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Cover illustration: Male *Ischnura pumilio*, taken near Herstmonceux Castle, East Sussex. 8 August 2025. Photograph by S. Linington.

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Migratory and dispersive dragonflies in Britain during 2025

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Summary

Migrant Odonata produced a number of highlights during 2025. Most striking were the major early-summer and autumn influxes of *Anax ephippiger* (Vagrant Emperor), along with one of Britain's largest-ever arrivals of *Sympetrum fonscolombii* (Red-veined Darter). *Isoaeschna isoceles* (Norfolk Hawker) also continued its recent pattern of turning up far from established breeding sites, though the origin of these outlying individuals remains uncertain.

In addition, although involving smaller numbers, several species produced unusually northerly records during the year. The Shetland Islands saw an *Anax imperator* (Emperor Dragonfly) on 1 August, while later that month the Orkney Islands recorded both their first-ever *Sympetrum striolatum* (Common Darter) and *Aeshna cyanea* (Southern Hawker). Two *Aeshna mixta* (Migrant Hawker) were also reported from the Islands during the year.

These, together with sightings of other migrant and dispersive species, are documented in the current annual report.

Account of species

Notable sightings reported to the BDS Migrant Dragonfly Project during 2025 are detailed below; for information on events during 2024 see Parr (2025).

Chalcolestes viridis (Vander Linden) – Willow Emerald Damselfly

Following several years in which range expansion by this relatively recent colonist appeared to have slowed, 2025 saw a clear resumption of spread. Noteworthy records included several from Wales, mainly in the Newport area of Monmouthshire during August and September, but also from Abergavenny in that same county on 24 August (AU), from Cardiff in Glamorganshire on 23 September and, further north, from Four Crosses in Powys also on 23 September (MWa). These were initially thought to represent the first records

for the country, although a likely sighting near Cardiff in September 2023 has since come to light. Elsewhere, substantial range expansion was evident in Lancashire and in Durham/Northumberland, with a record from Holy Island on 6 October (IB) bringing the species to within sight of the Scottish border. Further south, Somerset also produced numerous new sites. The species does, however, appear slow to advance westwards along the south coast of England beyond the Bournemouth/Poole area of Dorset, where it has now been established for several years. Nonetheless, 2025 did produce the first records for the Isle of Wight, with sightings from Dickson's Copse in the Medina Valley and at St Catherine's Point (KAM).

Lestes barbarus (Fab.) – Southern Emerald Damselfly

The species had a good year in England during 2024 (Parr, 2025), but the current reporting year saw a marked reversal in fortunes for this relatively recent colonist. No fresh immigration was detected, and records came from only a handful of sites, with typically only relatively low numbers reported. Most sites were within the species' main stronghold around the greater Thames Estuary, though two Cornish localities and one currently undisclosed inland site also produced sightings. Although individuals can easily be overlooked, the severe drought of early 2025 (Environment Agency, 2026; Met Office, 2026) appears to have dried out many shallow breeding waters before emergences had peaked, or even begun, so suppressing local numbers. Similar conditions on the near Continent would likely explain the absence of immigration. As a result of all this, it seems probable that some colonies will now have been lost. On a more positive note, the new colony discovered at Penhale Sands in Cornwall during 2024 (Parr, 2025) seemed to fair well, and another potential colony was discovered in the county at Porthgwarra, with individuals seen between 14 June and 15 September (KD, SJ *et al*.). Cornwall thus now becomes one of the strongholds for the species in Britain.

Ischnura pumilio (Charp.) – Scarce Blue-tailed Damselfly

Despite the species normally being very scarce and erratic in south-east England, a succession of unexpected sightings, of individuals and possibly even newly established colonies, was made in the region during 2025. A male was seen at Higham Marshes, Kent, on 10 August (MG) while, in East Sussex, records came from a site on the Pevensey Levels near Herstmonceux Castle on 29 July and 8 August (MM, PM, SL), as well as from Cuckmere Haven over 22–24 August (AM, AGr). Further inland, Buckinghamshire saw its first ever county records, with small numbers recorded at Amersham Flood Meadow between 18 July and 19 August (GS *et al*.) as well as at a private site nearby. Several individuals, including an ovipositing pair, were then noted at Enfield Chase,



Plate 1. *Ischnura pumilio*, male; near Herstmonceux Castle, East Sussex; 8 August 2025. Photograph by S. Linington.

Greater London, on 15 August (SWe). These observations are clearly indicative of one or more recent dispersal events, though their precise timing remains uncertain. The discovery of 'aurantiaca' form immature females at Amersham on three dates between 23 July and 19 August (EBr, GS) suggests the species was already established at this site by late summer. However, as *Ischnura pumillio* can be bivoltine (Sadler & Chelmick, 2022), initial arrivals could still have taken place in 2025.

Aeshna affinis (Vander Linden) – Southern Migrant Hawker

As with *Anax parthenope* (Lesser Emperor), this species was until recently known chiefly as an immigrant, but substantial local breeding populations have now become established. As a result, separating migrants from locally bred individuals is becoming increasingly challenging, though migration undoubtedly continues. A male present at Woodhouse Washlands, south-west Yorkshire, over 18–22 July (CC, AD, DPd) was a notable record, but setting aside cases of local range expansion, the lack of other particularly unusual sightings suggests that migration during the current reporting year was relatively subdued. This

accords with observations from the Netherlands, where 2025 produced the lowest number of sightings for nearly a decade (Waarneming.nl, 2026a), rather indicative of both reduced local population levels and reduced immigration. As a species that typically breeds in shallow waters, the droughts of early 2025 are likely to have had a significant negative impact.

***Aeshna cyanea* (Müller) – Southern Hawker**

Despite *Aeshna cyanea*'s ongoing range expansion in northern Scotland, a record from North Ronaldsay in the Orkney Islands on 23 August (CG) was unexpected and constitutes the first confirmed record for the archipelago. This observation highlights the species' considerable dispersive potential. In Ireland, *A. cyanea* is likewise recorded only as a vagrant (National Biodiversity Data Centre, 2026).

***Aeshna mixta* Latreille – Migrant Hawker**

With *Aeshna mixta* now a common resident across much of Britain, migratory movements can be difficult to detect. Nevertheless, there were clear indications of migration during 2025. In the Orkney Islands, an individual was reported from North Ronaldsay Lighthouse on 18 July (CG, GG), this representing only the second record for the archipelago and one of just a small number of records from northern Scotland in general. A second individual was then observed elsewhere on North Ronaldsay over 10–12 September (RDu, CF, CG). Further south, a total of approximately 600 seen on the Somerleyton Estate in Suffolk on 30 July (HV) likely represent a migratory gathering, as could the 190 seen in Orlestone Forest, Kent, on 3 August (DB). Records of individuals attracted overnight to moth traps, which frequently include migrants (Parr, 2006), include a female caught at an undisclosed site in south-west Scotland on 12 October (OF).

***Isoaeschna isoceles* (Müller) – Norfolk Hawker (Green-eyed Hawker)**

Isoaeschna isoceles continued its recent dramatic range expansion, with records from several new areas significantly away from known breeding sites, some of these being well to the north. Perhaps the most dramatic record was of a male photographed in Northumberland at a private site near Wooler on 21 June (PAH), not far short of the Scottish border. Several other individuals were also seen in north-east England, notably at Saltholme RSPB Reserve, Co. Durham, on 10 July (DH), at Nosterfield in North Yorkshire during most of July (SWo), on the Leven Canal in East Yorkshire on 9 July (FM) and in West Yorkshire at both Rodley NR during late June (JC *et al*.) and Staveley NR on 17 June (PT) and 8 July (SH, MJ). Oviposition was noted at Rodley on both 25 and

29 June (JC, AT), and it seems likely that new breeding populations may soon develop in the Yorkshire area.

Elsewhere, other unusual sightings included individuals reported from the Fenns, Whixall and Bettisfield Mosses NNR during late June and early July (JH *et al*.), with records from both the English and Welsh sectors of the complex. One was also observed at Kenfig, Glamorganshire, over 30–31 July (PG, MCr).

***Brachytron pratense* (Müller) – Hairy Dragonfly**

This is another species that is currently expanding its British range. A mature male was photographed at Marazion Marsh, Cornwall, on 4 May (CM) and multiple individuals were then noted at the Great Pool on Tresco in the Isles of Scilly on 30 May (JS). These are the first records for Cornwall; that they should come from the far west of the county may suggest immigration from France was involved rather than local dispersal within England.



Plate 2. *Brachytron pratense,* male; Marazion Marsh, Cornwall; 4 May 2025. Photograph by C. Moore

Anax ephippiger (Burmeister) – Vagrant Emperor

A significant arrival of *Anax ephippiger* took place over the period 2 May to 13 July, with sightings from over 20 localities. During May, records were restricted to occasional singletons seen at sites in the Isles of Scilly, Cornwall, Devon and Dorset. As spring progressed, records then became more widespread, and the period 14 June to 13 July saw both the appearance of larger numbers and the occurrence of some very northerly records. Highlights included ten or more present at Winterton Dunes, Norfolk, on 14 June (HB) and similar numbers at both Carlton Marshes in Suffolk (AE, KD) and Newmains near Reston in the Scottish Borders (DG) on 20 June. Oviposition was observed at both these latter sites, though there was no hard evidence that either breeding attempt was successful; successful breeding was however documented in the Netherlands, where emergences were noted during mid-August (Waarneming.nl, 2026b). Other notable British records came from Dundee, Angus, on 2 July (SN); Embleton Quarry NR, Northumberland, on 5 July (IEB); and, on 8 July, from the Isle of Mull in the Inner Hebrides (TML) and the Mull of Galloway RSPB Reserve in Dumfries and Galloway (GC). On the Isle of Man, an individual was reported from the Calf of Man on 29 June (EBe), while in Northern Ireland there were three reports from Rathlin Island, County Antrim, during the period 21 June to 11 July (RE, HW).



