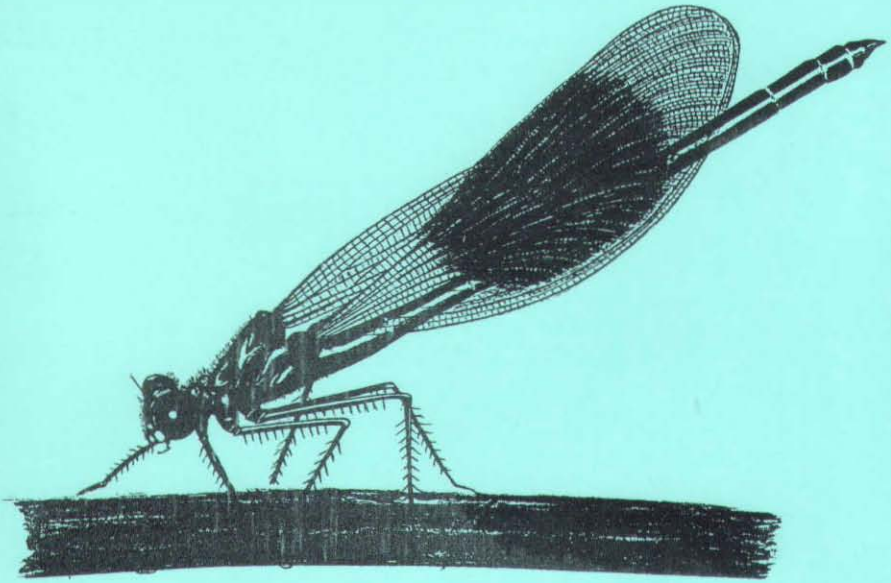
Journal of the British Dragonfly Society

Volume 12
Number 1

April
1996



Editor: R. R. Askew
Assistant Editor: B. H. Harley

member of the Societas Internationalis Odonatologica

The *Journal of the British Dragonfly Society*, published twice a year, contains articles on Odonata that have been recorded from the United Kingdom. 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:	R. R. Askew, 5 Beeston Hall Mews, Beeston, Tarporley, Cheshire CW6 9TZ
Secretary:	W. H. Wain, The Haywain, Hollywater Road, Borden, Hants GU35 0AD
Librarian/Archivists:	P. M. & C. Allen, 'Little Thatch', North Gorley, Fordingbridge, Hants SP6 2PE

Articles for publication (two copies please) should be sent to the Editor. Instructions for authors appear inside back cover.

Back numbers of the Journal can be purchased from the Librarian/Archivists at 1—4 copies £2.75 per copy, 5 copies or over £2.60 per copy (members) or £5.50 (non-members).
Other enquiries (including membership applications) should be addressed to the Secretary. Annual subscription: £5.50; Library subscription: £11.
Overseas subscriptions: £7.50 and £13 respectively. All subscriptions are due on 1st April each year. Late payers will be charged £1 extra. Life membership: £80.

Front cover illustration of male *Calopteryx splendens* by Roderick Dunn

Migrant species of *Sympetrum* in Norfolk, 1995

Stuart Pittman
101 Old Hale Way, Hitchin, Hertfordshire SG5 1XR

A visit to the main cemetery in Great Yarmouth, Norfolk on 5 August 1995 confirmed the presence there of the extremely rare (in Britain) Vagrant Darter (*Sympetrum vulgatum* (L.)). It had been seen earlier, on 1 August, by Peter Milford.

The Vagrant Darter is best identified face on, when the black, 'handlebar' moustache across the top of the frons can be seen to continue down along the inner margins of the eyes. Because this feature can be very difficult to see clearly, usually being obscured by the eyes, it is generally believed that individuals need to be trapped in order to verify identification. However, in my opinion, with patient study, cautious stalking and close-focusing binoculars, the black facial mark can be seen in the field. The Vagrant Darter is slightly smaller than the Common Darter (*S. striolatum* (Charpentier)), it is slightly constricted in the middle part of the abdomen, and the areas on the thorax which in *S. striolatum* are yellowish, are in *S. vulgatum* suffused with red (olive in the female). Previously recorded numbers of *S. vulgatum* are extremely low and Hammond (1983) quotes only eight, the latest in 1946. Due to its similarity to *S. striolatum*, however, it has perhaps been overlooked.

A male and female Vagrant Darter were in the company of numerous Yellow-winged Darters (*Sympetrum flaveolum* (L.)) in the cemetery. This is another infrequent immigrant, with only three records in the 1980s reported in the Norfolk Dragonfly Survey, 1989. *S. flaveolum* spread widely and rapidly inland following its arrival all along the East Coast (some 200 individuals observed), with sightings in the first week of August from Bedfordshire (Willington - SC, SP, MW), Hertfordshire (Ickleford near Hitchin - MW, Tring reservoirs - (RBA), Leicestershire (RBA) and Warwickshire (Alvecote Pools on the border with Staffordshire - BRM). Reports from the West Coast, at Kenfig in South Wales and Heysham in Lancashire, quickly followed.

Migrant individuals of the Black Darter (*Sympetrum danae* (Sulzer)), a species very rare in Norfolk because of its preference for acid bogs, were also in the cemetery, as too were many individuals of the Ruddy Darter (*Sympetrum sanguineum* (Müller)), the commonest species present. This had not been seen in Great Yarmouth before 1993, and the large number present suggest that there had been an immigration (Mendel, 1992).

Sources of the observations referred to above under initials are Steve Cham (SC), Peter Milford (PM), Brian Mitchell (BRM), Stuart Pittman (SP), Mike Watson (MW) and 'Rare Bird Alert' (RBA).

References

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

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

The Southern Damselfly *Coenagrion mercuriale* (Charpentier) on the Ministry of Defence Ranges, Lulworth, Dorset

E. D. V. Prendergast
Manor House, Bagber, Sturminster Newton, Dorset DT10 2EY

The Southern Damselfly (*Coenagrion mercuriale* (Charpentier)) was first found in Dorset in 1837 at Cosmore Common by J. C. Dale, the discoverer of the Orange-spotted Emerald (*Oxygastra curtisii* (Dale)) in 1820. Cosmore is about 12km south of Sherborne on the north edge of the North Dorset Downs, where there is a band of acidic greensands. The site has since been drained, and no sign of it or of the Southern Damselfly remains.

In recent years *C. mercuriale* has been reliably reported in Dorset from a few small sites on the heathlands of the Poole Basin between Wareham and Corfe Castle in the Isle of Purbeck. As the nearest of these sites is just a few kilometres from the edge of the Lulworth Ranges Training Area, where I am a member of the Conservation Committee, I was aware that it might occur there (Map 1). After a few specimens were found beside a small drainage ditch near the west edge of the Ranges in July 1989, in May 1992 a major colony was discovered at Orchard Cottage Mire (Figure 1). Orchard Cottages are ruined buildings alongside the old Lulworth road just to the east of a large and expanding claypit, operated by the English China Clay Company (ECC). The centre of the Mire is some 300m to the north-west (SY891832). It lies on the west side of a long flat field of unimproved grassland, used for cattle grazing, which forms the bottom of a small valley of light, silty soil between low hills of pine-dominated acid heathland. The Mire extends for about 250m by 50m, and is edged on the south-west by sallows, birch and oak scrub along the line of a ditch, and on the other sides by an electrified wire fence.

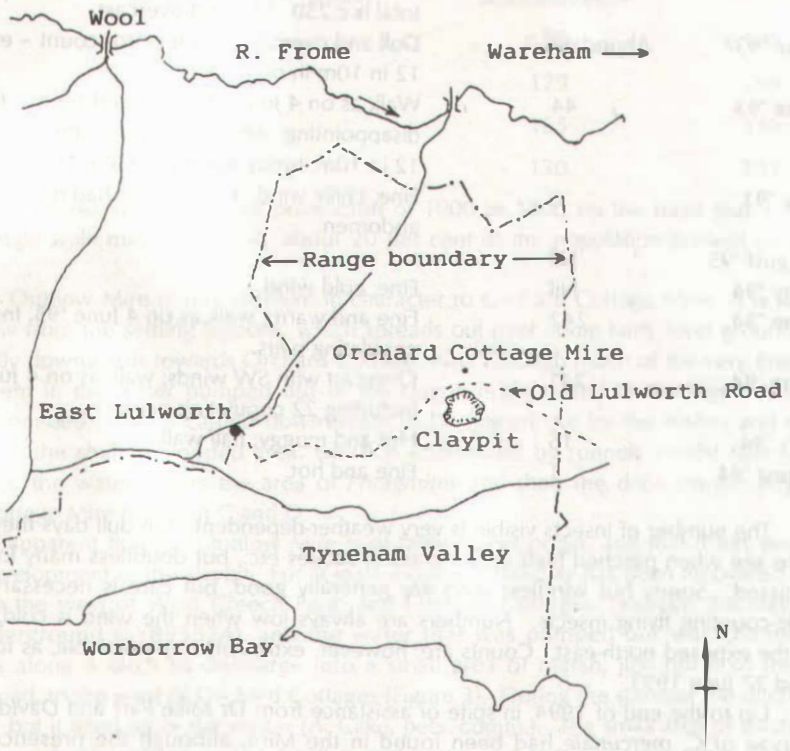
The area, according to the long-time tenant farmer, Mr A. Cake, has always been wet and hence has, for many years, been fenced off to prevent the cattle getting bogged. The electric fence does not, however, prevent Sika Deer (*Cervus nippon*) which are locally numerous, and sometimes young cattle, from feeding inside its confines and hence providing some check on the vegetation. The sources of water within the Mire are springs and seepages. They are unevenly distributed resulting in varying degrees of wetness in the Mire, with a few fairly solid patches, a large area of quaking bog near the centre, and elsewhere areas of shallow water, mud and a few runnels. The water from the springs and seepages is only mildly acidic, with a pH between 6.6 and 6.9, indicating that it originates from somewhere other than the immediately surrounding acid peat-lands. An area of the field for about 10 to 20m outside the electric fence is also, at times, very boggy. It is heavily grazed and poached by the cattle in summer, leaving puddles, areas of wet mud and tufts of rushes.

A second source of water that affects the Mire is some that is pumped out of the ECC claypit into settling lagoons, and thence flows across country and finally through a bed of tall Common Reed (*Phragmites australis*) into a ditch on the south-west side of the Mire, between C and D on Figure 1. Most then continues along the ditch to E, but some overflows into the Mire between B and D. This has the effect of keeping the west side of the Mire damp and

helping to prevent the rest drying out. The water in the ditch, with pH 7.0 to 7.4, is more alkaline than that of the Mire springs.

