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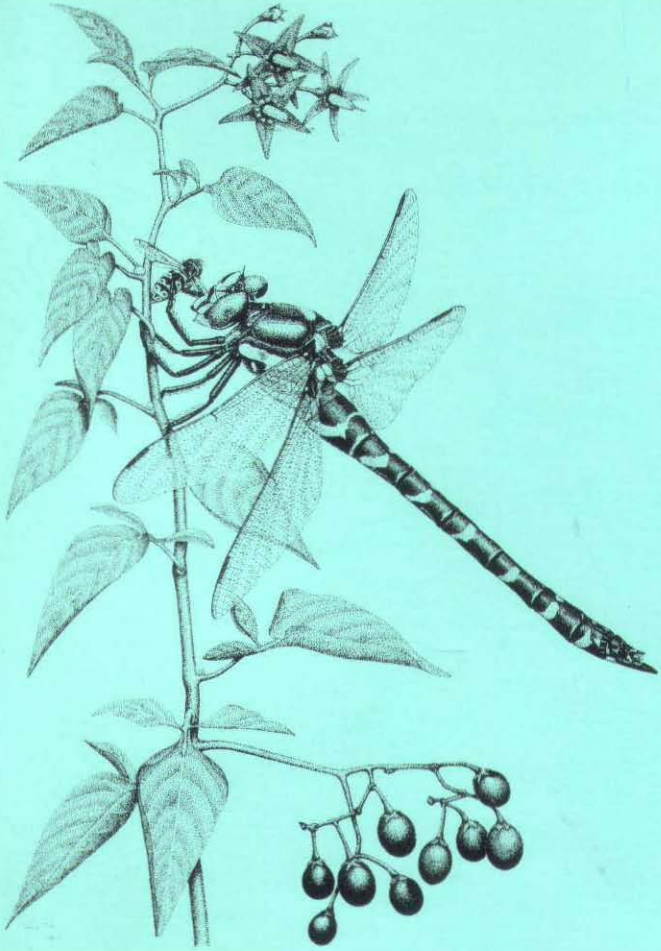

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affiliated to the Societas Internationalis Odonatologica

The *Journal of the British Dragonfly Society*, normally 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. The B.D.S. is affiliated to the Societas Internationalis Odonatologica (S.I.O.).

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Front cover illustration of *Cordulegaster boltonii* by Steven Jones.

Forty years on: a comparison of the dragonfly fauna of Bedfordshire in the 1940s with the situation today

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An excellent entomologist, Ray Palmer, published in the 1947 edition of *The Bedfordshire Naturalist* an account of the dragonfly species then known in the county. This was based on his own records, and those of Bernard West, Bernard Verdcourt, D. W. Snow and D. Ashwell, all from the 1940s, and on records sent to Cynthia Longfield when she was preparing the second edition of her *Dragonflies of the British Isles* first published in 1937. For records during the years 1948 to 1950 we have Ray Palmer's species cards on which he noted the observations of his four fellow odonatists and of D. A. Reid of Leighton Buzzard, as well as his own.

It is interesting to compare Ray Palmer's account with the present position, roughly 40 years later. During this period dragonfly habitats have changed considerably. Most of the farm ponds have gone, and the River Ouse downstream of Bedford has been canalised. On the credit side, however, are the very extensive water-filled mineral workings — gravel, sand, clay and chalk pits — many now our best dragonfly sites. Garden ponds and irrigation pits have also increased in number, especially during the last 20 years.

Of the large hawker dragonflies Ray Palmer describes the Southern Hawker *(Aeshna cyanea)*
common', the Migrant Hawker *(A. mixta)* as 'by no means common', but 'commoner than *A. juncea*' (the so-called Common Hawker). He records the Emperor Dragonfly *(Anax imperator)* as 'scarce' and the Golden-ringed Dragonfly *(Cordulegaster boltonii)* as a casual, with only two records from the county, one in West Wood, Knotting (July 1947) and one in Putnoe Wood (July 1948). The current position is that *Aeshna cyanea, A. grandis* and *A. mixta* are all now ubiquitous, *Anax* quickly colonises many new pits and large ponds, *Aeshna juncea* has not been recorded in the county since 1948 although it is present in Hunts., and *Cordulegaster* remains a casual — the only recent record being a migratory swarm that arrived at Felmersham Gravel Pits during the hot summer of 1975.

Of the darters, chasers and skimmers, the status of all species has changed since the war except two — the Common Darter *(Sympetrum striolatum)* and the Scarce Chaser *(Libellula fulva). S. striolatum* in the 1940s was 'very common and widespread being found in all types of localities'. This is still true today. *Libellula fulva* has only ever been recorded once in the county, at Newnham, Bedford in the 19th century. Ray

Palmer reported that it was found regularly on the Ouse near Huntingdon between 1909 and 1913. It is still present there today, and has colonised some near-by gravel pits. There is no reason why it should not occur on the Bedfordshire Ouse near the county boundary with Hunts..

Broad-bodied Chaser *(Libellula depressa)* is described by Ray Palmer as 'probably the most abundant large dragonfly in the county . . . frequently to be seen round small farm ponds and ditches'. I could not find this species in Bedfordshire in the early 1970s, its decrease perhaps to be linked with the loss of farm ponds. However, it is now frequent, rapidly colonising new garden ponds, even quite tiny ones, and occasionally occurring on the Ouse.

Four-spotted Chaser *(Libellula quadrimaculata)* according to Ray Palmer 'seems to be rare in the county and may possibly be only a casual visitor'. It is now by no means rare as its preferred habitat has increased considerably. It favours the smaller pits and the trench-like 'trial digs' for gravel, as well as the shallow margins of larger brick and chalk pits. Many of these were dug during the war or shortly afterwards, and are now well vegetated with beds of emergent sedges, bulrushes and reeds on which the territorial males like to perch.

Black-tailed Skimmer *(Orthetrum cancellatum)* is the species that has increased most spectacularly since the war. Ray Palmer in his 1947 article had no records for it in the county — the first sightings were by D. A. Reid in 1950 at Grovebury Pits, Leighton Buzzard and Brickworks Pit, Stanbridge. It is now abundant in all newly dug pits and in the Ouse after dredging works as it prefers bare mud. It seems to be moving steadily north from its original stronghold in the south of Great Britain, and by 1984 had reached Derbyshire.

Ruddy Darter *(Sympetrum sanguineum)* is described by Ray Palmer as 'apparently rare but may be overlooked' and he cites two records only. It is now present at several older gravel and chalk pits and some large ponds and has recently colonised the River Ouse at Willington and Felmersham Gravel Pits, both sites that were well studied in the 1960s and 70s without this little darter ever being seen.

