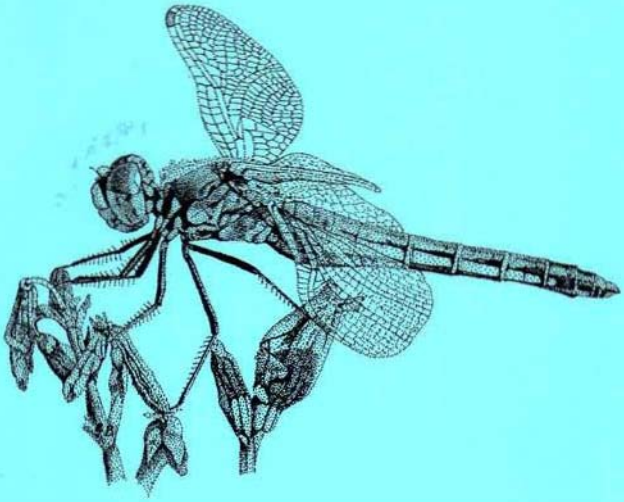
Journal of the British Dragonfly Society

Volume 21 Number 1 October 2005

Editor Dr Jonathan Pickup



The Journal of the British Dragonfly Society, published twice a year, contains articles on Odonata that have been recorded from the United Kingdom and articles on European Odonata written by members of the Society. The aims of the British Dragonfly Society (B.D.S.) are to promote and encourage the study and conservation of Odonata and their natural habitats, especially in the United Kingdom.

ADDRESSES

Editor:
J. Pickup,
129 Craigleith Road,
Edinburgh EH4 2EH
e-mail: jon.pickup@sasa.gsi.gov.uk

Secretary:
W. H. Wain,
The Haywain, Hollywater Road,
Bordon,
Hants GU35 0AD
Tel: 01420 472329

Librarian/Archivist:
D. Goddard,
30 Cliffe Hill Avenue,
Stapleford,
Nottingham NG9 7HD

Articles for publication should be sent to the Editor. Instructions for authors appear inside the back cover.

Back numbers of the Journal can be purchased from the Librarian/Archivist at
£2.75 per copy to members or
£5.50 per copy to non-members.

Ordinary membership annual subscription £15.00.
Overseas subscription £20.00.
All subscriptions are due on 1st April each year.

Life membership subscription £1000.

Other subscription rates (library, corporate) on application to the Secretary, who will also deal with membership enquiries.

B.D.S. website: www.dragonflysoc.org.uk

Front cover illustration: Yellow-winged Darter *Sympetrum flaveolum* at Dungeness, Kent, 11 August 1995, by Gill Brook.

Distribution and habitat of the Banded Demoiselle *Calopteryx splendens* (Harris) in Northumberland

MICHAEL JEFFRIES, HARRY T. EALES & GEORGE STOREY

MJ: Division of Environmental Management, Ellison Building, Northumbria University, Newcastle upon Tyne NE1 8ST, UK.
HTE: 11 Ennerdale Terrace, Low Westwood, Derwentside, County Durham NE17 7PN, UK.
GS: 36 Elsdon Road, Whickham, Newcastle upon Tyne NE16 5HZ, UK.

Introduction

The last decade has witnessed significant changes to the distribution and numbers of species of Odonata in the UK. Changes include range expansions (Cham, 2004a), the establishment and spread of a new species, the Small Red-eyed Damselfly *Erythromma viridulum* (Charpentier) (Cham, 2004b) and increasing numbers of migrant species (reviewed by Parr, 2004).

Eales (2003) outlined regional examples of these national trends within Northumberland, including the northward range expansion of the Ruddy Darter *Sympetrum sanguineum* (Müller), and increasing numbers of vagrant species for Northumberland, e.g. Emperor Dragonfly *Anax imperator* Leach and Migrant Hawker *Aeshna mixta* Latreille which appear on the verge of permanent establishment within the county. North-east England has always been a Cinderella region for Odonata, poor in species compared to the south whilst lacking Scotland's northern specialities. However, the recent changes make Northumberland a good venue in which to investigate the patterns and processes underlying range expansions by the British Odonata. In addition to the spread of highly mobile species of Anisoptera, Eales (2003) noted exceptional numbers of the Banded Demoiselle *Calopteryx splendens* (Harris) at one lake site. There is one record of *C. splendens* in Northumberland in 1769, but modern records start in 1988. By 2000, small colonies of the damselfly were established on meandering, low gradient stretches of several rivers in south-east Northumberland (Jeffries, 2001).

One problem with studies of range expansion is a reliance on *post hoc* interpretations of patterns. We know when a species was recorded but often do not know when it was not present. Negative records go unreported, even assuming that the significance of not seeing a species is appreciated in the first place. There then remains the classic problem that absence of evidence is not evidence of absence; a species may have been present at a site but went unseen so the negative record is not an accurate reflection of status. These problems afflict data for *C. splendens* in Northumberland. Whilst the species may be expanding its range this might be an artifact of no-one recording it in earlier years. This

paper presents both the positive and negative records for the region of Northumberland north of Tyneside, providing a baseline of recent negative records against which any future changes may show
Northumberland were used to examine differences between known positive and negative sites.

Methods

Northumberland records

All positive records of *C. splendens* in Northumberland held by the local recorder have been used to show known locations. In addition, negative records have been collated from systematic surveys carried out in southern Northumberland since 1991, extending further north in 2002 and 2003. For these surveys riversides were
or watched from vantage points offering views of 50 to 100 or more metres. Surveys were
regional flight period. The surveys have tended to concentrate on low gradient, meandering stretches of local rivers that apparently offer the most suitable habitat locally.

Characterizing habitat

Jeffries (2001) suggested that *C. splendens* in Northumberland was restricted to low gradient, well vegetated rivers, where a combination of narrow width and tall, steep banks, provided
between sites form which *C. splendens* had been recorded versus
River Habitat Survey (RHS) methodology (Raven *et al.*, 1998). RHS is a standard methodology developed by the Environment Agency
quality of river habitats in the UK, using a survey
describing visible features of the river channel, riparian habitat and adjacent land use over a 500m length of river,
experimented with RHS assessment of *C. splendens* sites in Northumberland in 2002, using a simplified version of the RHS. Rather than assessing habitat over the standard 500m length of river with ten separate spot-check sites along its length, he characterized the habitat immediately around the site, treating it as a single spot check. No distinct differences were found between positive and negative sites except a slight positive association with adjacent tilled land. However, his survey included all sites visited, including what might be entirely
reached. To look for differences between negative and positive sites, the strategy modified for the 2003 survey,
support *C. splendens*. The RHS methodology records in-channel, bankside and adjacent landscape, primarily relying on simple presence or absence. The bankside and land use data are recorded separately for both sides of the river. For this survey the assessments were
bankside vegetation

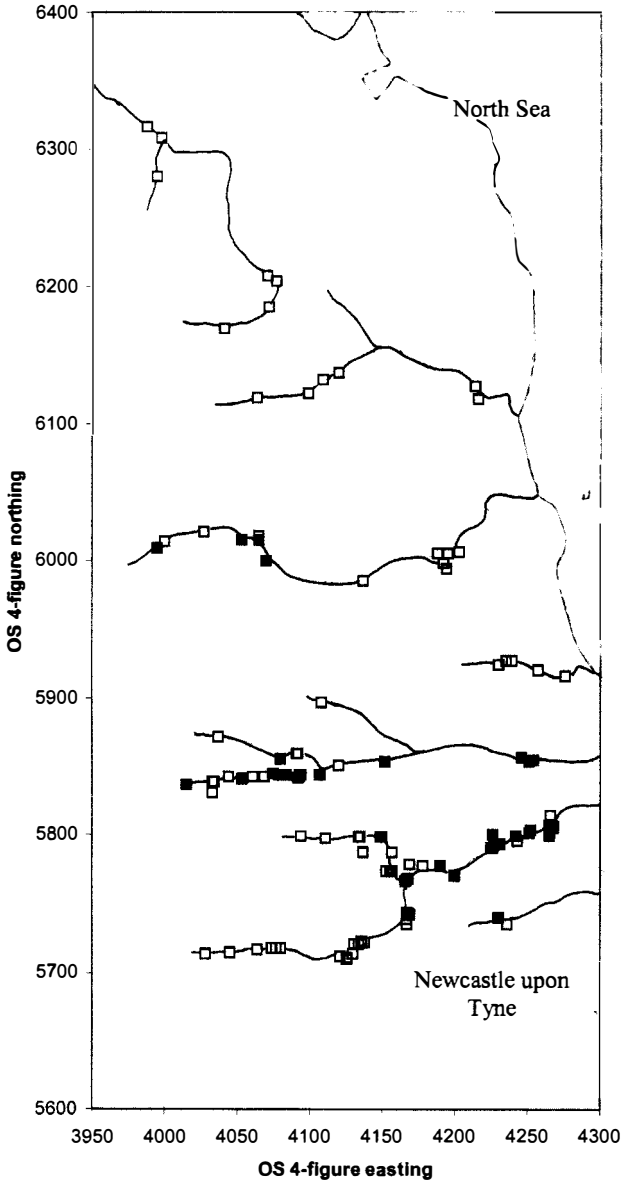


Figure 1. Positive and negative records of the Banded Demoiselle *Calopteryx splendens* in Northumberland north of Newcastle upon Tyne, 1988–2003. ■ = positive records, □ = negative records.

e.g. 'left bank material', 'left bank face vegetation structure', 'left bank top vegetation structure', 'land use within 5m of left bank top'. This multivariate dataset was subject to principal component analysis to highlight major patterns in the characteristics of the sites. This technique takes all the disparate information collected for each site and uses it to depict each site on an ordination so that sites with many features in common are grouped close together and those that show considerable differences are plotted further apart.

Analysis

Northumberland records

Figure 1 shows a plot of positive and negative records. Note that this is not a conventional dot map or tetrad plot. Each point is plotted by its six-figure British National Grid Reference, to locate the position more exactly, relative to the river systems. The recorded range of *C. splendens* has increased beyond that given by Jeffries (2001). In particular, the Banded Demoiselle was found on the River Coquet in 2003, an apparent northward expansion. The main Coquet sites are in and around the town of Rothbury, alongside a heavily used public footpath. This stretch of river was included on Storey's 2002 survey and proved negative (Storey, 2003); hence the 2003 records appear to be an expansion rather than just an overlooked population.

Many negative records are also shown in Figure 1. We now have a variety of negative site records in northern Northumberland, many on what look to be suitable sites on the more northerly Rivers Aln and Till, and these provide a baseline against which future changes can be more reliably judged. The following apparently suitable, negative sites are accessible or visible from bridges. Sites on the River Aln: Broomepark NU 099122, Bridge End NU 109132, Aberwick Mill NU 120137, Lesbury Road bridge NU 214147, Stepping Stones NU 216118. Sites on the Rivers Breamish/Till: Harehope bridge NU 077204, New Bewick NU 071208, Doddington Bridge NT 998308, Doddington footbridge NT 988316, Wooler NT 995280.

