in Britain (Read, 2008). |
| Siphonophoridae sp. | 1 | Accidental import, probably with plants. Undescribed species of unknown origin collected from Humid Tropical Biome of Eden Project in 2010. |
| *Unciger foetidus* | 0 | Accidental import, probably with plants. Central European species reported from one garden in Norfolk in 1983. |
| *Cryptops anomalans* | 27 | Mediterranean species naturalised in synanthropic habitats in southern Britain. |

| Scientific name | Post-1990 hectads | Rationale for exclusion |
|---|---|---|
| *Cryptops doriae* | 1 | Accidental import, probably with plants. Originates from Indian sub-continent, SE Asia and Seychelles. Only found in heated glasshouses in Britain. |
| *Cryptops cf hispanus* | 1 | Accidental import, probably with plants. Specimen from heated greenhouse in Swansea resembles this Spanish species. |
| *Cryptops parisi* | 39 | Widespread European species. Probable accidental introduction to Britain. Mostly in gardens in southern Britain except naturalised in semi-natural woodland in the South West. |
| *Dicellophilus carniolensis* | 0 | Accidental import, probably with plants. Central European species recorded from glasshouses in Newcastle and Edinburgh and gardens in Glasgow in 1913. |
| *Lamyctes caeculus* | 2 | Originates from Australasia. Widely introduced. Occurs indoors in Europe including Britain. |
| *Lamyctes emarginatus* | 95 | Originates from Australasia. Widely introduced. Naturalised in synanthropic and semi-natural sites throughout Britain. |
| *Lithobius lucifugus* | 3 | A European montane species (Barber, 2009b). Reported from synanthropic sites in Scotland. Presumably introduced. |
| *Lithobius peregrinus* | 2 | Temporary colonist introduced to Sheerness and Harwich from southern Europe |
| *Mecistocephalus guildingii* | 1 | Accidental import, probably with plants. Originates from Atlantic coasts of Neotropics. Only found in heated glasshouses in Britain. |
| *Schendyla dentata* | 23 | Assumed native in W Europe from France to Austria. Reported only from synanthropic sites across S England. Presumably introduced. |
| *Schendyla monoeci* | 0 | Accidental import, probably with plants. Assumed native in Europe from France to Ukraine. One record from a glasshouse in Cornwall (Barber, 2009b). |
| *Scutigera coleoptrata* | 9 | Occasional import. Not established. |
| *Stenotaenia linearis* | 14 | Widespread in Central Europe. Naturalised in synanthropic sites, especially gardens, in northern Europe including Britain. |

| Scientific name | Post-1990 hectads | Rationale for exclusion |
|---|---|---|
| *Tygarrup javanicus* | 2 | Accidental import, probably with plants. Originates from Indochina. In Britain restricted to heated glasshouses. |
| *Agabiformius lentus* | 1 | Accidental import, probably with plants. Originates from Mediterranean coasts. Only found in glasshouses in Britain. |
| *Armadillidium* sp. (provisionally determined as *A. assimile* previously) | 1 | Accidental import, probably with plants. Only found in glasshouses in Britain. |
| *Burmoniscus meeusei* | 1 | Accidental import, probably with plants. Originates from tropical regions. Only found in heated glasshouses in Britain. |
| *Caecidotea communis* | 1 | Accidental import from North America. First recorded in 1962 in Bolam Lake, Northumberland (Harding & Collis, 2006) but has not spread. |
| *Chaetophiloscia sicula* | 1 | Accidental import, probably with plants. Originates from Mediterranean. Only found in glasshouses in Britain. |
| *Chaetophiloscia* sp. | 0 | Females collected from gardens on Tresco in 1985 and 1986 (Jones & Pratley, 1987). Most likely species is *C. elongata* (could be native or accidental import from NW France) or may be a Mediterranean species introduced with ornamental plant stock. Male required to determine species. |
| *Cordioniscus stebbingi* | 2 | Accidental import, probably with plants. Originates from eastern Spain. Only found in heated glasshouses in Britain. |
| *Eluma caelata* | 19 | Accidental import, possibly more than once via horticultural trade. Naturalised throughout England in disturbed semi-natural and synanthropic habitats. |
| *Gabunillo* n.sp. | 1 | Undescribed species established in heated glasshouses of Eden Project. Accidental import, probably with plants. Origins unknown. |
| *Lucasius pallidus* | 1 | Accidental import, probably with plants. Originates from Mediterranean. Only found in glasshouses in Britain. |
| *Miktoniscus linearis* | 1 | Accidental import, probably with plants. Unknown origin, possibly USA. Described new to science from heated glasshouses at Kew. |
| *Nagurus cristatus* | 1 | Accidental import, probably with plants. Widespread in tropical regions. Restricted to heated glasshouses in Britain. |

| Scientific name | Post-1990 hectads | Rationale for exclusion |
|---|---|---|
| *Nagurus nanus* | 1 | Accidental import, probably with plants. Widespread in tropical regions Established in humid tropical biome glasshouse of Eden Project. |
| *Oritoniscus flavus* | 3 | Probably an ancient introduction to Ireland that is naturalised in south Wales and near Edinburgh. |
| *Pseudotyphloscia alba* | 1 | Accidental import, probably with plants. Possibly from SE Asia. Restricted to heated glasshouses in Britain. |
| *Reductoniscus costulatus* | 2 | Accidental import, probably with plants. Native to Seychelles, Mauritius, Malaysia and Hawaiian Islands. Only in heated glasshouses in Britain. |
| *Setaphora patiencei* | 0 | Accidental import, probably with plants. Native to Mauritius and Réunion. Only in heated glasshouses in Britain. |
| *Styloniscus mauritiensis* | 0 | Accidental import, probably with plants. Native to Mauritius and Hawaii. Only in heated glasshouses in Britain. |
| *Styloniscus spinosus* | 0 | Accidental import, probably with plants. Native to Mauritius, Réunion, Madagascar and Hawaii. Only in heated glasshouses in Britain. |
| *Trichorhina tomentosa* | 5 | Accidental import, probably with plants. Originates from Neotropics. Only in heated glasshouses in Britain. |
| *Venezillo parvus* | 1 | Accidental import, probably with plants. Occurs widely in Tropics. Only in heated glasshouses in Britain. |

# 8 Format of the species accounts

## 8.1 Information on the species accounts

Species accounts have been prepared for each of the Endangered, Vulnerable, Data Deficient and Near Threatened species. Additionally, as there has been no previous status review of centipedes, millipedes and woodlice, accounts have been prepared for Nationally Rare and Nationally Scarce taxa.

Information on each species is given in a standard form. The species accounts are in the form of data sheets designed to be largely self-contained in order to enable site managers to compile species-related information on site files; this accounts for some repetition between the species accounts. This section provides context for eight items of information on each of the data sheets.

## 8.2 The species name

Nomenclature is intended to be as up to date as possible and is based on the World Catalog of Terrestrial Isopods (Isopoda: Oniscidea) (Schmalfuss, 2004) and the Fauna Europaea checklists of Chilopoda and Diplopoda. Information is also provided on any older names that have been used in the main identification literature.

## 8.3 Identification

The emphasis in the accounts, where possible, is on readily available English language publications covering the British Isles; work in other languages or from other/wider geographical areas is only referred to where no other options are available or where the non-English/wider work is more detailed or up-to-date. Richards (2011) provides an introductory guide to all three groups that explains the characters used in identification and illustrates many of the British species with colour photographs but this ebook is not comprehensive. The BMIG website (www.bmig.org.uk) is a useful online resource with a photo gallery including images of many species and access to papers in the BMIG publications describing additions to the British fauna.

### 8.3.1 Millipedes

Identification of many British species of millipede can be achieved in the field, even when immature, with a good hand lens and some experience; however, a microscope is required to identify or confirm the suspected identity of some species and sometimes dissection is required. The major difficulty in the identification of British millipedes is the absence of readily available literature. Blower (1985b) is still the standard work on the British fauna but is long out of print and almost impossible to obtain second hand. There are 18 species recorded from Britain, not all of which are non-native, that are not in Blower and references for identification of these species are shown in Table 7. Richards (2011) provides a key to the more common and easily identified species along with many colour images but is not comprehensive.

**Table 7.** Species not in Blower (1985b)

| **Species** | **Identification reference(s)** |
|---|---|
| *Trachysphaera lobata* | Jones & Keay (1986) |
| *Rhinotus purpureus* | Read (2008) |
| *Anthogona britannica* | Bolton & Jones (1996) |
| *Anamastigona pulchella* | Anderson (1996) |
| *Hylebainosoma nontronensis* | Mauriès & Kime (1999) |
| *Ceratosphys amoena confusa* | Demange (1981), Ribaut (1955) |
| *Melogona voigtii* | Corbet (1996) |
| *Polydesmus barberii* | Bolton & Jones (1996) |
| *Cylindrodesmus hirsutus* | Read (2008) |
| *Eutrichodesmus* sp. | see photos at www.bmig.org.uk/species/eutrichodesmus-sp |
| *Poratia digitata* | Blower & Rundle (1986) |
| *Amphitomenus attemsi* | Andersson *et al*. (2005) |
| *Paraspirobolus lucifugus* | Read (2008) |
| *Pseudospirobolellus avernus* | Loomis (1934), Hoffman (1981) |
| *Haplopdoiulus spathifer* | Corbet & Jones (1996) |
| *Cylindroiulus salicivorus* | Read, Corbet & Jones (2002) |
| *Brachyiulus lusitanus* | Shelley (1978), Strasser (1967) |
| Siphonophoridae sp. | see photos at www.markgtelfer.co.uk/category/millipedes/ |

### 8.3.2 Centipedes

Centipedes are considered the most difficult of the three groups to identify and most British centipedes require the use of a microscope or at least a good hand lens. Even under the microscope it is sometimes necessary to use clearing agents so that the distinguishing features are readily visible. Barber (2009b) contains dichotomous keys, tabular keys, descriptions and diagrams of distinguishing characters for most British centipedes. It is the most comprehensive guide to the identification of the British fauna; only two recently collected non-native species *Cryptops* cf. *hispanus* and *Thereuonema tuberculata* (Wood, 1863), are omitted. These taxa are described in the *Bulletin of the British Myriapod and Isopod Group* volume 25. Barber (2008) is very similar in scope but the species descriptions are brief, there are fewer diagrams and *Cryptops doriae* Pocock, 1891 is omitted. Although intended to enable the identification of adult specimens, it is often possible to identify immature specimens, especially of geophilid centipedes, using the tabular keys. Both publications update the nomenclature in Eason (1964).

### 8.3.3 Woodlice and Waterlice

The identification of the larger British woodlice species is relatively straightforward and many can be identified in the field even when immature; however, a microscope

is required to identify many of the small Trichoniscids to species level and sometimes dissection is required. The most complete coverage of woodlice is provided by Hopkin (1991) and by Oliver & Meechan (1993). 18 non-native species, mostly restricted to glasshouses, are omitted from these publications. Gregory (2015) describes 11 of these non-natives and plans to deal with the remaining species in a future paper. Reference to Gledhill *et al.* (1993) allows identification of all four British species of waterlice of the basis of superficial characteristics but, as these are variable, microscopic examination of the first abdominal appendages (Figs. 47 & 48 in Gledhill *et al.*) is preferable for certain identification. Gregory (2009), although not an identification guide, provides supplementary notes on the characteristics of all species of both woodlice and waterlice and includes colour photographs of many species.

### 8.4 Distribution

Records held in the database of the national species recording schemes form the basis for determining the distribution of each species. In most cases these data can be accessed through the NBN Gateway (https://data.nbn.org.uk/) and therefore individual records have generally not been listed. The exceptions are those species known from only a relatively small number of sites and where site information is considered essential to understanding habitat, ecology, status, threats and conservation. The Watsonian vice-counties (Dandy, 1969) are included in the NBN database for many records but are not referred to in this review. Voigtländer *et al*. (2011), following their work on the German Red Lists for myriapods, recommended that the national responsibility for a species within the whole of its international distribution should be examined as part of the evaluation thus increasing the status of endemic species but decreasing that of those on the edge of their range. In this review international distribution is referred to within the species accounts where a comment on biogeography is considered relevant and where the information is readily accessible but it has not influenced the assessment of status.

### 8.5 Habitat and ecology

This section aims to provide an overview of both the precise habitat requirements of each species and the wider landscape context. In many cases current knowledge is inadequate or incomplete and speculation remains the only option.

Separation of where species are found by recorders from the actual habitat preferences of those species is fraught with difficulty. In general most species are collected from humid micro-sites, especially leaf litter and under surface debris. Searching such sites is generally a good strategy for finding organisms most of which are very susceptible to water loss. Thus, a species that has physiological or behavioural adaptations to reduce water is possibly under recorded. A species that spends most of its life deeper within the substrate is possibly under recorded but without more soil sampling this is only speculation.

The situation is further complicated by climatic factors and these will vary across the country. As might be expected, species on the northern edge of their European range in Britain are most likely to be found in urban areas where temperatures remain higher or in rural locations in micro-sites with the highest insolation. The habitat preferences of myriapods and isopods are not always so straightforward to explain. Many species are believed to move within the soil column in response to temperature and humidity. It might be expected that unless specifically adapted to cold, dry conditions most species would move deeper into the soil in a cold winter or a dry summer thus resulting in under recording. Although these is some evidence of aestivation within the soil in adverse conditions there is evidence also of increased surface activity by small, soil dwelling species in sub-zero temperatures.

Considerable emphasis is placed in this review on the importance of relict sites in supporting rare species. This indicates that such species have poor dispersal capacity or that they require a special set of conditions provided only by such sites, or perhaps a combination of the two. These factors relate to the use of species assemblages in monitoring the rehabilitation of disturbed habitats as discussed in section 2.

### 8.6 Status

Status is largely based on range size and both short and long term trends, but association of a species with particular habitats under threat is also taken into account. Counts of hectads known to be occupied since 1990 were used to establish whether or not a species might be considered scarce. The IUCN guidelines (see Section 3) were then used to decide whether such species might also be considered under threat, and to assign a category. Detailed survey data is rare but has been used where available.

Only species which have been assessed as Endangered, Vulnerable, Near Threatened, Data Deficient, Nationally Rare or Nationally Scarce are provided with species accounts. The status of these and all other species in this review is summarised in Appendix 1.

The IUCN criteria are not rigid about the need for real data, but allow for expert opinion – ‘estimated, inferred, projected or suspected’ are acceptable reasons. Therefore, some species currently known from fewer than one hundred hectads have been excluded from Nationally Scarce status on this basis i.e. taking an equivalent approach given that the IUCN criteria do not cover Nationally Scarce status. It is appreciated that many species of invertebrate are not yet recorded from more than one hundred hectads but might be expected to be found in more than one hundred when their distribution is better known. Thus, assessments of status can only be based on current knowledge, which is very unlikely to be comprehensive in the majority of cases, being based on the experience of a limited number of active recorders in each generation. The likely national distribution of each species and trends in population

size must, therefore, be extrapolated from the available information so as to arrive at the best estimate of the likely national status of each species.

### 8.7 Threats

It is those human activities that result in the loss of sites or that change the nature of habitats that are most likely to pose the greatest threats to myriapod and isopod populations. Where specific threats might arise they are mentioned, otherwise the statements attempt to summarise in general terms those activities that are considered most likely to place populations at risk.

One of the most important threats during the latter half of the 20$^{th}$ century in particular was the loss of ancient woodland, many areas being cleared to make way for plantations of greater economic value to the forestry industry but of lesser ecological value. Other woodlands were lost under large-scale housing and infrastructure developments or converted to arable use in the drive towards intensification. With the resulting disturbance, reduction in humidity and reduction in quantity and / or quality of leaf litter came reductions in invertebrate diversity and only a limited suite of species able to thrive in the more hostile conditions was left. In urban areas especially these survivors have often been joined by introduced species that can cause further problems by outcompeting native species.

One human activity that has impacted on myriapod and isopod populations in a range of habitat types is increased land drainage. The loss of damp corners in innumerable meadows and improved drainage in small areas of wet woodland contributed to a reduction in suitable habitat just as much as the large scale destruction of wetlands such as Thorne and Hatfield Moors.

Pesticide use is also likely to have had an impact on myriapods and isopods as part of the broad intensification of land use but this has been less well studied than for other arthropod groups with the exception of the impact of water treatment chemicals and other pollutants on waterlice.

Locations in different coastal habitats are prime spots for developments including, port facilities, marinas and golf courses. In addition to the resulting significant habitat loss further degradation due to factors such as pollutants in road run-off or oil spills and pressure through increased site use, is unsympathetic to any remaining conservation value of the sites. Not all threats to invertebrate populations are anthropogenic and coastal populations are especially vulnerable to episodes of extreme weather. Coastal erosion is often essential for maintaining the habitat of species associated with soft cliffs but can cause extinction if it removes every population of a species with a very restricted distribution in a single extreme event. Species living on shingle formations may be similarly vulnerable. Species inland can

be threatened by flooding such as was experienced early in 2014 if they exist at only a very small number of sites.

The reduction or cessation of traditional land management and land use also led to habitat loss and degradation through succession with calcareous grassland areas becoming scrubbed over and open areas within woodland reverting to closed-canopy conditions. This neglect can even be seen in sites with some conservation protection or designation where the required level of rotational disturbance (e.g. felling, coppicing, mowing, grazing) is not implemented. Further, land management is often unsympathetic to less well-known and familiar groups of organisms, especially when their conservation ecology is not well known and understood. As noted by Rackham (2006), conservation measures should be based on practical observation rather than unstable theory. Sometimes there is so little known with regard to a species that nothing can be said other than that the threats are unknown.

### 8.8 Management and conservation

Where known sites have the benefit of statutory protection, as, for example, in the case of National Nature Reserves (NNRs) or Sites of Special Scientific Interest (SSSI), this is noted although myriapods and isopods are rarely quoted in site designation. Within the Species Accounts, designated sites are usually named only for Endangered, Vulnerable, Near Threatened and Data Deficient species. The designation of new sites and other policy measures are proposed for a small number of species.

It is very rare that a threatened British millipede, centipede or woodlouse has been subject to detailed ecological research or even a standardised monitoring scheme but these are referred to where such schemes are known about, although a few species have been investigated in detail as part of the UK Government's Biodiversity Action Plan. More often the implemention of further survey, of a monitoring programme, or a specific line of research is recommended.

Preventative measures and positive action designed to maintain populations are suggested where these are known or can reasonably be inferred. Inevitably, in many cases, this section tends to be generalised, identifying practices that have been found to favour those aspects of the habitat with which the species may be associated. However, this general advice is retained in order to ensure that the species data sheets can be read as stand-alone documents.

### 8.9 Published sources

Literature references specific to the taxon that have contributed information to the data sheet are cited here.

# 9 Acknowledgements

Jon Webb (Natural England) commissioned the current review. The format and content is based closely on the recent water beetle review (Foster, 2010) and subsequent publications in this review series (Alexander, 2014; Alexander, Denton & Dodd, 2014; Hubble, 2014; Macadam, 2015); key sections of text have been adopted and adapted for the current review in order to maintain consistency of approach.

The review would not have been possible with out the efforts of the many contributors to the national recording schemes for centipedes, millipedes and woodlice. It is not possible to list here every individual that has contributed to the recording schemes but special mention must be made of the recording scheme organisers: Tony Barber, Colin Fairhurst, Douglas Richardson, Dick Jones, Paul Harding, Stephen Sutton, Steve Hopkin, Dave Bilton and Steve Gregory whose work in collating and verifying records over the years has proven invaluable.

A number of people provided invaluable comments on draft versions of the review spreadsheet and the species accounts: Tony Barber, Steve Gregory, Adrian Fowles, Paul Harding, Helen Read, Paul Richards, Jon Webb and those members of the Inter-Agency Working Group (IAWG) whose comments were anonymised or combined.

Special thanks also go to Helen Roy, Colin Harrower and Stephanie Rorke at the Biological Records Centre for prompt and precise completion of several data-handling requests – essential help through this review and much appreciated.

This work was completed as part of the activities of Hymettus and funded by Natural England.

Paul Lee

BMIG and Hymettus
Little Orchard
Capel Road
Bentley
Ipswich
IP9 2DW

# 10 Species listed by IUCN status category

In this list the species are given in taxonomic order within status categories.

**Critically Endangered**

**Endangered**

| | | |
|---|---|---|
| Chilopoda | | |
| | Geophilidae | *Nothogeophilus turki* Lewis, Jones & Keay, 1988 |
| Diplopoda | | |
| | Julidae | *Metaiulus pratensis* Blower & Rolfe, 1956 |

**Vulnerable**

| | | |
|---|---|---|
| Diplopoda | | |
| | Glomeridae | *Trachysphaera lobata* (Ribaut, 1954) |
| | Chordeumatidae | *Chordeuma sylvestre* C.L. Koch, 1847 |
| Isopoda | | |
| | Trichoniscidae | *Metatrichoniscoides celticus* Oliver & Trew, 1981 |
| | Halophilosciidae | *Stenophiloscia glarearum* Verhoeff, 1908 |

**Near Threatened**

| | | |
|---|---|---|
| Diplopoda | | |
| | Anthogonidae | *Anthogona britannica* Gregory, Jones & Mauriès, 1993 |
| | Polydesmidae | *Propolydesmus testaceus* (C.L. Koch, 1847) |
| Chilopoda | | |
| | Himantariidae | *Haplophilus souletinus* Brölemann, 1907 |
| | Schendylidae | *Hydroschendyla submarina* (Grube, 1869) |
| | | *Schendyla peyerimhoffi* Brolemann & Ribaut, 1911 |
| | Lithobiidae | *Lithobius lapidicola* Meinert, 1872 |
| Isopoda | | |
| | Oniscidae | *Oniscus asellus occidentalis* Bilton, 1994 |

**Data Deficient**

| | | |
|---|---|---|
| Diplopoda | | |
| | Glomeridae | *Adenomeris gibbosa* Mauriès, 1960 |
| | Chordeumatidae | *Hylebainosoma nontronensis* Mauriès & Kime, 1999 |
| | | *Ceratosphys amoena confusa* Ribaut, 1955 |
| | | *Melogona voigtii* (Verhoeff, 1899) |

Chilopoda

| | |
|---|---|
| Geophilidae | *Pachymerium ferrugineum* (C.L. Koch, 1835) |
| | *Geophilus proximus* C.L. Koch, 1847 |
| | *Geophilus pusillifrater* Verhoeff, 1898 |
| | *Arenophilus peregrinus* Jones, 1989 |
| Lithobiidae | *Lithobius tenebrosus* Meinert, 1862 |

Isopoda

| | |
|---|---|
| Trichoniscidae | *Metatrichoniscoides leydigii* (Weber, 1880) |

# 11 Species listed by GB Rarity Status category

In this list the species are given in taxonomic order within status categories.

**Nationally Rare**

Diplopoda

*Adenomeris gibbosa* Mauriès, 1960
*Trachysphaera lobata* (Ribaut, 1954)
*Anthogona britannica* Gregory, Jones & Mauriès, 1993
*Chordeuma sylvestre* C.L. Koch, 1847
*Melogona voigtii* (Verhoeff, 1899)
*Hylebainosoma nontronensis* Mauriès & Kime, 1999
*Ceratosphys amoena confusa* Ribaut, 1955
*Propolydesmus testaceus* (C.L. Koch, 1847)
*Thalassisobates littoralis* (Silvestri, 1903)
*Metaiulus pratensis* Blower & Rolfe, 1956
*Enantiulus armatus* (Ribaut, 1909)

Chilopoda

*Haplophilus souletinus* Brölemann, 1907
*Hydroschendyla submarina* (Grube, 1869)
*Schendyla peyerimhoffi* Brolemann & Ribaut, 1911
*Pachymerium ferrugineum* (C.L. Koch, 1835)
*Nothogeophilus turki* Lewis, Jones & Keay, 1988
*Geophilus proximus* C.L. Koch, 1847
*Geophilus pusillifrater* Verhoeff, 1898
*Eurygeophilus pinguis* (Brölemann, 1898)
*Arenophilus peregrinus* Jones, 1989
*Lithobius piceus* L. Koch, 1882
*Lithobius tricuspis* Meinert, 1872
*Lithobius tenebrosus* Meinert, 1862
*Lithobius lapidicola* Meinert, 1872

Isopoda

*Buddelundiella cataractae* Verhoeff, 1930
*Metatrichoniscoides celticus* Oliver & Trew, 1981
*Metatrichoniscoides leydigii* (Weber, 1880)
*Stenophiloscia glarearum* Verhoeff, 1908

**Nationally Scarce**

Diplopoda

*Geoglomeris subterranea* Verhoeff, 1908
*Polyzonium germanicum* Brandt, 1837
*Craspedosoma rawlinsii* Leach, 1814
*Brachychaeteuma bagnalli* Verhoeff, 1911
*Brachychaeteuma bradeae* (Brolemann & Brade-Birks, 1917)
*Brachychaeteuma melanops* Brade-Birks & Brade-Birks, 1918
*Stosatea italica* (Latzel, 1886)
*Choneiulus palmatus* (Nimec, 1895)
*Leptoiulus belgicus* (Latzel, 1844)
*Leptoiulus kervillei* (Brölemann, 1896)
*Allajulus nitidus* (Verhoeff, 1891)
*Cylindroiulus londinensis* (Leach, 1814)
*Cylindroiulus parisiorum* (Brölemann & Verhoeff, 1896)

Chilopoda

*Henia vesuviana* (Newport, 1845)
*Henia brevis* (Silvestri, 1896)
*Geophilus osquidatum* Brölemann, 1909
*Geophilus fucorum seurati* Brolemann, 1924
*Lithobius macilentus* L. Koch, 1862
*Lithobius pilicornis* Newport, 1844
*Lithobius muticus* C.L. Koch, 1862
*Lithobius curtipes* C.L. Koch, 1847

Isopoda

*Proasellus cavaticus* (Leydig, 1871)
*Haplophthalmus montivagus* Verhoeff, 1941
*Miktoniscus patiencei* Vandel, 1946
*Trichoniscoides helveticus* (Carl, 1908)
*Trichoniscoides sarsi* Patience, 1908
*Halophiloscia couchii* (Kinahan, 1858)
*Oniscus asellus occidentalis* Bilton, 1994
*Armadillidium album* Dollfus, 1887
*Armadillidium pictum* Brandt, 1833
*Porcellio laevis* Latreille, 1804

# 12 Criteria used for assigning species to IUCN threat categories

**Table 8.** Criteria used to assign extant species to GB IUCN categories with a level of threat VU or greater, not including Data Deficient (DD) species. (See Appendix 2 for summary of criteria and categories)

| **Scientific name** | **Status** | **Criteria used** |
|---|---|---|
| **Diplopoda** | | |
| *Metaiulus pratensis* Blower & Rolfe, 1956 | Endangered | B2ab(ii)(iv) |
| *Trachysphaera lobata* (Ribaut, 1954) | Vulnerable | D2 |
| *Chordeuma sylvestre* C.L. Koch, 1847 | Vulnerable | D2 |
| **Chilopoda** | | |
| *Nothogeophilus turki* Lewis, Jones & Keay, 1988 | Endangered | B2ab(i)(ii)(iv) |
| **Isopoda** | | |
| *Metatrichoniscoides celticus* Oliver & Trew, 1981 | Vulnerable | D2 |
| *Stenophiloscia glarearum* Verhoeff, 1908 | Vulnerable | D2 |

# 13 Taxonomic list of Threatened, Nationally Rare and Nationally Scarce species

| Species Name | Bratton (1991) | This review (IUCN Status) | This review (GB Rarity Status) |
|---|---|---|---|
| **Diplopoda** | | | |
| *Adenomeris gibbosa* | | DD | NR |
| *Trachysphaera lobata* | RDBK | VU | NR |
| *Geoglomeris subterranea* | | | NS |
| *Polyzonium germanicum* | | | NS |
| *Craspedosoma rawlinsii* | | | NS |
| *Hylebainosoma nontronensis* | | DD | NR |
| *Ceratosphys amoena confusa* | | DD | NR |
| *Anthogona britannica* | | NT | NR |
| *Chordeuma sylvestre* | RDBK | VU | NR |
| *Melogona voigtii* | | DD | NR |
| *Brachychaeteuma bagnalli* | | | NS |
| *Brachychaeteuma bradeae* | | | NS |
| *Brachychaeteuma melanops* | | | NS |
| *Stosatea italica* | | | NS |
| *Propolydesmus testaceus* | | NT | NR |
| *Choneiulus palmatus* | | | NS |
| *Thalassisobates littoralis* | | | NR |
| *Leptoiulus belgicus* | | | NS |
| *Leptoiulus kervillei* | | | NS |
| *Metaiulus pratensis* | RDBK | EN | NR |
| *Allajulus nitidus* | | | NS |
| *Cylindroiulus londinensis* | | | NS |
| *Cylindroiulus parisiorum* | | | NS |
| *Enantiulus armatus* | | | NR |
| | | | |
| **Chilopoda** | | | |
| *Haplophilus souletinus* | | NT | NR |
| *Hydroschendyla submarina* | | NT | NR |
| *Schendyla peyerimhoffi* | | NT | NR |
| *Henia vesuviana* | | | NS |
| *Henia brevis* | | | NS |
| *Pachymerium ferrugineum* | | DD | NR |
| *Nothogeophilus turki* | | EN | NR |
| *Geophilus osquidatum* | | | NS |
| *Geophilus fucorum seurati* | | | NS |

| | | | |
|---|---|---|---|
| *Geophilus proximus* | RDBK | DD | NR |
| *Geophilus pusillifrater* | | DD | NR |
| *Eurygeophilus pinguis* | | | NR |
| *Arenophilus peregrinus* | | DD | NR |
| *Lithobius piceus* | | | NR |
| *Lithobius tricuspis* | | | NR |
| *Lithobius tenebrosus* | RDBK | DD | NR |
| *Lithobius lapidicola* | RDBK | NT | NR |
| *Lithobius macilentus* | | | NS |
| *Lithobius pilicornis* | | | NS |
| *Lithobius muticus* | | | NS |
| *Lithobius curtipes* | | | NS |
| | | | |
| **Isopoda** | | | |
| *Proasellus cavaticus* | | | NS |
| *Buddelundiella cataractae* | | | NR |
| *Haplophthalmus montivagus* | | | NS |
| *Metatrichoniscoides celticus* | RDBK | VU | NR |
| *Metatrichoniscoides leydigii* | | DD | NR |
| *Miktoniscus patiencei* | | | NS |
| *Trichoniscoides helveticus* | | | NS |
| *Trichoniscoides sarsi* | | | NS |
| *Halophiloscia couchii* | | | NS |
| *Stenophiloscia glarearum* | | VU | NR |
| *Oniscus asellus occidentalis* | | NT | NS |
| *Armadillidium album* | | | NS |
| *Armadillidium pictum* | RDB3 | | NS |
| *Porcellio laevis* | | | NS |

# 14 The data sheets

Data sheets for the species assessed as Endangered, Vulnerable, Data Deficient, Near Threatened, Nationally Rare and Nationally Scarce are given in this section. The data sheets are arranged, within each of the three Classes, in alphabetical order by scientific name.

## 14.1 DIPLOPODA (MILLIPEDES)

***ADENOMERIS GIBBOSA***
**DATA DEFICIENT**
Pill Millipede
Order GLOMERIDA
Family GLOMERIDAE

*Adenomeris gibbosa* Mauriès, 1960

**Identification**
*A. gibbosa* is a very small, pale pill millipede with two transverse rows of tubercules in the rear portion of each segment. Keyed with description and diagrams by Blower (1985b). Lee (2006b) contains a colour photograph of the species. Notes on the appearance of the species along with further black and white photographs are given in Harper and Richards (2006).

**Distribution**
*A. gibbosa* has been recorded from just two further locations, Wendover Woods (Read, Barber, Gregory & Lee, 2006) and Great Missenden (Lee, 2006b), since it was first discovered in Britain at Aston Clinton in 2004 (Harper & Richards, 2006). All three sites are within a relatively small area of Buckinghamshire. It had been thought to be endemic to the western Pyrenees until discovered near Dublin in 1978 (Kime & Enghoff, 2011).

**Habitat and Ecology**
*A. gibbosa* typically occurs in limestone scree and calcareous soils covered with vegetation litter (Kime & Enghoff, 2011). It was collected originally in *Fagus* forest (Mauriès, 1960). It is known from mixed woodland and scrub on calcareous soils in England (Lee, 2006b) but the Irish records are from an old garden (Blower, 1985b).

**Status**
Harper and Richards (2006) suggest that *A. gibbosa* could have been introduced to England (and presumably to Dublin) from the Pyrenees a century or more ago. Kime (2001) argues that the remoteness of the three known locations in the Pyrenees would make any such introduction very fortuitous and other microglomerid species first

described from the Pyrenees have since been found to have wider natural distributions. Soil sampling in calcareous areas of western France would help to determine the natural range of the animal. *A. gibbosa* is known to occur at just three locations in Britain and so might be considered a Vulnerable species under IUCN criterion D2. However, its small size, cryptic colouration and soil dwelling habitats make it a difficult species to find (Kime & Enghoff, 2011). In addition there is the remaining doubt over its native status. As a result it was considered best to assess *A. gibbosa* as a Data Deficient species until more information on its range in Western Europe becomes available.

