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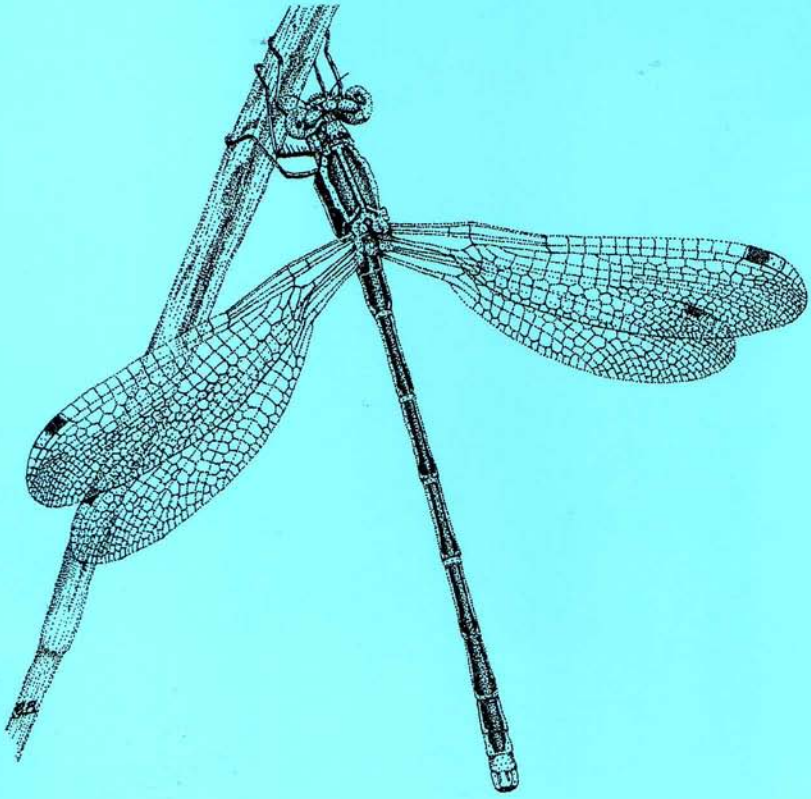

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Front cover illustration: Male Southern Emerald Damselfly *Lestes barbarus* at Sandwich Bay, 29 September 2004, by Gill Brook

Maintenance of the female androchrome colour polymorph in the Blue-tailed Damselfly *Ischnura elegans* (Vander Linden)

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Summary

In order to explain the maintenance of the male-like androchrome colour form in female Zygoptera, a form that would otherwise suffer severe disadvantages through lack of recognition by males, a number of theories have been developed. Cordero & Andrés (1996) reviewed these theories and concluded that a "Density Dependence" theory offered the most likely explanation. This paper reports on research into the implications for female androchrome colour forms in both low and high density populations as a test of the Density Dependence theory, and was applied to the Blue-tailed Damselfly *Ischnura elegans* (Vander Linden) in Northamptonshire. For the low and high density populations studied, mating success was found to be directly related to the proportion of each colour form in the population as a whole, with no one colour form exhibiting preferential advantages or disadvantages. Similarly there was found to be no significant difference between the mating frequencies in the two populations. These observations suggest that the female androchrome in *Ischnura elegans* is not a perfect male mimic and that the male is readily able to recognize this colour form as female.

Introduction

The females of the Blue-tailed Damselfly *Ischnura elegans* (Vander Linden) exhibit a range of colour variations to the thorax and abdominal segment eight that demonstrate both genetic and age-related forms. These colour variations exist in the immature phase as *rufescens* (a bright pink-red colouration) and *violacea* (purple) and change as the individual matures. Individuals of the colour form *rufescens* mature into the reddish-brown *rufescens-obsoleta* (formerly called *infuscans-obsoleta*), while *violacea* mature into either the greenish *infuscans* or the typical male colouration known as androchrome (andromorph) (Killington, 1924; Parr, 1973). As an extra aide to their identification, *rufescens* and *rufescens-obsoleta* have no black antehumeral stripes, while these are present in *violacea*, *infuscans* and androchrome. The mature *rufescens-obsoleta* loses the blue tail marking on segment eight, while the androchrome and *infuscans* retain theirs. The terminology used in this paper is that of Cordero & Andrés (1996), where androchrome refers to the male colouration form and gynochrome to the other colour forms of the female.

Cordero & Andrés (1996) reviewed three previously published theories to account for the phenomenon of colour polymorphism: 1) Reproductive Isolation, where androchrome females rarely mate with males of another species, while gynochrome females do; 2) Male Mimetism, where females can fertilize a lifetime's supply of eggs in one mating. This avoids unnecessary harassment from other males (as they can be confused with males) allowing them to concentrate on feeding and oviposition. Androchrome females, being larger than other females, would also be able to carry more eggs; and 3) Density Dependence, where at high population densities, androchrome females would be at an advantage through not being harassed by males, but would be at a disadvantage in low population densities. Their own research concluded that the Density Dependence theory is the most likely explanation for maintaining female colour polymorphism, and that this confers an advantage to androchrome females in high population densities. If the advantage to androchromes is reduced harassment, allowing greater concentration on feeding and oviposition, then this is counterbalanced by reduced mating success through the inability of males to recognize them as females, with the result that some androchrome females will never mate.

In *I. elegans*, androchrome body length is significantly larger than gynochrome body length for the populations quoted by Cordero & Andrés (1996), although male body length was not measured for comparison. This larger body size could be expected to contain more eggs, and/or confer increased longevity. Cordero & Andrés detected no significant difference in mean lifespan between androchromes and gynochromes. The increased egg production was not tested, only inferred from the significantly larger body size of the androchrome females.

In species with long copulation periods, such as *I. elegans*, which typically last up to six hours (Parr, 1997), androchrome colouration might be advantageous in high population densities in deceiving other males. This allows females to avoid unnecessary harassment and matings, especially if one copulation can fertilize all eggs the female will lay in a lifetime. The female can then concentrate her energy on feeding and oviposition.

Corbet (1962; 1999) described how male Zygoptera use colour (brightness and reflectivity), patterns and other distinctive female characteristics as visual cues in selecting a mate. In species with androchrome forms, there must therefore be a mechanism whereby males can distinguish between the colouration of an androchrome female and another male, and be able to tell that androchromes are conspecific. This may not be entirely colour related. Females of *Ischnura verticalis* (Say) attract males with characteristic movements (Corbet, 1962), and Thompson (2004) reports that female Zygoptera will give 'honest' signals to males. To mate, the female must comply by bending her abdomen to complete the wheel position. Androchrome females that cannot be distinguished from other males might therefore signal to the males that she is female and available for copulation; this may be prior to or during tandem formation. The question of whether androchromes are perfect male mimics needs to be studied.

Cordero & Andrés (1996) investigated the above Density Dependence hypothesis using live and dead female 'baits' and found that for two populations of *I. elegans* androchromes were less attractive to males than were gynochromes. The attractiveness to all three female colour forms increased considerably when the baits were dead, indicating that perhaps there is a behavioural aspect that influences their attractiveness. They also showed that male responses to androchromes were similar to their responses to other males for both live and dead 'baits'. The conclusion was made that males will respond to the commonest female colour morph in the population, and that the correct way to test this hypothesis is to compare the degree of sexual response in populations that differ in the relative frequency of the female colour polymorphs.

The current study set out to examine this aspect of the Density Dependence theory by studying the level at which each colour form was involved in breeding behaviour as a function of low and high population densities.

