A review of the Red List status of the Odonata of Great Britain

2026

British Dragonfly Society

With Natural England and UKCEH

Authors: Eleanor Colver, Pam Taylor, Dave Smallshire, Steve Cham, Gary Powney, Pat Batty, Adrian Parr & John Winterbottom.

Image left to right: Northern Damselfly – Tim Coleshaw, White-faced Darter – Dave Smallshire, Northern Emerald – Joanna Hood.

Contents

		Page
1	**Introduction**	**4**
1.1	IUCN Red List	4
1.2	Introduction to the Odonata Review	5
1.3	Previous Reviews	5
1.3.1	British Red Data Books: 2. Insects (1987)	5
1.3.2	The Odonata Red Data List for Great Britain (2008)	5
1.4	This review	6
2	**Methods**	**6**
2.1	Data sources and verification	6
2.2	Regional IUCN Red List Assessment	6
2.2.1	Determining which taxa and which regional populations to assess	7
2.2.2	Application of the Guidelines	8
2.2.3	Regional Adjustments to Categories	12
2.3	GB Rarity Assessments	13
2.4	Taxonomy	13
3	**Results**	**13**
3.1	Data obtained	13
3.2	UKCEH Occupancy Modelling	15
3.3	IUCN Red List Status	15
3.4	British Rarity Status	15
3.5	Species Status Summary	16
4	**Discussion**	**18**
5	**References**	**24**
6	**Acknowledgements**	**37**
7	**Appendices**	**38**
	Appendix 1: Species Profiles	38
A.1.1	Aeshna affinis	38
A.1.2	Aeshna caerulea	39
A.1.3	Aeshna cyanea	40
A.1.4	Aeshna grandis	41
A.1.5	Aeshna juncea	41
A.1.6	Aeshna mixta	42
A.1.7	Anax ephippiger	43
A.1.8	Anax imperator	44
A.1.9	Anax junius	44
A.1.10	Anax parthenope	45
A.1.11	Brachytron pratense	46
A.1.12	Calopteryx splendens	46

A.1.13 Calopteryx virgo 47
A.1.14 Ceriagrion tenellum 48
A.1.15 Chalcolestes viridis 49
A.1.16 Coenagrion armatum 50
A.1.17 Coenagrion hastulatum 50
A.1.18 Coenagrion mercuriale 51
A.1.19 Coenagrion puella 53
A.1.20 Coenagrion pulchellum 54
A.1.21 Coenagrion scitulum 55
A.1.22 Cordulegaster boltonii 56
A.1.23 Cordulia aenea 56
A.1.24 Crocothemis erythraea 57
A.1.25 Enallagma cyathigerum 58
A.1.26 Erythromma najas 58
A.1.27 Erythromma viridulum 59
A.1.28 Gomphus vulgatissimus 60
A.1.29 Ischnura elegans 61
A.1.30 Ischnura pumilio 62
A.1.31 Isoaeschna isosceles 63
A.1.32 Lestes barbarous 64
A.1.33 Lestes dryas 65
A.1.34 Lestes sponsa 66
A.1.35 Leucorrhinia dubia 67
A.1.36 Leucorrhinia pectoralis 68
A.1.37 Libellula depressa 68
A.1.38 Libellula fulva 69
A.1.39 Libellula quadrimaculata 70
A.1.40 Orthetrum cancellatum 70
A.1.41 Orthetrum coerulescens 71
A.1.42 Oxygastra curtisii 72
A.1.43 Pantala flavescens 72
A.1.44 Platycnemis pennipes 72
A.1.45 Pyrrhosoma nymphula 73
A.1.46 Somatochlora arctica 74
A.1.47 Somatochlora flavomaculata 75
A.1.48 Somatochlora metallica 75
A.1.49 Stylurus flavipes 77
A.1.50 Sympecma fusca 77
A.1.51 Sympetrum danae 77
A.1.52 Sympetrum flaveolum 78
A.1.53 Sympetrum fonscolombii 79
A.1.54 Sympetrum nigrescens 79
A.1.55 Sympetrum pedemontanum 80
A.1.56 Sympetrum sanguineum 80
A.1.57 Sympetrum striolatum 81
A.1.58 Sympetrum vulgatum 81

Appendix 2: Geography of Great Britain 82

Appendix 3: UKCEH occupancy modelling methodology: ROBITT (Risk-Of-Bias In studies of Temporal Trends in ecology) assessment report 87

Citation Colver, E., Taylor, P., Smallshire, D., Cham, S., Powney, G., Batty, P., Parr, A., & Winterbottom, J. 2026. A review of the Red List status of the Odonata of Great Britain, 2026. British Dragonfly Society.

1 Introduction

1.1 IUCN Red List

The UK government's current Environmental Improvement Plan (EIP) (Wilkins *et al*., 2022) includes commitments to:

- Halt and reverse the decline in species abundance.
- Take targeted action to conserve and recover threatened species.

These commitments are supported by specific targets to:

- Halt the decline in species abundance by 2030.
- Increase species abundance so that by 2042 it is greater than in 2022 and at least 10% greater than in 2030.
- Improve the Red List Index for England for species extinction by 2042 compared to 2022 levels.

The last of these targets is now underpinned by statute in The Environmental Targets (Biodiversity) (England) Regulations. These commitments clearly require a sound understanding of the status of all species in Great Britain, including knowledge of which are threatened. The internationally recognised, objective approach to describing extinction risk is by assigning each species to one of the International Union for the Conservation of Nature (IUCN) threat categories and collating these into a 'Red List'. Red Lists can be compiled at global or regional/national levels. Categorisation is a strictly defined process, to ensure traceability, comparability and repeatability. The current categories and criteria were set out in 2001 (IUCN, 2001) and are supported by guidelines for assigning species to the threat categories (IUCN, 2012a; IUCN Standards and Petitions Committee, 2024).

Reviews of Red Lists for Great Britain (GB) are initiated by the UK's statutory nature conservation agencies and are often produced in cooperation with non-governmental organisations and taxonomic specialist societies and recording schemes. This review was commissioned and partially funded by Natural England. All approved lists are published following formal review by two independent referees and sign-off by a qualified global and regional assessor. Summary information may be published within the JNCC Conservation Designations Spreadsheet (https://hub.jncc.gov.uk/assets/478f7160-967b-4366-acdf-8941fd33850b).

The aim of IUCN Red Lists is to identify those species at greatest risk from extinction. IUCN GB Red Lists play an important role in prioritising conservation work; they are an essential reference for decision makers when prioritising the allocation of resources towards species conservation. The British Dragonfly Society (BDS), for example, recognises the presence of breeding populations of Red Listed Odonata species as a criterion in the BDS Priority Sites Assessment process (https://british-dragonflies.org.uk/recording/priority-sites/), a method used to identify the most valuable wetland sites for Odonata in GB.

1.2 Introduction to the Odonata Review

The *State of Dragonflies in Britain and Ireland 2021* (Taylor *et al*., 2021) outlined the significant changes in occupancy (the proportion of the geographical area in which the species of interest is present) GB's and Ireland's Odonata exhibited from 1970 to 2019. The document reported that 19 of the resident and/or regular migrant species (41%) significantly increased in occupancy while five (11%) significantly decreased. This rapid change in occupancy exhibited by many species of Odonata in GB was attributed to the Order's sensitivity to changes in climate, as well as its ability to actively and rapidly respond to changes in the distribution of suitable breeding habitat via dispersal. The 2021 report results highlighted the necessity for a review of The Odonata Red Data List for Great Britain, the previous of which was published in 2008 (Daguet *et al*., 2008), in order to ensure IUCN threat categories accurately reflect the current state of the region's taxa.

An up-to-date Red List will not only assist in promoting the conservation needs of specific taxa but also shed light on the factors threatening their associated freshwater habitats, many of which are ecologically diverse, support other Red Listed taxa, and provide a wide range of ecosystem services (Khan, 2015).

Odonata have a low diversity in GB (compared to the other invertebrate groups), are charismatic in appearance, and can be identified and surveyed using non-lethal techniques; these factors make them a popular study group among amateur entomologists. A range of detailed identification guides and atlases for the British Odonata are available; two of the most up to date include guides to adult Odonata in Britain and Ireland by Smallshire & Swash (2025) and by Brooks and Cham (2026), and a guide to the larvae and exuviae of British Odonata by Cham (2012).

The British Odonata Recording Scheme has been running since 1968, when it was set up by the Biological Records Centre; it was taken over by the British Dragonfly Society when the organisation was formed in 1983. The scheme's data for England, Wales and Scotland formed the backbone of the previous Odonata species status assessments in GB (Daguet *et al*., 2008) and will fulfil the same role in this review.

1.3 Previous Reviews

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

The Red Data Book system was initiated in 1966 by the IUCN; Odonata in GB were first assigned threat categories in the *British Red Data Books: 2. Insects* (Shirt, 1987). Species were assigned to five categories: Endangered, Vulnerable, Rare, Out of Danger and Endemic. Shirt (1987) listed nine Odonata (Table 1); only the six species listed as Endangered (Category 1) and Vulnerable (Category 2) are profiled in the Red Data Book data sheets.

1.3.2 The Odonata Red Data List for Great Britain (2008)

The *Odonata Red Data List for Great Britain* (Daguet *et al*., 2008**)** was the first to be produced in accordance with the IUCN's categories and criteria (IUCN, 2001, 2003,

2005; IUCN Standards and Petitions Working Group, 2006). Table 4 in this document alphabetically lists the taxa included in the report, 51 in total, and their categorisation.

1.4 This review

Since the publication of *The Odonata Red Data List for Great Britain* (Daguet *et al*., 2008), the arrival of new species in GB and their subsequent establishment of colonies, as well as the significant change in occupancy exhibited by resident species (Taylor *et al*., 2021), mean that the report no longer accurately reflects the level of extinction threat faced by Odonata taxa within the region, and an update is overdue. This review was commissioned by Natural England to be carried out by the BDS and its Dragonfly Conservation Group (DCG), a volunteer team of Odonatological experts. Since the 2008 publication there have been a number of updates to the IUCN guidelines and this review follows the latest versions (IUCN, 2012a, 2012b; IUCN Standards and Petitions Committee, 2024). Nomenclatural changes have also been adopted and incorporated where necessary.

2 Methods

2.1 Data sources and verification

Quantitative data for this review were sourced from the BDS Recording Scheme database, which is stored on the National Biodiversity Network atlas (https://registry.nbnatlas.org/public/show/dp97). The database incorporates records from various recording schemes, the most significant being the BDS recording projects, the British Trust for Ornithology's partnership project, BirdTrack, Butterfly Conservation's UK Butterfly Monitoring Scheme, and iNaturalist. These records, along with those entered directly, are collated and reviewed by County Dragonfly Recorders in iRecord, (https://irecord.org.uk), prior to export to the NBN Atlas. Only data from the BDS Recording Scheme database was used to ensure comprehensive verification, and an additional quality check was performed by the BDS Dragonfly Conservation Group to remove any remaining erroneous records. However, it should be recognised that this assessment could not incorporate all existing data for British Odonata as some data sources could not be accessed; for example, the results of commissioned surveys on private property, which have not been made public.

Both County Dragonfly Recorders and the DCG provided insight into species-specific ecology, threats and trends, as well as knowledge regarding local populations, records, and conservation action. The accumulation of this information was vital in performing a comprehensive review of species categorisation.

2.2 Regional IUCN Red List Assessment

The three regional assessment process steps comprise:

1. Determining which taxa and which regional populations to assess.
2. Evaluating and assigning preliminary status categories to the regional population of each taxon using the IUCN Red List Categories and Criteria (IUCN, 2012b).
3. Assessing the potential impact of interactions with populations outside that region on taxon extinction risk and assigning final categorisation (IUCN, 2012a).

2.2.1 Determining which taxa and which regional populations to assess

2.2.1.1 Not Applicable (NA)

All taxa with records accepted into the BDS Recording Scheme database were considered for assessment; records date back to the early 1800s.

A taxon can be categorised as Not Applicable (NA) in circumstances where the regional population 'is not a wild population or is not within its natural range in the region, or because it is a vagrant to the region'. A vagrant is a 'taxon that is currently found only occasionally within the boundaries of a region'. Taxa which have been recorded in GB, but which have been categorised as NA, are identified in Table 1.

All 'breeding' taxa were fully assessed during this review. Breeding taxa were identified as having evidence that they have successfully reproduced within GB consistently for at least 10 years; evidence consisted of records for larvae, exuviae, emerging adults and teneral (newly emerged) adults. All other taxa with GB records were identified as 'vagrants', did not undergo assessment and were assigned to NA.

Table 1. Taxa categorised as Not Applicable (NA), with 2014-2023 tetrad (2 km × 2 km OS grid squares) occupancy, and a brief description of their status history in GB.

Species Name	Tetrads (2014-2023)	Rationale for categorisation
Anax ephippiger	194	Irregular migrant, although records are becoming more frequent. Species is most regularly recorded at coastal sites around GB, most commonly on the south coast of England. Evidence of attempted breeding (copulating pairs, ovipositing females) has been recorded in England since 2011. Evidence of successful breeding (larvae and emerging adults) was reported in Cornwall in 2023.
Anax junius	3	Vagrant. Recorded in 1998 on the Isles of Scilly and in Cornwall (East and West Vice Counties) and in 2023 on the Isles of Scilly.
Crocothemis erythraea	5	Predominantly a vagrant; however, adults were observed copulating and ovipositing for the first time in GB, in Dorset, in 2024.

Leucorrhinia pectoralis	3	Vagrant. Only recorded in GB in 2012 and 2018, both in Suffolk (East Suffolk Vice County).
Pantala flavescens	0	Vagrant. Only two records for GB: 1823 in Norfolk (East Norfolk Vice County) and 1951 in Lancashire (South Lancashire Vice County).
Somatochlora flavomaculata	3	Vagrant. Only record for GB from Suffolk in 2018 (East Suffolk Vice County).
Stylurus flavipes	0	Vagrant. Only record for GB from Sussex (East Sussex Vice County) in 1818.
Sympecma fusca	1	Vagrant. Only two records for GB: 2008 in West Glamorgan (Glamorganshire Vice County) and 2022 in Hampshire (South Hampshire Vice County).
Sympetrum flaveolum	2	Vagrant. Most recent records consist of individual vagrants observed in England. GB experiences rare influxes of this migrant. A significant influx in 1995 led to the short-term colonisation of a number of sites in England and South Wales; breeding colonies did not persist longer than 3 years (Parr 1997).
Sympetrum pedemontanum	0	Vagrant. Only record for GB from Gwent (Breconshire Vice County), in 1995.
Sympetrum vulgatum	2	Vagrant. Most recently recorded in 2020 in Somerset (North Somerset Vice County).

2.2.2 Application of the Guidelines

For full details of the assessment process, please refer to IUCN guideline documents (IUCN, 2012a, 2012b; IUCN Standards and Petitions Committee, 2024). In this section, the application of guidelines to GB Odonata during assessment is outlined.

2.2.2.1 Criterion A: assessing population size reduction

Population change was estimated using the following measurements:

A1-4, *an index of abundance appropriate to the taxon*

Population trend calculations were available as a result of the occupancy modelling conducted by the UK Centre for Ecology & Hydrology (CEH) for the State of Dragonflies in Britain and Ireland 2021 (Taylor *et al*., 2021). Full details of this occupancy modelling methodology can be found in Appendix 3. The analysis fitted hierarchical occupancy models following the same implementation as Powney *et al*. (2019). By using two hierarchically coupled sub-models, their occupancy model simultaneously estimated and accounted for variation in detectability, while estimating

species presence for a given site, year combination. The model was fitted at the 1km Ordnance Survey grid square (monad) scale using records between 1970 and 2021 from the BDS Recording Scheme database. The monad occurrence records were organised into unique combinations of grid cell, date and species. It excluded grid cells with fewer than two years of data, ensuring exclusion of the most poorly sampled regions. These observations constitute presence-only data, so non-detections were inferred from records of other Odonate species within the same visit.

The occupancy models produced a time-series of annual occupancy estimates, the proportion of sites occupied for the given species. Trends were estimated by first calculating the annual growth rate (% change per year) between the first and last year for the long and short-term trends. The first and last year vary among species. We define the first year for the long-term trend as the earliest reliable year (rhat <1.1) after (or equal to) the first year where the species was recorded. The last year is consistent for the long and short-term trend and was defined as the final reliable (rhat <1.1) year. The first year of the short-term trend is 9 years prior to the last year, ensuring the short-term trend was estimated across a 10-year window. Short-term trends were not estimated for species with an unreliable short-term first year. The annual growth rates estimated from occupancy models over the two periods were then used to estimate total percentage changes over 50-year (1972-2021) and 30-year (1992-2021) periods (long-term, using the long-term annual growth rate) and a 10-year (2012-2021) period (short-term). Only the 10-year period percentage change estimates were used as the index of abundance; however, the 50-year and 30-year percentage change estimates provide a useful insight into population change in the long term.

Population reduction was measured over 10 years for all taxa assessed as this is a longer length of time than three generations. Larvae of *Cordulegaster boltonii* can experience delayed development when experiencing colder conditions and/or prey scarcity; however, the generational length for the majority is three years or under.

c) a decline in Area of Occupancy (AOO)/extent of occurrence (EOO)

We do not know the precise AOO or EOO in a given year. Instead, we derive an estimate of these measures by using data consolidated across longer time periods. Records were combined over two 5-year time periods (2009-2013, 2019-2023).

For each of the two time periods, the AOO was calculated at tetrad level only using tetrads with Odonata records in both datasets (13805 tetrads; 45% of the total number of tetrads with at least one Odonata record in both time periods), following the common squares method (CSM) (Hickling *et al*., 2005). This will have reduced but not fully eliminated recording effort biases and this variable needs to be considered when interpreting the results.

For each of the two time periods, the EOO was calculated via the construction of alpha-hull concave polygons using alpha threshold parameter values 0.3, 0.5 and 0.7 on QGIS. A comparison of the mapped results identified 0.3 as producing polygons that best fit species' distribution based on expert judgement. Again only records that fell in tetrads with Odonata records in both datasets were used.

For each species, the AOO and EOO values for the two time periods were assigned to the nominal years 2011 and 2021 and used to construct an exponential curve using the downloadable IUCN Criterion A tool.

2.2.2.2 Criterion B: assessment of geographic range

To qualify, EOO and/or AOO need to be below certain threshold values (EOO: <20000km^2, EOO: <2000km^2 for qualification against a threat criteria*)*

Current EOO and AOO were estimated from data consolidated across a 10-year time period: 2014-2023. AOO was calculated at tetrad level. EOO was calculated via the construction of the area of a minimum convex polygon in QGIS.

Additional conditions…

a) *Severely fragmented or a small number of locations*

'Location' and 'severely fragmented' have specific definitions under IUCN guidelines (IUCN Standards and Petitions Committee, 2024).

- Location is defined as a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present, as fully described in IUCN guidelines pages 63-64 (IUCN Standards and Petitions Committee, 2024).
- Severely fragmented refers to the situation in which increased extinction risk to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonization, as fully described in IUCN guidelines page 49.

To understand the distribution of existing subpopulations, recent records (2019-2023) were mapped in QGIS. An initial visual assessment of subpopulation distribution was used to identify taxa that potentially meet these conditions, whose records are clustered and localised with large geographical distances in between. Species' dispersal ability vs geographical distance between subpopulations, habitat fragmentation, and barriers to dispersal were then taken into consideration. In addition to species' surveys and habitat suitability assessments, online habitat mapping tools were used as reference, including MAGICMap (https://magic.defra.gov.uk/), the Scotland's Environmental Map (https://map.environment.gov.scot/sewebmap/), and Natural Resources Wales Map Viewer (https://experience.arcgis.com/experience/dd852f0e12864928973e3e165a1b4631/). Information on subpopulation size is limited; in some cases subpopulation count data is available; however, these counts will reflect a fraction of the actual population size (long-term monitoring count data is primarily used to identify trends). In addition, the minimum viable populations (MVP) of these taxa are unknown. Median MVP has been calculated as 4169 individuals (meta-analysis of 141 sources and 212 species); however, this analysis only included five insect taxa which had a median of 10,841 (Trail *et al*., 2007). This figure helps guide viability assessments when subpopulation count data is available; for example, a well monitored subpopulation, isolated to a small site, that produces counts below 1000 is unlikely to be viable.

Species experts were also consulted to provide assistance; information on how individual taxa were identified as meeting either of these conditions is provided in the species' profiles in Appendix 1.

b) *Continuing decline, observed, inferred or projected, in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals.*

Decline in AOO and EOO was determined from the results of the assessment against Criterion A. Changes in habitat area, extent and/or quality were estimated based on evidence collected by species-specific habitat assessments at known sites, and inferred from evidence collect by assessments of habitat characteristics, such as water quality. Results from long-term population monitoring projects, where available, were reviewed in order to gather evidence of a decline in number of locations or subpopulations, or 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*

Extreme fluctuation has specific definitions under IUCN guidelines: "Extreme fluctuations can be said to occur in a number of taxa where population size or distribution area varies widely, rapidly and frequently, typically with a variation greater than one order of magnitude (i.e., a tenfold increase or decrease)." (IUCN Standards and Petitions Committee, 2024).

In the case of species that have been subject to comprehensive long-term monitoring, it was possible to assess population fluctuation from their data. Life history was also considered in order to identify aspects of a species ecology or behaviour that would cause extreme fluctuations in distribution and population size.

2.2.2.3 Criterion C and Subcriterion D1: estimating number of mature individuals

Number of mature individuals, for the purpose of this review, was defined as the maximum number of mature adults of a species alive at any point in time within their respective flight seasons. This number is unknown for all taxa in this assessment, and cannot be accurately estimated owing to a lack of sufficient abundance data.

2.2.2.4 Subcriterion D2: AOO <20km^2 or number of locations

AOO measurements and estimates for number of locations from the Criterion B assessment were used to assess taxa against this criterion.

2.2.2.5 Criterion E: predicting population decline and extinction

There are no population models to inform an assessment for any species.

2.2.2.6 Application of Near Threatened (NT) status

Near Threatened (NT) categorisation applies when a taxon does not currently 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. Species qualified for Near Threatened categorisation via the following criteria:

Criterion A: Population reduction
A1: ≥45%
A2, A3 & A4: ≥25%

Criterion B: Geographic range
Vulnerable threshold of B1 or B2 passed and one of the three conditions met.

Criterion D: Small population size
D2. AOO <30km^2 or locations ≤7, and a plausible existing threat that could result in the taxon meeting the requirements for qualification against a threat category in the near future.

2.2.2.7 Application of Data Deficient (DD) status

Individual species datasets were sufficient to test at least two (A and B) of the five criteria during the initial assessment. Therefore, no species was determined to be Data Deficient.

2.2.2.8 Application of Regionally Extinct (RE) status

The Regionally Extinct (RE) status was applied to species with evidence of historic breeding, but no recorded breeding within the past 30-year period (1994-2023). Odonata are comprehensively recorded in GB through the British Dragonfly Society Odonata national recording scheme; therefore, 30 years of recorder effort is sufficient in determining a species' breeding status.

2.2.3 Regional Adjustments to Categories

The final step in the regional IUCN Red List assessment takes into consideration the existence and status of any populations outside of GB that may affect the risk of extinction of the resident population.

Species whose British population is considered isolated, due to a lack of evidence of migratory behaviour, adopted the status assigned during the initial assessment. The need for 'uplisting' or 'downlisting' was determined by examining evidence of migratory behaviour collected by the British Dragonfly Society's Migrant Dragonflies Project, and by referring to the European Red List of Odonata (De Knijf *et al*., 2024a) for extra-regional population trends and statuses.

For breeding populations, the guidelines state that if the population experiences significant immigration, the population acts as a sink, and immigration is expected to decrease, uplisting is required. If the British population experienced significant immigration which is not expected to decrease, downlisting is required.

2.3 GB Rarity Assessments

Assessment of rarity is not included in the IUCN Red List process but is a useful tool for describing the geographic distribution of species, and is widely used as an additional classification of conservation status of invertebrates in GB. Rarity and threat, as described in the IUCN Red List process, are different; a species may be classified as scarce because it has a restricted range but not qualify under a threat category because it has a stable population.

Rarity is traditionally assessed based on the number of hectads (10 km × 10 km Ordnance Survey grid squares) a species has been recorded in. This assessment will follow the same criteria applied by other recent British invertebrate status reviews, such as Musgrove (2023):

Nationally Rare (NR): recorded from 1-15 hectads, where there is reasonable confidence that exhaustive recording would not find them in more than 15 hectads.

Nationally Scarce (NS): species recorded from 16-100 hectads, where there is reasonable confidence that exhaustive recording would not find them in more than 100 hectads.

