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BDS

The aims of the **British Dragonfly Society** (BDS) are to promote and encourage the study and conservation of Odonata and their natural habitats, especially in the United Kingdom.

The Journal of the British Dragonfly Society, published twice a year, contains articles on Odonata that have been recorded from the United Kingdom and articles on European Odonata written by members of the Society.

Articles for publication should be sent to the Editor. Instructions for authors appear inside the back cover.

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Species Reviews: Various species reviews are in the process of being written so if anyone is considering writing a review of their favourite species, please contact the Editor first.

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Cover illustration: Large White-faced Darter *Leucorrhinia pectoralis*. Photograph by Clive Ireland.

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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.

- Word processed manuscripts may be submitted in electronic form either on disk or by e-mail.
- Manuscripts should be one and a half spaced, on one side of the page only and with margins at least 25mm on both sides and top and bottom. Footnotes should be avoided.
- 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.
- Dates in the text should be expressed in the form: 24 July 2010.
- 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 the following forms:

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

  Longfield, C. 1949. The Dragonflies of the London area. *The London Naturalist* **28**: 90-98.
- Titles of journals should be written out in full.
- Figures, plates and tables should be presented on separate, unnumbered pages.
- Legends for figures, plates and tables should be presented together in sequence on separated, unnumbered pages.
- The legend for each table and illustration should allow its contents to be understood fully without reference to the text.

Please refer to a recent issue of the journal for further style details.

SCIENTIFIC AND ENGLISH NAMES OF BRITISH ODONATA

ZYGOPTERA	DAMSELFLIES	*Aeshna juncea*	*Common Hawker*
Calopteryx splendens	*Banded Demoislle*	*Aeshna mixta*	*Migrant Hawker*
Calopteryx virgo	*Beautiful Demoiselle*	*Anax ephippiger*	*Vagrant Emperor*
Lestes barbarus	*Southern Emerald Damselfly*	*Anax imperator*	*Emperor Dragonfly*
Lestes dryas	*Scarce Emerald Damselfly*	*Anax junius*	*Green Darner*
Lestes sponsa	*Emerald Damselfly*	*Anax parthenope*	*Lesser Emperor*
Lestes viridis	*Willow Emerald Damselfly*	*Brachytron pratense*	*Hairy Dragonfly*
Sympecma fusca	*Winter Damselfly*	*Gomphus flavipes*	*Yellow-legged Clubtail*
Coenagrion armatum	*Norfolk Damselfly*	*Gomphus vulgatissimus*	*Common Club-tail*
Coenagrion hastulatum	*Northern Damselfly*	*Cordulegaster boltonii*	*Golden-ringed Dragonfly*
Coenagrion lanulatum	*Irish Damselfly*	*Cordulia aenea*	*Downy Emerald*
Coenagrion mercuriale	*Southern Damselfly*	*Somatochlora arctica*	*Northern Emerald*
Coenagrion puella	*Azure Damselfly*	*Somatochlora metallica*	*Brilliant Emerald*
Coenagrion pulchellum	*Variable Damselfly*	*Oxygastra curtisii*	*Orange-spotted Emerald*
Coanagrion scitulum	*Dainty Damselfly*	*Leucorrhinia dubia*	*White-faced Darter*
Erythromma najas	*Red-eyed Damselfly*	*Leucorrhinia pectoralis*	*Large White-faced Darter*
Erythromma viridulum	*Small Red-eyed Damselfly*	*Libellula depressa*	*Broad-bodied Chaser*
Pyrrhosoma nymphula	*Large Red Damselfly*	*Libellula fulva*	*Scarce Chaser*
Enallagma cyathigerum	*Common Blue Damselfly*	*Libellula quadrimaculata*	*Four-spotted Chaser*
Ischnura elegans	*Blue-tailed Damselfly*	*Orthetrum cancellatum*	*Black-tailed Skimmer*
Ischnura pumilio	*Scarce Blue-tailed Damselfly*	*Orthetrum coerulescens*	*Keeled Skimmer*
Ceriagrion tenellum	*Small Red Damselfly*	*Crocothemis erythraea*	*Scarlet Darter*
Platycnemis pennipes	*White-legged Damselfly*	*Sympetrum danae*	*Black Darter*
		Sympetrum flaveolum	*Yellow-winged Darter*
ANISOPTERA	*DRAGONFLIES*	*Sympetrum fonscolombii*	*Red-veined Darter*
Aeshna affinis	*Southern Migrant Hawker*	*Sympetrum pedemontanum*	*Banded Darter*
Aeshna caerulea	*Azure Hawker*	*Sympetrum sanguineum*	*Ruddy Darter*
Aeshna cyanea	*Southern Hawker*	*Sympterum striolatum**	*Common Darter**
Aeshna grandis	*Brown Hawker*	*Sympetrum vulgatum*	*Vagrant Darter*
Aeshna isosceles	*Norfolk Hawker*	*Pantala flavescens*	*Wandering Glider*

* Includes dark specimens in the north-west formerly treated as a separate species, *Sympetrum nigrescens* Highland Darter.