Material and Method

Records of *Ischnura elegans* exhibiting breeding behaviour – in tandem, copulation and oviposition – were made during normal recording of breeding at two different wetland habitat types in Northamptonshire: Ditchford Lakes and Meadows Local Nature Reserve (British National Grid Reference SP 934682), a static water site in the suite of Nene Valley gravel pits (Tyrrell & Brayshaw, 2004), with high population densities and the River Ise at Burton Latimer Pocket Park (British National Grid Reference SP 888743), a slow flowing riverine habitat with a low population density. Observations were made over three seasons: 2003, 2004 and 2005. Specifically, when a female was seen exhibiting breeding behaviour, the colour form was noted in addition to the normal recording data. An estimate of the population of each colour form was also made by counting the numbers seen. The counts of breeding females were included in the total population counts.

To analyze the data, two null hypotheses were established: 1) that the frequencies of each of the female colour forms exhibiting breeding behaviour were the same as the frequencies in the population as a whole and 2) that there was no difference in the relative frequencies of the colour forms between the two populations.

The count data were transformed into percentages to express their frequency in the population. Errors in the relative frequencies were determined by calculating the standard error for percentages at the 95% confidence limit. These confidence limits define the range within which the true relative frequency will be found with 95% confidence. Estimates of the relative frequencies are affected by the sample size used to determine them; hence the lower sample sizes for the low-density population lead to more uncertainty.

Results

At Ditchford, typically a population of more than100 adults were estimated per visit, of which about 10% were female. At Burton Latimer Pocket Park, typically 20 adults were recorded per visit. Only those females that could be positively identified were included. The total counts for females and breeding females are listed in Table 1, along with the estimates of the population frequency of each colour form for both populations.

Table 1. Numbers of mature females and breeding females in the two population densities studied along with the relative frequencies for each mature colour form.

Colour Form	High Density Population		Low Density Population	
	Population Frequency	Breeding Frequency	Population Frequency	Breeding Frequency
androchrome	58%	59%	63%	59%
rufescens-obsoleta	25%	25%	22%	24%
infuscans	16%	16%	15%	17%
Count Total	257	132	59	32

A small percentage of breeding records in the high-density population were of the immature *rufescens* form; in all cases these were recorded in copula – none were observed ovipositing. These were added to the data for *rufescens-obsoleta* for the analysis. In both populations the androchrome females comprise over half the mature female population with *rufescens obsoleta* being the next most abundant and *infuscans* the least abundant.

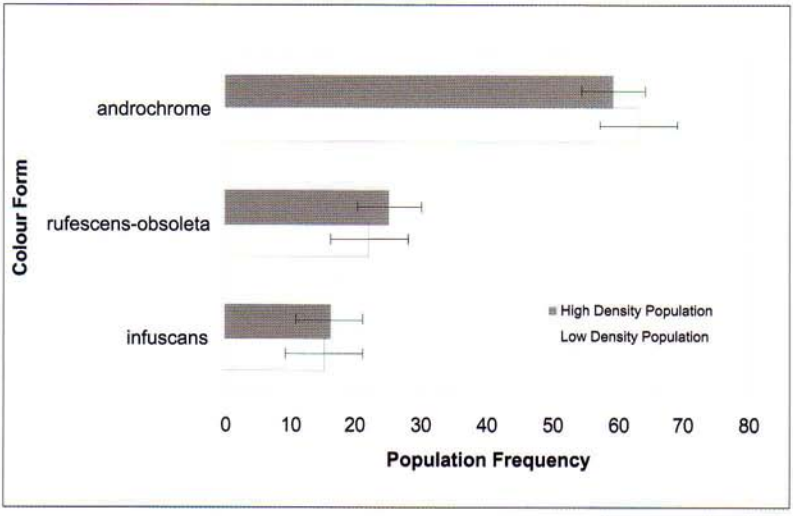

Figure 1. Comparison of the relative proportions of the mature colour forms within both populations studied, with 95% confidence limits.

It is considered that there is no difference between the proportions of the female colour forms in the low density and high-density populations since, for each colour form, there is overlap at the 95% confidence level (Fig. 1).

The analysis gave the following results:

a) There is no statistical evidence of any difference in the proportion of each colour form between the high and low-density populations for the samples sizes used.
b) There is no evidence that the proportion of each colour form breeding is any different from the proportion of that colour form in the population as a whole.

It is particularly clear when observing male-andromorph matings that the female is by no means a perfect male mimic (Plate 1).

Plate 1. *Ischnura elegans* mating with a female of the androchrome colour form. Note the colour and shape differences between male and female that suggest the female is not a perfect male mimic.

Discussion

In both population densities, breeding behaviour of each female colour form matches the expected frequency from the population as a whole. This then implies that the individual receives no breeding advantage or disadvantage from their colour form, and that males readily recognize all colour forms as conspecific.

Cordero & Andrés (1996) concluded their research with the assumption that if the density-dependence theory is correct, then there should be a higher proportion of

androchrome females in high-density populations than in low-density populations. This finding was borne out for *I. graellsii* (Vander Linden). However, the work reported here indicates that for these populations of *I. elegans*, this assumption is not supported.

If the androchrome form is an imperfect male mimic, an alternate theory to density dependence must apply to explain the androchrome form. The results of this work support the contention that males recognize androchrome females as conspecific, therefore implying that androchrome *I. elegans* are not perfect male mimics.

Parr (1997) noted that mating may occasionally be seen between apparently immature, green males and one of the immature female forms, *rufescens* and *violacea*. However, the only immature female form observed to mate in the current study was *rufescens*. This might be explained by the visual similarity between *rufescens* and *rufescens-obsoleta*, while the *violacea* form may be an unrecognizable colouration compared to the mature colour forms. It has been recorded that the maturation of *rufescens* into *rufescens-obsoleta* (formerly called *infuscans-obsoleta*) takes an average of 8.1 days whereas that of *violacea* into *infuscans* takes only 6.9 days (Parr, 1973). Assuming that sexual maturity is reached at the same time in both cases, then either *rufescens* is mature before it becomes *rufescens-obsoleta* or else *violacea* is still immature until after it becomes *infuscans*; this may also be a reason why the only 'immature' females seen to mate in the present study were *rufescens*. However, it should be noted that Parr & Palmer (1971) observed that *I. elegans* is able to mate after only 3–4 days, so it maybe that both immature forms become sexually mature before they undergo colour change.

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Migrant and dispersive dragonflies in Britain during 2006

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Summary

The 2006 season saw some of the most spectacular movements of migrant dragonflies ever recorded in Britain, perhaps even exceeding those of the famous summer of 1995. In terms of sheer numbers, the highlight of the year was the profusion of Red-veined Darter *Sympetrum fonscolombii* that were reported. Approaching a thousand individuals – the highest annual total for Britain by some long way – were observed during the summer months, with many staying to breed. Autumn emergents were later noted at over a dozen sites, some as far north as Lancashire and East Yorkshire. Lesser Emperor *Anax parthenope* also had a record-breaking year, with some 90 individuals being observed and oviposition being noted from five different areas. Small Red-eyed Damselfly *Erythromma viridulum* similarly had an eventful season, showing a very major expansion of range, at least some of which seemed to involve fresh immigration. Other notable events included a major influx of Yellow-winged Darter *S. flaveolum* and the discovery of a female Southern Emerald Damselfly *Lestes barbarus* at an inland site on the Somerset/Gloucestershire border. No less than four Southern Migrant Hawker *Aeshna affinis* were also reported from southern England, there having only ever been one previous confirmed British record of this species.

Account of species

Notable sightings reported to the BDS Migrant Dragonfly Project during 2006 are detailed below (for a report of events during 2005 see Parr, 2006a). For some of the more numerous migrants observations have been summarised, followed by an analysis of the available information.

