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A review of the beetles of Great Britain

The Soldier Beetles and their allies

Species Status No.16

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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

Making good decisions to conserve species should primarily be based upon an objective process of determining the degree of threat to the survival of a species. The recognised international approach to undertaking this is by assigning the species to one of the IUCN threat categories.

This report was commissioned to update the threat status of beetles from the named families from work originally undertaken in 1987, 1992 and 1994 respectively using the IUCN methodology for assessing threat.

It is expected that further invertebrate status reviews will follow.

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Further information

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CONTENTS

1. Introduction to the Species Status Reviews

1.1 Species Status

The Species Status Assessment project initiated by JNCC in 1999 ended in 2008 after a number of reviews (http://jncc.defra.gov.uk/page-3352) were published. However, there remains a need to continue assessing the threat status of species in the UK so a new project renamed Species Status has been created. The purpose is to provide an up-to-date threat status of taxa against standard criteria based on the internationally accepted guidelines developed by the International Union for Conservation of Nature (IUCN) (see IUCN, 2012a,b 2013). This publication is part of a new series of reports produced under this project.

Under the Species Status, JNCC and the statutory nature conservation agencies within the UK will be able to produce, initiate and fund Red Lists prepared by Non-governmental Organisations and other specialists, submitting these reports to JNCC for accreditation (http://jncc.defra.gov.uk/page-1773). Assessments will be produced as Red Lists or as broader National Reviews of taxonomic groups of species (see 1.3). Both types of publication provide an audit trail of the assessment. The approved data will be used in the JNCC database of species conservation designations (http://jncc.defra.gov.uk/page-3408).

Red lists that are eligible under the JNCC Species Status must have a UK- or GB-wide coverage, follow the IUCN Red List guidelines (IUCN, 2012a,b 2013), be accredited by JNCC and made freely available via the authoring agencies' website.

1.2 The Red List system

The Red List system was initiated by IUCN in 1966 with the publication of the first Mammal Red Data Book. Since then Red Lists, and more detailed Red Data Books, have been published that deal with many plants, fungi and animals at global, regional, country, and even local scales. The aim has been to identify those species at greatest risk from extinction and to identify the critical factors responsible, so that action may be taken to improve the chances of these species surviving in the long term.

Comparisons are facilitated by assessing all taxa to the same standards. This is not without difficulty because species have a variety of life and reproductive strategies. Status assessments are prepared on the basis of the best available information for the group concerned, recognising that this will vary according to the intensity of recording and study, the majority of which is carried out by volunteer naturalists.

In Britain the first published Red Data Book endorsed by a statutory conservation agency was by Perring and Farrell (1977, 2nd edition published 1983), dealing with vascular plants. The Red Data Book for insects, edited by Shirt, was published in 1987, with volumes dealing with other animal and plant groups appearing thereafter. The geographic range is normally Great Britain, and hence excludes Northern Ireland as well as the Isle of Man and the Channel Isles.

Only one volume has a combined treatment for Britain and Ireland, that by Stewart and Church (1992) for stoneworts, although separate statuses were provided.

The British Red List of vascular plants has had a full update twice (Wigginton, ed. 1999, Cheffings and Farrell, 2005) following the production by the IUCN of a new, quantitative approach to threat assessment (IUCN, 1994, 2001, 2003). The recent Red Lists of British Odonata (Daguet *et al.*, eds, 2008) and butterflies (Fox *et al.* 2010), as well as reviews of Diptera (Falk and Crossley, 2005, Falk and Chandler, 2005) and water beetles (Foster, 2010), have continued to follow the revised IUCN guidelines (http://jncc.defra.gov.uk/page-3352).

1.3 Status assessments other than Red Lists for species in Britain

Conservation assessments that are broader in scope than the traditional Red Data Books and Red Lists have been produced. These assessments add GB-specific categories based on restricted distribution rather than risk. The term Nationally Scarce, originally coined for plants, is applied to species that are known to occur in 16 to 100 ten-km squares (or hectads). Early assessments of invertebrate taxa used the term Nationally Notable and, for some taxa this category was further split into Notable A (Na) for species occurring in 16 to 30 hectads and Notable B (Nb) for those occurring in 31 to 100 hectads.

A further category is that of 'Nationally Rare'. This category is used for species that occur in 15 or fewer hectads in Britain and is used in SSSI designation and Common Standards Monitoring.

The restricted distribution categories have now been standardised to Nationally Rare and Nationally Scarce without further subdivision. The GB system of assessing **rarity** based solely on distribution is used alongside the IUCN criteria which, although they also use measures of geographical extent, are concerned with assessing **threat**.

Publications that compile information about Red List species are known as Red Data Books and usually cover broad taxonomic groups (e.g. insects). Publications that include information about both Red Listed and Nationally Scarce species are known as National Reviews. Both types of publication can contain individual species accounts that include information about their biology, distribution and status as well as threats to the species and their conservation needs.

1.4 Species Status Assessment and conservation action

Making good decisions to conserve species should primarily be based upon an objective process of determining the degree of threat to the survival of a species, in the present exercise by assigning the species to one of the IUCN threat categories. This 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.

When making decisions as to which species should be treated as priorities for conservation action, factors to be considered other than IUCN threat category include: the likely chances of recovery being achieved; the cost of achieving recovery (and whether sources of funding are available or likely to be available); the benefits to other threatened species of a recovery programme; the fit of a recovery programme with other conservation activities (including conservation actions to be taken for habitats); the likely gains for the profile of conservation; and the relationship and fit between national and international obligations. Under the UK Biodiversity Action Pan a list of priority species has been identified as a focus for conservation effort. In England, this list has been superseded by the Section 41 list of the NERC Act (2006). In addition, certain species are legally protected in Great Britain under legislation such as the Wildlife and Countryside Act 1981, and British wildlife legislation is overlaid by international directives such as the Habitats Directive (Directive 92/42/EEC). Threat assessments and rarity assessments also underlie the criteria used for protected site selection and qualifying species can then be considered as protected interest features on the site.

1.5 References

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2. Introduction to the beetle reviews

Beetles are important as ecological indicators, possibly more refined than most plants, due to the dependency of many species on complex factors such as vegetation structure. Monitoring their status and abundance provides a very useful indication of ecological health, in a way that monitoring the plants, birds or bats does not. They also cover a wider range of habitats than do more popular groups of insects such as butterflies, dragonflies and bumblebees.

2.1 Taxa considered in this review

The selection of taxa to be included in this review was primarily based on some of the families which have been the subject of a national recording scheme, as coordinated by the Biological Records Centre (http://www.brc.ac.uk). The work of these schemes variously 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 available through national and local museums.
- Modern records, arising from the recording activity of the Coleoptera recording community.

By focusing on the work of recording schemes it was possible to compare and contrast the modern data with the historic data in a way that has not been possible in the past. It was important to remain fully aware, however, of the variation in recorder effort – both regionally and in time. The taxa selected for this review are accordingly shown in Table 1:

Table 1. Beetle taxa review in this study

Superfamily	**Family**	**Species**	**Name of Recording Scheme**
Buprestoidae	Buprestidae	17	Cantharoidea & Buprestoidea Recording Scheme (now the Soldier Beetles, Jewel Beetles & Glow-worms Recording Scheme)
Elateroidea (pt)	Drilidae	1	
	Cantharidae	41	
	Lampyridae	3	
	Lycidae	4	
Lymexyloidea	Lymexylidae	2	Part of the Heteromera & Cleroidea Recording Scheme (no longer active)
Cleroidea	Phloiophilidae	1	
	Trogossitidae	5	
	Cleridae	14	
	Dasytidae	9	
	Malachiidae	17	
		114	Total species covered by this review

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 Isle of Man and the Channel Islands are also not included.

Beetle names follow Duff (2012a) and plant names Stace (1997). It should be borne in mind that earlier reviews will have used earlier checklists, and that nomenclature will therefore be somewhat different.

2.2 Previous reviews

2.2.1 British Red Data Books: 2. Insects (1987)

The first account of threatened British Coleoptera was included in the *British Red Data Books: 2. Insects* (Shirt, 1987). This listed 546 of the total British fauna (c3900), ie 14.0%. Data sheets were given for each of the Category 1 (Endangered) and 2 (Vulnerable) species.

Table 2 analyses the species coverage by Category for the Superfamilies and families covered in the present volume, allowing for taxonomic changes which have occurred since 1987.

Table 2. Red List Categories (Shirt, 1987) for species covered in this review

Superfamily & Family	Category 1 Endangered	Category 2 Vulnerable	Category 3 Rare	Category 5 Endemic	Appendix No post 1900 records
Buprestoidae					
Buprestidae	1	3			
Elateroidea (pt)					
Drilidae					
Cantharidae			2		
Lampyridae	1				
Lycidae	1		1		
Lymexyloidea					
Lymexylidae		1			
Cleroidea					
Phloiophilidae					
Trogossitidae	1		1		
Cleridae					4
Dasytidae					
Malachiidae	1	1	3		1

2.2.2 A review of the scarce and threatened beetles of Great Britain (1992 & 1994)

The *British Red Data Book* volume was followed by the publication of *A review of the scarce and threatened beetles of Great Britain* (Part 1) (Hyman, 1992) and Part 2 (Hyman, 1994) which reviewed the status for all British beetles and presented data sheets for all scarce and threatened terrestrial species. Data sheets for aquatic beetles were not included; the statuses have subsequently been revised and data sheets provided (Foster, 2010).

Table 3 analyses the species coverage by Category for the Superfamilies and families covered in the present volume, allowing for taxonomic changes which have occurred since 1992.

Table 3. Red Data Book and rarity categories (Hyman, 1992) for species covered in this review

Superfamily & Family	Category 1 Endangered (RDB1)	Category 2 Vulnerable (RDB2)	Category 3 Rare (RDB3)	Category I Indeterminate (RDBI)	Category K Insufficiently Known (RDBK)	Extinct	Notable
Buprestoidae							
Buprestidae	2	1					7
Elateroidea (pt)							
Drilidae							1
Cantharidae	1		2				11
Lampyridae	1					1	
Lycidae				1			3
Lymexyloidea							
Lymexylidae		1					1
Cleroidea							
Phloiophilidae							1
Trogossitidae	1		1				1
Cleridae						4	3
Dasytidae					1		6
Malachiidae	2		3		1	1	2

2.2.3 The new review

The IUCN Guidelines have been revised (IUCN, 1994) and subsequently updated (IUCN, 2012a), making it necessary to revise the status of all beetle species. It should be noted that the IUCN criteria for threat categories concentrate on imminent danger of extinction which hopefully applies to very few species, whilst the older, non-IUCN criteria for Nationally Rare and Nationally Scarce relate to a small geographic distribution within Great Britain, without taking any account of trends, whether for increase or decline.

In addition, much new information has become available since the publication of Shirt (1987) and Hyman (1992 & 1994). This present review is therefore one of a series which updates the statuses assigned to British Coleoptera – Water Beetles were the first group to be covered (Foster, 2010). The status assigned to many species by the earlier reviews has now been revised and at the same time the nomenclature has been brought up to date in accordance with the latest checklist (Duff, 2012a). Appendix 1 lists all species assigned to status categories.

3. The IUCN threat categories and selection criteria

3.1 The evolution of threat assessment methods

The first, provisional, outline of a new system was published in Mace & Lande (1991). This was followed by a series of revisions, and the first version of the new Red List categories was adopted as the global standard by the IUCN Council in December 1994. The guidelines were recommended for use also at the national level. In 1995, JNCC endorsed their use as the new national standard for Great Britain, and subsequent British Red Data Books have used these revised IUCN criteria. Following further minor revisions to the IUCN guidelines, the 2001 IUCN Red List Categories and Criteria are now used as the GB standard (IUCN, 2001).

Newly established categories were *Extinct in the wild* (EW), and *Critically Endangered* (CR). Whilst the names *Endangered* (EN) and *Vulnerable* (VU) were maintained, they were defined differently from in the original guidelines, and species in one of these threat categories in the old system will not necessarily be in the same category in the new. Most species deemed to be '*Rare'* in the old system have been assigned to the *Near Threatened* (NT) category in the new system, although on the basis of the new criteria, some are now regarded as *Vulnerable*. The *Least Concern* (LC) category represents most other species, but some species are regarded as *Nationally Scarce* (ns), a status peculiar to Great Britain (see Sections 3.4 and 4.5).

Taxa that are confidently assumed to be extinct in Great Britain are listed here as Regionally Extinct (RE) to indicate that populations no longer exist within Britain but do occur elsewhere in the world. This follows guidance published for Regional Red Lists (IUCN 2003). Proving extinction beyond reasonable doubt is difficult for many organisms and especially invertebrates. Species not recorded in Britain since 1900 are typically assumed to now be extinct, while species not recorded since 1950 but known to be especially difficult to find on demand have been tagged as Possibly Extinct (IUCN 2011). This was developed to identify those Critically Endangered species that are likely to be Extinct, but for which confirmation is still required. The Guidelines point out that this is not a new criterion, but a qualifier that is appended to Critically Endangered, such that relevant taxa are reported as Critically Endangered (Possibly Extinct), abbreviated as CR(PE).

In addition, IUCN (2003, updated 2013) has published regional guidelines (applicable to individual countries) particularly concerned with developing a two-step process, the first with taxa evaluated purely on their status within the region under assessment, the second with how that status might be amended to take into account interaction with populations of the taxon in neighbouring regions.

3.2 Summary of the 2001 categories and criteria

A brief outline of the revised IUCN criteria and their application is given below, a full explanation being available (IUCN, 2001, 2013) and on 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 (see Appendix 1). The category *Extinct in the wild* has not been applied in this review. All categories refer to the status in the GB (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)

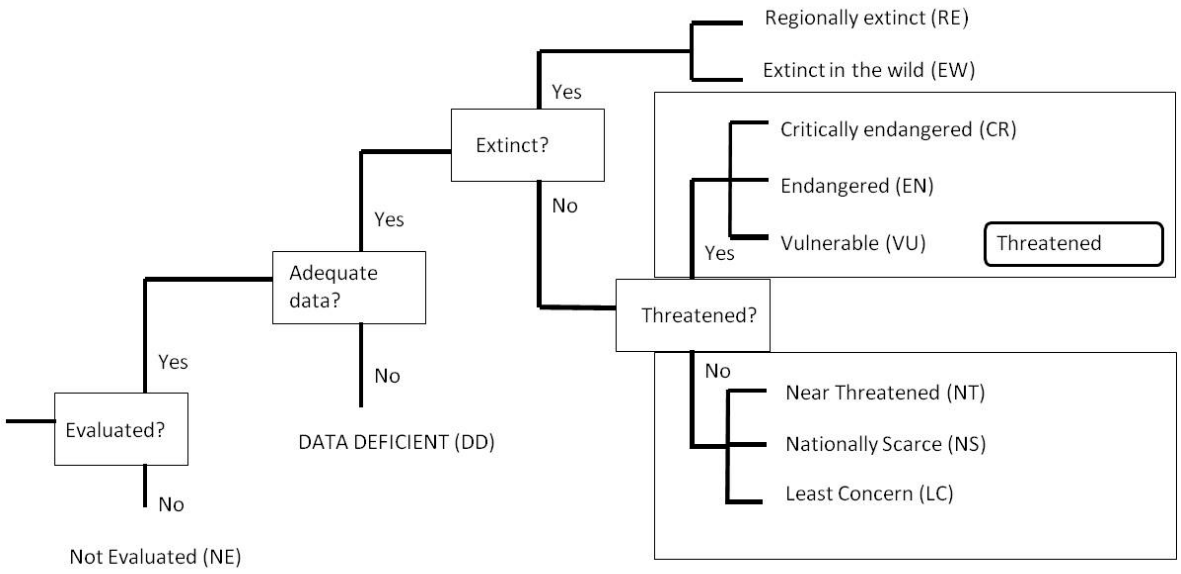

Figure adapted from IUCN (2001)

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), and one of which qualifies a taxon for listing at that level of threat. The qualifying thresholds within the criteria A-E differ between threat categories. They are summarised in Table 4.