Black Darter *(Sympetrum danae)* now appears to be absent from Bedfordshire. Ray Palmer records that two were taken from Bromham Park in 1943 by Bernard West and one from Wavendon Heath in 1951 by himself. It is a species that favours peaty pools and the acid Wavendon Heath Ponds is a site it may possibly recolonise.

A similar picture emerges with the damselflies. Some species are much as Ray Palmer found them, some have benefited from the new wet habitats while others have declined or been lost from the county. Three species whose status is unchanged are the

Blue-tailed Damselfly *(Ischnura elegans)*, described by Ray Palmer as 'common and widespread', the Large Red Damselfly *(Pyrrhosoma nymphula)* which was 'generally distributed but always in very small numbers' and the Banded Demoiselle *(Calopteryx splendens)* which was 'common along the rivers and their main tributaries'. These descriptions are still valid today.

Less valid now are Ray Palmer's comments on other species. Of the Common Blue Damselfly *(Enallagma cyathigerum)* he says 'fairly common and sometimes abundant locally but less so than the Azure Damselfly *(Coenagrion puella)*' which is 'very common in most localities'. The position is now reversed. *Enallagma* is present in thousands on nearly all new pits whereas *C. puella* prefers smaller ponds with some shelter and so took a hammering with the loss of farm ponds. It seems to be able to colonise suitable garden ponds and so may be staging a come-back. Another species that has suffered recently but may be recovering is the White-legged Damselfly *(Platycnemis pennipes)*. D. W. Snow considered it the 'commonest damselfly on the Ouse' in the 1940s and it was also common on the Ousel near Leighton Buzzard. It was greatly affected by the canalisation of the Ouse downstream of Bedford in the 1970s and for some years was virtually absent. Its numbers seem to be building up again. The Red-eyed Damselfly *(Erythromma najas)* was also regarded by Ray Palmer as a river species and he states that it was 'frequent in some parts of the Ouse'. This is still true, especially upstream of Bedford, but now its most characteristic habitat is old, shallow pits with plenty of the floating leaves of water lilies *(Nuphar* sp.) or the broad-leaved pondweed *(Potamogeton natans)*. So far about eight such sites have been recorded as supporting this species. We now have about twice that number of sites for the Emerald Damselfly *(Lestes sponsa)*. This species was described by Ray Palmer as 'apparently rare' and had not been taken by him when the 1947 article was written. Like *Libellula quadrimaculata* it favours shallow pits or large ponds with lots of emergent vegetation. This habitat has increased in recent years with the maturation of war-time excavations.

Finally, there are two damselflies present in the decade after the war which have not recently been recorded in the county. One is the Scarce Emerald *(Lestes dryas)*. Only a single specimen has ever been captured in Bedfordshire — a female taken from Heath and Reach by D. A. Reid in 1950. The other species might still be present as it is found in at least four gravel pits in Hunts.. It is the Variable Damselfly *(Coenagrion pulchellum)*, described by Ray Palmer as 'rare and local'. He gives three locations on the River Ouse and one at Grovebury Pits.

So the overall picture is that *A. mixta, A. imperator, O. cancellatum, L. quadrimaculata, S. sanguineum, E. cyathigerum, E. najas* and *L. sponsa* seem to have

become more abundant and widespread in the last 40 years benefiting by the increase in water-filled pits, while the status of *A. cyanea, A. grandis, L. fulva, S. striolatum, I. elegans, P. nymphula, C. splendens* and *C. bolitonii* remains unchanged. On the debit side *A. juncea, S. danae, C. pulchellum* and *L. dryas* have not been recorded since Ray Palmer's time and *L. depressa, C. puella* and *P. pennipes* have suffered decreases due to habitat changes from which they appear to be recovering.

Our rarest dragonfly was not mentioned at all by Ray Palmer and would, no doubt, have astonished him. Two small colonies of *Ischnura pumilio* were discovered in South Bedfordshire in early July 1987 by John Comont, the Conservation Officer of the Beds. and Hunts. Wildlife Trust. Both colonies were in chalk quarries in the marshy seepage zone at the foot of a cliff where a spring line had been cut through. Another colony in a very similar site has now been discovered in Buckinghamshire.

The formation of a regional group (New Forest)

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This short article is not intended as a blueprint for the formation of further groups but is an account of the origins, activities and aims of the New Forest Group. It is hoped however that it might act as a stimulant to other enthusiasts to pool their resources and thereby further their own enjoyment.

I had been interested in dragonflies for many years prior to moving to the New Forest in 1977. For the first year or so I recorded in a rather haphazard manner and then came across a serious wetland management error. Initially I did not really consider that it was anything to do with me, but in any case I reported it to both the Forestry Commission and the Nature Conservancy Council both of whom disclaimed any knowledge of the value of the site. I had wrongly assumed that because the forest is so environmentally sensitive that all sites would be known and well recorded. On inspecting the Forestry Commission records I found that 95% of all records referred to the traditional, time-honoured collecting sites. Many people were recording but they were all going to the same areas. This I thought a terrible waste of manpower. As a result I wrote to all who had submitted records and who lived within reasonable travelling distance suggesting a meeting. This eventually came about, eight or nine of us attended that inaugural meeting and luckily all agreed on a common policy. Tony and Noelle Welstead, who had been recording systematically in the S.E. of the forest

the previous year (1981), were at that meeting and during the ensuing years were to become an inspiration to us all with their systematic efficiency.

Because of the close proximity of differing habitats in the New Forest, we found it necessary to record on a kilometre square basis with the objective of covering the whole area within the perambulation. This of course was rather more easily said than done as there is a great deal of private land and even more coniferous inclosure. Although there was no true leader I acted as co-ordinator and Tony and Noelle were official recorders. We decided that to sustain enthusiasm we should have regular monthly meetings from April until October and chose a mutually acceptable pub. In point of fact the meetings continued throughout the year and during the winter we would plan for the forthcoming season. We devised our own recording sheets on A4 paper. On these we could record 20 different sites and utilised symbols to indicate approximate numbers and attempted breeding of dragonflies. Locally scarce species were normally accurately counted. Recording sheets were returned to the co-ordinator at the end of each month, these were then copied, photocopied and a full set distributed back to each recorder hopefully within a week. Additional sets were made available to the Forestry Commission and the N.C.C.. It had already been decided that if members supplied no input they would not receive records. I also spent considerable time researching journals and periodicals at the University library. All but the lengthiest papers of interest were photocopied and distributed. We usually had two or three meetings each year when we would all descend on a particular area for a concerted effort. We would also usually have an away trip each year, sometimes only going as far as Studland but once we hired a minibus for a day trip to Shropshire in search of *Leucorrhinia*. At Christmas we would hire a village hall for a social evening and invite friends, acquaintances and sometimes even family for beer, wine, cheese and biscuits etc., a few colour slides and a lot of chatter. In retrospect I feel the social factors played as big a part in keeping us together as the common interest. It prevented the overall objective from becoming too 'heavy'.