Plate 3. *Anax ephippiger*, ovipositing pair; Newmains, Scottish Borders; 20 June 2025. Photograph by D. Graham.

High summer proved to be a quiet period for the species, though a male was photographed at Skeffling in East Yorkshire on 28 July (AD). On 8 September, two individuals – apparently an immature and a fully mature male – were discovered at East Runton, Norfolk (SCi). There then followed a major autumn influx, with nearly 30 sightings over the period 22 September to 22 November. The majority of these records came from Devon and Cornwall, though scattered reports were received from other parts of the south coast and from the east coast of England as far north as Withernsea in East Yorkshire (15 November, AGa). There were also two records from the Isle of Man, on 22 September (AQ) and 13 October (LC).

***Anax imperator* Leach – Emperor Dragonfly**

The dispersive potential of this species is frequently overlooked, but 2025 saw a number of extralimital or otherwise unusual records. On the East Anglian coast, one was seen arriving off the sea at Landguard, Suffolk, on 29 June while a "small influx" was noted there on 3 July (WB, NO). Much further north, one was photographed at St Ninians beach on the Shetland Islands on 1 August (CH), this being the first record for the island group and a considerable distance beyond the current known breeding range. There was also a less-well documented report of the remains of another having been found on Fair Isle earlier in the year. In Northern Ireland, Rathlin Island, off the coast of Co. Antrim, saw only its third ever record of the species when two were seen on 21 June (RE). These were accompanied by *Anax ephippiger*, *Anax parthenope* (Lesser Emperor) and *Sympetrum fonscolombii* (Red-veined Darter), and were clearly part of a significant arrival of migrant dragonflies.

***Anax parthenope* Sélys – Lesser Emperor**

Anax parthenope was well recorded during 2025, with over 450 records received. This substantial total reflects both the continued expansion of our resident population and the ongoing arrival of migrants, and the overlap between these processes is making it increasingly difficult to determine the precise origin of individual dragonflies. Particularly northerly records – most of which likely represent migrant individuals originating from southern Britain or from the Continental mainland – included sightings in Northumberland at Ashington on 9 July (MWe), Cheswick on 11 July (MHu) and Embleton on 13 July (NM). There were also reports from Washington Wetlands, Co. Durham, on 16 July (JG) and from Barrow Lodge, Lancashire, on the same date (PL). Records from Seton Mains, East Lothian, during late June and July (AB, BH, MQ) probably also include migrants but it is worth noting that a very rare 'blue-phase' male was photographed there on 23 July (MQ). A similar blue-phase male had been spotted at the site in 2022 (Parr, 2023), and just conceivably

there is some genetic connection between the two individuals, i.e. local breeding is also occurring.

Elsewhere, unusual records included individuals seen at Rame Head in Cornwall (CB) and along the south coast of Wales at Skokholm Island (RDo, GE), Lavernock NR (AI) and Goldcliff NR (SP, DW) over the period 23–28 September. This is very late in the species' local flight period, and sightings likely indicate a small but well-defined influx from further south, where the flight period is longer. Alternatively, favourable weather conditions in this part of south-west Britain may have supported the local emergence of a small autumn generation.

***Libellula fulva* Müller – Scarce Chaser**

A male was photographed at Magor Marsh, Monmouthshire, on 20 May (PJ); this is the first county record. Another male photographed at Berrington Hall, Herefordshire, on 25 May (DPy) is also of interest, being about 35 km from previously known sites. The species is known to currently be expanding its British range.

***Orthetrum coerulescens* (Fab.) – Keeled Skimmer**

The reporting year saw a number of extralimital or otherwise unexpected sightings, likely reflecting enhanced dispersal brought about by the extended period of drought. Coastal sightings included single males at Kessingland Beach, Suffolk, on 29 June (AE) and Spurn, East Yorkshire, on 28 July (HA). Inland, a female was photographed in a garden at Broughton, Lincolnshire, on 30 June (CP), while a male was at Minera Quarry, Wrexham, on 21 July (JH).

***Crocothemis erythraea* (Brullé) – Scarlet Darter**

Confirmation of successful breeding at the site near Crossways in Dorset discovered during 2024 (Parr, 2025) was achieved with the discovery of tenerals on 18 and 22 June (CR *et al*.). There followed several sightings of oviposition by mature females during July (SCa *et al.*), and it would appear an established colony is now present. No sightings, either of dispersing British individuals or of fresh immigrants, were reported from elsewhere.

***Sympetrum fonscolombii* (Sélys) – Red-veined Darter**

Following a poor year in 2024 (Parr, 2025), *Sympetrum fonscolombii* returned in force during 2025, producing one of the more substantial arrivals ever documented in Britain. The first sighting was on 2 May, when a male was noted at Braunton Burrows, Devon (AMG). The following day saw reports from

Cornwall, Dorset and Bedfordshire, and a steady flow of new sightings took place throughout much of May. Mid-June then saw a fresh surge in sightings, with further discoveries continuing into July. By the end of that month, the species had been recorded from over 100 sites in Britain covering 33 counties as far north as Kincardineshire [St Cyrus NNR, 15 June (BF)]; 'red darters' seen at two sites in the Orkney Islands on 12 July may also have been this species. High counts included over 60 at Flamborough Head, East Yorkshire, on 16 June (AA) and 30 at Yeolands Quarry on the Isle of Portland, Dorset, on 20 May (AS, AL). Mating and oviposition were widely reported within England and Wales, with records also from Newmains in the Scottish Borders during mid-June (DG). Overall, there were at least 21 sites where breeding behaviour was seen, and no doubt others where it went unobserved..

Occasional worn adults, likely lingerers from the early-season influxes, continued to be noted until late August. From mid July, immature second-generation darters also began appearing. Early records were often of single tenerals that had clearly emerged nearby, though follow-up visits often failed to locate further individuals – either conditions had deteriorated (e.g. ponds had dried out) or else further emergents were dispersing before being spotted. A number of more substantial potential breeding sites were also identified. In Wales, immatures seen at Marloes Mere in Pembrokeshire (BS, GM) and in the Cosmeston/Porthkerry area of Glamorganshire (AI, PB) on several dates during early August strongly suggest the presence of breeding sites in both these regions. In England, a large emergence was noted at Yeolands Quarry on the Isle of Portland, Dorset, on 17 August, with good numbers of tenerals or immatures continuing to be reported until at least 27 September (MCa). Similarly, a significant emergence was noted at Brogborough, Bedfordshire, over the period 19 September to 6 October (SCa). Elsewhere, multiple records of immatures from Cley, Norfolk, between 7–27 September (CK, CL, SR *et al*.) also rather imply successful breeding nearby. As is the norm, British-bred second generation individuals left their natal sites before reaching maturity. The last record of the year was of four immatures seen at Dungeness Point, Kent, on 9 October (DBO).

Sympetrum striolatum (Charp.) – Common Darter

The Orkney Islands recorded their first-ever *Sympetrum striolatum* on 13–14 August, with a male being photographed on Shapinsay (TW). This individual resembled the nominate form of the species, rather that the dark form 'nigrescens' that is typical of the northern Scottish mainland, so is likely to have been a long distance migrant. Elsewhere, individuals were attracted overnight to moth-traps at Postlip in Gloucestershire on the night of 25 July (JB) and a site in Cambridgeshire during mid-August (MHo); such dragonflies attracted to light



Plate 4. *Sympetrum fonscolombii*, immature female; Brogborough, Bedfordshire; late September 2025. Photograph by S. Cham.

frequently involve migrants (Parr, 2006). Schröter *et al*. (2023) have recently published further insights into the migrations of *S. striolatum*.

Discussion

Weather-wise, 2025 was the warmest and sunniest year on record in Britain, with a prolonged period of drought during spring and summer (Environment Agency, 2026; Met Office, 2026). Across much of Europe, conditions were similarly extreme, though drought impacts were more uneven and indeed at their very strongest in the south-east (Copernicus Climate Change Service, 2026). Migrant dragonflies respond rapidly to such extreme conditions, but the drivers can pull in different directions. Within limits, high temperatures can facilitate dispersal and migration (Knoblauch *et al*., 2021; Gil-Tapetado *et al*., 2023), and frequent warm southerly winds will have aided movements from Mediterranean Europe and North Africa. Low-level drought may also impose stresses that encourage both migration and shorter-distance dispersal. Conversely, more severe drought may cause breeding sites in source regions to dry out before emergences are complete, hence reducing the available numbers of certain migrants. In Britain, the year's events clearly reflected a complex mix of all

these influences, producing many notable events but also leaving several species with an unexpectedly quiet season.