**Threats**

New residential developments, especially Government policy regarding the construction of a new garden city in Buckinghamshire, could threaten at least one of the English sites. Scrub clearance or tree felling at any of the known sites could change microclimates and reduce litter cover to the detriment of the species.

**Management and Conservation**

The three locations have no conservation designations. Testing of soil sampling protocols that could be used to survey and monitor *A. gibbosa* on calcareous screes in woodland in southern England is recommended. Accidental loss of occupied habitat may be avoided by awareness raising amongst landowners and managers.

**Published sources**

Blower (1985b), Harper & Richards (2006), Kime (2001), Kime & Enghoff (2011), Lee (2006b), Mauriès (1960), Read, Barber, Gregory & Lee (2006)

***ALLAJULUS NITIDUS***
**NATIONALLY SCARCE**
Snake Millipede
Order JULIDA
Family JULIDAE

*Allajulus nitidus* (Verhoeff, 1891)
Previously known as *Cylindroiulus nitidus* (Verhoeff, 1891)

**Identification**

*A. nitidus* is an amber-coloured snake millipede with a down-curved tail. Keyed with description and diagrams by Blower (1985b). BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**

*A. nitidus* is widespread in northern and eastern Britain but almost unknown from Wales and SW England (Lee, 2006b). It occurs across Europe north of the Alps with a

range stretching from southern France to southern Norway and eastwards to Poland but it is probably at the western limits of its range in Britain and it does not occur in Ireland (Kime 1990; 1999).

**Habitat and Ecology**

In both Britain and Europe *A. nitidus* is associated with deciduous woodland on calcareous soils (Lee, 2006b) but sometimes occurs in pine woodland on acidic soils in Belgium (Kime, 2004). Kime (1990) notes a high correlation with clay rich soils in Europe but data from British records show no such preference (Lee, 2006b) and it is known from lighter soils in Belgium (Kime, 2004). A high proportion of British records of *A. nitidus* are from synanthropic habitats including gardens and churchyards possibly due to it being on the limits of its range here (Lee, 2006b). This species has a tendency to become subterranean in adverse conditions and this could be part of the cause of its apparent scarcity (Blower, 1985b).

**Status**

Although it has a widespread distribution, *A. nitidus* has been recorded from just 44 hectads since 1990 and less than 70 hectads in total. On the basis of this restricted area of occupancy it satisfies the criterion for being considered Nationally Scarce in Britain.

**Threats**

Loss of semi-natural woodland sites on calcareous soils to agriculture and to development projects could threaten existing populations. Semi-natural woodland habitat remains under threat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013). Government policy on regional development and high targets for the construction of new houses may intensify the threats to semi-natural habitat but provide further synanthropic habitat in the longer term.

**Management and Conservation**

A number of the sites where *A. nitidus* is found are SACs, NNRs and SSSIs. No specific conservation actions are considered necessary for this species at the present time.

**Published sources**

Blower (1985b), Kime (1990, 1999 & 2004), Lee (2006b)

***ANTHOGONA BRITANNICA***
**NEAR THREATENED B1ab(ii)(iv), B2ab(ii)(iv)**
False Flat-backed Millipede
Order CHORDEUMATIDA
Family ANTHOGONIDAE

*Anthogona britannica* Gregory, Jones & Mauriès, 1993

**Identification**
This species was mistaken for juvenile *Craspedosoma rawlinsii* when first collected in 1983. Gregory *et al*. (1993) and Bolton & Jones (1996) provide a description and diagrams of the species.

**Distribution**
*A. britannica* is restricted to the coastal area of South Devon. It was first collected at Slapton Ley and has since been found in just ten further tetrads across four adjacent hectads in the Dartmouth area. All specimens of *Anthogona* collected in France have belonged to *A. variegata* Ribaut, 1913 (Kime, 2001) and *A. britannica* appears to be the only millipede endemic in Britain.

**Habitat and Ecology**
*A. britannica* is known from sea cliffs, grassland, vegetated shingle and deciduous woodland. Although this suggests no clear habitat association, most specimens have been found in leaf litter under ivy and deciduous trees (Bolton, 1996). All adults have been found during winter months and the millipede probably has an annual life cycle.

**Status**
*A. britannica* appears to be endemic to Britain. It is known from only 11 locations within 4 hectads in the Dartmouth area despite intensive survey effort in South Devon (Bolton, 1996). The geographic range is sufficiently restricted to satisfy IUCN criteria B1 and B2 as the extent of occurrence and area of occupancy have maximum values of 400km$^2$ (equivalent to 4 hectads). However, the number of known locations is slightly greater than the maximum of 10 necessary to qualify as Vulnerable under B1a or B2a and there is no clear evidence of continuing decline in geographic range, habitat or population size or of fluctuations in geographic range or population size. Thus *A. britannica* does not quite satisfy the IUCN criterion B for a Vulnerable species but it is susceptible to loss at any of the 11 locations through stochastic events, especially development, and even the loss of one location would result in the conditions for B1ab(ii)(iv) and B2ab(ii)(iv) being met. Therefore the species has been allocated Near Threatened status.

**Threats**
Coastal sites are always at risk from human disturbance and new leisure developments. Even protected vegetated shingle habitats such as Slapton Ley are

vulnerable to damage from stochastic events including severe weather e.g. storm surges and marine pollution e.g. oil spills. There are no specific threats known at the locations not directly on the coast but increasing pressure on Local Authorities to identify further land for residential development may affect those sites.

**Management and Conservation**

*A. britannica* was first discovered on Slapton Ley NNR and a good population still exists there. There are further records from the Lyme Bay and Torbay SAC. No specific conservation actions are in place for this species. Further winter surveys to the east and west of the known extent of occurrence could determine if isolated populations exist outside the main range. If combined with the collection of environmental data it may be possible to gain a better understanding of why *A. britannica* has such a restricted distribution.

**Published sources**

Bolton (1996), Bolton & Jones (1996), Gregory *et al.* (1993), Kime (2001)

***BRACHYCHAETEUMA BAGNALLI***

**NATIONALLY SCARCE**

Millipede

Order CHORDEUMATIDA

Family BRACHYCHAETEUMATIDAE

*Brachychaeteuma bagnalli* Verhoeff, 1911

**Identification**

This is a small, pale millipede and could easily be overlooked as an immature animal. There is some uncertainty as to whether *B. bagnalli* and *B. bradeae* are extreme forms of a single, variable species (Blower, 1986). The two species can be separated only by microscopic examination of the male gonopods. Females cannot be identified currently. Keyed, with brief descriptions and diagrams of typical gonopods, by Blower (1985b). Blower (1986) provides diagrams of the range of variation in gonopod structure.

**Distribution**

*B. bagnalli* is widespread in northern and western Britain but, despite its occurrence throughout Ireland, is unknown from Wales as yet (Lee, 2006b). To date there are only a very few records of the millipede from NW Europe i.e. Belgium, France and Germany (Kime, 2004).

**Habitat and Ecology**

Records collected by BMIG suggest that *B. bagnalli* is active mainly in winter and early spring when few recorders are active, possibly leading to under recording of the

species. It lives in the litter and upper soil layers of disturbed sites including gardens in Britain (Lee, 2006b). It has occurred in similar synanthropic situations in Europe but has mostly been collected from caves (Kime, 2004; Schubart, 1938). It is likely to be present in cave systems in Britain.

**Status**
There is no evidence of a decline in this species but it is rarely recorded so any trend would be difficult to detect. Specimens matching the description of *B. bagnalli* have been collected from only 11 hectads since 1990 and a further 6 prior to that, 17 hectads in total. Given the taxonomic uncertainty and potential under recording, Nationally Scarce rather than Nationally Rare is considered the most appropriate status for the species.

**Threats**
Unknown

**Management and Conservation**
No specific conservation actions are in place for this species. Surveys of cave systems throughout Britain, not just in areas where the species has been recorded at the surface, may help to determine more of the animal's ecology. Also collection of further male specimens may help to answer some of the taxonomic uncertainty around *B. bagnalli* and *B. bradeae.*

**Published sources**
Blower (1985b, 1986), Kime (2004), Lee (2006b), Schubart (1938)

***BRACHYCHAETEUMA BRADEAE***
**NATIONALLY SCARCE**
Millipede
Order CHORDEUMATIDA
Family BRACHYCHAETEUMATIDAE

*Brachychaeteuma bradeae* (Brolemann & Brade-Birks, 1917)

**Identification**
This is a small, pale millipede and could easily be overlooked as an immature animal. There is some uncertainty as to whether *B. bagnalli* and *B. bradeae* are extreme forms of a single, variable species (Blower, 1986). The two species can be separated only by microscopic examination of the male gonopods. Females cannot be identified currently. Keyed, with brief descriptions and diagrams of typical gonopods, by Blower (1985b). Blower (1986) provides diagrams of the range of variation in gonopod structure. A photograph of the whole animal, superficially identical to *B. bagnalli*, is provided in Lee (2006b) and another on the BMIG website

(www.bmig.org.uk).

**Distribution**

*B. bradeae* is widespread in Britain with a more southerly and easterly distribution than *B. bagnalli* (Lee, 2006b) and it has recently been found in Wales (Lee, 2012a). It appears to be more widespread than *B. bagnalli* in Europe with records from at least France, Germany, the Netherlands, Romania, Sweden and Switzerland (Kime, 2001).

**Habitat and Ecology**

*B. bradeae* appears to be mainly synanthropic in Britain but also occurs in ancient semi-natural woodland on clay (Gregory & Campbell, 1996). In Europe it is synanthropic also (Kime, 2001) but has been found in caves in France (Schubart & Husson, 1937) and Jeekel (2001) considered its occurrence on limestone in the southern part of the Netherlands may be natural. As with the previous species, *B. bradeae* may be present in cave systems in Britain.

**Status**

The records provide no evidence of a decline in this species but it is rarely recorded so any trend would be difficult to detect. Specimens matching the description of *B. bradeae* have been collected from only 17 hectads since 1990 and a further 16 between 1970 and 1989. On the basis of its restricted area of occupancy it satisfies the criterion for being considered Nationally Scarce in Britain.

**Threats**

Unknown

**Management and Conservation**

Several of the semi-natural woodland sites where *B. bradeae* occurs are designated SSSI and/or NNR. No specific conservation actions are in place for this species. Further survey in limestone areas, especially of cave systems and clay woodlands, may help identify the natural habitat of *B. bradeae.* Collection of further male specimens may help to answer some of the taxonomic uncertainty around *B. bagnalli* and *B. bradeae.*

**Published sources**

Blower (1985b, 1986), Gregory & Campbell (1996), Jeekel (2001), Kime (2001), Lee (2006b, 2012a), Schubart & Husson (1937).

***BRACHYCHAETEUMA MELANOPS***
**NATIONALLY SCARCE**
Millipede
Order CHORDEUMATIDA
Family BRACHYCHAETEUMATIDAE

*Brachychaeteuma melanops* Brade-Birks & Brade-Birks, 1918

**Identification**
Although similar in general appearance to *B. bagnalli* and *B. bradeae*, *B. melanops* is usually distinguished by the greater number of simple eyes. Keyed, with brief descriptions and diagrams of gonopods, by Blower (1985b). A photograph of the whole animal is provided on the BMIG website (www.bmig.org.uk).

**Distribution**
*B. melanops* is widespread in southern England and South Wales (Lee, 2006b). There is a recent outlying record from North Wales (Lee, 2012a). In Europe the species is restricted to southern Ireland and the milder areas of western France (Kime, 2001).

**Habitat and Ecology**
*B. melanops* appears to reach its northern climatic limits in southern Britain. It often occurs in synanthropic sites but also in semi-natural habitat (Lee, 2006b) including caves (Chapman, 1979). In Europe the preferred habitat is semi-natural woodland but it also occurs in synanthropic sites (Kime, 2001). In both Britain and France it is most frequent on calcareous soils.

**Status**
*B. melanops* is known from just 52 hectads since 1990 and only 82 since 1970 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
Unknown

**Management and Conservation**
*B. melanops* occurs within several designated sites. No specific conservation actions are considered necessary for this species.

**Published sources**
Blower (1985b), Chapman (1979), Kime (2001), Lee (2006b, 2012a)

***CERATOSPHYS AMOENA CONFUSA***
**DATA DEFICIENT**
Millipede
Order CHORDEUMATIDA
Family OPISTHOCHEIRIDAE

*Ceratosphys amoena confusa* Ribaut, 1955
Ribaut (1955) originally described this taxon as a new species, *Ceratosphys confusa*, but it has since been synonymised with *C. amoena* Ribaut, 1920. *Fauna Europaea* does not list the subspecies but other authorities recognise it and a revision of the genus is likely (Kime, pers. comm.).

**Identification**
Although superficially similar to *Craspedosoma rawlinsii*, adults (with 30 segments) are shorter at around 10-12 mm. Microscopic examination of male gonopods is required to distinguish the subspecies. Described (in French) with diagrams of gonopods and compared with *C. amoena s.s*. by Ribaut (1955). Colour montage images of a male specimen are provided by Telfer (2014).

**Distribution**
First recognized from Groesfaen Woods, Bargoed in 2014 (Telfer, 2014) but the earliest British record to date is a specimen in Cardiff Museum from Cefn Onn, Caerphilly in 1983 (Christian Owen, pers. comm.). Currently known only from a triangle formed by Bargoed, Caerphilly and Pontypridd in South Wales. It is widespread in the Central Pyrenees (Kime, pers. comm.) to the south of the type locality in the Montage Noire (Ribaut, 1955) and the subspecies is known from Belgium (Kime, 2004). It has an Atlantic distribution and its presence in Britain is not unexpected (Kime, pers. comm.).

**Habitat and Ecology**
In South Wales *C. amoena confusa* has been found mainly but not exclusively in deciduous woodland. It has been collected from hedgerows and brownfield sites, especially colliery spoil, also and even here is usually collected from leaf litter and from under bark. The soils at most sites in South Wales have been reported to be acid, although Kime (2004) associated it with carboniferous limestone in coal mining areas of Belgium. As with *C. rawlinsii* it may show a preference for sites providing high soil moisture / humidity but be able to survive in drier, sandy woodlands. It has been observed "grazing on a large rock" in association with *Nanogona polydesmoides*, presumably feeding on encrusting lichens. Members of the Chordeumatida are known to browse on fungi (Blower, 1985b).

**Status**
As the taxon is so recently recognized from Britain it is not possible to assess its true status. On current evidence it would appear to be restricted to a small area of South

Wales which might suggest an introduction. The high altitudes of its strongholds in the Montage Noire and the Pyrenees could appear to support an introduced status but other millipede species first described from the Pyrenees have since been found to have wider natural distributions (Kime, 2001). Its presence in Belgium and the possibility it has been widely overlooked (already *C. amoena confusa* has been identified in an existing collection) allow for uncertainty regarding its position as a native or indtroduction. More data is required before the true status of the species can be assessed.

**Threats**

No specific threats are known but the continuing loss of semi-natural woodland habitat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013), is likely to impact some populations and other activities that could lead to reduced soil moisture and humidity are likely to pose a threat.

**Management and Conservation**

None of the existing sites for *C. amoena confusa* appear to be protected. Existing collections labeled as *C. rawlinsi* require checking and all known *C. rawlinsi* sites should be resurveyed as both species may occur together. A wider survey of the South Wales valley woodlands is recommended.

**Published sources**

Blower (1985b), Kime (2001, 2004), Ribaut (1955), Telfer (2014)

***CHONEIULUS PALMATUS***

**NATIONALLY SCARCE**

Millipede

Order JULIDA

Family BLANIULIDAE

*Choneiulus palmatus* (Nimec, 1895)

**Identification**

*C. palmatus* is superficially similar to the very common species *Proteroiulus fuscus* but considerably more hairy on close examination. Keyed, with brief descriptions and diagrams of gonopods, by Blower (1985b). A colour photograph of a male animal is provided on the BMIG website (www.bmig.org.uk).

**Distribution**

*C. palmatus* has a widespread distribution in Britain but is very local in occurrence (Lee, 2006b). The British distribution lies within its native range of the Atlantic zone of NW Europe as described by Kime (1999). It is widely introduced to the north and

east of this region.

**Habitat and Ecology**
*C. palmatus* is found in deciduous woodland in southern Britain but becomes increasingly synanthropic further north. It is often collected from leaf litter and from under bark in woodland sites (Lee, 2006b). Kime (1999) suggested that deciduous woodland might be its natural habitat although Pedroli-Christen (1993) reported it from calcareous grassland. Kime (2004) notes a preference for calcareous soils in semi-natural habitats.

**Status**
*C. palmatus* is known from only 34 hectads since 1990 and from 56 hectads in total since 1970 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats are known but semi-natural woodland habitat that supports *C. palmatus* is potentially under threat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013).

**Management and Conservation**
*C. palmatus* has been recorded from several designated sites. No specific conservation actions are considered necessary for this species.

**Published sources**
Blower (1985b), Kime (1999, 2004), Lee (2006b), Pedroli-Christen (2003)

***CHORDEUMA SYLVESTRE***
**VULNERABLE D2**
Millipede
Order CHORDEUMATIDA
Family CHORDEUMATIDAE

*Chordeuma sylvestre* C.L. Koch, 1847

**Identification**
*C. sylvestre* is a brownish millipede, much darker dorsally than ventrally. Reliable separation from *C. proximum* requires microscopic examination of male sexual structures. Female and immature specimens cannot be distinguished from
*C. proximum*. A description and figures based on British material are given by Blower (1985a). Keyed by Blower (1985b).

**Distribution**

Following its discovery at Trellil in 1961 (Blower, 1985b), *C. sylvestre* was thought to be restricted to Cornwall until it was discovered in the gardens of Culzean Castle, Ayr in 2006 (Collis, 2007). It is a central European species, most common from Italy to Belgium but with a range extending north to near Hanover and west to Normandy (Kime, 1990). It is almost certainly introduced in Scotland but the Cornish populations form a logical extension of its range in northern France (Kime, 2001).

**Habitat and Ecology**

Kime (2004) did not consider *C. sylvestre* to be a habitat specialist although he previously described it as a 'generalist forest species' (Kime, 1990). It is common in woodland in the Netherlands (Jeekel, 2001) and Belgium and the Cornish records are from woodland along the River Camel valley. The presence of a deep litter layer appears to be a common factor linking the woodlands to most of the other habitats from which *C. sylvestre* has been recorded. The deep litter retains the high soil moisture required by the millipede (Kime & Wauthy, 1984). Other soil characteristics appear less important in determining distribution but the species is often found on acidic, even peaty soils (Kime, 1990). *C. sylvestre* is an annual species (Blower, 1985b) that is mature only in late winter and early spring.

**Status**

*C. sylvestre* was listed as RDBK Insufficiently Known by Bratton (1991). It has been recorded from just three locations since 1990 (Culzean Castle straddles the boundary between two hectads, the millipede being collected from both, although it is effectively a single location) and only the locations in Cornwall can be considered semi-natural habitat. The IUCN criteria for Vulnerable D2 are satisfied as the species is present at three locations and plausible threats could cause the species to become Critically Endangered very rapidly.

**Threats**

Ancient semi-natural woodland habitat remains under threat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013). The latter is especially important due to the high soil moisture required by *C. sylvestre*. In addition to development pressures, forestry activities including scrub clearance, thinning and clear felling could result in moisture loss through increased exposure of leaf litter to insolation and wind. Improved drainage both of non-wooded habitat and of areas surrounding woodland habitat could be damaging. The population at Culzean is vulnerable to specific threats from gardening activities including over zealous tidying and application of pesticides.

**Management and Conservation**

The Culzean records fall within the Maidens – Doonfoot SSSI. Trelill Woods and the woodland at St Kew are within the River Camel Valley and Tributaries SSSI. Systematic searches of woodland litter from locations around the known Cornish sites

to be carried out between February and the end of April would help to determine the precise distribution of the millipede and could provide baseline data for future analysis of population trends.

**Published sources**
Blower (1985a, b), Collis (2007), Jeekel (2001), Kime (1990, 2001, 2004), Kime & Wauthy (1984)

***CRASPEDOSOMA RAWLINSII***
**NATIONALLY SCARCE**
Millipede
Order CHORDEUMATIDA
Family CRASPEDOSOMATIDAE

*Craspedosoma rawlinsii* Leach, 1814

**Identification**
Prior to 2014 *C. rawlinsii* was considered a relatively distinctive member of the British fauna distinguished from the common *Nanogona polydesmoides* by the even colouration of the latter compared with the patterning of *C. rawlinsii*. However, the recent discovery of *Ceratosphys amoena confusa* in South Wales necessitates that existing specimens, as well as future finds thought to be *C. rawlinsii*, are checked carefully. Christian Owen has already found one sample of *Ceratosphys* in the collections at Cardiff that had been identified as *C. rawlinsii* in 1983. Immature specimens can also be mistaken for another recent discovery, *Hylebainosoma nontronensis*. Keyed with description and diagrams of gonopods by Blower (1985b). Colour photographs of two animals are provided on the BMIG website (www.bmig.org.uk).

**Distribution**
Although the existing records show *C. rawlinsii* to be widely distributed in Britain, it is very local in occurrence (Lee, 2006b). As a number of the existing records may prove to be of *Ceratosphys amoena confusa* there remains uncertainty over its precise distribution. *C. rawlinsii* has a wide distribution across central Europe reaching Belgium but not western France (Kime, 2004).

**Habitat and Ecology**
*C. rawlinsii* appears to be associated with sites providing high soil moisture / humidity including woodlands and wetlands (Lee, 2006b) but can survive in dry, sandy woodlands subject to summer drought, presumably by burrowing deeply into the soil (Harding & Jones, 1994).

**Status**
Even if all post 1990 records are based on correct identifications, *C. rawlinsii* has been reported from only 31 hectads since that date thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
Any activity that could lead to reduced soil moisture and humidity is a potential threat where *C. rawlinsii* is found. Thus threats to semi-natural woodland habitat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013) will impact *C. rawlinsi* populations. Even without the pressures of development, normal forestry practices including felling of woodland would result in reduced humidity through increased exposure of leaf litter to insolation and wind. Agricultural improvement based on drainage of wetland habitats constitutes a further threat.

**Management and Conservation**
A number of the sites where *C. rawlinsii* is found are SACs, NNRs and SSSIs. No specific conservation actions are considered necessary for this species but with the discovery of *Ceratosphys amoena confusa* and *Hylebainosoma nontronensis* existing collections labeled as *C. rawlinsii* require checking and further survey is needed to determine the true status of the species.

**Published sources**
Blower (1985b), Harding & Jones (1994), Kime (2004), Lee (2006b)

***CYLINDROIULUS LONDINENSIS***
**NATIONALLY SCARCE**
Millipede
Order JULIDA
Family JULIDAE

*Cylindroiulus londinensis* (Leach, 1814)

**Identification**
*C. londinensis* is a distinctive, large, black species keyed with a description and diagrams by Blower (1985b). The BMIG website (www.bmig.org.uk) provides colour photographs of the species.

**Distribution**
*C. londinensis* is widely distributed in Britain but it occurs most frequently in SE England. Even here it is very local in occurrence (Lee, 2006b). It is an Atlantic species with a limited European distribution in western France and northern Spain (Kime, 1999).

**Habitat and Ecology**
*C. londinensis* is typically, but not exclusively, a woodland animal in Britain (Lee, 2006b). Kime (1990) considered it a woodland species in Europe. British data suggests an association with free draining sandy soils (Lee, 2006b) but Kime (1999) reported it to be most frequent on calcareous soils in Europe.

**Status**
*C. londinensis* is known from only 18 hectads since 1990 and a similar number in the previous two decades thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats are known but as a woodland species *C. londinensis* is likely to be vulnerable to the continuing loss of semi-natural woodland habitat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013).

**Management and Conservation**
A number of the sites where *C. londinensis* is found are SACs, NNRs and SSSIs. No specific conservation actions are considered necessary for this species.

**Published sources**
Blower (1985b), Kime (1990, 1999), Lee (2006b)

***CYLINDROIULUS PARISIORUM***
**NATIONALLY SCARCE**
Millipede
Order JULIDA
Family JULIDAE

*Cylindroiulus parisiorum* (Brölemann & Verhoeff, 1896)

**Identification**
*C. parisiorum* is a pale snake millipede with red spots along the flanks. It lacks a projecting tail and usually has more hairs (> 5 pairs) on the rear end than other tailless species but the number of hairs can vary. The scarcity of records from Europe may be due to confusion with these related species, especially *C. truncorum*, and for certain identification microscopic examination of male sexual structures is recommended. Keyed with a description and diagrams by Blower (1985b).

**Distribution**
*C. parisiorum* is mainly found in southern and eastern England with just a few occurrences in northern England and Wales and none at all in Scotland (Lee, 2006b).

It is widespread across central Europe but a limited number of records are known (Kime, 1990).

**Habitat and Ecology**
In Britain *C. parisiorum* has been reported from semi-natural grassland and woodland as well as from synanthropic sites more typical of its European range. Usually it is associated with decaying wood, especially under bark (Kime, 2004; Lee, 2006b).

**Status**
*C. parisiorum* is known from only 22 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats are known but the continuing loss of semi-natural woodland habitat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013), is likely to impact some populations.

**Management and Conservation**
*C. parisiorum* is known from a number of SACs. No specific conservation actions are considered necessary for this species.

**Published sources**
Blower (1985b), Kime (1990, 2004), Lee (2006b)

***ENANTIULUS ARMATUS***
**NATIONALLY RARE**
Millipede
Order JULIDA
Family JULIDAE

*Enantiulus armatus* (Ribaut, 1909)

**Identification**
*E. armatus* is a snake millipede very similar in appearance to *Allajulus nitidus* but is distinguished by the projection on the ventral edge of the last segment. This is additional to but shorter than the projecting tail on the dorsal edge of the segment. *E. armatus* is keyed with a description and diagrams by Blower (1985b).

**Distribution**
In Britain, *E. armatus* is restricted to Devon and Cornwall (Lee, 2006b) and otherwise is known only from SW France (Kime, 1999).

**Habitat and Ecology**
*E. armatus* occurs in a range of coastal, synanthropic and woodland sites in Devon and Cornwall (Blower, 1985b; Barber, 1987; Bolton, 1996). It has been collected from a variety of habitats in France (Kime, 1990).

**Status**
Although *E. armatus* is known from just 5 hectads since 1990, thus satisfying the criterion for being considered Nationally Rare in Britain, there are records from at least 13 locations within this area so the IUCN criteria for Vulnerable D2 are not satisfied. There are no plausible threats likely to result in the species becoming critically endangered or extinct so the species cannot be considered Near Threatened.

**Threats**
No specific threats are known but the continuing loss of semi-natural woodland habitat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013), is likely to impact some populations.

**Management and Conservation**
No specific conservation actions are considered necessary for this species.

**Published sources**
Blower (1985b), Barber (1987), Bolton (1996), Kime (1990, 1999), Lee (2006b)

***GEOGLOMERIS SUBTERRANEA***
**NATIONALLY SCARCE**
Millipede
Order GLOMERIDA
Family GLOMERIDAE

*Geoglomeris subterranea* Verhoeff, 1908
Previously known as *Geoglomeris jurassica* Verhoeff, 1915 and *Stygioglomeris crinata* Brolemann, 1913

**Identification**
*G. subterranea* is a very small, colourless, eyeless, pill millipede. It lacks the cuticular tubercules present in *Adenomeris gibbosa* and *Trachysphaera lobata*, our other minute pill millipedes. Keyed with a description and diagrams by Blower (1985b). The BMIG website (www.bmig.org.uk) provides colour photographs of the species.

**Distribution**
Although recorded widely, *G. subterranea* appears to be absent from areas with unsuitable geology in North and West Scotland, Mid and North Wales and SW

England (Lee, 2006b). Even where the geology is apparently suitable the species is often not found. Britain and Ireland mark the northern and western limits of a patchy European range that extends east to Austria and south to the Pyrenees (Kime & Enghoff, 2011).

**Habitat and Ecology**
*G. subterranea* appears to be a strict calcicole. It is a soil dwelling species that usually lives in the top 10-20cm but will migrate deeper in adverse conditions (Bocock, Heath & Blower, 1973). It has been collected from a range of habitats on calcareous soils including grassland, old quarries and woodland (Lee, 2006b). The preferred habitat in Europe appears to be beech and oak woodland on chalk / limestone (Kime & Enghoff, 2011). Spelda (2005) has found it most frequently in loose limestone soil types on steep wooded slopes in Bavaria but notes it is difficult to find at all.

**Status**
*G. subterranea* is recorded from just 25 hectads since 1990 and from a similar number in the previous two decades thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats are known.

**Management and Conservation**
*G. subterranea* has been recorded from several NNR, SSSI and SAC designated locations. No specific conservation actions are considered necessary for this species but it would be useful to know the factors limiting its local distribution in apparently suitable habitat.

**Published sources**
Blower (1985b), Bocock, Heath & Blower (1973), Kime & Enghoff (2011), Lee (2006b), Spelda (2005)

***HYLEBAINOSOMA NONTRONENSIS***
**DATA DEFICIENT**
Millipede
Order CHORDEUMATIDA
Family HAASEIDAE

*Hylebainosoma nontronensis* Mauriès & Kime, 1999
Mauriès was uncertain that the genus was correct when describing this species and its taxonomy and Spelda believes it belongs in the genus *Xylophageuma* (Kime, pers. comm.).

**Identification**

A small (c.6mm), white to pale brown species. The adults (with 30 segments) are easily overlooked as immature Craspedosomatids. Will always have more segments than immature specimens of *Ceratosphys*, *Craspedosoma* or *Nanogona* of similar size. Colour montage images of a male specimen are provided by Telfer (2014). The BMIG website (www.bmig.org.uk) provides colour photographs of the species.

**Distribution**

First recognized from Groesfaen Woods, Bargoed in 2014 (Telfer, 2014). Currently known only from a triangle formed by Bargoed, Caerphilly and Pontypridd in South Wales. Previously *H. nontronensis* was known only from the two neighbouring French departments of Dordogne and Haute-Vienne (Mauriès & Kime, 1999). Kime (pers. comm.) considers that the species might have been expected to occur in Britain.

**Habitat and Ecology**

In South Wales *H. nontronensis* has been found mainly in deciduous woodland but also in hedgerows and brownfield sites, especially colliery spoil. It is usually collected from leaf litter, often on damp, acidic soils. It is quite common on acidic soils in the foothills of the Massif-Central (Kime, pers. comm.)

**Status**

The species has only recently been described so it is not unexpected that it has not been recognised previously in Britain and it is not possible to assess its true status. On current evidence it would appear to be restricted to a small area of South Wales which might suggest an introduction and its European distribution might at first sight appear to support this. However, a number of other rare millipedes e.g. *Enantiulus armatus*, *Metaiulus pratensis* show a broadly similar distribution. The apparent difference between the distribution of *H. nontronensis* and that of a more widespread species such as *Chordeuma proximum* may be due to limited recording in NW France. More data is required before the true status of the species can be assessed.

**Threats**

No specific threats are known but the continuing loss of semi-natural woodland habitat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013), is likely to impact some populations and other activities that could lead to reduced soil moisture and humidity are likely to pose a threat.

**Management and Conservation**

None of the existing sites for *H. nontronensis* appear to be protected. Checking existing collections is unlikely to be profitable as 'immature *C. rawlinsii*' are rarely if ever collected but all known *C. rawlinsii* sites should be resurveyed as both species may occur together. A wider survey of the South Wales valley woodlands is recommended.

**Published sources**
Mauriès & Kime (1999), Telfer (2014)

***LEPTOIULUS BELGICUS***
**NATIONALLY SCARCE**
Millipede
Order JULIDA
Family JULIDAE

*Leptoiulus belgicus* (Latzel, 1844)

**Identification**
*L. belgicus* is superficially similar to other black or dark brown snake millipedes with a pointed, downturned tail. The pale, dorso-median pale band is not always apparent in older mature animals when only adult males are readily identified but even these require microscopic examination. *L. belgicus* is keyed with a description and diagrams by Blower (1985b). The BMIG website (www.bmig.org.uk) provides colour photographs of the species.

**Distribution**
Apparently restricted to Devon and Cornwall up to the mid 1980s (Blower, 1985b) the species has since spread further northwards into SW England and South Wales. There are more isolated populations further north in Wales and records from Eigg in the north and from Kent and Norfolk in the east (Lee, 2006b). This trend has continued in recent years with further records from synanthropic sites in north Wales, Cheshire and Yorkshire. *L. belgicus* has an Atlantic distribution in Europe but reaches its northern limits on the continent in Belgium (Kime, 1999). On this basis it would be expected to occur more widely in southern England and Kime (pers. comm.) considers its presence in the Western Isles to be a natural extension of an Atlantic distribution.

**Habitat and Ecology**
*L. belgicus* shows no associations with particular soil types in Britain but does appear to prefer coastal sites (Lee, 2006b). Kime (2004) noted a preference for light, sandy soils and warmer microclimates in Belgium. The latter may explain the preponderance of coastal and synanthropic records in Britain.