We were very fortunate with the weather in the early eighties and achieved remarkable coverage of a difficult area. The full benefit of our records will become apparent in the future when comparative studies can be made. Even now we can make some reasonable assumptions which prior to the study would have been rather speculative. First, *Gomphus vulgatissimus* is extinct in the area but it is just possible that it is still holding on in the lower reaches of the Beaulieu river on private land, although personally I doubt it. Second, *Platycnemis pennipes* only retains the one foothold on the Oberwater. Both of these insects were abundant in the New Forest forty years ago. Third, *Erythromma najas* is probably the species most in need of care on the open forest, as it retains a precarious hold at a very few ponds but has lost its

once abundant population on a major pond in the North. Fourth, it is now established that *Sympetrum sanguineum* breeds on the open forest, a fact hitherto not reported. My only disappointment is that we were not able to discover *Somatochlora metallica*. I feel that it should be there, possibly on a well-wooded pond on private ground where access is difficult.

The Group's activities were not confined solely to insect recording. Two water surveys were undertaken. Fifty-three ponds were checked for pH in January and again in July, the values varying from 5.0 to 8.0 indicating great diversity. A more exhaustive survey was made of the running water at 30 representative locations. Five volunteers were allocated six sites each and each set of sites was visited on a weekly rotation (i.e. every five weeks) for a year. The samples taken were analysed so that seasonal fluctuations could be observed. The original objective was to examine whether the chemical properties of water were likely to determine the distribution of *Coenagrion mercuriale*. However, we found the insect to live in waters with varying chemical properties particularly pH. We found by default that its distribution is governed mainly by the physical characteristics of the stream and its geographical aspect and the minimum winter temperature of the water. This latter factor is critical for the development and well-being of the larvae. Much of the New Forest water is spring-fed and the closer the water to the spring the less likely it is to freeze solid in hard weather. It was found that in mire areas inhabited by *C. mercuriale* the top layer may freeze, leaving an air gap with water still flowing in the base of the runnel.

The advantages of belonging to a group are manifold. There is a good-natured competitive spirit which inspires the members, and problems can be discussed when they arise. All of the major conservation bodies need all the constructive information they can get: it cannot be assumed that everything is already known. Also it should not be assumed that rarity value is the only criticism for conservation. The continued destruction of our more mundane wetland habitats may yet put our most common damselflies in the rare category in a few decades. It is vital that we continue to monitor the more commonplace now, otherwise we cannot make comparisons at a later date.

In the long term, the formation of a network of regional groups could be of great value to the British Dragonfly Society. I can foresee the time when it may be necessary for us to have a record retrieval system of our own. Enthusiasts with local knowledge who can be easily contacted will be invaluable. A list of regional groups could be compiled annually and published in the newsletter. Groups, at their own discretion could have an Open Day, open to all, especially beginners. This could well be the way to flush our ranks with new members. It is of limited value always preaching to the already converted. The possibilities are endless. It is up to us to provide the drive and enthusiasm to put British Odonata on the map and provide a serious challenge to the butterfly brigade seated on their pinnacle!

Dragonflies in Jersey

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In July 1988 we paid a visit to Jersey, hoping to see at least some of the seven species recorded from the Island that have not been found, or are no longer found, in mainland Britain namely *Sympeca fusca, Lestes barbarus, L. viridis, Coenagrion scitulum, Sympetrum meridionale, S. vulgatum* and *Crocothemis erythraea*. In addition to these we hoped we might find *Sympetrum flaveolum, S. fonscolombii* and *Aeshna isosceles*, all of which (together with eighteen other species) are listed as being present in Jersey (Hammond, 1983; Askew, 1988). Sadly our success was minimal.

Introduction

Jersey is the largest and most southerly of the Channel Islands and is sheltered from the northeast by the Cherbourg peninsula. Its area of 120 sq. km and resident population of around 80,000 compare with 200 sq. km and 123,000 resident population for the Isle of Wight. In both cases the population is greatly swollen by summer visitors.

The island slopes from north to south, with a series of steep-sided valleys following this slope. The higher ground in the north is cultivated almost to the cliff edge; hence the run-off from the fields is concentrated principally in these valleys. Many of them have been dammed for either domestic or agricultural water supply and most of the others are overgrown.

Behind the foreshore in the large western bay of the Island there is a flat raised beach one to two km deep, backed by dunes against the hillside. This area (Les Mièlles) is of considerable archaeological, botanical and ornithological interest and is designated as a "Special Place". The Conservation Office of the States of Jersey maintains a well-kept Interpretation Centre there (sadly without much entomological information and dragonflies are not shown at all). Much of the area is owned either by the States of Jersey or the Jersey National Trust. Les Mièlles contains the largest natural water body on the island — La Mare au Seigneur (St Ouen's Pond) — which is owned by the National Trust and administered by the Société Jersiaise. Other smaller ponds, under the same ownership, are looked after by the RSPB.

During the last war the German occupation forces dug a wide canal extending some distance north and south of St. Ouen's pond to prevent aeroplanes landing on the more level northern half of Les Mièlles. This canal, together with the pond itself, provided some of the richest dragonfly records of the 1940's and early 1950's

(LeQuesne, 1946-51). Much of the canal was filled in after the War and a disused quarry at Mount Mado in the north of the Island, which produced a number of records, was also filled in.