Habitat

The result of the PCA analysis of site characteristics is shown in Figure 2. If the positive sites differed from the negative sites in a systematic fashion then the two types of sites may show up as separate sets on the ordination. Positive and negative sites are generally interspersed in Figure 2 suggesting that there are no characteristic differences between the two. There is some grouping of negative sites towards the left hand end of PCA axis 1, all exhibiting narrow stream width (1–2m) and a very choked habitat. The ordination shown in Figure 2 plots the two most important axes of the PCA, representing the most important variation in the data set. PCA axis 1 captures 16 per cent of the variation in the data set, primarily representing wider sites (towards the right) versus narrower (on the left). PCA axis 2 represents an additional 13 per cent of the information in the data set, the spread primarily reflecting two unusual sites, one of which was wide, exposed,

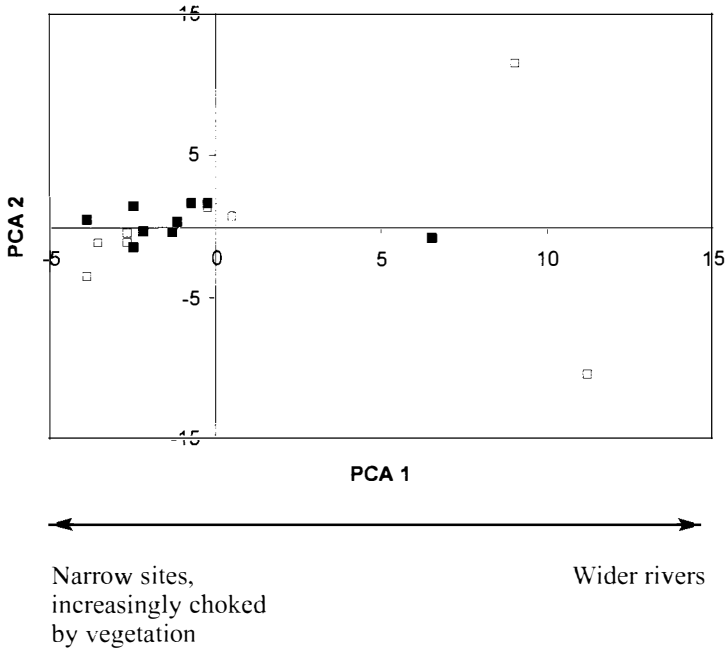


Figure 2. Principle component analysis ordination of the River Habitat Survey data for 17 sites in Northumberland. Each point represents one of the 17 sites, ■ = sites from which the Banded Demoiselle *Calopteryx splendens* has been recorded, □ = sites from which *C. splendens* has not been recorded. Sites sharing many characteristics are close together, sites that differ considerably are far apart.

unvegetated and in rough pasture, the other a wooded, steep valley. Removing these two from the original data set and re-analyzing produces no more distinctive separation of positive and negative sites. The results suggest that *C. splendens* in Northumberland may be more catholic in habitat use than previously assumed (Jeffries, 2000).

Discussion

Collation of these recent records shows that *C. splendens* is now even more widespread in Northumberland. Some apparently new records are not very recent (e.g. several reports from the eastern River Blyth in 1997) but other records do appear to represent genuine range expansion, notably the 2003 records for the Coquet, from which the species has never previously been reported, and records from other sites that were negative in 2002. Records plotted as conventional tetrads (Figure 3) show a consolidated bridgehead in southern Northumberland but, as Figure 1 shows, the actual distribution is patchily spread throughout partial sections of local rivers. Collation of survey records has provided many negative records. Whilst these are not proof that the species was absent,

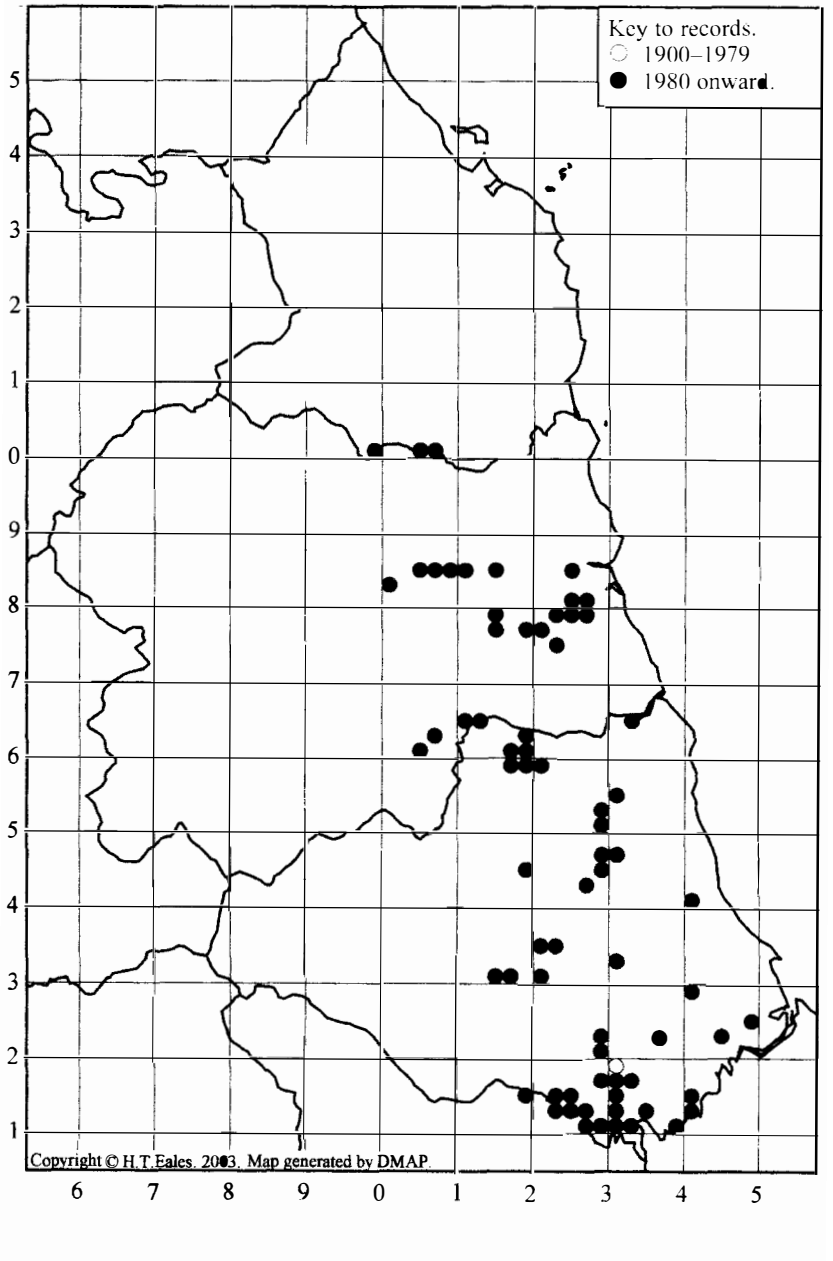


Figure 3. Recorded distribution of the Banded Demoiselle *Calopteryx splendens* in Northumberland and County Durham, 1988–2003 inclusive.

the negative records provide some basis against which any
judged. Figure 1 shows an array of negative sites on the Rivers
which
no highly restrictive requirements. Results from the 2002 and 2003 surveys have found *C. splendens* on wider, less sheltered stretches than before. The Rivers Aln and Till include many such lengths. Available habitat appears to be no restriction to the northward spread of the Banded Demoiselle.

References

Cham, S. 2004a. Odonata range changes. *Darter* (Newsletter of the Dragonfly Recording Network) **21**: 1–2

Cham, S. 2004b. Observations on an inland population of the Small Red-eyed Damselfly *Erythromma viridulum* (Charpentier) with notes on the first discovery of larvae in Britain. *Journal of the British Dragonfly Society* **20**: 31–34

Eales, H. T. 2003. Here be dragons. *Dragonfly News* (Newsletter of the British Dragonfly Society) **43**: 17–19

Jeffries, M. 2001. The Northumbrian frontier of the Banded Demoiselle *Calopteryx splendens* (Harris). *Journal of the British Dragonfly Society* **17**: 55–58

Parr, A. 2004. Migrant dragonflies in the 21st Century. *Darter* (Newsletter of the Dragonfly Recording Network) **21**: 4–5

Raven, P. J., Holmes, N. T. H., Dawson, F. H., Fox, P. J. A., Everard, M., Fozzard, I. R. & Rouen, K. J. 1988. *River Habitat Quality. The physical character of rivers and streams in the UK and the Isle of Man.* Environment Agency, Bristol.

Storey, G. 2003. *Distribution and colonisation of the Banded Demoiselle,* Calopteryx splendens *(Harris) on the Rivers Pont, Wansbeck, Blyth and Coquet in Northumberland.* Unpublished BSc (Hons) Thesis, Division of Environmental Management, Northumbria University, Newcastle upon Tyne.

Population studies of the Southern Damselfly *Coenagrion mercuriale* (Charpentier) in the New Forest. Part 9. The Crockford streams, 20 years on

DEREK K. JENKINS

7 Lakewood Road, Ashurst, Southampton SO40 7DH, UK

Summary

Following detailed monitoring of the Southern Damselfly *Coenagrion mercuriale* in the Crockford area of the New Forest between 1985 and 1994, a follow up survey was carried out in 2004 to assess the effect of changes to the climate and habitat over the intervening years. Population numbers in all the sections of the stream system studied were at higher levels than previously recorded and were still increasing in mid June, when poor weather intervened.

Introduction

In 1984, the conditions for a modified 'Pollard Walk' (Pollard, 1977) were developed in order to monitor the Southern Damselfly *Coenagrion mercuriale* (Charpentier) along the upper Crockford Stream (Jenkins, 1986a). In order to obtain consistent counts, observations were only made when the following parameters were met:

1) Wind Force 3 or less.
2) Air temperature of greater than 16°C.
3) Time of day - between 1100h and 1400h.
4) Cloud cover less than 5 tenths. Subsequently the amount of cloud was found to have a large effect on the numbers of damselflies observed and therefore observations made in full sun were desirable but rarely possible.

From 1985 to 1994, *C. mercuriale* was monitored over most of the Crockford area (divided for convenience into the Upper Crockford Stream, Lower Crockford Stream, Lower Peaked Hill tributary and Upper Peaked Hill West tributary, see Jenkins (1986b) for map). The results have been published for the years 1985–1989 (Jenkins, 1991) although detailed counts were continued for a further five years. From these results it was concluded that, apart from a slow increase along Lower Peaked Hill stream, *C. mercuriale* populations were relatively stable and that variation in the conditions at the time of counting, particularly cloud cover and possibly the previous overnight temperature, made any real annual fluctuations in populations difficult to detect. No correlation was found between number of damselflies observed and the severity of the

previous winter, as might have been expected for a bivoltine species near the northern edge of its range.

Although poor weather occurred at various times throughout the flight seasons during this ten-year survey, a period of fine settled weather usually occurred at some time between mid June and early July when populations passed through a clearly defined peak. If conditions were poor at the beginning of the flight season, maximum emergence occurred later than usual when the weather improved while, if conditions deteriorated later in the season, numbers fell immediately with the onset of bad weather. Thus, by counting at intervals of at most a week through the season, it was possible to obtain an estimate of maximum numbers on the wing. Subsequent mark/recapture work (Jenkins, 1995, 1998) suggested that maximum counts were at least four to five times lower than the overall population size. Nevertheless, the maximum count is useful as a quick means of determining major changes in population density over a period of years.

