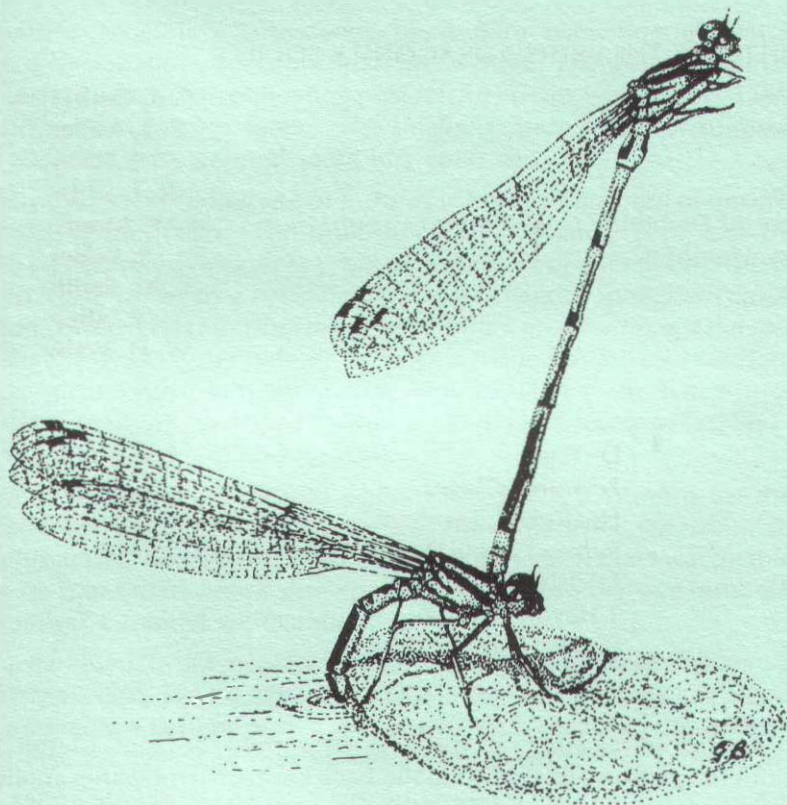


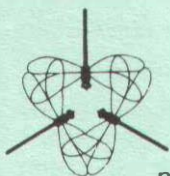
Journal of the British Dragonfly Society

**Volume 8
Number 1**

**April
1992**



Editor: D. Tagg



member of 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 a member of the Societas Internationalis Odonatologica (S.I.O.).

COMMITTEE OF THE BRITISH DRAGONFLY SOCIETY

<i>President:</i>	P. S. Corbet
<i>Vice-President:</i>	P. L. Miller
<i>Secretary:</i>	J. Silsby
<i>Treasurer:</i>	R. I. Silsby
<i>Convenor of Dragonfly Conservation Group:</i>	N. W. Moore
<i>Ordinary Members:</i>	S. Butler
	E. M. Smith
	P. Allen
	W. H. Wain

ADDRESSES

<i>Editor:</i>	D. Tagg, 7 Santina Close, Heath End, Farnham, Surrey GU9 0LD.
<i>Secretary:</i>	J. Silsby, 1 Haydn Avenue, Purley, Surrey CR8 4AG.

Articles for publication in the *Journal* should be sent to the Editor. Instructions for authors appear inside the back cover. Membership applications should be sent to the Secretary. Completed forms should be returned to: B.D.S. Membership Office, 68 Outwoods Road, Loughborough, Leics. LE11 3LY. Annual subscription £5.50 due 1st April. Library subscription £11. Overseas members pay an extra £1 to cover postage. Back numbers can be purchased from the Secretary for £2.50 (members) or £5.50 (non-members).

The White-Faced dragonfly *Leucorrhinia dubia* (Vander Linden) at Chartley Moss National Nature Reserve, Staffordshire

M. P. Bailey

Warden, Dyfi NNR, Plas Gogerddan, Aberystwyth, Dyfed.

Chartley Moss is a subsidence basin mire consisting of two hollows separated by a shallow, peat covered mineral ridge. The western basin contains the largest schwingmoor, or floating peat raft, in Britain, with a central *Sphagnum* lawn surrounded by pine forest. The smaller eastern basin contains solid peat which was effectively drained some fifty years ago.

The principal breeding site of *L. dubia* is a dystrophic pool of unsure origin, on the *Sphagnum* lawn. The pool, known as Shooters Pool, and therefore possibly an excavated duck decoy, has a central area of open water which is up to 3m deep, surrounded by a marginal belt of submerged *Sphagnum cuspidatum*. Common cotton-grass *Eriophorum angustifolium* grows amongst the sphagnum in the shallow water. One side of the pool is shaded by tall pines and therefore lacks marginal vegetation, except for clumps of rush *Juncus effusus*. The circumference of the pool is approximately 85m. Electrical conductivity readings are in the range of 90-170 microsiemens.

Over the four years 1987-90 whilst I was N.C.C's Warden for the site, I collected information on emergence dates and some aspects of habitat selection of *L. dubia* at Chartley Moss. I must point out, however, that I was unable to visit the site on more than two or three days per week, and that as a result dates and counts must be treated with caution.

The earliest date of emergence observed for each of the four years was 5 May 1987, 17 May 1988, 15 May 1989 and 2 May 1990. In each case it is possible that actual emergence commenced a day or two earlier than the observed dates. I suspect that the 1990 date may be the earliest recorded for *L. dubia* in Britain.

In 1989 I counted 98 exuviae at Shooters Pool over a two day period, and in 1990, 57 exuviae were collected also over two days. Emergence supports were invariably *Eriophorum*, and no exuviae were found along the shaded western margin of the pool. The nymphs of *L. dubia* are easily found amongst submerged *Sphagnum*, but numerous sweeps with the net have failed to catch any in the open water area.