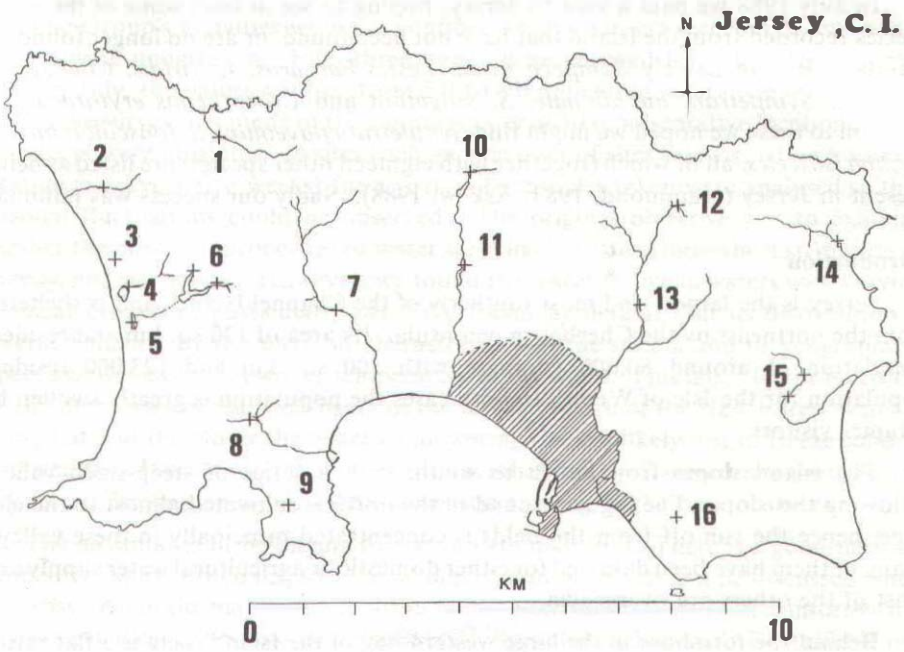

Figure 1. Jersey, Channel Islands showing sites visited in July 1988.

Sites visited

The locations of the sites visited by us in July 1988 are illustrated by numbers on the map (Fig. 1), while Table 1 lists the sites and indicates the number of species seen at each. Some sites were visited once only, others several times. It is ironic that Queen's Valley, where the most species were seen, is shortly to be flooded to form a new reservoir.

Table 1. Sites visited and species recorded in Jersey, July 1988 (Fig. 1 refers).

1.	Val de Lecq	nil
2.	L'Etacq	*Anax imperator, Ischnura elegans*
3.	RSPB ponds	*A. imperator, A. mixta, ?Cordulia aenea, I. elegans*
4.	St Ouen's Pond	*I. elegans* (1F. only)
5.	South Canal	nil
6.	Val de la Mare	*A. imperator*
7.	St Peter's Valley	nil
8.	Corbi	*A. imperator*
9.	Ouaisné Common	nil
10.	Handois	*A. imperator, I. elegans* (Reservoir & stream)
11.	Waterworks Valley	*A. imperator, I. elegans, S. striolatum, C. puella*
12.	Des Augres (Zoo)	nil
13.	Grands Vaux	*A. imperator*
14.	St Catherines's Valley	*A. imperator, A. mixta*
15.	Queen's Valley	*A. imperator, A. cyanea, A. mixta, Cordulegaster boltonii, I. elegans, Pyrrhosoma nymphula*
16.	Samarès Manor	*A. imperator, I. elegans*

Comparison with earlier records

Table 2 compares our observations with earlier records (LeQuesne, 1946-51; Fraser, 1961) and more recent observations of Walter LeQuesne and Margaret & Roger Long (pers. comm.). It should be noted that Dr LeQuesne was absent from the Island, apart from brief visits, between 1951 and 1985.

Table 2 shows that, of the 28 species reported from the late 1940's (LeQuesne, 1946-51), only nine were recorded between 1983 and 1987. We saw seven of these plus *Pyrrhosoma nymphula* and probably *Cordulia aenea*. Of the 17 species apparently lost, eight (shown in Table 2 by bold print) were represented by only isolated records. It should be noted that the three specimens of *C. scitulum* taken by Dr LeQuesne in 1941 were originally incorrectly identified as *C. pulchellum* (LeQuesne, 1951). Of the remaining nine:

— two, *Sympecma fusca* and *Crocothemis erythraea*, are not recorded from the British mainland and

— three, *Lestes viridis, Sympetrum* *lo*
migrants to mainland Britain.

— with the exception of *S. flaveolum* all of these bred in Jersey.

Table 2. Total species recorded in Jersey between 1941 and 1988.

Species	LeQuesne 1941-51	Fraser 1961	LeQuesne/Long 1983-87	R. I. & J. D. Silsby 1988
Calopteryx virgo L.	Breeding		1983	
***C. splendens* Harris**	**2 records**			
L. viridis v. d. Linden	Breeding	Breeding		
***L. barbarus* Fabr.**	**2 females**			
Sympecma fusca v. d. Lind.	Breeding			
Ischnura elegans v. d. Lind.	Breeding		Breeding	Breeding
Pyrrhosoma nymphula Charp.	Common			Only Queen's Valley
Coenagrion puella L.	Common		1985 & 1987	Only Waterworks Valley
***C. scitulum* Rambur**	**3 records**			
Enallagma cyathigerum Charp.	Common			
Anax imperator Leach	Breeding		Breeding	Breeding
Brachytron pratense Müller	Breeding			
Aeshna mixta Latreille	Breeding	Breeding	Common	Singles at 3 sites
A. cyanea Müller	Breeding		1987	Only Queen's Valley
A. isosceles Müller	St. Ouen's			
Cordulegaster boltonii Don.	Few		1983, 1986	Only Queen's Valley
Cordulia aenea L.	Breeding			? F. dipping RSPB pond
Orthetrum cancellatum L.	St. Ouen's		1984/1985	
Libellula quadrimaculata L.	Breeding			
***L. fulva* Müller**	**1 female**			
***L. depressa* L.**	**3 F, 1 M**			
***Sympetrum meridionale* Selys**	**1 female**			
S. striolatum Charpentier	Breeding		Common	1 M. Waterworks Valley
***S. vulgatum* L.**	**4 records**			
S. fonscolombii Selys	Breeding			
S. flaveolum L.	Common			
***S. sanguineum* Müller**	**5/6 records**			
Crocothemis erythraea Brullé	Breeding			

Sarnian Island Records

It is of interest to compare Jersey records with Odonata in the Sarnian Islands (Guernsey, Alderney, Herm and Sark) (Belle, 1980; 1981). An extensive review of the dragonfly fauna of these islands was carried out by Dr Jean Belle in 1978. This showed that, of 18 specimens recorded around the turn of the century, 12 seem to have become extinct. The losses differ in kind from those in Jersey but the 6 remaining species have all been recorded recently in Jersey.

Reasons for Decline

One can, at this stage, only speculate about possible reasons for the decline in Jersey's dragonfly species. The most obvious is pollution. We were, for example, told of an unpublished report indicating nitrate levels some five times higher than the UK average. Several of the more promising-looking water bodies had sizable flocks of domestic water fowl. On the other hand, we saw no water with high algal growth and *Ischnura elegans* was present at almost all sites where any Odonata were seen. It has been suggested (Kiauta, 1965) that this species can, to some extent, be regarded as a pollution indicator due to its tolerance of high levels of pollution.