**Status**
Despite the apparent expansion in range *L. belgicus* has been recorded from just 40 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats are known.

**Management and Conservation**
*L. belgicus* has been record from several designated sites but is not listed in the citations. It would seem that no specific conservation actions are necessary for this species.

**Published sources**
Blower (1985b), Kime (1999, 2004), Lee (2006b)

***LEPTOIULUS KERVILLEI***
**NATIONALLY SCARCE**
Millipede
Order JULIDA
Family JULIDAE

*Leptoiulus kervillei* (Brölemann, 1896)

**Identification**
*L. kervillei* is superficially similar to other black or dark brown snake millipedes with a pointed, downturned tail and only adult males are readily identified. Even these require microscopic examination. *L. kervillei* is keyed with a description and diagrams by Blower (1985b).

**Distribution**
*L. kervillei* appears to be at the northern limits of its range in the south of England and Wales (Lee, 2006b). This pattern agrees with an Atlantic distribution in Europe that reaches its northern limit in the Low Countries (Kime, 1999). There is no evidence of the range expansion that *L. belgicus* appears to be undergoing

**Habitat and Ecology**
*L. kervillei* shows no strong association with soil type in Britain although there is some evidence of a preference for non-calcareous soils in coastal habitats (Lee, 2006b). In contrast, Kime and Wauthy (1984) reported an association with base-rich soils in Belgium but they also noted a preference for warmer microclimates, as with *L. belgicus*, which again may explain the number of British records from coastal habitats.

**Status**
*L. kervillei* has been recorded from just 19 hectads since 1990 and a similar number in the previous two decades thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats are known.

**Management and Conservation**
No specific conservation actions are considered necessary for this species.

**Published sources**
Blower (1985b), Kime (1999), Kime & Wauthy (1984), Lee (2006b).

***MELOGONA VOIGTII***
**DATA DEFICIENT**
Millipede
Order CHORDEUMATIDA
Family CHORDEUMATIDAE

*Melogona voigtii* (Verhoeff, 1899)

**Identification**
*M. voigtii* was not recognised as a species distinct from *M. gallica* in Britain until recently. Corbet (1996) provides a description and diagrams of the male gonopods, examination of which is required for identification. Female and immature specimens cannot be separated from *M. gallica.*

**Distribution**
Prior to 2013 the species had been recorded from just three locations, all in the Lothians, (Lee, 2006b) but a fourth site was recently discovered in Glasgow (Davidson, 2013). Jeekel (2001) believes the species has been introduced to Scotland from the Netherlands but Kime (2001) considers its presence natural on the basis of its European range and that populations may yet be found in eastern England. It is found mainly to the north and east of *M. gallica* but the two species do overlap in the Low Countries (Kime, 2004).

**Habitat and Ecology**
The few Scottish records are all from synanthropic sites or from semi-natural woodland with some evidence of human disturbance (Corbet, 1996; Davidson, 2013). Spelda (1999) considered it a woodland animal in Germany but Jeekel (2001) described it as synanthropic in the Netherlands. *M. voigtii* probably has an annual life cycle.

**Status**
It is likely that *M. voigtii* is still under recorded as a result of past taxonomic confusion. As a result of this and the uncertainty regarding native status it was considered best to assess it as a Data Deficient species until more information on its

distribution becomes available.

**Threats**
Unknown

**Management and Conservation**
None of the known locations have statutory conservation designations. Thornton Glen is a local nature reserve managed by the Scottish Wildlife Trust. Further survey by experts able to distinguish the species from *M. gallica* is required.

**Published sources**
Corbet (1996), Davidson (2013), Jeekel (2001), Kime (2001, 2004), Lee (2006b), Spelda (1999)

***METAIULUS PRATENSIS***
**ENDANGERED B2ab(ii)(iv)**
Kentish Snake Millipede
Order JULIDA
Family JULIDAE

*Metaiulus pratensis* Blower & Rolfe, 1956

**Identification**
A small, blind snake millipede that is similar in appearance to the spotted snake millipedes, especially *Blaniulus guttulatus*, in the field. Readily distinguished by the purplish spots and densely hairy terminal segments. Blower and Rolfe (1956) provide a full description, with diagrams, based on the original British material. Keyed by Blower (1985b). The BMIG website (www.bmig.org.uk) provides colour photographs of the species.

**Distribution**
*M. pratensis* is restricted to SE England. Most records are from Kent with only one from East Sussex (Lee, 2006b). It has never been refound in East Sussex. The only post-1980 records are from the Medway valley near Maidstone. Outside of Britain *M. pratensis* is known only from four sites in SW France (Kime, 1999).

**Habitat and Ecology**
Most of the specimens collected between 1939 and 1951 were from arable land (often recently broken up grassland) on heavy clay. Many of these specimens were collected as part of a wireworm sampling programme. However, the more recent records in Kent have been restricted to flood meadows and carr woodland. The absence of more recent records from any of the original localities may suggest that *M. pratensis* is a subterranean species of undisturbed soils. The records along the Medway suggest that

it is most likely to occur at the surface when soils are waterlogged. One of the Continental records was also from 'farmland' (Kime, 1999) but the others were from caves (Demange, 1958; 1965; Mauriès, 1965) and these animals are considered three separate subspecies.

**Status**

Between 1986 and 1988 *M. pratensis* was recorded in a wetland and four wet woodlands near Maidstone (Eric Philp, pers. comm.). It was not seen again until 2011 when large numbers were found at Yalding Fen in the Medway Valley (Lee, Gregory & Read, 2011). Intensive survey of other potential sites up and down stream was unsuccessful in discovering further populations. *M. pratensis* is regarded as Endangered as it satisfies the IUCN criteria B2ab(ii)(iv). It has a very restricted area of occupancy much less than 500km$^2$ as the species has been recorded from just one hectad (equivalent to 100km$^2$) since 1990. It is known from a single location (<5 locations) and there have been declines in the area of occupancy from three hectads to one (equivalent to 300km$^2$ to 100km$^2$) and in the number of locations from five to one since 1986. Continuing declines in both area of occupancy and in the number of locations can be inferred from these trends.

**Threats**

Increased development pressure, specifically to build a new town on greenbelt land at Yalding, is a threat to undisturbed soils that could potentially support *M. pratensis*. Further threats to habitat arise from industrial development and changes from pasture to arable land on clay soils. The impact on the population at Yalding Fen of prolonged and heavy flooding in early 2014 is yet to be seen.

**Management and Conservation**

Yalding Fen has the status of a Local Nature Reserve run jointly by Kent Wildlife Trust, Syngenta Agrochemicals and Medway Valley Countryside Partnership. The habitat requirements of the species need to be confirmed by investigating the importance of soil texture, soil disturbance and soil moisture. Sites with suitable environmental conditions should be surveyed for *M. pratensis* by suitable methods such as chemical extraction or deep soil cores. Annual monitoring of the population at Yalding Fen could provide important autecological data including information on life history, seasonal movements within the soil profile and fluctuations in population size.

**Published sources**

Blower & Rolfe (1956), Blower (1985b), Demange (1958 & 1965), Kime (1999), Lee (2006b), Lee, Gregory & Read (2011), Mauriès (1965)

***POLYZONIUM GERMANICUM***
**NATIONALLY SCARCE**
Kentish Pinhead Millipede
Order POLYZONIIDA
Family POLYZONIIDAE

*Polyzonium germanicum* Brandt, 1837

**Identification**
A very distinctive animal, orangey brown with a tiny, triangular head. BMIG website (www.bmig.org.uk) provides colour photographs of the species. Keyed with a description and diagrams by Blower (1985b).

**Distribution**
*P. germanicum* is restricted to Kent; an old record from Surrey based on a fragment of cuticle is not considered reliable (Lee, 2006b). It is widespread in Europe but with disjunct populations in the east and west (Kime & Enghoff, 2011).

**Habitat and Ecology**
An apparent association with sweet chestnut coppice in Kent results from bias in early sampling by pitfall trapping studies (Lee, 2006b). A more recent survey in Kent (Lee, in prep.) found the millipede to occur in a variety of habitats from wet heath to carr woodland, but all providing high soil moisture or humidity. Sometimes 'dry' ditches provided sufficiently moist conditions within otherwise very dry sites. David (1986, 1989, 1990) reported a similar situation in France where the animal occurred in coniferous, mixed or deciduous forests or wooded heaths but the soils were wet or even waterlogged. However, whereas acidic conditions appeared to be preferred in France, many of the Kent sites are on chalk.

**Status**
*P. germanicum* is recorded from just 16 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
Any activity that could lead to reduced soil moisture is a potential threat where *P. germanicum* is found. The most serious threat is the loss of semi-natural habitats, particularly woodland and wet heath. The ongoing loss of semi-natural woodland, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013), is exacerbated in SE England by the constantly increasing demand for land for residential development and Government policies to meet this demand.

**Management and Conservation**
A number of the sites where *P. germanicum* is found are SACs, NNRs and SSSIs.

Soil moisture levels need to be maintained at high levels on sites where the millipede occurs.

**Published sources**
Blower (1985b), David (1986, 1989, 1990), Kime & Enghoff (2011), Lee (2006b, in prep.)

***PROPOLYDESMUS TESTACEUS***
**NEAR THREATENED D2**
Flat-backed Millipede
Order POLYDESMIDA
Family POLYDESMIDAE

*Propolydesmus testaceus* (C.L. Koch, 1847)
Previously known as *Polydesmus testaceus* C.L. Koch, 1847.

**Identification**
*P. testaceus* is superficially similar in appearance to other large, brownish flat-backed millipedes. Microscopic examination is required for identification and particular care is required with female animals. Keyed with description and diagrams by Blower (1985b). BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**
*P. testaceus* shows a rather fragmented distribution. It is on the northern limits of its range in Britain; the location at Hintlesham Woods in Suffolk is possibly its most northerly, non-synanthropic station in Europe (Lee, 2005). Further post-1990 records are from South Wales and from one hectad in Oxfordshire (Gregory & Campbell, 1996). In the previous two decades there were records from the chalk downs in East Kent. Its Continential range stretches from the Mediterranean coasts of France and northern Italy through to Germany in the north and the Czech Republic in the east. There are records from Sweden but these are presumed to be introductions (Kime & Enghoff, 2011).

**Habitat and Ecology**
*P. testaceus* is thermophilic and prefers base-rich soils explaining why it is most abundant in calcareous grassland (Kime & Enghoff, 2011). However, other open habitats on calcareous substrates can provide suitable conditions and it is known from a number of post-industrial sites (Harper, 2004b; Christian Owen, pers. comm.). Also, there are records from caves and from damp woodland but always on base-rich soil (Lee, 2006b).

**Status**
This millipede has been recorded from just six locations since 1990 and it is susceptible to further losses, the most plausible threat being development on brownfield sites, such that the criteria for VU D2 would be satisfied. However, locations on the North Downs in Kent have not been resurveyed in recent years and hence the millipede is very probably under recorded. Further survey is not expected to uncover more than two or three further locations and there are probably enough locations such that stochastic losses would not result in endangerment. For this reason the Near Threatened status is judged to be appropriate.

**Threats**
Two of the known locations are brownfield sites where development pressures are an ongoing threat. Even the calcareous grassland and woodland sites are not immune to development pressures. A threat to Hintlesham Woods SSSI, where clearance of a significant area of habitat for electricity distribution pylons from Sizewell was proposed, appears to have been avoided for the moment. As the remaining five locations are without protected status, development proposals on these sites will be more difficult to resist. Scrub encroachment on unmanaged calcareous grassland is a further threat.

**Management and Conservation**
There are several pre-1990 records from the Folkestone to Etchinghill Escarpment SSSI and Shakespeare Cliff SSSI. The only recent records from a designated site are those from Hintlesham Woods, a SSSI and RSPB Nature Reserve. New survey work is required to determine the current status of *P. testaceus* in East Kent. Where *P. testaceus* is found in calcareous grassland it is likely to benefit from the same management techniques suitable for other invertebrates of early successional mosaics and short sward.

**Published sources**
Blower (1985b), Gregory & Campbell (1996), Harper (2004b), Lee (2005, 2006b), Kime & Enghoff (2011)

***STOSATEA ITALICA***
**NATIONALLY SCARCE**
Millipede
Order POLYDESMIDA
Family PARADOXOSOMATIDAE

*Stosatea italica* (Latzel, 1886)
Previously known as *Strongylosoma italicum* Latzel, 1886 and *Entothalassinum italicum* (Latzel, 1886)

**Identification**
*S. italica* is a distinctive flat-backed millipede as seen by colour photographs of the species on the BMIG website (www.bmig.org.uk) and in Lee (2006b) and in Kime and Enghoff (2011). Keyed with description and diagrams by Blower (1985b).

**Distribution**
The range of *S. italica* appears not to have changed significantly since the publication of Blower (1985b). Its distribution is centred on south east England and the Severn Estuary with an isolated record from near Shrewsbury (Lee, 2006b). It appears to have spread north and west through Europe from central areas of the Mediterranean (Kime & Enghoff, 2011) and is presumed to be an ancient introduction to Britain (Lee, 2006b).

**Habitat and Ecology**
Although all sites reported by Blower (1985b) were synanthropic, *S. italica* is not restricted to such sites and has been found in a wide variety of habitats including semi-natural woodland. It appears to be strongly associated with calcareous soils in Britain (Lee, 2006b).

**Status**
*S. italica* has been reported from just 10 hectads since 1990 but was recorded in a similar number of different hectads in the previous two decades. There is no reason to suppose that populations no longer exist in the majority of these hectads and targeted surveys would be expected to confirm the presence of the millipede. Additionally it might be expected that climate change would assist in the spread of this 'Mediterranean' species in future. Therefore Nationally Scarce is considered to be the most appropriate status.

**Threats**
No specific threats are known.

**Management and Conservation**
*S. italica* is known from a number of designated sites. No specific conservation actions are considered necessary for this species.

**Published sources**
Blower (1985b), Lee (2006b), Kime & Enghoff (2011)

***THALASSISOBATES LITTORALIS***
**NATIONALLY RARE**
Millipede
Order JULIDA
Family NEMASOMATIDAE

*Thalassisobates littoralis* (Silvestri, 1903)
Previously known as *Isobates littoralis* Silvestri, 1903

**Identification**
The equilateral triangular arrangement of ocelli, visible with a hand lens, distinguishes *T. littoralis* from the superficially similar spotted snake millipedes. It is most readily separated from *Nemasoma varicorne* by consideration of habitat and by its much hairier appearance. Keyed, with a description and diagrams, by Blower (1985b). BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**
*T. littoralis* is recorded from widely scattered coastal sites in East Anglia, southern England, Wales and SW Scotland (Lee, 2006b). The species also occurs along the south coast of Ireland but, apart from isolated locations in Norway (Kime, pers. comm.) and Sweden, all other records are from the western Mediterranean (Kime, 1990). It has been introduced to North America (Enghoff, 1987) leading Kime (1999) to speculate on the possibility of its introduction to NW Europe.

**Habitat and Ecology**
*T. littoralis* has been found between tide marks (Eason, 1957; Blower, 1985b) and in various littoral microsites on shingle or rocky coasts but never above the splash zone (Harding, 1985). Barber (2009a) classified *T. littoralis* as an obligate halophile.

**Status**
*T. littoralis* is recorded from just 7 hectads since 1990. It may be under recorded due to the difficulties of finding small invertebrates in shingle and rock crevices. For this reason it has not been considered as Near Threatened but it clearly satisfies the criterion for being considered Nationally Rare in Britain.

**Threats**
Marine pollution generally as well as specific pollution events (e.g. oil spills, chemical spills) could threaten the survival of individual populations. Extreme weather events (e.g. storm surges) have the potential to destroy large proportions of existing habitat in a very short time. Human disturbance from coastal protection, commercial shingle extraction, port developments and other coastal development projects pose further threats.

**Management and Conservation**
A number of the sites where *T. littoralis* is found are designated. No specific conservation actions other than site designation are considered viable for this species.

**Published sources**
Barber (2009a), Blower (1985b), Eason (1957), Enghoff (1987), Harding (1985), Kime (1990, 1999), Lee (2006b)

***TRACHYSPHAERA LOBATA***
**VULNERABLE D2**
Sand Pill-millipede
Order GLOMERIDA
Family DODERIIDAE

*Trachysphaera lobata* (Ribaut, 1954)
Following morphological and DNA studies Wesner, Lee & Read (2011) resolved questions regarding the taxonomic status of the *Trachysphaera* species found in England and Wales.

**Identification**
A very small (<4mm), pale pill millipede with transverse rows of tubercules on each segment. Jones & Keay (1986) described material collected from the Isle of Wight. Steve Hopkin photographed specimens collected in 2005 and one of his images appears in Lee (2006b). Keyed with further photographs by Richards (2011).

**Distribution**
*T. lobata* was first collected in Britain in 1984 from two sites near Bembridge on the Isle of Wight, one of which has since been lost to a hotel development (Jones & Keay, 1986). It was later discovered in Wales at Llanwrtyd, Brecon and at Bynea, Camarthen (Harper, 2010a). There is still considerable uncertainty over the taxonomic boundaries within the genus but on current understanding *T. lobata* is a strictly Atlantic species with limited records but from across a wide area of western France and a few from around Paris (Kime, 2001; Kime & Enghoff, 2011).

**Habitat and Ecology**
Most Continental records of *T. lobata* are from caves (Kime & Enghoff, 2011) in contrast to the scrub / woodland habitat of the British populations. However, it has been found in similar habitats in both Britain and France. Although it can be collected from moss and leaf litter, most specimens are found in calcareous, free draining soils in these wooded habitats. This preference is well illustrated at Bembridge where the millipedes occur in pockets of humus-rich sand within a mainly clay soil formed on a land slip below eroding soft earth cliffs. Studies of the Bembridge population have suggested significant fluctuations in population density may occur between years

(Lee, 2012b) but more work is required to determine the life history of the animal and its movements within the soil column over the year and/or as environmental conditions change.

**Status**

Bratton (1991) listed the species as RDBK Insufficiently Known as he considered it likely to be under recorded. Only three extant populations are known despite intensive survey of other suitable habitat on the Isle of Wight (Lee *et al.*, 2005; Lee, 2011 and Lee, 2012b) and in South Wales (Morgan, 2011). The IUCN criteria for Vulnerable D2 are satisfied on the basis of a very restricted area of occupancy as the species has been recorded from just three, widely dispersed localities since 1990. The loss of one of the original locations at Bembridge to development is evidence of the vulnerability of the species to stochastic events.

**Threats**

In its one remaining semi-natural coastal site at Bembridge erosion of the soft cliff is part of the geomorphological processes that generate the habitat. However, the species is potentially vulnerable to an extreme weather event leading to catastrophic erosion that could remove all of the existing habitat and cause the species to become critically endangered within a very short time. Harper (2010a) identified industrial and residential development as potential threats at Bynea. He also identified pollution from road run-off and pesticide use as threats. Fly-tipping and over zealous management activities, including scrub clearance and footpath construction, have been observed at two of the sites and could be a problem at all three sites.

**Management and Conservation**

Carmarthenshire County Council own the site at Bynea, that at Bembridge is believed to be owned by the Parish Council and that at Llanwrtyd is presumed to be part of church lands. The only site with any protection is Bynea as that forms part of an area designated for Water Vole conservation. Statutory protection for the Bembridge site should be considered. As noted above, research is required to determine the life history of the animal and its movements within the soil column over the year and/or as environmental conditions change. There is scope for further survey both along the coasts of SW England and South Wales based on the characteristics of the sites at Bembridge and Bynea and in the cave systems of southern England and South Wales based on data from France. A monitoring programme, at least triennial, is required at Bembridge and should the rate of erosion increase to threaten the continued existence of suitable habitat, at least one location has been identified on the Isle of Wight that could be suitable for translocation of individuals.

**Published sources**

Bratton (1991), Harper (2010a), Jones & Keay (1986), Kime (2001), Kime & Enghoff (2011), Lee (2006, 2012b), Lee, Gregory, Keay & Read (2005), Richards (2011), Wesner, Lee & Read (2011)

## 14.2 CHILOPODA (CENTIPEDES)

***ARENOPHILUS PEREGRINUS***
**DATA DEFECIENT**
Least shore centipede
Order GEOPHILOMORPHA
Family GEOPHILIDAE

*Arenophilus peregrinus* Jones, 1989

**Identification**
A small (<12mm), pale centipede with 45 leg pairs and, unusually for a British geophilid, the claws on the last legs are replaced by an inconspicuous tubercule (Barber, 2009b). Easily mistaken for an immature of another species (Barber, pers. comm.). Jones (1989) described material collected from the Isles of Scilly. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
*A. peregrinus* has been recorded from the Isles of Scilly (Jones, 1989) and from two sites in mainland Cornwall, Lamorna Cove in 1998 (Gregory & Jones, 1999) and Higher Trewithen near Stithians in 2007 (Barber, 2008b). Although all other species in the genus occur only in the USA (with the exception of one found also in China), the collection in 2004 of *A. peregrinus* from Portugal suggests this is a European species with an Atlantic distribution (Gregory & Lewis, in prep.).

**Habitat and Ecology**
Although the type locality was a rocky shore, well above high water and the centipede was subsequently found in similar habitat on the mainland, the most recent Cornish record was from a nondescript inland copse. The Portugese animal was collected in open *Pinus* woodland at an inland location (Gregory & Lewis, in prep.).

**Status**
Bratton (1991) does not mention *A. peregrinus* although the species had been described from its type locality at the time of publication. On the evidence available at present *A. peregrinus* occurs at only three locations in Britain but it is a small species that can be difficult to find and may be under recorded as a result. With the uncertainty regarding its natural habitat and the high probability of under recording more data is required before the status of the species can be assessed fully.

**Threats**
No specific threats have been identified at the known locations. At coastal sites there is a general threat from development and marine pollution events. Human disturbance resulting from leisure activities may damage coastal habitats also. The increasing

demand for development land and the continuing loss of semi-natural woodland (DEFRA & Forestry Commission, 2005; DEFRA, 2013) may impact any inland populations.

**Management and Conservation**
Lamorna Cove lies within an AONB but none of the sites where *A. peregrinus* is found have conservation designations. Management requirements for the species are unknown. Data from targeted surveys in SW England are required to assess the IUCN status of the species and may provide further ecological insights.

**Published sources**
Barber (2008a, 2008b, 2009b), Gregory & Jones (1999), Gregory & Lewis (in prep.), Jones (1989)

***EURYGEOPHILUS PINGUIS***
**NATIONALLY RARE**
Cut-short centipede
Order GEOPHILOMORPHA
Family GEOPHILIDAE

*Eurygeophilus pinguis* (Brölemann, 1898)
Previously known as *Chalandea pinguis* (Brölemann, 1909)

**Identification**
Easily distinguished from other geophilid centipedes. A short, stout yellowish-brown animal with 35-37 leg pairs. Often found curled in a ball with its underside facing outwards. Jones & Barber (1997 & 1998) described material from Devon. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
Well established in a small area of North Devon. Also recently discovered at two locations in West Cornwall, a domestic garden (Barber, 2013a) and at Trellisick, a National Trust property (Barber, Gregory & Lee, 2010). It may have been transported to these two sites with plants from the National Trust property at Arlington Court, Devon. Outside of Britain it is known only from Corsica, the Alps, the Pyrenees and the Picos (Bonato, Barber & Minelli, 2006). This distribution raises the possibility that the centipede has been introduced to Britain but there are other examples of montane species from southern Europe occurring in lowlands at higher latitudes.

**Habitat and Ecology**
*E. pinguis* is associated with deciduous trees (Barber, 2009b), mainly in woodland close to the coast. It is usually found in leaf litter and sometimes under bark (Barber, 1992b) and in woodrush rhizomes.

**Status**
*E. pinguis* has been found in just 7 hectads since 1990 thus satisfying the criterion for being considered Nationally Rare in Britain.

**Threats**
No specific threats have been identified at the known locations although the increasing demand for development land and the continuing loss of semi-natural woodland (DEFRA & Forestry Commission, 2005; DEFRA, 2013) may come to impact some sites.

**Management and Conservation**
Some of the sites where *E. pinguis* has been found are designated SSSI (Bratton, 1991) but the centipede is not listed in the citations. No specific conservation methods are considered necessary for this species but further survey in SW England would help to establish whether the species is spreading beyond Devon.

**Published sources**
Barber (1992b, 2008a, 2009b, 2013a), Barber, Gregory & Lee (2010), Bonato, Barber & Minelli (2006), Bratton (1991), Jones & Barber (1997)

***GEOPHILUS FUCORUM SEURATI***
**NATIONALLY SCARCE**
Beach geophilus
Order GEOPHILOMORPHA
Family GEOPHILIDAE

*Geophilus fucorum seurati* Brolemann, 1924
Previously known as *Geophilus gracilis* Meinert, 1870

**Identification**
*G. fucorum seurati* is easily confused with the common and widespread species *G. flavus* and with the scarce species *G. osquidatum* when they occur in coastal locations. All three species are yellowish with a darker head and medium sized (30-45mm). Counting the number of leg pairs (51-57 in *G. fucorum seurati*) can be helpful but microscopic examination of diagnostic features is often required to separate these species. Keyed with brief descriptions and diagrams, by Barber (2008a, 2009b). The BMIG website (www.bmig.org.uk) provides a colour photograph of the animal.

**Distribution**
*G. fucorum seurati* has a widespread coastal distribution in Britain from Kent to Cornwall and north to the west of Scotland (Barber, 2009b). The subspecies was

originally described from Algeria. Brölemann (1896) first noted its occurrence in Ireland (as *G. gracilis*) and Lewis and Kime (1988) reported it from Brittany. The nominate subspecies is known from the Mediterranean and Atlantic coasts of France (Eason, 1964; Demange, 1981).

**Habitat and Ecology**

*G. fucorum seurati* is found intertidally or in the splash zone, under stones on mud and in other microhabitats on the seashore (Barber & Keay, 1988; Barber 2009b). Smith and Barber (2011) report its occurrence in core samples from intertidal muddy sand and speculate that the centipede is living under the surface layer of algae (mainly *Ulva torta*) and hunting enchytraeid worms.

**Status**

The widespread distribution suggests that this animal exists in more than the 14 hectads it has been recorded from since 1990, especially if the difficulties of identification and sampling are taken into account. Therefore Nationally Scarce is considered a more appropriate category than the Nationally Rare status that the raw data strictly justifies. On current evidence Britain would appear to support a globally significant proportion of the population of *G. fucorum seurati.*

**Threats**

No specific threats have been identified at the known locations. There is a general threat to the habitats of *G. fucorum seurati* from development e.g. marinas and from marine pollution events. Human disturbance resulting from leisure activities including sailing and fishing may cause damage also but is unlikely to be on a scale that threatens survival of the centipede.

**Management and Conservation**

Management requirements for the species are unknown. *G. fucorum seurati* is known from a number of SACs. Targeted survey of suitable coastal habitat is required to establish the rarity status of *G. fucorum seurati*. Data from targeted surveys of the Atlantic coasts of Europe are required to assess the true importance of the British populations of the subspecies.

**Published sources**

Barber (2008a, 2009b), Barber & Keay (1988), Brölemann (1896), Demange (1981), Eason (1964), Lewis & Kime (1988), Smith & Barber (2011)

***GEOPHILUS OSQUIDATUM***
**NATIONALLY SCARCE**
Western geophilus
Order GEOPHILOMORPHA
Family GEOPHILIDAE

*Geophilus osquidatum* Brölemann, 1909

**Identification**
*G. osquidatum* is easily confused with the common and widespread species *G. flavus* and, in coastal locations, with the scarce species *G. fucorum seurati*. All three species are yellowish with a darker head and medium sized (30-45mm). Counting the number of leg pairs (53-63 in *G. osquidatum*) can be helpful but microscopic examination of diagnostic features is often required to separate these species. Keyed with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
*G. osquidatum* is largely found in Wales and SW England (Barber & Keay, 1988) but has been reported from Kent (Barber, 2001) and on the Cumbrian coast (Barber, pers. comm.). The species appears to be widespread but not common in Europe with Eason (1964) reporting its occurrence in France and Czechoslovakia, Rundle (1986) reporting the first record from Ireland, Barber (2009b) adding Germany, Italy and Spain and Lock (2010) reporting the first record from Belgium.

**Habitat and Ecology**
British records of *G. osquidatum* come from a range of semi-natural sites including woodland, grassland and coastal shingle and from synanthropic sites including gardens and waste ground (Barber & Keay, 1988). It was collected from woodland in Belgium (Lock, 2010).

**Status**
*G. osquidatum* has been reported from only 33 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats have been identified at the known locations. Development pressure is likely to be the most significant threat to populations in semi-natural habitats. Coastal populations may be threatened by marine pollution.

**Management and Conservation**
No specific conservation methods are considered necessary for this species.

**Published sources**
Barber (2001, 2008a, 2009b), Barber & Keay (1988), Eason (1964), Lock (2010), Rundle (1986)

***GEOPHILUS PROXIMUS***
**DATA DEFECIENT**
Northern geophilus
Order GEOPHILOMORPHA
Family GEOPHILIDAE

*Geophilus proximus* C.L. Koch, 1847

**Identification**
A medium sized (<40mm) yellowish centipede with 45-55 leg pairs. Requires careful examination with a hand lens or microscope to distinguish from the very common *G. alpinus (= insculptus)*. Description and diagrams of a Norwegian specimen are given by Barber & Jones (1999). Keyed, with brief descriptions and diagrams by Barber (2008a, 2009b).

**Distribution**
There is just one confirmed record of a single female specimen collected from Unst, Shetland in 1974 (Barber, 1986). Older records are believed to refer to *G. alpinus* (Eason, 1964) and the centipede has not been reported again from Shetland. In Europe it occurs widely including further north in Scandinavia although some records may refer to other species.

**Habitat and Ecology**
The only British record was from "under boulders in the bottom of a nettle-grown hollow in a limestone hillock covered in closely grazed turf, close to the shore of a freshwater Loch of Cliff; sheep bones were piled in amongst the turf" (Barber, 1986). In Scandinavia the species appears to be parthenogenetic (Meidell, 1969).

**Status**
*G. proximus* was listed as RDBK Insufficiently Known by Bratton (1991). It has not been reported from Britain in the period since 1990; the species may be regionally extinct. However, it is a widespread species in NW Europe and as few myriapodologists visit the Northern Isles, there is a high probability that it is under recorded here. More data is required before the status of the species can be assessed fully.

**Threats**
Unknown.

**Management and Conservation**
Management requirements for *G. proximus* are unknown. The site where the species was found has no conservation designations. Further survey is needed in the Northern Isles and mainland Scotland to establish the status of *G. proximus*.

**Published sources**
Barber (1986, 2008a, 2009b), Barber & Jones (1999), Eason (1964), Meidell (1969)

***GEOPHILUS PUSILLIFRATER***
**DATA DEFICIENT**
Scarce geophilus
Order GEOPHILOMORPHA
Family GEOPHILIDAE

*Geophilus pusillifrater* Verhoeff, 1898
*G. pusillifrater* was the name given to a single specimen collected inland in what is now Bosnia-Herzegovina. The description was poor and the name probably should not be applied to the British specimens (Barber, 2009b).

**Identification**
A small (<13mm), pale centipede with 41 or 43 leg pairs. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
*G. pusillifrater* was recorded from Cuckmere Haven in Sussex (Lewis, 1961), somewhere between Newtown and Cowes on the Isle of Wight, Porthgawa in Cornwall and the Isles of Scilly (Jones & Pratley, 1987) before 1990 but not at all in recent years. Otherwise known only from Ireland (Cawley, 2001) and Brittany and the Channel Islands (Barber, 2009b).

**Habitat and Ecology**
*G. pusillifrater* is a littoral species in Britain. It has been collected from rock crevices (Jones & Pratley, 1987) and from shingle (Lewis, 1961; Cawley, 2001).

**Status**
Bratton (1991) excluded the animal from RDB status on the basis of it being under recorded due to the difficulty of collecting small centipedes from coastal shingle and rock crevices. However, as *G. pusillifrater* has not been reported from Britain in the period since 1990, the species may be regionally extinct. Based on current knowledge of its distribution, any surviving population in Britain is of global importance. More data is required before the status of the species can be assessed fully.

**Threats**
There are no specific threats known at the locations recorded but coastal sites are always at risk from marine pollution, human disturbance and new leisure developments. Vegetated shingle habitats are especially vulnerable to human disturbance and to severe weather events e.g. storm surges.

**Management and Conservation**
Cuckmere Haven falls within the Seaford to Beachy Head SSSI. Collections from the Isles of Scilly included Higher Moors and Porth Hellick Pool (St Mary's) SSSI and Chapel Down (St Martin's) SSSI. No specific conservation actions are in place for this species. Further targeted survey of the previously known sites and other potential sites are required in order to assess the status of the centipede.