The Mire has a varied and rich flora according to the depth of the water. The main shrubs, along the west side, are the Grey Willow (*Salix cinerea*), Eared Willow (*S. aurita*) and Bog-myrtle (*Myrica gale*); and the tall vegetation includes Cottongrass (*Scirpus angustifolium*), Bulrush (*Schoenoplectus lacustris*), Common Reed (*Phragmites australis*), Branched Bur-reed (*Sparganium erectum*), several common rushes and the very uncommon Blunt-flowered Rush (*Juncus subnodulosus*) and the rare sedge, Long-stalked Yellow-sedge (*Carex lepidocarpa*). Important marginal plants include Meadow Thistle (*Cirsium dissectum*), Sneezewort (*Achillea ptarmica*), Heath-grass (*Danthonia decumbens*), Marsh St John's-wort (*Hypericum elodes*), Water-pepper (*Polygonum hydropiper*), Water-purslane (*Lythrum portula*), Devils'-bit Scabious (*Succisa pratensis*) and a few plants of Marsh Speedwell (*Veronica scutellata*). Altogether 41 species of plant were identified in the Mire (Anne Horsfall, pers. comm.).

When I first visited the Mire in July 1986 during my survey of the Lulworth Ranges for Odonata, there were only a few dragonflies and I concluded that it was of prime interest because of its plants, a view reinforced by my second visit in September 1990. Unfortunately



Map 1. Location map of Orchard Cottage Mire

my first spring visit was not until 29 May 1992 when, to my surprise, I found *Coenagrion mercuriale* numerous and widespread. It may well have been, and indeed probably was, established in the Mire for many years previously. However, with some 30 to 40 actual or potential dragonfly sites, in an area of some 6400ha, many accessible only on foot, and because of restrictions on entering a live firing range, and other commitments elsewhere, coverage of any particular site was inevitably thin (Table 1).

Table 1. Numbers of *Coenagrion mercuriale* seen at Orchard Cottage Mire, up to the end of 1994

Date	Total seen	Remarks
29 May '92	200	Less than a quarter of the mire covered. Gentle southerly breeze, rather overcast.
29 May '93	nil	Too cold and windy for any Odonata.
4 June '93	405	A modified Pollard-type walk. Dull and overcast.
13 June '93	122	Half the distance covered on 4 June, so equivalent total is c.250. Dry and overcast.
26 June '93	Abundant	Dull and overcast. No time for count - except for 12 in 10m in one place.
27 June '93	44	Walk as on 4 June '93. Hot and sunny. Count disappointing: where on 26 June there had been 12 in 10m, today there were 3 in 100m.
31 July '93	6	Fine, chilly wind. One female had mud-encrusted abdomen.
30 August '93	Nil	
30 May '94	Nil	Fine, cold wind.
17 June '94	242	Fine and warm; walk as on 4 June '93. Including 42 copulating pairs.
26 June '94	241	Overcast with SW winds; walk as on 4 June '93. Including 22 copulating pairs.
23 July '94	15	Hot and muggy; half walk.
5 August '94	1	Fine and hot.

The number of insects visible is very weather-dependent. On dull days they are quite easy to see when perched high up on grasses, sedges etc., but doubtless many lower down are missed. Sunny but windless days are generally good, but care is necessary to avoid double-counting flying insects. Numbers are always low when the wind is cold, strong or from the exposed north-east. Counts are, however, extremely unpredictable, as for example 26 and 27 June 1993.

Up to the end of 1994, in spite of assistance from Dr Mike Parr and David Winsland, no larvae of *C. mercuriale* had been found in the Mire, although the presence of many copulating pairs and a single female with dried mud on her abdomen were indications of breeding. As Lucas (1900) wrote, regarding a mud-encrusted female of this species; 'The

explanation was obvious. These females had been engaged in oviposition, and some instinct had prompted them to sink their eggs as deeply as possible in the mud, so as to afford some chance of escape from the consequence of further evaporation.' With the large areas of mud, especially just outside the wire fence, and the difficultly of sieving through such a glutinous medium, it is perhaps not surprising that no larvae were found in it.

The breakthrough came on 14 April 1995 when, after another failure to find any larvae in Orchard Cottage Mire, the stream to the east or the ditch along the south-west side, attention was turned to a small boggy area at A on Figure 2. Immediately some larvae were found in a little runnel, followed by others further towards the settling lagoons, in the Outflow Mire.

On 29 May 1995 with David Winsland and my son, Dr Hew Prendergast, we again failed to find any larvae in Orchard Cottage Mire, but without much effort found forty or fifty in the Outflow Mire, as well as adults in both places. Comparative counts of adults on this and subsequent visits in 1995 were:

	Orchard Cottage Mire	**Outflow Mire**	**Total**
	Standard Walk (c.500m)	Selected Areas	
29 May	52	c.50	c.100
1 June	140	129	269
9 June	151	165	316
25 June	51	130	181

These figures indicate a total population of 1000 to 1500 on the basis that a count during a single walk may reveal only about 20 per cent of the population present (Jenkins, 1995).

The Outflow Mire is very different in character to Orchard Cottage Mire. It is fed by the overflow from the settling lagoons, which spreads out over some fairly level ground that slopes gently downwards towards Orchard Cottage Mire. Though much of the very fine ball-clay sediment in the water pumped out of the claypit is deposited in the lagoons, some remains suspended. This is carried downstream to be filtered out by the rushes and other vegetation in the shallow flooded area, which is intersected by runnels amidst fallen pine trees, before the water enters the area of *Phragmites* and then the ditch on the edge of Orchard Cottage Mire between C and D.

It is apparent that the Outflow Mire is of fairly recent origin, and that it has evolved with the development of the claypit. For at least a century, ball-clay has been recovered from the area to the west of West Creech Farm and Orchard Cottages. Initially, the clay was mined underground (SY893824), and the water that was pumped out was channelled northwards along a ditch to discharge into a small area of marsh, just north of the old Lulworth Road, to the west of Orchard Cottages (Figure 3). During the summer the ditch was usually dry, but it filled up in the winter (A. Cake, pers. comm.). The small area of discharge was amidst peatland, with pine trees, heather and gorse, and some invasive scrub (Defence Land Services Habitat Map 1977-82; OS 1/25,000 Sheet SY 88, revised 1963).

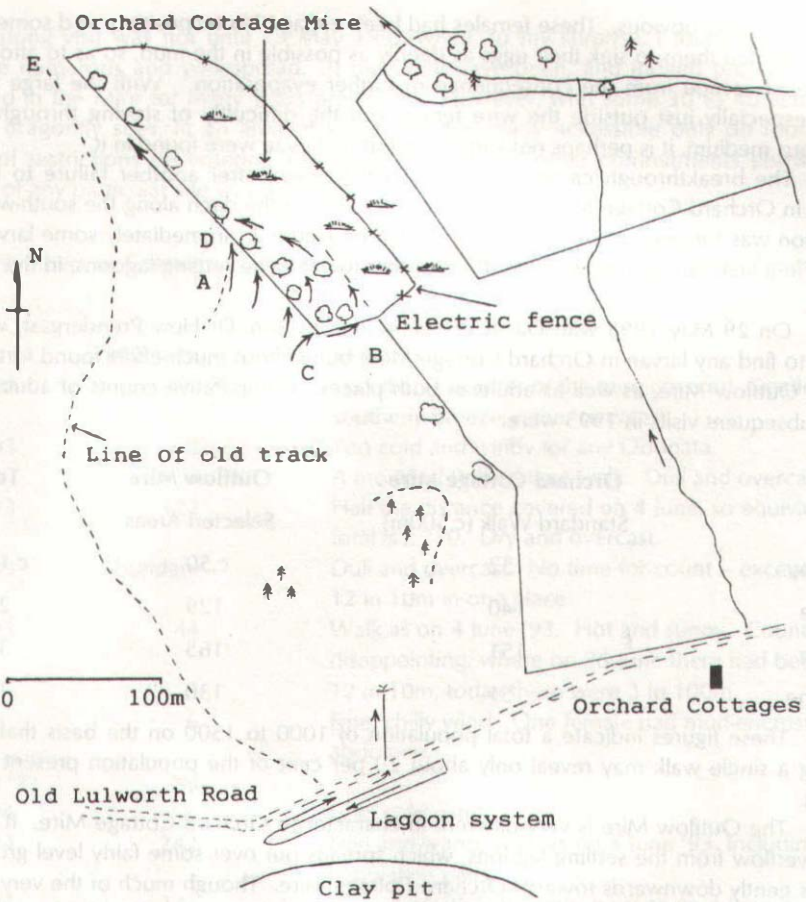


Figure 1. Orchard Cottage Mire

In the early 1970's, ECC, which had bought the ball-clay quarrying firm in 1968, extended opencast operations in the area between the old mine and the old Lulworth road. By 1980, the pit had expanded so much that it was necessary to construct a system of three settling lagoons just south of this road, through which the water pumped out of the pit passed before being discharged through the same channel as previously (Figure 4). However the volume of water was considerably greater than the peak outflow from the mine, and a way was cut through the belt of pines to allow it to flow northwards, to enter the Orchard Cottage Mire from the south between B and C. With the addition of this silt laden water came a lush growth of rushes, sedges and other vegetation to the south of the belt of pine trees, and a carr of Bog-myrtle and tall Purple Moor-grass (*Molinia caerulea*) tufts between here and Orchard Cottage Mire.

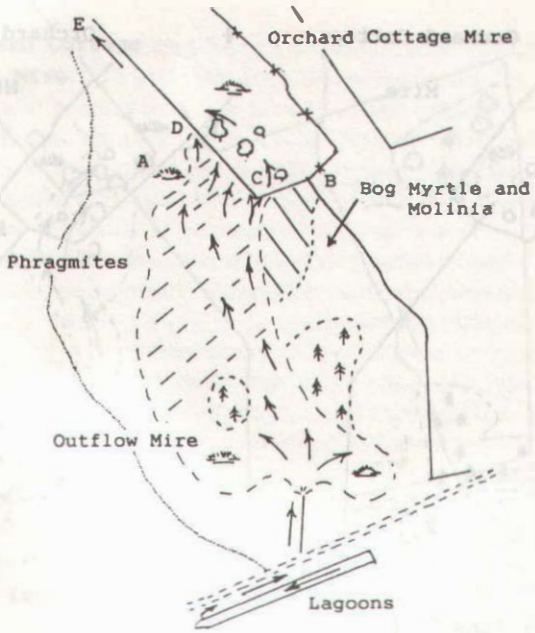
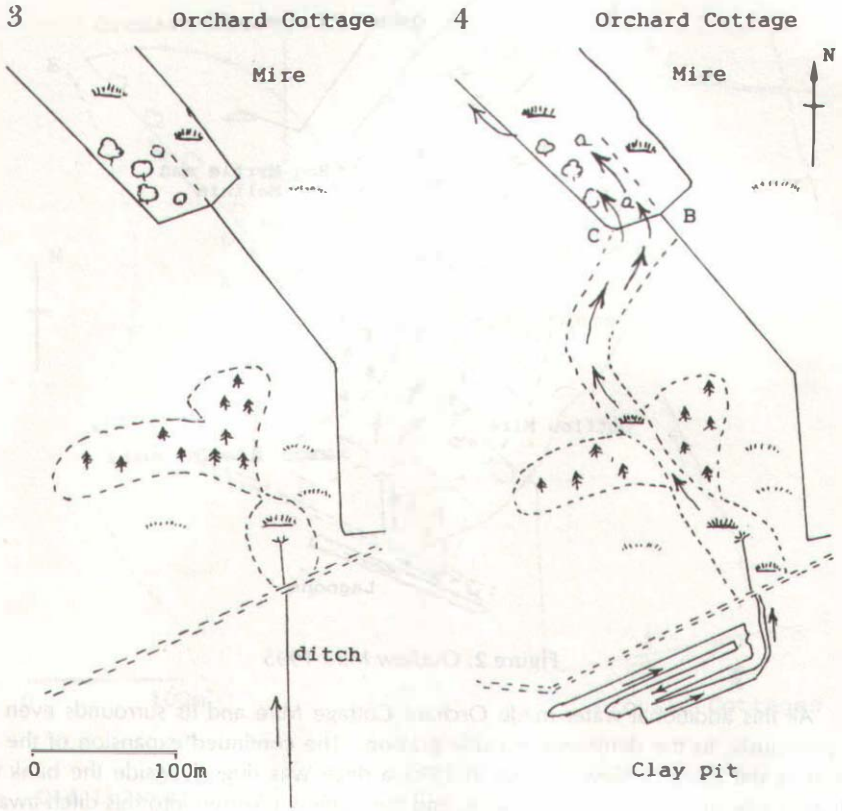