Species list in accordance with Davies, D.A.L. & Tobin, P. (1984 & 1985) The Dragonflies of the World: A systematic list of the extant species of Odonata. Vols 1 & 2.

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Species Review 7:

The Azure Hawker *Aeshna caerulea* (Ström)

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Summary

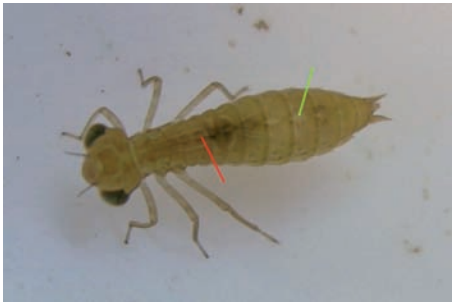
In the British Isles the Azure Hawker *Aeshna caerulea* (Ström) is restricted to Scotland, where it is classified as Vulnerable and appears to be undergoing a decline, although it remains under-recorded. The characteristics of the larva and adult are described and its habitat, behaviour and distribution are discussed.

Introduction

The Azure Hawker *Aeshna caerulea* was named first as *Libellula caerulea* by Hans Strom, a Norwegian Provost, in 1783 (McLachlan, 1898). The type specimen came from Norway but the author has not been able to find out where exactly it was found. It is thought that the generic name was altered to *Aeshna* at the end of the 1800's. 'caerulea' refers to the sky-blue colouring on its abdomen.

A. caerulea has a Palaearctic boreal distribution. It is replaced by *Aeshna septentrionalis* (Burmeister) in the northern latitudes of America, which is the most northern of the darner (hawker) species found in the Yukon (Canning, 2002) and currently the most northerly breeding species of Odonata in North America (Catling, 2003), being found above the treeline and at 68^{o} N (the Arctic Circle is at 66^{o} 33' N). Previously this was thought to be a sub-species of *A.caerulea* (Askew, 1988) but is listed as a species by Davies & Tobin (1985).

In Europe *A.caerulea* is found above the Arctic Circle along with a few other species and is one of the few species that are widespread and numerous in Eurasia's polar regions (Dijkstra & Lewington, 2006; Clausnitzer, 2009). It is found in Scandinavia (except Denmark), Estonia, Latvia, Belarus and extends through Russia to Asia. The other European locations are isolated post-glacial relict populations in Scotland, the Alps of France, Austria, Switzerland, northern Italy, southern Germany, Hungary, France and the Caucasus (Askew 1988, Dijkstra & Lewington 2006; Clausnitzer, 2009).



A

B

C

Plate 1. *Aeshna caerulea*. (A) a small larva about 5 mm in length, (B) a larger larva showing small wing buds, (C) an exuvia. ____ indicates the light dorsal spot on abdominal segment 7____ indicates the mid-dorsal yellow line.

Description

Egg

The egg stage does not appear to have been described.

Larva

The larva is characterised most commonly by a light spot on segment seven, and this is most obvious in smaller larvae that have a light overall colouration. Older larvae can have a darker colouration and this light spot is not that obvious (Plate 1). Both young and old, though not final stage (Clark 1994), larvae often have a complete or broken mid-dorsal yellow line terminating in the pale spot on segment seven (Plate 1). At emergence the larvae are 34-39 mm long.

In the UK a diagnostic feature for *A.caerulea* is that it has six antennal segments

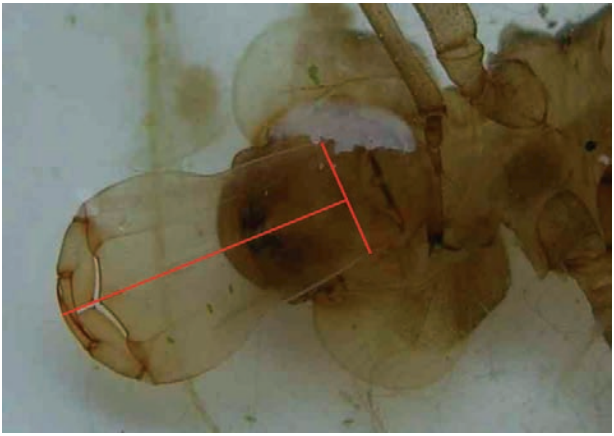


Plate 2. *Aeshna caerulea.* Labium of an exuvia to show the 3:1 ratio of its length compared to its breadth (____).