***Calopteryx virgo* (L.) – Beautiful Demoiselle**

The species did well during 2006, and the year was notable for both high counts at some previously known sites and for a number of unexpected new records. Most notable was an unprecedented series of sightings from Norfolk, where the last accepted record was as long ago as 1975 (P. Taylor, pers. comm.). Both sexes were present in the Hoe/Hoe Rough area on 7 June (CJ) and 10 July (JCh), with another report from nearby Worthing on 13 July (per JCh). Up to three were seen at Titchwell RSPB Reserve on 29 June (MF) and one was also at Dersingham on 30 June (MF). Elsewhere, unusual

records included sightings from five new locations in Wiltshire (Covey, 2007) and regular, though erratic, observations of singletons at a pond on the South Downs in Hampshire some 17km from the nearest known breeding site (Gillingham *et al.*, 2007). It would seem that there was significant dispersal during the year. This was perhaps driven by high population levels, though the unusually hot summer weather may also have had an influence, the extreme summer of 2003 likewise producing a series of unexpected sightings (Parr, 2004).

***Lestes barbarus* (Fab.) – Southern Emerald Damselfly**

A female was photographed by the River Avon near Keynsham, N. Somerset, on 26 August 2006 (M. Dimery).This is the third British locality from which the species has been recorded in recent years – the first-ever confirmed British record coming from Winterton Dunes, Norfolk, during 2002 and with sightings there and at Sandwich Bay, Kent, during 2003 and 2004 (Parr, 2005). It would seem that this species remains a potential, though as yet un-established, colonist. Although coastal dune systems probably represent the most favoured habitat for the species in our region, the present record suggests the potential for further records from inland sites.

***Erythromma viridulum* (Charp.) – Small Red-eyed Damselfly**

This damselfly has been steadily spreading throughout southern England following its first sightings in Essex during 1999, but 2006 was notable for a very major further expansion of range. First county records were thus received from areas such as Devon, Dorset, Somerset, Wiltshire, Gloucestershire, Worcestershire, Oxfordshire, Leicestershire, Lincolnshire, Nottinghamshire, Derbyshire and even East Yorkshire. Many of these sightings, and particularly the more southerly ones, occurred between 19 July and 2 August, during a period of exceptionally hot weather (it was the warmest July on record – Hadley Centre, 2007). New reports, however, continued for several more weeks and the first Derbyshire records were not until 22 August.

With a well-established resident population now already present in Britain, it is becoming increasingly difficult to separate the contribution of local dispersal and continued immigration to any range expansion. However, it seems likely that events seen during 2006 were the result of both factors. The sightings at Weymouth, Dorset, on 19 July (JB) and at Lower Bruckland, Devon, from 20 July onwards rather suggest fresh immigration in this region, being associated with arrivals of other migrants such as Lesser Emperor *Anax parthenope* in southwest and south central England around this time. Some 106 individuals of *E. viridulum* were also observed in coastal *Suaeda* bushes at Blakeney Point, Norfolk, on 30 July (RP), this atypical sighting also being highly suggestive of fresh immigration. Indeed it is tempting to speculate that further immigration may also have accounted for the records from the Hull area of East Yorkshire [Oak Road Lake, 8–24 August (AA) and Bransholme Fishing Ponds, 9 August (MA)], that lie some 100km from the nearest other known sites.

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

There were no less than four verified sightings of this species from southern England during 2006, namely:

3 July	Male near Shoreham-by-Sea, West Sussex (R. Hamblett)
21 July	Male at Grimston Warren, Norfolk (D. Weaver & R. Lee)
6 August	Male at Little Wootton Inclosure, New Forest, Hampshire (S. Lankester)
10 August	Male near mouth of River Beaulieu, Hampshire (L. Stride)

In addition to these individuals, all but one of which were photographed, there was also a report of one from Les Augrès Manor, Jersey on 29 August (J. Banks via R. Long). Although there are other recent records from the Channel Islands (Parr, 2005), there has been only one previous confirmed sighting from the British mainland, as long ago as 5 August 1952 (Longfield, 1954). 'Probables' have, however, been reported more recently from near Bristol, N. Somerset, on 14 August 1992 (Holmes, 1993) and from Chartley Moss, Staffordshire, on 11 September 2000 (T. Beynon, unpublished).

As with several other species whose strongholds are in more Mediterranean regions (e.g. Small Red-eyed Damselfly *E. viridulum*, Lesser Emperor *Anax parthenope* and Scarlet Darter *Crocothemis erythraea*), *A. affinis* is another species that has become noticeably more frequent in several areas of Europe at latitudes similar to our own during the last 15–20 years. These include Belgium (De Knijf *et al.*, 2006), Germany (Ott, 2000) and Poland (Buczyñski, 2006). It seems likely that the recent English and Channel Island records form part of the same phenomenon, and future developments are awaited with interest.

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

A number of sites recorded particularly good numbers during the season, and given the extent of insect immigration observed during 2006 it is likely that many of these may have experienced migratory influxes. High counts and obvious movements included: 180+ at Bixley Wood, East Sussex, on 3 August (SSm); 200 at Laughton Forest, Lincolnshire, on 18 August (BH); 200+ at Kingsgate, Kent, on 20 August (FS); "very large numbers" at the Dale Fort Field Centre, Pembrokeshire, in the fourth week of August (JCa); a marked increase in numbers, with many seen moving west, at Cliffsend, Kent, on 4 September (DB); and finally "hundreds" at Dungeness, Kent, on 3 October (DWa), coincident with increased numbers of Common Darter *Sympetrum striolatum* and a very large visible southerly passage of Red Admiral butterflies *Vanessa atalanta*. Single *A. mixta* were also caught in UV moth-traps at Bradwell-on-Sea, Essex, on 21, 22 and 28 July (SD), at Spurn, East Yorkshire, on 21 September (BS) and Portland Bill, Dorset, on 11 October (MC). Many light-trap records of dragonflies seem likely to refer to night-flying migrants (Parr, 2006b).

***Anax parthenope* Selys – Lesser Emperor**

The year saw record numbers of *A. parthenope* recorded from Britain, with roughly 90 individuals being seen. This is almost double the previous highest annual total, itself set only the year before (Parr, 2006a). Records were widespread, with several waves of immigration occurring throughout the summer (Figs 1, 2). Arrivals started during mid

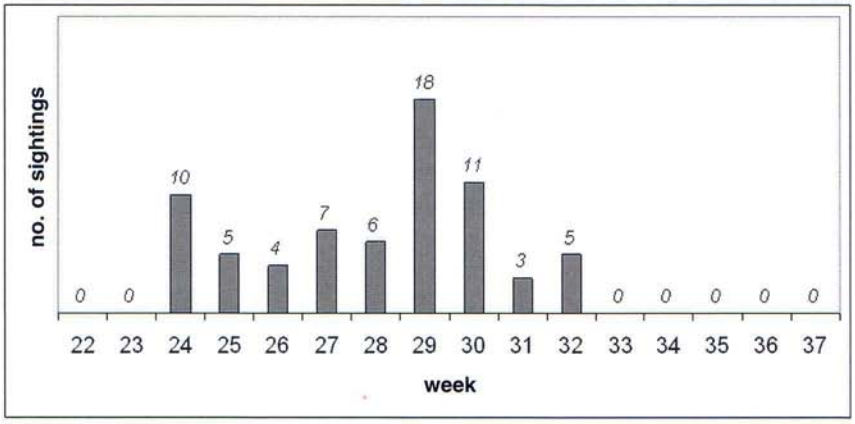

Figure 1. Timing of first records of Lesser Emperor *A. parthenope* at British sites during 2006. Week 23 = 4–10 June, week 27 = 2–8 July, week 31 = 30 July–5 August

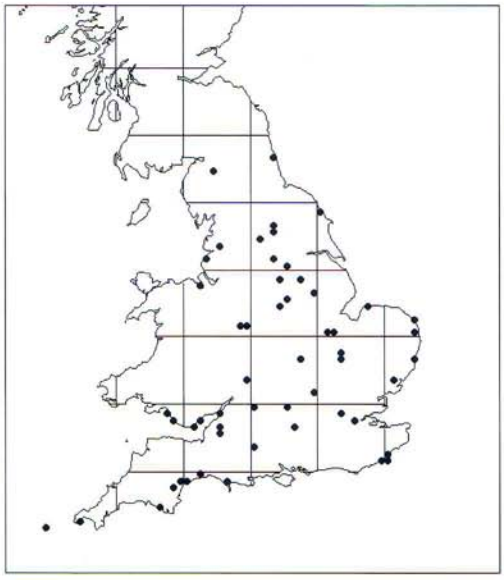

Figure 2. Distribution of sightings of Lesser Emperor *A. parthenope* during 2006.

