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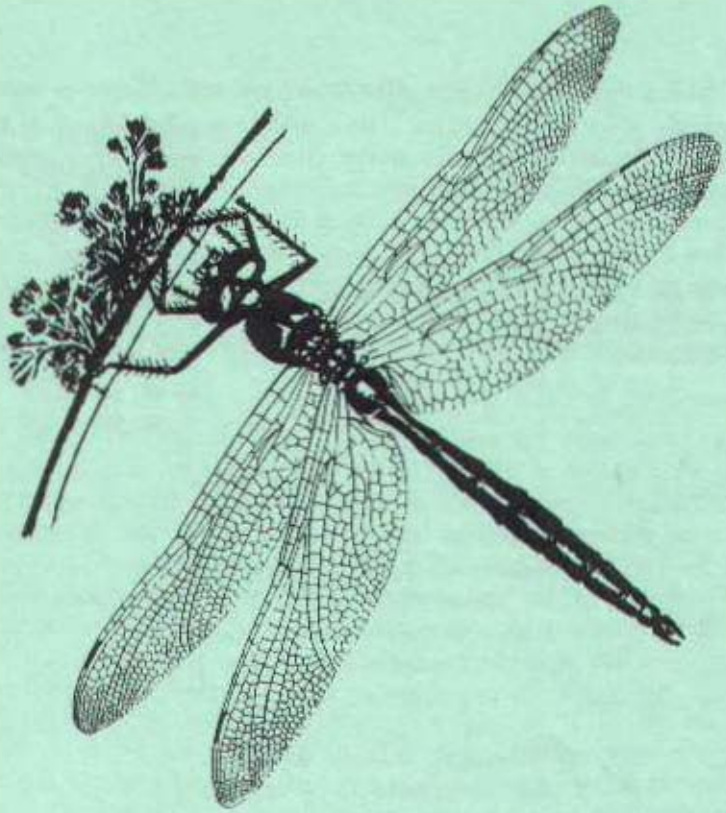

Edited
by
S. Brooks

affiliated to the Societas Internationalis Odonatologica

The *Journal of the British Dragonfly Society*, normally published twice a year, contains articles on Odonata which have been recorded from the United Kingdom. The aims of the British Dragonfly Society (B.D.S.) are to promote and encourage the study and conservation of Odonata and their natural habitats, especially in the United Kingdom. The B.D.S. is affiliated to the Societas Internationalis Odonatologica (S.I.O.).

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Front cover illustration of *Somatochlora metallica* by R. H. Dunn

Libellula depressa in Cumbria: a case of natural colonisation, or an accidental introduction?

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Libellula depressa is a most attractive dragonfly which appears to be widely distributed in southern England and Wales, but further north the species becomes more localised, with the northern-most records on the west coast being from Cheshire (Hammond, 1983). It was therefore an exciting event when I was told that a male had established a territory over a garden pond at Eskmeals, near Ravenglass, Cumbria (SO 092926). The pond itself is small (4m by 3m), weakly acidic (pH 5.5.-6.5) and dries out in the summer if not topped up. The pool is surrounded to the north, east and west by a small but dense bed of *Phragmites*, and is, therefore, quite sheltered. The only other odonates present in the pool are *Pyrrhosoma nymphula*, *Ischnura elegans* and *Coenagrion puella*.

Small larvae were found during August 1983 when weed from the pool was removed and placed in an aquarium. Netting the pool in March 1984 produced a number of large larvae, which I casually assumed were *L. quadrimaculata*, a common species in the Ravenglass area. The subsequent emergence of adult *L. depressa* indicated that I was mistaken. A male was present over the pool, on and off for about one month, during late May and June, and mating and oviposition was observed on two occasions, although such behaviour probably occurred more frequently. It is possible that other pools in the locality were also used, although no such observations were made.

The main problem is, how did the species get there? No deliberate introduction of the species was made. During the past two years I have been engaged in field work near Eskmeals, and in Hampshire, which has involved netting pools at both sites. *L. depressa* is common at the Hampshire site, however, I cannot imagine any way in which the species could have been translocated, except by the eggs being transferred from one pool to another by sticking to the wide mesh of my pond-net, an unlikely proposition. It may well be that the species has colonised the pool naturally. Another southern insect, *Dytiscus circumflexus*, which previously had its most northern station in Cheshire (Banks, in prep.) has become established in a number of pools in the locality during 1983/84.

In conclusion, it cannot be said for certain how the species arrived in Cumbria. However, the dragonfly has managed to complete one generation in the county, and it will be interesting to see if it survives the northern climate any longer and if it is able to extend its range. It is certainly an impressive addition to the garden!

Acknowledgements

I am grateful to Mr. A. B. Warburton for access to his pond, and apologise for occasionally wrecking it with my netting activities!

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The red-veined darter (*Sympetrum fonscolombei* (Selys)) in Devon and Cornwall, 1984

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Late in July, 1984, a swarm of seven Red-veined darter dragonflies (six males, one female) were found on the shores of a lake in west Cornwall by Mr. H. P. K. Robinson. All but one were in good condition. By August 8th they had all apparently departed.

On August 17th, at 10.00 hours, in bright sunlight, I approached the north-east shore of the triangular lake behind Beesands beach (south-east Devon), where a very red *Sympetrum* was immediately spotted, basking on the bleached shore. On examination through modified close-focus binoculars I identified the insect as a male *Sympetrum fonscolombei*. (The careful conversion of an old pair of binoculars to close focus use, by unscrewing one or both eyepieces, can provide a very preferable alternative to netting). It transpired that four or five specimens of the dragonfly were present at this beautiful lake, which is mainly fringed with tall sedges and reeds. Is it possible that this small group of dragonflies travelled the 100 miles from Cornwall to Beesands?