In addition to Shooters Pool a number of additional depressions exist in the *Sphagnum* lawn. Most of these depressions are marked as 'pools' on the OS 1:2500 map of 1960, but have developed into *Sphagnum* filled 'soaks' (in effect rather like waterlogged sponges). Searches for nymphs and exuviae in these

soaks has revealed that most are ignored by *L. dubia*, ~~but~~ some are used. In one small soak measuring only approximately 2m x 2m, I found 16 nymphs in early May 1988. At this time no open water was present, only waterlogged *Sphagnum* and *E. angustifolium*. In 1989 the same soak produced 10 exuviae, but in 1990 only one exuvia was found. The nymphs would therefore appear to survive in a dense mat of *Sphagnum* so long as it remains waterlogged, (though their tolerance limits in this respect need investigating).

The reason for some 'soaks' being used for breeding while others are apparently ignored may be found in their degree of waterlogging at egg-laying time. My observations suggest that for egg-laying to be elicited the *Sphagnum* needs to be covered by standing water, albeit over only a very small area. One soak in which no nymphs or exuviae were found in 1988 or 1989, had a few centimetres of water covering the *Sphagnum* in June 1990 when egg-laying was observed.

Between May and August 1988 a series of shallow pools were created at Chartley adjacent to the main access path across the *Sphagnum* lawn. The pools started off as hollows where invading birch trees were being winched out to maintain the open lawn. Subsequently some of these small hollows were enlarged with a spade. The purpose of this was two-fold. Firstly, the path (which had originally consisted of chestnut pailing) had become treacherous, and after renewing the surface with pine logs produced by habitat management on site, a covering of *Sphagnum*/peat was deemed desirable for aesthetic and safety reasons. Secondly, creating open water beside the path would hopefully allow visitors to see *L. dubia* without the need to trample the delicate bog vegetation around the main breeding pool. This strategy has worked well and has provided additional opportunities to observe the behaviour of *L. dubia*.

By early 1989 the excavated hollows mostly displayed a complete carpet of submerged *Sphagnum*, and on 15 June *L. dubia* males were holding territory at nearly all of these new pools, a further 3 pairs were seen in tandem and one female was ovipositing. Soon after this date the water level dropped to expose the *Sphagnum* at the surface. The water table did however, remain only just below surface throughout the summer. In 1990 egg-laying was observed at one of the new pools as early as 17 May. The pool which measured 3.5m x 1m contained a complete cover of submerged *E. angustifolium*. The average water depth above the *Sphagnum* was 40-50mm and the maximum depth was 75mm. Three nymphs were found in the pool on 3 September 1990, and it will be interesting to see how many (if any) *L. dubia* complete the life-cycle in the newly created habitat.

It is planned to create further pools at the edge of the *Sphagnum* lawn to counter the effects of successional infilling of pools with *Sphagnum* and maintain sufficient habitat for *L. dubia* (and other rare invertebrates). The successional loss of open water appears to be progressing fairly rapidly at Chartley, and added to this, a second pool the size of Shooters Pool has virtually disappeared in the last ten years due to hydrostatic changes on the peat raft. On such an important peatland site the excavation of new pools needs very careful planning and recording since it destroys the peat record, and may cause wider damage to the vegetation and or hydrology of the site. At Chartley new pools will be created in areas where encroaching pine forest has recently been removed from the *Sphagnum* lawn periphery. An All Terrain Vehicle will be used to minimise damage to the peat surface and all excavated material will be used to infill old ditches. It will be interesting to monitor the life span of new pools excavated to a range of sizes and depths. The dredging of *Sphagnum* from existing pools may be necessary to maintain breeding habitat, but will only be undertaken where it can be placed immediately into a new pool, since *L. dubia* is bi-voltine and hence nymphs are always likely to be removed with the *Sphagnum*.

Access to Chartley Moss NNR, which is privately owned and leased by English Nature, is strictly by permit only (because of sensitivity to trampling, its treacherous nature and the owners' shooting interests). Arrangements can usually be made for group visits by contacting the Warden at Attingham Park, Shrewsbury, Shropshire SY4 4TW. Individuals wishing to see or photograph *L. dubia* can do so more readily at Whixall Moss, Shropshire. Finally, if any BDS Member would like to assist with dragonfly monitoring at Chartley they should contact the Warden Mr Tim Coleshaw at Attingham Park.

Acknowledgements

Thanks to Jonathan Pickup and Mark July for comments on a draft of this paper.

Habitat preferences of dragonflies in the Cotswold Water Park

A. D. Fox, T. Jones* and S. C. Holland**

The Wildfowl & Wetlands Trust, Slimbridge, Glos. GL2 7BT; *International Waterfowl and Wetlands Research Bureau, Slimbridge, Glos. GL2 7BT; **64 All Saints Road, Cheltenham, Glos.

The Cotswold Water Park is a complex of over 100 abandoned and active gravel pits situated in the Upper Thames catchment. The Park was established in 1967 to serve the needs of various users of this important recreational area, and covers some 5700 hectares. The area lies mainly within south-eastern Gloucestershire, but extends into north-east Wiltshire and a small corner of Oxfordshire. Many of the pits have been landscaped and most of the abandoned ones are flooded, although their steep sides often result in there being little shallow water or emergent vegetation. However, even during extraction, the formation of small pools and wetlands makes the whole area highly attractive to Odonata and the Water Park is now one of the most important dragonfly haunts in south-west England (Holland, 1991).

Geology and hydrology

The extensive deposits of oolitic limestone in this part of the Thames catchment are the result of glacial erosion of the Cotswolds further west. Massive quantities of material were brought down by the (then much larger) Thames and its tributaries and deposited as extensive sheets of gravel in the Thames floodplain. The gravel overlays thick and highly impermeable Oxford Clay deposits which consequently maintain a high watertable within the gravel measures. Despite their extent, the gravel deposits are nowhere very deep, so gravel extraction in the area results in relatively shallow (less than 6m depth) lakes.