Figure 2. Outflow Mire 1995

All this additional water made Orchard Cottage Mire and its surrounds even wetter than previously, to the detriment of cattle grazing. The continued expansion of the claypit resulted in still more outflow, so that in 1991 a ditch was dug alongside the bank on the south-west side of Orchard Cottage Mire, and the outflow diverted into this ditch away from the area of *Molinia* and Bog-myrtle. At the same time, the direction of flow in the lagoons was reversed, and the outlet moved some 50m further west. All this resulted in the present position (Figure 2) with a complete change in the character of the area; the main features of which are the expansion of the previously flooded area, now with a maze of runnels and shallow channels through rushes, sedges and grasses at the southern end, merging with a large, and in places dense, bed of tall *Phragmites* towards the north. The channels in the latter are too narrow and over-shadowed for any Odonata, but the former appear to be very suitable for *C. mercuriale* and are rich in their larvae.

The pH of the water in the runnels was, on the days visited, in the range 6.6 to 7.0, which was about the same as the outflow from the lagoons, although the latter has sometimes been between 7.0 and 7.4. The variation is probably related to the part of the claypit from which the water is being pumped.

The land on either side of the flooded area is peatland, dry with invasive scrub on the east; and with a wet fringe on the west with pondweeds (*Potamogeton* spp.), Sundew (*Drosera* sp.), *Sphagnum* sp. and some stunted Bogbean (*Menyanthes trifoliata*). This fringe is acid, with pH 4.3 to 4.8 measured about 30cms away from the edge of the flooded area, where the pH was 6.5 to 6.7.



Figures 3 and 4. (3) Pre-1970 outflow from clay mine near West Creech Farm along ditch which dried up in summer. (4) Early 1980s lagoon system established with greatly increased volume of water flowing across country into south-east side of Orchard Cottage Mire

From the above history, it appears that prior to 1980 this had been a little valley of acid peatland. It was then flooded with the outflow from the lagoons and, over the years with the deposition of silt and constant passage of water, it has evolved into the type of habitat ideal for *C. mercuriale*, with narrow and shallow runnels, abundant emergent and marginal vegetation and a pH very slightly acid. It also, in some ways, appears more suitable than Orchard Cottage Mire for this species, as it is in a warm hollow, sheltered by tall trees and bushes in all directions but not so near as to over-shadow it.

The area was colonized by *C. mercuriale*, presumably from Orchard Cottage Mire, probably as a result of the flooding of the area in the early 1980s, and it is suggested that it might well serve as a model for creating new habitats for the species. The basic essentials to re-create the situation here would appear to be a constant supply of silt-carrying base-rich

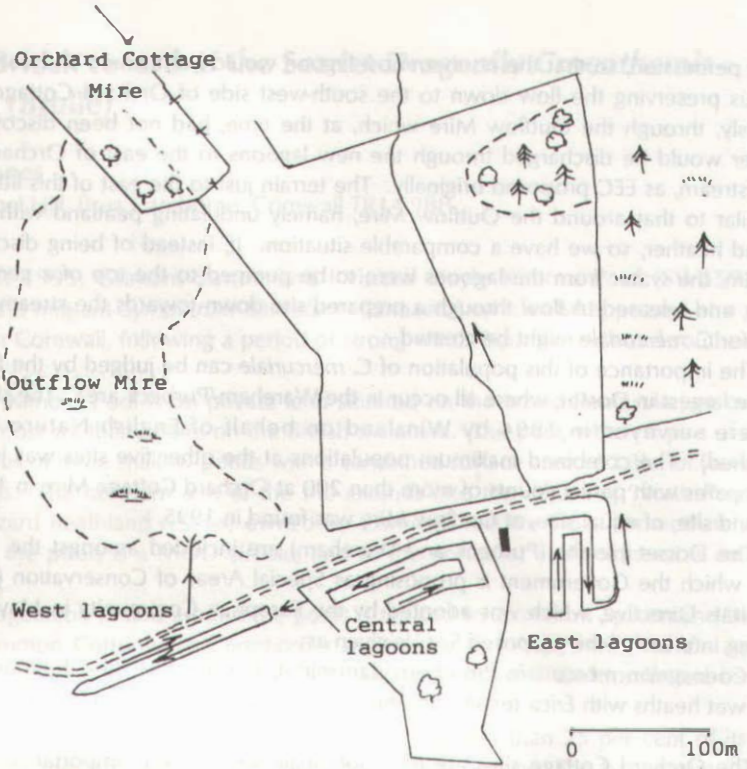


Figure 5. Future lagoon systems. In 1993, it was proposed that the three West lagoons be filled in and that all outflow should be through new lagoons east of Orchard Cottage, to the detriment of the Orchard Cottage and Outflow Mires. In 1995, a compromise plan was formulated by which some outflow would pass through a new Central lagoon system to the northernmost West lagoon, and thence into the Mires. The remainder would be discharged through the East lagoons into the small stream.

water, which can be flooded over a slightly sloping area of acid peatland, in which there are shallow runnels, the whole being sheltered from the prevailing winds. This is an unusual combination of circumstances, but there might be an opportunity to test the hypothesis in the context of ECC's new plans for the Lagoon system.

During late 1993, as part of their plan for the continued development of the claypit, ECC announced their intention of altering the system of discharging the outflow from the pit. In brief, they proposed filling in the present three west lagoons, and constructing new ones to the east of Orchard Cottages, with the outflow into the little stream. This proposal would have cut off the water supply to the south-west of Orchard Cottage Mire, and might well have resulted in at least part of it drying up, to the detriment of the *C. mercuriale* population. Following discussions, ECC in 1995 modified their proposals (Figure 5) in an application for

planning permission, so that the northernmost lagoon would be retained and continue to be used, thus preserving the flow down to the south-west side of Orchard Cottage Mire and, fortuitously, through the Outflow Mire which, at the time, had not been discovered. The remainder would be discharged through the new lagoons to the east of Orchard Cottages into the stream, as EEC proposed originally. The terrain just to the east of this little stream is very similar to that around the Outflow Mire, namely undulating peatland with pine trees, gorse and heather, so we have a comparable situation. If, instead of being discharged into the stream, the water from the lagoons were to be pumped to the top of a gentle slope in this area, and released to flow through a prepared site down towards the stream, conditions suitable for *C. mercuriale* might be created.

The importance of this population of *C. mercuriale* can be judged by the fact that it is by far the largest in Dorset, where all occur in the Wareham/Purbeck area. The six heathland sites were surveyed in 1994 by Winsland on behalf of English Nature (Winsland, unpublished). The combined maximum populations at the other five sites was just over 70. This compares with partial counts of more than 200 at Orchard Cottage Mire in 1994, before the second site, of equal size, at Outflow Mire was found in 1995.

The Dorset Heaths (Purbeck and Wareham) are included amongst the 123 sites in England which the Government is proposing as Special Areas of Conservation (SAC) under the Habitats Directive, which was adopted by the European Community in May 1992. The 'qualifying interest' of the proposed SAC is given as:

'Coenagrion mercuriale (Southern damselfly); Dry heaths (all sub-types); Northern Atlantic wet heaths with *Erica tetralix*; Southern Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix*.'

The Orchard Cottage sites are thus potentially of European importance and so, it is suggested, every effort must be made to preserve and enhance them, throughout the life of the claypit and particularly afterwards.

Acknowledgments

In addition to those already mentioned, the assistance and advice of the following is acknowledged; Dr N. W. Moore, Major M. Burgess (Range Officer), Mr A. Hill (ECC), Mr R. Watts (Defence Land Agent, Lands), Mr R. Gogan, Mr D. Vallance (Defence Land Agent, Forestry) and Mr A. Nicholson (English Nature).

References

Jenkins, D. K. 1995. A population study of *Coenagrion mercuriale* (Charpentier) in the NewForest. Part 6. Mark/recapture programme. *Journal of the British Dragonfly Society* **11** (1): 10–14.

Lucas, W. J. 1900. *British dragonflies (Odonata).* Upcott Gill, London. 356pp.

The first British record of the Scarlet Dragonfly *Crocothemis erythraea* (Brullé)

Steven P. Jones
Hyfield, Chapel Hill, Brea Camborne, Cornwall TR14 9BP

On 7 August 1995, Graham Sutton and I visited Hayle Kimbro Pool (SW659169) to photograph the migrant *Sympetrum flaveolum* (Linnaeus) which had appeared at a number of localities in Cornwall, following a period of strong winds from the east and southeast on 4 and 5 August.

Hayle Kimbro Pool is on private land situated on the Lizard Peninsula just over 5km north of the most southerly point on the British mainland. The pool, which is part of an SSSI, is really a series of three shallow ponds with a combined surface area of 2.3ha of water in the winter months. The northern arm of the site extends into the adjoining 'North Predannack Downs', a Lizard heathland reserve owned by Cornwall Wildlife Trust. Immediately to the southwest of the pools is a MOD airfield, and to the northeast and southeast is an area of rough grazing.

The vegetation in and around the pools is typified by Common Spike-rush (*Eleocharis palustris*), Common Cottongrass (*Eriophorum angustifolium*), Water Mint (*Mentha aquatica*), and Marsh Pennywort (*Hydrocotyle vulgaris*). The drier margins are dominated by rushes (*Juncus spp.*).

At the time of our visit, the pool had dried up to less than 25 per cent of its winter area and the weather was warm and sunny though a little breezy. The *Sympetrum flaveolum* male which I had found the previous day (6 August) was quickly located flying low over the drier areas, hugging the contours of the Common Spike-rush. After photographing the *S. flaveolum* we started to do a circle of the remaining water body in the hope of seeing *Sympetrum fonscolombei* (Sélys), which I had also seen the previous day at another site on the Lizard Peninsula.