From a pan-European perspective, the arrivals of both *Anax ephippiger* and *Sympetrum fonscolombii* were of particular note. Although formerly a considerable rarity in Britain, autumn influxes of the Afro-tropical *A. ephippiger* have now become a regular feature. Spring/early summer arrivals remain more erratic, which makes the significant influx noted during May through to early July of some interest. It seems plausible that the unusually wet conditions in parts of the Sahara and Sahel regions of Africa during late 2024 (Ligtenberg, 2024) allowed more extensive and successful breeding by the species in those areas, with large numbers of progeny subsequently moving northwards and individuals eventually reaching northern Europe once conditions became favourable. The precise origins of the *S. fonscolombii* reaching Britain each year remain unknown. However, given the close similarity in timing and behaviour between the spring/early summer arrivals of both *S. fonscolombii* and *A. ephippiger*, it is tempting to speculate that, in 2025, at least some may also have originated in North Africa.

With continuing change in Britain's and the World's climate, patterns of migration will no doubt also continue to shift. It will be of considerable interest to follow what the next few years have in store.

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Significant declines in Dragonflies in England and Wales. A review of existing data and of methods to assess trends

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Summary

Despite several positive reports of Odonata having stable populations in England and Wales, a new analysis (based on three different methods) of the counts of the 11 most frequently recorded species (*Sympetrum striolatum* (Common Darter)*, Enallagma cyathigerum* (Common Blue Damselfly)*, Coenagrion puella* (Azure Damselfly), *Ischnura elegans* (Blue-tailed Damselfly), *Pyrrhosoma nymphula* (Large Red Damselfly), *Anax imperator,* (Emperor Dragonfly)*, Aeshna cyanea* (Southern Hawker), *Aeshna mixta* (Migrant Hawker), *Aeshna grandis* (Brown Hawker), *Calopteryx splendens* (Banded Demoiselle) and *Libellula quadrimaculata* (Four-spotted Chaser)), showed a decline in abundance of approximately 50% in the period 2005 to 2023. This decline is shown at sites with consistent recording over five years and is corroborated by a simple reduction in proportion of high counts across all the Dragonfly records. This is in line with the Dragonfly abundance data from the Netherlands.

These declines are against a background of increasing concentrations of the pet insecticides, imidacloprid, fipronil and fluralaner, in UK waterbodies with fewer achieving good ecological status, largely due to persistent pollutants that accumulate in the environment, together with climate change stresses.

Introduction

There is a widespread concern about general insect decline ('Insectageddon') including declines in pollinators being a risk to agriculture (HM Government (2026a). Halsch *et al.* (2026) reviewed the causes and found land use change, agricultural pollution, invasive species and climate change warming to be well established direct drivers of insect biodiversity decline.

Many studies show a decline in British terrestrial insects, but less so in aquatic

insects (Outhwaite *et al.,* 2019; Burns *et al.*, 2023; Buglife, 2026). Data published by DEFRA (2026a) show that the abundance of 235 species of freshwater invertebrates, including several species of dragonflies, has declined by just 2% between 2013 and 2024. DEFRA (2026b), reported breeding water and wetland bird populations in England on average have declined by 11% since 1975, and by 7% since 2020, with considerable variation between species.

Hammond (1983) reported that four of 41 breeding dragonfly species in the British Isles became extinct between 1953 and 1983 (although, retrospectively, one of these may not have been truly extinct), with several other species in significant decline "with conservation measures urgently needed", despite the setting up of a chain of National Nature Reserves. In the 2014 Atlas of Dragonflies of Britian and Ireland (Cham *et al.* 2014), 12 species were shown to have increased occupancy by more than 10% in the previous decade and nine declined by a similar amount.

Taylor, *et al.* (2021) found that 18 species increased their occupancy with high certainty in the period 1970 to 2019, only three of which were newcomers to the UK in that period, while three species declined. Termaat (2023) found similar increases after the Millenium in dragonfly occupancy in the Netherlands after a decline in the 20th century.

Termaat *et al.* (2019) found 55 of 99 dragonfly species increased in occupancy across Europe, 32 species remained stable, and none declined. In Germany, Bowler *et. al.* (2022) found 45% dragonfly species increased in occupancy but only 29% decreased and 26% remained stable in the number of 5km squares occupied.

However, CLO (2026) found that dragonfly populations in the Netherlands have declined since 2010, resulting in the average population size of the fifteen most widespread species in the Netherlands decreasing by 15% compared to 1999, a decline that was not revealed in the occupancy trend alone. They had previously risen in the period from 2000 to 2010. Common species such as *Ischnura elegans* (Bluetailed Damselfly) even disappeared locally. The decrease was not considered to be explained by the temperature preferences of these common species, as the more heat-loving ones also declined. Increased competition with. or predation by. other species benefiting from water quality improvement and climate change was ruled out but an accumulation of toxic substances was suspected.

Preliminary abundance modelling results in France showed six of 23 species showing significant declines since 2011 and only three with significant positive trends. (Martin Jeanmougin, *pers. comm.*). In contrast to these reported declines,

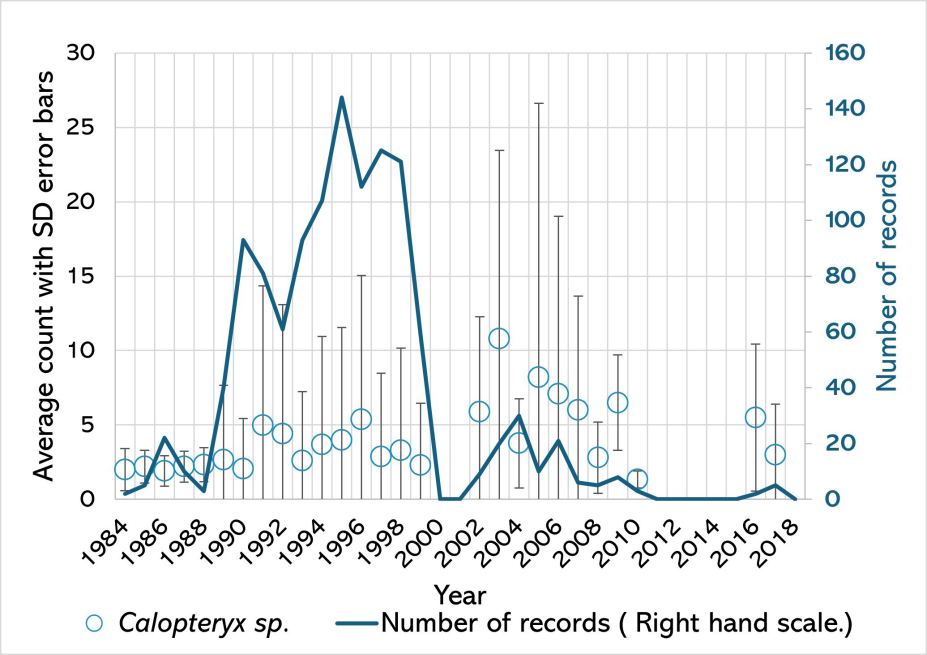

Figure 1. Average counts (with Standard Deviations) and the number of records for Calopteryx sp. larvae in Environment Agency water body sampling. Records reported as '*Calopteryx sp.*','*C. splendens*' and '*C. virgo*' were included. (Source: Bachiller-Jareno *et al.* (2025)).

Sadykova *et al* (2026) reported that the median abundance of the dragonflies in the DEFRA list in British rivers increased from 2003 to 2018 but this was based on Environment Agency macroinvertebrate survey data (Bachiller-Janero *et al*., 2025), with 75% of the records being zeros, potentially biasing the result. The data itself are difficult to interpret, partly because of changes in the EA counting methods. In 2002, the EA changed the method of counting to a log scale that could not be directly compared with these measures of abundance; the monitoring more or less stopped around 2005 preventing analysis of later trends by this method. Taking the example of *Calopteryx* species - there were very few (14) reports of *Calopteryx virgo* (Beautiful Demoiselle). Plotting these together with records reported as *Calopteryx sp.* and *C. splendens* and recorded as "Actual abundance of taxa in the sample" or "Estimate of abundance (locally defined scale)" (Fig. 1) show a picture that is very difficult to interpret as supporting the study's positive conclusions.

The present study is to determine if these reported increases in Odonata in England and Wales have actually occurred or if dragonflies are in decline as seen in the Netherlands.

General, but disputed, declines in British terrestrial insects

Occupancy modelling by Burns *et al.* (2023) and Outhwaite *et al.* (2019) showed a decline in British terrestrial insects, the prey of adult dragonflies, especially in pollinators.

Two studies using more direct methods confirmed this with Buglife (2026) finding that the number of insect splats on cars recorded in the UK fell by an average of 19% a year between 2021 and 2025. This valuable study needs to be continued over many more years to be certain of a long-term trend. Secondly, Macgregor *et al.* (2019), looking at the combined weight of moths caught in traps, confirmed a decline of around 10% per decade since the early 1980s, following an increase between the late 1960s and 1982.

However, the story of decline was challenged by Bourhis *et al.* (2025) who found "no Great Britain-wide decline since 1990, but instead local declines and changes in community compositions". Mungee *et al*. (2025) used a novel weather radar method to argue that "flying arthropods increased in the south and declined mainly in the far north; on average, only nocturnal arthropods showed an overall decline" in the short time frame (2014-2021), so might not have detected long term patterns. However, it is not clear what exactly was being detected by the radar signal (D. Goulson, *pers. comm*.).