Having established the relative stability of the various colonies, no regular monitoring was carried out after 1994, although the sites were checked on an *ad hoc* basis for obvious signs of decline or damage to habitat.

Effects of temperature on populations

During the original monitoring period, the first frosts were usually recorded in September and there were years when winter daytime temperatures did not rise above 0°C for several days. In 1992, for example, the main Crockford stream, apart from an initial 20m stretch warmed by the upwelling spring-fed stream at the outlet, was covered in thick ice for over a week. Since then, winters have steadily become warmer and summers more unpredictable. Thus a survey of *C. mercuriale* in Hampshire (excluding the Crockford area due to previous monitoring) was hampered by cloud, rain and wind throughout the flight season (Thurner & Stevens, 1998). There was no well defined peak of abundance and at one site the highest numbers occurred at the beginning of August, when a period of fine, settled weather finally occurred. Access to the Forest in 2001 was prevented by the Foot and Mouth outbreak, but in 2002 and 2003, hot dry conditions prevailed from July to September and June to September respectively. Correspondingly, *C. mercuriale* populations peaked rather late in 2002 and breeding pairs were still present well into September, while in 2003 breeding was largely over by mid August. 2004 started well with warm sunny spells at the end of April and from late May to mid June but the weather deteriorated after this, although the first hard frost did not occur until November.

The changes in weather patterns have been ascribed to climate change and, whether due to natural or human causes, the effects can clearly be seen in the extended flight season of *C. mercuriale*. In the 1980s, the first *C. mercuriale* was usually recorded around the third or fourth week in May and the last had disappeared by early August. For the last few

years, fully coloured males have been seen by
date of 6 May, and the flight season now extends well into September with last records for 2002 and 2003 of males on 28 and 25 September respectively. Even in 2004, when the weather was poor from mid June onwards, there were still six solitary males at Lower Crockford, five at Lower Peaked Hill and nine at Upper Peaked Hill West on 3 September.

Effects of habitat change on populations

The change in climate may also have had a marked impact on the habitat. The valley mires have become much wetter
the Crockford Stream and the Upper Peaked Hill East and West tributaries. Until the early 1990s, water from the spring feeding Crockford Stream emerged from a pipe and flowed
Moor. The ground on either side of the stream was
without
summers, the heath to the east of the stream was
west side, several new
C. mercuriale in this area is now considerably

Further downstream, in the centre of Deep Moor, the former single stream with
has split into so many small runnels that the main flow is now difficult to determine. Even further downstream, a Bogbean (*Menyanthes trifoliata*) dominated mire has expanded slightly and become wetter, but there has been little obvious
stream beyond this mire. Similar changes are ev
narrow flows have either broadened considerably
This was noticeable even before weirs were constructed downstream in 2001. Recent winters have had little effect on the tributary at Horsebush Bottom. Although the winter flow here has probably increased and the source area has become boggier, the stream still dries out in summer if there are a few
C. mercuriale here and between one and seven males have been recorded annually from 1998 to 2003. These sightings tend to occur when
stream coincides with maximum emergence elsewhere at Crockford and suggests dispersion due to population pressure. In 2004, the weather pattern was such that the stream dried out at the end of April and remained dry,
July and no *C. mercuriale* were found.

Over the twenty-year period there has been remarkably little change in vegetation. myrtle (*Myrica gale*) has increased, mostly in bankside density rather than height, and scrub has spread, mostly along the Lower Crockford Stream and Lower Peaked Hill stream, but does not, as yet, appear to be a major threat to the suitability of the habitat. However, at the bottom end of the Crockford Stream, just above the junction with Horsebush Bottom, Bog-myrtle has now grown much taller and no *C. mercuriale* are

now present. In 1991, there were sufficient *C. mercuriale* here to enable limited mark recapture experiments to be carried out (Jenkins, 1995). A belated 'one-off' conservation effort to clear the banks has resulted in even denser growth. This is in contrast to a short length of the Lower Crockford Stream, some 200m below the road bridge where *C. mercuriale* has successfully recolonized a section of bank recently cleared of dense scrub. However, in the former case the area is isolated by a scrub barrier restricting recolonization, while in the latter, *C. mercuriale* were already present a short distance downstream and in runnels in the valley mire to the west.

Table 1. Population counts of *Coenagrion mercuriale* at the four Crockford stream sites (see Jenkins, 1986b) in 2004

Site	Date	Approx.Time	Males	Females	Total
Upper Crockford	7 June	1100h to 1200h	319	135	454
	15 June		440	217	657
	25 June		307	88	395
	23 July		136	18	154
Lower Crockford	7 June	1200h to 1230h	203	75	278
	15 June		299	146	445
	25 June		160	61	221
	23 July		115	11	126
Lower Peaked Hill	7 June	1230h to 1300h	427	169	596
	15 June		528	291	819
	25 June		330	115	445
	23 July		234	36	270
Upper Peaked Hill West	7 June	1300h to 1345h	627	171	798
	15 June		717	296	1013
	25 June		463	130	593
	23 July		240	38	278

2004 population study

The changes described above, which have occurred since the last detailed monitoring at Crockford ceased in 1994, suggested that a reappraisal of the health of the *C. mercuriale* populations would be valuable. For consistency, the same methodology involving a 'Pollard' type walk was used and the same line of the original stream course was followed as far as possible. In 2004, there was a week of dry warm weather at the end of April and a possible teneral *C. mercuriale* was seen at Peaked Hill on 27 April. A series of dull days followed, often starting clear but clouding over before mid morning, and the first confirmed record, a single fully coloured male on May 10, was later than expected. Good weather from mid May onwards resulted in a very rapid population increase through to mid June, with only a temporary set-back at the end of May due to 2–3 days of cold easterly winds. Subsequently the weather deteriorated badly and remained poor for the remainder of the summer. Peak populations were recorded on 15 June, an exceptionally

early date, and counts never recovered to more than 50–60 per cent of those of 15 June. Details are given in Table 1 for days on which all four sites were visited, although quick checks were made at Peaked Hill on suitable days between 15 June and 23 July to confirm the population decline.

The average counts recorded during 1985–89 (from Jenkins, 1991) are compared with those for 2004 in Table 2. Counts in 2004 were higher at all four sites, most notably at Lower Peaked Hill where the stream still continues to mature and at Lower Crockford, where some 20 per cent of the total was found in the newly created habitat.

Table 2. Comparison of population counts of *Coenagrion mercuriale* at four sites on the Crockford streams between 1985–1989 and 2004

Site	Average maximum count 1985–1989	Maximum annual count	Maximum count 2004
Upper Crockford	243	358 (1985)	657
Lower	146	186 (1989)	445
Lower Peaked Hill	163	422 (1989)	818
Upper Peaked Hill West	521	900 (1989)	1013

Although numbers may have been boosted by the unusually hot and dry weather in the summers of 2002 and 2003 and at the beginning of the 2004 season, *C. mercuriale* appears to be doing well in all parts of the Crockford area and there has been no obvious detrimental effect from the increasing water levels in the upper section of Crockford and Peaked Hill streams. Bog-myrtle has increased over the last 20 years along sides of the more open stretches of water, but remains reasonably short and has had little effect on the density of *C. mercuriale*. In the future it might be beneficial to remove Bog-myrtle from some sections, but only if combined with annual monitoring to check for excessive regrowth. The loss of *C. mercuriale* from the bottom end of the Crockford area should provide sufficient warning of the risks.

References

Jenkins, D. K. 1986a. of *Coenagrion mercuriale* (Charpentier) at a New Forest site using a modified "Pollard Walk". *Journal of the British Dragonfly Society* **2**: 17–20

Jenkins,
Part 2. Lower Crockford stream and its Peaked Hill tributary, 1985. *Journal of the British Dragonfly Society* **2**: 37–41

Jenkins,
Part 4. A review of the years 1985–1989. *Journal of the British Dragonfly Society* **7**: 1–3

Jenkins, D. K. 1995. A population
Part 6. Mark/recapture programme. *Journal of the British Dragonfly Society* **11**: 10–14

Jenkins,
Part 7. Mark/recapture
Society **14**: 1–5

Pollard, E. 1977. A method for assessing changes in the abundance of butterflies. *Biological Conservation* **12:** 115–134

Thurner, [illegible]

Southern Damselfly (Coenagrion mercuriale) *in Hampshire (New Forest, Test Valley and Itchen Valley).* Environment Agency.

Migrant and dispersive dragonflies in Britain during 2004

ADRIAN J. PARR

10 Orchard Way, Barrow,

Summary

2004 was not an outstanding year for migration, perhaps in part because of the rather variable weather during the summer. In particular Red-veined Darters *Sympetrum fonscolombii* faired poorly. Some significant arrivals were however
the month of August. High points of 2004 included a scattering of Lesser Emperors *Anax parthenope* throughout England during the course of the summer, a small influx of Yellow-winged Darters *Sympetrum flaveolum* to the east coast, and more spectacularly, a sighting of a Scarlet Darter *Crocothemis erythraea* in Cumbria, this record complementing one from Guernsey in the Channel Islands. A Southern Migrant Hawker *Aeshna affinis* was also seen in the Channel Islands, this time on Jersey. Perhaps the real highlight of 2004 was the continued consolidation of our new colonist species. The Small Red-eyed Damselfly *Erythromma viridulum* showed
further immigration was also noted. While breeding has still to be proven, it is also becoming increasingly probable that the Southern Emerald Damselfly *Lestes barbarus* is establishing itself both in Kent and Norfolk.

Account of Species

Important records received by the Migrant Dragonfly Project during 2004 are summarized below. For a summary of events in Britain during 2003 see Parr (2004).

***Calopteryx splendens* (Harris) – Banded Demoiselle**

During 2004 a number of individuals were observed near the east coast, well away from the riverine habitats typical of this species. 'Several' were reported from unexpected sites in County Durham over 12 and 13 June (per MH), coincident with the appearance of a Lesser Emperor *Anax parthenope* and also a Black-tailed Skimmer *Orthetrum cancellatum*, which is almost as rare to that area. Several were also present at the Long Pits, Dungeness, Kent over the period 15–21 June, with a peak count of 16 on 16 June (DW). In addition, an individual was seen at Bradwell-on-Sea, Essex on 16–19 June (SD), and one was at Landguard, Suffolk on 18 June (NO). These observations may represent the outcome of some sort of dispersive event. There is circumstantial evidence that the species may be an occasional immigrant to our shores, e.g. at the start of the great Darter influx of 1995 (Mendel & Marsh, 1996) a male was found along with

Yellow-winged Darters *Sympetrum flaveolum* early one morning in grass near the shoreline at Sizewell, Suffolk. Since a wandering *C. splendens* was also reported from Cumbria in an upland area some 10km from the nearest breeding sites during early June (DC), the precise basis for the 2004 records remains uncertain. The period 7–16 June was associated with high pressure over central Europe, drawing warm continental air into Britain. This was then followed by the passage of a cold front on 17 June, bringing blustery west to northwest winds (Meteorological Office, 2005).

