

**Butterfly
Conservation**

Saving butterflies, moths and our environment

A review of the status of the macro-moths of Great Britain

Butterfly Conservation report to Natural England, 2019

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Contents

	Page
Executive summary	1
1. Introduction to the Species Status project	2
1.1 The Species Status project	2
1.2 The status assessments	2
1.3 Species status and conservation action	2
2. Introduction to the macro-moth review	2
2.1 The significance of moths	2
2.2 Macro-moths and micro-moths	3
2.3 Moth trends	3
2.4 Previous status assessments	4
3. The IUCN categories and criteria as adapted for invertebrates in Great Britain	4
3.1 Summary of the IUCN categories	4
3.2 Application of the guidelines to invertebrates	6
3.2.1 The three-stage process in relation to developing a Red List	7
3.2.2 The use of the Near Threatened category	7
4. GB Rarity Status categories and criteria	8
5. Methods and sources of information	8
5.1 Taxonomic scope	8
5.2 Geographical scope	9
5.3 Resident status	9
5.4 Data sources	10
5.5 Selection of IUCN criteria	13
5.5.1 Extinct species	13
5.5.2 Application of IUCN criterion A (reduction in population size)	13
5.5.3 Application of IUCN criterion B (geographical range)	15
5.5.4 Application of IUCN criterion D2 (very small or restricted population)	17
5.6 Consideration of the 'rescue effect'	17
5.7 Classification into Nationally Rare and Nationally Scarce categories	18
5.8 Peer-review	19
6. Results of the macro-moth status review	19
6.1 Results spreadsheet	19
6.2 Red List assessment of GB macro-moths	19
6.3 National rarity assessment of GB macro-moths	23
6.4 Resident macro-moth species in different GB countries	25
7. Discussion	26
7.1 Distribution recording intensity relative to other GB invertebrates	26
7.2 Application of IUCN criterion A2	26
7.3 Application of IUCN criterion B	27
7.4 Date period	28

8. Acknowledgements	Page 28
9. References	29
Appendix 1. Summary results of GB macro-moth status review	34
Appendix 2. IUCN Red List categories and criteria	67

List of Figures

Figure 1. Definitions of IUCN Red List categories used for regional assessment (from IUCN 2012a, 2012b).	4
Figure 2. Hierarchical relationships of the IUCN categories used for regional assessment (reproduced from IUCN 2012b).	5
Figure 3. Total number of macro-moth records (all species) per year in the NMRS database 1960-2014.	11
Figure 4. Species-richness of GB macro-moth records 2000-2014 at 10 km x 10 km grid square resolution derived from the National Moth Recording Scheme.	12

List of Tables

Table 1. Summary of the IUCN categories assigned to GB macro-moths.	19
Table 2. Regionally extinct, threatened and Near Threatened Red GB macro-moths.	20
Table 3. GB macro-moths classified as Nationally Rare.	23
Table 4. Total number of macro-moth species currently resident in each GB country.	25
Table 5. Geographical distribution of currently resident GB macro-moths by counties.	25
Table 6. The number of threatened, Near Threatened and Nationally Rare/Scarce macro-moth species that occur in each GB country.	25

Executive summary

Macro-moths are a species-rich group in Great Britain (GB) and perform important roles in ecosystems as herbivores, pollinators and prey items for many animal species. Macro-moth recording is popular among naturalists and, as a result, macro-moths are one of the most comprehensively recorded and monitored invertebrate groups in Britain. It is clear from this recording and monitoring work that, overall, macro-moths have declined substantially during the past 40 years, although trends vary greatly between species.

Under the auspices of the Species Status project co-ordinated by the UK statutory nature conservation agencies, we assessed the status of all macro-moth species that are currently or were formerly resident in GB. A total of 768 species were assessed against the International Union for Conservation of Nature (IUCN) Red List criteria, with some modifications arising from additional guidelines set by the Invertebrate Inter-agency Working Group (IIAWG) and Joint Nature Conservation Committee. Macro-moths were also assessed against national rarity criteria. This is the first time that GB macro-moths have been systematically assessed against the current threat status categories and criteria produced by IUCN.

For the assessment, long-term (minimum 30 years) population data from the Rothamsted Insect Survey was used to assess species against IUCN criterion A (reduction in population size). In addition, the number of hectads (10 km x 10 km grid squares) in which each species was resident, the Extent of Occurrence and the Area of Occupancy during the period 2000-2014 were calculated from the National Moth Recording Scheme, run by Butterfly Conservation. These were combined with robust evidence of decline corrected for recording effort bias, in order to assess species against IUCN criteria B and D, as well as the national rarity thresholds.

In this GB status review:

- 23 macro-moth species were classified as Regionally Extinct
- 3 species were determined as Critically Endangered (Possibly Extinct)
- 5 species were determined as Critically Endangered
- 25 species were determined as Endangered
- 22 species were determined as Vulnerable
- 58 species were categorised as Near Threatened
- 628 species were categorised as Least Concern
- 1 species was categorised as Data Deficient
- 3 species were categorised as Not Applicable
- 64 species were listed as Nationally Rare
- 99 species were listed as Nationally Scarce

In total, 7.2% (55 species) of GB resident macro-moths were listed as threatened under the IUCN Red List criteria and a further 7.6% (58 species) were classified as Near Threatened. These proportions are broadly similar to those classified in other insect and invertebrate groups that have undergone the GB status review process recently.

Due to the rapid rates of distribution and population change observed for many GB macro-moths, and continual improvements in statistical techniques, it is recommended that the status review be repeated at 5-10 year intervals.

1. Introduction to the Species Status project

1.1 The Species Status project

The Species Status project provides up-to-date assessments of the status and extinction risk faced by individual species using the internationally accepted Red List criteria and guidelines developed by the International Union for Conservation of Nature (IUCN) Standards and Petitions Subcommittee (IUCN 2012a, 2012b, 2017). It is the successor to the Joint Nature Conservation Committee's (JNCC) Species Status Assessment project which ended in 2008.

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 (GB). All publications will explain the rationale for the assessments made. The approved threat and rarity statuses will be entered into the JNCC spreadsheet of species conservation designations. This publication is one in a series of reviews to be produced under the auspices of the new project.

1.2 The status assessments

This review adopts the procedures recommended for the regional application of the IUCN threat assessment guidelines (IUCN 2012b). Sections 3 and 5 plus Appendix 2 provide further details. It is a three-step process, the first identifying the taxa to be assessed, the second classifying those threatened in the region of interest using information only on the status of the taxa in that region (IUCN 2012a) and the third amending the initial assessment, where necessary, to account for interaction with populations of the taxon in neighbouring regions (IUCN 2017).

In addition, but as a separate exercise, the GB Rarity System, used for assessing rarity and based solely on distribution, is used here alongside the IUCN classification.

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 status of species, not least including 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, although IUCN point out that a category of threat is often not sufficient to determine priorities for conservation action. 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.

2. Introduction to the macro-moth review

2.1 The significance of moths

Moths are a diverse and species-rich group of insects that occur in a wide range of habitats. Over 2,500 moth species have been recorded in GB, forming a significant portion of the nation's biodiversity and playing important roles in ecosystem functioning. In addition to the substantial impact of moth caterpillars as herbivores and, to a lesser extent, detritivores, many adult moths visit flowers. The role of moths, especially nocturnal species, in pollination is under-studied and under-appreciated, but there is growing evidence that they are important pollinators for a wide range of plants in many habitats both in GB and globally (Macgregor *et al.* 2015; Hahn & Brühl 2016). The essential

contribution of moths in many food webs is clearer (Fox *et al.* 2010). Moth caterpillars in particular are vital dietary components for many vertebrate species, including most of Britain's familiar garden birds, as well as a wide range of invertebrate predators and parasitoids. Blue Tit *Parus caeruleus* chicks alone consume an estimated 35 billion moth caterpillars in GB each year.

Moths are important to humans too. A minority are considered to be economically important pests and a very few are even of concern to human health (e.g. Oak Processionary *Thaumetopoea processionea*, Mindlin *et al.* 2012). However, moths are also fascinating and beautiful creatures that provide people with an opportunity to engage with biodiversity in their gardens and in the countryside. The increasing popularity of public moth events, moth recording schemes and citizen science projects, coupled with a plethora of recent books and websites dedicated to moth identification and natural history, suggest that the long-standing negative representation of moths in British culture is slowly being transformed (Fox *et al.* 2011).

2.2 Macro-moths and micro-moths

Moths have traditionally been divided at the Family level into macro-moths and micro-moths, largely and arbitrarily based on the size of the adult insects. Although this division is taxonomically invalid (Kawahara & Breinholt 2014), it remains prevalent in natural history and biodiversity recording and conservation in GB and so is appropriate for this review.

Following the current checklist (Agassiz, Beavan & Heckford 2013), macro-moths included in this status review were defined as resident species in Lepidoptera families: Hepialidae, Cossidae, Sesiidae, Limacodidae, Zygaenidae, Drepanidae, Lasiocampidae, Endromidae, Saturniidae, Sphingidae, Geometridae, Notodontidae, Erebidae, Noctuidae and Nolidae.

2.3 Moth trends

With the exception of a very few charismatic but species-poor groups such as butterflies, macro-moths are the most comprehensively recorded and monitored invertebrates in GB. Parsons (2003) documented the extinction in GB of 24 macro-moth species during the twentieth century, although a small number have since re-colonised. In addition, population monitoring and distribution recording of macro-moths (see section 5.4 for details) have enabled the assessment of long-term national trends for resident species. Analyses of these trends have provided clear evidence of dramatic changes in the abundance and distribution of macro-moths in GB. Conrad *et al.* (2006) found that 66% of 337 species of widespread macro-moths studied had negative population trends over 35 years, while the total abundance of nocturnal macro-moths decreased by 28% in GB as a whole and by 40% in southern GB over a 40-year period (1968-2007) (Fox *et al.* 2013). An analysis of frequency of occurrence trends derived from distribution records, found an overall decrease among GB resident macro-moths (Fox *et al.* 2014). Similar patterns of decline in moth faunas have been reported from Finland (Mattila *et al.* 2006, 2008) and the Netherlands (Groenendijk & Ellis 2011).

Not all macro-moth species are in decline, however. Some species have increased in abundance and distribution, with many extending their ranges northwards in GB at an increasing rate (Mason *et al.* 2015). Furthermore, dozens of macro-moth species have colonised GB over the course of the past century (Parsons 2003, 2010). Most have arrived naturally, as immigrants from continental Europe, though some (e.g. Common Forest Looper *Pseudocoremia suavis*, Oak Processionary and Gypsy Moth *Lymantria dispar*) are thought to have been imported accidentally through the horticultural trade. Many of the

new arrivals utilise native larval host plants in GB, but some are dependent upon non-native plants, such as Cypress Carpet *Thera cupressata*, Cypress Pug *Eupithecia phoeniceata* and Blair's Shoulder-knot *Lithophane leautieri* on cypress trees.

2.4 Previous status assessments

GB macro-moths have never been systematically assessed against the current threat status categories and criteria produced by IUCN in 2001. This fact, together with the evidence for major changes in the distribution and abundance of GB macro-moths summarised in section 2.3, highlights the need for an up-to-date status review. Although the IUCN Red List system is designed to facilitate standardised assessment of extinction risk and explicitly not to provide a prioritisation of species for conservation action (Collen *et al.* 2016), it does often stimulate the development of conservation policies and projects. Thus, this new review will help to inform evidence-based decision making and ensure efficient use of conservation resources.

Macro-moths were included in the first Red Data Book of British insects (Shirt 1987) and were subsequently assessed on several occasions by Paul Waring (most recently in Waring, Townsend & Lewington 2009). However, the criteria used for these assessments differed from those used in this study.

GB micro-moths have also been recently reassessed (Davis 2012). However, the current IUCN criteria were not applied to the micro-moth review due to a lack of quantitative evidence for species' declines.

3. The IUCN categories and criteria as adapted for invertebrates in Great Britain

3.1 Summary of the IUCN categories

A brief outline of the IUCN criteria and their application is given below. For a full explanation see IUCN (2012a, 2012b, 2017) and the IUCN web site (www.iucnredlist.org). The definitions of the categories are given in Figure 1 and the hierarchical relationship of the categories in Figure 2. All categories refer to the status in GB (not globally).

REGIONALLY EXTINCT (RE)

A taxon is Extinct when there is no reasonable doubt that the last individual has died. In this review, species not recorded in GB this century are considered Regionally Extinct.

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 Appendix 2). 'Possibly Extinct' is an additional tag used for Critically Endangered taxa that are, on the balance of evidence, likely to be extinct, but for which there is a small chance that they may be extant.

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 Appendix 2).

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 Appendix 2).

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 APPLICABLE (NA)

A taxon that is deemed to be ineligible for assessment at a regional level is listed as Not Applicable. This can be for a variety of reasons e.g. because it is not within its natural range in the region or because it is a vagrant to the region. In this review, GB species that are resident because of human introduction are considered Not Applicable.

NOT EVALUATED (NE)

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

Figure 1. Definitions of IUCN Red List categories used for regional assessment (adapted from IUCN 2012a, 2012b).

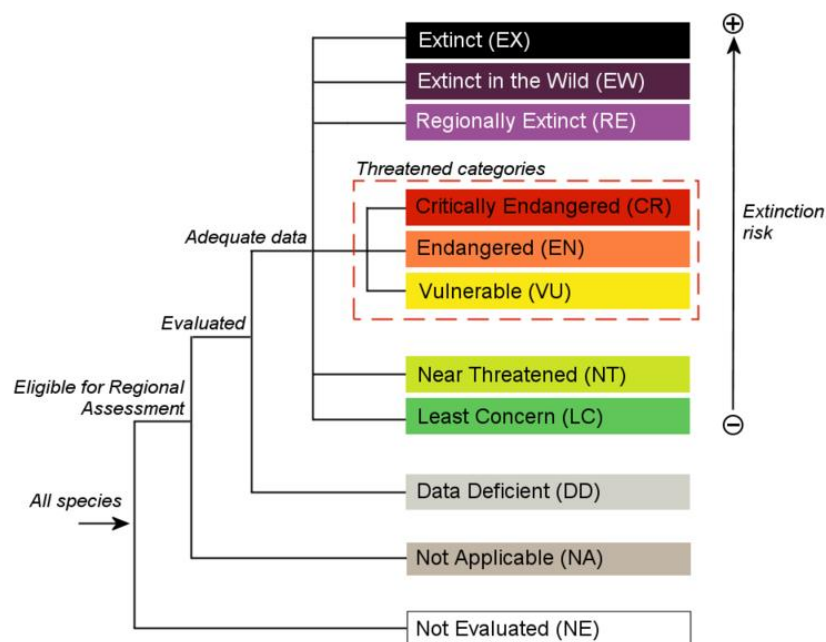


Figure 2. Hierarchical relationships of the IUCN categories used for regional assessment (reproduced from IUCN 2012b).

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 subcriteria within A, B and C (and an additional subcriterion in D for the Vulnerable category), any one of which qualifies a taxon for listing at that level of threat. Where a species qualifies under more than one criterion, the highest threat level is applied as the final classification. The A-E criteria and qualifying thresholds are detailed in Appendix 2.

In the main, the status evaluation procedure relies on an objective assessment of the available evidence. In certain cases, however, subjective assessments are acceptable as, for example, in predicting future trends and judging the quality of the habitat and methods involving estimation, inference and projection are acceptable throughout. Inference and projection may be based on extrapolation of current or potential threats into the future (including their rate of change), or of factors related to population abundance or distribution (including dependence on other taxa), as 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, which should be specified as part of the documentation. 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 can qualify for a particular threat category on any single criterion.

The categorisation process is only to be applied to wild populations inside their natural range (IUCN 2012a, 2017). 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.

3.2 Application of the guidelines to invertebrates

The criteria A, C, D1 and E (see Appendix 2) are rarely appropriate for invertebrates as, for most taxa, population data are not available. In the case of GB macro-moths, however, population data are available for a subset of species from the Rothamsted Insect Survey light-trap network, the Garden Moth Scheme and from monitoring of rare species, which has allowed criterion A to be used, as described in section 5.5.2.

Criterion B requires the estimation of extent of occurrence (EOO) or area of occupancy (AOO). Both were used in this status review. Assessments based on AOO are influenced by the spatial resolution at which they are calculated (Gaston & Fuller 2009; IUCN 2017). Because AOO is calculated from the number of grid squares occupied by each species multiplied by the total area of each grid square, the finer the grid at which species are recorded and mapped, the smaller AOO estimates will be. IUCN guidelines state that “In all cases, 4 km² (2 x 2 km) cells are recommended as the reference scale for estimating AOO to assess criteria B2” (IUCN 2017).

In addition to the IUCN criteria and guidelines, the Invertebrate Inter-agency Working Group (IIAWG) and JNCC have defined specific guidelines for use in GB status reviews of invertebrate and these were applied in the assessment of macro-moths. These non-IUCN guidelines had a significant impact on the macro-moth review, especially with the effect of downgrading of species to Near Threatened or Least Concern under criterion B2 (see sections 3.2.2 and 7.3).

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

The IUCN regional guidelines (IUCN 2012b) indicate that if a given taxon is known to migrate into or out of the region it should be assessed using a three-stage approach. First, the taxa appropriate for assessment should be determined. Second, populations in the region under review should be assessed as if they were isolated taxa. Finally, 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 there is no significant movement between GB and continental Europe for the majority of macro-moth species, recruitment from abroad has clearly accounted for the establishment of some newcomers to the British fauna and there is potential for an immigration 'rescue effect' for a minority of species.

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 that almost meet one or more of the criteria and where a potential threat, natural habitat dependency or range change demand frequent review of status.

This category would be best considered for those species that come close to qualifying as threatened. This could be because there is sufficient evidence to show that the taxon is close to the relevant criteria thresholds. Alternatively, it could be where a species exceeds the threshold but does not meet requirements for subcriteria. Details of the methods used and evidence for NT status must be provided.

Following IUCN guidance, species meeting EOO or AOO thresholds under criterion B, but only meeting one of the three subcriteria would normally be assessed as NT. However, the IAWG and JNCC have defined specific (non-IUCN) guidelines for the use of criterion B2. These state that "for B2bii, '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 fewer current localities then Critically Endangered (single locality), Endangered (≤ 5 localities), Vulnerable (≤ 10 localities) are applicable
- If 11 or 12 current localities then Near Threatened applies
- If 13-15 current localities and the taxon can be shown to be vulnerable to a specific and realistic threat, then Near Threatened applies
- If > 15 locations then Least Concern applies"

Unless the number of colonies of a species is accurately known, the number of localities should equal the number of occupied hectads (10 km x 10 km grid squares). The effect of this guidance is that species that would have qualified as NT by meeting the AOO threshold and subcriterion b, are downlisted to LC if they occur in over 15 hectads. The application of this additional IAWG/JNCC guidance about subcriterion a had a significant impact on the classification of GB macro-moth species (see section 7.3 for further discussion).

4. GB Rarity Status categories and criteria

At the national level, countries are permitted under the IUCN guidelines to refine the definitions for the non-threatened categories and to define additional ones of their own. The Nationally Rare and Nationally Scarce categories are unique to GB. Broadly speaking, the Nationally Rare category is equivalent to the Red Data Book categories used by Bratton (1991), namely: Endangered (RDB1), Vulnerable (RDB2), Rare (RDB3), Insufficiently Known (RDBK) and Extinct. These are not used in this review. The Nationally Scarce category is directly equivalent to the combined Nationally Notable A (Na) and Nationally Notable B (Nb) categories previously applied to GB macro-moths (e.g. in Waring, Townsend & Lewington 2009) and used in the assessment of various other taxonomic groups (e.g. by Hyman & Parsons 1992 in assessing the status of beetles).

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

Nationally Rare	Native species recorded (as resident breeding species) from 15 or fewer hectads (10 km x 10 km grid squares) of the GB Ordnance Survey national grid in the period 2000-2014 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 that are not regarded as Nationally Rare and which have not been recorded (as resident breeding species) from more than 100 hectads of the GB Ordnance Survey national grid in the period 2000-2014 and where there is reasonable confidence that exhaustive recording would not find them in more than 100 hectads.

The choice of 2000-2014 as the macro-moth recording period is discussed in section 5.

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

5. Methods and sources of information

5.1 Taxonomic scope

The status review of British macro-moths was undertaken at species level. No subspecies have been separately assessed. Macro-moths were defined as species in Lepidoptera families: Hepialidae, Cossidae, Sesiidae, Limacodidae, Zygaenidae, Drepanidae, Lasiocampidae, Endromidae, Saturniidae, Sphingidae, Geometridae, Notodontidae, Erebididae, Noctuidae and Nolidae.

Taxonomy follows the current checklist (Agassiz, Beavan & Heckford 2013). Thus, Arran Carpet *Chloroclysta concinnata* was not assessed as a separate species as it is now regarded as a subspecies of Common Marbled Carpet *Dysstroma truncata* (Hausmann & Viidalepp 2012).