Positive but disputed impression of life in British waterbodies

Burns *et a*l. (2023) reported "freshwater nutrient cycling" organisms markedly increasing their distribution over the period 1980 to 2010 and Outhwaite *et al.* (2019,) looking at 1970 to 2015, found freshwater species had strongly recovered, since previous declines, from its lowest point in 1994, albeit with considerable species turnover. Vaughan *et. al* (2019) confirmed this finding and argued that, despite large temperature increases between 1991 and 2011, macroinvertebrate stream communities in England and Wales remained close to their predicted equilibrium "with water quality improvements offsetting the impact of climate warming", it being considered that the removal of one stress will enable organisms to survive other, unrelated stresses.

Pharaoh *et al.* (2023) found aquatic macroinvertebrate communities indicated water quality improvements over 29 years, with taxonomic richness increasing in the 1990s; with weaker evidence for gain after 2015. Qu *et al*. (2023) used an index of family richness to show that "macroinvertebrate diversity has benefited from a national improvement in critical components of water quality" in English rivers from 1989 to 2018. They found for Crustacea, Diptera, Ephemeroptera, Plecoptera and Trichoptera, positive to very positive trends over the 30 years,

but this was less clear for Gastropoda and Odonata and with a decline for Annelida (Qu *et al*., 2023). The conclusions drawn are problematic because the higher taxonomic levels used mask individual species trends and many of the rivers at the beginning of the study were in very poor quality and improved to only a moderate quality in the survey period. It is unsurprising for an index of family richness to increase in the context of Odonata, with the British species list increasing 7% in the period 1990 to 2014 (Cham *et al*., 2014). Martin *et al* (2024) found the numbers of species of odonate recorded in Sussex continuing to rise up to 2020, in response to climate change. Family richness is not a proxy for abundance but an index of changing climate rather than pollution. Additionally, much of the difference between the family richness changes between groups investigated can be accounted for by the volant (flying) groups' greater dispersive ability to repopulate lost sites than non-flying organisms like annelids and gastropods.

Direct abundance measurements of Riverflies (Plecoptera, Ephemeroptera and Trichoptera) do not tell such a positive story. The Riverfly Partnership (2026) used standardised sampling procedures to provide valuable abundance data on river invertebrates and reported that the median number of invertebrates according to their scoring system was 100 in 2016 but dropped to 60 in 2025. Some of this drop might be due to an increase in reporting from more urbanised rivers but it cannot be the whole story. A longitudinal study based on data from individual sites would be valuable to make a detailed assessment of riverfly trends.

Quality of water bodies

Significant declines have been achieved in orthophosphate (biologically available phosphate) in English waterbodies (Environment Agency, 2019) but nitrate concentrations declined less significantly, (Environment Agency, 2025b) with further reductions planned. (Environment Agency, 2025b). Metal concentrations and pesticides such as malathion have also declined substantially (Environment Agency, 2025c) but it was noted that while not detected in the water column, metals can remain in the sediments affecting benthic life.

Environment Agency water quality monitoring data show concentrations of the commonly used pet insecticides, imidacloprid and fipronil, are increasing and the newer fluralaner markedly so (Environment Agency, 2025a), with concentrations of these chemicals typically above the lowest Predicted No-Effect Concentrations (PNECs) (NORMAN, 2026), implying potential for ecological damage. Hadley *et al.* (2026) noted that imidacloprid is toxic to insects by irreversibly blocking neurotransmission pathways, so that PNECs fall rapidly with prolonged exposure. In theory, longer lived larvae are therefore

more susceptible. However, sedimentary build up is seldom appraised (Hadley *et al.*, 2026). This long term build up may result in a slow, steady decline in Odonata, long after the stressor is no longer in use, especially in species with benthic larval stages.

An open letter from 24 conservation organisations to the UK Government (Pesticide Action Network, 2023) called for a ban on all pesticides that are not permitted for use on agricultural crops from being included in veterinary medicines. The Veterinary Medicines Directorate (2025) did not take regulatory action but launched "a cross-Department action plan" focusing on topical treatments, despite the growing use of oral treatments where more of the active ingredient is excreted rather than actually affecting the parasite (Bourne-Taylor, 2026).

Some in the water industry have challenged this lack of action (BBC, 2026) since currently it is only possible to remove these products with carbon filters and ion exchange at an experimental, small scale, and many outfalls bypass the sewage system (Hadley *et al.*, 2026). There are also other pathways such as dogs entering the water (Yoder *et al.*, 2024.)

Rumschlag *et al.* (2020) noted more than 350 pesticides are applied in the U.S. annually. They found that, in general, herbicides reduced primary productivity by decreasing the abundance of the phytoplankton, while insecticides affected zooplankton composition and abundance, but not richness. In an experimental set up, they found that "insecticides generally reduce insect predators (such as *Anax junius* (Green Darner)) increasing the survival and growth of their prey."

Concerns have also been raised about the wide variety of PFAS (organofluorine compounds that have multiple fluorine atoms attached to an alkyl chain). As persistent organic pollutants, they are so-called 'forever chemicals'. Consistent with the wide range of environmental stresses on species in urban areas, Babik *et al.* (2023) compared the genome of *Ischnura elegans* (Bluetailed Damselfly) at 31 rural and urban localities in Poland and Sweden, and found polygenic adaptations in the genetics of the nervous system but did not detect consistent differences in urban, compared with rural, environments, implying the species was having to respond to different stresses at different locations.

Only 14.3% of England's surface waters achieved good ecological status in 2026, using the standards set out under the Water Framework Directive Regulations (WFDR) (HM Government, 2026b) down from 16.3% in 2019 "largely due to persistent pollutants that accumulate in the environment and take decades to deplete". The Office for Environmental Protection (OEP) currently has an open investigation into Defra and the Environment Agency (EA)

compliance with the Water Framework Directive (WFD) Regulations, (Office for Environmental Protection, 2026). There are additional pollutants stressing the aquatic environment not covered by the testing for the WFDR.

These stresses come at a time of climate change, resulting in range shifts northwards (Holmes, 2025). Vaughan *et. al* (2019) considered the impact of climate warming offset by changes in water quality but the various stresses could be additive.

Methods of assessing abundance of dragonfly populations

Against the background of a challenging water environment and dragonfly decline in abundance not being fully captured by occupancy modelling (Bried *et al*., 2020; CLO, 2026,), an issue seen in other taxa (Rumschlag *et al.*, 2020), there is a need to directly measure dragonfly abundance. Termaat (2023) found occupancy trends similar, but not the same, as abundance trends; the trends were more pronounced in some species and in others reduced. Despite efforts to start a national standardised system of transect counts (Smallshire & Beynon, 2010), there have been no general uptake of such a system. Currently, where records are submitted with counts, it is unknown exactly what protocol is being followed at a particular site. Owing to the practicalities of estimating dragonfly numbers, many records are given in abundance bands rather than as counts, limiting how they can be manipulated. An alternative, newer, protocol based on timed counts (Opie *et al.* 2025) may be more successful but will need a large number of records before being useful. Attempts are made here to track dragonfly abundance trends with existing data by three different methods:

Method 1: "Simple" overview of reported abundance bands. Only verified records in England and Wales from the British Dragonfly Society Recording Scheme (NBN, 2026) with a grid reference accuracy of 100m were used. The numbers of records in each abundance band of, 2-5, 6-20, 21-100, 101-500 and 501+ were calculated as a percentage of all records excluding the counts of '1'. Using only one grid reference resolution reduced the chances of counts of very large or very small areas being included. Excluding the counts of "1" was to exclude casual records, potentially increased with the rise in the use of mobile phone cameras for recording. They might only mean that the species was present and could result in a false reduction in average count.

Results:

The results show a clear decline in the proportion of records recording more than 21 individuals from approximately 20% of records in 2000 to about 12% in 2024 (Fig. 2). The decline was very steady with time (R^2= 0.71) which, if corroborated with other

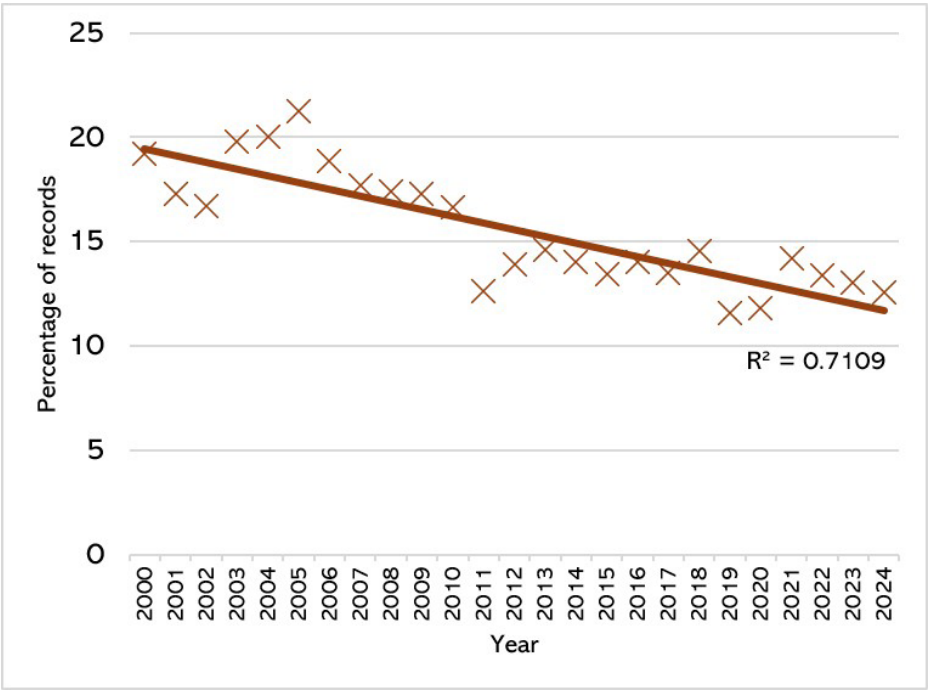

Figure 2. The number of Odonata records, with 100m grid references in England, in abundance bands 21-100, 101-500 and 501+ as a percentage of all records with a count of over 1. A total of 610,464 records met the criteria.

evidence, must have severe conservation implications.

