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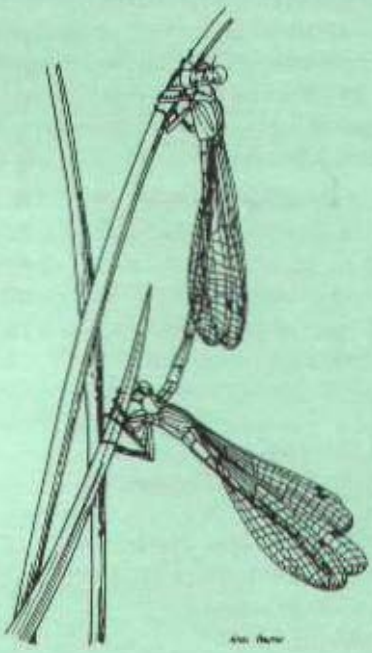

Edited
by
S. and A. Brooks

affiliated to the Societas Internationalis Odonatologica

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

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Front cover illustration of *Ischnura elegans* by N. Hawtin.

The Odonata of the north of Ireland

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Crannach, Drumkeen, Ballinamallard, Co. Fermanagh, N. Ireland.

There are few publications relating to the Odonata, or to most other insect groups, of the north of Ireland. The distribution of most Odonata species is poorly documented and often corresponds more to the distribution of recorders than to that of the species. This situation is improving and now some areas, particularly Fermanagh and north Armagh, have been well surveyed. In the past three summers *Sympetrum sanguineum*, *Ischnura pumilio* and *Coenagrion lunulatum* have been recorded in the region for the first time and additional localities have been discovered for the less common species.

Excluding rare vagrants, twenty-two species of dragonfly have been recorded in Ireland of which eighteen are known from the north of Ireland, this comprising the counties of Fermanagh, Tyrone, Donegal, Londonderry, Antrim, Down and Armagh (Table 1). *S. striolatum*, *I. elegans*, *E. cyathigerum*, *L. quadrimaculata* and *P. nymphula* are undoubtedly the commonest species and occur in a wide range of habitats. *S. danae*, the two *Aeshna* species, *C. puella*, *C. pulchellum* and *L. sponsa* are more localised in distribution, though frequently common. For example, *C. pulchellum* is often the dominant species on lowland bogs. *C. splendens* is also locally distributed, though usually common along suitable rivers especially in north Armagh.

Table 1

List of Odonata recorded from the north of Ireland

Anisoptera	Zygoptera
Aeshna grandis	*Calopteryx splendens*
A. juncea	*Coenagrion lunulatum*
Brachytron pratense	*C. puella*
Libellula quadrimaculata	*C. pulchellum*
Orthetrum cancellatum	*Enallagma cyathigerum*
O. coerulescens	*Ischnura elegans*
Sympetrum danae	*I. pumilio*
S. sanguineum	*Lestes sponsa*
S. striolatum	*Pyrrhosoma nymphula*

The remaining six species are much scarcer. *B. pratense* has been recorded from all seven counties but it is never numerous. Favoured habitats are small, sheltered loughs and areas of fen around L. Neagh. In 1985 and 1986, *Brachytron* was particularly easy to see at favoured locations and some individuals were still flying well into July. The habitat preferences of *S. sanguineum* are similar to those of *Brachytron*. Since the first record of *S. sanguineum* in Fermanagh in 1983, it has been recorded from at least ten localities in Fermanagh, Armagh and Down.

The two *Orthetrum* species are the rarest Anisoptera in the region. *O. coerulescens* has been recorded at four localities in the Mourne Mountains, Co. Down and at a single locality in Co. Donegal since 1983. There are also old records from Antrim, Armagh and additional areas of Donegal where the species may still occur. All currently known localities are areas of *Molinia/Erica* heath on sunny, south-facing slopes where females have been seen to oviposit in seepages. *O. cancellatum* is known from a single site in west Donegal, which is the northernmost locality for the species in the British Isles. The site is a shallow lake in an area of machair-type vegetation, which has recently been purchased as a nature reserve, following an almost successful attempt to drain the lake.

One of the highlights of the dismal summer of last year was the discovery of two colonies of *I. pumilio*. There are two old records of *I. pumilio* from the north of Ireland, but in the absence of supporting specimens these are not considered acceptable. One of the newly found colonies is in a small, disused quarry in Co. Londonderry. As this is obviously of fairly recent origin, there must be at least one other colony in the vicinity. This area, however, has received very little attention from Odonata recorders.

The prize species amongst the Irish Odonata is *Coenagrion lunulatum*. A colony was found in Fermanagh in 1984 and two more were found in 1985 — a second in Fermanagh and one in Londonderry. Most of the colonies in the region are at small mesotrophic and probably slightly acidic lakes in marginal hill areas, between 300 and 700ft.

Scirpus lacustris. Once recognised this is a distinctive type of lake, so potential *C. lunulatum* sites can be identified relatively easily. However, in Fermanagh at least, the number of possible sites is small, despite the abundance of lakes.

During 1986 the distribution of *C. lunulatum* in the north of Ireland has been considerably extended. A further 15 sit
the total of known sites in the region to 20 in 19 10km squares. Most of the new sites have been found amongst the many small lakes in Fermanagh and south Tyrone.

Several colonies have also been found on cutover bog around L. Neagh. In the region only Donegal still lacks a county record. *C. lunulatum* therefore is widely but very locally distributed in the north of Ireland.

C. lunulatum is an easily identified species, very different from the other 'blue' damselflies found in Ireland. The large extent of black on the abdomen, the completely blue eighth and ninth segments and the bright green underside of the thorax, which is surprisingly conspicuous in flight, all contribute to give the species a very conspicuous 'jizz'.

There are a few unconfirmed records from the north of Ireland. One example is the record of *Erythromma najas* sent in by Haliday, a well-known and respected entomologist, from an unlikely locality at a lake in the Mourne Mountains at 1300ft.

Much still remains to be discovered about the dragonflies of the north of Ireland, but it is already clear that the region has important populations of some species. Most of the known colonies of *C. lunulatum* are found in this part of Ireland. The population of *C. hubbelluni* is of particular importance in view of its scarcity in Britain. This species is commonest on the remnant areas of lowland bogs, which is the richest dragonfly habitat and under increasing pressure from agricultural development. This habitat is thus in great need of conservation. The developing interest and concern for Odonata in the north of Ireland is therefore timely.

West Wales riparian Odonata

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The physical characteristics of Dyfed's main rivers show considerable diversity and some contain interesting features. Is it possible, by considering the Odonata occurring along rivers of various characteristics, to form some views on the particular habitat requirements of different riparian species? Such an understanding would enable the prediction of the presence of species.

Three rivers which possessed
recording had already taken place were initially selected. The longitudinal profiles of these rivers are shown in Fig. 1. A short description of the rivers follows.