My observations on the colouration of these specimens may provide a helpful supplement to the descriptions of *fonscolombei* given in Hammond (1983). The abdomen, including the anal appendages, is a very striking, brilliant, slightly pinkish crimson. This uniform colouring is not interrupted by any black segment rings after the first two segments. The two very prominent black marks on the ninth and tenth segments are slightly irregular in shape, and the two similar marks on the sides of those segments are equally prominent. The entire thorax is scarlet in contrast to that of *S. striolatum*, which has pale lateral stripes and is a rather scruffy brown dorsally. The upper part of the face
west Cornwall I observed one specimen with the black-edged pterostigma pale primrose, but in all other specimens a soiled yellow would be a more appropriate description.

The appearance of the wing colouration is fascinating because the immediate surroundings are so influential. The wings can vary from a brilliant crystal-glass clarity over white pebbles; brown over dark earth; rust red-brown in certain angles in sunshine; partially red; pale green from reflections whilst hovering over weed; to a hint of blue over water. All the specimens seen were mature. In certain light conditions, it is difficult or impossible to see any red veining with the naked eye. *S. striolatum*, however,
scarlet wing attachments, although of similar brilliance in both species, only stand out in the commoner species.

S. fonscolombei is a shorter and stouter dragonfly than *striolatum*. The abdomen tapers very gradually and evenly, with no hint of a "wasp-waist". Both species usually adopt a perky stance when first alighting, with the tip of the abdomen raised. At rest, *fonscolombei* keeps the abdomen straight, only allowing the tip to rest, whilst *striolatum* creates a "sagging" impression with the last three segments touching the ground.

It was interesting to note that these far-travelling migrants tended to remain in a group, on a short stretch of beach shared with *Orthetrum cancellatum*, at both sites. At Beesands, *fonscolombei* was hovering and cruising in the company of *Aeshna mixta* and *Anax imperator* and one specimen was seen to be taken by an Emperor dragonfly. Late one evening at Beesands two specimens were found apparently roosting in grass some thirty metres from the water. *S. fonscolombei* often ventured far out across the water, returning at intervals to bask on the favoured stretch of shore. It was spectacular to see this dapper dragonfly wander out over the millpond calm, under a blue sky, with its brilliant red body and the blueish wing reflections so vividly referred to by Hammond (1983).

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Population fluctuations in New Forest dragonflies

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The years 1983 and 1984 have been notable in the New Forest for low densities of some species of Odonata which are normally abundant. Both years have had unseasonal Spring weather; 1983 was cold and very wet, and 1984 was cold and abnormally . In 1983 *Pyrrhosoma nymphula* and *Enallagma cyathigerum* emerged in usual numbers but were subsequently decimated by severe rain and hail storms. During the ensuing hot spell populations increased but never achieved their usual densities. In 1984, emergence was somewhat later but even by mid-July they were still not common. Although oviposition may have been less in 1983, less intraspecific larval competition due to lower initial density should have redressed the balance somewhat. The situation was similar in the Anisoptera; *Anax*, which normally tenants all suitable water from early June onwards, was very scarce. The first specimen seen this year was on June 24th. *Libellula quadrimaculata*, normally very abundant locally, was also well down in numbers in 1984.

Other species, such as *Orthetrum cancellatum* and *O. coerulescens*, were plentiful and we have seen unusually high numbers of the former species in the New Forest this year. *Cordulegaster boltonii*, *Calopteryx virgo* and *Coenagrion mercuriale* are locally abundant, possibly with even higher numbers than usual. *Coenagrion puella* reached its usual abundance and was common even on ponds which are normally dominated by *E. cyathigerum*. In 1983, *Cordulia aenea* emerged later than usual and was seen from mid-June until the beginning of August in high numbers. This year it was seen in mid-June but by mid-July could not be found, even though the weather was amenable.

On face value and from rather personal subjective observations, not all of the disparities can be attributed to local weather conditions. Could it be possible that some species may attain cyclical peaks as is sugge
Holly
1977 were very good years for all Odonata species in the New Forest, as was 1982.

Brachytron pratense (Müller) and other Odonata of the Black Lochs, Argyll

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Following our discovery of *Coenagrion pulchellum* at the Black Lochs on 31st July 1983, we revisited the area on four different occasions in 1984. The Black Lochs, NM925315, lie approximately 6 Km east of Oban. They extend for about 3 Km in a NE direction as a string of three lochs each connected to the next by a short, narrow, canal-like stream. Low hills surround the lochs affording shelter. On the west side is improved grazing land and some cultivated fields, backed by extensive old oak woods. There are four or five feeder burns on the east side and one main outlet stream, the Lusragan Burn, leaves at the SW corner. Off-shore there is a fringe of tall emergent vegetation, mainly reeds (*Phragmites communis*) but also Bulrush (*Schoenoplectus lacustris*) and Saw Sedge (*Cladium mariscus*). Some of these form dense stands but there are many areas where the reeds form a thin screen with patches of open water among the water-lily pads. The bank-side vegetation is dominated by Bog Myrtle (*Myrica gale*) in the wetter areas and by grasses where it is drier. East of the oak wood lies Loch Lagain, NM935315. This is a peaty pond, well vegetated and with *Sphagnum* bordering about a third of it. In the area of the Black Lochs the underlying rock is Andesite, an intermediate igneous rock of Old Red Sandstone age. There are also some raised beaches (Kynaston & Hill, 1908). The substrate in the sheltered areas of the Black Lochs is of fen peat. Water samples tested by universal indicator solution showed a pH just on the alkaline side of neutral.