Limitations:

Records in the NBN database are *ad hoc* records and highly skewed in time, and no attempt was made to standardise for this.

There has been a change in recorder behaviour from the first atlas in 1996, progressing from hectad (10km square) recording, developing through tetrad recording (2km) and to, most recently, the monad level (1km). Only at 100m square resolution is an estimate of numbers providing useful data. Some recorders are careful to note the resolution, and hence implied area, when recording abundance bands; others accept the iRecord default resolution. A lower resolution might sometimes have been used to provide geoprivacy for a private pond. A grid reference square may indicate the centre of a site like the middle of a large lake or a linear feature like a valley or river. Revised recording guidelines might help, but we have to accept and be grateful for all the records

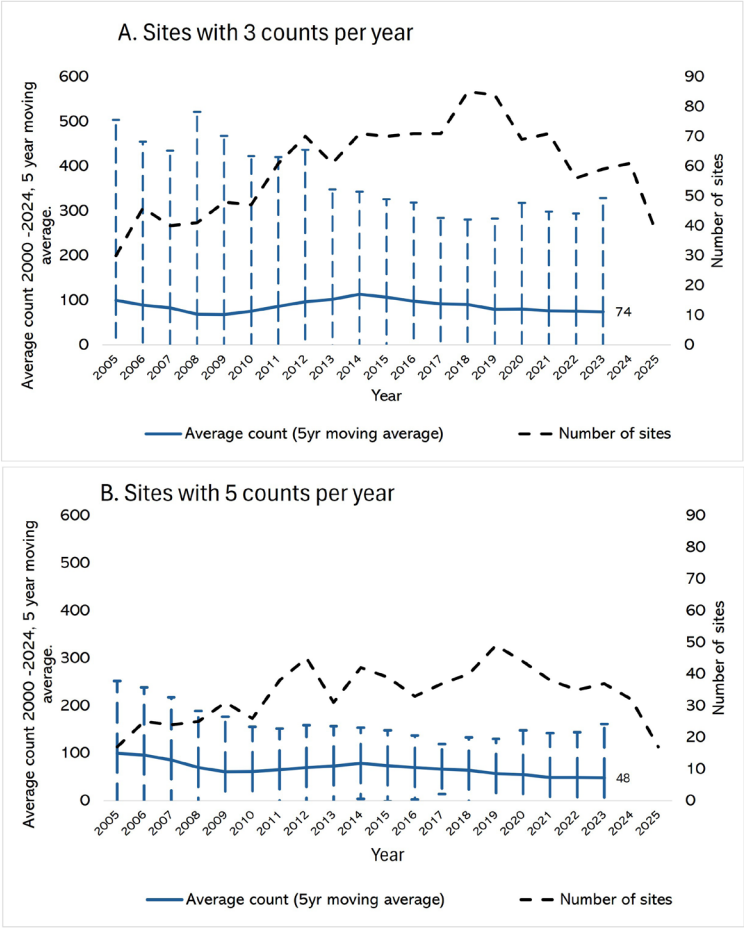

Figure 3. The results for *Ischnura elegans*, Blue tailed Damselfly using Method 1, showing the five-year moving average of raw counts, with the Standard Deviation together with the number of qualifying sites. The 2005 average count is normalised to 100. (A) shows results for sites with a minimum of three counts for the species per year; (B) shows the results for sites with a minimum of five counts for the species per year.

volunteers provide. (Steve Cham, *pers comm*.). Using only 100m grid references attempts to take out this change in recorder effort but perhaps not completely. The smooth decline rather than a stepped decline, as might happen if recorders were focusing on specific projects and abruptly changing recording methods, implies that the decline is real.

Table 1. The number of verified records in the NBN database in England from 2003 to 2025.

Species name	Number of records
Sympetrum striolatum, Common Darter	167569
Enallagma cyathigerum, Common Blue Damselfly	131518
Coenagrion puella, Azure Damselfly	124861
Ischnura elegans, Blue-tailed Damselfly,	115171
Pyrrhosoma nymphula, Large Red Damselfly	107479
Anax imperator, Emperor Dragonfly	85382
Aeshna cyanea, Southern Hawker	78263
Aeshna mixta, Migrant Hawker	74835
Aeshna grandis, Brown Hawker	67086
Calopteryx splendens, Banded Demoiselle	66974
Libellula quadrimaculata, Four-spotted Chaser	59375

Method 2: Average of sites with long term programme of standardised counts. Only verified records of adult stages in England, Wales and the Isle of Man were included and only records with abundance as a number, as reported in the 'verbatimIndividualcount' section of the 'dynamicProperties' field in NBN (2026), together with counts reported in the DRN abundance band 'A', meaning '1'. Counts reported in other abundance bands - B (2-5), C (6-20), etc. were not used. Other abundance formats used, such as 'Present' or '+' were ignored. This has the consequence that none of the records used in Method 1 are included. From 2003 to 2025, 1,085,252 records met the Method 2 criteria.

To enable the handling of the records in MS Excel, the records were spilt into three time periods, 2003-2009, 2010-2019 and 2020-2025. To constrain the number of calculations that had to be made, the median average count of the target species was taken from sites (= unique grid references) with more than five records of the species in any of these periods (see explanation below). Secondly, only sites with at least five years of records were used to minimise site turnover in the data and was taken as a loose proxy of consistent recording, there being no information on the recording intent of the recorder except what could be searched for automatically. The median average count number of the target species observed in each year at each site was recorded. This results in a list of average values for all the sites that year with consistent recording. The median average of this list of average values was then used. The median average value is taken to smooth out casual records, making the calculation more robust to outliers.

Separately the number of unique grid references for which sufficient records have been found ('Number of Sites') each year with qualifying records was recorded. Note that there might be more than one 'Site' for one larger nature reserve if the data has been recorded at different compartments within a larger area.

Only the 11 species with over about 60,000 records are included (Table 1). These are different from the DEFRA (2026a) list. To avoid the paucity of sites counted at the Millenium, the count is taken from 2003, enabling a 5-year moving average to be calculated from 2005.

A subjective decision had to be taken about the minimum number of records a year that were required before using the data. As the minimum number is increased, the number of eligible sites is greatly reduced and the Standard Deviation is also greatly reduced. This reduction in Standard Deviation is also reduced when the number of counts per year is increased. To show general trends rather than the vagaries of each season, the five-year moving average was used. The data for *Ischnura elegans* (Blue-tailed Damselfly) illustrate this (Fig 3), showing a clear decline both for sites with three counts per year and for those with five counts per year but with the degree of the decline greater for the former. Thus a minimum of five was used throughout. This ensures that heavily reported sites, which are more likely to have a standardised method of counting (i.e. formal surveys), are emphasised but note that different results are obtained according to the minimum value chosen and this methodological uncertainty must constrain the accuracy of the results.

Results:

Of the 11 species for which the data were analysed (Fig. 4) only two, *Pyrrhosoma nymphula,* (Large Red Damselfly) and *Enallagma cyathigerum* (Common Blue Damselfly) showed any increase in their population counts over the period but they too showed a decrease since about 2016. A third species, *Libellula quadrimaculata* (Four-spotted Chaser) maintained a level until about 2012. On average, species counts declined by approximately 50%.

Method 3: Average of sites with long term programme of standardised counts, including counts reported as abundance bands. Method 2 discards many potentially valuable records as many are reported as abundance bands. Therefore, the NBN field "raw_individual Count" converts verbatim abundance bands into numerical values according to the following mapping: + is converted to Null, 1 to 1, 2-5 to 3, 6-20 to 10, 21-100 to 47, 101-500 to 230, and 500+ to 700. This field was then treated the same way as described in Method 2.