Other obvious factors include the filling in of water bodies (much of the canal on Les Mièlles and a quarry at Mont Mado) and the flooding of valleys for water supply. A further factor may be a change in management or, in other cases, a lack of management. We saw examples of ornamental water in gardens where all marginal and floating vegetation had been cleared and we found that a number of the larger ponds feeding reservoirs were now run as trout farms. On the other hand, several of the valleys were choked with trees and other vegetation so that practically no sun could penetrate through to their streams. They contrast with Queen's Valley which is light and open, having grazed meadows for most of its length.

One of the richest dragonfly sites in the 1940's was St Ouen's Pond. Until 1950 the reeds here were regularly harvested by thatchers; now the reeds are far too deep and far too dense to support large numbers of Odonata and the same applies to another old site, the pond at Ouaisnè.

Conclusions

Sadly the distribution maps in recent dragonfly publications appear to be wrong. Hammond (1983) lists 28 species for Jersey (three post 1961) and Askew (1988) lists 29 for the Channel Islands. Many good sites have disappeared and many more have suffered deterioration but we feel that all is not lost. If the beauty of dragonflies,

together with their plight, can be brought to the notice of the residents of Jersey we are sure that the downward trend could be halted. Indeed, some of the lost species may still be present in the large private gardens on the Island and an appeal is to be made in the forthcoming issue of *Bulletin Annuel. Société Jersiaise* for readers to keep a lookout for dragonflies in their gardens and to report any sitings. Margaret Long thinks she may have seen a single *L. viridis* resting for a few seconds on Virginia creeper growing on the walls of a private house, St Ouen's Manor. We very much hope that this lovely little damselfly may still be breeding on Jersey.

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The distribution and abundance of *Calopteryx splendens* (Harris), *C. virgo* (L.) and *Platycnemis pennipes* (Pallas) on the Wey river system (Hampshire and Surrey)

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Introduction

Calopteryx splendens (Harris) and *C. virgo* (L.) are widespread and abundant species in the south of England; *Platycnemis pennipes* (Pallas), on the other hand, is local in its distribution although it can be quite abundant where it does occur (Hammond, 1983).

There has been considerable variation in the reported habitat requirements of these damselflies in Britain (Chelmick *et al.*, 1980; Kemp, 1981; Corbet, 1983; Hammond, 1983; Dunn, 1984; Welstead & Welstead, 1984; Corbet *et al.*, 1985). The general consensus, however, is that *C. splendens* prefers slow-flowing, alkaline, open rivers with muddy bottoms; that *C. virgo* prefers smaller, faster-flowing, rather acid, tree-lined streams and rivers with sand or gravel bottoms; and that *P. pennipes* is found in unpolluted, sluggish rivers and canals with abundant marginal vegetation.

The aim of this study was to investigate the effects of biotic (aquatic and marginal vegetation) and abiotic (river width, depth, current and pH) factors on the distribution and abundance of these three species on the Wey river system in Hampshire and Surrey.

Methods

Study area

The River Wey has three main branches: the North and South Wey, which rise in Hampshire, and the Bramley Wey, which rises in Surrey (Fig. 1). Most of the river system is in Surrey.

Twenty-three survey sites were selected at well-spaced, but varying intervals, along a total length of 113km of the Wey river system. (Fig. 1; Table 1). The sites were selected to encompass a wide range of environmental conditions (Table 2) and to be readily accessible; they also each had to hold at least one of the species under study.

Abundance and distribution

For all species, abundance was measured by counting adults, which are readily

*Deceased. Paper completed by H. D. V. and E. D. V. Prendergast.

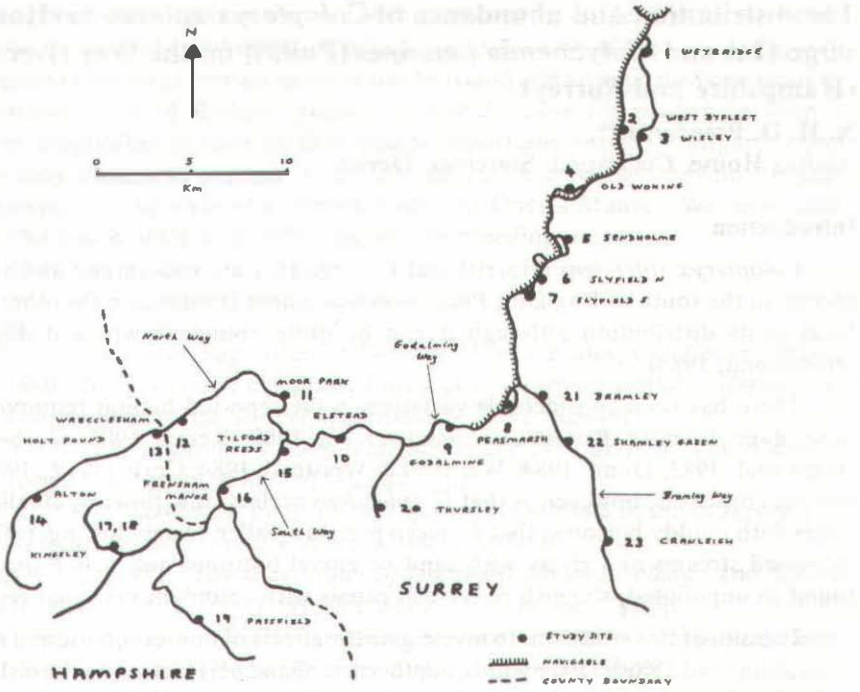

Figure 1. Study sites on the Wey river system.

identifiable, along a fixed length of bank (see below). As the females of *C. splendens* and *C. virgo* are easily confusable, I decided to count males only.

For the calopterygids the counting of adults rather than larvae is considered a satisfactory method for three reasons. First, Macan (1980) concluded that the occurrence of these species depends more on the requirements of the adults than of the larvae. Second, Zahner (1960) noted that adults tend to remain very near to the emergence site and to return to it regularly for reproduction; when not engaged in sexual activity both sexes roost in bankside or emergent vegetation. Third, Zahner (1959) found that larvae tend to remain close to the oviposition site and to travel no more than 20-120 cm/day. The same method was applied to *P. pennipes* even though this species may wander rather further away from water.

Deciding on an appropriate bank length along which to count was a problem. Each species, but particularly *C. splendens*, tends to occur patchily so that some lengths of bank may have very high concentrations of individuals and others very low concentrations. The situation is further complicated by groups of altercating males flying up and down a short stretch of water. I eventually concluded that the best approach would be to count that 10m length of bank at each site (one side of the river only) with the greatest number of males.