For Odonata in GB, whose occurrence is rigorously surveyed, five years of data (2019-2023) should be a sufficient representation of distribution for the purpose of assessing rarity.

2.4 Taxonomy

The online world checklist available via Odonata Central (https://www.odonatacentral.org/app/#/wol/) provides up to date taxonomic listings (Paulson *et al*., 2025).

Odonata taxonomy continues to develop, and there have been two significant taxonomic change since Daguet *et al*. (2008). *Sympetrum nigrescens,* was formerly treated as a distinct species and was listed as Data Deficient but has since been described as a phenotypic variant of *Sympetrum striolatum* (Parkes *et al*., 2009). In addition, *Aeshna isoceles* is now *Isoaeschna isoceles*, after molecular phylogenetic research placed it in a new genus (Schneider *et al.*, 2023).

3 Results

3.1 Data obtained

1,361,156 records dating 2004-2023 (561,607 dating 2004-2013, 799,549 dating 2014-2023) were obtained from the BDS Recording Scheme database on NBN Atlas for the 46 species that were selected for evaluation and not categorised as NA.

A steady increase in recorder effort has resulted in a rise in records received annually into the database (Figure 1); annual record submission now comfortably rests above

30,000. Temporal variation in recording effort was taken into consideration when assessing population change by only examining change in tetrads where dragonfly observations were made in both periods.

In addition, recording effort varies between species, because of factors such as species conspicuousness to recorders. For example, *Gomphus vulgatissimus* is under-recorded most years as its presence cannot easily be determined by surveying adults, the standard Odonata recording methodology. Targeted searches for *Gomphus vulgatissimus* exuviae are periodically performed, which results in a short-term increase in records. In figure 2 an increase in records is shown leading up to, during, and just after the Clubtail Count citizen science project, which ran from 2017-2019 (British Dragonfly Society, 2019).
While the database contains duplicates, this does not affect AOO and EOO results.

Figure 1. Number of records for the 46 Red List assessment species verified and accepted into the BDS Recording Scheme database each decade; 2020 represents records for 2020-2023 only.

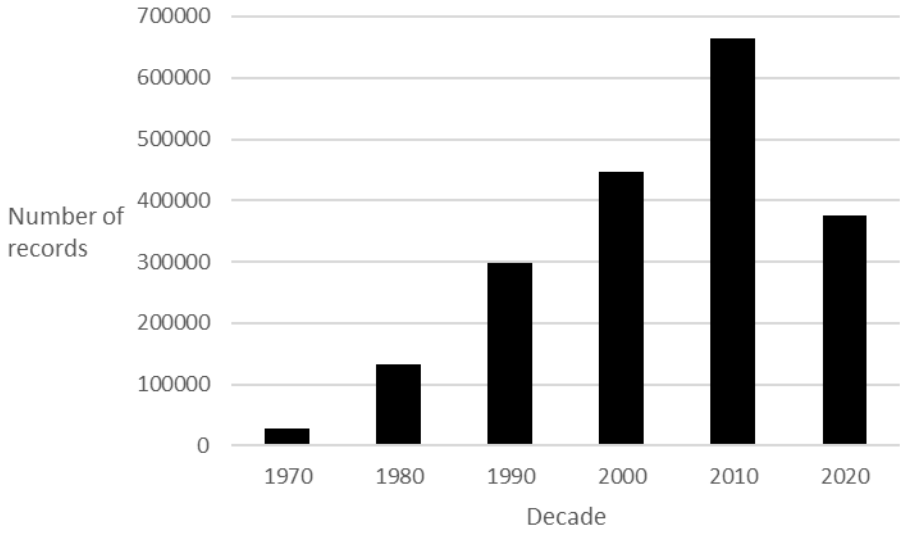
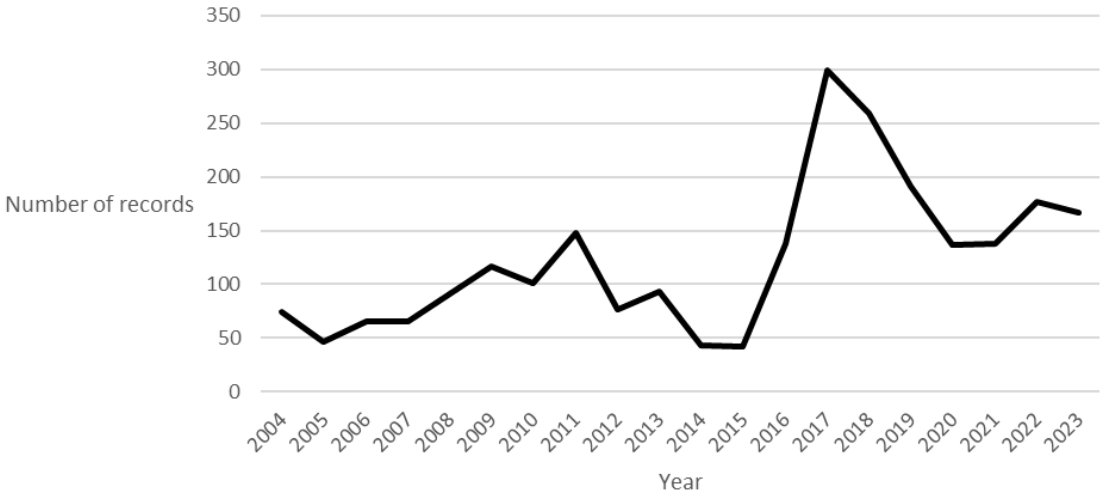


Figure 2. Number of records for *Gomphus vulgatissimus* verified and accepted into the BDS Recording Scheme database 2004-2023.



3.2 UKCEH Occupancy Modelling

All species-level, presence-only records at monad resolution or finer were extracted from the BDS Recording Scheme database. The resulting dataset underwent a Risk-Of-Bias In studies of Temporal Trends in ecology assessment, detailed in Appendix 3, which identifies existing biases, such as variations in recorder effort, and appropriate mitigation. The subsequent analysis produced estimates of total percentage population change over a 10, 30 and 50 year period, along with lower and upper 95% confidence intervals. Statistically significant estimates ($p < 0.05$) were assessed against criteria as a robust index of abundance.

3.3 IUCN Red List Status

The British Odonata Species Status Review data table accompanying this report provides the categorisation for each species, along with the qualifying criteria, associated metrics and rationale in support of the categorisation.

Table 2. A summary of the number of Odonata species assigned to each IUCN Red List Status in the 2026 and 2008 Red List Reviews.

IUCN Red List Status	Number of species 2026	Number of species 2008 (Daguet *et al*., 2008)
Least Concern	33	27
Near Threatened	3	6
Vulnerable	0	2
Endangered	8	4
Critically Endangered	0	0
Regionally Extinct	2	3
Extinct in the Wild	0	0
Extinct	0	0
Data Deficient	0	1
Not Applicable	11	10
Not Evaluated	1	2
Total	58	55

3.4 British Rarity Status

The GB Odonata Species Status Review data table accompanying this report provides the British Rarity Status for each species, along with the numbers of hectads, which produced records 2019-2023, on which the statuses were based.

Table 3. The number of Odonata species assigned to each British Rarity Status (the table excludes species that did not qualify).

British Rarity Status	Number of species
Nationally Scarce	11
Nationally Rare	1
Extinct	2
Total	14

3.5 Species Status Summary

Table 4 lists species' updated Red List statuses as a result of this review; Appendix 1 gives species profiles detailing geography, habitat requirements, status rationale, and threat.

Table 4. The assigned IUCN Red List Status of GB Odonata species in the 2026 and 2008 (Daguet *et al*.) Red List reviews, as well as their European IUCN Red List Status from the 2024 review (European population trend, 2000-2020: ↑ increasing, - stable, ↓ decreasing, *unknown) (De Knijf *et al*., 2024a), and British Rarity Status (Nationally Rare NR – occurs in 1-15 hectads, Nationally Scarce NS – occurs in 16-100 hectads).

Species Name	**GB IUCN Status 2026**	**GB IUCN Status 2008**	**European IUCN Status 2024**	**British Rarity Status 2026**
Aeshna affinis	Least Concern	NA	LC ↑	
Aeshna caerulea	Endangered	VU	NT ↓	NS
Aeshna cyanea	Least Concern	LC	LC -	
Aeshna grandis	Least Concern	LC	VU ↓	
Aeshna juncea	Near Threatened	LC	EN ↓	
Aeshna mixta	Least Concern	LC	LC -	
Anax ephippiger	Not Applicable	NA	LC ↑	
Anax imperator	Least Concern	LC	LC ↑	
Anax junius	Not Applicable	NA	NA *	
Anax parthenope	Least Concern	NE	LC ↑	
Brachytron pratense	Least Concern	LC	LC -	
Calopteryx splendens	Least Concern	LC	LC -	
Calopteryx virgo	Least Concern	LC	LC -	
Ceriagrion tenellum	Near Threatened	LC	LC -	NS
Chalcolestes viridis	Least Concern	NA	LC -	
Coenagrion armatum	Regionally Extinct	RE	LC -	Extinct
Coenagrion hastulatum	Endangered	EN	VU ↓	NS
Coenagrion mercuriale	Endangered	EN	VU ↓	NS
Coenagrion puella	Least Concern	LC	LC -	
Coenagrion pulchellum	Least Concern	NT	LC -	
Coenagrion scitulum	Endangered	RE	LC -	NR

Cordulegaster boltonii	Least Concern	LC	LC -	
Cordulia aenea	Least Concern	LC	LC -	
Crocothemis erythraea	Not Applicable	NA	LC ↑	
Enallagma cyathigerum	Least Concern	LC	LC -	
Erythromma najas	Least Concern	LC	LC -	
Erythromma viridulum	Least Concern	NE	LC ↑	
Gomphus vulgatissimus	Near Threatened	NT	LC -	NS
Ischnura elegans	Least Concern	LC	LC ↓	
Ischnura pumilio	Endangered	NT	LC -	NS
Isoaeschna isoceles	Least Concern	EN	LC ↑	
Lestes barbarus	Least Concern	NA	LC -	NS
Lestes dryas	Least Concern	NT	LC -	NS
Lestes sponsa	Least Concern	LC	NT ↓	
Leucorrhinia dubia	Endangered	EN	VU ↓	NS
Leucorrhinia pectoralis	Not Applicable		LC ↑	
Libellula depressa	Least Concern	LC	LC -	
Libellula fulva	Least Concern	NT	LC -	
Libellula quadrimaculata	Least Concern	LC	LC -	
Orthetrum cancellatum	Least Concern	LC	LC ↑	
Orthetrum coerulescens	Least Concern	LC	LC ↑	
Oxygastra curtisii	Regionally Extinct	RE	NT ↓	Extinct
Pantala flavescens	Not Applicable	NA	LC ↑	
Platycnemis pennipes	Least Concern	LC	LC ↑	
Pyrrhosoma nymphula	Least Concern	LC	LC -	
Somatochlora arctica	Endangered	NT	LC ↓	NS
Somatochlora flavomaculata	Not Applicable		LC -	
Somatochlora metallica	Endangered	VU	VU ↓	NS
Stylurus flavipes	Not Applicable	NA	LC ↑	
Sympecma fusca	Not Applicable		LC ↑	
Sympetrum danae	Least Concern	LC	EN ↓	
Sympetrum flaveolum	Not Applicable	LC	EN ↓	
Sympetrum fonscolombii	Least Concern	LC	LC ↑	
Sympetrum nigrescens	Not Evaluated	DD		
Sympetrum pedemontanum	Not Applicable	NA	NT ↓	
Sympetrum sanguineum	Least Concern	LC	LC -	
Sympetrum striolatum	Least Concern	LC	LC -	
Sympetrum vulgatum	Not Applicable	NA	VU ↓	

The cause of a species' status change can be 'genuine' (reflecting either real increase or decrease, or diminution in the threats the species is experiencing, or the effective implementation of conservation measures), or 'non-genuine' (reflecting changes in taxonomy, discovery of data that would have changed the previous status, or simply an error in previous application of the criteria).

All species seeing a status change between the previous 2008 Red List and this 2025 review did so for genuine reasons. The only exception is *Sympetrum nigrescens*,

which was previously treated as a distinct species, but is now regarded as a phenotypic variant of *Sympetrum striolatum*.

4 Discussion

This is the third published review of the status of British Odonata, following Shirt (1987) and Daguet *et al*. (2008). All Odonata species with verified records in the BDS Recording Scheme database were considered for review: a total of 57. *Sympetrum nigrescens* was previously treated as a distinct species, listed as Data Deficient (Daguet *et al*., 2008), but has since been described as a phenotypic variant of *Sympetrum striolatum*; as a result it was not subject to assessment. This was the only non-genuine change in status, and was due to new information; all other changes in status were genuine and recent.

A Red List assessment was determined to be Not Applicable for 11 of the 57 species (19%). Eight of these species are vagrants that do not regularly migrate to GB and only have a small number of historic records, which do not include evidence of breeding. The other three have recorded evidence of attempted or successful breeding, but no evidence that they have successfully reproduced within GB consistently for at least 10 years. Short-lived breeding colonies of *Sympetrum flaveolum* were recorded in the mid-1990s and the species was previously categorised as Least Concern (Daguet *et al*., 2008), but has now been re-categorised owing to a lack of recent breeding evidence. *Anax ephippiger* is an irregular migrant that was first recorded successfully breeding in GB in 2023, and *Crocothemis erythraea* was recording attempting to breed (female observed ovipositing) for the first time in 2024.

The remaining 46 species were determined to have sufficient data to undergo full assessment.

GB now has a more diverse Odonata community, with 44 extant established breeding species, compared with 39 in 2008 when the previous Red List review was conducted. This is primarily a result of new species expanding their range into GB in response to climate change. It is likely that more species will colonise GB in the next decade considering the recent successful and attempted breeding exhibited by *Anax ephippiger* and *Crocothemis erythraea*

33 of the 46 assessed species (approximately 72%) were classified as Least Concern, including five new colonists that were listed as Not Evaluated or Not Applicable in 2008: *Aeshna affinis*, *Anax parthenope*, *Chalcolestes viridis*, *Erythromma viridulum* and *Lestes barbarus*. While all five currently have a low level occupancy (AOO), their populations are expanding, either in occupancy or range, reducing the risk of extinction. Of these five species, only *Lestes barbarus* (AOO: 26km^2) initially qualified as Near Threatened (against Criterion D); however, ongoing immigration (which continues for all five species) reduces the risk of extinction, resulting in the need for *Lestes barbarus* to be downlisted to Least Concern. All five species have a European IUCN status (2024) of Least Concern: *Chalcolestes viridis* (Vinko *et al*., 2024g) and

Lestes barbarus (Vinki *et al*., 2024k) are considered to have stable populations on a European scale, while *Aeshna affinis* (Vinko *et al*., 2024a), *Anax parthenope* (van Grunsven *et al*., 2024) and *Erythromma viridulum* (De Knijf *et al*., 2024e) are increasing. Climate change is considered a primary factor resulting in population and range expansion of these species in GB and elsewhere in Europe, combined with a lack of significant threats. The adults of these species have the ability to disperse significant distances, taking advantage of warmer temperatures during their respective flight periods to migrate and colonise new sites with suitable habitat that fall within their climate envelope.

24 species remain listed as Least Concern, maintaining their 2008 categorisation, owing to a lack of significant decline in their population. While some appear to show no notable recent change in population size, others exhibit population growth, with occupancy increase and range expansion. These include *Orthetrum cancellatum*, *Orthetrum coerulescens* and *Platycnemis pennipes,* which are all showing expansion on a European scale (Vinko *et al*., 2024n; Prunier *et al*., 2024b; Vinko *et al*., 2024o), likely in response to climate change.

Species identified as Least Concern do not qualify for assignment of a threatened category against the Red List assessment criteria, and are therefore considered to be at a low threat of extinction. However, two species classed as Least Concern (*Ischnura elegans* and *Lestes sponsa*) could qualify in the near future and their populations should therefore be monitored. *Ischnura elegans* has exhibited a recent decline in occupancy; it is also declining on a European scale, with inappropriate management of wetlands and pesticide pollution identified as potential drivers of population decline, although its European Status is currently Least Concern (Vinko *et al*., 2024i). *Lestes sponsa* has a long-term trend of occupancy decline, is declining on a European scale and is now classified as Near Threatened in Europe. Identified potential drivers of decline include the desiccation of their shallow breeding wetlands earlier in the year before larvae have emerged, a result of climate change, and the drainage of wetland areas for agriculture, forestry and urban development (Billqvist *et al*., 2024n).

Aeshna grandis should also be monitored for signs of population decline; while the GB population does not appear to be in decline, it is currently declining elsewhere in Europe and has a European categorisation of Vulnerable (Billqvist *et al*., 2024c).

Table 5. The Odonata species assigned Threatened or Near Threatened categories in the 2008 or 2026 Red List review, their updated 2026 IUCN status, and the direction of change of their updated status.

Species Name	GB IUCN Status 2026	GB IUCN Status 2008	Change in status
Isoaeschna isoceles	Least Concern	Endangered	Improved
Coenagrion pulchellum	Least Concern	Near Threatened	Improved
Lestes dryas	Least Concern	Near Threatened	Improved
Libellula fulva	Least Concern	Near Threatened	Improved
Aeshna juncea	Near Threatened	Least Concern	Deteriorated

Ceriagrion tenellum	Near Threatened	Least Concern	Deteriorated
Gomphus vulgatissimus	Near Threatened	Near Threatened	No change
Aeshna caerulea	Endangered	Vulnerable	Deteriorated
Coenagrion hastulatum	Endangered	Endangered	No change
Coenagrion mercuriale	Endangered	Endangered	No change
Coenagrion scitulum	Endangered	Regionally Extinct	Improved
Ischnura pumilio	Endangered	Near Threatened	Deteriorated
Leucorrhinia dubia	Endangered	Endangered	No change
Somatochlora arctica	Endangered	Near Threatened	Deteriorated
Somatochlora metallica	Endangered	Vulnerable	Deteriorated
Coenagrion armatum	Regionally Extinct	Regionally Extinct	No change
Oxygastra curtisii	Regionally Extinct	Regionally Extinct	No change

Encouragingly, the number and percentage of GB Odonata species classed under a Threatened or Near Threatened category has reduced. In the previous 2008 review, 15 of the 42 species assessed received a Threatened or Near Threatened category classification, approximately 36% (Table 5). In this review, 13 of the 46 species that were subject to assessment, approximately 28%, received a Threatened or Near Threatened category classification. The status of six of these remains unchanged from the 2008 Red List. *Coenagrion armatum* and *Oxygastra curtisii* both remain Regionally Extinct and are likely to remain so; neither readily migrates long distance and the availability of suitable breeding habitat in GB is limited, making natural recolonization unlikely. However, the viability of reintroducing *Oxygastra curtisii* through habitat restoration and translocation is currently being explored. *Gomphus vulgatissimus* remains categorised as Near Threatened, while *Coenagrion hastulatum, Coenagrion mercuriale* and *Leucorrhinia dubia* remain categorised as Endangered.

While fewer species are listed under a Threatened or Near Threatened category, more species have deteriorated (six) than improved (five) from their 2008 status (Table 5), so although fewer species are currently considered under threat of extinction, those that are face a higher level of threat.

Coenagrion scitulum was re-categorised from Regionally Extinct to Endangered, as it was rediscovered in Kent and has since sustained a small population there.

Four species have improved and been re-categorised as Least Concern because of recent population growth with occupancy increase and range expansion: *Coenagrion pulchellum*, *Lestes dryas* and *Libellula fulva* from Near Threatened, and *Isoaeschna isoceles* from Endangered. Warmer temperatures are likely facilitating dispersal and range expansion, particularly in the case of *Isoaeschna isoceles*, which is increasing across its northern European range (Vinko *et al*., 2024b). All four species have benefitted from targeted conservation efforts, as a result of their previous Red List threat categories, including site protection, particularly *Isoaeschna isoceles* which receives legal protection under the Wildlife and Countryside Act 1981.

While four species are no longer listed under a threat category, two were re-categorised from Least Concern to Near Threatened: *Aeshna juncea* and *Ceriagrion tenellum*.

The number of species listed as Endangered has doubled to eight; four species have deteriorated to Endangered: *Aeshna caerulea* and *Somatochlora metallica* from Vulnerable, and *Ischnura pumilio* and *Somatochlora arctica* from Near Threatened.

Of the 11 extant species assigned Threatened or Near Threatened categories, *Aeshna juncea* is the only species that was assigned a Threatened category as a result of meeting Criterion A2 b, due to recent decline in its index of abundance (modelled occupancy analysis). The other 10 qualified for Threatened categories against Criterion B2 due to their small AOO: eight were severely fragmented or had a small number of locations (condition a); one had a continuing decline in EOO (condition b i); one had a continuing decline in AOO (condition b ii); eight had a continuing decline in area, extent and/or quality of habitat (condition b iii); one exhibited extreme fluctuation in AOO (condition c ii); and one exhibited extreme fluctuation in number of locations or subpopulations.

Nine of the 11 have a British Rarity Status of Nationally Scarce (*Aeshna caerulea*, *Ceriagrion tenellum*, *Coenagrion hastulatum*, *Coenagrion mercuriale*, *Gomphus vulgatissimus*, *Ischnura pumilio*, *Leucorrhinia dubia*, *Somatochlora arctica*, and *Somatochlora metallica*), while *Coenagrion scitulum* is Nationally Rare, highlighting their highly restricted distribution in GB. All 11 are considered habitat specialists, requiring range-restricted or specific environmental conditions to successfully reproduce. Four only reproduce in acidic peatland pools, although they have different requirements in features such as water depth and vegetation structure: *Aeshna caerulea, Aeshna juncea*, *Leucorrhinia dubia*, and *Somatochlora arctica*. *Coenagrion scitulum* and *Ceriagrion tenellum* have similar habitat requirements: both breed in warm, unshaded, shallow, permanent, still or flowing waterbodies with good water quality and lush aquatic vegetation. *Coenagrion mercuriale* requires the same features but only breeds in slow-flowing waterbodies that are base-rich, well oxygenated and have a fine sediment or detritus benthic layer. *Ischnura pumilio* breeds in sparsely vegetated, unshaded, shallow pools, runnels and seepages that may dry up in late summer. *Coenagrion hastulatum, Gomphus vulgatissimus* and *Somatochlora metallica* have an association with woodland. *Coenagrion hastulatum* breeds in acidic or neutral, well-vegetated, shallow pools and the shallow edges of lochs with woodland shelter. *Gomphus vulgatissimus* breeds in slow-flowing sections of unpolluted rivers, with fine benthic sediment and adjacent woodland. *Somatochlora metallica* requires tree cover, inhabiting still and slow-flowing, woodland waterbodies in England and *Sphagnum*-fringed lochans in Scotland, close to forest.

The decline in populations of habitat specialist species, and the contrasting increase in populations of generalists, such as *Anax imperator*, is a pattern observed on a global scale, with the homogenization of community composition across space. This is in response to human activities, such as agriculture and urbanisation, homogenising the landscape; while the habitats of specialists are lost, generalists can utilise altered or man-made habitats, such as garden ponds and canals (Samways *et al*., 2025; Smith *et al*., 2022).

Many habitat specialists are now limited to small, fragmented subpopulations, as a result of habitat degradation, loss and fragmentation resulting from human activity and land use change. The widespread drainage of wetland areas for agriculture, forestry and urban development since the industrial revolution has significantly reduced the abundance and diversity of wetland habitat in GB. Up to 90% of lowland ponds in the UK were lost in the 20th century, as a result of drainage or neglect (Oldham & Swan, 1997). In GB, an estimated 1.5 million ha of upland blanket peatland was drained in the mid-20th century (Stewart & Lance, 1983). In eastern England alone, 99% of lowland fen (which once covered ca. 3,900 km^2) has been drained for agriculture over the last 400 years (Convention on Wetlands, 2025). The loss of surface waters continues, at a reduced rate; across the UK, urban expansion resulted in the loss of 1,000ha of wetland between 2006 and 2015 (University of Leicester, 2015).

Habitat degradation, loss and fragmentation, a result of human activity, continue to drive decline in GB species. Isolated populations of habitat specialists on remnant sites are at an increased risk of local extinction, as their remaining areas of habitat continue to degrade, lacking management plans to maintain suitable conditions for breeding. For example, neglect and a lack of vegetation management, through grazing and manual scrub control, has led to the decline in the quality of breeding habitat at sites for *Coenagrion mercuriale, Ceriagrion tenellum*, and *Ischnura pumilio*, which all have specific requirements in terms of vegetation structure and prefer open, unshaded conditions (Taylor *et al*., 2021).

The water quality of many wetlands, particularly rivers, is negatively affected by the input of a cocktail of pollutants, the main contributors to which are sewage and diffuse agricultural pollution, and include nitrates and phosphates. Only 16% of assessed surface waters in England achieved ‘good ecological status’ in 2025 (Natural England, 2025).