***Lestes barbarus* (Fabricius) – Southern Emerald Damselfly**

After 2003 (Parr, 2004), this species was again recorded from Sandwich Bay in Kent (PF *et al.*) and from Winterton Dunes in Norfolk (PT, RF *et al.*). At Sandwich Bay, the first individual was seen on 15 July, and reports continued at least until the end of August. The maximum count was 15 (on 7 August) and ovipositing pairs were seen on several occasions. Forrest (2005) describes events in more detail. At Winterton Dunes the first individuals were seen on 11 August, and low numbers of males continued to be reported from various localities along a 1km stretch of the dunes until 28 August.

In Kent the first sighting took place during a period of low migration activity and numbers then built up gradually, perhaps implying that the population here may have been locally bred. Certainly, with oviposition having been noted during the summer of 2004, the potential for future breeding at the site seems high, although it should be noted that the site became temporarily contaminated with seawater during early January 2005 (P. Forrest, pers. comm.). In Norfolk the first sightings coincided with a period of more obvious immigration (see below). Also, no females were definitely recorded. Although there were records from the site during both 2002 and 2003 (Parr, 2004), the precise status of the species at this locality remains unclear. The sporadic sighting of small numbers of damselflies from various locations along the Dunes suggests that these Norfolk individuals may be rather elusive, in marked contrast to their behaviour in Kent. This may however simply reflect a difference in habitat rather than status.

***Pyrrhosoma nymphula* (Sulzer) – Large Red Damselfly**

One was seen and photographed at Sandgarth (north of Voe), on central Mainland, Shetland over the period 29 June–3 July (via MP). Although the species occurs in Orkney, this is the first record for Shetland.

***Erythromma najas* (Hansemann) – Red-eyed Damselfly**

The second positive identification for the Isle of Wight was recorded on 30 July (DD). This species is known to be expanding its range in England (Brooks, 1999).

***Erythromma viridulum* (Charpentier) – Small Red-eyed Damselfly**

This species is now well-established in Britain, and is thus no longer covered in full detail. The year was however noteworthy for a major expansion of the UK range. Several records were received from Hampshire and the end of the first week in August saw the

start of a period during which many new inland sightings occurred, including the first county records for Cambridgeshire, Northamptonshire, Buckinghamshire and Warwickshire. In this last county, a few individuals were seen near Rugby on 15 August (PR), making this the most north-westerly record from Britain to date.

In addition to the range expansion, a significant fresh immigration was also observed in coastal Norfolk. Several hundred were seen at Winterton Dunes on 11 August and later that day individuals were seen roosting 'several to every bush or tree' in scrub along a 3–4km stretch of the dunes (PT *et al.*). High numbers were also reported during the following week. Elsewhere on the Norfolk coast, waves of immigration were also noted at Eccles-on-Sea, with the largest on 4 September (NB). It is not known whether the fresh immigration and the inland range expansion were in any way related; it may well simply be that conditions for dispersal were favourable in many areas of north-western Europe during the year. The first records for Jersey, Channel Islands, were also received during late July 2004 (JM).

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

Individuals were noted as being unusually common at Berrow, Somerset on 14 August and at Wrabness, Essex on 15 August, perhaps suggesting a degree of migration. Sightings during August and September from the Montgomery Canal, Mongomeryshire (MW) apparently represent the first records for mid Wales, although the increasing numbers seen as the season progressed suggest that the species may already be well established in the area. Elsewhere a male was observed at Baldrine, Isle of Man on 18 September, and the first confirmed Scottish records were received during the year (although there had previously been a record of a 'possible' from Dumfriesshire at the end of August 2003). Singles were recorded at Lochmaben, Dumfriesshire in September and at Peterhead, Aberdeenshire in July (per PB & DC). There was also a record from Barony, Ayrshire on 29 August (FS).

***Aeshna affinis* (Vander Linden) – Southern Migrant Hawker**

A male was photographed at Noirmont headland, Jersey on 8 August 2004, but was initially passed over as simply a bright Migrant Hawker *Aeshna mixta*. Its true identity was brought to light when the photograph was examined in early 2005 by Mr. R. Long, one of Jersey's leading naturalists. This is the second time in seven years that a similar event has happened to Mr. Long (see Long, 2000). Given this fact, and bearing in mind that every individual that arrived is unlikely to have been photographed, it seems that *A. affinis* may now be a reasonably frequent visitor to Jersey. It also strongly hints at the possibility that this species may be being overlooked in southern England. Currently there is only an old (1952) record from Kent, and it is probable that *A. affinis* was seen in Avon during 1992 (Holmes, 1993). However, the species has been recorded fairly regularly as an immigrant in the Netherlands during recent years, with the possibility that occasional breeding may have occurred (Ketelaar, 2002).

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

The following records have been accepted by the Odonata Records Committee (two further submissions currently remain under consideration):

27 May	One near Truro, Cornwall (G. Thomas).
7 June	One at Lower Lydbrook, Gloucestershire (J. Phillips).
13 June	One near Sunderland, County Durham (D. Foster, M. Hunter).
22 July–8 August	Intermittent sightings of males (one photographed), including two together on 4 August and with possibly up to four in total, at Dungeness, Kent (P. Akers *et al.*).
24–26 July	Male photographed at Priddy Mineries, Somerset (J. Thomas, S. Holdsworth).
31 July	One at Merstone Manor, Isle of Wight (D. Dana).

Despite the very low level of immigration shown by Red-veined Darter *Sympetrum fonscolombii*, a species that often accompanies it on migration (Parr *et al.*, 2004), the number of sightings for *A. parthenope* held up reasonably well, with two or three phases of immigration being noted. Records remain regular at Dungeness, and the presence of several individuals there during a generally uneventful year could even imply that a small resident population has now been established. By contrast, there were no sightings during 2004 from its other regular site at Bake Lakes in Cornwall, although the outcome of oviposition observed in 2003 (Parr, 2004) remains open, given that the generation time is normally two years (Brooks, 1999).

***Libellula quadrimaculata* L. – Four-spotted Chaser**

One at Sullom Voe, Shetland on 12 August was the third record for these islands. An unidentified Chaser *Libellula* sp. seen on Fair Isle on 6 September is also likely to have been this species (via MP).

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

Early June produced the first confirmed county records for Worcestershire when individuals were noted along the Avon between Pershore and Strensham (via MA). In addition to adults, a single exuvia was also discovered, so an established breeding population is perhaps now present in the region. Elsewhere, an immature was observed near Gilling Down, Somerset on 2 June (PD via DS), representing the first record for the county away from the River Avon area. A male was also photographed at the Testwood Lakes in Hampshire (LS via PL) on 13 June and, while the species is well know from the Dorset/Hampshire border, this is a new area.

Following the atypical record from Devon during 2003 (Parr, 2004), the continued sightings from unexpected areas strongly suggest that this species is currently undergoing significant range expansion.

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

The following record has been accepted by the Records Committee, representing the sixth record for Britain (all since 1995):

30 August Immature male at Bowness NR, Cumbria (T. Reid).

In addition, two mature males, one of which was photographed, were reported from Guernsey, Channel Islands on 31 July, with at least one remaining until 21 August (J. Medland, B. Wells). It should be noted that 31 July also saw the appearance of *Anax parthenope* on the Isle of Wight.

***Sympetrum striolatum* (Charpentier) – Common Darter**

The only report of note was of *c.* 26 caught at a UV light at Bradwell-on-Sea, Essex between 30 July and 9 September, with a further singleton on 28 September (SD). The maximum count for one day was four, on 5 August.

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

It was a very quiet year for this species by modern standards, with only limited immigration and sporadic records from breeding sites, with the exceptions of Spurn, East Yorkshire and Dungeness, Kent which faired somewhat better. Some sites may have been under-watched.

The season started on 14 May when a dragonfly thought to be of this species was seen at Portland, Dorset. During early to mid June, individuals were reported from Windmill Farm, Cornwall; Portland, Dorset; Dungeness, Kent; Bedfords Park, Essex; and Spurn, East Yorkshire. At least some records are likely to refer to locally bred individuals since many sites have a history of past breeding. Numbers were generally very low, with sometimes just isolated singletons being noted. At Dungeness, seven were seen on 16 June. On the 27 and 28 June, a small immigration appeared to take place with records from the Isle of Wight and Nottinghamshire, and an additional sighting from Guernsey, Channel Islands (individuals here remained throughout the summer). Later in the season, occasional individuals put in an appearance at Windmill Farm, Dungeness and Spurn, with other possibly locally bred individuals also being reported from Middleton, Lancashire and Kelling, Norfolk . The latest record of the year was of a singleton from Somerset on 14 August. In contrast to many recent years there was no evidence for an autumn generation during 2004.

***Sympetrum flaveolum* (L.) – Yellow-winged Darter**

A singleton was reported from near Whitstable, Kent on 30 June (GH). Between 7 August and 4 September a small influx took place along the east coast, although fewer than 10 individuals were seen in total. Records were received from Walton-on-the-Naze, Essex; Orford Ness, Suffolk; Winterton, Norfolk; near Saltfleetby, Lincolnshire; and Flamborough and Filey, East Yorkshire. Regrettably, individuals rarely lingered.

***Sympetrum sanguineum* (Müller) – Ruddy Darter**
Twelve were caught at a UV light at Bradwell-on-Sea, Essex between 22 July and 22 August (SD). Records peaked during the first few days of August.

***Sympetrum danae* (Sulzer) – Black Darter**
Some notable late season movements were observed during 2004. In Lancashire there were reports of significant dispersal towards the coast during August and early September, with a record count at Birkdale Sandhills LNR on 9 September (PS). Elsewhere, the first site record for Dawlish Warren NNR, Devon occurred on 14 September (JF) and individuals were seen on 27 September (two), 28 September and 28 October at Spurn, East Yorkshire (BS).

Conclusions

The year 2004 was a relatively quiet one for dragonfly migration in Britain, at least in terms of volume. However, the now regular arrivals of 'southern' species continued, with a good range of species being involved, even if numbers were low. *Erythromma viridulum*, our new colonist species, also continued to do well. *Lestes barbarus* similarly seems to be in the process of colonization, although given an apparent preference for coastal sites at our latitudes (Askew, 2004) it is unlikely to spread as rapidly as *E. viridulum*. There is no shortage of further potential colonists to Britain, e.g. Winter Damselfly *Sympecma fusca* (breeding as close as the Dutch dunes), Goblet-marked Damselfly *Erythromma lindenii* (also in the Netherlands) and perhaps also Southern Darter *Sympetrum meridionale* (now breeding as close as Normandy). Given a continuation of current trends, it will be of interest to see what lies in store for the years to come.

Acknowledgements

Thanks go to all the people who submitted records during the year. The following have been identified in the text by their initials: M. Averill (MA); P. Batty (PB); N. Bowman (NB); D. Clarke (DC); D. Dana (DD); P. Dawson (PD); S. Dewick (SD); R. Fairhead (RF); P. Forrest (PF); G. Hawgood (GH); M. Hunter (MH); P. Lord (PL); J. Medland (JM); N. Odin (NO); M. Pennington (MP); P. Reeve (PR); E. Simpson (ES); B. Spence (BS); D. Smallshire (DS); P. Smith (PS); L. Stride (LS); P. Taylor (PT); M. Walters (MW). The help of people from Insect Line is also appreciated.