whereas all other UK aeshnids have 7. The distal two segments have fused to form a terminal segment that is twice as long as the penultimate one. However, this characteristic is not always easy to see in the field, especially in exuviae, if the antennae have been damaged or broken, and is only apparent in the final stages of development (Clark, 1994).

The ratio of the breadth of the labium at its base to its overall length is about 1:3, in common with most aeshnids found in Britain. This high ratio gives the labium a slender and tapering appearance (Plate 2). Digital photography of the labium and measuring the enlarged image on a computer screen makes this calculation more straightforward than in the field.

A. caerulea is regularly found in the same pools as the Common Hawker *Aeshna juncea*. However, in Scotland, young larvae of the latter species are pale with dark longitudinal stripes. Larger larvae of *A. juncea* are dark and the pale stripes may be faint and some individuals are completely black (Table 1). At emergence the larvae of *A. juncea* are larger (40-51 mm long) than those of *A. caerulea* (Cham, 2007). Furthermore, the labium in *A. juncea* is broad and rectangular with the ratio of its breadth at the base to its overall length being 1:2.2 -2.5 (Table 1).

Adult

The eyes of this medium sized Hawker touch for only a short distance; they are blue in the male and brown in the female. In both sexes the costa is brown and there are narrow, wavy, pale stripes on the sides of the thorax (Plate 3). The

Table 1. Comparison of the larval features of *Aeshna caerulea* and *A. juncea*. Information from Cham (2007).

Characteristic	*A.caerulea*	*A.juncea*
Young larva (sub-2cm)	Pale golden colour with a pale spot on segment 7	Pale colour with obvious, dark longitudinal stripes, though not in larvae found in southern populations.
Older larva (3cm+)	Darker but usually with a pale spot on segment 7 but not always present. No pale spots on 8, 9 or 10.	Dark colour with visible, though sometimes faint, stripes. Some individuals are completely black with no stripes visible.
Labium ratio (base: length)	1:3	1:2.2-2.5
Length of larva at emergence	34-39mm	40-51mm
No. of antennal segments	6	7

male has extensive blue markings on the abdomen and short ante-humeral stripes (Plate 4). The female occurs in two colour forms, brown and blue; in the former the abdominal spots are yellowish. Ante-humeral stripes are absent (Plate 5). The black markings on the abdomen of the female cover a larger area than those on the male, giving the female a darker appearance (BDS website 2012).

The other large species found in the same habitat as *A.caerulea* are *A. juncea* and the Golden-ringed Dragonfly *Cordulegaster boltonii. C. boltonii* is easy to identify with its large size, green eyes, bright yellow colouration and, in the female, a pointed ovipositor; all obvious features that distinguish it from *A.caerulea*. However, *A. caerulea* may easily be confused with *A. juncea* (Smallshire & Swash, 2010) and hence possible sitings of *A. caerulea* outside its normal range need to be viewed with extreme caution. *A.caerulea* is smaller than *A. juncea* (Table 2) but this is not always a useful identification feature when in flight. Usually, but not always, some yellow can be seen on the thorax of male *A. juncea* when they are in flight. However, some *A. juncea* in the northwest