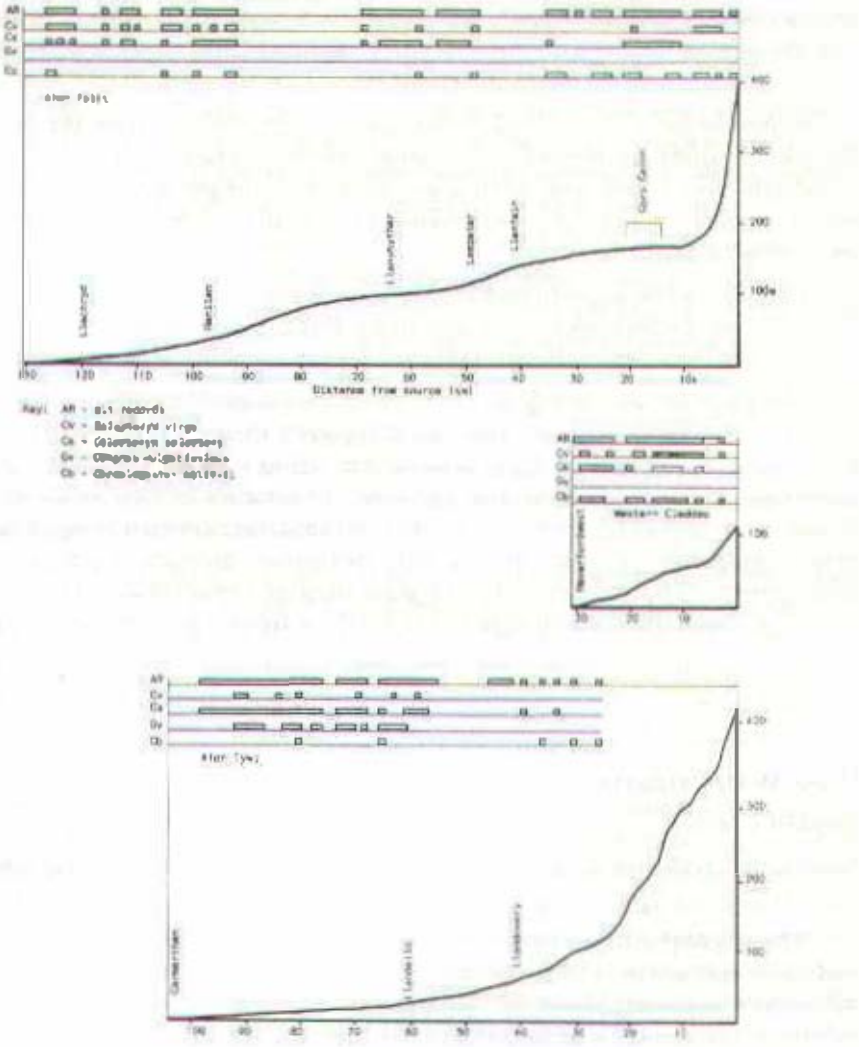

Figure 1 Distribution of riparian Odonata along three of Dyfed's rivers. The longitudinal sections of the Afon Teifi, the Western Cleddau and Afon Tywi are shown together with the recorded occurrence of four species of Odonata *Calopteryx virgo*, *C. splendens*, *Gomphus vulgatissimus* and *Cordulegaster boltonii*, and sites from which records have been made.

Afon Teifi is Dyfed's longest river. For the first 12km from its source it has a bed of bare rock, boulders, cobbles, gravel, is steeply graded and fast flowing. It then flows into Cors Caron, a raised bog complex developed in a moraine dammed wide valley. Here the river wanders sluggishly through a vast quagmire. When not in flood the river consists of a long series of still pools connected by short lengths of shallower water. Holmes (1980) states that this section of river supports at least 100 truely aquatic higher plants, a much higher total in its upper section than any other sections of other rivers rising at high altitude. The bed, infilled by glacial activity, never slackens its gradient along the rest of its route to the sea. The river maintains a steady current and is characterised by great beds of *Ranunculus* and *Callitriche*. It is an oligotrophic-mesotrophic river.

Afon Twyi is Dyfed's largest river. It has a classic profile of a gradually decreasing gradient as it flows to the sea. Its lower section contains many meanders and ox-bow lakes. Here the depth of the river is variable with pools, often at deeply cut bends, with a thick silt substrate alternating with gravel banks and cobble bottomed shallows. The river is oligotrophic in its upper reaches and becomes eutrophic but there is now some concern that large scale afforestation in the catchment combined with airborne pollution has acidified the river's upper waters.

Western Cleddau is a river whose character results from a landscape extensively moulded by glacial meltwater, flowing often under hydrostatic pressure beneath the ice, eroding the bedrock, resulting in channels which defy gravity, hollows etc. Such meltwater channels, with narrow flat bottoms, are a feature of the North Pembrokeshire landscape.

The river rises at about 100m some 3km from the sea and then flows slowly inland over soft substrate in a wide marshy valley occasionally bordered by extensive fens. On passing downstream, it flows faster over rocks, pebbles and gravel particularly through Treffgarne gorge. After the gorge, it slows and meanders through a 0.25km wide flat bottomed valley to the Milford Haven inlet. This is a mesotrophic river.

The Odonata fauna of Dyfed rivers comprises nine species, four exclusively of moving water (*Calopteryx virgo, C. splendens, Gomphus vulgatissimus* and *Cordulegaster boltonii*) whilst the other five may be found on still water bodies (*Pyrrhosoma nymphula, Ischnura elegans, Enallagma cyathigerum, Coenagrion puella* and *Sympetrum striolatum*). Although these species exist as larvae in rivers, often in large numbers, they are not restricted to flowing water and hence their

presence may be influenced by factors other than the characteristics of the river (the presence of ox-bow lakes, back waters, nearby ponds etc). Only records for the four riparian species were included in the analysis. Fig. 1 shows the extent of each where these species were recorded.

The general conclusions that can be drawn from this presentation are.

1. More data is required
2. There is a tendency for *C. virgo* to be replaced by *C. splendens* as the gradient of the river becomes slacker
3. *Gomphus vulgatissimus* is restricted to the flattest gradient
4. *Cordulegaster boltonii* is not restricted by river gradient
5. This presentation does not indicate abundance, hence optimum and marginal habitat types cannot be differentiated

Within these macro-features of a river system there is great variation. Consideration of micro-features shows how the above analysis may be misleading. Site inspection shows how rivers vary even over quite short lengths. The very flat lower reaches of the Afon Twyi actually consist of pools and riffles providing silt, mud slow current habitats and fast turbulent stoney bottomed habitats in the same stretch of river. Even the same features in a river bed provide very different habitats depending on the volume of water flowing. Steep sections can develop cascades where a series of long deep pools scooped out of the rock are connected by shallow rapids. At normal discharges these pools become quite still and are bottomed by stone and sandy debris whilst heavy flows maintain turbulent fast flowing water over the whole section. How these micro-features may effect distribution is considered below species by species.

Gomphus vulgatissimus: Emergence of larvae was noted to occur almost exclusively on the 'pool' sections of river. Unfortunately Dyfed records of the species are virtually restricted to emerging specimens, no mature adults have been recorded. Hence the oviposition/mating habitat locations are unknown. Similar gradients occur on the Afon Teifi but to date surveys of this river during the emergence period of this species have only occurred below Henllan and near Lampeter.

A survey of the stretches within Cors Caron and about Llanybyther might yet prove successful.