**Published sources**
Barber (2008a, 2009b), Bratton (1991), Cawley (2001), Jones & Pratley (1987), Lewis (1961)

***HAPLOPHILUS SOULETINUS***
**NEAR THREATENED D2**
Cornish yellow centipede
Order GEOPHILOMORPHA
Family HIMANTARIIDAE

*Haplophilus souletinus* Brölemann, 1907
Previously known as *Nesoporogaster souletina brevior* Eason, 1962. Bonato & Minelli (2014) consider the Cornish animals to fall within the inter-individual and inter-population variation of the species and thus the subspecies not to be valid.

**Identification**
A large (<70mm) yellowish centipede with 93-101 leg pairs. Easily confused with the very common *H. subterraneus* in the field but can be distinguished by the greater number of segments giving it a more slender appearance and the characteristic sternal pits visible with a hand lens. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
In Britain *H. souletinus* is known from just six locations, all within 10km of each other in the Falmouth area (Barber, 2013b). Elsewhere the centipede is found only in the Pyrenees and Iberia. The possibility of *H. souletinus* being an introduced species associated with plants imported in the nineteenth century has been raised (e.g. Eason, 1962; Barber & Keay, 1988) but there are other examples of montane species from southern Europe occurring in lowlands at higher latitudes. It is quite possible that the animal is native to Cornwall (Eason, 1962). There exists no clear evidence either way.

Eason (1962) found *H. souletinus* in association with *H. subterraneus* at Carclew and suggested that it may have gone unnoticed in mixed populations elsewhere in SW England.

**Habitat and Ecology**

*H. souletinus* was first discovered in mixed species estate woodland including introduced species such as rhododendrons. It has since been found in gardens, waste ground and in further woodlands with less evidence of ornamental planting. Often it occurs in association with *H. subterraneus*. Barber (2013b) found the undoubtedly native *H. subterraneus* to be the only species present in an ornamental garden in Falmouth whereas *H. souletinus* was dominant in semi-rural mixed woodland. Both species were found in an area of urban waste ground.

**Status**

Although first reported in 1962, there were no records of *H. souletinus* between 1970 and 1989. It has been recorded from 6 locations since 1990 and so cannot be considered to be declining. The increase in recent records due to targeted recording combined with the possibility that it may still be unnoticed in mixed populations with *H. subterraneus* elsewhere in SW England suggest that the species may be under recorded. Therefore *H. souletinus* should be considered Near Threatened.

**Threats**

No specific threats have been identified at the known locations.

**Management and Conservation**

Based on current knowledge, no specific conservation actions can be recommended for this species at existing sites. Further surveys in the Falmouth area of west Cornwall are recommended to identify any overlooked mixed species populations. Comparison of the DNA of Cornish and Pyrennean animals may help to clarify the status of the species in Britain.

**Published sources**

Barber (2008a, 2009b, 2013b), Barber & Keay (1988), Bonato & Minelli (2014), Eason (1962)

***HENIA BREVIS***

**NATIONALLY SCARCE**

Southern garden centipede

Order GEOPHILOMORPHA

Family DIGNATHODONTIDAE

*Henia brevis* (Silvestri, 1896)

Previously known as *Chaetechelyne montana oblongocribellata* Verhoeff, 1898

**Identification**
A relatively short centipede (<20mm) with 53-57 leg pairs in British specimens. Continental specimens have only 43-47 leg pairs (Demange, 1981; Lock, 2010) leading Lock (2010) to question the presence of the true *H. brevis* in Britain and to suggest that the British specimens are more likely to be *H. montana* (Meinert, 1870). However, in all other characters than number of segments they are more similar to *H. brevis* (Tony Barber, pers. comm.). Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
*H. brevis* is on the northern edge of its range in southern England and Wales (Barber & Keay, 1988). It has been found also in Ireland (Jones, 1992) and Germany (Spelda, 2005) but Minelli (1982) and Iorio (2014) regarded it as essentially a Mediterranean species. The latter states that *H. brevis* is introduced in the UK and Germany.

**Habitat and Ecology**
Many British records of *H. brevis* are from synanthropic sites, especially gardens but it occurs also in semi-natural sites including grassland, wetland and woodland (Barber & Keay, 1988). Spelda (2005) considers it likely to be an ancient introduction in rural abandoned vineyards in Baden-Wuerttemberg.

**Status**
*H. brevis* is most probably not native to Britain but as in Germany its presence in rural, semi-natural habitat is suggestive of an ancient introduction. It has been reported from only 25 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
There are no specific threats known.

**Management and Conservation**
Management requirements for *H. brevis* are unknown. No specific conservation actions are considered necessary for the centipede.

**Published sources**
Barber (2008a, 2009b), Barber & Keay (1988), Demange (1981), Iorio (2014), Jones (1992), Lock (2010), Minelli (1982), Spelda (2005)

***HENIA VESUVIANA***
**NATIONALLY SCARCE**
White-striped centipede
Order GEOPHILOMORPHA
Family DIGNATHODONTIDAE

*Henia vesuviana* (Newport, 1845)
Previously known as *Chaetechelyne vesuviana* (Newport, 1845)

**Identification**
*H. vesuviana* is a large (c. 50mm) centipede with 63-75 leg pairs in British specimens. The body segments are greenish with a longitudinal, central white line but the head and rear segment are reddish-brown giving the animal a very distinctive appearance. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b). The BMIG website (www.bmig.org.uk) provides several colour photographs of the species.

**Distribution**
*H. vesuviana* appears to be restricted to southern England, especially locations along the south coast but has also been collected in Bristol and London (Barber, 2009b) and a population appears to be persisting in a house in Heysham, Lancashire. It is on the NW European edge of its range in Britain but has been found in the Netherlands (Jeekel, 1977), Belgium (Lock, 2010) and most recently in Ireland (Anderson, 2011). It occurs more widely across central Europe south of a line from Hungary to Normandy and into North Africa (Keay, 1984). Iorio (2014) reported it from more than half (52) of the départements across mainland France.

**Habitat and Ecology**
*H. vesuviana* has been collected in a variety of semi-natural habitats in Britain including sand dunes, arable farmland, grassland, wetland and woodland but is noticeably synanthropic especially away from coastal areas (Barber & Keay, 1988) and further north. Barber (pers. comm.) notes a preference for warm micro-sites such as south facing slopes. Apparently aestivates in soil in unfavourable conditions when it coils into a ball, underside facing outwards. The only specimen found in the Netherlands was in a garden (Jeekel, 1977). Keay (1984) noted that it was most frequent on clay soils on the Isle of Wight. Keay (1986) observed predation on a range of invertebrates including large earthworms and snails but the centipede did not attack invertebrates with hard exoskeletons e.g. millipedes, or potentially dangerous taxa e.g. larger spiders, predatory beetle larvae.

**Status** *H. vesuviana* has been reported from only 29 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats** There are no specific threats known.

**Management and Conservation** Management requirements for *H. vesuviana* are unknown. No specific conservation actions are considered necessary for the centipede.

**Published sources** Anderson, (2011), Barber (2008a, 2009b), Barber & Keay (1988), Iorio (2014), Jeekel (1977), Keay (1984, 1986), Lock (2010)

***HYDROSCHENDYLA SUBMARINA***
**NEAR THREATENED D2**
Sea-shore schendylid
Order GEOPHILOMORPHA
Family SCHENDYLIDAE

*Hydroschendyla submarina* (Grube, 1869)

**Identification**
A medium sized (<40mm) reddish-brown centipede with 45-53 leg pairs. *H. submarina* is readily confused with the common *Strigamia maritima* without careful examination with a hand lens or microscope. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b). The BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**
*H. submarina* has been recorded from a small number of locations in South Wales as well as more frequently in SW England, especially in the Plymouth area and the Isles of Scilly (Lewis, 1962; Barber & Keay 1988). An outlier record from the coast of North Yorkshire requires confirmation (Barber & Keay, 1988). Records from Ireland and the Channel Islands are part of a range known to extend along the northern coasts of the Mediterranean Sea and along Atlantic coasts from North Africa to Scandinavia (Eason, 1964).

**Habitat and Ecology**
*H. submarina* is a littoral species that often occurs in rock crevices (that need to be prised open to find it) around high tide level and lower on the shore. Lewis (1981) summarises the ecology of the species and the physiological adaptations that enable it to survive in the mid-littoral zone. It is believed to feed on polychaete worms (Elliot *et al.*, 1990).

**Status**
Bratton (1991) excluded *H. submarina* from RDB status on the basis of it being under recorded due to the difficulty of collecting small centipedes from coastal shingle and rock crevices. It has been recorded from just 6 locations since 1990 but it was collected from only 3 locations in the previous two decades hence there is no

evidence of decline and Tony Barber (pers. comm.) believes the centipede is still under recorded and may even be widespread along suitable coasts. Although it does not satisfy the IUCN D2 criterion for a Vulnerable species, it only just fails to meet the criterion and this would not change even if a few more locations were discovered. Therefore *H. submarina* should be considered Near Threatened.

**Threats**

No specific threats have been identified at the known locations but coastal sites are always at risk from disturbance arising from leisure activities and new developments connected with the leisure industry or shipping. Marine pollution events may prove damaging to populations of this intertidal centipede.

**Management and Conservation**

Pre-1990 *H. submarina* was collected from Wembury Point SSSI, Craig Ddu to Wharley Point Cliffs SSSI, and several SSSIs within what is now the Scilly Isles Complex SAC. No specific conservation actions are in place for *H. submarina*. Further surveys, potentially destructive of rocky coast habitat, in SW England and South Wales are recommened.

**Published sources**

Barber (2008a, 2009b), Barber & Keay (1988), Eason (1964), Elliot *et al.* (1990), Lewis (1962, 1981)

***LITHOBIUS CURTIPES***
**NATIONALLY SCARCE**
Curling lithobius
Order LITHOBIOMORPHA
Family LITHOBIIDAE

*Lithobius curtipes* C.L. Koch, 1847

**Identification**

A small (c.11mm) species having few antennal segments (c.20) when compared with most British *Lithobius* sp. but it can be very difficult to distinguish from the much more common *L. crassipes*. Microscopic examination of the rear leg of an adult male is required to establish the presence of a small, rear facing extension on the tibia of *L. curtipes*. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b). The BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**

There are scattered records of *L. curtipes* from across most of England, and Wales but it appears to be absent from Devon and Cornwall and from Scotland. *L. curtipes* is a widespread and common centipede in northern and central Europe although there are

no records from Ireland (Zapparoli, 2013). It occurs in Turkey and across central Asia into Siberia and is one of only a few centipedes to be found above the Arctic Circle (Zapparoli, 2003).

**Habitat and Ecology**

Voigtländer (2005) classified *L. curtipes* as a species of wet and humid habitats with high vegetation cover in Central Europe. Zulka (1992) had previously reported it as a typical member of the floodplain assemblage of the Rivers Morava and March in Austria but it was restricted to flooded forest and not present in grassland. Tajovský & Wytwer (2009) also noted a relationship with high soil humidity and high vegetation cover when *L. curtipes* was the only centipede recorded from all four wet alder stands they studied in NE Poland. However, in their proposed ecological classification of myriapods in the Czech Republic, Tuf & Tufová (2008) consider *L. curtipes* to be a eurytopic species. Data from British records (Barber & Keay, 1988) suggest that although *L. curtipes* has been collected from a range of habitats it has more specific requirements here than in the Czech Republic and never occurs in synanthropic sites. Most British records are from woodland, many from ancient woodland, but there is no evidence of especially high soil humidity at these sites and the centipede occurs in limestone grassland in Wales (Barber, 2009b).

**Status**

*L. curtipes* has been reported from only 23 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain. Although there may have been some under recording of *L. curtipes* due to confusion with *L. crassipes*, the problem is unlikely to have been so great as to change the rarity status of the species.

**Threats**

No specific threats to *L. curtipes* have been identified at the known locations but its ancient woodland habitat remains under threat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013). Further, the European information on the ecology of *L. curtipes* suggests that such activities leading to a loss of vegetation cover through tree felling and a reduction in soil humidity are the very changes to the habitat that are likely to have the greatest impact on the centipede. Another possible threat would arise from a change in conditions that allowed the common and currently largely synanthropic *L. microps* to increasingly move into woodland habitats. *L. microps* has been shown to be capable of replacing *L. curtipes* in centipede communities in Sweden (Andersson, 1983).

**Management and Conservation**

*L. curtipes* is known from several designated sites including SACs, SSSIs and NNRs. Based on current knowledge, no specific conservation actions, beyond protection of habitat, can be recommended for this species.

**Published sources**
Andersson (1983), Barber (2008a, 2009b), Barber & Keay (1988), DEFRA (2013), DEFRA & Forestry Commission (2005), Tajovský & Wytwer (2009), Tuf & Tufová (2008), Voigtländer (2005), Zapparoli (2003, 2013), Zulka (1992)

***LITHOBIUS LAPIDICOLA***
**NEAR THREATENED D2**
Sandy lithobius
Order LITHOBIOMORPHA
Family LITHOBIIDAE

*Lithobius lapidicola* Meinert, 1872
Previously known as *Lithobius pusillus* Latzel, 1880
A different species, *Lithobius borealis* Meinert, 1868, was listed as *Lithobius lapidicola* Meinert by Eason (1964) and has been known previously as *Lithobius lapidicola* Latzel, 1880

**Identification**
One of our smallest species (8-9mm), *L. lapidicola* requires microscopic examination for identification. The key characteristics can be variable allowing for confusion with other species and it is often the absence of features rather than their presence that is diagnostic (Barber, 1992a). Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
The only records of *L. lapidicola* from semi natural sites are in East Anglia and Kent. It was collected from coastal sites at Havergate Island RSPB reserve, Suffolk and Sandwich Bay, Kent (Barber, 1992a). More recent inland records are from Ipswich, Suffolk and near Thetford in the Suffolk breckland. Additionally it has been reported from glasshouses in Edinburgh (Rawcliffe, 1987), Abbotsbury Gardens, Dorset (Barber, 1996) and Bangor (Barber, 2011a). *L. lapidicola* is widespread in Europe from northern Mediterranean coasts (including Corsica, Sardinia and Sicily) to Sweden (Zapparoli, 2013) and has been reported in glasshouses e.g. in Germany (Decker *et al*., 2014).

**Habitat and Ecology**
All of the British specimens of *L. lapidicola*, excepting those from glasshouses, have been collected from free-draining soils in open habitats i.e. shingle, sand dune, upper saltmarsh, lowland heath or acid grassland. This contrasts with the situation in Europe where the centipede has been reported from woodland and scrub habitats (Dányi, 2008; Leśniewska *et al*., 2011; Novák & Dányi, 2010; Zapparoli, 2011a, b), from wetlands in Italy (Zapparoli, 2011b) and also from caves (Zapparoli, 2009). Voigtländer (2005) noted that some centipedes show such divergence in habitat

preferences with climatic zone even over relatively short distances e.g. within Germany.

**Status**

*L. lapidicola* was listed as RDBK Insufficiently Known by Bratton (1991). Further records of the centipede from new locations have been made in the intervening period (although the presence of the species at the original Sandwich Bay location has not been confirmed in the last ten years). Even so *L. lapidicola* has been recorded from only four semi-natural locations (plus three glasshouse records) since 1990 and might be considered to satisfy IUCN criteria for Vulnerable (VU D2) on the basis of this restricted number of locations but there is likely to be an element of under recording (Barber, 2009b) due to the difficulty of identifying the species. The two inland locations currently known are under threat from development projects and as a result of this a status of Near Threatened is considered to be appropriate for *L. lapidicola* in Britain.

**Threats**

The Ipswich site is almost certain to be lost as it is currently under development in part as a retail park with residential development proposed for the remaining area. A plan for holiday lodges on the site near Thetford is likely to leave some areas of suitable habitat intact but the total area will be reduced. There are no specific threats at Havergate Island or Sandwich Bay but sea level rise through isostatic release and climate change is a recognised problem for the east coast of England and threatens all coastal habitats where coastal squeeze is an issue.

**Management and Conservation**

Havergate Island is a RSPB reserve and part of the Orfordness-Havergate NNR that in turn lies within the Alde-Ore Estuary SSSI. The location at Sandwich Bay lies partly within the Nature Reserve owned jointly by Kent Wildlife Trust, National Trust and RSPB. The reserve is part of the Sandwich Bay and Hacklinge Marshes SSSI. Based on current knowledge, no specific conservation actions, beyond protection of habitat, can be recommended for this species.

**Published sources**

Barber (1992a, 1996, 2008a, 2009b, 2011a), Dányi (2008), Decker *et al*. (2014), Leśniewska *et al*. (2011), Novák & Dányi (2010), Rawcliffe (1987), Voigtländer (2005), Zapparoli (2003, 2009, 2011a, 2011b, 2013)

***LITHOBIUS MACILENTUS***
**NATIONALLY SCARCE**
Virgin lithobius
Order LITHOBIOMORPHA
Family LITHOBIIDAE

*Lithobius macilentus* L. Koch, 1862
Previously known as *Lithobius aulacopus* Latzel, 1880

**Identification**
*L. macilentus* is a small, chestnut species (c. 14mm). Careful examination of the shape of the plates on the back of the animal, the claw on the last leg and the underside of the head is required to distinguish it from several superficially species, especially the common *L. melanops*. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
There are scattered records of *L. macilentus* from England, Wales and southern Scotland. It is widespread across Europe but absent from Iberia and the Irish Republic (Zapparoli, 2013).

**Habitat and Ecology**
*L. macilentus* is characteristic of rural, semi-natural woodland, but has been reported from other habitats (Barber & Keay, 1988). These observations support those of Geoffroy & Etienne (2009) on the habitat of *L. macilentus* in France. According to Voigtländer (2005) the species shows no clear preferences for moist or dry habitats or for the level of vegetation cover. All British populations of the species appear to be parthogenetic as male specimens have never been collected; males are found elsewhere in Europe (Barber, 2009b).

**Status**
*L. macilentus* has been reported from only 59 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats to *L. macilentus* have been identified at the known locations but ancient woodland habitat remains under threat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013).

**Management and Conservation**
Some of the known sites are designated SACs, SSSIs and/or NNRs or are otherwise protected but *L. macilentus* does not appear in the site citations. Based on current knowledge, no specific conservation actions, beyond protection of habitat, can be

recommended for this species.

**Published sources**
Barber (2008a, 2009b), Barber & Keay (1988), Geoffroy & Etienne (2009), Voigtländer (2005), Zapparoli (2013)

***LITHOBIUS MUTICUS***
**NATIONALLY SCARCE**
Broad-headed lithobius
Order LITHOBIOMORPHA
Family LITHOBIIDAE

*Lithobius muticus* C.L. Koch, 1862

**Identification**
*L. muticus* is a small, almost black species (c. 14mm). Male specimens are distinguished by the unusually broad head but careful examination is required to distinguish females from similarly dark *L. calcaratus* as the broadening of the head is less extreme. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b). The BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**
*L. muticus* is mainly found in SE England but there are scattered records from Wales and north to Lancashire. Zapparoli (2003) describes the distribution of *L. muticus* as central European but it is absent from Scandinavia and the Baltic states (Zapparoli, 2013).

**Habitat and Ecology**
*L. muticus* is characteristic of semi-natural woodland, especially sweet chestnut, in SE England (Barber & Keay, 1988) although Gregory & Campbell (1996) report its collection from calcareous grasslands where these adjoin woodlands. These observations support those of Spelda (1999) that *L. muticus* inhabits the edge of woods, but not the interior and of Zapparoli (2003) that the species, although a forest dweller, is thermophilous. According to Voigtländer (2005) the species can be found in a range of habitats from moist grassland and forest through to dry grassland but is especially common in dry pine forest and thermophilic oak woods. The paper concludes that *L. muticus* should be characterised as an inhabitant of dry habitats and vegetation cover plays only a secondary role.

**Status**
*L. muticus* has been reported from only 29 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**
No specific threats to *L. muticus* have been identified at the known locations although one site, Penn Wood near Amersham, was threatened with being converted into a golf course before being purchased by the Woodland Trust in 1999. Ancient woodland habitat remains under threat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013). If Voigtländer is correct, it is the indirect impact of changes to drainage that is likely to be a more significant threat than the loss of tree cover.

**Management and Conservation**
Many of the known sites are designated SACs, SSSIs and/or NNRs or are otherwise protected. Based on current knowledge, no specific conservation actions, beyond protection of habitat, can be recommended for this species.

**Published sources**
Barber (2008a, 2009b), Barber & Keay (1988), Gregory & Campbell (1996), Spelda (1999), Voigtländer (2005), Zapparoli (2003, 2013)

***LITHOBIUS PICEUS***
**NATIONALLY RARE**
Long-horned lithobius
Order LITHOBIOMORPHA
Family LITHOBIIDAE

*Lithobius piceus* L. Koch, 1882
Sometimes referred to as *Lithobius quadridentatus* Menge, 1851

**Identification**
*L. piceus* is a mid-sized chestnut-brown centipede, superficially similar to the very common *L. forficatus* but with longer antennae. However, a range of other microscopic characters in combination, e.g. the arrangement of spines and the presence of a double claw on the rear most leg, need to be checked to confirm identification. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
*L. piceus* is largely restricted to Surrey, Sussex and Hampshire (Barber, 2009b) but has been reported from south Wales (Harper, 2002). The species shows a southern European distribution (Zapparoli, 2003) and appears to be on the very northern limits of its range in Britain.

**Habitat and Ecology**
*L. piceus* is usually found in semi-natural woodland and scrub in Britain (Barber &

Keay, 1988; Harper, 2002) but has been reported also from grassland and heath. Voigtländer (2005) considers *L. piceus* to be eurytopic in central Europe with no clear habitat preferences.

**Status**

*L. piceus* was reported from 14 hectads in 1972 as a result of intensive survey across Surrey, Sussex and Hampshire (Barber, 1972). It has been reported from only 8 hectads since 1990 but this reflects a reduced level of recording rather than a true decline. Although it cannot be considered threatened, *L. piceus* does satisfy the criterion for being considered Nationally Rare in Britain.

**Threats**

No specific threats to *L. piceus* have been identified at the known locations although there are continuing threats to woodland habitat in Britain, both directly from the impact of development in southern England and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013).

**Management and Conservation**

Most of the known sites are designated e.g. Headley Heath SSSI, The Mens SAC and SSSI or at least Nature Reserves owned by the Forestry Commission, National Trust, Surrey Wildlife Trust or Surrey Wildlife Trust. There has been little recording in central southern England in recent years but the species was collected quite widely here in the 1960s. A re-survey of as many of these historical sites as possible would be beneficial.

**Published sources**

Barber (1972, 2008a, 2009b), Barber & Keay (1988), Harper (2002), Voigtländer (2005), (Zapparoli, 2003)

***LITHOBIUS PILICORNIS***
**NATIONALLY SCARCE**
Greater lithobius
Order LITHOBIOMORPHA
Family LITHOBIIDAE

*Lithobius pilicornis* Newport, 1844

**Identification**

*L. pilicornis* is superficially similar to the very common *L. forficatus* but even larger (35mm) and has comparatively long terminal legs. However, a range of microscopic characters in combination, e.g. the arrangement of spines on the rear most legs, need to be checked to confirm identification. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**

*L. pilicornis* is most frequently encountered in SW England but there are scattered records from across southern England and South Wales. There are also isolated records further north to Wakefield (Barber & Keay, 1988) and Edinburgh (Barber, pers. comm.). Zapparoli (2003) describes its distribution as Western European stretching from Britain south along the Atlantic coasts to North Africa but also inland to the Alps. It can also be found in the Mediterranean (Corsica and Sardinia) and on the Canary Islands and Madeira and has been introduced to Ireland (Zapparoli, 2011a) A single record from Amsterdam is also considered an introduction (Berg, 1999).

**Habitat and Ecology**

Records of *L. pilicornis* from semi-natural woodland and grassland are mostly restricted to Devon and Cornwall. In some woods in West Cornwall it is the only large *Lithobius* present, possibly having out competed the slightly smaller *L. forficatus* and *L. variegatus* (Barber, pers. comm.). Elsewhere records are mainly synanthropic and the sites in northern England are exclusively urban (e.g Keay, 1987; Richards, 1997). Zapparoli (2011a) regards *L. pilicornis* as a woodland species based on Sardinian records from holm oak forest, lowland wet alder forest and montane alder scrub but notes its occurrence also in high altitude caves.

**Status**

*L. pilicornis* has been reported from only 31 hectads since 1990 thus satisfying the criterion for being considered Nationally Scarce in Britain.

**Threats**

No specific threats to *L. pilicornis* have been identified at the known locations although there are continuing threats to woodland habitat in SW Britain, both directly from the impact of development in southern England and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013).

**Management and Conservation**

*L. pilicornis* occurs within several designated sites but is not recognized in the citations. Based on current knowledge, no specific conservation actions, beyond protection of semi-natural woodland habitat in SW England, can be recommended for this species.

**Published sources**

Barber (2008a, 2009b), Barber & Keay (1988), Berg (1999), DEFRA (2013), DEFRA & Forestry Commission (2005), Keay (1987), Richards (1997), Zapparoli (2003, 2011a)

***LITHOBIUS TENEBROSUS***
**DATA DEFICIENT**
Scarce lithobius
Order LITHOBIOMORPHA
Family LITHOBIIDAE

*Lithobius tenebrosus* Meinert, 1862
Previously known as *Lithobius nigrifrons* Latzel & Haase, 1880

**Identification**
*L. tenebrosus* is a small species (c. 14mm), similar in appearance to other small *Lithobius* centipedes, especially *L. melanops*. It cannot easily be distinguished from these other species without careful examination under a microscope. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
Older records of *L. tenebrosus* from Durham (Bagnall, 1913) and Cornwall (Turk, 1945) are not supported by specimens. The only confirmed British record is from Constitution Hill, Aberystwyth in 1988 (Keay, 1989). It has a widespread distribution across central Europe (Zapparoli, 2003) and there is no obvious reason for it having a restricted distribution in Britain but it is considered rare in France (Geoffroy & Iorio, 2009). Iorio (2014) reports it from just two French départements.

**Habitat and Ecology**
The early specimens of *L. tenebrosus* were all reported as being taken in 'a field' (Bagnall, 1913; Turk, 1945). The specimen from Aberystwyth was collected from a rock crevice in a sea cliff (Keay, 1989). Despite the most recent record being coastal this is not a maritime species. Zapparoli (2003) linked it with woodland, mainly deciduous but also sometimes coniferous, and Voigtländer (2005) classified it as a species of wet and humid habitats with high vegetation cover. Tuf & Tufová (2008) considered it to be adaptable to a range of artificial habitats also.

**Status**
*L. tenebrosus* was listed as RDBK Insufficiently Known by Bratton (1991). It has not been reported from Britain in the period since 1990, the species may be regionally extinct. However, it may be under recorded due to confusion with other species. More data are required before the status of the species can be assessed fully.

**Threats**
Unknown

**Management and Conservation**
Constitution Hill is a geological SSSI. No specific conservation actions are in place for this species and none can be recommended without further knowledge of the

ecology of the centipede in Britain.

**Published sources**
Bagnall (1913), Barber (2008a, 2009b), Bratton (1991), Geoffroy & Iorio (2009), Iorio (2014), Keay (1989), Tuf & Tufová (2008), Turk (1945), Voigtländer (2005), Zapparoli (2003)

***LITHOBIUS TRICUSPIS***
**NATIONALLY RARE**
Three-spined lithobius
Order LITHOBIOMORPHA
Family LITHOBIIDAE

*Lithobius tricuspis* Meinert, 1872

**Identification**
*L. tricuspis* is a small species (c. 14mm), similar in appearance to other small *Lithobius* centipedes, especially *L. melanops*. It cannot be distinguished from these other species without careful examination under a microscope. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b). The BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**
Most British records of *L. tricuspis* are from South Devon but there are isolated records from the Isle of Wight (Barber & Keay, 1988) and most recently from Dorset, Somerset and two sites in South Wales. The centipede has a widespread distribution across central Europe from Spain to Denmark and from Britain to Ukraine (Zapparoli, 2011b).

**Habitat and Ecology**
Tuf & Tufová (2008) consider *L. tricuspis* to be a relic species, stenotopic and intolerant of human disturbance in the Czech Republic but in Devon it is recorded from synanthropic as well as various semi-natural habitats. The synanthropic sites are not in urban areas. The Somerset record was from a cave. Zapparoli (2003) describes it as one of a group of species associated mainly with woodland but also found in peat bogs (Zapparoli, 2011b) and able to colonise a range of open semi-natural and urban habitats. It is found mainly in forests in France (Geoffroy & Iorio, 2009) and occurs from low altitudes up to the alpine level at 2000m asl in Bavaria (Spelda, 2005).

**Status**
*L. tricuspis* has been reported from only 9 hectads since 1990 thus satisfying the criterion for being considered Nationally Rare in Britain.

**Threats**
*L. tricuspis* has been reported from Hembury Woods SSSI within the South Datmoor Woods SAC and the Prawle Point & Start Point SSSI within the South Devon Shore Dock SAC. No specific threats to *L. tricuspis* have been identified at the known locations. The species does appear to be tolerant of human disturbance in Britain but increasing development pressure is likely to result in threats to some habitats.

**Management and Conservation**
No specific conservation actions are in place for this species.

**Published sources**
Barber (2008a, 2009b), Barber & Keay (1988), Geoffroy & Iorio (2009), Spelda (2005), Tuf & Tufová (2008), Zapparoli (2003, 2011b)

***NOTHOGEOPHILUS TURKI***
**ENDANGERED B2ab(i)(ii)(iv)**
Turk's Earth-centipede
Order GEOPHILOMORPHA
Family GEOPHILIDAE

*Nothogeophilus turki* Lewis, Jones & Keay, 1988

**Identification**
*N. turki* is a small (<12mm) pale centipede with 37-39 leg pairs. Lewis, Jones & Keay (1988) provide a full description. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b).

**Distribution**
*N. turki* is recorded only from the Isles of Scilly and the Isle of Wight although there was an unconfirmed sighting from Cornwall in the mid 1990s (Tony Barber, pers. comm.). On current evidence it appears to be endemic to the British Isles.

**Habitat and Ecology**
*N. turki* appears to be a coastal species but it has been collected up to 500m inland at one location on St Marys, Isles of Scilly where it occurred in deciduous woodland along the banks of a stream. Coastal sites have included estuaries and soft rock cliffs. It has been found in soil and leaf litter and under stones (Lewis *et al.*, 1988).

**Status**
Intensive survey work in recent years (Lee, 2011; 2012b) has failed to find the centipede on the Isle of Wight. There have been no searches on the Isles of Scilly in recent years but there is no reason to suppose that the species no longer survives there. However, the loss of the colonies on the Isle of Wight represents a significant

decline in area of occupancy. The IUCN criteria are satisfied on the basis of a very restricted area of occupancy as the species is believed to exist at less than 5 locations and there have been significant declines in area of occupancy and the number of locations between the two recording periods despite the intensity of recording effort.
*N. turki* is regarded as Endangered as it satisfies the IUCN criteria B2ab(i)(ii)(iv). It has a very restricted area of occupancy, much less than 200km$^2$, assuming the species survives in its original sites on St Marys and Tresco. Even should the unconfirmed record from mainland Cornwall prove valid the area of occupancy would still be far less than 500km$^2$. It is believed to survive at a maximum of three locations, including the mainland site thus satisfying criterion B2a. The loss of the populations from the Isle of Wight mean that the extent of occurrence, area of occupancy and the number of locations have all declined thus satisfying criteria b(i), b(ii) and b(iv).

**Threats**
One site at Newport Docks, Isle of Wight was developed as a car park. As a coastal species the habitat of *N. turki* is under threat from development and marine pollution events at all locations. Human disturbance resulting from leisure activities may damage habitats also.

**Management and Conservation**
The type locality, Higher Moors and Porth Hellick Pool on St Marys, Isles of Scilly is a SSSI and along with Tresco is part of the Isles of Scilly complex SAC. A resurvey of St Marys and Tresco is required urgently to establish the status of the species there. If details of the unconfirmed record from Cornwall can be located further field survey should be organized. Once populations of the species are located research on ecology and habitat preference becomes feasible.

**Published sources**
Barber (2008, 2009), Lee (2011, 2012b), Lewis, Jones & Keay (1988)

***PACHYMERIUM FERRUGINEUM***
**DATA DEFICIENT**
Red-headed centipede
Order GEOPHILOMORPHA
Family GEOPHILIDAE

*Pachymerium ferrugineum* (C.L. Koch, 1835)

**Identification**
*P. ferrugineum* is a medium sized to large (<50mm) yellowish-orange centipede with a darker, red head and 43-47 leg pairs. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b). The BMIG website (www.bmig.org.uk) provides colour photographs of the species.

**Distribution**

Known from a small number of coastal locations in East Anglia and the southern counties of England. Although there are few records from Britain, *P. ferrugineum* is extremely widespread in Europe, Asia Minor and North Africa and has been introduced throughout the Americas, to Japan and to many oceanic islands (Barber, 2009b). It may be on the extreme western edge of its natural range in Britain (Barber, 2011b). In southern Norway the species is more frequent on much of the east coast and replaced by *Strigamia maritima*, a common littoral centipede in Britain, on the west coast except for in overlap zones in the north and south (Meidell, 1979).