References

Askew, R. R. 2004. *The dragonflies of Europe* (revised edition). Harley Books, Colchester. 308pp.

Brooks, S. (ed.) 1999. *Field guide to the dragonflies and damselflies of Great Britain and Ireland.* Second edition. British Wildlife Publishing, Hook, Hampshire. 160pp.

Forrest, P. J. 2005. Southern Emerald Damselfly *Lestes barbarus* (Fabr.) at Sandwich Bay, Kent. *Atropos* **24**: 24–25

Holmes, J. D. 1993. A possible sighting of *Aeshna affinis* in Avon. *Journal of the British Dragonfly Society* **9**: 17–18

Ketelaar, R. 2002. Odonata in the Netherlands, 2001. *Atropos* **17**: 58–59

Long, R. 2000. Southern Migrant Hawker *Aeshna affinis* in Jersey, Channel Islands. *Atropos* **9**: 81

Mendel, H. & Marsh, M. C. 1996. Invasion of dragonflies in 1995. *Transactions of the Suffolk Naturalists' Society* **32**: 22–27

Meteorological Office, 2005. Past weather, UK, June 2004, monthly assessment. Internet publication; http://www.met-office.gov.uk/climate/uk/2004/june.html

Parr, A. J. 2004. Migrant and dispersive dragonflies in Britain during 2003. *Journal of the British Dragonfly Society* **20**: 42–50

Parr, A. J., De Knijf, G. & Wasscher, M. 2004. Recent appearances of the Lesser Emperor *Anax parthenope* (Sélys) in north-western Europe. *Journal of the British Dragonfly Society* **20**: 5–16

A re-examination of the status of the Norfolk Damselfly *Coenagrion armatum* (Charpentier): a species of Odonata now presumed extinct in Britain

ANTHONY BROWNETT

28 Colesbourne Road, Brookside, Bloxham, Banbury

The Norfolk Damselfly *Coenagrion armatum* (Charpentier) is a boreal species, distributed across the Palaearctic region from Fenno-Scandia to Siberia and Mongolia, which in Central Europe occurs as far south as the northernmost parts of Romania (Askew, 1988). Although stable in the Nordic countries, there have been serious declines in Western and Central Europe due to habitat deterioration of various kinds (Sahlén *et al.*, 2004). In this paper I have set out to reconstruct its history in Britain, using museum and other unpublished sources as well as reviewing the literature.

A summary of the material, traced in museum collections up and down the country and preserved to this day, is presented in Table 1. At least 75 museum specimens are accounted for in the process.

Historical record

In Britain, prior to its presumed extinction as a member of the British dragonfly fauna, *C. armatum* was confined to the Norfolk Broads (Vice County 27). The broads are the flooded remains of peat pits (or 'turbaries') dug in the Middle Ages (Lambert *et al.*, 1965). Discovery of *C. armatum* in Britain is accredited to Frank Balfour-Browne, who took two specimens, one of each sex, at Sutton Broad (situated in British National Grid tetrad TG32R) towards the end of May 1903 (Balfour-Browne, 1904; Lucas, 1904). Although he took at least 17 further specimens in 1904–1905, the classic paper on his follow-up
Zygoptera (Balfour-Browne, 1909), contains no mention of *C. armatum*.

Then, in 1910 and 1912, prompted by Balfour-Browne's unwillingness to let him have a specimen, George Porritt visited Norfolk and collected a total of 31 (19 males, 12 females, including 4 tandem pairs) at Stalham Broad (tetrad TG32R) from 26–28 May 1910 and a further 4 (3 males, 1 female) at either Stalham/Sutton Broads on 30 May 1912 (Porritt, 1910, 1912; C. Yeates, pers. comm.). During the first of his two visits, Porritt stated that he only caught a few on 26–27 May and that he captured fewer than half the number he saw
vicinity on that day. Later in the decade, Thomas Coward caught a few of both sexes at Hickling Broad (in tetrad TG42A) on 24 May 1919 (Lucas, 1920).

Table 1. Catalogue of specimens of the Norfolk Damselfly (*Coenagrion mercuriale* Charpentier) held in British museums.

Date	No.	Collector	Museum	Informant
00.00.04	1♀	FBB	Glasgow	G. Hancock
00.05.05	10	FBB	Cambridge	D. A. L. Davies
00.05.05	1♀	FBB	Edinburgh	A. E. Whittington
00.05.05	3 (2♂,1♀)	FBB	Glasgow	G. Hancock
00.05.05	2♀	FBB	London	S. J. Hine
26.05.10–28.05.10	3 (1♂, 2♀)	GTP	Edinburgh	A. E. Whittington
26.05.10–28.05.10	20 (13♂, 7♀)	GTP	Huddersfield	C. Yeates
27.05.10	3 (1♂, 2♀)	GTP	Glasgow	G. Hancock
30.05.12	4 (3♂, 1♀)	GTP	Huddersfield	C. Yeates
24.05.47	3 (2♂, 1♀)	CEL	London	S. J. Hine
25.05.51	3 (2♂, 1♀)	FCF	Oxford	G. C. McGavin
02.06.51	1♂	AEG	Edinburgh	A. E. Whittington
02.06.51	5♂	AEG	London	S. J. Hine
03.06.51	1♂	AEG	Liverpool	M. Bigmore
04.06.51	2♀*	AEG	London	S. J. Hine
23.06.51	1♂	AEG	London	S. J. Hine
00.06.52	1♂	AEG	Cardiff	M. R. Wilson
30.05.53	8 (6♂, 1♀)	AEG	London	S. J. Hine
30.05.55	3 (2♂, 1♀)	SB	Norwich	R. J. Driscoll

Collectors' names: F. Balfour-Browne (FBB), S. Beaufoy (SB), F. C. Fraser (FCF), A. E. Gardner (AEG), C. E. Longfield (CEL) and G. T. Porritt (GTP).
Museums concerned: Castle Museum Norwich, National Museum & Gallery Cardiff, National Museums & Galleries on Merseyside Liverpool, National Museums of Scotland Edinburgh, The Natural History Museum London, Tolson Memorial Museum Huddersfield, University Museum Oxford (Hope collections), University of Cambridge, and University of Glasgow (J. J. F. X. King collection).
The total number of specimens at Glasgow was originally 8 (3♂, 5♀) (O'Farrell, 1950).
Those collected as eggs and reared to term in captivity are marked with an asterisk(*).
Dates refer to the 20th century.

Following this, there was a long period without records until 1947, when the species was re-discovered in broadland by Cynthia Longfield. She counted *c.* 57 adults (48 males, 9 females) mostly mating (*per collum*), and collected 6 specimens (4 males, 2 females), in an area known as Big Bog close to the River Ant at Stalham Broad (tetrad TG32R) over a period of 4 days between 24–29 May 1947 (Longfield, 1948; this study, Appendix 1A). More records followed, mainly from Stalham (e.g. Eagles, 1951, 1953), but in 1953 (as confirmed in Appendix 1A) Longfield found a further breeding site for the species in Ranworth Inner Broad (tetrad TG31M), although curiously no mention was made of it in the literature at the time (Longfield, 1954).

There is disagreement as to the date of the last record in Britain, given as 1957 by Hammond (1983) and 1968 by Milford & Irwin (1990), the latter reproduced verbatim

by Taylor (2003). Both years have been quoted by various subsequent authors (e.g. Parr, 2000; Smallshire & Swash, 2004), but neither appears to be correct. First, it has come to light that Sam Beaufoy has confirmed that his last record, overlooked hitherto, was in 1958 (Appendix 1B–C). Secondly, the source of the record for 1968 was of a sighting at Big Bog by Allen Davies (P. J. Milford & P. Taylor, pers. comms.). However, Allen Davies has since explained that the occurrence was not in 1968 but at some time in the 1950s, pointing to a misquotation or transcription error (Appendix 1D).

Discussion

This review has added one 10 km square to the distribution map, and an extra year to the date of last record, given by Merritt *et al.* (1996). Two questions arise.

First, was *C. armatum* formerly more widespread? Oviposition was observed into one species of plant, viz. Frogbit (*Hydrocharis morsus-ranae*) (Gardner, 1954), an example of highly stenotopic habitat selection (Corbet, 1962, 1999). Certainly if this plant were important, it occurred in a wide variety of broads (Ellis, 1965), so there may well have been a somewhat wider distribution of *C. armatum* in years gone by. Norman Moore (in Mendel, 1992) went so far as to say that the species may once have occurred in Suffolk, where broads in the north-east of the county (V.C. 25) have a similar origin to those in Norfolk.

Secondly, is *C. armatum* now extinct in Britain? The answer would appear to be 'yes'. Not only is there the test of time, with no records for five decades in spite of subsequent searches, but also there has been habitat loss. Around the time that *C. armatum* was discovered, the River Ant broads were species-rich with Water-soldier (*Stratiotes aloides*) dominant (Mason & Bryant, 1975). Already by 1953, when *C. armatum* was still 'quite plentiful', the restricted habitat at the main site Big Bog was deteriorating (Longfield, 1954) and by the mid-1970s it had become totally unsuitable with encroachment by arboraceous vegetation (Shirt, 1987). Nevertheless, the re-discovery of *C. armatum* at a locality in the Netherlands in 1999 (Parr, 1999) has re-ignited debate as to the possibility of its re-discovery, or re-colonization, in Britain.

Acknowledgements

Thanks are due to the following correspondents and informants who have kindly responded to my enquiries with personal communications: H. R. Arnold, M. Bigmore, J. Buckley, Dr D. A. L. Davies, R. J. Driscoll, J. Goldsmith, G. Hancock, S. J. Hine, Dr G. C. McGavin, P. J. Milford, Dr P. Taylor, A. E. Whittington, Dr M. R. Wilson, and C. Yeates. In particular I am most grateful to Henry Arnold for supplying Biological Records Centre data, Peter Milford and Pam Taylor for relevant extracts from Norfolk dragonfly records, John Buckley for unearthing and conveying some key historical documentation, and finally the late Allen Davies for recounting details of his field exploits in the Broads.

References

Askew, R. R. 1988. *The dragonflies of Europe*. Harley Books, Colchester. 291 pp.

Balfour-Browne, F. 1904. A bionomical investigation of the Norfolk Broads. *Transactions of the Norfolk and Norwich Naturalists' Society* **7**: 661–673

Balfour-Browne, F. 1909. The life-history of the agrionid dragonfly. *Proceedings of the Zoological Society of London* **1909**: 253–285

Corbet, P. S. 1962. *A biology of dragonflies*. Witherby, London. 247 pp.

Corbet, P. S. 1999. *Dragonflies: behaviour and ecology of Odonata*. Harley Books, Colchester. 829 pp.