Table 4. Summary of the thresholds for the IUCN Criteria

Criterion	**Main thresholds**		
	Critically Endangered	**Endangered**	**Vulnerable**
A. Rapid decline	>80% over 10 years or 3 generations in past or future	>50% over 10 years or 3 generations in past or future	>30% over 10 years or 3 generations in past or future
B. Small range + fragmented, declining or fluctuating population	Extent of occurrence <100 km^2 or area of occupancy <10 km^2 + two of the following: - severely fragmented or only a single location - continuing decline - extreme fluctuations	Extent of occurrence <5,000 km^2 or area of occupancy <500 km^2 + two of the following: - severely fragmented or no more than 5 locations - continuing decline - extreme fluctuations	Extent of occurrence 20,000 km^2 or area of occupancy <2,000 km^2 + two of the following: - severely fragmented or no more than 10 locations - continuing decline - extreme fluctuations

Criterion	Main thresholds		
	Critically Endangered	**Endangered**	**Vulnerable**
C. Small population and declining	<250 mature individuals, population declining	<2,500 mature individuals, population declining	<10,000 mature individuals, population declining
D. Very small population	<50 mature individuals	<250 mature individuals	D1. <1,000 mature individuals
D2. Very small area of occupancy			D2. <20 km^2 or 5 or fewer locations
E. Quantifiable probability of extinction	>50% within 10 years or three generations	>20% within 20 years or five generations	>10% within 100 years

The revised IUCN criteria have more quantitative elements than the previous criteria, although these can be difficult to apply where there are limited data on abundance and distribution for the group concerned. However, subjective assessments are still required as, for example, in predicting future trends and judging the quality of the habitat – methods involving estimation, inference and projection are emphasised as being 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 criteria A, C, D1 and E are rarely appropriate for beetles.

The guidelines emphasise that a precautionary principle 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 worse-case scenario which will determine the threat category to which the taxon will be assigned.

The categorization process should only be applied to wild populations inside their natural range (IUCN, 2001); it should also only be applied to species with a long-term presence in the region, with 1500 AD used as the standard (IUCN, 2003). Taxa deemed to be ineligible for assessment at a regional level are placed in the category of '**Not Applicable (NA)'.** This category is used for species where the evidence suggests that the species concerned are not long-term natives, either the result of accidental importation through trade and travel, or else

may be recent colonists (or attempted colonists) responding to the changing conditions available in Britain as a result of human activity and/or climate change. A taxon may also be NA because it occurs at very low numbers in the region and the population is a very minor part of the global population.

In this Review, **Extent of occurrence** (EOO) is not applied, as an agreed methodology for its measurement in relation to these beetle species is not available. Calculating EOO often requires sophisticated modelling software and there is some doubt as to the value of the output for patchily distributed taxa (i.e. most invertebrates).

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,b 2013).

"Area of occupancy is defined as the area within its 'extent of occurrence' which 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 4 km^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. This highlights the importance of peer review and shared expert opinion for making decisions on scale.

3.3 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. The extent to which populations of beetles under threat are interdependent within Britain and between Britain and the Continent is uncertain and perhaps controversial. Recruitment from abroad has clearly accounted for the establishment of some newcomers to the British fauna, eg *Agrilus cyanescens* and *Sphinginus lobatus*. The latter examples are in this Review assessed as being part of the continental population and are therefore deemed to be ineligible for assessment at a regional level and placed in the category of Not Applicable (NA). Although currently occurring in fewer than 100 hectads these species continue to expand and are expected to exceed 100 within the lifetime of this Review (within the next 5 to 10 years). A different case

is apparent with *Melanophila acuminata*, which may have colonised Britain around 1900 and established large viable populations across a wide area of country. Adults are attracted by the infrared radiation caused by wood-fires and fly great distances to forest fires – up to 20 miles are known – and it is conceivable that it could cross the English Channel in response to large fires. These populations now appear to be under threat. Colonisation is speculation – it might equally have been an overlooked native. It is either Critically Endangered as a native or else part of the Continental fauna and therefore Not Applicable. The precautionary principle has been applied and it has been assigned CR.

3.4 The use of Near Threatened, Nationally Rare and Nationally Scarce categories

IUCN (2001) recognised the value of a *Near Threatened* category to identify species that need to be kept under review to ensure that they have not become vulnerable to extinction. This category is used for species where a potential threat, natural habitat dependency or range change demand frequent review of status.

At the national level, countries are permitted to refine the definitions for the non-threatened categories and to define additional ones of their own. The *Nationally Rare* category is defined as species recorded from 15 or fewer hectads of the Ordnance Survey national grid in Great Britain. The *Nationally Scarce* category is defined in the same way but the species is recorded from between 16 and 100 hectads since 1980. The Nationally Rare category was formerly known as Red Data Book Categories 1-3 while the Nationally Scarce category was formerly known as Nationally Notable for invertebrates, and was divided into Lists A (species in Great Britain thought to occur between 15 and 30 10km squares) and B (between 31 and 100 10km squares) .This national set of definitions is referred to as the GB Rarity status within this document.

4. Methods and sources of information

4.1 Introduction

The most recent published list of scarce and threatened beetles (Hyman & Parsons, 1992 & 1994) was based on the Red Data Book criteria used in the British Insects Red Data Book (Shirt, 1987) with the addition of the category RDB K (Insufficiently Known) after Wells, Pyle & Collins (1983). The original IUCN criteria for assigning threat status used in these publications had the categories Endangered, Vulnerable and rare, which were defined rather loosely and without quantitative thresholds. The application of these categories 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.

4.2 Data sources

The author of this Review assessed the status of all the species using the information sources described in this section and the system explained in Sections 3 and 6. During the process he sought the views of a large number of other specialists (see Acknowledgements). The bulk of the data however comes from the respective beetle recording schemes supplemented from information posted on the NBN Gateway (http://data.nbn.org.uk/). All of this data was validated either by the the national recorder. It is important to acknowledge the considerable contribution made by all of the contributing recorders.

For Buprestidae and the Cantharidae group of the Elateroidea, the key source is the data compilation used for the 2003 Provisional Atlas (Alexander, 2003a), as accessed through the NBN Gateway. This was then supplemented using more recent data gathered by the national recorder but not yet accessible via the 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 Lymexyloidea and Cleroidea, with no current recording scheme, the basic source was data uploaded to the NBN Gateway. This was supplemented by the data collated by R.S. Key for the former recording scheme which had been inactive for some time. The latter data provided an authoritative overview from which to judge the quality of the data obtained via the NBN. For species achieving IUCN or GB Rarity status, this data was also carefully examined and related to published information and data held by the author (available mainly for saproxylics). Records which were judged unreliable by the national recorder were discarded.

5. The assessments

5.1 The data table

The key outcome of this Review is the generation of a table which lists all of the taxa in the beetle families covered. The full table has been produced as a spreadsheet which 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 up to and including 1979

Total number of hectads occupied from period from 1980-2012

Total number of dual hectads where species have been recorded from within the hectad in both date classes (see 5.2 below).

GB IUCN status (2013)

Qualifying criteria

Rationale

Global IUCN status (2010)

GB Rarity status (2013)

Status in Shirt (1987)

Status in Hyman (1986)

Status in Hyman (1992)

Ecological account

Popular synonyms

5.2 Date classes

This Review uses 1980 as the **point of measurement** between old and recent date classes to assess decline as this was judged to be the date most applicable to the data concerned. 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 is clearly not feasible for most invertebrate groups. It is extremely rare that any

beetle has been comprehensively surveyed in the past ten years – even with *Malachius aeneus* survey work has been limited to one group of known sites. 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 B2b for any taxon therefore demands justification by an explanation of confidence in the rate of decline.

5.3 Evidence of habitat declines

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 quantitative data on a species' habitats are also rarely available, and that the reviewer needs to work with very imperfect data. Invertebrate habitat cannot be assumed to be equivalent to specific vegetation types (Kirby, 1992; Fry & Lonsdale, 1991). 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.

The following sections address certain key beetle habitat types which support a range of rare and threatened species, and provides an overview of the evidence available that demonstrates or suggests significant habitat decline.

5.4 Heartwood decay and hollowing in old trees

In the case of large old and hollowing trees, a precedent is available from the *IUCN Red List of European Saproxylic Beetles* (Nieto & Alexander, 2010) where it was unanimously accepted by experts from across the continent that this precise habitat type is rare and threatened across Europe and that it was therefore reasonable to infer that any beetle completely dependent on this situation is at the very least of Near Threatened status. A decline in large old trees is also acknowledged globally (Eliasson et al, 2002; Hannah et al, 1995; Nilsson, 1997; Gibbons et al, 2008; Lindenmayer et al, 2012a, b). While Britain is one of the very few European countries which still retains large old hollow trees in relatively large numbers (as has been stated by widely acknowledged experts such as Ted Green, Oliver Rackham and the late Francis Rose), there is currently no protection for such trees other than in protected sites, and even in such sites long-term viability is not assured. The Tree Council have been campaigning in the UK for a number of years for the most important old trees to have special protection in law as 'Green Monuments'.

There is plentiful evidence for a continued decline in the numbers of veteran trees, both in protected sites and in the wider countryside (see below). Habitat continuity is another key factor which determines presence/absence of these beetle species, mainly due to their

dispersal ability, and is a severe limitation on their ability to colonise new sites in an increasingly fragmented treescape (Harding & Rose, 1986; Alexander, 2004).

The requirement for 'evidence for recent, current or projected future decline which is liable to continue unless remedial measures are taken' is very straightforward for the saproxylic beetles which have a specific requirement for the heartwood-decay succession which results in hollowing veteran and ancient trees. While the evidence has not yet been fully collated and assessed - Natural England is currently considering such a project (S. Perry, pers. comm.) – some aspects of that evidence can be referred to here:

- 20th century declines, many of which are continuing into the 21st century;
- Changing land-use practices;
- There has been a general decline in 'trees outside of woods' (TOWs) as their values as fodder, fuel and structural timbers have gradually been replaced by modern – generally unsustainable – alternatives (Brown & Fisher, 2009);
- FC data (1953 onwards) demonstrate major losses;England suffered a 64% decline in individual trees outside woods between 1980 and 1997, only partly attributed to Dutch elm disease as this was past its peak by then and elm constituted only 19.5% of TOWs;
- Countryside Survey 2009 data indicates a continuing decline.
- Loss of hedgerows and hedgerow trees: Case studies such as Nidderdale (North Yorkshire), Kirton and Falkenham (Suffolk), etc (Muir, 2005);
- Loss of in-field trees – there is strong evidence historically that 'pastures' were rich in trees (Muir, 2005; G. Bathe, pers. comm.);
- Decreasing tree density in historic parklands, many examples apparent from National Trust studies, and also new research by the Crown Estate at Windsor Great Park;
- Imported tree diseases (http://treedisease.co.uk/threats-to-our-trees/);
- Dutch elm disease removed virtually all veteran and ancient elms from the landscape by the end of the 1970s, further denuding agricultural landscapes – an estimated 25 million elm trees lost - there has been insufficient time for replacements from other tree species to develop;
- *Phytophthora* species are becoming an increasing problem;
- Oaks affected by oak decline, sudden oak death, acute oak decline, etc - so many new diseases that FR are struggling to think up new names for them - which have removed the mid generations in particular, widening gaps in age structures;
- Sweet chestnut and alder affected by *Phytophthora;*
- Horse chestnut affected by canker;
- Countless examples of veteran trees continuing to be lost through development – urban and industrial.

Projected future declines

- Ash – *Chalara* projected to be as damaging to ash in the modern severely depleted landscapes as Dutch elm disease was in the 1970s; wide implications for already devastated landscapes;
- Beech in Windsor Forest – evidence that there are insufficient medium-aged trees to replace the rapidly declining ancient trees (T. Green, pers. comm.);

- Reliance on unproven hypotheses of ‘natural’ closed canopy original forest to guide conservation management, leading to damaging fashions such as ‘minimum intervention’ management;
- Unsympathetic land management, in protected sites as well as in wider countryside; examples of currently damaging activity can be seen in Dunham Park SSSI (Cheshire) and Attingham Park (Shropshire) where new tree plantings have been positioned where they will cause early decline and death of important veteran trees, especially oaks with red-rotten heartwood;
- Caledonian pine forest (see later);
- Poor recruitment of new generations of veteran trees – sensible, sympathetic, tree plantings remain the exception rather than the rule.

Climate change:

- Beech said to be declining along the South Downs & elsewhere due to increased droughting (K. Kirby, A. Whitbread, etc, pers. comm.).

With regard to evidence of losses on ‘protected’ sites:

- Surveys of Ashtead Common (Surrey) calculate a 1.3% mortality rate per annum from 2003 to 2009 (data from Treework Environmental Practice);
- Burnham Beeches is perhaps the best surveyed old tree site, with considerable long term data available (data also from Treework Environmental Practice):
- In 1931 there were 1795 oak and beech pollards and by 2007 approx. 76% of the population (1369 trees) were lost – a rate of 1.87% a year.
- From 1989 to 1999 annual average attrition rates increased to an average of 1.9% for ancient beech, leading to the well documented conservation management programme of the City of London, perhaps the reason for this having these rates reduced to 1.7% per annum subsequently; ancient oak p.a. mortality rates however rose from 1989 (0.35%) to 1999 (1.07%).
- Recruitment rates are known to be much lower, and so these nationally significant concentrations of ancient trees are both in attrition. The data from other sites, eg Hatfield Forest, provide a very similar picture of long-term attrition (N. Fay, Treework, pers. comm.).

This necessarily superficial review of the evidence makes it clear that the habitat of the heartwood-decay succession beetles has been and still is declining in the wider landscape and in protected sites.

5.5 Stands of tall herbaceous vegetation on low nutrient soils

The other major specific habitat type which appears to be crucial to rare and threatened beetles in the taxa being assessed is much less well understood. Many Dasytidae and Malachiidae appear to develop in the dead hollow stems of tall robust herbaceous plants – plants with a tough outer layer which maintains rigidity when dead but with soft central pith in which the larvae feed. The specific plants are those characteristic of relatively low nutrient status soils. The history of these species also appears to indicate that habitat continuity is very significant, indicating relatively low mobility. In situations where a large amount of habitat or

host plant is available, only a small fraction may be suitable for any given species (Kirby, 1992). This difficult habitat type is nonetheless not explored in any detail nor given prominence by that author. Miles & Sokoloff (1991) give the situation more prominence. Lack of research undermines attempts at assessing habitat decline but clearly some associated species have undergone or are undergoing severe declines. This Review has necessarily had to rely on the precautionary principle to a considerable extent in assessing these species.