The only instances where this review departs from the current checklist are as follows:

- Ling Pug *Eupithecia goossensiata* is treated as conspecific with Wormwood Pug *E. absinthiata* in the checklist (as formerly), but there is recent evidence to suggest that it is a good species in its own right (Hausmann, Haszprunar & Hebert 2011). As a precautionary measure, we have assessed it separately.
- Fen Square-spot *Diarsia florida* is treated as a good species in the checklist, but there is considerable doubt about its taxonomic status, which, in the opinion of the authors, make GB records unreliable. It was listed as Data Deficient in the final assessment.
- Northern Deep-brown Dart *Aporophyla lueneburgensis* and Deep-brown Dart *A. lutulenta* are listed as separate species in the checklist, although it is noted that some authors consider them to be conspecific. The two taxa are combined as a single entity in this review as the specific identity of many GB records of these species is unclear.

5.2 Geographical scope

Following guidance from Natural England and other statutory agencies, the assessment was restricted to GB only (i.e. England, Scotland and Wales). Offshore islands that form part of these countries were included, but those under separate administration (e.g. the Isle of Man, Channel Islands) were not.

In Ireland, Red Lists are compiled at an all-Ireland level by the National Parks and Wildlife Service and the Northern Ireland Environment Agency. An Irish Red List of moths was published recently (Allen *et al.* 2016).

5.3 Resident status

This status review was restricted to resident or formerly resident species. Macro-moths that occur only as immigrants (even if they are capable of breeding in GB) or non-colonising adventives were not included. It is acknowledged that such species are potential colonists and would be included in future status reviews if they were to establish resident populations in GB. No start-date restriction was applied to the overall species list, so macro-moths that were regarded, on the balance of evidence, to have ever been resident in GB were included in the review. However, highly transitory residents or suspected residents (i.e. species that are believed to have become temporarily established for just a few years in the past before dying out) were not included e.g. Scarce Brindle *Apamea lateritia*. The exclusion of non-resident species, plus the taxonomic considerations discussed in section 5.1, resulted in a total of 768 macro-moth species for assessment.

Moreover, the review only utilised data from parts of each species' range where it was considered to be resident. Some resident species also occur as immigrants or wander considerable distances from their breeding areas. A good illustration is Rannoch Looper *Macaria brunneata*, which is a resident GB species only in central Scotland but which has occurred as an immigrant in many counties in southern England (Higgott & Davey 2010). In this case only the populations in the resident Scottish range were included in the application of both IUCN criteria and GB rarity categories. Considerable time and effort were expended in excluding species distribution records thought to relate to immigrants.

Species that are resident in GB only as a result of deliberate or accidental human introduction were not assessed under the IUCN criteria (and were classified as Not Applicable) and were categorised as Naturalised under the national rarity assessment.

The native or non-native status of larval host plants did not affect how macro-moth species were assessed in this review. Thus, species such as Feathered Beauty *Peribatodes*

secundaria (which uses Norway Spruce *Picea abies*) and Channel Islands Pug *Eupithecia ultimaria* (which uses Tamarisk *Tamarix* spp.) that have colonised GB without human assistance, are reviewed in the same way as other native moth species.

5.4 Data sources

There are three national recording/monitoring schemes with the potential to contribute data to a status review of macro-moths: the National Moth Recording Scheme (run by Butterfly Conservation), the Rothamsted Insect Survey (run by Rothamsted Research) and the Garden Moth Scheme (run by volunteers). The National Moth Recording Scheme (NMRS) collates species occurrence records to map changing distributions of macro-moths, while the other two schemes aim to monitor changing moth abundance. As discussed in section 5.5, population monitoring data from the Garden Moth Scheme were not used in this status review, due to the short duration of the time series. Data from this source may be appropriate to use in status assessments in the future. Thus, the IUCN Red List assessment presented in this report is based on data from the Rothamsted Insect Survey (RIS) and NMRS, supplemented for a small number of very rare macro-moths by information from specific surveys and monitoring programmes co-ordinated by Butterfly Conservation and partner organisations. The GB rarity assessment is based solely on NMRS data.

The RIS has operated a national network of standard light-traps since 1968 (Conrad, Fox & Woiwod 2007). The traps are run every night, the catches are retained and all macro-moths are identified and counted. In the past, much of the identification and counting was undertaken by professional staff at Rothamsted Research, but nowadays expert volunteers carry out all of this work. RIS light-traps have been run at over 525 sites, covering a variety of habitats, from gardens to upland moor using, on average, 97 traps per year (Fox *et al.* 2013). Through this network, Rothamsted Research has amassed a unique database, with around 10 million moths recorded in GB, over a period spanning more than five decades. It has been used for scientific studies of individual species (e.g. Garden Tiger *Arctia caja* Conrad, Woiwod & Perry 2002), national-level assessments of population change (Fox *et al.* 2013), official Government biodiversity indicators (Eaton *et al.* 2015) and research into impacts of climate change (e.g. Thackeray *et al.* 2016; Martay *et al.* 2018).

The NMRS was set up in 2007 and collates historical and contemporary distribution records of moths across the UK (Fox *et al.* 2011). It has been used to produce a provisional set of distribution maps for all UK macro-moths (Hill *et al.* 2010). Records are mainly provided by amateur enthusiasts via a nationwide network of County Moth Recorders, volunteer experts who collate, verify and, where necessary, computerise records. Verified county data sets are then passed to the NMRS. To date, over 25 million macro-moth records have been added to the NMRS database. While these span almost 250 years, and include records from the first UK Lepidoptera Recording Scheme run by the Biological Records Centre from the late 1960s until the early 1980s, the NMRS dataset is heavily biased towards recent records (see Figure 3).

Although not yet in the league of birds or butterflies, GB macro-moth recording has grown rapidly in popularity over recent decades, spurred on by the publication of field guides and online resources, as well as citizen science projects such as Moth Night (Tunmore & Hill 2014), the Garden Moth Scheme (Wilson *et al.* 2015) and Moths Count (Fox *et al.* 2011). As a result, thousands of recorders submit macro-moth records annually to County Moth Recorders, yielding an average of 930,000 records per annum in the NMRS over the period 2000-2014.

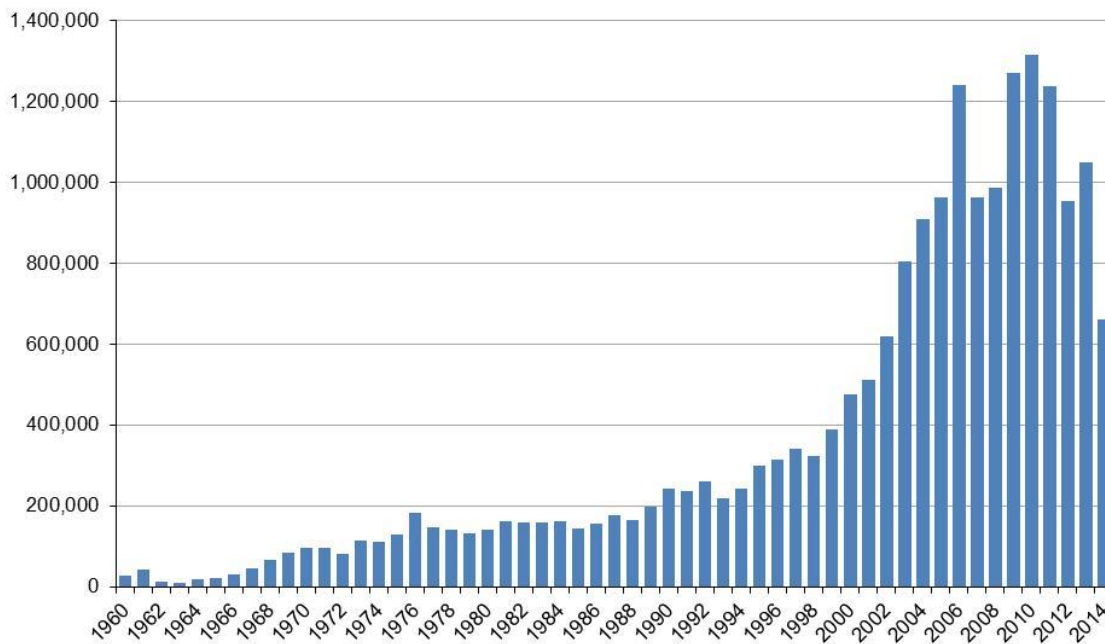


Figure 3. Total number of macro-moth records (all species) per year in the NMRS database 1960-2014. Note that the total for 2014 was relatively low at the time of assessment, as not all county datasets had been updated.

Geographical coverage of records in the NMRS during recent years is extensive (see Figure 4). Although most moth recorders run traps regularly in their own gardens, many also record actively across the landscape using portable generators to sample nocturnal macro-moths in a wide range of habitats from seashore to mountains. The NMRS also includes records of diurnal moth species and of immature stages, which further improves overall coverage, particularly in remote areas.

The geographical precision of modern NMRS records is very high. In the period 2000-2014, 91% of macro-moth records in the database have a spatial resolution of a 100m x 100m grid square or finer, and most of the rest have a 1 km x 1 km square resolution. Only 0.06% of NMRS records in the 2000-2014 time period are at a coarser spatial scale than 2 km x 2 km square (tetrad).

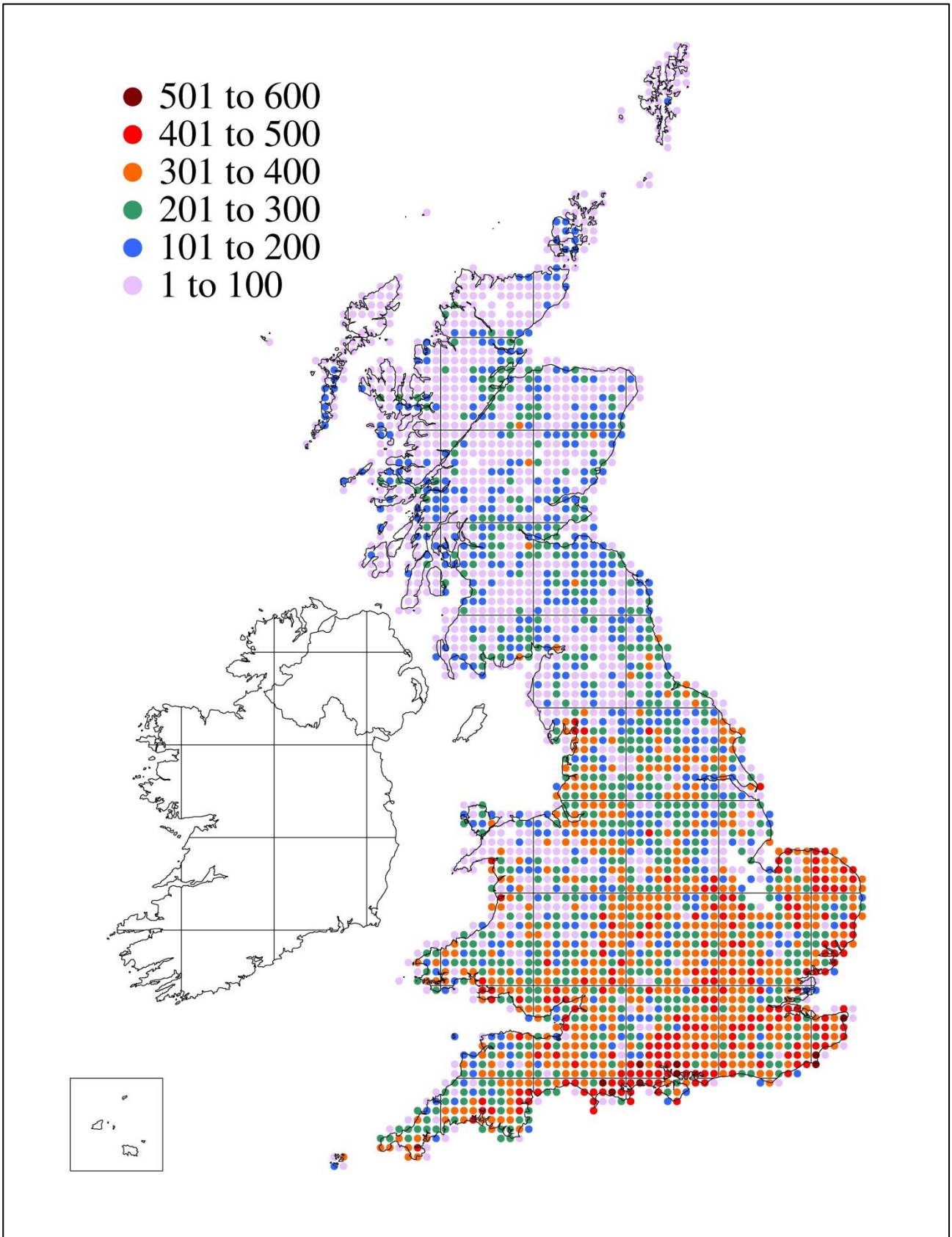


Figure 4. Species-richness of GB macro-moth records 2000-2014 at 10 km x 10 km grid square resolution derived from the National Moth Recording Scheme. This includes all macro-moth species, not just the 768 resident species assessed in this status review.

5.5 Selection of IUCN criteria

As mentioned in section 3.2, the five IUCN Red List criteria (A-E) potentially available to determine the extinction risk of species are typically limited in their applicability to invertebrates at global and regional scales due to insufficient data (Cardoso *et al.* 2011). While some of the most comprehensive invertebrate data in the world exist for GB macro-moths, the use of IUCN criteria is still restricted. Absolute population numbers are not known for any GB macro-moths so criterion C cannot be applied and we are not aware of any population vulnerability analyses that have been carried out, ruling out criterion E. Trends over time in relative population size of some GB macro-moths have been derived from the RIS (e.g. Conrad *et al.* 2006; Fox *et al.* 2013) and these can be used for criterion A. Finally, good data exist from the NMRS for the calculation of geographical range for criterion B and, for very rare species, criterion D2.

5.5.1 Extinct species

The IUCN category of Regionally Extinct (RE) is used where there is confidence that a species no longer occurs in the region being assessed, but does occur elsewhere in the world. For this review, we assigned macro-moth species as RE if they had previously been resident in GB but are no longer believed to be resident here. The IIAWG/JNCC guidelines recommend using 1900 as the cut off period for determining extinction (i.e. if a species has not been recorded in GB since 1900 it can be assumed to be extinct), but also state that species not seen since 1950 can be classified as RE if there is good reason to believe that no populations remain. While these lengthy time periods may be necessary and appropriate to determine extinction of invertebrate taxa with low levels of annual recording in GB, much shorter intervals can be used for well-recorded groups such as macro-moths. The intensity of GB macro-moth recording, coupled with targeted survey and conservation work on many threatened species, results in higher levels of confidence in species extinction and many extinctions have been documented (Parsons 2003, 2010). Thus, we use the year 2000 as the cut-off date for this review. Resident macro-moths with no known or suspected breeding records after 31 December 1999 are considered Regionally Extinct. The date of the last known record of a resident individual is given in Appendix 1. A small number of macro-moth species with post-2000 records are also suspected to be extinct now as breeding species in GB, but these have been listed as threatened.

5.5.2 Application of IUCN criterion A (reduction in population size)

Change in relative population size for moths derived from sources such as the RIS, Garden Moth Scheme and monitoring of rare moths carried out by Butterfly Conservation can be used to assess species against criterion A2b. IUCN specifies that such population trends must be based on the last 10 years (or three generations, whichever is the longer). However, inappropriate assessment of the extinction risk of species can occur if such short-term population trends do not accurately reflect longer term patterns (Dunn 2002; Connors *et al.* 2014; White 2019). This is a particular concern for insects, which often have fluctuating population dynamics caused, for example, by environmental variability or density dependence. The substantial inter-generational population fluctuations (often of more than an order of magnitude) that commonly occur in Lepidoptera species (driven, for example, by climatic events or biotic interactions with hostplants and predators) make short-term trends highly variable depending on the particular time period selected for analysis (van Strien *et al.* 1997; Fox *et al.* 2018). As a result, Red List classifications of insects based only on population trends over the last 10 years are likely to be strongly affected by the start date of the 10-year trend, and therefore reflect spurious responses to short-term environmental stochasticity rather than an accurate classification of extinction risk. An exploration of this problem, using short-term population trends of GB macro-moths

derived from the RIS data, found that varying the start year of 10-year trends by just one year could have a substantial effect on the resultant Red List classification (Fox *et al.* 2018). In the most extreme case, the difference of a single year, reduced the number of moth species qualifying as threatened under criterion A2 from 62 (14% of the total number of species assessed) to just 20 (5%).

Based on this evidence, we believe it could be misleading to assess the extinction threat of GB macro-moth species using a population trend based solely on data from the last 10 years. However, it is important to assess species against as many IUCN criteria and using as much available information as possible. Thus, after discussion and agreement with Natural England, an assessment of moth population change against criterion A2 was undertaken, based upon long-term trends but using more recent change to moderate the final classification of species' extinction risk. Although a departure from IUCN guidelines, we consider this approach justified in this review as it avoids the problems associated with using short-term trends to assess underlying population change, while still representing the current extinction risk of species. However, it meant that the population trends from the Garden Moth Scheme and rare species monitoring by Butterfly Conservation could not be included in this status assessment against criterion A2, as these are only short-term at present. In the future, when time series of a longer duration are available from these data sources, it will be possible to utilise them in this process.

Annual indices of relative population change and temporal abundance trends were calculated for all macro-moth species using RIS data from GB sites for 1970-2016. Different time periods were used for a small subset of species, after consideration of taxonomic or identification issues. For example, some of the *Eupithecia* species were not reliably identified across the RIS network in the early years, so a start year of 1986 was used for their long-term trends. The analysis was undertaken by the Centre for Ecology & Hydrology (CEH) using the Generalized Abundance Index approach (Dennis *et al.* 2016). The approach had two main stages; the first attempts to correct for any intra-annual gaps in sampling, while the second uses the corrected data to estimate the annual relative abundances across all monitored sites. In the first stage, intra-annual sampling gaps were controlled for by determining annual flight curves for each moth species and then using these curves to impute annual site totals (i.e. the estimated annual site totals if the whole of the flight curve had been fully sampled for each site) and thus adjust the observed annual site totals. In the second stage, the relative yearly abundance indices were determined by fitting a Poisson generalized linear model (GLM) to the imputed annual site totals. Site was incorporated as a categorical effect in the GLM but the year effect was continuous not categorical, allowing the temporal trend to be estimated from the full site level data (thereby incorporating as much of the original variability as possible), rather than by simply fitting a standard linear model to the final yearly indices.

For each species, the annual population change across the whole time series was calculated from the year coefficient returned by the GLM and, from this, a 10-year trend was calculated. It is important to note that this is an average 10-year trend across the whole time series and not the trend of the most recent 10 years of the series. The statistical significance of trends was estimated using bootstrapping. The results for each species were examined by staff from Butterfly Conservation, Rothamsted Research and CEH to differentiate reliable trends from those based on insufficient data. This yielded 422 resident macro-moth species with long-term trends that could be used in the criterion A2 assessment.

The average 10-year trends from the long-term time series for 422 resident species were assessed against the criterion A2 thresholds (CR \geq 80% decrease, EN \geq 50% decrease, VU \geq 30% decrease) to generate an initial classification. Species were not classified as NT at this stage, even if their trend was close to 30% decrease, although they could be assigned NT status by being downgraded in the subsequent adjustments. Species with statistically significant trends were classified directly against the thresholds.

Where species trends did not exceed the \geq 30% decrease threshold and were not statistically significant, we considered the 95% confidence intervals generated by the bootstrapping procedure. If the lower 95th centile trend failed to meet the \geq 30% decrease threshold, then we classified that species as LC, as we can have high confidence that the species has not decreased sufficiently to be at risk of extinction as defined by criterion A. If, however, the lower 95th centile trend exceeded the \geq 30% threshold, then we did not assess the species against criterion A as we have little confidence as to whether it is decreasing or not. Only a small minority of species fell into this category.

For those species that qualified for an initial threat classification, the species trend in recent years was then considered and the classification modified accordingly using expert judgement. This enables the recent change in population to be taken into account (as expected by IUCN under criterion A2), while recognising the increased extinction risk resulting from previous declines and depleted populations (IUCN 2017). Where the recent population change of each species was broadly comparable with the long-term change then no adjustment was made to the initial classification. If, however, the recent population data indicated that a species was no longer decreasing in population size at all, or if the recent decrease fell short of the IUCN threshold of \geq 30% decrease, its status was downlisted by one threat category (e.g. EN to VU, or VU to NT). If, on the other hand, the recent trend of a species indicated a far more rapid decrease than the long-term situation, its status was upgraded by one threat category. In extreme cases, changes of more than one threat category were considered (see Section 7.2). There were a small number of species that had undergone such severe decreases that they were no longer being monitored effectively by the RIS network in the most recent years (e.g. V-Moth *Macaria wauaria*, Stout Dart *Spaelotis ravidia*). In these cases, with no evidence to suggest that the rate or causes of decline had lessened, it was assumed that the long-term change had continued and no modification of the initial classification was made (in keeping with the precautionary principle).

5.5.3 Application of IUCN criterion B (geographical range)

NMRS data can be used to assess species against IUCN criteria B1 and B2, limited geographical range in the form of EOO and AOO respectively. Compromise is required in the choice of recording time period used to calculate these range size variables; it should be long enough to ensure that recording effort is sufficient to estimate species distributions accurately, but it should also, ideally, be recent enough to represent the current situation for each species (especially if species distributions are known to be changing rapidly over time). After exploration of these issues in the NMRS dataset, the period 2000-2014 was selected. This represents a very up-to-date record of species distribution combined with high levels of recording coverage.