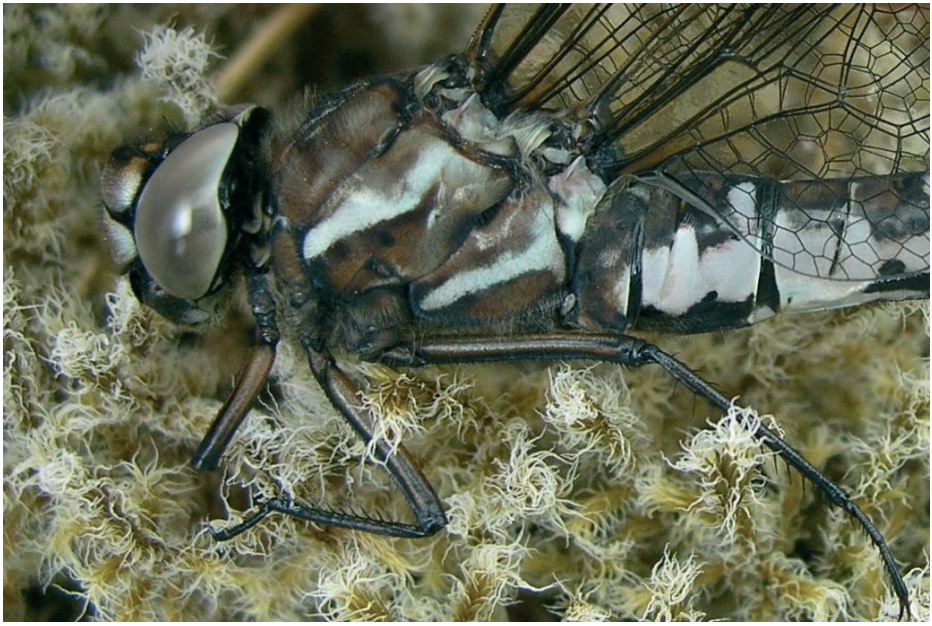


Plate 3. *Aeshna caerulea* female (blue form) showing the wavy, pale stripes on the side of the thorax. The pattern on the male is similar.

highlands can have very blue abdomens. Close inspection is required to make a correct identification on the wing and this may not always be possible.

Fortunately, *A. caerulea* basks a great deal, thus providing the opportunity to get a closer look. The lack of any bright yellow in the male of *A. caerulea* is the key difference between it and *A. juncea*, the latter having a yellow frons and costa and yellow thoracic stripes (both antehumeral and lateral) (Table 2). The frons of the male *A. caerulea* is pale blue or a bluey-yellow, so when seen head-on the insect does appear quite blue; also its antehumeral stripes are short, blue and not very obvious. The female is a little more difficult but again she lacks any bright yellow and also lacks any ante-humeral stripes. It should be noted that, as in *A.caerulea*, some *A.juncea* females have male colouration; this however does not cause a problem in separating the species.

Another feature that is unique to *A.caerulea* is that the male's blue pigment fades to a paler colour when the temperature falls below a certain level; this can be a greyish purple (Sternberg, 1987) or a greyish blue (Plate 4B). The same does not happen in *A. juncea*. This may be a camouflage adaptation, allowing the male to fade into the light coloured substrate it usually perches on. There appears to be no mention of this happening to the female's

A

B

Plate 4. *Aeshna caerulea*. Males. (A) typical blue colouration when warm, (B) faded colouration in cold conditions. Note that the latter tends to blend with its background (the trunk of a Scot's Pine). Photographs by Tim Careon.

A

B

Plate 5. *Aeshna caerulea*. Females. (A) blue form, (B) brown form. Photographs (A) by Catherine Isherwood, (B) by Tim Careon.

Table 2. Comparison of adult features of *Aeshna caerulea* and *A. juncea*. Information from Brooks & Lewington (1997), Dijkstra & Lewington (2006) and Smallshire & Swash (2004).

Feature	*A.caerulea*	*A.juncea*
Eye contact	Short	Broad
Eyes	Blue (male), brown (female)	Blue (male), green-brown (female)
Frons	Pale blue or a bluey-yellow (male). Browny-yellow (female).	Yellow
Costa	Brown	Yellow
Antehumeral stripes	Short and blue (male). None (female)	Narrow and yellow (male). Short and yellow (female)
Thoracic stripes	Narrow, wavy, blue stripes (male)	Broad, yellow, straight stripes (both sexes).
Abdominal colouration/ features	No yellow on abdomen (male)	Yellow markings on abdomen (male)
Overall length	54-64mm	65-80mm
Hindwing length	37-41mm	40-48mm

colouration but she is already better camouflaged than the male. Certainly in females with male colouration the expectation would be that the same colour fade would occur. However, Sternberg (1997) notes that this physiological colour change occurs in some other anisopterans but has not so far been recorded in the females of any European odonate; he also suggests that it is a method of thermoregulation (see 'Adult Behaviour').

Habitat

Key sites such as Loch Maree/Torridon and Dundreggan represent stem/source habitats (Corbet & Brooks, 2008) with substantial populations that persist for many years. Adults dispersing from these areas colonise secondary habitats

where populations may not persist for long but are reliant on immigration of individuals from the source habitats to bolster the population. A sub-set of the secondary habitats are termed latency habitats, where populations do not last long but they act as useful stepping stones to new areas of breeding habitat or different source habitats with existing populations. All these classes of breeding habitat act as a meta-population, with interactions both within patches and between patches at varying geographical scales.