Weather conditions may affect the activity and visibility of damselflies. During the study period the weather in south-east England was characterised by rainfall being 46% greater than the mean for the time of year, and the mean temperature being 0.5°C below, and sunshine 95% of, the mean. For final analysis the maximum number of males/10m of bank at each site was used — an optimal conditions approach advocated by Schmidt (1985). All sites were visited at least twice, and 13 sites at least three times, during the period 1 June — 11 August 1985. 18 days were spend on field-work.

Abiotic factors

River width at survey sites was measured either directly with a steel tape or by throwing a weighted cord across and measuring off against the tape. Maximum river depth was measured with a pole or heavily weighted cord. Maximum surface current was found by timing a dog biscuit (these floated low in the water and allowed an object of near identical size, shape and specific gravity to be used each time) over a measured distance of 10-20m, depending on local conditions. The fastest of three trials was recorded for each site. pH was measured using 3-colour litmus paper.

Biotic factors

Vegetation was divided into four categories: submerged, emergent, bankside and shading (Table 2). Submerged vegetation included plants with floating leaves, as well as those which also had short emergent parts (e.g. *Nuphar* flower heads). The emergent category was confined to plants emerging 1m or more from the water. Bankside vegetation comprised only tall herbaceous plants growing close to, but not in, the water, whilst shading vegetation comprised trees and shrubs. The abundance of each vegetation category was scored against an index ranging from 1-5. Submerged and emergent vegetation indices were assessed semi-quantitatively, whereas bankside and shading indices were assessed subjectively. The criteria used, and typical species encountered, are shown in Table 2.

Vegetation indices recorded were the maxima for a 10m stretch either coinciding with where damselfly abundance was assessed or within c. 15m either side of it. This took some account of the movement of damselflies up and down river. The index for submerged vegetation related to the full river width; the indices for emergent and bankside vegetation related only to the bank where damselfly abundance was assessed; the index for shading related to the full river width and to both banks within c. 5m of the river.

Results

The distribution and abundance of damselflies, and the measurements of biotic and abiotic factors at each survey site, are shown in Table 1.

C. splendens was the most abundant species (sum of abundance indices = 173; relative abundance = 75%). It was also the most widely distributed, occurring at 20 of the 23 sites. These encompassed the full range of river width, current and pH, and all depths except the shallowest, as well as the full range of vegetation indices except for a shading index of 5. The three sites (19, 20, 23) from where it was absent were all on small headwaters. Its site of greatest abundance (12) was on the North Wey.

C. virgo was the next most abundant species (sum of abundance indices = 35; relative abundance = 15%). It occurred at 14 sites (including all on the South Wey and Bramley Wey), from the smallest headwaters to all but the four furthest downstream (northernmost) sites on the Wey (one male, however, was found on a side-branch of the river parallel to, and level with, site 4). It was absent from the six sites with the greatest river width. Otherwise the nine sites from where it was absent encompassed the full range of depth, current, pH and vegetation indices.

P. pennipes was the scarcest species (sum of abundance indices = 24; relative abundance = 10%). It occurred at only 11 sites: at all three sites on the Bramley Wey and at all sites downstream of its confluence with the Godalming Wey, but not upstream of site 8 on the Godalming Wey. The sites where it occurred included all but the very narrowest, shallowest and most swiftly flowing. It was not found where pH was less than 6, where there was very little submerged vegetation, nor where emergent and shading vegetation indices were highest.

No significant correlations were found between the index of abundance of *C. splendens* and indices of any of the environmental factors at the sites where it occurred. At the three sites (12, 13, 18) with an emergent vegetation index of 5, among the highest species abundance figures of all were recorded: 56, 18 and 6 respectively. With the omission of these sites, there was a significant positive correlation ($p=<0.05$) between the log of *C. splendens* index of abundance and river width.

Table 1. Location, and biotic and abiotic characteristics, of survey sites and abundance of study species.

Site			Species abundance			River characteristics				Vegetation indices			
No.	Name	Grid ref.	S	V	P	W	D	C	pH	Vs	Ve	Vb	Vc
1	Weybridge	TQ067643	3	0	1	20.0	1.7	14	6.0	4	2	3	4
2	West Byfleet	055602	4	0	4	13.0	1.1	18	7.0	2	4	2	2
3	Wisley	061597	7	0	1	17.0	2.2	30	6.0	2	3	4	3
4	Old Woking	025564	5	0	1	11.0	1.6	48	6.5	4	4	1	1
5	Sendholme	015546	18	1	8	13.0	1.7	29	6.5	2	2	2	2
6	Slyfield North	003517	8	0	3	16.0	2.2	19	6.0	2	2	4	2
7	Slyfield South	003513	4	1	1	12.0	2.2	27	6.0	2	1	3	3
8	Peasmarsh	SU990453	4	0	1	13.0	1.3	28	6.0	5	4	3	1
9	Godalming	962444	4	0	0	14.5	1.3	33	6.5	3	3	3	3
10	Elstead	896439	5	2	0	13.0	1.3	21	6.0	3	1	1	1
11	Moor Park	868458	5	1	0	8.0	1.5	10	7.0	5	2	4	3
12	Wrecclesham	819451	56	0	0	9.0	0.8	18	7.0	4	5	3	2
13	Holt Pound	806442	18	2	0	7.0	0.4	57	7.0	5	5	2	3
14	Alton	733404	2	0	0	6.0	0.3	56	7.0	2	3	4	4
15	Tilford Reeds	868430	7	3	0	8.0	0.5	59	5.0	5	4	5	4
16	Frensham Manor	835405	10	2	0	11.0	0.8	36	5.5	3	2	4	4
17	Kingsley East	779377	2	4	0	3.0	0.3	11	6.5	1	4	1	3
18	Kingsley West	778377	6	2	0	2.0	0.4	5	6.5	1	5	1	1
19	Passfield	823342	0	4	0	8.5	0.3	36	5.5	1	1	3	5
20	Thursley	915401	0	10	0	2.0	0.2	37	6.0	1	1	2	5
21	Bramley	TQ006456	2	1	2	8.0	1.5	5	6.0	3	3	5	2
22	Shamley Green	025429	3	1	1	4.5	0.5	29	6.0	2	1	1	2
23	Cranleigh	041387	0	1	1	3.5	0.3	30	6.5	2	1	4	3

Notes

1. S, *C. splendens;* V, *C. virgo;* P, *P. pennipes.* Males per 10m.
2. W, width (m); D, maximum depth (m); C, current (cm s^{-1}).
3. Vegetation categories: Vs, submerged; Ve, emergent; Vb, bankside; Vc, shading.

