

Natural England Commissioned Report NECR188

A review of the Hemiptera of Great Britain: The Aquatic and Semi-aquatic Bugs

Dipsocoromorpha, Gerromorpha, Leptopodomorpha &
Nepomorpha

Species Status No.24

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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 national status of aquatic and semi-aquatic bugs using IUCN methodology for assessing threat. It covers all species of aquatic and semi-aquatic bugs (Heteroptera) in Great Britain, identifying those that are rare and/or under threat as well as non-threatened and non-native species.

Reviews for other invertebrate groups will follow.



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Further information

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1. Introduction to the Species Status project

1.1 The Species Status project

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

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

1.2 The status assessments

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

1.3 Species status and conservation action

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

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2. Introduction to this Review

2.1 Taxa covered

The bugs (Heteroptera) covered in this review (93 species) comprise a fairly diverse group taxonomically, but nearly all are either aquatic, or are found in damp habitats which are usually close to water. Three of the species belong to the infraorder Dipsocoromorpha (litter bugs), a small taxon with 200 species worldwide that is thought to represent a basal or primitive group from which nearly all other Heteroptera evolved during the Triassic (Grimalkin & Engel 2005). Twenty-one species belong to the infraorder Gerromorpha (pond skaters and allies), a larger group of semi-aquatic bugs with 1,860 species worldwide including the familiar pond skaters as well as a number of less familiar smaller species. The truly aquatic bugs, the only insects apart from some beetles that spend most of their lives under water, belong to the infraorder Nepomorpha (water boatmen and allies), with 2000 species worldwide and 48 species in the UK. This forms the largest group covered by the review and consists largely of water boatmen (Corixidae and Notonectidae), but also includes the Naucoridae and Nepidae which contain the larger species of water bug in the UK. The final taxon represented is the Leptopodomorpha, a small infraorder of ‘shore bugs’ with 300 species worldwide, which as their name implies, generally live close to water. There are 23 species in the UK and a relatively high proportion is either Nationally Rare or Nationally Scarce. A more detailed breakdown of aquatic and semi-aquatic bugs is given in table 2.1 below.

Table 2.1. A summary of taxa covered in this review, with current IUCN and GB status

Infrorder	Families	Number of species	Number of species with IUCN status of threatened or near threatened	Number of species with GB status of Nationally Rare or Nationally Scarce
Dipsocoromorpha	Ceratocombidae	1	0	0
	Dipsocoridae	2	1	1
Gerromorpha	Mesoveliidae	1	0	2
	Hebridae	2	0	1
	Hydrometridae	2	1	1
	Veliidae	5	1	2
	Gerridae	10	0	2
Nepomorpha	Nepidae	2	0	0
	Corixidae	37	0	7
	Naucoridae	2	0	0
	Aphelocheiridae	1	0	0
	Notonectidae	4	0	0
	Pleidae	1	0	0
Leptopodomorpha	Aepophilidae	1	0	1
	Saldidae	22	6	20

2.2 Publications and recording

The earliest comprehensive publication on British Heteroptera was by Douglas and Scott, published in 1865. Most of the material for the book was collected from southern counties of England, chiefly in the vicinity of London, although records are included from collectors working further afield. The number of species known at that time was considerably less than now; in the case of aquatic and semi-aquatic bugs Douglas and Scott described 9 species of Gerromorpha, 28 Nepomorpha, 12 Leptopodomorpha and 2 Dispsocoromorpha. There followed publications by Saunders (1892), the first to provide keys to the species described, and by Butler (1923) who gave detailed accounts of life history, habitat and national distribution. Butler's work on distribution, for which he divided the British Isles into 54 regions (52 English and Welsh administrative counties, Scotland and Ireland), was extended by Bedwell (1945) and Masee (1955). The information provided by Masee and previous authors shows the distribution of species in the different regions on a simple presence / absence basis. Ryan (2014) has updated Masee's nomenclature and converted his tabular data into maps for 507 species.

An atlas of British water bugs (Gerromorpha and Nepomorpha) was produced by Huxley in 2003. Distributions are shown for England, Wales and Scotland on a 10km² basis and maps for each species are accompanied by brief descriptions of distribution, habitat and identification features. Thomas Huxley was the national organizer for the Aquatic Heteroptera Recording Scheme between 1999 and 2002, succeeding John Blackburn who was the first organizer for the scheme, which was initiated in 1983 alongside others for recording terrestrial bugs (see Eversham 1983). Sheila Brooke succeeded Huxley and was organizer for 10 years before the author took over in 2012. All records, which come mainly from individual specialists, are collated and checked by the organizer and passed on to the British Records Centre (BRC) who in turn pass them on to the National Biodiversity Network (NBN). While a large proportion of aquatic bug records come through the recording scheme, many more are sent in independently by other organizations or individuals, either to BRC or direct to NBN Gateway.

The first modern keys to British water bugs were produced by Macan (1939, 1965), who also published an extensive series of papers on the ecology of corixids. Savage (1989) updated and revised Macan's key and made further contributions to our knowledge of corixid ecology, most notably on the environmental factors governing species associations in different habitats. Keys to water bugs, shore bugs and litter bugs, as well as to all other British Heteroptera, were produced by Southwood and Leston (1959) in their classic book 'Land and Water Bugs of the British Isles'. Although now somewhat out of date this remains the only publication covering all British species known at that time. Ryan (2012) has provided an update to the book, adding 89 new species of Heteroptera that have been recorded in Britain since 1959 and listing 91 name changes to species described. Eight of the species of aquatic Heteroptera covered in this review are among the recent additions and a few have been subject to name changes (see data sheets for details). The most recent and comprehensive key to aquatic and semi-aquatic bugs, describing all the species covered in this review, is by Nau (2012, unpublished), which includes excellent illustrations. There are various European publications on aquatic and semi-aquatic bugs, among them a detailed monograph on shore bugs by Pericart (1990), in the Faune de France series, that covers all species found in Britain.

2.3 Previous reviews and red data books

The British Red Data Book on insects (Shirt 1987) was the first evaluation of threatened and rare species within the major insect groups. Seventy-nine species of Heteroptera are listed under various categories, nine of which are species covered in this review. A major review of scarce and threatened Hemiptera, which included Auchenorrhyncha as well as Heteroptera, was produced by Kirby (1992) and this remains the most comprehensive reference work to the habitat, threats and conservation of all species considered to be endangered, rare or vulnerable (and in a few cases, extinct) at that time, although some assessments have now changed (see Table 13.1). Brooke (2009) provided a short account of water bugs that have recently arrived in Britain.

Since the 1865 work by Douglas and Scott the number of species in the infraorders covered in this review that have been recorded in Britain has risen from 51 to 93. The increase is due mainly to the discovery, over the last 150 years, of additional established native species as well as to a minor contribution made by more recent immigrants from Europe.

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

3.1 Summary of the 2001 Threat Categories

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

REGIONALLY EXTINCT (RE)

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

CRITICALLY ENDANGERED (CR)

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

ENDANGERED (EN)

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

VULNERABLE (VU)

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

NEAR THREATENED (NT)

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

LEAST CONCERN (LC)

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

DATA DEFICIENT (DD)

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.

NOT EVALUATED (NE)

A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

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

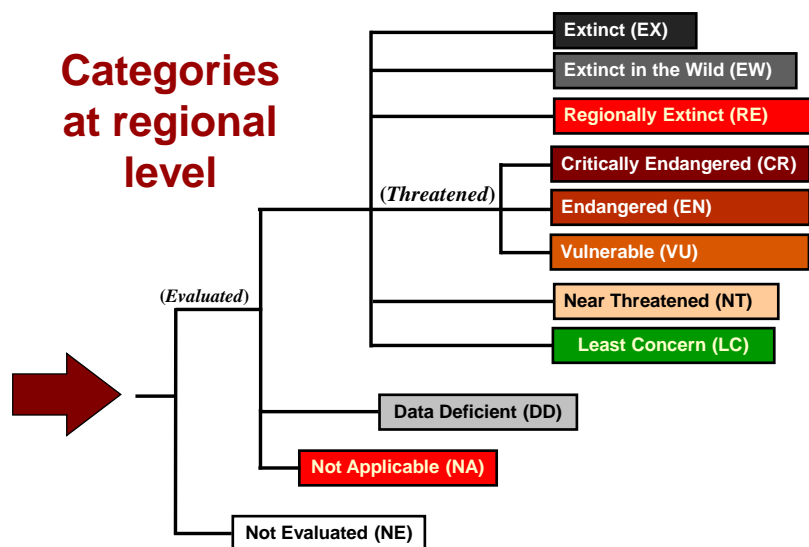


Figure adapted from IUCN (2001)

Figure 2. Hierarchical relationships of the categories

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

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

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

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

3.2 Application of the Guidelines to Invertebrates

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

Both **Extent of Occurrence (EOO)** and **Area of Occupancy (AOO)** are measures used to estimate the status of species. Extent of Occurrence is defined as: the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known sites of present occurrence of a taxon, excluding cases of vagrancy. EOO can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence). In this Review, EOO has not been used in the assessments as the calculation 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 (see Alexander 2014).

The Area of occupancy on the other hand is relatively straightforward to estimate and although subject to difficulties due to scale (see below) is widely used in the assessment of invertebrates. AOO has been used exclusively in this review and is defined as: the area occupied by a taxon within its Extent of Occurrence', excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its EOO, which may contain unsuitable or unoccupied habitats. In some cases 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.

The IUCN have recommended a scale of 4km² (a tetrad) as the reference scale for AOO estimates (IUCN, 2013). This needs to be applied with caution and there will be instances where a different scaling is more applicable (e.g 10km²), or where

attempting to apply any scale is extremely difficult. For common and widespread species applying this rule will lead to under-estimation of their true AOO and a degree of interpretation is required. This highlights the importance of peer review and shared expert opinion for making decisions on scale. For rarer, more restricted, species the tetrad is more applicable, in particular those species which may occur on a few fragmented sites within the UK and/or whom are often restricted to certain, well-defined habitat types that are easily identified. In most instances, the reviewer (and peers) is best placed to judge which these species are.

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

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

3.2.2 The use of the Near Threatened category

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

The NT category is not specified by its own criteria, but by its proximity to the category Vulnerable (IUCN 2014 guidelines). The IUCN documentation gives a number of examples of when the NT category would be justified, for example: 'The taxon meets the area requirements for threatened under criterion B (AOO <2,000km²) and is severely fragmented, but the population is not declining, occurs at more than 10 locations and is not subject to extreme fluctuations.' Here an assessment of NT is based only on AOO and fragmentation, without the requirements for population decline or fluctuations for which reliable information for insects, and many other taxa, is usually lacking.