Cordulegaster boltonii: As already noted this species seems to show no particular preference for river type. It is in fact found on most types of flowing water in Dyfed. The larvae and successfully emerging specimens have been found in habitats ranging from very small streams to the lower reaches of the Afon Twyi. Oviposition has been noted both in the pool stretches of rivers and on the small turbulent streams.

Calopteryx virgo and *C. splendens*. Both these species are widespread in Dyfed but *C. splendens* is restricted to the larger rivers whereas *C. virgo* occurs on all types of flowing water. An interesting change in distribution of these two species has occurred on the upper reaches of the Western Cleddau which may be used to illustrate their different requirements. The dominant feature of Odonata records for this length of the river before 1960 (Davis, 1980; Lloyd, 1938) was the large population of *C. splendens*. In the early 1960's works were carried out to improve drainage of the catchment area. The River Authority, in their submission for approval for the scheme describe the site as follows. 'The whole of the valley floor which is served by the river is suffering acutely from being continually overcharged with water. During the winter the growth of reeds is the only thing that saves the valley from appearing as one large lake and during this period it is impossible to enter on to it. As one moves up the valley so the conditions described get even worse, the width of marsh land widens and becomes more treacherous. The channel way in turn suffers from encroachment by reeds which have collected a deal of alluvial deposit, reducing the channel size'. The works consisted of a general lowering of the river bed to provide an exposed bank height above flood peak flow of about a metre and the removal of silt and other obstacles to flow. The long section for these works is shown in Fig. 2. It can be seen

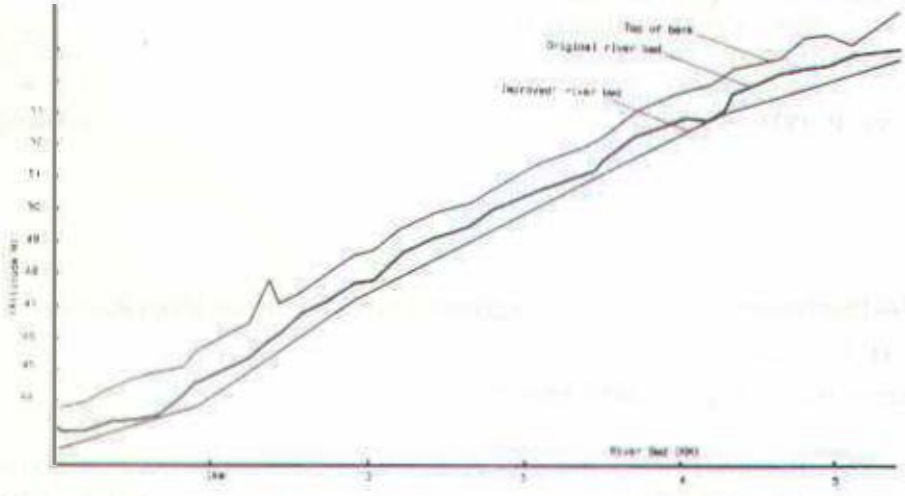

Figure 2 The longitudinal section of the part of the Western Cleddau altered by river works in the 1960's. The original river bed and new river bed are shown.

that the uneven profile which allowed long pools to form has been removed. It should be noted that many important small scale features do not show up on such a section and no doubt many more local pools were lost. I have walked along the river bed for much of its length and the substrate is now hard packed gravel. Today *C. splendens* will not be seen along this length of the river but *C. virgo* is common and seems to have replaced *C. splendens*. *C. splendens* still exists in large numbers along the lower stretches of the river. This would suggest that it is not changes in factors such as water chemistry, water temperature, sediment load, food availability responsible but the reconstruction of the physical shape of the river. No records on aquatic vegetation changes are available but the pool/riffle *structure* has been replaced by constant gradients with constant water current and the accumulated silt has been replaced by packed gravel.

Acknowledgements

I would like to thank the Welsh Water Authority for providing information on the Western Cleddau drainage scheme.

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Northernmost record of *Coenagrion puella* (L.): an introduction

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Though *Coenagrion puella* occurs widely throughout England, the only locations in Scotland shown by Hammond (1983) are in the area of Edinburgh and a few further west on the same latitude.

On the morning of 16 July 1984, I found about a dozen amongst rough grass, bracken and small bushes on a steep slope near the River South Esk, near Memus,

north of Forfar, Angus (NO 431578). Later that day, and the next, I found several more at the same place and along the river bank. *Ischnura elegans* and *Lestes sponsa* were also present.

The record for *C. puella* is the most northerly for Britain by about 70km. This would constitute a remarkable jump if achieved naturally. However, all the specimens were within 50m of a large artificial pond beside a house, both of which were constructed in the mid-1970s, when the owners moved up from their house at Chiddingfold in Surrey. They brought waterlilies from their previous pond, and there is little doubt that the dragonfly larvae came too.

This record shows not only how some species can be spread unwittingly by humans, but also that the absence of a species from an area is not necessarily because conditions are unsuitable, as these have survived for nearly ten years.

References

Hammond, C. O. 1983. *The dragonflies of Great Britain and Ireland*. 2nd edition (revised by R. Merritt). Harley Books, Colchester. 116 pp.

Instances of dragonflies consuming vegetable matter

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This short article was inspired by a superb series of photographs of *Cordulegaster boltonii* eating leaves of yellow flag (*Iris pseudacorus*). These photographs were taken by Bob Frederick, who is under contract to Oxford Scientific Films, and specialises in photographing the more unusual aspects of animal behaviour. I was allowed to retain the photographs for a short while so I forwarded them to Bob Merritt and thence to Philip Corbet for comment. None was forthcoming because in Professor Corbet's words "they are unique in my experience". Amongst reams of odonatological abstracts I managed to find one reference related to this subject (Pavlyuk,

The *Cordulegaster boltonii* in question was a captive specimen brought to Bob Frederick by an acquaintance. It had apparently been deprived of food and water for about six hours. It was released into a large flight cage which was immediately sprayed with water whereupon the insect began to drink. Shortly afterwards the leaves of the yellow flag were introduced. When the cage was revisited half an hour later the

dragonfly was seen eating the leaves. From the photographs it is apparent that the leaf is not cleanly cut but has been removed in small pieces by a sawing action. There is one closeup photograph showing the mouthparts covered in minute particles of vegetable matter. There is absolutely no doubt in my mind that vegetable matter was ingested.

Bob Frederick cites two other occasions when he observed similar behaviour in the wild. In 1976 he saw aeshnids eating plants. On another occasion a male *Libellula depressa* was seen in a woodland glade eating forget-me-not (*Myosotis* spp.). A photograph of this was supplied and although it does not show the detail of the previous slides, the insect has certainly removed a petal from the plant and is holding it in its mouthparts. At the time the photographer was not aware of the significance of his sightings. He assumed that in times of need dragonflies, in common with some other insects, supplement their moisture intake from plant tissues to combat dessication.

Pavlyuk (1978) states that he had on two occasions seen *Erythromma najas* chewing the leaves of sweetflag (*Acorus calamus*). The leaf pieces were removed in the form of serrated ovals about three-quarters the size of the head. These were then masticated with the mouthparts and ingested. These damselflies were observed on the shores of lakes and ponds in areas of high humidity and the sightings were after recent rain. He therefore discounts the habit as a means of obtaining moisture and considers it a physiological need. He also mentions that gut contents of both *Ischnura elegans* and *Lestes dryas* have on occasions been found to contain tiny pieces of vegetable matter.