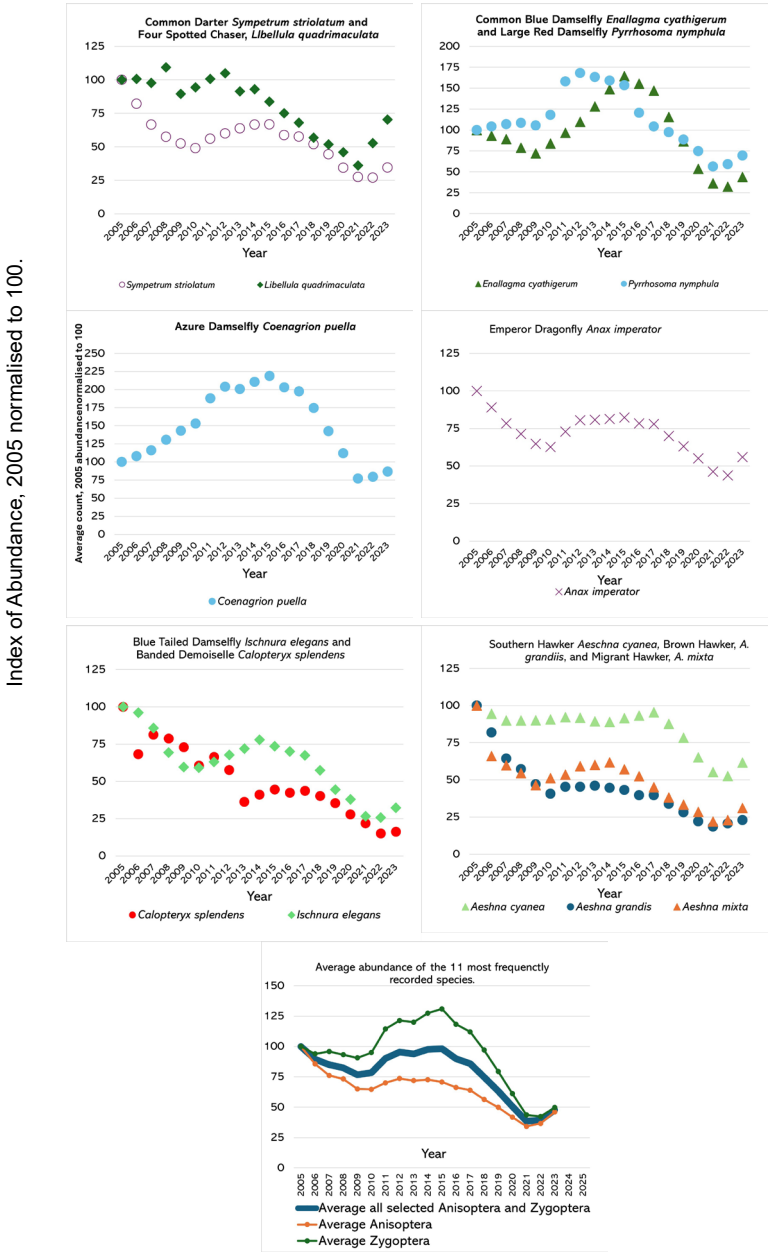

Figure 4. The abundance of the 11 most frequently recorded dragonflies and damselflies in England and Wales, expressed as a five-year moving average. The 2005 abundance is normalised to 100. The bottom graph shows the results for the average of all 11 species; also the Zygoptera and Anisoptera separately.

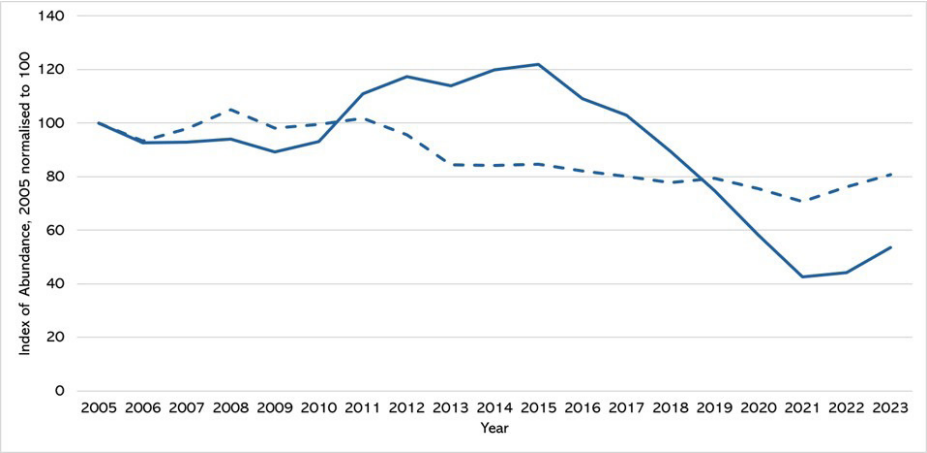

Figure 5. A comparison between calculation based on raw counts only and abundance estimates, with the average figure taken for each abundance band for the six most frequently recorded species: *Sympetrum striolatum* (Common Darter), *Libellula quadrimaculata* (Four-spotted Chaser), *Enallagma cyathigerum* (Common Blue Damselfly), *Pyrrhosoma nymphula* (Large Red Damselfly), *Coenagrion puella* (Azure Damselfly) and *Calopteryx splendens* (Banded Demoiselle). The lines show a five-year running average (using data from 2003 to 2025). The 2005 data are normalised to 100. Continuous line, raw counts only (Method 2); Dashed line, averages for the abundance bands (Method 3). The correlation between the lines is 0.51.

Results

Comparison between abundance Methods 2 and 3 shows that the latter produces less smoothing of the five-year averages that using one value for a band (Method 2) (Fig 5). Secondly, on average, in Method 3 there is only a 10% increase in sites.

This is probably an interesting aspect of observer behaviour. Those doing exact counts are more likely to be doing a standardised protocol and reporting it from a standardised grid reference than more *ad hoc* records given as abundance bands. To achieve as accurate picture of abundance as possible, the focus is on the records from standardised protocols, so Method 2, using exact counts only was preferred.

Limitations.

Geographical. This analysis uses *ad hoc* NBN data which is skewed to the South of England with few in the North of England (Plate 1) and this bias is not weighted. There was insufficient data to include Scotland in the study.

Ecological succession. When land is given over to a nature

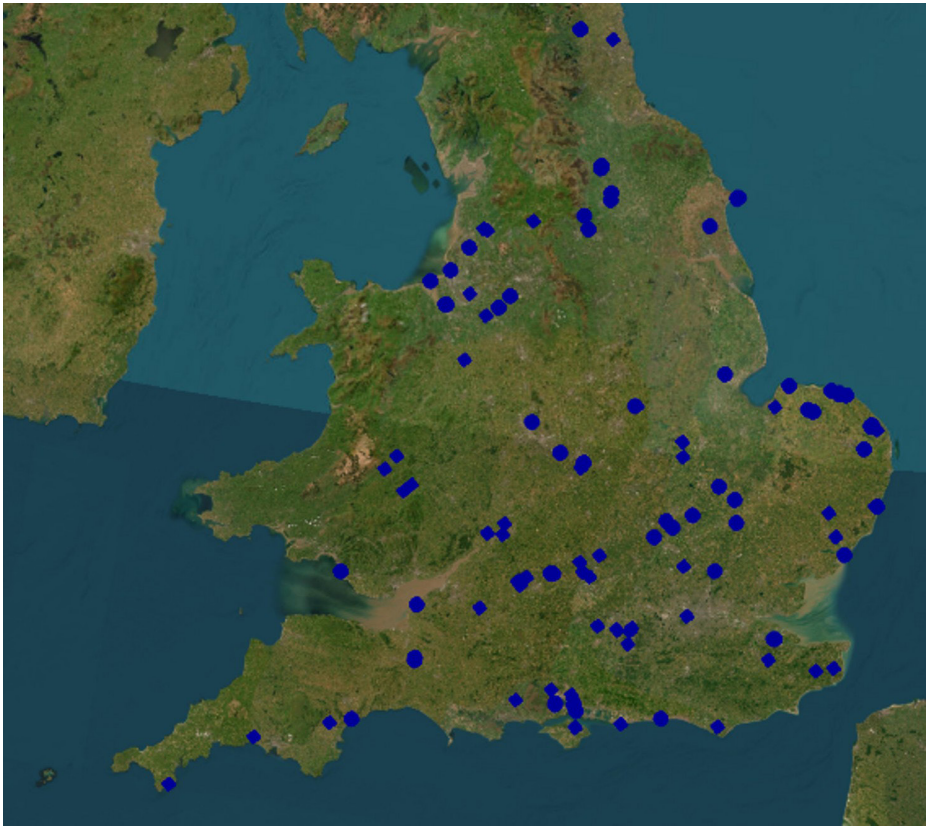

Plate 1. An example of the location of eligible sites using data for *Sympetrum striolatum* (Common Darter). Not all sites were used for the full period of the study, but at least five years of data were taken from each one. Mapping data from ArcGIS Earth. © Earthstar Geographics/esri.

reserve, such as spare ground after infrastructure development or when a gravel pit is finished, recording might start on a relatively open site, but vegetation might start crowding out dragonflies and also change the species mix (Moore, 1991). In the context of an increasing number of sites with time (Fig. 6), sites getting overgrown are balanced by new sites being added, but the effect cannot be discounted.

Site selection. Sites need to be accessible to the recorder and presumably the more interesting sites are recorded.

Inconsistency in recording of location. Inconsistency in recording location, particularly over a large site, can lead to loss of data

detected for this calculation. It may be possible to improve on the current analysis by using the site name to group grid references and so find more sites in the data, but this must be done carefully to avoid introducing inaccuracies. Cham *et al.* (2014) encountered similar issues.