June, co-incident with the appearance of Red-veined Darter *Sympetrum fonscolombii*, a species with which *A. parthenope* is often associated (Parr *et al.*, 2004). Numbers decreased somewhat after the initial peak. An even more marked peak in records then occurred in late July, during a period of very high temperatures with winds often from between the east and south over southern England and the near Continent (WeatherOnline, 2007). During this second major influx relatively few *S. fonscolombii* apparently arrived at the same time, but instead a range of other mobile species such as Yellow-winged Darter *S. flaveolum* and Small Red-eyed Damselfly *E. viridulum* were noted. In addition to these dramatic summer records, there was also one additional late sighting from St Mary's, Isles of Scilly, on 16 October (SR), this being by some way the latest-ever record for Britain. This record probably represents a case of autumn emergence (though not necessarily locally); such emergences are already described for the species (Werzinger & Werzinger, 2001).

Although many individuals were obviously primary immigrants, it seems likely that, although no exuviae were found, a number of locally-bred individuals may also have been present. Several records thus came from sites were the species had also been recorded during 2004 or 2005, and a notable concentration of sightings in the Wintersett area of West Yorkshire is particularly suggestive of local breeding. Here the first dragonflies appeared on 17 June but counts peaked on 16 July when 11 individuals (10 male, one female) were noted on the adjacent waters of Wintersett Reservoir, Anglers Country Park Lake and Moorhouse Lane Ponds (PM, MTh). At least one other female had also been seen in the area a few days earlier.

Reports of oviposition were received during July 2007 from Chew Valley Lake, Somerset (RA, RM), Swillbrook Lakes Wiltshire Wildlife Trust Reserve, Wiltshire/ Gloucestershire (SC), Belvide Reservoir, Staffordshire (SN), Whisby Nature Reserve, Lincolnshire (GH) and in the Wintersett area, West Yorkshire (PM, MTh *et al.*). It seems possible that the species may now be in the process of colonising Britain; established populations have long been known at similar latitudes in Germany/Poland (Parr *et al.*, 2004).

***Libellula depressa* L. – Broad-bodied Chaser**

The second- and third-ever records for Scotland were made during the peak of the hot weather in late July – a female was seen near Dumfries on 24–26 July (SG) and a pair were reported from the Mabie Forest, Kirkcudbrightshire, on 27 July (SSp). The first Scottish record came from the Edinburgh region in June 2003 (Parr, 2004).

***Orthetrum cancellatum* (L.) – Black-tailed Skimmer**

There were a number of notable northerly sightings during the year, again particularly during the hot spell of late July. The first-ever Scottish records occurred when small numbers were noted at two sites in the Coldingham Loch area, Borders, during the last 10 days of July (PG, DG), and one was subsequently seen at Angle Park in Fife on

5 August (KS). Elsewhere, up to four were seen at Tindale Tarn, Cumbria, over 18–24 July (SW) with a singleton in a country garden 10km to the north-west on 21 July (per DCl).

***Crocothemis erythraea* (Brullé) – Scarlet Darter**
A male was reported from Guernsey, Channel Islands, on 3 July (B. Wells), and another was seen (and photographed) at St Ouen's Pond, Jersey, from 1–6 August (per R. Long; see also Parr, 2007).

***Sympetrum striolatum* (Charp.) – Common Darter**
There was evidence for significant movement of *S. striolatum* in eastern England during 2006, though no particularly dramatic events were reported. At Kingsgate Golf Course, Kent, a mixed group of migrant darters, including some 17 Yellow-winged Darter *S. flaveolum* and 40 *S. striolatum*, were seen on 21 July, with most individuals having left by the following day (FS). Later in the season, on 4 September, a marked increase in numbers of *S. striolatum* (and also Migrant Hawker *Aeshna mixta*) was noted at Cliffsend, Kent (DB), with many individuals seen moving west. "Hundreds" of *S. striolatum* also appeared at Dungeness, Kent, on 3 October (DWa), again coincident with increased numbers of *A. mixta* and on this occasion also a very large visible southerly passage of Red Admiral *Vanessa atalanta*. In addition to these records, there were several reports of *S. striolatum* attracted to UV moth-traps at east coast sites throughout the autumn; these too are likely to refer to migrants (Parr, 2006b). Four were caught between 8 August and 18 October at Bawdsey, Suffolk (MD), and a total of five were trapped between 29 August and 27 September at Spurn, East Yorkshire (BS). Forty-two were caught at Bradwell-on-Sea, Essex, between 22 July and 7 October (SD).

***Sympetrum fonscolombii* (Selys) – Red-veined Darter**
Teneral individuals presumably resulting from local emergences were seen at Windmill Farm, the Lizard, Cornwall, on 17 June (SJ). The year was however most notable for the dramatic immigrations that took place over the summer. A red darter *Sympetrum* sp. seen at Radipole, Dorset, on 18 May is likely to have been *S. fonscolombii*, but it was not until 11 June that the influx began in earnest, coincident with the passage across the country of a cold front preceded by very warm air (Met Office, 2007). Several additional smaller waves of arrivals also took place later in the summer (Fig. 3), with some 900 adults eventually being reported from Britain, and smaller influxes also noted from Ireland (A. Tyner, pers. comm.) and Alderney, Channel Islands (DWe). In Britain, records showed a concentration along the south and east coasts, and also in the Midlands/Yorkshire region (Fig. 4). Sightings were however widespread with reports as far north as the Scottish Borders – Scottish records having only ever occurred in one other year, as long ago as 1911 (National Biodiversity Network, 2007). Notable concentrations reported included 80 in the Filey Dams area, North Yorkshire (JH), and up to 90 at Lound Gravel Pits, Nottinghamshire (Hursthouse, 2007), both during late June–early July.

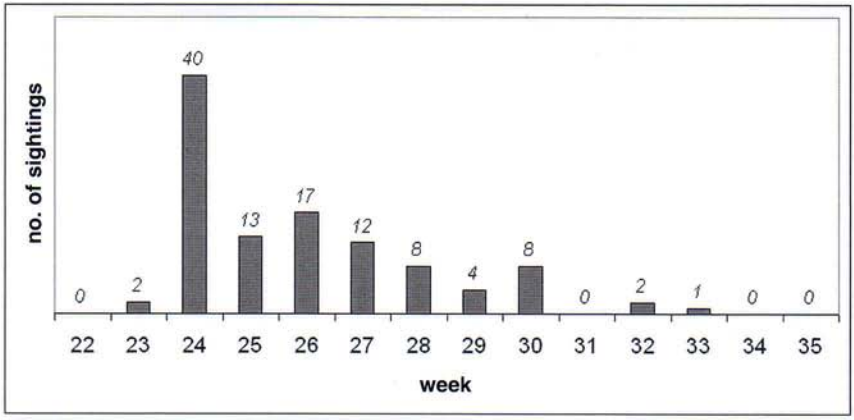

Figure 3. Timing of first records of mature, presumed immigrant, Red-veined Darter *S. fonscolombii* at British sites during summer 2006 (August records of locally-bred immatures are ignored). Week 23 = 4–10 June, week 27 = 2–8 July, week 31 = 30 July–5 August

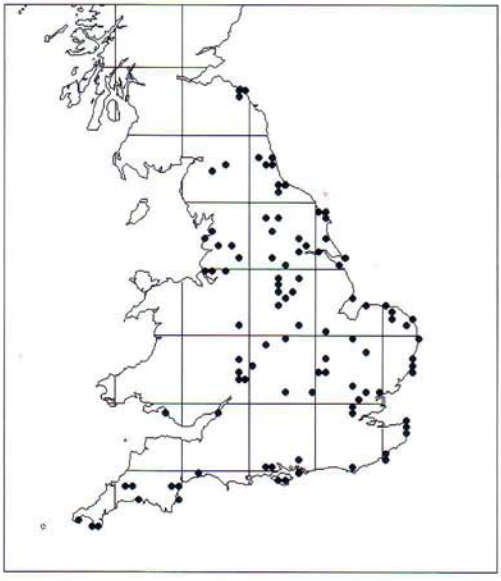

Figure 4. Distribution of sightings of Red-veined Darter *S. fonscolombii* during the summer 2006 influxes.