Our attention was drawn to a dramatic flash of vivid red, far more striking than any of the similarly coloured darters. Although the insect flew very fast it made several passes close to us and from experience gained on the Iberian Peninsula we realised that this was in fact a male *Crocothemis erythraea* (Brullé).

Aware of the significance of this sighting, we followed the dragonfly around the margins of the pool in the hope of photographing it to provide firm proof of the record. The dragonfly tended to frequent an area of open water bordered by Common Spike-rush. Unfortunately it was not allowed to settle as it was ceaselessly harried by up to four male *Orthetrum cancellatum* (Linnaeus).

The insect finally settled on some low vegetation about 1.5m from the water's edge. The flattened abdomen was a brilliant nail-varnish red, slightly darkened towards the central axis viewed from above. The thorax and eyes were a brick red colour, with the rest of the head being the same nail-varnish red as the abdomen. Both fore- and hind-wings had extensive red veins, the latter having patches of orange-yellow colouring at their bases. The

pterostigmata and legs were both a reddish brown colour. At rest the insect held its wings forward, giving it the appearance of a red *Orthetrum coerulescens* (Fabricius). After having settled just long enough for its two delighted observers to take photographs, the dragonfly resumed its conflict with the *O. cancellatum* males and then disappeared.

Our observations took place between 1345 and 1530h, and when GPS returned to the site at about the same time on 8 August he observed the *C. erythraea* male again. Despite numerous visits after this date, the insect was not seen again.

These observations represent the first confirmed record of *Crocothermis erythraea* in Britain (Merritt *et al.*, 1996) though it was recorded in Jersey many years ago. It is a common and widespread species in the Mediterranean region of Europe, extending up to central Europe (Askew, 1988). In view of the weather conditions of 4 and 5 August, it would seem likely that this British specimen originated from southern France, or the northern Iberian Peninsula, in the company of *Sympetrum fonscolombei* and *S. flaveolum*.

Acknowledgements

I would like to thank Mr H. Bosustow who very kindly allowed access to his land at Hayle Kimbro pool and Graham Sutton whose photographic skills provided a permanent reminder of a memorable day.

References

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

Merritt, R., Moore, N. W. & Evesham, B. C. 1996. *Atlas of the dragonflies of Britain and Ireland*. HMSO, London. 149pp.

Dragonflies of the Grand Western Canal, Tiverton, Devon

J. E. Flory

George Cottage, Chains Road, Sampford Peverell, Tiverton, Devon EX16 7BL

Introduction

The Grand Western Canal is an isolated section of canal, approximately 18km in length, located in mid-Devon and running from Tiverton to the edge of the Devon and Somerset border. The canal dates from the turn of the 19th century and was originally part of a scheme to link the Bristol and English Channels. Today the canal is owned by Devon County Council and is managed as a country park. Its present use is as a low key recreation resource for fishing, walking and limited boat traffic, principally a horse-drawn barge at the Tiverton end (Devon County Council, 1993).

Throughout most of its length the canal contains a rich diversity of aquatic macrophytes, including submerged, floating and emergent forms. However, the submerged forms are reduced towards the basin at Tiverton, due to the boat traffic, and at the far end, due to heavy shading. A summary of the main species within the canal is given in Table 1. The riparian land-use is largely arable and pasture farmland, with areas of urbanization around Tiverton and Sampford Peverell. The canal is bordered by a mixture of hedgerow and trees, consisting largely of hawthorn (*Crataegus monogyna*), ash (*Fraxinus excelsior*), oak (*Quercus robur*), sycamore (*Acer pseudoplatanus*), beech (*Fagus sylvatica*) and alder (*Alnus glutinosa*) and areas of grass and scrub.

Methods and results

Over 1994 and 1995 I have conducted two benthic macro-invertebrate surveys on the canal, sampling roughly at each milestone using methods developed by Pond Action (1989-1990). Records were also made of all adult Odonata and exuviae seen during visits to the canal. The resulting taxa list is shown in Table 2. The diversity is apparently low, with only five species of Anisoptera and five species of Zygoptera. Of these, two species were deemed to be non-resident, *Cordulegaster boltonii* (Donovan) and *Calopteryx virgo* (L.), due to the inappropriate habitat offered by the canal. *Calopteryx splendens* (Harris) and *Sympetrum* sp. have only been seen once as individual adults. This apparently low diversity was confirmed by the canal's ranger, Vicky Thomas. Attempts were also made to gather archive data on the Odonata in the canal, but this appears limited and according to David Bolton (Exeter Museum) there have been few records of Odonata on the canal.

Basic data on the water quality were obtained during the macro-invertebrate surveys and are summarized in Table 3.

Data on the fish population were obtained from the National Rivers Authority, South Western Region. This showed an abundant fishery consisting mainly of roach (*Rutilus rutilus*), tench (*Tinca tinca*), bream (*Abramis brama*), perch (*Perca fluviatilis*), dace (*Leuciscus leuciscus*) and pike (*Esox lucius*).

Discussion

The low diversity is puzzling considering the apparently favourable habitat offered by the canal. Indeed, the conditions would appear to be ideal for species such as *Brachytron pratense* Sélys, *Orthetrum cancellatum* (L.), *Cordulia aenea* (L.) and *Pyrrhosoma nymphula* (Sulzer). However, although the diversity is low, the abundance of the main species that are present, *Ischnura elegans* (Vander Linden), *Enallagma cyathigerum* (Charpentier), *Coenagrion puella* (L.) and *Anax imperator* Leach, appears to be high. The reason for this low diversity is not clear.

The water quality in the canal is generally good, but there is probably a degree of nutrient enrichment caused by run-off from surrounding fields and the occasional discrete discharge. This in turn may be particularly responsible for the extensive growths of filamentous algae, largely *Spirogyra* spp., and frequent 'blooms' of duckweed (*Lemna minor* and *L. trisulca*), that are apparent on the canal during the summer months. These growths

Table 1. Main aquatic macrophytes in the Grand Western Canal

Submerged and floating vegetation	Emergent vegetation
Elodea spp.	*Typha latifolia*
Ceratophyllum spp.	*Schoenoplectus lacustris*
Myriophyllum spp.	*Iris pseudacorus*
Callitriche spp.	*Juncus* spp.
Potamogeton spp.	*Phalaris arundinacea*
Fontinalis antipyretica	*Oenanthe crocata*
Nymphaea alba	*Sparganium erectum*
Nymphoides peltata	*Alisma* sp.
Lemna spp.	*Sagittaria sagittifolia*
Persicaria amphibia	
Azolla filiculoides	

Table 2. Odonata of the Grand Western Canal

	Adult	Nymph	Exuviae	Abundance
ZYGOPTERA				
Coenagrion puella	+	+	+	M
Enallagma cyathigerum	+	+	+	M
Ischnura elegans	+	+	+	H
Calopteryx splendens	+	-	-	L
Calopteryx virgo	+	-	-	L
ANISOPTERA				
Aeshna mixta	-	+	-	L
Aeshna cyanea	+	+	-	L
Anax imperator	+	-	+	M
Cordulegaster boltonii	+	-	-	L
Sympetrum sp.	+	-	-	L

Abundance categories: H = high, M = medium, L = low

Table 3. Summary of water quality and environmental data for the Grand Western Canal

Determinand	Mean
pH	7.5
Conductivity	414us
Temperature	10.75°C
Width	13m
Depth	111cm
Secchi depth	100cm

have led to de-oxygenation in some parts of the canal, resulting in fish mortalities, the most recent of which was in July 1995. The extent to which this would affect the Odonata community is difficult to gauge, but given the comparatively small area that is affected, it is not likely to be a significant factor. It is possible that a slightly reduced pH would prove more favourable, but this on its own is very unlikely to explain the low diversity.

The habitat within the canal appears to be very good, with large areas of submerged vegetation together with ample emergent growth (Table 1). The area of suitable riparian habitat along some parts of the canal, available for use by juvenile adults, may be limiting but is probably not sufficient to be a significant factor. Colonization would also not appear to be a limiting factor, considering the canal's size and age.

Competition is unlikely to explain low diversity on its own in such a large habitat and is probably significant only during the early stages of colonization (Henrickson & Oscurson, 1985).

The rest of the aquatic macro-invertebrate community is relatively varied with a total of 83 taxa, excluding zooplankton oligochaetes and dipterans, being recorded in 1994 (Flory, 1994). However, it was noted that the number of large active taxa, such as the larger water beetles, were low in number if present at all. One explanation for this could be predation by fish. Macan (1965) showed that fish populations can produce notable decreases in biotic diversity. It is possible that fish predation is affecting the Odonata population in the canal. Most coarse fish at some stage of their lives feed on aquatic macro-invertebrates (Maitland, 1972). The effect this would have on Odonata is not clear, but it is possible that certain families and genera would be more affected that others. For example, most cyprinids tend to feed on the bottom, disturbing the substrate, which in turn could directly affect such families as Libellulidae, which tend to bury themselves into the sediment. Conversely, taxa that tend to occur in or around aquatic plants may have a better chance of escape due to camouflage and inaccessibility. Indeed, I have enountered situations before where the presence of a large fish population has been linked to a lack of diversity (Flory, 1992). However, this is purely speculative and at present I have no evidence to prove or disprove it.

The canal also supports a thriving avian population, including such species as coot (*Fulica atra*) and moorhen (*Gallinula chloropus*), which could also influence the Odonata community by their predation on both nymphs and adults.

There is the possibility that the community has been under-sampled and that species present in low numbers have been missed. The problem of under-recording is hard to overcome, especially when it is considered that the canal has a surface area of 23.4ha extended over 18km. As a result, surveys have tended to be centred along areas which were perceived as providing good habitat. In contrast, the macro-invertebrate survey was carried out over the full length of the canal using a method of sampling that has proved successful for capturing Odonata nymphs before. But again the actual area sampled is tiny in relation to the size of the canal and it is conceivable that significant populations could have been missed. If other species are present, however, they are probably in low numbers.

This leaves the question why the four main species in the canal, *I. elegans, E. cyathigerum, C. puella* and *A. imperator*, are so abundant. All four species have weed-

dwelling nymphs and are common in still-water conditions (Gibbons, 1994; McGeeney, 1986). All three of the zygopterans have nymphs which develop in a year, a factor which may be important in relation to tolerance of higher levels of predation. The abundance of *A. imperator* could be related to its nymph's large size, together with its weed-dwelling preferences.

Conclusions

With the evidence collected to date the apparently restricted diversity in the canal cannot easily be explained. Although predation may be an element, it is unlikely to be the single factor responsible for the low diversity. Instead, as with most ecological problems, it is likely to be a combination of factors, all of which conspire to maintain a low diversity. It is also possible that there are more species in the canal but due to the problems of surveying the site they have been missed, especially if the populations are low.

There are plans to construct a wetland area at the north end of the canal in the basin of an old lock system. As it is intended to keep large fish out of this area, it will be interesting to follow its development and to see if a more diverse Odonata population develops.