Freshwater abstraction is a growing issue as population growth increases demand, in combination with climate change which is expected to result in decreased flows in summer months; rivers in GB are becoming more water-stressed, particularly in the south of England (Tanguy *et al*., 2023; Wildfish, 2025). The increasing frequency and severity of droughts is a significant threat to Odonata, particularly those associated with shallow waterbodies; in combination with rising spring and summer temperatures there is an increasing risk that waterbodies utilised for breeding will become desiccated (Environment Agency, 2023; Kendon *et al*., 2024).

Climate change is likely to continue to drive range contraction in *Aeshna juncea, Aeshna caerulea, Coenagrion hastulatum, Leucorrhinia dubia,* and *Somatochlora arctica* in GB. These five species are considered boreo-alpine, are associated with cooler climates, and are exhibiting population decline on a European scale (Table 4). *Sympetrum danae* also fits this description and is Red Listed in Europe; similar to *Ischnura elegans* and *Lestes sponsa*, it is a species of concern in GB due to ongoing long-term occupancy decline. As novel warm-adapted generalist species move into their range these species will experience a higher level of competition. There is evidence that elevated temperatures can reduce the foraging capacity of native species in the presence of these novel competitor species (Nagano *et al*., 2023). In central European peat bogs, there has been a marked shift in assemblage composition

from cold-adapted, bog specialists to warm-adapted habitat generalists (Šigutová *et al*., 2025).

Invasive freshwater species are now widespread across GB; common invasive species include *Dikerogammarus villosus* and *Pacifastacus leniusculus*, which act as predators and competitors of Odonata larvae (Mancini *et al*., 2021; Ludányi *et al*., 2022).

Odonata are receiving increasing attention and conservation effort in GB: for example, the BDS 'Dragonflies on the Bog' project, which aims to restore peatland sites in Scotland for *Aeshna caerulea*, *Leucorrhinia dubia* and *Somatochlora arctica* (British Dragonfly Society, 2025). Our understanding of resident population ecology is also improving through monitoring projects such as the BDS Northern Damselfly Survey, which aims to map the distribution of *Coenagrion hastulatum* in Scotland and collect information on its habitat requirements (British Dragonfly Society, 2024). Targeted species-conservation projects are also proving successful in increasing populations, such as the ongoing introduction of *Leucorrhinia dubia* to the Solway Mosses (RSPB, 2025). There has also been significant recent investment in the restoration of wetland habitats, particularly peatlands, which benefits Odonata; for example, the Peatland ACTION programme through which the Scottish Government has pledged to invest more than £250 million up to 2030 (NatureScot, 2025).

This Red List assessment required the estimation of population trends over a short time-period. This is a difficult task for many GB invertebrate groups, including those with long-term abundance data, such as Butterflies (Fox *et al*., 2022). The data available for GB Odonata is predominantly composed of sparse opportunistic occurrence records. In addition, Odonata are highly sensitive to environmental changes, which can result in dramatic population shifts, making it hard to determine genuine long-term trends (Tang and Visconti, 2020). Data from multiple years was combined to provide a more accurate representation of current AOO and EOO, while estimates of AOO and EOO change also only used data from tetrads subject to repeat visits to reduce the effect of bias resulting from increased (or reduced) recording effort. The disadvantage of this method is that it reduces the size of the dataset, particularly for species like *Ischnura pumilio*, which breed in shallow, often temporary wetlands, and can be the only species present. More robust population trends were calculated through occupancy modelling by UKCEH, which provided an index of abundance for assessment against Criterion A. It utilised a detection model that contains a random categorical year effect, to account for variation in detectability temporally and geographically, and a fixed three-level categorical effect of list length to account for varying levels of recorder effort on a given visit (see Appendix 3). This assessment also relied on the expert opinion of GB Odonata specialists to review the population trends and figures, and provide insight into species ecology to ensure the assignment of appropriate categories.

The updated GB Red List now needs to be incorporated into environmental policy and planning. National plans to restore biodiversity, such as the Nature Recovery Network, are currently working towards some targets set for species that are now categorised as Least Concern, while other more threatened species are not included.

The significant changes in the GB Red List illustrate how rapidly the Odonata assemblage of GB is changing, and it is likely to continue to do so in response to ongoing pressures from climate change, human activity and land use change. A more regular reviewing process of the Red List is necessary to ensure that environmental conservation in GB adapts and continues to target the species at most risk of extinction.

5 References

Batty, P. 2022. Scotland. In: British Dragonfly Society, 2021 Scotland Country Dragonfly Recorder Reports, 1-4. [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2022/04/County-Dragonfly-Recorder-Reports-2021-Scotland.pdf [Accessed 10 December 2024].

Batty, P. 2023. Scotland. In: British Dragonfly Society, 2022 Scotland County Dragonfly Recorder Reports, 1-7. [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2023/05/Scotland-CDR-2022-1.pdf [Accessed 1 April 2024].

Batty, P. 2025. Scotland. In: British Dragonfly Society, Country Dragonfly Record Reports Scotland 2024, 3-5 [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2025/04/CDR-report-2024-Scottish-for-website.pdf [Accessed 6 July 2024].

BBC. 2023. Climate change: 2022 was Scotland's hottest year. [online] *BBC News*. BBC. Available at: https://www.bbc.co.uk/news/uk-scotland-64174150 [Accessed 4 January 2024].

Bently-Fox, H. 2000. *A study to determine the habitat requirements of the White-faced Darter (Leucorrhinia dubia (Vander Linden)) at Fen's Whixall and Bettisfield Mosses National Nature Reserve (NNR)*. Farnborough College of Technology School of Environmental Management [Unpublished M Sc dissertation].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024a. *Aeshna caerulea (Europe assessment)*. The IUCN Red List of Threatened Species 2024: e.T158688A208823366. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158688A208823366.en [Accessed 9 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024b. *Aeshna cyanea* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165524A208851515. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165524A208851515.en [Accessed 9 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024c. *Aeshna grandis* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158686A208822987. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158686A208822987.en [Accessed 9 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024d. *Aeshna juncea* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165518A208849284. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165518A208849284.en. [Accessed 9 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024e. *Brachytron pratense* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165514A208848015. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165514A208848015.en [Accessed 24 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024f. *Coenagrion hastulatum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158706A208827902. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158706A208827902.en [Accessed 9 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024g. *Coenagrion puella* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158707A208828327. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158707A208828327.en [Accessed 24 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024h. *Coenagrion pulchellum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165484A208837994. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165484A208837994.en [Accessed 24 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024i. *Cordulia aenea* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158702A208827063. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158702A208827063.en [Accessed 25 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024j. *Enallagma cyathigerum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T173805983A208854649. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T173805983A208854649.en [Accessed 24 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024k. *Erythromma najas* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165497A208842979. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165497A208842979.en [Accessed 25 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024l. *Gomphus vulgatissimus* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165523A208851085. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165523A208851085.en [Accessed 16 September 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024m. *Lestes dryas* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165516A208848675. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165516A208848675.en [Accessed 25 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024n. *Lestes sponsa* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165475A208834702. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165475A208834702.en [Accessed 25 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024o. *Leucorrhinia dubia* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158683A208821567. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158683A208821567.en [Accessed 1 May 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024p. *Libellula quadrimaculata* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165469A208832871. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165469A208832871.en [Accessed 1 May 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024q. Pyrrhosoma nymphula (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165500A208843840. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165500A208843840.en [Accessed 1 May 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024r. *Somatochlora arctica* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165490A208840311. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165490A208840311.en [Accessed 12 March 2026].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024s. *Somatochlora metallica* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158705A208827490. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158705A208827490.en [Accessed 12 April 2025].

Billqvist, M., De Knijf, G., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024t. *Sympetrum danae* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165473A208834172. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165473A208834172.en [Accessed 2 May 2025].

British Dragonfly Society. 2019. The Clubtail Count 2019 Report. [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2020/04/Common-Clubtail-report-2019.pdf [Accessed 12 April 2025].

British Dragonfly Society. 2024. Northern Damselfly Survey. [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/recording/northern-damselfly-survey/ [Accessed 12 April 2025].

British Dragonfly Society. 2025. Dragonflies on the Bog Project - British Dragonfly Society. [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/dragonflies-on-the-bog-project/ [Accessed 12 April 2025].

Brooks, S. & Cham, S. 2026. *Field Guide to the Dragonflies & Damselflies of Great Britain and Ireland.* Sixth edition. Bloomsbury Publishing, London, UK.

Brownett, A. 2005. A re-examination of the status of the Norfolk Damselfly *Coenagrion armatum* (Charpentier): a species of Odonata now presumed extinct in Britain. *Journal of the British Dragonfly Society*, **21**(1): 21–26.

Cham, S.A. 2012. *Field Guide to the Larvae and Exuviae of British Dragonflies*. British Dragonfly Society.

Cham, S.A., Nelson, B., Parr, A., Prentice, S., Smallshire, D., & Taylor, P. 2014. Atlas of Dragonflies in Britain and Ireland. Field Studies Council.

Climate Central. 2021. Sea level rise and coastal flood risk maps -- a global screening tool by Climate Central. [online] *Climate Central*. Climate Central Inc. Available at: https://coastal.climatecentral.org/map/ [Accessed 12 April 2025].

Convention on Wetlands. 2025. Global Wetland Outlook 2025: Valuing, conserving, restoring and financing wetlands. [online] *Global Wetland Outlook*. Secretariat of the Convention on Wetlands, Gland, Switzerland. Available at: https://static1.squarespace.com/static/5b256c78e17ba335ea89fe1f/t/6880f0b61f02906e4f1a72ee/1753280741948/GWO2025_Eng_Rev.1.pdf [Accessed 8 August 2025].

Daguet, C.A., French, G.C. & Taylor, P. 2008. *The Odonata Red Data List for Great Britain. Species Status*, **11**: 1-34. Joint Nature Conservation Committee, Peterborough, UK.

Defra Press Office. 2023. Landowner sentenced to 12 months in prison for destruction on the River Lugg, Herefordshire – Defra in the media. [online] *GOV.UK*. GOV.UK. Available at: https://deframedia.blog.gov.uk/2023/04/21/landowner-sentenced-to-12-months-in-prison-for-destruction-on-the-river-lugg-herefordshire/ [Accessed 10 December 2024].

De Knijf, G., Billqvist, M., van Grunsven, R.H.A., Prunier, F., Vinko, D., Trottet, A., Bellotto, V.,Clay, J. and Allen, D.J. 2024a. *Measuring the pulse of European biodiversity. European Red List of Dragonflies & Damselflies (Odonata)*. European Commission, Brussels, Belgium.

De Knijf, G., Billqvist, M., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024b. *Ceriagrion tenellum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165495A208842108. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165495A208842108.en [Accessed 9 April 2025].

De Knijf, G., Billqvist, M., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024c. *Coenagrion mercuriale* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T203582437A203582849. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T203582437A203582849.en [Accessed 9 April 2025].

De Knijf, G., Billqvist, M., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024d. *Cordulegaster boltonii* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165509A208846207. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165509A208846207.en. [Accessed 9 April 2025].

De Knijf, G., Billqvist, M., van Grunsven, R.H.A., Prunier, F. & Vinko, D. 2024e. *Erythromma viridulum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165478A208835745. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165478A208835745.en [Accessed 25 April 2025].

Dieck, C. 2017. *Habitat suitability assessment of southern damselfly Coenagrion mercuriale sites in Dorset* [unpublished].

Environment Agency. 2023. Review of the research and scientific understanding of drought. [online] *GOV.UK*. GOV.UK. Available at: https://www.gov.uk/government/publications/review-of-the-research-and-scientific-understanding-of-drought [Accessed 1 January 2024].

Environment Agency. 2024. Environment Agency publishes storm overflow spill data for 2023. [online] *GOV.UK*. GOV.UK. Available at: https://www.gov.uk/government/news/environment-agency-publishes-storm-overflow-spill-data-for-2023 [Accessed 10 December 2024].

Environment Agency. 2025. Classifications data for Avon Warwickshire Management Catchment. [online] *Catchment Data Explorer*. Department for Environment Food & Rural Affairs. Available at: https://environment.data.gov.uk/catchment-planning/ManagementCatchment/3007/classifications [Accessed 6 July 2025].

Fox, R., Dennis, E.B., Brown, A.F. & Curson, J. 2022. A revised Red List of British butterflies. *Insect Conservation and Diversity*, **15**(5): 485–495.

Hickling, R., Roy, D.B., Hill, J.K. & Thomas, C.D. 2005. A northward shift of range margins in British Odonata. *Global Change Biology*, **11**(3): 502–506.

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

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

IUCN. 2005. *Guidelines for Using the IUCN Red List Categories and Criteria*. Prepared by the Standards and Petitions Subcommittee of the IUCN SSC Red List Programme Committee, IUCN, Gland, Switzerland and Cambridge, UK.

IUCN. 2012a. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0. [online] *IUCN Red List*. IUCN, Gland, Switzerland and Cambridge, UK. Available at: https://www.iucnredlist.org/resources/regionalguidelines [Accessed 23 January 2026].

IUCN. 2012b. IUCN Red List Categories and Criteria: Version 3.1. Second edition. [online] *IUCN Red List*. IUCN, Gland, Switzerland and Cambridge, UK. Available at: https://www.iucnredlist.org/resources/categories-and-criteria [Accessed 23 January 2026].

IUCN Standards and Petitions Committee. 2024. Guidelines for Using the IUCN Red List Categories and Criteria. [online] *IUCN Red List*. IUCN, Gland, Switzerland and Cambridge, UK. Available at: https://www.iucnredlist.org/resources/redlistguidelines [Accessed 23 January 2026].

IUCN Standards and Petitions Working Group. 2006. *Guidelines for Using the IUCN Red List Categories and Criteria: Version 6.1*. Prepared by the Standards and Petitions Working Group for the IUCN SSC Biodiversity Assessments Sub-Committee in July 2006, IUCN, Gland, Switzerland and Cambridge, UK.

Jones, S. 2025. Cornwall with Scilly, East Cornwall. In: British Dragonfly Society, Country Dragonfly Record Reports England 2024. [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2025/04/CDR-report-2024-England-for-website.pdf [Accessed December 2025].

Kendon, M., Doherty, A., Hollis, D., Carlisle, E., Packman, S., McCarthy, M., Jevrejeva, S., Matthews, A., Williams, J., Garforth, J. & Sparks, T. 2024. State of the UK Climate 2023. *International Journal of Climatology*, **44**(1): 1–117.

Kent, K. 2023. Water Quality Monitoring Network Severn Pilot Interim Report July 2023. [online] *Angling Trust*. Angling Trust. Available at: https://anglingtrust.net/wp-content/uploads/2023/07/WQMN-Severn-Pilot-Interim-Report-11.07.2023.v2.pdf [Accessed 10 December 2024].

Khan, J. 2015. UK Natural Capital Freshwater Ecosystem Assets and Services Accounts. [online] *Office for National Statistics*. Office for National Statistics. Available at: https://www.ons.gov.uk/economy/environmentalaccounts/articles/uknaturalcapitalfreshwaterecosystemassetsandservicesaccounts/2015-03-20 [Accessed 20 December 2024].

Kirkpatrick Baird, F., Stubbs Partridge, J. & Spray, D. 2021. Anticipating and mitigating projected climate-driven increases in extreme drought in Scotland, 2021-2040. NatureScot Research Report No. 1228. [online] *NatureScot*. NatureScot. Available at: https://www.nature.scot/sites/default/files/2021-02/Publication%202021%20-%20NatureScot%20Research%20Report%201228%20-%20Anticipating%20and%20mitigating%20projected%20climate-driven%20increases%20in%20extreme%20drought%20in%20Scotland%202021-2040.pdf [Accessed 10 December 2024].

Ludányi, M., Peeters, E., Kiss, B., Gáspár, Á., Roessink, I., Magura, T. & Müller, Z. 2022. The current status of Pacifastacus leniusculus (Dana, 1852) and their effect on aquatic macroinvertebrate communities in Hungarian watercourses. *Aquatic Invasions*, **17**(4): 543–559.

Mancini, F., De Giorgi, R., Ludovisi, A., Vizzini, S. & Mancinelli, G. 2021. Ontogenetic shift in the trophic role of the invasive killer shrimp Dikerogammarus villosus: a stable isotope study. *Biological invasions*, **23**(6): 1803–1817.

Muir, D. 2022. Azure Hawker surveys, habitat changes and trials at Corrour Estate. *Dragonfly News*, **82**: 33.

Musgrove, A. 2023. A review of the status of the sawflies of Great Britain. Phase 2: The Athaliidae and the Tenthredinidae (excluding Nematinae). [online] *The Sawflies (Symphyta) of Britain and Ireland*. Sawflies.org. Available at: https://www.sawflies.org.uk/wp-content/uploads/2023/08/Sawfly-Review-Phase-2-FINAL.pdf [Accessed 10 December 2024].

Nagano, K., Hiraiwa, M.K., Ishiwaka, N., Seko, Y., Hashimoto, K., Uchida, T., Sánchez-Bayo, F. & Hayasaka, D. 2023. Global warming intensifies the interference competition by a poleward-expanding invader on a native dragonfly species. *Royal Society Open Science*, **10**(11).

Natural England. 2025. State of the water environment indicator B3: supporting evidence. [online] *GOV.UK*. GOV.UK. Available at: https://www.gov.uk/government/publications/state-of-the-water-environment-indicator-b3-supporting-evidence/state-of-the-water-environment-indicator-b3-supporting-evidence#state-of-the-water-environment-in-england-data-summary [Accessed 6 July 2025].

Natural England & RSPB. 2019. Climate Change Adaptation Manual - Evidence to support nature conservation in a changing climate, 2nd Edition. [online] *Natural England*. Natural England, York, UK. Available at: https://publications.naturalengland.org.uk/publication/5679197848862720 [Accessed 10 December 2024].

NatureScot. 2025. Peatland ACTION - What we do. [online] *NatureScot*. NatureScot. Available at: https://www.nature.scot/climate-change/nature-based-solutions/nature-based-solutions-practice/peatland-action/peatland-action-what-we-do [Accessed 1 December 2025].

Oldham R.S. & Swan M.J.S. 1997. Pond loss and amphibians; historical perspective. In: Boothby, J. (Ed.), *British Pond Landscapes Action for Protection and Enhancement, The Pond Life Project*, 3–16. John Moores University, Liverpool.

Parkes, K.A., Amos, W., Moore, N.W., Hoffman, J.I. & Moore, J. 2009. Population structure and speciation in the dragonfly *Sympetrum striolatum*/*nigrescens* (Odonata: Libellulidae): An analysis using AFLP markers. *European Journal of Entomology*, **106**(2): 179–184.

Parr, A.J. 1997. Migrant and dispersive dragonflies in Britain during 1996. *British Dragonfly Society Journal*, **13**(2): 41–48.

Parr, M.J. & Parr, M. 1979. Some observations on Ceriagrion tenellum (de Villers) in southern England (Zygoptera: Coenagrionidae). *Odonatologica*, **8**(3): 171–194.

Paulson, D., Schorr, M., Abbott, J., Bota-Sierra, C., Deliry, C., Dijkstra, K.-D. & Lozano, F. 2025. World Odonata List. [online] *OdonataCentral*. University of Alabama. Available at: https://www.odonatacentral.org/app/#/wol/ [Accessed 10 December 2025].

Pickwell, A. 2011. *The influence of salinity on the distribution and survival of the Norfolk Hawker dragonfly (Isoaeschna isoceles Müller, 1767) in the Norfolk Broads*. Norfolk: Broads Authority.

Powney, G.D., Carvell, C., Edwards, M., Morris, R.K.A., Roy, H.E., Woodcock, B.A. & Isaac, N.J.B. 2019. Widespread losses of pollinating insects in Britain. *Nature Communications*, **10**(1).

Prunier, F., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Vinko, D. 2024a. *Anax ephippiger* (Europe assessment). [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T59811A208814779.en [Accessed 9 April 2025].

Prunier, F., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Vinko, D. 2024b. *Orthetrum coerulescens* (Europe assessment*).* [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158682A208821070.en [Accessed 9 April 2025].

Prunier, F., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Vinko, D. 2024c. *Sympetrum fonscolombii* (Europe assessment). [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T60038A208818015.en [Accessed 9 April 2025].

Pryke, L. 2025. 17: Surrey. In: British Dragonfly Society, Country Dragonfly Record Reports England 2024, 22-23. [online] *British Dragonfly Society.* British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2025/04/CDR-report-2024-England-for-website.pdf [Accessed 6 July 2024].

Reid, C., Hornigold, K., McHenry, E., Nichols, C., Townsend, M., Lewthwaite, K., Elliot, M., Pullinger, R., Hotchkiss, A., Gilmartin, E., White, I., Chesshire, H., Whittle, L., Garforth, J., Gosling, R., Reed, T. & Hugi, M. 2021. State of the UK's Woods and Trees 2021. [online] *Woodland Trust*. Woodland Trust. Available at: https://www.woodlandtrust.org.uk/media/51705/state-of-the-uks-woods-and-trees-2021-thewoodlandtrust.pdf [Accessed 10 December 2024].

RSPB. 2025. *Rare dragonfly introduced into a hidden corner of Cumbria*. [online] *RSPB*. The Royal Society for the Protection of Birds. Available at: https://www.rspb.org.uk/media-centre/rare-dragonfly-introduced-into-a-hidden-corner-of-cumbria [Accessed 24 September 2025].

Rushbrook, B., Whitfield, D. & Selby, T. 2021. Assessment of the status of southern damselfly *Coenagrion mercuriale* in the New Forest: [Higher Level Stewardship Agreement: The Verderers of the New Forest AG00300016]. [online] *HLS New Forest*. Verderers of the New Forest. Available at: https://www.hlsnewforest.org.uk/app/uploads/sites/3/2022/10/Southern-damselfly-in-the-New-Forest-survey.pdf [Accessed 10 December 2024].

Sadler, D. & Chelmick, D. 2022. Observation on a new colony of *Ischnura pumilio* (Charpentier) (Scarce Blue-tailed Damselfly): the first record for West Sussex. *Journal of the British Dragonfly Society*, **38**(1): 65–83.

Samways, M.J., Córdoba-Aguilar, A., Deacon, C., Alves-Martins, F., Baird, I.R.C., Barmentlo, S.H., Brasil, L.S., Bried, J.T., Clausnitzer, V., Cordero-Rivera, A., Datto-Liberato, F.H., De Knijf, G., Dolný, A., Futahashi, R., Guillermo-Ferreira, R., Hassall, C., Juen, L., Khelifa, R., Lozano, F., Muzón, J. Sahlén, G., Herrera, M.S., Simaika, J.P., Stoks, R., Suárez-Tovar, C.M., Suhling, F., Tsubaki, Y. & Vilenica, M. 2025. Scientists' warning on the need for greater inclusion of dragonflies in global conservation. *Insect Conservation and Diversity*, **18**(4): 465–484.

Sayers, P., Moss, C., Carr, S. & Payo, A. 2022. Responding to climate change around England's coast - The scale of the transformational challenge. *Ocean & Coastal Management*, **225**.

Schneider, T., Vierstraete, A., Kosterin, O., Ikemeyer, D., Hu, F.S., Snegovaya, N. & Dumont, H. 2023. Molecular Phylogeny of Holarctic Aeshnidae with a Focus on the West Palaearctic and Some Remarks on Its Genera Worldwide (Aeshnidae, Odonata). *Diversity*, **15**(9): 950.

Shirt, D.B. (Ed.). 1987. *British Red Data Books: 2. Insects*. JNCC, Peterborough, UK.

Shrubb, M. 2003. *Birds, scythes and combines: a history of birds and agricultural change*. Cambridge University Press, UK.

Šigutová, H., Pyszko, P., Bílková, E. & Dolný, A. 2025. Highly Conserved Ecosystems Facing Climate Change: Rapid Shifts in Odonata Assemblages of Central European Bogs. *Global Change Biology*, **31**(4).

Smallshire, D. 2025. Dragonflies in Devon. [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2025/03/Dragonflies-in-Devon-v11ill.pdf [Accessed 30 February 2025].

Smallshire, D. & Swash, A. 2025. *Dragonflies of Britain and Ireland*. Fifth Edition. Princeton University Press.

Smith, B.D., Villalobos-Jiménez, G., Perron, A.C., Sahlén, G., Assandri, G., Vilenica, M., Calvão, L.B., Juen, L., Cerini, F. & Bried, J.T. 2022. Odonata assemblages in human-modified landscapes. In: *Dragonflies and Damselflies. Model Organisms for Ecological and Evolutionary Research*, 247–260.