It is of interest to note that in two geographically isolated cases the plant concerned has been a type of flag. It is well known that sweet flag has medicinal properties and Pavlyuk (1978) also mentions that it kills some insects. In many years of dragonfly watching I have never noticed them consuming vegetable matter, neither have I seen them drink. Were it purely a physiological need I would have expected it to have been more widely recorded. Bearing in mind that the *C. haitorni* was in captivity it is possible that this behaviour is a reaction to stress.

Acknowledgements

I would like to thank Stephen Brooks (BMNH) for obtaining a copy of the Pavlyuk reference.

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Pavlyuk, R. S. 1978. [Some instances of dragonflies feeding on vegetable matter?]. *Vestnik Zoologii* 1: 8.

An early emergence of Odonata from an artificially warmed water source in south Wales

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Introduction

On the morning of February 17th 1982, a dead *Libellula depressa* was found in the roadway of an industrial complex at Port Talbot, West Glamorgan. The specimen was in good condition, indicative of a recent death, and the discovery gave rise to speculation as to the likely origin of the dragonfly on such an unusually early date and prompted the investigation described below.

Site description

Approximately 40m from the spot where the *L. depressa* was found is a water channel which forms part of the recirculating system for the utility-water of the complex. The water channel is, in effect, an open trench about 2m wide and 2m deep. It runs for hundreds of metres through the complex but in the area under investigation it passes for about 120m through a flat, open car-parking zone. The sides of the channel are made up of earth and stoney infill and the bottom comprises a layer of very fine mud to a depth of 15-20cm. The water depth is between 5-12cm. A pipe discharges warm water (27-30°C) into the northern end of the channel causing a rise in temperature to about 26°C immediately below the discharge point. As the water flows over down-channel from the warm discharge point, cooling takes place and there is a temperature gradient downstream from that point. There are variations in both the volume and temperature of the water depending on precipitation and air temperature. Water clarity, which is usually quite good, is affected by run-off which brings an influx of suspended solids and grease into the flow.

The bed of the channel supports a luxuriant flora which comprises at the north end: *Polygonum amphibium, Apium nodiflorum, Equisetum fluviatile, Sparganium erectum, Potamogeton* sp., *Callitriche* sp., along the central stretch: Alisma plantago-*aquatica, Callitriche* sp., various pondweeds and filamentous algae; and at the southern end: *Typha latifolia, Iris pseudacorus, Juncus* sp., *Equisetum fluviatile, Alisma plantago-aquatica* and *Callitriche* sp. Casual faunal records include newts, frogs, freshwater snails and pond skaters. This channel seemed a likely source for the *L. depressa* and it was decided to monitor it to see whether this could be confirmed.

Table 1. Channel Observations: February - May 1982

DATE	SPECIES AND NUMBER	EXUVIA	WEATHER CONDITIONS	AIR TEMP (°C)			WATER CONDITIONS
			SUN & CLOUD	MAX	MIN	SUN (HRS.)	
17.2.82	1 x *Libellula depressa* (dead)		Exceptional sunny spell 15th & 16th	2.6	0.8		
23.3.82	1 x *Sympetrum (striolatum)*	1 found general area	Sunny	11.7	3.0	10.8	
24.3.82	1 x *S. striolatum*	1 on same stalk	Sunny	13.0	3.1	10.6	
25.3.82	1 x *Sympetrum sp.*	1 found general area	Sunny	13.4	2.5	10.8	24.5°C near exuvia
26.3.82	1 x *Sympetrum sp.* 1 x *Aeshnura elegans*		Sunny	15.1	4.3	10.9	
29.3.82	Nil observed			9.4	2.7	8.7	
30.3.82	1 x *S. striolatum*	1 on same stalk.	Sunny, some cloud	9.5	1.1	6.8	17.5°C at point
31.3.82	1 x *S. striolatum* 1 x *L. depressa* (floating)		Sunny	10.8	0.7	10.5	
2.4.82	2 x *S. striolatum*	1 on same stalk	Sun through haze	11.9	3.4	4.3	26.5°C near exuvia
5.4.82	Nil observed			12.1	8.2	0.1	
6.4.82	1 x *Aeshnura elegans*		Sunny	13.8	8.2	4.4	
7.4.82	Nil observed			12.7	8.9	3.8	
13.4.82	Nil observed		Sun and cloud				
14.4.82	Nil observed						
16.4.82	Nil observed		Sun through haze				
19.4.82	c4 x *Sympetrum sp.*		Sunny				

20.4.82	1 x *I. elegans*		Vegetation lush
20.4.82	Nil observed		Water flow low
21.4.83	1 x *Sympetrum sp.* 1 x *Sympetrum sp.* (dead)	Cloud and haze	
22.4.82	Nil observed	Haze	
23.4.82	Nil observed		
27.4.82	1 x *L. depressa*	Sunny	
28.4.82			Low water level
29.4.82	Nil observed	Spotting rain	
5.5.82	1 x *S. striolatum*	Sun and cloud	
6.5.82	Nil observed		Low water level
10.5.82	2 x *I. elegans*	Sun and cloud	Water rising
13.5.82	1 x *Pyrrhosoma nymphula* 2 x *L. depressa*	Sunny	
14.5.82	1 x *L. depressa* 3 x *I. elegans*	Sun through haze	
17.5.82	5 x *I. elegans*	Dull, overcast	
25.5.82	6 x *I. elegans*	Sun and cloud	

Observations

Observations on the water channel over a three month period in 1982 are summarised in Table 1. Most observations took place between 12.30 and 14.00. 1983 records are tabulated in Table 2. Weather records show that February 1983 was the sunniest for 73 years although air temperatures were slightly below average. Early April was also unusual with night temperatures falling below freezing on several dates. However, there was an average of 6-7 hours of sunshine per day.

Table 2. Channel Observations: Spring 1983

DATE	SPECIES AND NUMBER	EXUVIA
7.3.83	1 x *Pyrrhosoma nymphula*	
11.3.83	6 x *Libellula depressa*	Present
14.3.83	3 x *L. depressa*	Present
15.3.83	1 x *P. nymphula* (female) 2 x *L. depressa*	
7.4.83	2 x *P. nymphula*	1 - Libellulid
8.4.83	1 x *Libellula quadrimaculata*	
15.4.83	2 x *P. nymphula* 1 x *I. elegans* 1 x *Sympetrum striolatum*	
26.4.83	2 x *P. nymphula*	
3.5.83	7 x *P. nymphula* 6 x *I. elegans* 1 x *L. depressa* 2 x *Coenagrion puella*	

Discussion

The results (Tables 1 & 2) show a range of exceptionally early emergence dates for three species (*L. depressa, S. striolatum* and *I. elegans*) in 1982 and five species, (the three above plus *L. quadrimaculata* and *P. nymphula*) in 1983. A sixth species, *C. puella*, was recorded in 1983 three weeks earlier at the study site than at the control site, a coastal sand dune locality (Kenfig I.N.R. 5 Km south-south-east), but within the flight period of the species (Hammond, 1983). The two years, however, form an interesting contrast since "natural" emergence dates, for the species found at Kenfig, were 2-3 weeks earlier in 1982 than in 1983 (Table 3). This suggests that *C. puella* also emerged unusually early at the channel site in 1983. The main factor influencing these

events is thought to be water temperature which ranged from 10-16°C higher in the channel than at the control site.