5.6 Caledonian pine forest

Following widespread concerns about the impacts of wild deer on the natural development of new generations of pine trees - and hence on age structures long-term – and compounded by livestock grazing in some cases, there has recently been a concerted effort by Forest Enterprise, Scottish Natural Heritage and RSPB to address the perceived problem. Many Caledonian pine forest sites have accordingly been deer-fenced and livestock removed, eg Black Wood of Rannoch and Glen Feshie. The consequence has been extensive development of young birch and pine, leading to dense thickets of developing saplings, the individual trees being drawn up tall and thin through competition, the trees lacking lateral branch development and the forest floor becoming subject to relatively heavy shade. The resulting conditions are not suitable for the development of future old granny pines of the form which support the richest variety of wood-decay habitats. Open-grown conditions are needed for pine trees to achieve their full potential in terms of crown development and to live on into the granny pine stage. Tall, thin-poled, high forest form pine trees will not be as valuable a habitat resource for beetles.

This management regime may not be a threat to species developing in the leaf litter, e.g. *Rhagonycha elongata* (Cantharidae), nor to those species which develop in small dead pine branches, e.g. *Anaspis bohemica*, but it has considerable potential to be damaging to many other species. Examples include species with larvae that develop in heartwood decay, in sun-exposed bracket fungi, and the sun-loving adult stages of other rare and threatened beetles.

Site managers need to be much more aware of these issues – the requirement for open-grown conditions for pine and exposure to sunshine at ground level – and to adjust their management regimes accordingly. The current approach to management involves threats to the long-term survival of many rare and threatened beetle species.

6. Format of the species accounts

6.1 Information on the species accounts

Species accounts have been prepared for each of the CR, EN, VU and NT species. Previous reviews have also included species accounts for Nationally Rare and Nationally Scarce taxa.

Information on each species is given in a standard form. The data sheets are 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 nine items of information on each of the data sheets and includes a final section discussing taxa which have formerly had conservation status but which have been down-graded as part of this re-assessment process.

6.2 The species name

Nomenclature is intended to be as up to date as possible and is based on Duff (2012a). Where the name differs from that used by Shirt (1987) or Hyman (1992 & 1994) the previous name is indicated, with citation of any relevant references. Information is also provided on any older names which have been used in the main identification literature.

6.3 Identification

The latest or most convenient work from which the identity of the species can be determined is stated; both adults and larvae are included wherever possible. The emphasis is on English language publications, and work in other languages is only referred to where no other options are available.

A new reference work on British beetles is under way, but - at the time of writing – only Volume 1: Sphaeriusidae to Silphidae has been published (Duff, 2012b). Otherwise, the most recent full coverage was provided by Joy (1932), which still remains the key work, supported by Hodge and Jones (1995). The fuller coverage of Fowler (1887-1891) and Fowler & Donisthorpe (1913) remain important supplementary accounts.

In the case of the Buprestidae, the above has been superseded by a Royal Entomological Society handbook (Levey, 1977), but this is now very out-of-date – especially in lacking recent arrivals of several new *Agrilus* species - and a new edition is in progress (B. Levey, pers. comm). Fortunately Bílý's (1982) *Fauna Entomologica Scandinavica* review covers the gaps adequately. Two British species are not featured in Bílý (1982): *Agrilus sinuatus* and *Trachys subglaber*.

Cantharidae have not been so well-served, with the most useful identification work being in Fitton's (1973) unpublished PhD thesis. However, photocopies have been in wide circulation for some time and Brian Eversham has recently up-dated this (Fitton & Eversham, 2006) and made it available on-line at http://markgtelfer.co.uk/files/2012/04/CantharidaeKeys_v3.pdf. A

field key to the larger and more colourful Cantharinae has also been available as part of the national recording scheme since 1984 and has recently also been made available on-line (Alexander & Harvey, 2010) on the same website. The illustrations of male terminalia in Joy (1932) remain very useful for determining the males.

Fitton & Eversham (2006) also includes a family key for all of the soft-winged Elateroidea, and has an Appendix with keys to the British species of Lampyridae (only *Lampyris* and *Phosphaenus*), Lycidae (four species) and Drilidae (one species). Speight (1990) provides a useful key to all of the European Lycidae.

Larval keys to most species are available in English (van Emden, 1943) although this does not include Dasytidae or Malachiidae. Klausnitzer (1978) has generic keys to these (in German) and also contains useful illustrations of many species.

For Cleroidea and Lymexyloidea, the old literature remains the main source, but Gerstmeier (1998) is a very useful, relatively modern, identification guide to the European Cleridae.

6.4 Distribution

Records held in the databases of the respective national species recording scheme form the basis for determining the distribution of each species.

For Buprestidae, Cantharidae, Drilidae, Lampyridae and Lycidae, this is the Soldier Beetles, Jewel Beetles and Glow-worms Recording Scheme. In most cases these data can be accessed through the NBN Gateway (www.searchnbn.net) 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 Cleroidea and Lymexyloidea were covered by the Heteromera & Cleroidea Recording Scheme but this was discontinued before a provisional atlas became feasible. The collated data remains as an Excel Spreadsheet and is not available through the NBN Gateway.

The Watsonian vice-counties (Dandy, 1969) are also indicated, where appropriate.

International distribution is only referred to where a comment on the species' biogeography is considered particularly relevant and where the information is readily accessible.

6.5 Habitat and ecology

This section aims to provide an overview of both the precise habitat requirements of each species – larvae and adults - and the wider landscape context. In many cases current knowledge is inadequate and speculation remains the only option. Information on the life cycle and seasonal patterns is also included.

Separation of where species are found by recorders from the actual habitat preferences of those species is fraught with difficulty. A good example is provided by arboreal beetles which are often taken by sweep-netting the field layer below after they have fallen from the canopy. Fogging often demonstrates that such species typically occur in greater numbers in the canopy than in the field layer, as one might expect. In the absence of fogging data one can only speculate.

Vegetation structure is well known to be of major importance to invertebrates and yet recorders very rarely note the key features of the situations in which they find the beetles. Comments on structure provided in the following species accounts may be based on a relatively few, often personal, experiences.

Flight and mobility are very important in understanding the use beetles make of habitat mosaics, but little is known about these aspects. Climatic factors are an important influence and will vary across the country – in many beetle species active flight is associated with conditions of relatively high temperatures, relatively high humidity, and little or no air movement. Mobility will naturally be higher under the more continental climatic conditions of southern and eastern Britain than in the cooler north and west. Species on the edge of their European range in Britain may be less mobile than their continental equivalents. Thus, while buprestids can be very active fliers when conditions are favourable, some species appear to be relatively immobile in Britain under present conditions. This can change dramatically, as in the case of *Agrilus biguttatus* which has moved from exhibiting an old forest refugia distribution up until the 1970s and early 1980s, to being common and widespread across a large area of lowland England in a period of little more than a decade.

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.

6.6 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 1980 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 extremely rare but has been used where available.

Only species which have been assessed as Critically Endangered, Endangered, Vulnerable or Near Threatened are provided with species accounts. The status of other species 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 – and so some species

currently known from fewer than one hundred hectads have been excluded from Nationally Scarce status on this basis: it is appreciated that many species of Coleoptera are not yet recorded from more than one hundred hectads but are expected to be found to occur in more than one hundred when their distribution is better known. *Drilus flavescens* is an example of a species known from 61 hectads since 1980 but which is widespread in the Chalk and neighbouring areas of south-eastern England, shows no indications of any decline in those areas, and is under-recorded there. It appears reasonable to estimate its actual distribution as in excess of 100 hectads. In contrast, *Aphanisticus pusillus* is known from 63 hectads since 1980 but is much more restricted in habitat availability, their habitat (short or open-sward calcareous grassland) is popular with recorders and so there is much less potential for under-recording. The latter has retained its Nationally Scarce status but the former has been downgraded by this review.

In conclusion, 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.

Beetles lend themselves to preservation as sub-fossils by virtue of their hard body parts. Many studies of organic deposits that can be reliably dated to postglacial times generate valuable information on the history of a particular species in what is now referred to as Britain. Those studies provide irrefutable evidence for long-term presence. The data has been collated and made available by Buckland & Buckland (2006). Information is therefore provided in this section to supplement knowledge of species status.

6.7 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 invertebrate populations. Where specific threats might arise they are mentioned, otherwise the statements attempt to summarise in general terms those activities which are considered most likely to place populations of these beetles at risk.

Particularly threatened are those species that are dependent on veteran and hollow trees for their saproxylic habitats (Nieto & Alexander, 2010). Even in sites with some conservation protection, land management is all too often unsympathetic to specialist saproxylics. Knowledge and understanding of the conservation ecology of veteran trees has expanded considerably in recent years, largely stimulated by a small group of enthusiasts which led to the formation of the Ancient Tree Forum. The first national conferences on the management of veteran trees (Read, 1991 & 1996) resulted and led to the establishment of English Nature's Veteran Tree Project and to the publication of *Veteran Trees: A guide to good management* (Read, 2000). The latter publication has been up-dated by a supplement (Lonsdale, 2013). A key threat has been excessive felling in the name of 'health and safety'; these aspects have recently been the subject of new guidance (National Tree Safety Group, 2011).

Other threats, such as the inmpact of climate change, non-natitve species etc) are considered where such information is aviable.

6.8 Management and conservation

Some of the oldest nature reserves in Britain were created to protect their invertebrate interest, eg Wicken Fen, but beetles are rarely the prime movers in site designation and protection. Nevertheless the value of beetles as indicators of site condition has been recognised when many SSSI have been re-evaluated. Beetles also feature in designations for some Special Areas of Conservation (SAC).

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. Sites designated as SAC under the European Habitats Directive and SSSI have the potential to provide protection for beetles as long as the conservation interest associated with them is acknowledged, and as long as that interest is effectively translated into site conservation objectives. Loss of suitable habitat continues in undesignated sites. The populations of many beetle species with fragmented distributions are relicts of previously widespread populations, surviving in small patches of relatively undisturbed habitats after loss of the intervening habitats. For these species it is critical to maintain a chain of protected sites. Other species are more mobile and often rely on dynamic ecological processes operating over areas larger than those normally covered by individual designated sites. Some of these species have benefited from recent changes in the modern landscape, for example the tall herb pioneer community that colonises brownfield sites following abandonment of use. Others, such as the beetle assemblages associated with thermophilic patchwork landscapes, where the small scale intricacies provide local shelter and warmth, have been likely to have been impacted by rigid approaches to flood control and land management.

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. It is very rare that a threatened British beetle has been subject to a 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.

Key factors in the conservation management for veteran trees include: are described in Lonsdale (2013) and include:

- Provision of adequate space for the desired trees to develop their full potential - in terms of lateral branching, heartwood decay, etc, ensuring that stands do not become overcrowded, as closed canopy conditions results in early death of trees through competition, resulting in a uniformly poor age structure for saproxylics;

- Protection of the root zone, eg from compaction, accumulations of waste from large herbivores, residues of veterinary drugs used on livestock, ploughing, etc, such that trees remain alive and healthy, and continue to produce decaying wood habitats throughout their life spans;
- Encouragement of the development of new generations of trees and diverse age structures generally;
- Maintenance and enhancement of the total numbers of veteran trees.

6.9 Published sources

Literature references that refer to the previous conservation status of the species in Britain, or that have contributed information to the Data Sheet, are cited here.

6.10 Downgraded species

Down-grading of species should not be seen necessarily as evidence that species status is improving. In many cases the species were graded too highly in the 1992 Review through lack of availability of supporting data. The intervening period has seen a huge increase in recorder effort, targeting species with Nationally Scarce or RDB status – the Review acted as a focus or a 'call to arms', stimulating new recording – and the revised statuses presented here more accurately reflect the status of those species. The 1992 Review should – in many ways - be regarded as a first draft, a first attempt at assessing status.

Some species have actually increased their abundances and/or ranges in the intervening 20 year period, as a result of a variety of factors. Other species appear truly to be declining, and the lack of records of these, following publication of the 1992 Review, is all the more significant in comparison.

The following species were included in the earlier reviews (Shirt, 1987; Hyman, 1992 & 1994), but are not included here for the reasons stated in the following table.

Table 5. Species in previous reviews but excluded here

Family & Scientific name	**Shirt, 1987**	**Hyman, 1992**	**Rationale for exclusion**
Buprestidae			
Agrilus biguttatus	RDB2	Na	Considerable expansion in numbers and range; reported from 102 hectads since 1980.
Agrilus laticornis		Nb	Reported from 113 hectads since 1980.
Agrilus sinuatus	RDB2	Na	Considerable expansion in range; reported from 161 hectads since 1980.
Drilidae			
Drilus flavescens		Na	Common and widespread in the Chalk districts of south-eastern England; much suitable habitat not yet investigated; very likely that many additional hectads

Family & Scientific name	Shirt, 1987	Hyman, 1992	Rationale for exclusion
			will be forthcoming; predicted to occur in more than 100.
Lycidae			
Platycis minutus		Nb	Reported from 111 hectads since 1980.
Lampyridae			
Lamprohiza splendidula		Extinct	Only known from a single occurrence of two specimens at a single site in 1884; no evidence that it ever was an established population
Phosphaenus hemipterus	RDB1	RDB1	Earliest records all suggest a series of accidental introductions; now established outside of its natural range.
Cantharidae			
Malthinus balteatus		Nb	Reported from 122 hectads from 1980.
Malthodes brevicollis	RBD3	RDB1	No evidence for an established population; all voucher material examined misidentified (Alexander, 2003b)
Silis ruficollis		Nb	Currently expanding range; predicted to occur in more than 100 within next few years.
Lymexylidae			
Hylecoetus dermestoides		Nb	Known from 88 hectads from 1980 onwards and known to be expanding its range; predicted to occur in more than 100.
Dasytidae			
Dasytes cyaneus		RDBK	A single record; no evidence for an established population.

There are other species that occur in 100 hectads or less, but which the author believes should not be listed as Nationally Scarce as they are not considered to be native to Britain. Under the IUCN Guidelines they have been assigned ‘Not Applicable’. The rationale for these exclusions is given in Table 6.

Table 6. Rationale for not listing species occurring in 100 hectads or fewer

Scientific name	**Number of post-1980 hectads**	**Rationale for exclusion**
Buprestidae		
Agrilus cuprescens	2	First noticed in Britain in 2008, and already known from second locality. The records suggest a recent arrival in Britain, probably the beginnings of a colonisation; not a long-established native.
Agrilus cyanescens	6	First noticed in Britain in 2008 and already known from four counties. The records suggest a recent arrival in Britain, probably the beginnings of a colonisation; not a long-established native.
Agrilus sulcicollis	12	First noticed in Britain in 1992 and already known from nine counties. A recent arrival from the near continent; possibly first introduced with timber imports as its epicentre appears to have been Hertfordshire. A specimen is known from a 19th century collection at Hammersmith, which may suggest an earlier incidental introduction which failed to establish (Hancock, 2007).
Cantharidae		
Malthodes lobatus	1 or 2	First noticed in Britain in 2003; a possible second site in 2009. It is most feasible that the discovery may have arisen as a result of importation with plant material, etc - part of the site was formerly used for allotments – and has been able to survive locally for a period at least due to the effects of recent climate change. The possible record elsewhere in 2009 may add weight to the idea of a casual importation. In the absence of a demonstrable long-term established population it would appear sensible to defer a review its status to a later data.
Dasytidae		
Dasytes cyaneus	0	A single report of a single specimen; clearly not an established population.
Colotes punctatus	1	Welch (2008) suggests either introduced on some form of maritime flotsam, or else introduced with plant material from southern Europe.
Axinotarsus marginalis	50	A recent arrival in Britain; expanding dramatically.

Scientific name	Number of post-1980 hectads	Rationale for exclusion
Troglops cephalotes	5	Recent arrival; probably accidental importation; expanding range.
Sphinginus lobatus	7	Recent arrival; expanding along main river valleys.

