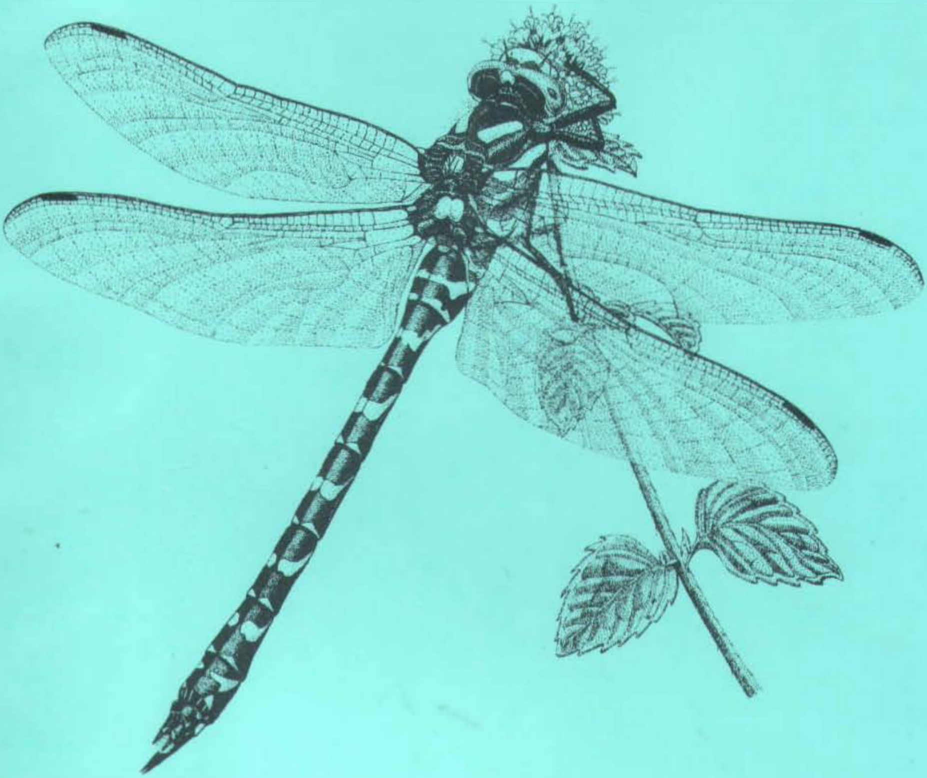
Journal of the British Dragonfly Society

Volume 11
Number 2

October
1995



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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.

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Front cover illustration of female *Cordulegaster boltonii* by S. Jones

Observations on *Lestes dryas* Kirby habitat in Norfolk: is there a typical inland site for this species?

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The Scarce Emerald Damselfly (*Lestes dryas* Kirby) is a rare damselfly in Britain. Its exact status is unclear since it may be overlooked, particularly as it is hard to distinguish from the far commoner *L. sponsa* (Hansemann) with which it often co-exists. Drake (1990, 1991) has described in detail the classic sites in the south Essex coastal marshes where it is found, but little has been written about the more inland sites for *L. dryas*.

In late July 1994 I observed populations of *L. dryas* at a Breckland site in Norfolk, from where it has previously been recorded (Milford & Irwin, 1990). This site consists of pingoes (ponds formed at the end of the last ice age, when ice lenses beneath the soil thawed), old grassland and scattered woodland. The most characteristic feature of the ponds at this time of year was that they were dry. They are well-shaded localities fringed by sallows (*Salix* spp.), alder (*Alnus glutinosa*) and oak (*Quercus* sp.) being typical. The vegetation in and round the margins of the ponds consisted of Greater Tussock-sedge (*Carex paniculata*), *Juncus*, occasional Water Plantain (*Alisma* sp.), Mare's-tail (*Hippuris vulgaris*), Water Mint (*Mentha aquatica*), and in some ponds, the vegetative parts of Water Violet (*Hottonia palustris*). *L. dryas* was associated only with these shaded 'dry' ponds, and was not found on the more open, water-filled ponds nearby. The most numerous dragonfly, co-dominant with *L. dryas* at this site, was *Sympetrum sanguineum* (Müller), and good numbers of males of this species were very active, flying low over the pond bases and settling prominently on emergent plants.

Both lone males and pairs of *L. dryas* in copulation particularly frequented the Tussock-sedge clumps, either hanging from the narrow, curved leaves or flying weakly between the dense, branching fronds. Indeed, in some of the dry ponds, where a few Tussock-sedge plants sprouted alone in the centre, *L. dryas* was only to be found in association with these plants. Interactions between males of this species and with those of *L. sponsa* resulted in only very brief disturbances, the resident male quickly resuming his supposed territorial position.

The female of at least one pair of *L. dryas* in tandem was observed ovipositing into the leaves of Yellow Flag (*Iris pseudacorus*). The pair was observed backing down the stem, to insert eggs into fresh sites, at a height some 20–30cm above the estimated water-level of the pond when wet. Such dry-site ovipositing has been noted by other authors for this species (Gardner, 1952).

Clearly the drying out of these ponds during late summer does not affect the survival of *L. dryas*, a feature commented on also by Drake (1991) for the Essex coastal sites. Presumably larvae can survive in the mud beneath the matted vegetation covering the pond base, since this must remain cool and moist even when the pond is otherwise dry.

I would be interested to hear from others whether the presence of *S. sanguineum* plus the lush plant-assemblages found in this Norfolk site are typical for *L. dryas* elsewhere at inland localities, especially the presence of *C. paniculata* in the pond and of tall, shading bushes and trees nearby. I know of one other *L. dryas* site at Epping Long Green in Essex that is very similar in habitat structure to the Norfolk pingoes. The Essex coastal sites are strongly associated (over 70 per cent) with the presence of Sea Club-rush (*Scirpus maritimus*) and Creeping Bent (*Agrostis stolonifera*) (Drake, 1990), and I am wondering whether the recognition of a characteristic habitat type for certain inland ponds could act to alert observers to search specifically for the presence of *L. dryas*, even when the ponds themselves may be seasonally dry.

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Predation of emerging Odonata by the Black Ant (*Lasius niger* (L.))

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During mid-May 1994, an occurrence was brought to my attention by a friend and fellow BDS member living near Ringwood, Hampshire. He has, in his garden, a series of small ornamental and interconnected pools, the uppermost of which has a clump of overhanging saxifrage trailing into the water. Both *Libellula depressa* L. and *Pyrrhosoma nymphula* (Sulzer), the only species of Odonata present, use the plant for emergence.

On occasions he had noticed fully-formed but dead *P. nymphula* floating upon the surface of the water. Little significance was attached to this until a partially emerged *L. depressa* was noticed with an ant upon the thorax. The dragonfly had reached the position where the thorax, head and legs were hanging free, prior to withdrawal of the abdomen. Closer inspection showed clearly that something was amiss, in spite of the fact that the dragonfly's head and legs were moving. An attempt to dislodge the ant resulted in the exposed part of the carcase falling into the water. It was then apparent that the abdominal cavity of the exuviae was completely full of ants which had devoured all of the soft tissue.

Subsequent investigation revealed that a single bite, delivered in the area of the prothorax, was sufficient to render a fully emerged *P. nymphula* incapable of retaining its hold on the plant and to cause it to fall into the water. From this situation, it was not possible for the ants to recover the carcase. Having seen the abundance of ants in the locality, it is surprising that so many damselflies emerged successfully.