Many dragonflies from the summer influxes stayed around to breed, and from 3 August (Bake Farm, Cornwall) locally-bred second generation individuals started to emerge in many areas. In all some 16 breeding sites were eventually discovered. While autumn

emergences have been reported from southern England in recent years (e.g. Pellow, 1999), during 2006 such sightings were made as far north as Brockholes Quarry, Lancashire (AH) and Filey Dams, North Yorkshire (JH). Such rapid larval development is seemingly unprecedented at these latitudes in Britain, and probably in part reflects the record-breaking weather experienced in Britain during July – it being the warmest July on record (Hadley Centre, 2007). In keeping with past observations (Parr, 1999), at all breeding sites few, if any, mature individuals were observed during the autumn, despite the emergence of several hundreds of individuals at some sites. Emergents apparently disperse before reaching sexual maturity and do not return. Quite where they go is unknown; perhaps they migrate south.

Away from known and suspected breeding sites there were rather few autumn records, in contrast to the widespread summer influxes. There was, however, a thin scattering of singletons reported, especially during late September and October. Of these, records from Bardsey Island, Gwynedd, on 24 September (SSt) and from St Mary's, Isles of Scilly, on 9 October (per MWTS) are of particular interest. Reports of individuals attracted to UV moth traps in Cornwall and Lincolnshire during the second half of September (MG, MTu, Parr, 2006b) are also of note. Whether these late season records relate to dispersing British-bred individuals or to fresh immigrants is not fully clear; possibly both are involved. The season ended with records from the Penlee Point area, Cornwall, on 1 November (LT) and from Bolney, W. Sussex, on 4 November (DCh).

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

Summer 2006 brought the largest immigrations of *S. flaveolum* seen since the famous events of 1995 (Attridge, 1996; Heath, 1996; Silsby & Ward-Smith, 1997), with some

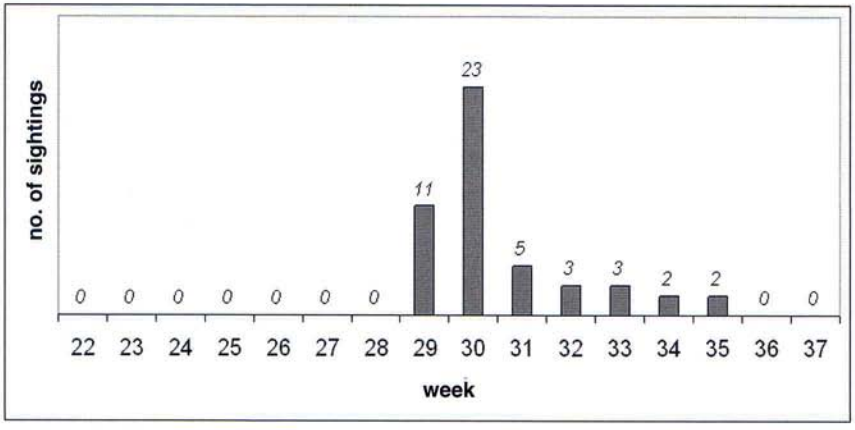

Figure 5. Timing of first records of Yellow-winged Darter *S. flaveolum* at British sites during 2006. Week 27 = 2–8 July, week 31 = 30 July–5 August, week 36 = 3–9 September

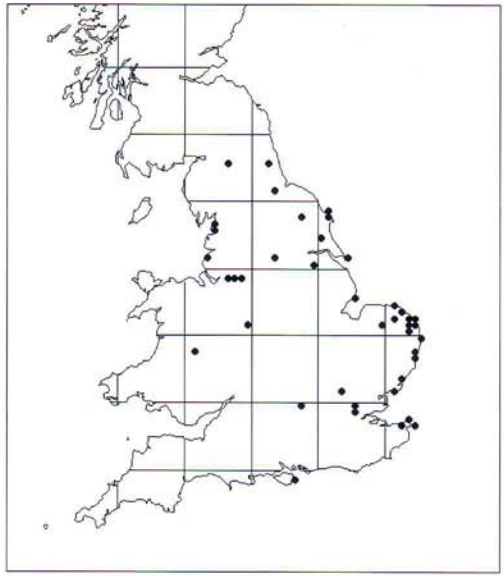

Figure 6. Distribution of sightings of Yellow-winged Darter *S. flaveolum* during 2006.

200 individuals being observed during the season. The main arrivals started on 19 July, with numbers building up rapidly (Fig. 5). Most sightings were along the east coast of England, particularly in Norfolk, but a substantial secondary concentration also occurred in north-west England (Fig. 6). Perhaps these represent migrants that failed to stop on reaching the British coast, but instead pushed on westward. Towards the end of August there were also a few records from central England. These perhaps resulted from onward movement of individuals originally settled in eastern areas, though a cluster of late records along the east coast at the same time perhaps hint at a second phase of arrivals.

Records of breeding activity were limited, being restricted to sightings of pairs *in cop.* at single sites on the Lune Estuary, Lancashire (DH), and near Smallburgh, Norfolk (PH). Although attempted breeding could have been overlooked elsewhere, concentrations of individuals were generally low, with few sites holding more than a dozen individuals. The maximum reported count was of 44 near Upton, Norfolk (PH).

***Sympetrum sanguineum* (Müller) – Ruddy Darter**

There was clearly substantial movement of this species during 2006. Small numbers of mature individuals were present along with *S. fonscolombii* on Alderney, Channel Isles, from mid-June (DWe) – this being a notable record for the Islands. The second half of July then saw numerous sightings from Devon, an area where the species is normally very scarce. Localities included Seaton Marshes, Bystock Nature Reserve, Dawlish Warren, Braunton Burrows, Chudleigh Knighton Heath and Little Bradbury Ponds

(per DSm; RCC). Elsewhere, on 21 July six were noted amongst a mixed group of migrant darters, including *S. flaveolum*, at Kingsgate, Kent (FS) and a lone individual was on Blakeney Point, Norfolk, on 30 July (RP). Single individuals were also caught at UV light at Bradwell-on-Sea, Essex, on 24 and 27 July, with two on 28 July (SD); such light-trap records are likely to refer to migrants (Parr, 2006b). Further north in England in the Lancashire/Cumbria area there were other unexpected sightings during late July. Some of these probably reflect increasing population levels at the northwestern limits of the species in Britain, though given the detailed timing it is possible that migration may also have been involved.

***Sympetrum danae* (Sulzer) – Black Darter**

A few were reported from the east coast of southern England at the same time as the influx of *S. flaveolum*, in a manner similar to the events of 1995 (Attridge, 1996; Heath, 1996). One was thus seen amongst a collection of mixed darter species (*S. flaveolum*, *S. sanguineum*, *S. striolatum* and *S. danae*) at Kingsgate, Kent, on 21 July (FS) and three were reported from Cley, Norfolk, on 30 July. These are likely to represent Continental immigrants. Further west there was also evidence of movement during the summer and early autumn; in this case almost certainly referring to dispersing British individuals. During September several were thus reported from the Merseyside/Lancashire coast, up to 40 km from known breeding sites (PS). Back on the east coast, the origin of a singleton reported from Filey Dams, North Yorkshire, on 30 September (per PA), well away from known breeding sites, is less clear-cut.