Eagles, T. R. 1951. South London Entomological and Natural History Society: August 22nd, 1951. *Entomologist's Monthly Magazine* **87**: 288

Eagles, T. R. 1953. South London Entomological and Natural History Society: June 24th, 1953. *Entomologist's Monthly Magazine* **89**: 235–236

Ellis, E. A. 1965. *The Broads*. Collins, London. 401 pp.

Gardner, A. E. 1954. A key to the larvae of the British Odonata. Introduction and Part 1, Zygoptera. *Entomologist's Gazette* **5**: 157–171

Hammond, C.O. 1983. *The dragonflies of Great Britain and Ireland*. 2nd edition, revised R. Merritt. Harley Books, Colchester. 116 pp.

Lambert, J.
by E. A. Ellis. Collins, London. 401 pp. (pp. 36–65)

Longfield, C. 1948. *Coenagrion armatum* (Charpentier), a dragonfly re-discovered in England. *Entomologist* **81**: 7–8

Longfield, C. 1954. The British dragonflies (Odonata) in 1952 & 1953. *Entomologist* **87**: 87–91

Lucas, W. J. 1904. Dragonflies in 1902 and 1903. *Entomologist* **37**: 29–34

Lucas, W. J.

Mason, C. F. & Bryant, R. J. 1975. Changes in the ecology of the Norfolk Broads. *Freshwater Biology* **5**: 257–270

Mendel, H. 1992. *Suffolk dragonflies*. Suffolk Naturalists' Society, Ipswich. 159 pp.

Merritt, R., Moore, N.W. & Eversham, B.C. 1996. *Atlas of the dragonflies of Britain and Ireland*. ITE research publication no. 9. HMSO, London. 149pp.

Milford, P. J. & Irwin, A. G. 1990. The dragonflies of Norfolk. *Transactions of the Norfolk and Norwich Naturalists' Society* **28**: 357–380

O'Farrell, A. F. 1950. The J. J. F. X. King collection of British Odonata. *Entomologist* **83**: 14–18

Parr, A. 1999. Norfolk Damselfly *Coenagrion armatum* rediscovered in the Netherlands. *Atropos* **8**: 52

Parr, A. 2000. An annotated list of the Odonata of Britain and Ireland. *Atropos* **11**: 10–20

Porritt, G. T. 1910. *Agrion armatum*, Charp., at Stalham Broad, Norfolk. *Entomologist's Monthly Magazine* **21**: 161–162

Porritt, G. T. 1912. *Agrion armatum*, Charp., in the Norfolk Broads. *Entomologist's Monthly Magazine* **23**: 163

Sahlén, G., Bernard, R., Cordero Rivera, A., Ketelaar, R. & Suhling, F. 2004. Critical species of Odonata in Europe. *International Journal of Odonatology* **7**: 385–398

Shirt, D. B. 1987. *British red data books: 2. Insects*. Nature Conservancy Council, Peterborough. 402 pp.

Smallshire, D. & Swash, A. 2004. *Britain's dragonflies: a guide to the identification of the damselflies and dragonflies of Great Britain and Ireland*. WildGuides, Old Basing. 168 pp.

Taylor, P. 2003. *Dragonflies of Norfolk*. Norfolk and Norwich Naturalists' Society, Norwich. 32 pp. (with appendix pp. 357–380)

Appendix 1.

Firsthand accounts of the Norfolk Damselfly *Coenagrion armatum* by odonatologists of the day. The text has been reproduced verbatim throughout with the author's annotations placed in square brackets.

A. Text of letter from Cynthia Longfield to John Buckley dated 16 April 1975.
'Looking at the Nat.[ure] Cons.[ervancy] map you have sent me, you do not appear to have been any way near the correct piece of marsh, where I (and others) found *armatum* still breeding in 1947–48. You have to start from Stalham village and walk south, crossing over the motor road (Stalham to Yarmouth), and entering the marshy ground on the left hand side (going south), of what still remains of the 2 Broads—Sutton and Stalham. The River Ant will be on your right hand. When I and 2 friends were last there in the late 40's—Sutton Broad was almost choked up. We did not attempt to look at Barton Broad, because it was too deep, too large and too full of pleasure-boats. By 1949 Barton had been enlarged and dredged. However, it was the original habitat of the late Prof. Balfour-Browne for *armatum* in 1903, and still found there by G.T. Porritt in 1910 to 1912. In any case, we did not need to go far, as the ground between Sutton Broad and the River Ant was full of reeds and small scattered open pools, where the sun could penetrate. We were wading in very damp marsh—1 to 2 feet deep. Here the *armatum* were flying slowly and low, both sexes and mostly mating. When I first re-found it here in 1947, I believed it must be laying its eggs in the water-lily leaves. I later found this was not so. Eric Gardner confirmed the habitat necessary for breeding, had to have the Frogbit (*Hydrocharis morsus-ranae*) to be present. The floating water-lily leaves were apparently too tough to be used by the female *armatum*. I would suggest on your Nat. Cons. plan, you would need to get down onto the wettest part of the 'Big Bog' and look for Frogbit. I have marked with blue pencil, the area, where roughly, I and A.E. Gardner found the species. C.O. Hammond, on my directions, also found a good number the following year. You must get from Norwich Library or the Museum, my article on the re-finding of *armatum* (Entomologist, Vol. LXXXI, page 7–8, January 1948). The late Prof. Balfour-Browne first discovered it breeding in 1903 (Tran. N.N. Nat. Soc. 7, p. 661, 1904). I found it still breeding in 1953, in one of the River Bure Broads. So it was definitely there, somewhere in the Norfolk Broads for 50 years. Mr E.A. Ellis (Norwich Mus.[eum]) never told me that he found it at Alderfen, which he watched for years, and it was I who told him of it breeding in Ranworth Inner Broad, where I took it in 1953.'

B. Extract of letter from Sam Beaufoy to John Buckley dated 25 June 1974.
'I first saw this damselfly [*C. armatum*] with Miss Cynthia Longfield in 1947 at the spot ringed green on your map. I saw it in the same spot occasionally until 1958, but I have not seen it since. I have, however, visited the area in only a few years between then and now, and I have not spent very long searching. A few months ago I spoke to Eric Gardner about this species. He had found it in the same spot, but had not been there for

some years. I found that the insect was far from conspicuous and flies low down among the stems of the reeds.'

C. Extract of letter from Eric Gardner to John Buckley dated 30 July 1974.
'I do remember the last time I saw *Coenagrion armatum*, it was end of May and early June, 1953. It was quite plentiful and having got eggs and bred the species right through I did not need to go again. I was under the impression Sam Beaufoy saw it much later than this. It is easily overlooked owing to its habits—even Fraser failed to find it two days before I was there.'

D. Extract of letter from Allen Davies to the author dated 7 January 1999.
'I do not have the *C. armatum* data but the circumstances are that among many *Ischnura elegans* [Vander Linden] I casually netted a specimen near Sutton Broad, took it out of the net and at the moment of releasing it, saw, but too late, that it had the long anal appendages and could only be *C. armatum*. I will try to find a date for you but that will be quite difficult. I feel sure that it was pre-1960s . . . Needless to say following the release of the crucial specimen, I searched diligently for a long time afterwards but with no success.'

Variations in key features of the final instar larvae and exuviae of the Common Blue Damselfly *Enallagma cyathigerum* (Charpentier)

KEN CRICK

29 Village Way, Yateley, Hampshire GU46 7SE, UK.

Summary

Some features used for species identification of final instar larvae and exuviae in published keys have proved to have levels of variability beyond that currently defined. This paper seeks to address those variations as they apply to *Enallagma cyathigerum*, outlining in detail specific variations found through close examination of 253 individuals collected from a number of water bodies in the Blackwater Valley on the border of Hampshire and Berkshire. The features addressed include the species-specific characteristics of the caudal lamellae, the prementum and the short spine on the outer surface of the anterior palpal seta. The current published keys have proved to be very useful but their interpretation requires considerable dedication, at least when they are first put to the test. This report proposes a format for a mainly pictorial approach to an identification key for damselfly larvae.

Introduction

Of the eleven species of Zygoptera found in the Blackwater Valley (Crick & Bennett, 2003), eight are commonly encountered in the collection area. All the water bodies used for oviposition are mildly acidic man-made ponds, scrapes and lakes. A standard data card was devised that would allow for the recording of key features of the exuviae of these eight species. This paper addresses the Common Blue Damselfly *Enallagma cyathigerum* (Charpentier) with occasional reference to other species. Larvae and exuviae of *E. cyathigerum* closely resemble *Coenagrion* species, demanding precision from the keys. When viewing key features, close attention needs to be applied to the caudal lamellae, prementum and labial palps. As a number of these key features appear to vary, it was decided to make a systematic record of each feature, and the analysis of the results is presented here.

Collection area

Exuviae were collected over two seasons mainly at the northern end of the Blackwater Valley on the Hampshire/Berkshire border. The main sources of supply were the Moor Green Lakes Nature Reserve and a complex of ponds and scrapes on Bramshill

Common. Other sites in the River Blackwater catchment area provided specimens but only in low numbers.

Method

The identification keys used were those of A. E. Gardner (published in Hammond, 1983), Askew (1988) and Brooks (1997). To ensure that each specimen was in the final instar of development only exuvia cases were used, these being collected largely from marginal vegetation. The exuviae of all Zygoptera regardless of species were collected between April and August of 2003 and 2004. Only those exuviae that appeared at the outset to be structurally intact were recorded.

Each complete exuvia first had its antennal segments counted. The rear of the head behind the eyes was examined and any distinctive shape or marking was noted. The caudal lamellae were then removed from the abdomen with a sharp scalpel. They were invariably welded together but were easily separated by soaking in a small amount of water. The prementum complete with its labial palps was sprung free of the head by applying pressure to the base of the prementum, and thereby removed without sustaining any damage.

At a magnification of $\times 20$ the number and character of setae on the lateral field of the prementum were recorded, as was the number of setae on the labial palp. The presence or otherwise of a small spine located at the base of the anterior palpal seta on its outer surface was also recorded. Having separated the caudal lamellae, one from another, the median was selected. Very occasionally, when the median was missing, an outer caudal lamella was used and this deviation from the norm was noted on the data sheet. The length and width of the caudal lamellae were recorded, as were the disposition of any banding, and the presence and character of any stout setae on the margins.

Results – Morphological features

Two hundred and fifty three exuviae of *E. cyathigerum* were positively identified and recorded over the two-year period.

Antennae

All the specimens identified as *E. cyathigerum* had six segments to their antennae as described in the standard keys referred to earlier.

Head

No exuviae of *E. cyathigerum* were found with spots present to the rear of the head behind the eyes. Here, the head was populated by a number of small setae. Where these had broken off, the remains could be mistaken for spots, but one soon learnt to discriminate between setae and the head spots characteristic of the Azure Damselfly *Coenagrion puella* (L.).

Labial palp

In the great majority of exuviae, both labial palps possessed six stout long setae. Ten specimens had other paired combinations, i.e. 5 + 5, 5 + 6, 6 + 7 or 7 + 7.