The following Odonata were seen in 1984:

Calopteryx virgo: present on all feeder burns and on Lusragan Burn. The population numbered about 70 (including about 15 females) on a 200 m stretch of a narrow feeder burn on 5th July.

Lestes dryas: several on 12th August; over 200, including pairs ovipositing, on 25th August; over 20 still present on 14th September.

Pyrrhosoma nymphula: over 60, including females, on 4th and 5th July on feeder burns and by loch side.

Ischnura elegans: over 60, including females, on 4th and 5th July, still numerous on 25th August.

Enallagma cyathigerum: over 60, including females and some in tandem, on 4th and 5th July; still numerous on 25th August.

Coenagrion pulchellum: over 50, mostly males, on 4th and 5th July; only a few left on 25th August.

Brachytron pratense: two males noted, both acting territorially. One, at the most southerly loch on 4th July in a bay sheltered by a thin screen of reeds, was caught and retained. We were unfamiliar with this species but identified it that evening. The second, at the northern-most loch on the following day, patrolled a 140 m stretch of a narrow inlet where a burn entered the loch. It perched near us in perfect conditions and the yellow spot on the first segment of the abdomen was clearly seen. A small blue dragonfly seen hawking in the oak woods was probably this species.

Aeshna juncea: on 25th August several large aeshnas were seen but not positively identified. Some were almost certainly this species.

Aeshna cyanea: about three males on 25th August at the canal between the two northern lochans. In flight, when seen laterally, the contrast between the apple-green thorax and the blue abdomen was very noticeable and quite distinct from *A. juncea* in our experience. This character, useful in the field, is not stressed in our identification books. A large yellow *Aeshna* seen the same day was probably a female of this species.

Cordulegaster boltonii: on 4th and 5th July about 20 were seen, some in a glade in the oak wood, others patrolling the burns and flying along the loch-side. It was still present on 12th August.

Cordulia aenea: about seven males and one female seen on 4th and 5th July at both ends of the Black Lochs. A female was watched dipping the tip of her abdomen into the water at least ten times before a male grasped her and carried her off well away from the loch-side. The female was ovipositing in open water 15 to 60 cms deep, sheltered by thin stands of *Phragmites communis* and water-lily pads.

Libellula quadrimaculata: over 60 seen on 4th and 5th July in the glades and near the loch-side.

Sympetrum nigrescens: on 4th and 5th July over ten were seen, probably all immature males, in the wood and near the loch. Hundreds of both sexes were seen on 25th August when oviposition was observed. They were still present on 14th September.

Sympetrum danae: about 12 were present on 12th August and over 50 on 25th August. A few were by the loch-side on 14th September but over 30 were seen on the same day at Loch Lagan.

Specimens of *B. pratense* and *C. aenea* have been deposited in the Royal Scottish Museum, Edinburgh.

Discussion

During a visit to Scotland in 1845, Selys (1846) put *B. pratense* on the Scottish list on the basis of a specimen seen in Dr. Greville's collection. This record has been disregarded by most subsequent authors but Longfield (1948) attributed the occurence

to migration. There is no other Scottish record, the nearest being recorded before 1961 from Durham, some 300 Km to the southeast (Hammond, 1983). Although there is no evidence of breeding at the Black Lochs, two males were observed holding territory 2 Km apart, and another unconfirmed specimen was seen in the woods, suggesting a resident population.

Selys (1846) saw a reputed Scottish specimen of *A. cyanea* in the collection of Mr. Wilson of Edinburgh in 1845. Commenting on this record, Longfield (1948) says, "No one since that date seems to have considered this to be an authentic record, and so the matter remained, until the years 1939 and 1940, when Prof. Harrison recorded the capture in V.C. 104 of one specimen in 1933 in South Rona and a single specimen on Raasay in each of the years 1936 and 1937." However, Mackay recorded it from Argyll in 1866 (Lucas, 1900) but since Lucas' publication this record seems to have been disregarded. A small breeding colony was discovered in Morayshire in 1978 and there are three other recent Scottish records; two to the north of the Moray colony and one to the south of Oban (Hammond, 1983). At the Black Lochs breeding has yet to be proved, though the sighting of several territorial males and a probable female strongly suggests that there is a breeding population. *A. cyanea* may well have been a local resident in Scotland for many years.

Of the three other species present, which in general have a more southerly distribution, *C. aenea* fits neatly half-way between the known colonies in Stirlingshire and Inverness-shire. *C. virgo* is well represented in the area within a radius of approximately 75 Km from Oban but is present on some of the feeder burns of the Black Lochs in much greater numbers than elsewhere.

C. pulchellum was recorded in Hammond (1983) from only one 10 Km square in south-west Scotland. It had been recorded from a few sites further north in earlier literature but some of these records were discarded as doubtful in later years. In July 1845, while looking for dragonflies in Scotland, Selys (1846) saw one specimen either at Tarbet (Loch Lomond), Inveraray (Loch Fyne) or Oban. He also saw one in the collection of Mr. Blyth of Glasgow taken apparently at Renfrew (Longfield, 1948). Mackay recorded it for Argyll in 1886 (Lucas, 1900) but Evans was very doubtful of the authenticity of the mainland Argyll record (Longfield, 1948). King captured a female in 1904 near Forres and had specimens said to have been taken at Houston, Renfrewshire (Evans, 1911). There is obviously a well established population at the Black Lochs which is perhaps the source of Mackay's record. It seems likely that there are other extant colonies north of the known Solway sites.

The total of 13 (perhaps 14) species of Odonata is probably the highest recorded for a Scottish site. It is interesting that none of the three boreo-alpine Scottish 'specialities' are included. Instead, there are five species with a mainly southern distribution. The area is low-lying, with a very mild winter climate. Apparently in

summer, this small corner escapes much of the cloud and rain that affects the surrounding hills. The nature of the substrate is obviously important as some rather similar looking lochs in the area with a mainly stony substrate have, so far, revealed none of the four southern loch species.