The Invertebrate Inter Agency Working Group and JNCC have defined the following for the use of B2bii which is commonly used in reviews. Continuing decline has to be demonstrated – and proven that it isn't an artefact of under-recording. If decline is demonstrated then the reviewer needs to consider whether or not B2a (and B2c if the data is present) is met:

- If 10 or less current localities then Critically Endangered, Endangered, Vulnerable is applicable;
- If 11 or 12 current localities then Near Threatened applies;

- If 13-15 and the taxon can be shown to be vulnerable to a specific and realistic threat, then Near Threatened applies;
- If more than 15 locations then Least Concern applies.

There is no specific mention in the guidelines of how to deal with under-recording, the main source of inaccuracy for the rare species considered in this review. The information available suggests that an under-recorded species with very small known AOO, fragmented population and a habitat known to be under threat may still warrant a status of Near Threatened (or possibly threatened) rather than Data Deficient (see below), especially if supporting evidence shows that under-recording is unlikely to be a major factor. In such cases a balance has to be struck between a precautionary and evidentiary attitude (see section on Data Quality and Uncertainty below).

3.2.3 The application of Data Deficient (DD) and Not Evaluated (NE) categories

An assessment of a taxon as either DD or NE means that no estimation of threat has been made, although the reasons for this are different in each case. NE indicates that no attempt to evaluate has been made, while DD indicates that a taxon was evaluated but the data were found to be insufficient to place it into a category. When the data are very uncertain the category of DD may be justified but when the available information indicates that a taxon may be threatened the issue becomes more complex and a decision will hinge on how far it is acceptable to take inference and projection (IUCN 2014 guidelines).

In this review, for example, *Cryptostemma waltli* is species that falls into this area of uncertainty. It is a cryptic species, for which there are very few past or recent records, that occurs in *Sphagnum* and other mosses in damp, boggy areas. It may occur more extensively in poorly surveyed upland bog, although so far nearly all records are from lowland habitats in the south of Britain. The extent of under-recording is unknown, but evidence against the assumption of significant under-recording is provided by the fairly large number of records throughout Britain for another small, cryptic species with similar habitat requirements (*Hebrus ruficeps*). A precautionary approach has been taken in this case and *C. waltli* has been assessed as NT.

3.2.4 Location

Although a species may occur at a number of different sites, perhaps distant enough to fall into different tetrads, these will not necessarily constitute different locations. A location defines a geographically or ecologically distinct area in which a single threatening event could rapidly affect all the individuals of a species present (IUCN 2014, guidelines). In this review *Hydrometra gracilenta* provides an example of the difference between sites and locations; it has been recorded in nine tetrads since 1990, seven in east Norfolk and two in Sussex, but five of the sites in Norfolk are within the same fen / marsh complex as are the two sites in Pevensy, Sussex. *Hydrometra gracilenta* has, therefore, been assessed as occurring in four locations, rather than nine.

3.2.5 Data Quality and Uncertainty

Although the criteria are quantitative in nature, the lack of high quality data should not deter attempts to apply the criteria (IUCN 2014). Data available are often partial and subjective assessments are permitted when based on reasonable evidence. In this review a threat status is assigned to some species on the basis of Area of Occurrence combined with an *inferred* threat

to habitat. The inference is that, because of known threats, the habitat will decline in quality or extent over the foreseeable future resulting in a reduction or extinction of the species population. The terms that may be used to justify the use of particular criteria (*Observed*, *Projected*, *Inferred*, and *Suspected*) are defined in detail in the IUCN Guidelines.

Measurement error is often the main source of uncertainty in data, which may be due to inaccuracies in estimating values or lack of knowledge. In this review uncertainty has been mainly the result of under-recording, leading to under-estimates in the area of occupancy of particular species that may or may not be under threat. In some cases this has led to a designation of DD (data deficient) but where possible allowances have been made in the light of expert opinion and a threat status given, which may be lower than that indicated by the raw data. Classifying a species, as threatened, or near threatened, despite inadequacies in the data is a precautionary approach, which will help to raise its profile and hopefully encourage more recording.

A precautionary attitude would classify a taxon as threatened unless it is highly unlikely that it is not, whereas an evidentiary attitude would classify a taxon as threatened only when there is strong supporting evidence. The IUCN recommend a precautionary, but realistic, attitude.

3.2.6 Taxonomic level for assessments

The criteria can be applied to any taxonomic unit at or below species level (IUCN 2014). Taxa could include subspecies, varieties (for plants only) and, under certain conditions, subpopulations. For invertebrate assessments the taxonomic unit will invariably be the species, although Foster (2010) assessed four subspecies in his review of water beetles. In this review all taxa assessed are species although the corixid *Glaenocoris propinqua* consists of two subspecies in the UK, *G. propinqua propinqua* and *G. propinqua cavifrons*, both of which occur in upland lakes but differ in their geographical distribution. However, records available only allow an assessment at species level. It is also possible that *Saldula arenicola*, a species assessed as Least Concern, may be divided into two groups; one associated with coastal sites and a more recently recorded group associated with inland water bodies in abandoned sand and gravel workings (P. Kirby *pers. comm.*). If this turns out to be the case the species will have to be re-assessed.

3.2.7 Native and Non-native taxa

The IUCN Red List assessments should only be applied to wild populations, (whether native or non-native). The definition of a native species is far from clear but one generally agreed criterion is that its presence in a region is due to natural colonisation. Botanists divide plants into neophytes (introduced post 1500), archaeophytes (introduced pre 1500) and natives. A native plant species is defined as one that arrived naturally after the ice age, as evidenced, in some cases, by fossil remains. This is a reasonable definition of nativeness for all taxa, but often very difficult to confirm because of the inevitable confusion between natives and long established introductions. However, a definition of nativeness that requires ancient establishment fails to address the status of species that have arrived in Britain more recently, usually from mainland Europe, as a result of a natural extension of range. Alexander (2014), following IUCN guidelines (IUCN 2003) states that assessments should only be applied to species with a long-term presence in a region, with 1500 AD being the cut-off point. He does, however make an exception for the beetle *Melanophila acuminata*, which may have colonised Britain naturally around 1900, or may be an overlooked native, and is now under

threat. Following the precautionary principle the species was assessed as Critically Endangered rather than as Not Applicable.

The problem of distinguishing recent colonists, whether arriving naturally or by human agency, from overlooked natives may arise when the species in question is very similar to a known native species. One example from aquatic bugs is that of *Micronecta griseola* which was discovered recently in Bedfordshire (Brooke & Nau 2003) and can only be distinguished from the established native *M. minutissima* by dissection. This may be an overlooked native, although in view of its recent spread across Western Europe and recent discovery in Ireland (Cuppen & Nelson 2007) seems more likely to be a recent 'natural' colonist. A similar situation exists with another recently recorded corixid *Sigara iactans*, which is easily confused with the common native *Sigara falleni*. In this review both are considered suitable for assessment – either as a native species or as species that have naturally extended their range. Kirby (1992) considers newly arrived species that have established stable distributions to be potentially as informative and interesting as long established species.

3.2.8 Threat assessments and conservation action

The assessment of threats and decisions about conservation priorities and action are separate issues. Although the threat status of a species will be a factor in deciding upon appropriate conservation measures, many other factors such as cost, the chances of success and benefits to other species at risk have to be taken into account. A threat status does not imply the need for action, but does imply the need to keep a species under review.

4. GB Rarity Status categories and criteria

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 and Nationally Scarce categories are unique to Britain. Broadly speaking, the Nationally Rare category is equivalent to the Red Data Book categories used by Shirt (1987), Kirby (1992) and Huxley (2003), namely: Endangered (RDB1), Vulnerable (RDB2), Rare (RDB3), Indeterminate (RDBi), Insufficiently Known (RDBK) and Extinct. The Nationally Scarce category is equivalent to Nationally Notable, sometimes divided into Nationally Notable A (Na) and Nationally Notable B (Nb) as, for instance, in Hyman and Parsons (1992; 1994).

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

- | | |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nationally Rare | Native species which have not been recorded from more than 15 British hectads since 1990 and where there is reasonable confidence that exhaustive recording would not find them in more than 15 hectads. This category includes species that are probably extinct. |
| Nationally Scarce | Native species which are not regarded as Nationally Rare and which have not been recorded from more than 100 hectads since 1990 and where there is reasonable confidence that exhaustive recording would not find them in more than 100 hectads. |

NB. The choice of 1990 as the start of the modern recording period for aquatic and semi-aquatic bugs is discussed in Section 7.2.

5. The use of an Amber List category

The IUCN threat criteria are principally concerned with identifying rare species at risk of extinction and are only applicable to species with a small AOO (under 20 hectads). In order to highlight species that may be declining, but are still quite widely distributed, the creation of an Amber List category is considered desirable. This would focus solely on assessing decline and be entirely independent of absolute rarity. Ideally an assessment of decline would be based on data obtained from population censuses over a suitable period of time, but unfortunately such data are not available for the species covered in this review. A straight comparison of hectads occupied between the recent period (1990 -2013) and the previous period (1966 – 1989) would provide another approach if the data for both periods were equivalent, but this is not the case here. As explained in section 6.3, the 71 species in this review that occurred in more than 20 hectads in the recent time period showed an average increase in AOO between time periods of $188\% \pm 30\%$ ($P < 0.05$). It is very probable that this figure represents the increased availability of records for the recent time period rather than an unlikely general increase in the abundance of the species. If this is accepted, the figure of 188% could be taken as a steady state base line for the purpose of comparison. This approach, based on the assumption that most of the commoner species under review have undergone no marked change in AOO between time periods, allows the highlighting of species that may be at risk in the future. These are arbitrarily defined, for the purpose of this review, as species that show an increase in AOO of 75% or more below the average, i.e. an increase of 47% or less, with the proviso that no sampling bias can be found to account for the low increase (see Table 12.1).

6. Methods and Sources of information

6.1 Introduction

The first statement on the status of threatened British Heteroptera was the British Red Data Book on insects (Shirt, 1987). This was followed by a comprehensive and detailed assessment of both risk and rarity based on Red Data Book categories and GB rarity status by Kirby (1992), in his review of scarce and threatened Hemiptera of Great Britain. Huxley (2003) also provides assessments for water bugs in his atlas of British aquatic bugs, based on Kirby's review. Although all the species listed by the above authors still qualify for either a threat or rarity status, assessments have changed in the light of recent criteria, resulting in 'upgrades' or 'downgrades' (see table 13.1). In addition, a few species not previously considered to qualify for a conservation status have been reassessed and added to the list (see Table 13.1). Out of a total of 93 species of aquatic and semi-aquatic Hemiptera assessed for this review, nine qualified for an IUCN threatened or near threatened status and an additional 27 for a GB status.