Gravel extraction

The area before extraction comprised flood meadows and permanent pasture, although in recent years, the area had become important for its arable agriculture. Generally, there was little or no permanent standing water in the area which now makes up the Park, although doubtless in earlier times, there would have been extensive seasonal floodlands associated with the Thames and its tributaries. There remain several important meadow communities in the floodplain (the best examples of which are protected as Sites of Special Scientific Interest), but the effects on these of the long-term quarrying and consequent

modifications to the water regime of the area are unknown. The extraction of aggregates in the Upper Thames catchment has been carried out for much of the present century, but there has been a rapid increase in the industry in the last thirty years as the demand for construction materials has increased. The deposits are highly calcareous and are covered in relatively thin overburden. Although the exact level of the water-table varies according to local water abstraction (most of the pits are currently worked in a dry condition), season, topography and other factors, most of the gravel is naturally saturated, and the underlying clays tend to collect water even in the normal circumstances of water abstraction during mining operations. On cessation of digging, the natural flooding of new pits constantly expands the area of open water and associated wetlands, making the area of national importance for seven species of wintering wildfowl and of considerable local importance for its breeding wetland birds.

Use of lakes

Worked out pits may be used as landfill sites, but the majority are "restored", flooded and are frequently leased or purchased by water-based recreation interests. Many lakes are used for angling, but sailing, wind-surfing, jet-skiing, water-skiing, swimming, model boating and canoeing are all popular in the Water Park. Even the pits which have no water-based recreation support horse-riding, walking, picnicking, caravanning and other recreational use. At present, there are also proposals for at least two major recreational developments in the Water Park, including the construction of a substantial holiday village in the Somerford Keynes area. At present, only three waters are secured for nature conservation as reserves of the Gloucestershire Trust for Nature Conservation (GTNC), two of these are in the process of being modified under proposed developments (although alternative habitats will be created elsewhere in part compensation), while a third suffers from existing public access which causes considerable recreational disturbance. There are currently no Sites of Special Scientific Interest (SSSI) in the Park to protect the aquatic habitats of a site designated in the Nature Conservation Review (Ratcliffe, 1977).

Dragonfly survey data

The Park supports 8 breeding species of damselfly and 10 of dragonflies, making the area of considerable local and regional importance. Two nationally local species, *Ischnura pumilio* and *Sympetrum sanguineum* occur, whilst other species such as *Cordulia aenea*, *Erythromma najas* and *Lestes sponsa* are scarce in Gloucestershire and Wiltshire. As well as the rare species, the Park also poses interesting distributional anomalies. Some species, namely *Anax imperator*,

Aeshna cyanea, *Coenagrion puella* and *Libellula depressa*, are common locally but past records suggested were relatively scarce in the Park and added to the need for adequate survey of the entire Park.

Considerable casual recording had been carried out in the Water Park for many years, particularly by SCH. In 1987, a full survey was carried out under contract to the then Nature Conservancy Council (NCC), with visits made to all pits at regular intervals during the summer during suitable weather. Wherever possible, details of proof of breeding was collected and the information collated. Follow-up survey was carried out in summer 1988 and these surveys have also been supplemented with observations in subsequent years.

The total of 18 species makes the site of regional importance for its dragonfly fauna alone. While no single one water body held all species, some sites were found to hold 15 or more species and consequently qualify for SSSI designation on this criteria. Three river-dwelling species have historically been recorded from the Water Park, but do not occur regularly on the gravel pits, namely *Calopteryx virgo*, *C. splendens* and *Platycnemis pennipes*. *Platycnemis* breeds along the Thames in Wiltshire and wanderers may occasionally be seen in the Gloucestershire part of the Park. *C. virgo* used to occur along the Thames, Coln and Swill Brook and their tributaries, but the hydrology of these streams has changed radically with pumping and recent dry summers, and there are few records post-1980 from the Park. *C. splendens* is still fairly frequent along the smaller rivers and tributaries throughout the Water Park and wandering adults are frequently encountered on gravel pits, particularly those close to breeding streams and rivers.

Sympetrum sanguineum remains highly restricted within the Water Park, although known from the Edward Richardson GTNC Reserve since 1953. It breeds only on waters with shallow margins supporting very dense emergent vegetation, favouring *Typha* beds or dense stands of *Eleocharis palustris*, as well as stands of *Schoenoplectus tabernaemontanii* on some pits. The slow-flowing rivers, streams and canals of the area also support dense emergent vegetation and currently support important breeding numbers.

Lestes sponsa remains scarce in the Water Park, being restricted to eight existing sites and from two former pits now infilled. The characteristic feature of all these sites is the presence of extensive shallow water, usually colonised by *Eleocharis palustris*. Since *L. sponsa* oviposits into plant tissue and is generally a weak flier, the almost invariable association in the Park between the species and this particular plant suggests that *L. sponsa* may select the plant for oviposition.

Of the remaining rarer species, *Ischnura pumilio* exhibits the most distinctive habitat requirements. Oviposition also takes place into the tissue of

emergent vegetation, usually soft grasses (especially *Agrostis stolonifera* in the Water Park (Fox and Jones, 1991). However, it favours almost bare substrates and shallow waters in the Water Park and is consequently always associated with fresh or very recent gravel workings, egg-laying in culverts and tractor ruts which dry out in summer. Territorial males need some emergent vegetation on which to perch, whilst females oviposit into grasses either floating on, or emergent through, the water. Hence, an integral element of habitat selection is the presence of at least some colonisation of bare gravel by a few grasses. Completely bare gravel substrate and shallow water is therefore unlikely to be colonised until the first few flowering plants have grown up. Equally, after two or three seasons, the development of dense vegetation over such substrates (particularly the reed-mace *Typha latifolia* which is quick to invade such shallow water) renders the site unsuitable for *I. pumilio* and leads to the disappearance of the insect. It is therefore totally dependent in the Park on extraction to create new suitable breeding habitat, which it will exploit for two to three years before conditions become unsuitable. As it is highly dispersive (Fox, 1987), it seems able to colonise new sites often far from its known range, although the difficulty of finding this unobtrusive species and its short flight period doubtless leads to under-recording. The conservation of *I. pumilio* therefore raises several problems, but the potential for positive management of shallow lagoons scraped bare of colonising vegetation (at one of the GTNC Reserves, for example) would greatly secure the future presence of the species in the Park.