Table 3. Comparison of emergence dates at study site with those in Hammond (1983) and Kenfig Local Nature Reserve.

SPECIES	FIRST DATES THIS STUDY		EARLIEST DATE EX HAMMOND	FIRST DATE FOUND AT KENFIG	
Libellula quadrimaculata	—	8.4.83	Last fortnight in April	17.5.82	4.6.83
Libellula depressa	17.2.82	11.3.83	Last week in April	13.5.82	31.5.83
Sympetrum striolatum	23.3.82	15.4.83	First week in June	5.6.82	19.6.83
Ischnura elegans	26.3.82	15.4.83	Last week in April	2.5.82	8.5.83
Pyrrhosoma nymphula	13.5.82	7.3.83	Third week in April	12.4.82	3.5.83
Coenagrion puella	1.6.82	3.5.83	First week in May	7.5.82	22.5.83

From meteorological observations, it appears that the two days prior to 17th February 1982 were the sunniest since the middle of October 1981, each with over eight hours recorded. This fact, coupled with the effect of the warm water on larval development, presumably allowed the successful emergence and subsequent flight of the *L. depressa* at the study site.

Larval growth rates are determined mainly by temperature and availability of food, but the duration of the larval life is determined by the need to pass the winter in a cold resistant stage and the necessity in some species for synchronised emergence of adults. Factors which possibly affect this last requirement include the presence of a diapause in the final larval instar, lower temperature thresholds in a progressively ascending series in the last few larval instars, and the length of the photoperiod when the larva is in the final and penultimate instars (Corbet, 1962).

One interesting aspect of the present study is the fact that, despite the water temperature, so few individuals emerged early. For example only three individuals of *I. elegans* were seen between 26th March and 20th April 1982, whereas from mid-May three or more were recorded daily with 24 present on 1st June.

S. striolatum showed a widely dispersed range of emergence dates from 23rd March to 5th May in 1982. *S. striolatum* is a univoltine species which grows rapidly and usually emerges over a 2½ month period from mid-June onwards. We do not know if greater numbers of *S. striolatum* would have emerged during the normal flight

period as observations were discontinued after 3rd June 1982 when two individuals were present at the channel sites.

Two of the early emerging *L. depressa* were measured and were found to be slightly smaller than normal (Table 4). It was observed that some of the early emergents were either incapable of making a maiden flight or were only able to fly weakly, presumably due to the low air temperatures. It suggests that this, coupled with the lack of flying prey species, is responsible for such early individuals being incapable of surviving long enough to mature and breed.

Table 4. Measurements of specimens found in channel compared with measurements quoted in Hammond (1983)

SPECIMEN	BODY LENGTH (mm)	ABDOMEN LENGTH (mm)	WING SPAN (mm)
Libellula depressa found 17.2.82	42	24	71
Libellula depressa found 31.3.82	36	20	70
Range of measurements quoted in Hammond	44av.	24-28	76av.
Sympetrum striolatum found 31.3.82	36	25	60
Range of measurements quoted in Hammond	37av.	25-30	58av.

Acknowledgements

We wish to record our appreciation to Mr. John Powell for providing meteorological data from Penmaen, Gower.

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A population study of *Coenagrion mercuriale* (Charpentier) at a New Forest site. Part 2. Lower Crockford Stream and its Peaked Hill tributary, 1985.

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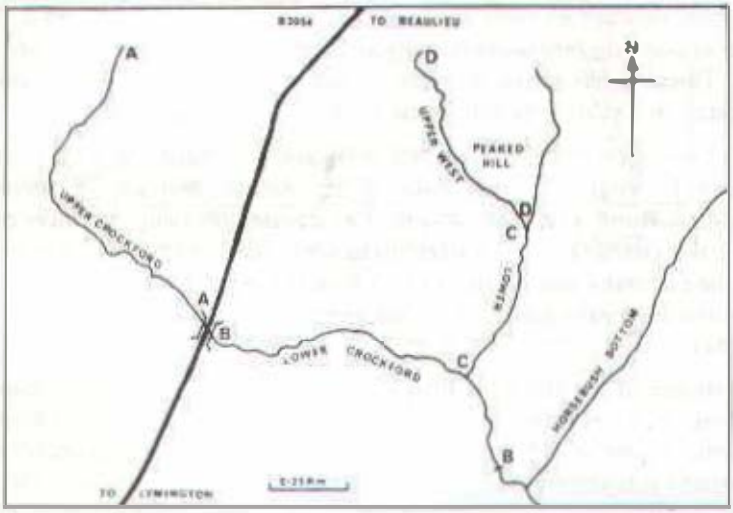
The basis for this study was discussed in Jenkins (1986) which dealt with population changes with time for *mercuriale* on the Upper Crockford Stream in the New Forest in 1984and 1985. Thepresent work concernsanextensionofthe surveyin 1985 to cover Lower Crocklord Stream (SZ352990 to 360987) and its tributary running in from Peaked Hill. This tributary is fed from twosources, east and west streams, in its upper section (Fig. 1). Only the western stream and the main tributary (358998 to 359988) were studied asaccess to theeastern source stream was extremely difficult and it appeared to hold only low numbers of *mercuriale*.



A-A Upper Crockford Stream
B-B Lower Crockford Stream
C-C Lower Peaked Hill Stream
D-D Upper Peaked Hill Stream

Figure 1. Map of survey area.

The section of Lower Crockford Stream investigated runs from the road bridge downstream for about 1½ miles until it becomes completely enclosed in woodland. This area is very different in character from the majority of Upper Crockford Stream. Whereas the latter runs through completely open valley mire and heathland except for a small patch of scrub near the road bridge, the Lower Stream flows through a series of scrub patches containing willow, hawthorn, holly, birch and in places a few larger oaks and pines. In only two or three places are both sides of the stream open and then only for a few yards. There are however several longer stretches where the stream is open on one side and the bank grades up from mire to heathland. The main concentrations of *mercuriale* were in the completely open areas with some extension into the areas with one open side. No *mercuriale* were found where the stream was completely surrounded by scrub. During the late spring of 1985 some partial clearance of overhanging branches and bushes was carried out but this did not affect the main *mercuriale* sites.

The Peaked Hill tributary is divided into two reasonably distinct sections. The upper section (358998 to 362994) is very narrow averaging about 1ft in width and flows sluggishly through an open valley mire. The lower section (362994 to 359988) is much wider at 2-4ft, slightly faster flowing although still shallow, and is surrounded by heathland. This area has obviously been dredged fairly recently and the bankside and stream vegetation has not yet fully recovered.

Apart from *mercuriale*, the commonest species found on Lower Crockford Stream were *C. virgo*, *P. nymphula*, *S. striolatum*, and *O. coerulescens* with occasional *C. hettoni* and *C. tenellum*. For about 200yds at the lower end of the survey area the character of the stream changes. The stream becomes deeper and wider and the east bank opens onto a small area of typical New Forest "lawn". In this area *L. sponsa*, *I. elegans* and *L. depressa* were recorded but only in ones or two's on any given day.