Acknowledgements

I would like to express my thanks to Dave Smallshire and Lesley Kerry for their useful comments, Vicky Thomas for her support, Dave Bolton for providing archive data, and finally Julie, my wife, for putting up with a dragonfly anorak!.

References

Devon County Council, 1993. *Grand Western Canal Country Park management plan.* Engineering and Planning Dept, Devon County Council.

Flory, J. E. 1992. The dragonflies of Yateley Common, Hampshire. *Journal of the British Dragonfly Society* **8** (2): 3-5.

Flory, J. E. 1994. *A macro-invertebrate survey of the Grand Western Canal, mid Devon.* Report to the Wildlife Advisory Group and Management Committee, Devon County Council.

Gibbons, R. B. 1994. *Dragonflies and damselflies of Britain and northern Europe.* Hamyln Guide, London. 144pp.

Henrickson, L. & Oscurson, H. C. 1985. Waterbugs in acidified lakes, habitat selection and adaptions. *Ecological Bulletins* 37: 232-239.

Macan, T. T. 1965. Predation as a factor in the ecology of water bugs. *Journal of Animal Ecology* 34: 691-699.

Maitland, P. S. 1972. *Key to British freshwater fishes.* Freshwater Biological Association publication No. 27.

McGeeney, A. 1986. *A complete guide to British dragonflies.* Jonathan Cape, London. 133pp

The breeding dragonflies of Wessex rivers

P. D. Smith
National Rivers Authority, Southern Region Laboratory, 4 The Meadows, Waterberry Drive, Waterlooville, Hampshire P07 7XX

Introduction

The Wessex region[1] includes the counties of Avon, Dorset and Somerset, and a large part of Wiltshire. It also includes small areas of Devon, Gloucestershire and Hampshire. The region has a varied topography and geology from the hills of the southern Cotswolds, the Mendips, the eastern slopes of Exmoor, and the chalk downlands of Salisbury Plain and Dorset, to the low-lying Somerset Levels and Moors. This variability is reflected in a wide diversity of watercourses from fast-flowing steams draining Exmoor, the New Forest and the chalk-streams of Dorset, to large lowland rivers such as the Bristol Avon and River Parrett, and the rhynes (drainage ditches) of the Somerset and Avon Levels (Figure 1). The region's rivers are of generally high water quality. The 1990 River Quality Survey carried out by the NRA indicated that 94 per cent of rivers in Wessex were good or fair quality (NRA, 1991).

Between January 1991 and November 1993, qualitative samples of aquatic macro-invertebrates were collected for NRA monitoring purposes from over 700 sites across the Wessex region. Most sites were sampled on at least five separate occasions. The vast majority of samples were taken using a pond net, although a Naturalist's Dredge and artifical colonization samplers were employed at a number of deep-water sites (e.g. Somerset Levels). When a Naturalist's Dredge was used, this was in conjunction with pond net sampling of the margins.

Sampling sites were located over the full range of flowing watercourses within the Wessex region. Very few sites were, however, located close to river sources. No samples were taken from the region's canals, ponds, lakes or reservoirs. Identification of larval dragonflies was based on the key given in Hammond (1983).

Results

A total of 14 species of Odonata was recorded from the macro-invertebrate samples taken. This total included seven species of damselfly and seven dragonfly species. In addition, larvae of the *Coenagrion puella* (L.)/*pulchellum* (Vander Linden) and *Sympetrum striolatum* (Charpentier)/*sanguineum* (Müller) species couplets were recorded, but no attempt was made to separate these species. Larval records were obtained from a total of 291 sites. Table 1 lists the species recorded in each catchment and the total number of different sites at which they occurred.

The large number of records of damselfly compared to dragonfly larvae is due, in the main, to the greater densities at which damselfly larvae occur in suitable riverine habitats. In

[1]The Wessex region refers to the former National Rivers Authority Wessex Region. Following the merger of the Wessex Region and the South West Region, the NRA Wessex Region now forms the North and South Wessex Areas of the NRA South Western Region.

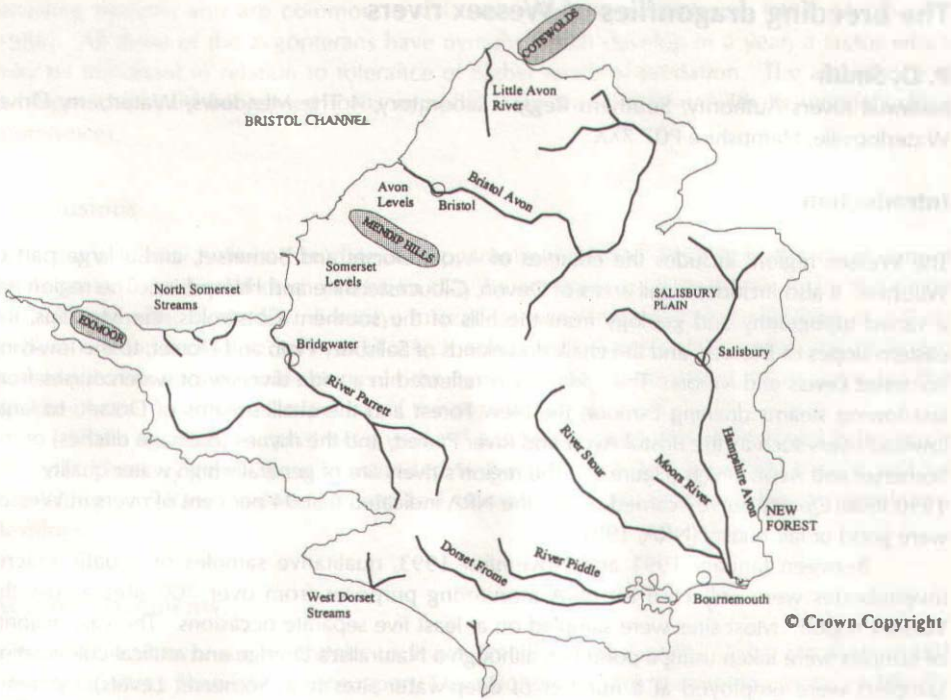


Figure 1. Map of the Wessex region showing the major river catchments

addition, many dragonfly species live buried in the river bed and these are likely to be underestimated by the sampling methods employed. In contrast, most species of damselfly live on the surface of aquatic plants and are therefore more likely to be captured.

Calopteryx splendens (Harris) and *Ischnura elegans* (Vander Linden) were by far the most frequently recorded species, reflecting the predominance of lowland streams and rivers across the Wessex region. Both species were widely distributed, although generally absent from the more upland parts of the region. *C. splendens* was the only species commonly recorded from the Dorset chalk streams.

Calopteryx virgo (L.) was widely distributed across the survey area, but largely confined to streams of moderate to fast flow and with a stony bed. *C. virgo* commonly co-existed with *C. splendens*, indicating that although *C. splendens* is more typical of slow-flowing streams with depositing substrata, there is considerable overlap of habitat requirements.

Platycnemis pennipes (Pallas) was almost exclusively confined to three river catchments: the Bristol Avon, the River Isle/Parrett and the River Stour. Records were also obtained from an isolated site on the River Brue. This species shows a preference for

sheltered slow-flowing rivers with abundant vegetation, although it also occured on faster-flowing stretches on the Somerset Frome. *P. pennipes* is considered to be relatively sensitive to pollution, and its widespread distribution in the region's larger rivers confirms their generally high water quality.

Pyrrhosoma nymphula (Sulzer) is one of Britain's commonest and most widely distributed damselflies. In the current survey, records were obtained from slower-flowing rivers and streams across the survey area. Randolph (1992) states that this species is well established on parts of the Somerset and Avon Levels, but no larval records were obtained from these areas in this study.

Because of difficulty with reliable identification, no attempt was made to separate larvae of *Coenagrion puella* from those of the much rarer *Coenagrion pulchellum*. Records were widely distributed across the Somerset and Avon Levels, areas known to support both species. *C. pulchellum* characteristically occurs in discrete and very localized populations (Randolph, 1990), whilst *C. puella* has a more widespread distribution. In the current study, records, presumably of *C. puella*, were also obtained from the River Parrett catchment, and other isolated sites in Somerset, Avon and Dorset. Sites were characterized by their still or slow-flowing nature.

Erythromma najas (Hansemann) was restricted in its distribution to fourteen sites located on the Kings Sedgemoor Drain, River Brue and River Axe catchments on the Somerset Levels, and the Bristol Avon between Bradford-on-Avon and Bristol. Sites were typically located on still or slow-flowing stretches of water with abundant aquatic vegetation. The main habitat requirement of this species is thought to be floating-leaved vegetation (e.g. Water-lily spp. and Broad-leaved Pondweed). Records obtained from the Huntspill River, on the River Brue catchment, are of interest because this watercourse supports very little aquatic vegetation. Randolph (1992) provided evidence to show that this species has shown a significant westward extension of its range during the last few years. Prior to 1982, there were no records for Avon or Somerset, and a major survey by the Nature Conservancy Council failed to record any larvae from 243 samples taken on the Somerset Levels and Moors (Drake, 1987). The results of the current survey confirm the apparent recent increase in the range of this species.

Lestes sponsa (Hansemann) was recorded from just three sites located on the River Banwell, Blind Yeo and Portbury Ditch on the Avon Levels. All sites were situated close to the coast in canalized watercourses with very little flow. It is unclear why this nationally widespread species has such a limited local distribution and in particular why it is absent from the Somerset Levels.

Larvae of the *Sympetrum striolatum/Sympetrum sanguineum* group could not be reliably separated. Records were widely distributed across the Wessex region, being most frequent on the Somerset and Avon Levels. *S. striolatum* is a nationally widespread species, whilst *S. sanguineum* is less common. *S. sanguineum* favours densely vegetated ponds and ditches and is well established on the North Somerset Levels.

Cordulegaster boltonii (Donovan), a species characteristic of small, moderate or fast-flowing streams, is essentially a western and northern species in Britain. In the current survey, records were widely distributed across Dorset, especially on the Moors River, Dorset Frome

and River Piddle catchments. Records were also obtained from two small Somerset streams, on the River Tone and River Parrett catchments.

Libellula fulva Müller is a nationally rare species, confined to a few slow-flowing rivers, and nearby lakes, in southern England and East Anglia. In the current survey it was recorded from two sites on the Moors River and two on the River Stour, north of Bournemouth. Within the Wessex region this species is also known from the Dorset Frome (Prendergast, 1991) and the Bristol Avon (Randolph, 1990).

Brachytron pratense (Müller) is a nationally uncommon species, although the Avon and Somerset Levels represent an important stronghold. This species was one of the most frequently encountered as larvae in a survey of the Somerset Levels carried out by Drake (1987). Larvae occurred in a variety of rhynes, although sites tended to be characterized by a rich aquatic flora. In the current survey only two records were obtained for this species; the Kings Sedgemoor Drain and South Drain, on the Somerset Levels.

