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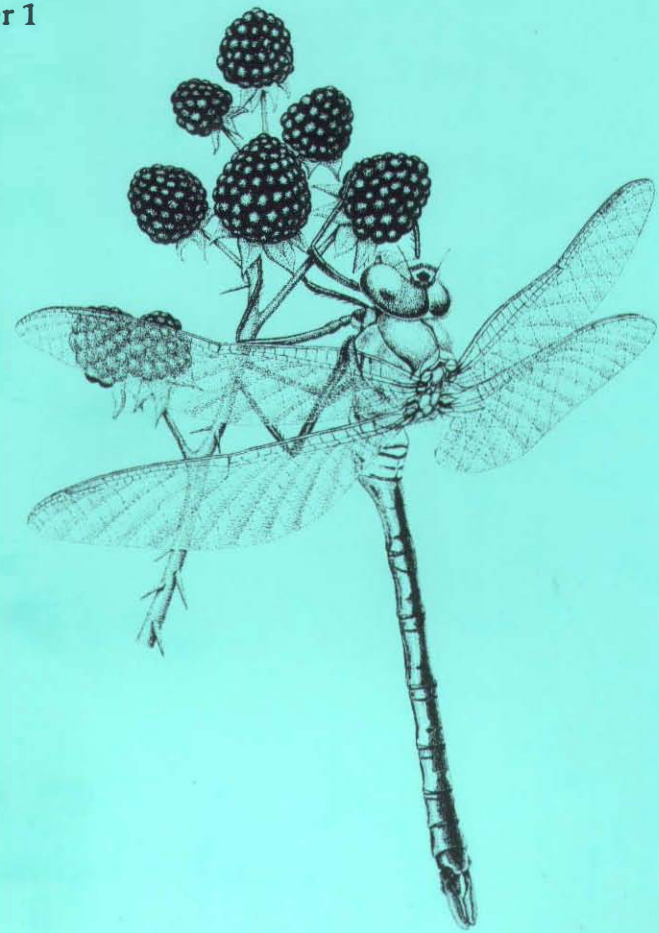

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member of the Societas Internationalis Odonatologica

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Front cover illustration of *Anax imperator* by S. Jones.

A population study of *Coenagrion mercuriale* (Charpentier) at a New Forest site. Part 5. Temperature and pH

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During previous annual surveys, it was noticed that C. *mercuriale* regularly emerged about two weeks earlier in part of a New Forest tributary designated Upper Peaked Hill (Jenkins 1986) than in the lower section of the same stream or in the upper and lower sections of the main Crockford Stream. In addition, there appeared to have been a gradual decrease in numbers of *mercuriale* at Upper Crockford since 1984. The current measurements were made to see if there was an obvious reason for these observations. All the results are from sampling at approximately 250 metre intervals, using prominent natural features as markers (unnatural markers tended to vanish between visits!).

a) Temperature

Measurements were made about 3-5cm from the stream bed using a thermocouple probe attached to a digital thermometer reading in 1°C intervals. When the display alternated between one degree and the next, a reading halfway between (0.5°) was assumed. As far as possible, visits were made on windless days and air temperatures were measured with the probe shielded from draughts. During severe conditions in winter, water continued to flow beneath the ice throughout and in only one or two places was it necessary to break the ice to insert the probe. The measurements of 9 February 1991 were made at the end of a week in which temperatures remained below zero and minimum night temperatures reached -8° in the Southampton area.

A preliminary set of readings was taken on a morning in June but it was found that the heat from the sun was sufficient to raise the water temperature in the shallower parts of the stream by as much as 10°C during the two hours required to complete the survey, giving the false impression that the Upper Peaked Hill stream (measured last) was much warmer than Upper Crockford (measured first). Subsequent visits were made around noon on overcast days.

The results (Table 1) show that in general, the temperature of the water closely followed the air temperature, except for a 100 metre stretch between the point where Crockford Stream emerges from a pipe at the edge of the old Beaulieu airfield and the point where it passes through a broad ponded area. In this region the temperature remained between 8° and 11°C throughout the year and suggests that the stream is spring fed from deep below the surface. The Peaked Hill tributary shows no such effect and probably originates directly by drainage from the complex area of mire and channels at its head.

b) pH measurement

In a general survey of pH at *mercuriale* sites in the New Forest (Winsland,1985), values between 8.02 and 5.94 were recorded at one point on Upper Crockford Stream in five visits over one year, and between 7.25 and 6.51 under similar conditions on Lower Crockford Stream. A single figure of 7.3 was given for Crockford Stream by the Southern Water Authority (Mayo and Welstead, 1983).

Table 1. Temperature profiles

1) Crockford Stream

a) Source to bridge (Upper Crockford)

Sample Point No.	12/10/90 Stream	12/10/90 Air	9/2/91 Stream	9/2/91 Air	19/5/91 Stream	19/5/91 Air
1	11.0	5.5	8.5	-1.0	9.0	15.0
2	7.0	5.0	3.0	-0.5	16.0	16.5
3	6.0	5.0	1.0	0.0	16.5	16.0
4	5.5	5.5	1.5	0.0	17.0	16.5
5	5.5	5.0	1.0	-0.5	17.0	16.0
6	5.0	5.0	1.0	0.0	17.0	16.0

b) Bridge to bottom of site (Lower Crockford)

7	5.0	5.0	0.5	-0.5	16.0	16.0
8	5.0	5.5	1.0	0.0	15.0	16.0
9	5.5	5.5	0.5	0.0	14.5	16.0
10	5.0	5.5	1.0	-0.5	14.0	16.5
11	5.0	5.5	1.0	0.0	13.5	17.0
12	5.5	6.0	1.0	0.0	15.0	17.0

2) Peaked Hill stream

a) Upper Peaked Hill from source

Sample Point No.	12/10/90 Stream	12/10/90 Air	9/2/91 Stream	9/2/91 Air	19/5/91 Stream	19/5/91 Air
1	7.0	5.0	1.0	-1.0	18.5	19.5
2	6.5	5.5	0.5	-0.5	17.5	18.0
3	6.0	5.5	0.5	-1.0	18.0	17.0
4	5.5	5.5	0.0	-0.5	17.5	17.5
5	5.0	4.5	0.0	0.0	17.0	17.5

b) Lower Peaked Hill to junction with Crockford stream

6	5.0	4.5	0.5	0.0	17.0	16.5
7	4.5	4.5	0.5	-0.5	16.0	16.0
8	5.5	5.5	1.0	-0.5	16.5	17.0
9	5.0	5.5	0.5	0.0	16.0	16.0
10	5.5	5.5	0.5	0.0	16.5	17.0

In the present survey, water samples were taken in 8oz jars at the selected points and pH measurements were made within one hour of sampling using a meter measuring to 0.01 of a pH unit and calibrated with a standard pH7 solution. The results are shown in Table 2.