Table 2. Vegetation categories, their index criteria and typical species

	submerged Vs	emergent Ve	bankside Vb	shading Vc
	approximate % of river bed obscured	approximate area (m) covered along 10m bank length		
Index				
1	0 - 9	0 - 2.4	well grazed to water's edge	open or a few small trees
2	10 - 19	2.5 - 4.9	thin strip of good growth, grazed behind; or more entensive but sparse and low	regular small trees; or intermittent larger trees
3	20 - 29	5.0 - 7.4	wider strip, grazed behind; or patchily luxuriant over wider area	one bank open, one bank full shade; or both banks partially shaded
4	30 - 39	7.5 - 9.9	luxuriant but of limited extent; or interrupted	many large trees but admitting much sunlight
5	≥ 40	≥ 10	luxuriant and extensive	almost full shade
Typical species	*Callitriche* spp. *Nuphar lutea* *Potamogeton* spp. *Ranunculus* spp. *Sagittaria sagittifolia*	*Alisma plantago-aquatica* *Glyceria maxima* *Iris pseudacorus* *Phalaris arundinacea* *Sparganium erectum*	*Impatiens glandulifera* *Phalaris arundinacea* *Urtica dioica*	*Alnus glutinosa* *Quercus robur* *Salix* spp.

In the case of *C. virgo* there was a significant positive correlation ($p = < 0.05$) between the log of its index of abundance and the index for shading vegetation, and a significant negative correlation ($p = < 0.05$) with maximum river depth.

No significant correlations at all were found for *P. pennipes*.

Discussion and conclusions

Weather conditions during this study were suboptimal for recording purposes and this may have contributed to the paucity of significant correlations between the abundance of *Calopteryx* spp. and *P. pennipes* and measurements of environmental factors.

The most successful of the three species in terms of both abundance and distribution is *C. splendens*. Highest numbers were recorded where there was luxuriant emergent vegetation; this probably offered particularly favourable resting places. Its absence from small headwaters may possibly be explained by dislike of heavy shading. Lack of space for adult territories may be excluded as a reason since Zahner (1960) found that territory size was dependent (inversely) on population density.

C. virgo has a somewhat patchy distribution. Although there were single records from two non-navigable sites (5, 7) on the lower reaches of the River Wey, there were none from the three navigable sites (2, 6, 8), suggesting it may be susceptible to some direct or indirect effects of water traffic. *C. virgo's* increasing abundance with decreasing river depth may be connected with O_2 requirements. Certainly Zahner (1959) found this species to be more susceptible to O_2 shortage than *C. splendens*. It is also not clear why *C. virgo* abundance should increase with shading. It was often observed resting in trees in contrast to *C. splendens* which was nearly always in herbaceous vegetation. *C. virgo* was more abundant than *C. splendens* only at four headwater sites (17, 19, 20, 23). These are not only the shallowest sites (with a depth of 0.2-0.3m) but also among the most shaded (with indices of 3-5).

Except for on the Bramley Wey (sites 21-23), the recorded distribution of *P. pennipes* is almost the mirror image of that of *C. virgo*. Why it does not occur upstream of site 8 on the Godalming Wey is a mystery. Although this species is reputed to be particularly susceptible to pollution (Hammond, 1983), this study shows that there is no apparent effect either from water traffic (at sites 2, 6, 8) nor from enrichment immediately downstream of sewage works outlets (at sites 3, 6).

Future study under optimal recording conditions would probably raise species abundance indices and uncover additional correlations with measurements of

environmental factors. Selection of more sites in the headwaters might elucidate the differing habitat requirements of the calopterygids whilst study of additional sites at the edge of the range of *P. pennipes* might pinpoint the reason for its absence upstream of site 8. My final conclusion reiterates the contention of Macan (1980), namely that it is difficult for human senses to detect what attracts a dragonfly!

Acknowledgements

For their contributions to this paper, extracted from a thesis submitted to the Open University, I particularly wish to thank Mrs R. Pontin (Open University) and Dr A. J. Pontin (Royal Holloway College). Thanks are also due to Mr P. T. Harding, Mr R. Merritt, Dr J. E. C. Steel, Miss V. Hogarth and several members of the British Dragonfly Society.

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Book Reviews

The dragonflies of Essex. Edward Benton. The Essex Field Club, London (1988). 138pp. £5.95 (p/b).

Ted Benton's thorough book is the culmination of an extensive survey of the Essex Odonata which began in 1980. With the help of a handful of recorders, all but six 5km squares in the county were visited during the survey which is a remarkable achievement in just eight years. The result is that we now have an excellent idea about the current status and distribution of odonates in Essex, with information on their habitat requirements, which will be vital for conservation management and for recognizing any future changes in their populations.

The book starts with a brief synopsis of how the survey was planned and developed. A 10km square was not considered to have been adequately surveyed until the five commonest species had been recorded there and this method helped to produce the impressive coverage of the survey. The next chapter deals with the natural history of dragonflies and is the standard fare that we have come to expect in this type of book, dealing with the structure and biology of Odonata. Chapter three discusses the different aquatic biotopes available in Essex and which species frequent them. This is followed by a breakdown of the conservation status of the six most important sites for dragonflies in Essex. Unfortunately, most of them appear to have been degraded in recent years by unsympathetic management or pollution.

The main part of the book is composed of accounts of the 28 species which have been recorded in Essex during the survey. For each species we are provided with a distribution map; the mention of a few diagnostic characters which help to distinguish the adult in the field; a brief description of the sort of sites where the species is likely to be encountered; a detailed review of earlier records of the species, in many cases back over the last 100 years; and a discussion of its current status. The chapter is concluded with conservation objectives for the seven species identified as being most at risk and a strategy for the continuation of the survey.

The book concludes with some appendices which discuss the species which have not been recorded in the county since 1903 (most of these are bog species which have been lost from Epping Forest), a detailed history of dragonfly recording in Essex, and an illustrated key to the adults. From the long list of references, it is obvious that Dr Benton has painstakingly reviewed the literature and this forms a valuable part of the work.

The dragonflies of Essex is quite a long book and I think it could have been

slimmer with the omission of a couple of chapters which do not substantially add to the main theme. I think the key to the adults is superfluous. The author admits that the key is largely untried and that caution is necessary when using it but nevertheless it is designed for use by "beginners". This seems to me to be rather unwise, particularly when it is hoped that the book will stimulate interest in Odonata and produce reliable records for the furtherance of the survey. The key is incomplete since it only deals with the Essex species and it would be difficult to use in the field because the user is expected to note characters only visible at close range and make measurements to the nearest millimetre. In addition, the second half of many of the couplets are extremely unhelpful and simply read "not as above". I think it would have been preferable if readers were simply referred to one of the many excellent identification guides that are now available. Similarly, I did not like the potted natural history of dragonflies provided in chapter two since, again, this has all been said elsewhere more thoroughly and authoritatively.