In addition to Odonata other aquatic taxa with predominantly southern distributions are present in the Black Lochs. We were impressed by the large stands of Saw Sedge *(Cladium mariscus)*, the dominant sedge of the East Anglian fens. There are a scattering of sites for this species in the north-west of Scotland. On 14th September we obtained specimens of the Water Measurer *(Hydrometra stagnorum)*. This water-bug is much commoner in England but has been previously recorded in Scotland from the Solway area (Brown, 1940-44) and in addition specimens from Loch Ard (Perthshire) and from Loch Tayinish (Kintyre) are in the Royal Scottish Museum collections.

The area including the Black Lochs is designated an SSSI primarily due to its oak woods. It is becoming evident that the site is remarkably rich in a wide variety of fauna and flora.

Acknowledgement

We are grateful to Dr. Mark R. Shaw for permission to examine the insect collection and to search the Scottish Insect Records Index at the Royal Scottish Museum.

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The dragonfly fauna of the Ouse Valley gravel pits

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Digging for sand and gravel has created over three thousand acres of water-filled pits along a twenty-five mile stretch of the Great Ouse river valley in Huntingdonshire. Although the bird life of these flooded workings has been intensively studied, little attention has been paid to their impact on other forms of wetland wildlife. This paper presents the results of a study on the dragonfly fauna of six gravel workings in the Ouse valley.

The study sites

The six sites were carefully chosen to cover a broad spectrum of gravel pit types, age and habitats. The sites varied in age from those still being actively worked to one which had been disused for over forty years, and in size from eight to three hundred and fifty acres. Three sites lay adjacent to the river, the remainder being up to one mile distant. Water depths were extremely variable, shallow water pits supporting extensive stands of Reed *(Phragmites australis)*, Bulrush *(Typha latifolia)* and Club Rush *(Scirpus lacustris)* whilst those pits with deep water had only a scanty growth of emergent vegetation along the marginal "wave-cut" platform. Full details of each site are given in Table 1.

In general the older workings provide conditions far more attractive to wetland wildlife. The less efficient methods of gravel extraction prevailing in earlier years resulted in relatively small, shallow pits with long irregular shorelines forming numerous bays and peninsulas. Subsequently, natural regeneration has given rise to a rich diversity of habitats. More recently, modern technology and the need to win maximum gravel yield has created large deep water pits with straight featureless shorelines. Planning permission usually requires the banks to be sloped and landscaped with the implementation of a planned planting programme after the completion of gravel extraction, producing a relatively uniform habitat. Such sites are much in demand for recreational use (Table 1).

The dragonfly fauna

With the exception of Site E, which was visited for the first time in 1984, all the other sites were visited regularly over a period of two to three years. Sixteen species of dragonfly were recorded, the totals for individual sites varying from nine to fifteen species. Full details of the species recorded at each site are given in Table 2.

An earlier study of the bird community of a newly excavated gravel pit showed that breeding species colonised in a clearly defined sequence as their particular habitat and food requirements became available (Milne 1974). Much the same story appears to be true for dragonflies, species such as *Orthetrum cancellatum*, *Enallagma cyathigerum* and *Ischnura elegans* being among the first colonisers, often well before the establishment of marginal vegetation. Just as the Little Ringed Plover (*Charadrius dubius*) is highly dependent on newly worked gravel pits for the provision of suitable nesting habitat, so *O. cancellatum* characteristally shows a marked preference for pits with bare gravel margins and islands. Dry summers, such as that experienced in 1984, greatly favour this species. At one site with a good growth of marginal vegetation the falling water level exposed an extensive gravel margin and the entire shoreline was occupied by territory holding males. As the pits age and become overgrown, the numbers of *O. cancellatum* decline and at Site E which has been disused for over forty years it appears to have been lost as a breeding species.

With the appearance of marginal vegetation *Simpetrum striolatum* appears and there is a rapid build-up in the populations of *E. cyathigerum* and *I. elegans*, both of which can run into thousands of individuals. The real increase in the variety of species appears to be associated with the establishment of emergent vegetation and many older sites support between eleven and fifteen species of dragonfly. With the exception of the two damselflies already mentioned, the other species were relatively slow to colonise and the presence of six to seven species was invariably indicative of a very old working. The close proximity of areas of willow woodland was attractive to many species of dragonflies particularly *Aeshna mixta*, gatherings of fifty to sixty individuals being frequently recorded along woodland rides. These shelter belts were also favoured by *Coenagrion puella* and *C. pulchellum*.

Libellula fulva is typically a species associated with slow-flowing lowland rivers and its presence along certain stretches of the Great Ouse has been known for many years. At present all records of *L. fulva* are of national importance as it is a critically rare species (Chelmick *et al.* 1980). It was therefore particularly pleasing to find this species well established on one large complex of pits lying adjacent to the river. In 1982 twenty-one males were located defending territories in several well-defined areas, but further observations suggest that it is in fact rather more widespread on this pit complex than was at first thought. However, it seems to show a definite preference for pits that are at least twenty years old. Although *L. fulva* was only recorded from one of the study sites, it has been recorded from other workings in the Ouse valley although its exact status at these sites is as yet unknown (N. W. Moore, pers. comm.).