Erythromma najas also shows some very specific habitat requirements, being only found on still waters with rafts of floating vegetation. The males defend territories on water-lily leaves (*Nymphaea* and *Nymphoides*) as well as *Polygonum amphibium*, *Potamogeton natans* and *P. lucens*. Floating *P. pusillus*, *P. pectinatus* and mats of algae also provide territorial males with perches. The species was first recorded from the Water Park in 1977 and has shown some signs of spreading to more and more pits as the vegetation has become suitable.

Cordulia aenea was first discovered in 1988 and has since been recorded from six different waters, all of very differing age and habitat. All sites seem to be near old overgrown hedgerows with standard trees about which the insect hawks for prey, and most waters seem to be older pits with longer established vegetation. However, the species remains extremely local in the Water Park and requires further research to establish its precise habitat requirements.

Libellula depressa is very much rarer in the Park than its ubiquitous relative *L. quadrimaculata*, seemingly selecting for recently created waters and for water bodies of restricted size. A female was watched ovipositing in a pool in one pit with very low water levels in 1989 — although there were large stretches of

apparently suitable shoreline along the main lake. The insect restricted her ovipositing activities to the pool which was little over 2m by 3m in extent. Such small, newly created bodies of water are scarce in the Park, and are generally associated with active extraction.

Some species are present almost throughout the Park; there can be few waters where *Enallagma cyathigerum*, *Ischnura elegans*, *Sympetrum striolatum*, *Libellula quadrimaculata*, *Orthetrum cancellatum*, *Aeshna grandis* and later in the season *Aeshna mixta*, do not breed. The sheer numbers of *Enallagma* in particular, being very impressive at the height of the season.

The distributional patterns of the less common species are still far from clear. *Anax imperator*, for instance, appears to favour small mature bodies of water with dense emergent vegetation, particularly with fringing *Typha*. The latter may again be related to the need for oviposition sites within suitable vegetation. *Aeshna cyanea* is more commonly encountered in the Park than in earlier years, but we know little about its habitat requirements and breeding status. *Coenagrion puella* is an abundant species throughout Gloucestershire, but is relatively rare in the Park — the degree of competition and ecological overlap between this species and *Enallagma* remains one of the great mysteries of dragonfly ecology in the Park. Despite their similar appearance, considerable effort has gone into searching for *C. puella* and the general increase in the numbers of sites from which it has been recorded in recent years may suggest a modest expansion since the 1970s.

Conservation needs

There is a clear need to safeguard the dragonfly and other invertebrate interest of the Water Park. The current network of GTNC reserves support several of the rare and vulnerable species, but the recent modification of the Edward Richardson Reserve through development underlines the need for a network of protected and adequately managed reserves. We are now more able to predict the type of management prescriptions required to encourage specific dragonfly species to breed and for those that we do not, more research is being carried out. The most precarious species appear to be those such as *Ischnura pumilio* and perhaps *Libellula depressa* which exploit the early stages of wetland succession in years before the vegetation growth is too great. These shallow water habitats are associated with extraction processes which in turn may be subject to enormous disturbance, pollution and destruction. There is a need to actively manage for these in the Water Park to ensure conditions exist somewhere in the area to facilitate adequate dispersion to colonise new sites.

Unfortunately, there remains a perception that the crucial elements of

dragonfly habitat all lie below the water surface and that the emergent adults are able to forage anywhere in the terrestrial environment. However, the rare *C. aenea* forages in the canopies of trees and the tops of hedgerows, as do many of the Aeshnids, while the masses of damselflies emerging from lakes forage in vast numbers in adjacent rough ground and pasture which may also be vital to their survival, especially during the post-emergence teneral period. There is thus also a need to safeguard a diversity of insect-rich terrestrial habitats integrated with the wetland matrix of the Park to ensure adequate survival of the adult forms.

On the basis of these surveys, English Nature is currently considering a programme of site safeguard in the Cotswold Water Park and the GTNC is currently structuring a Conservation Strategy for the Park which will address protection of the wider countryside features of this important wetland complex, aimed especially at integrating conservation into local planning structures. Although these are artificial wetlands, they have come to be of considerable significance for their dragonfly communities. While it may be possible to replicate certain wetland features elsewhere (as in the case of newly developed sections of the GTNC Edward Richardson reserve), we are still not in a position to identify and manipulate all of the complex features operating to provide for the requirements of different invertebrate species at different lakes. It is hence not possible to fully reproduce a wetland habitat which supports a rich community of these attractive insects. For this reason it is vital to maintain, protect and, where possible, enhance the existing interest. As important, however, will be the ability to secure the development of future new lakes, some of which may be designated for a conservation after-use and which could be designed specifically to maximise their dragonfly interest.

References

- Fox, A. D. 1987. *Ischnura pumilio* (Coenagrionidae: Odonata) — a wandering opportunist? *Entomologists Gazette* **101**: 25-26.
- Fox, A. D. and Jones, T. 1991. Oviposition and generation time in *Ischnura pumilio*. *Entomologists Monthly Magazine*, in press. Full ref. available (see Recent Publ.)
- Holland, S. C. 1991. *Distribution of Dragonflies in Gloucestershire*. Toddington Press, Cheltenham.
- Ratcliffe, D. A. 1977. *A Nature Conservation Review*. Cambridge University Press.

Feeding behaviour of *Aeshna mixta* Latreille in the maturation period

A. Brownett

28 Colesbourne Road, Brookside, Bloxham, Banbury, Oxfordshire OX15 4TB

The spread of the Migrant Hawker (*Aeshna mixta*) in Britain has been well shown by Biological Records Centre data, though it cannot easily be explained (Harding, 1991). In my home county of Oxfordshire the species has been recorded from 7% of the available tetrads since 1980 (Campbell, 1988). Most field studies on the adult stage of the life cycle of Odonata concern their breeding sites, so it seems worth while recording on some observations on *A. mixta* in the maturation period. There is little information on specific differences in dragonfly behaviour in the identification manuals currently available, which rely by and large on morphological characters.