An elementary guide to environmental factors

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In the assessment of any aquatic habitat for its value and potential there are five major factors which must be considered. Firstly the physical nature and aspect of the site, secondly the degree of base enrichment, thirdly the trophic status, fourthly temperature, and last of all pH. In this paper the examples are taken from Hampshire and Dorset, mainly from the New Forest.

The pH of water is widely used, often somewhat erroneously, as an environmental indicator, because it is easy to measure. There is nothing intrinsically wrong in this provided that the assessor takes the other factors into account as well, and does not rely solely upon the pH reading as many have done in the past. This oversimplification has come about because, as a rule of thumb, a high pH usually indicates a high base state and a high trophic status whereas a low pH will indicate the reverse. Even at the extremes of range this rule is not infallible, but in the mid-range (pH 5.5—7.5) it can be wholly misleading.

Base enrichment is determined by the underlying geology of the water-body or that of the water source, or by sea-spray. It can generally be thought of in terms of calcium magnesium, sodium and iron. This may be modified by the vegetation. For example, in the New Forest, springs often occur where a calcareous clay-lens outcrops under sand or gravel. The water may well flow on over a peat base, but the high base status may be determined by the flora, in particular the absence of *Sphagnum* mosses.

Trophic status is less easily determined, although with a minimum of experience an assessor may be able to estimate it with reasonable accuracy. It is a measure of the feeding value for plants and may be thought of in terms of nitrates and phosphates. Although odonate larvae do not eat plants, plants do provide numerous important niches, including a habitat for many species of odonate larvae while in growth, organic detritus as a base layer, and of course sites for the endophytic ovipositing of adult Odonata. Plants are the basis of the food chain and thus control the total amount of life in a water-body. A low trophic state means that there is little food value, as in the peat pools, whereas a high status, as in most chalk streams, supports an abundance of plant growth. The terminology used to describe these states is as follows: dystrophic — sparse feeding, oligotrophic — low feeding, mesotrophic — medium feeding, eutrophic — high feeding and hyper-eutrophic — over feeding. Most New Forest streams are oligotrophic but a few, including the Ober Water and the

Beaulieu River, are mesotrophic. Rivers such as the Hampshire Avon, Itchen and Test are eutrophic. Hyper-eutrophic states are not normally naturally induced; they are usually the result of agricultural run-off or the outfall of sewage treatment plants. In the case of the latter, it must be said, if they are correctly run then the effect should be minimal provided it does not constitute too high a percentage of total volume. Hyper-eutrophication results in abnormally high populations of algae and duckweeds. One effect of algae is to coat other aquatic plants with a 'fur' which retains undissolved solids in the form of silt and sewage (on occasions) and, together with the duckweed, prevents light and warmth penetrating the surface, thereby creating a mini-thermocline, an unnatural occurrence in shallow waters. Both of these effects are deleterious to invertebrate larvae, in particular those reliant upon the macrophytes as a habitat. An additional, albeit minor, problem with excessive plant growth and in particular algae, is that they use oxygen and can deoxygenate still waters. This will restrict the numbers of animals that can survive.

When one speaks of water temperature, one is generally thinking of minimum winter temperatures and the ability to warm up quickly with the coming of spring. High minimum winter temperatures are generally found in spring-fed situations, although not those associated with chalk. A silt rather than gravel base is a bonus. Many of the New Forest streams which are spring fed never freeze on the base even in the hardest winter, although there may be thick ice on the top. Chalk streams are very clear, have gravel bases, and the water is constantly being thoroughly mixed. Each of these factors contributes to heat loss, making them colder than other streams. In summer, the high plant-growth traps the heat of the sun in the surface layers and the depths do not warm. This is probably a significant factor in the paucity of dragonfly species inhabiting chalk streams. A quick warm-up in spring is achieved by water of optimum depth, not too deep and not too shallow, in which the benefit of warming by the sun in the day is not wholly negated by the contrasting cold of the night. The optimum depth is affected by the physical situation of the water-body and other edaphic factors.

The pH is a measurement of the hydrogen ion potential. It is not necessarily a stable figure. Larger bodies of water are reasonably well-buffered against pH change, but those which are more acidic, smaller and seasonally flashy can alter considerably. Rainwater is naturally acid and in areas of high surface run-off this can be an important factor. Plant growth takes up carbon dioxide and this can raise pH levels in summer.

In conclusion, it will be seen that pH is just one of several factors that determine the suitability of aquatic habitats for dragonfly larvae. Together trophic status and temperature affect the rate of growth of all species in a pond or stream directly, whereas pH and base status have an indirect effect, as does the physical nature and aspect of the site. It is the author's opinion that the most important factors to be considered in assessing the quality of a habitat are trophic status and temperature.

Observations on the distribution and phenology of *Cordulia aenea* (L.) in vice-county 23

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In recent years the Downy Emerald (*Cordulia aenea* (L.)) has not been recorded in Oxfordshire north of Wychwood Forest (SP/350175) and only once previously, as long ago as 1920 (Brownett, 1990). Atlas studies, in various parts of the range in Britain, have shown that the species has a tendency to occur in clusters of adjacent or nearby tetrads, for example in Epping Forest, the Forest of Dean and Poole Basin (Benton, 1988; Holland, 1991; Prendergast, 1991). It seemed to me that there was a distinct possibility that *C. aenea* has been overlooked, and that it might be present in Oxfordshire in the vicinity of Wychwood.

All previous records of adult *C. aenea* in Oxfordshire are confined to a 30-day period from 27 May to 25 June (Brownett, 1990), far shorter than the period nationwide, which runs as a rule from mid-May to the end of July (Hammond, 1983). The question arises as to whether this represents under-recording or an edge-of-range effect, akin to that shown in the Gatekeeper butterfly (*Pyronia tithonus* (L.)) (Pollard & Yates, 1993).

In the spring of 1994 a check was made on some suitable habitats, secluded tree-sheltered lakes in or adjoining deciduous woodland, in rural areas up to 10km to the north of Wychwood. Visits were made on dates from 15 June onwards. These resulted in records of *C. aenea* at Ditchley Park (SP/387214) and Sandford Park (SP/414268), with up to four and six territorial males respectively in these localities. Both lie on the Great Oolite and Chipping Norton Limestone belt across the north of the county. The fieldwork has added two 10km squares to the present national distribution, as shown by Hammond (1983), and the site at Sandford St Martin, lying at 51°56′ N, is apparently the furthest north the species has ever been recorded in the south-east England region of the Odonata Recording Scheme, which holds the bulk of the population found in Britain.

The records of *C. aenea* at Sandford and Ditchley in 1994 continued on dates up to 30 July, so the updated flight period for Oxfordshire — a 65-day period from 27 May to 30 July — is of much the same length as that shown by published phenological data for other isolated and fringe populations, for example Cheshire 27 May to 22 July, Essex 1 June to 31 July, and Gloucestershire 28 May to 16 August (Benton, 1988; Gabb & Kitching, 1992; Holland, 1991). Clearly there has been serious under-recording of *C. aenea* in Oxfordshire in previous years.

I would like to thank Una Fenton and Royston Scroggs for their part in the fieldwork in 1994. Noelle Welstead kindly read an earlier draft of this paper.