Discussion and Conclusions

Both methods 1 and 2 show clear declines in dragonfly numbers, in contrast to more positive reports in previous analyses using proxies of freshwater insect numbers (Outhwaite *et al*., 2019; Pharaoh *et al*., 2023; Burns *et al*., 2023), but is in line with surveys using direct insect counts (Buglife, 2026; Riverfly Partnership, 2026) and the situation in the Netherlands (CLO, 2026). It might be that these analyses use a time period later than that used in other studies which had already found a less pronounced improvement towards the end of their time periods (Pharaoh *et al*., 2015). However, academic publications are not referencing *ad hoc* resources such as Taylor *et al*. (2021) and Bourne-Taylor (2026).

When the first attempts were made to assess trends in dragonfly populations, there were not enough standardised abundance data to calculate meaningful trends and non-standardised occupancy had to be used (Termaat, 2023) but there seems to be enough data now to estimate abundance trends of common species, even if occupancy modelling is not superseded. Where they show abundance decline with increased or steady occupancy, they imply a thinning out of the population, matching Rumschlag *et al.* (2020)'s finding with the effect of insecticides. Other stresses such as drought could have the same effect.

Bried *et al*. (2020) noted that reporting abundances in a record is not straightforward or possible in most portals, such as iRecord Dragonfly Species Group forms. Together with the ability to report if all species seen are recorded, this improves the type of analyses possible.

The results show an approximately 50% decline in counts of the 11 most frequently recorded Odonata species since 2005, with similar declines in both the Anisoptera and the Zygoptera, against a backdrop of increasing stresses in the water environment. In common with all trend analyses, these results have to be based on certain subjective assumptions, in particular the filter of minimum number of counts. Nonetheless, these results are in line with what is seen in riverfly monitoring counts. It is hoped that these results can inform the DEFRA species abundance index and governmental policy decisions.

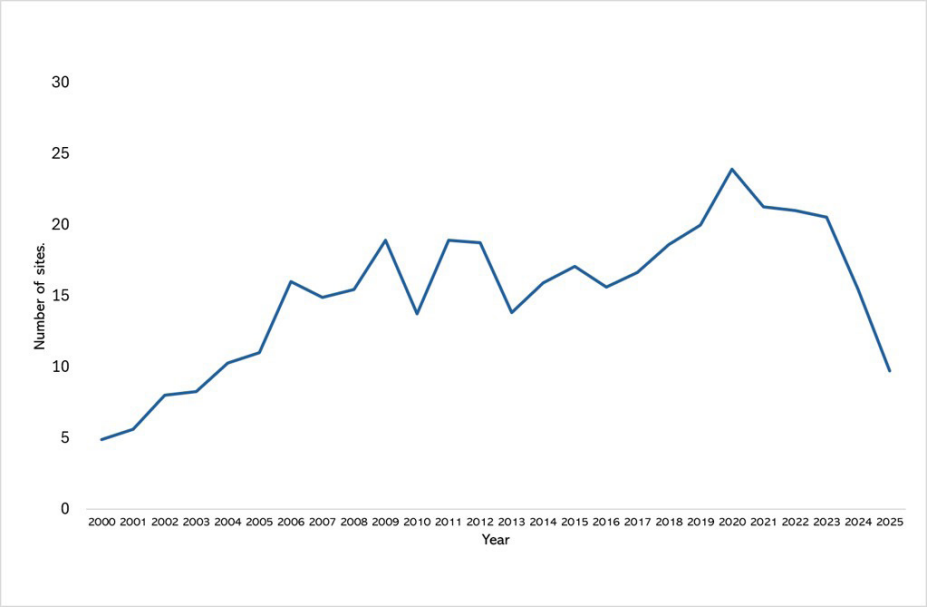

Figure 6. The average number of sites each year of the 11 most recorded odonate species.

Some stresses on dragonfly populations like climate change are part of a bigger societal discussion and loss of dragonfly sites are subject to individual planning decisions, but water quality is something we can relatively easily influence on a national scale.

For example, The House of Lords (2026) noted that Fipronil had the highest environmental risk score of all 1,600 chemicals screened by the Environment Agency. They acknowledged the sensitivity of dragonflies and other aquatic insects to pet insecticides and found the concentration and toxicity of pet insecticides a cause for concern, and that the lack of systemwide evidence was not proof of non-effect. They advocated a more precautionary approach to pet insecticides and to a reduction in the number of unnecessary treatments.

Water quality standards have to be brought up to date to allow for the modern stresses on the freshwater environment. Systemic insect poisons, some of which are already considered too dangerous to be used in agriculture, should be severely restricted, if they should be allowed at all. It is difficult to tease out correlations between concentrations of specific pollutants and dragonfly populations from the many other pollutants in the urban environment (Hadley *et al*., 2026) and laboratory studies of larval sensitivity to specific pollutants are needed. However, this should not be seen as justification for delay in regulating

these highly potent pollutants.

Recorders are encouraged to provide count data rather than in abundance bands, where this is feasible. A record of '50', even if it is approximate, is more useful than '21-100', as it can be used in calculations rather than just as a broad indication. Uploading the data as a spreadsheet into iRecord defeats iRecord's default abundance bands. Breid *et al.* (2020) dedicated their call for the recording of dragonfly abundance "to the tireless Odonata citizen scientists past, present, and future". We are counting on them - in other words - you - to keep counting for us!". It will help us protect dragonflies for the next generation.

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Victoria amazonica (Poeppig) Klotzsch (The Giant Water Lily) as an emergence site for *Anax imperator* Leach (Emperor Dragonfly)

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Summary

On 26 February 2025, 15 exuviae of *Anax imperator* were recorded fixed to the wall-like rim of the floating leaves of *Victoria amazonica* (The Giant Water Lily) at the Giant Water Lily Pond in the Sir Seewoosagur Ramgoolam Botanical Garden of Pampelmousses, Mauritius. Until now there have been no records of odonates emerging on this plant. In botanical gardens the species is present worldwide. The absence of emergence observations is almost certainly due to the massive introduction of goldfish and koi into the same pools.

Introduction

Victoria amazonica (Poeppig) Klotzsch (The Giant Water Lily), the so-called Victoria Regia, is present in many botanical gardens worldwide. This aquatic plant species is an outstanding feature for visitors to botanical gardens and the pools are generally a special attraction. The Sir Seewoosagur Ramgoolam Botanical Garden of Pampelousses, Mauritius, the oldest botanical garden in the southern hemisphere (Sir Seewoosagur Ramgoolam Botanic Garden, 2026), is one of the most well-known tourist sites worldwide. This report is of *Anax imperator* exuviae on the leaves of *V. amazonica* in this botanical garden

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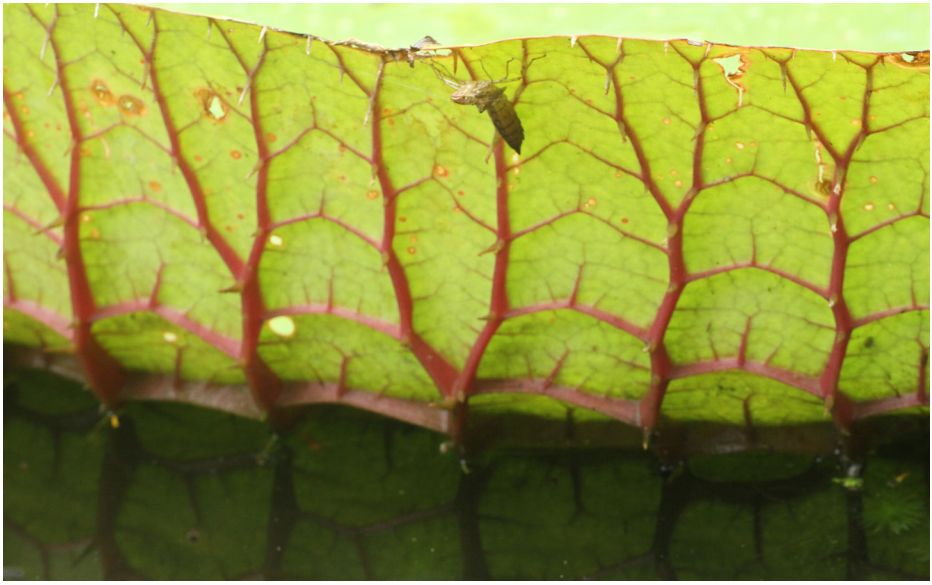
Observations

On 26 February 2025, 15 exuviae of *Anax imperator* (Emperor Dragonfly) were recorded attached to the wall-like rim of the floating leaves of *Victoria amazonica* (Plate 1). They were recorded at the Giant Water Lily Pond in the Sir Seewoosagur Ramgoolam Botanical Garden of Pampelmousses, Mauritius (20° 6' 28.75''S, 57° 34' 48.38''E); two of them were collected.



A



B

Plate 1. (A, B) An exuviae of *Anax imperator*, attached to the rim of a Victoria amazonica leaf in the Botanical Garden of Pampelmousses, Mauritius, 26 February 2025.