EOO values (in km²) were calculated by CEH from NMRS records for each resident GB species for the period 2000-2014. EOO was calculated by fitting the minimum convex polygon to the records of each species, retaining discontinuities and disjunctions in distributions in keeping with IUCN guidance (IUCN 2017). The fitting of minimum convex

polygons was done in R using the `mcp` function in the `adehabitatHR` package (Calenge 2006). The minimum convex polygons were fitted to centroids of Ordnance Survey grid references, at the finest resolution available, for each record. The portion of the minimum convex polygon area that intersected with the land mass of GB was used as the EOO estimate. Thus, potentially large areas of sea that can be incorporated as part of the minimum convex polygon were excluded from EOO values, as they cannot provide habitat for any moth species. In keeping with IUCN guidelines, if the EOO calculated for a macro-moth species was less than its AOO, the EOO value was changed to make it the same as the AOO (IUCN 2017).

AOO was calculated from the number of 2 x 2 km grid squares (tetrads) occupied by each species in accordance with IUCN guidelines (IUCN 2017). All records in the period 2000-2014 for GB resident macro-moths were extracted from the NMRS and screened to remove occurrences from areas where the species was not likely to be breeding (see section 5.3). In addition to the NMRS database, for a few rare species, more detailed site dossiers and monitoring data were consulted to ensure that the correct distribution was recorded. The number of occupied tetrads was calculated for each species and converted into AOO (in km²). The number of occupied hectads, 10 km x 10 km grid squares, was also calculated for each species for use with subcriterion a and criterion D2 (see below).

Species with EOO values that met criterion B1 thresholds (CR < 100 km², EN < 5000 km², VU < 20000 km²) or AOO values that met criterion B2 thresholds (CR < 10 km², EN < 500 km², VU < 2000 km²) were then judged against three subcriteria (a = severely fragmented populations/small number of locations, b = evidence of continuing decline and c = extreme fluctuations) using rules and guidance from both IUCN and the IAWG/JNCC (see section 3). A species must meet two of the three subcriteria in order to qualify for the appropriate threat status. The IAWG/JNCC provide specific guidance on the application of subcriterion a (a species can only be considered to meet this subcriterion if it occurs in 10 or fewer current localities nationally) and subcriterion c (a species can only be considered to meet this subcriterion if it is subject to extreme population fluctuations that occur widely, rapidly and frequently and are not part of the natural population dynamics of the species). For the purposes of this review 'localities' were defined as occupied hectads.

Subcriterion b (continuing decline) was, in the main, assessed quantitatively, supplemented by expert judgement. GB trends in frequency of occurrence (covering the period 1970-2010) derived from NMRS data were used to assess most species, using results from Fox *et al.* 2014. These trends were generated using a statistical approach called Frescalo (Hill 2012; Isaac *et al.* 2014) to remove the potentially significant bias resulting from highly variable recording effort over time and space (Boakes *et al.* 2010). Even in recent years, annual sampling in the NMRS is insufficient to calculate short-term occupancy trends for a large number of species, hence a longer time-period was used to assess decline. Given that the most likely environmental drivers of change in GB macro-moth distributions (i.e. habitat deterioration, climate change, chemical and light pollution) are ongoing and intensifying, it is reasonable to assume that long-term occurrence trends represent the continuing situation for species. In addition to these frequency of occurrence trends, annual monitoring data were available for a few rare species enabling quantitative evidence of moth population trends to be used. In a small minority of species for which no quantitative trends were available, expert judgement was used to assess ongoing decline in the population, distribution or extent and quality of habitat. Whenever subcriterion b was met, the type of evidence used to support the decision was listed in the results spreadsheet.

Much checking and rechecking was undertaken to ensure that the subcriteria were applied consistently across species. If a species met two or more subcriteria then it was initially classified as CR, EN or VU depending on EOO and AOO value. If a species met only one subcriterion it was considered for NT status (see below) and if a species met none of the three subcriteria then it was classified LC. Subcriteria were not applied to species with EOO values exceeding the 20,000 km² threshold or AOO values exceeding the 2000 km² threshold under criterion B, as this is not required by the IUCN process.

The category NT is often used for species that meet the EOO or AOO thresholds under criterion B, but which only meet one of the three subcriteria. However, the IIAWG/JNCC have provided specific guidance that impacts on this approach (see section 3.2.2). Thus, in this review, moths have been classified as NT under criterion B in two circumstances: i). species that only meet subcriterion a (not b or c) as defined by the IIAWG/JNCC guidance and ii). species that only meet subcriterion b but which almost meet subcriterion a (i.e. occur in 11-12 hectads, or occur in 13-15 hectads and can be shown to be vulnerable to a specific and realistic threat). Species that meet subcriterion b but occur in more than 15 hectads had to be classified as LC under the IIAWG/JNCC guidance.

Species that have only recently (since year 2000) colonised Britain were an exception to this process. Most such species are likely to have a small EOO and AOO values simply as a result of having only just become established in Britain. As a result, they may meet EOO/AOO thresholds and subcriterion a and could qualify as NT. However, experience shows that many such species will spread rapidly in subsequent years and, in such circumstances, NT status would be inappropriate. More time is required to adequately judge the EOO and AOO of such recent arrivals and, in the future, they may genuinely qualify as threatened or NT species. In this review, these species have been downgraded to LC, with the reasoning noted in the results spreadsheet.

5.5.4 Application of IUCN criterion D2 (very small or restricted population)

GB macro-moths were also assessed against criterion D2. The IUCN process permits species to be classified as Vulnerable under criterion D2 if they have a very small AOO or number of locations (five or fewer) and if there is a plausible natural or anthropogenic threat that might, in the future, have such a massive impact on the existing population(s) as to lead to extinction or near extinction in one or two generations (i.e. max of one or two years for most moths). Simply meeting the AOO or number of locations threshold is not sufficient to merit listing a species under D2 (IUCN 2017).

Throughout this review, in keeping with IIAWG/JNCC guidelines, we defined locations as occupied hectads (unless the number of colonies was accurately known) and, therefore, only GB macro-moth species with current range size of ≤ 5 hectads could potentially qualify as threatened under IUCN criterion D2. We used expert opinion to judge whether such species faced a plausible threat that could rapidly result in Critically Endangered status or national extinction.

5.6 Consideration of the 'rescue effect'

The process described in section 5.5 produced an initial classification of IUCN threat status for each species. IUCN guidelines state that for threat classification at a regional level, as opposed to a global level, a third step in the process is required (see section 3.2.1). This third step involves adjustments to the assigned threat categories to take into account the potential for populations of threatened species to be supplemented by individuals originating elsewhere – the 'rescue effect' (Miller *et al.* 2007; IUCN 2012b).

Species that might realistically be subject to such a rescue effect should have their initial threat status downlisted, normally by one level.

Therefore, all macro-moth species initially classified as threatened (i.e. CR, EN, VU) or NT were subsequently assessed for the potential of a rescue effect from populations in other nearby countries. Other species were not assessed. Information on three aspects were used to assess the likelihood of a plausible rescue effect from outside GB:

- Knowledge of the size and frequency of past immigration events and likely dispersal ability for each species were derived from field guides (e.g. Waring, Townsend & Lewington 2009) and the scientific literature (e.g. Betzholtz & Franzén 2011; Slade *et al.* 2013; Jones *et al.* 2016).
- Information about the current status of species in neighbouring countries that could act as sources for a rescue effect was obtained from appropriate publications. Knowledge of the distribution, status and trends of macro-moths is limited in most European countries and lags far behind that available for butterflies or birds. However, recent Red Lists of macro-moths for Ireland (Allen *et al.* 2016) and the Netherlands (Ellis *et al.* 2013), as well as distribution maps for northern France (Lepertel & Quinette 2016) were utilised.
- Expert knowledge of larval hostplants and suitable habitats for each species was used to make a judgement as to the likelihood of an immigrant individual locating the necessary conditions to breed in GB.

Combining information from these three aspects enabled an expert judgement decision to be made for each species. Threat status was modified downwards, by one category, if we considered that there was a significant likelihood of a rescue effect, in accordance with IUCN guidelines (IUCN 2012b).

5.7 Classification into Nationally Rare and Nationally Scarce categories

As discussed in section 4, the Species Status project additionally classifies taxa according to national rarity categories of Nationally Rare (for those recorded as resident in ≤ 15 hectads) and Nationally Scarce (for those resident in 16-100 hectads).

We only assessed resident macro-moths against national rarity categories for this review. All records in the period 2000-2014 for GB resident macro-moths were extracted from the NMRS and screened to remove occurrences from areas where the species was not likely to be breeding (see section 5.3). In addition to the NMRS database, for a few rare species, more detailed site dossiers and monitoring data were consulted to ensure that the correct distribution was recorded. The number of occupied hectads was calculated for each species.

For the application of GB rarity status, it was not deemed appropriate to include species that have colonised recently. The year 2000 was chosen as the cut off, so moths that became resident in GB from 2000 onwards were not assessed. They will be assessed in future reviews, once it is clear whether they are likely to become widespread species in GB or remain scarce. The only exception was Pine-tree Lappet *Dendrolimus pini*, which although only added to the GB list in 2004 is assumed to be a long-term resident (Leverton 2016a).

5.8 Peer-review

The species assessments resulting from both the IUCN process and the national rarity classification were sent for consultation to experts in the statutory agencies and moth recording community. Comments were reviewed by the authors and adjustments made in a small number of cases.

6. Results of the macro-moth status review

6.1 Results spreadsheet

The key outcome of this status review is a results spreadsheet that lists all GB resident macro-moth species with their Red List assessment based on IUCN criteria (with supporting information), their national rarity category, and whether they are currently resident in each GB country (England, Scotland and Wales). The full results spreadsheet accompanies this report, but a summary version appears in Appendix 1 and the key findings are discussed below.

6.2 Red List assessment of GB macro-moths

In all, 768 resident or formerly resident macro-moth species were evaluated using the IUCN criteria and IAWG/JNCC guidelines as described in section 5.5. Table 1 shows the number classified to each appropriate IUCN Red List category. One species (Fen Square-spot *Diarsia florida*) was listed as Data Deficient as the status of this taxon is uncertain and the validity of recent GB records is unclear. In addition, three species (Common Forest Looper, Oak Processionary and Gypsy Moth), which are thought to have become established in Britain only as a result of accidental human importation, were treated as Not Applicable in accordance with IUCN rules (IUCN 2012a; 2012b).

Overall 3% (23 species) of GB macro-moths were categorised as Regionally Extinct and 7.2% (55 species) listed as threatened under the IUCN criteria. A further 7.6% (58 species) were classified as Near Threatened. All of these species are listed, together with their qualifying criteria codes, in Table 2. Almost all species with threatened or Near Threatened status were classified under criteria A2, B1 or B2. Only three species qualified under criterion D2. The remaining 81.8% of GB macro-moths were classed as Least Concern.

Table 1. Summary of the IUCN categories assigned to GB macro-moths.

IUCN category	Number of species	Percentage of species
Regionally Extinct	23	3.0%
Critically Endangered (Possibly Extinct)	3	0.4%
Critically Endangered	5	0.7%
Endangered	25	3.3%
Vulnerable	22	2.9%
Near Threatened	58	7.6%
Least Concern	628	81.8%
Data Deficient	1	0.1%
Not Applicable	3	0.4%

Table 2. Regionally extinct, threatened and Near Threatened GB macro-moths. Red List categories: RE= Regionally Extinct, CR (PE)= Critically Endangered (Possibly Extinct), CR= Critically Endangered, EN= Endangered, VU= Vulnerable, NT= Near Threatened.

Check-list No.	Taxon name	Vernacular name	Red List	Qualifying criteria
52.004	<i>Paranthrene tabaniformis</i>	Dusky Clearwing	RE	
66.011	<i>Phyllodesma ilicifolia</i>	Small Lappet	RE	
70.007	<i>Idaea humiliata</i>	Isle of Wight Wave	RE	
70.019	<i>Scopula immorata</i>	Lewes Wave	RE	
70.058	<i>Costaconvexa polygrammata</i>	Many-lined	RE	
70.220	<i>Isturgia limbaria</i>	Frosted Yellow	RE	
70.269	<i>Fagivorina arenaria</i>	Speckled Beauty	RE	
70.301	<i>Thetidia smaragdaria</i>	Essex Emerald	RE	
71.019	<i>Leucodonta bicoloria</i>	White Prominent	RE	
72.008	<i>Arctornis l-nigrum</i>	Black V Moth	RE	
72.014	<i>Laelia coenosa</i>	Reed Tussock	RE	
72.068	<i>Colobochyla salicalis</i>	Lesser Belle	RE	
72.086	<i>Minucia lunaris</i>	Lunar Double-stripe	RE	
73.029	<i>Acontia trabealis</i>	Spotted Sulphur	RE	
73.041	<i>Acronicta strigosa</i>	Marsh Dagger	RE	
73.043	<i>Acronicta auricoma</i>	Scarce Dagger	RE	
73.054	<i>Cucullia gnaphalii</i>	Cudweed	RE	
73.106	<i>Trachea atriplicis</i>	Orache Moth	RE	
73.153	<i>Pabulatrix pabulatricula</i>	Union Rustic	RE	
73.198	<i>Conistra erythrocephala</i>	Red-headed Chestnut	RE	
73.203	<i>Lithophane furcifera</i>	Conformist	RE	
73.262	<i>Pachetra sagittigera</i>	Feathered Ear	RE	
73.287	<i>Hadena irregularis</i>	Viper's Bugloss	RE	
73.143	<i>Oria musculosa</i>	Brighton Wainscot	CR (PE)	B2 a,b(iv)
73.199	<i>Jodia croceago</i>	Orange Upperwing	CR (PE)	B2 a,b(iv)
73.277	<i>Sideridis reticulata</i>	Bordered Gothic	CR (PE)	B2 a,b(iv)
54.007	<i>Zygaena viciae</i>	New Forest Burnet	CR	B2 a,c(iv)
70.291	<i>Siona lineata</i>	Black-veined Moth	CR	B1 a,b(iv,v)
72.032	<i>Coscinia cribraria</i>	Speckled Footman	CR	B1 a,b(iv,v)
73.078	<i>Acosmetia caliginosa</i>	Reddish Buff	CR	B2 a,b(iv)
73.349	<i>Spaelotis ravida</i>	Stout Dart	CR	A2 b, B2 a,b(iv),c(iii,iv)
52.015	<i>Pyropteron chrysidiformis</i>	Fiery Clearwing	EN	B2 a,b(iii,v)
54.005	<i>Zygaena loti</i>	Slender Scotch Burnet	EN	B1 a,b(iv), B2 a,b(iv)
65.014	<i>Cymatophorina diluta</i>	Oak Lutestring	EN	A2 b
66.012	<i>Gastropacha quercifolia</i>	Lappet	EN	A2 b
70.020	<i>Scopula nigropunctata</i>	Sub-angled Wave	EN	B2 a,b(iv)
70.088	<i>Eustroma reticulata</i>	Netted Carpet	EN	B2 a,c(iv)
70.124	<i>Pareulype berberata</i>	Barberry Carpet	EN	B2 a,b(iv)
70.148	<i>Eupithecia inturbata</i>	Maple Pug	EN	A2 b

70.178	<i>Eupithecia extensaria</i>	Scarce Pug	EN	B1 a,b(iv), B2 a,b(iv)
70.215	<i>Macaria wauaria</i>	V-Moth	EN	A2 b
70.228	<i>Epione vespertaria</i>	Dark Bordered Beauty	EN	B2 a,b(v)
70.260	<i>Peribatodes secundaria</i>	Feathered Beauty	EN	B2 a,b(iv)
70.293	<i>Aspitates gilvaria</i>	Straw Belle	EN	B2 a,b(iv)
70.304	<i>Thalera fimbrialis</i>	Sussex Emerald	EN	B2 a,b(iii,v)
72.018	<i>Orgyia recens</i>	Scarce Vapourer	EN	B2 a,b(iv)
72.064	<i>Lygephila craccae</i>	Scarce Blackneck	EN	B1 a,b(iv), B2 a,b(iv)
73.014	<i>Polychrysis moneta</i>	Golden Plusia	EN	A2 b
73.033	<i>Diloba caeruleocephala</i>	Figure of Eight	EN	A2 b
73.073	<i>Heliolithis maritima</i>	Shoulder-striped Clover	EN	B1 a,b(iv), B2 a,b(iv)
73.103	<i>Athetis pallustris</i>	Marsh Moth	EN	B2 a,b(iii,iv)
73.125	<i>Hydraecia osseola</i>	Marsh Mallow Moth	EN	B1 a,b(iii,v), B2 a,b(iii,v)
73.135	<i>Sedina buettneri</i>	Blair's Wainscot	EN	B2 a,b(iii)
73.146	<i>Photodes captiuncula</i>	Least Minor	EN	B2 a,b(iv)
73.259	<i>Polia bombycina</i>	Pale Shining Brown	EN	B2 a,b(iv)
73.285	<i>Hadena caesia</i>	Grey	EN	B2 a,b(iv)
65.002	<i>Watsonalla binaria</i>	Oak Hook-tip	VU	A2 b
66.002	<i>Trichiura crataegi</i>	Pale Eggar	VU	A2 b
66.003	<i>Malacosoma neustria</i>	Lackey	VU	A2 b
69.014	<i>Hyles gallii</i>	Bedstraw Hawk-moth	VU	B2 a,b(iv)
70.040	<i>Scotopteryx mucronata</i>	Lead Belle	VU	A2 b
70.069	<i>Pelurga comitata</i>	Dark Spinach	VU	A2 b
70.092	<i>Eulithis mellinata</i>	Spinach	VU	A2 b
70.158	<i>Eupithecia pusillata</i>	Juniper Pug	VU	A2 b
70.177	<i>Eupithecia satyrata</i>	Satyr Pug	VU	A2 b
70.247	<i>Phigalia pilosaria</i>	Pale Brindled Beauty	VU	A2 b
70.256	<i>Erannis defoliaria</i>	Mottled Umber	VU	A2 b
70.282	<i>Theria primaria</i>	Early Moth	VU	A2 b
71.029	<i>Clostera anachoreta</i>	Scarce Chocolate-tip	VU	D2
73.061	<i>Stilbia anomala</i>	Anomalous	VU	A2 b
73.064	<i>Amphipyra tragopoginis</i>	Mouse Moth	VU	A2 b
73.065	<i>Asteroscopus sphinx</i>	Sprawler	VU	A2 b
73.148	<i>Photodes morrisii</i>	Morris's Wainscot (incl. Bond's Wainscot)	VU	D2
73.271	<i>Ceramica pisi</i>	Broom Moth	VU	A2 b
73.252	<i>Tholera cespitis</i>	Hedge Rustic	VU	A2 b
73.313	<i>Euxoa tritici</i>	White-line Dart	VU	A2 b
73.314	<i>Euxoa nigricans</i>	Garden Dart	VU	A2 b
73.338	<i>Lycophotia porphyrea</i>	True Lover's Knot	VU	A2 b
50.003	<i>Phragmataecia castaneae</i>	Reed Leopard	NT	B1 a, B2 a
54.001	<i>Jordanita globulariae</i>	Scarce Forester	NT	B1 a, B2 a
54.006	<i>Zygaena exulans</i>	Scotch Burnet	NT	B1 a, B2 a
65.006	<i>Sabra harpagula</i>	Scarce Hook-tip	NT	B1 a, B2 a