No pH over about 7 was recorded, in contrast to the original survey, and there appeared to be regular changes in pH along the two streams under certain conditions. Thus, the measurements of 2 June and 27 August 1989 and 7 May 1990 were fortuitously made after extended periods of dry weather and show an increase in pH with distance downstream for both Crockford and Peaked Hill streams. Presumably this is because the streams are flowing over the shelly, alkaline Headon Beds which outcrop in this part of the Forest. Indeed, Crockford Stream, after an initial rise from very low pH, shows little change in pH as it flows for about 1km through a typical valley mire. pH then increases steadily as the stream passes into an area where the type of vegetation, and presence of marl pits, indicate less acid soils (Fig.1, p.5). Like the temperature readings, the very low pH at the start of Crockford Stream is anomalous but consistent with a deep spring source. In spite of a minimum recorded pH of 5.3, *mercuriale* regularly breed in this section of stream at densities similar to those found further downstream.

The measurements of 14 January and 18 March 1990 were made after periods of unsettled weather. The results are more scattered, but although the range of pH is reduced, there is still a discernible trend to higher pH with distance downstream. Under these conditions, the streams are receiving rainwater directly, as surface run-off or as rapid shallow seepage, in addition to the slow seepage from depth which maintains flow in dry conditions.

c) Conductivity and calcium content

An attempt was made to measure conductivity at points along the streams but the sensitivity of the portable meter (reading to ± 5 microsiemens) was too low to show any changes with distance. A value of approximately 100 microsiemens was recorded for Crockford Stream and a slightly higher value of 135 for Peaked Hill. Calcium content of the water was measured by EDTA titration on samples and found to be between 8-10ppm in both streams.

Taking all the previous data into account, there appears to be no factor significant enough to affect *mercuriale* populations. The somewhat higher pH values for Lower Peaked Hill and Lower Crockford streams could perhaps have resulted in higher numbers of insects but these have atypical habitats. Thus Lower Crockford Stream is shaded in most places, on one or both banks, by narrow areas of scrub, and *mercuriale* occurs only in isolated pockets where the stream is shallow, well vegetated and open. Lower Peaked Hill on the other hand, is only slowly recovering from dredging and canalization carried out some twelve to fifteen years ago. Upper Crockford and Upper Peaked Hill streams can be compared directly, as the vegetation, drainage and exposure are very similar and although Upper Peaked Hill has a higher pH and conductivity, the differences are marginal. Early emergence at Upper Peaked Hill may be related to the very high population density recorded there, but none of the factors examined indicate why the density should be higher than elsewhere in the area.

Table 2. pH values measured on two streams

From Upper Crockford to Lower Crockford Stream

a) Source to bridge (Upper Crockford)

Sample Point No.	3/6/89	27/8/89	14/1/90	18/3/90	7/5/90
1	5.66	5.55	5.67	5.29	5.59
2	6.01	6.13	6.08	5.99	6.11
3	6.15	6.27	6.18	6.33	6.32
4	6.12	6.31	6.10	6.34	6.36
5	6.14	6.28	6.12	6.38	6.38
6	6.23	6.44	6.16	6.34	6.46

b) Bridge to bottom of site (Lower Crockford)

7	6.37	6.67	6.32	6.43	6.59
8	6.42	6.82	6.28	6.44	6.72
9	6.54	6.74	6.34	6.47	6.86
10	6.66	6.82	6.38	6.44	6.82
11	6.73	6.77	6.40	6.45	6.84
12	6.92	6.93	6.38	6.52	6.88

From Upper Peaked Hill to Lower Peaked Hill Stream

a) Upper Peaked Hill

Sample Point No.	3/6/89	27/8/89	14/1/90	18/3/90	7/5/90
1	6.17	6.03	6.09	6.14	6.16
2	6.42	6.29	6.21	6.36	6.38
3	6.45	6.40	6.15	6.46	6.46
4	6.50	6.43	6.23	6.47	6.45
5	6.61	6.51	6.14	6.43	6.52

b) Lower Peaked Hill

6	6.68	6.48	6.32	6.46	6.57
7	6.70	6.60	6.29	6.53	6.69
8	6.77	6.82	6.36	6.84	6.83
9	6.77	6.82	6.36	6.64	6.83
10	6.91	6.89	6.41	6.86	7.06
	Stream flow in metres per second				
	0.29	0.34	1.41	0.82	0.48

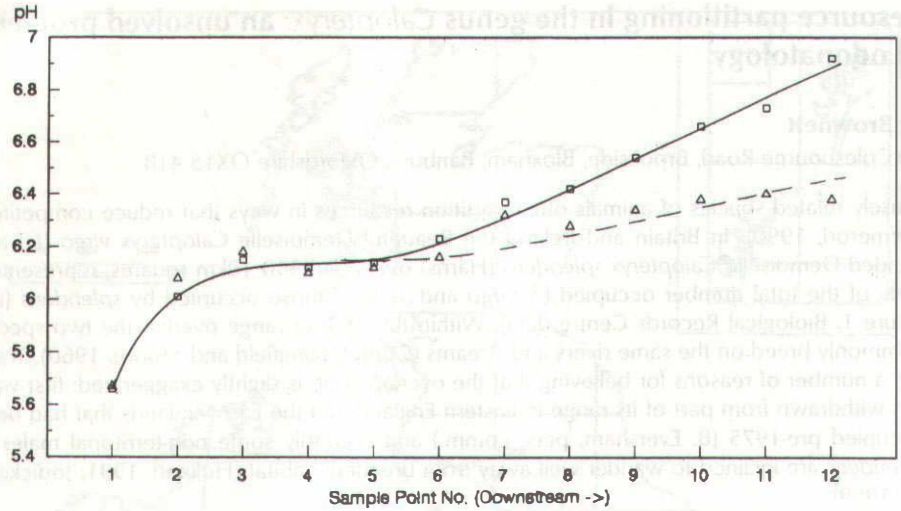

Figure 1. pH profiles at Crockford Stream

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Resource partitioning in the genus *Calopteryx*: an unsolved problem of odonatology

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Closely related species of animals often partition resources in ways that reduce competition (Ormerod, 1990). In Britain and Ireland the Beautiful Demoiselle *Calopteryx virgo* (L.) and Banded Demoiselle *Calopteryx splendens* (Harris) overlap in 330 10km squares, representing 50% of the total number occupied by *virgo* and 39% of those occupied by *splendens* (see Figure 1, Biological Records Centre data). Within this area of range overlap the two species commonly breed on the same rivers and streams (Corbet, Longfield and Moore, 1960). There are a number of reasons for believing that the overlap zone is slightly exaggerated: first *virgo* has withdrawn from part of its range in eastern England and the East Midlands that had been occupied pre-1975 (B. Eversham, pers. comm.) and secondly some non-territorial males of *splendens* are inclined to wander well away from breeding habitat (Holland, 1991; Jödicke *et al.*, 1989).

Recently, in a study carried out on the Wey river system, Prendergast (1988) compared the abundance of the two calopterygids with various habitat factors and found little or no evidence of a correlation between the abundance of *splendens* and any environmental factor, while the abundance of *virgo* was positively correlated with the index of vegetation shading and negatively correlated with maximum river depth. This goes some of the way towards explaining partitioning, but fails to explain how the two species co-exist in the same place at the same time; the BRC database contains 156 records of the two species flying together (Figure 2).