**Habitat and Ecology**

In Britain *P. ferrugineum* appears to be a strictly coastal species, most usually found in shingle. It has been found in unconsolidated shingle below drift material as well as in sparsely vegetated shingle (Barber & Keay, 1988). It is very tolerant of immersion in sea water (Schubart, 1929; Suomalainen, 1939) and Barber (2011b) suggests 'oceanic rafting' as a method of colonizing new coastal locations. Outside of Britain it is clearly not restricted to the seashore as it occurs in landlocked countries. In France it still tends to favour the shore but does occur more widely (Geoffroy & Iorio, 2009). In southern Germany it appears to be restricted by competition to dry meadows at one extreme and bogs at the other (Spelda, 2005). In Scandinavia it occurs in a wider range of habitats (Palmén & Rantala, 1954), presumably due to a reduced number of competitors.

**Status**

Bratton (1991) excluded *P. ferrugineum* from RDB status on the basis of it being under recorded due to the difficulty of collecting small centipedes from coastal shingle and rock crevices. Although further coastal populations have been identified since 1990 and the centipede is conspicuous and unlikely to be confused with other species, it is probably still under recorded. Based on current knowledge of its distribution, the population in Britain is not of global importance. More survey data are required before the status of the species in Britain can be assessed fully.

**Threats**

There are no specific threats known to affect the locations where *P. ferrugineum* has been recorded but coastal sites are always at risk from human disturbance, developments and marine pollution events. Vegetated shingle habitats are especially vulnerable to extreme weather events e.g. storm surges and to disturbance from leisure activities.

**Management and Conservation**

Originally recorded from the Seaford to Beachy Head SSSI. Corbet (1989) recorded the centipede from Walberswick NNR, part of the Minsmere to Walberswick Heaths and Marshes SSSI and the same year it was found at Newtown Harbour SSSI / NNR. It was found within the Higher Moors and Porth Hellick Pool (St Mary's) SSSI in

1990. Most recently it was collected from the Essex Wildlife Trust reserve at Colne Point. No specific conservation actions are in place for this species. Further surveys are required in order to fully assess the status of the centipede.

**Published sources**
Barber (2008a, 2009b, 2011b), Barber & Keay (1988), Bratton (1991), Corbet (1989), Geoffroy & Iorio (2009), Palmén & Rantala (1954), Schubart (1929), Spelda (2005), Suomalainen (1939)

***SCHENDYLA PEYERIMHOFFI***
**NEAR THREATENED A4c**
Lesser shore schendyla
Order GEOPHILOMORPHA
Family SCHENDYLIDAE

*Schendyla peyerimhoffi* Brolemann & Ribaut, 1911

**Identification**
*S. peyerimhoffi* is a smallish (c.20mm) very pale centipede very similar in appearance to the common species *S. nemorensis*. Careful microscopic examination of the last legs and inside edge of poison claw is required to distinguish the two species. Keyed, with brief descriptions and diagrams, by Barber (2008a, 2009b). More complete account and further diagrams in Jones (1998).

**Distribution**
*S. peyerimhoffi* has been collected from Sussex along the coasts of southern and SW England (including the Isles of Scilly) and Wales (Jones, 1998). It is known from a scattering of records along the Atlantic coasts of Europe to North Africa and the Canary Isles.

**Habitat and Ecology**
*S. peyerimhoffi* is associated with the supralittoral zone of rocky shores, shingle beaches and estuarine mud in Britain. It is found in rock crevices, on lichen covered stones and under stones on mud. It has been reported from inland locations in Algeria and Portugal (Barber, 2011b).

**Status**
*S. peyerimhoffi* has been recorded from only 4 hectads since 1990. It was recorded from 12 different hectads in the previous two decades suggesting this species has undergone significant decline in area of occupancy and might be assessed as Endangered under criterion A4c. However, the animal is almost certainly under recorded (Barber, 2009b) due to the difficulty of collecting small centipedes from coastal mud and rock crevices. For this reason Near Threatened is considered to be a

more appropriate status.

**Threats**

There are no specific threats known to affect the locations where *S. peyerimhoffi* has been recorded but coastal sites are always at risk from human disturbance, developments and marine pollution events. Shingle formations are especially vulnerable to extreme weather events e.g. storm surges.

**Management and Conservation**

Pre-1990 records included Seaford to Beachy Head SSSI, Erme Estuary SSSI, Exe Estuary SSSI and several SSSIs within the Isles of Scilly. No specific conservation actions are in place for this species. Further targeted survey, of pre 1990 locations at which it has not been recorded since, is required.

**Published sources**

Barber (2008a, 2009b, 2011b), Jones (1998)

## 14.3 ISOPODA (WOODLICE)

***ARMADILLIDIUM ALBUM***
**NATIONALLY SCARCE**
Sand Pill Woodlouse
Order ISOPODA
Family ARMADILLIDIIDAE

*Armadillidium album* Dollfus, 1887

### Identification

A small, pale pill woodlouse, *A. album* is easily confused with pale, juvenile *A. vulgare*. As the two species may be associated, it is necessary to use a hand lens or microscope to observe the characteristic minute spines covering the surface of *A. album*. Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993). BMIG website (www.bmig.org.uk) provides several colour photographs of the species.

### Distribution

*A. album* occurs sporadically around the British coastline as far north as the Scottish borders with a preponderance of sites along the west coasts of England and Wales. Surprisingly it is scarce in the extensive dune systems of eastern England. It is a European species known at several sites on the east coast of Ireland, along the Atlantic coasts south from the Netherlands and in the Mediterranean east to Greece.

### Habitat and Ecology

*A. album* shows a strong association with undisturbed dune systems where wind and tides have minimal impact (Harding & Sutton, 1985). Gregory (2009) notes a preference for a narrow range of sand grain sizes. It is usually found under storm strandline debris, sometimes in large numbers but may also occur in sand under dune sward and rarely in saltmarsh.

### Status

Although widely distributed, *A. album* has been reported from only 28 hectads since 1990 and less than 40 hectads in total. Targeted surveys of the east coast dune systems have failed to produce the expected records. On the basis of this restricted area of occupancy *A. album* satisfies the criterion for being considered Nationally Scarce in Britain.

### Threats

Marine pollution generally as well as specific pollution events (e.g. oil spills, chemical spills) could potentially threaten the survival of individual populations. Human disturbance of sand dunes and salt marsh, including coastal protection, heavy

tourist pressure, excessive tidying of strandline debris, commercial sand extraction, marina and port developments, new golf courses and other coastal development projects could pose significant threats. Chater (1996a) considered the population at Ynys-las Dunes NNR was unlikely to be threatened by heavy tourist pressure as this was mainly restricted to the foreshore. Extreme weather events have the potential to destroy large proportions of existing habitat in a very short time.

**Management and Conservation**

A number of the sites where *A. album* is found are SACs, NNRs and SSSIs. No specific conservation actions are considered necessary for this species at the present time.

**Published sources**

Chater (1996a), Gregory (2009), Harding & Sutton (1985), Hopkin (1991), Oliver & Meechan (1993)

***ARMADILLIDIUM PICTUM***

**NATIONALLY SCARCE**

Pill Woodlouse

Order ISOPODA

Family ARMADILLIDIIDAE

*Armadillidium pictum* Brandt, 1833

**Identification**

*A. pictum* is a pill woodlouse that shares its distinctive mottling with *A. pulchellum* and even some specimens of *A. vulgare* leading to frequent misidentification. Females of *A. pictum* and *A. pulchellum* are difficult to separate. Keyed, with brief descriptions and diagrams, by Hopkin (1991). The key in Oliver & Meechan (1993) contains errors and reference should be made to Gregory & Richards (2008). The shape of the first pereonite is a difficult distinguishing character to use as it has to be viewed from exactly the correct angle (Steve Gregory, pers. comm.). The BMIG website (www.bmig.org.uk) provides colour images of the species.

**Distribution**

*A. pictum* is a north-western species in Britain known from strongholds in the English Lake District, Yorkshire Dales (Richardson, 1989) and Peak District (Alexander, 2010; Richards, 2004) with more isolated records from Charnwood Forest (Daws, 1996) and the border counties of Breconshire (Harding, 2006), Gloucestershire (Alexander, 1995), Herefordshire (Gregory, 2008) and Radnorshire (Chater, 1988).

**Habitat and Ecology**

*A. pictum* appears to be restricted to semi-natural habitats including ancient deciduous

woodland, unimproved grassland and limestone pavement (Gregory, 2009). In Europe it is considered a species of natural woodland (Berg *et al.*, 2008; Vandel, 1962). It occurs on a range of rock types showing no preference for acidic or calcareous geology but Alexander (2010) believes that free-draining soils are important for the species. Within these habitats its occurrence can be patchy (Gregory, 2008) and weather conditions, especially humidity, may be important in determining whether the animal is active at the surface or not (Alexander, 2010; Chater, 1988). In addition to the typical micro-sites occupied by woodlice at ground level *A. pictum* will climb vegetation and has been beaten from shrubs (Alexander, 2010; Harding & Sutton, 1985) and found under loose bark (Alexander, 1995; Chater, 1988) and within rot holes high on mature trees (Chater, 1988).

**Status**

An increased understanding of habitat requirements and improved knowledge of identification characters have resulted in a significant increase in records from a wider area of the country since the last assessment of status when *A. pictum* was listed as RDB3 (Bratton, 1991). Although only reported from 14 hectads since 1990 it is probably under-recorded (Gregory, 2009) and is likely to occur in further locations both within its current range and possibly in SW England or SW Scotland also. On this basis Nationally Scarce seems to be the most appropriate status.

**Threats**

Soil compaction and disturbance from off-road vehicles or forestry activities may be detrimental through its impact on soil drainage. However, Alexander (2010) suggests that allowing rhododendron to become dominant on a site may be more of a problem for the woodlouse than the forestry operations required to remove the scrub. Bratton (1991) identified removal of rock from limestone pavement for ornamental use as a potential threat.

**Management and Conservation**

A number of the sites where *A. pictum* is found are designated SACs, NNRs and/or SSSIs. Unusually the woodlouse is mentioned in the citation for Bach Howey Gorge SSSI. No specific conservation actions are in place for this species.

**Published sources**

Alexander (1995 & 2010), Berg *et al.* (2008), Bratton (1991), Chater (1988), Daws (1996), Gregory (2008 & 2009), Gregory & Richards (2008), Harding & Sutton (1985), Hopkin (1991), Oliver & Meechan (1993), Richards (2004), Richardson (1989), Vandel (1962)

## *BUDDELUNDIELLA* CATARACTAE
## NATIONALLY RARE

Woodlouse
Order ISOPODA
Family TRICHONISCIDAE

*Buddelundiella cataractae* Verhoeff, 1930

### Identification

Although very small and resembling a sand grain, *B. cataractae* is readily identified once it unrolls and begins moving. Re-described from British material by Oliver (1983). Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993). BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

### Distribution

The stronghold for *B. cataractae* is in South Wales where, since its discovery in Cardiff (Oliver, 1983), it has been collected from four other coastal sites, most recently from Mumbles Head and Llanelli (Morgan, 2011). Other coastal records are from Snettisham, Norfolk (Irwin, 1982), Eastbourne and Plymouth (Gregory, 2009). There are inland records from South Wales (Harper, 2004c & 2010b) and Oxford (Gregory & Campbell, 1995). Records of *B. cataractae* in Europe are widely and even more thinly scattered than in Britain.

### Habitat and Ecology

*B. cataractae* is known from both synanthropic and semi-natural sites in coastal and inland locations (Gregory, 2009). It has probably been introduced to the inland semi-natural site at Clydach Gorge (Harper, 2004c). The animal seems to be associated with disturbed areas where the substrate is free draining but rich in damp organic material. It has been found in these conditions, at times some distance below the surface, in coastal shingle as well as on a boulder beach, in riverside gravels and in a clay bank above a shingle beach (Gregory, 2009).

### Status

Since the first records in 1981, *B. cataractae* has been reported from only 9 hectads in total. As the species was then collected in East Anglia, Harding & Sutton (1985) suggested that other coastal locations might be discovered and Gregory (2009) repeats this view noting that its subterranean habits and small size likely mean that it remains under recorded. However, despite increased awareness of the species amongst BMIG recorders and a concentration of efforts on coastal sites in recent years, *B. cataractae* remains as elusive here as elsewhere in Europe and on the basis of its restricted area of occupancy it satisfies the criterion for being considered Nationally Rare in Britain.

**Threats**
Marine pollution generally as well as coastal development projects may directly threaten the survival of some populations. A low level of human or natural disturbance seems to characterise many of the known *B. cataractae* sites and visitor pressure, especially on shingle beaches, is a relatively manageable threat. Extreme weather events causing rapid coastal erosion are a significant threat.

**Management and Conservation**
*B. cataractae* is found in several designated SACs, NNRs and/or SSSIs but the woodlouse is not mentioned in the citations. No specific conservation actions are in place for this species. It is difficult to know what could be done, other than general habitat protection, without further knowledge of the ecology of the species.

**Published sources**
Gregory (2009), Gregory & Campbell (1995), Harding & Sutton (1985), Harper (2004c, 2010b), Hopkin (1991), Irwin (1982), Morgan (2011), Oliver (1983), Oliver & Meechan (1993)

***HALOPHILOSCIA COUCHII***
**NATIONALLY SCARCE**
Woodlouse
Order ISOPODA
Family HALOPHILOSCIIDAE

*Halophiloscia couchii* (Kinahan, 1858)

**Identification**
*H. couchii* bears a superficial resemblance to immature *Ligia oceanica*, with which it often occurs, but the stepped outline is more reminiscent of *Philoscia muscorum*. Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993). BMIG website (www.bmig.org.uk) provides several colour photographs of the species.

**Distribution**
*H. couchii* occurs along the south and west coasts of England and Wales from Ramsgate, Kent to Anglesey with an outlying population at St Bees Head, Cumbria (Gregory, 2009). In Europe it has a very widespread distribution extending south from Britain along the Atlantic coast, around the Mediterranean Sea and into the Black Sea. It is also found down the coast of West Africa as far as Senegal (Schmalfuss, 2004).

**Habitat and Ecology**
*H. couchii* is restricted to the coast where it is associated with unvegetated rocky cliffs, boulder beaches or shingle beaches (Gregory, 2009). A record from 100m

inland on a boulder beach exposed to sea spray (Daws, 1993) is very unusual as it is rarely found far above the supralittoral zone (Gregory, 2009). By day it occupies dark and humid microsites in rock crevices, under boulders and in the interstitial spaces of unvegetated shingle.

**Status**

*H. couchii* is probably under recorded due to the inaccessible microsites it occupies by day. However, given that St Bees Head is the most northerly known locality in the world and the nature of the East Anglian coast, there are unlikely to be many undiscovered populations outside of the current range of the species. Although widely distributed, it been recorded from just 29 hectads since 1990 and on the basis of this restricted area of occupancy it satisfies the criterion for being considered Nationally Scarce in Britain.

**Threats**

Marine pollution generally as well as specific events such as oil spills could potentially threaten the survival of individual populations. Also coastal protection, commercial shingle extraction, port developments and other coastal development projects could pose significant threats. Extreme weather events could threaten populations through the erosion of large areas of habitat in a very short time.

**Management and Conservation**

A number of the sites where *H. couchii* is found are SACs, NNRs and SSSIs. No specific conservation actions are considered necessary for this species at the present time.

**Published sources**

Daws (1993), Gregory (2009), Hopkin (1991), Oliver & Meechan (1993), Schmalfuss (2004)

***HAPLOPHTHALMUS MONTIVAGUS***
**NATIONALLY SCARCE**
Southern Ridgeback Woodlouse
Order ISOPODA
Family TRICHONISCIDAE

*Haplophthalmus montivagus* Verhoeff, 1941

Not recognised as a part of the British fauna until 1987 when a reference collection of *H. mengii* was re-examined (Hopkin & Roberts, 1987).

**Identification**

A small, white woodlouse with longitudinal rows of tubercules characteristic of the genus. However, microscopic examination of the final leg of males is necessary to

separate *H. montivagus* from *H. mengii* and females cannot be separated at present. Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993). BMIG website (www.bmig.org.uk) provides a colour photograph of the whole animal and a photograph and diagram of the characteristic spines on the seventh leg of the male of this species.

**Distribution**

*H. montivagus* has strongholds on the limestone and chalk of SE England and South Wales but was recently discovered in Devon (Gregory, 2009). A record from Haddon Hall, Derbyshire is almost certainly an introduction (Harper, 2004a). This is a widespread species across Europe known from France, Switzerland, Germany, Italy, Austria, Hungary and Poland (Schmalfuss, 2004).

**Habitat and Ecology**

Typically *H. montivagus* is associated with ancient deciduous woodlands on friable, calcareous soils but sometimes is found in gardens and other synanthropic sites (Gregory, 2009). Hopkin & Roberts (1987) believed it inhabited wetter woodland than *H. mengii*. The presence of a woodland canopy may be important in maintaining humidity on free draining soils but does not explain the link with ancient woodland. This is more suggestive of a species intolerant of disturbance.

**Status**

Although *H. montivagus* has been reported from only 10 hectads since 1990, its true area of occupancy is probably less restricted as some degree of under-recording of the species is suspected (Gregory, 2009). However, its distribution appears to be patchy and it is replaced by the much more widespread *H. mengii* in some apparently suitable habitat (Gregory & Campbell, 1995). The combination of these two observations would suggest that *H. montivagus* should be considered Nationally Scarce in Britain.

**Threats**

The ancient woodland habitat of *H. montivagus* remains under threat, both directly from the impact of development and indirectly through changes to drainage (DEFRA & Forestry Commission, 2005; DEFRA, 2013). Government policy regarding increases in infrastructure and housing developments enhances the risk that populations in SE England will be lost.

**Management and Conservation**

*H. montivagus* occurs in a number of designated sites but the woodlouse is not recognized in the citations. Specialist survey is necessary to determine the extent of occurrence of the species and to elucidate those aspects of its habitat that are most important to survival.

**Published sources**

DEFRA (2013), DEFRA & Forestry Commission (2005), Gregory (2009), Gregory &

Campbell (1995), Harper (2004a), Hopkin (1991), Hopkin & Roberts (1987), Oliver & Meechan (1993), Schmalfuss (2004)

***METATRICHONISCOIDES CELTICUS***
**VULNERABLE D2**
Celtic Woodlouse
Order ISOPODA
Family TRICHONISCIDAE

*Metatrichoniscoides celticus* Oliver & Trew, 1981

**Identification**
A very small, white species lacking eyes. Reliable separation from *M. leydigii* and from preserved specimens of the species of *Trichoniscoides* requires microscopic examination of male sexual structures. A full description is given by Oliver & Trew (1981) and summarized by Harding & Sutton (1985). Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993).

**Distribution**
All confirmed records of *M. celticus* are from South Wales and on current evidence it appears to be endemic to the British Isles. Putative records from St Bees Head, Cumberland (Hopkin, 1987) and the Giant's Causeway, Antrim are of females only and may refer to other species (Gregory, 2009).

**Habitat and Ecology**
*M. celticus* is primarily a coastal animal found just above the supralittoral zone on rocky, calcareous shores. It is usually found under stones deeply embedded in the damp, humus-rich soil of sparsely vegetated erosion banks where it occurs in association with other Trichoniscid woodlice. However, *M. celticus* has been recorded from a disused limestone quarry 7km inland and at an altitude of 170m. Here the animals were in damp, stony soil. A suspected association with high soil humidity is likely to result in animals moving deeper into the soil in dry conditions (Harding & Sutton, 1985).

**Status**
*M. celticus* was first described on the basis of specimens collected from seven sites in three hectads between Ogmore-by-Sea and St Donat's in Glamorgan in 1979 (Oliver & Trew, 1981). Arthur Chater subsequently found the species 50km to the west in Crwbin, Carmarthen (Chater, 1986b) but it has not been seen there in the period since 1990. Bratton (1991) assessed it as Insufficiently Known (RDBK) and noted that repeated visits to a site are necessary to provide reliable evidence of presence/absence. Despite intensive recording along the southern Welsh coast (and around the putative Cumbrian site and apparently suitable sites in SW England), the

species has been recorded from just three localities since 1990. In its semi-natural coastal habitat, the species is potentially vulnerable to a marine pollution event that could cause the species to become critically endangered within a short time. Thus the IUCN criteria for Vulnerable D2 are satisfied on the basis of its presence in three localities and its vulnerability to stochastic events.

**Threats**

Marine pollution generally as well as specific pollution events (e.g. oil spills, chemical spills) could potentially threaten the survival of the population. Human disturbance from coastal protection and development projects pose other potentially serious threats. Although some degree of coastal erosion is essential in maintaining habitat, extreme weather events have the potential to destroy large proportions of existing habitat in a very short time.

**Management and Conservation**

*M. celticus* was recorded from Dunraven Bay SAC, Merthyr Mawr SSSI and Southerndown Coast SSSI near Ogmore-by-Sea, Ewenny and Pant Quarries SSSI and Coeddyd Capel Dyddgen SSSI (Crwbin) before 1990. No specific conservation actions are in place for this species. Investigation of further suitable Continental habitat is required to assess the international importance of the Welsh population of *M. celticus*. This should be combined with taxonomic studies of other *Metatrichoniscoides* species to confirm that *M. celticus* has not already been recorded under another name. Annual monitoring at all of its previously known locations would allow gathering of important autecological data including information on life history, seasonal movements within the soil profile and fluctuations in population size and the subsequent development of a more effective monitoring porotocol.

**Published sources**

Bratton (1991), Chater (1986b), Gregory (2009), Harding & Sutton (1985), Hopkin (1987 & 1991), Oliver & Meechan (1993), Oliver & Trew (1981)

***METATRICHONISCOIDES LEYDIGII***

**DATA DEFFICIENT**

Woodlouse

Order ISOPODA

Family TRICHONISCIDAE

*Metatrichoniscoides leydigii* (Weber, 1880)

**Identification**

A very small, white species lacking eyes. Reliable separation from *M. celticus* and from preserved specimens of the species of *Trichoniscoides* requires microscopic examination of male sexual structures. Keyed, with brief descriptions and diagrams,

by Hopkin (1991) and Oliver & Meechan (1993). Gregory (2012) gives further diagrams of male sexual structures.

**Distribution**

*M. leydigii* was first recorded in Britain from Oxford in 1989 (Gregory & Campbell, 1995). No further sites were discovered until it was found at Abbey Mead Lakes near Snodland, Kent in 2011 (Gregory, 2012). The species is considered native only to the coastal regions of Belgium, western France, western Germany and the Netherlands (Schmalfuss, 2004).

**Habitat and Ecology**

The Oxford site was a garden centre (where *Buddelundiella cataractae* also occurred) and has now been redeveloped for housing (Gregory, 2009). Abbey Mead Lakes lies on the flood plain of the River Medway and includes a number of semi-natural habitats as well as flooded gravel pits. *M. leydigii* occurred in reedbed subject to occasional tidal flooding (Gregory, 2012). The species was associated with peaty soil at both locations. This habitat (and associated species assemblage) in Kent is very similar to that reported for the species in The Netherlands (Berg *et al.*, 2008).

**Status**

Undoubtedly an accidental introduction in Oxford (Gregory, 2009), *M. leydigii* was listed on the Non-native Species Register (https://secure.fera.defra.gov.uk/nonnativespecies/) prior to its discovery in Kent. Based on the habitat similarities between Abbey Mead Lakes and sites in the Netherlands, Gregory (2012) argues that the species is probably native, at least in SE England, and suggests that there may be other overlooked populations in eastern Britain. Without data from further survey its status in Britain is uncertain.

**Threats**

Difficult to assess until its extent of occurrence is established. Assuming that *M. leydigii* occurs in further sites where the habitat is similar to that in the Netherlands then habitat damage / loss from work on sea defences and flood defences is a potentially significant threat.

**Management and Conservation**

*M. leydigii* was recorded from Abbey Mead Lakes, part of the Holborough to Burnham Marshes SSSI in 2011. No specific conservation actions are in place for this species. Specialist survey is necessary to determine the extent of occurrence of the species and enable assessment of its native status.

**Published sources**

Berg *et al.* (2008), Gregory (2009 & 2012), Gregory & Campbell (1995), Hopkin (1991), Oliver & Meechan (1993), Schmalfuss (2004)

***MIKTONISCUS PATIENCEI***
**NATIONALLY SCARCE**
Coastal Black-eye Woodlouse
Order ISOPODA
Family TRICHONISCIDAE

*Miktoniscus patiencei* Vandel, 1946

**Identification**
A very small, white woodlouse readily distinguished with a lens from superficially similar species inhabiting the same microsites as each eye is composed of a single, black ocellus. Re-described from British material by Oliver & Sutton (1982) and summarized by Harding & Sutton (1985). Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993). BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**
*M. patiencei* has a widespread distribution along the southern coasts of England from Suffolk to Somerset with outlying populations known from Anglesey, Spurn Head and Kincardineshire (Gregory, 2009). Schmalfuss (2004) gives its distribution as Britain, Ireland and northern France but it occurs in northern Spain also (Bilton, 1993; Gregory *et al.*, 2012).

**Habitat and Ecology**
*M. patiencei* occurs in the coastal, supralittoral zone up to 40m inland (Oliver & Meechan, 1993). Recorded habitats include salt marsh, sparsely vegetated shingle banks, sea cliffs (Harding & Sutton, 1985) and erosion banks (Gregory, 2009). It is found where damp organic material has collected e.g. under strandline debris, in crevices in sea cliffs, several centimetres below the surface of shingle or in grass litter on maritime turf (Harding & Sutton, 1985).

**Status**
Recorded from just 15 hectads since 1990 and from less than 40 hectads in total. More intensive survey of suitable coastal habitat will reveal further populations but the area of occupancy is expected to remain restricted such that the criterion for a Nationally Scarce assessment is met.

**Threats**
Marine pollution generally as well as specific pollution events (e.g. oil spills, chemical spills) could potentially threaten the survival of individual populations. Human disturbance from coastal protection, commercial shingle extraction, port developments and other coastal development projects pose other potentially serious threats. Extreme weather events have the potential to destroy large proportions of existing habitat in a very short time.

**Management and Conservation**
A number of the sites where *M. patiencei* is found are designated but do not recognize the woodlouse in the citation. No specific conservation actions are considered necessary for this species.

**Published source**
Bilton (1993), Gregory et al. (2012), Harding & Sutton (1985), Hopkin (1991), Oliver & Meechan (1993), Oliver & Sutton (1982), Schmalfuss (2004)

***ONISCUS ASELLUS OCCIDENTALIS***
**NEAR THREATENED** B2ab(i)(iii)
Common Shiny Woodlouse
Order ISOPODA
Family ONISCIIDAE

*Oniscus asellus occidentalis* Bilton, 1994
Morphological variation in *Oniscus asellus* populations from SW England was first reported by Bilton (1990) and the south-western taxon was initially considered a separate species. Recognition of intermediate forms resulted in the description of the subspecies (Bilton, 1994). The genetic distinctness of the subspecies was confirmed by Bilton *et al.*(1999).

**Identification**
There are differences between *O .a. asellus* and *O. a. occidentalis* in the size and shape of individuals but these are not reliable. The subspecies are separated most reliably by the male sexual structures that are visible with a hand lens. Described by Bilton (1994).

**Distribution**
The distribution of pure populations of *O. a. occidentalis* is centred on SW England extending to the Isle of Wight along the south coast and across the Bristol Channel into South Wales. The distribution of intermediate hybrid populations is fragmented with records east to Kent and north through Yorkshire and the Isle of Man to Peebles in the Scottish Borders (Davidson, 2010). Isolated pure populations have been discovered in the Channel Islands, on the south coast of Ireland, NW France and in the Pyrenees. Intermediate hybrid populations are more widespread in western Europe.

**Habitat and Ecology**
*O. a. asellus* has been recorded from almost all terrestrial habitats in Britain but *O. a. occidentalis* inhabits a much narrower range of habitats and is not found in synanthropic sites. In SW Britain typical habitats are semi natural damp woodland, wetland and rank grassland and it becomes restricted to wet habitats in its more

eastern and northern stations (Gregory, 2009). Where both subspecies meet due to human intervention intermediate forms of hybrid origin occur and these intermediates become isolated in wetland habitats as the more competitive *O. a. asellus* comes to totally dominate surrounding habitats. As with the nominate subspecies, *O. a. occidentalis* is usually found at ground level under dead wood and rocks and in leaf litter, moss and tussocks.

**Status**

As the taxon was not described until 1994, records from the period 1970-1989 are based on specimens in museum and private collections and come from just 6 hectads compared with the 24 hectads that *O. a. occidentalis* has been found in post 1990. These records give a maximum estimated area of occupancy of 2400km$^2$. Although the current distribution of *O. a. occidentalis* is restricted to SW Britain, from the presence of isolated intermediate hybrid populations north to the Scottish Borders and east to Kent it can be concluded that the extent of occurrence was much greater in the past. Further, the presence of intermediate populations within the current distribution of *O. a. occidentalis* indicates a continuing decline of the taxon. Consideration of the ecology of *O. a. occidentalis* shows that there is a long term and continuing decline in the area of its habitat. Loss of semi natural woodland (DEFRA, 2013; Natural England, 2009) and of wetland (Hume, 2008; Natural England, 2009) is still occurring both nationally and specifically within SW England. Past losses of a large proportion of the region's culm grassland to agricultural improvement (Hughes & Tonkin, 1997) and more recent losses to scrub invasion when management is neglected may have been halted (Natural England, 2013) but have assisted in the production of a severely fragmented distribution for *O. a. occidentalis*. Thus the taxon comes close to satisfying the IUCN criteria under B2ab(i)(iii) as the remaining populations are severely fragmented and there are continuing declines in the extent of occurrence and the area and quality of habitat but the geographic range in terms of area of occupancy may be slightly greater than 2000km$^2$ at the present time.

**Threats**

The direct threat of extinction arises through hybridisation with *O. a. asellus*. Human activities that favour the synanthropic and more competitive *O. a. asellus* will increase the risk of extinction of *O. a. occidentalis*. The loss of semi-natural habitat in SW England, especially extensive wetlands, culm grasslands and damp woodlands, through agricultural intensification and drainage for other developments will benefit *O. a. asellus* at the expense of *O. a. occidentalis.*

**Management and Conservation**

*O. a. occidentalis* occurs on a number of designated sites but smaller sites surrounded by drier habitat are unlikely to be large enough to prevent interaction between the subspecies. The preservation or creation of buffer habitat around such sites may be feasible. A better understanding of the occurrence of *O. a. occidentalis* and intermediate populations within SW England is required urgently. The rate at which

*O. a. occidentalis* is declining is currently unknown but the results of field survey would enable this to be estimated and a quantitative estimate of the risk of extinction to be arrived at.

**Published sources**
Bilton (1990), Bilton (1994), Bilton *et al.* (1999), Davidson (2010), Gregory (2009)

***PORCELLIO LAEVIS***
**NATIONALLY SCARCE**
Woodlouse
Order ISOPODA
Family PORCELLIONIDAE

*Porcellio laevis* Latreille, 1804

**Identification**
A large species distinguished from other members of the genus *Porcellio* by its very smooth surface. Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993). BMIG website (www.bmig.org.uk) provides a colour photograph of the species.

**Distribution**
*P. laevis* has been recorded most frequently in SE England but there are scattered records from across Britain from Penzance to Glasgow (Gregory, 2009). It is widespread across Europe and North Africa and widely introduced elsewhere (Schmalfuss, 2004). Vandel (1962) considered it had originated in North African and had been introduced to Europe.

**Habitat and Ecology**
*P. laevis* is found in synanthropic habitats in Britain. It is associated principally with livestock farming i.e. dairy farms and stables and with well-established, mature gardens. Within these habitats it is found in moist, warm microsites, especially compost and manure heaps (Gregory, 2009). In NW France it inhabits caves as well as compost and manure heaps (Noel & Sechet, 2007) and possibly colonised caves in Britain following the last ice age. A secondary colonisation of animal housing, compost and dung heaps would then have followed when humans arrived (Gregory, pers.comm.).

**Status**
The calcified remains of *P. laevis* have been identified from 13$^{th}$ century archaeological deposits in Kent (Girling, 1979). Like *P. dilatatus*, it may be an ancient introduction to Britain in which case it has probably been here since at least Roman times. However, it is also plausible that a native population was subsequently

bolstered by imports from the mesolithic onwards (Gregory, pers.comm.). Harding & Sutton (1985) commented on an apparent decline in the species during the 20th century attributing it to the loss of horses due to mechanisation. They did not believe that experienced recorders would consistently overlook such a large and distinctive species. As with *P. dilatatus*, a woodlouse occupying similar habitats, the species is probably under recorded due to its specialist habitat (Gregory, 2009) but it is known from just 15 hectads since 1990, less than 20% of the hectads that *P. dilatatus* has been recorded from over the same period. On the basis of its restricted area of occupancy *P. laevis* satisfies the criterion for being considered Nationally Scarce in Britain.