Smith, R.W.J., Smith, E.M. & Richards, M.A. 2000. Habitat and development of larvae of the Azure Hawker Aeshna caerulea (Ström) in northern Scotland. *Journal of the British Dragonfly Society*, **16**(1): 1–16.

Stewart, A. & Lance, A. 1983. Moor-draining: a review of impacts on land use. *Journal of Environmental Management*.

Tang, D.H.Y. & Visconti, P. 2020. Biases of Odonata in Habitats Directive: Trends, trend drivers, and conservation status of European threatened Odonata. *Insect Conservation and Diversity*, **14**(1).

Tanguy, M., Magee, E., Hannaford, J., Bell, V., Rameshwaran, P., Baron, H., Keller, V. & Barker, L. 2023. *CS-N0W-D2 Task 5: Analysis of future scenarios D2 – Future water resources for water intensive energy infrastructure*. [online] *GOV.UK*. GOV.UK. Available at: https://assets.publishing.service.gov.uk/media/672b4fbbabb279b2de1e8c34/cs-now-d2-future-water-resources-output-analysis.pdf [Accessed January 2024].

Taylor, P., Smallshire, D., Parr, A.J., Brooks, S.J., Cham, S.A., Colver, E.F., Harvey, M., Hepper, D., Isaac, N.J.B., Logie, M.W., McFerran, D., McKenna, F., Nelson, B. & Roy, D.B. 2021. *State of Dragonflies in Britain and Ireland.* [online] *British Dragonfly Society*, British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2021/09/State-of-Dragonflies-2021-final-website.pdf [Accessed 3 July 2025].

Thompson, D.J., Purse B.V. & Rouquette J.R. 2003. *Monitoring the Southern Damselfly, Coenagrion mercuriale. Conserving Natura 2000 Rivers Monitoring Series No. 8*. English Nature, Peterborough, UK.

Traill, L.W., Bradshaw, C.J.A. & Brook, B.W. 2007. Minimum viable population size: A meta-analysis of 30 years of published estimates. *Biological Conservation*, **139**(1-2): 159–166.

University of Leicester. 2015. State of our countryside: Land use map of the United Kingdom reveals large-scale changes in environment. [online] *University of Leicester*. University of Leicester. Available at: https://www2.le.ac.uk/offices/%20press/press-releases/2015/june/state-of-ourcountryside-land-use-map-of-the-unitedkingdom-reveals-large-scale-changes-inenvironme [Accessed 3 May 2024].

van Grunsven, R.H.A., Billqvist, M., De Knijf, G., Prunier, F. & Vinko, D. 2024. *Anax parthenope* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158686A208822987. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165488A208839483.en [Accessed 9 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024a. *Aeshna affinis* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158694A207839525. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doiorg/10.2305/IUCN.UK.2024-1.RLTS.T158694A207839525.en [Accessed 9 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024b. *Isoaeschna isoceles* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158692A208824966. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158692A208824966.en [Accessed 9 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024c. *Aeshna mixta* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165499A208843381. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165499A208843381.en [Accessed 9 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024d. *Anax imperator* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T59812A208815239. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T59812A208815239.en [Accessed 9 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024e. *Calopteryx splendens* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158701A208826598. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158701A208826598.en [Accessed 24 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024f. *Calopteryx virgo* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165505A208845263. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165505A208845263.en [Accessed 24 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024g. *Chalcolestes viridis* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165529A208853331. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165529A208853331.en [Accessed 25 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024h. *Coenagrion scitulum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165502A208844811. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165502A208844811.en [Accessed 25 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024i. *Ischnura elegans* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165479A208836177. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165479A208836177.en [Accessed 25 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024j. *Ischnura pumilio* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165525A208851979. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165525A208851979.en [Accessed 12 March 2026].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024k. *Lestes barbarus* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158684A208821963. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158684A208821963.en [Accessed 25 April 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024l. *Libellula depressa* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165531A208853768. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165531A208853768.en [Accessed 1 May 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024m. *Libellula fulva* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165496A208842480. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165496A208842480.en [Accessed 1 May 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024n. *Orthetrum cancellatum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T165521A208850407. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T165521A208850407.en [Accessed 1 May 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024o. *Platycnemis pennipes* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158709A208828820. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158709A208828820.en [Accessed 1 May 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024p. *Sympetrum sanguineum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158691A269770755. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://www.iucnredlist.org/species/158691/269770755 [Accessed 2 May 2025].

Vinko, D., Billqvist, M., De Knijf, G., van Grunsven, R.H.A. & Prunier, F. 2024q. *Sympetrum striolatum* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T158685A208822454. [online] *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature and Natural Resources. Available at: https://dx.doi.org/10.2305/IUCN.UK.2024-1.RLTS.T158685A208822454.en [Accessed 2 May 2025].

Wildfish. 2025. Wildfish Abstraction Report 2025. [online] *Wildfish*. Wildfish. Available at: https://wildfish.org/wp-content/uploads/2025/06/WildFish-Abstraction-Report_090625.pdf [Accessed 10 June 2025].

Wilkins, T.C., Wilson, R.J. & Brown, A.F. 2022. *Outcome Indicator Framework for England's 25 Year Environment Plan: D5 Conservation status of our native species – Technical Document 2022. NERR124.* Natural England. York, UK.

6 Acknowledgements

The authors would like to thank the volunteer recorders who have contributed to the BDS Recording Scheme database, particularly the volunteer County Dragonfly Recorders for maintaining the high standards of the recording scheme and providing insight into Odonata assemblages in their respective Vice Counties.

Thanks are also extended to the Dragonfly Conservation Group for providing their expertise and support throughout this Red List Review, Gary Powney at the UK Centre for Ecology & Hydrology for performing the occupancy modelling analysis, and Andrew Brown, Richard Wilson, and Simon Curson at Natural England for guiding this assessment.

This revised Red List assessment of British Odonata was part funded by Natural England.

7 Appendices

Appendix 1: Species Profiles

A.1.1 *Aeshna affinis*

Southern Migrant Hawker

2026 status: LC. 2008 status: NA. Change: Genuine (recent).

GB population profile

Records indicate this species has been breeding in GB since at least 2010, qualifying it for assessment. It was not assessed during the 2008 Red List analysis owing to its then status as a vagrant (Daguet *et al*., 2008). Breeding colonies are now located in the East of England and the South East of England, most notably around the Thames Estuary in Essex (regions of England are shown on Map 1 in Appendix 2). Dispersing adults from the resident population as well as immigrants, are recorded annually elsewhere in England, but predominantly in southern England. There are also occasional records along the coast in South Wales (regions of Wales are shown on Map 2 in Appendix 2).

The species is associated with shallow, standing freshwater and brackish waterbodies that are well vegetated, unshaded but sheltered. They can also breed in ephemeral waterbodies that become dry in late summer.

Assessment

Criterion A: The species has continued to become more established in GB over the past 10 years, which is reflected in the dramatic increase in the index of abundance (modelled occupancy analysis: 545.2% from 2012 to 2021), AOO (1991.7% from 2014 to 2023) and EOO (7714.2% from 2014 to 2023). Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species is exhibiting population increase and range expansion on a European scale (European Red List status: Least Concern (Vinko *et al*., 2024a)).

Criterion B: While the EOO (167350km^2) does not meet the Criterion B1 threshold, the AOO is small (1180km^2) meeting the threshold for qualification as Vulnerable against Criterion B2. However, as there is no evidence of decline, severe fragmentation or extreme fluctuations and there are more than 10 locations, it does not meet any additional conditions required for qualification against Criterion B.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO is greater than 20km^2 and the species is present in more than five locations; as a result, the species does not meet the threshold for qualification as Vulnerable against Criterion D2.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.2 *Aeshna caerulea*

Azure Hawker

2026 status: EN. Qualifying criteria: B2ab(iii). 2008 status: VU. Change: Genuine (recent).

GB population profile

The British population is confined to Scotland, with its stronghold located in the Highlands (Map 4 in Appendix 2). The species breeds in bog pools that contain a combination of open water and abundant *Sphagnum cuspidatum*, within which its larvae live. Breeding pools also have thick layers of benthic detritus that larvae use as a refuge during drought or particularly cold winters. The most productive breeding sites are located at lower altitudes in large extents of blanket bog with abundant pools. Shallow pools are preferred; larvae are most abundant in pools 15-20 cm deep and around 1m in diameter (Smith *et al*., 2000). Breeding sites can be from near sea level to an elevation of over 300m.

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy) did not change significantly from 2012 to 2021; EOO decreased from 2014 to 2023 (-14.9%) while AOO increased (154.8%). However, this primarily reflects an increase in recorder effort resulting from funding for targeted species surveys. The species is declining on a European scale (European Red List status: Near Threatened) and climate change is identified as the main cause, particularly along the southern edge of its range (Billqvist *et al*., 2024a).

Criterion B: While EOO (17372km^2) meets the Criterion B1 threshold for qualification as Vulnerable, the AOO (428km^2) meets the threshold for qualification as Endangered against Criterion B2. It also meets the additional two conditions required for qualification against Criterion B. Its current small AOO is due to the loss and degradation of its blanket bogs, primarily from drainage and afforestation (Cham *et al*., 2014). The species meets condition B2a: it is limited to five locations, areas of blanket bog at Rannoch Moor and Corrour; around Glen Affric and the Dundreggan area; in the north-west around Loch Maree; Glen Garry; and around Loch Arkaig. A single threatening event within one of these locations, such as drought, or changes in management, such as land drainage, could rapidly affect all individuals present. It also meets condition B2b(iii) as there is an observed and projected continuing decline in area, extent and quality of habitat. This is primarily a result of climate change; droughts are now, and will continue to become, a more frequent extreme weather event in Scotland (Kirkpatrick Baird *et al*., 2021). Drought can have a significant and long-lasting negative effect on the species' breeding pools. Its larvae take, on average, three years to develop and cannot survive the desiccation of their bog pools. The most productive breeding pools are shallow and therefore more vulnerable to desiccation during periods of reduced rainfall. For example, at the Corrour monitoring project site only seven larvae were found in 2022 after the 2021 drought, compared to 231 in 2019. Many of the shallow, previously productive pools were either infilled with *Sphagnum* or no longer provided suitable conditions as the benthic layer, utilised by

larvae, had dried and become compressed. Deeper pools showed less evidence of desiccation, but numbers in these pools were low due to the presence of other predatory Odonata species (Muir, 2022).

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO is greater than 20km^2 but the species is only present in five locations; as a result the species also qualifies as Vulnerable against Criterion D2, given the plausible future threat posed by climate change.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.3 *Aeshna cyanea*

Southern Hawker
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Common across most of England and Wales, apart from areas of higher elevation, such as Eryri National Park; it is less abundant in Scotland with scattered colonies in lowland areas.

The species is capable of breeding in a wide variety of still and slow-flowing wetlands, alkaline to neutral, from shaded woodland ponds to well-vegetated sections of canals.

Assessment
Criterion A: The species range has expanded in GB over the past 10 years, particular in Wales and Scotland, illustrated by the increase in the index of abundance (modelled occupancy analysis: 5.04% from 2012 to 2021), AOO (77.9% from 2014 to 2023) and EOO (6.1% from 2014 to 2023). This is likely a response to climate change, aided by the species' strong dispersal ability and capacity to breed in a wide range of habitats (Taylor *et al*., 2021). Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species is showing population increase and range expansion on a European scale (European Red List status: Least Concern (Billqvist *et al.*, 2024b).

Criterion B: Both EOO (335256km^2) and AOO (22340km^2) do not meet the thresholds for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.4 *Aeshna grandis*

Brown Hawker

2026 status: LC. 2008 status: LC. Change: None.

GB population profile

The species has a south-easterly distribution in GB. It is widespread across large parts of England apart from Devon and Cornwall where it is absent, the North East, Yorkshire and the Humber, and Cumbria where it is scarce (Vice Counties are shown on Map 3 of Appendix 2). In Wales, its distribution is centred in Powys; records in Scotland are rare.

The species breeds in a range of still and slow-flowing freshwater wetlands that have abundant emergent vegetation or organic debris for ovipositing, for example mature gravel pits or slow-flowing rivers with fallen deadwood. Breeding sites usually have some form of nearby tree cover.

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. There was no significant change in the index of abundance (modelled occupancy analysis from 2012 to 2021); AOO increased 11.4% from 2014 to 2023 and EOO increased 25.3% from 2014 to 2023. The European Red List status is Vulnerable due to ongoing decline, which has been linked to climate change and nutrient deposition resulting in habitat degradation (Billqvist *et al*., 2024c). These are both relevant to the British population so decline in the next decade is a possibility, highlighting a need for continued monitoring.

Criterion B: Both EOO (200339km^2) and AOO (13830km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.5 *Aeshna juncea*

Common Hawker

2026 status: NT. Qualifying criteria: A2b. 2008 status: LC. Change: Genuine (recent).

GB population profile

The species is most common in Scotland, where it is found across large areas of the country. In Wales, it is most abundant in South and Mid Wales with a more scattered

distribution in the North. In England, it has a northerly distribution and is most abundant in the North West and North East of England; the species is scarce in the East, and South East of England, and most of the East Midlands.

The species is primarily associated with acidic wetlands including pools in upland and lowland bogs, tarns, as well as slow-flowing runnels and streams; most breeding sites are below 600m (Cham *et al*., 2014).

Assessment
Criterion A: Suspected population decline approaches, but does not meet, the -30% threshold for qualification as Vulnerable against Criterion A2b. The index of abundance (modelled occupancy analysis) declined by 25.3% from 2012 to 2021, and has exhibited long-term decline: -29.6 from 1992 to 2021 and 44.8% from 1972 to 2021. AOO also declined by 12.8% from 2014 to 2023, although EOO increased 0.7% over the same time-period. Based on the occupancy modelling results, which provide more robust estimates of population trends due to controls for factors such as recorder bias, the conclusion of Near Threatened is made.

The species' main threats are habitat loss, fragmentation and degradation from land management practices, which include drainage of wetland sites to make land suitable for agriculture and afforestation, and peat harvesting. Peatland habitats are also classified as being at medium risk from climate change, particularly changes in rainfall patterns that can destabilise bog ecosystems, altering vegetation structure and hydrology, and reducing the ability to form peat (Natural England & RSPB, 2019). The species is also declining on a European scale and is now classified as Endangered; this is a result of a combination of threats, and the amplification of their effect by climate change (Billqvist *et al*., 2024d).

Criterion B: Both EOO (415226km^2) and AOO (7144km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.6 *Aeshna mixta*
Migrant Hawker
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Widespread across most of lowland England. In Wales it is most widespread in the south-east; scattered colonies also exist elsewhere in Wales, primarily along the coast

and the English border. In Scotland scattered breeding colonies can be found south of Stirling, primarily along the coast.

The species breeds in a wide diversity of neutral to alkaline, slow-flowing or still, wetlands with abundant aquatic vegetation, from brackish coastal marshland ditches to garden ponds.

Assessment
Criterion A: In GB the species has expanded its range northwards. The index of abundance (modelled occupancy analysis) did not change significantly from 2012 to 2021, but has increased in the long-term: 59.7% from 1992 to 2021 and 120.6% from 1972 to 2021. This is likely a response to climate change aided by the species' strong dispersal ability (Taylor *et al*., 2021). The species is also categorised as Least Concern in the European Red List as its European population is stable (Vinko *et al*., 2024c). Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A.

Criterion B: Both EOO (401357km^2) and AOO (16716km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20,000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible.

AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.7 *Anax ephippiger*
Vagrant Emperor
2026 status: NA. 2008 status: NA. Change: None.

GB population profile
An irregular migrant to GB, although records are becoming more frequent. The species is predominantly recorded at coastal sites in England and Wales; it is rarely recorded in Scotland. Evidence of breeding (copulating pairs and ovipositing females) has been recorded in England since 2011; successful breeding (emergence) was reported in Cornwall in 2023.

The species is increasing on a European scale (European Red List status: Least Concern), and is likely benefitting from climate change (Prunier *et al*., 2024a). There is a high possibility that the species could establish breeding colonies in GB in the near future.

Assessment
This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.8 *Anax imperator*
Emperor Dragonfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Widespread through most of lowland England and Wales, and expanding its range into the south of Scotland.

Breeding occurs in a range of still and slow-flowing wetland habitats with abundant aquatic vegetation, such as mature lakes and the vegetated shallow margins of rivers.

Assessment
Criterion A: The species has exhibited a long-term trend of occupancy increase in GB; the index of abundance (modelled occupancy analysis) increased over all three timelines: 16.3% from 2012 to 2021, 145.8% from 1992 to 2021, and 357% from 1972 to 2021. This is likely a response to climate change, aided by the species' strong dispersal ability and capacity to breed in a wide range of habitats (Taylor *et al.*, 2021). Suspected Population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species is also exhibiting population increase and range expansion on a European scale (European Red List status: Least Concern (Vinko *et al*., 2024d).

Criterion B: Both EOO (352258km^2) and AOO (20636km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible.

AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.9 *Anax junius*
Green Darner
2026 status: NA. 2008 status: NA. Change: None.

GB population profile
A vagrant to GB, it was recorded in 1998 on the Isles of Scilly and in Cornwall (East and West Vice Counties) and again in 2023 on the Isles of Scilly.

Assessment
This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.10 *Anax parthenope*

Lesser Emperor
2026 status: LC. 2008 status: NA. Change: Genuine (recent).

GB population profile
Occurs as a regular migrant in England, although the number of confirmed breeding colonies is increasing. It is most abundant in the South and the East of England, and the East Midlands. A few breeding colonies are located in the east of South Wales, where the species also occurs as a regular migrant. Occasional migrant individuals are recorded in Scotland.

The species utilises a wide range of neutral, still and slow-flowing freshwater habitats with emergent vegetation, primarily ponds and lakes; it can also tolerate brackish conditions.

Assessment
Criterion A: At the time of the 2008 Red List assessment the species was a recent colonist in GB. The first evidence of breeding was recorded in 1999; since then breeding has been recorded at an increasing number of sites in England and Wales as the species has become more established. This is reflected in the increase in AOO and EOO from 2014 to 2023 (AOO: 367.9%, EOO: 126%) and the long-term increase in the index of abundance (modelled occupancy analysis) across all three timelines: 117.7% from 2012 to 2021, 819.3% 1992 to 2021, and 4145.6% 1972 to 2021. Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species is expanding on a European scale (European Red List status: Least Concern) and is expected to continue to expand its population and range in GB (van Grunsven *et al*., 2024).

Criterion B: While the EOO (375791km^2) does not meet the Criterion B1 threshold, the AOO is small (1152km^2), meeting the threshold for qualification as Vulnerable against Criterion B2. However, as there is no evidence of decline, severe fragmentation or extreme fluctuations and there are more than 10 locations, it does not meet any additional conditions required for qualification against Criterion B.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.11 *Brachytron pratense*

Hairy Dragonfly

2026 status: LC. 2008 status: LC. Change: None.

GB population profile

Within England, the species is most abundant in the South East and East of England, and the East Midlands; its distribution is more scattered elsewhere, although it is absent from the North East of England, Cumbria and Cornwall. In Wales, the species is most abundant in the South of Wales and a few scattered colonies exist on Anglesey. In Scottish, colonies can be found in Dumfries and Galloway, as well as Argyll and Bute.

The species breeds in still and slow-flowing mature freshwater wetlands with abundant aquatic and bankside vegetation, as well as areas of open water, such as grazing marsh ditch systems and lakes.

Assessment

Criterion A: The species has exhibited consistent long-term increase in the index of abundance (modelled occupancy analysis): 48.3% from 2012 to 2021, 108.7% from 1992 to 2021, and 246.7% from 1972 to 2021; AOO also increased by 50.5% from 2014 to 2023, although EOO declined 17.4%. Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024e).

Criterion B: Both EOO (216624km^2) and AOO (5008km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.12 *Calopteryx splendens*

Banded Demoiselle

2026 status: LC. 2008 status: LC. Change: None.

GB population profile

The species is common and widespread across most of England apart from the South East and North, where populations are more sparsely distributed. In Wales, it has a scattered distribution apart from in the south-east where it is most widespread. In Scotland the species has a limited distribution in the Lowlands.

The species only breeds in slow-flowing streams, rivers and canals, with benthic mud or fine sediment. Waterways used for breeding are unshaded and have abundant bankside and aquatic vegetation.

Assessment
Criterion A: The index of abundance (modelled occupancy analysis) increased across all three timelines: 11.9% from 2012 to 2021, 26.1% from 1992 to 2021, and 48% from 1972 to 2021. AOO and EOO also increased from 2014 to 2023 (AOO: 31.9%, EOO: 5.9%). This is likely a reaction to climate change, but it could also reflect improvements in water quality along certain waterways (Taylor *et al*., 2021). Suspected population decline does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species is considered stable on a European scale (European Red List status: Least Concern (Vinko *et al*., 2024e).

Criterion B: Both EOO (219420km^2) and AOO (14816km^2) do not meet the thresholds for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.13 *Calopteryx virgo*
Beautiful Demoiselle
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Widespread across the South of England, the West Midlands, and Cumbria; scattered colonies exist elsewhere in England. Widespread in South and Mid Wales, but less so across North Wales. In Scotland the species' range is centred in Argyll and Bute. The species is associated with the shallow sections of fast-flowing streams and rivers that are characterised as having a benthic layer of sand or gravel.

Assessment
Criterion A: The index of abundance (modelled occupancy analysis) increased over all three timelines: 23.5% 2012 to 2021, 25.2% 1992 to 2021, and 46.2% 1972 to 2021. Its AOO and EOO also increased from 2014 to 2023 (AOO: 73.9%, EOO: 3.1%); this is likely a reaction to climate change (Taylor *et al*., 2021). Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species is considered stable on a European scale (European Red List status: Least Concern (Vinko *et al*., 2024f).

Criterion B: Both EOO (254489km^2) and AOO (11308km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.14 *Ceriagrion tenellum*

Small Red Damselfly

2026 status: NT. Qualifying criteria: B2a. 2008 status: LC. Change: Genuine (recent).

GB population profile

In England scattered populations are found in the South, with a few located in the East; it is most abundant in the New Forest National Park, around Wareham in Dorset, and around Camberley on the Surrey, Hampshire, Berkshire border. In Wales, scattered colonies are located in Pembrokeshire, Cardiganshire, Merionethshire, and Caernarvonshire. The species is absent from Scotland.

This species breeds in bogs, valley mires, flushes and calcareous fens where it favours shallow, relatively warm, good-quality water. Waterbodies utilised for breeding consist of permanent pools, seepages and small streams with lush submerged or emergent vegetation. It can also be present at shallow pools in old tin and clay workings, particularly in the South West of England (Cham *et al.*, 2014; Parr & Parr, 1979).

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) did not significantly change between 2012 and 2021; AOO and EOO increased during 2014 to 2023 (AOO: 12.6%, EOO: 12.9%). The species' European population is considered stable (European Red List status: Least Concern (De Knijf *et al*., 2024b).

Criterion B: While the EOO (100317km^2) does not meet the Criterion B1 threshold, the AOO is small (776km^2), meeting the threshold for qualification as Vulnerable against Criterion B2. However, it only meets one additional condition required for qualification as Endangered against Criterion B, not two; as a result, it qualifies as Near Threatened.

Its small AOO is largely due to the historic peat extraction and drainage and conversion of wetland sites to farmland; for example, this resulted in the species being lost from the Somerset Levels in the 1970s (Cham *et al*., 2014). This historic loss of habitat is

reflected in historic decline in the index of abundance (modelled occupancy analysis): -19.4% from 1992 to 2021, and -30.5% from 1972 to 2021.

The species meets condition B2a: a majority of the population is severely fragmented; while the species can be locally abundant a significant proportion of its surviving colonies are isolated as a result of habitat fragmentation, and few recent records (2019-2023) concern sightings of more than 10 individuals. Climate change could result in the range expansion of this species, whose range extends south to North Africa, with warmer temperatures encouraging dispersal and colonisation. However, changes in rainfall patterns are also a significant threat to the existing vulnerable population; for example, the most well-known Norfolk population, breeding at Scarning Fen, was almost lost following the hot, dry summer of 2022 (survey results indicated the population was likely in decline prior to this event) and now it survives in very low numbers. This is a particular concern for small, isolated subpopulations in the South East and East of England, which are 'water stressed'; additional examples include the subpopulations at Parsonage Moor (Oxfordshire) and the single known Buckinghamshire site (private). Existing sites continue also to be threatened with land use change and development; an example is the infilling of a breeding wetland near Tolvaddon, Cornwall, in 2024 (Jones, 2025) and the development of the M25 Junction 10 in Surrey on *Ceriagrion tenellum* heathland (Pryke, 2025).