The findings of the present study can usefully be compared with observations along the valley of the Great Ouse in Bedfordshire. Along this stretch of the valley much of the gravel deposits are overlaid with first class agricultural land and

permission for gravel extraction has only been granted at a few selected areas. The dragonfly fauna of three of these sites has been extensively studied for many years and has produced totals of nine, eleven and sixteen species respectively (N. Dawson, pers. comm.). With the exception of *L. fulva*, all the other fifteen species reported in the present study were also recorded from the Bedfordshire pits. Four additional species *Platycnemis pennipes*, *Pyrrhosoma nymphula*, *Cordulegaster boltonii* and *Libellula depressa* were recorded at the Bedfordshire pits. Two of these sites are now local nature reserves but despite the implementation of a management plan *C. pulchellum*, *Erythromma najas* and *L. depressa* have all been lost over the past decade. The remaining site has largely been infilled with domestic rubbish.

Conclusions

Observations in Huntingdonshire suggest that gravel extraction along the valley of the Great Ouse has greatly benefited the dragonfly fauna of the region, a total of sixteen species being recorded from six sites. Several species, notably *O. cancellatum*, *I. elegans*, *E. cruthigerum* and *A. mixta* have profited enormously from the creation of these man-made lakes. One national rarity, *L. fulva*, is firmly established as a breeding species on one of the study sites. Older workings with their rich emergent vegetation are of particular importance to dragonflies, the close proximity of tracts of willow woodland greatly enhancing the value of the site. Such sites usually support in the region of twelve to fifteen species of dragonflies and should be considered as possible conservation areas in a region of intensive arable farming with its "prairie-like" expanses of cereals and oil seed rape. Most recent gravel workings are much less attractive to dragonflies and are subject to an ever increasing demand for recreational usage, much of which is incompatible with wildlife.

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Table 1

Site details of six gravel pits

Site	A	B	C	D	E	F
Age (years)	30	45	47	47	44	340
Present status	Active working	Active working	Disused for 14 years	Disused for 5 years	Disused for 40 years	Disused but reworked in last 10 years
Size (acres)	250	350	120	120	8	12
Water Depth	Deep water 20-30 ft.	Variable up to 20 ft.	Mainly less than 6 ft.	Variable up to 20 ft.	3-12 ft.	Mainly less than 3 ft.
Emergent Vegetation	Very scanty	Mainly marginal	Extensive stands	Mainly marginal	Some large stands	Plentiful in marsh areas
Willow Woodland	Absent	Extensive area	Extensive area	Extensive area	Small area	Small area
Proximity to river	Adjacent	Adjacent	1 mile	¼ mile	¼ mile	Adjacent
Recreational Usage	Water skiing Windsurfing Fishing	Sailing Windsurfing Model boats Fishing	Private Shooting and Fishing	Local residents nature trail Fishing Private Shooting & Windsurfing	Private Fishing	Private Shooting and Fishing

Table 2

Dragonfly fauna of six gravel pits

	Site					
	A	B	C	D	E	F
Calopteryx splendens	*	*	*		*	*
Lestes sponsa			*			
Ischnura elegans	*	*	*	*	*	*
Enallagma cyathigerum	*	*	*	*	*	*
Coenagrion puchellum		*	*	*	*	
C. pulchellum		*	*	*	*	
Erythromma najas		*	*	*	*	
Aeshna grandis	*	*	*	*	*	*
A. cyanea	*	*	*	*	*	*
A. mixta	*	*	*	*	*	*
Anax imperator	*	*	*	*		
Libellula fulva		*				
L. quadrimaculata	*		*			*
Orthetrum cancellatum	*	*	*	*	*	*
Sympetrum striolatum	*	*	*	*	*	*
S. sanguineum			*			
Totals	10	13	15	11	11	9

* = Species recorded

The exuviae of *Aeshna juncea* (L.) and *Aeshna subarctica* (Wlk.)

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I sometimes wonder whether *Aeshna subarctica* occurs in Scotland and am surprised that only *A. juncea* is present. It is possible that *A. subarctica* has never been reported from this area because of the difficulty of separating it from *A. juncea*. Exuviae can be found in greater numbers than imagines and so give a better idea of the distribution and total numbers of individuals in a population. In this paper I have discussed the merits of the use of several exuvial characters to distinguish *A. juncea* from *A. subarctica*.

Aeshna juncea and *A. subarctica* are indigenous in the Stemmer Moor area (TK 3417/3, German map system, Topographische Karte 1:25000) on both sides of the border between Lower Saxony and Northrhine-Westfalia, in West Germany (Altmüller *et al.*, 1981; Clausen, 1982). During 1981, 17 ♂, 5 ♀ imagines and 40 ♂, 52 ♀ exuviae of *subarctica* and 16 ♂, 10 ♀ imagines and 23 ♂, 26 ♀ exuviae of *juncea* were found on Stemmer Moor. The sex ratio of both species has been reported to be about 1 : 1 (Schmidt, 1964; Peters, 1979).

Aeshna exuviae are large, and will remain intact for several weeks if the weather is good. They are often occupied by young spiders which sometimes enter the exuviae immediately after the dragonfly has emerged. One exuvia was found to be occupied by a spider which still had a teneral dragonfly on it. Damaged exuviae, with parts of the head or abdomen missing, cannot be identified with certainty using current keys.

Mentum (Fig. 1)

The figures given by Walker (1934), Schmidt (1936) and especially Geijskes and van Tol (1983) show a difference between *juncea* and *subarctica* in the size and shape of the mentum margin. This is not confirmed by my results (Table 1). In addition, Schmidt (1936) states "Bestes Artentrennungsmerkmal ist die Form des Labiums, genauer des Mentums mit seinen distalen Anhängen" (The best way of distinguishing the species is in the shape of the labium, especially the mentum, with its distal appendages). However, this could not be confirmed either. Therefore, the mentum does not appear to provide any useful characters to distinguish the two species.