65.015	<i>Polyphoca ridens</i>	Frosted Green	NT	A2 b
66.009	<i>Dendrolimus pini</i>	Pine-tree Lappet	NT	B2 a
67.001	<i>Endromis versicolora</i>	Kentish Glory	NT	B1 b(iv), B2 b(iv)
70.003	<i>Idaea ochrata</i>	Bright Wave	NT	B2 a
70.005	<i>Idaea dilutaria</i>	Silky Wave	NT	B2 a
70.014	<i>Idaea contiguaria</i>	Weaver's Wave	NT	B1 a, B2 a
70.030	<i>Cyclophora pendularia</i>	Dingy Mocha	NT	B1 b(iv), B2 b(iv)
70.048	<i>Xanthorhoe decoloraria</i>	Red Carpet	NT	A2 b
70.052	<i>Xanthorhoe ferrugata</i>	Dark-barred Twin-spot Carpet	NT	A2 b
70.140	<i>Gagitodes sagittata</i>	Marsh Carpet	NT	B1 b(iv), B2 b(iv)
70.150	<i>Eupithecia linariata</i>	Toadflax Pug	NT	A2 b
70.160	<i>Eupithecia tripunctaria</i>	White-spotted Pug	NT	A2 b
70.163	<i>Eupithecia lariciata</i>	Larch Pug	NT	A2 b
70.187	<i>Eupithecia icterata</i>	Tawny Speckled Pug	NT	A2 b
70.188	<i>Eupithecia succenturiata</i>	Bordered Pug	NT	A2 b
70.190	<i>Eupithecia subfuscata</i>	Grey Pug	NT	A2 b
70.196	<i>Chesias rufata</i>	Broom-tip	NT	A2 b
70.197	<i>Lithostege griseata</i>	Grey Carpet	NT	B2 b(iv)
70.218	<i>Chiasmia clathrata</i>	Latticed Heath	NT	A2 b
70.232	<i>Ennomos autumnaria</i>	Large Thorn	NT	A2 b
70.235	<i>Ennomos fuscantaria</i>	Dusky Thorn	NT	A2 b
70.236	<i>Ennomos erosaria</i>	September Thorn	NT	A2 b
70.292	<i>Dyscia fagaria</i>	Grey Scalloped Bar	NT	A2 b
70.296	<i>Aplasta ononaria</i>	Rest Harrow	NT	D2
72.026	<i>Arctia caja</i>	Garden Tiger	NT	A2 b
72.039	<i>Pelosia muscerda</i>	Dotted Footman	NT	B2 a
72.040	<i>Pelosia obtusa</i>	Small Dotted Footman	NT	B2 a
72.048	<i>Eilema pygmaeola</i>	Pigmy Footman	NT	B2 a
72.051	<i>Paracolax tristalis</i>	Clay Fan-foot	NT	B1 b(iv), B2 b(iv)
72.056	<i>Pechipogo strigilata</i>	Common Fan-foot	NT	B2 b(iv)
72.063	<i>Lygephila pastinum</i>	Blackneck	NT	A2 b
72.081	<i>Catocala sponsa</i>	Dark Crimson Underwing	NT	B2 a
72.082	<i>Catocala promissa</i>	Light Crimson Underwing	NT	B1 a, B2 a
73.027	<i>Deltote bankiana</i>	Silver Barred	NT	B1 a, B2 a
73.031	<i>Tyta luctuosa</i>	Four-spotted	NT	B2 b(iv)
73.122	<i>Gortyna borelii</i>	Fisher's Estuarine Moth	NT	B1 a, B2 a
73.140	<i>Archanara neurica</i>	White-mantled Wainscot	NT	B1 a, B2 a
73.150	<i>Protarchanara brevilinea</i>	Fenn's Wainscot	NT	B1 b(iii), B2 b(iii)
73.157	<i>Apamea anceps</i>	Large Nutmeg	NT	A2 b
73.171	<i>Litoligia literosa</i>	Rosy Minor	NT	A2 b
73.182	<i>Cirrhia icteritia</i>	Sallow	NT	A2 b
73.183	<i>Cirrhia gilvago</i>	Dusky-lemon Sallow	NT	A2 b
73.186	<i>Agrochola lychnidis</i>	Beaded Chestnut	NT	A2 b
73.188	<i>Agrochola helvola</i>	Flounced Chestnut	NT	A2 b
73.218	<i>Dicycla oo</i>	Heart Moth	NT	B1 b(iv), B2 b(iv)
73.220	<i>Brachylochia viminalis</i>	Minor Shoulder-knot	NT	A2 b

73.228	<i>Antitype chi</i>	Grey Chi	NT	A2 b
73.234	<i>Dasypolia templi</i>	Brindled Ochre	NT	A2 b
73.279	<i>Hecatera bicolorata</i>	Broad-barred White	NT	A2 b
73.284	<i>Hadena albimacula</i>	White Spot	NT	B1 a, B2 a
73.306	<i>Eriopygodes imbecilla</i>	Silurian	NT	B1 a, B2 a
73.351	<i>Graphiphora augur</i>	Double Dart	NT	A2 b
73.364	<i>Coenophila subrosea</i>	Rosy Marsh Moth	NT	B1 a, B2 a
73.365	<i>Eugnorisma glareosa</i>	Autumnal Rustic	NT	A2 b

6.3 National rarity assessment of GB macro-moths

A total of 64 species were classified as Nationally Rare (Table 3) and an additional 99 species as Nationally Scarce. A further 16 species that potentially qualified as Nationally Rare or Nationally Scarce (i.e. occur in ≤ 100 hectads) were instead listed as Naturalised (3 species, which occur due to accidental introduction) or were not assessed (13 species, which have only recently colonised GB).

Interestingly, none of the Nationally Scarce species achieved a Red List threatened or Near Threatened category; all were categorised as Least Concern under the IUCN and IAWG/JNCC guidelines. This is due to the emphasis placed on recent or ongoing decline in the IUCN process rather than geographical rarity. Furthermore, just over half of the Nationally Rare species also failed to meet the Red List criteria for threatened status. Most of these were classified as Near Threatened, but five Nationally Rare species were listed as Least Concern.

Table 3. GB macro-moths classified as Nationally Rare, listed in checklist order.

Check-list No.	Taxon name	Vernacular name	National rarity
50.003	<i>Phragmataecia castaneae</i>	Reed Leopard	Nationally Rare
52.015	<i>Pyropteron chrysidiformis</i>	Fiery Clearwing	Nationally Rare
54.001	<i>Jordanita globulariae</i>	Scarce Forester	Nationally Rare
54.005	<i>Zygaena loti</i>	Slender Scotch Burnet	Nationally Rare
54.006	<i>Zygaena exulans</i>	Scotch Burnet	Nationally Rare
54.007	<i>Zygaena viciae</i>	New Forest Burnet	Nationally Rare
65.006	<i>Sabra harpagula</i>	Scarce Hook-tip	Nationally Rare
66.009	<i>Dendrolimus pini</i>	Pine-tree Lappet	Nationally Rare
67.001	<i>Endromis versicolora</i>	Kentish Glory	Nationally Rare
69.014	<i>Hyles gallii</i>	Bedstraw Hawk-moth	Nationally Rare
70.003	<i>Idaea ochrata</i>	Bright Wave	Nationally Rare
70.005	<i>Idaea dilutaria</i>	Silky Wave	Nationally Rare
70.014	<i>Idaea contiguaria</i>	Weaver's Wave	Nationally Rare
70.017	<i>Idaea degeneraria</i>	Portland Ribbon Wave	Nationally Rare
70.020	<i>Scopula nigropunctata</i>	Sub-angled Wave	Nationally Rare
70.030	<i>Cyclophora pendularia</i>	Dingy Mocha	Nationally Rare
70.088	<i>Eustroma reticulata</i>	Netted Carpet	Nationally Rare
70.124	<i>Pareulype berberata</i>	Barberry Carpet	Nationally Rare
70.140	<i>Gagitodes sagittata</i>	Marsh Carpet	Nationally Rare
70.149	<i>Eupithecia abietaria</i>	Cloaked Pug	Nationally Rare

70.178	<i>Eupithecia extensaria</i>	Scarce Pug	Nationally Rare
70.197	<i>Lithostege griseata</i>	Grey Carpet	Nationally Rare
70.228	<i>Epione vespertaria</i>	Dark Bordered Beauty	Nationally Rare
70.249	<i>Lycia lapponaria</i>	Rannoch Brindled Beauty	Nationally Rare
70.260	<i>Peribatodes secundaria</i>	Feathered Beauty	Nationally Rare
70.291	<i>Siona lineata</i>	Black-veined Moth	Nationally Rare
70.293	<i>Aspitates gilvaria</i>	Straw Belle	Nationally Rare
70.296	<i>Aplasta ononaria</i>	Rest Harrow	Nationally Rare
70.304	<i>Thalera fimbrialis</i>	Sussex Emerald	Nationally Rare
71.029	<i>Clostera anachoreta</i>	Scarce Chocolate-tip	Nationally Rare
72.018	<i>Orgyia recens</i>	Scarce Vapourer	Nationally Rare
72.032	<i>Coscinia cribraria</i>	Speckled Footman	Nationally Rare
72.039	<i>Pelosia muscerda</i>	Dotted Footman	Nationally Rare
72.040	<i>Pelosia obtusa</i>	Small Dotted Footman	Nationally Rare
72.048	<i>Eilema pygmaeola</i>	Pigmy Footman	Nationally Rare
72.050	<i>Setina irrorella</i>	Dew Moth	Nationally Rare
72.051	<i>Paracolax tristalis</i>	Clay Fan-foot	Nationally Rare
72.056	<i>Pechipogo strigilata</i>	Common Fan-foot	Nationally Rare
72.064	<i>Lygephila craccae</i>	Scarce Blackneck	Nationally Rare
72.081	<i>Catocala sponsa</i>	Dark Crimson Underwing	Nationally Rare
72.082	<i>Catocala promissa</i>	Light Crimson Underwing	Nationally Rare
73.027	<i>Deltote bankiana</i>	Silver Barred	Nationally Rare
73.031	<i>Tyta luctuosa</i>	Four-spotted	Nationally Rare
73.073	<i>Heliothis maritima</i>	Shoulder-striped Clover	Nationally Rare
73.078	<i>Acosmetia caliginosa</i>	Reddish Buff	Nationally Rare
73.103	<i>Athetis pallustris</i>	Marsh Moth	Nationally Rare
73.122	<i>Gortyna borelii</i>	Fisher's Estuarine Moth	Nationally Rare
73.125	<i>Hydraecia osseola</i>	Marsh Mallow Moth	Nationally Rare
73.135	<i>Sedina buettneri</i>	Blair's Wainscot	Nationally Rare
73.140	<i>Archanara neurica</i>	White-mantled Wainscot	Nationally Rare
73.143	<i>Oria musculosa</i>	Brighton Wainscot	Nationally Rare
73.146	<i>Photodes captiuncula</i>	Least Minor	Nationally Rare
73.148	<i>Photodes morrisii</i>	Morris's Wainscot	Nationally Rare
73.150	<i>Protarchanara brevilinea</i>	Fenn's Wainscot	Nationally Rare
73.199	<i>Jodia croceago</i>	Orange Upperwing	Nationally Rare
73.218	<i>Dicycla oo</i>	Heart Moth	Nationally Rare
73.259	<i>Polia bombycina</i>	Pale Shining Brown	Nationally Rare
73.277	<i>Sideridis reticulata</i>	Bordered Gothic	Nationally Rare
73.284	<i>Hadena albimacula</i>	White Spot	Nationally Rare
73.285	<i>Hadena caesia</i>	Grey	Nationally Rare
73.306	<i>Eriopygodes imbecilla</i>	Silurian	Nationally Rare
73.349	<i>Spaelotis ravida</i>	Stout Dart	Nationally Rare
73.362	<i>Xestia ashworthii</i>	Ashworth's Rustic	Nationally Rare
73.364	<i>Coenophila subrosea</i>	Rosy Marsh Moth	Nationally Rare

6.4 Resident macro-moth species in different GB countries

The current resident status of 768 macro-moth species was assessed in this review. Twenty-three species that were once resident in GB are not currently considered to be resident. The current resident status of the remaining 745 species in each GB country is summarised in Table 4. Although more species occur in England than in either Scotland or Wales, all three countries have over 500 currently resident macro-moth species.

Almost two-thirds of macro-moth species that are currently resident in GB occur in all three countries. A further 17% occur in England and Wales only and 15% in England only. Only 22 species are resident only in Scotland (within GB) and just 2 are only resident in Wales. Table 5 sets out the GB distributions of macro-moth species by country.

Table 4. Total number of macro-moth species currently resident in each GB country.

Country	No. currently resident macro-moth species	Percentage of currently resident GB macro-moth species
England	721	97%
Scotland	505	68%
Wales	597	80%

Table 5. Geographical distribution of currently resident GB macro-moths by countries.

Geographic area	No. currently resident macro-moth species	Percentage of currently resident GB macro-moth species
England only	110	15%
Scotland only	22	3%
Wales only	2	0.3%
England & Scotland only	16	2%
England & Wales only	128	17%
Scotland & Wales only	0	0%
All three countries	467	63%

The threatened species identified in this review are very unevenly distributed between the three GB countries; 52 of the 55 threatened species are currently resident in England and 26 of these occur only in England. Twenty-five threatened species are resident in Scotland (three of these only in Scotland) and 25 currently occur in Wales. Among the 58 macro-moths categorised as NT, 54 are resident in England, 27 in Scotland and 33 in Wales. Twenty-two NT species occur only in England, three only in Scotland and one only in Wales. The figures for Nationally Rare and Nationally Scarce species are given in Table 6.

Table 6. The number of threatened, Near Threatened and Nationally Rare/Scarce macro-moth species that occur in each GB country.

	Threatened species (n=55)	NT species (n=58)	Nationally Rare species (n=64)	Nationally Scarce species (n=99)
England	52	54	55	84
Scotland	25	27	10	42
Wales	25	33	8	42

7. Discussion

This status review was carried out in general accordance with both IUCN and IAWG/JNCC guidelines. While we believe that the results outlined in section 6, Appendix 1 and the accompanying spreadsheet are a fair and correct assessment of GB macro-moths in this context, it is clear that the classification of species has been influenced by a number of specific factors. These may affect both the classification of macro-moths into IUCN Red List categories and how the overall status review results for macro-moths compare with those of other invertebrate groups and, therefore, they are discussed briefly here.

7.1 Distribution recording intensity relative to other GB invertebrates

Macro-moths are one of the most comprehensively recorded invertebrate taxa in GB, with thousands of active recorders and millions of recent distribution records. While this effort provides good evidence for the classification of macro-moth species against criteria B and D in this review, the high levels of recording may make direct comparison with status reviews of other much more sparsely recorded taxa more difficult. Only 3.9% of GB macro-moths qualified as threatened under criteria B or D (i.e. excluding those that qualified under criterion A). This compares to almost 16% of spiders (Harvey *et al.* 2017), 12.9% carabid beetles (Telfer 2016), 9.8% mayflies (Macadam 2016) and 8.7% of caddis flies (Wallace 2016) that were classified using criteria B or D.

Are rare macro-moths genuinely more widespread (and therefore less threatened) than rare species of these other invertebrate groups, or is this an artefact of the higher levels of moth recording? We suspect that the latter is the case and that increased recording for other invertebrate taxa would lead to larger recorded distributions and lower numbers of Red List species (and, indeed, Nationally Rare species).

The existence of the Rothamsted Insect Survey and the long-term, standardised monitoring of moth abundance enables the application of criterion A to macro-moths in this review – something that is impossible for most other GB invertebrates. As a result of the use of criterion A, the total proportion of moths classified as threatened rises to 7.2% of assessed species. This total is much more similar to the proportions for other recent status reviews of GB insects e.g. 9.8% mayflies (Macadam 2016) and 8.7% of caddis flies (Wallace 2016) and invertebrates e.g. 9.4% of non-marine molluscs (Seddon, Killeen & Folwes 2014).

7.2 Application of IUCN criterion A2

The application of criterion A to the macro-moths in this review engendered much discussion and resulted in the use of a modified assessment methodology. The raw population data from the Rothamsted Insect Survey were modelled and trends estimated using a complex, computer-intensive, innovative approach developed by statisticians at Butterfly Conservation and CEH. In particular, trends were derived from within the model, making use of the variance estimated around each annual population index, rather than simply being applied *post hoc* as regressions through the mean annual indices. Variance around the trend estimates themselves was also determined, using a 1000 iteration bootstrapping procedure, enabling the statistical significance of the population trends to be determined.

Aside from these analytical advances, the main difference in our approach to that of a standard IUCN Red List assessment was in the use of 10-year population change

averaged over the entire time series to determine the initial classification of each species. This approach was used due to the high likelihood of inaccurate extinction risk assessments (false positives and false negatives) arising from trend estimates based only on the most recent 10 years for species, such as GB macro-moths, with short (typically ≤ 1 year) generation times and very high inter-annual population variability (Fox *et al.* 2018). However, having adopted this approach, we then sought to ensure compliance with the ethos behind IUCN criterion A, namely that it should reflect recent population decrease and not be used to add species to Red Lists on the basis of historical rates of decline that have long since ameliorated.

Thus, we examined the recent population data for each species that qualified as threatened using the average population change from the whole time series and used this information, together with expert judgement, to adjust the threat category, where deemed appropriate. Where the steep decline of species appeared to be slowing, stabilizing or reversing in recent years, the risk of extinction was downgraded. In cases where there was no apparent change to the rate of decline, the initial classification was retained and if the rate of decline had substantially increased in recent years, the threat category would have been upgraded (although no species qualified for this adjustment). In many cases, where the rate of decline had slowed, the change was recent and there were ongoing indications in the data that further population decrease may occur (as well as no evidence that the drivers of decline had ceased). Thus, we deemed it appropriate to downgrade the initial threat category for such species rather than classifying them as Least Concern, as might have been the result if they had been assessed just over the last 10 years.

Of the 57 species that met the criterion A2 decline threshold of $\geq 30\%$ when assessed using the average 10-year trend, the threat category was not modified in 25 cases, was downgraded by one category in 31 cases and downgraded by two categories in a single case (Dusky Thorn *Ennomos fuscantaria*) on the basis of data from recent years. The latter case was the only example that clearly showed a historical decline that had ceased a considerable time ago (in the early 1990s) followed by a recent steep increase in abundance.

In future assessments a more complex trend modelling approach incorporating all of the available time series data (as is encouraged by IUCN) while only estimating the trend from the final 10 years could be employed to ameliorate the problems with trends based on just the last 10 years of data. This might then negate the need for the use of a long-term average trend with expert judgement modification.

7.3 Application of IUCN criterion B

In applying criterion B (geographical range in the form of EOO and AOO), the IAWG/JNCC guidelines played a significant role in determining the outcome. Specifically, these guidelines state that a declining species cannot be listed as threatened if it occurs in > 10 current localities/hectads, even if it would normally have qualified under IUCN rules because it meets EOO or AOO thresholds and the required subcriteria. This precise guidance was created to reduce variation in how different reviewers can apply criterion B and thus help standardise the species status review process across different taxonomic groups. However, in our experience the > 10 hectads rule had notable implications for the macro-moth review. Rare species with ongoing declines that occurred in just over 10 hectads (e.g. Dingy Mocha *Cyclophora pendularia*, Marsh Carpet *Gagitodes sagittata* and Kentish Glory *Endromis versicolora*) could only be listed as NT, even if their occupied hectads were widely separated (highly fragmented) in the landscape. It could be argued

that 10 locations is not a very extensive distribution and, therefore, quite a low threshold, especially if those locations are isolated from each other and if the species is in decline.

The IAWG/JNCC guidelines had an even greater impact on the number of species ultimately listed as NT under criterion B. A total of 80 macro-moth species that would have been classified as NT on the basis of meeting EOO or AOO thresholds plus subcriterion b (ongoing decline) were downgraded to LC because they occurred in > 15 hectads. Given that only 58 species qualify as NT in this status review, the exclusion of a further 80 from this category shows the significant effect of the (non-IUCN) IAWG/JNCC guidelines.

7.4 Date period

In any status review there is a trade-off involved in the choice of date period. The period needs to be long enough to ensure that sufficient recording has been undertaken to represent adequately the true distributions of species. However, many species are undergoing rapid distribution change and so such changes within the chosen date period will not be reflected in the results.

Thanks to the high levels of recording of GB macro-moths, we were able to use a date period (2000-2014) for criteria B and D assessments that was both up-to-date and very short by comparison with recent status reviews of many other taxa. Nevertheless, it still represents a 15-year period and inevitably, some macro-moth species have changed considerably in that time. For example, Pale Shining Brown *Polia bombycina* was considered resident in seven hectads in the period 2000-2014, but has only been recorded in two of these since 2010 (and only in two tetrads). Thus, while Pale Shining Brown qualifies as Endangered based on the period 2000-2014, it would be Critically Endangered under criterion B based on records for 2010-2014.

This date period problem is unavoidable, but its influence on the results should be acknowledged. Repeating the status review process at regular intervals (e.g. every 5-10 years) in the future will enable changes to be reflected over time.