In the summer of 1991 for the first time on record *A. mixta* was found at the Slade, a county Trust reserve in rural Oxfordshire close to the village of Bloxham (SP422355). Covering 2.2ha, the Slade is one of the smallest Trust reserves in this part of the English Midlands (for a site map see Young, 1989). Its name derives from a wet meadow and the portion within the reserve is now sheltered by trees on all sides. The meadow, over much of which Meadowsweet (*Filipendula ulmaria*) is the dominant herb, has a willow-lined stream — a former osier-bed — to the north and a relict valley alderwood forming a block to the east, effectively closed-canopy apart from some light-pools in the interior. Over a hundred years ago the meadow was cut off on its southern side by the building of the Banbury and Cheltenham Direct Railway; this was dismantled in 1964, the stretch of railway within the reserve now resembles a double hedgerow with trees, and some open areas are maintained by management.

Visits were made to the Slade on a weekly basis throughout the year, so the period of records of *A. mixta* — 17th August to 6th October — must represent more or less the whole of its occupancy period there. Within this period all sightings of *mixta* were recorded and data collected on their activity together with the habitat occupied and time of day. For resting sites the types of site used and the height of the dragonfly above the ground were noted and for foraging flights a rule-of-thumb estimate of the height was made. The flight of *mixta* when feeding is basically back and forth, but with a propensity for sudden changes of direction and — to use Longfield's (1949) term — 'zooming' to a greater height, so for present purposes a foraging height is defined as the estimated height of any level flight and an individual's flight session, which may continue for up to 5-

10 minutes, could count as two or more records. *A. mixta* is instantly identifiable when airborne, even with the naked eye, by its relatively small size and the manner in which it conducts its feeding behaviour and this consistent with the jizz of 'small bright and breezy' as described by Winsland (1989). Compared with *Aeshna cyanea*, for instance, both overall body length and abdominal length, even when corrected for differing mass by dividing by the cube root of body weight, are 14% smaller in *mixta* (author's data).

In 1991 I counted up to 10 individuals of *A. mixta* on the reserve at any one time, occupying both the meadow and the railway sections for both resting and feeding, and up to 6 were observed feeding together in the airspace above the meadow without obvious interaction. On no occasion were any seen inside or entering the wood; foraging flights in the vicinity ended at or skirted the woodland edge, where some resting sites were also found. There were further sightings of ones and twos in the village nearby, where they turned up in gardens, round houses and up and down the village streets. As there is no previous record for the Slade, and no attempt was made to catch and mark the dragonflies, there is no way of knowing the emergence site(s) whence they came or where they proceeded, having achieved maturity, to copulate and oviposit. Two small ponds have been created in the meadow and breeding of *Libellula depressa* and *Sympetrum striolatum* was confirmed on them in 1991. Other odonates which have been recorded on the site in recent years, apparently as non-breeders, are *Calopteryx virgo*, *Enallagma cyathigerum* and *Aeshna cyanea*. No sexual behaviour was apparent in *mixta* throughout the study period and most individuals of which good views were obtained were in the immature colouration with pale blue markings on the abdominal segments.

Feeding activity in *A. mixta* was regularly both diurnal and crepuscular and recorded at times from 10.00 to 20.00 B.S.T., though significantly more flights occurred in the afternoon/evening period than in the morning (Table 1). The latest evening record was on 31 August, shortly after sunset. The figures for foraging height, although approximate, show that feeding took place in the range 1-9m; a total of 131 records were obtained with a median height of 2.5m and interquartile range 2.0m. I do not have adequate comparable data for known breeding sites, but it seemed to me that foraging flights on the maturation ground differed from those of adults in the vicinity of water bodies in tending to be higher and with no (or next to no) hovering. There was some indication of the influence of the ambient temperature on dragonfly activity, as on 15th September, when the temperature in the meadow rose from 19°C at 11.00 to 22°C at 12.12, no *mixta* were seen on the wing until one appeared briefly at 11.24 and then up to 3 together in protracted flights from 11.33-12.20 hours. Obviously

more readings are required to prove the point.

Resting sites were found most easily either by searching in the morning, when *A. mixta* spent long periods resting, or by following the end of a foraging flight, when they were found to be close to foraging areas. Most sites were relatively low down (Table 2). They were always on the sunlit side of bushes and trees and, where they occurred on herbs, these always had dead or bare parts affording an unimpeded view in all directions. Whether clinging to a leaf or stem or hanging from the underside of a branch, the resting attitude was such that the dragonfly body was positioned vertically with the head uppermost and sun-oriented, so that the incidence of the sun's rays fell dorsally. Consequently, the resting sites changed to different sides of the meadow during the course of the day. Resting *mixta* occurred singly or in loose groups and the closest that two individuals were found together was 30cm apart. Askew (1988) referred to two strategies whereby Odonata achieve a high enough thoracic temperature for flight; first basking employed by perch-hunters and secondly wing-whirring performed by flight-hunters such as Aeshnidae. My observations on maturing *mixta* do not conform to this scenario, as they were clearly preparing for flight solely by basking, with the wings outstretched and motionless, and on no occasion was wing-whirring observed prior to take-off.

With the benefit of hindsight, it is recommended first that in any further study of this kind the ambient temperature should be recorded, as it is likely that there is a temperature threshold for resting to be abandoned in favour of spells of feeding activity. It has been found in a study in the New Forest that such a temperature threshold operates in the case of a dragonfly-predator the Hobby (*Falco subbuteo*), which refrains from insect-hunting at temperatures below 13°C (Milsom, 1987). Secondly, since maturing *mixta* spent long periods resting and they did so typically at no great distance from the ground, it should be an easy matter to catch and mark them to try and discover something about their subsequent movements. Finally, it is suggested that the flight characteristics of *mixta* on the maturation ground, where feeding is at a premium, differ from those of adults at breeding sites and this would be deserving of further study too.

References

- Askew, R. R. 1988. *The dragonflies of Europe*. Harley Books, Colchester. 291pp.
Campbell, J. M. 1988. *An atlas of Oxfordshire dragonflies*. Oxfordshire County Council, Oxford. 39pp.
Longfield, C. 1949. *The dragonflies of the British Isles*. 2nd edition. Warne, London. 256pp.