Criteria C and D: The population of mature individuals is unknown; while AOO is small, the species can be locally abundant and could exceed the population threshold for qualification as Vulnerable against Criterion C (<10000); it certainly exceeds the population threshold for qualification as Vulnerable against Criterion D1, (<1000). AOO and the number of locations far exceeds the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.15 *Chalcolestes viridis*

Willow Emerald Damselfly

2026 status: LC. 2008 status: NA. Change: Genuine (recent).

GB population profile

The species was not assessed during the 2008 Red List analysis owing to its then status as a vagrant (Daguet *et al*., 2008). Significant numbers of this species were first reported in 2009 on the coast of Suffolk, since when it has rapidly spread. Currently, in England, it is most widespread in the East Midlands, the South East and the East; however, its distribution stretches as far west as Weston-super-Mare, and as far north as Newcastle-upon-Tyne. It is currently absent from Wales and Scotland.

Breeding occurs in a range of still or slow-flowing freshwater habitats, such as ponds, lakes and ditches with overhanging vegetation. Eggs are laid into the stems of woody and herbaceous plants overhanging the water's edge.

Assessment
Criterion A: Range expansion, likely a response to climate change, continues, averaging 15–20 km a year up to 2021 (Taylor *et al*., 2021). This is reflected in the dramatic increase in index of abundance (modelled occupancy analysis) across all three timescales: 1181.2% from 2012 to 2021, 120607% from 1992 to 2021, and 16108764% from 1972 to 2021), as well as AOO and EOO from 2014 to 2023 (AOO: 1028.8%, EOO: 1751.1%). Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species is considered stable on a European scale (European Red List status: Least Concern (Vinko *et al*., 2024g).

Criterion B: Both EOO (97382km^2) and AOO (6112km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.16 *Coenagrion armatum*
Norfolk Damselfly
2026 status: RE. 2008 status: RE. Change: None.

GB population profile
It was first discovered at Barton Broad, Norfolk, in 1903. All historic records are limited to a small area of East Norfolk. Historical records from multiple years of different life stages provide evidence of a breeding population (Brownett, 2005). To the north of its historic range, records came from the linked Stalham, Sutton and Barton Broads; to the south it was recorded at Ranworth Inner Broad and in-between it might also have been present at Alderfen. To the east it was recorded at Swim Coots at Hickling Broad. The last sighting is believed to be from Big Bog at Sutton Fen in 1958. The habitat in this area is now totally unsuitable for the species.

Assessment
With no confirmed sightings since 1958, the species is considered regionally extinct.

A.1.17 *Coenagrion hastulatum*
Northern Damselfly
2026 status: EN. Qualifying criteria: B2ab(iii). 2008 status: EN. Change: None

GB population profile
The British population is restricted to Scotland where its stronghold is in Cairngorms National Park. The species is associated with acidic or neutral well-vegetated shallow

pools, preferably 30-60cm deep, as well as the shallow edges of lochs. Breeding sites have abundant emergent and floating vegetation, including *Equisetum fluviatile* and *Potamogeton polygonifolius*; they are also associated with woodland, usually birch or pine, which provides shelter (Cham *et al*., 2014).

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) increased from 2012 to 2021 (119.9%); AOO and EOO also increased from 2014 to 2023 (AOO: 72.2%, EOO: 85.5%); however, this is to some degree the result of an increase in recorder effort. The BDS Northern Damselfly Survey Project, which ran from 2019 to 2023, has helped to identify new breeding sites and has increased the number of records reported annually in recent years.

Criterion B: EOO is small (7518km^2), meeting the threshold for qualification as Vulnerable against Criterion B1; the AOO is also small (292km^2), meeting the threshold for qualification as Endangered against Criterion B2; it also meets the additional two conditions required to qualification as Endangered against Criterion B. The species meets condition B2a: it is limited to five locations: Aviemore and Strathspey, north into Moray; Castle Fraser; Dinnet/Braemar/Upper Deeside; Logierait, Perthshire; and near Tain. A single, threatening event within one of these locations, such as drought, or changes in management practices, such as forestry, could rapidly affect all individuals present.

It also meets condition B2b(iii), as there is a continuing observed and projected decline in area, extent and quality of habitat. For example, The BDS Northern Damselfly Survey Project surveyed 22 historic breeding sites in 2021: eight were deemed in moderate/poor conditions and three had become completely dried and infilled with vegetation (Batty, 2022). Succession naturally results in pools infilling with vegetation, a process accelerated by warmer temperatures and low water levels; increasing summer temperatures and more frequent droughts are both a result of climate change (Kirkpatrick Baird, *et al*. 2021). Another impact of climate change is the range expansion of potential competitors, such as *Coenagrion puella*, into the range of *Coenagrion hastulatum*. Inter-specific competition has been hypothesised as a cause of low larval counts at the Castle Fraser long-term monitoring site, although the mechanisms for this interaction have not yet been established (Batty, 2022). Another threat to the species' surviving breeding sites is urban development; recent developments that have directly impacted known breeding sites include a supermarket and roadways. Ongoing habitat degradation, with climate change as a key driver, is also the reason for the species ongoing decline on a European scale (European Red List status: Vulnerable (Billqvist *et al*., 2024f)).

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO does not meet the threshold for qualification as Vulnerable against Criterion D2 but the number of locations does; the species is only found at five locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.18 *Coenagrion mercuriale*

Southern Damselfly

2026 status: EN. Qualifying criteria: B2ab(i,iii). 2008 status: EN. Change: None.

GB population profile

In GB its population is limited to the South of England, as well as South West Wales and Anglesey; the species is absent from Scotland.

The species is associated with shallow, permanent, slow-flowing flushes and streams on lowland heathland, chalk streams and calcareous fens. Watercourses where it breeds are unpolluted, base-rich and well oxygenated with a fine sediment or detritus benthic layer. Productive breeding sites are sheltered but unshaded, providing warm conditions (Thompson *et al*., 2003). Breeding sites consist of mosaics of open water and lush, diverse vegetation growth; plant life includes *Potamogeton polygonifolius* and *Hypericum elodes* on heathland wetlands, and *Rorippa nasturtium-aquaticum* and *Helosciadium nodiflorum* in calcareous wetlands.

Assessment

Criterion A: Suspected population change meets the -30% threshold for qualification as Vulnerable against Criterion A2; EOO declined by 40.2% from 2014 to 2023. AOO increased over the same time period (8.7%) and the index of abundance (modelled occupancy analysis) showed no significant change from 2012 to 2021. New colonies have been discovered in the past 10 years; for instance, targeted surveying has been taking place along the River Test since 2021, which has discovered previously unknown colonies. How long these colonies have been present is unknown; some were located on private sites that had previously not been visited, others were on public sites that had only previously been subject to ad hoc recording. There have also been recorded incidents of colony extinction within the past 10 years, including Colaton Raleigh Common in Devon (Smallshire, 2025). The species is declining on a European scale (European Red List status: Vulnerable); reduced water levels and desiccation of breeding sites, as a result of abstraction and climate change, are identified as key ongoing threats (De Knijf *et al*., 2024).

Criterion B: While the EOO (45679km^2) does not meet the Criterion B1 threshold, the AOO is small, 220km^2, meeting the threshold for qualification as Endangered against Criterion B2; it also meets the additional two conditions required to qualification as Endangered against Criterion B.

The species meets condition B2a: the population is severely fragmented, consisting of small, isolated colonies. The species is most abundant in the New Forest, the Itchen and Test Valleys (Hampshire), and in Pembrokeshire. The species can also be found on Anglesey and in Gower (south-west Wales), Purbeck (Dorset), Oxfordshire, and Dartmoor and the Pebblebed Heaths (Devon). The species' weak dispersal ability limits migration between sites and the colonisation of new sites when areas of suitable habitat become available within the surrounding landscape (Thompson *et al*., 2003).

As a result, many of the smaller populations are showing a continuing decline in size, and instances of localised extinction have been observed.

It also meets condition B2b(i), a continuing observed and projected decline in EOO, and B2b(iii), as there is a continuing observed decline in area, extent and quality of habitat; this has been documented by habitat suitability assessments in locations such as the New Forest (Rushbrook *et al*., 2021). In some cases, this is a result of a lack of management, which results in waterways become entrenched and shaded by their banks, or overgrown with vegetation (Dieck, 2017). Urban development threatens some surviving sites, the effects of which include increased water abstraction and water pollution; in addition, the construction of new infrastructure, such as bridges, can act as barriers to migration (Rushbrook *et al*., 2021).

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.19 *Coenagrion puella*

Azure Damselfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
This species is common and widespread across most of England and Wales apart from areas of higher elevation such as the Pennines. In Scotland it is most abundant in the Lowlands and is absent from much of the Highlands.

Breeding takes place in a wide range of lentic waterbodies, but the species is primarily associated with small, sheltered pools and ditches with abundant aquatic vegetation, such as garden ponds.

Assessment
Criterion A: The species is increasing its range northwards (Taylor *et al*., 2021), which is reflected in the 12.1% increase index of abundance (modelled occupancy analysis) from 2012 to 2021, as well as the 23.7% increase AOO from 2014 to 2023 (no change in EOO). Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024g).

Criterion B: Both EOO (331744km^2) and AOO (20912km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible.
AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.20 *Coenagrion pulchellum*

Variable Damselfly
2026 status: LC. 2008 status: NT. Change: Genuine (recent).

GB population profile
This species is scarce across most of England, with sporadic colonies; it is most abundant in the East of England, the East Midlands and the South East of England. It is scarce in Wales, with populations located near Swansea, Newport, and Brecon, and on Anglesey. In Scotland it can be found in Dumfries and Galloway and near Oban.

The species mainly breeds in still or slow-flowing freshwater sites with abundant floating and submerged plants and lush marginal growth; examples include dykes, ditches, fens, ponds and mature gravel pits.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The population has increased in the past 10 years, which is reflected in the 42.8% increase in the index of abundance (modelled occupancy analysis) from 2012 to 2021; AOO also increased from 2014 to 2023 while there was a small decline in EOO (AOO: 20.4%, EOO: -2.4%). The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024h).

Criterion B: While the EOO (160835km^2) does not meet the Criterion B1 threshold, the AOO is small, 1136km^2, meeting the threshold for qualification as Vulnerable against Criterion B2. However, as there is no evidence of decline, severe fragmentation or extreme fluctuations and there are more than 10 locations, it does not meet any additional conditions required for qualification against Criterion B.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.21 *Coenagrion scitulum*

Dainty Damselfly

2026 status: EN. Qualifying criteria: B1ac(iii)+B2ac(iii). 2008 status: RE. Change: Genuine (recent).

GB population profile

In GB, the species only breeds in Kent, England. Records indicate this species has been breeding in GB since at least 2010, qualifying it for assessment. It was assessed during the 2008 Red List analysis as Regionally Extinct (Daguet *et al*., 2008).

This species is associated with open, shallow, standing and slow-flowing freshwater habitats with lush aquatic vegetation, such as *Myriophyllum*. Known sites in Kent include coastal grazing marshes, dominated by *Myriophyllum spicatum* and *Bolboschoenus maritimus*, and freshwater grassland pools with plant life such as *Elodea canadensis*.

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The population is currently very small but increasing, reflected in the increase in AOO and EOO from 2014 to 2023 (AOO: 400%, EOO: 100%); the index of abundance (modelled occupancy analysis) could not be calculated due to insufficient data. Its European Red List status is Least Concern, as it is considered stable and is expanding its range north (Vinko *et al*., 2024h).

Criterion B: EOO is small, 207km^2, meeting the threshold for qualification as Endangered against Criterion B1; the AOO is also small (24km^2), meeting the threshold for qualification as Endangered against Criterion B2. It meets the additional two conditions required to qualify as Endangered against Criterion B. The species meets condition (a), as it is only present at two locations, and condition (ciii), extreme fluctuations in any of the number of locations or subpopulations. The species was recorded in the Benfleet/Hadleigh area of Essex from 1946 to 1952; it subsequently became extinct because of coastal flooding in 1953. The species was rediscovered on the Isle of Sheppey, Kent in 2010, and an additional colony at Sandwich Bay, Kent, was discovered in 2019. At least two other locations in Kent were colonised and have subsequently gone extinct since 2010 illustrating the instability of the British population.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO is 24km^2, almost meeting the <20km threshold for qualification as Vulnerable against Criterion D2, and therefore qualifies as Near Threatened. However, the species is only present in two locations; as a result, the species also qualifies as Vulnerable against Criterion D2. The two remaining breeding sites are both located in the coastal marshlands of Kent, areas at high risk from climate change. Sea level rise and the increasing frequency and intensity of extreme weather events involving heavy rainfall and high wind speeds (which increase tidal wave action) threaten the stability of the coastline and are degrading coastal

wetland habitats (Climate Central, 2021; Sayers *et al*., 2022). The population could become Critically Endangered in a very short period of time as a result of stochastic event, such as tidal flooding, at which point reassessment will be required.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.22 *Cordulegaster boltonii*

Golden-ringed Dragonfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
In England, the species is most widespread in the South, the North East and Cumbria; it can also be found in upland areas such as the Peak District and North York Moors. Breeding colonies can be found across Wales, but it is most abundant in upland areas, such as in and around Bannau Brycheiniog National Park. In Scotland, it is widespread in the Highlands, as well as Dumfries and Galloway.

The species is associated with small, shallow, unshaded, acidic runnels and streams on moorland or heathland that have a benthic layer of fine sediment or sand.

Assessment
Cordulegaster boltonii remains categorised as Least Concern. The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024d).

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) increased 12.6% from 2012 to 2021; AOO increased 20.7% from 2014 to 2023, although EOO decreased 12% over the same time period.

Criterion B: Both EOO (341455km^2) and AOO (11120km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criteria C and D: While the population of mature individuals is unknown, due to the large AOO, there is a high level of certainty that it does not meet the population thresholds for qualification as Vulnerable against Criteria C (<10000) and D1 (<1000). AOO and number of locations far exceed the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.23 *Cordulia aenea*

Downy Emerald
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
In England this species is most widespread in the South East and Cumbria; scattered colonies can be found elsewhere, such as near Cinderford in Gloucestershire, around

Westwick in Norfolk, and around Shrewsbury in Shropshire; it is absent from the North East including Yorkshire and the Humber. The strongest Welsh population is in the Vale of Glamorgan; a few isolated populations are located further north, such as at Llyn Tecwyn Isaf. In Scotland colonies are found around Oban, Loch Ness, and Glen Affric.

The species is associated with woodland ponds and tree-lined lakes in England and Wales, and sheltered tree-lined lochs in Scotland. Waterbodies are neutral to acidic with abundant aquatic vegetation and benthic layers of leaf litter and other organic debris.

Assessment
Cordulia aenea remains categorised as Least Concern. The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024i).

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. There was no significant change in the index of abundance (modelled occupancy analysis) from 2012 to 2021, and a small increase in AOO (10%) and decrease in EOO (6.9%) from 2014 to 2023.

Criterion B: While the EOO (198663km^2) does not meet the Criterion B1 threshold, the AOO is small, 1344km^2, meeting the threshold for qualification as Vulnerable against Criterion B2. However, as there is no evidence of decline, severe fragmentation or extreme fluctuations and there are more than 10 locations, it does not meet any additional conditions required for qualification against Criterion B.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible.
AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.24 *Crocothemis erythraea*
Scarlet Darter
2026 status: NA. 2008 status: NA. Change: None.

GB population profile
Predominantly a vagrant; however, adults were observed copulating and ovipositing for the first time in GB, in Dorset, in 2024.

Assessment
This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.25 *Enallagma cyathigerum*

Common Blue Damselfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
This is one of the most widespread species in GB occurring across England, Scotland and Wales at a range of altitudes.

The species is primarily associated with still waterbodies, such as lakes and reservoirs, but will also utilise slow-flowing waterways; submerged and floating vegetation must also be present.

Assessment
Enallagma cyathigerum remains categorised as Least Concern. The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024j).

Criterion A: Suspected population decline does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) declined by 5.8% from 2012 to 2021; EOO declined 1.4% between 2014 and 2023 while AOO increased 9.8% over the same time period.

Criterion B: Both EOO (502213km^2) and AOO (25144km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible.
AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.26 *Erythromma najas*

Red-eyed Damselfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
In England, the species is widespread across most of the South, the East, the Midlands, Yorkshire and the Humber, and around Liverpool. In Wales its stronghold is in the south-east; there are a few scattered colonies elsewhere, primarily in the South and close to the English border. It is absent from Scotland.

The species is primarily found in still, eutrophic waterbodies; however, it will also utilise slow-flowing waterbodies, such as rivers and canals. Breeding sites are sheltered and have abundant emergent, submerged and floating vegetation; it is associated, in particular, with waterbodies that have floating-leaved hydrophytes, such as *Nymphaeaceae*.

Assessment
Erythromma najas remains categorised as Least Concern. The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024k).

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. There was no significant change in the index of abundance (modelled occupancy analysis) from 2012 to 2021, while AOO and EOO increased from 2014 to 2023 (AOO: 5.9%, EOO: 15.7%).

Criterion B: Both EOO (135231km^2) and AOO (5996km^2) do not meet the threshold for qualification as Vulnerable against Criteria B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.27 *Erythromma viridulum*
Small Red-eyed Damselfly
2026 status: LC. 2008 status: NE. Change: Genuine (recent).

GB population profile
The species was Not Evaluated during the previous Red List analysis, as it was then a recent colonist (Daguet *et al*., 2008). It was discovered at multiple sites in Essex in 1999; it is now widespread across most of the South and East of England as well as the Midlands. The species is more scarce in Yorkshire and the Humber and the North East; it is absent from the North West north of Lancaster. In Wales breeding colonies are distributed across the South, although it is most abundant in the south-east. The species is absent from Scotland.

Breeding sites consist of unshaded still or slow-flowing waterbodies, such as ponds and lakes, with abundant floating aquatic vegetation, such as *Myriophyllum* and *Ceratophyllum*, or algae.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species' population is growing and expanding its range, which is reflected in its 79.9% increase in the index of abundance (modelled occupancy analysis) from 2012 to 2021, as well as the increase in AOO and EOO from 2014 to 2023 (AOO: 85.2%, EOO: 101%). The species is also increasing on a European scale (European Red List status: Least Concern (De Knijf *et al*., 2024e).

Criterion B: Both EOO (156815km^2) and AOO (3996km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.28 *Gomphus vulgatissimus*

Common Clubtail

2026 status: NT. Qualifying criteria: B2biii. 2008 status: NT. Change: None.

GB population profile

Populations are located in England and Wales; it is absent from Scotland. Its strongest populations are located on the rivers Dee, Severn, Thames and Wye. Smaller populations breed on the rivers Arun, Rother, Teme, and Vyrnwy.

The species is associated with slow-flowing sections of rivers, with good water quality and fine benthic sediment, with adjacent deciduous woodland (Cham *et al*., 2014).

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) increased 33.3% from 2012 to 2021, EOO also increased from 2014 to 2023 (EOO: 7%) while AOO decreased over the same time period (AOO: -7.4%). However, the increase in index of abundance and EOO is likely a result, in part, of an increase in targeted recording. Adults of the species are elusive; as a result, this species has historically been under-recorded. The Clubtail Count citizen science project ran from 2017 to 2019 and used exuviae surveys to map the species' breeding range (British Dragonfly Society, 2019). At a European scale, *Gomphus vulgatissimus* remains categorised as Least Concern. The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024l).

Criterion B: While the EOO (44013km^2) does not meet the Criterion B1 threshold, the AOO is small (725km^2), meeting the threshold for qualification as Vulnerable against Criterion B2. However, it only meets one of the two additional conditions required to qualify as Endangered against Criteria B; as a result, it qualifies as Near Threatened. It meets condition B2b(iii), as there is a continuing observed and projected decline in quality of habitat. Its current distribution is restricted to a few river systems in England and Wales, a result of historic and ongoing habitat loss and degradation. River engineering works, such as dredging and canalisation, increase flow rate and remove the larval benthic niche; they also result directly in larval mortality. Although restricted, dredging continues within its waterways illegally (Defra Press Office, 2023). Pollution

events, such as sewage spills, also result in habitat degradation by reducing water quality. A single pollution event upstream can negatively affect breeding habitat along an entire waterway. Sewage spills are a pollutant of particular concern owing to the 54% increase in spill incidents in 2023 (Environment Agency, 2024); the River Severn, one of the most important catchments for the species, experienced 33,667 spillages during 2021 and 2022 (Kent, 2023). The River Avon, Warwickshire, has not produced evidence of successful breeding (larvae, exuviae or emerging adults) since 2015; only one of the waterbodies within the catchment was classified as having a good ecological status in the most recent assessment (Environment Agency, 2025). The species is also sensitive to the loss and degradation of deciduous woodland, the adult habitat niche. The destruction and degradation of woodland, particularly riparian woodland, close to breeding sites, from threats including climate change and infrastructure developments (Reid *et al*., 2021) are, therefore, also significant pressures.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.29 *Ischnura elegans*

Blue-tailed Damselfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Widespread across England, Scotland and Wales, but is scarcer in areas of higher altitude.

The species breeds in a wide range of lowland still and slow-flowing freshwater habitats of varying size, pH and nutrients levels, from garden ponds to peatland pools. It is also tolerant of mildly brackish conditions. Abundant submerged, floating and emergent vegetation is usually present.

Assessment
Criterion A: The index of abundance (modelled occupancy analysis) declined from 2012 to 2021 (5.4%); while AOO and EOO increased from 2014 to 2023 (AOO: 8.7%, EOO: 3.1%). Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species is declining on a European scale although it is still listed as Least Concern (Vinko *et al*., 2024i). Continued monitoring is required, along with research to identify the key pressures resulting in population decline in GB.

Criterion B: Both EOO (443688 km^2) and AOO (21488 km^2) do not meet the threshold for qualification as Vulnerable against Criteria B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.30 *Ischnura pumilio*

Scarce Blue-tailed Damselfly
2026 status: EN. Qualifying criteria: B2b(iii)c(ii). 2008 status: NT. Change: Genuine (recent).

GB population profile
In England, its range stretches as far north as Liverpool; it is scarce across most of its English range apart from in Cornwall and the New Forest National Park. It is scarce in North and Mid Wales, with most breeding colonies located in the South. The species is absent from Scotland.

Breeding habitat consists of shallow pools, runnels and seepages that are often ephemeral in nature and in the early stages of succession. The species also occurs at quarry sites including chalk, limestone, clay and gravel, where there are standing waters, seepages and water-filled wheel ruts and ditches. Breeding sites are unshaded with sparse emergent vegetation, such as grasses and sedges.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. AOO increased 15.2% from 2014 to 2023, while EOO decreased 19% over the same time period. The index of abundance (modelled occupancy analysis) did not change significantly from 2012 to 2021, but exhibited long term decline: -34.6% from 1992 to 2021, -51.2% from 1972 to 2021. The species' European population is considered stable (European Red List status: Least Concern (Vinko *et al*., 2024j).

Criterion B: While the EOO (110994km^2) exceeds the Criterion B1 threshold, the AOO is small (480km^2), meeting the threshold for qualification as Endangered against Criterion B2; it also meets the additional two conditions required for qualification as Endangered against Criterion B.

It meets condition B2b(iii) as there is an observed continuing decline in area, extent and quality of habitat. The species' small AOO is a result of historic and ongoing habitat loss and degradation, which is reflected in historic occupancy decline: -34.6% from 1992 to 2021, and -51.2% from 1972 to 2021. Habitat loss and degradation have been linked to changes in livestock practices, in particular a shift to lower intensity grazing, resulting in breeding pools and streams becoming too vegetated, as well as the closure of mineral extraction sites, which often inadvertently create and maintain

breeding habitat (Taylor *et al*., 2021). This has been well documented in Devon, which used to be a stronghold for the species; for example, habitat extent and quality on Dartmoor has declined notably since the 1990s as a result of reduced livestock densities, and the previously strong population at Smallhanger Waste has slowly declined as a result of its reworking for clay (Smallshire, 2025).

The species meets also condition B2c(ii), as it exhibits extreme fluctuations in AOO. Isolated subpopulations exhibit sporadic extreme fluctuations in size and location in relation to habitat availability. The species has a pioneering lifestyle utilising shallow waterbodies; colonies are often short-lived, disappearing as their wetlands become vegetated and dry out. The species takes advantage of suitable habitat when it is available, with some populations bivoltine (Sadler & Chelmick, 2022). There is little data available to measure population fluctuations; the species is under-recorded; it is similar in appearance to the far more widespread and abundant *Ischnura elegans*, which means many short-term breeding populations are likely to be missed. More detailed recording is primarily carried out at well-known large populations, where there is interest in maintaining habitat. However, evidence of extreme fluctuations can be observed in areas of its range where Odonata recorders have been more active. Longer-term fluctuations within the subpopulations of Devon are described in the county review by Smallshire (2025), and illustrate the role of changes in land use such as mining activities and livestock management, as a driver of population change. Many new populations were recorded in the 1990s when higher stocking densities produced poached/trampled streams with bare banks and sides. Examples from in and around Dartmoor include: Corndonford Bog (1995-2006), Doetor Common (1995-98), Gutter Tor Mire-Sheepstor (1995-1999), Legis Mire (1995-2005), Lud Brook Head, Ugborough Beacon (1995-2005), and Simon's Lake, Sherberton Common (1995-1997).