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Sympetrum sanguineum (Müller) ovipositing on dry land

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At about 13.00h GMT on 29 July 1995, by the Waldegrave Pool, Priddy, Somerset, I saw a tandem pair of Ruddy Darter (*Sympetrum sanguineum*) ovipositing on hard, dry earth about six metres from the marshy edge of the pool. Weather conditions were hot and sunny at the time. The eggs were being deposited in flat, earthy depressions between large tufts of Purple Moor-grass (*Molinia caerulea*). I should add that other Ruddy Darters were egg-laying at the same time in the area, but this was into open water or, at least, over wet marsh and close to water.

Even if the Ruddy Darter eggs which were dropped on dry land hatched after heavy rain, I think it is very unlikely that the small larvae could reach water so, presumably, the outcome of egg-laying in this case would have been quite fruitless. Of course, heavy flooding could alter the situation.

Moore in Corbet *et al.* (1960) mentioned libellulines ovipositing on a tarmac road in Africa and *Aeshna cyanea* egg-laying by the edge of a stony lane in Dorset. Corbet (1983) states that *S. sanguineum*, flying in late summer, may lay its eggs in grassy depressions without water; he refers to the observations of Wesenberg-Lund (1913) who saw females of *S. sanguineum* ovipositing on patches of brown, dry moss in Denmark in early September, and which were five metres from water. Such eggs would be held by the moss vegetation, which would become damp after rain, until covered by water in early winter; maturation could then occur if development was successfully delayed over the cold winter months.

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Distribution and habitat of the Downy Emerald Dragonfly *Cordulia aenea* (L.) (Odonata: Corduliidae) in Britain and Ireland

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Introduction

In Britain and Ireland the Downy Emerald Dragonfly (*Cordulia aenea* (L.)) has a disjunct distribution, with a stronghold in southeast England and scattered colonies elsewhere (Merritt *et al.*, in press) (Fig. 1). It is locally common in Surrey, Sussex, Berkshire, Hampshire, Dorset and Gloucestershire. Smaller populations occur in Devon, Somerset, Oxfordshire, Buckinghamshire, Kent, Essex, Norfolk, Shropshire, Cheshire, Glamorgan, Westmorland and Lancashire. In Scotland it occurs in Stirlingshire, Inverness-shire and Argyll. In Ireland the species is found in Co. Kerry and Co. Cork. Earlier observations (Askew, 1988; Benton, 1988; Gibbons, 1986; Holland, 1991; Longfield, 1937; Welstead & Welstead, 1984) and more recent studies (Brooks *et al.*, in prep.) suggest that this species is associated with trees and woodland. Records submitted to the Odonata Recording Scheme (ORS) at the Biological Records Centre (BRC) are analysed here for the presence or absence of woodland in the proximity of *C. aenea* sites in order to assess how the habitat influences the distribution of the species.

Methods

Records of *C. aenea* submitted to ORS were obtained from BRC on a print-out which contained all records received up to and including 1989. Additional, more recent records were obtained from the literature (Fox *et al.*, 1992; Gabb & Kitching, 1992; Holland, 1991; Mendel, 1992; Milford & Irwin, 1990; Prendergast, 1991; Randolph, 1992.). Each site record was located on Ordnance Survey maps (scale 1:50,000 and 1:25,000) and details of proximity and extent of woodland recorded. Some older records did not include sufficient information to locate sites accurately, and these have been excluded. In this analysis broad habitat classifications have been used because of the difficulty in obtaining some detailed local information.

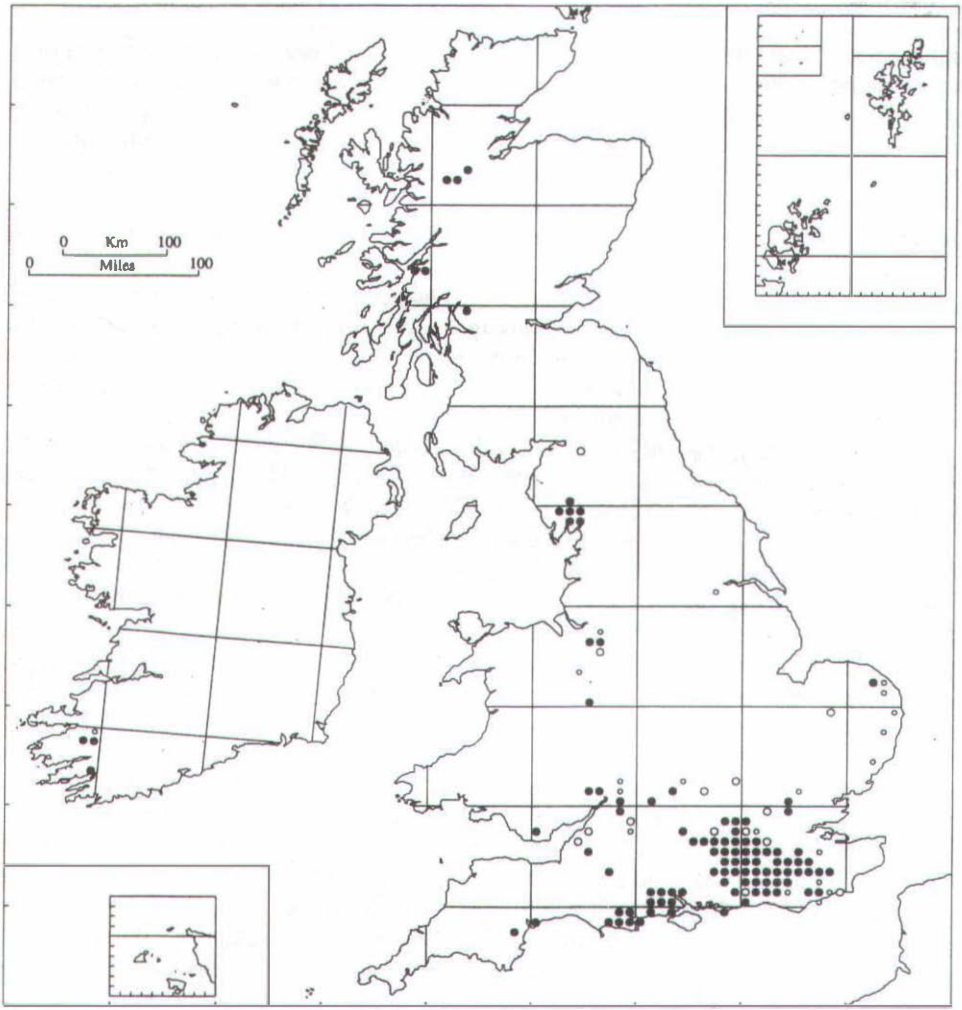
Results

Each site record was assigned to one of the habitat classes in Table 1. *C. aenea* occurs at a variety of still-water habitats ranging from small ponds to large lakes, including Scottish lochs and Lake District tarns. No attempt has been made to classify such still-water sites according to size.

Table 1. The number of sites with records of *C. aenea* according to type of habitat.