Discussion

Anax imperator uses vertical structures for emergence (Wildermuth & Martens, 2019). However, in European water lilies, only the stems with flowers are useful structures for this purpose. *Anax imperator* occurs in Mauritius and in the other Mascarene islands (Wildermuth & Martens, 2019).

Compared with those of other water lilies, the floating leaves of *Victoria amazonica*, as well as those of the newly described *V. boliviana*, form strong vertical structures at the rim of their leaves (Smith *et al*., 2022). These structures could be very useful for emerging dragonflies. Therefore, an emergence of odonates at these leaves would be expected to be common.

Victoria amazonica is naturally distributed in the Amazonian basin (Smith et *al*., 2022; Kew Science, 2026). This plant has an extreme prestige and is distributed worldwide in many botanical gardens. It is remarkable that, so far, there have been no emergence records of *A. imperator* or of any other odonate in British, Dutch, Swiss or German *Victoria* pools in Botanical Gardens. In these Botanical Gardens, *V. amazonica* grows in glasshouses only. Laister (2015) reported larval *A. imperator* in a temporary pool situated in a glasshouse in the Botanical Garden in Linz, Austria. He explained these records as resulting from females entering through open roof vents or doors for the purpose of oviposition. However, especially in Europe, most of these pools in botanical gardens harbour numerous goldfish and koi carp. Therefore, the aquatic fauna of these pools is extremely poor and probably explains the absence of records of odonate emergence.

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A review of the Red List status of the Odonata of Great Britain 2026

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Summary

This report highlights the most at-risk Odonata in Great Britain, promotes their conservation needs and sheds light on the factors threatening their associated freshwater habitats. A regional Red List assessment was performed following guidelines set by the International Union for Conservation of Nature. The 46 species assessed were categorised as follows: two Regionally Extinct, eight Endangered, three Near Threatened and 33 Least Concern.

Introduction

The aim of the International Union for Conservation of Nature (IUCN) Red Lists assessment is to identify those species at greatest risk from extinction. IUCN Great British (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.

This review (Colver *et al.*, 2026) was commissioned and partially funded by Natural England because the previous Odonata Red Data List for Great Britain (Daguet *et al.*, 2008) no longer accurately reflected the current state of the region's taxa.

Methodology

A regional assessment was performed using data from the BDS Recording Scheme database. It followed the steps and guidelines set out by the IUCN (IUCN, 2001, 2012a, 2012b; IUCN Standards and Petitions Committee, 2024).

1. **Determining which taxa and which regional populations to assess.**

   All 'breeding' taxa (taxa that have successfully reproduced within GB consistently for at least 10 years) were fully assessed. All other

taxa with GB records were identified as 'vagrants', did not undergo assessment and were assigned to Not Applicable (NA).

2. **Evaluating and assigning preliminary status categories to the regional population of each taxon using the IUCN Red List Categories and Criteria (IUCN, 2012b).**

   Taxa were evaluated against IUCN criteria to determine whether they met the set thresholds for a Threatened Species category. The Threatened Species categories are: Critically Endangered (CE), Endangered (EN) and Vulnerable (VU). Taxa can also be classified as Near Threatened (NT) if they come close to meeting category thresholds. Species that do not come close to meeting the thresholds are categorised as Least Concern (LC). The Regionally Extinct (RE) status was applied to species with evidence of historic breeding, but no recorded breeding within the past 30-year period.

   The criteria assessed population size reduction (Criterion A), geographic range (Criterion B) and population size (Criteria C and D). The British Dragonfly Society's (BDS) national Odonata Recording Scheme (ORS) database for England, Wales and Scotland formed the backbone of the species status assessments. In addition, occupancy modelling conducted by the UK Centre for Ecology and Hydrology provided population trend calculations for Criterion A, using ORS records for 1970-2021; the change in occupancy during 2012-2021 was the main measure of population change. Changes in Area of Occupancy (AOO) and Extent of Occurrence (EOO) for each species were estimated from tetrad-level analysis of records during two five-year periods, 2009-2013 and 2019-2023.

   For threatened category application under Criterion B, additional evidence is required of the following taxon characteristics: a severely fragmented population, a small number of known locations, continuing decline in habitat or population, and/or extreme population fluctuations. Current AOO and EOO were estimated from 2014-2023 data, using tetrad-level analysis and the construction of minimum convex polygons in QGIS, respectively.

   Information on taxa ecology and population characteristics were primarily gathered from academic research and population and habitat survey reports. In addition, both BDS County Dragonfly Recorders and its Dragonfly Conservation Group provided insight

into species-specific ecology, threats and trends, as well as knowledge regarding local populations, records and conservation action.

3. **Assessing the potential impact of interactions with populations outside the region on taxon extinction risk and assigning final categorisation (IUCN, 2012a).**

   Species may have their category 'uplisted' to a higher threatened category or 'downlisted' to a lower one or to Least Concern, depending on the existence and status of any populations outside of GB that may affect the risk of extinction of the resident GB population. Comparisons are made with a recent European Red List review that used 2000-2020 trend data (De Knijf *et al*., 2024a).

   For comparison with the new GB Red List categorisation, British Rarity Status was calculated from hectad (10 km × 10 km grid square) occupancy during 2019-2023, where Nationally Rare species are found in 15 or fewer hectads and Nationally Scarce species are found in between 16 and 100 hectads.

Results

Table 1 gives the updated Red List status for all species resulting from this review. *Sympetrum nigrescens*, which was previously treated as a distinct species, but Data Deficient (DD) in the previous review, is now regarded as a phenotypic variant of *Sympetrum striolatum*, so was not evaluated.

Discussion

Of the 57 species recorded in Great Britain (including two Regionally Extinct species), the Red List assessment for 11 (19%) was deemed Not Applicable. Great Britain now has a more diverse Odonata community, with 44 established breeding species, compared with 39 in the 2008 review.

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. One species, *Coenagrion scitulum*, has moved from Regionally Extinct to Endangered, following its discovery in Kent.

Encouragingly, the number and percentage of species classed as Threatened (EN, VU) or Near Threatened (NT) are slightly lower than in the 2008 Red List: down to 11 (28% of those assessed) from 12 (29%). Two species were re-categorised from Least Concern to Near Threatened: *Aeshna juncea* and *Ceriagrion tenellum*. The former is Endangered in Europe as a result of northward range contraction due to climate change. All 11 Threatened or Near Threatened species are considered to be habitat specialists, requiring range-restricted or specific environmental conditions to successfully reproduce. 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. Isolated populations of habitat specialists are at an increased risk of local extinction if their remaining areas of habitat become degraded without suitable management to maintain breeding conditions.

Thirty-three of the 46 species (72%) assessed were classified as Least Concern, including five new colonists (Not Applicable or Not Evaluated (NE)) in 2008): *Aeshna affinis*, *Anax parthenope*, *Chalcolestes viridis*, *Erythromma viridulum* and *Lestes barbarus*. Climate change and a lack of significant threats are considered primary factors resulting in population and range expansion of these species in GB, and indeed elsewhere in Europe. Species identified as Least Concern do not qualify for assignment to a Threatened category, but three such species (*Ischnura elegans, Lestes sponsa*, and *Sympetrum danae*) are exhibiting ongoing occupancy decline and their trends should be monitored closely.

The status of four species has improved and been re-categorised as Least Concern because of recent population growth (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 of these species, particularly in the case of *Isoaeschna isoceles*, which is increasing across its northern European range (Vinko *et al*., 2024). All four species have also benefitted from targeted conservation efforts, including site protection, resulting from their previous Red List threat categories, particularly *Isoaeschna isoceles*, which receives legal protection under the Wildlife and Countryside Act 1981.

Coenagrion armatum and *Oxygastra curtisii* both remain Regionally Extinct and are likely to remain so. Neither readily migrate long distances and the availability of suitable breeding habitat in Britain is limited, making natural recolonization unlikely.

Table 1. The assigned IUCN Red List status of GB Odonata species in the current and 2008 (Daguet et al.) reviews, compared with European population trend during 2000-2020 (↑ increasing, – stable, ↓ decreasing, *unknown) and British Rarity Status (NR = Nationally Rare, NS = National Scarce).

Species Name	Current GB Red List status	GB Red List status 2008	European Red List status and trend	British Rarity
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

Species Name	Current GB Red List status	GB Red List status 2008	European Red List status and trend	British Rarity
Ischnura elegans	Least Concern	LC	LC ↓	
Ischnura pumilio	Endangered	NT	LC –	NS
Isoaeschna isosceles	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 ↓	

Habitat degradation, loss and fragmentation resulting from human activity continue to drive declines in some species. Key drivers include invasive freshwater species, water pollution and increased freshwater abstraction. Climate change is likely to continue to drive range contraction in *Aeshna juncea, Aeshna caerulea, Coenagrion hastulatum, Leucorrhinia dubia* and *Somatochlora arctica* in Britain; all are exhibiting population decline on a European scale.

Odonata are receiving increasing attention and conservation effort in Britain. For example, the BDS 'Dragonflies on the Bog' project 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 (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).

The significant changes in the GB Red List illustrate how rapidly Britain's Odonata assemblage is changing. It is likely to continue to do so in response to ongoing pressures from climate change, human activity and land use change. This updated GB Red List now needs to be incorporated into environmental policy and planning, and into revised BDS criteria for the identification of Priority Sites.

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