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Appendix 1. Summary results of GB macro-moth status review (species in taxonomic order)

Taxon	Vernacular name	Red List category	Red List qualifying criteria	Rationale	No. hectads 2000-14	GB Rarity status	England			Scotland			Wales		
							E	S	W	E	S	W	E	S	W
<i>Triodia sylvina</i>	Orange Swift	LC			1307		E	S	W						
<i>Korscheltellus lupulina</i>	Common Swift	LC			1410		E	S	W						
<i>Korscheltellus fusconebulosa</i>	Map-winged Swift	LC			1150		E	S	W						
<i>Phymatopus hecta</i>	Gold Swift	LC			769		E	S	W						
<i>Hepialus humuli</i>	Ghost Moth	LC			1539		E	S	W						
<i>Cossus cossus</i>	Goat Moth	LC			106		E	S	W						
<i>Zeuzera pyrina</i>	Leopard Moth	LC			755		E							W	
<i>Phragmataecia castaneae</i>	Reed Leopard	NT	B1 a, B2 a	Rare moth threatened by sea level rise, water abstraction and eutrophication	8	Nationally Rare	E								
<i>Pennisetia hylaeiformis</i>	Raspberry Clearwing	LC		Recent colonist (2007 - Parsons 2010)	26	recent colonist not assessed	E								
<i>Sesia apiformis</i>	Hornet Moth	LC			174		E								
<i>Sesia bembeciformis</i>	Lunar Hornet Moth	LC			235		E	S	W						
<i>Paranthrene tabaniformis</i>	Dusky Clearwing	RE		Last resident record 1924 (Parsons 2003)	0										
<i>Synanthedon scoliaeformis</i>	Welsh Clearwing	LC			37	Nationally Scarce	E	S	W						
<i>Synanthedon sphecoformis</i>	White-barred Clearwing	LC			21	Nationally Scarce	E								W
<i>Synanthedon culiciformis</i>	Large Red-belted Clearwing	LC			56	Nationally Scarce	E	S	W						
<i>Synanthedon formicaeformis</i>	Red-tipped Clearwing	LC			156		E								W
<i>Synanthedon flaviventris</i>	Sallow Clearwing	LC			23	Nationally Scarce	E								
<i>Synanthedon andrenaeformis</i>	Orange-tailed Clearwing	LC			107		E								W
<i>Synanthedon myopaeformis</i>	Red-belted Clearwing	LC			158		E								W
<i>Synanthedon vespiformis</i>	Yellow-legged Clearwing	LC			137		E								W
<i>Synanthedon tipuliformis</i>	Currant Clearwing	LC			254		E	S	W						

<i>Bembecia ichneumoniformis</i>	Six-belted Clearwing	LC			292		E		W
<i>Pyropteron chrysidiformis</i>	Fiery Clearwing	EN	B2 a,b(iii,v)	Rare species with population decline and habitat deterioration	8	Nationally Rare	E		
<i>Pyropteron muscaeformis</i>	Thrift Clearwing	LC			75	Nationally Scarce	E	S	W
<i>Apoda limacodes</i>	Festoon	LC			175		E		
<i>Heterogenea asella</i>	Triangle	LC			38	Nationally Scarce	E		
<i>Jordanita globulariae</i>	Scarce Forester	NT	B1 a, B2 a	Rare species with no evidence of current decline but sensitive to grazing intensity on chalk downland sites	8	Nationally Rare	E		
<i>Adscita stacies</i>	Forester	LC			150		E	S	W
<i>Adscita geryon</i>	Cistus Forester	LC			56	Nationally Scarce	E		W
<i>Zygaena purpuralis</i>	Transparent Burnet	LC			20	Nationally Scarce		S	
<i>Zygaena loti</i>	Slender Scotch Burnet	EN	B1 a,b(iv), B2 a,b(iv)	Rare and highly restricted species with distribution decline	7	Nationally Rare		S	
<i>Zygaena exulans</i>	Scotch Burnet	NT	B1 a, B2 a	Rare and highly restricted species that is considered stable at present but potentially threatened by climate change	3	Nationally Rare		S	
<i>Zygaena viciae</i>	New Forest Burnet	CR	B2 a,c(iv)	Only resident at one site. Severe fluctuations in abundance resulting from unplanned livestock incursions	1	Nationally Rare		S	
<i>Zygaena filipendulae</i>	Six-spot Burnet	LC			1438		E	S	W
<i>Zygaena lonicerae</i>	Narrow-bordered Five-spot Burnet (incl. Talisker Burnet)	LC			765		E	S	W
<i>Zygaena trifolii</i>	Five-spot Burnet	LC			287		E		W
<i>Falcaria lacertinaria</i>	Scalloped Hook-tip	LC			894		E	S	W
<i>Watsonalla binaria</i>	Oak Hook-tip	VU	A2 b	Continued steep population decline	1000		E	S	W
<i>Watsonalla cultraria</i>	Barred Hook-tip	LC			484		E		W
<i>Drepana falcataria</i>	Pebble Hook-tip	LC			1314		E	S	W
<i>Sabra harpagula</i>	Scarce Hook-tip	NT	B1 a, B2 a	Rare species, confined to small GB range but no evidence of current decline	4	Nationally Rare	E		W
<i>Cilix glaucata</i>	Chinese Character	LC			1294		E	S	W

<i>Thyatira batis</i>	Peach Blossom	LC			1447		E	S	W
<i>Habrosyne pyritoides</i>	Buff Arches	LC			1310		E	S	W
<i>Tetthea ocularis</i>	Figure of Eighty	LC			1019		E	S	W
<i>Tetthea or</i>	Poplar Lutestring	LC			279		E	S	W
<i>Tettheella fluctuosa</i>	Satin Lutestring	LC			199		E	S	W
<i>Ochropacha duplaris</i>	Common Lutestring	LC			1155		E	S	W
<i>Cymatophorina diluta</i>	Oak Lutestring	EN	A2 b	Continued steep population decline	218		E		W
<i>Polyplocia ridens</i>	Frosted Green	NT	A2 b	Steep population decline to early 2000s, but some amelioration over recent years	540		E		W
<i>Achlya flavicornis</i>	Yellow Horned	LC			832		E	S	W
<i>Poecilocampa populi</i>	December Moth	LC			1145		E	S	W
<i>Trichiura crataegi</i>	Pale Eggar	VU	A2 b	Continued steep population decline, reaching the lowest index of the whole time series in 2016	519		E	S	W
<i>Malacosoma neustria</i>	Lackey	VU	A2 b	Ongoing steep population decline despite high index value in 2007	675		E		W
<i>Malacosoma castrensis</i>	Ground Lackey	LC			20	Nationally Scarce	E		
<i>Eriogaster lanestris</i>	Small Eggar	LC			137		E		W
<i>Lasiocampa trifolii</i>	Grass Eggar (incl. Pale Grass Eggar)	LC			40	Nationally Scarce	E		W
<i>Lasiocampa quercus</i>	Oak Eggar (incl. Northern Eggar)	LC			1216		E	S	W
<i>Macrothylacia rubi</i>	Fox Moth	LC			1021		E	S	W
<i>Dendrolimus pini</i>	Pine-tree Lappet	NT	B2 a	Rare species but no evidence of current decline. Treating this species as an overlooked resident, although its GB origins are not completely clear	5	Nationally Rare		S	
<i>Euthrix potatoria</i>	Drinker	LC			1611		E	S	W
<i>Phyllodesma ilicifolia</i>	Small Lappet	RE		Last resident record 1939 (Leverton 2016b)	0				

<i>Gastropacha quercifolia</i>	Lappet	EN	A2 b	Steep population decrease and now effectively extinct in RIS network. There is no evidence that the rate or causes of decline have lessened	135		E		W
<i>Endromis versicolora</i>	Kentish Glory	NT	B1 b(iv), B2 b(iv)	Rare species with distribution decline. Its ephemeral habitat is threatened by either too much or too little grazing/ browsing of birch woodlands	15	Nationally Rare		S	
<i>Saturnia pavonia</i>	Emperor Moth	LC			998		E	S	W
<i>Mimas tiliae</i>	Lime Hawk-moth	LC			1013		E		W
<i>Smerinthus ocellata</i>	Eyed Hawk-moth	LC			1020		E	S	W
<i>Laothoe populi</i>	Poplar Hawk-moth	LC			1910		E	S	W
<i>Sphinx ligustri</i>	Privet Hawk-moth	LC			766		E		W
<i>Sphinx pinastri</i>	Pine Hawk-moth	LC			557		E		W
<i>Hemaris tityus</i>	Narrow-bordered Bee Hawk	LC			179		E	S	W
<i>Hemaris fuciformis</i>	Broad-bordered Bee Hawk	LC			101		E		W
<i>Macroglossum stellatarum</i>	Humming-bird Hawk-moth	LC			1534		E		W
<i>Hyles gallii</i>	Bedstraw Hawk-moth	VU	B2 a,b(iv)	Definite loss of one colony and possible declines at another. No evidence of new colonies/expansion but plausible rescue effect	10	Nationally Rare	E		
<i>Deilephila elpenor</i>	Elephant Hawk-moth	LC			1753		E	S	W
<i>Deilephila porcellus</i>	Small Elephant Hawk-moth	LC			1096		E	S	W
<i>Idaea muricata</i>	Purple-bordered Gold	LC			43	Nationally Scarce	E		W
<i>Idaea ochrata</i>	Bright Wave	NT	B2 a	Rare moth with colonies threatened by development, alien invasive plants and potentially sea level rise	4	Nationally Rare	E		
<i>Idaea rusticata</i>	Least Carpet	LC			403		E		W
<i>Idaea dilutaria</i>	Silky Wave	NT	B2 a	Rare moth with habitat that is threatened by under or over grazing	4	Nationally Rare	E		W

<i>Idaea fuscovenosa</i>	Dwarf Cream Wave	LC			639		E		W
<i>Idaea humiliata</i>	Isle of Wight Wave	RE		Last resident record 1931 (Parsons 2003)	0				
<i>Idaea seriata</i>	Small Dusty Wave	LC			920		E	S	W
<i>Idaea subsericeata</i>	Satin Wave	LC			453		E	S	W
<i>Idaea sylvestraria</i>	Dotted Border Wave	LC			42	Nationally Scarce	E		
<i>Idaea dimidiata</i>	Single-dotted Wave	LC			1396		E	S	W
<i>Idaea trigeminata</i>	Treble Brown Spot	LC			581		E		W
<i>Idaea biselata</i>	Small Fan-footed Wave	LC			1763		E	S	W
<i>Idaea contiguaria</i>	Weaver's Wave	NT	B1 a, B2 a	Highly restricted moth threatened by burning	6	Nationally Rare			W
<i>Idaea emarginata</i>	Small Scallop	LC			461		E		W
<i>Idaea aversata</i>	Riband Wave	LC			1890		E	S	W
<i>Idaea degeneraria</i>	Portland Ribbon Wave	LC		Plausible rescue effect	5	Nationally Rare	E		
<i>Idaea straminata</i>	Plain Wave	LC			560		E	S	W
<i>Scopula immorata</i>	Lewes Wave	RE		Last resident record 1961 (Parsons 2003)	0				
<i>Scopula nigropunctata</i>	Sub-angled Wave	EN	B2 a,b(iv)	Highly restricted and evidence of distribution decline but plausible rescue effect	1	Nationally Rare	E		
<i>Scopula ornata</i>	Lace Border	LC			20	Nationally Scarce	E		
<i>Scopula rubiginata</i>	Tawny Wave	LC			18	Nationally Scarce	E		
<i>Scopula marginepunctata</i>	Mullein Wave	LC			371		E	S	W
<i>Scopula imitaria</i>	Small Blood-vein	LC			928		E		W
<i>Scopula immutata</i>	Lesser Cream Wave	LC			464		E	S	W
<i>Scopula ternata</i>	Smoky Wave	LC			306		E	S	W
<i>Scopula floslactata</i>	Cream Wave	LC			860		E	S	W
<i>Scopula emutaria</i>	Rosy Wave	LC			79	Nationally Scarce	E		W
<i>Timandra comae</i>	Blood-vein	LC			1208		E	S	W
<i>Cyclophora pendularia</i>	Dingy Mocha	NT	B1 b(iv), B2 b(iv)	Rare species with continuing distribution decline and a range of immediate threats including grazing, scrub removal, lack of management leading to shrub encroachment (i.e. loss of young scrub in open situations)	14	Nationally Rare	E		
<i>Cyclophora annularia</i>	Mocha	LC			230		E		W

<i>Cyclophora albipunctata</i>	Birch Mocha	LC			352		E	S	W
<i>Cyclophora pupillaria</i>	Blair's Mocha	LC		Recent colonist (c.2004 - Parsons 2010) and plausible rescue effect	5	recent colonist not assessed	E		
<i>Cyclophora ruficiliaria</i>	Jersey Mocha	LC		Recent colonist (2003 - Parsons 2010)	13	recent colonist not assessed	E		
<i>Cyclophora porata</i>	False Mocha	LC			43	Nationally Scarce	E		
<i>Cyclophora punctaria</i>	Maiden's Blush	LC			718		E		W
<i>Cyclophora linearia</i>	Clay Triple-lines	LC			650		E	S	W
<i>Phibalapteryx virgata</i>	Oblique Striped	LC			47	Nationally Scarce	E		W
<i>Scotopteryx mucronata</i>	Lead Belle	VU	A2 b	Steep population decline with some recovery in recent years, although reached lowest counts in series as recently as 2005/2006	222		E	S	W
<i>Scotopteryx luridata</i>	July Belle	LC			419		E	S	W
<i>Scotopteryx bipunctaria</i>	Chalk Carpet	LC			121		E		W
<i>Scotopteryx chenopodiata</i>	Shaded Broad-bar	LC			1571		E	S	W
<i>Orthonama vittata</i>	Oblique Carpet	LC			458		E	S	W
<i>Xanthorhoe decoloraria</i>	Red Carpet	NT	A2 b	Steep population decline to 2007, but some improvement over recent years	296		E	S	W
<i>Xanthorhoe fluctuata</i>	Garden Carpet	LC			1810		E	S	W
<i>Xanthorhoe biriviata</i>	Balsam Carpet	LC		On non-native host plant	84	Nationally Scarce	E		
<i>Xanthorhoe spadicearia</i>	Red Twin-spot Carpet	LC			1297		E	S	W
<i>Xanthorhoe ferrugata</i>	Dark-barred Twin-spot Carpet	NT	A2 b	Continued steep population decline to 1998. More stable since then, although reached the lowest index of the whole time series in 2016	1153		E	S	W
<i>Xanthorhoe designata</i>	Flame Carpet	LC			1775		E	S	W
<i>Xanthorhoe montanata</i>	Silver-ground Carpet	LC			2180		E	S	W
<i>Xanthorhoe quadrifasiata</i>	Large Twin-spot Carpet	LC			556		E		
<i>Catarhoe cuculata</i>	Royal Mantle	LC			158		E	S	
<i>Catarhoe rubidata</i>	Ruddy Carpet	LC			204		E		W

<i>Costaconvexa polygrammata</i>	Many-lined	RE		Last resident record 1879 (Waring, Townsend & Lewington 2009). Still occurs as scarce immigrant	0				
<i>Camptogramma bilineata</i>	Yellow Shell	LC			1751		E	S	W
<i>Epirrhoe tristata</i>	Small Argent & Sable	LC			320		E	S	W
<i>Epirrhoe alternata</i>	Common Carpet	LC			2089		E	S	W
<i>Epirrhoe rivata</i>	Wood Carpet	LC			327		E	S	W
<i>Epirrhoe galiata</i>	Galium Carpet	LC			337		E	S	W
<i>Euphyia biangulata</i>	Cloaked Carpet	LC			228		E	S	W
<i>Euphyia unangulata</i>	Sharp-angled Carpet	LC			375		E		W
<i>Earophila badiata</i>	Shoulder Stripe	LC			1182		E	S	W
<i>Anticlea derivata</i>	Streamer	LC			1267		E	S	W
<i>Mesoleuca albicillata</i>	Beautiful Carpet	LC			616		E	S	W
<i>Pelurga comitata</i>	Dark Spinach	VU	A2 b	Continued steep population decline, including a zero count in 2016	430		E	S	W
<i>Larentia clavaria</i>	Mallow	LC			428		E		W
<i>Entephria flavicinctata</i>	Yellow-ringed Carpet	LC			35	Nationally Scarce	E	S	W
<i>Entephria caesiata</i>	Grey Mountain Carpet	LC			263		E	S	W
<i>Spargania luctuata</i>	White-banded Carpet	LC			26	Nationally Scarce	E		
<i>Hydriomena furcata</i>	July Highflyer	LC			1937		E	S	W
<i>Hydriomena impluviata</i>	May Highflyer	LC			1085		E	S	W
<i>Hydriomena ruberata</i>	Ruddy Highflyer	LC			181		E	S	W
<i>Pennithera firmata</i>	Pine Carpet	LC			968		E	S	W
<i>Thera cognata</i>	Chestnut-coloured Carpet	LC			91	Nationally Scarce	E	S	W
<i>Thera britannica</i>	Spruce Carpet	LC			1520		E	S	W
<i>Thera obeliscata</i>	Grey Pine Carpet	LC			1578		E	S	W
<i>Thera juniperata</i>	Juniper Carpet	LC			376		E	S	W
<i>Thera cupressata</i>	Cypress Carpet	LC			233		E		W
<i>Plemyria rubiginata</i>	Blue-bordered Carpet	LC			924		E	S	W
<i>Cidaria fulvata</i>	Barred Yellow	LC			1383		E	S	W
<i>Electrophaes corylata</i>	Broken-barred Carpet	LC			1206		E	S	W
<i>Cosmorhoe ocellata</i>	Purple Bar	LC			1600		E	S	W

<i>Eustroma reticulata</i>	Netted Carpet	EN	B2 a,c(iv)	Rare moth highly dependent on annual ground disturbance and, consequently, subject to severe fluctuations in population	8	Nationally Rare	E		
<i>Eulithis prunata</i>	Phoenix	LC			1158		E	S	W
<i>Eulithis testata</i>	Chevron	LC			1027		E	S	W
<i>Eulithis populata</i>	Northern Spinach	LC			920		E	S	W
<i>Eulithis mellinata</i>	Spinach	VU	A2 b	Steep population decline, but more stable in recent years (with the exception of a zero count in 2016)	597		E	S	W
<i>Gandaritis pyraliata</i>	Barred Straw	LC			1794		E	S	W
<i>Ecliptopera silaceata</i>	Small Phoenix	LC			1722		E	S	W
<i>Chloroclysta siterata</i>	Red-green Carpet	LC			1593		E	S	W
<i>Chloroclysta miata</i>	Autumn Green Carpet	LC			524		E	S	W
<i>Dysstroma truncata</i>	Common Marbled Carpet	LC			1987		E	S	W
<i>Dysstroma citrata</i>	Dark Marbled Carpet	LC			1199		E	S	W
<i>Colostygia olivata</i>	Beech-green Carpet	LC			173		E	S	W
<i>Colostygia pectinataria</i>	Green Carpet	LC			2041		E	S	W
<i>Colostygia multistrigaria</i>	Mottled Grey	LC			811		E	S	W
<i>Coenotephria salicata</i>	Striped Twin-spot Carpet	LC			205		E	S	W
<i>Lampropteryx suffumata</i>	Water Carpet	LC			1397		E	S	W
<i>Lampropteryx otregiata</i>	Devon Carpet	LC			290		E	S	W
<i>Operophtera fagata</i>	Northern Winter Moth	LC			408		E	S	W
<i>Operophtera brumata</i>	Winter Moth	LC			1324		E	S	W
<i>Epirrita dilutata</i>	November Moth	LC			934		E	S	W
<i>Epirrita christyi</i>	Pale November Moth	LC			355		E	S	W
<i>Epirrita autumnata</i>	Autumnal Moth	LC			498		E	S	W
<i>Epirrita filigrammaria</i>	Small Autumnal Moth	LC			194		E	S	W
<i>Asthenes albulata</i>	Small White Wave	LC			564		E	S	W
<i>Euchoeca nebulata</i>	Dingy Shell	LC			673		E	S	W
<i>Hydrelia sylvata</i>	Waved Carpet	LC			170		E		W
<i>Hydrelia flammeolaria</i>	Small Yellow Wave	LC			935		E	S	W
<i>Venusia cambrica</i>	Welsh Wave	LC			429		E	S	W

<i>Venusia blomeri</i>	Blomer's Rivulet	LC			165		E	S	W
<i>Minoa murinata</i>	Drab Looper	LC			56	Nationally Scarce	E		W
<i>Philereme vetulata</i>	Brown Scallop	LC			311		E		W
<i>Philereme transversata</i>	Dark Umber	LC			452		E		W
<i>Rheumaptera hastata</i>	Argent & Sable	LC			163		E	S	W
<i>Rheumaptera undulata</i>	Scallop Shell	LC			660		E	S	W
<i>Hydria cervinalis</i>	Scarce Tissue	LC			141		E	S	W
<i>Triphosa dubitata</i>	Tissue	LC			248		E	S	W
<i>Pareulype berberata</i>	Barberry Carpet	EN	B2 a,b(iv)	Rare species with continued distribution decline. Despite conservation effort, new discoveries and introductions, several sites have gone extinct in the period and most introductions have failed	9	Nationally Rare	E		
<i>Coenocalpe lapidata</i>	Slender-striped Rufous	LC			30	Nationally Scarce		S	
<i>Horisme vitalbata</i>	Small Waved Umber	LC			500		E		W
<i>Horisme tersata</i>	Fern	LC			422		E		W
<i>Melanthia procellata</i>	Pretty Chalk Carpet	LC			428		E		W
<i>Anticollix sparsata</i>	Dentated Pug	LC			32	Nationally Scarce	E		W
<i>Odezia atrata</i>	Chimney Sweeper	LC			852		E	S	W
<i>Mesotype didymata</i>	Twin-spot Carpet	LC			1258		E	S	W
<i>Perizoma affinitata</i>	Rivulet	LC			1148		E	S	W
<i>Perizoma alchemillata</i>	Small Rivulet	LC			1558		E	S	W
<i>Perizoma bifaciata</i>	Barred Rivulet	LC			450		E	S	W
<i>Perizoma minorata</i>	Heath Rivulet	LC			19	Nationally Scarce	E	S	
<i>Perizoma blandiata</i>	Pretty Pinion	LC			180		E	S	
<i>Perizoma albulata</i>	Grass Rivulet	LC			629		E	S	W
<i>Perizoma flavofasciata</i>	Sandy Carpet	LC			1254		E	S	W
<i>Martania taeniata</i>	Barred Carpet	LC			62	Nationally Scarce	E	S	W
<i>Gagitodes sagittata</i>	Marsh Carpet	NT	B1 b(iv), B2 b(iv)	Rare species with continued distribution decline	12	Nationally Rare	E		
<i>Gymnoscelis rufifasciata</i>	Double-striped Pug	LC			1651		E	S	W
<i>Chloroclystis v-ata</i>	V-Pug	LC			1281		E	S	W
<i>Pasiphila chloerata</i>	Sloe Pug	LC			267		E	S	W
<i>Pasiphila rectangulata</i>	Green Pug	LC			1459		E	S	W
<i>Pasiphila debiliata</i>	Bilberry Pug	LC			75	Nationally Scarce	E	S	W
<i>Eupithecia haworthiata</i>	Haworth's Pug	LC			426		E	S	W