Conclusions

Summer 2006 saw perhaps the most dramatic dragonfly migrations ever reported from Britain. Many events were clearly linked to the periods of very hot, sometimes record-breaking, weather experienced during the summer, and a number of species whose main centre of distribution is in more Mediterranean regions were reported in record numbers. Recent colonists such as Small Red-eyed Damselfly *E. viridulum* did well, and there were indications that other species (e.g. Southern Emerald Damselfly *L. barbarus* and Lesser Emperor *A. parthenope*) may also be in the process of colonising. While it is unclear when the next summer like that of 2006 will come along, events do seem to be linked to on-going climate change, and future developments need to be monitored closely. Certainly Southern Migrant Hawker *A. affinis* seems likely to figure more prominently in years to come, and new additions to the UK list are also to be expected.

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What was the British list like 120 years ago? Robert McLachlan's 1884 list of Odonata compared with today's lists

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Summary

A comparison is made between the list of Odonata from Britain recorded in 1884 and those published recently. Robert McLachlan, who published the nineteenth century list, relied on his own observations and earlier accounts, together with records of museum and private collections. The species which have become extinct and those recorded for the first time in Britain since McLachlan's paper was published, are of particular interest.

Introduction

The intention of this paper is to bring the work of one of the earliest British odonatologists to the attention of the reader. To quote from Miall (1912), "To know what is we must know how it came to be."

Robert McLachlan

James (1920) provides useful biographical information about Robert McLachlan. Robert McLachlan (1837–1904) was an important British entomologist and a Fellow of the Royal Society. Born in London to a Scottish father, who was a successful chronometer maker, and an English mother, he went to school in Ilford, Essex. In 1855, when only 18 years of age, he made a voyage to Australia and China collecting botanical specimens and later turned to entomology. He specialised in Neuroptera (at that time the dragonflies and damselflies came under this group) and Trichoptera (caddis flies). His first paper on Neuroptera was published in 1861.

McLachlan was an avid collector and keen correspondent with fellow naturalists at home and abroad. He was a member of several British national scientific societies including the Zoological Society, Ray Society, Linnean Society (elected a Fellow in 1862) and the Royal Society (elected in 1877), being supported in the last of these by, amongst others, Charles Darwin. He also held various posts in the Entomological Society including that of President (1885–1886). When the *Entomologist's Monthly Magazine* was established in 1864, he became the first editor and later became the owner. McLachlan died unmarried on 23 May 1904.

McLachlan's list of British Odonata

In the *Entomologist's Monthly Magazine* of 1884, McLachlan published an annotated list of British dragonflies and damselflies. This valuable paper summarized the British species, reviewed previous work, established which were doubtful or casual visitors only and listed each species with comments from his direct observations and experience. McLachlan's (1884) paper illustrates the value of examining old accounts and museum collections, especially those in the national collections at the British Museum (Natural History) in London.

This paper attempts to compare and contrast the information in McLachlan (1884) with that of the present day, using the lists of British odonates published in particular by Brooks (2004) and Parr (2000) and inside the back cover of *Dragonfly News* (2007).

Other lists compared

McLachlan listed 46 British odonates but added, "the claims of some species to be considered 'British' rest on very slender grounds". Brooks (2004) lists 56 species, of which 39 (16 Zygoptera and 23 Anisoptera) are classified as resident (i.e. breeding) in Great Britain, one (*Coenagrion lunulatum*) as breeding in Ireland, 13 as migrants or vagrants and three as now extinct. The list inside the back cover of the current issue of the newsletter of the British Dragonfly Society, *Dragonfly News* (2007) also has 56 species, the only difference between this and Brook's list being the inclusion in the former of the migrant/vagrant *Sympecma fusca* and the omission of the migrant/vagrant *Sympetrum meridionale*. Parr (2000) lists 55 species as "resident in Britain and Ireland or recorded as a genuine immigrant", and in addition *L. viridis, Pachydiplax longipennis* and *S. meridionale* of unclear or doubtful status. According to Parr (pers. comm.), the status of *L. viridis* has now been clarified as that of a genuine vagrant. Like Brooks (2004), Parr (2000) includes *S. meridionale*, a Mediterranean species, but both question its authenticity in the list. The status of *Erythromma viridulum* has been confirmed as now breeding in this country and another one, *Sympetrum flaveolum* has certainly bred here on occasions in the past. The BDS web site refers to 42 species as resident breeders with others described as extinct, vagrants or new species giving a figure of 56 overall.

Most species are shared in McLachlan's list (1884) and the current literature but it is the remainder which are of particular interest. There are some different species of note: those recorded for the first time since 1990, and others which have become extinct over the last few decades. The six recently recorded species listed on the Wikipedia web site are *Anax junius, Anax parthenope, Crocothemis erythraea, Erythromma viridulum, Lestes barbarus, and Sympetrum pedemontanum*. One of these is of particular interest in the present context. The Southern Emerald Damselfly *Lestes barbarus*, listed by McLachlan as 'doubtful', is said to have been recorded for the 'first' time on the British mainland at Winterton Dunes, Norfolk on 30 July 2002 (Nobes, 2003) and then at Sandwich, Kent (Forrest, 2005). It is known from Alderney and Jersey in the Channel Islands

Table 1. Species from current British lists not recorded by McLachlan (1884), with explanations where known.

ZYGOPTERA	
Coenagrion armatum	First discovered in 1902 in Norfolk (Brooks, 2004). Extinct since 1957 due to pollution of its habitat (Hammond, 1977).
Coenagrion hastulatum	A mainly northern species, found only in the north of Scotland in Britain (Hammond, 1977).
Coenagrion lunulatum	Only known from Ireland at present and first discovered there in 1981 (Cotton, 1982).
Coenagrion scitulum	Recorded in Essex only, between 1946 (Longfield & Pinniger [in Hammond, 1977] and 1953. Extinct since 1953 due to flooding of its habitat by the sea in that year (Hammond, 1977).
Erythromma viridulum	First recorded 1999 in Essex (Dewick & Gerussi, 2000) – Range expansion is still occurring (Parr, 2006) and it is 'Now locally not uncommon in many parts of S.E. England' (A. Parr, pers. comm.).
ANISOPTERA	
Aeshna grandis	A common dragonfly surely known to McLachlan, who must have used another name but this is not clear, perhaps *A. rufescens* (see comment under name changes with regard to *A. isosceles*). It appears *A. grandis* and *A. isosceles* may have once been considered varieties of the same species.
Aeshna affinis	Very rare migrant, with the only confirmed record in mainland Britain being in 1952 but it has been observed in Jersey (Long, 2000) and may well have been overlooked in southern England (Parr, 2005).
Anax junius	New – first recorded in 1998; vagrant from the USA. (Pellow, 1999).
Anax parthenope	New – first recorded in 1996 in Gloucestershire (Phillips, 1997) and in most/all years since – appears to be increasing in frequency and there are indications that it may have bred in recent years (Parr, 2006).
Hemianax ephippiger	Migrant, rare until mid 1980's (Askew, 1988). Currently returned to being rare.
Crocothemis erythraea	Migrant, first record from Cornwall in 1995 (Jones, 1996). Now six records (Parr, 2005). Occurs in the Channel Islands (Askew, 1988).
Sympetrum nigrescens	Scottish species not described/separated until 1912 (Lucas, 1912; Gardner, 1955); validity has been questioned as it may be the same species as *S. striolatum* (e.g. Brooks, 2004).
Sympetrum pedemontanum	Rare migrant, recorded for the first time in 1995 (Brooks, 2004).
Pantala flavescens	Rare migrant, recorded only four times; most recently in 1989. (Brooks, 2004).