A further four species of dragonfly, which are usually associated with still-water habitats, were also recorded in the current survey. *Aeshna mixta* Latreille was recorded from the Bristol Avon at Melksham and Bradford-on-Avon, and the Kings Sedgemoor Drain on the Somerset Levels. This species was once considered to be only a regular immigrant from southern Europe, but is now known to breed in southern Britain, and appears to be currently extending its range. *Aeshna cyanea* (Müller) was recorded from one site on the upper Bristol Avon and one on the River Stour, near Bournemouth. This species is widespread across the Somerset and Avon Levels, although Drake (1987) also noted that larvae are not often recorded. *Orthetrum cancellatum* (L.) was recorded from two sites on the Somerset Levels; the River Brue at Westhay and the Hartlake at Godney. This coincides with the observations of Randolph (1992), who stated that the stronghold for this species, in the Bristol area, is centred on Westhay and Shapwick Heath, the favoured habitat being acid pools associated with flooded peat workings. *Libellula depressa* L. was recorded at just one site on the Bristol Avon, near Melksham.

Discussion

The rivers of the Wessex region provide important habitats for breeding dragonflies. Of the six British species which are virtually confined to running water, only *Gomphus vulgatissimus* (L.) was not recorded in the current survey. *L. fulva* was recorded from both the River Stour and Moors River catchments, with Dorset regarded as one of the strongholds for this rare dragonfly. The now extinct species *Oxygastra curtisii* (Dale) also bred on the Moors River until about 1962 (Prendergast, 1991). A number of species which are characteristic of both still and flowing water were also recorded from the region's rivers. The Bristol Avon has long been recognized as an important river for dragonflies. In the current survey, larvae of eight species were recorded from this river, with a total of eleven in the catchment as a whole. Ten species were recorded from the River Stour catchment, eight from the Parrett and seven from the Moors River, a tributary of the lower Stour.

The importarrce of the 'levels' habitat of Somerset and Avon has also been well documented. The Somerset Levels represent one of Britain's most important remaining

wetlands. The network of rhynes and flooded peat workings provide habitats for a wide range of wildlife, including dragonflies. A total of ten species were recorded in the current survey, including the nationally scarce *B. pratense*, and a number of rather local species such as *E. najas* and *O. cancellatum*. The Somerset Levels are also an important stronghold for *C. pulchellum* and *S. sanguineum*. The Avon Levels also represent an important wetland habitat within the Wessex region. Although less extensive than the Somerset Levels, the Avon Levels support a wide range of dragonfly species including *C. pulchellum* and *B. pratense*. In addition, *L. sponsa* was confined to the Avon Levels, there being no recent records for this species from the Somerset Levels.

Table 1. Dragonfly species recorded in the major river catchments of the Wessex region

Catchment	CS	IE	CV	PP	PN	CP	EN	LS	SS	CB	LF	BP	AM	AC	OC	LD	Total number of species
Hampshire Avon	+	+	+		+				+	+							6
Stour (exc. Moors)	+	+	+	+	+	+			+	+	+			+			10
Moors River	+	+	+		+				+	+	+						7
Dorset Frome/Piddle	+		+		+				+	+							5
W. Dorset streams	+		+		+					+							4
River Parrett	+	+	+	+	+	+			+	+							8
N. Somerset streams	+	+								+							3
Somerset Levels	+	+	+	+		+	+		+			+	+		+		10
Avon Levels	+	+	+			+		+	+								6
Bristol Avon	+	+	+	+	+	+	+		+				+	+		+	11
Little Avon	+	+	+														3
Total number of sites	176	109	49	38	33	24	14	3	30	26	4	2	2	2	2	1	

Species codes:
CS = *Calopteryx splendens*, IE = *Ischnura elegans*, CV = *Calopteryx virgo*, PP = *Platycnemis pennipes*, PN = *Pyrrhosoma nymphula*, CP = *Coenagrion puella/pulchellum*, EN = *Erythromma najas*, LS = *Lestes sponsa*, SS = *Sympetrum striolatum/sanguineum*, CB = *Cordulegaster boltonii*, LF = *Libellula fulva*, BP = *Brachytron pratense*, AM = *Aeshna mixta*, AC = *Aeshna cyanea*, OC = *Orthetrum cancellatum*, LD = *Libellula depressa*

Acknowledgements

I am very grateful to a number of former colleagues at the NRA Wessex Region, without whom this project would not have been possible. I would particularly like to thank George Green, Dave Cooling, Debbie Snook, Peter Hall and Richard Thornton. The views expressed are the author's own and not necessarily those of the NRA.

References

Drake, C. M. 1987. Dragonflies on the Gwent and Somerset Levels and Moors. *Journal of the British Dragonfly Society* **3** (1): 1–4.

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

NRA, 1991. *The quality of rivers, canals and estuaries in England and Wales. Report of the 1990 survey.* Water quality series no. 4, National Rivers Authority, Bristol. 64pp.

Prendergast, E. D. V. 1991. *The dragonflies of Dorset.* The Dorset Natural History and Archaeological Society, Dorchester. 76pp.

Randolph, S. 1990. The breeding dragonflies of the Bristol area. *Journal of the British Dragonfly Society* **6**(2): 29–34.

Randolph, S. 1992. *Dragonflies of the Bristol region.* City of Bristol Museums and Art Gallery, Bristol. 88pp.

Notes on the identification of the exuviae of *Coenagrion pulchellum* (Vander Linden) and *C. puella* (Linnaeus)

R. Seidenbusch
Klenze-Str. 5, 92237 Sulzbach-Rosenberg, Germany

Introduction

Accurate determination of exuviae of *Coenagrion pulchellum* (Vander Linden), and their separation from those of *C. puella* (L.), is difficult because of the variability in often microscopic characters. Some distinguishing features can be tentatively suggested, but the need remains to prove their reliability in material from a range of widespread sites. Characters already known and used, such as pigmentation of the nodal line, or features mentioned by Carchini (1983), are excluded here.

Methods

Some dozens of exuviae of *C. pulchellum* and *C. puella* from various north Bavarian sites (Oberpfalz) were microscopically examined and compared in an attempt to find valid characters for separation of the species. Characters discovered are presented here so that they may be tested on further populations.

Results

1. Mentum: angle (σ) of the rows of mental setae (in pressed slide) (Fig. 1)
   - wide angle (≈ 100°) ..... *C. pulchellum*
   - narrower angle (≈ 80°) ..... *C. puella*

2. Mentum: lateral bumps of articulation (Fig. 2)
   - distinctly erect and curved, almost semicircular and more symmetrical ($\alpha \approx 9°$, $\beta \approx 16°$ in pressed slide) ..... *C. pulchellum*
   - relatively flatly curved, elongated and more asymmetrical ($\alpha \approx 6°$, $\beta \approx 11°$ in pressed slide) ..... *C. puella*

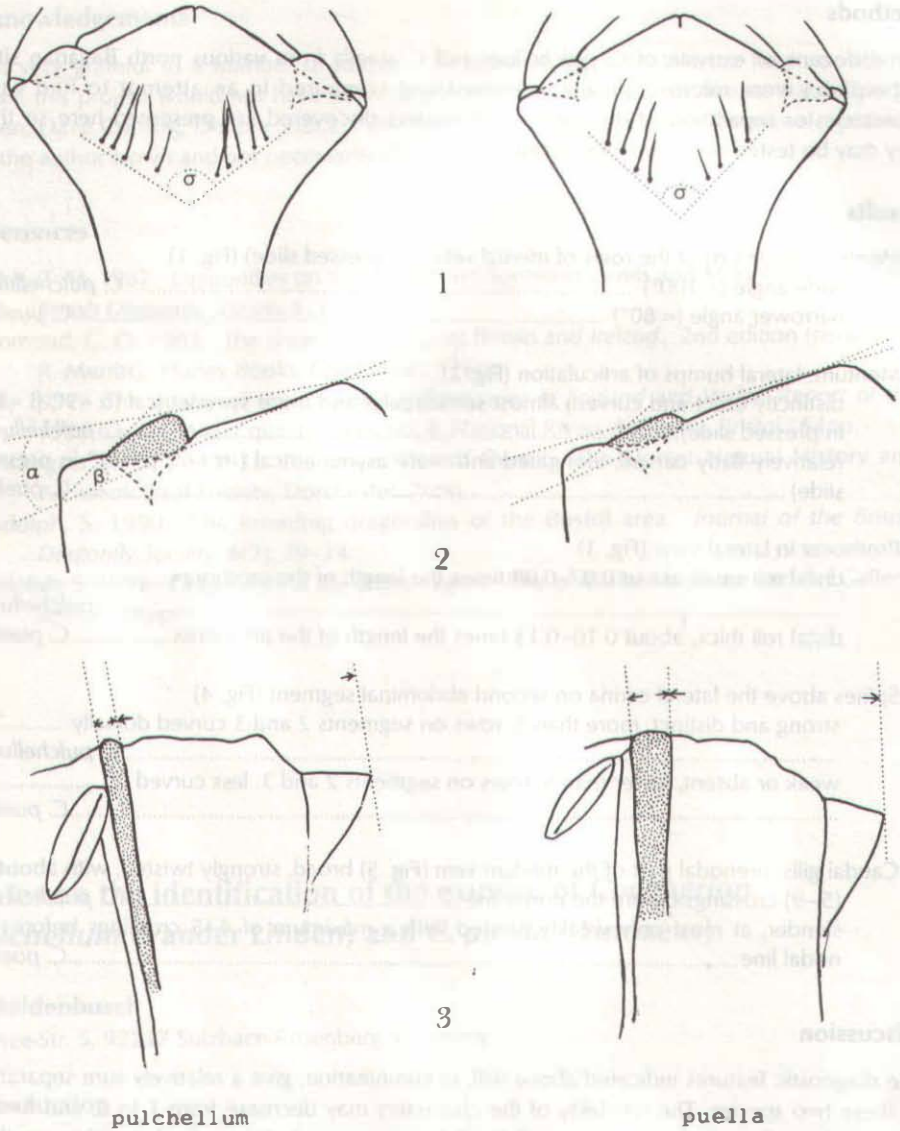
3. Prothorax in lateral view (Fig. 3)
   - distal roll small, about 0.07–0.08 times the length of the prothorax ..... *C. pulchellum*
   - distal roll thick, about 0.10–0.13 times the length of the prothorax ..... *C. puella*

4. Spines above the lateral carina on second abdominal segment (Fig. 4)
   - strong and distinct, more than 8; rows on segments 2 and 3 curved dorsally ..... *C. pulchellum*
   - weak or absent, fewer than 6; rows on segments 2 and 3. less curved ..... *C. puella*

5. Caudal gills: prenodal part of the median vein (Fig. 5) broad, strongly twisted, with about 7 (5—9) crossings before the nodal line ..... *C. pulchellum*
   - slender, at most only weakly twisted with a maximum of 4–5 crossings before the nodal line ..... *C. puella*