	Woodland				**Heath**		**Open**	
Vice-County	A	B	C	D	E	F	G	H
3 S. Devon	4	2					1	
6 N. Somerset		1						
7 N. Wiltshire	1							
9 Dorset	3	7			5			
11 S. Hampshire	8	2		2	11	1	1	
12 N. Hampshire	11	3		1				
13 W. Sussex	7	5					3	1
14 E. Sussex	8	7	1				1	1
15 E. Kent			1				1	
16 W. Kent	4	4						
17 Surrey	26	4		5				2
18 S. Essex	5							1
19 N. Essex	1							
22 Berkshire	13	3						
23 Oxfordshire	1							
24 Buckinghamshire	6	2						
27 E. Norfolk	1							
28 W. Norfolk	1							
33 E. Gloucestershire			3					
34 W. Gloucestershire	8	1					1	
40 Shropshire	1	1					1	
41 Glamorgan	2							
58 Cheshire	3							
69 Westmorland	2	8					1	
86 Stirlingshire	1							
96 E. Inverness-shire	13	1						
98 Argyll Main		4					1	
Total	130	55	5	8	16	1	11	5
%	56.3	23.8	2.2	3.5	6.9	0.4	4.8	2.1

A - Pond/lake in woodland
B - Pond/lake on edge or adjacent to woodland
C - Pond/lake with sparse tree surround
D - River/canal in or adjacent to woodland
E - Pond/lake on open heathland
F - River/canal on open heathland
G - Pond/lake, no woodland
H - River/canal, no woodland



● 1975 onwards (GB - 98, Ir - 3, Ch.Is. - 0)

○ 1950 - 1974 (GB - 14, Ir - 0, Ch.Is. - 0)

∘ pre 1950 (GB - 19, Ir - 1, Ch.Is. - 1)

Figure 1. Distribution of *Cordulia aenea* in Britain and Ireland (after Merritt *et al.*, in press)

Discussion

It has been thought for some time that *C. aenea* is associated with woodland across its range in Britain. Most observations away from the breeding sites are in woodland, and the species is rarely reported in more open habitat. At some sites without woodland, such as the Cotswold Water Park in Gloucestershire, adults away from water were most often observed hawking about the tops of tall hedgerows and trees (A. D. Fox, pers. comm.). This study has established that more than 85 per cent of records are from sites which are in close proximity to woodland. This percentage would be higher if breeding sites only were considered (see discussion below).

In Dorset (VC9) and S. Hampshire (VC11) however, a high proportion of the records are from open heathland habitat, comprising 7.4 per cent of the total site records. The reasons for this are not clear at present. In the case of VC11, which consists mainly of New Forest sites, open woodland is never far away. The remaining 6.9 per cent of sites are from other open habitat away from woodland.

Unfortunately, the ORS records give insufficient information to determine whether some of these records are of wandering individuals or breeding colonies. Also, some of these records are from the 1940s and habitat conditions may have changed since.

C. aenea shows a distinct preference for still-water habitat with only 6.0 per cent (n=14) of all records coming from rivers, streams and canals. Of these, five are flash sites on the Basingstoke Canal (VCs 12 & 17), which is in many respects a still-water site. The New Forest (VC11) records for slow-flowing streams are for sites very close to known still-water breeding colonies and may represent wandering individuals. Streams such as Dockens Water in the New Forest regularly form still pools at times of low water, and this is when *C. aenea* is most often recorded (D. C. Winsland, pers. comm.). The records from South Essex (VC18) and West Sussex (VC13) are of lone individuals from river sites (Raven, 1987; J. Silsby, pers. comm.) and those from rivers in East Sussex (VC14) and Surrey (VC17) are single entry records suggesting wandering individuals. It can therefore be concluded that rivers and streams are not utilized readily by *C. aenea*. There can be little doubt that still-water habitats in or near woodland are important in the ecology of *C. aenea*. Further study is required to establish how this habitat is utilized by the different life-stages of *C. aenea*. What are the similarities between the sites in south-east England and Scotland for example? The BDS North of London Group is currently undertaking a detailed study to investigate habitat preferences in the London area. Observations to date have shown that *C. aenea* adults spend a considerable amount of time in woodland, dispersing into the tree canopy on the maiden flight, feeding and resting in woodland rides and glades, mating and roosting in the tree canopy. Preliminary results from mark–recapture have shown that males divide their time between holding pondside territories and returning to the tree canopy (Brooks et *al.*, in prep.). At sites in Epping Forest, Essex, observations suggest that males disperse through woodland, having been observed visiting other woodland ponds where breeding is yet to be confirmed. *C. aenea* is rarely reported away from woodland and dispersal behaviour has not been reported. Woodland corridors may be important for the dispersal of this species, and the loss of this habitat from the British countryside may explain the disjunct distribution.

Studies of the kind presented here require access to a detailed biological records database such as that at BRC. The protection and conservation of our native dragonfly species is dependent on having a better understanding of their habitat requirements. It is therefore of increasing importance that recorders submitting records, whether to local or national recording schemes, include any confirmation of breeding success. Whilst records of lone or wandering individuals are useful in our understanding of the movement of dragonflies, they play little part in the needs of conservation and site management.

Acknowledgements

The authors are particularly grateful to Brian Eversham of BRC for making available the distribution map and the print-outs from the ORS database. We would also like to thank A. D. Fox, J. Silsby and D. C. Winsland for their local knowledge, and members of the BDS North of London group for their continuing support.

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Somatochlora metallica (Vander Linden) in Scotland

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Summary

The present known distribution of *S. metallica* (Vander Linden) in Scotland is within two separate groups of sheltered lochans on either side of the Great Glen and at two small lochans in Argyllshire. Specific types of shore are patrolled by males, used as oviposition sites and for emergence. From limited observations, egg-laying occurs mainly on a sphagnum lawn or on wet peat or *Sphagnum* on an overhanging bank, above water more than half a metre deep with a fibrous detritus substrate. Comparison is made between aspects of breeding of this species and those of *Cordulia aenea* (L.).

Introduction

S. metallica has been recorded from three separate localities in Scotland.

1. The first Scottish (and British) record was of specimens taken in Strathglass by Dr Buchanan White in 1869 (Longfield, 1948). The species is still abundant in this area.
2. A male and female *S. metallica* in the Royal Museum of Scotland were collected by K. J. Morton at Loch a' Chrion-doire on 1 September 1922. After several unsuccessful visits in recent years by various odonatists the species was seen by the authors on 27 June 1995.
3. The third *S. metallica* locality was discovered by Mrs C. A. Whittle at Loch Bran, Inverness-shire, in 1979 (Odonata Recording Scheme), and the species has subsequently been reported from several other adjacent lochans.

Loch Bran Group

In 1989 and 1990 the authors systematically surveyed all waters in this immediate area. A group of 23 small to medium-sized lochs lie at an altitude of 170–250m asl along a rocky ridge some 3km wide and bordered on the north-west by Loch Ness. Much of the area is afforested and many of the lochans are small and sheltered. The pH is neutral to slightly alkaline. The largest of these waters, Loch Kemp, which has a surface area of about 25ha, has an exposed rocky shore along which no Odonata activity was noted. However the small inflow burn at the south end runs into a canal-like inlet which provides suitable breeding conditions for *S. metallica*. Loch Pàiteag, just to the south, has good numbers of this species.

To the west of Loch Kemp lies the small Lochan a' Choin Uire which, although a possible site, has not yet produced any sightings. Beyond these to the south-west are four lochans of which two are very shallow, one deep, and one, in thickly planted conifers, as yet unvisited.