There may be other ways in which the available resources are partitioned – these could include things like food, oviposition sites, or preference for different resting sites. Both Askew (1988) and Prendergast (1988) mention that *virgo* frequently prefers to rest on bushes and trees, while *splendens* almost always prefers resting on herbage such as the Common Reed (*Phragmites australis*).

In the spring of 1993, a comparison was made of the resting sites selected by the two species of calopterygids on the River Swere, an eastward-flowing tributary of the River Cherwell. This is in an area of the English Midlands which lies towards the eastern fringe of the present area of overlap in Britain. The Swere has the characteristics of a lowland stream, meandering through fields of permanent pasture and arable land; its catchment area embraces Middle Lias and Oolite limestone, and pH readings, falling within the range 7.5 to 8.0, are higher than any recorded by Prendergast on the Wey. The study areas covered were on the stretch between Wigginton and Barford St Michael (SP387323 to 433329), where both *virgo* and *splendens* are to be found, but *virgo* predominates and has occurred since at least 1958 (Brownett, 1990). Two lengths each of 500m were selected for fieldwork. One plot was located between Wigginton and South Newington (SP396331 to 397334) and flows between two hayfields; the bankside vegetation is generally open and includes some scattered clumps of bushes and small trees. The second plot was situated between South Newington and Barford (SP423334 to 427336), running between a mature deciduous wood and a field recently converted from permanent pasture to arable; along most of the way the

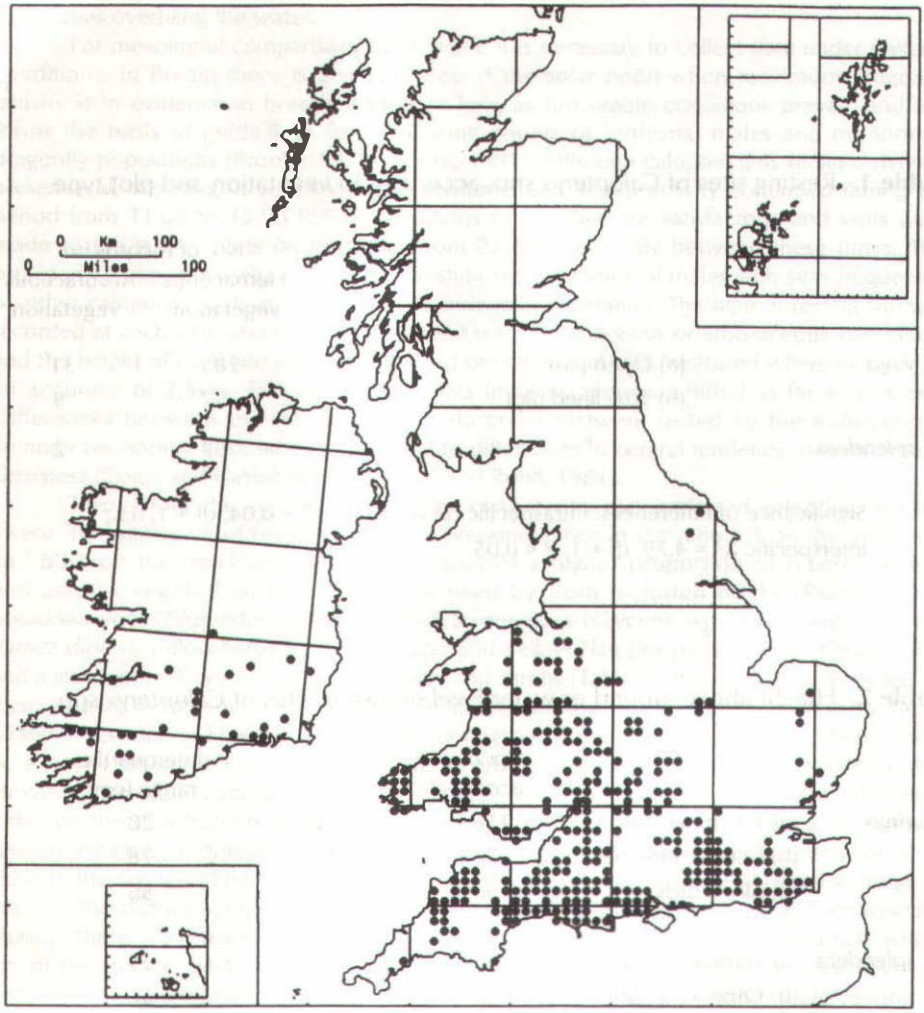

Figure 1. Distribution map, based on 10km square cartographic units, showing where *Calopteryx virgo* and *C. splendens* occur together in Britain and Ireland. (Courtesy of Biological Records Centre: data up to and including 1988).

Table 1. Resting sites of *Calopteryx* spp. according to vegetation and plot type

		No. of records in: Herbaceous vegetation	Arboraceous vegetation
C. virgo	(a) Open plot	285	31
	(b) Tree-lined plot	97	9
C. splendens		94	2

Significance of differences: intraspecific (a) *versus* (b) $X^2 = 0.04$, df = 1, n.s.; interspecific $X^2 = 4.79$; df = 1, $P < 0.05$.

Table 2. Height above ground or water level of resting sites of *Calopteryx* spp.

		No. of records	Median (cm)	Interquartile range (cm)
C. virgo	(a) Territorial males	116	25	20
	(b) Other categories	76	84	78
	(c) All records	192	36	56
C. splendens	(a) Territorial males	48	25	23
	(b) Other categories	10	56	66
	(c) All records	58	25	25

Significance of differences by Kolmogorov-Smirnov two-sample test: intraspecific (a) *versus* (b) for *virgo* ($D = 0.607$, $P<0.001$), for *splendens* ($D = 0.500$, $P<0.05$); interspecific (a) *versus* (a) ($D = 0.103$, n.s.), (c) *versus* (c) ($D = 0.153$, n.s.).

lining trees overhang the water.

For meaningful comparisons to be made it is necessary to collect data under uniform conditions. In Britain there is a period around the solar noon when maximum dragonfly activity is in evidence at breeding sites, as long as favourable conditions prevail, and this forms the basis of guide-lines for comparing counts of territorial males and monitoring dragonfly populations (Brooks, 1993; Moore, 1991). Although calopterygids retain a riverine presence all day long, it was found that territorial and sexual activity continued during the period from 11.00 to 15.00 BST, if conditions were otherwise satisfactory, and visits were made to the survey plots on ten dates from 22 May to 3 July between these times. This provided an opportunity to compare the resting sites of territorial males with sites frequented by other categories such as those roosting in riparian vegetation. The type of resting site was recorded at each visit, according to whether it was in herbaceous or arboraceous vegetation, and the height of each site above the ground or water level was measured where possible to an accuracy of 2.5cm. The species of plants involved were identified as far as possible. Differences between the sets of height data collected were tested by the Kolmogorov-Smirnov two-sample test, which is sensitive to differences in central tendency, dispersion and skewness (Siegel and Castellan, 1988; Sokal and Rohlf, 1981).