A.caerulea tends to fly at low altitudes in Scotland and Scandinavia and, in Scottish populations, the maximum breeding habitat height is around 550 m a.s.l. (Clarke *et al*., 1990). Work at Dundreggan in 2010-11 gave a range of breeding habitat elevations from 310 to 580 m a.s.l. At Loch Maree this drops to 20 metres a.s.l. (Clark *et al*., 1990). Where it is found further south it rarely occurs at altitudes below 1000 m a.s.l. (Clausnitzer, 2009). Thus, in the Alps it has been reported between 1400 and 2200 m a.s.l. in Switzerland (Dijkstra & Lewington 2006) and between 1700 and 2200 m a.s.l. in France (Haute-Savoie) (Grand & Boudot, 2006).

In Scotland *C.boltonii* and *A.juncea* are more commonly encountered at the highest altitudes. This may be due to the fact that *A.caerulea* seldom travels very far from its breeding habitats (Corbet & Brooks 2008), unlike these other two wandering species. However, little is known about this species to say this for certain. Both in the Swiss Alps and Scotland *A. juncea* breeds at higher attitudes than *A. caerulea*; 2757 metres (Corbet, 1999) and 900 metres (P. Batty pers comm.) a.s.l. respectively have been recorded for the former.

In Continental Europe *A.caerulea* breeds in alpine and arctic moors, heaths and tundras (Askew, 1988) and in bog pools and sedge swamps (Dijkstra & Lewington 2006). It breeds in small pools (a few m^2) of heath- , forest- , and Sphagnum-bogs (Gerker & Sternberg, 1999). Both *A. caerulea* and *A. juncea* are regularly found in the same pools. Although *A. caerulea* seems to prefer pools with Drowned Kitten's Fur Sphagnum *Sphagnum cuspidatum* and Cottongrass *Eriophorum* spp., both species can be found in this habitat. Certainly in the early larval stages at Dundreggan *A. caerulea* preferred more openly structured Sphagnum, presumably allowing more light and heat to penetrate. This is also noted in Clark (1994). So far, *A. caerulea* has only been found in shallow bog pools typically with 15-20cm of water (Smith *et al*., 2000). This shallowness, linked with the brown water and the dark (peaty) substrate, produces a relatively warm habitat, ensuring rapid larval growth (Sternberg, 1997).

Hammond (1994) mentions seepages but to date no larvae have been found there. Pools that are too shallow will dry out in periods of drought. This has occurred more frequently in the early Spring in the Highlands of Scotland in the

last 10 years and this may be having a major local effect on larval survival if they dry out completely. Such pools are often very small (1x1 metre) but some are larger, over 5 m^2

Smith *et al*. (2000) postulated that the shallow pools are selected to limit competition with *A.juncea,* a species that prefers deeper pools, since fewer *A. juncea* were found in pools with lots of *A.caerulea.* The drying out of these shallow pools leads to a high mortality, leaving few final year larvae to emerge as adults. Pools with slightly deeper areas, over 20cm in depth, offer a retreat in the drought, however whether this is a criterion for the female's choice of oviposition site or just down to luck is something that there is no answer for yet.

The older larval stages are very difficult to find, presumably as they seek different habitat from the younger stages (which are fairly easy to find) and 'hide' more in the pools at the sides and the bottom rather than basking on the submerged Sphagnum and *Eriophorum* spp. as the smaller larval stages do . They will also be the least numerous larval stage due to mortality.

Distribution in Scotland

Historic Distribution

A single individual of *A. caerulea* was caught in 1845 in the North of Scotland by Mr Wilson (Lucas, 1900; Corbet *et al*., 1960) and was confirmed as a resident Scottish species by Robert McLachlan, an eminent Odonatologist, who caught two males and a female in 1865 on the south side of Loch Rannoch (Lucas, 1900). Further collections were made of several individuals on June 22 1889 by Morton and King in the Black Wood of Rannoch and by Morton in June 1895 in a more southerly locality in Glen Lochay (Morton 1895) and Breadalbane (Lucas, 1900). In summary, Lucas (1900) noted that, in the British Isles, it had only been recorded from Scotland and "has at present been recorded …. only from the Rannoch and Breadalbane districts of Perthshire" but that "it is probably present in the intervening country between these two districts, and perhaps in other localities as well". Longfield (1949) stated that, in the British Isles, *A.caerulea* is entirely confined to Scotland "and rare even there, although in good years it is sometimes fairly plentiful in its few known localities". She noted that "It is found in the counties of Sutherland, Inverness, Argyll and Perth."; also possibly in Ross.