6.2 Sources of data

Much of the data used in this review has been accessed through NBN Gateway. A large proportion of recent water bug records (42,000) on Gateway have been collated and checked by the Aquatic Heteroptera Recording Scheme, but there are, in addition, many that have been passed on independently, either by individual recorders or organizations, including the Environment Agency and Natural England. For species that clearly fell into the IUCN category of Least Concern and occurred in 20 or more hectads during the period 1990 -2013 the Gateway records were generally considered sufficient, despite the risk of bias due to misidentification, a risk the author considers to be generally low. The vast majority of contributors to NBN Gateway are reliable recorders working either individually or for recognized conservation / environmental organizations. A more serious problem is that there are undoubtedly records for many species that have not been passed on. With this in mind, species recorded in close to 100 hectads were not assessed as Nationally Scarce (cf. *Mesovelia furcata*). For all rarer species occurring in under 20 hectads and for species that appeared to have declined in abundance (see below) considerable effort was made to obtain further information from individual specialists, local biological record centres and other organizations (see acknowledgements) before any assessments were made. Records of rare species were also queried if they fell outside the established geographical range and in most such cases were found to be the result of probable misidentification. None of the records for *Hydrometra gracilentata*, for instance, that fell outside the known east Norfolk / south Sussex areas could be verified.

6.3 Trends in data

The 71 species of aquatic and semi-aquatic bugs recorded in 20 or more hectads between 1990 & 2013 show an average increase in hectads occupied during this period, as compared with the previous 30 years (1966 – 1989), of 188% \pm 30% ($P < 0.05$). This figure is undoubtedly a result of more records being available for the recent period, due in large part to the growth of recording schemes and a greater interest in recording, rather than to a general increase in the abundance of species. Of the 42,000 records on the Aquatic Heteroptera Recording Scheme's database, 98% are post 1989. Although longer established organizations will hold a greater proportion of older records, this bias towards the recent period is likely to be present in many data sets. If it is assumed that an increase in the region of 188% between

time periods represents a steady state situation then figures well above and below this baseline may indicate a rise or fall in abundance. This is of special interest in relation to those species that fall well below the limits and may qualify for inclusion in an 'Amber List' - a list of species that although still qualifying as Least Concern according to IUCN criteria should be kept under review (see section 5 above for definition). Seven species fall very significantly short of the average increase (by 75% or more) between time periods and these are listed in Table 12.1.

The greatest increase in hectads occupied was shown by *Aquarius paladum* (614%) followed by *Macrosaldula scotica* (517%) and *Micronecta sholtzi* (479%). The apparent increase in *A. paladum* is supported by the observations of various recorders that have contributed information to this review.

A similar calculation for the 15 rare species (excluding seven species not recorded in the period 1966-1989) shows an increase in records of $282\% \pm 304\%$ ($P < 0.05$). Although the small number of records for many species and the wide confidence limits mean that little significance can be attached to this figure it is worth pointing out that *Micronecta minutissima* and *Saldula fucicola*, two species recorded in over 15 hectads between 1990 and 2013, showed an increase well beyond the confidence limits (over 1000% in both cases). Whether this was due to more targeted recording or to an increase in abundance is difficult to assess. The former reason is more likely in the case of *M. minutissima* (Brooke & Nau 2003). Both are Nationally Rare, but have an IUCN status of Least Concern.

7. The assessments

7.1 The data table

This review is based on a data table in which all species are assessed in accordance with IUCN and local GB criteria. Assessments are backed by an account of the supporting evidence (rationale) and, in the case of a threat status, by qualifying criteria. Additional information includes geographical range, number of records for different time periods and ecological accounts. The full list of the Excel data table columns is as follows (A summary table is given in Appendix 1):

Species name
Family
NBN taxon number (identification code)
Presence in England
Presence in Scotland
Presence in Wales
AOO (hectads) up to and including 1989
AOO (hectads) during the period 1966-1989
AOO (hectads) during the period 1990-2013
Dual hectads for the period up and including 1989 and 1990-2013
Dual hectads for the 1966-1989 and 1990-2013
AOO tetrads 1990-2013 for species under threat
Proposed GB IUCN status
Qualifying criteria
Rationale
Current global IUCN status
Suggested GB Rarity status
Status in Shire (1987)
Status in Kirby (1992)
Status in Huxley (2003)
Larval habitat key habitat / microhabitat
Adult habitat key habitat / microhabitat
Ecological account
Popular synonyms

7.2 Supporting information

Species nomenclature in this Review follows Aukema & Rieger (1995) (see section 6.2 below for details). The NBN taxon numbers were obtained from the NBN website.

The date periods follow the convention adopted in previous reviews, with the addition of an equivalent date period preceding the most recent (1966-1989) for the purpose of comparison. The 'point of measurement' between old and recent date classes is 1990, as this was judged to provide a suitable time period over which to assess abundance in the recent time period – the crucial period for determining the status of a species. Although these judgments are subjective, a shorter time period could result in a mistaken assessment of threat or rarity due to fewer records and a smaller Area of Occupancy (AOO) and a longer period may risk an error due to overestimation. Detailed and reliable evidence of population decline in the species covered in this review is not available and any difference between the recent and

preceding time periods may be due to a number of factors other than a change in abundance. Nevertheless, comparisons can provide indications of change that may be of value. Species status assessments have been based largely on areas of occupancy (AOO) during the period 1990 – 2013 and known or perceived threats to habitat, which can be used as a proxy for population declines in those species associated with specific habitats (Alexander 2014).

Dual hectads can provide additional information on changes in distribution. If past and current records of a species largely overlap this may suggest little change in AOO, while if current records are mainly from new hectads, without necessarily showing a greater change in AOO between time periods than that of a species with overlapping records, this may suggest a species has either been overlooked or spread into new areas. Alternatively, overlapping records may merely indicate that recorders return to habitats known to support certain species, while new records may indicate an increase in recording effort due, perhaps, to more interest in certain groups. Shore bugs (Saldidae) are probably attracting more interest now than they did in the past, despite being difficult insects to catch and, according to Butler (1923) ‘requiring great wariness, patience, promptitude and a steady hand if they are to be secured without damage to their delicate framework’. This may be one reason for the large increase in records for some species.

The proposed GB IUCN status (see 3.2) is supported by Qualifying Criteria given in alphanumeric form (see 3.3) and by the Rationale, which, in the case of species assessed as threatened or near threatened, provides a detailed account of the factors justifying the assessment. The remaining columns in the data sheet give the Global IUCN status (none for species in this review); Suggested GB rarity status i.e. Nationally Rare or Nationally Scarce (see section 4); Status in previous publications (also shown in Table 13.1); Adult habitat, given as codes (supplied by Natural England); an Ecological account that gives more detail on habitat and, finally, Popular synonyms obtained from a variety of sources.

8. Format of the species accounts

The species accounts have been prepared for those species that have been assessed, using IUCN criteria, as either under threat (CR, EN, or VU) or near threatened (NT). Information is given in a standard form under the seven headings, which are listed below with relevant background information.

8.1 The species name

Nomenclature for the species covered by this review is based on that of Aukema & Rieger (1995), accessed from a checklist of Heteroptera of the British Isles by Nau (2007). Identification keys by Nau (2012) and the British Bugs website (www.britishbugs.org.uk) can also be referred to for correct nomenclature.

8.2 Identification

Recent keys to water bugs (Nepomorpha and Gerromorpha) are by Savage (1989) and Nau (2012, unpublished), the latter also providing keys to the shore bugs (Saldidae) and litter bugs (Dipsocoridae and Ceratocombidae). With a little experience the larger species can be identified in the field, but generally dead specimens must be examined under a stereomicroscope. While external characters are sufficient to identify the vast majority of species a few require dissection of the male genitalia. The above keys are to adult insects. A key to the nymphs of British Corixidae (lesser water boatmen) has been produced by Savage (1999).

8.3 Distribution

All species described in the accounts are rare, occurring in 15 or fewer hectads for the period 1990 – 2013 and most have a restricted distribution. Records on NBN Gateway were supplemented by information obtained from individual specialists, local biological record centres and other organizations (see acknowledgements) to obtain the best possible picture of distribution.

8.4 Habitat and ecology

The species described in the accounts occupy a range of habitats, all of which have, to varying degrees, declined in quality and area over the past years. Data on population trends for the species under review are not available and so the best indication that a species may be under threat is a decline in quality or extent of the habitat occupied. Most, if not all, the species considered to be under threat in this review appear to have very specific habitat requirements, making them particularly vulnerable to changing conditions, although for most species the details of their biotic and abiotic interrelationships are poorly understood. Research is needed on life cycles, feeding habits, population ecology and distribution if assessments of threat and status are to become more accurate.

8.5 Status

The status of a species has been assessed, at least initially, on the number of hectads occupied during the period 1990 – 2013. Account has also been taken of past records, the likelihood of under-recording, the association of a species with particular habitats under threat, and evidence that a species has been searched for, but not found, in areas where it could occur. It has also been necessary to distinguish between sites and locations (see section 3.6) in the assessment of some species. Species accounts are only provided for those species assessed as Critically Endangered, Endangered, Vulnerable or Near Threatened. Species falling into the

GB-specific categories of Nationally Rare and Nationally Scarce are listed in sections 10 and 11 below.

8.6 Threats

Loss of suitable habitat, whether due to physical destruction (e.g. by clearance, drainage, forestry, development, sea level rise) or to damaging modification (e.g. by pollution or climate change) is the reason why most species become threatened with extinction. The species described in the accounts have specific habitat requirements, and the actual or predicted loss or damage to the habitats is an important consideration in their status assessments. All the relevant habitats (see below) have been reduced in area, damaged in the past and face future threats.

Fens and marshes

Wetlands have declined dramatically over the last couple of centuries due to drainage and conversion to agriculture. In the region of 1,000 sq km of wetlands were drained annually between 1840 and 1880 (State of Nature Report) and losses have continued to the present day; an estimated 90% of East Anglian fenland has been lost since the 1930's (www.nhm.ac.uk). Fens are usually fed by mineral rich surface or ground water and are characterised by their water chemistry, which has a neutral to alkaline pH. The Norfolk and Suffolk Broads contain 3000 hectares of calcareous rich fen, the largest remaining area in Britain, although this is only a fraction of the original area. Historically the Fenlands of Cambridgeshire and Lincolnshire were even more extensive but centuries of drainage have reduced the area to just 500 ha, concentrated mainly in two nature reserves, Wicken Fen and Woodwalton Fen (Lott et al.). Semi-natural fenland in Lincolnshire has decreased from an original 100,000 ha to present area of 55 ha (lincsfenlands.org.uk). Attempts are being made to restore fenland, most notably by the National Trust at Wicken Fen, where the addition of 5,300 ha is the long-term aim. East Anglian fens contain distinctive communities and are nationally important for a large number of rare species; 43% of threatened wetland invertebrates are recorded from here, including a number unique to the area. These habitats are under threat in many areas from a variety factors, most notably: changes in the hydrological conditions due to water abstraction, leading to lowering of water tables and changes in water chemistry; nutrient enrichment leading to eutrophication and changes in plant communities; ecological succession due to lack of management, resulting in the loss of open fen; sea level rise leading to more frequent flooding by salt water of many low lying sites.