These criticisms aside, *The dragonflies*
and provides a useful review of the status of Odonata in the county.

S. J. Brooks

The dragonflies of Europe. R. R. Askew. Harley Books, Colchester (1988). 291pp + 29 pls, 502 figs. £49.95 (h/b).

For what seems like the last five years or so rumours have been rife about the imminent publication of Askew's book on the European Odonata and one of the frequent greetings from one odonatist to another would be "Do you know if Askew's book is out yet?". Well, finally it is out and now the question on everyone's lips is was it worth the wait?

I can answer a categorical "yes". From the amount of work that has obviously gone into this book it is apparent why it has taken so long to complete. There are 210 colour paintings, of a higher standard than those we have become accustomed to in earlier publications on Odonata, which depict the majority of the European species together with very clear line drawings showing the genitalia and other important structures which aid in the identification of these species. Furthermore, Dr Askew has thoroughly reviewed the literature and this has enabled him to produce detailed distribution maps, list the important synonymies and provide a certain amount of biological information for each species.

The opening chapters of the book summarise odonate life history and behaviour and the introduction serves to put the European species in a world context and with regard to their fossil record. I was interested to see a diagram illustrating the possible relationships between the European families of Odonata. Although some of the

characters chosen to define sister groups might not meet the approval of the cladists among us, at least we are able to make up our own minds. This sets the tone for other possibly controversial statements in the book since the arguments are clearly presented and I find this a refreshing change in a book of this nature. Dragonfly morphology is also very clearly explained and the confusing, sometimes conflicting, thoracic, genitalic and wing vein nomenclature is resolved with the aid of large, comprehensively labelled line drawings.

The dragonflies of Europe is not a field guide; its large format and high price preclude its use in most of the places dragonfly watchers find themselves. Nevertheless, as an identification manual for use in the laboratory or study it will prove invaluable. Well illustrated keys and diagnoses are provided for the families, genera and all 114 species known to breed in Europe (i.e. roughly from Crete westwards and excluding North Africa). The keys work well although I was puzzled by the decision to figure *Crocothemis erythraea* with abberant venation. Brief notes are also given to distinguish many of the species which may be found at the periphery of the region. The treatment of species is not always consistent however and a few truly European taxa such as *Anax immaculifrons* and *Gomphus schneideri helladicus* are only briefly dealt with. There is also information on the flight period and biology of each species and this is supplemented with references to more detailed works. Large distribution maps are given for each species which, from the tortuous curves at the edges of the shaded areas, appear to reflect actual distributions rather than just broad ranges within which the species might occur. However, the maps are not complete, as Askew freely admits, and for example *Coenagrion scitulum* and *Gomphus pulchellus* which I found in Brittany last summer and are recorded from this region in d'Aguilar *et al.*, are not recorded by Askew. I am surprised to note that little use was made of the extensive collections of the British Museum (Natural History) since much additional distribution data could have been acquired from this source.

The illustrations are the main strength of this work and clear, accurate line drawings of the male and female genitalia of almost all the European species are provided, although they vary in style from rather crude cross-hatch shading to more delicate stipple. Added to this are the beautiful colour plates which in some ways are a bonus because the descriptions are so thorough that it is not really necessary to refer to the plates to make a correct identification. The final section of the book deals with the indentification of larvae and again superbly illustrated keys are provided. As is to be expected, a warning is given that knowledge of the larvae is far from complete and that the keys are only 100% reliable to genera. Most of the larvae that I tried the keys out with arrived at a sensible answer but I got different answers when keying two species of *Sympetrum* using the keys of Askew, Carchini, Vick and Gardner!

Unlike other recent publications covering European Odonata this is also a serious taxonomic work and full references are given for all the species and important synonyms. Where the taxonomic status of certain groups is still in a state of flux, such

as *Calopteryx* or *Cordulegaster,* Askew presents the arguments and his own conclusions. Some of these may be debatable, for example placing *isosceles* Müller in *Aeshna* rather than *Anaciaeschna,* but at least we are able to follow his reasoning. One error that did strike me, however, was the omission of the final letter in certain species names such as *boltonii* and *curtisii.* The names are spelt correctly in the list of synonyms but not in the main heading and this is probably due to a misunderstanding of the *International Code of Nomenclature.*

The dragonflies of Europe does not present anything significantly new in the study of European Odonata but it is an important synthesis of the information currently available and for this reason will be of value to anyone with a serious interest in the European dragonfly fauna.

S. J. Brooks

An Atlas of Oxfordshire Dragonflies. John Campbell. Oxfordshire County Council, Department of Museum Services, Fletcher's House, Woodstock, Oxford, OX7 1SP (1988). 39pp + 28 species maps. £2.35 (including postage and packing).

The rising interest in Odonata, as indicated by the increase in the number of publications now available on this group, has been matched by an increase in Odonata recording. In Oxfordshire, recording has developed so rapidly in recent years that John Campbell has found it necessary to update his *Atlas of Oxfordshire Dragonflies* first published in 1983. A 50% increase in records has enabled many of the previously blank areas to be filled.

The distribution of the 28 species of Odonata recorded in the county of Oxfordshire is presented on tetrad maps for the time periods, pre-1950, 1950 to 1979 and post-1980. A brief text accompanying each map relates to distribution and status within Oxfordshire. The introduction mentions that spots on the maps usually signify sightings of adult dragonflies and do not necessarily indicate breeding. This is an important point to remember when interpreting such maps, a spot may represent a *Coenagrion pulchellum* emerging from a garden pond or an *Aeshna mixta* hawking along a woodland ride some distance from water. Whilst such records are equally valid, within the above limitations, future emphasis in Oxfordshire is to be placed on obtaining breeding data. Such a move is welcome. As an aid to interpretation, maps showing the main towns, the clay vales, main watercourses and large water bodies are included. Inevitably, when handling large amounts of data, a few errors creep in, particularly in the summary of species per 10 kilometre square, and a map of tetrads with records plus a list of recorders would have improved the atlas. The main aim of the atlas, however, is to stimulate further recording in Oxfordshire, enabling revised editions to be produced every few years. The atlas should succeed in this aim.

Noelle and Tony Welstead

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

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.

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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.

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