Throughout the survey period *virgo* consistently outnumbered *splendens* on the Swere. The aggregate of records showed a preponderance in the ratio 6:1 on the open plot and 60:1 on the tree-lined plot. In both species a higher proportion of records was in herbaceous vegetation; herbs regularly used by both included docks (*Rumex* spp.), Meadowsweet (*Filipendula ulmaria*), Reed Sweet-grass (*Glyceria maxima*), Stinging Nettle (*Urtica dioica*), willow-herbs (*Epilobium* spp.) and Yellow Flag (*Iris pseudacorus*). Clearly *virgo* had a stronger preference for resting in trees and shrubs (Table 1) and they were recorded on them at heights from under 1m on trailing shoots of Dog Rose (*Rosa canina*) up to 3m in sizable trees such as Hawthorn (*Crataegus monogyna*). It might be expected that there would be a higher proportion of records of *virgo* in arboraceous vegetation in the tree-lined plot. However, no significant difference was found. Nor was there any significant difference between the distributions of heights of resting sites between territorial males of the two species, which both operated from vantage points in emergent and bankside vegetation fairly close to the surface of the stream (Table 2). Juxtaposition of territorial perches led to frequent interspecific clashes between males on the open plot, as well as the more usual intraspecific chases. These were occasionally quite prolonged; those of *splendens* were generally within 1m of the surface, while those of *virgo* sometimes reached 2–3m above the water level. In both species copulation took place after a short courtship with the female resting in herbaceous bankside or emergent vegetation below 1m and endophytic oviposition of both species was observed towards the apex of pre-emergent leaves of *Iris pseudacorus* at the surface of the stream.

Apart from differences in range and habitat use, and slight asynchrony of flight-periods, the clearest pattern of resource partitioning in *Calopteryx* spp. occurred in the overall proportion of records of each species in herbaceous and arboraceous vegetation. This accords with previous accounts. Having said that, the categories resting on trees and shrubs were mainly non-territorial individuals and spatial segregation did not enter into the theatre of territorial activity, which was played out near the surface of the stream with males competing for the available resources. This study therefore shows that, whilst there are definite habitat preferences, the two species do overlap and, where this occurs as on the River Swere, there

is no evidence of resource partitioning among territory-holders leading to frequent interspecific conflict (i.e. interference competition). If there is any partitioning of resources among breeding adults where they occupy the same habitat, it remains very much an unsolved problem of odonatology.

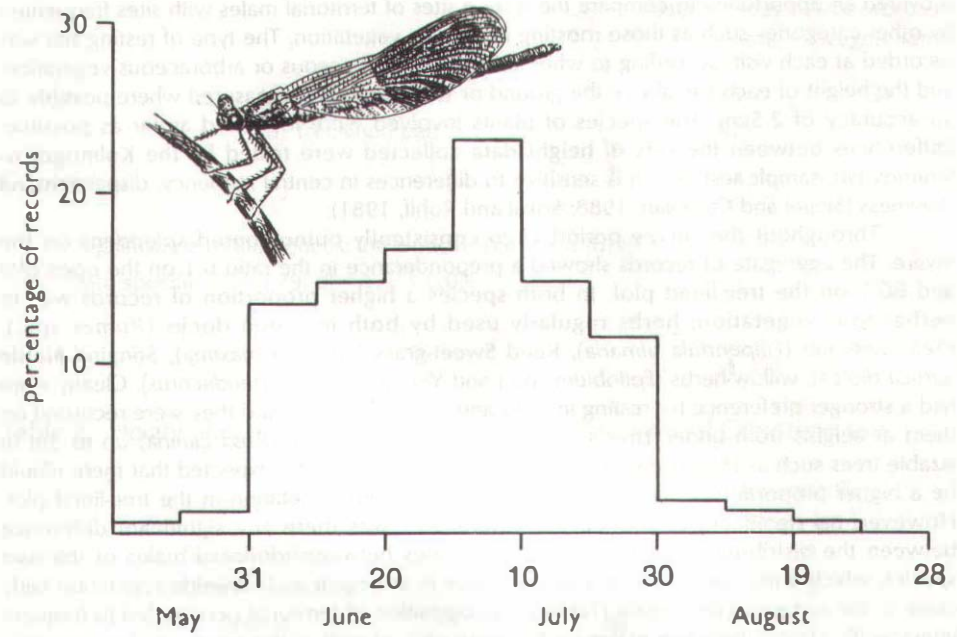

Figure 2. Records of *Calopteryx virgo* and *C. splendens* occurring in the same place on the same day in Britain and Ireland by 10-day periods commencing 11 May (BRC data up to and including 1988; n = 156).

I would like to thank Brian Eversham for making available Biological Records Centre data, Dr John Hogger of Thames Water for water chemistry data, Rupert Lee for the vignette of *Calopteryx splendens*, Roger Stein for translation of the German text, Cliff Christie for helpful comments on the manuscript, and finally the local farmers Messrs Page and Scarr for granting permission to visit their land.

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Observations of *Sympetrum danae* (Sulzer) away from breeding areas

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It is widely believed that *Sympetrum danae* (Sulzer) is a sedentary species rarely moving far from breeding sites. The observation on 11 and 12 August 1990 of a single male *Sympetrum danae* at Holt Lowes, Norfolk is therefore perhaps surprising. Holt Lowes lies 40km to the east of the nearest breeding colony at Sandringham Warren/Roydon Common. This sighting was by no means unprecedented. Moore (1986) reports a similar occurrence at Holt Lowes on 6 August 1984; again a single male was involved.

Holt Lowes consists of a small valley mire and contains an extremely isolated population of *Orthetrum coerulescens* (Fabricius), another acidophilous species. Despite the

apparent suitability of the habitat, *Sympetrum danae* has not been recorded breeding (P. Milford, pers. comm.).

A further sighting of a vagrant male *Sympetrum danae* in a typical habitat (a gravel-pit complex, near Frimley, Surrey), on 10 October 1991 is perhaps less surprising. The Hampshire/Surrey heathlands are a stronghold for this species, so this individual would not have flown far. Its behaviour was however of interest. When disturbed, whilst basking, it flew off strongly to the north at a height of 5m until out of sight. This species is obviously capable of dispersive flight and the label of sedentary is perhaps unwarranted.

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Observations on the current status of some of the scarcer Odonata of vice-county 11

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In the past there have been two notable papers on the status of Odonata in this area. The first, by Lt-Col. F. C. Fraser (1950), includes all of the species which occur here; the other, by Keith Goodyear (1967), is concerned with those species which were locally or nationally scarce. These two papers give a valuable insight into conditions and the status of Odonata during the twenty-five years succeeding the Second World War and readers are recommended to read them for comparisons. This short paper, subjective though it may be, is the result of experiences gained by myself and fellow enthusiasts in the New Forest Study Group from 1977 to 1991. It attempts to outline trends of change during this period and, in the case of the rare migrants, to tabulate known observations.

An overview

The post–1945 trend of deterioration of streams and rivers has continued throughout this period. Pollution in varying forms on the larger rivers, and scrub incursion on the smaller streams, are situations with which riverine dragonflies are coping at present but, should these conditions further deteriorate, there must be concern for their long-term future. The Forestry Commission has made some inroads to the scrub problem in their selective 'lawn' clearance programme. Where this has been carried out there is a marked improvement in the general

health of the streams concerned. Still-water species continue to flourish with some of the larger disused gravel pits, particularly those in the Avon valley, now attaining good vegetational cover and providing reservoirs of previously scarce species for dispersal. Some of the smaller ponds are showing the signs of lack of management with the encroachment of Grey Sallow (*Salix cinerea*) and several decades of silt. Numerous new ponds have been created but few are situated other than in coniferous areas and none has been excavated with invertebrates in mind.