Bogs

Blanket and raised bog covers 1.5 million hectares in the UK, including 6000 ha of lowland raised bog (ukreate.defra.gov.uk). Bogs support specialised communities adapted to wet, often anoxic, acidic conditions and limited nutrients. Large areas of bog have been drained for agriculture and forestry; it is estimated that the area of raised lowland bog has diminished by about 94 % (www.buglife.org.uk). Apart from continuing threats from agriculture and forestry, bogs are threatened by increased atmospheric nitrogen, climate change, grazing and trampling. Research has shown that a combination of atmospheric nitrogen deposition and climate change could lead to a loss of *Sphagnum* moss, a keystone species of acid bogs, as well as other species of plants and lichens. Many upland invertebrate species appear to be in decline – out of a total of 356 species for which data are available 66% have shown a recent decrease in population size (State of Nature report, 2013).

Saltmarshes

Saltmarshes are found all round the coastline of Britain but vary considerably in character and extent. Lowland marshes are associated with major estuaries and inlets in low-lying areas, most notably around the south-east coast of England, in the Severn estuary, the Welsh estuaries, Liverpool Bay and the Solway Firth. Marshes bordering upland areas in Scotland are mainly small isolated areas associated with minor estuaries or sea lochs. Over 70% of UK saltmarshes (32,500 ha) occur round the coast of England (Boorman 2003), concentrated mainly in the south-east and north-west. Although considerable areas of saltmarsh have been reclaimed for agriculture in the past, the main current threats are from pollution (eutrophication) and climate change. Over the last 20 years 4.5% of marshes in Britain have been lost to sea-level rise and this rate is likely to increase in the future. The species richness of insects found on the lower salt marsh levels (areas subject to regular submersion by tides) is not high, but many of the species that occupy this habitat, which included a number of shore bugs (Saldidae), are specialists which occur nowhere else.

9. Acknowledgements

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Many other individuals and organisations have contributed records to both the Aquatic Heteroptera Recording Scheme and to NBN Gateway and they are gratefully acknowledged.

10. Species listed by IUCN status (Criteria in parenthesis)

Critically Endangered

Saldidae *Saldula setulosa* (Puton) B2ab,ii,iii

Vulnerable

Hydrometridae *Hydrometra gracilentata* Horváth, D2

Saldidae *Saldula melanoscela* (Fieber) D2

Near Threatened

Dipsocoridae *Cryptostemma waltlii* (Fieber)

Saldidae *Chiloxanthus pilosus* (Fallén)

Micraanthia marginalis (Fallén)

Teloleuca pellucens (Fabricius)

Velidae *Microvelia buenoi* Drake

Data Deficient

Corixidae *Micronecta griseola* Horváth

Saldidae *Aepophilus bonnairei* Signoret

11. Species listed by GB rarity status

Nationally Rare

Dipsocoridae	<i>Cryptostemma waltli</i> (Fieber)
Hydrometridae	<i>Hydrometra gracilenta</i> (Horvath)
Saldidae	<i>Aepophilus bonnairei</i> Signoret
	<i>Chiloxanthus pilosus</i> (Fallén)
	<i>Chartoscirta elegantula</i> (Fallén)
	<i>Micracanthia marginalis</i> (Fallén)
	<i>Saldula melanoscela</i> (Fieber)
	<i>Teloleuca pellucens</i> (Fabricius)
Velidae	<i>Microvelia buenoi</i> Drake

Nationally Scarce

Ceratocombidae	<i>Ceratocombus coleoptratus</i> (Zetterstedt)
Corixidae	<i>Arctocorisa carinata</i> (C.R. Sahlberg)
	<i>Corixa affinis</i> (Leach)
	<i>Corixa iberica</i> (Janson)
	<i>Glaenocorisa propinqua propinqua</i> (Fieber)
	<i>Micronecta minutissima</i> (Linnaeus)
	<i>Sigara selecta</i> (Fieber)
	<i>Sigara striata</i> (Linnaeus)
Dipsocoridae	<i>Cryptostemma alienum</i> Herrich-Schäffer
Gerridae	<i>Aquarius najas</i> (De Geer)
	<i>Aquarius paludum</i> (Fabricius)
Hebridae	<i>Hebrus pusillus</i> (Fallén)
Salididae	<i>Chartoscirta cocksii</i> (Curtis)
	<i>Halosalda lateralis</i> (Fallén)
	<i>Salda littoralis</i> (Linnaeus)
	<i>Salda morio</i> (Zetterstedt)
	<i>Salda muelleri</i> (Gmelin)

Saldula arenicola (Scholtz)

Saldula c-album (Fieber)

Saldula fucicola (J. Sahlberg)

Saldula opacula (Zetterstedt)

Saldula orthochila (Fieber)

Saldula pallipes (Fabricius)

Saldula palustris (Douglas)

Saldula pilosella (Thomson)

Velidae

Microvelia pygmaea (Dufour)

12. Potential Amber list species

Table 12.1. Species that show a significant relative fall in records (see Section 5) between recent (1990-2013) and past (1966-1989) time periods. WPIS – Welsh Peatland Invertebrate Survey

Species	Habitat / Distribution	Sampling bias that may explain fall in records
<i>Glaenocorisa propinqua</i>	Deep upland pools in northern England and Scotland	None apparent
<i>Arctocorisa carinata</i>	Acid pools in upland moorland of northern England and Scotland	None apparent
<i>Corixa affinis</i>	Brackish ditches and pools, mostly near the coasts of central and southern England and Wales	None apparent
<i>Sigara selecta</i>	Saltmarsh pools, mainly southeast and southern England	None apparent
<i>Sigara stagnalis</i>	Saltmarsh pools, mainly southeast England	None apparent
<i>Chartoscirta cocksii</i>	In <i>Sphagnum</i> and grass tussocks in bogs, throughout GB but records concentrated in Wales	WPIS increased number of records for the 1980s, but has not been repeated.
<i>Salda littoralis</i>	Margins of lakes and rivers and in brackish habitats. Mainly coastal in England and Scotland	None apparent
<i>Salda morio</i>	Upland peat bogs at the margins of pools. Wales, northern England and Scotland	WPIS increased number of records for the 1980s, but has not been repeated.

13. Conservation status of scarce and rare species in past publications and this review

Table 13.1. A comparison of the conservation status given to species of aquatic and semi-aquatic bugs in Shirt (1987), Kirby (1992), Huxley (2003) and this review

Species (scientific name)	Conservation Status in Shirt (1987)	Conservation Status in Kirby (1992)	Conservation Status in Huxley (2003)	IUCN Status in this review	GB Rarity Status in this review
<i>Cryptostemma waltli</i>		Notable		NT	NR
<i>Hebrus pusillus</i>		Notable	Nationally Scarce	LC	NS
<i>Hydrometra gracilentata</i>	Endangered	Rare	Rare	VU	NR
<i>Microvelia buenoi</i>	Rare	Rare	Rare	NT	NR
<i>Microvelia pygmaea</i>	Rare	Notable	Nationally Scarce	LC	NS
<i>Aquarius najas</i>				LC	NS
<i>Aquarius paladum</i>		Notable	Nationally Scarce	LC	NS
<i>Glaenocoris propinqua</i>				LC	NS
<i>Arctocoris carinata</i>				LC	NS
<i>Corixa affinis</i>				LC	NS
<i>Corixa iberica</i>		Notable	Nationally Scarce	LC	NS
<i>Micronecta griseola</i>				DD	NR
<i>Micronecta minutissima</i>	Rare	Rare	Rare	LC	NR
<i>Sigara selecta</i>				LC	NS
<i>Sigara striata</i>	Rare	Notable	Nationally Scarce	LC	NS
<i>Aepophilus bonnairei</i>		Notable		DD	NS
<i>Chartoscirta cocksii</i>				LC	NS
<i>Chartoscirta elegantula</i>				LC	NS
<i>Chiloxanthus pilosus</i>				NT	NR
<i>Halosalda lateralis</i>				LC	NS
<i>Macrosaldula scotica</i>				LC	NS
<i>Micracanthia marginalis</i>	Rare	Notable		VU	NR
<i>Salda littoralis</i>				LC	NS
<i>Salda morio</i>				LC	NS
<i>Salda muelleri</i>				LC	NS
<i>Saldula arenicola</i>		Notable		LC	NR
<i>Saldula c-album</i>				LC	NS
<i>Saldula fucicola</i>	Rare	Notable		LC	NS
<i>Saldula melanoscela</i>				VU	NR
<i>Saldula opacula</i>	Rare	Notable		LC	NS
<i>Saldula orthochila</i>				LC	NS
<i>Saldula pallipes</i>				LC	NS
<i>Saldula palustris</i>				LC	NS
<i>Saldula pilosella</i>				LC	NS
<i>Saldula setulosa</i>	Vulnerable	Vulnerable		CR	NR
<i>Teloleuca pellucens</i>				NT	NR

14. Species Accounts

The following accounts have been prepared for species assessed as Critically Endangered, Endangered, Vulnerable or Near Threatened, against IUCN criteria. The data sheets for species covered by Kirby's 1992 review are based on his detailed descriptions, with appropriate additions and updates.

MICROVELIA BUENOI

NEAR THREATENED

A small skater

Order HEMIPTERA

Family VELIDAE

Microvelia buenoi Drake, 1920

Identification

Nau (2012), Savage 1989, Southwood & Leston (1959), Poisson (1957), Macan, T.T. (1965).

M. buenoi is one of three species of *Microvelia* found in Britain. All three are usually apterous (wingless) in the adult stage and *M. buenoi* can be distinguished by a sinuous hind margin to the pronotum and a continuous yellowish-brown band along the front of the pronotum. The winged form has a distinctive pattern of white patches. It was first recognised as a British species by Walton (1939).

Distribution

Since 1990, *M. buenoi* has been recorded from Wicken Fen, Cambridgeshire and Norfolk. In Norfolk it has been found mainly in The Broads to the east (Hickling, Catfield Great Fen, Barton Fen, Sutton Fen and Reedham Marsh among others), with a few records from the west of the county (Foulden Common) and one from the north coast (Titchwell). The recent distribution is very similar to that prior to 1990, with the exception of the Titchwell record. *M. buenoi* an holartic species distributed from Great Britain to Central Asia, also in Canada and USA. It is a local species in mainland Europe where it has been recorded from Denmark, Germany, Sweden, Poland and the Czech Republic. It has been classified as Endangered in the Red List of Czech Heteroptera (Kment & Vilimova 2006).