**Threats**

Harding & Sutton (1985) identified greater tidiness and hygiene in animal housing on farms as a potential threat to *P. laevis* through habitat loss. A more direct threat that was only just becoming apparent as a more general issue when this suggestion was made was the impact of livestock worming chemicals such as avermectins on dung feeding invertebrates (Wall & Strong, 1987). Much of the subsequent concern has been directed at dung feeding insects but avermectins have been shown to be highly toxic to other soil invertebrates including *P. scaber* (Kolar *et al.*, 2008). There is little doubt that the high concentrations of these chemicals in manure heaps would have a significant impact on populations of *P. laevis* around livestock farms and stables.

**Management and Conservation**

A number of the sites where *P. laevis* is found are designated but do not recognize the woodlouse in the citation. It is important to raise awareness of the importance of compost heaps and/or dung heaps where these are present on designated sites. Controls on the application of vermicides (and wide spectrum insecticides) aimed at the conservation of other taxa are likely to benefit *P. laevis.*

**Published sources**

Girling (1979), Gregory (2009), Harding & Sutton (1985), Hopkin (1991), Kolar *et al.* (2008), Noel & Sechet (2007), Oliver & Meechan (1993), Schmalfuss (2004), Vandel (1962)

***PROASELLUS CAVATICUS***
**NATIONALLY SCARCE**
Cave Hoglouse
Order ISOPODA
Family ASELLIDAE

*Proasellus cavaticus* (Leydig, 1871)
Previously known as *Asellus cavaticus* Leydig, 1871
Eme *et al.* (2013) have confirmed the two size morphs that occur in Britain to be one species, rather than a group of cryptic species.

**Identification**
*P. cavaticus* lacks both eyes and pigment but almost colourless specimens of both *P. meridianus* and *Asellus aquaticus* have been collected (Harding, 1989). All specimens should be identified based on the structure of the first abdominal appendages as illustrated in the key by Gledhill *et al*. (1993). The Hypogean Crustacea Recording Scheme website (hcrs.freshwaterlife.org) provides colour photographs of the species.

**Distribution**
*P. cavaticus* is widespread in South Wales and southern England (Gregory, 2009). It is widespread in Europe north of the Alps (Eme *et al.*, 2013) but absent from Ireland (Gregory, 2009).

**Habitat and Ecology**
*P. cavaticus* is a specialist stygobite. It is typically recorded from underground streams, shallow pools, water films covering flowstones and small seepages in carboniferous limestone caves and mines. Vagrants are recorded where underground waters issue at the surface (Gregory, 2009).

**Status**
Although recorded from just 8 hectads since 1990 and 16 in total, this in part reflects under recording in hypogean habitats. However, surveys of carboniferous limestone systems in Derbyshire and North Yorkshire have not recorded *P. cavaticus* (Gregory, 2009) so its restricted extent of occurrence appears to be real. The restricted area of occupancy of *P. cavaticus* further justifies its status as Nationally Scarce.

**Threats**
Pollution of groundwater by pesticides and fertilisers is considered a serious threat to subterranean crustaceans (Fiers & Wouters, 1985; Harding, 1989). Biocides used in water treatment are a very direct threat. The trade name ‘Permasect’ refers to a group of permethrin based pesticides. ‘Permasect W.T.’ is specifically marketed ‘for control of *Asellus’* (Harding, 1989) and is still approved for use in the disinfestation of mains and treatment of slow sand filters (Drinking Water Inspectorate, 2014). When the biocide is used the levels of permethrins and related chemicals in discharges should

be monitored but it is inevitable that surface water discharges will find their way into groundwater. There is a potential cumulative threat to *P. cavaticus* from low level discharges as well as the threat from accidental high concentration pollution. The increasing demand for water means that at sites where groundwater is abstracted for agricultural, domestic or industrial use over-abstraction may pose a threat to the species (Harding, 1989).

**Management and Conservation**

No specific conservation actions are in place for this species. Specialist survey is necessary to determine the area of occupancy of the species. Improved knowledge of the movements of groundwater where the species occurs is needed to assess the risks to populations from pollution.

**Published sources**

Drinking Water Inspectorate (2014), Eme *et al.* (2013), Fiers & Wouters (1985), Gledhill *et al*. (1993), Gregory (2009), Harding (1989)

***STENOPHILOSCIA GLAREARUM***

**VULNERABLE D2**

Woodlouse

Order ISOPODA

Family HALOPHILOSCIIDAE

*Stenophiloscia glarearum* Verhoeff, 1908

Previously known as *Stenophiloscia zosterae* Verhoeff, 1928

**Identification**

Live specimens appear reminiscent of a large, pinkish *Trichoniscus pusillus* (Gregory *et al*., 2001). Description and figures based on British material are given by Harding & Sutton (1985). Keyed with diagrams and brief descriptions by Hopkin (1991) and Oliver & Meechan (1993) under the name *Stenophiloscia zosterae*. A colour photograph appears in Noël *et al.* (2014).

**Distribution**

*S. glarearum* was collected at Slapton Ley, Devon in 1974, Goldhanger, Essex in 1976 and Scolt Head Island, Norfolk in 1977. Despite intensive hand searching and pitfall trapping at the known sites and at Southwold, Suffolk in the 1970s the species could not be found again (Harding & Sutton, 1985). It was not until 1995 that another *S. glarearum* was seen when a single animal was collected at Shingle Street, Suffolk (Daws, 1995a). The most recent records are from 2001 when relatively large numbers were found along a stretch of beach at Colne Point, Essex (Gregory *et al*., 2001). More recent pitfall trap surveys at Sudbourne Beach, Suffolk (Lee, 2003a), Cley, Norfolk (Lee, 2003b; 2006a; 2007) and Orford Ness, Suffolk (Telfer, 2013) have

failed to detect further populations. *S. glarearum* is a European species found around western Mediterranean coasts and along the Atlantic fringe (Schmalfuss, 2004) to the Canary Islands (Taiti & Lopez, 2008).

**Habitat and Ecology**

*S. glarearum* occurs exclusively in the supralittoral zone of unvegetated or sparsely vegetated shingle or sandy shores. Although live animals have been found under strandline driftwood, it probably inhabits the interstitial spaces of the substrate and only appears at the surface when a combination of factors, including weather and tides, is suitable (Gregory, 2009).

**Status**

Despite intensive recording around the East Anglian coast, *S. glarearum* has been recorded from just two locations since 1990. Its coastal habitat is very vulnerable to damage by extreme weather events e.g. storm surges and the species itself is potentially vulnerable to a marine pollution event that could cause it to become critically endangered within a short time. Thus the IUCN criteria for Vulnerable D2 are satisfied on the basis of its presence at two localities and its vulnerability to stochastic events.

**Threats**

Marine pollution generally as well as specific pollution events (e.g. oil spills, chemical spills) could potentially threaten the survival of individual populations. Human disturbance from coastal protection, commercial shingle extraction, port developments and other coastal development projects pose other potentially serious threats. Extreme weather events have the potential to destroy large proportions of existing habitat in a very short time.

**Management and Conservation**

Pre-1990 records of *S. glarearum* included Slapton Ley SSSI / NNR, Blackwater Estuary SSSI / NNR and Scolt Head Island NNR. More recent records are from Shingle Street within the Alde-Ore Estuary SSSI and Colne Point partly within the Colne Estuary NNR. However, the woodlouse is not recognized in the site citations and no specific conservation actions are in place for the species. Improved knowledge of the biology of the species, in particular identification of the factors that result in vertical migration within the substrate, would be useful in developing a monitoring protocol.

**Published sources**

Daws (1995a), Gregory (2009), Gregory *et al*. (2001), Harding & Sutton (1985), Hopkin (1991), Lee (2003a, 2003b, 2005, 2006a & 2007), Oliver & Meechan (1993), Noël *et al*. (2014), Schmalfuss (2004), Taiti & Lopez (2008), Telfer (2013)

***TRICHONISCOIDES HELVETICUS***
**NATIONALLY SCARCE**
Swiss Red-eye Woodlouse
Order ISOPODA
Family TRICHONISCIDAE

*Trichoniscoides helveticus* (Carl, 1908)
*T. helveticus* was not recognised as a British species distinct from *T. sarsi* until 1990 (Hopkin, 1990).

**Identification**
A very small, pale species with red eyes in life but the pigment disappears when preserved. Separation from *T. sarsi* and *T. saeroeensis* and from the two *Metatrichoniscoides* species requires microscopic examination of male sexual structures. Females cannot be identified currently. Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993). A colour photograph appears in Gregory (2009).

**Distribution**
Confirmed records of male *T. helveticus* exist at scattered localities in central southern England from Worcestershire to Essex and south to Sussex (Gregory, 2009). It is a widespread species in NW Europe (Hopkin, 1990; Schmalfuss, 2004).

**Habitat and Ecology**
*T. helveticus* demonstrates a strong preference for semi-natural habitats (Gregory, 2009). The presence of undisturbed friable calcareous soils appears to be more important than the vegetation type. Berg (2008) also notes a preference for friable clay soils in the Netherlands and suggests that such soils allow the woodlouse to more easily penetrate deeper to moist, cool conditions when the surface dries out. He links this to a more continental climate where *T. helveticus* is found as compared to where *T. sarsi* occurs in the Netherlands but this interpretation does not appear to be as valid when applied to British populations.

**Status**
*T. helveticus* has been recorded from just 8 hectads since 1990 and 12 in total. Although it is likely that the species is still under recorded as a result of past confusion, Gregory (2009) shows records for the aggregate taxon from less than 25 hectads in total. The semi-natural habitats of the species are fragmented in southern England resulting in an area of occupancy sufficiently restricted as to justify Nationally Scarce status.

**Threats**
As the species appears to be so strongly linked to undisturbed, friable calcareous soils any activity that would impact on such soils within the known extent of occurrence of

*T. helveticus* must be considered a potential threat.

**Management and Conservation**
*T. helveticus* occurs at a number of designated sites but the woodlouse is not recognized in the citations. There are no specific conservation actions currently in place for this species. Specialist surveys are required to determine the full extent of occurrence. It is essential to check for the presence of *T. helveticus* on a site with undisturbed, friable calcareous soils in southern England before any potentially damaging work begins.

**Published sources**
Berg (2008), Gregory (2009), Hopkin (1990 & 1991), Oliver & Meechan (1993), Schmalfuss (2004)

***TRICHONISCOIDES SARSI***
**NATIONALLY SCARCE**
Sars' Red-eye Woodlouse
Order ISOPODA
Family TRICHONISCIDAE

*Trichoniscoides sarsi* Patience, 1908
A number of older records of *T. sarsi* have been shown to be misidentifications of *T. helveticus* (Hopkin, 1990).

**Identification**
A very small, pale species with red eyes in life but the pigment disappears when preserved. Separation from *T. helveticus* and *T. saeroeensis* and from the two *Metatrichoniscoides* species requires microscopic examination of male sexual structures and legs. Females cannot be identified currently. Keyed, with brief descriptions and diagrams, by Hopkin (1991) and Oliver & Meechan (1993). A colour photograph appears in Gregory (2009).

**Distribution**
*T. sarsi* is known currently from Kent, Suffolk, Leicestershire and Shropshire in England (Gregory, 2009) and from Kincardineshire in Scotland (Davidson, 2010). Schmalfuss (2004) describes an Atlantic distribution from northern France to southern Scandinavia.

**Habitat and Ecology**
*T. sarsi* is widespread in coastal habitats in the Netherlands (Berg, 2008) and probably first colonised semi-natural coastal sites in Britain. There are a few records of *T. sarsi* from such habitats in Kent (Gregory, 2012) and Scotland (Davidson, 2010) and it is possible that *T. sarsi* has been overlooked as the much more frequently recorded *T.*

*saeroeensis* in eastern coastal locations. However, most of the records are from synanthropic habitats such as old gardens or churchyards (Daws, 1995b; Gregory, 2009). Berg (2008) reports an association with 'sea clays' in the Netherlands as opposed to the more friable 'river clays' favoured by *T. helveticus*.

**Status**

*T. sarsi* is probably an ancient introduction in Britain that is believed by Vandel (1960) to have originated in western France and spread northwards. Although it is likely that the species is still under recorded as a result of past confusion with other *Trichoniscoides* species, Gregory (2009) shows records for the aggregate taxon from less than 25 hectads in total. This restricted area of occupancy justifies its status as Nationally Scarce.

**Threats**

Difficult to assess until its extent of occurrence and habitat preferences can be established.

**Management and Conservation**

*T. sarsi* occurs at Abbey Mead Lakes, part of the Holborough to Burnham Marshes SSSI in Kent (Gregory, 2012) but is not recognised in the citation. No specific conservation actions are in place for this species. Survey by experienced specialists is necessary to determine the extent of occurrence of the species, especially along eastern coasts, and enable assessment of its status.

**Published sources**

Berg (2008), Davidson (2010), Daws (1995b), Gregory (2009 & 2012), Hopkin (1990 & 1991), Oliver & Meechan (1993), Schmalfuss (2004), Vandel (1960)

# 15 References


Alexander, K.N.A. 1995. *Armadillidium pictum* Brandt (Isopoda: Armadillidiidae) new to Gloucestershire. *British Journal of Entomology and Natural History,* **8**:76.

Alexander, K.N.A. 2004. *Revision of the Index of Ecological Continuity as used for saproxylic beetles.* English Nature Research Reports, No.574.

Alexander, K.N.A. 2010. *Armadillidium pictum* Brandt. 1833, discovered in Staffordshire, and comments on its habitat associations. *Bulletin of the British Myriapod and Isopod Group,* **24**: 51-52.

Alexander, K.N.A. 2014. *A review of the scarce and threatened beetles of Britain. Buprestidae, Cantharidae, Cleridae, Dasytidae, Drilidae, Lampyridae, Lycidae, Lymexylidae, Malachiidae, Phloiophilidae and Trogossitidae.* Species Status No.16. Natural England Commissioned Reports, Number 134.

Alexander, K.N.A., Dodd, S. & Denton, J.S. 2014. *A review of the scarce and threatened beetles of Britain. The darkling beetles and their allies. Aderidae, Anthicidae, Colydiidae, Melandryidae, Meloidae, Mordellidae, Mycetophagidae, Mycteridae, Oedemeridae, Pyrochroidae, Pythidae, Ripiphoridae, Salpingidae, Scraptiidae, Tenebrionidae & Tetratomidae (Tenebrionoidea less Ciidae).* Species Status No. 18. Natural England Commissioned Reports, Number 148.

Alonso, J., Arillo, A., Barrón, E., Corral, J.C., Grimalt, J., López, J.F., López, R., Martínez-Delclòs, X., Ortuño, V., Peñalver, E. & Trincão, P.R. 2000. A new fossil resin with biological inclusions in lower Cretaceous deposits from Álava (Northern Spain, Basque-Cantabrian Basin). *Journal of Paleontology*, **74(1)**: 158-178.

Anderson, J.M., Leonard, M.A., Ineson, P. and Huish, S. 1985. Faunal biomass: a key component of a general model of nitrogen mineralization. *Soil Biology and Biochemistry*, **17**: 735-737.

Anderson, R. 1996. *Anamastigona pulchellum* Silvestri (Chordeumatida: Anthroleucosomatidae) an addition to the fauna of northern Europe, recorded from Ireland. *Bulletin of the British Myriapod Group*, **12**: 7-11.

Anderson, R. 2011. *Henia vesuviana* (Newport) (Dignathodontidae), the latest addition to aliens at Mount Stewart, Co. Down, Ireland. *Bulletin of the British Myriapod and Isopod Group,* **25**: 48.

Andersson, G. 1983. The Chilopod fauna in the vicinity of Göteborg - a comparison between collecting results obtained in the 1920s and 1970s. *Acta entomologica Fennica*, **42**: 9-14.

Andersson, G., Meidell, B.A., Scheller, U., Djursvoll, P., Budd, G. & Gärdenfors, U. 2005. *Nationalnyckeln till Sveriges flora och fauna. Mångfotingar. Myriapoda*. ArtDatabanken, SLU, Uppsala. [In Swedish with English keys]

Bagnall, R.S. 1913. The myriapods of the Derwent Valley. *Transactions of the Vale of Derwent Naturalists' Field Club* (NS), **1**: 23-35.

Barber, A.D. 1972. Some notes on the Chilopoda of South East England. *Bulletin of the British Myriapod Group*, **1**: 39-48.

Barber, A.D. 1986. *Geophilus proximus* C.L. Koch (Chilopoda, Geophilomorpha) and other Chilopoda from the Shetland Islands. *Bulletin of the British Myriapod Group*, **3**: 29-39.

Barber, A.D. 1987. Recent records of *Enantiulus armatus* (Ribaut). *Bulletin of the British Myriapod and Isopod Group*, **4**: 51.

Barber, A.D. 1992a. *Lithobius lapidicola* Meinert, 1872 in Britain. *Bulletin of the British Myriapod Group*, **8**: 25-30.

Barber, A.D. 1992b. *Chalandea pinguis* (Brolemann) in Britain & Southern Europe. *Bulletin of the British Myriapod Group*, **8**: 31-38.

Barber, A.D. 1996. Dorset (and Somerset) centipede records. *British Myriapod Group Newsletter*, **25**: 3-4. Unpublished.

Barber, A.D. 2001. *Geophilus osquidatum* in Kent. *Bulletin of the British Myriapod and Isopod Group*, **17**: 93.

Barber, A.D. 2005. Myriapods from the Eden Project, Cornwall. *British Myriapod and Isopod Group Newsletter*, **11**: 1. Unpublished.

Barber A.D. 2008a. *Key to the identification of British centipedes*. The AIDGAP Project. Field Studies Council, Shrewsbury.

Barber A.D. 2008b. Some recent Cornish myriapod records. *British Myriapod and Isopod Group Newsletter*, **17**: 3-4. Unpublished.

Barber, A.D. 2009a. Littoral myriapods: a review. *Soil Organisms*, **81**(3): 735-760.

Barber, A.D. 2009b. *Centipedes*. Synopses of the British Fauna (New Series) No. 58, published for the Linnean Society of London and the Estuarine and Brackish-Water Sciences Association by Field Studies Council, Shrewsbury.

Barber, A.D. 2011a. A further greenhouse record of *Lithobius lapidicola* Meinert, 1872. *Bulletin of the British Myriapod and Isopod Group*, **25**: 52.

Barber, A.D. 2011b. Geophilomorph centipedes and the littoral habitat. *Terrestrial Arthropod Reviews*, **4**: 17-39.

Barber, A.D. 2013a. A second Cornish site for *Eurygephilus pinguis*. *British Myriapod and Isopod Group Newsletter*, **No.27**: 1. Unpublished.

Barber, A.D. 2013b. Further records of the centipede *Stigmatogaster souletina* (*Haplophilus souletinus*) *British Myriapod and Isopod Group Newsletter*, **No.27**: 4. Unpublished.

Barber, A.D., Gregory, S.J. & Lee, P. 2010. Reports on the 2009 BMIG Spring meeting in Cornwall. *Bulletin of the British Myriapod and Isopod Group*, **24**: 65-74.

Barber, A.D. & Jones, R.E. 1999. A description of *Geophilus proximus*. *Bulletin of the British Myriapod Group*, **15**: 19-25.

Barber, A.D. & Keay, A.N. 1988. *Provisional Atlas of the Centipedes of the British Isles.* Biological Records Centre, Huntingdon.

Berg, M.P. 1999. Naamlijst van de Nederlandse duizendpoten (Myriapoda: Chilopoda). *Nederlandse Faunistische Mededelingen*, **8**: 50-76.

Berg, M.P. 2008. Distribution and ecology of two enigmatic species, *Trichoniscoides sarsi* Patience, 1908 and *T. helveticus* (Carl, 1908) (Crustacea, Isopoda) in the Netherlands. *Bulletin of the British Myriapod and Isopod Group*, **23**: 2-8.

Berg, M.P., Soesbergen, M., Tempelman, D. & Wijnhoven, H. 2008. *Verspreidingsatlas Nederlandse landpissebedden, duizendpoten en miljoenpoten (Isopoda, Chilopoda, Diplopoda).* Amsterdam, EIS-Nederland, Leiden & Vrije Universiteit-Afdeling Dierecologie.

Bilton, D.T. 1990. Two *Oniscus* in Britain! *British Isopod Study Group Newsletter*, **No.28**: 3. Unpublished.

Bilton, D.T. 1993. Woodlice in northern Iberia. *British Isopod Study Group Newsletter*, **No.35**: 5-6. Unpublished.

Bilton, D.T. 1994. Intraspecific variation in the terrestrial isopod *Oniscus asellus* L. *Zoological Journal of the Linnean Society*, **110**: 325-354.

Bilton, D.T., Goode, D. & Mallet, J. 1999. Genetic differentiation and natural hybridization between two morphological forms of the common woodlouse, *Oniscus asellus* Linnaeus, 1758. *Heredity*, **82**: 462-469.

Blower, J.G. 1985a. The British Chordeumatidae. *Bulletin of the British Myriapod Group*, **2**: 8-23.

Blower, J.G. 1985b. *Millipedes*. Synopses of the British Fauna (New Series) No. 35, published for the Linnean Society of London and the Estuarine and Brackish-Water Sciences Association by E.J. Brill / Dr. W. Backhuys, London – Leiden – Köln - København.

Blower, J.G. 1986. Distribution and variation of the species of *Brachychaeteuma* occurring in Britain and Ireland. *Bulletin of the British Myriapod Group*, **3**: 43-48.

Blower, J.G. & Rolfe, S.W. 1956. *Metaiulus pratensis*, gen. et sp. nov., and *Leptoiulus kervillei* (Brölemann), (Diplopoda, Iulidae), from Britain. *Annals and Magazine of Natural History*, (12) **9**:513-520.

Blower, J.G. & Rundle, A.J. 1980. *Prosopodesmus panporus*, an interesting new species of polydesmoid millipede from the Royal Botanic Gardens, Kew, England. *Myriapodologica*, **1**(4): 27-34.

Blower, J.G. & Rundle, A.J. 1986. *Poratia digitata*, a new British hothouse millipede. *Bulletin of the British Myriapod Group*, **3**: 11-16.

Bocock, K.L., Heath, J. & Blower, J.G. 1973. Some observations on the biology of the millipede *Geoglomeris jurassica* Verhoeff, 1915. *Journal of Natural History*, **7**: 691-697.

Bolton, D.E. 1996. *Polydesmus barberii* Latzel and *Anthogona britannica* Mauriès in Devon. *Bulletin of the British Myriapod Group*, **12**: 23-26.

Bolton, D.E. & Jones, R.E. 1996. *Anthogona britannica* Mauriès and *Polydesmus barberii* Latzel in Devon: Millipedes new to the British Isles. *Bulletin of the British Myriapod Group*, **12**: 21-22.

Bonato, L.. Barber, A.D. & Minelli, A. 2006. The European centipedes hitherto referred to *Eurygeophilus*, *Mesogeophilus*, and *Chalandea* (Chilopoda, Geophilomorpha): taxonomy, distribution, and geographical variation in segment number. *Journal of Natural History*, **40**(7-8): 415-438.

Bonato, L. & Minelli, A. 2014. Chilopoda Geophilomorpha of Europe: a revised list of species, with taxonomic and nomenclatorial notes. *Zootaxa*. **3370** (1): 1-36.

Bratton, J.H. (ed) 1991. *British Red Data Books: 3. Invertebrates other than Insects*. Peterborough, JNCC.

Brewer, M.S., Sierwald, P. & Bond, J.E. 2012. Millipede Taxonomy after 250 Years: Classification and Taxonomic Practices in a Mega-Diverse yet Understudied Arthropod Group. *PLoS ONE*, **7**(5): e37240. doi:10.1371/journal.pone.0037240

Brölemann, H.W. 1896. *Lithobius variegatus* Leach. *The Irish Naturalist*, **5**: 12-15.
Broly, P., Deville, P. & Maillet, S. 2013. The origin of terrestrial isopods (Crustacea: Isopoda: Oniscidea). *Evolutionary Ecology*, **27**: 461-476.

Cawley, M. 2001. Distribution records for uncommon centipedes (Chilopoda), including three species new to Ireland. *Irish Naturalist's Journal*, **26**: 374-377.

Chapman, P. 1979. The biology of Otterhole, near Chepstow. *British Cave Research Association Transactions*, **6**(4): 159-167.

Chater, A.O. 1986a. Woodlice in Ceredigion. *Dyfed Invertebrate Group Newsletter*, **No.2**: 3-10. Unpublished.

Chater, A.O. 1986b. Recent woodlouse records from Dyfed. *British Isopod Study Group Newsletter*, **No.21**: 4-5. Unpublished.

Chater, A.O. 1988. *Armadillidium pictum* in Radnorshire. *British Isopod Study Group Newsletter*, **No.24**: 2. Unpublished.

Collis, G.M. 2007. Report on the 2006 BMIG meeting in Ayrshire. *Bulletin of the British Myriapod and Isopod Group*, **22**: 32-35.

Corbet, G.B. 1989. A second British site for *Pachymerium ferrugineum* CL Koch). *Bulletin of the British Myriapod Group*, **6**: 34-35.

Corbet, G.B. 1996. *Melogona voigti* (Verhoeff) from the Lothians: A millipede new to the British Isles. *Bulletin of the British Myriapod Group*, **12**: 17-20.

Corbet, G.B. & Jones, R.E. 1996. *Haplopodoiulus spathifer* (Brölemann, 1897) in southeast England: A millipede new to the British Isles. *Bulletin of the British Myriapod Group*, **12**: 13-16.

Dányi, L. 2008. Review and contribution to the Chilopoda fauna of Maramureş, Romania. *Studia Universitatis Vasile Goldiş, Seria Ştiinţele Vieţii (Life Science Series)*, **18**: 185-197.

David, J.-F. 1986. Les peuplements de Diplopodes de trois stations diversement enrésinées en forét d'Orléans. *Compte rendu hebdomadaire des séances de l'Academie des Sciences, Paris 302*, (3) **1**: 7-10.

David, J.-F. 1989. Les peuplements de Diplopodes d'une forét tempérée: variations spatiales et stabilité dans le temps. *Revue d'Écoogie et de Biologie du Sol*, **26**: 75-90.

David, J.-F. 1990. Habitat dimensions of Diplopoda in a temperate forest on acid soil. *Revue d'Écoogie et de Biologie du Sol*, **27**: 95-112.

Davidson, M. 2010. New Scottish isopod records. *British Myriapod and Isopod Group Newsletter*, **No.22**: 3. Unpublished.

Davidson, M. 2013. Recent Millipede Finds at Glasgow Necropolis. *British Myriapod and Isopod Group Newsletter*, **No.27**: 3-4. Unpublished.

Daws, J. 1993. BISG/BMG Field Meeting, Sussex. *British Isopod Study Group Newsletter*, **No.35**: 1-3. Unpublished.

Daws, J. 1995a. The woodlouse *Stenophiloscia zosterae* – First record since 1977. *Suffolk Natural History*, **31**: 25.

Daws, J. 1995b. Trichoniscoides in Suffolk. *British Isopod Study Group Newsletter*, **No.38**: 2. Unpublished.

Daws, J. 1996. *Armadillidium pictum* in Leicestershire. *British Isopod Study Group Newsletter*, **No.39**: 1. Unpublished.

Decker, P., Reip, H.S. & Voigtländer, K. 2014. Millipedes and centipedes in German greenhouses (Myriapoda: Diplopoda, Chilopoda). *Biodiversity Data Journal*, **2**: e1066. doi:10.3897/BDJ.2.e1066

DEFRA. 2013. Government Forestry & Woodland Policy Statement. Available online at www.gov.uk/government/uploads/system/uploads/attachment_data/file/221023/pb13871-forestry-policy-statement.pdf

DEFRA & Forestry Commission. 2005. *Keepers of time: A statement of policy for England's ancient and native woodland*. DEFRA and the Forestry Commission, England.

Demange, J.-M. 1958. Trois nouveaux myriapods cavernicoles de France. *Notes Biospéologiques*, **13**: 51-56.

Demange, J.-M. 1965. Remarques sur quelque myriapods cavernicoles de France: Description d'un forme nouvelle du genre *Metaiulus*. *Bulletin de la Société d'Histoire Naturelle de Toulouse*, **100**: 446-450.

Demange, J.-M. 1981. *Les Mille-pattes: Myriapodes*. Société Nouvelle des Éditions Boubée, Paris.

Djursvoll, P. 2010. Mangeføttinger – Myriapoda. In Kålås, J.A., Viken, Å., Henriksen, S. & Skjelseth, S. (eds.) *Norsk rødliste for arter 2010*. Artsdatabanken, Norge, pp.223-226.

Drinking Water Inspectorate. 2014. *List of Approved Products for use in Public Water Supply in the United Kingdom, July 2014*. http://dwi.defra.gov.uk/drinking-water-products/approved-products/soslistcurrent.pdf. Accessed 20th August 2014.

Dunger, W. & Voigtländer, K. 2005. Assessment of biological soil quality on wooded mine sites. *Geoderma*, **129**(1-2): 32-44.

Dunger, W. & Voigtländer, K. 2009. Soil fauna (Lumbricidae, Collembola, Diplopoda and Chilopoda) as indicators of soil ecosubsystem development in post-mining sites of Eastern Germany – a review. *Soil Organisms*, **81**(1): 1-51.

Eason, E.H. 1957. Chilopoda and Diplopoda from Caernarvonshire. *Proc. Zool. Soc. Lond.* **129**: 273-291.

Eason, E.H. 1962. The chilopod genus *Nesoporogaster* Verhoeff. *Proc. Zool. Soc. Lond.* **138**(1): 123-132.

Eason, E.H. 1964. *Centipedes of the British Isles*. Warne. London.

Elliot. P., King, P.E., Morgan, C.I., Pugh, P.J.A., Smith, A. & Wheeler, S.L.A. 1990. Chelicerata, Uniramia and Tardigrada. Chapter 11 in Hayward, P.J. & Ryland, J.S. (eds) *The Marine Fauna of the British Isles and North-West Europe. Volume 1: Introduction and Protozoans to Arthropods.* Clarendon Press, Oxford.

Eme, D., Malard, F., Konecny-Dupré, L., Lefébure, T. & Douady, C. J. 2013. Bayesian phylogeographic inferences reveal contrasting colonization dynamics among European groundwater isopods. *Molecular Ecology*, **22**: 5685–5699.

Enghoff, H. (1987). *Thalassisobates littoralis* (Silvestri) – an amphiatlantic millipede (Diplopoda, Julidae, Nemasomatidae). *Entomologists' Monthly Magazine*, **123**: 205–206.

Fiers, F. & Wouters, K. 1985. *Human impacts on the crustacean stygiofauna. Proceedings of the conference – Debat Invertebres menacants, Invertebres menaces.* Gembloux, Faculte des Sciences Agronomiques de l'Etat.

Foster, G.N. 2010. A review of the scarce and threatened Coleoptera of Great Britain Part (3): Water beetles of Great Britain. *Species Status* 1. Joint Nature Conservation Committee, Peterborough.

Geoffroy, J. & Iorio, E. 2009. The French centipede fauna (Chilopoda): updated checklist and distribution in mainland France, Corsica and Monaco. *Soil Organisms,* **81**: 671–694.

Girling, M.A. 1979. Calcium carbonate-replaced arthropods from archaeological deposits. *Journal of Archaeological Science,* **6**: 309-320.

Gledhill, T., Sutcliffe, D.W. & Williams, W.D. 1993. *British freshwater Crustacea Malacostraca: a key with ecological notes. Freshwater Biological Association Scientific Publication No.52.* Ambleside, FBA.

Gregory, S.G. 2004. BMIG expedition to Galicia – a preliminary woodlouse report. *British Myriapod and Isopod Group Newsletter,* **No.9**: 2-3. Unpublished.

Gregory, S.G. 2008. *Armadillidium pictum* Brandt, 1833 (Isopoda: Oniscidea) in Downton Gorge NNR, Herefordshire. *Bulletin of the British Myriapod and Isopod Group*, **23**: 13-14.

Gregory, S.J. 2009. *Woodlice and Waterlice (Isopoda: Oniscidea & Asellota) in Britain and Ireland*, published for Biological Records Centre by Field Studies Council Publications.

Gregory, S.J. 2012. The occurrence of two elusive woodlice, *Metatrichoniscoides leydigii* (Weber, 1880) and *Trichoniscoides sarsi* Patience, 1908, in semi-natural habitat in Kent. *Bulletin of the British Myriapod and Isopod Group,* **26**: 37-40.

Gregory, S.J. 2015. Woodlice (Isopoda: Oniscidea) from the Eden Project, Cornwall, with descriptions of species new to Britian and poorly known British species. *Bulletin of the British Myriapod and Isopod Group*, **27**: 3-26.

Gregory, S.J. & Campbell, J.M. 1995. *An atlas of Oxfordshire Isopoda: Oniscidea (Woodlice).* Occasional Paper No. 17. Oxford, Oxfordshire County Council.

Gregory, S.J. & Campbell, J.M. 1996. *An atlas of Oxfordshire Myriapoda: Diplopoda and Chilopoda.* Occasional Paper No. 19. Oxford, Oxfordshire County Council.

Gregory, S.J. & Jones, R.E. 1999. *Arenophilus peregrinus* Jones, 1989 in Cornwall: A centipede new to mainland Britain. *Bulletin of the British Myriapod Group*, **15**: 28-29.