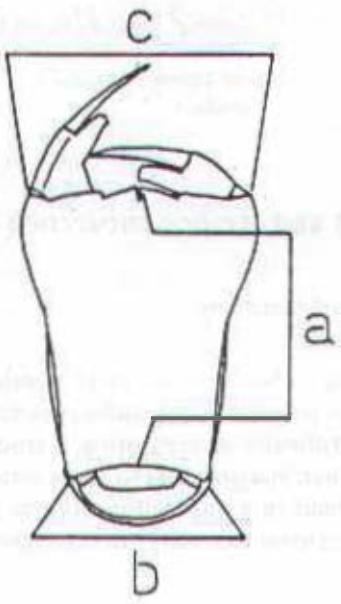

Fig. 1 Mentum
Measurements:
a = median
b = basal
c = distal

Legs (Fig. 2)

The legs of *subarctica* were found to be shorter than *juncea*, as stated by earlier authors. In *subarctica* the fore femur was never more than 4 mm but in *juncea* it was always longer than 4 mm. The middle and hind femora and tibiae of *juncea* were longer than *subarctica* but there was an overlap between the maximum lengths for *subarctica* and the minimum for *juncea*. Thus these characters are of no use in separating the species. Walker (1934) writes that the hind femur of *subarctica* is 6.1-6.5 mm and this is confirmed in this study.

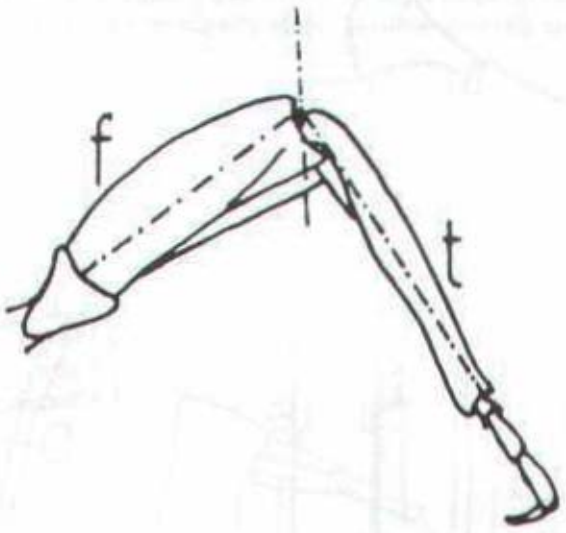

Fig. 2 Leg
Dotted lines:
f = length of femur
t = length of tibia

Wing-sheaths (Fig. 3)

The position of the bases of the wing-sheaths depends on how far the skin has opened. However, on the back of the sheaths two little cross-sutures are easily discernable which are never distorted during emergence. Usually they are smaller in *subarctica* than *juncea*.

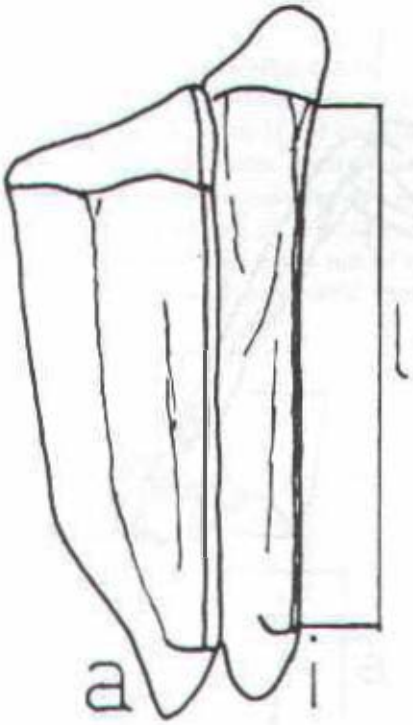

Fig. 3 Wing-sheaths
a = outer
i = inner
l = length measured

Anal pyramid (Figs 4a-c)

Walker (1912) stated that *subarctica* had longer anal appendages than *juncea*. Later he amended this statement because he discovered that he had confused the two species (Walker, 1934). Of *A. juncea americana* Walker says "cerci . . . usually about four-sevenths, or, in the female sometimes only one-half, the length of the paraprocts". Concerning *subarctica*, he states "cerci two-thirds as long as paraprocts, or very nearly so". When studying the important work of Schmidt (1936), it should be remembered that some parts of the anal pyramid are named differently today: what he termed the "cercus" is now called the "paraproct", and his "appendix superior" is now the "cercus". Both Schmidt (1936) and Franke (1979) measured the cerci and paraprocts dorsally. However, if the anal appendages are wide open this method can be inaccurate. It is better to measure these structures laterally so measurements are not affected by the position of the cerci or the examiner's head (Fig. 4c). For this reason the ratios given in Table 1 differ from those of Schmidt (1936). In *juncea* the cerci : paraproct ratio is 0.5 or slightly more; in *subarctica* this ratio is 0.6 or slightly less.

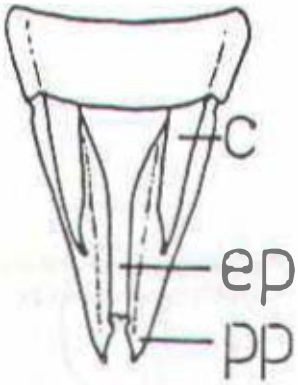

Fig. 4a *Aeshna juncea*

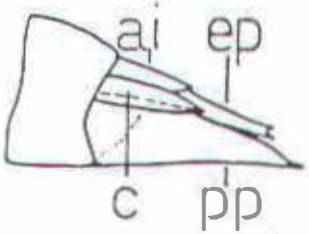

Fig. 4b A. juncea

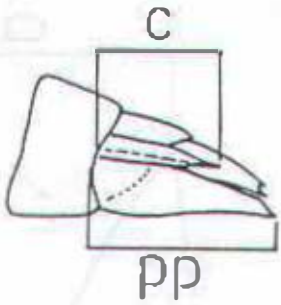

Fig. 4c *Aeshna subarctica*

Anal pyramid:
c = cerci, pp = paraprocts, ep = epiprocts,
ai = inferior anal appendages