Habitat and ecology

M. buenoi is a minute, semi aquatic, bug living on the water surface. Adults have been recorded between May and September and are usually apterous, macropterous specimens occurring only rarely. The species has two generations per year and overwinters as an adult. It is confined to still, usually shallow, water where there is dense shading vegetation and, often, peaty substrates. Many records are from ditches where it is found close to the edge under overhanging marginal plants. *M. buenoi* can be found with *M. reticulata*, *M. pygmaea* and with the rare water measurer *Hydrometra gracilentia*. In the Netherlands *M. buenoi* has been described as occurring along the margins and shores of canals, ditches, fens and pools where it is especially abundant between macrophytes and beneath the overhanging branches of shrubs and trees (Aukema *et. al.* 2002 quoted in Kmenti *et. al.* 2012). It prefers a better water quality than the common *M. reticulata* and, according to Savage (1989), is found in habitats with a high content of organic matter in the substrate, a pH > 6, a conductivity of 100-1000 µS/cm and at altitudes below 300 m. It is a predator, feeding on small crustacea and other

aquatic invertebrates as well as on collembolans trapped in the surface film (Wroblewski, 1980).

Threats

Although most of the sites where *M. buenoi* occurs are protected (SSSIs etc) they are still subject to threats from agriculture and development. The lowering of water tables in fenland habitats as a result of drainage and water abstraction is a threat to a number of sites in the Norfolk Broads where *M. buenoi* occurs, as is a decline in water quality due to pollution and consequent enrichment. Rising sea levels may also be a future threat to the Norfolk Broads, North Norfolk and associated fenland. Lack of management, or the wrong type of management, of ditches and water margins could also be detrimental; if left to undergo succession these narrow linear habitats become choked with vegetation, reducing the area of open water, and if managed too severely the overhanging marginal and bank-side vegetation, an essential component of the habitat of *M. buenoi*, may be lost.

Status

Although recorded in only 9 hectads since 1990, with an AOO of <1000 km², *M. buenoi* has been assessed as Near Threatened because, despite a restricted distribution in sensitive habitats, there is no evidence of decline. Some of its Fenland / Broads habitats have been damaged and are still threatened but on the positive side future abstraction from Catfield Fen and Sutton Fens is being contested (by RSPB and others) and at Wicken Fen the National Trust has launched a long-term programme to enlarge the present site to improve the habitat and provide a buffer against encroaching agriculture and development. The site on the North Norfolk Coast at the RSPB reserve at Titchwell is probably secure for the time being but is at risk from future sea level rise, as are other sites close to the coast, including the Broads, where the species may occur. IUCN criteria are satisfied for the status of NT as the species comes close to qualifying for a threat status on the basis of AOO and potentially threatened habitats.

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HYDROMETRA GRACILENTA

VULNERABLE, D2

The lesser water measurer

Order HEMIPTERA

Family HYDROMETRIDAE

Hydrometra gracilenta Horváth, 1899

Identification

Nau (2012), Savage 1989, Southwood & Leston (1959), Poisson (1957), Macan, T.T. (1965).

Hydrometra gracilenta is one of two species of *Hydrometra* found in Britain, the other, *H. stagnorum*, being common and widespread. It is the smaller of the two and has been confused with *H. stagnorum* nymphs, leading to a number of false records. Among other key features,

the eyes of *H. gracilentata* are situated nearly half-way along the elongated narrow head, while those of *H. stagnorum* are about a third of the way along the head (closer to the pronotum). Nearly all specimens have very rudimentary wings (micropterous). It was first recorded as a British species by Walton (1938).

Distribution

Since 1990 the species has been recorded from the Norfolk Broads and Pevensey Levels, East Sussex. Recent records outside this distribution were confirmed as misidentifications. There are no recent records for the New Forest, where it has been found in the past. Nearly all the Norfolk records are from Catfield Fen and adjoining fens and marshes (Sutton Fen, Turf Fen, Reedham Marsh). It is widely distributed in Europe, occurring in Norway (where it is fairly common in the SE) Finland, Denmark, France and Italy (but not the Mediterranean area). In Asia it extends to the far-east, including China.

Habitat and ecology

In Norfolk this species has been found in shallow water, over deep mud, shaded by overhanging cyperus sedge *Carex pseudocyperus* and soft rush *Juncus effuses* growing on peaty banks. In Sussex it has been found in well-vegetated ditches in the Pevensey grazing levels where the marginal vegetation included sedges and rushes. The nature of the New Forest site(s), where it was recorded in the 1950s, is not known in detail. In Europe it has been described as inhabiting the margins of well-vegetated smaller lakes and ponds, including *Sphagnum* bogs (Coulianos *et. al.* 2008). *H. gracilentata* is univoltine and overwinters as an adult. Like *H. stagnorum*, it probably migrates to land in the autumn and overwinters in moist earth or in other protected places. Adults have been collected between April and October. Like all species of Hydrometridae, it is probably entirely carnivorous and although there appears to be no specific information on feeding habits it is likely to take small crustacea, insect larvae below the water surface, and adult insects, such as chironomid midges and mayflies, trapped in the surface film.

Status

Hydrometra gracilentata is a species with a very restricted distribution and a localized occurrence within known sites where it is often absent from apparently suitable habitats. It was assessed as vulnerable by Shirt (1987), Kirby (1992) and Huxley (2003). The only known recent sites are the Broads and Pevensey levels and it may have been lost from the only other confirmed site in the New Forest, where it was recorded in 1952. This species satisfies IUCN criteria for the status of Vulnerable under D2 as it is present in less than five locations and occurs in habitats that face plausible future threats.

Threats

Nearly all the Norfolk records are from Catfield and adjoining fens and marshes (Sutton Fen, Turf Fen, Reedham Marsh) which all constitute one location as, since 1986, all have been adversely affected by water abstraction that has resulted in damaging changes to water chemistry and water levels. There are two additional sites outside this area, Burgh Common and Bure Marshes, which constitute two more locations for *H. gracilentata* in east Norfolk. Pollution and eutrophication, due to the intensive use of surrounding land are additional threats to all the locations. Records from the Pevensey levels all come from one location, a fairly small area north east of Westham, which is subject to threats of drainage, alien aquatic plants and sea level rise. Unsympathetic management of fen and marsh drainage ditches and channels by the clearance of large stretches in a single operation, or the creation of steep

profiles unsuitable for the establishment of marginal vegetation is likely to be damaging to the species' survival.

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CRYPTOSTEMMA WALTLI

NEAR THREATENED

A Litter bug

Order HEMIPTERA

Family Dipsocoridae

Cryptostemma waltli (Fieber, 1860)

Identification

Nau (2012), Heiss & Pericart (2007), Southwood & Leston (1959).

There are two species in the Dipsocoridae in the UK, *Cryptostemma alienum* and *C. waltli*. They are minute bugs (1.8 – 2.4 mm and 1.1 – 1.6 mm respectively) that can be distinguished not only by size but also by the shape of the pronotum, which is almost parallel sided in *C. waltli* but with tapering sides (widest at base) in *C. alienum*.

Distribution

Since 1990 *Cryptostemma waltli* has been recorded from Anglesey, Gloucestershire, Cambridgeshire and Roxburghshire and prior to 1990 from Berkshire, Surrey, Dorset, Devon, Norfolk, Pembrokeshire and Cardiganshire. The first British record was from Devon where a specimen was shaken from moss in a swampy wood near Dawlish in 1907 and identified by Champion (1908). It has been recorded from SW Ireland and is widely distributed in Europe.

Habitat and Ecology

C. waltli is found in permanently wet places, usually in *Sphagnum* but also in other mosses. It occurs in lowland bogs and wet heaths, usually close to water level, or even below it, and nearly always where there is some water movement. Most of the older records described by Butler (1923) are from wet moss by small streams and the recent records from Roxburghshire and Cambridgeshire were from moss and sedge litter respectively, both near flowing water. Howe (2004) describes the bug as occurring in wet mosses by running water in Welsh sites. *C. waltli* often occurs in *Sphagnum* with *Hebrus* spp. The bug is very sensitive to desiccation and rapidly dies in a dry environment. All stages occur in moss and tend to form small colonies, even if there are extensive areas of apparently suitable habitat. Adults have been collected between February and June and between July and November, which indicates a single generation per year, with adults probably overwintering in moss. All Dipsocoridae are generalized predators of small arthropods and have been observed to feed on dead insects, but there are no specific details on the feeding habits of *C. waltli*.

Status

C. waltli has been recorded from 5 sites, 2 in Anglesey, 1 in Gloucestershire, 1 in Cambridgeshire and 1 in Roxburghshire since 1990. It was recorded from only 2 sites in

Wales in the late 1980s during the Welsh Peatland Invertebrate Survey (Howe 2004). *C. waltli* may be under-recorded in the west and the uplands of Britain, although all records to date are from lowland sites. It is often associated with *Hebrus* spp, which have been recorded in 143 hectads throughout much of GB including a number of sites in the Welsh, English and Scottish uplands. The sites where it does occur are well established and stable, supporting other rare species but it is a very local bug with a patchy distribution. On the basis of known AOO (=500 km²), restricted number of locations and the vulnerability of the habitat IUCN criteria are satisfied for a status of VU, but in view of probable under-recording the species has been assessed, on a precautionary basis, as NT.

Threats

A small cryptic species that is usually flightless and very dependent on wet conditions, so vulnerable to local extinction as a result of drought, drainage and loss of *Sphagnum*. Both upland and lowland *Sphagnum* bogs are under threat from air pollution, forestry, agriculture and climate change; a high percentage of monitored invertebrate species in upland habitats have declined (State of Nature Report). The lowland sites where the species occurs are small isolated areas and therefore particularly vulnerable to changes in the conditions and management of surrounding land. The sites are also widely spaced, which would make recolonisation following local extinction unlikely.

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CHILOXANTHUS PILOSUS

NEAR THREATENED

A shore bug

Order HEMIPTERA

Family SALDIDAE

Chiloxanthus pilosus (Fallen, 1807)

Identification

Nau (2012), Pericart (1990), Southwood & Leston (1959).

Only *Chiloxanthus pilosus* and *Halosalda lateralis*, among the shore bugs found in the UK, have yellow margins to the pronotum. Both are salt marsh species and can be separated on the basis of size (*C. pilosus* is larger), the length of pubescence and the number of cells in the membrane (the apex of the wing).

Distribution

Chiloxanthus pilosus is a coastal species with a disjunct distribution in England. There are post 1989 records on the east coast for Lincolnshire, Norfolk, Suffolk and Kent and on the west coast for Cumbria and Lancashire. According to Southwood & Leston (1959) there are older records for Durham, the Bristol area and the south coast of Devon. The species occurs in the Netherlands, around the Baltic coast and extends into northern Asia, but has apparently disappeared from France and Belgium. The UK is on the western limit of its range.