To the north-east of Loch Kemp are another 16 lochans, on 12 of which *S. metallica* occurs. Of the others, one is used as a reservoir, two are very shallow, and a tiny one, in thick forest, has not been visited. To summarize, *S. metallica* has been recorded from 14 lochans in an area 12.5km in length and mostly under 2km wide, with half of the lochans being under one hectare in extent. Apparently all other adjacent waters are unsuitable for the species.

Habitat

On 4–7 July 1989, during a heat-wave, we recorded a total of 80 male *S. metallica* on 12 lochans, most of them actively patrolling what were, presumably, suitable shore-lines for egg-laying females. The territorial site-preferences appear to be mainly of two basic types. A good example of one of these is at Loch Pàiteag, a triangular waterbody, where some 20 males were noted along one 250m bank. The bank is peaty, with heathers, grasses, sedges and *Sphagnum*, backed at varying distances by conifers. There is a steep drop of up to one metre from the bank-edge to the water surface and a similar depth of water beneath to a fibrous detritus substrate. Close offshore is a sparse growth of emergent, submerged and floating-leaved vegetation. In contrast to this bank, the other two shore-lines are generally shallower and stony-bottomed, and lack dragonfly activity.

The second favoured ecotype, easily seen at Loch Bran, is a sphagnum lawn growing out from the bank bordering the lochan and with a drop of perhaps 0.4–1.0m through the water below to a detritus substrate. Where the *Sphagnum* is broken by clumps of rushes and sedges, the *S. metallica* males will search these and any adjacent inlets. *S. metallica* is not confined to these two distinct microhabitats but may explore intermediate type shores. In our very limited observations, a suitable soft medium for egg-laying above (or perhaps even below) water-level, and adjacent suitable underwater detritus, appear to be the essentials. *S. metallica* avoids the areas of shallower water with soft peaty mud much favoured by *Libellula quadrimaculata* L.

Wildermuth and Knapp (1993) write '*S. metallica* prefers natural still waters (areas > 5–10a) with little vegetation and wide open water areas, steep or even undermined shores, grounds covered with fine non-compact mud, and mesotrophic water'. This summary of observations in the Swiss Alps fits perfectly the Scottish situation.

Strathglass Group

With one exception, all of the known *S. metallica* sites are in Glen Affric. Much of the recent, more systematic work in this area has been done by Mr and Mrs J. M. Boyd, Dr A. D. Fox and the authors. A group of 29 small to medium-sized lochs lie at an altitude of 190–425m above sea level to the south-east of the Loch Affric/River Affric glen. They are in an area roughly 14 x 2km.

Most of the lochans are within the remnants of the Old Caledonian Forest managed by Forest Enterprise. The waters are all acidic, varying from pH 4.1 to 6.39 (Nature Conservancy Council (Scotland), unpublished data). Apart from the pH, the situation is in many ways remarkably similar to that appertaining in the Loch Bran group. However the Affric lochans are much more variable in character than the Loch Bran ones, offering a greater variety of odonate habitats and, in addition, there are many bogs and bog-pools. The total number of breeding dragonfly species in Affric is fourteen compared to ten in the Loch Bran area. These 'extras' are *C. aenea*, *S. arctica* (Zetterstedt), *Aeshna caerulea* (Ström) and

Leucorrhinia dubia (Vander Linden) all of which are local in Scotland. Only one other Scottish locality supports a greater number of odonate species.

Habitat

The more complex situation in Glen Affric means that the clear-cut habitat preferences shown by *S. metallica* in the Loch Bran group are much less obvious here, although closer study suggests that the basic habitat requirements are similar. Coire Loch (190m asl), at the north-east corner of the group, has suitable banks and sphagnum lawns but *S. metallica* is rarely seen there although apparently recorded as breeding. By contrast, the similar-looking *C. aenea* breeds in very good numbers. Just over one kilometre to the south is Loch Innis Gheamhraidh where a few *C. aenea* are the only emeralds recorded. About 3.5km south-west of the Coire Loch is Loch an Amair (310m asl) where both *S. metallica* and *C. aenea* breed. From here to Loch Pollain Buidhe, some 9km to the south-west, *S. metallica* has been recorded from another 12 lochans – making a total of 14 in the glen. Most of these are around one hectare or less, particularly those in sheltered hollows among the Scots pines.

Away from the steeper valley slopes, some of the *S. metallica* sites are on larger lochs on exposed uplands with restricted habitat potential. At Loch na h-Eiridh (400m asl) the sheltered south-west corner seems to provide the only suitable breeding conditions. The 400 x 150m Loch nan Sean-each (425m asl) to the west, is even more extreme, its edge having 30cm deep water over an unvegetated stony substrate. Only at the south-west corner on each side of a tiny peninsula are there two stretches of underwater detritus, each some 30 x 10m in extent. On 12 July 1990 there was one *S. metallica* patrolling the bank adjacent to these small detritus deposits. It is uncertain whether these deposits would provide enough cover for successful breeding.

Four kilometres east of the Coire Loch and outwith Glen Affric, Loch Carn Bingally lies on a treeless exposed moor at 310m asl. *S. metallica* was first recorded here on 13 July 1989 by Mr and Mrs Boyd and exuviae have been found in subsequent years. The surface area is less than one hectare and there is a detritus substrate. Most of the banks are overhanging and about 30cm above the water-level, but one tiny stretch of bank affords exit for emerging final-instar larvae. Although there are no other recorded *S. metallica* sites nearby, there is a string of 20 lochans stretching some 6 km to the south which are, as yet, unexplored.

Loch a' Chrion-doire

The two small lochans comprising Loch a' Chrion-doire are each some five hectares or less and have a pH of 7.5. They lie south of Loch Nant in Argyllshire in a rocky afforested area at 225m asl.

On the morning of 28 June 1995, during a heat wave when Odonata activity was perhaps at a maximum, eight *S. metallica* were recorded at the south lochan and nine (including a pair flying off in tandem) at the north lochan.

The water-level of the south lochan has been raised some 30cm by damming the outflow burn and thus 'drowning' some of the bank. Males of *S. metallica* patrolled the 'drowned' bank. Otherwise the habitat preference of territorial males was similar to that at Affric and Bran.

Oviposition sites

There are relatively few records of egg-laying by *S. metallica* in Scotland. Most are from the sphagnum lawn on the south side of Loch Bran (e.g. Smith,1984). There would appear to be just one recorded observation in Scotland of egg-laying on a peaty bank (Fox, 1989). We saw a similar occurrence at Lac de Servière in southern France on 18 August 1991. A female was watched for about two minutes egg-laying into *Sphagnum* on a bank overhanging the water's edge some 15cm above water-level. The tail was bent backwards and it stabbed regularly into the bank with an occasional dip down into the water before recommencing its stabbing action.

An intermediate type site was noted briefly at a lochan near Loch Bran on 18 July 1994. The female was egg-laying at 15.10h BST, into flat wet mud below a 15cm high heather bank (the water-level was below high-water mark). Over an area 1 x 0.5m of muddy peat/vegetation detritus it moved constantly making a stabbing action at least five times. It then flew out over the water's edge, dipping its abdomen once under the water before making another five or so stabs into the mud and then flying off. Fox (1991) discusses aspects of oviposition in this species.