Supracoxal armature (Fig. 5)

"Die Verwendung der über den Hüften gelegenen Prothorax-fortsätze zur Artunterscheidung der Aeschniden-Larven geht auf Hagen (1835) zurück, ihre bildliche Darstellung auf Cabot (1881). Individuelle Variation ist wenigstens bei einzelnen Arten vorhanden, jedoch unbedeutend, die spezifische Verschiedenheit aber auch nicht gross" (Schmidt, 1936). (The identification of Aeshnidae larvae using the supracoxal armature dates back to Hagen (1853), and the publication of figures to Cabot (1881). Individual variation (of the supracoxal armature) is found in some species but is insignificant and the specific differences are not large). Gardner (1954) states "In the Aeshnidae the supracoxal armature . . . although slightly variable in outline, will help to confirm the identification". However, neither his, nor Schmidt's (1936) nor even Aguesse's (1968) figures of the supracoxal armature of Aeshnidae show convincing differences which may be used in identification. The figure of the supracoxal armature of *juncea* given by Carchini (1983) is similar to the findings of this study. The distance between the tops of the supracoxal armature is about 0.9 mm in *subarctica* and 0.7 mm in *juncea*. The angle between the tips is about 90° in *subarctica* and 70°-80° in *juncea*. Nevertheless, this character is of little practical value in separating the two species.

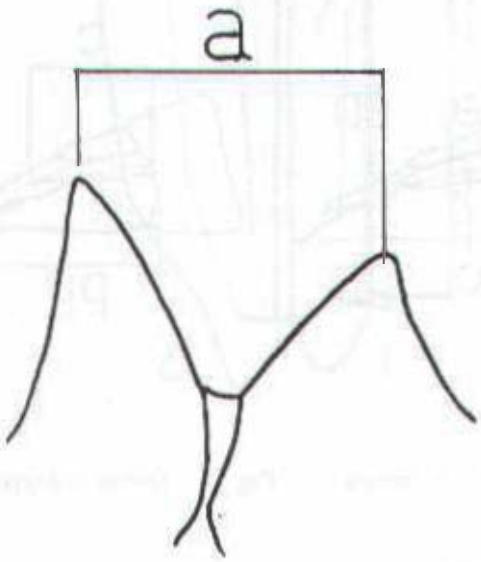

Fig. 5 Supracoxal armature
a = distance between tips

Genitalia (Figs 6a, b)

There is no consistent difference between the female genitalia of the two species. Sometimes, there are more spines on the valvae of *juncea* than *subarctica*, but this is variable.

The male genitalia are situated ventrally on the ninth abdominal segment. In *subarctica* (Fig. 6a) they are clearly elevated, and divided by a medium groove. They resemble the print of a cloven hoof. In *juncea* the two halves are not completely divided (Fig. 6b), and they are flat, not elevated as in *subarctica*.

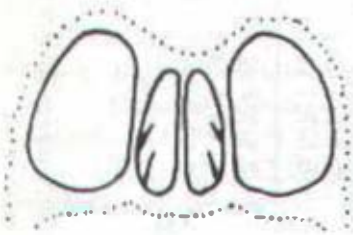

Fig. 6a
Genitalia of *Aeshna subarctica*

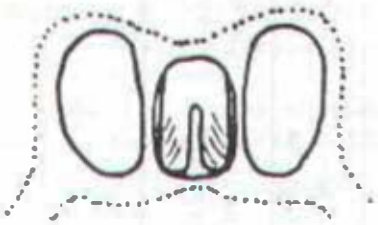

Fig. 6b
Genitalia of *Aeshna juncea*

Table 1. Results (see Figs. 1-6)

		Aeshna subarctica ♂	Aeshna subarctica ♀	Aeshna juncea ♂	Aeshna juncea ♀
Mentum	Median	5,9-6,1 (6,0)	5,9-6,2 (6,0)	5,9-6,4 (6,2)	5,8-6,4 (6,2)
	Basal	2,8-2,9 (2,8)	2,7-2,9 (2,8)	2,6-2,9 (2,8)	2,6-2,9 (2,7)
	Distal	4,6-4,6 (4,7)	4,5-4,9 (4,7)	4,5-4,9 (4,7)	4,6-5,0 (4,8)
Femur	1	3,8-4,0 (3,9)	3,7-4,0 (3,8)	4,2-4,6 (4,4)	4,2-4,7 (4,4)
	2	4,9-5,2 (5,1)	4,8-5,2 (5,0)	5,3-5,8 (5,7)	5,3-5,9 (5,5)
	3	6,0-6,5 (6,3)	6,0-6,5 (6,3)	6,5-7,1 (7,0)	6,4-7,4 (6,8)
Tibia	1	4,6-4,8 (4,7)	4,5-5,0 (4,7)	5,0-5,2 (5,1)	4,8-5,6 (5,2)
	2	5,0-5,2 (5,1)	4,9-5,4 (5,1)	5,2-5,7 (5,6)	5,4-6,1 (5,6)
	3	6,2-6,5 (6,4)	6,1-6,6 (6,3)	6,5-7,1 (6,8)	6,6-7,7 (6,9)
Wing-sheaths	Outer	6,1-6,7 (6,4)	5,9-6,3 (6,2)	6,6-7,1 (6,9)	6,4-7,0 (6,8)
	Inner	6,6-7,2 (6,9)	6,6-7,1 (6,8)	7,1-7,8 (7,4)	7,0-7,6 (7,3)
Anal pyramid	Cerci	2,5-2,7 (2,6)	2,5-2,7 (2,6)	2,2-2,4 (2,3)	2,0-2,5 (2,2)
	Paraprocts	3,9-4,4 (4,2)	4,1-4,4 (4,3)	4,4-4,7 (4,6)	4,1-4,9 (4,6)
	C : Pp	0,59-0,68 (0,65)	0,59-0,64 (0,61)	0,49-0,52 (0,50)	0,48-0,51 (0,48)

Measurements in mm, average figures in brackets.