The status of new arrivals in Britain is very difficult to ascertain. Where this results from a natural colonisation from the near continent, they may be expected to continue to expand and may exceed 100 hectads within the next few decades. Their natural range, or 'area 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 for this reason. 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. Climate change may impose such a threat. In many cases there is a strong suspicion that the arrival in Britain is actually a chance importation and imported populations are not normally afforded conservation status.

7. Acknowledgements

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8. Species listed by IUCN status category

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

Regionally Extinct

Buprestidae	*Anthaxia nitidula* (Linnaeus)
Cleridae	*Tilloidea unifasciata* (Fabricius)
	Trichodes alvearius (Fabricius)
	Trichodes apiarius (Linnaeus)
Malachiidae	*Ebaeus pedicularius* (Linnaeus)

Critically Endangered (Possibly Extinct)

Buprestidae	*Aphanisticus emarginatus* (Olivier, 1790)

Endangered

Buprestidae	*Melanophila acuminata* (De Geer)
Lycidae	*Erotides cosnardi* (Chevrolat)
Trogossitidae	*Ostoma ferrugineum* (Linnaeus)

Vulnerable

Lycidae	*Dictyoptera aurora* (Herbst)
Trogossitidae	*Nemozoma elongatum* (Linnaeus)
Malachiidae	*Hypebaeus flavipes* (Fabricius)
	Axinotarsus pulicarius (Fabricius)

Near Threatened

Buprestidae	*Trachys minuta* (Linnaeus)
Cantharidae	*Malthodes crassicornis* (Mäklin)
Dasytidae	*Dasytes virens* (Marsham)
Malachiidae	*Malachius aeneus* (Linnaeus)
	Clanoptilus marginellus (Olivier)

9. Species listed by GB Rarity Status category

Nationally Rare

Buprestidae	*Aphanisticus emarginatus* (Olivier, 1790) - Extinct?
	Melanophila acuminata (De Geer
	Trachys minuta (Linnaeus)
	Trachys troglodytes Gyllenhal in Schönherr
Lycidae	*Dictyoptera aurora* (Herbst)
	Erotides cosnardi (Chevrolat)
Cantharidae	*Malthodes crassicornis* (Mäklin)
Trogossitidae	*Nemozoma elongatum* (Linnaeus)
	Ostoma ferrugineum (Linnaeus)
Cleridae	*Thanasimus femoralis* (Zetterstedt)
Dasytidae	*Dasytes niger* (Linnaeus)
	Dasytes virens (Marsham)Malachiidae
	Axinotarsus pulicarius (Fabricius)
	Clanoptilus barnevillei (Puton)
	Clanoptilus strangulatus (Abeille de Perrin)
	Cerapheles terminatus (Ménétries)
	Hypebaeus flavipes (Fabricius)
	Malachius aeneus (Linnaeus)

Nationally Scarce

Buprestidae	*Agrilus angustulus* (Illiger)
	Agrilus viridis (Linnaeus)
	Aphanisticus pusillus (Olivier)
	Trachys scrobiculatus Kiesenwetter
Lycidae	*Pyropterus nigroruber* (De Geer)
Cantharidae	*Ancistronycha abdominalis* (Fabricius)
	Cantharis fusca Linnaeus
	Cantharis obscura Linnaeus
	Rhagonycha elongata (Fallén)
	Rhagonycha lutea (Müller, O.F.)
	Rhagonycha translucida (Krynicki)
	Malthinus frontalis (Marsham)
	Malthodes fibulatus Kiesenwetter
	Malthodes maurus (Laporte)
	Malthodes pumilus (Brébisson)
Lymexylidae	*Lymexylon navale* (Linnaeus)
Phloiophilidae	*Phloiophilus edwardsii* Stephens
Trogossitidae	*Thymalus limbatus* (Fabricius)
Cleridae	*Tillus elongatus* (Linnaeus)
	Opilo mollis (Linnaeus)
	Korynetes caeruleus (De Geer)

Dasytidae	*Aplocnemus impressus* (Marsham)
	Aplocnemus nigricornis (Fabricius)
	Dasytes plumbeus (Müller, O.F.)
	Dolichosoma lineare (Rossi)
Malachiidae	*Axinotarsus ruficollis* (Olivier)
	Anthocomus fasciatus (Linnaeus)
	Clanoptilus marginellus (Olivier)

10. Taxonomic list of Red Data Book and Nationally Scarce species

O/L (over-looked) refers to species over-looked at the time but subsequently recognised within the name being used for another species.

Table 7. Taxonomic list of Red Data Book and Nationally Scarce species

Scientific name	**Shirt 1987**	**Hyman 1992**	**This review (GB Rarity status)**	**This review (IUCN status)**
Buprestidae				
Anthaxia nitidula (Linnaeus)	RDB1	RDB1	-	Regionally Extinct
Melanophila acuminata (De Geer)	-	-	NR	Endangered
Agrilus viridis (Linnaeus)	RDB2	Na	NS	
Agrilus angustulus (Illiger)	-	Nb	NS	
Agrilus biguttatus (Fabricius)	RDB2	Na	-	
Agrilus laticornis (Illiger)	-	Nb	-	
Agrilus sinuatus (Olivier)	RDB2	Na	-	
Aphanisticus emarginatus (Olivier)	-	RDB1	NR/Extinct?	Critically Endangered (Possibly Extinct)
Aphanisticus pusillus (Olivier)	-	Nb	NR	
Trachys minuta (Linnaeus)	-	RDB2	NR	Near Threatened
Trachys scrobiculatus Kiesenwetter	-	Na	NS	
Trachys troglodytes Gyllenhal in Schönherr	O/L	O/L	NR	DD
Drilidae				
Drilus flavescens (Fourcroy)	-	Na	-	
Lycidae				
Platycis minutus (Fabricius)	-	Nb	-	
Erotides cosnardi (Chevrolat)	RDB1	RDBI	NR	Endangered
Pyropterus nigroruber (De Geer)	RDB3	Na	NS	
Dictyoptera aurora (Herbst)	-	Nb	NR	Vulnerable
Lampyridae				
Lamprohiza splendidula (Linnaeus)	-	Extinct	-	
Phosphaenus hemipterus (Goeze)	RDB1	RDB1	-	
Cantharidae				
Ancistronycha abdominalis (Fabricius)	-	Nb	NS	
Cantharis fusca Linnaeus	-	RDB3	NS	
Cantharis obscura Linnaeus	-	Nb	NS	
Rhagonycha elongata (Fallén)	-	Na	NS	

Scientific name	Shirt 1987	Hyman 1992	This review (GB Rarity status)	This review (IUCN status)
Rhagonycha lutea (Müller, O.F.)	-	Nb	NS	
Rhagonycha translucida (Krynicki)	-	Nb	NS	
Silis ruficollis (Fabricius)	-	Nb	-	
Malthinus balteatus Suffrian	-	Nb	-	
Malthinus frontalis (Marsham)	-	Nb	NS	
Malthodes brevicollis (Paykull)	RDB3	RDB1	-	
Malthodes crassicornis (Mäklin)	RDB3	RDB3	NR	Near Threatened
Malthodes fibulatus Kiesenwetter	-	Nb	NS	
Malthodes guttifer Kiesenwetter	-	Nb	-	
Malthodes maurus (Laporte)	-	Nb	NS	
Malthodes pumilus (Brébisson)	-	-	NS	
Lymexylidae				
Hylecoetus dermestoides (Linnaeus)	-	Nb	-	
Lymexylon navale (Linnaeus)	RDB2	RDB2	NS	
Phloiophilidae				
Phloiophilus edwardsii Stephens	-	Nb	NS	
Trogossitidae				
Ostoma ferrugineum (Linnaeus)	RDB1	RDB1	NR	Endangered
Thymalus limbatus (Fabricius)	-	Nb	NS	
Nemozoma elongatum (Linnaeus)	RDB3	RDB3	NR	Vulnerable
Cleridae				
Tillus elongatus (Linnaeus)	-	Nb	NS	
Tilloidea unifasciata (Fabricius)	App	Extinct		Regionally Extinct
Opilo mollis (Linnaeus)	-	Nb	NS	
Thanasimus femoralis (Zetterstedt)	-	RDB3	NR	
Trichodes alvearius (Fabricius)	App	Extinct		Regionally Extinct
Trichodes apiarius (Linnaeus)	App	Extinct		Regionally Extinct
Tarsenostenus univittatus (Rossi)	App	Extinct	-	
Korynetes caeruleus (De Geer)	-	Nb	NS	
Dasytidae				
Aplocnemus impressus (Marsham)	-	Nb	NS	
Aplocnemus nigricornis (Fabricius)	-	Na	NS	
Dasytes cyaneus (Fabricius)	-	RDBK	-	
Dasytes niger (Linnaeus)	-	Na	NR	
Dasytes plumbeus (Müller, O.F.)	-	Nb	NS	
Dasytes virens (Marsham)	-	Nb	NR	Near Threatened
Dolichosoma lineare (Rossi)	-	Nb	NS	

Scientific name	Shirt 1987	Hyman 1992	This review (GB Rarity status)	This review (IUCN status)
Malachiidae				
Ebaeus pedicularius (Linnaeus)	App	Extinct		Regionally Extinct
Hypebaeus flavipes (Fabricius)	RDB1	RDB1	NR	Vulnerable
Axinotarsus pulicarius (Fabricius)	RDB2	RDB1	NR	Vulnerable
Axinotarsus ruficollis (Olivier)	-	-	NS	NS
Malachius aeneus (Linnaeus)	RDB3	RDB3	NR	Near Threatened
Clanoptilus barnevillei (Puton)	RDB3	RDB3	NR	NR
Clanoptilus marginellus (Olivier)	-	Nb	NS	Near Threatened
Clanoptilus strangulatus (Abeille de Perrin)	RDB3	RDB3	NR	
Sphinginus lobatus (Olivier)	-	RDBK	-	
Cerapheles terminatus (Ménétries)	-	Na	NR	
Anthocomus fasciatus (Herbst)	-	-	NS	

11. Criteria used for assigning species to threatened categories (see Appendix 2 for criteria and categories)

Table 8. Criteria used for assigning species to threatened categories

Scientific name	Status	Criteria used
Buprestidae		
Aphanisticus emarginatus (Olivier)	Critically Endangered (Possibly Extinct)	
Melanophila acuminata (De Geer)	Endangered	B2ab iii & iv
Lycidae		
Erotides cosnardi (Chevrolat)	Endangered	B2a b ii & iii;
Dictyoptera aurora (Herbst)	Vulnerable	B2a b ii & iii & iv
Trogossitidae		
Ostoma ferrugineum (Linnaeus)	Endangered	B2ab iii
Nemozoma elongatum (Linnaeus)	Vulnerable	D2
Malachiidae		
Hypebaeus flavipes (Fabricius)	Vulnerable	D2
Axinotarsus pulicarius (Fabricius)	Vulnerable	B2ab ii iii & D2

12. The data sheets

The data sheets are given in alphabetical order by scientific name within each family. Individual species can be found by looking up the generic or specific names (including synonyms used in Shirt (1987) and Hyman (1992) in the index.

12.1 Buprestidae

Jewel beetles are phytophagous and associated with one or few host plants. *Aphanisticus* and *Trachys* species develop as miners in living plant tissues, while most *Agrilus* require freshly dead or dying hosts and burrow in the nutrient-rich cambial layers of woody stems. *Melanophila acuminata* is in the latter category but especially favours stems damaged by fire. *Anthaxia nitidula* had a very restricted distribution, being confined to a small area of the New Forest but became extinct as a result of unsympathetic scrub control management in the 1950s.

They are a potentially important group in monitoring the impacts of climate change (see 3.4) – they have a broadly continental distribution and are strongly warmth-loving species, flying actively in hot sunshine. Some long-term natives have increased in abundance and expanded their ranges in recent decades – *Agrilus biguttatus* and *A. sinuatus* – while others are establishing across southern and eastern counties either through natural colonisation or via accidental importation – *A. cuprescens, A. cyanescens* and *A. sulcicollis.*

APHANISTICUS EMARGINATUS **CRITICALLY ENDANGERED (POSSIBLY EXTINCT)**

Rush jewel beetle

Order COLEOPTERA Family BUPRESTIDAE

Aphanisticus emarginatus (Olivier, 1790)

Identification The adult is keyed by Levey (1977) and Bílý (1982); Levey (1977) is currently undergoing up-dating. Bílý (1982) includes a larval key to genus level only.

Distribution Only ever known from a small number of sites across southern England (Alexander, 2003): North Devon (Braunton Burrows, 1931), Dorset (Uddens, 1953), Isle of Wight (Parkhurst Forest, 1903-1936), North Hampshire (Longmoor Camp, 1951), Oxfordshire (VC22 Berkshire: Bagley Wood, 19th C). Most site records have been verified by examination of voucher specimens, but no material from Braunton or Longmoor has been examined (B. Levey, pers. comm.).

Habitat and ecology Known from long-established rush-pastures and damp rides in ancient woodlands. The larvae develop in the stalks of rushes, especially *Juncus articulatus*; Robbins (1989) describes the mine as a long narrow corridor that may lie mainly in the leaf sheath. Adults are active from late May to late September, and overwinter (Levey, 1977). Most

British records come from sweeping rushes in flower in Parkhurst Forest (a former wood-pasture), and presumably relate to wide and unshaded damp forest rides. Rushes are however currently extremely localized and scant within this area, the main forestry rides being maintained as hard surfaces using gravel, and others largely neglected and shaded, with just a few still open, poorly-drained and with rushes. The other sites are an ecclectic mix with little in common: Braunton Burrows is a large sand dune complex with well-developed wet slacks, Uddens is a complex of parkland, pasture and plantation on the south side of Holt & West Moors Heaths SSSI, Longmoor Camp is an area of heathy bog and forestry plantations in the southern part of Woolmer Forest SSSI, and Bagley Wood is an ancient woodland site now extensively modified by plantation forestry. Wet rushy grasslands and woodland rides in these areas will have changed dramatically in habitat quality over the intervening years. Soil type appears to range from clay (Parkhurst) to sand (Braunton Burrows). It is significant that waterside rushes appear not to have generated records – the draw-down zone of lakes or large rivers – although the dune slacks of Braunton Burrows might come into that category; presumably the overwintering adults would be at risk from flooding, although other insects move into adjoining areas during the winter.

Status Only known from five hectads and there have been no records since 1953. The species can however be difficult to find and surviving populations may still be present. The diversity of the known sites, in terms of soils and land-use, would also suggest that the species may have been much more widespread than appreciated in the past. However, the few known sites – like much of the countryside of southern England – have undergone significant changes in land use, particularly intensification of agriculture or abandonment of common and woodland grazings, and it is likely that suitable fine rush-pasture habitat has been widely lost. Sub-fossil material is known from the Neolithic (Sweet Track, Somerset Levels) and Roman Fishbourne (Buckland & Buckland, 2006), suggesting a long-established native population. Crowson (1981) regarded the species as having a warm climate relict pattern of distribution.

Threats Precise details of its habitat requirements are not known but rush-pastures are vulnerable to agricultural improvements as well as abandonment of active management. Rushy forest rides are vulnerable to drainage, hard surfacing or over-shading.

Management and Conservation Little information can be provided given the poor state of knowledge of the ecology of this species. Four of the historic sites are currently designated SSSI (or partly so), while a fifth (Bagley Wood) is a PAWS (plantation on ancient woodland site); all four SSSI citations refer to invertebrate interests. Continuation of active maintenance cutting of damp open woodland/plantation rides would be advisable, presumably on a rotational programme, should the species be re-found in a woodland situation. Similarly, maintenance of grazing on any rush-pastures and boggy heaths would be advisable should it be re-found in such situations, the grazing system being targeted at maintaining structural diversity.