- Harding, P. T. 1991. National species distribution surveys. In *Monitoring for conservation and ecology*. Edited by F. B. Goldsmith. Chapman and Hall, London. 275pp. (pp. 133-154).
- Milsom, T. P. 1987. Aerial insect-hunting by Hobbies *Falco subbuteo* in relation to weather. *Bird Study* 34(3): 179-184.
- Winsland, D. C. 1989. The jizz: some thoughts on dragonfly recognition. *Journal of the British Dragonfly Society* 5(1): 2-6.
- Young, G. 1989. *Where to go for wildlife in Berkshire, Buckinghamshire & Oxfordshire*. Berkshire, Buckinghamshire & Oxfordshire Naturalists' Trust, Oxford. 222pp.

Table 1. Activity of maturing *Aeshna mixta* in relation to habitat and time of day.

Habitat category	No. of records of individuals engaged in activity specified			
	10.00-13.00 hours		13.00-20.00 hours	
	Resting	Feeding	Resting	Feeding
Deciduous wood	—	—	—	—
Railway	15	3	1	7
Wet meadow	16	13	4	18
Village	—	—	1	5

Times quoted are B.S.T. The proportion engaged in feeding was more frequent in the afternoon or evening ($\chi^2 = 18.1$, $df = 1$, $P < 0.001$).

Table 2. Resting sites of *Aeshna mixta* in the maturation period.

		No. of records
Trees/shrubs		
Dog Rose	<i>Rosa canina</i>	1
Hawthorn	<i>Crataegus monogyna</i>	4
Alder	<i>Alnus glutinosa</i>	4
White Willow	<i>Salix alba</i>	8
Herbs		
Meadowsweet	<i>Filipendula ulmaria</i>	2
Cow Parsley	<i>Anthriscus sylvestris</i>	3
Curled Dock	<i>Rumex crispus</i>	1
Stinging Nettle	<i>Urtica dioica</i>	2
Miscellaneous		
Ash (lopping)	<i>Fraxinus excelsior</i>	1
Brick wall of house		1

For all sites the height range above the ground was 0.3-4.0m (median = 1.0m, interquartile range = 1.4m).

Notes and observations

Compiled by Alan Paine

3a Burnham Close, Trimley St. Mary, Suffolk IP10 0XJ

Firstly, my thanks to everyone who has contributed to this section over the years. The reports have been of great interest, and I look forward to receiving many more.

After each report appears a capital letter in brackets; this identifies the contributors, who are listed at the end of the section. All records refer to 1991 unless stated otherwise.

Mixed pairings

On 9 September a tandem pair of *Aeshnas* were disturbed from a hedge alongside the Grand Union Canal between Long Clawson Bridge and the Leics./Notts. border. On examination the pair turned out to be a male Migrant Hawker (*Aeshna mixta*) and a female Southern Hawker (*Aeshna cyanea*). After flying a short distance the *cyanea* shook herself free and flew off. (F). [Considering the difference in size one wonders what the male thought about this!!! — sub-ed.]

On 20 July a male Scarce Blue-tailed Damselfly (*Ischnura pumilio*) and a male Azure Damselfly (*Coenagrion puella*) were seen in tandem on Bodmin Moor, Cornwall, the latter in the 'female' position. They remained attached for about 10 minutes (during which time they were photographed), with the *puella* occasionally arching his abdomen towards the *pumilio*. When they eventually parted the *puella* attacked the *pumilio* extremely viciously about the head. (N).

Also on 20 July on Bodmin Moor, a male *Coenagrion puella* in tandem with a female *puella* was also being clasped by a male *Ischnura pumilio*. (via N).

Odonata caught in light traps

A female Ruddy Darter (*Sympetrum sanguineum*) was found in a moth-catching light trap in Portadown during the year, whilst in 1990 an Emerald Damselfly (*Lestes sponsa*) was similarly found in Co. Antrim. (M). [Has anybody else any other records of Odonata being found in such circumstances?]

Unusual ovipositing sites

On 22 September a pair of Common Darter (*Sympetrum striolatum*) in

tandem were noted showing a lot of interest in an old plastic windscreen thrown into the bottom of a chalk pit near Stone, Kent. After several weeks without rain the ponds had completely dried out, but following a heavy shower during the night the windscreen was wet. The female *striolatum* was ovipositing on the wet windscreen, and when disturbed merely moved several yards away to oviposit on the other half of the windscreen. (L).

On a warm, sunny day in mid-September, near Braunton Burrows in Devon, a tractor door with two large areas of glass were left laid flat in a sheltered position on long grass. On returning in late afternoon a cloud of dragonflies were disturbed, which included several tandem pairs of *Sympetrum striolatum*, three pairs of which repeatedly dipped onto the glass (which now had condensation on its underside), with the females' abdomens contacting the glass. This continued for several minutes with pairs exchanging but never room for more than three at one time. When the door was placed in an upright position the dragonflies lost interest in it. (C).

During the hot spell of July 1989 a Golden-ringed Dragonfly (*Cordulegaster boltonii*) entered the lounge of a cottage on the banks of the River Seaton near Menheniot, Cornwall, and flew around repeatedly dipping its abdomen to touch the carpet, presumably releasing eggs. Eventually it was shepherded out of the front door. (G). [Presumably the dragonfly thought the shaded interior was cooler than the outside, and if the carpet's colour was correct it had found a good ovipositing area. — sub-ed.]

Predation

During the year a male Banded Demoiselle (*Calopteryx splendens*) was found bitten in half across both wings and abdomen and impaled onto a rush stem along the banks of the River Blythe near Blithfield Reservoir, Staffs. (E). [Could this possibly have been the work of a shrike? — sub-ed.]

At Minsmere, Suffolk, on 28 September, a loud buzzing sound attracted attention to a male Migrant Hawker (*Aeshna mixta*) which was being stung and killed by a Hornet. The *Aeshna* was hanging from vegetation (as were another 4 males nearby), and presumably the Hornet had pounced on the dragonfly whilst it was resting. (J).