Table 2 Species from McLachlan's (1884) British list but not in current records – with explanations where known.

ZYGOPTERA	
Lestes nympha	See comment above re nomenclature. This species is now known as *L. dryas*.
Lestes virens	Regarded as doubtful by McLachlan (1884), with some additional question of original misidentification; not in British list but is a candidate to occur in Britain as it is found in both Brittany and The Netherlands. (Dijkstra, 2006)
ANISOPTERA	
Onychogomphus forcipatus	"A casual at the most" (McLachlan, 1884).
Leucorrhinia pectoralis	"Casual visitor"(McLachlan, 1884).
Gomphus flavipes	"Casual visitor" (McLachlan, 1884). Now classed as a migrant (vagrant). Status identical to that of *L. pectoralis*, i.e. single old record of vagrant, but no further sightings since McLachlan's time.

Table 3. Species from current lists recorded under a different name by McLachlan (1884).

ZYGOPTERA	
Chalcolestes viridis	Listed as *L. viridis* by McLachlan (and Parr, 2000); migrant; first record in 1899. Status unclear but found in Jersey, Channel Islands. Bred in Kent in 1992 (Brook & Brook, in Brooks, 2004) (1 exuvia found, but only identified in 2003 as belonging to this species). Has possibly been overlooked (Brooks, 2004).
Lestes barbarus	Listed as *Lestes barbara* by McLachlan. Migrant, found in Channel Islands (Long & Long, 2000). First recorded in mainland Britain in 2002 (Nobes, 2003).
Lestes dryas	Listed as *Lestes nympha* by McLachlan.
Ceriagrion tenellum	Listed as *Pyrrhosoma tenellum* by McLachlan.
Coenagrion pulchellum	Listed as *Agrion pulchellum* by McLachlan.
Coenagrion puella	Listed as *Agrion puella* by McLachlan.
Coenagrion mercuriale	Listed as *Agrion mercuriale* by McLachlan.
ANISOPTERA	
Aeshna caerulea	Listed as *Aeshna borealis* in McLachlan. Scottish records only.
Anax imperator	Listed as *Anax formosus* by McLachlan.
Pyrrhosoma nymphula	Listed as *Pyrrhosoma minium* by McLachlan.
Aeshna isosceles	Listed as *Aeshna rufescens*. Only found in East Anglia.
Cordulegaster boltonii	Listed as *Cordulegaster annulatus* by McLachlan.
Sympetrum danae	Listed as *Sympetrum scoticum* by McLachlan.
Sympetrum striolatum	Listed as *Sympetrum vulgatum* by McLachlan.
Libellula depressa	Listed as *Platetrum depressum* by McLachlan.

(Wikipedia web site). One species, the Orange spotted Emerald *Oxygastra curtisii* appears in McLachlan's list but is now extinct (1963) in Britain.

McLachlan believed the following to be casual visitors to Britain: *L. pectoralis, S. meridionale, S. fonscolombii, O. forcipatus* and *Gomphus flavipes* with no evidence, at least at that time, for them breeding in Britain. He also listed an additional three species, *Lestes viridis, L. virens* and *L. barbara* (= *barbarus*) as 'doubtful'. Today, *S. fonscolombii* is a common migrant, breeding regularly, and *Lestes barbarus* has been recorded at a few sites in recent years. *Lestes (=Chalcolestes) viridis* is still casual and highly erratic, while most of the other 'casuals' have not been recorded in the UK for many decades

Sympetrum meridionale is a Mediterranean species. Earlier records for Britain mentioned in McLachlan (1884), who included it as a 'casual', are now considered doubtful (Merritt *et al.*, 1996; Brooks, 2004, Parr, 2000). The species has been recorded from Jersey, Channel Islands. Parr (2000) regards it as a "strong migrant" and predicted it as a candidate to appear in Britain in the next few years.

Conclusion

The odonate fauna is undergoing some significant changes at the present time due to climate change, migration, pollution and habitat destruction. New species are being found and others have become extinct. In the context of such changes it is interesting to note the comments of McLachlan (1884), "England possesses two dragon-flies (*Oxygastra curtisii* and *Pyrrhosoma* (=*Ceriagrion*) *tenellum*) that are of South European distribution, and which should not occur. On the other hand, if we compare our list with that of the species found in Belgium, Holland and Scandinavia, there are several that *should* occur, not as 'casuals', but as residents".

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Spacing behaviour in larval Banded Demoiselle *Calopteryx splendens* (Harris)

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Introduction

An understanding of spacing behaviour leads to greater appreciation of relationships between individuals and how they utilise their environment. Banded Demoiselle *Calopteryx splendens* larvae are regarded as 'claspers' (Corbet, 1999), with a tendency to associate themselves with a firm substrate on which to cling (Ward & Mill, in press). The widely held view is that *C. splendens* larvae tend to inhabit aquatic vegetation growing on a silt substrate where they use the roots and stems for shelter and as emergence supports. However, considering the patchy distribution of aquatic vegetation in a river and the semivoltine nature of the larval life cycle (Brooks, 2004) this could potentially result in serious overcrowding of larvae at oviposition sites. In the current study the spacing behaviour of *C. splendens* larvae was investigated, under experimental conditions, with regard to the density of an emergent support.

Methods

From 23rd to 29th April 2001 spacing behaviour experiments were carried out with Banded Demoiselle *Calopteryx splendens* larvae. A glass aquarium (300mm × 220mm) was filled with silt sediment to a depth of 20mm covered by tap water to a total depth of 120mm. It was divided into three equal regions, each of 100mm × 220mm. The region at one end contained 8 evenly spaced dowel rods, the distance between them being 60mm. The middle region contained 18 dowel rods spaced 40mm apart and the third region contained 55 dowel rods spaced 20mm apart. Two airstones were used to aerate the water and the tank left for 24 hours to dechlorinate.

12 final instar Banded Demoiselle *C. splendens* larvae were used in the experiment and four larvae were placed in the centre of each region. The larvae could move freely between regions and their positions were recorded twice per day at 1000 and 1800 (GMT). The experiment ran for seven days.

On alternate days, four *Chironomus* sp. were placed into each of the three regions. Where any uneaten food items remained, no further *Chironomus* sp. were introduced to prevent settling of uneaten food items influencing larval distribution.

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An Index of Dispersion (Fowler *et al.*, 1998) was used to analyse the distribution of the larvae within the sections containing different dowel densities. This is given by the ratio of the variance (s^2) to the mean (m). Where this equals 1 (or is close to 1) the distribution is random; where it is greater than 1 the distribution is contagious (clumped); where it is less than 1 the distribution is regular. The critical values of the ratio that separate these distribution patterns is obtained by standardising the variance/mean ratio by multiplying it by the degrees of freedom (number of observations in the sample minus one). This results in values that can be compared to the Chi^2 distribution.

The variance and mean of each region at each of the 14 observation times (twice per day for seven days) was obtained by subdividing each region into 10 quadrats of 44mm × 50mm in area and recording the number of larvae in each quadrat. Thus at each observation time larval dispersion was determined as regular, random or contagious.