The first evidence of breeding of *A. caerulea* in Scotland was gained by Fraser in 1952 in Perthshire, where larvae were dredged in numbers (Smith *et al*.,

2000). There was little further information until Gabb (1985) found a freshly emerged female and its exuvia beside a large bog pool in Wester Ross.

David Clarke in an unpublished paper dated 1988 in the Merrick Kells SSSI file mentions that *A. caerulea* was found at Silver Flowes by Derek Ratcliffe in 1949. This location is well over 100 miles from the next nearest known site in Perthshire. Hammond (1994) stated that this species is nowhere common but distributed over a wide area and he published the first 10km square distribution map of this species. The atlas, published by Merritt *et al*. (1995), showed a slight increase in the number of 10km squares with positive records. They state "It is a scarce dragonfly in Britain, restricted to northern Scotland and Galloway. It seems to have been more frequent in the past, and has probably suffered in some areas from the increase in conifer planting and drainage that entails." Brooks & Lewington (1997) contains a distribution map that shows this species being present in the western Highlands north of Oban and around Speyside, with a concentration around Wester Ross. Several sites are mentioned as being good places to watch this species - Silver Flowes, Rannoch, Glen Affric and Loch Maree. Smallshire & Swash (2004) show a patchier distribution in the Highlands of Scotland, from the records on the NBN. The species is described as scarce and local. They also mention the RSPB Reserve at Forsinard as being another reliable site.

Current distribution

On the NBN Gateway (2013) nearly all of the current records are post 1975 - there are 102, 10km square records in suitable habitat. Roughly a third of the records date from 2000 and most of them are post 2005, reflecting the work done on the British Dragonfly Society Atlas 2008-13 project (Fig. 1).

Dragonfly surveys were conducted at many of the upland sites having EIAs for wind farm applications and *A.caerulea* were recorded at a number of them, thus expanding the known distribution (P. Cosgrove, pers comm.). *A.caerulea* is almost certainly under-recorded with much of its potential habitat being in remote upland with unpredictable weather, making it difficult to survey suitable habitat thoroughly. Until the ecological surveys for wind farms most of the best known sites were the most accessible sites, rather than perhaps the best sites for this species.

Site condition monitoring work in Galloway by the author over 2010-11 failed to find larvae or adults. One fleeting and tantalising possible sighting of a flying-off adult that had been perched on a boulder in a ditch suggests the species is not extinct in Galloway. However, it is highly likely that the Silver Flowes is not