Discussion

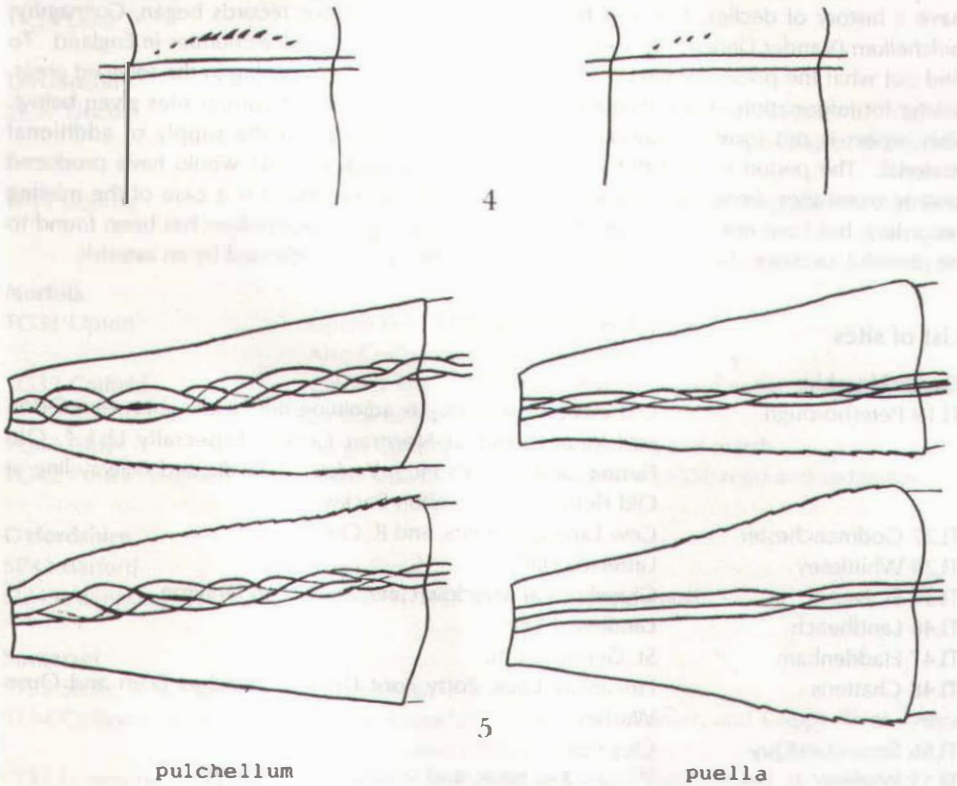
The diagnostic features indicated above will, in combination, give a relatively sure separation of these two species. The reliability of the characters may decrease from 1 to 5, and further examination of more European material will be necessary before a final decision on their value can be reached.



Figures 1–3. Morphology of exuviae of Coenagrion *pulchellum* (left) and *C. puella* (right): (**1**) Mentum to show differing angles of rows of setae; (**2**) Mentum to show differing forms of the lateral bumps, and the angles α and β referred to in the text; (**3**) Prothorax in right lateral view.

Reference

Carchini, G. 1983. A key to Italian odonate larvae. *Societas Internationalis Odonatologica (Rapid Communications)* Suppl. 1: 101 pp.



Figures 4,5. Morphology of exuviae of *Coenagrion pulchellum* (left) and *C. puella* (right): (**4**) Second abdominal segment from the left to show the difference in the rows of spines above the lateral carinae; (**5**) Prenodal parts of caudal gills.

Coenagrion pulchellum (Vander Linden) in England since 1990

E. Waring
7 Amberlands Close, Backwell, Bristol BS19 3LW

Introduction

For conservation purposes we need to keep up-to-date with our knowledge of species which have a history of decline, lest they become endangered. Since records began, *Coenagrion pulchellum* (Vander Linden) has vanished from a dozen or more vice-counties in England. To find out what the present situation might be, I wrote to members living in the relevant areas, asking for information. From their replies is constructed the list of current sites given below. This report is put forward now in the hope that it will prompt the supply of additional material. The period since 1990 was chosen. Going back to 1981 would have produced twenty more sites, from the same set of data. Optimists say that it is a case of the missing recorders, but I am not convinced. Places where *Coenagrion pulchellum* has been found to be plentiful, or more abundant than *Coenagrion puella* (L.), are indicated by an asterisk.

List of sites

Cambridgeshire

TL19 Peterborough	Old clay-pits or brick-pits adjoining brickworks, between Orton and Yaxley, and at Norman Cross. Especially Lb1 *, Old Fletton, and Beeby's Pit *, Yaxley. Also disused railway line at Old Fletton, and Alwalton Backwater.
TL27 Godmanchester	Cow Lane gravel pits, and R. Ouse.
TL29 Whittlesey	Lattersey Hill*.
TL37 St. Ives	Gravel pits at Meadow Lane, and at Fen Drayton.
TL46 Landbeach	Landbeach pits.
TL47 Haddenham	St. George Farm.
TL48 Chatteris	Horseway Lock, Forty Foot Drain *, Welches Dam and Ouse Washes.
TL56 Stow-cum-Quy	Quy Fen.
TL57 Wicken	Wicken Fen NNR, and Stretham Ferry Bridge.
TL58 Littleport	R. Gt. Ouse; dykes and meadows.

Cheshire

SJ45 Churton	Marl-pits at King's Marsh.
SJ56 Tarporley	Marl-pits at Huxley.
SJ57 Delamere	Hatchmere *. Lake with willow and alder carr, and floating bog. Tandem pairs/ovipositing seen.

Cumbria

NY00 Braystones	Low Church Moss.
NY02 Ullock	Mockerkin Tarn.

Hampshire

SZ39 Lymington	Sowley Pond. Reduced numbers since 1989.

Kent

TR26 Canterbury	Stodmarsh NCCR, SSSI. Lagoons and reed-beds.
TR35 Deal	Worth Marshes in Lydden Valley.

Lincolnshire

SK97 Lincoln	Boultham Mere* NNR. Old railway ballast-pit with Yellow Water-lily (*Nuphar lutea*). 500 seen. Ovipositing and exuviae reported.
TF11 Bourne	Thurlby Slipes NR: small ponds with sallows, and Basten Fen NR: well-vegetated dykes with osiers.

Norfolk

TG31 Upton	Upton Fen* SSSI; turf ponds and dykes. Also Cockshoot Broad and dykes.
TG32 Catfield	Catfield Fen NNR, SSSI; open reed and sedge fen, and dykes. Shrubs used as shelter.
TG41 Filby	Burgh Common*, SSSI. Dykes, fen and marsh.
TG42 Potter Heigham	South side of Hickling Broad NNR, SSSI; reed and sedge fen.

Oxfordshire

SP43 Barford	Plank Pond.
SU49 Abingdon	Cothill NT/NCCR: pond, fen and marsh.

Somerset

ST32 Stoke St. Gregory	Rhynes near R. Tone.
ST34 Chilton Polden	Chilton Moor*, S. Drain, Gold Corner, and Cripps River. Also Tealham Moor STNCR.
ST42 Langport	Rhynes by R. Parrett at Middle Moor *, and at Westmoor, nr Kingsbury.
ST44 Theale	Theale Moor *, and at Stoke Moor.
ST45 Cheddar	Cheddar Moor, N of Nyland.
ST46 Nailsea	Nailsea Moor SSSI: by droves, between rhynes.

Surrey

TQ07 Runnymede	Langham's Pond, NT.

Sussex

TQ01 Amberley	Amberley Wild Brooks * SWTR. On grass by tracks, nr ditches. When cloudy on hedges. Also Stopham Bridge, R. Arun.
TQ32 Scayne's Hill	Waterworks nr R. Ouse.
TQ40 Southease	Sites along R. Ouse.
TQ50 Exceat	Ditches by R. Cuckmere.
TQ60 Pevensey	Pevensey Levels*. Rushy meadows with willow and gorse. Fields divided by ditches. Found in about 30 streams/ditches, from Horse Eye to Hooe Levels, and nr Rickney.
TQ61 Herstmonceux	The castle pond.

Habitat

Man-made features of the landscape are important for the survival of the species in England. First, there are the drainage-ditches in the fens and levels. *Coenagrion pulchellum* is found among the vegetation growing in or bordering upon these ditches. For some reason, the populations are very local, often frequenting the same patch of grasses or reeds year after year, and presumably breeding (though this is not normally easy to observe) in some nearby ditch. They can change their position, and will do so slightly on a day-to-day basis in accordance with the wind-direction, being very much in need of shelter from trees, hedges or grasses. Even old railway embankments may in some cases have helped to provide the right environment.

Secondly, there are the lakes and ponds. Typically these are the result of gravel, clay or marl extraction. They have the advantage of not being subject to disturbance such as is caused by the dredging of drainage-ditches, which can cause *pulchellum* to shift its position or be lost, on the levels. Pond-watchers report tandem-pairs and ovipositing, these phenomena being more easily seen at the edges of open water. It is clear that *pulchellum* thrives in lakes and ponds just as successfully as in the relatively still waters of the levels.

Rivers are frequently mentioned in the site-descriptions. Some of them are very slow-moving, and may support *pulchellum*. Others have ditches draining into them, which may be the breeding-place. It is doubtful whether the species ever breeds in swiftly-moving water. Some sites are coastal, others inland but dependent on low-lying moors and marshes. Yet others are at higher altitudes, as is clear from a few of the items above, and from the distribution maps shown in Hammond (1983).

Conclusion

Addenda to the list would be very welcome. Notes on 'lost sites' would be of interest too. On the evidence available, there has been a marked decline in Lincolnshire over the past two decades. In Oxfordshire and the Thames Valley, the species is now becoming scarce. It would be encouraging to have evidence contrary to these propositions.

Acknowledgments

Thanks are due to those who have helped so far: John Boyd, David Clarke, John Copley, Alan Hold, David Kitching, Mike Parr, Val Perrin, Mike Powell, John Redshaw, Jill Silsby and Pam Taylor.

Reference

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

Somatochlora metallica (Vander Linden) ovipositing: some observations

M. A. Richards
No 1 The Cottages, Tilberthwaite Ghyll, Coniston, Cumbria LA21 8DG

On 26 June 1995 at 13.30 BST I watched a female Brilliant Emerald (*Somatochlora metallica* (Vander Linden)) ovipositing into a moss carpet (*Sphagnum* spp.) at the edge of Loch Bran, Inverness-shire. It was sunny and very hot (temperature 28°C). The south-facing site was in a shady position under a birch tree (*Betula* sp.), in a sheltered corner of the loch.

The rustling of wings in the vegetation alerted me to her presence. I watched for five minutes whilst unaccompanied she oviposited into the *Sphagnum*. Four or five presses into the moss were followed by a quick dip of the ovipositor into the loch, only 0.3 metres away. This process was repeated continuously until she flew away. When dipping the vulvar scale, the female flew horizontally tilting her abdomen downwards much in the manner of an ovipositing *Cordulia aenea* (L.). Though I was less than a metre away from her, she seemed unaware or unconcerned by my presence. When dipping her abdomen into the loch, was she cleaning the vulvar scale?