Habitat and ecology

A species confined to saltmarshes where it occurs on muddy silt or muddy sand with a sparse covering of plants, which in at least one site included *Salicornia*, generally on the middle to lower marsh. It has been recorded on patches of bare mud in the *Juncus* zone of a marsh in Dublin Bay (Speight 1980). Little is known of the ecology of *C. pilosus*, but it is likely to show similar adaptations to its habitat as *S. palustris*, described by Brown (1945) (although then considered a dark form of *S. pallipes*), which is able to tolerate submergence by sea-water in both nymphal and adult stages, the nymphs being more tolerant of submergence than the adults and found in greater numbers at lower levels. The pilose cuticle of the adult probably aids the retention of air on the body surface when the insect is submerged. Adults are found from May until September and those found after mid-July are probably the new generation. There is no information on the overwintering stage but as adults are found in May it is possible they have overwintered. Saldids often hibernate some distance from their summer breeding sites (Stock & Lattin 1976), so in the case of *C. pilosus* this may be in vegetation or litter well beyond the littoral zone.

Status

A very local species recorded recently only from limited areas on the east and west coasts of England. Although this apparently disjunct distribution could be due to under-recording, other saldid species found in coastal habitats, including saltmarshes, have been recorded from many areas outside these two regions since 1989. *Saldula pilosella*, for instance, has been recorded along the south coast from Kent to Devon. It is unlikely that recorders searching for coastal shore bugs would miss *C. pilosus* as it is a relatively conspicuous species. There is some evidence for a contraction in range in the UK, based on older records for South West England and for Dublin Bay. A restricted Area of Occupancy (<2,000km²) and a plausible future threat to saltmarsh habitats satisfy IUCN guidelines for a status of Near Threatened for this species.

Threats

Historically large areas of saltmarsh in the UK have been reclaimed for agriculture; for instance, along the North Norfolk Coast in the region of 50% of the original marsh has been isolated by embankments and converted to either grazing or arable land. Such large-scale schemes are now rare, but smaller areas are still lost to industry, port facilities and other developments. The main current threats to saltmarshes are rising sea levels and erosion, both consequences of climate change. One-third of the area of saltmarsh in England is concentrated along the east coast between North Lincolnshire and the Thames estuary and it has been estimated that up to a third of this will be lost by 2050. As sea levels rise coastal habitats are increasingly 'squeezed', either against naturally rising ground behind the shoreline or by man-made barriers. The increasing frequency of severe storms, apparent over the last decade, has also had a destructive impact on coastal habitats.

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MICRACANTHIA MARGINALIS
VULNERABLE B2a b (ii, iii, iv); D2

A shore bug
Order HEMIPTERA
Family SALDIDAE

Micracanthia marginalis (Fallen 1807)

Identification

Nau (2012), Pericart (1990), Southwood & Leston (1959).

A small oval shore bug (2.7 – 3.0 mm) with straight sides to the pronotum and with pale markings only on the outer edge of otherwise dark wings (elytra), which are covered with patches of flat, silvery pubescence.

Distribution

Micracanthia marginalis has been recorded from England and Wales. There are confirmed records since 1990 for only Cumbria and Surrey but it has been previously recorded in Norfolk (single locality in 19th cent), Dorset, Hampshire, Shropshire, Yorkshire, Denbighshire and Cardiganshire. The bug was first recorded on Lewell Heath, Dorset, in 1830. It occurs in central, northern and eastern Europe, but is absent from France, Italy and the Iberian Peninsular. The species also occurs in North America.

Habitat and ecology

Micracanthia marginalis is usually found on bare or sparsely vegetated ground in damp hollows and at the margins of small areas of standing water on heathland. Colonies are generally quite small, a few square feet of suitable habitat being sufficient to support the insect. It is an efficient colonizer over short distances and established populations can be found within a few years of the creation of suitable habitats by fire or clearance. In Cumbria (Solway) *M. marginalis* was found at the eroding edge of a lowland raised bog on a restricted area of bare peat, with a thin skim of patchy algal growth, in sheltered hollows. The life cycle is not fully known; nymphs have been found in the first half of June and adults from June to September, with one April record. Woodroffe (1959) considered it likely that there was a single generation per year which overwintered in the egg stage, but the April record suggests that some adults may also overwinter, a strategy supported by an observation in America that in one batch of eggs some developed immediately into adults while the remainder entered diapause. *M. marginalis* is probably a predator, feeding on small invertebrates, but there appears to be no specific information on feeding habits.

Status

This is a species that has long been considered scarce and, to quote both Southwood & Leston (1959) and Pericart (1990), 'surviving precariously'. In Shirt (1987) it was assessed as rare and in Kirby (1992) Notable. It has been recorded from only 3 sites since 1990, an apparent decline compared with the previous period. This decline is in part due to additional records obtained by the Welsh Peatland Invertebrate Survey during the 1980s when it was found in 3 sites, which have not been resurveyed since. Even if the species is still present in those sites the known AOO is still very small. The most northerly known site before the post 1990 Cumbrian record was Thorne Moors in South Yorkshire where it was recorded in 1980, but despite an extensive survey of the area in the 1990s it hasn't been found again. The restricted

number of locations (3) and the plausible future threat to the specialized habitat of *M. marginalis* satisfy IUCN criteria for the status of Vulnerable (under D2), but in view of under-recording (it may still be present in a few Welsh sites) it has been assessed as Near Threatened.

Threats

An estimated 80% of the UK's lowland heathland has been lost over the last 200 years. Lewell Heath, the site of the first record of *M. marginalis* has been lost to agriculture and there has been extensive loss of other suitable habitats more recently. The area where the bug was recorded at Thorne Moors in 1980, (from one small damp hollow), has since been destroyed by peat cutting. Because of the transitory nature of its habitat the bug must move both within and between sites as suitable areas of bare ground become available. Its survival will, therefore, depend on the size of heathland sites, their proximity to other similar sites and appropriate management. Fragmentation of heathland and lack of management are both likely to be threatening. Chobham Common, the site of one of the post 1990 records, is one of the largest areas of remaining lowland heath in the country, despite past losses to agriculture, development and roads. The extensive spread of birch and pine has been a long-term problem but recent management by grazing and cutting has restored much of the habitat and maintained areas of bare ground. The main current threat to the site is from proposed housing development nearby.

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SALDULA MELANOSCELA

VULNERABLE, D2

A shore bug

Order HEMIPTERA

Family SALDIDAE

Saldula melanoscela (Fieber 1859)

Identification

Nau (2012), Pericart (1990).

Easily confused with the more common *Saldula c-album*, but is smaller and less ovate. The wing pattern is different, *S. c-album* usually having a c-shaped mark on the outer section of the wing, which is absent in *S. melanoscela*. Conclusive identification may require examination of male genital structures.

Distribution

Saldula melanoscela is only known from the mouth of the River Wampool, Cumbria, where it was first recorded in 2000 (Hewitt 2001). It is widespread in Europe, from southern Italy north to Denmark and is also found across temperate Asia (Pericart, 1990).

Habitat and Ecology

Saldula melanoscela is found on fine, sandy mud flats backed by rough coastal grassland

bordering the tidal reaches of the River Wampool (near Whitrigg Bridge). In Europe the species has a preference for sandy substrates bordering rivers, lakes and temporary water bodies. Adults, which overwinter, have been recorded between April and July. There is no information on feeding habits.

Status

Although first recorded in 2000, *S. melanoscela* has been found in museum and private collections, among the very similar *Saldula c-album*, dating back to 1928. These previously unidentified specimens all came from the R. Wampool indicating the species has been present at the site for over 80 years (Hewitt 2001). The species may occur elsewhere but searches of similar sites along the Cumbrian coast have proved negative, as have further searches of museum collections (Hewitt, *pers. comm.*). There is no evidence of a decline in population (the species was still present at the site in 2009) or of immediate threats to the habitat, but there is clearly a future risk of extinction. IUCN criteria are satisfied for a status of Vulnerable under D2 as the species is present in less than five locations and faces plausible future threats.

Threats

There are no immediate threats to the R. Wampool site, although a proposed tidal barrage across the Solway Firth may be a future threat.

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SALDULA SETULOSA

CRITICALLY ENDANGERED (POSSIBLY EXTINCT) B2ab,ii,iii

Hairy shore bug

Order HEMIPTERA

Family SALDIADAE

Saldula setulosa (Puton 1880)

Identification

Nau (2012), Pericart (1990), Southwood & Leston (1959).

A short (3.4 -3.8 mm) broadly oval bug characterised by long dense pubescence over much of the body. Similar to the more common *S. pilosella* (also a saltmarsh species) but smaller and with more sharply defined wing markings.

Distribution

Saldula setulosa is known in the UK only from Poole Harbour, although there are no post 1989 records. The species was first recorded by Butler, in August 1904, from ‘the south side of Poole Harbour’. Records from Studland Heath and Arne, taken by J. Harwood, are described by Brown (1948) but no exact dates are given. The most recent record is from Arne, taken by M.G. Morris in 1964 (P. Kirby *pers.comm.*). It is a southern European species occurring along the Mediterranean coasts of Spain, France, Italy and Morocco. There are only scattered records for the French coast and Poole Harbour appears to be the most northerly site. The bug has also been recorded from the edge of inland lakes in southern Europe.

Habitat and ecology

Saldula setulosa is found at the upper edge of the tidal zone, often bordering heathland, along a thin strip of shoreline among tidal litter and cord-grass (*Spartina anglica*) on sandy silt. The habitat is submerged by high spring tides. Adults have been found between August and September and nymphs between June and early August. The stage that overwinters is unknown. Like other species of Saldidae, *S. setulosa* is probably predacious but there is no information on feeding habits.

Status

This is a very rare species in Britain, occurring only in Poole Harbour. It was assessed as vulnerable by Kirby (1992) and Shirt (1987) and is described by Pericart (1990) as being rare throughout its known range. In France it is known from three coastal sites. Searches for the species in 1995 and in September 2008, in a number of areas where it had been found in the past, were unsuccessful (Hewitt *pers.comm.* & B. Nau, *pers. comm.*). The species qualifies as Critically Endangered under B2ab,ii,iii, as its current AOO is below 10km², it occurs in one location subject to a number of potential threats, its habitat is in decline and, in the light of recent unsuccessful searches in known locations, is undergoing decline or possibly extinct.

Threats

Over 50 years ago Southwood & Leston (1959) described the Poole – Studland area as ‘despoiled’. Current threats to saltmarsh habitats in Poole Harbour, which have declined in area over the last few years, include oil pollution, eutrophication, erosion due to wash from passing vessels and rising sea levels. Recent studies have shown that overgrazing and trampling by Sika deer can have a detrimental impact on saltmarshes (www.pooleharbouraqmp.co.uk), and this may be damaging to the upper marsh areas occupied by *S. setulosa*. The area as a whole is subject to a number of conservation designations (SSSI, Ramsar site and Special Protection Area), which should ensure some protection to wildlife habitats. Both Studland Heath and Arne Heath are NNRs.