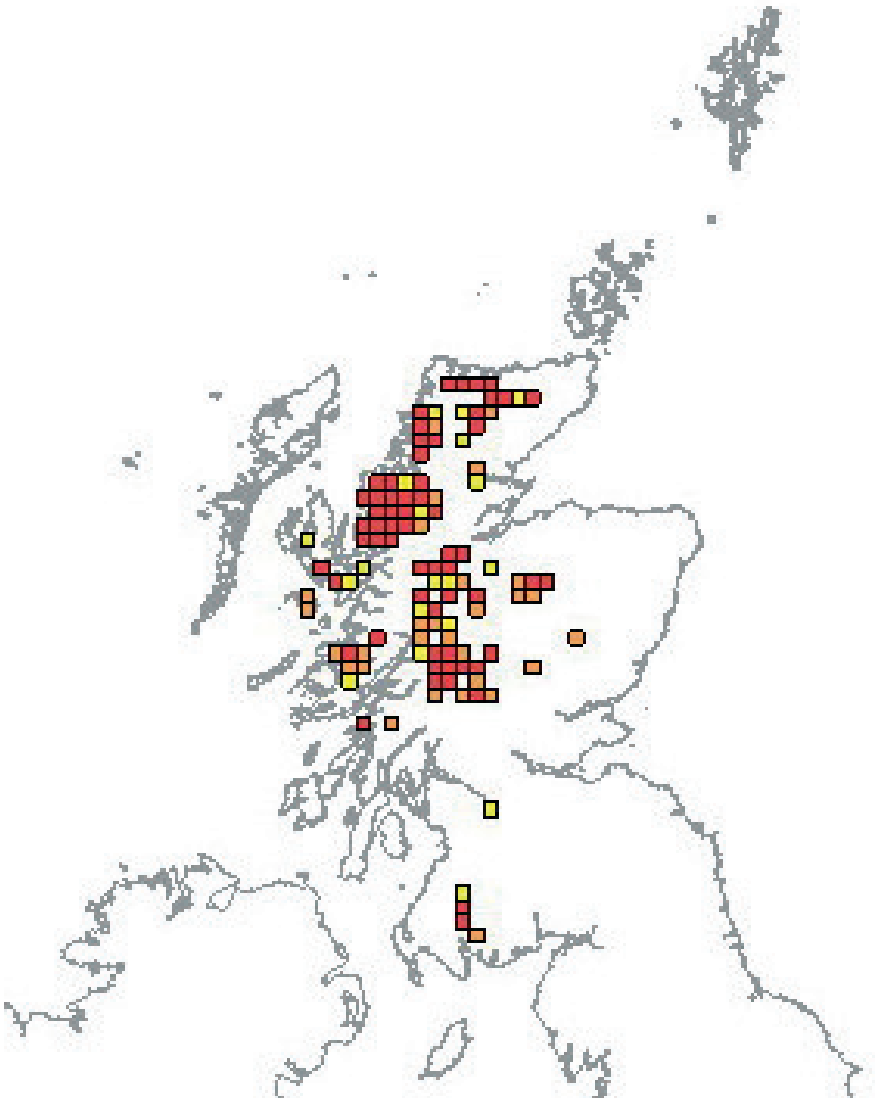


Figure 1. Distribution of *Aeshna caerulea* in Scotland at 10km square resolution. © Crown copyright and database rights 2011 Ordnance Survey [100017955].

, 1985 to 2004; , before 1985; , 2005 to 2012. **Note:** the '1985-2004' dates overlie the earlier ones where squares have records in more than one date class; similarly the 'before 1985' dates overlie the '2005-2012' ones where squares have records in both date classes. Thus the red squares show the core range over the 20 years from 1985-2004, the orange shows squares where no records have been obtained since before 1985 (range reduction) and the yellow shows squares where new records have been obtained since 2004 (range expansion).

a source population but suffers from periodic extinctions and is re-colonised by individuals from populations breeding at higher altitudes.

Life Cycle

Egg

A.caerulea has obligate diapause (Corbet & Brooks 2008), The eggs are laid in the summer and do not develop until the next calendar year, with hatching in late April or May, depending on the warmth of the early spring weather.

Larva

The delay in hatching is thought to protect the earliest larval stages, which are the most susceptible to low temperatures and would explain why nearly all of the *A.caerulea* larvae caught at Dundreggan in 2010-11 were less than 5mm long. During the first few weeks after hatching the larvae are thermophilic and require a fairly constant temperature of about 20^{o}C; older larvae are more tolerant (Sternberg, 1997). Thermal regimes may vary in different parts of a pond and larvae in the Black Forest in Germany have been observed to enter deeper water during a cool night but stay in the warm surface water during a sunny day (Sternberg, 1997).

Clark (1994) proposed a 3 to 4 year larval life cycle following his findings from larval sampling in Galloway. If correct this may take even longer in cooler breeding locations. He also proposed that there may be a diapause in penultimate instar larvae to allow a relatively synchronised early emergence in late-May to late-June.

A. caerulea larvae are classified as Claspers and Sprawlers by Corbet & Brooks (2008). Claspers cling to vegetation close to the water's surface staying very still to camouflage themselves. They respond promptly and actively to movement, readily stalking or pursuing potential prey if it fails to come close enough to them to grasp with their labium. The description of them as "Sprawlers" hunting by touch does not match the fact that they have large eyes similar to other aeshnids and so would be active hunters using sight not touch The golden colour of the *A.caerulea* larva gives it superb camouflage against the background of the green/gold *S. cuspidatum.* Similar to the adult stages the larvae will eat any animal the same size or smaller than them, including conspecifics.

Emergence

Gerken & Sternberg (1999) state that *A. caerulea* emerges either directly onto Sphagnum moss at the edge of the pool or on emergent vegetation e.g. Sedges *Carex* spp. In Scotland *A. caerulea* emerges between noon and early afternoon (E.M. Smith, pers comm. in Corbet & Brooks, 2008). Clark *et al*. (1990) note that experiments with captive bred *A. caerulea* have shown it can complete its emergence in much less time than *A. juncea*, possibly giving it an advantage in windswept and exposed localities.