Published sources Alexander (2003), Bílý (1982), Buckland & Buckland (2006), Levey (1977).

MELANOPHILA ACUMINATA **ENDANGERED**

Fire jewel beetle

Order COLEOPTERA Family BUPRESTIDAE

Melanophila acuminata (De Geer, 1774)

Identification The adult is keyed by Levey (1977) and Bílý (1982), the larvae by Bílý (1982); Levey (1977) is currently undergoing up-dating.

Distribution Overall, known from just 17 hectads with suitable habitat (Alexander, 2003), concentrated across the Thames Basin Heaths, from Bucklebury Common across to Horsell, Woking and Esher, as well as on the New Forest and East Dorset heaths. Interestingly, not known from the Wealden heaths.

First reported in Britain in 1909, in Surrey (Woking and Horsell, many records 1909 and 1910) and subsequently in South Hampshire (Holmsley, Ringwood, 1910), Berkshire (Crowthorne, 1918, 1919, 1921, 1926; Sandhurst, 1918; Bucklebury Common and Mortimer in 1923; Wellington College, 1918-1921 & Windsor Forest in 1930); North Hampshire (Bramshill Common, Eversley, 1921); East Kent (Deal, near shore, 1921); South Devon (Newton Abbot – Bovey Tracey, 1926); and East Dorset (Branksome, in Pearce, 1929).

The only relatively modern reports are from near the railway line on Chobham Common NNR in 1992, and Brentmoor Heath in 1997, both Surrey. John Owen (in lit.) found larvae on Horsell Common in the 1970s or 1980s but the details appear not to have been published. These two reports do indicate that the species may still be present in Surrey at least.

Habitat and ecology Trees generally, on and around lowland heathland, where they are subject to periodic fires. The larvae feed in and under the bark of scorched and burnt conifers and birches. Development takes 2 to 3 years, pupation taking place in the wood (Bílý, 1982). Adults are attracted by the infrared radiation caused by wood-fires (Bílý, 1982); females oviposit on very recently burnt and scorched trees, and fly great distances to forest fires – up to 20 miles known; adult June to early October (Levey, 1977). The adults are very difficult to see when at rest on charred wood.

Status Difficult to assess as the species is highly mobile and capable of flying large distances to heath fires; it may be feasible that Channel crossing is normal for this species and that the British records form just part of a wider highly mobile European population. If this could be adequately demonstrated then the status should be NA (Not Applicable); however, there have only been three sightings reported since 1980, suggesting that the population is in severe decline and threatened with regional extinction - the precautionary principle suggests that a Red List assessment is appropriate. IUCN criteria satisfied are based on the area of occupancy (less than 3 tetrads), with severely fragmented populations (only three locations reported since 1980), further losses likely as a result of human activity - currently little or no recognition of

the ecological significance of fire on lowland heath; accidental and pyromanic fires tend to be rapidly extinguished as a result.

Threats Threatened by fire suppression activities across lowland heaths; also loss of lowland heath habitat to development.

Management and Conservation This species is completely dependent on fires occurring periodically within the larger heathland landscapes of southern England. Whether or not fires are considered to be a natural part of heathland ecology in southern England remains controversial, but fire control and fire suppression have become increasingly sophisticated in recent decades, in part due to widespread development on and adjacent to former heathlands and the need to avoid fires which threaten human life and property. Fire is the critical issue for this beetle and conservation planners need to accept this and ensure that habitat is constantly available at landscape level. However, fire may be used by Railtrack to keep railway embankments clear of vegetation and this may explain the Chobham Common record.

Published sources Alexander (2003), Bílý (1982), Fowler & Donisthorpe (1913), Levey (1977); Pearce (1929).

TRACHYS MINUTA **NEAR THREATENED**

Bush jewel beetle

Order COLEOPTERA Family BUPRESTIDAE

Trachys minuta (Linnaeus, 1758)

Identification The adult is keyed by Levey (1977) and Bílý (1982 & 1992), the larvae by Bílý (1982 & 1992); Levey (1977) is currently undergoing up-dating.

Distribution Confined to central and south-eastern England. Verified records from Dorset, East Sussex, Hertfordshire, Berkshire, East Norfolk, Worcestershire, North Lincolnshire; unverified from South Wiltshire, South & North Hampshire, West Kent, Surrey, Oxfordshire, Buckinghamshire, Cambridgeshire, Huntingdonshire, Northamptonshire, Leicestershire (Levey, 1977). Distribution mapped by Alexander (2003). First noted from Kent in 1896 (Chitty, 1898). Relatively few modern records however, including North Hampshire (Stockbridge Down, 2002); South Hampshire (Botley Wood, 1966-96); North Essex (Marks Hall Estate, 1997); Oxfordshire & Buckinghamshire (Bernwood Forest, 1978-1980); North Lincolnshire (currently known from seven ancient woodlands in six 1km squares).

Habitat and ecology The majority of records come from enclosed and ungrazed ancient semi-natural woodlands which have a history of management as coppice or coppice-with-standards. Larvae are leaf-miners in *Salix* spp and *Carpinus betulus* in Britain (Levey, 1977) although also known from hazel *Corylus avellana*, elm *Ulmus* and whitebeam *Sorbus* on the Continent (Bílý, 1982); Robbins (1989) describes the mine as a blotch on the upper side of the

leaf, pyriform, and starting at the leaf tip where a conspicuous shiny black dried secretion covers the egg. Shaw (1980) reared the beetle from a leaf mine found in Salix atrocinerea in mid April. Larval development lasts 4 to 6 weeks (Bílý, 1982). Adults are active from mid May to late July, feeding on the foliage of the host-plant (Bílý, 1982), generally where growing in open sunny situations along woodland rides; they hibernate amongst leaf and grass litter (Levey, 1977); oviposition in the following April-May (Bílý, 1982).

Status A long established native which appears to have been very localized in Britain throughout the recording period. Sub-fossil material is known from the Late Glacial, through the Holocene, and into the Bronze Age (Buckland & Buckland, 2006) thereby providing unusually excellent evidence for its long-term native status. The species has however clearly declined across much of its limited modern range in Britain, with a large number of sites having only very old records. Only eight hectads have records for the period 1980 to 2012; 30 only older records. The area of occupancy is less than 12 tetrads = 48 km^2, with severely fragmented populations –currently known from 12 sites, but no firm evidence for continuing decline. The species appears to have been lost from a high proportion of its known sites, presumably due to changes in woodland management, and it clearly remains vulnerable. It has accordingly been assessed as Near Threatened.

Threats It seems likely that active woodland exploitation creates optimal conditions for this beetle in terms of habitat structure, and that minimum-intervention management and abandonment both lead to severe decline and local extinction through canopy closure. Young growth of the host plants may be essential. Clearance of the woodland habitat is also clearly damaging.

Management and Conservation The ecological history of the species suggests that it is dependent on active management of its woodland habitat in order to maintain suitable conditions. This has traditionally involved exploitation as coppices but it does seem able to survive along ride networks in the absence of an active coppice-cutting regime where these are regularly maintained and kept open. Known sites include a number of SSSI and nature reserves; no monitoring schemes are known to be in operation.

Published sources Alexander (2003), Bílý (1982 & 1992), Buckland & Buckland (2006), Chitty (1898), Cooter (1970), Heyworth (1995), Key (1998), Levey (1977 & 1987a).

12.2 Lycidae

Lycidae are entirely saproxylic, developing in decaying wood, and having strong associations with areas that have been continuously wooded for many centuries. They include an old pine forest species *Dictyoptera aurora* and an old beech forest species *Erotides cosnardi*. They are however a poorly studied group and relationships with habitat structure are poorly known.

DICTYOPTERA AURORA **VULNERABLE**

A net-winged beetle

Order COLEOPTERA Family LYCIDAE

Dictyoptera aurora (Herbst, 1784). Also known as *Eros aurora* in the old literature.

Identification The adult is keyed by Speight (1990) and in an appendix to Fitton & Eversham (2006). No larval key is available.

Distribution A speciality of the Scottish Highlands, best known from East Inverness-shire (Abernethy Forest SSSI, etc), but also reported from West Inverness-shire (Glenfinnan), Aberdeenshire (Glen Tanar SSSI), Moray, Mid-Perthshire and east Sutherland. Mapped by Alexander (2003). Some records may have resulted from timber transported to saw-mills.

Habitat and ecology A montane conifer forest species in Europe, where associated with *Abies*, *Picea* and *Pinus* (Speight, 1990); in Britain associated with native Scots pine forest. The larvae develop in decaying, standing or fallen, white-rotten pine trunks, but with no record of girth classes required, nor of the bracket fungi species causing the decay; either carnivorous or omnivorous - food is digested externally by means of enzymes secreted via the mouthparts and they only ingest liquid food (Crowson, 1981). The beetle is assumed to require large girth trunks. Adults are short-lived and fly in the evening sunshine in May and June (Alexander, 2003a). No information is available on the influence of canopy density, although it is strongly suspected that open canopy conditions will favour the species.

Status Recently reported from just six tetrads, but formerly known from another eleven, although one of these may have been an importation at a saw-mill. IUCN criteria satisfied are based on the area of occupancy (less than 6 tetrads = 24km^2), with severely fragmented populations (only six locations reported since 1980), and projected further losses as a result of human activity, affecting both the numbers of localities and area, extent and quality of habitat. Historically ‘taken in some numbers’ in the known Highland localities (Fowler, 1890) but Welch (1981) lists it amongst beetles ‘more local’ under pine bark. It appears to have become increasingly scarce. It was overlooked in the British Red Data Book (Shirt, 1987) and only assessed as Nationally Scarce by Hyman (1992). No sub-fossil reports (Buckland & Buckland, 2006) but assumed to be native.

Threats Loss of mature pine forest and removal of dead stems; forestry activity can be especially damaging by removing and/or fragmenting too many stems. Biofuel developments

may also create new threats. Gross changes in grazing regimes may have dramatic impacts in both age structure and physical structure of habitat, and reduced potential for development of future veterans – open forest conditions appear to be important.

Management and Conservation The remnant old pine forest areas are currently much better protected and there is more awareness of the importance of retaining old pine trees, but favourable management regimes still remain elusive – grazing management has not yet found the right balance which maintains open structure while still permitting the development of new generations of trees. Known sites tend to be SSSI for old pine forest, although the extent to which old growth and deadwood are being actively and sympathetically conserved at these sites is debatable. There is an urgent need to clarify its habitat requirements in terms of forest structure and extent, and to establish monitoring protocols. In the meantime it is important that open structured forest is maintained, generally by maintaining suitable grazing regimes which keep new woody growth patchy and enable a high proportion of individual trees to develop into granny pines, ie without restrictive canopy competition.

Published sources Alexander (2003), Buckland & Buckland (2006), Crowson (1981), Fowler (1890), Joy (1932), Speight (1990) and Welch (1981).

EROTIDES COSNARDI **ENDANGERED**

Cosnard's net-winged beetle

Order COLEOPTERA Family LYCIDAE

Erotides cosnardi (Chevrolat, 1829). Formerly placed in the genera *Platycis* and *Dictyopterus*.

Identification The adult is described by Airy Shaw (1944) and keyed by Speight (1990) and in an appendix to Fitton & Eversham (2006). No larval key is available.

Distribution Wye Gorge (Monmouthshire) and West Sussex Downs. The most recent map is provided by Alexander (2003). Welch (1987) and Hyman (1992) give 'West Gloucestershire' for the Wye Gorge record but do not explain why. A central European species on the very edge of its range in southern Britain.

Airy Shaw (1944) recorded two specimens taken 'in the garden of a house on the Staunton road, a mile or so to the east of Monmouth', on 6 and 29 May 1944. What may have been a third specimen was seen flying through the garden on 25 June. The garden was surrounded by woods containing some very old oaks and beeches. The finder ascertained that the two local sawmills use only home grown timber. The locality lies in the well-wooded Wye Gorge close to Lady Park Wood NNR; within Monmouth Community (Wales), but on the east side of the Wye Valley and on the edge of the Forest of Dean (predominantly in West Gloucestershire). Airy Shaw (loc .cit.) clearly regarded this location as Monmouthshire and this is supported by Atty (1983). The transfer to West Gloucestershire by Welch (1987) is not explained, although Staunton is in that vice county.

On 25 May 1969 Cooter (1973) took a single specimen in Red Copse, near Goodwood in West Sussex – close to East Dean Park Wood SSSI, a site designated for its old growth lichens. The copse was revisited in 1970 and found to have been clear-felled, sprayed, and replanted with conifers. Porter (1985 & 1987) found another specimen close to a decaying beech tree near Duncton on 16th June 1984 – Duncton Hanger forms part of the Duncton to Bignor Escarpment SSSI, designated for its mature beech woodland. Porter (loc. cit.) noted that the day had been particularly hot and that the specimen was taken by sweep-netting the herb layer at about 17.00 GMT. A '*Platycis*' is said to have been seen one May in Arundel Park, probably during the 1990s, although the full details are not available (via P.J. Hodge). Three individuals were most recently seen on rideside grass stems in the FC Houghton Forest, Arundel, 11 May 2008 (D. Bangs, pers. comm.). The latter site has little by way of remaining old native beech trees, just a very thin remnant. All of these records come from within the area of a medieval chase used for hunting by the Earls of Arundel.

A record from Dinton Pastures Country Park, Berkshire (Chandler, 1994) cannot be substantiated and must be rejected as the habitat – on low foliage in a hedge by a lake - appears very unlikely.

Habitat and ecology Confined to ancient beech forest (Speight, 1990); it is almost certainly a native species of old growth beech in Britain. The larvae develop in white-rotten heartwood of old beech hulks – no information is available on girth class; either carnivorous or omnivorous - food is digested externally by means of enzymes secreted via the mouthparts and they only ingest liquid food (Crowson, 1981). The adults are short-lived and have been reported from May and June; they fly in hot sunshine, especially in late afternoon, and have also been taken at rest amongst the field layer in shady woodland – mosaics of sun and shade may be important. It is assumed to be a wood pasture species, although the sites where found are no longer open to grazing - possibly a key reason for its rarity - the few surviving populations suppressed by conversion to high forest structures – trees die relatively young, even shade-tolerant species, as natural retrenchment with age effectively becomes suicide under closed canopy conditions.

Status *Erotides cosnardi* has been recorded from two, possibly three, sites since 1980 and only two others previously; there have been no reports at all from the Wye Gorge area since its discovery there in 1944. It clearly still survives in the old Arundel Forest area of the South Downs but may have been lost from the Wye Gorge. IUCN criteria satisfied are based on the area of occupancy (less than 3 tetrads = 12 km^2), with severely fragmented populations (based on 2 or 3 records from an area of very thinly scattered veteran beech trees), and projected continuing decline in both the beetle and the area, extent and quality of habitat - currently little or no recognition of the ecological significance of old growth beech in either the South Downs National Park or the Wye Valley AONB. No sub-fossil reports (Buckland & Buckland, 2006) but assumed to be native. Red-listed over much of its European range - Germany, Denmark, and Sweden – and so likely to be added to the IUCN European Red List in due course.

Threats Loss of large old beech trees, trunks, stumps, etc; canopy closure and minimum intervention management, which lead to development of younger stands through canopy competition; lack of livestock grazing, which would diversify stand structure and favour the beetle.

Management and Conservation The Wye Valley is an Area of Outstanding Natural Beauty although the woodlands are either under active forestry management, or abandoned, or in the case of Lady Park Wood managed as a minimum intervention research site. Active management favouring the development of old growth beech appears not to be taking place anywhere.