Other species found along the Peaked Hill tributary were *C. virgo*, mainly on the lower section, *P. nymphula*, *O. coerulescens*, *C. tenellum* and *C. hettoni*. Odd specimens of *L. depressa* and *A. imperator* were seen but these had probably strayed in from the eastern side stream where there is a wide area of shallow water. Of particular interest was the discovery of *I. pumilio* at one place on the lower section. One to three insects were seen on every visit between the end of June to the end of July.

One general observation on *mercuriale* was that populations began to build up at different times in each area suggesting different times of emergence (no immature insects were observed) even though all the areas studied were within about 3 miles of one another. Thus on 1st June, five or six males were seen both at Upper Crockford

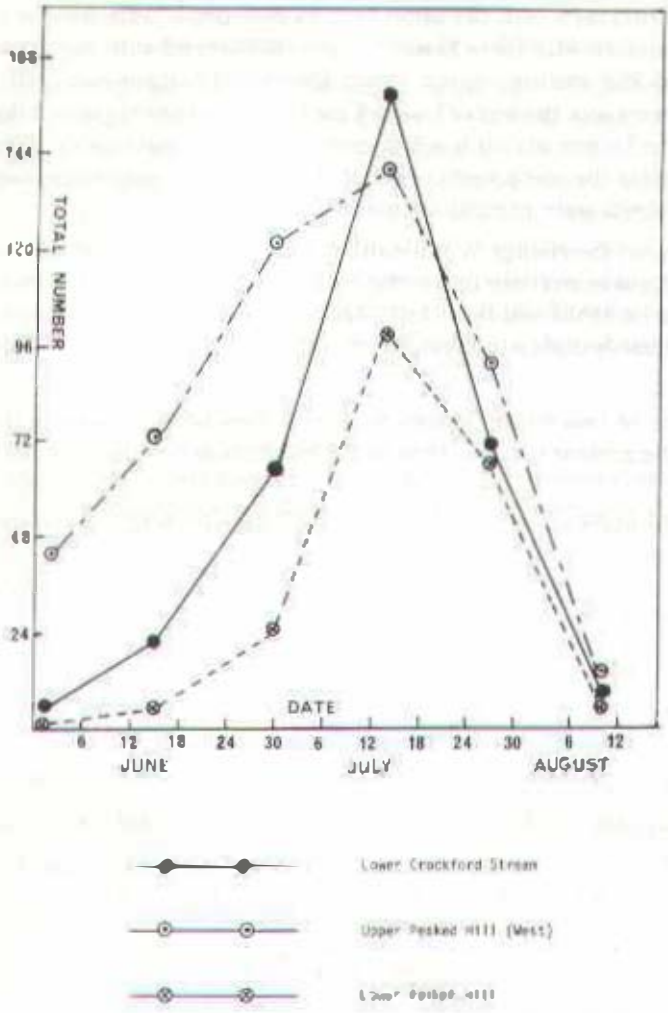


Figure 2. Temporal changes in the population size of *C. mercuriale* at a New Forest site.

and Lower Crockford. On the same date 44 *mercuriale* were present on the upper Peaked Hill section with three breeding pairs, in contrast with one male only on the lower Peaked Hill section. Since Upper Crockford Stream eventually produced a population over twice the size of Lower Crockford it may be suggested that emergence was later at the former site. It is worth mentioning here that a newly discovered small *mercuriale* site in the north west corner of the New Forest was visited two weeks later and all the insects were present in the immature stage.

Fig. 2 shows the change in populations with time and it can be seen that in spite of possible different emergence times, the peak numbers appeared for all areas at about the same time i.e. in the middle of July. The sudden reduction in numbers after the end of July is probably due to the very bad weather at the beginning of August (Jenkins, 1986).

Only one or two single females were ever seen by the stream in the three areas covered by the present survey. Thus of the numbers of females given in Table 1, over

Table 1. Numbers of males and females of *C. mercuriale* recorded during the survey

	Lower Crockford				Upper Peaked Hill			
Date	Total	Male	Female	% Female	Total	Male	Female	% Female
1/6/85	5	5	0	0	44	41	3	7
15/6/85	22	22	0	0	73	62	11	15
30/6/85	65	53	12	18	122	102	20	16
13/7/85	159	134	25	16	140	123	17	12
27/7/85	71	57	14	20	92	77	15	16
10/8/85	9	9	0	0	14	14	0	0

Lower Peaked Hill			
Total	Male	Female	% Female
1	1	0	0
5	5	0	0
25	20	5	20
99	84	15	15
66	44	22	33
5	5	0	0

98% were in tandem or *in cop.* No effort was made to search for females away from the stream as this was not consistent with the policy of the survey.

Finally, one factor which may influence a comparison of numbers for different areas should be noted. In order to visit Upper Crockford, Lower Crockford and Peaked Hill on the same day while retaining the consistent timing which was a crucial factor in the method of survey employed, the three sites were surveyed from 11 a.m. to 12.00 noon, 12.30 p.m. to 1.15 p.m. and 1.15 p.m. to 2 p.m. respectively, i.e. Peaked Hill was visited 2 hours later than Upper Crockford on every occasion. The question arises, therefore, as to whether the *mercuriale* populations change significantly between 11 a.m. and 2 p.m. In 1986 it is hoped to answer this by selecting one area and recounting it several times in one day, hopefully on a day of constant weather conditions.

Acknowledgements

My thanks to David Winstanley for encouragement and helpful comment and to the New Forest Odonata Study Group for providing the necessary stimulus.

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Abdominal deformities in *Pyrrhosoma nymphula* (Sulzer) on the Gibraltar Point National Nature Reserve

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The Gibraltar Point National Nature Reserve is an area of some 1000 acres (430 hectares) comprising sandy and muddy sea-shore, sand-dune, saltmarsh and freshwater habitats, extending for a distance of about three miles along the Lincolnshire coast from the southern end of Skegness to the entrance of the Wash. The reserve is managed by the Lincolnshire and South Humberside Trust for Nature Conservation under lease from its owners, Lincolnshire County Council and East Lindsey District Council.

The Freshwater Marsh, once part of the Old Saltmarsh, but isolated from maritime influences years ago by the construction of a sea bank, is managed as meadow grassland. In addition to an extensive man-made Mere there are several small, shallow, water table ponds and ditches of a more or less brackish nature interspersed with areas of thorny scrub, mainly Sea Buckthorn *(Hippophae rhamnoides)* with some Elder *(Sambucus nigra)* and Hawthorn *(Crataegus monogyna)*.

In the course of conducting a general survey of Odonata at Gibraltar Point NNR every Saturday I noticed a high proportion of abdominal abnormalities in individual *Pyrrhosoma nymphula*.

This year, despite the late spring, *Pyrrhosoma nymphula* was first recorded at those ponds that form the main centres of its population on Saturday 10th May, the principal emergence having occurred between May 3rd and 10th, during a period of high and exceptionally turbulent winds. Confronted by a single distorted damselfly I at first thought that this was probably the consequence of a not wholly successful attack by some predator. When faced with evidence of abdominal malformations on a massive scale, however, I was forced to a different conclusion.