An hour later I saw another Brilliant Emerald ovipositing into loch-side *Sphagnum* a short distance away, but this one flew off at my approach. Also seen were six males patrolling the loch edge which comprised a mixture of mosses, heather (*Calluna vulgaris*) and rocky outcrops.

Notes and observations

Compiled by **Alan Paine**
3a Burnham Close, Trimley St Mary, Suffolk IP10 OXJ

My thanks to all who have contributed. May I please have items for the next issue by 15 July 1996. All reports which follow refer to 1995.

Rock pools

Common Darter (*Sympetrum striolatum*) have been reported again ovipositing into intertidal pools. A number were present in August on the beach at Beachy Head, Sussex: a few pairs were in tandem, and females were laying into pool-edges with a sandy substrate and plenty of seaweeds. Migrant Hawkers (*Aeshna mixta*) were also numerous, but no breeding activity was noted. (E)

Mating problem

In September at a gravel pit in the S.E. Berkshire Blackwater valley, a female Common Blue Damselfly (*Enallagma cyathigerum*) was found with the abdomen of a male attached as if in tandem but with his head and thorax missing. The female appeared unhampered. (E)

Unusual female coloration

At Chartley Moss NNR, W. Midlands, on 21 August, a blue female Common Hawker (*Aeshna juncea*) was ovipositing. It showed apparently no yellow or green on the abdomen but the blue seemed more intense than that of the males. It was in very good condition with undamaged wings. (A)

Mixed pairing

At the North Warren reserve, Suffolk, on 12 August, a male Yellow-winged Darter (*Sympetrum flaveolum*) was seen and photographed in tandem with a female Common Darter (*S. striolatum*). (D)

Early risers

At c.0700h on 7 August two Brown Hawkers (*Aeshna grandis*) were seen flying in the cool morning air by the R. Blackwater in Berkshire. Their behaviour implied foraging or exploration, being very active at this early hour. (E)

Parasites

During the summer a disproportionate number of adult Red-eyed Damselflies (*Erythromma najas*) in Berkshire were found infested by mites, mainly on the abdomen. Even some fairly fresh tenerals had a burden of these small parasites. Other species seemed less affected. (E)

Moth-trap captures

Sometime between 0315 and 0530h on 23 August, during a spell of all-night moth trapping at the Saltwells LNR, a male Common Darter (*Sympetrum striolatum*) entered the MV trap, and although dark, the dragonfly was very active in the trap. (A)

On 8 August a male Yellow-winged Darter (*Sympetrum flaveolum*) was found in a light trap at Muston, Scarborough, Yorkshire. (B)

Polymorphism in some coenagrionid species

At the 1995 Members' Day meeting at Leeds University in November, Adolfo Cordero, from the University of Pontevedra (near Santiago in Spain), gave an excellent account of the confusing situation of polymorphism in various damselfly females. He described the various hypotheses put forward to account for the occurrence of male-like females (andromorphs) in some species, including *Ischnura graellsii* and *I. elegans* as well as *Enallagma cyathigerum* and *Ceriagrion tenellum*. Possible explanations range from a reduction of harassment at high population densities (with perhaps an increased risk of predation and of not finding mates at low densities) to the avoidance of heterospecific tandem formation. After examining the mating and lifetime reproductive success of the various morphs, he concluded that no single explanation was applicable to all species. There was good evidence that andromorphs had a reduced mating success in *Ischnura* species but not in *Enallagma* or *Ceriagrion* and that they are sometimes larger and capable of greater egg production than other morphs. (P. L. Miller)

One year life-cycle of the Emperor Dragonfly

This account continues from the article in Volume 10 (2): 25-28 of the Journal.

In Hickstead, Sussex, one pond is checked annually. It is purely concrete and water with no marginal or emergent plants at all. Blanket-weed forms, and leaf-litter falls in from trees, and the pond is teeming with life.

On 11 May, among the Odonata larvae caught, were four *Anax imperator*, all of which were over 35mm long. The largest of them was removed to a garden pond. Here, on the morning of 8 June the *Anax* larva was seen on the surface, much larger than when it had been put into the pond. It was put into a tank with 35mm of water and rocks and twigs for it to climb. The larva remained half-submerged under a rock for the rest of that day and all of the next, but at 0600h on 10 June a perfect and already coloured female *Anax* was found.

The pond from which the larva was collected had been completely drained and scrubbed out on 14 May 1994, which means that this individual completed its life-cycle in little over a year (if that). The draining and scrubbing is carried out annually. (C)

Observers

(A) T. Beynon, Saltwells LNR, Pedmore Road, Brierley Hill, W. Midlands DY5 1TF.
(B) D. Clarke, Burnfoot, Cumwhitton, Carlisle CA4 9EX.
(C) D. Dey, 26 Manor Avenue, Hassocks, Sussex BN6 8NG.
(D) I. Dawson, 122a Station Road, Tempsford, Bedfordshire SG19 2AY.
(E) D. Sussex, 3 Edgcumbe Park Drive, Crowthorne, Berkshire RG45 6HB.

Recent odonatological publications

Boudot, J. -P. & Jacquemin, G. 1995. Revision of *Cordulegaster boltonii* (Donovan, 1807) in southwestern Europe and northern Africa, with description of *C. b. iberica* ssp. nov. from Spain (Anisoptera: Cordulegastridae). *Odonatologica* **24**: 149–173.

Cordero, A., Santolamazza-Carbone, S. & Utzeri, C. 1995. Male disturbance, repeated insemination and sperm competition in the damselfly *Coenagrion scitulum* (Zygoptera: Coenagrionidae). *Anim. Behav.* **49**: 437–449.

David, S. 1994. Neobvyklé koplačni spojení u vážky *Lestes sponsa* (Hansemann, 1823) (Zygoptera: Lestidae) [Unusual copulation between dragonflies *Lestes sponsa*] *Acta Muysei tekovensis* **2**: 95–98.

Dunn, R. 1994. 1993 dragonfly (Odonata) report. *J. Derbyshire ent. Soc.* **116**: 3–7.

Ferreras-Romero, M. & Puchol-Caballero, V. 1994. Voltinism and phenological differences in *Aeshna cyanea* (Müller, 1764) (Odonata: Aeshnidae). *Abstr. 5th Europ. Congr. Ent. Univ. York.* p.167.

Gorb, S. N. 1995. Precopulatory and tandem directional activity of *Sympetrum sanguineum* (Müller) males at the places of pairing (Anisoptera: Libellulidae). *Odonatologica* **24**: 341–345.

Grover, S. & Ikin, H. 1994. *Leicestershire dragonflies.* Leicestershire Co. Council, Leicester. 64pp.

Johansson, F. & Samuelsson, L. 1994. Fish-induced variation in abdominal spine length of *Leucorrhinia dubia* (Odonata) larvae? *Oecologia* **100**: 74–79.

Miller, P. L. 1995. Sperm competition and penis structure in some libellulid dragonflies (Anisoptera). *Odonatologica* **24**: 63–72.

Miller, P. L. 1995. Visually controlled head movements in perched anisopteran dragonflies. *Odonatologica* **24**: 301–310.

Moore, N. W. 1995. Experiments on population density of male *Coenagrion puella* (L.) by water (Zygoptera: Coenagrionidae). *Odonatologica* **24**: 123–148.

Rehfeldt, G., Keserü, E. & Weinheber, N. 1993. Opportunistic exploitation of prey in the libellulid dragonfly *Orthetrum cancellatum* (Odonata: Libellulidae). *Zool. Jb. Syst.* **120**: 441–451.

Sternberg, K. 1995. Influence of oviposition date and temperature upon embryonic development in *Somatochlora alpestris* and *S. arctica* (Odonata: Corduliidae). *J. Zool., Lond.* **235**: 163–174.

Every member of the BDS will be very saddened to hear that Peter Miller, our dynamic but gentle Vice-President, died on 24th March. He will be so sadly missed, and our hearts go out to Kate, Claire and Fred.

Jill

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.

Manuscripts should be typewritten using black ribbon, double-spaced, on one side of the page only and with margins at least 25 mm at the left, top and bottom; text pages should be numbered. Footnotes should be avoided.

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

Use of these terms is acceptable: 'exuviae' for cast skin or skins (singular and plural); '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 1994.

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 typed, each on a separate, unnumbered page.

Legends for illustrations should be typed together in sequence on a single unnumbered page.

Illustrations (figures) should be prepared in black ink, and scaled to allow a reduction of 1.5 to 3 times. Lettering should be neat and uniform.

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 virgo	Beautiful Demoiselle
Calopteryx splendens	Banded Demoiselle
Lestes sponsa	Emerald Damselfly
Lestes dryas	Scarce Emerald Damselfly
Platycnemis pennipes	White-legged Damselfly
Pyrrhosoma nymphula	Large Red Damselfly
Erythromma najas	Red-eyed Damselfly
Coenagrion mercuriale	Southern Damselfly
Coenagrion scitulum	Dainty Damselfly
Coenagrion hastulatum	Northern Damselfly
Coenagrion lunulatum	Irish Damselfly
Coenagrion armatum	Norfolk Damselfly
Coenagrion puella	Azure Damselfly
Coenagrion pulchellum	Variable Damselfly
Enallagma cyathigerum	Common Blue Damselfly
Ischnura pumilio	Scarce Blue-tailed Damselfly
Ischnura elegans	Blue-tailed Damselfly
Ceriagrion tenellum	Small Red Damselfly

ANISOPTERA	DRAGONFLIES
Aeshna caerulea	Azure Hawker
Aeshna juncea	Common Hawker
Aeshna mixta	Migrant Hawker
Aeshna cyanea	Southern Hawker
Aeshna grandis	Brown Hawker
Anaciaeschna isosceles	Norfolk Hawker
Anax imperator	Emperor Dragonfly
Hemianax ephippiger	Vagrant Emperor Dragonfly
Brachytron pratense	Hairy Dragonfly
Gomphus vulgatissimus	Club-tailed Dragonfly
Cordulegaster boltonii	Golden-ringed Dragonfly
Cordulia aenea	Downy Emerald
Somatochlora metallica	Brilliant Emerald
Somatochlora arctica	Northern Emerald
Oxygastra curtisii	Orange-spotted Emerald
Libellula quadrimaculata	Four-spotted Chaser
Libellula fulva	Scarce Chaser
Libellula depressa	Broad-bodied Chaser
Orthetrum cancellatum	Black-tailed Skimmer
Orthetrum coerulescens	Keeled Skimmer
Sympetrum striolatum	Common Darter
Sympetrum nigrescens	Highland Darter
Sympetrum fonscolombei	Red-veined Darter
Sympetrum flaveolum	Yellow-winged Darter
Sympetrum sanguineum	Ruddy Darter
Sympetrum danae	Black Darter
Leucorrhinia dubia	White-faced Darter

Registered Charity No. 800196

CONTENTS

Printed by Westpoint Printing Co. Ltd, Birmingham B5 5RX