Spine on anterior palpal seta

The small spine at the base of the anterior palpal seta (Figure 1), described in both Hammond (1983) and Askew (1988) was not always present (Figure 2). The size of the

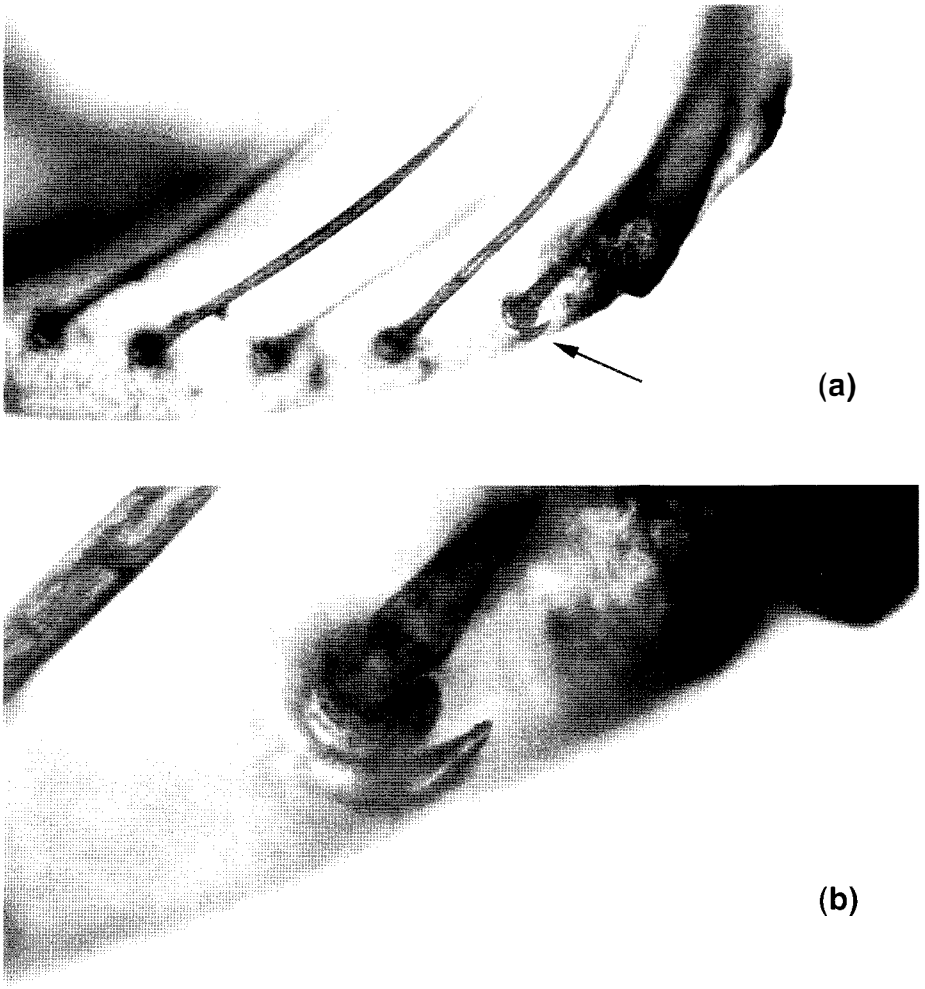


Figure 1. Common Blue Damselfly *Enallagma cyathigerum* labial palp showing presence of spine on anterior palpal seta: (a) magnification ×100; (b) magnification ×400.

spine was variable; on some specimens viewed at × 20 magnification it was clearly visible, whilst on others it was obscure. The sketch in Hammond (1983, p. 77) is misleading. Askew (1988, p. 201), is more representative.

It was observed that the mobile claw of the labial palp could rest on the opposing spine, leading to speculation that this contact might dislodge the spine and account for at least some of the absences recorded here. Fifty-one specimens (20 per cent) were lacking the spine on both labial palps, whereas seventeen specimens (7 per cent) were lacking a spine on one side only.

Figure 2. Common Blue Damselfly *Enallagma cyathigerum* labial palp showing absence of spine on anterior palpal seta at magnification × 100.

Prementum

The lateral field of the prementum supports two sets of stout setae; one set either side of the centre line. Published keys vary on the number of setae. Askew (1988) has a sketch with three long and one short setae (3.5) and Hammond (1983) reproduces a sketch with four long and one short setae (4.5) on each side of the centre line. In the Blackwater Valley study, fifty-six specimens matched the Askew sketch and only four specimens matched the Hammond reproduction (Table 1). In ninety-one cases this feature mirrored the 4 + + setae depicted in these keys for the prementum of the Blue-tailed Damselfly *Ischnura elegans* (Vander Linden). In all, there were a total of twenty different combinations of lateral field stout setae. The pairing was usually balanced, e.g. 3 + 3 or 4 + 4, but not always. There were specimens with combinations of 3 + 4, 4 + 5 and

Table 1. Common Blue Damselfly *Enallagma cyathigerum*: spatial distribution of setae on the prementum.

Setae to one side of the centre line	*Setae to the other side of the centre line*	*Sample size (frequency)*
2.5	3.5	1 (0.4%)
3	3	27 (11%)
3	3.5	8 (3.2%)
3	4	14 (5.5%)
3	4.5	1 (0.4%)
3*	3*	25 (10%)
3**	3*	1 (0.4%)
3.5	3.5	56 (22%)
3.5	4	12 (4.7%)
3#	3#	2 (0.8%)
3.5	4.5	1 (0.4%)
4	4	91 (36%)
4	4*	1 (0.4%)
4	4.5	1 (0.4%)
4	6	2 (0.8%)
4*	4*	2 (0.8%)
4.5	4.5	4 (1.6%)
4.5	5	1 (0.4%)
4.5	5.5	1 (0.4%)
5	5	2 (0.8%)

0.5 = one seta one half the length of its neighbours
* = one seta one quarter the length of its neighbours
** = two setae one quarter the length of their neighbours
\# = two setae one half the length of their neighbours

even 4 + 6.

Caudal lamellae setae

Invariably, the caudal lamellae of *E. cyathigerum* had a set of stout setae on both of the margins. The claim made in some published keys that the stout marginal setae reach the mid-point on both margins proved not to be always correct. On many examples, the margin with the loosely packed stout setae (i.e. the lower margin) was only populated in this manner for one third of its overall length. Setae on both margins terminate at a point where the first band (i.e. that nearest the point of attachment to the abdomen) intersected the margin or, in the case of incomplete banding, where an imagined projection of the band would intersect the margin. The upper margin was populated by tightly packed stout setae. The range of setae on the upper margin varied from 19 to 56 and that on the lower margin from 9 to 29. At no time did the number of setae on the lower margin equal or exceed that on the upper margin. The counting of this feature was discontinued

by August of 2003, though the nature of the packing continued to be noted.

Physical dimensions of the caudal lamellae

The length of the majority of caudal lamellae varied from 5mm to 6.4mm. A total of nine specimens lay out side this range, with the shortest being 4.8mm and the longest 7mm. The width generally lay between 1.7mm and 2.3mm, with a total of seven specimens outside this range, the narrowest being 1.5mm and the widest being 2.5mm. The length to width ratio lay between 2.5:1 and 3.3:1 with 92 per cent of the measured sample falling within this range. At the extremes, the length to width ratio was 4:1 and 2.2:1.

Caudal lamellae banding

A characteristic feature of this species is generally considered to be the banding on the caudal lamellae, with published keys declaring that there are usually one, two or three bands. In the study sample, 39 specimens (15 per cent) exhibited no banding at all. The pattern of banding, where present, was found to be quite variable (Figure 3). Double banding occurred in 118 specimens (47 per cent), with 77 single banded examples (30 per cent), and only 19 with triple banding (8 per cent). Banding was not found to be exclusively vertical as pictured in some keys. It would often commence at the tightly packed stout setae margin close to the mid point and sweep towards the insect's abdomen reaching the loosely packed stout setae margin at about one third distance from the point of attachment to the abdomen. There were examples of incomplete banding, bands not reaching the margins of the caudal lamellae, and bands offset towards the lamellae apex. Banding was observed to vary in intensity, being heavily or lightly mottled. Heavy mottling occasionally linked two or three bands. The frequency of banding by type is recorded in Figure 3.

Summary of Results

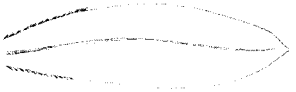
For any given species, the number of antennae segments appears to be constant. In *E. cyathigerum* the number is six.

E. cyathigerum has small setae on the head behind the eyes. These should not be mistaken for the spots that are a characteristic feature of certain damselflies, e.g. the Azure Damselfly *Coenagrion puella.*

The number of setae on the labial palps of *E. cyathigerum* only rarely deviates from six. In the sample size viewed to date, about 4 per cent of specimens have at least one palp with either 5 or 7 setae. The spine at the base of the anterior palpal seta is a unique diagnostic feature but may be absent from one (7 per cent of specimens in this study) or both palps (20 per cent of specimens). Therefore it is necessary to inspect both palps for this feature. A microscope is essential for locating the spine, as it varied in size considerably. The spine was not found on any of the 222 exuviae of other damselfly species examined during the study period.

Type 1 Single band in contact with both margins (14%)

Type 1A No banding (15%)



Type1B Banding barely visible (2.8%)

Type 1C Banding offset towards the apex (1.2%)

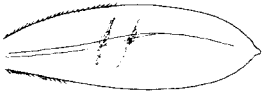
Type 1D Banding incomplete at one or both margins (12.3%)

Type 2 Double banding centrally joined (9.5%)

Type 2A Heavily mottled, centrally joined and incomplete (5.5%)

Type 2B Completely separate banding (14%)

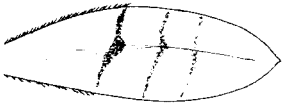
Type 2C Separate banding incomplete (15%)



Type 2D Heavily mottled, centrally joined and complete (0.4%)

Type 2E Banding barely visible (2.0%)

Type 3 Complete separate banding (3.2%)



Type 3A Incomplete separate banding (3.2%)

Type 3B Heavily mottled, centrally joined and incomplete (0.8%)

Type 3C Banding barely visible (0.4%)

Figure 3. Common Blue Damselfly *Enallagma cyathigerum*: caudal lamellae banding patterns. Drawings are reproduced from actual examples. Variations in marginal stout setae are as shown. Length to breadth ratio varies between 2.5 to 1 and 3.3 to 1. Relative frequencies of occurrence in this study presented as percentages.

The stout setae on the lateral field of the prementum are a variable feature. If the relative length of the setae is ignored, 76 per cent of the specimens had four setae either side of the lateral field centre line.

The banding on the caudal lamellae is arguably the single most recognizable feature and the one exhibiting the most variability. The lack of banding in a sizeable minority of cases (17 per cent in the study sample) is worthy of comment in any key.

The number of stout setae on the caudal lamellae margins is so variable as to offer no useful reference feature. The statement in some keys claiming 'stout setae to the mid-point on both margins' has been shown to be not always correct.

Discussion

The findings of this study on the exuviae of *E. cyathigerum* found in the Blackwater Valley are broadly similar to those of Andrews (2001). Andrews reported greater variability of some of the generally accepted key features, probably as consequence of the greater size of the sample taken in that study. However, comparison with Andrews (2001) stimulates a number of comments.