Emerging between dates when the survey was conducted, and thus not directly observed, the still delicate damselflies on their maiden flight must have been blown violently into the adjacent scrub with potentially disastrous results. Recorded numbers of *Pyrrhosoma nymphula* increased over the weeks of the 10th, 24th and 31st of May and the number of seriously traumatised individuals became even more apparent. Up to a fifth of the recorded population were distorted into the most bizarre shapes; a zig-zag sawtooth, an abdomen curved back upon itself in the form of a "U", flying right angles and almost every degree of curve imaginable, fixed immutably by the process of the hardening of the cuticle.

Surprisingly, at first, these deformities did not appear to seriously impair the hunting prowess of some individuals. A female with an abdomen twisted into the form of a corkscrew seemed to have little difficulty in taking a small moth on the wing in one of the pockets of still air provided by those small clearings in the dense scrub that maturing *Pyrrhosoma nymphula* seem to favour.

However, their survival capabilities must have been seriously reduced for the number of deformed individuals rapidly diminished in relation to the general population. Only one deformed specimen was recorded after 31st May.

Although a proportion of those injured survived for a short period it is almost certain that none of them, male or female, would have succeeded in mating. None of the pairs recorded on subsequent Saturdays included a damaged insect. It would

seem, therefore, that this unfortunate coincidence of emergence into a period of strongly gusting winds by the bulk of the *Pyrrhosoma nymphula* must have had a direct and deleterious effect on the population.

By contrast the teneral specimens of *Ischnura elegans*, the only other species flying at this time and whose emergence and dispersal pattern differs markedly from that of *Pyrrhosoma nymphula*, preferred to remain in the pond and ditch vegetation or the adjacent grasses and were noticeably free of such deformities.

Unusual feeding behaviour by *Aeshna grandis* (L.)

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On the 31st August 1986 we made an early morning visit to the River Great Ouse at Cardington Mill, Bedfordshire to look for roosting Odonata. The sun had already risen and was warming the bankside vegetation following a relatively cool night. At 07.20 our attention was drawn by the typical rustling of dragonfly wings coming from a dense patch of stinging nettles *(Urtica dioica)* partially warmed by the sun.

Observation revealed a male *Aeshna grandis* flying between the nettle stems, its wings frequently making contact with the vegetation. Our initial impression was that it was trying to fly clear of the nettle patch having roosted there overnight. However, having flown clear several times it re-entered the nettles and continued to fly between the stems. It seemed rather puzzling that a dragonfly should risk damage to its wings by such unusual behaviour.

Closer inspection revealed large numbers of chironomid midges roosting on the nettle leaves and these were being disturbed by the actions of the dragonfly as it flew between the nettle stems. At intervals the *A. grandis* would hover, catch and consume one of the midges before continuing this activity.

At this time in the morning there were very few prey insects on the wing and the nettle patch provided an ideal larder of food for the dragonfly. The midges were in rather inaccessible places on the nettle plants, such as the underside of leaves, and

clearly this dragonfly was having great success in catching them, having once disturbed them. The dragonfly was observed feeding in this manner for nearly twenty minutes. Further along the riverbank two other *A. grandis* were observed in nettle patches exhibiting the same behaviour.

Corbet (1962) recalls several observations of *Aeshna* species taking resting prey but makes no reference to the type of feeding behaviour reported here. We could but feel surprised at the risks taken to fly and manoeuvre in such dense vegetation.

Maybe it is a deliberate feeding strategy of this species to search out prey from vegetation when aerial prey is in short supply, such as encountered during the low temperatures of early morning. Capture of resting prey or attached prey is observed very infrequently and Corbet suggests that it maybe much commoner than is generally realised. The feeding behaviour exhibited here may be a variation of this.

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Book Reviews

A complete guide to British dragonflies. Andrew McGeeney. Jonathan Cape. London (1986). 133pp. £12.95 (hb).

The country life guide to dragonflies and damselflies of Britain and northern Europe. Bob Gibbons. Country Life Books, Hamlyn. London (1986). 144pp. £12.95 (hb), £7.95 (pb).

A field guide to the dragonflies of Britain, Europe and north Africa. Jacques d'Aguilar, Jean-Louis Dommanget & René Préchac. Collins. London (1986). 336pp. £14.95 (hb).

For many years the excellent volume on British dragonflies by Longfield (1937) was the standard work which most of us used to learn about the British species. We eagerly awaited Hammond (1977) which was to be "the dragonfly book of the century" as Cynthia Longfield said in the foreword. In many ways it was; its main function has been to remove dragonfly identification from its taxonomic context (wing venation, genitalia and general morphology) and bring it more into line with bird identification, making the order accessible to a new type of reader who is more interested in watching dragonflies in the field, and perhaps photographing them, than in taxonomic niceties. Hammond's book was timed just right because the SLR camera market was

expanding rapidly, and real-prices falling, throughout the 1970's. However, the contribution to the body of knowledge of our British species made by Hammond's book was negligible and many odonatists, who had advanced a little beyond the beginner's stage, were sorely disappointed.

This year has now produced an apparent glut of new Odonata texts. Are they worth buying, do they offer us any fresh information which is not readily available in other books and have the authors succeeded in contributing to the body of knowledge by their own observations? For all three books I would say "yes" to the first question (but with reservations); to the other questions I have to say "no" to McGeeney and Gibbins but "yes" to d'Aguilar *et al.*

McGeeney's book on the British species is well-produced and probably the easiest to use of the three, following the butterfly book from the same stable in general style and layout. Keys are provided which are just adequate for identification, supplemented by poor sketches of male anal appendages and female pronota where necessary. Photographs of each sex, and certain colour forms, are given for every species and these are generally good but, unfortunately, in some the printing is too dark and the contrast poor. A brief text for each species gives a basic minimum of information, but it is well-written and as non-technical as possible.

Unfortunately, there are many errors which, though not serious for the general interest reader, rather detract from the book's standing scientifically. The author's name and date of description are given for each species; unfortunately parentheses have been used in all cases, even when the taxon is still placed in the original genus. Also the writer's lack of knowledge of the British species in a European and World context is apparent. For example, the World range has merely been copied from an old text (probably Longfield, 1937) and the literature search has been minimal. We are told that *Cordulegaster boltonii* occurs "across Europe to northern India", giving away the fact that the author is unaware of the taxonomic problems of Palaearctic *Cordulegaster* (*C. boltonii* does not occur outside Europe and north Africa). Also, *Aeshna cuerulea* was thought to occur in north America when Longfield (1937) was writing, since *A. septentrionalis* Burmeister was then regarded as a subspecies of *A. caerulea*, but it is now considered to be a good species (Walker, 1958). This has been missed by McGeeney (and also by the French authors of the third book). In addition, the term boreo-alpine is used incorrectly and *Somatochlora arctica* should not be so described. In Britain we do not have "representatives of all the European families" as the Euphaeidae do not occur in this country. Many other examples of errors of this kind, which are not really serious in a popular handbook, could be quoted.