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.31 *Isoaeschna isoceles*

Norfolk Hawker

2026 status: LC. 2008 status: EN. Change: Genuine (recent).

GB population profile

The British population is located in England; its strongholds are in the East of England, though populations are now established in Kent and Surrey and, increasingly, scattered colonies can be found across the South of England, including in Devon, Wiltshire and Somerset. Further north, it can be found in counties including Lancashire and North Yorkshire.

The species is associated with still and slow-flowing freshwater dykes, ponds and lakes. Traditionally, it had a close association with *Stratiotes aloides*, although now it also breeds in wetlands with other climax aquatic macrophyte communities, such as reed-bed fringes (Pickwell, 2011).

Assessment
Criterion A: The species has expanded its range within England, most notably since 2021 (Taylor *et al*., 2021), as indicated by the increase in the index of abundance (modelled occupancy analysis; 237.8% from 2012 to 2021), as well as AOO (195.5% from 2014 to 2023) and EOO (656.2% from 2014 to 2023). The species is also showing population increase and range expansion on a European scale (European Red List Status: Least Concern (Vinko et al., 2024b). Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A.

Criterion B: While the EOO (123656km ^{2}) does not meet the Criterion B1 threshold, the AOO is small, 1756km ^{2}, meeting the threshold for qualification as Vulnerable against Criterion B2. However, as there is no evidence of decline, severe fragmentation or extreme fluctuations and there are more than 10 locations, it does not meet any additional conditions required for qualification against Criterion B.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.32 *Lestes barbarus*
Southern Emerald Damselfly
2026 status: LC. 2008 status: NA. Change: Genuine (recent).

GB population profile
This species was not assessed during the previous Red List analysis (Daguet *et al*., 2008); although it has been recorded as a regular migrant to GB since 2002, evidence of breeding was not obtained until 2004. Breeding colonies are sparse but can be found in the South and East of England; the species' stronghold is around the Thames Estuary. It is absent from Scotland and Wales.

Breeding sites consist of shallow, sunlit, warm still waterbodies that support emergent vegetation including sedges and rushes. These waterbodies are often ephemeral in nature; examples include pools in dune slacks and seasonally wet ditches.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. Its population and range have increased over the past 10 years, reflected in the increase in AOO and EOO from 2014

to 2023 (AOO: 30.8%, EOO: 142.1%). The index of abundance (modelled occupancy analysis) could not be calculated due to insufficient data. The species' European population is considered stable (European Red List status: Least Concern (Vinko et al., 2024k).

Criterion B: While the EOO (23931km^2) does not meet the Criterion B1 threshold, the AOO is small, 88km^2, meeting the threshold for qualification as Endangered against Criterion B2. However, as there is no evidence of decline, severe fragmentation or extreme fluctuations and there are more than 10 locations, it does not meet any additional conditions required for qualification against Criterion B.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.33 *Lestes dryas*

Scarce Emerald Damselfly
2026 status: LC. 2008 status: NT. Change: Genuine (recent).

GB population profile
In GB, the population is limited to England where its strongholds are in Kent and the East of England; however, its range extends into the East Midlands.

The species is associated with ephemeral and mature freshwater sites with dense emergent vegetation. These include shallow ponds and ditches, some of which are located in coastal dunes and marshes, as well as shallow streams, seepages, pools and ditches. The species is somewhat transient in nature, utilising wetlands when they become mature enough to produce the correct conditions for breeding, and abandoning them when succession leads to the sites becoming infilled with vegetation and drying out.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species' population has grown and its range has expanded in the past 10 years, as reflected by the 83.3% increase in the index of abundance (modelled occupancy analysis) from 2012 to 2021, and the increase in AOO and EOO from 2014 to 2023 (AOO: 62.9%, EOO: 133.8%). The species' European population is considered stable (European Red List status: Least Concern (Billqvist *et al*., 2024m).

Criterion B: EOO (18695km^2), meets the threshold for qualification as Vulnerable against Criterion B1; AOO (264km^2), meets the threshold for qualification as Endangered against Criterion B2. However, as there is no evidence of decline, severe

fragmentation or extreme fluctuations and there are more than 10 locations, it does not meet any additional conditions required for qualification against Criterion B.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.34 *Lestes sponsa*

Emerald Damselfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
The species' range extends across most of GB apart from upland areas, such as the Pennines, where suitable breeding habitat is scarcer.

Breeding habitat consists of shallow standing and slow-flowing wetlands with abundant dense emergent vegetation, such as rushes and sedges. The species can tolerate slightly brackish conditions. Some breeding wetlands are ephemeral, drying out in late summer-early autumn.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The population exhibits long term, sustained decline; the index of abundance (modelled occupancy analysis) occupancy declined by 14.7% from 2012 to 2021, 26.9% from 1992 to 2021, and 41.1% from 1972 to 2021. AOO and EOO increased slightly between 2014 and 2023 (AOO: 2.4%, EOO: 3.7%). Decline has been most significant in England since 1990; the mechanisms for occupancy decline are poorly understood, but have been linked to the drainage and destruction of shallow and ephemeral wetlands, as well as climate change, particularly the increasing frequency of droughts (Taylor *et al*., 2021). The same threats are likely to be responsible for the population decline exhibited across large areas of its European range; the species is now categorised as Near Threatened on the European Red List (Billqvist *et al*., 2024). It is likely the species will require revaluating in the near future.

Criterion B: Both EOO (390958km^2) and AOO (2074km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the

threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.35 *Leucorrhinia dubia*

White-faced Darter

2026 status: EN. Qualifying criteria: B2ab(i,iii). 2008 status: EN. Change: None.

GB population profile

In GB, scattered populations survive in the Scottish Highlands and at a handful of isolated sites in the West Midlands and the North West of England.

The species is associated with acidic peatland with deep, open water, large expanses of floating *Sphagnum* bog-mosses at the margins, and abundant emergent grasses and sedges such as *Eriophorum angustifolium* (Bently-Fox, 2000). Breeding pools are located in woodland glades or heathland sites near to woodland or scrub, and lack fish.

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The population exhibits long term, decline; the index of abundance (modelled occupancy analysis) occupancy declined by 42.1% from 1992 to 2021 and 60.2% from 1972 to 2021 (no significant change from 2012 to 2021). AOO and EOO increased between 2014 and 2023 (AOO: 64%, EOO: 56%); this increase is primarily a result of increased recorder effort in Scotland, but also re-introduction/introduction projects in England.

Criterion B: While the EOO (65393km^2) far exceeds the Criterion B1 threshold, the AOO is small, 408km^2, meeting the threshold for qualification as Endangered against Criterion B2; it also meets the additional two conditions required to qualify as Endangered against Criterion B. The drainage of the species' peatland breeding sites for use in agriculture and forestry has resulted in the species' current small AOO.

The species meets condition B2a(i) as the population is severely fragmented; in England there are currently seven known colonies on sites of remnant lowland bog, located in Cheshire (one), the West Midlands (two), and Cumbria (four). The viability of a number of these is questionable, either due to low count records (the Delamere Forest subpopulations, for example) or the subpopulations' reliance on a small number of breeding pools (such as at Chartley Moss NNR), combined with isolation. In Scotland, however, the species inhabits larger areas but at low density. These populations inhabit distinct areas, separated by large geographical distances, unsuitable habitat and areas of high elevation. These areas are: Loch Maree/Torridon area of Wester Ross, Glen Affric and Glen Strathfarrar, Abernethy and Monadh Mor, north of Inverness. Low counts of larvae and exuviae (the main recording method for this species) at known breeding pools, combined with the continuing decline and loss of habitat, detailed below, also raise concerns for the Scottish subpopulations.

It also meets condition B2b(iii), as there is an observed and projected continuing decline in area, extent and quality of habitat, which has been documented during breeding pool surveys. For example, surveys performed between 2018 and 2022 found that breeding pools at Glen Orchy, Glen Garry and Glen Affric are in the process of infilling with vegetation. Due to the limited extent of suitable peatland habitat, ongoing management is required to slow the process of natural succession, which eventually leads to pools becoming dry and overgrown with vegetation, and to create new pools. The rate of pool infilling is likely being hastened by climate change, with warmer temperatures accelerating plant growth. Climate change is amplifying the threats faced by the species across Europe, such as eutrophication through nitrogen deposition, and reoccurring droughts; as a result the species is declining on a European scale (European Red List status: Vulnerable (Billqvist *et al*., 2024o).
Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.36 *Leucorrhinia pectoralis*

Large White-faced Darter
2026 status: NA. 2008 status: None. Change: Genuine (recent).

GB population profile
A vagrant that has only been recorded in GB in 2012 and 2018, both in Suffolk (East Suffolk Vice County).

Assessment
This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.37 *Libellula depressa*

Broad-bodied Chaser
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Widespread across most of England and Wales, apart from North Wales where it is absent across much of the region. In Scotland, the species range reaches as far north as Stirling with breeding colonies concentrated in East Lothian and Berwickshire.

This species will breed in a variety of unshaded still and slow-flowing freshwater habitats but primarily prefers small, sparsely vegetated pools and ditches.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species exhibits long-term consistent population expansion, which is reflected in its increase in the index of abundance (modelled occupancy analysis) in all three timescales (20.3% from 2012 to 2021, 52.9% 1992 to 2021, and 105% from 1972 to 2021), and the increase in AOO (45.1%) and EOO (6.1%) from 2014 to 2023. The species' population is considered stable on a European scale (European Red List status: Least Concern (Vinko *et al*., 2024l).

Criterion B: Both EOO (272215km^2) and AOO (17528km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.38 *Libellula fulva*
Scarce Chaser
2026 status: LC. 2008 status: NT. Change: Genuine (recent).

GB population profile
In England the species is found along some river systems in the South and East of England and the Midlands; its strongholds include parts of the River Great Ouse in Huntingdonshire and Bedfordshire, the Somerset Levels, and the River Stour on the Suffolk-Essex border. It currently does not breed in Wales or Scotland.

Primarily associated with slow-flowing lowland river systems. However, it will also use adjacent gravel pits, ponds, lakes, drains, dykes and canals. Freshwater breeding sites have a layer of benthic silt and mud, and abundant emergent vegetation.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species exhibits long-term consistent population expansion, which is reflected in its increase in the index of abundance (modelled occupancy analysis) in all three timescales (57% from 2012 to 2021, 161.9% 1992 to 2021, and 408.7% from 1972 to 2021), and the increase in AOO (75.8%) and EOO (22%) from 2014 to 2023. The species is considered stable on a European scale (European Red List Status: Least Concern (Vinko *et al*., 2024m).

Criterion B: Both EOO (83136km^2) and AOO (2668km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.39 *Libellula quadrimaculata*

Four-spotted Chaser
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Widespread across England, Scotland and Wales, breeding in a wide range of still and slow-flowing freshwater habitats with abundant emergent aquatic vegetation, from slow-flowing streams to bog pools.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species exhibits long-term consistent population expansion, which is reflected in its increase in the index of abundance (modelled occupancy analysis) in all three timescales (10.5% from 2012 to 2021, 34.1% 1992 to 2021, and 64.2% from 1972 to 2021), and the increase in AOO (20.1%) and EOO (2.2%) from 2014 to 2023. The species is considered stable on a European scale (European Red List Status: Least Concern (Billqvist *et al*., 2024p).

Criterion B: Both EOO (399191km^2) and AOO (14916km^2) do not meet the threshold for qualification as Vulnerable against Criteria B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.40 *Orthetrum cancellatum*

Black-tailed Skimmer
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Widespread across most of England, but less common in the North East and North West. In Wales it is most abundant in the South and sparser in Mid and North Wales. In Scotland a few colonies are located in Berwickshire and East Lothian.

This species is associated with a wide range of lowland slow-flowing and still waterbodies, from man-made lakes to coastal marshes, with areas of bare bank. Vegetation may or may not be present and the species is often one of the first to colonise new waterbodies.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species exhibits long term consistent population expansion, and has spread significantly in England and Wales, which is reflected in its increase in the index of abundance (modelled occupancy analysis) in all three timescales (22.9% from 2012 to 2021, 74.2% from 1992 to 2021, and 155.6% from 1972 to 2021), and the increase in AOO (41.4%) and EOO (10.5%) from 2014 to 2023. The species is also increasing on a European scale (European Red List Status: Least Concern (Vinko *et al*., 2024n).

Criterion B: Both EOO (224291km^2) and AOO (11332km^2) do not meet the threshold for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.41 *Orthetrum coerulescens*
Keeled Skimmer
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
In England the species is most abundant in the South, Norfolk, and Cumbria, with sparse colonies elsewhere. In Wales it is most abundant in the uplands in and south of Bannau Brycheiniog National Park, the Preseli Hills, the Cambrian Mountains, and Eryri National Park. In Scotland the species is found along the west coast and is most abundant in Kintyre, Mid Ebudes, and West Inverness-shire.

It is associated with permanent runnels, flushes, ditches and streams with abundant vegetation, and will utilise acidic wetlands on peatland sites, including bog pools.

Assessment
Criterion A: Population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species population has grown in the past 10 years, reflected by the 37.1% increase the index of abundance (modelled occupancy analysis) from 2012 to 2021, and the increase in AOO and EOO from 2014 to 2023 (AOO: 28.4%, EOO: 7.4%). The species' is also increasing in most other European countries (European Red List status: Least Concern (Prunier *et al*., 2024d).

Criterion B: Both EOO (299972km^2) and AOO (2732km^2) do not meet the threshold for qualification as Vulnerable against Criteria B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.42 *Oxygastra curtisii*

Orange-spotted Emerald
2026 status: RE. 2008 status: RE. Change: None.

GB population profile
The only confirmed breeding site for the species was an 8km stretch of the Moors River north of Hurn, Dorset, where it was recorded during 1820-1963. The only other records came from another potential breeding site on the River Tamar north of Gunnislake, Devon, in 1946 (Cham *et al*., 2014).

Assessment
With no confirmed sightings since 1963, the species is considered regionally extinct.

A.1.43 *Pantala flavescens*

Wandering Glider
2026 status: NA. 2008 status: NA. Change: None.

GB population profile
A vagrant to GB where there are only two records: from 1823 in Norfolk (East Norfolk Vice County) and from 1951 in Lancashire (South Lancashire Vice County).

Assessment
This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.44 *Platycnemis pennipes*

White-legged Damselfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
In England, the species range extends across much of the South of England, the West Midlands excluding Staffordshire, the East of England excluding Norfolk, and the East Midlands south of Derby. In Wales, the species breeds along waterways close to the English border. The species is absent from Scotland.

It is associated with unshaded slow-flowing and still waterbodies with abundant floating, submerged and emergent aquatic vegetation.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The species exhibits long term consistent population expansion, which is reflected in its increase in the index of abundance (modelled occupancy) across all three timescales (16.3% from 2012 to 2021, 40.9% from 1992 to 2021, and 78.6% from 1972 to 2021), as well as AOO (53.5%) and EOO (10.3%) from 2014 to 2023. The species is also increasing on a European scale (European Red List Status: Least Concern (Vinko *et al*., 2024o).

Criterion B: Both EOO (81984km^2) and AOO (3664km^2) do not meet the threshold for qualification as Vulnerable against Criteria B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.45 *Pyrrhosoma nymphula*
Large Red Damselfly
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
Widespread and common across GB.

The species is associated with a wide variety of still and slow-flowing wetland habitats from canals to peatland pools. Breeding sites are usually sheltered, unshaded with abundant aquatic vegetation.

Assessment
Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) does not significantly change from 2012 to 2021; from 2014 to 2023 AOO increases 16.8% and EOO declines 2.6%. The species is categorised as Least Concern at a European scale as its population is considered stable (Billqvist *et al*., 2024q).

Criterion B: Both EOO (471756km^2) and AOO (27384km^2) do not meet the thresholds for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.46 *Somatochlora arctica*

Northern Emerald

2026 status: EN. Qualifying criteria: B2ab(iii). 2008 status: NT. Change: Genuine (recent).

GB population profile

In GB, its range is restricted to Scotland, north of Stirling and west of Perth.

The species is associated with bog pools, seepages and ditches below 400m in altitude, and within or near woodland, especially of native pine. Breeding wetlands are acidic or neutral, with mats of *Sphagnum* bog-mosses and emergent vegetation, such as *Eriophorum angustifolium*.

Assessment

Criterion A: Suspected population reduction meets the -30% threshold for qualification as Vulnerable against Criterion A; EOO declined by 46.3% from 2014 to 2023, with a lack of recent sightings at numerous sites across its historic range, suggesting range contraction. The index of abundance (modelled occupancy analysis) exhibited no short-term or long-term significant change. AOO increased 19.7% from 2014 to 2023; however, this is likely to be a result of this species receiving targeted recording effort in recent years. The species is categorised as Least Concern at a European scale, but the population is in decline (Billqvist *et al*., 2024r).

Criterion B: While the EOO (25649km^2) does not meet the Criterion B1 threshold, the AOO is small (456km^2), meeting the threshold for qualification as Endangered against Criterion B2; it also meets the additional two conditions required for qualification as Endangered against Criterion B.

The species meets condition B2a, as most of the population is severely fragmented. Records suggest this species breeds over large areas at low density, primarily in Strathspey, Glen Affric, around Loch Maree, Ardnamurchan and Lochaber. Many pools within long-term monitored breeding areas produce larval records inconsistently year-on-year (Batty, 2025). The species' low AOO and restricted range is primarily a result of the destruction of habitats from drainage and afforestation, which has been documented at historic breeding sites such as the Great Glen in the Scottish Highlands (Cham *et al.*, 2014) and has led to the fragmentation and isolation of subpopulations, increasing their risk of extinction. The decline in EOO illustrates that subpopulations likely shrinking in range, increases their vulnerability.

It also meets condition B2b(iii), as there is an observed and projected continuing decline in area, extent and quality of habitat. While changes in land use continue to impact subpopulations, climate change is now a major threat, which is exacerbating

population fragmentation. Higher mean temperatures and changes to seasonal rainfall result in unstable water levels and cause changes in resident plant communities within the species breeding pools, including the accelerated growth of trees and scrub resulting in further desiccation, and the loss of *Sphagnum* bog-mosses, a required breeding habitat feature. The resulting desiccation and loss of breeding pools continues to be documented during annual surveys; this includes historic sites located in Glen Torridon, Glen Garry and Argyll (Batty, 2022, 2023, 2025).

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.47 *Somatochlora flavomaculata*

Yellow-spotted Emerald
2026 status: NA. 2008 status: none. Change: Genuine (recent).

GB population profile
A vagrant to GB that has only been recorded once, in Suffolk in 2018 (East Suffolk Vice County).

Assessment
This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.48 *Somatochlora metallica*

Brilliant Emerald
2026 status: EN. Qualifying criteria: B2ab(iii). 2008 status: VU. Change: Genuine (recent).

GB population profile
In Scotland the species can be found at pinewood sites at Glen Affric, Glen Strathfarrar and Cannich, as well as around Loch Bran in Inverness-shire, and in hill lochans above Loch Awe, Argyll. In England, the species' range is restricted to the South East, east of Southampton. It is absent from Wales.

The species is associated with standing and slow-flowing waters that are usually partially or completely shaded. Lowland and mid-elevation sites are often in forestry or semi-forested areas. In Scotland the majority of its breeding sites are hill lochans in relatively open areas with forestry or woodland in close proximity. These pools are fringed by *Sphagnum* bog-mosses; areas of clear, open water close to the bank, where coarse organic debris is present and accumulates at the edge, appear to be especially attractive to larvae. In Scotland, larvae have been found under overhanging peat

banks. In England, the species occurs mainly at large woodland ponds and lakes with adjacent heathland; however, shaded, slow-flowing rivers and canals are also utilised. These wooded, shaded waterbodies provide the cool temperatures that this species requires, comparable to the more open sites in Scotland.

Assessment

Criterion A: Suspected population decline approaches, but does not meet, the -30% threshold for qualification as Vulnerable against Criterion A2b; EOO declined 26.1% from 2014 to 2023; as a result, the conclusion of Near Threatened is made. AOO also declined 16.7% from 2014 to 2023, while there was no significant change in the index of abundance (2012-2021). Records have been sparse in Scotland from 2022 onwards, which was the second hottest year on record for the country (BBC, 2023). This species is associated with cooler conditions and can be found breeding north of the Arctic Circle. The English population is restricted to woodland sites, which provide shade; during the summer, adults are more active in morning hours when the air is cooler and there is less competition, often disappearing as larger *Aeshna* and *Anax* species become active. The species is also declining on a European scale and is now classified as Vulnerable, primarily as a result of the effects of climate change: recurrent droughts and lower oxygen availability through higher water temperatures, as well as increased rate of afforestation and scrub encroachment (Billqvist *et al*., 2024s).

Criterion B: While the EOO (82516km^2) does not meet the Criterion B1 threshold, the AOO is small (98km^2), passing the threshold for qualification as Endangered against Criterion B2; it also meets the additional two conditions required for qualification as Endangered against Criterion B.

The species meets condition B2a, as a majority of the population is severely fragmented. The British population is split into three areas, separated by large geographical distances, located in the South East of England, Inverness-shire, and Argyll. A majority of the subpopulations within these three areas are small and isolated in fragments of suitable habitat, often separated by urban and agricultural areas, increasing their risk of extinction. The species' elusive nature makes monitoring changes in population hard; however, the decline in EOO and the lack of recent records from Scotland suggests subpopulations are shrinking and breeding sites have been lost, reducing confidence in their long-term viability.

It also meets condition B2b(iii), as there is a continuing observed decline in area, extent and quality of habitat, which is exacerbating population fragmentation. The English subpopulation is under significant threat as it shares its range with a large human population and faces pressure from development and human activity. At breeding sites, such as Thursley Common NNR, bank disturbance, water turbidity and pollution resulting from increased site use by the public and dogs, and the feeding of waterfowl, are reducing habitat quality. The reopening of canals to boat traffic can also result in increased water turbidity and degradation of habitat, issues that have been noted at canal breeding sites such as along the Basingstoke Canal. Climate change is another increasingly prominent threat, particularly to the South East of England population. Warmer summer temperatures result in a reduction in oxygen within breeding pools, while droughts can cause partial or complete desiccation of breeding

sites. Breeding site woodlands, a key feature, are also being degraded by climate change, the effects of which include increasing annual temperatures and changes in rainfall, which can limit natural regeneration, increase the prevalence of pathogens, and increase the risk of fire (Natural England & RSPB, 2019).

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible.
AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.49 *Stylurus flavipes*

River Clubtail
2026 status: NA. 2008 status: NA. Change: None.

GB population profile
A vagrant to GB with only one record from Sussex (East Sussex Vice County) in 1818.

Assessment
This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.50 *Sympecma fusca*

Winter Damselfly
2026 status: NA. 2008 status: none. Change: None.

GB population profile
A vagrant to GB with only two records: from 2008 in West Glamorgan (Glamorganshire Vice County) and 2022 in Hampshire (South Hampshire Vice County).

Assessment
This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.51 *Sympetrum danae*

Black Darter
2026 status: LC. 2008 status: LC. Change: None.

GB population profile
In England the species is most widespread in the North East and North West, and more sparsely distributed in the South and West Midlands; the species is absent from most of the East of England and East Midlands. Scattered colonies can be found across Wales; the species is most abundant in Mid Wales and south-east Wales. The species is widespread across much of Scotland.

Breeding habitat consists of acidic, nutrient-poor bog pools and the shallow margins of larger waterbodies. Breeding sites are unshaded but have abundant *Sphagnum* bog-mosses, emergent sedges and rushes.

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. However, there has been a long-term sustained decline in index of abundance (modelled occupancy analysis): 14.3% from 2012 to 2021, 33.4% from 1992 to 2021, and 49.7% from 1972 to 2021. This decline has predominantly taken place in England and Wales (Taylor *et al*., 2021). There was a slight increase in AOO and EOO from 2014 to 2023 (AOO: 3.6%, EOO: 1.4%). The species is declining on a European scale and is now classified as Endangered (Billqvist *et al*., 2024t); the ongoing decline of occupancy in GB highlights the need for ongoing monitoring and Red List reassessment in the near future.

Criterion B: Both EOO (382357km^2) and AOO (5096km^2) do not meet the thresholds for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.52 *Sympetrum flaveolum*

Yellow-winged Darter

2026 status: NA. 2008 status: LC. Change: Genuine (recent).