Sub-Order Anisoptera

1. *Brachytron pratense* (Müller). Historically Sowley Pond has always been known for its large population of this species. In the late 1980s individual males were frequently seen patrolling the Lymington river near Boldre and at a small pond near Norley. The proximity of Sowley makes dispersal to these areas most probable but this year a mating pair was seen at the small pond although no subsequent oviposition was observed in spite of a very careful watch being kept. Middle Pond on Beaulieu Estate holds another breeding colony but much smaller than that at Sowley. I suspect that there have, in the past, been many attempts by this species to disperse and colonise other waters, but there are few in the locality which are wholly suitable and Sowley Pond remains its true home here.

2. *Gomphus vulgatissimus* (Linnaeus). *'..... its true home is the New Forest where, in the course of a morning's walk more specimens may be seen than the total records for the whole of the other localities'.* Lt-Col. F. C. Fraser, 1950.
'Exuvia were numerous, mostly on the grass, but a few clinging to the reeds a foot above the water'. Keith Goodyear, 23 May 1965.
'.... last seen 1981.....can now be considered extinct'. Keith Goodyear, pers. comm.
Looking at the New Forest streams now it is difficult to believe that this species ever occurred here at any great density. The evidence shows that it clearly did and its demise is evidently related to stream channelling and consistent removal of emergent vegetation in efforts to improve hydrological efficiencies.

3. *Aeshna mixta* Latreille. Previous papers have considered this species as primarily an immigrant while noting the probability of breeding. Now it is undoubtedly the most common late summer aeshnid with exuviae having been found at numerous New Forest pond localities and at gravel pits in the Avon valley where very high numbers of adults can be seen with regularity. This species has increased dramatically within the last decade.

4. *Aeshna grandis* (Linnaeus). This has not enjoyed the dramatic population explosion of the previous species but significant populations have been established in the Avon valley. During the mid-1980s *grandis* was regularly seen at some of the more significant ponds in the west of the New Forest with copulation and oviposition being observed at Whitten and Broomy ponds. I doubt the success of these efforts as no specimens other than fully mature were ever seen, and neither have exuviae been found. Latterly no specimens at all have been seen in the New Forest but the colonies are still very strong at Blashford Lakes. Considering the fact that Fraser speaks only of isolated sightings, this is another success story.

5. *Cordulia aenea* (Linnaeus). Commented on as *'widely distributed throughout the Forest'* by Fraser and *'abundant at one New Forest pond.....extinct at another.....'* by Goodyear. Currently the description by Fraser is more apt. There are strong colonies at all the larger ponds in the New Forest, the better ones being at Eyeworth and a series of ponds on Beaulieu Estate. I believe population densities to have increased in the last few years, particularly since the hot dry summers of 1989 and 1990. This coincides with a depression in the numbers of *Libellula depressa* and *L. quadrimaculata* and it is possible that the decreased larval competition may be one of the reasons for this increase.

6. *Libellula fulva* Müller. Still common in its favoured areas in Dorset, it maintains variable colonies on the slower reaches of the River Avon and quite good numbers in sheltered backwaters. There is no reason to suppose any change in status.

7. *Sympetrum sanguineum* (Müller). The first breeding colonies in this area were located by Noelle and Tony Welstead in 1985. I believe that these were the first New Forest records since we began recording in 1977. At the same time I was alerted to another colony, this time on Forestry Commission land, by John Bowers. This colony, albeit small, has persisted on and off ever since but in spite of having personally witnessed copulation and oviposition I am reluctant to confirm successful colonisation because the adults are seen only late in the season and they do not compete well with the resident *S. striolatum*. This insect is commonly and regularly seen at numerous localities each year and I have little doubt that breeding does occur on the larger ponds particularly those which have Reed Mace (*Typha latifolia*). The increase noted is probably the result of the vegetational development of ponds created 40 or 50 years ago. It is, however, difficult to believe that the larger ponds on the private estates now differ very much from their condition in the past. It is equally difficult to believe that earlier observers missed this species and it may well be that they were denied access.

8. *Sympetrum flaveolum* (Linnaeus). I have only once encountered this species, a male, resting on a timber stack in Hawkhill Inclosure, July 1982.

9. *Sympetrum fonscolombei* (Selys). One specimen was seen in Wootten Inclosure during the very early 1980s by a friend of mine, the late Ray Brett. During 1984, 1985 and 1986, isolated individuals were recorded at Long Pond South in the west of the Forest. Also in 1985, two males were seen from 27 July to 1 August by George Green while carrying out a survey of Blashford Lakes. To the best of my knowledge, all of the records have been made during late July.

Sub-Order Zygoptera

10. *Platycnemis pennipes* (Pallas). Once *'.... a common insect throughout the Forest ....'* (Fraser, 1950), now restricted to a short section of the Ober Water where it does, surprisingly, maintain a stable population. On occasions it is difficult to find but diligent searching amongst the Bog-myrtle (*Myrica gale*) always produces numerous specimens. Maximum counts of adults are in the region of one hundred plus and larvae are not difficult to find in the adjacent stream. Population decline can probably be ascribed to the same reasons as those for the extinction of *Gomphus vulgatissimus* whose habitat this species shared.

11. *Coenagrion mercuriale* (Charpentier). There are now upward of thirty colonies in the New Forest. Of these, those colonies comprising the Beaulieu Heath West complex are by far the largest. Numbers decline in one colony and increase in another as local conditions change. The change is due to the encroachment of Bog-myrtle which gradually envelops the stream, making flight along the water impossible. Local cover, however dense, on one side of the stream is tolerated, indeed it may even be desirable, but as soon as the water becomes covered then the area becomes deserted. The one mainstream colony on the Ober Water disappeared after the vegetation was removed in 1977. At Holmsley the removal of seedling pine coincided with the demise of a small colony in about 1987 although it had been greatly diminished since the time Philip Corbet used it as one of his sites for the study of the life history of this species. Likewise at Stag Brake a thriving colony of one hundred plus males has been dramatically reduced by removal of self sown pine, thereby exposing the site to the elements. It should be noted that the self sown Scots Pine (*Pinus sylvestris*), which can cover vast areas, is the single greatest threat to heathland conservation. Its removal does not pose an overall threat to *mercuriale* in this area.

12. *Coenagrion pulchellum* (Vander Linden). Only one colony has ever been known from this area, Sowley Pond. Until the gales of 1989 it was abundant along the southern bank. Sadly now it is very scarce. The one essential factor for the well-being of this species is shelter and much of this was removed both by the gale and the subsequent extraction of the timber which also destroyed much of the emergent bankside vegetation. Only time will tell whether a recovery is possible. There are other areas around the pond where it may persist but I know it only from the southern margins.