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TELOLEUCA PELLUCENS

NEAR THREATENED

A Shore bug

Order HEMIPETRA

Family SALDIDAE

Teloleuca pellucens (Fabricius 1779)

Identification

Nau (2012), Pericart (1990), Southwood & Leston (1959).

One of the larger shore bugs (4.9 mm) characterised by the combined features of a pronotum with straight, strongly convergent sides, second antennal segment without long hairs and a black margin to the wing case interrupted by a yellow patch towards the apex.

Distribution

Since 1990 *T. pellucens* has been recorded from South Yorkshire (Thorne Moors), Cumbria (Cold Fell & Rundale Fell) and Scotland (Ben Loyal, Rum and Torridon). There is a past record for Snowdonia; but according to Howe (2004) it has not been recorded in Wales since 1946. The species occurs in northern and eastern Europe, Siberia and North America.

Habitat and ecology

Teloleuca pellucens has been found among boulders bordering an upland river in the Cairngorms and in upland and lowland moorland, often with *Sphagnum* moss. In Cumbria, the bug occurred on blanket bog where peat and *Sphagnum* had been churned up by stock and in the Highlands it has been found in an area of disturbed peat. It is essentially a species of upland habitats; the only known lowland site in the UK is Thorne Moors in South Yorkshire, the largest area of raised bog in England, where it was last recorded in 2001. *T. pellucens* may occur well away from water and is sometimes associated with *Saldula orthochila* – a species of shore bug characteristic of drier habitats. Woodroffe (1968) describes finding both species in the Cairngorms among dry fragmented, ‘cindery’ rock with sparse *Erica* and *Calluna*. There is no information on the life cycle in the UK; in Russia *Teloleuca* spp hibernate in the egg stage (Vinokurov 2009). Like other saldids *T. pellucens* is probably predatory, feeding on a range of small invertebrates, but there is no specific information available.

Status

The status of *T. pellucens* is hard to assess, given the extensive area of potentially suitable upland habitat in northern England and Scotland where it may occur. The bug has been recorded in only 7 hectads in GB since 1990, although there are a number of earlier records for sites, especially in the Yorkshire Pennines, where the species may still be present. If it is presently more common than records suggest it is, nevertheless, a very elusive insect; a number of experienced recorders have commented that they have either never seen it or have only come across it on rare occasions. For example, despite quite extensive searching for saldids in the Scottish Highlands during the 1990s *T. pellucens* was only recorded once (S. Moran *pers. comm.*). It wasn’t found during the Welsh Peatland Invertebrate Survey in the 1980s and has not been recorded in Wales for over 70 years. In view of potential under-recording, a status of Data Deficient may be appropriate from an evidentiary, rather than precautionary, point of view. However, this is a rare species, with few recent records, that may well have more specific, but at present unknown, habitat requirements. An assessment of Near Threatened, on the basis of a restricted AOO and plausible future threats, is considered justified.

Threats

UK upland habitats and their associated species face a number of threats and pressures. Over the last century semi-natural upland habitats have been substantially reduced in area and degraded by various factors, many of which continue to have an important influence. Climate change, air pollution, the construction of wind farms and hydro-electric schemes with their associated infrastructure, housing development, erosion, peat extraction and agricultural improvement, including drainage and intensive grazing, all pose future threats to upland habitats. A recent report stated that out of 356 upland invertebrate species for which data were

available 66% had declined, many seriously (State of Nature, 2013). Thorne Moors, the most southerly site for *T. pellucens* has been damaged in the past by drainage and peat extraction, which has led to the drying out of raised bogs and encroachment of scrub. The site is now an NNR and at present there is no threat to the sites where *T. pellucens* has been recently recorded (B. Eversham *pers.comm.*). There is no specific information on threats to other sites where the species has been found.

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Appendix 1. A Summary Table of the Water Bugs' Conservation Status

Table A.

Species Name	Proposed GB IUCN Status	Qualifying Criteria	Rationale/Notes	GB Rarity Status	Presence in England (>1990)	Presence in Wales (>1990)	Presence in Scotland (>1990)	AoO(hectads) up till 1989	AoO(hectads) 1990-2013	AoO (tetrads) 1990 - 2013 for species qualifying under IUCN
Ceratocombidae										
<i>Ceratocombus coleoptratus</i>	LC		A species that come close to a status of NT and should be kept under review. Probably under-recorded due to its small size and cryptic habits.	NS	E	W		23	16	
Dipsocoridae										
<i>Cryptostemma alienum</i>	LC			NS	E	W	S	18	42	

<i>Cryptostemma waltli</i>	NT	B2a	Since 1990 recorded from 5 sites, 2 in Anglesey, 1 in Gloucestershire, 1 in Cambridgeshire and 1 in Roxburghshire. The species was recorded from only 2 sites in Wales (in Cardiganshire and Pembrokeshire, both coastal) in the late 1980's during the Welsh Peatland Invertebrate Survey. A small cryptic species which is very dependent on wet conditions and usually flightless, so vulnerable to local extinction as a result of drought, drainage and loss of <i>Sphagnum</i> . On the basis of known AOO (<500 km ²), restricted number of locations and the vulnerability of the habitat IUCN criteria are satisfied for a status of VU, but in view of probable under-recording a precautionary status of NT, rather than DD, is considered appropriate.	NR	E	W		7	5	5
Nepidae										
<i>Nepa cinerea</i>	LC				E	W	S	332	757	
<i>Ranatra linearis</i>	LC				E	W	S	102	272	
Corixidae										
<i>Micronecta scholtzi</i>	LC				E	W		41	168	

<i>Micronecta griseola</i>	DD		First recorded from R. Great Ouse at Felmersham (Beds). Very similar to <i>M. minutissima</i> and may have been overlooked in the past - or could be a recent colonist (Brooke & Nau 2003). It is certainly more common than records suggest as, according to B. Nau, it is present in a high proportion of rivers sites checked in Bedfordshire and surrounding counties (<i>pers. comm.</i>). If a recent colonist then status of NA may be appropriate (see K.Alexander, 2014) but if an overlooked native DD would be the best assessment. It is likely, however, that even if <i>M. griseola</i> is a recent colonist this represents a natural extension of range and, as in the case of <i>Sigara iactans</i> , it should be regarded as 'native'. A status of DD is considered appropriate.	NR	E			0	7	
<i>Micronecta minutissima</i>	LC		Northern limit Northumberland (but 19th cent record). Recorded from 27 sites since 1990 and 16 tetrads but almost certainly under-recorded. Most modern records from S England / East Anglia obtained as a result of deliberate searching.	NR	E			5	15	
<i>Micronecta poweri</i>	LC				E	W	S	78	137	
<i>Cymatia bonzdorffii</i>	LC				E	W	S	111	222	
<i>Cymatia coleoprata</i>	LC				E	W		104	260	

<i>Cymatia rogenhoferi</i>	NA		First recorded in Bedfordshire in 2005 and also known from one site in Essex and one in Kent (Rye Harbour). Spread into western Europe over the last 20 years. A recent colonist, it probably bred in a gravel pit in Bedfordshire before dying out.		E			0	3	
<i>Glaenocorisa propinqua propinqua</i>	LC		An Amber List species (see Review sections 5 & 12)	NS	E	W	S	58	54	
<i>Arctocorisa carinata</i>	LC		An Amber List species (see Review sections 5 & 12)	NS	E	W	S	54	33	
<i>Arctocorisa germari</i>	LC				E	W	S	104	208	
<i>Callicorixa praeusta</i>	LC				E	W	S	341	860	
<i>Callicorixa wollastoni</i>	LC				E	W	S	124	157	
<i>Corixa affinis</i>	LC		An Amber List species (see Review sections 5 & 12)	NS	E	W		79	47	
<i>Corixa dentipes</i>	LC				E	W	S	105	167	
<i>Corixa iberica</i>	LC			NS			S	29	31	
<i>Corixa panzeri</i>	LC				E	W	S	151	293	
<i>Corixa punctata</i>	LC				E	W	S	452	956	
<i>Hesperocorixa castanea</i>	LC				E	W	S	130	326	
<i>Hesperocorixa linnaei</i>	LC				E	W	S	588	1219	
<i>Hesperocorixa moesta</i>	LC				E	W		62	112	
<i>Hesperocorixa sahlbergi</i>	LC				E	W	S	464	1023	
<i>Paracorixa concinna</i>	LC				E	W	S	172	345	
<i>Sigara selecta</i>	LC		An Amber List species (see Review sections 5 & 12)	NS	E		S	28	21	
<i>Sigara stagnalis</i>	LC		An Amber List species (see Review sections 5 & 12)		E	W	S	100	117	
<i>Sigara nigrolineata</i>	LC				E	W	S	364	727	
<i>Sigara limitata</i>	LC				E	W	S	80	173	
<i>Sigara semistriata</i>	LC				E	W	S	93	172	

<i>Sigara venusta</i>	LC				E	W	S	124	186	
<i>Sigara dorsalis</i>	LC				E	W	S	533	1175	
<i>Sigara striata</i>	LC		A species that has a restricted range in the South East England but within which is quite common (Kirby 1992). Very similar to <i>S. dorsalis</i> with which it can hybridise to produce viable offspring. <i>S. striata</i> may be spreading (recorded from north east Norfolk) but because of its similarity to <i>S. dorsalis</i> some older and more recent records outside its established range may be misidentifications. On the other hand it can easily be overlooked.	NS	E			33	19	
<i>Sigara distincta</i>	LC				E	W	S	335	803	
<i>Sigara falleni</i>	LC				E	W	S	439	787	
<i>Sigara fossarum</i>	LC				E	W	S	212	482	
<i>Sigara iactans</i>	LC		First recorded on the North Norfolk coast at Snettisham in 2005. As a presumed recent colonist the status NA could be given - but because it is very likely that its establishment and fairly rapid spread in England represents a natural extension of range it is designated as LC and considered an established 'native'.		E			0	19	
<i>Sigara longipalis</i>	NA		First recorded from Upton Great Broad in 2006. Has not been seen since (R. Chadd, <i>pers. comm</i>). B. Nau (<i>pers. comm</i>) searched Upton Great Broad for <i>S. longipalis</i> in 2013 -2014 but did not find it. An occasional immigrant, with no evidence of an established breeding population.		E			0	1	
<i>Sigara scotti</i>	LC				E	W	S	158	324	
<i>Sigara lateralis</i>	LC				E	W	S	276	676	