Colouring

Exuviae which have been exposed to the weather for some time become pale but even in fresh exuviae it is not possible to distinguish the species on the basis of markings.

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Notes on some New Forest dragonflies

D. C. Winsland

"School House", Emery Down, Lyndhurst, Hampshire

In the New Forest 1983 was a particularly good year for *Ischnura pumilio*. Under normal circumstances only a few specimens are found in each suitable locality and these localities may vary from year to year. There are however, a few sites which may be relied upon to produce reasonable numbers every year. One such site produced over 90 specimens during August 1983. It was here, while checking the 'tail' markings of males, that I noticed the particularly dark colouration of most of the females. On close inspection I found that the dorsal surface was entirely jet-black and this colouration extended to the lower half of the thorax and abdomen. Below this the colour graded to the normal lime green. Even under a hand lens, no antehumeral stripes could be discerned. Eye spots were totally absent and the eyes were black above and lime green below. A specimen was deposited in the British Museum (Natural History), where there were no similar specimens in the collections (S. J. Brooks, *in litt.*).

Numerous specimens of *Ischnura pumilio* f. *aurantiaca* have been found in the New Forest and the fact that none have been seen *in cop.* has prompted considerable discussion at 'New Forest Dragonfly Group' meetings. However, during a field meeting in August 1983 a male *I. pumilio* was found in tandem with a female f. *aurantiaca*. The pair was watched for about 15 minutes during which time the male repeatedly made strenuous efforts to swing the female to the full copulation position. This was resisted equally strenuously most of the time but on two occasions the female did make half-hearted attempts to comply, failing in both instances. The pair departed with no apparent copulatory success.

Towards the end of the hot spell in August 1983 unusual male specimens of *Orthetrum coerulescens* were encountered in widely differing localities in the New Forest. These specimens were unusual in that the last three segments of the abdomen were black. The initial impression was that they were similar to *O. cancellatum*, but the black was more solid with a definite demarcation line at the commencement of the eighth segment. The blue pruinescence on the rest of the abdomen appeared to be complete.

In August 1981 a male *Aeshna cyanea* was seen in tandem with an *Aeshna juncea* female. I am prompted to record this because the only other reference to a similar event was made by W. J. Lucas (1900).

References

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Book Review

The dragonflies of the New Forest. Nicole and Tony Welstead. Eldertons Press Ltd., Southampton (1984). 41 pp + X plates. £2.75 (including postage and packing).

The diverse nature of aquatic habitats in the New Forest, with heathland ponds and lakes, rivers and streams, and valley bogs, has given rise to a very rich dragonfly fauna. Twenty-seven species of Odonata, 70% of species resident in the British Isles, have been recorded as breeding in this part of southern England. The most important sites are the valley bogs, which harbour 21 breeding species. This kind of habitat has been drained throughout much of England, due mainly to the intensification of farming in the last 40 years, and the New Forest is one of the few places in this country where large tracts of bog-land still exist. Thus the importance of the New Forest for dragonfly conservation cannot be over-estimated. The large number of resident species, including several national rarities, also means it is an excellent place to get to know and to study dragonflies. The Welstead's booklet has been produced to assist in this.

I very much enjoyed reading this booklet. The text is written in a very accessible style and laid out in an easily referable manner so information on each species comes readily to hand. The booklet includes sections outlining the general structure and life-cycle of dragonflies, a brief description of the morphology and biology of Zygoptera and Anisoptera and a resumé of the broad habitat requirements of dragonflies and the habitats available in the New Forest. There is also a very useful section, written by David Winstand, on photography which hopefully will encourage people to collect photographs of Odonata rather than specimens.

The main part of this work deals with the identification and habits of each of the New Forest species, which are given both English and Latin names. Special attention is given to characters which help to distinguish the species in the field and there are notes on the particular habitat requirements of each species. The flight period and larval duration in the New Forest are also mentioned. There is a wealth of detailed information, much of it previously unpublished, which will be of interest to both the novice and the more experienced dragonfly-watcher.

The final part of the book has ten plates of very well executed black and white line-drawings, by Tony Welstead, depicting most of the species described in the text. Dorsal and lateral views are given for some species and in a few cases both males and females are shown. To accompany the figures a key, based on colouration, is also provided. However, black and white drawings are of limited use when identifying dragonflies in the field and it is often unpractical to work through a key in these conditions. Accurate though they are, I think a novice would have difficulty in using this section of the book. Of course, it must be realized that colour plates would have greatly increased the cost of publication.

The very reasonable purchase price should encourage people with even a vague interest in Odonata to obtain a copy and should be popular with visitors to the New Forest who will, perhaps, become more interested in dragonflies as a result. I hope the booklet will be readily available in tourist shops in the area. The booklet succeeds where Hammond fails in providing a lot of biological information about each species covered. However, at present, Hammond is still second to none as an identification guide to the British species.

Copies of *The dragonflies of the New Forest* are obtainable from B. Wakeford, 51, Rowans Park, Lymington, Hampshire.

S. J. Brooks

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 of 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 is '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.

CONTENTS

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