Sympetrum flaveolum was previously categorised as Least Concern (Daguet *et al*., 2008); the species was not evaluated during this review as it is now considered a vagrant to GB. The most recent records consist of individuals observed in England; however, GB experiences rare influxes of this migrant. A significant influx in 1995 led to the short-term colonisation of a number of sites in England and South Wales, which resulted in its inclusion in the 2008 Red List; however, breeding colonies did not persist longer than three years (Parr 1997).

Assessment

This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.53 *Sympetrum fonscolombii*

Red-veined Darter

2026 status: LC. 2008 status: LC. Change: None.

GB population profile

The species occurs as an annual migrant in England and Wales, and it is occasionally recorded in Scotland. Colonisation is currently underway and breeding has been recorded at scattered sites in the South and East of England.

Breeding sites usually consist of still, shallow, unshaded waterbodies with sparse vegetation, such as coastal lagoons, wader scrapes and the shallow edges of quarry pits and lakes.

Assessment

Criterion A: Suspected population change does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) did not significantly change from 2012 to 2021 but increased 347.1% from 1992 to 2021, and 1155.8% from 1972 to 2021; AOO increased 54.5% from 2014 to 2023, while EOO declined 9.6%. The species is exhibiting population increase and range expansion on a European scale (European Red List status: Least Concern (Prunier *et al*., 2024c).

Criterion B: While the EOO (312092km^2) does not meet the Criterion B1 threshold, the AOO is small (1028km^2), passing the threshold for qualification as Vulnerable against Criterion B2. However, as there is no evidence of decline, severe fragmentation or extreme fluctuations and there are more than 10 locations, it does not meet any additional conditions required for qualification against Criterion B.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.54 *Sympetrum nigrescens*

Highland Darter

2026 status: NE. 2008 status: DD. Change: Nongenuine (new information).

Sympetrum nigrescens was formerly treated as a distinct species but has since been described as a phenotypic variant of *Sympetrum striolatum* (Parkes *et al*., 2009).

A.1.55 *Sympetrum pedemontanum*

Banded Darter

2026 status: NA. 2008 status: NA. Change: None.

GB population profile

A vagrant to GB; there is one record from Gwent (Breconshire Vice County) in 1995.

Assessment

This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

A.1.56 *Sympetrum sanguineum*

Ruddy Darter

2026 status: LC. 2008 status: LC. Change: None.

GB population profile

Widespread across most of England, apart from Devon, Cornwall and the North West where it is scarcer. Scattered sites are found across South and Mid Wales; the species is rare in North Wales. It is absent from Scotland.

The species is associated with a variety of still and slow-flowing wetland habitats with abundant aquatic vegetation, such as marshland pools and ditches.

Assessment

Criterion A: Suspected population is increasing in range and size, and does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) increased across all timescales: 13.6% from 2012 to 2021, 84.3% from 1992 to 2021, and 181% from 1972 to 2021; AOO and EOO increased from 2014 to 2023 (AOO: 47.8%, EOO: 16.5%). The species is also considered stable on a European scale (European Red List status: Least Concern (Vinko *et al*., 2024q).

Criterion B: Both EOO (191497km^2) and AOO (8896km^2) do not meet the thresholds for qualification as Vulnerable against Criterion B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.57 *Sympetrum striolatum*

Common Darter

2026 status: LC. 2008 status: LC. Change: None.

GB population profile

Widespread and common across GB. The species utilises a wide variety of still and slow-flowing unshaded wetland habitats for breeding, and can tolerate brackish conditions.

Assessment

Criterion A: Suspected population is increasing in range and size, and does not meet the -30% threshold for qualification as Vulnerable against Criterion A. The index of abundance (modelled occupancy analysis) decreased 5.2% from 2012 to 2021; AOO increased 34% from 2014 to 2023, while EOO decreased 0.5% over the same time period. The species is also considered stable on a European scale (European Red List status: Least Concern (Vinko *et al*., 2024q).

Criterion B: Both EOO (420091km^2) and AOO (30656km^2) do not meet the thresholds for qualification as Vulnerable against Criteria B: EOO ≤20000km^2, AOO ≤2000km^2.

Criterion C: The population of mature individuals is unknown; therefore, assessment against Criterion C is not possible.

Criterion D: The population of mature individuals is unknown; therefore, assessment against Criterion D1 is not possible. AOO and number of locations do not meet the threshold for qualification as Vulnerable against Criterion D2: AOO <20km^2, ≤5 locations.

Criterion E: There are no population models to inform an assessment against Criterion E.

A.1.58 *Sympetrum vulgatum*

Vagrant Darter

2026 status: NA. 2008 status: NA. Change: None.

GB population profile

A vagrant to GB that was last recorded in 2020 in Somerset (North Somerset Vice County).

Assessment

This species has not reproduced within GB consistently for at least 10 years, so was not subject to assessment.

Appendix 2: Geography of Great Britain

Map 1. English Regions and the ceremonial counties they include.

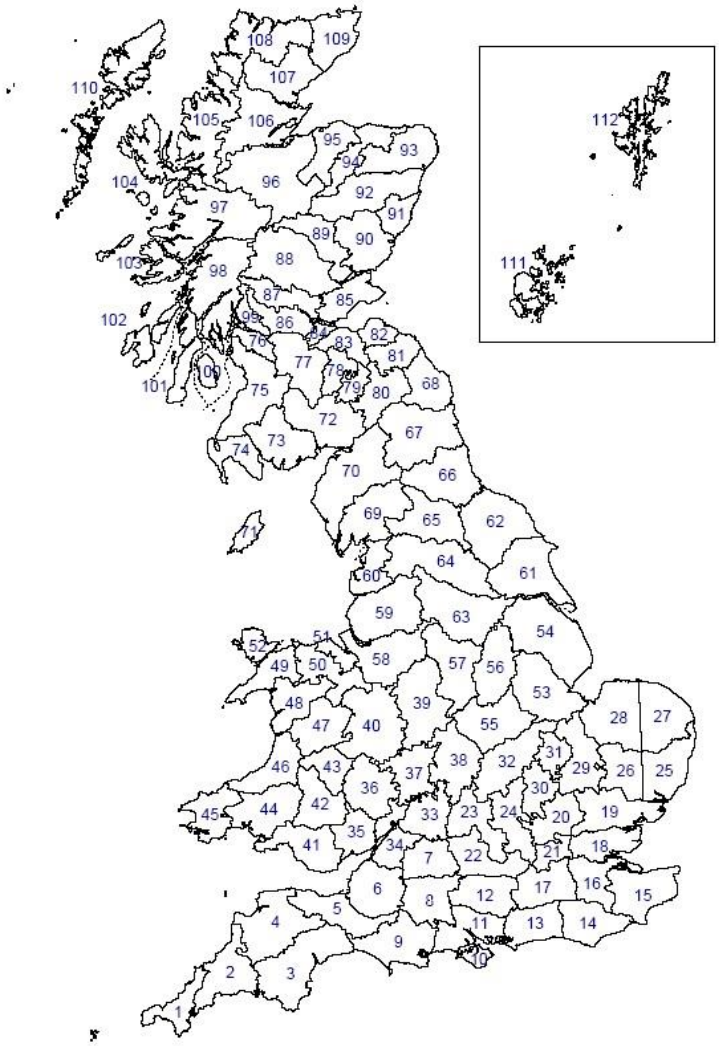
Number	Region of England ©TUBS	Ceremonial Counties Included
1	South West	Cornwall, Dorset, Devon, Bristol, Gloucestershire, Somerset and Wiltshire.
2	South East	Berkshire, Buckinghamshire, East Sussex, Hampshire, the Isle of Wight, Kent, Oxfordshire, Surrey and West Sussex.
3	London	Greater London.
4	East of England	Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk.
5	West Midlands	Herefordshire, Shropshire, Staffordshire, Warwickshire, West Midlands and Worcestershire.
6	East Midlands	Derbyshire, Leicestershire, Lincolnshire (except for North Lincolnshire and North East Lincolnshire), Northamptonshire, Nottinghamshire, and Rutland.
7	Yorkshire and the Humber	East Riding of Yorkshire, North Yorkshire (excluding areas in the Tees Valley), South Yorkshire, West Yorkshire, and the districts of North Lincolnshire and North East Lincolnshire that are in the county of Lincolnshire.
8	North West	Cheshire, Cumbria, Greater Manchester, Lancashire and Merseyside.
9	North East	County Durham, Northumberland, Tyne and Wear and part of North Yorkshire.

Map 2. Regions of Wales and the Principal Areas they include.

© Paul. at wts wikivoyage

Colour	Region of Wales	Principal Areas Included
	North	Isle of Anglesey (Ynys Môn), Conwy, Denbighshire, Flintshire, Gwynedd, and Wrexham
	Mid	Powys and Ceredigion.
	South	Blaenau Gwent, Bridgend, Caerphilly, Cardiff, Carmarthenshire, Merthyr Tydfil, Monmouthshire, Neath Port Talbot, Newport, Pembrokeshire, Rhondda Cynon Taf, Swansea, Torfaen and the Vale of Glamorgan.

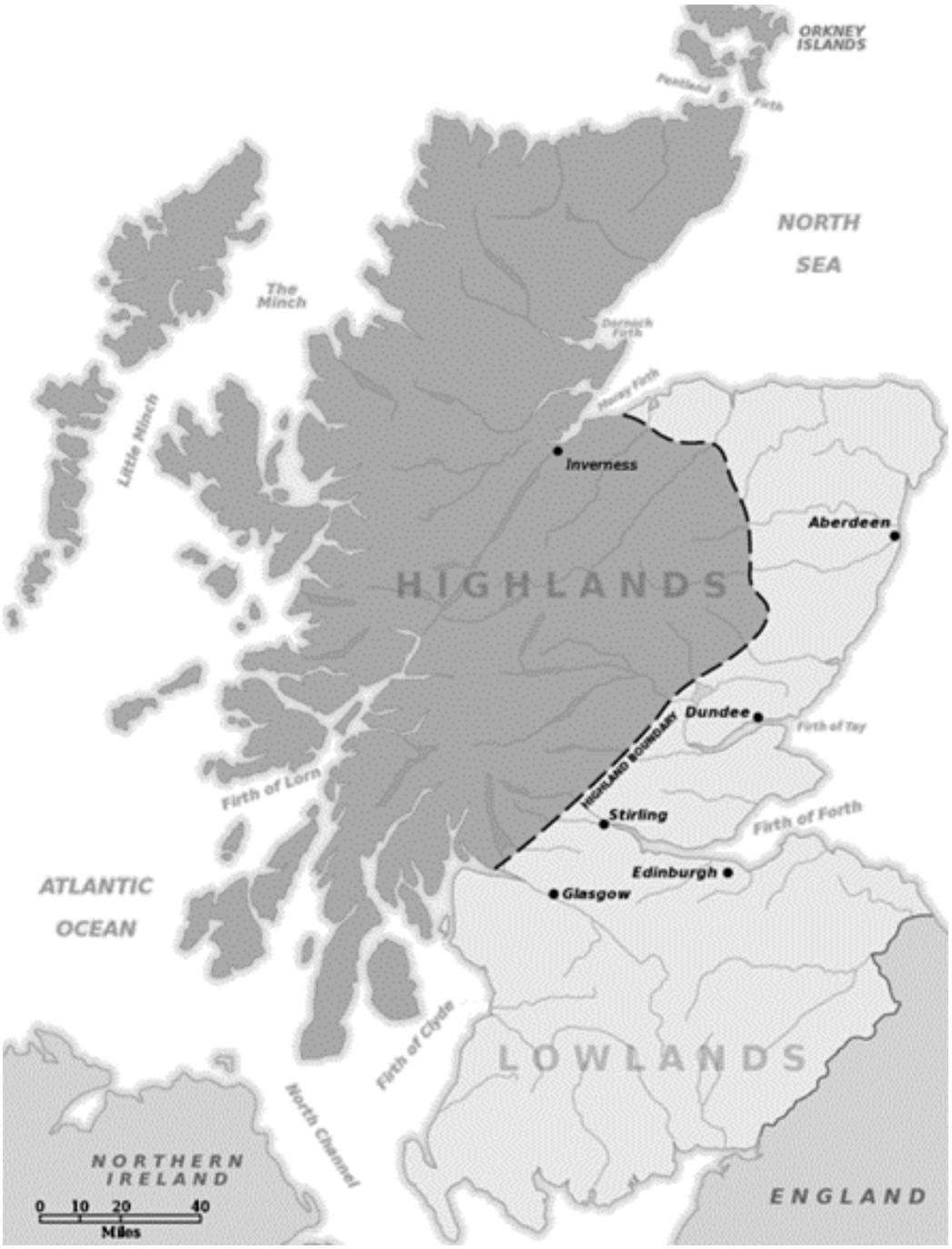
Map 3. Vice Counties of GB.



Number	Name
1	West Cornwall
2	East Cornwall
3	South Devon
4	North Devon
5	South Somerset
6	North Somerset
7	North Wiltshire
8	South Wiltshire
9	Dorset
10	Isle of Wight
11	South Hampshire
12	North Hampshire
13	West Sussex
14	East Sussex
15	East Kent
16	West Kent
17	Surrey
18	South Essex
19	North Essex
20	Hertfordshire
21	Middlesex
22	Berkshire
23	Oxfordshire
24	Buckinghamshire
25	East Suffolk
26	West Suffolk
27	East Norfolk

28	West Norfolk
29	Cambridgeshire
30	Bedfordshire
31	Huntingdonshire
32	Northamptonshire
33	East Gloucestershire
34	West Gloucestershire
35	Monmouthshire
36	Herefordshire
37	Worcestershire
38	Warwickshire
39	Staffordshire
40	Shropshire
41	Glamorgan
42	Breconshire
43	Radnorshire
44	Carmarthenshire
45	Pembrokeshire
46	Cardiganshire
47	Montgomeryshire
48	Merionethshire
49	Caernarvonshire
50	Denbighshire
51	Flintshire
52	Anglesey
53	South Lincolnshire
54	North Lincolnshire
55	Leicestershire
56	Nottinghamshire
57	Derbyshire
58	Cheshire
59	South Lancashire
60	West Lancashire
61	South-east Yorkshire
62	North-east Yorkshire
63	South-west Yorkshire
64	Mid-west Yorkshire
65	North-west Yorkshire
66	County Durham
67	South Northumberland
68	North Northumberland
69	Westmorland
70	Cumberland
71	Isle of Man
72	Dumfriesshire
73	Kirkcudbrightshire
74	Wigtownshire
75	Ayrshire
76	Renfrewshire
77	Lanarkshire
78	Peeblesshire
79	Selkirkshire
80	Roxburghshire
81	Berwickshire
82	East Lothian
83	Midlothian
84	West Lothian
85	Fifeshire
86	Stirlingshire
87	West Perthshire
88	Mid Perthshire
89	East Perthshire
90	Angus
91	Kincardineshire
92	South Aberdeenshire
93	North Aberdeenshire
94	Banffshire
95	Moray
96	East Inverness-shire
97	West Inverness-shire
98	Argyll
99	Dunbartonshire
100	Clyde Isles
101	Kintyre
102	South Ebudes
103	Mid Ebudes
104	North Ebudes
105	West Ross
106	East Ross
107	East Sutherland
108	West Sutherland
109	Caithness
110	Outer Hebrides
111	Orkney
112	Shetland
113	Channel Islands

Map 4. Highlands and Lowlands of Scotland.



Appendix 3: UKCEH occupancy modelling methodology: ROBITT (Risk-Of-Bias In studies of Temporal Trends in ecology) assessment report

1. Iteration

1.1 ROBITT iteration number

Iteration	Comments
1	NA

2. Research statement and pre-bias assessments

Statistical population of interest

2.1 Define the statistical target population about which you intend to make inferences.

Domain	Extent	Resolution
Geographic	Britain	1 km × 1 km grid
Temporal	1970-2021	Annual
Taxonomic (or other relevant organismal domain such as functional group etc.)	Odonata	Species
Environmental	UK environmental domain	1 km × 1 km grid scale

Inferential goals

2.2 What are your inferential goals?

We aim to produce species-specific annual estimates of occupancy (the proportion of occupied 1 km × 1 km grid cells) in Britain between 1970 and 2021.

Data provenance

2.3 From where were your data acquired (please provide citations, including a DOI, wherever possible)? What are their key features in respect of the inferential aims of your study (see the guidance document for examples)?

All species-level presence only records at the 1 km × 1 km grid cell resolution or finer were extracted from the British Dragonfly Society (BDS) records database (https://british-dragonflies.org.uk/). Only records between 1970 and 2021 and within Britain were included. This covers 54 species across 1,128,594 records and are available on the following link: https://doi.org/10.15468/dl.prrr2m, GBIF Occurrence Download (26 July 2022). The DOI alongside additional information is available on the NBN atlas: https://registry.nbnatlas.org/public/show/dr731.

Data processing

2.4 Provide details of, and the justification for, all of the steps that you have taken to clean the data described above prior to analyses.

Records available at a finer resolution than 1 km × 1 km were reformatted to the 1 km × 1 km grid scale using the *reformat_gr* function of BRCmap (https://github.com/colinharrower/BRCmap). Records were organised into a visit format: a unique combination of date (day precision), species and 1 km × 1 km grid cell. Duplicate visits were excluded from the analysis.

3. Bias assessment and mitigation

Assessment resolutions

3.1 At what geographic, temporal and taxonomic resolutions (i.e. scales or grain sizes) will you conduct your bias assessment?

We conduct this assessment on species-specific data at the 1 km × 1 km grid cell level for Britain between 1970 and 2021. These resolutions match the resolution of our inferential goal (i.e. what the model is designed to reveal).

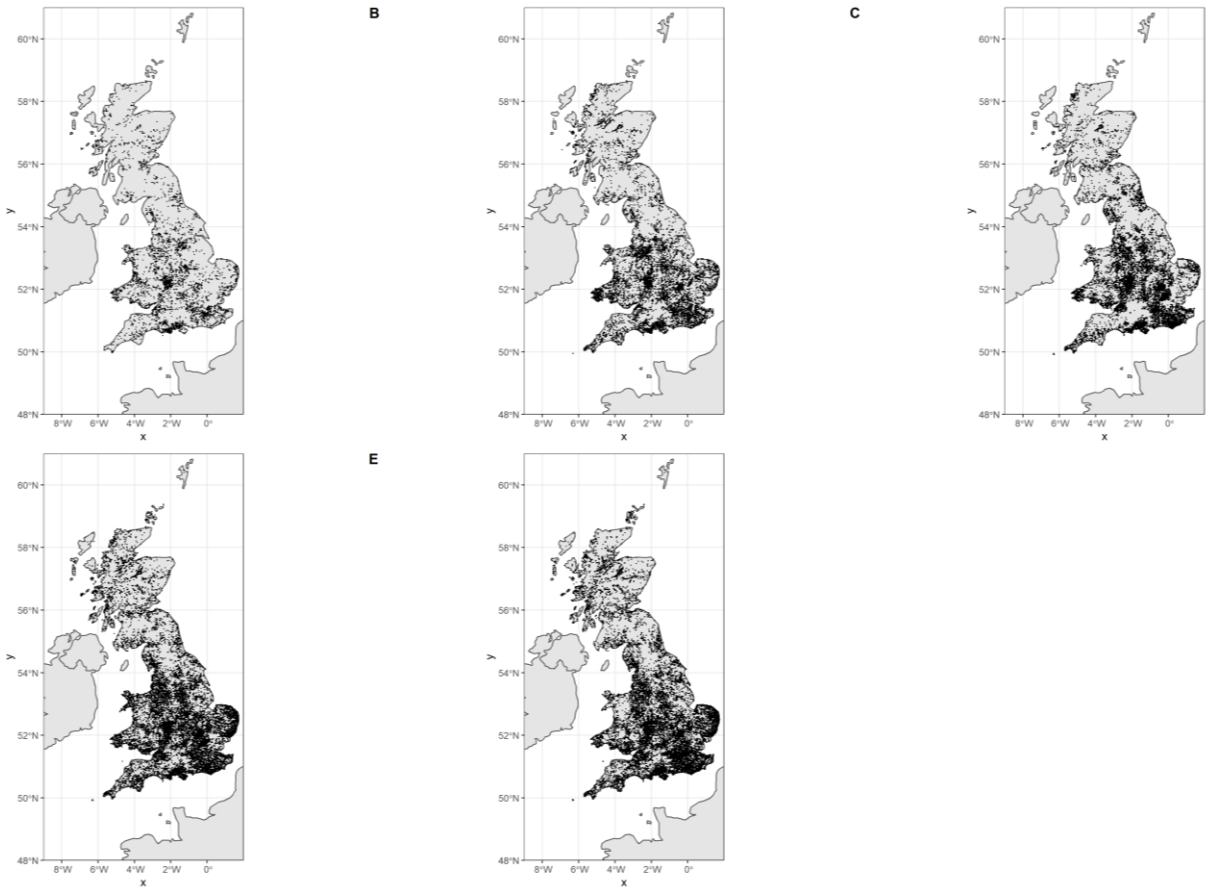
Given these data are presence only, we have no direct data on species absence; instead we infer absence of the focal species when only non-target species within the broad taxonomic group were detected on a given visit. In other words, if a site was visited and other Odonate species were recorded but not the species in question, we treat that as an absence record for the species in question.

Geographic domain

3.2 Are the data sampled from a representative portion of geographical space in the domain of interest?

The species records have good coverage across Britain and are likely to be representative of the distribution of Odonates in Britain (Figure 1). With 85% of the records, England dominates the survey effort. Scotland and Wales contribute 8% and 7% of the records, respectively.

Figure 1. The spatial pattern of Odonate records (at the 1 km × 1 km grid cell scale) included in this analysis. Records (black dots) are plotted separately for each of the following time periods: A) 1970-1982, B) 1983-1992, C) 1993-2002, D) 2003-2012, E) 2013-2021.



3.3 Are your data sampled from the same portions of geographic space across time periods?

Despite the temporal increase in survey effort, the broad spatial pattern of recording is consistent over time (Figure 1). Figure 1 shows that hotspots of recording can change between the time windows. It is worth noting the broad decadal maps in Figure 1 will mask finer temporal (annual) changes in the spatial pattern of recording, which is important given the outputs are at the annual scale.

Across all surveyed grid cells, 3790 (12%) cells were visited in at least ten years.

3.4 If the answers to the above questions revealed any potential geographic biases, or temporal variation in geographic coverage, please explain, in detail, how you plan to mitigate them.