Behaviour

On 17 July a pair of Azure Damselfly (*Coenagrion puella*) were sitting on a leaf beside a garden pond in Cheddar, Somerset, when suddenly the female

"attacked" the male, apparently trying to rouse him, but he just shrugged her off. It was noted that the female had a very short abdomen, only 6 segments and no genitalia, which would have made mating impossible. The abdomen ended neatly and smoothly and did not appear to have been damaged. (B).

On 28 September a male Southern Hawker (*Aeshna cyanea*) was quietly patrolling his 'patch' a few inches above the footpath near the West Hide at Minsmere, Suffolk, when a female suddenly flew in fast from one side and literally bashed straight into him. Both fell to the ground with a tremendous buzzing noise, and eventually they rose in the 'wheel' position and flew off (rather unsteadily at first). (J).

On 25 August at a small pond near Bedford a female Blue-tailed Damselfly (*Ischnura elegans*) var. *infuscans obsoleta* was flying over a grass bank when it made a direct flight at a small black fly caught but still alive in a spiders web, taking the fly out of the web and flying away without getting entangled. (D).

On 18 August a female Brown Hawker (*Aeshna grandis*) was ovipositing into the partly-submerged stem of a yellow Water-Lily along the River Ouse at Great Barford, with intermittent bouts of wing-whirring, when suddenly a tandem pair of White-legged Damselfly (*Platycnemis pennipes*) landed on its thorax. They seemed unperturbed by the wing-whirring and remained there for nearly 30 seconds before moving a few inches in front of the *Aeshna*, then ovipositing into the same stem. (D).

Last dates

It was envisaged that due to the fine summer weather during 1991 there might be some observations of Odonata later than usual. Although there are still records to come, here is a selection of those received so far:

Common Hawker (<i>Aeshna juncea</i>)	6 Oct. Isle of Wight. (H).
Norfolk Hawker (<i>Aeshna isosceles</i>)	2 Aug. Hickling Broad. (J).
Emperor (<i>Anax imperator</i>)	21 Sept. Minsmere. (J).
Broad-bodied Chaser (<i>Libellula depressa</i>)	24 Aug. Bodmin Moors. (via A).
Four-spotted Chaser (<i>Libellula quadrimaculata</i>)	6 Sept. Drumnavil Bog. (M).
Black Darter (<i>Sympetrum danae</i>)	15 Oct. Bodmin Moors. (A).
Ruddy Darter (<i>Sympetrum sanguineum</i>)	27 Oct. Minsmere. (J).
Common Darter (<i>Sympetrum striolatum</i>)	15 Nov. Penlee, Cornwall. (A).
Beautiful Demoiselle (<i>Calopteryx virgo</i>)	30 Sept. Traggo Mills, Cornwall. (A).

Emerald Damselfly (<i>Lestes sponsa</i>)	20 Sept. Bodmin Moors. (via A).
Large Red Damselfly (<i>Pyrrhosoma nymphula</i>)	21 Sept. Liskeard, Cornwall. (A).
Small Red Damselfly (<i>Ceriagrion tenellum</i>)	3 Sept. Bodmin Moors. (via A).

1992

The new year has got off to a very auspicious start, with a *Hemianax ephippiger* being seen and photographed on 8 January in Plymouth, Devon. (A).

Life-cycle

A pond was dug at Braunton Burrows NNR, Devon, it being completed on 9 July 1989. During excavation some Broad-bodied Chasers (*Libellula depressa*) were seen ovipositing in the vegetation-devoid water. In May 1990 several emergences of *L. depressa* were noted, thereby indicating the completion of its life-cycle in under one year. (C).

Range expansion, etc.

On 25 August a small population of Migrant Hawker (*Aeshna mixta*) was found in the Penhale dunes area of the North Cornish coast, including a freshly-emerged female beside the exuvia. There were only 5-6 previous records of this species from Cornwall (none from the North coast), and this also constitutes the county's first breeding record. (A).

A small colony of Scarce Blue-tailed Damselfly (*Ischnura pumilio*) found on 11 July near Portadown was the first record for Co. Armagh. (M).

The Ruddy Darter (*Sympetrum sanguineum*) appeared abundant in Co. Armagh during the year. (M).

A male Hairy Hawker (*Brachytron pratense*) at Lough Money, east of Downpatrick, on 29 May is the most easterly site in Northern Ireland and indeed Ireland generally. (M).

On 31 May some *Brachytron pratense* (including a mating pair) were seen at Drumnavilly Bay, South Armagh, for the first time here. (M).

An unexpected record was of a well-worn specimen of the Norfolk Hawker (*Aeshna isosceles*) seen and photographed at Landguard Bird Observatory, Suffolk, on 1st August. (P).

On 6 July 1986 a male Club-tailed Dragonfly (*Gomphus vulgatissimus*) was found in Wytham Woods, at a point approx. $2\frac{1}{4}$ miles from the nearest stretch of the River Thames, upriver from Swinford, and this individual had clearly flown a considerable distance from the river to the wood. (K).

Two interesting discoveries in Scotland in 1991 were Keeled Skimmer (*Orthetrum coerulescens*) in S.W. Scotland (NX 37) and Northern Damselfly (*Coenagrion hastulatum*) on Deeside (NO 39). (Q).

List of contributors

- (A) R. M. Belringer, 20 Wakefield Avenue, St. Budeaux, Plymouth PL5 1PU.
- (B) J. M. Boyd, Worthyland, Back Lane, Draycott, Cheddar, Somerset BS27 3TN.
- (C) J. M. Breeds, NCC, Broadeford Farm, Heddon Mill, Devon EX33 2NQ.
- (D) S. Cham, 45 Weltmore Road, Luton LU3 2TN.
- (E) N. Collingwood, 20 Dorridge Grove, May Bank, Newcastle, Staffs. ST5 0HX.
- (F) S. & E. Eyre, 50 Selby Road, West Bridgford, Nottingham NG2 7BL.
- (G) J. Holmes, Sunnymede, North Hill, Launceston, Cornwall PL15 7PQ.
- (H) S. A. Knill-Jones, 2 School Green Road, Freshwater, Isle of Wight PO40 9AL.
- (J) A. R. J. Paine, 3a Burnham Close, Trimley St. Mary, Suffolk IP10 0XJ.
- (K) J. & V. Phillips, 5 Beauchamp Close, Neath Hill, Milton Keynes MK14 6HZ.
- (L) E. G. Philp, 6 Vicarage Close, Aylesford, Kent ME20 7BB.
- (M) I. Rippey, 13 Enniscrone Park, Portadown, Co. Armagh, N. Ireland BT63 5DQ.
- (N) L. A. Truscott, 59 Cremyll Road, Torpoint, Cornwall PL11 2DZ.
- (P) c/o Warden, Languard Bird Observatory, Felixstowe, Suffolk.
- (Q) E. M. Smith, 33 Hunter Terrace, Loanhead, Midlothian EH20 9SJ.