Results

After the first four observation times (two days) a clear pattern of distribution emerged. From observation times 5 to 14 only one larva was recorded in the eight dowel block section and then on only one occasion (Fig. 1). Consequently, there were significantly

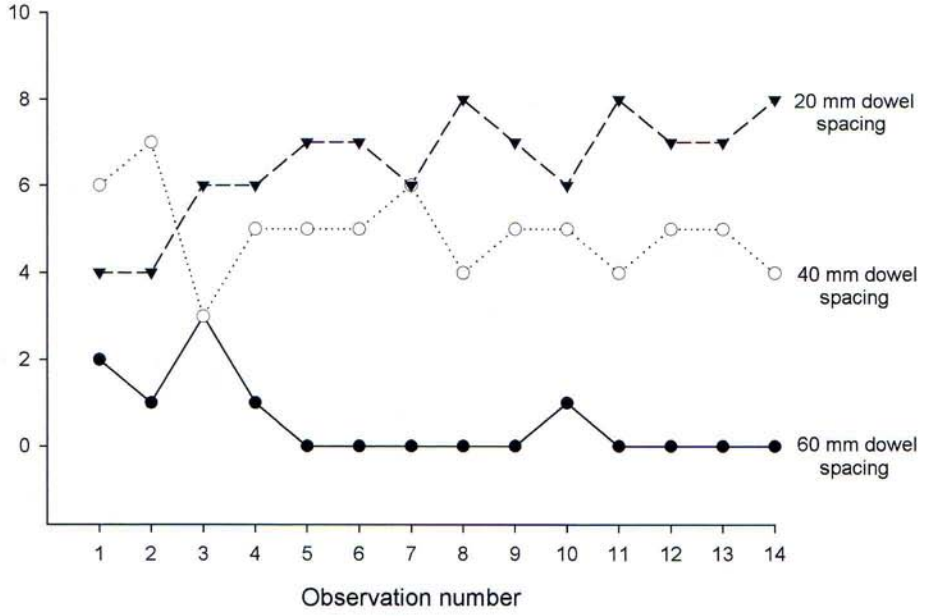

Figure 1. The number of individuals observed in each region at the three dowel densities at each of the 14 consecutive observation times.

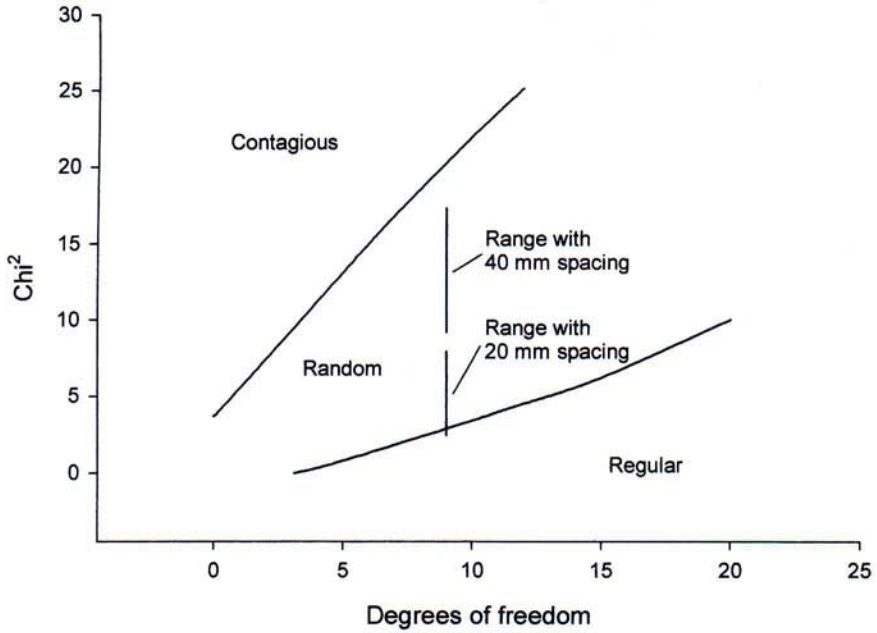

Figure 2. The Chi^2 value with nine degrees of freedom for the last 10 observation times (days 3–7) for the 18 dowel density block (40mm spacing) and for the 55 dowel density block (20mm spacing). The 95% confidence limits for random dispersal are shown, adapted from Fowler *et al.* (1998).

more larvae observed in the 18 and 55 dowel density blocks than in the eight dowel block ($Chi^2 = 66.04$, d.f. $= 28$, $P < 0.001$). Data from the eight dowel block were excluded from further analysis since the Index of Dispersion could not be estimated.

The data over days 3–7 (inclusive) were considered against the 95% confidence limits of random dispersal (adapted from Fowler *et al.*, 1998). During this period all observed distributions in the 18 dowel region, with 40mm spacing, were clearly random, although some did fall towards the upper 95% confidence limit, i.e. towards the contagious zone. However, in the 55 dowel region, with 20mm spacing, although most distributions were random they clustered towards the lower 95% confidence level and three could indeed be considered regular in distribution (Fig. 2).

Discussion

A shift in *Calopteryx splendens* from a random, approaching contagious, distribution towards a more regular pattern with increased density of dowels was observed in the current study. In a densely vegetated environment each larva can secure a territory on a

piece of vegetation and avoid antagonistic interactions with conspecifics by ensuring there is adequate space between the territories of individuals. The wider spacing between the 18 dowel-density rods (40mm) may be sufficient to avoid intrusion into the territory of another individual and therefore allow territories to be established on neighbouring dowel rods, giving a false impression of clumping. When the dowel rods were positioned closer together (20mm apart) in the 55 dowel density block, the size of a single territory may encompass more then one dowel rod, thus resulting in a more regular distribution of the individuals.

Territorial spacing of individuals has been reported in odonate larvae (Zygoptera) (Baker, 1980, 1981; Harvey & Corbet, 1985, 1986), including Banded Demoiselle *Calopteryx splendens* (Ryazanova & Mazokhin-Porshnyakov, 1996a). The benthic dwelling larvae of gomphids and libellulids are territorial and thus show attachment to a specific site. Subsequently, significantly few contacts with conspecifics occur (Ryazanova & Mazokhin-Porshnyakov, 1996b). This territorial competition is suggested as a mechanism of dispersion of individuals at sites of aggregation, reducing the probability of antagonistic encounters and the potential for cannibalism (Ryazanova & Mazokhin-Porshnyakov, 1996b), which has been reported in larval *C. splendens* (Ryazanova & Mazokhin-Porshnyakov, 1996a). In addition, the spacing behaviour of larvae may help determine the number of adults that emerge in a season by influencing prey availability (Baker, 1980). However, Crowley (1979) suggested that zygopteran larvae, in areas of low prey density, disperse to areas of higher prey density. When invertebrates are themselves subject to predation by fish, for example, it has been found that densities of invertebrates are two to six times greater in areas where trout are absent than where they are present (Minshall, 1984).

The ensuing competiton for food and space resulting from closely related taxa occupying the same habitat, can be alleviated by staggered life cycles, as some aquatic invertebrates change their spatial distribution patterns depending on their larval stadia. This has been found in various orders of insects including Odonata (Tamiya & Miyakawa, 1984; Suhling, 1994a; Wilson, 1995). Tamiya & Miyakawa (1984) found that larger larvae of *Epiophlebia superstes* were found attached to stones, whereas smaller larvae of the species were concealed among debris (Tabaru, 1984). Suhling (1994a) found that early instars of the Large Pincertail *Onychogomphus uncatus* inhabit sand, and the last two stadia live mainly in pebble and boulder areas. Conversely, Wilson (1995) found that last instar larvae of *Gomphidia keloggi* live in pools in muddy, weedy places, whereas earlier instars occupy coarse sand and gravel in fast flowing water. However, in contrast to the above, the Yellow Clubtail *Gomphus simillimus* showed no detectable difference in substrate choice in any larval stage (Suhling, 1994b).

Acknowledgements

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Erratum

Volume 23, page 29. The caption to Plate 3 should read "Line indicates the tip of the epiproct."

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 (Hemianax) ephippiger	Vagrant Emperor
Anax imperator	Emperor Dragonfly
Anax junius	Green Darner
Anax parthenope	Lesser Emperor
Brachytron pratense	Hairy Dragonfly
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

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CONTENTS

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