The specimens from the Blackwater valley were generally of a uniform light brown colour as observed by Andrews (2001), but it was noted that where there was evidence of iron oxide at the waters edge, specimens were stained rust orange. Like Andrews, a prominent mid-dorsal longitudinal pale line was observed on the abdominal segments, but as a similar pale line was observed on examples of exuviae of the Large Red Damselfly *Pyrrhosoma nymphula* (Sulzer) and Azure Damselfly *Coenagrion puella* (L.), this feature cannot be considered a clear diagnostic feature. However, the pale line on *E. cyathigerum* is not of uniform width across individual segments, being wider towards the middle of the segment. This feature may distinguish *E. cyathigerum* from the two species mentioned above.

For all the specimens examined by Andrews (2001), the small spine on the anterior palpal setae was present on at least one margin of the labial palp. In this study the sample produced 51 specimens (20 per cent) for which no small spine was observed. The magnification used for this work was significantly less than that employed by Andrews (2001) but it is worth noting that the specimens used for the photographs reproduced here were selected randomly from collections of labia classified as 'with spines' & 'without spines'. In both cases, the first specimen selected was used.

The data set collected for this report failed to support the statement made by Andrews (2001) and others that 'thicker setae generally reach to (or beyond) the mid point of both margins of the caudal lamellae'. Forty seven percent of the 253 specimens examined had stout setae on the ventral margin of the median caudal lamellae that terminated after only one third of the margin length.

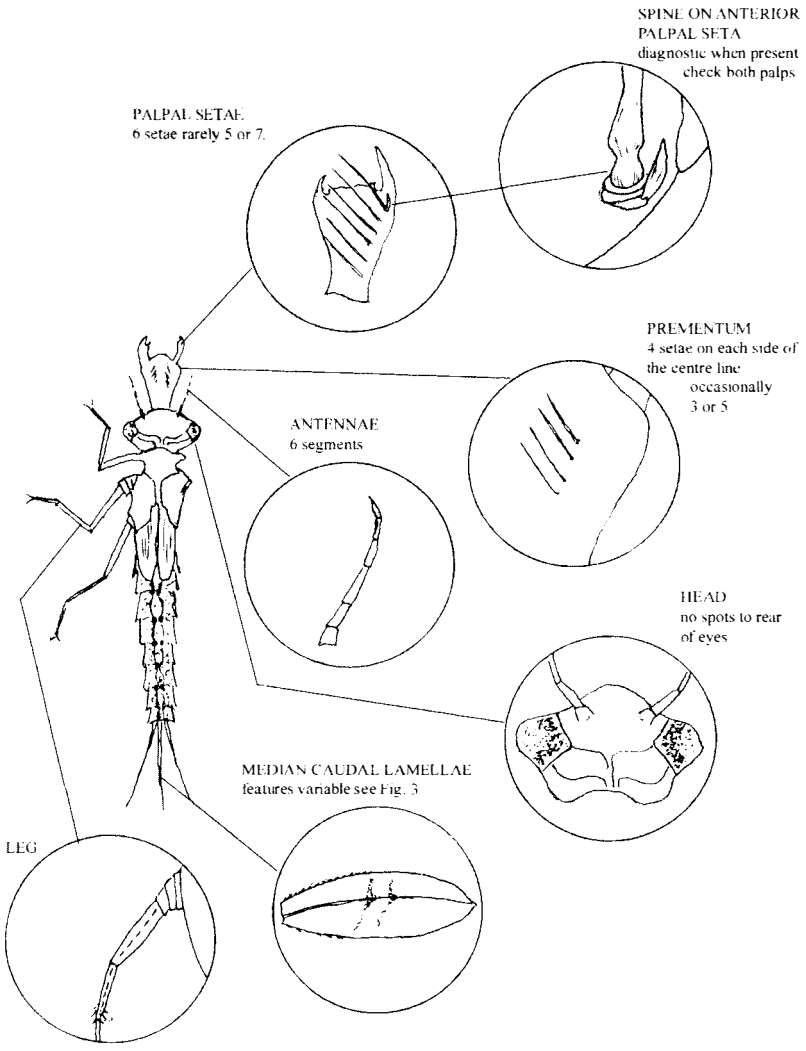


Figure 4. Pictorial key showing important diagnostic features of the final instar larvae and exuviae of the Common Blue Damselfly *Enallagma cyathigerum*.

The work carried out on the exuviae of *E. cyathigerum* by both studies shows a high level of variability in some of the characteristics used in published keys. Keys could usefully draw the user's attention to the potential for variability of any given characteristic. A. E. Gardner's key (reproduced by Hammond, 1983) does highlight some of the variability. However, for Zygoptera resident in the UK a different approach would be to present the information contained in keys in a largely pictorial manner, and a possible format is suggested (Figure 4).

Currently, some published keys refer to certain diagnostic features of particular species but fail to mention the extent to which these features occur in related species, e.g. the reference to 'distinct dark bands on the femora' of *Ischnura elegans* (Brooks, 1997). These omissions lead to frustration and confusion. The proposed pictorial key would, for each species, show all the features referred to in the key as a whole, highlighting important diagnostic features for each species. The result would be a separate page for each species, with an identical layout on each page. The individual characteristics would be reproduced in magnified form and, where the detail is diagnostic, it would be highlighted. Complex variations that are found in some species, such as caudal lamellae banding, could have a separate dedicated sheet, e.g. that shown in Figure 3.

The inclusion of features that help discriminate between species, yet are not diagnostic when all species are compared, would allow the inexperienced user to make a more objective assessment. A small field trial with people not well versed in the use of keys found this version easy to use.

Acknowledgements

My thanks go to Dr C J Bennett for the photographs reproduced here, and to Bob Merritt for his encouragement to write this paper and for his comments on the text.

References

Andrews, S. J. 2001. Some observations on the identification of the exuviae of the final-instar larvae of the Common Blue Damselfly *Enallagma cyathigerum* (Charpentier). *Journal of the British Dragonfly Society* **17**: 35–44

Askew, R. R. 1988. *The dragonflies of Europe*. Harley Books, Colchester. 291pp.

Brooks, S. (ed.) 1997. *Field guide to the dragonflies and damselflies of Great Britain and Ireland*. British Wildlife Publishing, Hook, Hampshire. 160pp.

Crick, K. & Bennett, J. 2003. *Blackwater Valley dragonflies*. Blackwater Countryside Partnership, Aldershot, Hampshire. 48pp.

Hammond, C. O. 1983. *The dragonflies of Great Britain and Ireland*. 2nd edition, revised R. Merritt. Harley Books, Colchester. 116 pp.

INSTRUCTIONS TO AUTHORS

Authors are asked to study these instructions with care and to prepare their manuscripts accordingly, in order to avoid unnecessary delay in the editing of their manuscripts.

Word-processed manuscripts may be submitted in electronic format either on disk or by e-mail.

Typewritten manuscripts should be produced using black ribbon, double-spaced, on one side of the page only and with margins at least 25mm at the left, top and bottom. Text pages should be numbered and footnotes avoided.

Words that are to appear in italics (e.g. names of genera and species, though not of families) should be underlined if an italic font is not available.

Use of these terms is acceptable: 'exuvia' for cast skin (plural: 'exuviae'); 'larva' (instead of 'naiad' or 'nymph'); 'prolarva' to designate the first larval instar.

Dates in the text should be expressed in the form: 24 July 2004.

References cited in the text should be in the form '(Longfield, 1949)' or '... as noted by Longfield (1949)'. All references cited in the text (and only these) should be listed alphabetically at the end of the article in this form:

Hammond, C. O. 1983. *The dragonflies of Great Britain and Ireland.* 2nd edition (revised by R. Merritt). Harley Books, Colchester. 116 pp.

Longfield, C. 1949. The dragonflies of the London area. *The London Naturalist* **28**: 90–98.

Titles of journals should be written out in full.

Tables should be presented on separate, unnumbered pages.

Legends for figures should be presented together in sequence on a single, unnumbered page.

Figures should be prepared in black ink, and scaled to allow a reduction of 1.5 to 3 times.

The legend for each table and illustration should allow its contents to be understood fully without reference to the text. The approximate position of each table and figure should be indicated in the text.

SCIENTIFIC AND ENGLISH NAMES OF BRITISH ODONATA

ZYGOPTERA	DAMSELFLIES
Calopteryx splendens	Banded Demoiselle
Calopteryx virgo	Beautiful Demoiselle
Chalcolestes viridis	Willow Emerald Damselfly
Lestes dryas	Scarce Emerald Damselfly
Lestes sponsa	Emerald Damselfly
Ceriagrion tenellum	Small Red Damselfly
Coenagrion armatum	Norfolk Damselfly
Coenagrion hastulatum	Northern Damselfly
Coenagrion lunulatum	Irish Damselfly
Coenagrion mercuriale	Southern Damselfly
Coenagrion puella	Azure Damselfly
Coenagrion pulchellum	Variable Damselfly
Coenagrion scitulum	Dainty Damselfly
Enallagma cyathigerum	Common Blue Damselfly
Erythromma najas	Red-eyed Damselfly
Erythromma viridulum	Small Red-eyed Damselfly
Ischnura elegans	Blue-tailed Damselfly
Ischnura pumilio	Scarce Blue-tailed Damselfly
Pyrrhosoma nymphula	Large Red Damselfly
Platycnemis pennipes	White-legged Damselfly
ANISOPTERA	DRAGONFLIES
Aeshna caerulea	Azure Hawker
Aeshna cyanea	Southern Hawker
Aeshna grandis	Brown Hawker
Aeshna isosceles	Norfolk Hawker
Aeshna juncea	Common Hawker
Aeshna mixta	Migrant Hawker
Anax imperator	Emperor Dragonfly
Anax junius	Green Darner
Anax parthenope	Lesser Emperor
Brachytron pratense	Hairy Dragonfly
Hemianax ephippiger	Vagrant Emperor
Gomphus vulgatissimus	Common Club-tail
Cordulegaster boltonii	Golden-ringed Dragonfly
Cordulia aenea	Downy Emerald
Oxygastra curtisii	Orange-spotted Emerald
Somatochlora arctica	Northern Emerald
Somatochlora metallica	Brilliant Emerald
Crocothemis erythraea	Scarlet Darter
Leucorrhinia dubia	White-faced Darter
Libellula depressa	Broad-bodied Chaser
Libellula fulva	Scarce Chaser
Libellula quadrimaculata	Four-spotted Chaser
Orthetrum cancellatum	Black-tailed Skimmer
Orthetrum coerulescens	Keeled Skimmer
Pantala flavescens	Wandering Glider
Sympetrum danae	Black Darter
Sympetrum flaveolum	Yellow-winged Darter
Sympetrum fonscolombii	Red-veined Darter
Sympetrum nigrescens	Highland Darter
Sympetrum pedemontanum	Banded Darter
Sympetrum sanguineum	Ruddy Darter
Sympetrum striolatum	Common Darter
Sympetrum vulgatum	Vagrant Darter

Registered Charity No. 800196

A full checklist can be found on the inside back cover of Dragonfly News.

CONTENTS

Printed by Gem Publishing Company, Brightwell, Wallingford, OX10 0QD