<i>Eupithecia tenuiata</i>	Slender Pug	LC			793		E	S	W
<i>Eupithecia inturbata</i>	Maple Pug	EN	A2 b	Continued steep population decline, including the lowest index in the whole series in recent years	460		E	S	W
<i>Eupithecia abietaria</i>	Cloaked Pug	LC		On non-native host plant	11	Nationally Rare	E	S	W
<i>Eupithecia linariata</i>	Toadflax Pug	NT	A2 b	Steep population decline, but lessening in recent years	573		E	S	W
<i>Eupithecia pulchellata</i>	Foxglove Pug	LC			1453		E	S	W
<i>Eupithecia ultimaria</i>	Channel Islands Pug	LC		Recent colonist on non-native plant	16	Nationally Scarce	E		
<i>Eupithecia plumbeolata</i>	Lead-coloured Pug	LC			78	Nationally Scarce	E	S	W
<i>Eupithecia pygmaeata</i>	Marsh Pug	LC			124		E	S	W
<i>Eupithecia venosata</i>	Netted Pug	LC			229		E	S	W
<i>Eupithecia abbreviata</i>	Brindled Pug	LC			1391		E	S	W
<i>Eupithecia dodoneata</i>	Oak-tree Pug	LC			868		E	S	W
<i>Eupithecia pusillata</i>	Juniper Pug	VU	A2 b	Continued steep population decline, including the three lowest indices in the whole time series in recent years	514		E	S	W
<i>Eupithecia phoeniceata</i>	Cypress Pug	LC		Recent colonist	286		E		W
<i>Eupithecia tripunctaria</i>	White-spotted Pug	NT	A2 b	Steep population decline, but recent fluctuations with some relatively high index values, as well as some low ones, suggest it is no longer declining as steeply	1094		E	S	W
<i>Eupithecia virgaureata</i>	Golden-rod Pug	LC			645		E	S	W
<i>Eupithecia tantillaria</i>	Dwarf Pug	LC			700		E	S	W
<i>Eupithecia lariciata</i>	Larch Pug	NT	A2 b	Steep population decline has ameliorated in recent years	505		E	S	W
<i>Eupithecia egenaria</i>	Pauper Pug	LC			47	Nationally Scarce	E		W
<i>Eupithecia pimpinellata</i>	Pimpinell Pug	LC			61	Nationally Scarce	E	S	W
<i>Eupithecia simpliciata</i>	Plain Pug	LC			384		E	S	W
<i>Eupithecia nanata</i>	Narrow-winged Pug	LC			1072		E	S	W
<i>Eupithecia innotata</i>	Angle-barred Pug (incl. Ash Pug and Tamerisk Pug)	LC			312		E	S	W
<i>Eupithecia irriguata</i>	Marbled Pug	LC			53	Nationally Scarce	E		W

<i>Eupithecia indigata</i>	Ochreous Pug	LC			494		E	S	W
<i>Eupithecia distinctaria</i>	Thyme Pug	LC			49	Nationally Scarce	E	S	W
<i>Eupithecia centaureata</i>	Lime-speck Pug	LC			1169		E	S	W
<i>Eupithecia insigniata</i>	Pinion-spotted Pug	LC			66	Nationally Scarce	E		
<i>Eupithecia trisignaria</i>	Triple-spotted Pug	LC			336		E	S	W
<i>Eupithecia intricata</i>	Freyer's Pug (incl. Edinburgh Pug)	LC			859		E	S	W
<i>Eupithecia satyrata</i>	Satyr Pug	VU	A2 b	Continued steep population decline	418		E	S	W
<i>Eupithecia extensaria</i>	Scarce Pug	EN	B1 a,b(iv), B2 a,b(iv)	Rare, range restricted species with ongoing distribution decline	4	Nationally Rare	E		
<i>Eupithecia absinthiata</i>	Wormwood Pug	LC			1283		E	S	W
<i>Eupithecia absinthiata</i>	Ling Pug	LC		Taxonomic status of this taxon in Britain is not confirmed. However, recent DNA evidence in Germany showed it was a good species (rather than a subspecies or Wormwood Pug) so it has been treated as such here too	215		E	S	W
<i>Eupithecia expallidata</i>	Bleached Pug	LC			116		E	S	W
<i>Eupithecia valerianata</i>	Valerian Pug	LC			143		E	S	W
<i>Eupithecia assimilata</i>	Currant Pug	LC			1035		E	S	W
<i>Eupithecia vulgata</i>	Common Pug	LC			1594		E	S	W
<i>Eupithecia exiguata</i>	Mottled Pug	LC			1153		E	S	W
<i>Eupithecia denotata</i>	Campanula Pug (incl. Jasione Pug)	LC			24	Nationally Scarce	E		W
<i>Eupithecia millefoliata</i>	Yarrow Pug	LC			144		E		
<i>Eupithecia icterata</i>	Tawny Speckled Pug	NT	A2 b	Steep population decline to early 2000s, but some amelioration over recent years	1102		E	S	W
<i>Eupithecia succenturiata</i>	Bordered Pug	NT	A2 b	Steep population decline seems to have ameliorated in recent years, but still reached lowest value in whole series in 2016	654		E	S	W
<i>Eupithecia subumbrata</i>	Shaded Pug	LC			271		E	S	W

<i>Eupithecia subfuscata</i>	Grey Pug	NT	A2 b	Steep population decline to early 2000s, but some amelioration over recent years	1374		E	S	W
<i>Carsia sororiata</i>	Manchester Treble-bar	LC			137		E	S	W
<i>Aplocera plagiata</i>	Treble-bar	LC			977		E	S	W
<i>Aplocera efformata</i>	Lesser Treble-bar	LC			408		E	S	W
<i>Chesias legatella</i>	Streak	LC			560		E	S	W
<i>Chesias rufata</i>	Broom-tip	NT	A2 b	Steep population decline seems to have levelled out in the mid-2000s but numbers remain very low	124		E	S	W
<i>Lithostege griseata</i>	Grey Carpet	NT	B2 b(iv)	Rare species with ongoing distribution decline and highly depended on ground disturbance	15	Nationally Rare	E		
<i>Lobophora halterata</i>	Seraphim	LC			649		E	S	W
<i>Pterapherapteryx sexalata</i>	Small Seraphim	LC			426		E	S	W
<i>Acasis viretata</i>	Yellow-barred Brindle	LC			1174		E	S	W
<i>Trichopteryx polycommata</i>	Barred Tooth-striped	LC			48	Nationally Scarce	E	S	W
<i>Trichopteryx carpinata</i>	Early Tooth-striped	LC			1049		E	S	W
<i>Archiearis parthenias</i>	Orange Underwing	LC			542		E	S	W
<i>Boudinotiana notha</i>	Light Orange Underwing	LC			62	Nationally Scarce	E		
<i>Abraxas grossulariata</i>	Magpie Moth	LC			1537		E	S	W
<i>Abraxas sylvata</i>	Clouded Magpie	LC			416		E	S	W
<i>Lomaspilis marginata</i>	Clouded Border	LC			1839		E	S	W
<i>Ligdia adustata</i>	Scorched Carpet	LC			735		E		W
<i>Macaria notata</i>	Peacock Moth	LC			529		E	S	W
<i>Macaria alternata</i>	Sharp-angled Peacock	LC			476		E	S	W
<i>Macaria signaria</i>	Dusky Peacock	LC		Recent colonist (2004 - Parsons 2010) and plausible rescue effect	3	recent colonist not assessed	E		
<i>Macaria liturata</i>	Tawny-barred Angle	LC			1217		E	S	W

<i>Macaria wauaria</i>	V-Moth	EN	A2 b	Steep population decrease and now effectively extinct in RIS network. There is no evidence that the rate or causes of decline have lessened	120		E	S	W
<i>Macaria carbonaria</i>	Netted Mountain Moth	LC		Decline in habitat area and quality at some sites due to lack of management. Also evidence of moth decline at some sites	18	Nationally Scarce		S	
<i>Macaria brunneata</i>	Rannoch Looper	LC			24	Nationally Scarce		S	
<i>Chiasmia clathrata</i>	Latticed Heath	NT	A2 b	Continued steep population decline but plausible rescue effect	1064		E	S	W
<i>Isturgia limbaria</i>	Frosted Yellow	RE		Last resident record 1914 (Parsons 2003)	0				
<i>Cepphis advenaria</i>	Little Thorn	LC			90	Nationally Scarce	E		W
<i>Petrophora chlorosata</i>	Brown Silver-line	LC			1686		E	S	W
<i>Plagodis pulveraria</i>	Barred Umber	LC			462		E	S	W
<i>Plagodis dolabraria</i>	Scorched Wing	LC			1277		E	S	W
<i>Pachycnemia hippocastanaria</i>	Horse Chestnut	LC			94	Nationally Scarce	E		
<i>Opisthograptis luteolata</i>	Brimstone Moth	LC			2073		E	S	W
<i>Epione repandaria</i>	Bordered Beauty	LC			878		E	S	W
<i>Epione vespertaria</i>	Dark Bordered Beauty	EN	B2 a,b(v)	Rare and restricted species with continuing decline in numbers	6	Nationally Rare	E	S	
<i>Pseudopanthera macularia</i>	Speckled Yellow	LC			535		E	S	W
<i>Angerona prunaria</i>	Orange Moth	LC			195		E		W
<i>Apeira syringaria</i>	Lilac Beauty	LC			792		E	S	W
<i>Ennomos autumnaria</i>	Large Thorn	NT	A2 b	Steep population decline but more stable in recent years at very low numbers (including some zeros) and plausible rescue effect	127		E		
<i>Ennomos quercinaria</i>	August Thorn	LC			665		E	S	W
<i>Ennomos alniaria</i>	Canary-shouldered Thorn	LC			1525		E	S	W

<i>Ennomos fuscantaria</i>	Dusky Thorn	NT	A2 b	Steep historical population decline until the early 1990s, followed by a recently partial recovery. Numbers still much reduced compared to historical levels	1005		E		W
<i>Ennomos erosaria</i>	September Thorn	NT	A2 b	Steep population decline but some suggestion of recovery in last few years	596		E	S	W
<i>Selenia dentaria</i>	Early Thorn	LC			1701		E	S	W
<i>Selenia lunularia</i>	Lunar Thorn	LC			536		E	S	W
<i>Selenia tetralunaria</i>	Purple Thorn	LC			1227		E	S	W
<i>Odontopera bidentata</i>	Scalloped Hazel	LC			1670		E	S	W
<i>Crocallis elinguaris</i>	Scalloped Oak	LC			1737		E	S	W
<i>Ourapteryx sambucaria</i>	Swallow-tailed Moth	LC			1490		E	S	W
<i>Colotois pennaria</i>	Feathered Thorn	LC			1390		E	S	W
<i>Alsophila aescularia</i>	March Moth	LC			1305		E	S	W
<i>Apocheima hispidaria</i>	Small Brindled Beauty	LC			340		E		W
<i>Phigalia pilosaria</i>	Pale Brindled Beauty	VU	A2 b	Ongoing steep population decline	1174		E	S	W
<i>Lycia hirtaria</i>	Brindled Beauty	LC			931		E	S	W
<i>Lycia lapponaria</i>	Rannoch Brindled Beauty	LC			13	Nationally Rare		S	
<i>Lycia zonaria</i>	Belted Beauty	LC			35	Nationally Scarce	E	S	
<i>Biston strataria</i>	Oak Beauty	LC			1103		E	S	W
<i>Biston betularia</i>	Peppered Moth	LC			1767		E	S	W
<i>Agriopsis leucophaearia</i>	Spring Usher	LC			695		E	S	W
<i>Agriopsis aurantiaria</i>	Scarce Umber	LC			777		E	S	W
<i>Agriopsis marginaria</i>	Dotted Border	LC			1319		E	S	W
<i>Erannis defoliaria</i>	Mottled Umber	VU	A2 b	Continued steep population decline	1188		E	S	W
<i>Menophra abruptaria</i>	Waved Umber	LC			941		E		W
<i>Peribatodes rhomboidaria</i>	Willow Beauty	LC			1594		E	S	W
<i>Peribatodes secundaria</i>	Feathered Beauty	EN	B2 a,b(iv)	A recent colonist (on non-native hostplant) that has remained rare and shown evidence of distribution decrease	3	Nationally Rare	E		

<i>Selidosema brunnearia</i>	Bordered Grey	LC			33	Nationally Scarce	E	S	
<i>Cleora cinctaria</i>	Ringed Carpet	LC			42	Nationally Scarce	E	S	
<i>Deileptenia ribeata</i>	Satin Beauty	LC			641		E	S	W
<i>Alcis repandata</i>	Mottled Beauty	LC			1856		E	S	W
<i>Alcis jubata</i>	Dotted Carpet	LC			303		E	S	W
<i>Hypomecis roboraria</i>	Great Oak Beauty	LC			151		E		W
<i>Hypomecis punctinalis</i>	Pale Oak Beauty	LC			440		E		
<i>Fagivorina arenaria</i>	Speckled Beauty	RE		Last resident record 1885 (Agassiz et al. 2013)	0				
<i>Ectropis crepuscularia</i>	Engrailed	LC			1494		E	S	W
<i>Ectropis sp.</i>	Small Engrailed	LC			360		E	S	W
<i>Paradarisa consonaria</i>	Square Spot	LC			376		E		W
<i>Parectropis similaria</i>	Brindled White-spot	LC			360		E		W
<i>Aethalura punctulata</i>	Grey Birch	LC			665		E	S	W
<i>Ematurga atomaria</i>	Common Heath	LC			1058		E	S	W
<i>Bupalus piniaria</i>	Bordered White	LC			1093		E	S	W
<i>Cabera pusaria</i>	Common White Wave	LC			1785		E	S	W
<i>Cabera exanthemata</i>	Common Wave	LC			1706		E	S	W
<i>Lomographa bimaculata</i>	White-pinion Spotted	LC			938		E	S	W
<i>Lomographa temerata</i>	Clouded Silver	LC			1492		E	S	W
<i>Aleucis distinctata</i>	Sloe Carpet	LC			31	Nationally Scarce	E		
<i>Theria primaria</i>	Early Moth	VU	A2 b	Continued steep population decline, despite relatively high index in 2011	782		E	S	W
<i>Campaea margaritaria</i>	Light Emerald	LC			1890		E	S	W
<i>Hylaea fasciaria</i>	Barred Red	LC			1311		E	S	W
<i>Gnophos obfuscata</i>	Scotch Annulet	LC			87	Nationally Scarce		S	
<i>Charissa obscurata</i>	Annulet	LC			185		E	S	W
<i>Cleorodes lichenaria</i>	Brussels Lace	LC			456		E	S	W
<i>Glacies coracina</i>	Black Mountain Moth	LC			43	Nationally Scarce		S	
<i>Pseudocoremia suavis</i>	Common Forest Looper	NA		Non-native species accidentally introduced and now breeding in wild	4	Naturalised	E		
<i>Siona lineata</i>	Black-veined Moth	CR	B1 a,b(iv,v)	Rare and restricted species with recent decline in distribution and abundance	2	Nationally Rare	E		

<i>Dyscia fagaria</i>	Grey Scalloped Bar	NT	A2 b	Steep population decline, which has ameliorated in recent years with relatively high index values in 2011 and 2015, but the lowest indices of the whole series in 2009 and 2010	157		E	S	W
<i>Aspitates gilvaria</i>	Straw Belle	EN	B2 a,b(iv)	Rare species with ongoing distribution decline	10	Nationally Rare	E		
<i>Aspitates ochrearia</i>	Yellow Belle	LC			262		E		W
<i>Perconia strigillaria</i>	Grass Wave	LC			132		E	S	W
<i>Aplasta ononaria</i>	Rest Harrow	NT	D2	Rare but stable species threatened by scrub encroachment and possible sea level rise, but there is a plausible rescue effect	5	Nationally Rare	E		
<i>Pseudoterpna pruinata</i>	Grass Emerald	LC			497		E	S	W
<i>Geometra papilionaria</i>	Large Emerald	LC			1397		E	S	W
<i>Comibaena bajularia</i>	Blotched Emerald	LC			438		E		W
<i>Thetidia smaragdaria</i>	Essex Emerald	RE		Last resident record c.1991 (Parsons 2003)	0				
<i>Hemistola chrysoprasaria</i>	Small Emerald	LC			706		E		W
<i>Jodis lactearia</i>	Little Emerald	LC			580		E	S	W
<i>Thalera fimbrialis</i>	Sussex Emerald	EN	B2 a,b(iii,v)	Rare species with decreasing abundance and habitat	4	Nationally Rare	E		
<i>Hemitheia aestivaria</i>	Common Emerald	LC			1160		E	S	W
<i>Chlorissa viridata</i>	Small Grass Emerald	LC			34	Nationally Scarce	E		
<i>Thaumetopoea processionea</i>	Oak Processionary	NA		Non-native species accidentally introduced and now breeding in wild	10	Naturalised	E		
<i>Cerura vinula</i>	Puss Moth	LC			1012		E	S	W
<i>Furcula furcula</i>	Sallow Kitten	LC			1276		E	S	W
<i>Furcula bicuspis</i>	Alder Kitten	LC			292		E		W
<i>Furcula bifida</i>	Poplar Kitten	LC			542		E		W
<i>Stauropus fagi</i>	Lobster Moth	LC			687		E		W
<i>Drymonia dodonaea</i>	Marbled Brown	LC			574		E	S	W
<i>Drymonia ruficornis</i>	Lunar Marbled Brown	LC			975		E	S	W
<i>Notodonta dromedarius</i>	Iron Prominent	LC			1630		E	S	W

<i>Notodonta ziczac</i>	Pebble Prominent	LC			1710		E	S	W
<i>Peridea anceps</i>	Great Prominent	LC			449		E	S	W
<i>Pheosia tremula</i>	Swallow Prominent	LC			1500		E	S	W
<i>Pheosia gnoma</i>	Lesser Swallow Prominent	LC			1668		E	S	W
<i>Leucodonta bicoloria</i>	White Prominent	RE		Last resident record mid 19th century (Agassiz et al. 2013)	0				
<i>Pterostoma palpina</i>	Pale Prominent	LC			1468		E	S	W
<i>Ptilodon capucina</i>	Coxcomb Prominent	LC			1718		E	S	W
<i>Ptilodon cucullina</i>	Maple Prominent	LC			322		E		
<i>Odontosia carmelita</i>	Scarce Prominent	LC			278		E	S	W
<i>Ptilophora plumigera</i>	Plumed Prominent	LC			19	Nationally Scarce	E		
<i>Phalera bucephala</i>	Buff-tip	LC			1629		E	S	W
<i>Clostera curtula</i>	Chocolate-tip	LC			692		E	S	W
<i>Clostera pigra</i>	Small Chocolate-tip	LC			57	Nationally Scarce	E	S	W
<i>Clostera anachoreta</i>	Scarce Chocolate-tip	VU	D2	Only resident at one site, where threatened by scrub removal	2	Nationally Rare	E		
<i>Scoliopteryx libatrix</i>	Herald	LC			1487		E	S	W
<i>Rivula sericealis</i>	Straw Dot	LC			1842		E	S	W
<i>Hypena proboscidalis</i>	Snout	LC			1982		E	S	W
<i>Hypena rostralis</i>	Buttoned Snout	LC			293		E		W
<i>Hypena obsitalis</i>	Bloxworth Snout	LC		Recent colonist	41	Nationally Scarce	E		
<i>Hypena crassalis</i>	Beautiful Snout	LC			334		E	S	W
<i>Arctornis l-nigrum</i>	Black V Moth	RE		Last resident record 1960 (Parsons 2003). Still occurs as scarce immigrant	0				
<i>Leucoma salicis</i>	White Satin	LC			643		E		W
<i>Lymantria monacha</i>	Black Arches	LC			863		E		W
<i>Lymantria dispar</i>	Gypsy Moth	NA		Breeding colonies due to accidental import, males also occur as immigrants	13	Naturalised	E		
<i>Euproctis chrysoorrhoea</i>	Brown-tail	LC			497		E		W
<i>Euproctis similis</i>	Yellow-tail	LC			1212		E	S	W
<i>Laelia coenosa</i>	Reed Tussock	RE		Last resident record 1879 (Agassiz et al. 2013)	0				
<i>Calliteara pudibunda</i>	Pale Tussock	LC			1280		E	S	W
<i>Dicallomera fascelina</i>	Dark Tussock	LC			186		E	S	
<i>Orgyia antiqua</i>	Vapourer	LC			1176		E	S	W