The South Downs area is now a National Park, and the area of the beetle records includes a series of SSSI: Duncton to Bignor Escarpment SSSI, East Dean Park SSSI, and West Dean Woods SSSI. None of these are known to be under management for old growth beech, nor are these known to be the best concentrations of habitat. The FC Houghton Forest has lost most of its old beech (D. Bangs, pers. comm.) and merits a conservation reappraisal.

There is an urgent need for: i) targeted survey of remaining old beech stands in the Wye Valley & the old Arundel Forest area of the South Downs; ii) assessment of the extent and condition of old beech stands in these areas; iii) identification of the key conservation management requirements; and iv) establishment of monitoring protocols for old beech trees, to identify population trends in known sites.

Published sources Airy Shaw (1944), Alexander (2003), Atty (1983), Buckland & Buckland (2006), Chandler (1944), Cooter (1973), Crowson (1981), Hyman (1992), Porter (1985 & 1987), Speight (1990) and Welch (1987).

12.3 Cantharidae

Many Cantharidae show interesting distribution patterns which reflect combinations of geology, climate and historic land-use. Many are particularly characteristic of Rackham's ancient countryside, as opposed to planned countryside (Rackham, 1986), and a few are more or less confined to the 'Highland Zone' of old hard rocks. The Highland Zone is a land of moors, dales, ancient woodlands and a pastoral way of life. The Lowland Zone is divided by a strong contrast: i) the ancient countryside of medieval farms, pollards and ancient trees, irregularly-shaped enclosed woodlands, and ancient hedgerows, all the result of at least a thousand years of continuity, and ii) the planned countryside, a mass-produced, drawing-board landscape, hurriedly laid out parish by parish under Enclosure acts in the 18th and 19th centuries. Remnants of ancient countryside survive within the planned countryside, notably ancient woodlands, but are the exceptions not the rule. It is easy to see how these major landscape types will have influenced wildlife. It is less easy to provide short statements about each species' particular requirements within this framework.

MALTHODES CRASSICORNIS **NEAR THREATENED**

A soldier beetle

Order COLEOPTERA Family CANTHARIDAE

Malthodes crassicornis (Mäklin, 1846). Some specimens have been misidentified as *brevicollis* (Paykull, 1878) in the literature (Alexander, 2003b).

Identification The adult is keyed by Fitton (1973); this has been updated, amended and made available on-line (Fitton & Eversham, 2006). Larval keys are only available to genera (Fitton, 1975). Described as new to Britain by Joy (1914) but voucher material previously identified as *M. brevicollis* were not checked at the time and this led to considerable confusion, with many old *brevicollis* records actually referring to *crassicornis* (Alexander, 2003b).

Distribution A highly fragmented range across lowland England, from Castle Hill SSSI and Duncombe Park NNR (North-east Yorkshire) in the north, to Grimsthorpe Park (South Lincolnshire), Staverton Park (East Suffolk), Hatfield (North Essex), Hainault and Epping Forests (South Essex), Windsor Forest (Berkshire) and Ashtead Common NNR (Surrey) along the eastern part of England. Also a concentration in the Severn Basin, with Moccas Park (Herefordshire), Croome Park and Longdon Marsh (Worcestershire), and Ashleworth Ham (West Gloucestershire); one further site, Blenheim Park (Oxfordshire). The site list reads like a 'Who's Who' of classic saproxylic sites.

Habitat and ecology This beetle develops in the red-rotten heartwood of old open-grown oaks in relict old lowland forest and ancient wood pastures. The trees presumably need to be in excess of 200 years old, preferably much more; the dimensions of inhabited trunks have not been recorded. Allen (2003) describes finding adults in a decayed (more or less red-rotten) oak log in Moccas Park, 5 June 1954; by chipping away at a sort of crevice running along its length, they were found ensconced in little cells in the wood; never more than one to a cell. The season was presumably a late one and the beetles had not yet emerged from their pupal cells. Unfortunately he did not record the dimensions of the 'log'. Adults may be found – in low numbers - from mid May until late June, and tend to be found by sweep-netting the field layer close to old oaks. Adults found away from larval habitat are assumed to be dispersing individuals as the species is not known to have any attraction to blossom or sap for feeding.

Status Only known from 16 hectads of which 11 have produced records since 1980; effectively currently known from only 11 sites nationally, although it may reasonably be expected to still be present in two of the old sites. The species may occur in other sites with ancient oaks. IUCN criteria are based on the area of occupancy (11 tetrads) with severely fragmented populations – with 11 localities it narrowly misses Vulnerable; while no information is available on current population trends, and projected continuing decline in the numbers of available suitable host trees. The habitat continues to be very vulnerable to damaging changes in land use.

Threats Declining populations of ancient oak trees in the historic sites, with losses through death not being adequately compensated for by recruitment. Most sites have serious age structure problems. The general trend of estate management in Britain is such as to threaten extinction of nearly all species dependent on old, dead or decaying trees.

Management and Conservation Ten of these thirteen sites have been designated SSSI and/or NNR primarily for their old trees and associated invertebrates, while another is a grassland SSSI with no recognition of tree or invertebrate interests. There is an urgent need to examine the population dynamics of the host trees at these known sites, to assess their individual conservation management needs and to develop individual tree management plans – this has already been carried out at Hatfield Forest. No monitoring schemes are known to be in operation for the beetle.

Published sources Alexander (2003a,b), Allen (2003), Buckland & Buckland (2006); Fitton (1973, 1975), Fitton & Eversham (2006), Joy (1914).

12.4 Trogossitidae

NEMOZOMA ELONGATUM **VULNERABLE**

A trogossitid beetle

Order COLEOPTERA Family TROGOSITTIDAE

Nemozoma elongatum (Linnaeus, 1761)

Identification Adults are keyed by Joy (1932). Larvae are keyed by van Emden (1943).

Distribution A curious distribution across the English Midlands, from Nottinghamshire and Derbyshire to Somerset, with more isolated reports from Cambridgeshire and along the lower Thames (Middlesex, East and West Kent).

Habitat and ecology A specialist of small girth, thin-barked dying or freshly dead stems of a wide variety of trees and shrubs, where it lives in the burrows of bark beetles and feeds on their larvae. In Britain it has formerly been especially associated with *Pteleobius vittatus* and *Hylesinus varius,* mostly known from split elm and ash palings, and often found in the wood-yards where palings were being made - this industry has long since ceased. Many historic sites are from floodplain situations, and two recent reports are from along the Thames (J. Denton, pers. comm.; Denton, 2000 & 2005). The latter records are both from dead blackthorn stems inhabited by *Scolytus rugulosus* and rich in other saproxylic beetles - one an old tall mixed hedge through allotments in an otherwise built up area of Isleworth (Middlesex), the other a fairly dense belt of scrub at Lower Rainham (East Kent) with lots of sloe at the top of the saltmarsh, in quite an exposed situation next to the Thames Estuary. In Poland and Finland it is associated with dying young spruce trees *Picea abies* (Grodzki, 2009), dbh ranging from 10-30cm (E. Hyvärinen, pers. comm.), from shady sites as well as open, even recently burned sun-exposed sites; in France it is known from pine or oak stems

down to about 3cm dbh, and in plantations as well as other situations (H. Brustel, pers. comm.). Experience suggests that the best way of detecting the species is using flight traps.

Status It has always been rare in Britain (Fowler, 1890). Large populations of scolytids in thin-barked trees may be scarcer in the modern countryside but at least one host *Hylesinus varius* is still widespread. Its rarity is difficult to understand. IUCN criteria satisfied are based on the very small or restricted population, the area of occupancy (4 tetrads), with severely fragmented populations (4 locations known). Sub-fossil remains have been found from the early Saxon period in South Yorkshire but not yet earlier (Buckland & Buckland, 2006).

Threats Difficult to assess. The 20th century decline in active exploitation of woodlands for wood products may have impacted on the species, but it has proved capable of exploiting aging hedgerows and thorn scrub. Loss of hedgerows and scrub from floodplains, arising from development, may be a key modern threat.

Management and Conservation Very little can be said as little is known about its habitat requirements in terms of woodland structure, etc. Retention of dying and dead woody stems is important, and in a wide variety of situations. One modern site, Calke Park (Derbyshire) is a NNR, although this species has not been found there during subsequent surveys. No monitoring schemes are known to be in operation.

Published sources Buckland & Buckland (2006); Denton (2000 &2005); van Emden (1943); Fowler (1890); Grodzki (2009); Joy (1932).

OSTOMA FERRUGINEUM **ENDANGERED**

A trogossitid beetle

Order COLEOPTERA Family TROGOSSITIDAE

Ostoma ferrugineum (Linnaeus, 1758)

Identification Adult described in German by Lloyd (1953); English summary in Hodge & Jones (1995); colour figure in Hammond et al (1989). Larva described in van Emden (1943).

Distribution Only known from the old pine forest areas at Guisachan Forest, Glen Affric, Glen More (East Inverness) and Mar Lodge Estate, Braemar, Deeside (South Aberdeen); possible larval borings and adult emergence holes have been seen at one or two other Highland sites but the presence of *Ostoma* has not been confirmed (Welch, 1987).

Habitat and ecology The larvae feed in heartwood and sapwood of large old Scot's pine *Pinus sylvestris* that have been extensively heart-rotted by the fungus *Phaeolus schweinitzii*; also *Fomitopsis pinicola* in Scandinavia; larvae have been found in early April and pupated in late May. The adults are usually found under bark on dead trunk sections, making characteristic semi-circular emergence holes in the bark where they emerge from the pupal

cell; may feed on fungal spores; recorded from April to June and also August (Owen & Mendel, 1992). *Ostoma* are reported to fly during the evening (Lyneborg, 1976) but appear to have poor powers of dispersal (Welch, 1987). An old pine forest species in Britain, and its requirement for large old pines suggests that open forest is a key requirement.

Status Sub-fossil remains have been found on Hatfield Moors, South Yorkshire, from the late Holocene period in Britain, demonstrating that this is a long-term native (Buckland & Buckland, 2006). Live specimens were first detected by A.M. Robertson at Linn O'Dee, Braemar on 18 May 1952 (Lloyd, 1953). It has since been found between 1965 and 1969 by F.A. Hunter, C. Johnson and P. Skidmore to be well-established in Glen Quoich, Glen Derry and Glen Lui on the Mar Lodge Estate. A single adult was found in Guisachan by Hunter (Welch, 1987). The most recent record published in the national literature appears to be from August 1990 (Owen & Mendel, 1992), while there is field record from Glen More in 1992 (M.G. Telfer, pers. comm.). Only three hectads have records for the period 1980 to 2012; only three other hectads known. IUCN criteria satisfied are based on the area of occupancy (3 tetrads), with severely fragmented populations (just three modern records), projected continuing decline in area, extent and/or quality of habitat, further losses likely as a result of human activity.

Threats Loss of mature pine forest and removal of dead stems; forestry activity can be especially damaging by removing and/or fragmenting too many stems. Biofuel developments may also create new threats. Gross changes in grazing regimes may have dramatic impacts in both age structure and physical structure of habitat, and reduced potential for development of future veterans – open forest conditions appear to be important.

Management and Conservation The remnant old pine forest areas are currently much better protected and there is more awareness of the importance of retaining old pine trees, but favourable management regimes still remain elusive – grazing management has not yet found the right balance which maintains open structure while still permitting the development of new generations of trees. Known sites tend to be SSSI for old pine forest, although the extent to which old growth and deadwood are being actively and sympathetically conserved at these sites is debatable. There is an urgent need to clarify its habitat requirements in terms of forest structure and extent, and to establish monitoring protocols. In the meantime it is important that open structured forest is maintained, generally by maintaining suitable grazing regimes which keep new woody growth patchy and enable a high proportion of individual trees to develop into granny pines, ie without restrictive canopy competition.

Published sources Alexander (2003a), Buckland & Buckland (2006), Owen & Mendel (1992), Welch (1987).

12.5 Dasytidae

The Dasytidae and Malachiidae are very much a sun-loving group of beetles, favouring warm and sheltered localities, and especially thermophilic patchwork landscapes. They have been referred to as soft-winged flower beetles, while malachiids are specifically referred to as malachite beetles. Some Dasytidae are specialist predators of bark-beetles (Scolytidae) and woodworms (Anobiidae).

DASYTES VIRENS **NEAR THREATENED**

A soft-winged flower beetle

Order COLEOPTERA Family DASYTIDAE

Dasytes virens (Marsham, 1802). This name has also been used for what is now known as *D. plumbeus* (Müller, O.F., 1776) and so old records need to be treated with caution. Both have also been referred to as *D. flavipes* (Fabricius, 1777) – in this case in Fowler (1890). *D. puncticollis* Reitter has been used in recent decades.

Identification The key in Joy (1932) is inadequate; Hodge & Jones (1995) describe the distinguishing features in comparison with *D. plumbeus*.

Distribution Confusion with *D. plumbeus* has meant that many old records are unreliable unless they have recently been confirmed by examination of voucher material. In Somerset for example all modern records have proved to be *D. plumbeus* and so evidence is needed in support of the old records for *D. virens* (Duff, 1993). Allen's (1998) reference specimens came from the Isles of Scilly (five) and one from Bearsted, Kent. The main concentration of records is from Surrey and Kent, with a scatter of reports from neighbouring counties – East and West Sussex, Berkshire, Buckinghamshire, Middlesex, and northwards in Bedfordshire, Cambridgeshire, Huntingdon, Suffolk, Lincolnshire, South-west Yorkshire, Cheshire and Worcestershire. Some of the latter may not be correctly identified however.

Habitat and ecology The adults are found by sweep-netting in tall flowery grasslands, especially along sea cliffs (Cooter, 2006), although Fowler (1890) says in lanes and woods; from late May to late July. The range of sites is very diverse, including saproxylic sites such as Cobham Park, Darenth Wood and Windsor Forest, also sites along the North Downs at Mickleham and Oxted, and Woodwalton Fen. Recent records come from Thames Gateway sites (Jones, 2007). The larvae are unknown but the diversity of sites suggests that they develop in the hollow stems of large herbaceous plants such as umbels and thistles in stands of rank herbaceous vegetation.

Status Joy (1932): 'rare' although Donisthorpe (1939) described it as 'common' at Windsor. Allen (1998) identified that this species appeared to have much declined in Britain. It had been regarded as widespread and rather common in the south – Fowler (1890) says not uncommon and rather generally distributed in the London district and south of England and certain Midland districts - but Allen had not found it himself. He suggested that the change set in before about 1930. Modern records come from only 11 hectads and it has been known in

the past from a further 29 tetrads. IUCN criteria are based on the area of occupancy (11 tetrads), with severely fragmented populations, only 11 currently known sites, and inferred continuing decline in area of occupancy and quality of habitat. No sub-fossil remains have yet been found in Britain (Buckland & Buckland, 2006) but current understanding suggests a long-term native.

Threats Difficult to assess while there is so much confusion about the identity of past records and poor ecological knowledge. Flowery countryside appears to be the key requirement and this has become rare through agricultural intensification. Thames Gateway sites are threatened by development.

Management and Conservation No modern records appear to come from protected sites. The few remaining sites need to be properly documented, with precise locations, vegetation structure, and population trends established. Until the species is better understood it is difficult to make management suggestions for its conservation. No monitoring schemes are known to be in operation.

Published sources Allen (1998); Buckland & Buckland (2006); Cooter (2006); Duff (1993); Fowler (1890); Hodge & Jones (1995); Jones (2007); Joy (1932).