Naucoridae										
<i>Ilyocoris cimicoides</i>	LC				E	W		175	562	
<i>Naucoris maculatus</i>	NA		First recorded in 2004 and again in 2006 at Samphire Hoe between Folkestone and Dover. In 2013 and 2014 it was recorded near Dungeness near the Kent / Sussex border. Samples have contained a number of specimens (10 in 2014) so it seems possible that this species may have, or will, become established.		E			0	2	
Aphelocheiridae										
<i>Aphelocheirus aestivalis</i>	LC				E	W	S	122	259	
Notonectidae										
<i>Notonecta glauca</i>	LC				E	W	S	506	1209	
<i>Notonecta maculata</i>	LC				E	W		131	333	
<i>Notonecta obliqua</i>	LC				E	W	S	111	289	
<i>Notonecta viridis</i>	LC				E	W	S	115	396	
Pleidae										
<i>Plea minutissima</i>	LC				E	W	S	162	694	
Mesoveliidae										
<i>Mesovelia furcata</i>	LC		This species is not assessed as NS as it close to the upper limit for this status (100 hectads) and is almost certainly under-recorded.		E	W	S	53	92	
Hebridae										

<i>Hebrus pusillus</i>	LC		Possibly spreading, new records for Devon and south west Wales since Huxley (2003) although it may have been lost from some inland locations. The more inland records on Gateway are either old or undated. Under-recorded. The Sussex Biodiversity Records Centre hold a number of recent records for this species not shown on Gateway.	NS	E	W		18	28	
<i>Hebrus ruficeps</i>	LC				E	W	S	78	115	
Hydrometridae										
<i>Hydrometra gracilenta</i>	VU	D2	Recorded from the Norfolk Broads and Pevensey Levels, East Sussex.. Nearly all the Norfolk records are from Catfield and adjoining fens and marshes (Sutton Fen, Turf Fen, Reedham Marsh). Water has been abstracted from Catfield Fen since 1986 and this has resulted in damaging changes in pH and water levels. As neighbouring fens are also affected this whole area constitutes one location. On the basis of a small known AOO (≤ 40 km ²), restricted number of locations (<5) and known threats to habitats (RSPB 2007, JNCC 2010 & other refs) <i>H. gracilenta</i> satisfies IUCN criteria for the status of VU.	NR	E			5	4	10
<i>Hydrometra stagnorum</i>	LC				E	W	S	327	859	
Veliidae										

<i>Microvelia buenoi</i>	NT	B2a	Little change since Huxley (2003) who recorded 5 hectads for <i>M. buenoi</i> between 1970 and 2001, 4 in Norfolk and 1 in Cambridgeshire. There are a few recent additional Norfolk records but no significant change in range or habitat. The species has a known AOO of <1000km ² and specific habitat requirements which could be threatened by lowering of water tables and unsympathetic management (Kirby 1992), satisfying IUCN criteria for a status of VU. However, as the species that can be easily overlooked and there is no evidence of serious threat or decline it is assessed NT.	NR	E			5	11	20
<i>Microvelia pygmaea</i>	LC		Has become more widespread since Kirby (1992) and Huxley (2003). More or less confined to the south and east of England, with a few more westerly sites and one recent record for Wales (near Neath). Nationally Scarce but not threatened.	NS	E	W		24	69	
<i>Microvelia reticulata</i>	LC				E	W	S	143	513	
<i>Velia caprai</i>	LC				E	W	S	386	999	
<i>Velia saulii</i>	LC				E	W	S	67	107	
Gerridae										
<i>Aquarius najas</i>	LC			NS	E	W	S	43	64	
<i>Aquarius paludum</i>	LC		Large increase in records since 1989 and now more widespread in the south east of England. Nationally Scarce, but not threatened	NS	E			17	50	
<i>Gerris argentatus</i>	LC				E	W		64	100	
<i>Gerris costae</i>	LC				E		S	96	178	
<i>Gerris gibbifer</i>	LC				E	W	S	132	181	

<i>Gerris lacustris</i>	LC				E	W	S	427	1152	
<i>Gerris odontogaster</i>	LC				E	W	S	220	560	
<i>Gerris thoracicus</i>	LC				E	W	S	209	445	
<i>Gerris lateralis</i>	LC				E	W	S	69	133	
<i>Limnopus rufoscutellatus</i>	NA		Most modern records from N. Ireland where it was first recorded in the early 1900's. Recent records from Notts in 2002 and Cumbria in 2000. It is a breeding species in Ireland, but always occurs in low numbers. Low numbers in England may indicate under-recording but it is a conspicuous species and there is no evidence of a breeding population - probably an occasional immigrant.		E			1	2	
Aepophilidae										
<i>Aepophilus bonnairei</i>	DD		Recent records from Devon, Cornwall and Pembrokeshire (P. Kirby <i>pers. comm.</i>). Although 4 post 1989 records (hectads) would place this species in the IUCN Endangered category it is almost certainly far more widespread than records suggest. Without a concerted sampling effort within its known range any assessment will be difficult. Assessed as DD.	NR	E	W		8	4	
Saldidae										
<i>Chiloxanthus pilosus</i>	NT	B2a	<i>C. pilosus</i> is confined to saltmarshes, which are threatened by sea level rise, erosion by storms and pollution. All recent records are for the south east and north west coasts of England. It is a very local species on the western limit of its range in GB and does not fall far short of a threat status. On the basis of AOO (<2,000km ²) and projected risk to	NR	E			6	15	

			saltmarsh habitats it is assessed as NT.							
<i>Chartoscirta cincta</i>	LC				E	W	S	84	119	
<i>Chartoscirta cocksii</i>	LC		One of the few species assessed as LC that shows a marked decline between time periods, although still too abundant to warrant a threat or NT status it could be regarded as an 'amber list' species. The WPIS added records for the 1966-1989 period, which accounts for some of the difference.	NS	E	W	S	71	39	
<i>Chartoscirta elegantula</i>	LC		Despite occurring in a fairly broad range of habitats there are few post 1989 records for this species. The species was downgraded from Notable to Local as a result of the Welsh Peatland Invertebrate Survey (WPIS) in the late 1980's during which it was 'found widely on Welsh wetlands' (Howe, 2004). In view of the small number of recent records it is a species that does not fall far short of a threat status (AOO <2,000 km ²), but given the WPIS findings a status of LC is appropriate.	NR	E	W	S	17	13	

<i>Halosalda lateralis</i>	LC		Recent records are for the east, south and west coasts of England and for the Moray Firth in Scotland. 50% of the records are from the Norfolk and Suffolk coasts, the rest being very scattered. <i>H. lateralis</i> is a very local species which is assessed as LC although it almost qualifies for NT, being confined to saltmarshes, and with a known AOO of 2000km ² .	NS	E	W	S	18	20	
<i>Macrosaldula scotica</i>	LC				E	W	S	28	74	
<i>Micracanthia marginalis</i>	VU	B2a b (ii, iii, iv); D2	The status of VU rather than EN is appropriate, despite the small known AOO (<500 km ²) and sensitive heathland habitat, in view of probable under-recording.	NR	E			9	3	3
<i>Saldula arenicola</i>	LC		Recent records show <i>S. arenicola</i> to be locally frequent over a sizeable area of SE England north to Huntingdonshire where it is associated with sand and gravel pits. The colonisation of these areas and habitats is a fairly recent phenomenon; the species has traditionally been confined to south the coast between Hampshire and Devon (where it still occurs). Kirby suggests the 'new' (inland) and 'old' (coastal) <i>S. arenicola</i> may be different in some way and should be assessed separately - although at present the information required to justify this is not available.	NR	E			12	18	
<i>Saldula c-album</i>	LC				E	W	S	40	54	
<i>Saldula fucicola</i>	LC		Post 1989 records concentrated in Cumbria but recent records for Herefordshire, Derbyshire and N. Northumberland (J. Webb) indicate a wider distribution. Nationally scarce, but LC.	NS	E		S?	8	17	

<i>Saldula melanoscela</i>	VU	D2	<i>Saldula melanoscela</i> was first found on the River Wampool at Whitrigg Bridge, Cumbria, in 2000. As there is no immediate threat to the R. Wampool habitat <i>S. melanoscela</i> is designated VU on the basis of a single known location and an AOO of <10km ² .	NR	E			1	1	1
<i>Saldula opacula</i>	LC		This species appears to have increased recently, especially in brownfield and other secondary sites Nationally Scarce, but not threatened.	NS	E	W		11	23	
<i>Saldula orthochila</i>	LC			NS	E		S	19	53	
<i>Saldula pallipes</i>	LC			NS	E	W		15	56	
<i>Saldula palustris</i>	LC			NS	E	W	S	17	29	
<i>Saldula pilosella</i>	LC			NS	E			27	27	
<i>Saldula saltatoria</i>	LC				E	W	S	175	257	
<i>Saldula setulosa</i>	CR (PE)	B2ab(i,iii)	Only known to occur in Poole Harbour but has not been recorded there since 1964. An IUCN status of CR (PE) is justified on the basis of a very restricted AOO (<10 km ²) a single vulnerable site and evidence from recent searches that the population may have declined - or even become extinct.	NR	E			2	1	1
<i>Salda littoralis</i>	LC		An Amber List species (see Review sections 5 & 12)	NS	E	W	S	43	36	
<i>Salda morio</i>	LC			NS	E	W	S	29	28	
<i>Salda muelleri</i>	LC		A scarce species, although probably more common than records suggest.	NS	E	W	S	21	19	

Teloleuca pellucens	NT	B2a	There are large areas of potentially suitable but under-recorded habitat in Northern England and Scotland where it may occur. With a recorded AOO of 7 tetrads (<30km2) a status of NT is appropriate and conforms more closely to IUCN guidelines on the balance between evidentiary and precautionary approaches.	NR	E			20	7	7
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Appendix 2. IUCN Criteria and Categories

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%
<p>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:</p> <ul style="list-style-type: none"> (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. <p>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.</p> <p>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.</p> <p>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.</p>			
B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
B1. Extent of occurrence (EOO)	< 100km ²	< 5,000km ²	< 20,000km ²
B2. Area of occupancy (AOO)	< 10km ²	< 500km ²	< 2,000km ²

AND at least 2 of the following:

(a) Severely fragmented, **OR**

Number of locations	= 1	≤ 5	≤ 10
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(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
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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
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C2. A continuing decline **AND** (a) and/or (b):

(a i) Number of mature individuals in each subpopulation:	< 50	< 250	< 1,000
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or

(a ii) % individuals in one subpopulation =	90–100%	95–100%	100%
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(b) Extreme fluctuations in the number of mature individuals.

D. Very small or restricted population**Either:**

Number of mature individuals < 50

| < 250

| **D1.** < 1,000**AND/OR****VU D2.** Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.| **D2.** typically:
AOO < 20km² or
number of locations ≤ 5

E. Quantitative AnalysisIndicating 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

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