Exuviae

Because exuviae provide proof of breeding, many hours have been spent looking for them. Generally they are more difficult to find than the similar-looking *C. aenea* exuviae which are regularly noted, often in numbers. *S. metallica* exuviae have been located at three lochans in the Bran group, including eight on one sphagnum lawn at Loch Bran, three at a similar site on the Dubh Lochan and one at Loch Pàiteag on the top of the bank. In Glen Affric they have been found at five lochans, with by far the most being seen on a sphagnum lawn at Loch an Eang. In 1994 seven were collected there by the Boyds, all on heather *Calluna vulgaris*. Only at Loch Carn Bingally has more than a single exuviae been recovered from above a steep drop, although dislodgement by strong winds may often reduce the number detected.

Discussion

The three known Scottish colonies of *S. metallica* have many similarities. Each breeds in a tight-packed group of small to medium-sized lochans lying mostly between 200--400m asl. The lochans are not deep and the breeding sites are protected from the wind. This shelter is provided by the undulating nature of the rocky ground and augmented by the surrounding conifer woods. The latter must give an abundance of shelter and food for the flying insects, but whether or not woodlands are an essential part of the habitat for *S. metallica* is unknown. Several occupied lochans are in open moorland above the (planted) tree-line but all are within easy flying distance from such woodlands. Whether wooded areas are essential or not, their value in such wind-swept landscapes is considerable.

Although the evidence is partly circumstantial, it seems that the egg-laying site includes certain essential features:

1. A moist medium such as *Sphagnum* or wet peat at the edge of an overhanging bank or near the edge of a sphagnum lawn whence the prolarvae can reach the water.
2. Adjacent water 0.5–1.0m or more deep over a soft fibrous peaty substrate.

The distribution of *S. metallica* in the Loch Bran group poses few problems. The species has been recorded from all but the more unsuitable lochans within an area 12.5km long and mostly under 2km wide. Further to the south-west, the few lochans are less suitable due to water depth. On the larger lochans further afield, fluctuating water-levels and exposure to strong winds make them largely inhospitable for odonates. There is a little emergent vegetation in many of the Loch Bran area lochans but none at all off many shores where *S. metallica* males are to be seen actively patrolling, so this factor seems to be unimportant.

The situation in Glen Affric is more complex. Of the 29 lochans surveyed in this group, 21 have records of either *S. metallica* or *C. aenea*. Both species have been recorded at nine of them, *C. aenea* alone at seven and *S. metallica* alone at five. Outwith the glen at Loch Carn Bingally only *S. metallica* is found. These six lochans where only *S. metallica* occurs are among the largest and deepest of the group. There is little in the way of emergent vegetation.

By comparison, the lochans from which only *C. aenea* is recorded are mainly small and with shallow edges. They are well vegetated with Soft Rush (*Juncus effusus*) sedges (e.g. *Carex rostrata*) around the edge and floating-leaved vegetation such as Bog-bean (*Menyanthes trifoliata*) and White Water Lily (*Nymphaea alba*).

Where both species breed, the two microhabitats are present and, indeed, these are further delineated by the particular shore-lines patrolled by the respective males. *C. aenea* lays eggs into open water, usually in an area sheltered by floating-leaved vegetation and apparently mainly in water less than one metre deep. There is thus a clear-cut difference between the egg-laying sites.

Larvae of both species live in bottom detritus and, in size and shape, are remarkably similar. Where *S. metallica* adults have been recorded on territory this detritus is of a fine fibrous, often peaty, nature. Aquatic plants of open water are often absent and water depths may be a metre or perhaps much more. *C. aenea* lays eggs into much shallower water and it is possible that the larvae may live amongst a substrate derived from the more plentiful vegetation of its preferred habitat and thus avoid competition with *S. metallica*. A few attempts by the authors to locate larvae of either species in the respective substrates have so far been unsuccessful. The pH factor seems irrelevant. Both species breed in the acidic Glen Affric pools. Elsewhere in northern Scotland they are in neutral to alkaline water (*S. metallica* in Loch Bran and Loch a' Chrion-doire areas and *C. aenea* in the Oban area). That the areas to which *S. metallica* is confined in these three colonies are so restricted is not fortuitous. The two other rare Scottish lochan species have a similarly restricted distribution. Apart from Strath Glass, *C. aenea* has been found in only a few lochans in the Oban area and one in Stirlingshire. *Brachytron pratense* (Müller) occurs in several adjacent lochans in three quite distinct areas of Scotland. These lochans, providing suitable water depths and vegetation for their various breeding dragonflies, have obviously been in existence and relatively undisturbed for many years. They are protected from the worst effects of the Scottish climate. Less protected lochs include those that are part of river systems and have water-levels that fluctuate suddenly and greatly, making them unsuitable for most odonates. Another factor is exposure to the very strong winds that create violent wave action, scouring the shore and inhibiting growth of aquatic vegetation. A map of Scotland, showing the hundreds of large and small waters, does not reveal how very few are protected from such deleterious effects. Baron de Sélys-Longchamps (1846) wrote 'I must however remark, that on visiting, from the 15th to the 25th of July, several apparently very favourable localities in Scotland, and that in very fine weather, I was much surprised not to see there, so to speak, any Libellulidae, except ...' (de Sélys mentions a total of six species from four localities). Without previous knowledge of habitat requirements and of likely sites, odonatists visiting Scotland may well share de Sélys's surprise at locating so few species.

Acknowledgements

We are grateful to all contributors of *S. metallica* records to the Odonata Recording Scheme and the subsequent Key Sites Project of the Biological Records Centre at Monks Wood. In particular we wish to thank Mr and Mrs J. M. Boyd and Dr A. D. Fox for their work in Strath Glass. Forest Enterprise, local landowners and Nature Conservancy Council (Scotland) and Scottish Natural Heritage have been very helpful, permitting access and providing local information. Staff of the Royal Museum of Scotland have been most helpful in allowing access to the Odonata collection. We are also grateful to Professor P. S. Corbet who read the first draft and made many helpful comments, and to G. H. Harper and S. Helfer for translation of a paper from German.

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Comparison of aquatic larval habitats of *Libellula fulva* Müller

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The Dorset colonies of *Libellula fulva* Müller are concentrated in the Frome, Stour and Moors River areas, these forming a substantial part of its British distribution, with the Broads and River Ouse being the only other areas holding populations of similar size (Prendergast, 1991).

This survey, conducted throughout 1994, did not include the Moors River north of Hurn Bridge as this has been the subject of several previous studies (e.g. Goodyear, 1977; Haskins, 1977; Winsland, 1991). The area of the Leaden Stour – Moors River confluence was used, with the assorted irrigation ditches and streams connecting them, as shown on the area plan (Fig. 1). This area has never been previously surveyed, despite containing a significant population of the species. The object was an assessment of some of the requirements of the aquatic larvae and of territories favoured by the imagines. Untouched by pesticides, herbicides or modern farming, this private and secluded area has long been maintained as a conservation area, with no public access.

All the streams are on an alluvial base, with only stream K flowing from valley gravel. The distribution of *L. fulva* was as follows:

A Limited numbers only.
B An excellent area with numerous imagines.
C Relatively shaded area with reduced populations.
D Basically hunting territory. Only males were observed.
E A superb area with the species abundant. Highest population recorded here.
F Present in moderate numbers.
G Limited numbers only.
H An excellent area with the species numerous.
I Another superb area. The second highest population was recorded here.
J Principally hunting territory. Mainly males recorded.
K A small, over-vegetated and frequently choked area. Few individuals observed.