13. *Ischnura pumilio* (Charpentier). During the middle of the last decade this species had an unprecedented population explosion. This was due to the programme of small flood relief channels on the New Forest lawns which was executed a few years before. As vegetation developed in these channels so an ideal habitat was created. Now with the rapid deposition of silt many channels have already disappeared and others are completely choked. In parallel with this, the railway line near Burley (drained in 1978) has reached a similar ideal habitat situation and vast numbers of *pumilio* could reliably be found. Unfortunately a series of gravel slips from the cutting sides and the rapid growth of *Sphagnum* mosses in the drain impeded drainage to an extent where rush *(Juncus effusus)* became dominant and created an environment too densely vegetated for the species. Coincident with this was the growth of pine and scrub on the cutting sides which greatly reduced the light reaching the floor, further decreasing the site's value as a habitat for dragonflies. The situation has been recovered to a small extent by the removal of some of the pine. The species now has been confined to its original home in the valley mires where, of late, it has been difficult to locate.

14. *Erythromma najas* (Hansemann). Neither Fraser nor Goodyear record this species from the New Forest so we must consider that its current comfortable state is an improvement. It is abundant at Eyeworth Pond, recovering its numbers following a decline when wildfowl were encouraged to breed in large numbers during the early 1980s, at Boarmans Pond on Beaulieu Estate and at Sowley Pond, although numbers here are much reduced following a recent reduction in the aquatic vegetation. It is from these three main sites that dispersal takes place and small colonies occasionally thrive for a few years on other

smaller ponds. Drought, competition from other species and being unable to distance itself from other species may well be the reasons for its inability to gain permanence on the smaller ponds.

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How much does acidity affect the distribution of 'acidophilic' dragonflies?

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Introduction

Many authors have commented on the propensity of certain species of dragonfly to be associated with acidic waters. For example, Corbet *et al.* (1960) discuss the distribution of British dragonflies and suggest that acidity is an important parameter governing their distribution. Such acidophilic species include *Aeshna caerulea, A. juncea, Orthetrum coerulescens, Sympetrum danae, Ischnura pumilio, Coenagrion mercuriale* and *Ceriagrion tenellum*. In their review of New Forest dragonflies, Welstead and Welstead (1984) cite acidity of the water as a major factor affecting the choice of Odonata breeding habitat. To the above list of species they add *Lestes sponsa, Calopteryx virgo* and *Cordulegaster boltonii* as being restricted to acidic sites. Similarly, McGeeney (1986) notes that waters with a low pH support a particular suite of species including *A. juncea, S. danae, O. coerulescens* and *C. tenellum*. Miller (1987) also states that pH affects the distribution of larvae and notes that *Libellula quadrimaculata, Pyrrhosoma nymphula, A. juncea, A. caerulea, S. danae, Leucorrhinia dubia and C. tenellum* all occur in acid bogs.

Another species often added to the list of species favouring acidic conditions is *Cordulia aenea*. For example, Gibbons (1986) states that this species has a slight preference for acidic lakes but will also occur in neutral or even calcareous sites. Here the emphasis is still placed on pH being an important factor affecting occurrence. Gabb and Kitching (1992) note that in Cheshire *C. aenea* is confined to a cluster of acidic pools.

That certain species of dragonflies are affiliated to a particular pH of water is a recurring theme in most of the recent publications dealing with the regional distribution of Odonata. However, while undoubtedly there is some correlation between pH and Odonata distribution, I think that this is a simplistic way of explaining distribution patterns.

Field observations

I first began to doubt the veracity of this accepted wisdom when I carried out a survey of Odonata of the Bourne Valley, Dorset, in 1989. This relatively small site occupied a narrow corridor about two miles long and about half a mile wide. However, it contained a wide variety of dragonfly habitats. A shallow, fast-flowing stream ran through the entire site. At its northern end the stream was pH 7.2 but this fell to pH 6.1 as it drained the surrounding wet heathland. The heathland contained a large number of pools and seepages that ranged from pH 4.0 to pH 6.8. Also on the site were two large ponds: at Talbot Pit the water was pH 6.6-6.8; at the second pond it varied from pH 6.8 at the stream inflow to pH 8.0 at the outfall.

The pools on the heath supported the typical acidophilic species, including *C. tenellum, A. juncea and O. coerulescens.* The two ponds supported a different group of species that were not present at the bog pools, such as *Enallagma cyathigerum, Erythromma najas, Anax imperator, Aeshna grandis, Orthetrum cancellatum* and *Libellula depressa.* However, although these 'pond' species were not present at the bog pools all three of the 'acidophilic' species were breeding at one or other of the ponds, albeit in low numbers. This observation suggests that the apparently acidophilic species are actually able to tolerate a wide pH range, from very acidic waters to water that is alkaline. Conversely, the group of 'pond' species were less tolerant of low pH but it should also be noted that they did not occur at those bog pools in which the pH was the same as the ponds.

The North of London BDS group has been studying the distribution of *Cordulia aenea* in Epping Forest and Burnham Beeches. Although often referred to as an acidophilic species, our studies have revealed it to be breeding in ponds with pH values ranging from 6.4 to 7.5. Similarly, *Ischnura pumilio* will breed in waters across a wide pH range (Fox, 1987) and *C. mercuriale* is now known to tolerate a wide range of pH (Winsland, 1985).

In Scotland, Garth Foster (pers. comm.) has been studying acid bogs that were limed in order to combat the effects of acid rain. The pH of many of the bog pools have risen from 4.0 to 8.0. Despite this, even five years after liming, the pools still supported larvae of *P. nymphula, A. juncea* and *S. danae*, which are usually thought of as acidophiles.

Conclusions

From these examples it appears to me that it is not simply the pH of the water that is governing the distribution of these species. In the case of *C. aenea* many factors appear to be responsible, but especially the presence of trees at the edge of the pond. *I. pumilio* breeds in warm shallow seepages, whether acidic or alkaline. The physical structure of the habitat is far more important in affecting the distribution of these two species than pH. The structure of the limed pools in Scotland remained largely unchanged and so *P. nymphula, A. juncea* and *S. danae* continued to breed. What was far more important in governing the bog pool Odonata faunas was whether the pools were temporary or permanent.

In the Bourne Valley the ponds supported luxuriant growths of macrophytes whereas the bog pools contained few plants. These structurally simple bog pools perhaps present suboptimal conditions for the pond species which do not breed in them. Work by Havas (1981) and Sutcliffe (1983) indicates that some invertebrate species have problems

with sodium and calcium regulation at pH values below 5.5 and this also may limit the ability of some dragonfly species to colonise highly acidic waters. However, the typical bog pool species may be able to tolerate more extreme conditions, or have less specialised habitat requirements, and thus do well in the less hospitable bog pools but also occur in the ponds that have a higher pH. Their lower numbers in the large ponds may be attributable to competition from the more aggressive pond species.

The pH of the water is often the first chemical parameter that is measured during the investigation of the ecology of a dragonfly species and the distribution of a particular species often correlates with pH. However, I suspect that pH is only indirectly influencing the distribution of many species of Odonata and that, as more information is obtained on the ecology of different species, the physical structure of the habitat will be found to be of overriding significance.

Acknowledgements

I would like to thank Dr Garth Foster for encouraging the development of this train of thought.