Gregory, S.J., Lee, P., Read, H.J. & Richards, J.P. 2012. Woodlice (Isopoda: Oniscidea) collected from northwest Spain and northern Portugal in 2004 by the British Myriapod and Isopod Group. *Bulletin of the British Myriapod and Isopod Group*, **26**: 6-23.

Gregory, S.J. & Lewis, J.G.E. (in prep.) Geophilomorph centipedes (Chilopoda: Geophilomorha) collected from north-west Spain and northern Portugal by the British Myriapod and Isopod Group in 2004.

Gregory, S.G. & Richards, J.P. 2008. Comparison of three often mis-identified species of pill-woodlouse *Armadillidium* (Isopoda: Oniscidea). *Bulletin of the British Myriapod and Isopod Group*, **23**: 9-12.

Gregory, S.J., Jones, R.E. & Mauriès, J.-P. 1993. A new species of millipede (Myriapoda: Diplopoda: Chordeumatidae) from the British Isles. *Journal of Natural History*, **28**: 47-52.

Gregory, S.J., Whiteley, D. & Wilde, I. 2001. Some observations of *Stenophiloscia zosterae* (Verhoeff, 1928) at Colne Point NNR, north Essex. *Bulletin of the British Myriapod and Isopod Group*, **17**: 79-80.

Harding, P.T. 1985. Recent records of *Thalassisobates littoralis* (Silvestri). *Bulletin of the British Myriapod Group*, **2**: 6-7.

Harding, P.T. 1989. The occurrence of Asellidae in the British Isles. Part 1. *Asellus cavaticus. Isopoda*, **3**: 5-7.

Harding, P.T. 2006. *Armadillidium pictum* at Tarren yr Esgob, Breconshire. *British Myriapod and Isopod Group Newsletter*, **No.12**: 3. Unpublished.

Harding, P.T. & Collis, G.M. (2006) *Asellus communis* in Northumberland. *Bulletin of the British Myriapod & Isopod Group*, **21**: 8-11.

Harding, P.T. & Jones, R.E. 1994. The occurrence of *Craspedosoma rawlinsii* Leach (Diplopoda) in East Anglia. *Bulletin of the British Myriapod and Isopod Group*, **10**: 19-21.

Harding, P.T. & Sutton, S.L. 1985. *Woodlice in Britain and Ireland*: *distribution and habitat*. Huntingdon, Institute of Terrestrial Ecology.

Harper, J. 2002. Notes on *Lithobius piceus* L. Koch, 1862 new to Wales. *Bulletin of the British Myriapod and Isopod Group*, **18**: 47-49.

Harper, J. 2004a. *Haplophthalmus montivagus* Verhoeff 1941 – extended distribution. *Bulletin of the British Myriapod and Isopod Group*, **20**: 38-39.

Harper, J. 2004b. On some myriapods new to Wales. *Bulletin of the British Myriapod and Isopod Group*, **20**: 40-41.

Harper, J. 2004c. *Buddelundiella cataractae* inland in Wales. *Bulletin of the British Myriapod and Isopod Group*, **20**: 49.

Harper, J. 2010a. Discovery of *Trachysphaera lobata* (Ribaut, 1954) in Wales. *Bulletin of the British Myriapod and Isopod Group*, **24**: 45-47.

Harper, J. 2010b. Further observations of *Buddelundiella cataractae* in Wales. *Bulletin of the British Myriapod and Isopod Group*, **24**: 54.

Harper, J. & Richards, J.P. 2006. *Adenomeris gibbosa* – new to the United Kingdom. *Bulletin of the British Myriapod and Isopod Group*, **21**: 14-18.

Hoffman, R.L. 1981. Studies on spiroboloid millipeds. XIV. Notes on the family Pseudospirobolellidae, and the description of a new genus and species from Thailand. *Steenstrupia*, **7**: 181-190.

Hopkin, S.P. 1987. *Metatrichoniscoides celticus* and *Trichoniscoides albidus*. *British Isopod Study Group Newsletter*, **No.23**: 2. Unpublished.

Hopkin, S.P. 1990. *Trichoniscoides helveticus* Carl 1908. *British Isopod Study Group Newsletter*, **No.28**: 2. Unpublished.

Hopkin, S.P. 1991. *A key to the woodlice of Britain and Ireland. AIDGAP Publication No 204.* Preston Montford, Field Studies Council Publications. (Reprinted from *Field Studies* **7**: 599-650).

Hopkin, S.P. & Blower, J.G. 1987. Displaced ocelli in blaniulid millipedes. *Bulletin of the British Myriapod Group*, **4**: 27-29.

Hopkin, S.P. & Roberts, A.W.P. 1987. A species of *Haplophthalmus* new to Britain. *Isopoda*, **1**: 37-48.

Hubble, D.S. 2014. *A review of the scarce and threatened beetles of Britain. The leaf beetles and their allies. Chrysomelidae, Megalopodidae and Orsodacnidae.* Species Status No.19. Natural England Commissioned Reports, Number 161.

Hume, C. 2008. *Wetland Vision Technical Document: overview and reporting of project philosophy and technical approach*. The Wetland Vision Partnership.

Hughes, M.R. & Tonkin, B. 1997. *The Culm Natural Area: A Nature Conservation Profile.* Unpublished report for English Nature.

Hyman, P.S. (revised Parsons, M.S.). 1992. A review of the scarce and threatened Coleoptera of Great Britain. Part 1. UK Nature Conservation: 3. Joint Nature Conservation Committee, Peterborough.

Iorio, É. 2014. Catalogue biogéographique et taxonomique des chilopodes (Chilopoda) de France métropolitaine. *Mémoires de la Société Linnéenne de Bordeaux*, **15**: 1-372.

Irwin, T. 1982. Finding *Buddelundiella cataractae* Verhoeff. *British Isopod Group Newsletter*, **No.15**: 6. Unpublished.

IUCN. 1994. *IUCN Red List Categories and Criteria: Version 2.3*, IUCN Species Survival Commission. IUCN, Gland.

IUCN. 2001. *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland and Cambridge.

IUCN. 2003. Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0. IUCN Species Survival Commission IUCN, Gland and Cambridge.

IUCN. 2012a. *IUCN Red List Categories and Criteria*. Version 3.1. 2nd Edition, IUCN Species Survival Commission. IUCN, Gland.

IUCN. 2012b. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels. Version 4.0, IUCN Species Survival Commission. IUCN, Gland.

IUCN, 2013. *Guidelines for Using the IUCN Red List Categories and Criteria*. Version 10, IUCN Species Survival Commission. IUCN, Gland.

Jeekel, C.A.W. 1977. Voorlopige atlas van de verspreiding der Nederlandse duizendpoten (Chilopoda). *Verslagen en Technische Gegevens, Instituut voor Taxonomische Zoölogie, Universiteit van Amsterdam*, **13**: 1-55.

Jekeel, C.A.W. 2001. The Dutch millipede fauna compared with the British. *Bulletin of the British Myriapod and Isopod Group*, **17**: 43-59.

Jones, R.E. 1989. On a new species of centipede (Chilopoda, Geophilomorpha) from the Isles of Scilly. *Journal of Natural History*, **23**:627-633.

Jones, R.E. 1992. A collection of Irish myriapods. *Bulletin of the British Myriapod Group*, **8**: 9-12.

Jones, R.E. 1998. A description of *Schendyla peyerimhoffi* Brölemann and Ribaut (1911). *Bulletin of the British Myriapod Group*, **14**: 26-30.

Jones, R.E. & Barber, A.D. 1997. A description of *Chalandea pinguis* (Brölemann, 1898). *Bulletin of the British Myriapod Group*, **13**: 22-26.

Jones, R.E. & Barber, A.D. 1998. Errata: A description of *Chalandea pinguis* (Brölemann, 1898). *Bulletin of the British Myriapod Group*, **14**: 37.

Jones, R.E. & Keay, A.N. 1986. *Trachysphaera lobata* (Ribaut, 1954), a millipede new to Britain, from the Isle of Wight. *Bulletin of the British Myriapod Group*, **3**: 17-20.

Jones, R.E. & Pratley, P. 1987. Myriapods of the Isles of Scilly. *Bulletin of the British Myriapod Group*, **4**: 7-15.

Keay, A.N. 1984. Some notes on *Chaetechelyne vesuviana* (Newport). *Bulletin of the British Myriapod Group*, **2**: 24-33.

Keay, A.N. 1986. Predation and prey in *Henia (Chaetechelyne) vesuviana* (Newport) (Chilopoda, Geophilomorpha). *Bulletin of the British Myriapod Group*, **3**: 21-25.

Keay, A.N. 1987. *Lithobius pilicornis* Newport in Yorkshire. *Bulletin of the British Myriapod Group*, **4**: 52.

Keay, A.N. 1989. *Lithobius tenebrosus* Meinert from Aberystwyth, Cardiganshire. *Bulletin of the British Myriapod Group*, **6**: 3-5.

Kime, R.D. 1990. *A provisional Atlas of European Myriapods Part 1*. Fauna Europaea Evertebrata Vol. 1. Luxembourg, European Invertebrate Survey.

Kime, R.D. 1999. The continental distribution of British and Irish millipedes. *Bulletin of the British Myriapod Group*, **15**: 33-76.

Kime, R.D. 2001. The continental distribution of British and Irish millipedes, part 2. *Bulletin of the British Myriapod and Isopod Group*, **17**: 7-42.

Kime, R.D. 2003. Some unpublished records of centipedes identified by Dr E.H. Eason. *Bulletin of the British Myriapod and Isopod Group*, **19**: 45-50.

Kime, R.D. 2004. The Belgian Millipede Fauna (Diplopoda). *Bulletin de l'Institut royal des Sciences Naturelles de Belgique, Entomologie*, **74**: 35-68.

Kime, R.D. & Enghoff, H. 2011. *Atlas of European Millipedes (Class Diplopoda). Volume 1. Orders Polyxenida, Glomerida, Platydesmida, Siphonocryptida, Polyzoniida, Callipodida, Polydesmida.* Co-published by Pensoft Publishers, Sofia - Moscow and European Invertebrate Survey, Leiden.

Kime, R.D. & Wauthy, G. 1984. Aspects of relationships between millipedes, soil texture and temperature in deciduous forests. *Pedobiologia*, **26**: 387-402.

Kolar, L., Eržen, N.K., Hogerwerf, L. & van Gestel, C.A.M. 2008. Toxicity of abamectin and doramectin to soil invertebrates. *Environmental Pollution*, **151**: 182-189.

Lee, P. 2003a. *A report on a survey of the invertebrates of Sudbourne Beach, Suffolk, April 2002 – March 2003.* Report to the National Trust / Environment Agency. Unpublished.

Lee, P. 2003b. *A report on a brief survey of the terrestrial invertebrates of Cley and Salthouse, Norfolk, June – August 2003*. Report to Mott Macdonald / Environment Agency. Unpublished.

Lee, P. 2006a. *A report on a survey of the terrestrial invertebrates of Cley and Salthouse, Norfolk, July – August 2006.* Report to Mott Macdonald / Environment Agency. Unpublished.

Lee, P. 2006b. *Atlas of the Millipedes (Diplopoda) of Britain and Ireland*. Published on behalf of the Biological Records Centre by Pensoft Publishers, Sofia - Moscow.

Lee, P. 2007. *A survey of the shingle and saltmarsh invertebrates of Cley and Salthouse, Norfolk, June 2007.* Report to Mott Macdonald / Environment Agency. Unpublished.

Lee, P. 2011. *Hymettus Ltd. Research report for 2011*. Unpublished. Available online at http://hymettus.org.uk/downloads/Hymettus-Annual-Report_2011.pdf

Lee, P. 2012a. Millipedes from North Wales: a report on the BMIG 2010 field meeting. *Bulletin of the British Myriapod and Isopod Group*, **26**: 41-46.

Lee, P. 2012b. *Hymettus Ltd. Research report for 2012*. Unpublished. Available online at http://hymettus.org.uk/downloads/HymettusAR_2012.pdf

Lee, P. (in prep.) The distribution and ecology of *Polyzonium germanicum* (Brandt, 1837) in Kent.

Lee, P., Gregory, S.J., Keay, A.N. & Read, H.J. 2005. *Survey of the pill millipede* Trachysphaera lobata *(Ribaut, 1954) in the Bembridge area of the Isle of Wight*. Report for English Nature. Unpublished.

Lee, P., Gregory, S.J. & Read, H.J. 2011. The rediscovery of *Metaiulus pratensis* Blower & Rolfe, 1956 (Diplopoda, Julidae) in Kent. *Entomologist's Monthly Magazine*, **147**: 156.

Leśniewska, M., Mock, A. & Kania, G. 2011. Centipede (Chilopoda) Diversity in Forest Habitats of Ojców National Park. *Polish Journal of Environmental Studies*, **20** (3): 581-590.

Lewis, J.G.E. 1961. On *Schendyla peyerimhoffi* Brölemann & Ribaut and *Geophilus pusillifrater* Verhoeff, two geophilomorph centipedes new to the British Isles. *Annals and Magazine of Natural History*: *Series 13*, **4**: 393-399.

Lewis, J.G.E. 1962. The ecology, distribution and taxonomy of the centipedes found on the shore in the Plymouth area. *Journal of the Marine Biological Association of the United Kingdom*, **42**: 655-664.

Lewis, J.G.E. 1981. *The biology of centipedes*. CUP, Cambridge.

Lewis, J.G.E., Jones, R.E. & Keay, A.N. 1988. On a new species of centipede (Chilopoda, Geophilomorpha, Chilenophilidae) from the British Isles. *Journal of Natural History*, **22**: 1657-1663.

Lewis, J.G.E. & Kime, R.D. 1988. Centipedes and millipedes from Finistère, Britanny. *Bulletin of the British Myriapod Group*, **4**: 6-8.

Lock, K. 2010. Updated checklist of the Belgian centipedes (Chilopoda). *Faunistic Entomology*, **62**(1): 35-39.

Loomis, H.F. 1934. Millipeds of the West Indies and Guiana collected by the Allison V. Armour expedition in 1932. *Smithsonian miscellaneous collections*, **89**(4): 1-69.

Macadam, C. 2015. *A review of the stoneflies (Plecoptera) of Great Britain.* Species Status No.20. Natural England Commissioned Reports, Number 174.

Mauriès, J.-P. 1960. Une nouvelle espèce Pyrénéenne du genre *Adenomeris*. *Bulletin de la Société d'Histoire Naturelle de Toulouse*,**95**: 401-404.

Mauriès, J.-P. 1965. Une nouvelle sous-espèce cavernicole de *Metaiulus pratensis* Blower & Rolfe, 1956. *Annales de Spéléologie*, **20**: 519-522.

Mauriès, J.-P. & Kime, R.D. 1999. Description, écologie et chorologie de trois espèces nouvelles de diplopodes (Myriapoda, Diplopoda) des zones périphériques du Massif central et du centre de la France. *Zoosystema*, **21**: 367-378.

Meidell, B.A. 1969. *Geophilus insculptus* Attems 1895 and *Geophilus proximus* C.L. Koch 1847 (Chilopoda) in Norway. *Norsk Entomologisk Tidsskrift* **16**: 9-12.

Meidell, B.A. 1979. Norwegian Myriapoda: Some Zoogeographical Remarks. pp 195-201. In: Camatini, M. (ed.). *Myriapod Biology*. London, Academic Press.

Mesibov, R. 2012. New species of *Prosopodesmus* Silvestri, 1910 (Diplopoda, Polydesmida, Haplodesmidae) from Queensland, Australia. *ZooKeys*, **190**: 33-54.

Minelli, A. 1982. Contributo alla revisione dei chilopodi Geofilomorfi finora riferiti ai generi *Henia* e *Chaetechelyne* (Chilopoda, Geophilomorpha). *Memorie della Società Entomologica Italiana*, **60**: 253-268.

Minelli, A. 2011. Class Chilopoda, Class Symphyla and Class Pauropoda. In: Zhang, Z.-Q. (ed.) Animal Biodiversity: an Outline of Higher-level Classification and Survey of Taxonomic Richness. *Zootaxa*, **3148**: 157-158.

Morgan, I.K. 1988. *Blaniulus guttulatus* (Fab.) – an unexpected carnivore? *Bulletin of the British Myriapod Group*, **5**: 39.

Morgan, I.K. 2011. A report on the British Myriapod and Isopod Group visit to Swansea, 27-30th March 2008. *Bulletin of the British Myriapod and Isopod Group*, **25**: 54-61.

Natural England. 2009. *State of the natural environment in the South West*. Natural England Report NE 136.

Natural England. 2013. *NCA Profile: 149. The Culm*. Natural England Report NE 389.

Noël, F. & Séchet, E. 2007. Crustacés Isopodes terrestres du Nord-Ouest de la France (Crustacea, Isopoda, Oniscidea). Clé de détermination et références bibliographiques. *Invertébrés Armoricains*, **2**: 1-48.

Noël, F., Séchet, E., Mouquet, C, & Bécheau, F. 2014. Découverte de *Chaetophiloscia sicula* Verhoeff, 1908 (Philosciidae) et de *Stenophiloscia glarearum* Verhoeff, 1908 (Halophilosciidae) dans l'Ouest de la France (Crustacea, Isopoda, Oniscidea). *Invertébrés Armoricains*, **10**: 47-53.

Novák, J. & Dányi, L. 2010. Faunistical and biogeographical survey of the centipede fauna in the Aggtelek National Park, Northeast Hungary. *Opuscula Zoologica Budapest*, **41**(2): 215–229.

Oliver, P.G. 1983. The occurrence of *Buddelundiella cataractae* Verhoeff, 1930 (Isopoda: Oniscoidea) in Wales, Great Britain. *Crustaceana*, **44**:105-108.

Oliver, P.G. & Meechan, C.J. 1993. *Woodlice*. Synopses of the British Fauna (New Series) No. 49, published for the Linnean Society of London and the Estuarine and Coastal Sciences Association by Field Studies Council, Preston Montford.

Oliver, P.G. & Sutton, S.L. 1982. *Miktoniscus patiencei* Vandel, 1946 (Isopoda: Oniscoidea), a redescription with notes on its occurrence in Britain and Eire. *Journal of Natural History*, **16**: 201-208.

Oliver, P.G. & Trew, A. 1981. A new species of *Metatrichoniscoides* (Crustacea: Isopoda: Oniscidea) from the coast of South Wales, UK. *Journal of Natural History*, **15**: 525-529.

Palmén, E. & Rantala, M. 1954. On the life-history and ecology of *Pachymerium ferrugineum* (C.L. Koch) (Chilopoda, Geophilidae). *Annales Zoologici Societatis Zoologicae-Botanicae Fennicae 'Vanamo'*, **16** (3): 1-44.

Pedroli-Christen, A. 1993. Faunistique des Mille-pattes de Suisse (Diplopoda). *Documentata faunistica Helvetiae 14*. Centre Suisse de Cartographie de la Faune, Neuchatel.

Rackham, O. 2006. *Woodlands*. Collins, London.

Rawcliffe, C.P. 1987. Myriapods in the Lothians. *Bulletin of the British Myriapod Group*, **4**: 49.

Read, H.J. 2008. Records of millipedes from Kew gardens and the Eden Project, including descriptions of three species. *Bulletin of the British Myriapod and Isopod Group*, **23**: 27-35.

Read, H.J., Barber, A.D., Gregory, S.J. & Lee, P. 2006. Report on the 2004 BMIG meeting in Buckinghamshire. *Bulletin of the British Myriapod and Isopod Group*, **21**: 61-67.

Read, H.J., Corbet, G.B. & Jones, R.E. 2002. *Cytlindroiulus salicivorus* Verhoeff, 1908: A millipede new to Britain. *Bulletin of the British Myriapod and Isopod Group*, **18**: 41-44.

Ribaut, H. 1955. *Ceratosphys amoena* Rib. et *C. confusa* n. sp. *Bulletin de la Société d'histoire naturelle de Toulouse*, **90**: 301-302

Richards, J.P. 1997. A second record for *Lithobius pilicornis* from Sheffield. *Bulletin of the British Myriapod Group*, **13**: 32.

Richards, J.P. 2004. Report on the 2002 BMIG meeting in Derbyshire and South Yorkshire. *Bulletin of the British Myriapod and Isopod Group*, **20**: 42-48.

Richards, J.P. 2011. *An introduction to Centipedes, Millipedes and Woodlice*. Pisces Publications, Newbury.

Richardson, D.T. 1989. *Armadillidium pictum* Brandt in Yorkshire. *Isopoda*, **3**:13-14.

Rota-Stabelli, O., Daley, A.C. & Pisani, D. 2013. Molecular timetrees reveal a Cambrian colonization of land and a new scenario for Ecdysozoan evolution. *Current Biology*, **23**(5): 392-398.

Rundle, A.J. Centipede records obtained on the Conchological Society expedition to Ireland, September/October 1984. *Bulletin of the British Myriapod Group*, **3**: 3-10.

Schmalfuss, H. 2004. World catalog of terrestrial isopods (Isopoda: Oniscidea). Available online at http://isopods.nhm.org/pdfs/27577/27577.pdf. A revised and updated version of Schmalfuss, H. 2003. World catalog of terrestrial isopods (Isopoda: Oniscidea). *Stuttgarter Beitrage zur Naturkunde, Serie A*, **654**: 1-341.

Schubart, O. 1929. Thalassobionte und thalassophile Myriapoda. In: Grimpe, G. & Wagler, E. (eds). *Tierwelt der Nord- und Ostsee*, **11**: 1-20.

Schubart, O. 1938. Ein fur Deutschland neuer Diplopode aus westdeutschen Höhlen. *Sonderdruck aus den Mittelungen uber Höhlen und Karstforschung*, **1938**: 133-137.

Schubart, O. & Husson, R. 1937. Les diplopodes de cavités souterraines du Nord-Est de la France. *Bulletin de la Société Zoologique de France*, **61**: 484-502.

Shear, W.A., Jeram, A.J. & Selden, P.A. 1998. Centiped legs (Arthropoda, Chilopoda, Scutigeromorpha) from the Silurian and Devonian of Britain and the Devonian of North America. *American Museum Novitates*, **3231**: 1-16.

Shelley, R. M. 1978. Millipeds of the eastern Piedmont region of North Carolina, USA. (Diplopoda). *Journal of Natural History*, **12**: 37-79.
Sierwald, P. & Bond, J.E. 2007. Current status of the myriapod class Diplopoda (millipedes): Taxonomic diversity and phylogeny. *Annual Review of Entomology*, **52**: 401-420.

Smith, P. & Barber, A.D. 2011. *Geophilus seurati* from core samples in muddy sand from the Hayle Estuary, Cornwall. *Bulletin of the British Myriapod and Isopod Group*, **25**: 51.

Spelda, J. 1999. *Verbreitungsmusterund Taxonomie der Chilopoda und Diplopoda Südwestdeutschlands. Diskriminanzanalytische Verfahren zur Trennung von Arten und Unterarten am Beispiel der Gattung* Rhymogona*, 1896 (Diplopoda: Chordeumatida: Craspedosomatidae).* Unpublished PhD dissertation, University of Ulm.

Spelda, J. 2005. Improvements in the knowledge of the myriapod fauna of southern Germany between 1988 and 2005 (Myriapoda: Chilopoda, Diplopoda, Pauropoda, Symphyla). *Peckiana*, **4**: 101-129.

Strasser, K. (1967) Über Diplopoden Griechenlands, einiger Ägäis-Inseln und Zyperns. *Senckenbergiana biologica*, **48**(4): 269-293.

Suomalainen, P. 1939. Zur Verbreitungsökologie von *Pachymerium ferrugineum* C.Koch (Myriopoda) in finnischen Schärenhof. *Annales Zoologici Societatis Zoologicae Botanicae Fennicae 'Vanamo'*, 7: 10-14.

Taiti, S. & Lopez, H. 2008. New records and species of Halophilosciidae (Crustacea, Isopoda, Oniscidea) from the Canary Islands (Spain). In: Zimmer, M., Cheikhrouha, F.C. & Taiti, S. (Eds.) *Proceedings of the International Symposium of Terrestrial Isopod Biology – ISTIB-07*. pp.43-58.

Telfer, M.G. 2013. *Invertebrate survey of lagoons at Orford Ness.* Version 2: 2nd April 2013. Report to the National Trust. Unpublished. Available online at http://www.lifealdeore.org/reports/20130910161903201308130910 45orford_ness_lagoons_invertebrate_survey_report_2012_v2.pdf

Telfer, M.G. 2014. Into the Valley of the Millipedes, part 2. Available online at http://markgtelfer.co.uk/2014/11/12/into-the-valley-of-the-millipedes-part-2/

Tuf, I. & Tufová, J. 2008. Proposal of ecological classifcation of centipede, millipede and terrestrial isopod faunas for evaluation of habitat quality in Czech Republic. *Casopis Slezského muzea Opava (A)*, **57**: 37-44.

Turk, F.A., 1945. Myriapodological notes I. *Northwestern Naturalist*, **20**: 137-144.

Vandel, A. 1960. Isopodes terrestes. (Première partie). *Faune de France*, **64**. Paris.

Vandel, A. 1962. Isopodes terrestes. (Deuxième partie). *Faune de France*, **66**. Paris.

Voigtländer, K. 2005. Habitat preferences of selected Central European centipedes. *Peckiana*, **4**: 163-179.

Voigtländer, K., Reip, H.S., Decker, P. & Spelda, J. 2011. Critical reflections on the German Red Lists of endangered myriapod species (Chilopoda, Diplopoda) (with species list for Germany). *International Journal of Myriapodology*, **6**: 85-105.

Wall, R. & Strong, L. 1987. Environmental consequences of treating cattle with the antiparasitics drug ivermectin. *Nature*, **327**: 418–421.

Webb, J.R. & Lott, D.A. 2006. The development of ISIS: a habitat-based assemblage classification system for assessing conservation interest in England. *Journal of Insect Conservation*, **10**:179-188.

Wesner, T., Lee, P. & Read, H.J. 2011. *Report on the origins, morphological and genetic structure of the* Trachysphaera c.f. lobata *population in the UK*. Report to Hymettus Ltd. Unpublished. Available online at http://hymettus.org.uk/downloads/Trachysphaera%20final%20report.pdf

Wilson, H.M. & Anderson, L.I. 2004. Morphology and taxonomy of Paleozoic millipedes (Diplopoda: Chilognatha: Archipolypoda) from Scotland. *Journal of Paleontology*, **77**: 169-184.

Zapparoli, M. 2003. The present knowledge on the distribution of the European fauna of Lithobiomorpha (Chilopoda). *Bulletin of the British Myriapod and Isopod Group*, **19**: 20-41.

Zapparoli M. 2009. An annotated catalogue of the epigeic and cave centipedes (Chilopoda) of Sardinia. In: Cerretti P., Mason F., Minelli A., Nardi G. & Whitmore D. (eds) Research on the Terrestrial Arthropods of Sardinia (Italy). *Zootaxa*, **2318**: 56-168.

Zapparoli, M. 2011a. New records and remarks on the centipede fauna of endogean habitats of Sardinia (Chilopoda). In Nardi, G., Whitmore, D., Bardiani, M., Birtele, D., Mason, F., Spada, L. & Cerretti, P. (eds) Biodiversity of Marganai and Montimannu (Sardinia). Research in the framework of the ICP Forests network. *Conservazione Habitat Invertebrati*, **5**: 223-242.

Zapparoli, M. 2011b. Centipedes in relic wetlands of north-eastern Italy: faunistic and ecological remarks (Chilopoda). *Gortania: Botanica, Zoologia,* **32**: 135-166.

Zapparoli, M. 2013. Fauna Europaea: Lithobiidae. In Enghoff, H. 2013. Fauna Europaea: Chilopoda. Fauna Europaea version 2.6.2. [http://www.faunaeur.org]

Zulka, K. P. 1992. Myriapods from a Central European river floodplain. In Meyer, E., Thaler, K. and Schedl, W. (eds.) Advances in Myriapodology: proceedings of the 8th International Conference of Myriapodology, Innsbruck, 15-20 July 1990. *Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck. Supplementum,* **10**: 189.