The spatial distribution of records shows good coverage of Britain. Given land area (not the distribution of species), England is overrepresented with 85% of the records, while Scotland at 8% is underrepresented. However, as Odonata species richness decreases with latitude in Britain (Taylor *et al.,* 2021), the overrepresentation of southern sites compared to northern sites may be a positive here, as the analysed records are more likely to reflect the desired inferential goal: the distribution of Odonates in Britain. Furthermore, the broad spatial pattern of survey effort is

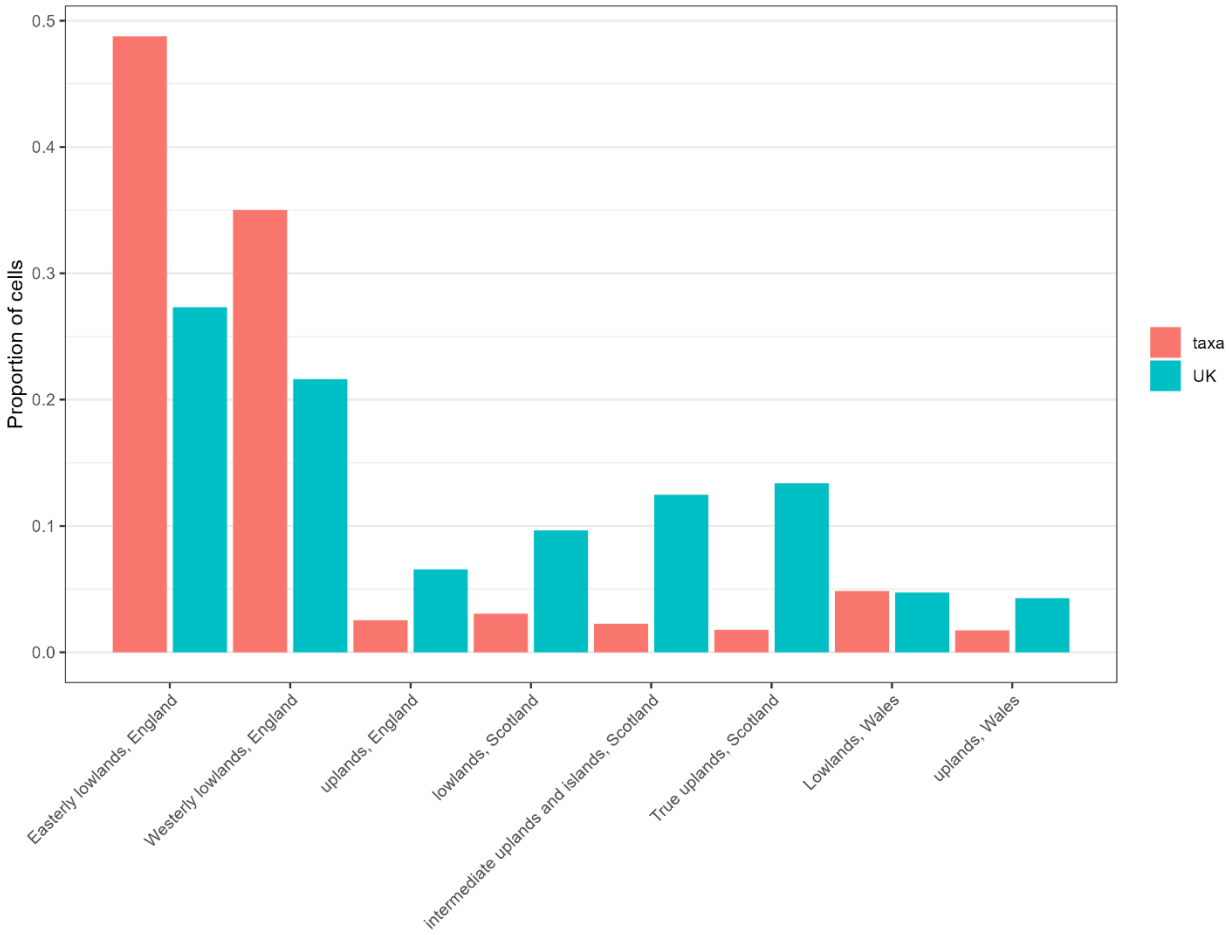
generally consistent over time, meaning issues associated with changing spatial pattern of recording will be minimal. In this analysis, 12% of all surveyed grid cells were visited in at least ten years, which is at the higher end compared to other groups included in this study (Powney *et al*., in prep). Technically, a large proportion of the records are not from the exact same location across time. In principle, this could be a concern, if the sites visited in different years varied systematically in ways that affect the probability of presence or detection of Odonates. For example, if earlier records tended to favour certain habitat types that were sampled less in the later period, this could bias trend estimates. In the worst case, if the types of sites being surveyed shifted over time in a way that happens to correlate with occupancy or detectability, then the model could mistake a change in survey behaviour for a real change in species trends. However, there is little evidence to suggest this is a serious issue here, given the broad geographic and environmental (see next section) recording patterns.

Environmental domain

3.5 Are your data sampled from a representative portion of environmental space in the domain of interest?

Datasets of biological records tend to contain a variety of spatial biases, perhaps the most common is a bias towards certain habitats or locations. For example, physical access to sites often leads to increased recording near urban environments or roads, while certain desirable locations, such as biodiversity hotspots, or locations of high-quality habitat often see increased recording effort (Kelling *et al*., 2015; Boakes *et al*., 2016). Here, we assess the extent of this spatial bias across the main environmental zones in Britain (UKCEH, 2013). Figure 2 reveals a slight overrepresentation of records from the Easterly and Westerly Lowlands of England, while the Scottish regions are underrepresented. As discussed above, Odonate diversity is greater in southern England than Scotland (Taylor *et al*., 2021), so the spatial breakdown of the records across these major environmental zones may reflect the true diversity of the species.

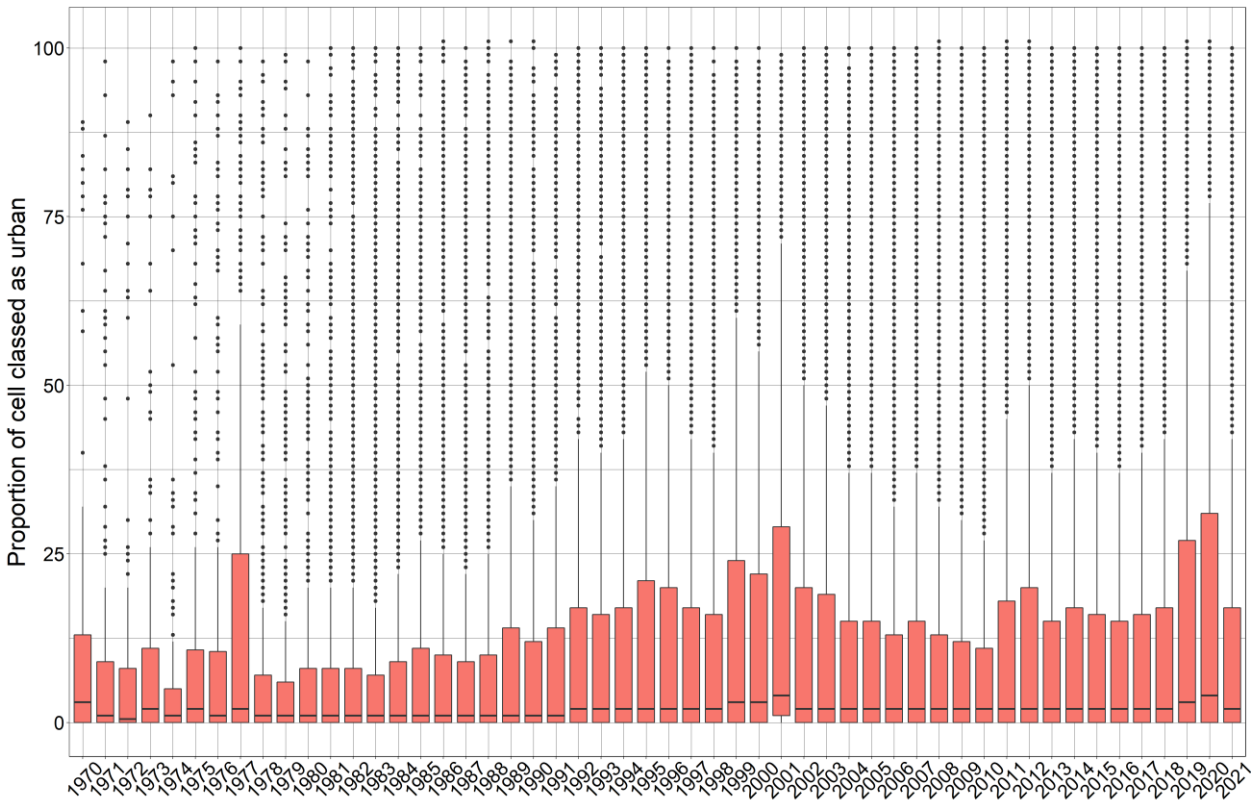
Figure 2. A plot showing the proportion of records (red) falling within each of the major eight biomes in Britain. This is compared to the proportion of all 1 km cells in Britain (blue) in each of the same eight biomes.



3.6 Are your data sampled from the same portion of environmental space across time periods?

Public participation in biological recording has increased in recent years. As a result, the proportion of records coming from urban environments has tended to increase (Kelling *et al*., 2015; Boakes *et al*., 2016). We assess the extent of this temporal change in the average proportion of urban land cover within recorded 1 km grid cells. Land cover data were extracted from Morton *et al*. (2011). There is a mild temporal increase in the proportion of records from urban environments across the time-series (Figure 3), and the potential impact of this on the species trends is discussed below (3.7). Here, we focus solely on change in the urban representation of records, given this is likely to be an issue with unstructured citizen science datasets, and that species' trends and detection probabilities are likely to differ between urban and non-urban environments.

Figure 3. A plot showing the temporal change in the average proportion of urban land area within recorded 1 km grid cells. Boxes show the medians and interquartile ranges for each year; points denote outliers.



3.7 If the answers to the above questions revealed any potential environmental biases, or temporal variation in environmental coverage, please explain, in detail, how you plan to mitigate them.

The records broadly reflect the distribution of Odonate species in Britain.

The occupancy model used here to model species trends was designed to handle two of the most common problems with opportunistic occurrence data. That is 1) unequal recorder effort (the fact that some years, sites, or habitats are surveyed more than others) and 2) imperfect detection (the fact that a species can be present but missed). It does this by attempting to separate genuine changes in where a species occurs from changes in recording effort in space and time. Specifically, the model here will attempt to account for the mild temporal shift towards urban recording environments identified above, as well as broader annual variation in detectability (the year effect). The gradual shift in recording effort is not a major concern here; however, if the recording pattern showed a very rapid or spatially concentrated shift in effort, then the reliability of the trend estimates would be a cause for concern. Furthermore, given these assessments utilise multiple metrics, any issues with relying on a single metric of change are reduced.

Taxonomic domain (or other organismal domain, e.g., phylogenetic, trait space etc.)

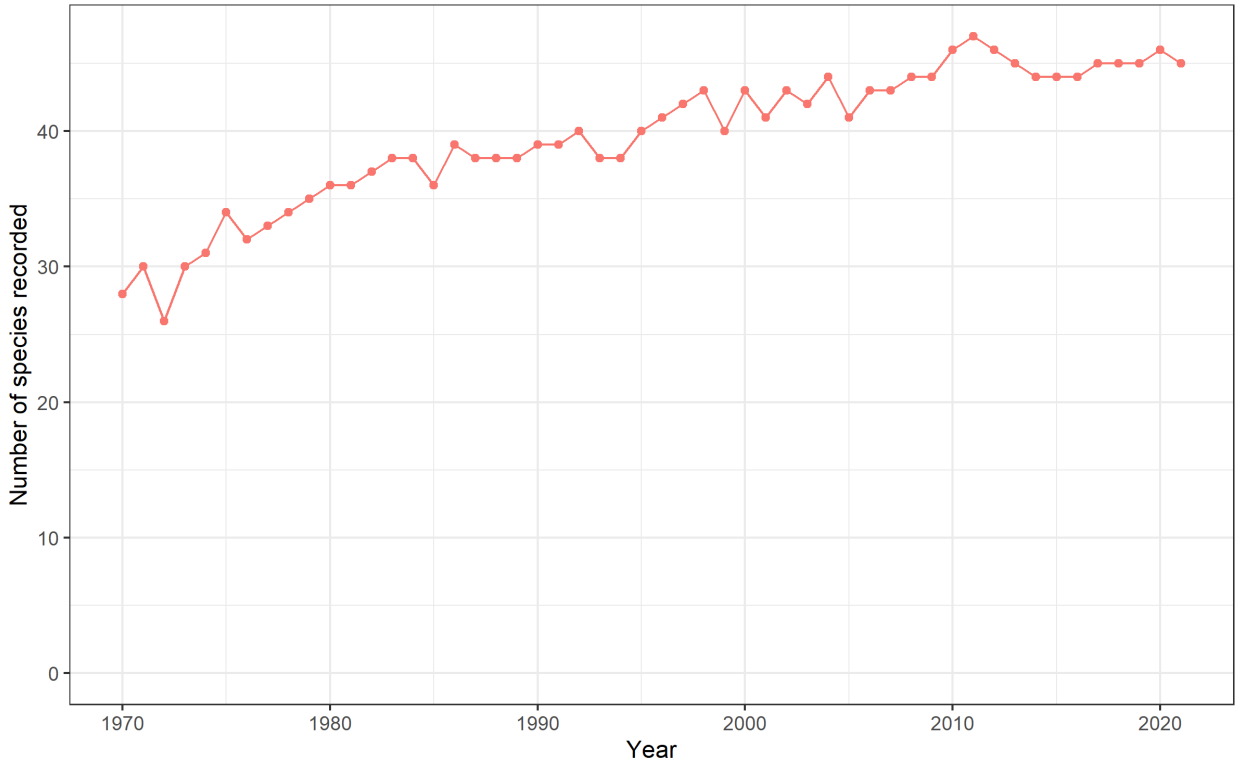
3.8 Is the sampled portion of the taxonomic (or phylogenetic, trait or other space if more relevant) space representative of the taxonomic (or other) domain of interest?

We have records for 54 species, but the trends for 9 species were excluded as they failed the minimum data inclusion criteria (minimum of 50 records required for trend estimation). We failed to estimate trends for a further three species where the annual occupancy estimates were considered unreliable.

3.9 Do your data pertain to the same taxa/taxonomic domain across time periods?

There was a gradual increase in the number of unique species recorded per year between 1970 and 2010 (Figure 4), moving from 28 to 45 species. The average proportion of Odonate species recorded per year is high at approximately 75% of all recorded Odonata species. This shows that there is some annual turnover in the composition of recorded species, but that this is likely driven by a lack of records for rarer species in certain year. This is expected given the high interannual variation in population abundance, typical of insect population dynamics.

Figure 4 The number of unique species recorded per year between 1970 and 2021.



3.10 If the answers to the above questions revealed any potential taxonomic biases, or temporal variation in taxonomic coverage, please explain, in detail, how you plan to mitigate them.

The very rare species, recorded on fewer than 50 occasions, will lack a trend estimate in this analysis. This is a caveat here given the taxonomic inferential goal of this study is to cover all species of Odonata in Britain. The gradual increase in taxonomic coverage is a further issue here. This is mainly due to the way we infer absences in this modelling approach (see 3.1 above), if certain species were the focus of effort (or ignored) in the earlier years then we may see biased trends in the early part of the times series. For example, if a common species was ignored (as is

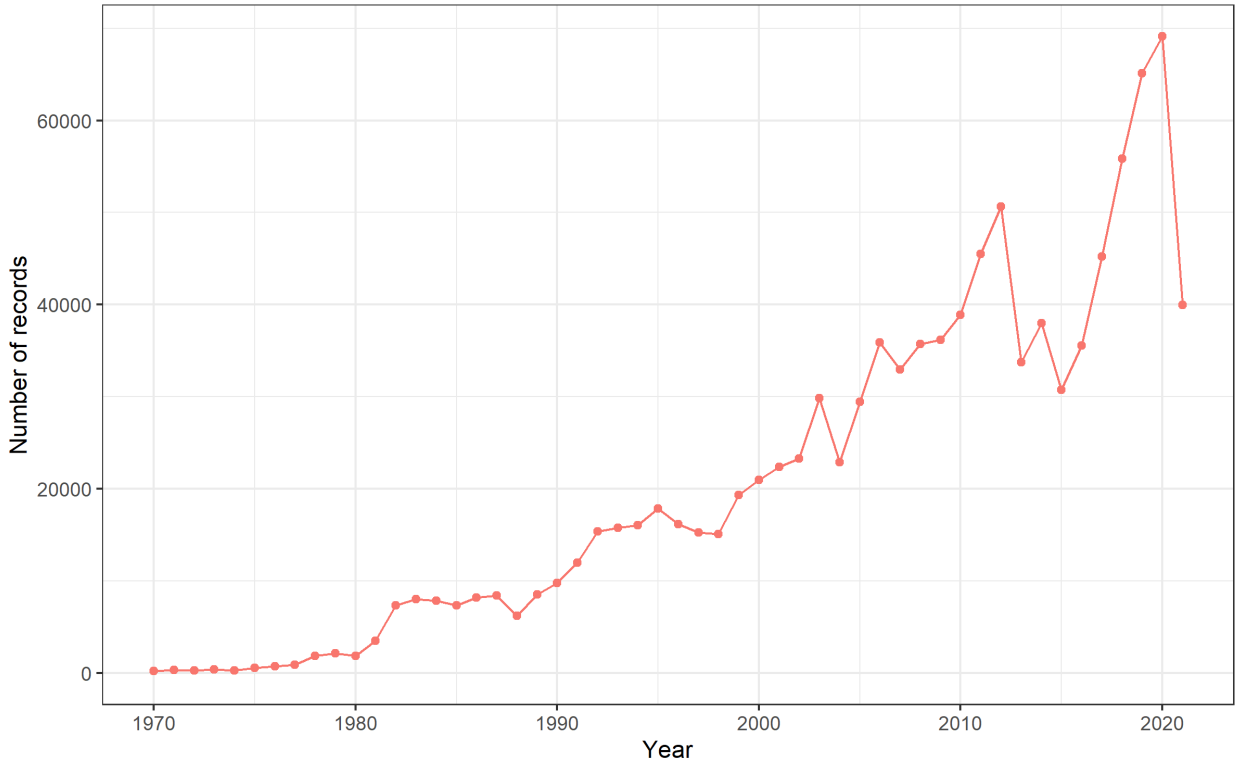
often the case for museum records) in the early period, say first ten years, then we may see artificially lower occupancy estimates in those early years.

Other potential biases

3.11 Are there other potential temporal biases in your data that relate to variables other than ecological states?

There is a strong temporal increase in the amount of occurrence data included in the analysis (Figure 5). Given we are investigating temporal changes in species occupancy, this variation in 'recorder effort' needs to be addressed. Reassuringly, Isaac *et al*., 2014, show that the occupancy model used here performs well, in comparison to other trend models in attempting to handle temporal variation in recorder effort. This assumes the observation sub-model of the occupancy model and quality/quantity of used to parameterise it are fit-for-purpose (discussed below).

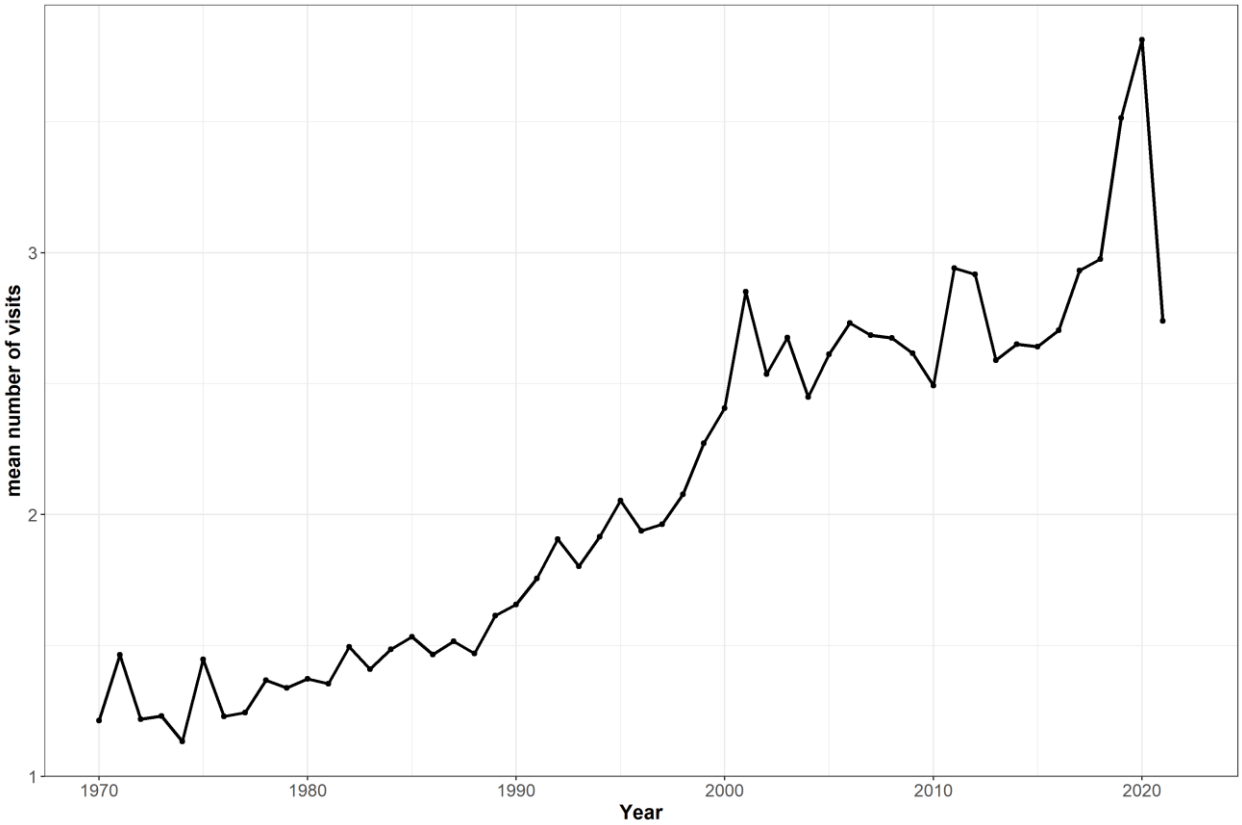
Figure 5 A plot showing the number of Odonata records each year.



3.12 Are you aware of any other potential biases not covered by the above questions that might cause problems for your inferences?

As discussed in 3.7 above, we use hierarchical occupancy models in this study. These models require repeat visits within a closure period (a year, in this case) to estimate, and account for variation in, species detectability on a given visit. On average, 1 km × 1 km sites were visited 2.5 times a year between 1970 and 2021. The mean number of repeat visits per year mirrors the gradual increase in the number of records per year. This means we should see an improvement in our ability to estimate detectability in later years compared to the earlier time periods.

Figure 6. Temporal change in the mean number of repeat visits (within a year) to 1 km × 1 km grid cells in Britain. Overall mean is 2.5.



3.13 If questions 3.11 or 3.12 revealed any important potential biases, please explain how you will mitigate them.

We use species-specific hierarchical occupancy models to estimate the proportion of occupied sites (1 km × 1 km grid cells) per year. The hierarchical aspect of this approach refers to the fact that we have a separate detection model, specifically aiming to estimate and account for variation in detectability. The detection model has two covariates, firstly a categorical year effect, allowing probability of detection to vary annually. Secondly, we include list length category (three levels: single species lists, short-day lists of 2 or 3 species recorded, and comprehensive day lists, visits with >3 species recorded) as a surrogate for recorder effort on a given visit. Probability of detection (the detection sub model) is estimated using repeat visits to a given site within a closure period (in this case, a year). We therefore need to ensure that we have adequate repeat visits across sites and years to accurately estimate variation in detectability. Given the temporal variation in mean repeat visits, the detectability in the early years may be imprecise relative to the later years. It is unclear if the low average number of repeat visits in the early part of the time series is likely to inhibit our ability to accurately estimate occupancy.

Note

This risk-of-bias assessment focusses on the species trend estimates extracted from the occupancy modelling. The occupancy model is well-suited to the challenges posed by opportunistic occurrence data, where key potential sources of bias include unequal recorder effort across time and space, and imperfect detection. Here, while the broad spatiotemporal pattern of recording is stable, we did detect a mild temporal shift in recording towards urban environments. As discussed, we do not feel that this is a major concern here. The list length covariate and random year effect in the detection sub-model together provide a means of separating genuine changes in species occupancy from changes in spatiotemporal pattern of recorder effort.

It is worth noting that no single method is without its limitations and caveats. Placing too much confidence in any one metric of change carries risk. This is why the Red List assessment process used here draws on multiple lines of evidence, considering all available information when reaching a final status assessment.

4. Supporting references

Boakes, E.H., Gliozzo, G., Seymour, V., Harvey, M., Smith, C., Roy, D.B. & Haklay, M. 2016. Patterns of contribution to citizen science biodiversity projects increase understanding of volunteers' recording behaviour. *Scientific Reports*, **6**: 33051.

Isaac, N.J., van Strien, A.J., August, T.A., de Zeeuw, M.P. & Roy, D.B. 2014. Statistics for citizen science: extracting signals of change from noisy ecological data. *Methods in Ecology and Evolution*, **5**: 1052-1060.

Kelling, S., Fink, D., La Sorte, F.A., Johnston, A., Bruns, N.E. & Hochachka, W.M. 2015. Taking a 'Big Data' approach to data quality in a citizen science project. *Ambio*, **44**: 601-611.

Morton, R.D., Rowland, C., Wood, C., Meek, L., Marston, G., Smith, G., Wadsworth, R. & Simpson, I. 2011. Land Cover Map 2007 (1km raster dominant target class, GB). *NERC Environmental Information Data Centre*. NERC (Dataset). Available at: https://doi.org/10.5285/337f9dea-726e-40c7-9f9b-e269911c9db6 [Accessed 20 February 2024].

Taylor, P., Smallshire, D., Parr, A.J., Brooks, S.J., Cham, S.A., Colver, E.F., Harvey, M., Hepper, D., Isaac, N.J.B., Logie, M.W., McFerran, D., McKenna, F., Nelson, B. & Roy, D.B. 2021. *State of Dragonflies in Britain and Ireland.* [online] *British Dragonfly Society*. British Dragonfly Society. Available at: https://british-dragonflies.org.uk/wp-content/uploads/2021/09/State-of-Dragonflies-2021-final-website.pdf [Accessed 3 July 2025].

UKCEH. 2013. Countryside Survey Environmental Zones. [online] *UKCEH*. UK Centre for Ecology & Hydrology. Available at: https://catalogue.ceh.ac.uk/id/0cfd454a-d035-416c-80dc-803c65470ea2 [Accessed 20 February 2024].