<i>Orgyia recens</i>	Scarce Vapourer	EN	B2 a,b(iv)	Rare species with declining distribution	9	Nationally Rare	E		
<i>Spilosoma lutea</i>	Buff Ermine	LC			1609		E	S	W
<i>Spilosoma lubricipeda</i>	White Ermine	LC			1918		E	S	W
<i>Spilosoma urticae</i>	Water Ermine	LC			59	Nationally Scarce	E		
<i>Diaphora mendica</i>	Muslin Moth	LC			1110		E	S	W
<i>Diacrisia sannio</i>	Clouded Buff	LC			373		E	S	W
<i>Phragmatobia fuliginosa</i>	Ruby Tiger	LC			1690		E	S	W
<i>Parasemia plantaginis</i>	Wood Tiger	LC			325		E	S	W
<i>Arctia caja</i>	Garden Tiger	NT	A2 b	Steep population decline to 2007, but some amelioration over recent years	1596		E	S	W
<i>Arctia villica</i>	Cream-spot Tiger	LC			222		E		W
<i>Callimorpha dominula</i>	Scarlet Tiger	LC			412		E		W
<i>Euplagia quadripunctaria</i>	Jersey Tiger	LC			184		E		W
<i>Tyria jacobaeae</i>	Cinnabar	LC			1570		E	S	W
<i>Coscinia cribraria</i>	Speckled Footman	CR	B1 a,b(iv,v)	Rare and highly restricted moth, decreasing in abundance and distribution	5	Nationally Rare	E		
<i>Mitochrista miniata</i>	Rosy Footman	LC			631		E		W
<i>Nudaria mundana</i>	Muslin Footman	LC			713		E	S	W
<i>Thumatha senex</i>	Round-winged Muslin	LC			512		E	S	W
<i>Cybosia mesomella</i>	Four-dotted Footman	LC			521		E	S	W
<i>Pelosia muscerda</i>	Dotted Footman	NT	B2 a	Rare moth restricted to Norfolk Broads and potentially threatened by sea level rise, water abstraction and eutrophication	5	Nationally Rare	E		
<i>Pelosia obtusa</i>	Small Dotted Footman	NT	B2 a	Rare moth restricted to Norfolk Broads and potentially threatened by sea level rise, water abstraction and eutrophication	4	Nationally Rare	E		
<i>Lithosia quadra</i>	Four-spotted Footman	LC			228		E		W
<i>Atolmis rubricollis</i>	Red-necked Footman	LC			769		E	S	W
<i>Eilema depressa</i>	Buff Footman	LC			1139		E	S	W

<i>Eilema griseola</i>	Dingy Footman	LC			1191		E	S	W
<i>Eilema lurideola</i>	Common Footman	LC			1574		E	S	W
<i>Eilema complana</i>	Scarce Footman (incl. Northern Footman)	LC			980		E	S	W
<i>Eilema caniola</i>	Hoary Footman	LC			197		E		W
<i>Eilema pygmaeola</i>	Pigmy Footman	NT	B2 a	Rare species but no evidence of current decline	8	Nationally Rare	E		
<i>Eilema sororcula</i>	Orange Footman	LC			763		E		W
<i>Setina irrorella</i>	Dew Moth	LC			15	Nationally Rare	E	S	W
<i>Paracolax tristalis</i>	Clay Fan-foot	NT	B1 b(iv), B2 b(iv)	Rare species decreasing in distribution and dependent on continual woodland management (e.g. coppicing)	13	Nationally Rare	E		
<i>Macrochilo cribrumalis</i>	Dotted Fan-foot	LC			148		E		
<i>Herminia tarsipennalis</i>	Fan-foot	LC			1433		E	S	W
<i>Herminia tarsicrinalis</i>	Shaded Fan-foot	LC			17	Nationally Scarce	E		
<i>Herminia grisealis</i>	Small Fan-foot	LC			1415		E	S	W
<i>Pechipogo strigilata</i>	Common Fan-foot	NT	B2 b(iv)	Rare species decreasing in distribution and dependent on continual woodland management (e.g. coppicing)	14	Nationally Rare	E		
<i>Pechipogo plumigeralis</i>	Plumed Fan-foot	LC		Recent colonist (c.2000 - Parsons 2010) and plausible rescue effect	3	recent colonist not assessed	E		
<i>Hypenodes humidalis</i>	Marsh Oblique-barred	LC			179		E	S	W
<i>Schrankia costaestrigalis</i>	Pinion-streaked Snout	LC			950		E	S	W
<i>Schrankia taenialis</i>	White-line Snout	LC			137		E		W
<i>Lygephila pastinum</i>	Blackneck	NT	A2 b	Steep population decline until the early 2000s, more stable recently but numbers remain very low	611		E	S	W
<i>Lygephila cracca</i>	Scarce Blackneck	EN	B1 a,b(iv), B2 a,b(iv)	Rare and highly restricted moth, decreasing in distribution	7	Nationally Rare	E		
<i>Parascotia fuliginaria</i>	Waved Black	LC			249		E		W
<i>Phytometra viridaria</i>	Small Purple-barred	LC			330		E	S	W

<i>Colobochyla salicalis</i>	Lesser Belle	RE		Last resident record 1977 (Parsons 2003). Still occurs as scarce immigrant	0				
<i>Laspeyria flexula</i>	Beautiful Hook-tip	LC			799		E		W
<i>Trisateles emortualis</i>	Olive Crescent	LC			30	Nationally Scarce	E		
<i>Catocala fraxini</i>	Clifden Nonpareil	LC		Recent colonist (c.2005 - Parsons 2010)	26	recent colonist not assessed	E		
<i>Catocala nupta</i>	Red Underwing	LC			902		E	S	W
<i>Catocala sponsa</i>	Dark Crimson Underwing	NT	B2 a	Rare species but no evidence of current decline	7	Nationally Rare	E		
<i>Catocala promissa</i>	Light Crimson Underwing	NT	B1 a, B2 a	Rare and restricted, but not declining in distribution	7	Nationally Rare	E		
<i>Euclidia glyphica</i>	Burnet Companion	LC			632		E	S	W
<i>Euclidia mi</i>	Mother Shipton	LC			964		E	S	W
<i>Minucia lunaris</i>	Lunar Double-stripe	RE		Last resident record 1958 (Parsons 2003). Still occurs as scarce immigrant	0				
<i>Abrostola tripartita</i>	Spectacle	LC			1809		E	S	W
<i>Abrostola triplasia</i>	Dark Spectacle	LC			801		E	S	W
<i>Macdunnoughia confusa</i>	Dewick's Plusia	LC		Recent colonist (c.2005 - Parsons 2010)	14	recent colonist not assessed	E		
<i>Diachrysia chryson</i>	Scarce Burnished Brass	LC			40	Nationally Scarce	E		W
<i>Diachrysia chrysitis</i>	Burnished Brass	LC			1930		E	S	W
<i>Polychrysia moneta</i>	Golden Plusia	EN	A2 b	Steep population decline and now effectively extinct in RIS network. There is no evidence that the rate or causes of decline have lessened	319		E	S	W
<i>Autographa pulchrina</i>	Beautiful Golden Y	LC			1778		E	S	W
<i>Autographa jota</i>	Plain Golden Y	LC			1353		E	S	W
<i>Autographa bractea</i>	Gold Spangle	LC			685		E	S	W
<i>Syngrapha interrogationis</i>	Scarce Silver Y	LC			262		E	S	W
<i>Plusia festucae</i>	Gold Spot	LC			1389		E	S	W
<i>Plusia putnami</i>	Lempke's Gold Spot	LC			510		E	S	W
<i>Deltote pygarga</i>	Marbled White Spot	LC			837		E		W
<i>Deltote uncula</i>	Silver Hook	LC			206		E	S	W
<i>Deltote bankiana</i>	Silver Barred	NT	B1 a, B2 a	Rare species but no evidence of recent decline	5	Nationally Rare	E		

<i>Acontia trabealis</i>	Spotted Sulphur	RE		Last resident record 1960 (Parsons 2003)	0				
<i>Tyta luctuosa</i>	Four-spotted	NT	B2 b(iv)	Rare species with ongoing distribution decline. Dependent on early-successional habitats and threatened by inappropriate management and eutrophication	15	Nationally Rare	E		
<i>Colocasia coryli</i>	Nut-tree Tussock	LC			1180		E	S	W
<i>Diloba caeruleocephala</i>	Figure of Eight	EN	A2 b	Continued steep population decline	430		E	S	W
<i>Moma alpium</i>	Scarce Merveille du Jour	LC			32	Nationally Scarce	E		
<i>Simyra albovenosa</i>	Reed Dagger	LC			99	Nationally Scarce	E		
<i>Acronicta alni</i>	Alder Moth	LC			835		E	S	W
<i>Acronicta tridens</i>	Dark Dagger	LC			414		E	S	W
<i>Acronicta psi</i>	Grey Dagger	LC			1209		E	S	W
<i>Acronicta aceris</i>	Sycamore	LC			716		E		W
<i>Acronicta leporina</i>	Miller	LC			1123		E	S	W
<i>Acronicta strigosa</i>	Marsh Dagger	RE		Last resident record 1933 (Parsons 2003). Still occurs as scarce immigrant	0				
<i>Acronicta menyanthidis</i>	Light Knot Grass	LC			252		E	S	W
<i>Acronicta auricoma</i>	Scarce Dagger	RE		Last resident record 1912 (Parsons 2003). Still occurs as scarce immigrant	0				
<i>Acronicta cinerea</i>	Sweet Gale Moth	LC			51	Nationally Scarce		S	
<i>Acronicta rumicis</i>	Knot Grass	LC			1571		E	S	W
<i>Subacronicta megacephala</i>	Poplar Grey	LC			1168		E	S	W
<i>Craniophora ligustri</i>	Coronet	LC			917		E	S	W
<i>Panemeria tenebrata</i>	Small Yellow Underwing	LC			495		E		W
<i>Cucullia absinthii</i>	Wormwood	LC			92	Nationally Scarce	E		W
<i>Cucullia umbratica</i>	Shark	LC			941		E	S	W
<i>Cucullia chamomillae</i>	Chamomile Shark	LC			433		E	S	W
<i>Cucullia gnaphalii</i>	Cudweed	RE		Last resident record 1979 (Parsons 2003)	0				
<i>Cucullia asteris</i>	Star-wort	LC			78	Nationally Scarce	E		W
<i>Cucullia lychnitis</i>	Striped Lychnis	LC			42	Nationally Scarce	E		

<i>Cucullia verbasci</i>	Mullein	LC			804		E		W
<i>Calophasia lunula</i>	Toadflax Brocade	LC			103		E		W
<i>Stilbia anomala</i>	Anomalous	VU	A2 b	Continued steep population decline, including the two lowest indices in the whole time series in recent years	359		E	S	W
<i>Amphipyra pyramidea</i>	Copper Underwing	LC			1189		E	S	W
<i>Amphipyra berbera</i>	Svensson's Copper Underwing	LC			948		E	S	W
<i>Amphipyra tragopoginis</i>	Mouse Moth	VU	A2 b	Continued steep population decline	1249		E	S	W
<i>Asteroscopus sphinx</i>	Sprawler	VU	A2 b	Fluctuating and with steep long-term population decline. Fluctuations have continued recently but reach lower and lower peaks showing continuing decline	495		E		W
<i>Brachionycha nubeculosa</i>	Rannoch Sprawler	LC			26	Nationally Scarce		S	
<i>Allophyes oxyacanthae</i>	Green-brindled Crescent	LC			1393		E	S	W
<i>Xylocampa areola</i>	Early Grey	LC			1411		E	S	W
<i>Pyrrhia umbra</i>	Bordered Sallow	LC			405		E	S	W
<i>Heliothis viriplaca</i>	Marbled Clover	LC			40	Nationally Scarce	E		
<i>Heliothis maritima</i>	Shoulder-striped Clover	EN	B1 a,b(iv), B2 a,b(iv)	Rare and range restricted species with continuing distribution decline	8	Nationally Rare	E		
<i>Acosmetia caliginosa</i>	Reddish Buff	CR	B2 a,b(iv)	Only resident at one site and evidence of ongoing decline	2	Nationally Rare	E		
<i>Cryphia algae</i>	Tree-lichen Beauty	LC		Recent colonist (c.2000 - Parsons 2010)	96	recent colonist not assessed	E		
<i>Bryophila domestica</i>	Marbled Beauty	LC			1281		E	S	W
<i>Nyctobrya muralis</i>	Marbled Green	LC			354		E		W
<i>Elaphria venustula</i>	Rosy Marbled	LC			137		E		
<i>Caradrina morpheus</i>	Mottled Rustic	LC			1269		E	S	W
<i>Caradrina kadenii</i>	Clancy's Rustic	LC		Recent colonist (2002 - Parsons 2010)	48	recent colonist not assessed	E		
<i>Caradrina clavipalpis</i>	Pale Mottled Willow	LC			1199		E	S	W
<i>Hoplodrina octogenaria</i>	Uncertain	LC			1354		E	S	W
<i>Hoplodrina blanda</i>	Rustic	LC			1382		E	S	W

<i>Hoplodrina ambigua</i>	Vine's Rustic	LC			841		E		W
<i>Chilodes maritima</i>	Silky Wainscot	LC			348		E	S	W
<i>Charanyca trigrammica</i>	Treble Lines	LC			1026		E	S	W
<i>Rusina ferruginea</i>	Brown Rustic	LC			1489		E	S	W
<i>Athetis pallustris</i>	Marsh Moth	EN	B2 a,b(iii,iv)	Rare and highly restricted species with evidence of recent decline in distribution and habitat	2	Nationally Rare	E		
<i>Dypterygia scabriuscula</i>	Bird's Wing	LC			431		E		W
<i>Trachea atriplicis</i>	Orache Moth	RE		Last resident record c.1915 (Parsons 2003). Still occurs as scarce immigrant	0				
<i>Mormo maura</i>	Old Lady	LC			960		E	S	W
<i>Thalpophila matura</i>	Straw Underwing	LC			846		E	S	W
<i>Hyppa rectilinea</i>	Saxon	LC			161		E	S	
<i>Phlogophora meticulosa</i>	Angle Shades	LC			1862		E	S	W
<i>Euplexia lucipara</i>	Small Angle Shades	LC			1668		E	S	W
<i>Celaena haworthii</i>	Haworth's Minor	LC			417		E	S	W
<i>Helotropha leucostigma</i>	Crescent	LC			728		E	S	W
<i>Eremobia ochroleuca</i>	Dusky Sallow	LC			764		E		W
<i>Gortyna flavago</i>	Frosted Orange	LC			1347		E	S	W
<i>Gortyna borelii</i>	Fisher's Estuarine Moth	NT	B1 a, B2 a	Rare and range restricted species but not declining. Some sites threatened by sea level rise and tidal surges, others are recently created and dependent on conservation management	7	Nationally Rare	E		
<i>Hydraecia micacea</i>	Rosy Rustic	LC			1777		E	S	W
<i>Hydraecia petasitis</i>	Butterbur	LC			81	Nationally Scarce	E	S	
<i>Hydraecia osseola</i>	Marsh Mallow Moth	EN	B1 a,b(iii,v), B2 a,b(iii,v)	Rare and highly restricted species with evidence of recent decline in abundance and habitat	4	Nationally Rare	E		
<i>Amphipoea fucosa</i>	Saltern Ear	LC			181		E	S	W
<i>Amphipoea lucens</i>	Large Ear	LC			395		E	S	W
<i>Amphipoea oculatea</i>	Ear Moth	LC			740		E	S	W
<i>Amphipoea crinanensis</i>	Crinan Ear	LC			125		E	S	W
<i>Luperina testacea</i>	Flounced Rustic	LC			1574		E	S	W

<i>Luperina nickerlii</i>	Sandhill Rustic	LC			31	Nationally Scarce	E		W
<i>Rhizedra lutosa</i>	Large Wainscot	LC			968		E	S	W
<i>Sedina buettneri</i>	Blair's Wainscot	EN	B2 a,b(iii)	Highly restricted species with habitat at some sites decreasing due to scrub encroachment and alien invasive species	5	Nationally Rare	E		
<i>Nonagria typhae</i>	Bulrush Wainscot	LC			869		E	S	W
<i>Arenostola phragmitidis</i>	Fen Wainscot	LC			380		E	S	
<i>Longalatedes elymi</i>	Lyme Grass	LC			49	Nationally Scarce	E	S	
<i>Lenisa geminipuncta</i>	Twin-spotted Wainscot	LC			388		E		W
<i>Archanara neurica</i>	White-mantled Wainscot	NT	B1 a, B2 a	Rare and range restricted species dependent on reed-bed habitat, which is threatened by increasing management	7	Nationally Rare	E		
<i>Archanara dissoluta</i>	Brown-veined Wainscot	LC			311		E		W
<i>Coenobia rufa</i>	Small Rufous	LC			601		E	S	W
<i>Oria musculosa</i>	Brighton Wainscot	CR (PE)	B2 a,b(iv)	Thought to be extinct with the last resident record in 2001 (Parsons 2010)	1	Nationally Rare	E		
<i>Denticucullus pygmina</i>	Small Wainscot	LC			1395		E	S	W
<i>Photedes fluxa</i>	Mere Wainscot	LC			129		E		
<i>Photedes captiuncula</i>	Least Minor	EN	B2 a,b(iv)	Rare species with decreasing distribution	10	Nationally Rare	E		
<i>Photedes minima</i>	Small Dotted Buff	LC			1340		E	S	W
<i>Photedes morrisii</i>	Morris's Wainscot (incl. Bond's Wainscot)	VU	D2	Rare moth with transient habitat that could be threatened by climate change (i.e. increased storms causing landslips)	2	Nationally Rare	E		
<i>Photedes extrema</i>	Concolorous	LC			21	Nationally Scarce	E		
<i>Protarchanara brevilinea</i>	Fenn's Wainscot	NT	B1 b(iii), B2 b(iii)	Rare moth largely restricted to Norfolk Broads and habitat quantity and quality decreasing due to increased reed-bed management and threatened by sea level rise	11	Nationally Rare	E		

<i>Globia sparganii</i>	Webb's Wainscot	LC			295		E		W
<i>Globia algae</i>	Rush Wainscot	LC			20	Nationally Scarce	E		
<i>Pabulatrix pabulatricula</i>	Union Rustic	RE		Last resident record 1919 (Parsons 2003)	0				
<i>Apamea remissa</i>	Dusky Brocade	LC			1628		E	S	W
<i>Apamea epomidion</i>	Clouded Brindle	LC			795		E	S	W
<i>Apamea crenata</i>	Clouded-bordered Brindle	LC			1766		E	S	W
<i>Apamea anceps</i>	Large Nutmeg	NT	A2 b	Steep population decline, but more stable in recent years and a high index in 2011	476		E		W
<i>Apamea sordens</i>	Rustic Shoulder-knot	LC			1165		E	S	W
<i>Apamea unanims</i>	Small Clouded Brindle	LC			863		E	S	W
<i>Apamea scolopacina</i>	Slender Brindle	LC			1054		E	S	W
<i>Apamea oblonga</i>	Crescent Striped	LC			71	Nationally Scarce	E		W
<i>Apamea monoglypha</i>	Dark Arches	LC			2170		E	S	W
<i>Apamea lithoxylaea</i>	Light Arches	LC			1527		E	S	W
<i>Apamea sublustris</i>	Reddish Light Arches	LC			256		E		W
<i>Apamea furva</i>	Confused	LC			199		E	S	W
<i>Apamea exulis</i>	Northern Arches (incl. Exile)	LC			78	Nationally Scarce		S	
<i>Lateroligia ophiogramma</i>	Double Lobed	LC			864		E	S	W
<i>Mesapamea secalis</i>	Common Rustic	LC			1175		E	S	W
<i>Mesapamea didyma</i>	Lesser Common Rustic	LC			678		E	S	W
<i>Litoligia literosa</i>	Rosy Minor	NT	A2 b	Steep population decline to late 2000s but slight recovery since then	1115		E	S	W
<i>Mesoligia furuncula</i>	Cloaked Minor	LC			1128		E	S	W
<i>Oligia strigilis</i>	Marbled Minor	LC			1063		E	S	W
<i>Oligia latruncula</i>	Tawny Marbled Minor	LC			864		E	S	W
<i>Oligia versicolor</i>	Rufous Minor	LC			799		E	S	W
<i>Oligia fasciuncula</i>	Middle-barred Minor	LC			1812		E	S	W
<i>Leucochlaena oditis</i>	Beautiful Gothic	LC			18	Nationally Scarce	E		
<i>Tiliacea citrigo</i>	Orange Sallow	LC			680		E	S	W
<i>Tiliacea aurago</i>	Barred Sallow	LC			853		E		W
<i>Xanthia togata</i>	Pink-barred Sallow	LC			1406		E	S	W