# Appendix 1 A complete listing of all species reviewed

**Table A DIPLOPODA (millipedes)**

| Species name | GB IUCN status (2014) | Qualifying criteria | Rationale | GB rarity status (2014) | Global IUCN status (2010) | Presence in England | Presence in Scotland | Presence in Wales | AoO (hectads) 1970-1989 | AoO (hectads) 1990-2012 | Dual hectads | AoO (tetrads) 1990-2012 | Locations 1990-2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Adenomeris gibbosa* | DD | | Recent discovery in 2004 with just three locations known. Further survey required to determine whether introduced or native and to assess status. | NR | | E | | | 0 | 2 | 0 | 3 | 3 |
| *Allajulus nitidus* | LC | | Widespread but localised | NS | | E | S | W | 25 | 44 | 6 | | |
| *Amphitomeus attemsi* | NA | | An alien species from heated glasshouses | Non-native | | E | | | 0 | 1 | 0 | | |
| *Anamastigona pulchella* | NA | | Probably introduced from Italy by horticultural trade | Naturalised | | E | S | W | 0 | 3 | 0 | | |
| *Anthogona britannica* | NT | B1ab(ii) (iv), B2ab(ii) (iv) | Endemic species. Intensive survey has found 11 locations within very restricted area. If just one was lost would meet criteria for Vulnerable | NR | | E | | | 0 | 4 | 0 | 11 | 11 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Archiboreoiulus pallidus* | LC | Widespread but localised. Probably under-recorded in recent years and likely to occur in more than 100 hectads | | E | S | W | 65 | 79 | 6 |
| *Blaniulus guttulatus* | LC | Widespread species | | E | S | W | 261 | 263 | 36 |
| *Boreoiulus tenuis* | LC | Widespread species, increase in number of recent records | | E | S | W | 68 | 132 | 11 |
| *Brachychaeteuma bagnalli* | LC | No evidence of decline but a very localised species. Taxonomic uncertainties exist, all records of *B. bagnalli/bradeae* may refer to one variable species recorded from >16 hectads | NS | E | S | | 6 | 11 | 0 |
| *Brachychaeteuma bradeae* | LC | A very localised species. Taxonomic uncertainties exist, as above all records of *B. bagnalli/bradeae* may refer to one variable species | NS | E | S | W | 17 | 17 | 1 |
| *Brachychaeteuma melanops* | LC | Widespread species but localised, some increase in number of recent records | NS | E | | W | 34 | 52 | 4 |
| *Brachydesmus superus* | LC | Widespread species | | E | S | W | 421 | 391 | 89 |
| *Brachyiulus lusitanus* | NA | May be overlooked native due to confusion with *B. pusillus* in past but most probably introduced by horticultural trade | Naturalised | E | | | 0 | 1 | 0 |
| *Brachyiulus pusillus* | LC | Widespread species, increase in number of recent records | | E | S | W | 116 | 157 | 11 |
| *Ceratosphys amoena confusa* | DD | Discovered in 2014 so too early to assign a threat category | | | | W | 1 | 4 (in 2014) | 0 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Choneiulus palmatus* | LC | | Widespread but localised species, increase in recent records probably due to inmproved ability of recorders to identify the species | NS | E | S | W | 25 | 34 | 3 | | |
| *Chordeuma proximum* | LC | | Widespread and extent of occurrence has increased in last few years despite decline in records due to less recording in strongholds in Southern England | | E | S | W | 97 | 76 | 15 | | |
| *Chordeuma sylvestre* | VU | D2 | Very localised, only known from Camel Valley, Cornwall and Culzean Castle, Ayr. IUCN criteria are satisfied as the species has been recorded from just three locations since 1990. | NR | E | S | | 1 | 4 | 0 | 4 | 3 |
| *Craspedosoma rawlinsii* | LC | | Widespread species but localised. At least one of records related to the newly recognised *Ceratosphys amoena confusa*. Other records may be misidentifications of this taxon. | NS | E | S | W | 38 | 31 | 5 | | |
| *Cylindrodesmus hirsutus* | NA | | An alien species from heated glasshouses | Non-native | E | | | 0 | 3 | 0 | | |
| *Cylindroiulus britannicus* | LC | | Widespread species | | E | S | W | 186 | 205 | 30 | | |
| *Cylindroiulus caeruleocinctus* | LC | | Widespread species | | E | S | W | 112 | 124 | 17 | | |
| *Cylindroiulus latestriatus* | LC | | Widespread, mainly coastal species | | E | S | W | 251 | 215 | 55 | | |
| *Cylindroiulus londinensis* | LC | | Widespread but very localised species | NS | E | S | W | 19 | 18 | 3 | | |
| *Cylindroiulus parisiorum* | LC | | Widespread but very localised species | NS | E | | W | 24 | 22 | 1 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Cylindroiulus punctatus* | LC | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | E | S | W | 1077 | 722 | 343 |
| *Cylindroiulus salicivorus* | NA | Probably introduced from Italy by horticultural trade, only recorded from glasshouses | Non-native | | S | | 0 | 2 | 0 |
| *Cylindroiulus truncorum* | NA | Probably introduced from North Africa by horticultural trade, likely to spread | Naturalised | E | S | | 2 | 6 | 1 |
| *Cylindroiulus vulnerarius* | NA | Probably introduced from Italy by horticultural trade but recent discovery in cave system in Belgium raises possibility of relict populations in Northern Europe | Naturalised | E | S | W | 9 | 15 | 2 |
| *Enantiulus armatus* | LC | Very restricted distribution in Devon/Cornwall but 13 locations known within this area and no specific threats are known to exist at any of them so the IUCN criteria for VU D2 are not satisfied. | NR | E | | | 7 | 5 | 1 |
| *Eutrichodesmus* sp. 'Eden A' | NA | An alien species from heated glasshouses | Non-native | E | | | 0 | 1 | 0 |
| *Geoglomeris subterranea* | LC | Widespread but localised on calcareous soils, subterranean so may be under recorded | NS | E | S | W | 29 | 25 | 2 |
| *Glomeris marginata* | LC | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | E | S | W | 652 | 385 | 171 |
| *Haplopodoiulus spathifer* | NA | Probably introduced by horticultural trade, likely to spread | Naturalised | E | | | 0 | 3 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hylebainosoma nontronensis* | DD | Discovered in 2014 so too early to assign a threat category | NR | | | W | 0 | 3 (in 2014) | 0 | | |
| *Julus scandinavius* | LC | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 441 | 297 | 80 | | |
| *Leptoiulus belgicus* | LC | Widespread but localised, increase in recent records | NS | E | S | W | 24 | 40 | 6 | | |
| *Leptoiulus kervillei* | LC | Very localised species in southern England and Wales | NS | E | | W | 16 | 19 | 4 | | |
| *Macrosternodesmus palicola* | LC | Widespread species, increase in recent records | | E | S | W | 88 | 156 | 6 | | |
| *Melogona gallica* | LC | Widespread species but localised | | E | S | W | 62 | 59 | 9 | | |
| *Melogona scutellaris* | LC | Widespread species, increase in recent records | | E | S | W | 79 | 105 | 10 | | |
| *Melogona voigtii* | DD | Difficult to separate from *M. gallica*, older records could refer to either species. Recorded from a fourth hectad in 2013. Further survey required to determine whether native or an introduction and to assess status. | NR | | S | | 0 | 3 | 0 | 3 | 3 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Metaiulus pratensis* | EN | B2ab(ii) (iv) | Very rare, restricted to Kent and a handful of sites in France. Little doubt that the AoO is less than 500 sq. km hence geographical threshold for criterion B2 is met. It exists at less than 5 locations (discovered at Yalding in 2011 after no records for 23 years despite ongoing survey) and there have been significant declines in AoO and the number of locations between the two recording periods despite the intensity of recording effort. Heavy flooding of the Yalding site in early 2014 may have caused a significant decline in the population present. Therefore the IUCN criteria for the Endangered category are satisfied. | NR | E | | | 6 | 1 | 1 | 1 | 1 |
| *Nanogona polydesmoides* | LC | | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 555 | 357 | 108 | | |
| *Nemasoma varicorne* | LC | | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 244 | 140 | 21 | | |
| *Nopoiulus kochii* | LC | | Widespread species but very localised. Difficult to identify and easily overlooked amongst populations of the very common *Proteroiulus fuscus* so probably under recorded | NS | E | S | W | 11 | 9 | 1 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Ommatoiulus sabulosus* | LC | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 411 | 223 | 81 |
| *Ophiodesmus albonanus* | LC | Widespread species, increase in recent records | | E | S | W | 74 | 118 | 8 |
| *Ophyiulus pilosus* | LC | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 533 | 454 | 133 |
| *Oxidus gracilis* | NA | An alien species from glasshouses but occasionally establishes temporary colonies outdoors | Non-native | E | S | W | 19 | 11 | 10 |
| *Paraspirobolus lucifugus* | NA | An alien species from heated glasshouses | Non-native | E | | | 0 | 1 | 0 |
| *Polydesmus angustus* | LC | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 756 | 492 | 179 |
| *Polydesmus barberii* | NA | Probably introduced from French or Italian rivieras. Found in synanthropic and semi-natural sites around Plymouth but may spread | Naturalised | E | | | 0 | 2 | 0 |
| *Polydesmus coriaceus* | LC | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 198 | 163 | 43 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Polydesmus denticulatus* | LC | | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 177 | 113 | 17 | | |
| *Polydesmus inconstans* | LC | | Widespread species | | E | S | W | 104 | 109 | 8 | | |
| *Polyxenus lagurus* | LC | | Widespread species but under recorded as ideally requires nocturnal surveys | | E | S | W | 124 | 99 | 18 | | |
| *Polyzonium germanicum* | LC | | Restricted to Kent but recent intensive survey has confirmed it to be widespread in suitable habitat | NS | E | | | 9 | 16 | 7 | | |
| *Poratia digitata* | NA | | An alien species from heated glasshouses | Non-native | E | | | 2 | 3 | 1 | | |
| *Propolydesmus testaceus* | NT | D2 | Very localised, recent records from just 5 hectads but does not meet the criterion for VU D2 as there are records from two locations within one of these hectads. Development pressures are an ongoing threat at two of the sites so Near Threatened status is appropriate. | NR | E | | W | 6 | 5 | 0 | 6 | 6 |
| *Prosopodesmus panporus* | NA | | An alien species from heated glasshouses | Non-native | E | | | 1 | 1 | 1 | | |
| *Proteroiulus fuscus* | LC | | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 665 | 451 | 144 | | |
| *Pseudospirobolellus avernus* | NA | | An alien species from heated glasshouses | Non-native | E | | | 0 | 1 | 0 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rhinotus purpureus* | NA | | An alien species from heated glasshouses | Non-native | E | | | 1 | 1 | 0 | | |
| Sphinophorida sp. | NA | | An alien species from heated glasshouses | Non-native | E | | | 0 | 1 | 0 | | |
| *Stosatea italica* | LC | | Possibly an ancient introduction. Very localised in Southern England and Wales but reduction in recent records probably due to fewer active recorders in former area | NS | E | | W | 15 | 10 | 2 | | |
| *Tachypodoiulus niger* | LC | | Widespread, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the common species | | E | S | W | 983 | 624 | 279 | | |
| *Thalassisobates littoralis* | LC | | A very localised, littoral species. | NR | E | S | W | 6 | 7 | 2 | | |
| *Trachysphaera lobata* | VU | D2 | Two sites in S Wales and one on the Isle of Wight. Intensive surveys in 2005, 2011 and 2012 failed to locate further populations on IOW. IUCN criteria satisfied as records from <5 locations and there is a specific threat of habitat loss through coastal erosion and / or human disturbance at Bembridge. Would satisfy criteria for Endangered status if evidence suggesting population at Bembridge undergoes severe fluctuations in the number of mature individuals is confirmed | NR | E | | W | 1 | 3 | 1 | 3 | 3 |
| *Unciger foetidus* | NA | | Probably introduced with plants | Non-native | E | | | 0 | 1 | 0 | | |

**Table B CHILOPODA (centipedes)**

| Species name | GB IUCN status (2014) | Qualifying criteria | Rationale | GB rarity status (2014) | Global IUCN status (2010) | Presence in England | Presence in Scotland | Presence in Wales | AoO (hectads) 1970-1989 | AoO (hectads) 1990-2012 | Dual hectads | AoO (tetrads) 1990-2012 | Locations 1990-2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Arenophilus peregrinus* | DD | | Recently described and known only from two coastal sites in Isles of Scilly and one inland site in Cornwall prior to discovery at a site in Portugal. May be under recorded on rocky shores as it can be difficult to find, even at the known locations. Further survey required to assess status. | NR | | E | | | 1 | 2 | 0 | 2 | 2 |
| *Cryptops anomalans* | NA | | Introduced to southern Britain from the Mediterranean | Naturalised | | E | | W | 19 | 27 | 3 | | |
| *Cryptops doriae* | NA | | An alien species from heated glasshouses | Non-native | | E | | | 0 | 1 | 0 | | |
| *Cryptops cf hispanus* | NA | | An alien species from heated glasshouses | Non-native | | | | W | 0 | 1 | 0 | | |
| *Cryptops hortensis* | LC | | Widespread species | | | E | S | W | 254 | 253 | 55 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Cryptops parisi* | NA | Widespread but localised species, probably introduced with plants and mainly found in gardens | Naturalised | E | S | W | 42 | 39 | 9 |
| *Dicellophilus carniolensis* | NA | An alien species from heated glasshouses | Non-native | E | S | | 0 | 0 | 0 |
| *Eurygeophilus pinguis* | LC | Very localised, restricted to north Devon and recently found at two locations in Cornwall | NR | E | | | 9 | 7 | 0 |
| *Geophilus alpinus* | LC | Widespread species, increase in recent records | | E | S | W | 188 | 283 | 39 |
| *Geophilus carpophagus s.s.* | LC | Widespread species. Low record numbers due to recent split from *G. easoni* and only confirmed records of segregate are included. Believed to occur in more than 100 hectads. | | E | S | W | 6 | 14 | 0 |
| *Geophilus easoni* | LC | Widespread species. Low record numbers due to recent split from *G. carpophagus* and only confirmed records of segregate are included. Believed to occur in more than 100 hectads. | | E | S | W | 37 | 65 | 3 |
| *Geophilus electricus* | LC | Widespread species, believed to occur in more than 100 hectads. | | E | S | W | 68 | 79 | 2 |
| *Geophilus flavus* | LC | Widespread species | | E | S | W | 331 | 332 | 60 |
| *Geophilus fucorum seurati* | LC | Widespread species but very localised. Restricted to littoral habitats where it is difficult to find and probably under recorded as a result | NS | E | S | W | 19 | 14 | 0 |
| *Geophilus osquidatum* | LC | Widespread but localised species across southern Britain | NS | E | | W | 27 | 33 | 2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Geophilus proximus* | DD | Recorded once from Shetland, data suggests species may be Regionally Extinct but area has not been revisted by myriapodologists and species is widespread in northern Europe | NR | | S | | 1 | 0 | 0 | 0 | 0 |
| *Geophilus pusillifrater* | DD | Raw data suggests species may be Regionally Extinct but animal remains under recorded due to difficulty of collecting from coastal shingle and rock crevices, any surviving population is of global importance | NR | E | | | 4 | 0 | 0 | 0 | 0 |
| *Geophilus truncorum* | LC | Widespread species, increase in recent records | | E | S | W | 349 | 438 | 76 | | |
| *Haplophilus souletinus* | NT | Restricted to Falmouth area where it may be introduced but further research and survey is required | NR | E | | | 0 | 3 | 0 | 6 | 6 |
| *Haplophilus subterraneus* | LC | Widespread species | | E | S | W | 302 | 292 | 79 | | |
| *Henia brevis* | LC | Localised species, restricted to Southern England | NS | E | | | 10 | 25 | 1 | | |
| *Henia vesuviana* | LC | Localised species, restricted to Southern England | NS | E | | | 23 | 29 | 5 | | |
| *Hydroschendyla submarina* | NT | Widespread but very localised species, possibly under recorded due to difficulty of collecting from coastal shingle and rock crevices | NR | E | S | | 3 | 6 | 0 | 6 | 6 |
| *Lamyctes caeculus* | NA | An alien species from heated glasshouses | Non-native | E | | W | 0 | 2 | 0 | | |
| *Lamyctes emarginatus* | NA | An Australasian species introduced to Britain and widely naturalised | Naturalised | E | S | W | 118 | 95 | 5 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lithobius borealis* | LC | | Widespread species of heath and moor. These are poor habitats for most myriapods, hence not often surveyed and species is under recorded. Believed to occur in more than 100 hectads | | E | S | W | 104 | 61 | 7 | | |
| *Lithobius calcaratus* | LC | | Widespread species of heath and moor. These are poor habitats for most myriapods, hence not often surveyed and species is under recorded. Believed to occur in more than 100 hectads | | E | S | W | 112 | 65 | 10 | | |
| *Lithobius crassipes* | LC | | Widespread species found in range of habitats including heath and moor. Reduced survey effort in latter habitats in recent years may account for decrease in records | | E | S | W | 432 | 346 | 89 | | |
| *Lithobius curtipes* | LC | | Widespread but localised species | NS | E | S | W | 25 | 23 | 0 | | |
| *Lithobius forficatus* | LC | | Widespread species, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | E | S | W | 869 | 811 | 307 | | |
| *Lithobius lapidicola* | NT | D2 | Very localised species, recorded from 3 glasshouses in Scotland and Wales but only 4 semi-natural sites in Kent and Suffolk, two of which are under threat from development | NR | E | S | W | 2 | 7 | 0 | 7 | 7 |
| *Lithobius lucifugus* | NA | | An alpine species assumed to be introduced to glasshouses and synanthropic sites in Scotland | Non-native | | S | | 0 | 3 | 0 | | |
| *Lithobius macilentus* | LC | | Widespread but localised species | NS | E | S | W | 47 | 59 | 5 | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lithobius melanops* | LC | Widespread species, increase in records | | E | S | W | 339 | 388 | 60 | | |
| *Lithobius microps* | LC | Widespread species | | E | S | W | 432 | 405 | 110 | | |
| *Lithobius muticus* | LC | Localised species, mainly restricted to SE England but scaterred records from further north | NS | E | S | | 28 | 29 | 1 | | |
| *Lithobius peregrinus* | NA | Vagrant species from southern Europe, establishes temporary colonies in ports | Non-native | E | | | 1 | 2 | 1 | | |
| *Lithobius piceus* | LC | Very localised species, mainly Surrey, Sussex and Hampshire, areas much under recorded in recent years so likely to occur in 16+ hectads | NS | E | | W | 5 | 9 | 0 | | |
| *Lithobius pilicornis* | LC | Localised species in semi natural habitats in Devon and Cornwall, synanthropic sites in S Wales and scattered locations further north | NS | E | | W | 24 | 31 | 5 | | |
| *Lithobius tenebrosus* | DD | One confirmed record, two pre-1970 records from N England considered doubtful due to possible misidentification of *L. macilentus*. May be Regionally Extinct or under recorded | NR | E | | W | 1 | 0 | 0 | 0 | 0 |
| *Lithobius tricuspis* | LC | Very localised, restricted to Devon and S Wales | NR | E | | W | 11 | 9 | 2 | | |
| *Lithobius variegatus* | LC | Widespread species, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | E | S | W | 652 | 388 | 222 | | |
| *Mecistocephalus guildingii* | NA | An alien species from heated glasshouses | Non-native | E | | | 0 | 1 | 0 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Nothogeophilus turki* | EN | B2ab(i)(ii)(iv) | Endemic species. Intensive survey work in recent years failed to locate surviving populations on Isle of Wight. Probably survives on Isles of Scilly but no surveys in recent years. Loss of the IOW colonies is significant decline in AoO (now < 500 sq. km) so meets geographical threshold for EN criterion B2. Significant declines in AoO and number of locations combined with survival in < 5 locations so IUCN criteria for Endangered status satisfied | NR | E | | | 4 | 0 | 0 | 0 | 0 |
| *Pachymerium ferrugineum* | DD | | Very localised, littoral species. Difficult to collect from coastal shingle so probably under recorded but more survey required | NR | E | | | 3 | 3 | 0 | 3 | 3 |
| *Schendyla dentata* | NA | | First recorded less than 50 years ago, all records associated with urban habitats so assumed to be naturalised introduction | Naturalised | E | S | W | 5 | 23 | 2 | | |
| *Schendyla monoeci* | NA | | An alien species from heated glasshouses | Non-native | E | | | 0 | 0 | 0 | | |
| *Schendyla nemorensis* | LC | | Widespread species, increase in records | | E | S | W | 210 | 270 | 34 | | |
| *Schendyla peyerimhoffi* | NT | | Very localised, difficult to record in coastal mud and rock crevices. Decrease in records thought to be due to lack of survey effort rather than real decline | NS | E | | W | 13 | 4 | 1 | 4 | 4 |
| *Scutigera coleoptrata* | NA | | Vagrant species occasionally reported from inside buildings | Non-native | E | S | | 0 | 9 | 0 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Stenotaenia linearis* | NA | Introduced species naturalised in synanthropic sites, especially gardens, throughout northern Europe | Naturalised | E | S | | 7 | 14 | 1 |
| *Strigamia acuminata* | LC | Widespread species, no obvious reason for decrease in records other than reduced recorder effort, believed to occur in 100+ hectads | | E | | W | 131 | 97 | 13 |
| *Strigamia crassipes* | LC | Widespread species, no obvious reason for decrease in records other than reduced recorder effort, believed to occur in 100+ hectads | | E | S | W | 95 | 67 | 9 |
| *Strigamia maritima* | LC | Widespread, littoral species certain to occur in 100+ hectads | | E | S | W | 93 | 99 | 16 |
| *Tygarrup javanicus* | NA | An alien species from heated glasshouses | Non-native | E | | | 1 | 2 | 0 |

**Table C ISOPODA (woodlice)**

| Species name | GB IUCN status (2014) | Qualifying criteria | Rationale | GB rarity status (2014) | Global IUCN status (2010) | Presence in England | Presence in Scotland | Presence in Wales | AoO (hectads) 1970-1989 | AoO (hectads) 1990-2012 | Dual hectads | AoO (tetrads) 1990-2012 | Locations 1990-2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Agabiformius lentus* | NA | | An alien species from heated glasshouses | Non-native | | E | | | | 1 | | | |
| *Androniscus dentiger* | LC | | Widespread species | | | E | S | W | 545 | 480 | 172 | | |
| *Armadillidium album* | LC | | Widespread but localised species | NS | | E | S | W | 23 | 28 | 12 | | |
| *Armadillidium* sp. | NA | | An alien species from heated glasshouses | Non-native | | E | | | | 1 | | | |
| *Armadillidium depressum* | LC | | Mainly found in SW Britain including S Wales, scattered records further north | | | E | | W | 115 | 129 | 45 | | |
| *Armadillidium nasatum* | LC | | Widespread species | | | E | S | W | 138 | 160 | 61 | | |
| *Armadillidium pictum* | LC | | Very localised species but almost certainly occurs in 16+ hectads. Misidentification from confusion with *A. pulchellum* possible. | NS | | E | | W | 6 | 14 | 2 | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Armadillidium pulchellum* | LC | Widespread species, localised but believed to occur in 100+ hectads. Misidentification from confusion with *A. pictum* possible. | | E | S | W | 69 | 59 | 19 | | |
| *Armadillidium vulgare* | LC | Widespread species, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | E | S | W | 865 | 758 | 524 | | |
| *Asellus aquaticus* | LC | Widespread species, increase in records submitted for recent distribution atlas (Gregory, 2009) | | E | S | W | 744 | 1141 | 660 | | |
| *Buddelundiella cataractae* | LC | Very localised species, only just failed to meet criteria for VU D2 but difficult to find even at known sites so probably under recorded | NR | E | | W | 4 | 6 | 1 | 6 | 6 |
| *Burmoniscus meeusei* | NA | An alien species from heated glasshouses | Non-native | E | | | | 1 | | | |
| *Caecidotea communis* | NA | Introduced from N America to one lake in Northumberland | Naturalised | E | | | 1 | 1 | | | |
| *Chaetophiloscia sicula* | NA | An alien species from heated glasshouses | Non-native | E | | | | 1 | | | |
| *Chaetophiloscia* sp. | NA | Probably introduced with plants to gardens on Tresco | Non-native | E | | | 1 | 0 | | | |
| *Cordioniscus stebbingi* | NA | An alien species from heated glasshouses | Non-native | E | S | W | 3 | 2 | | | |
| *Cylisticus convexus* | LC | Widespread species in semi-natural coastal habitats, synanthropic inland | | E | S | W | 157 | 114 | 23 | | |
| *Eluma caelata* | NA | Probably introduced several times via horticultural trade, naturalised in synanthropic or disturbed coastal sites | Naturalised | E | | | 12 | 19 | 4 | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Gabunillo* n.sp. | NA | | An alien species from heated glasshouses | Non-native | | E | | | | 1 | | | |
| *Halophiloscia couchii* | LC | | Localised, littoral species in southern Britain | NS | | E | | W | 33 | 29 | 9 | | |
| *Haplophthalmus danicus* | LC | | Widespread species | | | E | S | W | 243 | 275 | 71 | | |
| *Haplophthalmus mengii* | LC | | Widespread species, increase in records caused by search for *H. montivagus* following taxonomic split | | | E | S | W | 66 | 136 | 14 | | |
| *Haplophthalmus montivagus* | LC | | Very localised species, recently split from *H. mengii* and expected to occur in 16+ hectads | NS | | E | | W | 8 | 10 | 1 | | |
| *Ligia oceanica* | LC | | Widespread, littoral species, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | | E | S | W | 507 | 298 | 167 | | |
| *Ligidium hypnorum* | LC | | Widespread species in England south of line from Wash to Severn Estuary, absent from SW England | | | E | | | 148 | 112 | 53 | | |
| *Lucasius pallidus* | NA | | An alien species from heated glasshouses | Non-native | | E | | | | 1 | | | |
| *Metatrichoniscoides celticus* | VU | D2 | Possibly endemic. Restricted to coast of South Wales. IUCN criteria are satisfied as, despite intensive survey, it is recorded from just three localitions since 1990 and is vulnerable to a marine pollution event that could drive the species to CR status within a short time. | NR | VU D2 (needs updating) | | | W | 4 | 3 | 2 | 3 | 3 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Metatrichoniscoides leydigii* | DD | Very localised species. Originally considered an introduction but recently found in semi-natural habitat very similar to that in Netherlands where it is native. | NR | E | | | 1 | 2 | 1 | 1 | 1 |
| *Miktoniscus linearis* | NA | An alien species from heated glasshouses | Non-native | E | | | | 1 | | | |
| *Miktoniscus patiencei* | LC | Widespread but very localised, littoral species. Further survey likely to find it in 16+ hectads. | NS | E | S | W | 20 | 15 | 1 | | |
| *Nagurus cristatus* | NA | An alien species from heated glasshouses | Non-native | E | | | 1 | | | | |
| *Nagurus nanus* | NA | An alien species from heated glasshouses | Non-native | E | | | 1 | | | | |
| *Oniscus asellus* | LC | Widespread species, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | E | S | W | 2113 | 1425 | 1151 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Oniscus asellus occidentalis* | NT | B2ab(i) (iii) | Localised, restricted to SW Britain. Not recognised until 1990 so increase in records is not meaningful. Threatened by competition and hybridisation with *O. a. asellus*. Decline in EoO apparent from presence of isolated intermediate hybrid populations beyond the current distribution of *O. a. occidentalis*. Intermediate populations within current distribution of *O. a. occidentalis* indicate continuing decline. IUCN criteria close to being satisfied on basis of inferred continuing population decline due to hybridisation, restricted extent of occurence, increasingly fragmented populations and inferred continuing decline in extent of occurrence and suitable habitats. | NS | E | | W | 6 | 24 | 3 | 24 | 24 |
| *Oritoniscus flavus* | NA | | Probably introduced to South Wales from Ireland and certainly introducxed to Scotland | Naturalised | | S | W | 0 | 3 | 0 | | |
| *Philoscia muscorum* | LC | | Widespread species, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | E | S | W | 1454 | 1185 | 820 | | |
| *Platyarthrus hoffmannseggii* | LC | | Widespread species | | E | S | W | 462 | 451 | 214 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Porcellio dilatatus* | LC | Widespread species considered an ancient introduction now typical of synanthropic sites in rural locations. Requires specialist survey techniques so under recorded and expected to occur in 100+ hectads | | E | S | W | 50 | 84 | 2 |
| *Porcellio laevis* | LC | Widespread species but very localised. Possibly an ancient introduction but possibly native cave species. Requires specialist survey techniques so under recorded but not expected to occur in 100+ hectads | NS | E | S | W | 28 | 15 | 4 |
| *Porcellio scaber* | LC | Widespread species, decrease in recent records is considered to be result of BMIG members assuming it is no longer necessary to record one of the most common species | | E | S | W | 1976 | 1436 | 1112 |
| *Porcellio spinicornis* | LC | Widespread species | | E | S | W | 346 | 277 | 72 |
| *Porcellionides cingendus* | LC | Typical of coastal grassland in southern and western England and Wales. Decrease in records thought to be result of reduced recorder effort and believed to occur in 100+ hectads | | E | | W | 120 | 89 | 40 |
| *Porcellionides pruinosus* | LC | Widespread species | | E | S | W | 184 | 182 | 42 |
| *Proasellus cavaticus* | LC | Restricted to underground freshwater habitat in calcareous areas. Under recorded due to lack of specialist skills required | NS | E | | W | 12 | 8 | 4 |
| *Proasellus meridianus* | LC | Widespread species, increase in records submitted for recent distribution atlas (Gregory, 2009) | | E | S | W | 426 | 623 | 284 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pseudotyphloscia alba* | NA | | An alien species from heated glasshouses | Non-native | E | | | 1 | | | | |
| *Reductoniscus costulatus* | NA | | An alien species from heated glasshouses | Non-native | E | | | 2 | | | | |
| *Setaphora patiencei* | NA | | An alien species from heated glasshouses | Non-native | E | | 0 | 0 | | | | |
| *Stenophiloscia glarearum* | VU | D2 | Very localised, littoral species. Satisfies IUCN criteria as known from just 5 locations and only 2 in recent years and is vulnerable to human disturbance and marine pollution at all sites | NR | E | | 3 | 3 | 0 | 3 | 2 | |
| *Styloniscus mauritiensis* | NA | | An alien species from heated glasshouses | Non-native | | S | 1 | 0 | | | | |
| *Styloniscus spinosus* | NA | | An alien species from heated glasshouses | Non-native | E | S | 1 | 0 | | | | |
| *Trachelipus rathkii* | LC | | Widespread species, confused with both *Porcellio scaber* and *Oniscus asellus* by inexperienced recorders so expected to occur in 100+ hectads | | E | W | 71 | 87 | 28 | | | |
| *Trichoniscoides albidus* | LC | | Widespread species, overlooked as *Trichoniscus pusillus / provisorius* by inexperienced recorders so expected to occur in 100+ hectads | | E | | 58 | 87 | 6 | | | |
| *Trichoniscoides helveticus* | LC | | Very localised. Not recognised as distinct from *T. sarsi* until 1990 so likely to be under recorded but there are records for the aggregate taxon from less than 25 hectads in total | NS | E | | 5 | 8 | 1 | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Trichoniscoides saeroeensis* | LC | Widespread species typically, littoral but also in caves. Difficult to find and identify so under recorded and expected to occur in 100+ hectads | | E | S | W | 69 | 54 | 8 | |
| *Trichoniscoides sarsi* | LC | Very localised. Not recognised as distinct from *T. helveticus* until 1990 so likely to be under recorded but there are records for the aggregate taxon from less than 25 hectads in total | NS | E | S | | 2 | 14 | 0 | |
| *Trichoniscus provisorius* | LC | Widespread species but not recognised as species distinct from *T. pusillus* until 2004. Difficult to separate from *T. pusillus* so under recorded but expected to occur in 100+ hectads | | E | S | W | 59 | 36 | 2 | |
| *Trichoniscus pusillus* | LC | Widespread species but not recognised as species distinct from *T. provisorius* until 2004. Difficult to separate from *T. provisorius* so under recorded but expected to occur in 100+ hectads | | E | S | W | 47 | 26 | 2 | |
| *Trichoniscus pygmaeus* | LC | Widespread species | | E | S | W | 423 | 452 | 107 | |
| *Trichorhina tomentosa* | NA | An alien species from heated glasshouses | Non-native | E | S | | | 5 | | |
| *Venezillo parvus* | NA | An alien species from heated glasshouses | Non-native | E | | | | 1 | | |

# Appendix 2 IUCN Criteria and Categories

**Table D** Summary of the five criteria (A–E) used to evaluate if a taxon belongs in a threatened category (Critically Endangered, Endangered or Vulnerable)

| Use any of the criteria A–E | **Critically Endangered** | **Endangered** | **Vulnerable** |
|---|---|---|---|
| **A. Population reduction** | | | |
| **A1** | ≥ 90% | ≥ 70% | ≥ 50% |
| **A2, A3 & A4** | ≥ 80% | ≥ 50% | ≥ 30% |

**A1.** Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible **AND** understood **AND** have ceased, based on and specifying any of the following:

- **(a)** direct observation
- **(b)** an index of abundance appropriate to the taxon
- **(c)** a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality
- **(d)** actual or potential levels of exploitation
- **(e)** effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

**A2.** Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased **OR** may not be understood **OR** may not be reversible, based on (a) to (e) under A1.

**A3.** Population reduction projected or suspected to be met in the future (up to a maximum of 100 years) based on (b) to (e) under A1.

**A4.** An observed, estimated, inferred, projected or suspected population reduction (up to a maximum of 100 years) where the time period must include both the past and the future, and where the causes of reduction may not have ceased **OR** may not be understood **OR** may not be reversible, based on (a) to (e) under A1.

| | | | |
|---|---|---|---|
| **B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)** | | | |
| **B1.** Extent of occurrence (EOO) | < 100km² | < 5,000km² | < 20,000km² |
| **B2.** Area of occupancy (AOO) | < 10km² | < 500km² | < 2,000km² |

**AND at least 2 of the following:**

**(a)** Severely fragmented, **OR**

| | | | |
|---|---|---|---|
| Number of locations | = 1 | ≤ 5 | ≤ 10 |

**(b)** Continuing decline in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** area, extent and/or quality of habitat; **(iv)** number of locations or subpopulations; **(v)** number of mature individuals.

**(c)** Extreme fluctuations in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** number of locations or subpopulations; **(iv)** number of mature individuals.

| **C. Small population size and decline** | | | |
|---|---|---|---|
| Number of mature individuals | < 250 | < 2,500 | < 10,000 |
| **AND either C1 or C2:** | | | |
| **C1.** An estimated continuing decline of at least: (up to a max. of 100 years in future) | 25% in 3 years or 1 generation | 20% in 5 years or 2 generations | 10% in 10 years or 3 generations |
| **C2.** A continuing decline **AND** (a) and/or (b): | | | |
| **(a i)** Number of mature individuals in each subpopulation: **or** | < 50 | < 250 | < 1,000 |
| **(a ii)** % individuals in one subpopulation = | 90–100% | 95–100% | 100% |
| **(b)** Extreme fluctuations in the number of mature individuals. | | | |

| | | | |
|---|---|---|---|
| **D. Very small or restricted population** | | | |
| **Either:** | | | |
| Number of mature individuals | < 50 | < 250 | **D1.** < 1,000 |
| | | | **AND/OR** |
| **VU D2.** Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time. | | | **D2.** typically: AOO < 20km² or number of locations ≤ 5 |
| **E. Quantitative Analysis** | | | |
| Indicating the probability of extinction in the wild to be: | ≥ 50% in 10 years or 3 generations (100 years max.) | ≥ 20% in 20 years or 5 generations (100 years max.) | ≥ 10% in 100 years |

# INDEX

## CHILOPODA (centipedes)



## DIPLOPODA (millipedes)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Metaiulus pratensis* | P7 | P35 | P37 | P39 | P40 | P60 | P64 | | | |
| *Polyzonium germanicum* | P6 | P38 | P40 | P66 | | | | | | |
| *Propolydesmus testaceus* | P6 | P35 | P37 | P40 | P67 | | | | | |
| *Stosatea italica* | P6 | P38 | P40 | P68 | | | | | | |
| *Thalassisobates littoralis* | P7 | P37 | P40 | P70 | | | | | | |
| *Trachysphaera lobata* | P6 | P10 | P20 | P29 | P35 | P37 | P39 | P40 | P58 | P71 |

**ISOPODA (woodlice)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Armadillidium album* | P8 | P9 | P10i | P10ii | P38 | P41 | P101 | | | |
| *Armadillidium pictum* | P8 | P10i | P10ii | P10iii | P21 | P38 | P41 | P102 | | |
| *Buddelundiella cataractae* | P8 | P37 | P41 | P104 | P110 | | | | | |
| *Halophiloscia couchii* | P8 | P9 | P10i | P10ii | P38 | P41 | P105 | | | |
| *Haplophthalmus montivagus* | P8 | P38 | P41 | P106 | | | | | | |
| *Metatrichoniscoides celticus* | P8 | P9 | P10i | P10ii | P10iii | P35 | P37 | P39 | P41 | P108 |
| *Metatrichoniscoides leydigii* | P8 | P36 | P37 | P41 | P109 | | | | | |
| *Miktoniscus patiencei* | P8 | P38 | P41 | P111 | | | | | | |
| *Oniscus asellus occidentalis* | P8 | P35 | P38 | P41 | P112 | | | | | |
| *Porcellio laevis* | P9 | P38 | P41 | P114 | | | | | | |
| *Proasellus cavaticus* | P9 | P38 | P41 | P116 | | | | | | |
| *Stenophiloscia glarearum* | P9 | P35 | P37 | P39 | P41 | P117 | | | | |
| *Trichoniscoides helveticus* | P9 | P38 | P41 | P119 | | | | | | |
| *Trichoniscoides sarsi* | P9 | P38 | P41 | P120 | | | | | | |