In these streams the favoured emergence areas contain a thick growth of Reed Canary-grass (*Phalaris arundinacea*), with a lesser growth of Branched Bur-reed (*Sparganium erectum*) and Common Reed (*Phragmites australis*). Exuviae are frequently numerous in such areas at an average height of 50–60cm above water level. Tenerals can be numerous and very easily damaged, whilst clinging to the stems, unless the observer makes very careful progress.

The principal aquatic plants were Amphibious Bistort (*Polygonum amphibium*), Shining Pondweed (*Potamogeton lucens*), Lesser Duckweed (*Lemna minor*), Blunt-fruited Water-starwort (*Callitriche obtusangula*), Broad-leaved Pondweed (*Potamogeton natans*) and River Crowfoot (*Ranunculus fluitans*). The mean Trophic Rank of these six species is 101, indicating highly eutrophic conditions (Community A1 type) such as are frequently found in enriched sand and gravel rivers with intensive farming, and often in the lower reaches of

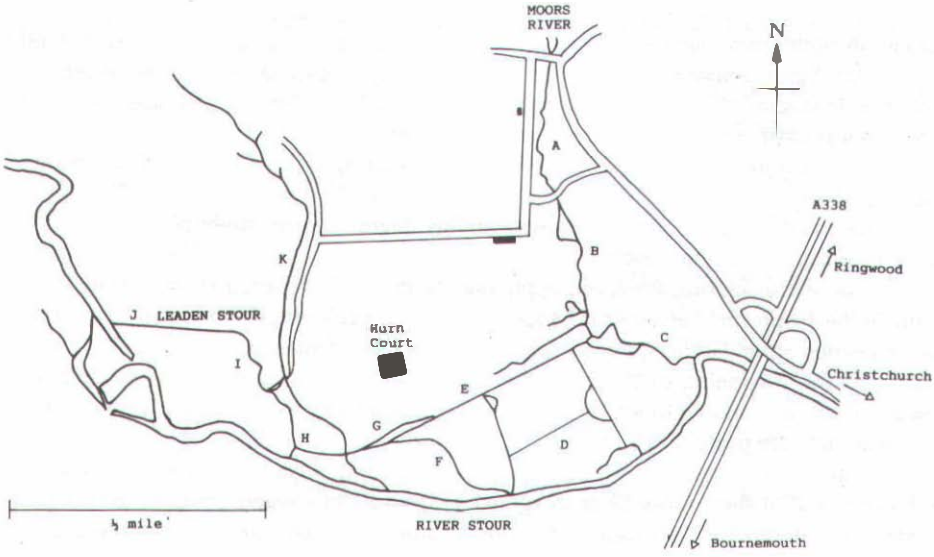

Figure 1. Plan of the area surveyed

lowland waterways (Holmes & Newbold, 1984). Intensive farming is a feature of some areas to the north and the eutrophic state apparently results from the accumulation of effects upstream.

The main River Stour is used by *L. fulva* primarily for hunting territory and very few exuviae are found on it, excluding it from this survey.

For purposes of analysis, the area was divided into two parts: A–C, collectively the Moors River, and D–K, collectively the Leaden Stour. The values in Tables 1–3 for Moors River and Leaden Stour are calculated from the component streams. Localities for sampling were chosen where the highest density of imagines and exuviae occurred in each waterway, it being assumed that these would be the most suitable sites for the species. Teneral imagines only are included.

During the first week of each month, pH at a known temperature was measured (Table 1). The relative acidity of the Moors River was unexpected, contrasting with the comparative alkalinity of the Leaden Stour area whose waters warmed two or three degrees more in the small streams. *L. fulva* would appear to prefer these latter conditions, with this area holding the highest breeding populations. At the peak time of emergence, in June, the higher pH was accompanied by an increase in temperature 3°C above that recorded in the Moors River area.

Rates of flow were recorded at the same times as pH and temperature were measured, both at the surface and in volume (Table 2). Surface movement frequently bore little relation-to underlying current, especially noticeable in the weed-choked areas and clear streams. The extreme was experienced in February, with severe flooding vastly affecting volume in both areas. Surface flow remained fairly stable in the Moors River, but trebled in the Leaden Stour. Maximum vegetative growth in July, with reduced rainfall, produced a reduction in volume during the following two months in both areas, but the affect on surface flow was less clear. Surface flow subsequently increased in October.

The considerably lower capacity of the Leaden Stour compared with Moors River appears to indicate a preference of *L. fulva* for smaller, quieter streams. The species' reluctance to colonize the main River Stour to any degree can be attributed, at least in part, to the high capacity of the latter.

These conclusions, however, apply only to the areas covered in this survey. Further north, in the Troublefield area of the Moors River, *L. fulva* colonies equal in size most of those on the Leaden Stour. Further data from this area would be of interest.

At the beginning of the four principal seasons of the year, in the first weeks of January, April, July and October, levels of oxygen and nitrates in the waters were measured. The mean data are presented in Table 3.

Both areas were well oxygenated. Over-saturation occurred at the Leaden Stour in mid-winter and at the Moors River in spring, with levels of oxygen being in excess of the maximum that can be dissolved at the temperature recorded, and far in excess of that required by larval *L. fulva*.

Nitrate levels were high on the Moors River in winter, when the results of autumnal vegetation decay would be leaching out, and even higher in the slower, more choked waters of the Leaden Stour streams. High levels were again reached in these ditches during the period of maximum vegetative growth.

Table 1. Monthly pH and temperature readings for the Moors River and Leaden Stour, 1994

	Moors River		Leaden Stour	
	pH	temp. °C	pH	temp. °C
Jan	5.98	8.1	6.27	8.7
Feb	6.85	7.4	6.86	6.9
Mar	6.72	9.9	7.15	9.7
Apl	7.54	11.5	8.27	12.1
May	7.81	12.3	9.02	13.4
Jun	6.84	12.6	7.94	15.5
Jul	7.12	16.7	8.29	18.7
Aug	6.62	18.1	8.14	20.8
Sep	6.34	14.5	7.59	17.0
Oct	6.54	13.4	7.15	14.9
Nov	6.88	8.2	7.57	8.2
Dec	6.75	5.6	7.50	4.8

Table 2. Flow rates at the surface (metres per second) and water volume (cubic metres per second) for the Moors River and Leaden Stour in 1994

	Moors River		Leaden Stour	
	m/sec.	m^3/sec.	m/sec.	m^3/sec.
Jan	0.354	2.121	0.219	1.474
Feb	0.301	5.746	0.609	10.870
Mar	0.520	2.453	0.335	2.562
Apl	0.389	1.576	0.236	1.107
May	0.425	1.957	0.212	1.113
Jun	0.497	2.151	0.101	0.638
Jul	0.355	1.536	0.071	0.420
Aug	0.320	1.456	0.222	0.139
Sep	0.316	1.438	0.047	0.297
Oct	0.323	1.541	0.098	0.619
Nov	0.260	1.183	0.106	0.567
Dec	0.383	1.828	0.141	0.906

Table 3. Levels of oxygen and nitrates (milligrams per litre) for the Moors River and Leaden Stour, 1994

	Moors River		Leaden Stour	
	Oxygen	Nitrates	Oxygen	Nitrates
Jan	8	75	9	100
Apl	9	25	5	50
July	5	50	5	75
Oct	5	25	4	25

Acknowledgements

I am indebted to The Viscount FitzHarris for extensive access to the Malmesbury Estate, and to Mr D. Vanes, Head Gamekeeper, for much assistance and hospitality.