A few errors also exist in the British distributions given. For example, *Leucorrhinia dubia* occurs in Staffordshire not Derbyshire, and *Sympetrum striolatum* f. *nigrescens* does not replace the typical form in much of southern

Scotland. However, as a beginner's book it has much to recommend it: it is very readable, enthusiastically written and generally well-illustrated. I am sure that a reader will arrive at many correct identifications using it and will, I hope, be spurred on to delve further into the subject. It was particularly encouraging to see a well-illustrated, simplified larval key in a book of this kind.

The Country Life Guide by Bob Gibbons is also a popular type of field guide. It is really a book on British dragonflies to which most of the northern European species have been added, perhaps to increase its appeal in the highly educated, English-speaking countries of northern Europe. The area of coverage excludes northern Scandinavia, Finland and the USSR and this makes the number of species that need to be included (and get photographs for) more manageable. The Alpine countries have "the great majority of species" covered but one of the most important is left out (see below). I do not regard the book as other than one on the British species which might occasionally be of value further afield. Judged as such, it has some very good points. It contains excellent photographs which have been printed to a high standard and as such it will surely sell well.

The introduction and biological chapters are informative and, although errors exist, the impression gained is that the author has spent more time reading the literature than has Andrew McGeeney, and I felt that the beginner has been well-served by Gibbons' text. The keys are fairly weak but presumably most users will just flick through the plates to identify a specimen, wrongly I would guess in some cases! I thought that the inclusion of the well-drawn male *Coenagrion* abdomens and anal appendages might at least encourage a few readers to check their identifications carefully.

There are a few annoying features of the book. Why has *Enallagma cyathigerum* changed gender? I was also irritated when Gibbons states that the larvae of a species are "analogous" to those of another when he really means that he cannot think of anything to say but he is saddled with the heading 'Larval Stages' for each species! Here a more thorough reading of the European literature could have helped him to fill out this section.

However, as a photographic guide to British dragonflies, the book represents a reasonable buy and, like McGeeney, will appeal especially to beginners. The author's apparent lack of experience with the European species and the omissions of important taxa such as *Aeshna serrata* (which seems to be extending its range in southern Scandinavia) and *Somatochlora alpestris* (which is usually more common than *S. arctica* at about 1000m in the Alps) prevent me from taking the book seriously in a European context.

The Collins Field Guide is an English translation of a book originally published in French. Although there are a few photographs of habitats and adult dragonflies, all

excellent quality, the book is clearly aimed at a different market to that of McGeeney and Gibbons: the area of coverage is much wider and the style of the book will only appeal to the serious naturalist who wants to study European (or north African) dragonflies. The species are illustrated by colour paintings (although I noted that *Leucorrhinia rubicunda* was omitted) which are accurate, well-executed and, I believe, more suitable for identification purposes than colour photographs. In a few cases the scale of reproduction is disappointingly small and detail is lost.

The writers have clearly researched the literature properly and, unlike the other two books, it is a genuinely scientific text. The species are dealt with briefly under various headings; the identification sections are concise and adequate for a specimen *in the hand*; intra-specific variation is dealt with where it may lead to confusion (but why not mention the variation in the male appendages of *Somatochlora flavomaculata*?); the sections on habitat and behaviour are brief but informative, being noticeably more adequate where the French species are concerned (i.e. the great majority of European species). The authors are cautious and reluctant to generalise from insufficient experience or data. The distribution section is well-researched and supplemented by maps at the back of the book which, unfortunately, are not named but just numbered. These maps are controversial and some intelligent guesswork has clearly gone into them. Nevertheless, they will be very useful if taken with a pinch of salt.

This is the first book available in English which covers the European and north African species comprehensively. It is reliable, accurate, mostly unoriginal but an enormous advance on the other available books (in French and Italian) in that it offers illustrations of nearly all the species, it covers the taxonomically difficult east European species, and especially because it is in English! I am sure that many odonatists who have a good grounding in the limited British fauna will find that this book will tempt them over the Channel in future years. However, it is not a book for complete beginners or those who do not want to study Odonata scientifically. Ironically, the one book of the three which is actually called a 'Field Guide' is the one which is least well described as such (its French title was just 'Guide'). The modern concept of a field guide seems to be a book which is portable and enables one to identify specimens in the field without killing them. It will undoubtedly be used in this manner but it will also be a useful manual to be used in the study while examining difficult material collected on the Continent.

I would recommend this book as an identification guide very strongly. If a more detailed work on natural history is required to supplement and flesh out the taxonomic skeleton it provides, I would recommend Robert (1958), surely the best book on practical dragonfly natural history ever written.

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C. S. Vick

West Wales Dragonflies. Stephen Cokes & Tony Fox. Mountain Books, Haverfordwest (1985). 168pp + 25 figs, 33 maps. £5.00.

This is a book for the dedicated dragonfly recorder; it is packed with tables, figures and maps. The first section of the book deals primarily with the eleven most important Odonata sites in Dyfed in exhaustive detail. The 25 species which occur in the area are then discussed, one species per page. Each species is figured by a large unshaded line drawing and the male is briefly described. Then follows a short description of the habitat, status and distribution of the species in Dyfed. On the facing page is a large map showing the distribution and a chart with the flight period. The final half of the book is devoted to presenting all the records so far received for the area. Unfortunately, the binding is poor and my copy is rapidly becoming loose-leaf.

The tables present the data concisely but I found them difficult to use. The codes employed for the species and status of record are often confusing and obscure, and the explanations of terms used, such as "rarity score", are hidden away in the depths of the book and are difficult to retrieve. Most of the maps are not numbered which also leads to confusion since they are referred to by number in the text.

The fact that the species descriptions do not apply to females is only mentioned in the introductory section of the book. This may cause difficulties and errors if anyone attempts to use the book to identify a female specimen simply by flicking through the species descriptions, always assuming the user can sex a dragonfly. The line drawings are good and most of the descriptions adequate, however, the authors are inaccurate when they state that the posterior lobe of the pronotum in *Coenagrion puchellum* is similar in shape to that of *C. puella*. In fact, the difference in morphology of the posterior pronotal lobe can be a useful character with which to separate the two species.

As a tool for aiding in the conservation of Odonata in Dyfed, the data presented in the book are vital and will also be of interest to those who record dragonflies in the area.

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 at least 25 mm at the left, top and bottom; text pages should be numbered. Footnotes should be avoided.

Words that are to appear in italics (e.g. names of genera and species, though not of families) should be underlined.

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

References cited in the text should be in the form '(Longfield, 1949)' or '. . . as noted by Longfield (1949).' All references cited in the text (and only these) should be listed alphabetically at the end of the article in this form:

Hammond, C. O. 1983. *The dragonflies of Great Britain and Ireland.* 2nd edition (revised by R. Merritt). Harley Books, Colchester. 116 pp.

Longfield, C. 1949. The dragonflies of the London area. *The London Naturalist* 28: 90-98.

The titles of journals should be written out in full.

Tables should be typed, each on a separate, unnumbered page.

Legends for illustrations should be typed together in sequence on a single unnumbered page.

Illustrations (figures) should be prepared in black ink, and scaled to allow a reduction of 1.5 to 3 times. Lettering should be neat and uniform.

The legend for each table and illustration should allow its contents to be understood fully without reference to the text. The approximate position of each table and figure should be indicated in the text.

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