<i>Cirrhia icteritia</i>	Sallow	NT	A2 b	Large population fluctuations in recent years, with evidence of recovery from late 1990s to c. 2010, but clear potential for further declines in recent years	1431		E	S	W
<i>Cirrhia gilvago</i>	Dusky-lemon Sallow	NT	A2 b	Steep population decline, but now more stable at very low numbers (including some zeros) with one relatively high annual index (2011). Plausible rescue effect	360		E	S	W
<i>Cirrhia ocellaris</i>	Pale-lemon Sallow	LC			34	Nationally Scarce	E		
<i>Agrochola lychnidis</i>	Beaded Chestnut	NT	A2 b	Steep population decline. Some suggestion of recovery in last few years, but lowest index values of whole series are in last 10 years	998		E		W
<i>Agrochola litura</i>	Brown-spot Pinion	LC			934		E	S	W
<i>Agrochola helvola</i>	Flounced Chestnut	NT	A2 b	Steep population decline to late 2000s, but some amelioration over recent years	523		E	S	W
<i>Agrochola lota</i>	Red-line Quaker	LC			1407		E	S	W
<i>Agrochola macilenta</i>	Yellow-line Quaker	LC			1357		E	S	W
<i>Agrochola haematidea</i>	Southern Chestnut	LC		Recent colonist	21	Nationally Scarce	E		
<i>Agrochola circellaris</i>	Brick	LC			1195		E	S	W
<i>Omphaloscelis lunosa</i>	Lunar Underwing	LC			1283		E	S	W
<i>Conistra vaccinii</i>	Chestnut	LC			1545		E	S	W
<i>Conistra ligula</i>	Dark Chestnut	LC			939		E	S	W
<i>Conistra rubiginosa</i>	Dotted Chestnut	LC			352		E		W
<i>Conistra erythrocephala</i>	Red-headed Chestnut	RE		Last resident record 1932 (Parsons 2003). Still occurs as scarce immigrant	0				
<i>Jodia croceago</i>	Orange Upperwing	CR (PE)	B2 a,b(iv)	Probably extinct. The only recent record, an individual seen in 2006 in Sussex, is thought most likely an immigrant, but could have been wanderer from potential breeding habitat nearby	0	Nationally Rare	E		
<i>Lithophane semibrunnea</i>	Tawny Pinion	LC			492		E	S	W

<i>Lithophane socia</i>	Pale Pinion	LC			971		E	S	W
<i>Lithophane ornitopus</i>	Grey Shoulder-knot	LC			850		E		W
<i>Lithophane furcifera</i>	Conformist	RE		Last resident record 1959 (Parsons 2003). Still occurs as scarce immigrant	0				
<i>Lithophane leautieri</i>	Blair's Shoulder-knot	LC			1009		E	S	W
<i>Xylena solidaginis</i>	Golden-rod Brindle	LC			98	Nationally Scarce	E	S	W
<i>Xylena exsoleta</i>	Sword-grass	LC			68	Nationally Scarce		S	
<i>Xylena vetusta</i>	Red Sword-grass	LC			752		E	S	W
<i>Eupsilia transversa</i>	Satellite	LC			1279		E	S	W
<i>Enargia paleacea</i>	Angle-striped Sallow	LC			197		E	S	
<i>Ipimorpha retusa</i>	Double Kidney	LC			202		E		W
<i>Ipimorpha subtusa</i>	Olive	LC			688		E	S	W
<i>Cosmia diffinis</i>	White-spotted Pinion	LC			17	Nationally Scarce	E		
<i>Cosmia affinis</i>	Lesser-spotted Pinion	LC			281		E		W
<i>Cosmia trapezina</i>	Dun-bar	LC			1584		E	S	W
<i>Cosmia pyralina</i>	Lunar-spotted Pinion	LC			462		E		W
<i>Dicycla oo</i>	Heart Moth	NT	B1 b(iv), B2 b(iv)	Rare and range restricted species with evidence of ongoing distribution decline	11	Nationally Rare	E		
<i>Atethmia centrago</i>	Centre-barred Sallow	LC			1316		E	S	W
<i>Brachylomia viminalis</i>	Minor Shoulder-knot	NT	A2 b	Steep population decline to 2009 but seemingly stable since then	767		E	S	W
<i>Parastichtis suspecta</i>	Suspected	LC			499		E	S	W
<i>Apterogenum ypsilon</i>	Dingy Shears	LC			756		E	S	W
<i>Dryobota labecula</i>	Oak Rustic	LC		Recent colonist on non-native plant	23	Nationally Scarce	E		
<i>Griposia aprilina</i>	Merveille du Jour	LC			1113		E	S	W
<i>Dryobotodes eremita</i>	Brindled Green	LC			954		E	S	W
<i>Dryobotodes tenebrosa</i>	Sombre Brocade	LC		Recent colonist (2008 - Parsons 2010)	18	recent colonist not assessed	E		
<i>Antitype chi</i>	Grey Chi	NT	A2 b	Steep population decline to 2007, but some amelioration over recent years	506		E	S	W
<i>Trigonophora flammea</i>	Flame Brocade	LC		Recent colonist (2011) and plausible rescue effect	7	recent colonist not assessed	E		
<i>Aporophyla australis</i>	Feathered Brindle	LC			61	Nationally Scarce	E		W

<i>Aporophyla lueneburgensis/lutulenta</i>	Northern/Deep-brown Dart	LC		<i>Aporophyla lueneburgensis</i> & <i>A.lutulenta</i> have been considered together as their taxonomy is uncertain with some sources claiming that <i>A.lutulenta</i> does not occur in Britain at all	637		E	S	W
<i>Aporophyla nigra</i>	Black Rustic	LC			1419		E	S	W
<i>Dasypolia tempfli</i>	Brindled Ochre	NT	A2 b	Steep population decline to 2008 but modest improvement in very recent years	254		E	S	W
<i>Polymixis lichenea</i>	Feathered Ranunculus	LC			402		E	S	W
<i>Polymixis xanthomista</i>	Black-banded	LC			36	Nationally Scarce	E		W
<i>Polymixis flavicincta</i>	Large Ranunculus	LC			494		E		W
<i>Mniotype adusta</i>	Dark Brocade	LC			718		E	S	W
<i>Panolis flammea</i>	Pine Beauty	LC			1058		E	S	W
<i>Orthosia incerta</i>	Clouded Drab	LC			1739		E	S	W
<i>Orthosia miniosa</i>	Blossom Underwing	LC			221		E		W
<i>Orthosia cerasi</i>	Common Quaker	LC			1757		E	S	W
<i>Orthosia cruda</i>	Small Quaker	LC			1420		E	S	W
<i>Orthosia populeti</i>	Lead-coloured Drab	LC			488		E	S	W
<i>Orthosia gracilis</i>	Powdered Quaker	LC			1282		E	S	W
<i>Orthosia opima</i>	Northern Drab	LC			118		E		W
<i>Orthosia gothica</i>	Hebrew Character	LC			1894		E	S	W
<i>Anorthoa munda</i>	Twin-spotted Quaker	LC			1319		E	S	W
<i>Egira conspicillaris</i>	Silver Cloud	LC			45	Nationally Scarce	E		W
<i>Tholera cespitis</i>	Hedge Rustic	VU	A2 b	Although steep population decrease seems to have ameliorated recently, the lowest and second lowest annual index values have occurred in recent years indicating potential for ongoing serious decline	584		E	S	W
<i>Tholera decimalis</i>	Feathered Gothic	LC			894		E	S	W
<i>Cerapteryx graminis</i>	Antler Moth	LC			1629		E	S	W
<i>Anarta trifolii</i>	Nutmeg	LC			870		E	S	W

<i>Anarta melanopa</i>	Broad-bordered White Underwing	LC			33	Nationally Scarce		S	
<i>Anarta myrtilli</i>	Beautiful Yellow Underwing	LC			350		E	S	W
<i>Coranarta cordigera</i>	Small Dark Yellow Underwing	LC		Severe decline and most recent hectad records are based on sighting of a single adult moth.	17	Nationally Scarce		S	
<i>Polia bombycina</i>	Pale Shining Brown	EN	B2 a,b(iv)	Rare species with decreasing distribution	7	Nationally Rare	E		
<i>Polia hepatica</i>	Silvery Arches	LC			38	Nationally Scarce	E	S	W
<i>Polia nebulosa</i>	Grey Arches	LC			987		E	S	W
<i>Pachetra sagittigera</i>	Feathered Ear	RE		Last resident record 1963 (Parsons 2003)	0				
<i>Lacanobia w-latinum</i>	Light Brocade	LC			533		E		W
<i>Lacanobia thalassina</i>	Pale-shouldered Brocade	LC			1446		E	S	W
<i>Lacanobia contigua</i>	Beautiful Brocade	LC			209		E	S	W
<i>Lacanobia suasa</i>	Dog's Tooth	LC			358		E	S	W
<i>Lacanobia oleracea</i>	Bright-line Brown-eye	LC			1856		E	S	W
<i>Melanchra persicariae</i>	Dot Moth	LC		Steep decline to 2008, but slight recovery since and plausible rescue effect	1202		E	S	W
<i>Ceramica pisi</i>	Broom Moth	VU	A2 b	Continued steep population decline, including two recent years with zero counts	1310		E	S	W
<i>Papestra biren</i>	Glaucous Shears	LC			411		E	S	W
<i>Hada plebeja</i>	Shears	LC			1234		E	S	W
<i>Mamestra brassicae</i>	Cabbage Moth	LC			1220		E	S	W
<i>Sideridis turbida</i>	White Colon	LC			97	Nationally Scarce	E	S	W
<i>Sideridis rivularis</i>	Campion	LC			1093		E	S	W
<i>Sideridis reticulata</i>	Bordered Gothic	CR (PE)	B2 a,b(iv)	Thought to be extinct with the last resident record believed to be 2001 (Parsons 2010). Still occurs as scarce immigrant	1	Nationally Rare	E		
<i>Conisania andalusica</i>	Barrett's Marbled Coronet	LC			34	Nationally Scarce	E		W

<i>Hecatera bicolorata</i>	Broad-barred White	NT	A2 b	Steep population decline, but recent rate of decrease reduced	783		E	S	W
<i>Hecatera dysodea</i>	Small Ranunculus	LC			245		E		W
<i>Hadena bicruris</i>	Lychnis	LC			1429		E	S	W
<i>Hadena compta</i>	Varied Coronet	LC			455		E		W
<i>Hadena confusa</i>	Marbled Coronet	LC			438		E	S	W
<i>Hadena albimacula</i>	White Spot	NT	B1 a, B2 a	Rare and range restricted species but no evidence of ongoing decline	6	Nationally Rare	E		
<i>Hadena caesia</i>	Grey	EN	B2 a,b(iv)	Rare and range restricted species with continuing decrease in distribution	3	Nationally Rare		S	
<i>Hadena perplexa</i>	Tawny Shears (incl. Pod Lover)	LC			428		E	S	W
<i>Hadena irregularis</i>	Viper's Bugloss	RE		Last resident record 1968 (Parsons 2003)	0				
<i>Mythimna turca</i>	Double Line	LC			237		E		W
<i>Mythimna pudorina</i>	Striped Wainscot	LC			360		E		W
<i>Mythimna conigera</i>	Brown-line Bright Eye	LC			1061		E	S	W
<i>Mythimna pallens</i>	Common Wainscot	LC			1641		E	S	W
<i>Mythimna favicolor</i>	Mathew's Wainscot	LC			44	Nationally Scarce	E		
<i>Mythimna impura</i>	Smoky Wainscot	LC			1987		E	S	W
<i>Mythimna straminea</i>	Southern Wainscot	LC			517		E	S	W
<i>Mythimna unipuncta</i>	White-speck	LC		Immigrant in most of UK, recent colonist in one small area (early 2000s - Parsons 2010) and plausible rescue effect	3	recent colonist not assessed	E		
<i>Mythimna albipuncta</i>	White-point	LC			485		E		
<i>Mythimna ferrago</i>	Clay	LC			1571		E	S	W
<i>Mythimna litoralis</i>	Shore Wainscot	LC			92	Nationally Scarce	E	S	W
<i>Mythimna l-album</i>	L-album Wainscot	LC			258		E		W
<i>Leucania comma</i>	Shoulder-striped Wainscot	LC			1240		E	S	W
<i>Leucania obsoleta</i>	Obscure Wainscot	LC			233		E	S	W
<i>Leucania putrescens</i>	Devonshire Wainscot	LC			44	Nationally Scarce	E		W
<i>Senta flammea</i>	Flame Wainscot	LC			53	Nationally Scarce	E		

<i>Eriopygodes imbecilla</i>	Silurian	NT	B1 a, B2 a	Rare and range restricted species. Although recently discovered to be more widespread than previously realised, impact of upland grazing and burning pose threats	5	Nationally Rare	E		W
<i>Actebia praecox</i>	Portland Moth	LC			25	Nationally Scarce	E	S	W
<i>Euxoa cursoria</i>	Coast Dart	LC			52	Nationally Scarce	E	S	
<i>Euxoa obelisca</i>	Square-spot Dart	LC			61	Nationally Scarce	E	S	W
<i>Euxoa tritici</i>	White-line Dart	VU	A2 b	Continued steep population decline, including recent zero counts. May now be effectively extinct in RIS network	568		E	S	W
<i>Euxoa nigricans</i>	Garden Dart	VU	A2 b	Steep population decline but relatively stable in recent years at very low levels (some years with zero counts)	516		E	S	W
<i>Agrotis cinerea</i>	Light Feathered Rustic	LC			97	Nationally Scarce	E		W
<i>Agrotis exclamationis</i>	Heart and Dart	LC		Large population fluctuations but clear decline until last 10 years, which are characterised by relatively high and low values. Plausible rescue effect	1740		E	S	W
<i>Agrotis segetum</i>	Turnip Moth	LC			1250		E	S	W
<i>Agrotis clavis</i>	Heart and Club	LC			889		E	S	W
<i>Agrotis vestigialis</i>	Archer's Dart	LC			251		E	S	W
<i>Agrotis ripae</i>	Sand Dart	LC			85	Nationally Scarce	E	S	W
<i>Agrotis trux</i>	Crescent Dart	LC			122		E	S	W
<i>Agrotis puta</i>	Shuttle-shaped Dart	LC			1221		E	S	W
<i>Axylia putris</i>	Flame	LC			1577		E	S	W
<i>Ochropleura plecta</i>	Flame Shoulder	LC			2044		E	S	W
<i>Diarsia dahlia</i>	Barred Chestnut	LC			395		E	S	W
<i>Diarsia brunnea</i>	Purple Clay	LC			1352		E	S	W
<i>Diarsia mendica</i>	Ingrailed Clay	LC			1887		E	S	W
<i>Diarsia rubi</i>	Small Square-spot	LC			1898		E	S	W

<i>Diarsia florida</i>	Fen Square-spot	DD		Taxonomy and identification so uncertain that records unreliable			E		W
<i>Cerastis rubricosa</i>	Red Chestnut	LC			1350		E	S	W
<i>Cerastis leucographa</i>	White-marked	LC			158		E		W
<i>Lycophotia porphyrea</i>	True Lover's Knot	VU	A2 b	Ongoing steep population decline	1565		E	S	W
<i>Rhyacia simulans</i>	Dotted Rustic	LC			158		E	S	
<i>Standfussiana lucernea</i>	Northern Rustic	LC			180		E	S	W
<i>Noctua pronuba</i>	Large Yellow Underwing	LC			2232		E	S	W
<i>Noctua fimbriata</i>	Broad-bordered Yellow Underwing	LC			1509		E	S	W
<i>Noctua orbona</i>	Lunar Yellow Underwing	LC			64	Nationally Scarce	E	S	
<i>Noctua comes</i>	Lesser Yellow Underwing	LC			1975		E	S	W
<i>Noctua interjecta</i>	Least Yellow Underwing	LC			1195		E	S	W
<i>Noctua janthina</i>	Langmaid's Yellow Underwing	LC		Recent colonist (2001 - Parsons 2010)	23	recent colonist not assessed	E		
<i>Noctua janthe</i>	Lesser Broad-bordered Yellow Underwing	LC			1942		E	S	W
<i>Spaelotis ravida</i>	Stout Dart	CR	A2 b, B2 a,b(iv),c(iii,i v)	Rapid recent decline in abundance and distribution in GB (and neighboring European countries) coupled with extreme fluctuations. This species is effectively extinct in RIS network. There is no evidence that the rate or causes of decline have lessened and the species may already be extinct in GB	1	Nationally Rare	E		
<i>Eurois occulta</i>	Great Brocade	LC			91	Nationally Scarce		S	
<i>Graphiphora augur</i>	Double Dart	NT	A2 b	Steep population decline, but more stable in recent years	551		E	S	W
<i>Anaplectoides prasina</i>	Green Arches	LC			1209		E	S	W
<i>Xestia baja</i>	Dotted Clay	LC			1300		E	S	W

<i>Xestia stigmatica</i>	Square-spotted Clay	LC			221		E	S	W
<i>Xestia castanea</i>	Neglected Rustic	LC			425		E	S	W
<i>Xestia agathina</i>	Heath Rustic	LC			567		E	S	W
<i>Xestia xanthographa</i>	Square-spot Rustic	LC			1943		E	S	W
<i>Xestia sexstrigata</i>	Six-striped Rustic	LC			1559		E	S	W
<i>Xestia c-nigrum</i>	Setaceous Hebrew Character	LC			1640		E	S	W
<i>Xestia ditrapezium</i>	Triple-spotted Clay	LC			661		E	S	W
<i>Xestia triangulum</i>	Double Square-spot	LC			1752		E	S	W
<i>Xestia ashworthii</i>	Ashworth's Rustic	LC			15	Nationally Rare			W
<i>Xestia alpicola</i>	Northern Dart	LC		Under-recorded, difficult to determine trends	17	Nationally Scarce		S	
<i>Coenophila subrosea</i>	Rosy Marsh Moth	NT	B1 a, B2 a	Rare and range restricted but no evidence of ongoing decline	5	Nationally Rare	E		W
<i>Eugnorisma glareosa</i>	Autumnal Rustic	NT	A2 b	Continued steep population decline (reaching the lowest indices of the whole time series in 2013 and 2014) despite relatively high values in 2007 and 2015. But plausible rescue effect	1223		E	S	W
<i>Eugnorisma depuncta</i>	Plain Clay	LC			140		E	S	W
<i>Protolampra sobrina</i>	Cousin German	LC			36	Nationally Scarce		S	
<i>Naenia typica</i>	Gothic	LC			1107		E	S	W
<i>Meganola strigula</i>	Small Black Arches	LC			25	Nationally Scarce	E		
<i>Meganola albula</i>	Kent Black Arches	LC			271		E		
<i>Nola cucullatella</i>	Short-cloaked Moth	LC			917		E		W
<i>Nola confusalis</i>	Least Black Arches	LC			1226		E	S	W
<i>Bena bicolorana</i>	Scarce Silver-lines	LC			774		E		W
<i>Pseudoips prasinana</i>	Green Silver-lines	LC			1179		E	S	W
<i>Nycteola revayana</i>	Oak Nycteoline	LC			837		E	S	W
<i>Earias clorana</i>	Cream-bordered Green Pea	LC			417		E		W

Appendix 2. IUCN Red List categories and criteria (IUCN 2012a)

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of $\geq 90\%$ over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

- (a) direct observation
- (b) an index of abundance appropriate to the taxon
- (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
- (d) actual or potential levels of exploitation
- (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of $\geq 80\%$ over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of $\geq 80\%$, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of $\geq 80\%$ over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 100 km², and estimates indicating at least two of a–c:

- a. Severely fragmented or known to exist at only a single location.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (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 the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 10 km², and estimates indicating at least two of a–c:

- a. Severely fragmented or known to exist at only a single location.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (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 the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):

- a. Population structure in the form of one of the following:
 - (i) no subpopulation estimated to contain more than 50 mature individuals, OR
 - (ii) at least 90% of mature individuals in one subpopulation.
- b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a very high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of $\geq 70\%$ over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

- (a) direct observation
- (b) an index of abundance appropriate to the taxon
- (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
- (d) actual or potential levels of exploitation
- (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of $\geq 50\%$ over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of $\geq 50\%$, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of $\geq 50\%$ over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 5,000 km², and estimates indicating at least two of a–c:

- a. Severely fragmented or known to exist at no more than five locations.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (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 the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 500 km², and estimates indicating at least two of a–c:

- a. Severely fragmented or known to exist at no more than five locations.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (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 the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

C. Population size estimated to number fewer than 2,500 mature individuals and either:

1. An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):

a. Population structure in the form of one of the following:

(i) no subpopulation estimated to contain more than 250 mature individuals,
OR

(ii) at least 95% of mature individuals in one subpopulation.

b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 250 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years).

VULNERABLE (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of $\geq 50\%$ over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are: clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

(a) direct observation

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of $\geq 30\%$ over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of $\geq 30\%$, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of $\geq 30\%$ over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, AND where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 20,000 km², and estimates indicating at least two of a–c:

- a. Severely fragmented or known to exist at no more than 10 locations.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (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 the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 2,000 km², and estimates indicating at least two of a–c:

- a. Severely fragmented or known to exist at no more than 10 locations.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (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 the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

C. Population size estimated to number fewer than 10,000 mature individuals and either:

1. An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):

- a. Population structure in the form of one of the following:
 - (i) no subpopulation estimated to contain more than 1,000 mature individuals, OR
 - (ii) all mature individuals are in one subpopulation.
- b. Extreme fluctuations in number of mature individuals.

D. Population very small or restricted in the form of either of the following:

1. Population size estimated to number fewer than 1,000 mature individuals.

2. Population with a very restricted area of occupancy (typically less than 20 km²) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

E. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.