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Notes and observations

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My thanks as usual to all those who have sent in records. The many first and last dates received will be incorporated in the Newsletter. Could I please have all reports for the next issue by 1 February 1996.

Ovipositing in marine habitats

The report in the last issue of Common Darter (*Sympetrum striolatum*) ovipositing in intertidal pools has brought the following further reports.

At the Moulton Marsh NR, adjacent to the tidal R. Welland in Lincolnshire, Four-spotted Chaser (*Libellula quadrimaculata*), Common Darter (*Sympetrum striolatum*), Ruddy Darter (*S. sanguineum*) and Migrant Hawker (*Aeshna mixta*) have all been seen ovipositing in brackish water over the past five years. In 1994, *S. striolatum* was seen ovipositing in a muddy pool on the saltmarsh of the Wash, left by the previous high tide. The reserve is in an intensively farmed area with no suitable fresh-water site within miles. (B)

S. striolatum has also been seen ovipositing on two or three occasions over the past five years at the verge of rising tidal water at the estuary of the R. Otter, Budleigh Salterton, Devon, despite fresh-water having been available in ponds or rhines in nearby fields. (D)

In the tropics, some species of the libellulid genera *Tramea* (in the Cocos-Keeling Islands) and *Erythrodiplax* (in the West Indies) are reported in the literature to be associated with strongly saline conditions.

Odonata caught in moth traps

Some more examples of this have been reported.

On 1 August 1995 single examples of Ruddy Darter (*Sympetrum sanguineum*) and Yellow-winged Darter (*S. flaveolum*) were caught in a moth trap at the Landguard Bird Observatory, Suffolk. (LBO Staff)

At the Saltwells LNR, West Midlands, moth-trapping was taking place overnight on 21/22 August 1994 at the garden, which is in the middle of a wood. From 00.30h there was intense Pipistrelle activity, with detached moth wings drifting down into the cone of light. At 02.00h two Brown Hawker (*Aeshna grandis*) wings drifted down from high up in the dark; they were freshly detached and the observers believe that the *A. grandis* was actually flying as opposed to having been taken off a leaf whilst roosting up in the Sycamore canopy. (A)

Odonata preying on Odonata

On 22 June 1995 a male Emperor (*Anax imperator*) caught and ate head-first a Four-spotted Chaser (*Libellula quadrimaculata*) at Winterton Dunes NNR, Norfolk. These two species usually fly together over the same water with no sign of predation. (C)

'Headless' life

Yet another report of life from a headless dragonfly, this one being a Black-tailed Skimmer (*Orthetrum cancellatum*) at a small pond near Sundon, Bedfordshire on 7 July 1995. The Skimmer had lost its head and front pair of legs, but would buzz its wings when touched and would hold on to a bush when it was placed there. (C)

The August 1995 invasion

1995 is going to be remembered for the tremendous influx of Yellow-winged Darters (*Sympetrum flaveolum*). The following is a generalization of the information that has reached me covering the period 1–8 August.

The first records (received so far) occurred on 1 August, with at least ten in eastern England. However, on 2 August there were an estimated 150–200 at one locality, with at least 26 reported elsewhere, all still in eastern England. On 3 August the main site numbers had dropped to an estimated 80–100, and 'many' were reported from Leicestershire and 'some' from Yorkshire. On 4 August only twelve were reported from the initial main site, indicating dispersal; numbers here have been in single figures since. On 5 August reports came in from Lancashire, Yorkshire and Bedfordshire, and on 6 August they had reached across the country to Kenfig in South Wales. At least 40 *S. flaveolum* were reported near Worcester on 8 August.

The male caught at Landguard had a damaged wing and the specimen is now with the Ipswich Museum. The Norwich Museum also has a male specimen. A female was seen ovipositing whilst in temporary captivity and two others were seen paired, both occurrences at the initial main site.

No doubt a full report will be written eventually about this influx, so do please report all sightings to your recorders; even singletons help to provide a comprehensive picture.

Another migrant species was discovered amongst all the *S. flaveolum;* the Vagrant Darter (*Sympetrum vulgatum*). The first two were reported on 2 August, thereafter they were reported daily, with a maximum of six at any one site. Black Darters (*S. danae*) are also reported to have occurred with this influx, as are a single Red-veined Darter (*S. fonscolombei*) on 3 August and a Vagrant Emperor (*Hemianax ephippiger*) on 6 August.

Also observed around this time were high numbers of butterflies, especially Painted Lady and Peacock, as well as a good number of Camberwell Beauty, and a Queen of Spain Fritillary (on 6 August). Large numbers of Silver Y Moths occurred at this same period, and there have been reports of two vagrant moths from Scandinavia trapped at Winterton, Norfolk, and a Dusky Hook-tip Moth trapped at Stiffkey (on 5 August).

My thanks to E. Jones for keeping me updated, J. Oates, and members of Landguard Bird Observatory .

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Book review

Woodland Pond Management, Adrian Hine (ed.).
Corporation of London (1995)
32 pp. £5.00 (cheque payable to Corporation of London). Available from Burnham Beeches Office, Hawthorn Lane, Farnham Common, Slough SL2 3TE.

This slim but well-produced book contains the proceedings of a meeting hosted by the Corporation of London at Burnham Beeches in July 1994. The focus of the meeting was the management of ponds for conservation. Five papers (plus a Foreword) are included, and these cover the subjects of ponds as a habitat, the creation and management of ponds, and the value of faunistic surveys in management programmes.

Of special interest to readers of this Journal will be the paper by Stephen Brooks, entitled 'The dragonflies (Odonata) of woodland ponds', wherein the biologies are reviewed of the two species, *Cordulia aenea* and *Somatochlora metallica*, mainly restricted to woodland ponds [but see Smith & Smith in this issue]. *Aeshna cyanea* is also discussed, although by no means restricted to woodland ponds, and seven other dragonfly species, together with six damselflies, are mentioned. Odonata also feature prominently in the invertebrate survey of woodland ponds at Burnham Beeches, described by Adrian Hine, and we learn here of the possible conflict in requirements between *Cordulia aenea* and *Sympetrum sanguineum*. Rampant Bogbean was reducing the habitat's suitability for *C. aenea*, but complete removal of the plant was avoided because it is utilized by *S. sanguineum*. This emphasizes the need, stated in the Foreword, for management to be based upon a sound understanding of the ecology of woodland ponds. The message comes over very clearly that ponds, being a stage in ecological succession, are naturally ephemeral, and the temptation should be avoided to try to maintain all ponds in a mid-successional state, the perceived 'ideal' condition.

There is much sound advice in this book for those concerned with the conservation and maintenance of ponds, and it should prove a most helpful guide. Further, the reference lists appended to each chapter will enable the reader to get started on researching any particular problem.

R. R. Askew

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

J. Br. Dragonfly Soc., Vol. 11, No. 2, October 1995

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