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Comphus vulgatissimus (Linnaeus) in Oxfordshire and Hampshire

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In the sixties, when Gom*phus* flourished on the Ober Water in the New Forest, I observed its habits and behaviour, assuming everything seen to be typical for the species, knowing no other sites at that time (Goodyear, 1967). This year (1993), on visiting the Goring area on the Thames on 29 May, 1 June and 4 June, I was struck by the comparisons of the two sites, coming to the conclusion that those populations in the New Forest were probably already struggling in a habitat not ideally suited to their needs.

The waterways themselves are vastly different, but almost all adults emerging in the Forest did so on short-cropped grass a few feet from the water, with the larva horizontal. Only very occasionally was one found vertically on an emergent stem, and Cynthia Longfield (1937) observed that the widely separated legs were not adapted for climbing reeds. However, the marginal sedges and bankside grass was so heavily grazed by ponies and Fallow Deer that, in retrospect, they had little available choice. Certainly the proportion emerging at Goring on the vertical concrete viaduct wall, wood shuttering, and marginal willows showed ample ability to use a wider surface. Averill (1991) reported 71 per cent vertical emergence and only 7 per cent horizontal, in a five year study. The grass at Goring is not grazed and the majority of *Comphus* larvae emerge within it, at a height of up to a foot, but they can attach themselves vertically by grasping a group of stems together.

It was also observed that in every case, the emerging imagine remained in a vertical position when at the 'resting' stage, instead of adopting the usual method for other species of hanging backwards. The latter position would be dangerous when emerging from a horizontal larva; unfortunately no record of failed emergences appears to have been kept for the New Forest. Failures appeared very low, with little avian predation, with the notable exception of May, 1965, when Red-backed Shrikes nested a hundred yards upstream. Chaffinches would on occasion take them, and grazing with trampling was always a possibility.

Comphus is present at Goring in larger numbers than were ever on record in the New Forest, but avian predation was also observed to be very high. Several pairs of Jackdaws were nesting in the sides of the railway viaduct and had noisy young. The adults were taking emerging tenerals, usually at the resting stage, with a snap of the beak usually including the exuviae. In addition Magpies were in the adjacent trees and taking them in a similar manner. The other principal predators were Blackbirds whose technique, somewhat more delicate, was to leave the exuviae, rub off the expanding wings, and fly away with the remainder. Large numbers of discarded wings along the banks possibly accounted for some of the considerable difference in the numbers of exuviae found, and the numbers of tenerals resting in the adjacent fields.

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Notes and observations

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My thanks again to all who have sent in their sightings to make another interesting section. As there have been no adverse comments, I am keeping to the same format for these reports. Looking ahead, could I please have all records for the next Journal by 15 July please.

All records which follow are for 1993 unless otherwise stated.

Mixed pairing

On 11 September at Chartley Moss near Stafford a male Common Hawker *(Aeshna juncea)* caught up an ovipositing female Southern Hawker *(Aeshna cyanea)* from rushes, and after attempting to mate they separated in the air and returned to the pool, whereupon the *cyanea* resumed ovipositing. Soon after the male *juncea* successfully achieved the wheel position with a conspecific female. (A)

Behaviour

On 16 August at Yeovilton, Somerset, a female Emperor *(Anax imperator)* was ovipositing. On three occasions, whilst she was in flight, a male *Anax* deliberately rammed her amidships, knocking her into the water. Can anyone suggest why? (H)

Range expansion and large populations

On 18 May a male Hairy Dragonfly *(Brachytron pratense)* netted at Newdigate, Surrey, may be the first record for that 10km square (D)

On 17 August numbers of Black Darters *(Sympetrum danae)* were seen at what could be a new site in Faygate, Sussex. (F)

Observations of Banded Demoiselle *(Calopteryx splendens)* between 15 June and 5 July, and of Black-tailed Skimmer *(Orthetrum cancellatum)* between 28 July and 17 August, at the Saltwells Local Nature Reserve, Brierley Hill, W. Midlands, are new records for the site. (A)

At the Chartley Moss National Nature Reserve on 13 August huge numbers of Black Darters *(Sympetrum danae)* were seen. A series of 5m x 10m box counts gave a total of 12,800 which did not take into account large numbers elsewhere on the Moss, and the conclusion was that on that day up to 15,000 may have been present. (A)

At Wicken Fen, Cambridgeshire, unusually high numbers of Emperor *(Anax imperator)* were noted this year. (N)

Odonata as prey and as predators

On 15 June, by the Wey and Avon canal, Newbridge, Sussex, a very loud buzzing sound was heard, and a brown 'ball' was seen in the air at about knee-height. When netted it was found that the 'ball' consisted of a pair of Hairy Dragonflies *(Brachytron pratense)* and a male Emperor *(Anax imperator)*. It is assumed that the *Anax* had attacked the *Brachytron* pair whilst they were mating. (J)

On 3 July at Priddy Minories, Avon, a male Emperor *(Anax imperator)* caught a Four-spotted Chaser *(Libellula quadrimaculata)* in flight and took it down to the ground to eat. (E)

On 7 July at Esher Common, Surrey, a Brown Hawker *(Aeshna grandis)* was hawking when a male Emperor *(Anax imperator)* shot about fifteen inches vertically upwards from bracken to grab the *grandis*, upon which both fell back into the bracken. The *Anax* started to eat the *Aeshna* but flew off before it finished its meal. (J)

A Brown Hawker *(Aeshna grandis)* was patrolling the river near Hampton Lode, Bridgnorth, Shropshire on 5 August. There were four Banded Demoiselle *(Calopteryx splendens)* displaying in and around the bankside reeds. The *Aeshna* swooped down and took one of the *splendens* in flight and began eating it before flying with it into a tree to finish its meal. (A)

On 15 August a male Blue-tailed Damselfly *(Ischnura elegans)* was seen on a lily pad at Ifield Wood, Sussex, being bitten round the prothorax by another male *elegans*. They both soon flew off. (F)

Miscellaneous

On 4 June on Bovington Ranges, Dorset, a newly-emerged teneral Golden-ringed Dragonfly *(Cordulegaster boltonii)* was found, still too weak to fly, in an area of seepage about 30 yards from the nearest running water (a small shallow ditch). Either the larva had crawled a long way from the ditch, or it had emerged from the uncharacteristic breeding site of the seepage. (H)

At Crawley, Sussex, on 22 July, a female Azure Damselfly *(Coenagrion puella)* was flying with the terminal segments of a male still attached to its pronotum. (F)

On 16 August near Ilchester, Somerset, three Emerald Damselflies *(Lestes sponsa)* were ovipositing simultaneously and close together into a single stem of Yellow Flag at about four feet above the water level. This seems to be unusually high. (H)

An ovipositing female Emperor *(Anax imperator)* at Crawley, Sussex, on 13 August, had the coloration of a male. (F)

On 23 September in Crawley, Sussex, a female Common Darter *(Sympetrum striolatum)* was seen with much red on dorsal abdomen (not just a thin line but quite extensive). (F)

Also on 23 September in Crawley, Sussex, a teneral (i.e. yellow) male Ruddy Darter *(Sympetrum sanguineum)* was seen paired with a female, indicating a recent and late emergence. (F)

Dates

Quite a lot of records were received of first and last dates, and it is clear that this is becoming increasingly interesting to observers. Space does not permit listing every date here,

but a selection is given which hopefully gives some idea of the 1993 flight periods for some species. All November records are given (there were more of these than was perhaps expected after the early cold snaps which some parts of the country experienced).