12.6 Malachiidae

AXINOTARSUS PULICARIUS **VULNERABLE**

A malachite beetle

Order COLEOPTERA Family MALACHIIDAE

Axinotarsus pulicarius (Fabricius, 1777)

Identification Adults are keyed by Joy (1932) but this key does not include the similar *A. marginalis*, a recent addition to the British fauna – Allen (1971) details the distinguishing characters. Larvae of *Axinotarsus* are generally similar to those of *Malachius* but may be distinguished by their narrower head and longer legs (see Klausnitzer, 1978).

Distribution Restricted to the south-east of England: through the lower Thames corridor, northwards along the coastal zone of East Anglia (North Essex and East Norfolk), and on the south coast in East Sussex and East Kent. Modern records are all from the Thames and East Anglia areas.

Habitat and ecology The larvae are believed to develop in the stems or at the roots of plants in areas of damp grassland and coastal shingle. The adults fly in rank herbage and visit flowers (Luff & Eyre, 2007); Harde (1984) associates the adult with flowering grasses. One recent record is from tall herbage by a mill leat (Hackett, 2007) while another is just described as ‘ruderal vegetation’ (Luff & Eyre, 2007). Adults have been found mainly by sweep-netting between late June and early August. The species may require stable high humidity and this is

achieved through the maritime influences on coastal vegetation and amongst tall rank vegetation on permanently moist soils inland.

Status Fowler (1890) recorded *A. pulicarius* as 'local and not common' within its restricted range, then known only from along the south side of the Thames in Surrey and West Kent. Although not reported at all for a long period through much of the 20th century, it has been found in five hectads in the period since 1980, concentrated in the Thames Gateway area; the southern coastal sites all appear to have been lost. IUCN criteria satisfied are based on the area of occupancy (6 tetrads = 24 km^2), with severely fragmented populations, only six known sites, and inferred continuing decline in area of occupancy and quality of habitat. No sub-fossil remains have yet been found in Britain (Buckland & Buckland, 2006) but current understanding suggests a long-term native.

Threats Agricultural intensification; clearance of tall rank vegetation; gravel-winning; coastal defense works; development generally.

Management and Conservation The species is associated with the Thames Gateway area – its sites there are threatened with redevelopment; few populations are currently known from protected sites, primarily Strumpshaw Fen, although the Lea Valley, Stratford site may have a degree of protection. The few remaining sites need to be properly documented, with precise locations, vegetation structure, and population trends established.

Published sources Allen (1971); Fowler (1890); Hackett (2007); Harde (1984); Joy (1932); Klausnitzer (1978); Luff & Eyre (2007).

CLANOPTILUS MARGINELLUS **NEAR THREATENED**

A malachite Beetle

Order COLEOPTERA Family MALACHIIDAE

Clanoptilus marginellus (Olivier, 1790). Formerly known as Malachius marginellus.

Identification Adults are keyed by Joy (1932). No larval key available.

Distribution Formerly widespread across south-eastern England, from Norfolk to Hampshire, with a few outposts beyond, in Devon, Somerset and Gloucestershire. There is also a single old record from Peebles in southern Scotland. There has however been a dramatic decline and contraction in range, with most modern records from coastal situations. Recent sites are coastal shingle in East Sussex and Kent: The Crumbles, Eastbourne; Winchelsea Beach; Dungeness; and also river valley marshes as at Lower Test Marshes Nature Reserve in South Hampshire.

Habitat and ecology Associated with rank herbage in a variety of semi-natural situations, generally on poorly-drained marshy ground along river valleys or coastal shingle. Rather like

Malachius aeneus it was associated with traditional pastoral countryside, and is now increasingly confined to the coast as a result of agricultural intensification, and probably especially land drainage. Now most typically associated with coastal shingle vegetation: sea-kale *Crambe maritima*, sea-sandwort *Honkenya peploides*, etc, although the few modern records also include a newly community orchard established on former riverside meadow land and a floodplain marsh. In Gloucestershire it was known from a few sites through the Severn Vale, and associated with growth of hogweed and tansy (Atty, 1983). The larvae probably develop in pith stems of large herbaceous plants, although there appear to be no published records of rearing. The adults are generally found either by sweep-netting tall rank vegetation or hand-searching amongst shingle vegetation; they are attracted to flowers for feeding. Permanently high humidity may be a requirement, with its association with the coast and poorly-drained land along river valleys. Adults have been found from late May to mid July.

Status Has undergone a dramatic contraction in range and is now virtually confined to a few coastal stronghold sites. IUCN criteria satisfied are based on the area of occupancy (15 tetrads), with severely fragmented populations, and inferred continuing decline in area of occupancy and quality of habitat. Sub-fossil remains have been found from the Holocene in Oxfordshire and the Roman period of both Oxfordshire and Warwickshire (Buckland & Buckland, 2006).

Threats Agricultural intensification; clearance of tall rank vegetation; gravel-winning; coastal defense works.

Management and Conservation The species has contracted its range to a few sites, mostly with some degree of protection such as Dungeness and Winchelsea Beach (Dungeness, Romney Marsh and Rye Bay SSSI) where the natural shingle vegetation provides favourable conditions and the Lower Test Marshes Nature Reserve. Site protection has not proved to be adequate however – the species has not been recorded in Monks Wood NNR since 1965, Wicken Fen since 1950 and Slapton Ley since 1943. The few remaining sites need to be properly documented, with precise locations, vegetation structure, and population trends established.

Published sources Atty (1983); Jones (1997); Morris (1996).

HYPEBAEUS FLAVIPES **VULNERABLE**

The Moccas beetle

Order COLEOPTERA Family MALACHIIDAE

Hypebaeus flavipes (Fabricius, 1787). Added to British List as *Ebaeus abietinus* Abeille by Donisthorpe & Tomlin (1934); its true identify was determined by Blair & Donisthorpe (1943)

Identification Adults are described by Donisthorpe & Tomlin (1934); Blair & Donisthorpe (1943). Distinguished from *Axinotarsus* and *Ebaeus* in Hodge & Jones (1995). Illustrations in Cooter (2000). No larval keys are available.

Distribution Only known in Britain from Moccas Park NNR, Herefordshire. It is also extremely rare across its range on the continent.

Habitat and ecology The larvae are thought to live in the galleries made by woodborers in the red-rotten heartwood of ancient oaks *Quercus* growing in open sunny situations – red-rot in oak is usually caused by the bracket fungi *Laetiporus sulphureus* or *Fistulina hepatica*. It has once been reared (in Germany) from red-rotten wood mould removed from a hole in a dead standing oak – the beetles present were *Dorcatoma chrysomelina* (Anobiidae) and *Pentaphyllus testaceus* (Tenebrionidae); the former is known from Moccas but not the latter. It has also been reported from a large rotten beech stump in Sweden, where the anobiid *Ptilinus pectinicornis* was present, as well as other wood-boring beetles. In Germany it is more regularly found by beating hornbeam (Cooter, 2000). Red-rot can also occur in beech and hornbeam, although white-rot (caused by different species of bracket fungi) tends to be much more frequent in these tree species. Continental sites all tend to be close to open water and so the Lawn Pool or the Wye floodplain situation may be significant.

Cooter (2000) has found specimens on several ancient oaks in Moccas Park – a total of seven trees (J. Cooter, pers. comm. 2013): around the Lawn Pool, on the hillside in the south eastern part and on wind-blown oaks in the northern area. He states that it is generally easy to find from early June to mid-July and sometimes occurs in numbers – six on the beating tray at one time not being unusual. Invariably the males appear a week or so before the females, with females surviving for some time after the males have disappeared. In sunny weather, the beetle is very active, an agile runner and readily takes flight. He has never found it by beating blossom, only the foliage of ancient, usually hollow oaks with red-rotten interiors, containing dry, red-coloured dead wood and wood mould or wood dust derived from decayed heartwood.

Status Originally described from three female specimens taken by J.R. le B. Tomlin on 26 June 1934 by sweep-netting under oaks at Moccas Park. In 1943 G.H. Ashe donated two pairs from the same locality from which Blair & Donisthorpe (1943) were able correctly to identify the species. In June and July 1975, using a sketch map indicating the position of the 'Ashe' oak, Cooter (1976) found the beetle to be reasonably common in the same tree some forty years after its discovery; he has subsequently found the beetle on a total of 7 ancient oaks in the park. No sub-fossil remains have yet been found in Britain (Buckland & Buckland, 2006) but current understanding suggests a long-term native. IUCN criteria satisfied are based on: very small or restricted population (7 ancient oak trees in one wood); restricted area of occupancy (less than one tetrad = 4km^2); and single location; with a plausible future threat that could drive the taxon to CR or EX in a very short time.

Threats Apparently completely dependent on the continued availability of large old open-grown oaks with advanced red-rotten heartwood decay within Moccas Park. The species is very vulnerable to chance events that might cause the loss of key trees, e.g. storm damage

and/or collapse and death through old age. Over-collecting appears an unlikely threat in a closed NNR. Recruitment rate of future ancient oaks may not be adequate.

Management and Conservation The sole known British site has been designated as a SSSI and is managed as a National Nature Reserve. Natural England (and its predecessor agencies) has been working with the Moccas Estate to maintain appropriate age structures of the oak population and to encourage long-term survival of ancient open-grown specimens in sufficient numbers to hopefully support viable populations of the beetle. The ecology of the beetle is however poorly known and no monitoring scheme is in operation – these issues need addressing urgently. The seven trees where it has been found need to be properly documented, with tag number recorded and individual tree health assessments carried out. The species has special legal protection under the Wildlife & Countryside Act 1981. No monitoring scheme is known to be in operation.

Published sources Blair & Donisthorpe (1943); Buckland & Buckland (2006); Cooter (1976 & 2000); Donisthorpe & Tomlin (1934); Hodge & Jones (1995); Welch (1987).

MALACHIUS AENEUS **NEAR THREATENED**

Scarlet Malachite Beetle

Order COLEOPTERA Family MALACHIIDAE

Malachius aeneus (Linnaeus, 1758)

Identification Adults are keyed by Joy (1932). No larval key available.

Distribution Currently known from only a small number of sites in Essex, Hertfordshire, Bedfordshire, Surrey, Hampshire and South Wiltshire. It was formerly much more widespread, with records concentrated across central and south-eastern England, extending west into Devon and Glamorganshire, and north to Cheshire and Northumberland; there is just one Scottish record, from the Isle of Arran – 37 vice counties overall (Coleman, 2006).

Habitat and ecology Buglife regard the species as a speciality of 'Olde England', ie landscapes of unimproved meadows, hedges and woods, with old cottages, etc. Adult beetles are active for a short period in May and June (three weeks in any one year), are sun-loving and live amongst tall grassy vegetation in meadows and along overgrown hedges that are often in close proximity to old cottages. Recent records include many village green sites. A common factor may be permanently moist soils, such as along river floodplains - agricultural improvement, compounded by increasing water abstraction lowering water tables, may explain the continued decline throughout the 20th century. However, Fowler (1890) associated it especially with woods, and the abandonment of active coppice cutting is likely to have been disastrous to those populations. Mark-release-recapture studies in 2004 showed that individual beetles live up to 18 days with a daily chance of survival of 70%. Dispersal distances were short with more than 95% of individuals being recaptured less than 100m from

the site of release (Muggleton, 2006). Captive rearing from gravid females has been successful only when old hay/thatch was available (Macadam, 2010).

A number of larvae, occurring not uncommonly under the bark of some logs on Slapton Causeway in 1962, were reared and proved to be *Malachius aeneus* (Welch, 1964).

Status Regarded as common across southern Britain by Victorian entomologists, but from 1890 onwards the beetle was described as local. In the south, records from East Anglia, Oxfordshire and apparent former strongholds in Berkshire peter out by the end of the 1950s. In the period since 1975, finds in Kent, Surrey and Somerset represent the only locations from current known sites (Coleman, 2006); known during the period 2000 – 2005 from just 6 hectads (Coleman, 2006). Recorded in Knighton Wood, South Wiltshire, in 2007 (Darby, 2009). A single male found on Bookham Common in 2011 (Chmurova, 2011). A strong decline has also been noted in Germany during the 20th century (B. Bueche, pers. comm.). No sub-fossil remains have yet been found in Britain (Buckland & Buckland, 2006) but current understanding suggests a long-term native. IUCN criteria are based on the area of occupancy (12 tetrads = 48 km^2) with severely fragmented populations, further losses likely as a result of human activity.

Threats Development, especially agricultural intensification and water abstraction.

Management and Conservation English Nature organized surveys between 1999 and 2001, and found the species in just 3 hectads, in sites in North Essex, Hertfordshire and the New Forest (Coleman, 2006). Buglife has been running the scarlet malachite beetle survey since 2005, to help monitor and to find possible new populations. Repeated survey in 2005 confirmed the beetle's continued presence at the sites recorded by the EN survey and added records from three new hectads. The autecology is being investigated on the populations in Essex, including mark-release-recapture work and captive rearing (Macadam, 2006, 2010). Monitoring has continued. Also Natural England, as a part of Action for Invertebrates in England, conducts trial management of this species and its habitat (Natural England, 2011, Species Recovery Programme advice and delivery projects, on-line).

Published sources Buckland & Buckland (2006); Chmurova (2011), Coleman (2006); Darby (2009); Joy (1932); Macadam (2010); Muggleton (2006); awaiting data from Buglife.

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Appendix 1. A complete listing of all species reviewed, namely those in the families Buprestidae, Cantharidae, Cleridae, Dasytidae, Drilidae, Lampyridae, Lycidae, Lymexylidae, Malachiidae, Phloiophilidae & Trogossitidae

Table A.