Book Reviews

The Dragonflies of Dorset. E. D. V. Prendergast. Dorset Natural History & Archaeological Society (1991). 72pp. £2.95 (p&p 50p).

This is another very welcome addition to the growing list of publications dealing with Dragonflies on a County basis. Dorset is particularly fortunate in its Dragonfly fauna, being able to boast no less than 28 out of Britain's 38 species.

The bulk of the book is devoted to detailed accounts of the 28 species, each account containing excellent recognition features, useful information about behaviour and details of individual habitats. In addition, each species is clearly illustrated with pen and ink drawings and (a real bonus) is accompanied by its own 1km square distribution map. All in all it should not be difficult, even for beginners, to identify the Dragonfly they see and the Outline Guides to males provide further aid.

One thing I found a little irritating was the use of the hyphen when referring to anisopterans as opposed to odonates as a whole. The double meaning for the word "dragonfly" has long exercised the minds of those writing about Dragonflies and it is time a way of distinguishing between the two meanings is decided upon. I don't think hyphenation is the answer: I would rather see the use of a capital "D" when referring to Dragonflies as a whole and a small one when referring to dragonflies as anisopterans.

What makes this booklet exceptional is the number of very special "extras" that are included. First, Dr Norman Moore has contributed an introductory chapter on modern day Dragonflies, a chapter that includes their structure and hints on where to look for them as well as a section concentrating on Dorset species and another on Dragonflies in a world context. Those of us who are familiar with Dr Moore's work will not need to be told what a fascinating chapter this is. Second, Dr Ed Jarzenbowski describes the species that were flying in Dorset from the Middle Eocene to the Lower Jurassic and thus gives us a second treat. These two chapters will undoubtedly provide a feast for all who read the book. Two final extras are the reproductions of the British Dragonfly Society's Code of Practice and their "Pond Construction for Dragonflies" which, respectively, provide useful guidelines and valuable information.

The Dragonflies of Dorset will provide an excellent starting point for the study of Dragonflies in Dorset but I also recommend it to Dragonfly-nuts wherever they live. It can be purchased from Dorset County Museum, High West Street, Dorchester DT1 1XA.

Jill Silsby

Recent odonatological publications

- [Anonymous]. Cynthia Longfield 1896-1991. [Obituary]. *Entomologist's Record* 103: 334.
- Arnold, A. 1990. *Wir beobachten Libellen*. Urania, Leipzig-Jena-Berlin.
- Beutler, H. 1991. *Die Flussjungfer [Gomphus vulgatissimus]*. Kinderbuch Verlag, Berlin.
- Blois-Heulin, C. 1990. Familiarization and spatial distribution in *Anax imperator* Leach larvae (Aeshnidae Odonata). *Ethology, Ecology & Evolution* 2: 335-344.
- Fox, A. D. & Jones, T. A. 1991. Oviposition behaviour and generation time in *Ischnura pumilio* (Charpentier) (Odonata: Coenagrionidae). *Entomologist's Monthly Magazine* 127: 253-255.
- Kerihuel, C. 1991. Migration de *Sympetrum sanguineum* (Müller) en Loire-Atlantique (Odonata: Aeshnidae). *Martinia* 7 (1): 18.
- Miller, P. L. 1991. The structure and function of the genitalia in the Libellulidae (Odonata). *Zoological Journal of the Linnean Society of London* 102: 43-73.
- Parr, M. J. 1991. Robert Moylan Gambles [Obituary]. *Odonatologica* 20 (3): 369-373.
- Perry, S. J. & Miller, P. L. 1991. The duration of the stages of copulation in *Enallagma cyathigerum* (Charpentier) (Zygoptera: Coenagrionidae). *Odonatologica* 20 (3): 349-355.
- Reder, G. 1991. Bemerkungswerte Flügelmissbildung bei der Grossen Heidelibelle — *Sympetrum striolatum* Charp. (Insecta: Odonata). *Fauna Flora Rheinland-Pfalz* 6 (2): 575-577.
- Redsaw, E. J. 1991. Odonata report. *Transactions of the Lincolnshire Naturalists' Union* 22 (4): 226-228.
- Tittizer, T., Schöll, F. & Schleuter, M. 1989. Zur Bestandssituation von *Gomphus vulgatissimus* (Linné, 1758) (Insecta, Odonata) an den Bundeswassertrassen. *Hessische Faunistische Briefe* 9 (4): 63-68.
- Wildermuth, H. & Spinner, W. 1991. Visual clues in oviposition site selection of *Somatochlora arctica* (Zetterstedt) (Anisoptera: Corduliidae). *Odonatologica* 20 (3): 357-367.
- Zannoni, C. [1991] 1989. Aspect particulier d'une activité de ponte chez *Lestessponsa*. *Sympetrum* 3: 27-29.

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: '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.

The 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.

LATIN AND ENGLISH NAMES OF BRITISH ODONATA

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

CONTENTS

BAILEY, M. P. The White Faced dragonfly <i>Leucorrhinia dubia</i> at Chartley Moss National Nature Reserve	1
FOX, A. D., JONES, T. & HOLLAND, S. C. Habitat preferences of dragonflies in the Cotswold Water Park	4
BROWNETT, A. Feeding behaviour of <i>Aeshna mixta</i> Latreille in the maturation period	10
Notes and observations	14
Book review	18
Recent odonatological publications	20

Corporate members

Southern Water Services Ltd



CHEM SYSTEMS