Firstly, a correction to this part of the report in the last Journal. The first date of 28 June 1993 for Ruddy Darter *(Sympetrum sanguineum)* was at Stanmore, Middlesex (not Stanwell).

Beautiful Demoiselle *(Calopteryx virgo)*
- 30/4 Torpoint, Cornwall (L)

Banded Demoiselle *(Calopteryx splendens)*
- 11/5 Bushy Park, Middlesex (C)

Emerald Damselfly *(Lestes sponsa)*
- 30/6 Capel, Surrey (D)

Large Red Damselfly *(Pyrrhosoma nymphula)*
- 25/4 Seaton, Devon (L)
- 27/4 Newdigate, Surrey (D)

Blue-tailed Damselfly *(Ischnura elegans)*
- 27/5 Torpoint, Cornwall (L)
- 27/5 Radipole Lake, Dorset (M)
- 28/5 Staines Moor, Middlesex (M)

Azure Damselfly *(Coenagrion puella)*
- 2/5 Torpoint, Cornwall (L)
- 6/5 Elstree, Hertfordshire (G)

Common Blue Damselfly *(Enallagma cyathigerum)*
- 8/5 Liskeard, Cornwall (L)
- 10/5 Newdigate, Surrey (D)

Red-eyed Damselfly *(Erythromma najas)*
- 13/5 Esher, Surrey (D)

White-legged Damselfly *(Platycnemis pennipes)*
- 29/5 nr Waltham Abbey, Essex (G)
- 7/6 Stopham, Sussex (D)

Southern Hawker *(Aeshna cyanea)*
- 20/6 Bodmin Moor, Cornwall (L)
- 4/11 Crawley, Sussex (F)

Common Hawker *(Aeshna juncea)*

Brown Hawker *(Aeshna grandis)*
- 29/6 Brierley Hill, W. Midlands (A)
- 2/7 Elstree, Hertfordshire (G)

Migrant Hawker *(Aeshna mixta)*
- 16/7 Brierley Hill, W. Midlands (A)
- 17/7 Minsmere, Suffolk (M)
- 19/7 Elstree, Hertfordshire (G)

Emperor *(Anax imperator)*
- 28/5 Newdigate, Surrey - cast exuviae (D)
- 6/6 Tregantle, Cornwall (L)
- 4/9 Seaton, Devon (L)
- 20/8 Leatherhead, Surrey (D)
- 21/8 nr Radlett, Hertfordshire (G)
- 11/10 Richmond Park, Surrey (C)
- 20/8 Crawley, Sussex (F)
- 22/9 Brierley Hill, W. Midlands (A)
- 24/9 Ifield, Sussex (F)
- 31/8 Brierley Hill, W. Midlands (A)
- 2/9 Ifield, Sussex (F)
- 10/10 Elstree, Hertfordshire (G)
- 11/10 Richmond Park, Surrey (C)
- 19/9 nr Radlett, Hertfordshire (G)
- 14/10 Brierley Hill, W. Midlands (A)
- 17/9 Brierley Hill, W. Midlands (A)
- 11/10 Elstree, Hertfordshire (G)
- 12/10 Elstree, Hertfordshire (G)
- 2/11 nr Berkhamsted, Herts (A)
- 5/11 Richmond Park, Surrey (C)
- 26/8 St. John, Cornwall (L)
- 29/8 Elstree, Hertfordshire (G)
- 31/8 Crawley, Sussex (F)

Golden-ringed Dragonfly *(Cordulegaster boltonii)*

6/6 Tregantle, Cornwall (L)
4/9 Hessenford, Cornwall (L)

Broad-bodied Chaser *(Libellula depressa)*

23/5 Brierley Hill, W. Midlands (A)
24/5 Capel, Surrey (D)
27/5 Radipole Lake, Dorset (M)
29/8 Hessenford, Cornwall (L)

Common Darter *(Sympetrum striolatum)*

13/6 Torpoint, Cornwall (L)
4/11 Bewbush, Sussex (F)
5/11 Ockley, Surrey (D)
6/11 Polbathie, Cornwall (L)
12/11 Sanderstead, Surrey (K)
15/11 Elstree, Hertfordshire (G)
15/11 Richmond Park, Surrey - one pair still ovipositing on 12/11 (C)

Ruddy Darter *(Sympetrum sanguineum)*

9/10 Welney, Norfolk (M)

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Book Review

Suffolk Dragonflies. Howard Mendel. Suffolk Naturalists' Society (1992).
159pp. £12.00. Available from Suffolk Naturalists' Society, c/o The Museum, High Street, Ipswich IP1 3QH.

The vogue for county dragonfly faunas is now well established and has shown increasing trends towards high-quality publications. *Suffolk Dragonflies* is a fine example of this genre and sets standards on which writers of future faunas will find hard to improve. Its author, Howard Mendel, is head of the Natural Sciences section at Ipswich Museum.

The book is beautifully produced and printed. The attractive format, with full colour hard covers and many illustrations, are complementary to a very thorough study of the status of Suffolk dragonflies, past and present.

Following the Foreword by Norman Moore, the most important background chapters deal with the dragonfly habitats of Suffolk, conservation, and the history of dragonfly recording in the area. The latter culminated in the major survey of 1987-1992, which provided the modern basis for the book. The author, as County Recorder, directed this work in association with local naturalists and the Suffolk Biological Records Centre.

All species which have been recorded from the county are included, plus one or two which are less certain. Four species are known to have become extinct (Downy Emerald, Black Darter, Scarce Emerald Damselfly and Small Red Damselfly). On the credit side, eight species are considered to have increased since 1929. The discovery for the first time ever in East Anglia of a colony of the White-faced Darter *(Leucorrhinia dubia)* was made just in time to include in the book. The origins and status of this population remain uncertain.

The species accounts are comprehensive. They include notes on habits, but sensibly avoid identification issues. The well-researched historical material is frequently referred to, with extracts, quoted in italics, giving an extra dimension of authority to the text.

Each species' account features a neat graphic which includes a good-sized dot distribution map based on 2km tetrads. Three date classes are used, the latest being 1980-1992. A smaller inset shows 10km square records for the whole of East Anglia for the latter period. There is also a flight season indicator, with earliest and latest recorded occurrences noted separately. Other good features of the text include a guide to Odonata names, a full bibliography, a list of useful addresses and a comprehensive index to species.

Full-colour illustrations appear throughout the book, many at half page size. They are of good or very good technical quality and well reproduced. There are ten shots of important sites, three of larvae and 57 of adult Odonata, showing both sexes of many species. Reproductive activity is often included, and features one or two unusual images such as a blue form *Anax imperator* female ovipositing. All the species occurring in Suffolk (and therefore all the widespread British species, except *Cordulegaster boltonii*) are illustrated.

The author and publishers alike are to be congratulated on an excellent piece of work, which will be a must for all who are interested in Suffolk dragonflies, or who just like good natural history books.

David Clarke

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

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