Species Name	GB IUCN Status (2013)	Qualifying Criteria	Rationale	GB Rarity Status (2013)	Global IUCN status (2010)	Presence in England	Presence in Scotland	Presence in Wales	AoO (hectads) <1980	AoO (hectads) 1980-2012	Dual Hectads
Buprestidae											
Melanophila acuminata	EN	B2ab iii	IUCN criteria satisfied are based on the area of occupancy (less than 3 tetrads), with severely fragmented populations (only three locations reported since 1980), further losses likely as a result of human activity - currently little or no recognition of the ecological significance of fire on lowland heath.	NR	none	E			17	3	1
Anthaxia nitidula	RE		No reports in past 50 years; known habitat destruction.		none	E			1	0	0
Anthaxia quadripunctata	NA		No demonstrable wild population; not within its natural range.	Non-native	none	E			1	0	0

Agrilus angustulus	LC			NS	none	E		W	39	48	14
Agrilus biguttatus	LC		Massive expansion of abundance and range in past 25 years; still continuing.		none	E			12	102	7
Agrilus cuprescens	NA		Recent arrival, actively spreading, so inappropriate for a conservation status.	Naturalised	none	E			0	2	0
Agrilus cyanescens	NA		Recent arrival, actively spreading, so inappropriate for a conservation status.	Naturalised	none	E			0	6	0
Agrilus laticornis	LC				none	E		W	56	113	22
Agrilus sinuatus	LC				none	E		W	26	161	13
Agrilus sulcicollis	NA		An importation, so not within its natural range; actively spreading, so inappropriate for conservation status.	Non-native	none	E			1	12	0
Agrilus viridis	LC			NS	none	E	S (Extinct)		13	19	3
Aphanisticus emarginatus	CR (PE)		Only known from five hectads and there have been no records since 1953. The species can however be difficult to find and surviving populations may still be present. The diversity of the known sites, in terms of soils and land-use, would also suggest that the species may have been much more widespread than appreciated in the past.	NR/Extinct?	none	E			5	0	0
Aphanisticus pusillus	LC			NS	none	E		W	74	63	8
Trachys minuta	NT	B2a	A long established native which appears to have been very localized in Britain throughout the recording period. Sub-fossil material is known from the Late Glacial, through the	NR	none	E			33	8	3

		Holocene, and into the Bronze Age (Buckland & Buckland, 2006) thereby providing unusually excellent evidence for its long-term native status. The species has however clearly declined across much of its limited modern range in Britain, with a large number of sites having only very old records. Only eight hectads have records for the period 1980 to 2012; 30 only older records. It has accordingly been assessed as Near Threatened.								
Trachys scrobiculatus	LC		NS	none	E			31	28	8
Trachys subglaber	LC	Much suitable habitat not yet investigated; very likely that 8 or more additional hectads will be forthcoming. NB verification of subglaber is only available for 8 hectads but the implication is that most records for troglodytes s.l. will prove to be subglaber.		none	E	S (Extinct)	W	47	93	10
Trachys troglodytes	DD	Apparently confined to just two areas of south-east England – the Brecks and the Chalk downs, and with all known voucher specimens very old. However, the realization that these populations are a separate species, distinct from *T. subglaber* is very new (Levey, 2012), it may be that recorders have not actively sought the genus in these areas in	NR	none	E			4	0	0

			recent decades. Both areas still retain extensive areas of apparently suitable habitat.							
Drilidae										
Drilus flavescens	LC		Much suitable habitat not yet investigated; very likely that many additional hectads will be forthcoming.		E			42	61	19
Lycidae										
Platycis minutes	LC				E		W	69	111	30
Erotides cosnardi	EN	B2a b ii & iii; D2	*Erotides cosnardi* has been recorded from two, possibly three, sites since 1980 and only two others previously. It clearly still survives in the old Arundel Forest area of the South Downs but may have been lost from the Wye Gorge. IUCN criteria satisfied are based on the area of occupancy (less than 3 tetrads), with severely fragmented populations, and projected continuing decline in both the beetle and the area, extent and quality of habitat.	NR	E		W	2	2	0
Pyropterus nigroruber	LC			NS	E	S		23	23	14
Dictyoptera aurora	VU	B2a b ii & iii	Recently reported from just six tetrads. IUCN criteria satisfied are based on the area of occupancy (less than 6 tetrads), with severely fragmented populations (only six locations reported since 1980), and projected further losses as a	NR		S		17	6	3

		result of human activity, affecting both the numbers of localities and area, extent and quality of habitat.							
Lampyridae									
Lampyris noctiluca	LC			E	S	W	575	436	254
Lamprohiza splendidula	NA	No demonstrable wild population; probable importation. Allen (1989) debated the implications of the historic specimens: i) a very local and rare native in Kent, for a period at least; ii)a casual importation, but against this is the fact that two examples were taken; and iii) these were the progeny of an accidentally introduced gravid female which had succeeded in raising a small brood at the spot. He favoured the last option. No sub-fossil material is known (BUGS).	Non-native	E			1	0	0
Phosphaenus hemipterus	NA	The association of all the earlier records with gardens and churchyards, followed by recent examples of more semi-natural situations, does suggest a series of accidental importations, with some populations becoming established for a few years at least. De Cock et al (2009) discuss its status at length and also speculate about it being a casual importation.	Non-native	E			8	4	2
Cantharidae									

Podabrus alpinus	LC			E	S	W	112	164	39
Ancistronycha abdominalis	LC		NS	E	S	W	32	25	8
Cantharis cryptica	LC			E	S	W	144	636	89
Cantharis decipiens	LC			E	S	W	188	530	116
Cantharis figurata	LC			E	S	W	45	193	16
Cantharis fusca	LC		NS	E	S	W	40	37	11
Cantharis lateralis	LC			E	S	W	116	321	68
Cantharis livida	LC			E	S	W	131	287	49
Cantharis nigra	LC			E	S	W	203	551	109
Cantharis nigricans	LC			E	S	W	217	664	119
Cantharis obscura	LC	Recently recorded from just 45 hectads.	NS	E	S	W	32	45	8
Cantharis pallida	LC			E	S	W	106	435	65
Cantharis paludosa	LC			E	S	W	67	143	15
Cantharis pellucida	LC			E	S	W	149	529	100
Cantharis rufa	LC			E	S	W	190	384	77
Cantharis rustica	LC			E	S	W	189	466	98
Cantharis thoracica	LC			E	S	W	77	202	34
Rhagonycha elongata	LC	Reported from only 10 hectads since 1980. IUCN criteria satisfied are based on the geographic range restricted both in extent of occurrence (170 km^2) and in area of occupancy (100 km^2) with severely fragmented populations, but with no information available on current population trends. With its key habitat type heavily protected these	NS		S		10	10	4

			days and its ability to exploit pine plantations it does not merit Near Threatened status; Nationally Scarce does seem to be the appropriate status, as it is presumed to be present in more than 15 hectads.							
Rhagonycha fulva	LC				E	S	W	352	1124	289
Rhagonycha lignosa	LC				E	S	W	231	641	144
Rhagonycha limbata	LC				E	S	W	234	645	133
Rhagonycha lutea	LC		Known from just 83 hectads since 1980.	NS	E	S	W	65	83	26
Rhagonycha testacea	LC				E	S	W	110	322	55
Rhagonycha translucida	LC		Known from just 65 hectads since 1980.	NS	E	S	W	63	65	19
Silis ruficollis	LC		Increasing its range and expected to achieve more than 100 hectads within the next few years.		E		W	44	93	21
Malthinus balteatus	LC				E		W	41	122	17
Malthinus flaveolus	LC				E	S	W	127	345	65
Malthinus frontalis	LC		Lott (2007) found evidence of significant population decline in a comparison of four wood-pasture sites.	NS	E	S	W	73	81	14
Malthinus seriepunctatus	LC				E	S	W	95	243	48
Malthodes crassicornis	NT	B2b iii	Effectively currently known from only 11 sites nationally, although it may reasonably be expected to still be present in two of the old sites. The species may occur in other sites with	NR	E			11	11	5

		ancient oaks. IUCN criteria satisfied are based on the area of occupancy (11 tetrads) with severely fragmented populations – with 11 localities it narrowly misses Vulnerable; while no information is available on current population trends, and projected continuing decline in the numbers of available suitable host trees. The habitat continues to be very vulnerable to damaging changes in land use.							
Malthodes dispar	LC			E	S	W	83	103	19
Malthodes fibulatus	LC	Known from just 41 hectads since 1980.	NS	E	S	W	38	41	11
Malthodes flavoguttatus	LC			E	S	W	49	122	18
Malthodes fuscus	LC			E	S	W	73	122	18
Malthodes guttifer	LC			E	S	W	38	115	7
Malthodes lobatus	NA	It is difficult to decide whether this is a long-overlooked native species or a recent colonist in Britain. It is most feasible that the colony may have arisen as a result of importation with plant material, etc. and has been able to survive locally for a period at least due to the effects of recent climate change. In the absence of a demonstrable long-term established population it would appear sensible to defer a review its status to a later data.	Non-native	E			0	1	0

Malthodes marginalis	LC					E	S	W	171	404	77
Malthodes maurus	LC		Known from just 17 hectads since 1980; may need to be reconsidered for NT in due course.	NS		E	S	W	12	17	1
Malthodes minimus	LC					E	S	W	153	353	88
Malthodes mysticus	LC					E	S	W	58	130	18
Malthodes pumilus	LC		The species has only been reported from 80 tetrads since 1980. It was excluded from the 1992 review solely due to its small size but targeted searches have demonstrated that it appears to be genuinely absent from many areas which appear suitable.	NS		E	S	W	87	80	14
Lymexylidae											
Hylecoetus dermestoides	LC		Under-recorded. Likely to be in excess of 100 hectads.			E	S	W	78	88	26
Lymexylon navale	LC		A rare species nationally apart from in the Thames Basin which appears to have a strong population leading to movements out of the main refugia.	NS		E		W	9	19	5
Phloiophilidae											
Phloiophilus edwardsii	LC			NS		E	S	W	60	50	10
Trogossitidae											
Ostoma ferrugineum	EN	B2ab iii	The most recent record published in the national literature appears to be from August 1990 (Owen & Mendel, 1992), while there is a field record from Glen More in 1992 (M.G. Telfer,	NR	LC		S		5	3	2

			pers. comm.). IUCN criteria satisfied are based on the area of occupancy (3 tetrads), with severely fragmented populations (just three modern records), projected continuing decline in area, extent and/or quality of habitat, further losses likely as a result of human activity.								
Thymalus limbatus	LC			NS	LC	E	S	W	45	60	15
Lophocateres pusillus	NA		introduced pest of stored produce.		NA	*	*	*			
Tenebroides mauritanicus	NA		an African species spread through trade.		NA	*	*	*			
Nemozoma elongatum	VU	D2	Large populations of scolytids in thin-barked trees may be scarcer in the modern countryside but at least one host *Hylesinus varius* is still widespread. Its rarity is difficult to understand. IUCN criteria satisfied are based on the very small or restricted population, the area of occupancy (4 tetrads), with severely fragmented populations (4 locations known).	NR	LC	E			23	4	1
Thaneroclerus buqueti	NA		Indian species introduced in Bombay ginger.			*	*	*			
Cleridae											
Tillus elongatus	LC			NS		E		W	50	68	11
Tilloidea unifasciata	RE		Regarded by Joy (1932) as very rare. Its status is very difficult to assess; the association in Britain with fresh oak			E			*		

		palings may suggest an importation established in timberyards. Whether native or not, certainly now extinct. No sub-fossil remains have yet been found in Britain (Buckland & Buckland, 2006).							
Opilo mollis	LC		NS	E		W	48	39	17
Thanasimus femoralis	LC	Known only from a restricted area of pine forest, but many sites now under protective management and able to exploit plantation forestry and so not obviously threatened.	NR		S		7	6	2
Thanasimus formicarius	LC			E	S	W	100	131	32
Trichodes alvearius	RE	Allen (1967 & 1969) presents a good case for regarding it as an extinct native, on the edge of its European range and therefore vulnerable to climatic fluctuations; the few sporadic captures represent some of the last lingering remnants from a more favourable past. No sub-fossil remains have yet been found in Britain (Buckland & Buckland, 2006). Fowler (1890) says: ‘doubtfully indigenous’.					*		
Trichodes apiarius	RE	Allen (1967 & 1969) presents a good case for regarding it as an extinct native, on the edge of its European range and therefore vulnerable to climatic fluctuations; the few sporadic captures represent some of the last					*		

		lingering remnants from a more favourable past. No sub-fossil remains have yet been found in Britain (Buckland & Buckland, 2006). Fowler (1890) says: 'doubtfully indigenous'.							
Paratillus carus	NA	Australian import.							
Tarsenostenus univittatus	NA	Accidental importations.							
Korynetes caeruleus	LC		NS	E	S	W	60	32	7
Necrobia ruficollis	LC	Cosmopolitan species of carrion and meat products. Under-recorded. Likely to be in excess of 100 hectads.		E		W	50	4	3
Necrobia rufipes	LC	Cosmopolitan species of carrion and meat products. Under-recorded. Likely to be in excess of 100 hectads.		E			43	11	3
Necrobia violacea	LC	Cosmopolitan species of carrion and meat products. Under-recorded. Likely to be in excess of 100 hectads.		E	S	W	83	50	9
Dasytidae									
Aplocnemus impressus	LC	Modern records are primarily from the southern part of its range, suggesting a contraction in its range. NS is justifiable on the basis of recent lack of recording effort.	NS	E	S	W	37	14	8
Aplocnemus nigricornis	LC		NS	E	S	W	26	17	3
Dasytes aeratus	LC			E	S	W	132	155	40

Dasytes cyaneus	NA		A single report of a single specimen; clearly not an established population.			W	1	0	0
Dasytes niger	LC			NR	E		27	10	5
Dasytes plumbeus	LC		Fowler (1890) regarded this species as rare, but it now appears much less so. There are records from 37 hectads since 1980.	NS	E	W	43	37	9
Dasytes virens	NT	B2b ii iii	IUCN criteria satisfied are based on the area of occupancy, with severely fragmented populations and inferred continuing decline in area of occupancy and quality of habitat.	NR	E		29	13	3
Psilothrix viridicoeruleus	LC		Abundant on favoured coasts across south and west; knowledge suggests would excede 100 hectads with targeted recording.		E	W	57	45	18
Dolichosoma lineare	LC			NS	E		20	21	11
Malachiidae									
Colotes punctatus	NA		Welch (2008) suggests either introduced on some form of maritime flotsam, or else introduced with plant material from southern Europe.		E			1	
Ebaeus pedicularius	RE				E		*		
Hypebaeus flavipes	VU	D2	IUCN criteria satisfied are based on: very small or restricted population (7 ancient oak trees); restricted area of occupancy (less than one tetrad); and single location; with a plausible future	NR	E		1	1	1

			threat that could drive the taxon to CR or EX in a very short time.						
Axinotarsus marginalis	NA		Recent arrival; expanding dramatically.		E		6	50	3
Axinotarsus pulicarius	VU	B2ab ii iii & D2	Although not reported at all for a long period through much of the 20th century, it has been found in five hectads in the period since 1980, concentrated in the Thames Gateway area; the southern coastal sites all appear to have been lost. IUCN criteria satisfied are based on the area of occupancy (6 km^2), with severely fragmented populations, only six known sites, and inferred continuing decline in area of occupancy and quality of habitat.	NR	E		12	5	2
Axinotarsus ruficollis	LC		Regarded by Fowler (1890) as local, but there are more old records than modern ones, suggesting that it has become increasingly scarce. It has been reported from only 20 hectads since 1980.	NS	E		35	20	8
Troglops cephalotes	NA		Recent arrival; probably accidental importation; expanding range.		E		1	5	
Cordylepherus viridis	LC				E	W	76	115	32

Malachius aeneus	NT	B2b ii iii	IUCN criteria satisfied are based on the area of occupancy (12 km^2) with severely fragmented populations, further losses likely as a result of human activity.	NR	E	S	W	75	12	3
Malachius bipustulatus	LC				E	S	W	231	338	109
Clanoptilus barnevillei	LC		Recent records throughout its restricted range; no evidence for any decline or threat.	NR	E			4	5	4
Clanoptilus marginellus	NT	B2b ii iii	Has undergone a dramatic contraction in range and is now virtually confined to a few coastal stronghold sites. IUCN criteria satisfied are based on the area of occupancy (16 modern hectads) with severely fragmented populations, and inferred continuing decline in area of occupancy and quality of habitat.	NS	E	S		58	16	4
Clanoptilus strangulatus	LC		Recent records throughout its restricted range; no evidence for any decline or threat.	NR	E			8	10	3
Sphinginus lobatus	NA		Recent arrival; expanding along main river valleys.		E				7	
Cerapheles terminatus	LC		Records for the period from 1980 to present suggest that the population is much as it has always been, with old unconfirmed records only from a strange miscellany of unlikely situations, presumably representing stray individuals. The data provides no	NR	E		W	14	13	7

		indication for any decline. No sub-fossil remains have yet been found in Britain but current understanding suggests a long-term native.						
Anthocomus fasciatus	LC	Fowler (1890) says ‘somewhat local’ but it has been reported from only 65 hectads in the period since 1980, with older records from 70.	NS	E	W	70	65	15
Anthocomus rufus	LC			E	W	51	112	27

Note: * = no detailed data available

Appendix 2. Summary of IUCN Criteria

Table B. 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)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²

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:	< 50	< 250	< 1,000
or			
(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 < 20 km² 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