Adult Behaviour

Flights of *A. caerulea* tend to be shorter than those of other aeshnids and they often bask on surfaces warmed by the sun with their wings pressed against the substrate (Sternberg, 1997). The basking behaviour of *A. caerulea* is its most obvious behaviour that differs from other hawkers. It seeks light coloured surfaces, stones, boulders, tree trunks and the grey-green of *Racomitrium lanuginosum* hummocks on which to bask (Askew, 1988; Clark *et al*. ,1990; Dijkstra & Lewington, 2006) but has also been observed basking on dark, peaty ground (Sternberg, 1997). This basking allows it to take up heat from the substrate; also the wings, which are lowered, produce a greenhouse effect which, depending on the substrate colour, can cause the temperature under the wings to be up to 7^{o}C higher than above them, thereby preventing heat loss from the thorax (Sternberg, 1990, 1997). In strong winds they tend to select sites on the ground for basking, where they are sheltered from the wind and where the substrate is warmest (Sternberg, 1997). Thus, in contrast to other aeshnids, the basking behaviour of *A. caerulea* means that little energy is required to warm up its body and maintain it at the level needed for flight (Sternberg, 1997), thus allowing it to colonise the very highest latitudes. The converse of this is that *A. caerulea* is rarely observed when the ambient temperature is above 22^{o}C, possibly due to overheating of its body. Indeed, at higher ambient temperatures, when other aeshnids are flying in the sun, adults of *A. caerulea* search for shaded places and bask on light substrates (which do not heat up as much as dark ones) (Sternberg, 1997).

When the temperature is below 12^{o}C adult males become dull coloured and, due to higher radiation absorption, will warm up faster and to a higher degree than if they retained their bright blue colouration. Hence, in the morning, when it is cold, they can become active earlier than other odonates. Conversely, at higher temperatures, the blue colour helps to protect the males from over-heating (Sternberg, 1997) by reflecting solar radiation.

Typical of odonates in general, adult *A. caerulea* seek out any species of flying insect smaller than themselves to eat. In strong winds few insects are on the wing and those that are flying tend to stay close to the ground and cannot be

preyed upon by most aeshnids, which normally catch their prey from below. However, since *A. caerulea* spend much of their time basking on the ground they are in a good position to catch such low flying insects and hence may have a relatively high success in catching prey in such conditions (Sternberg, 1997). Lepidoptera and the various moorland flies will make up the vast majority of the diet of *A. caerulea*. They normally take little notice of larger lepidopterans but it has been observed in the Black Forest in Germany that, when the wind is strong, they prey only on Macrolepidoptera, which are possibly the only insects flying (Sternberg, 1997). It is thought that they tend to seek more sheltered areas to feed in, which may be at lower altitudes and a few kilometres away from the breeding areas. When in suitable breeding habitat, they are either looking for a mate or egg laying rather than looking to feed.

Hammond (1994) states that *A. caerulea* prefers birch woodland to open moorland and is more likely to be found in clearings in woods than elsewhere. Clark *et al*. (1990) feel that the preference for woodland has been overstated. Silver Flowes had no woodland cover until 1964 so the species can persist without it. However, there is no doubt that woodland cover provides a good habitat for sheltering and feeding and certainly would improve a site for this species.

It appears from most research that the adults spend much of their time away from the breeding sites. Females oviposit alone and males will patrol ponds looking for ovipositing females to mate with. It is not clear where the adults spend the rest of their time but they may travel a fair distance to find both shelter and good breeding habitat. At Dundreggan on a couple of fine days in 2010, adult males were seen feeding along a sheltered burn 200 metres below the main breeding area and over a mile distant.

Reproduction

The only reference in the British literature of mating behaviour (Brooks & Lewington, 1997) states “Copulation lasts many minutes, and a pair in the wheel position may settle on boulders or low vegetation.” Using the flight period information, the earliest mating would happen in late-May/June and through into July. The female oviposits unaccompanied (Brooks & Lewington, 1997). It is not known if the female mates the day before oviposition, similar to other aeshnids. So there is more observation required on this aspect of *A. caerulea*’s behaviour.

Flight Season

The flight season is from mid-July to mid-September in most of Europe (Dijkstra

& Lewington, 2006) but Grand & Boudot (2006) note that it sometimes starts as early as the end of June. In Scotland it sometimes starts in late-May but most often in mid-June (Dijkstra & Lewington, 2006). It is mostly over in Scotland by the end of July (Askew, 1988). Lucas (1900) reported that in 1898 at Rannoch the species was common in the second half of June.

Conservation

In Scotland, *A. caerulea* is classified as Vulnerable in the Red Data Book, occuring in less than 10 geographical locations, all in Scotland, and is undergoing an inferred decline (inferred due to lack of data) (Daguet *et al*., 2008). As long ago as 1937, Longfield (1937) stated that "it should be rigorously preserved." The population in south-west Scotland is the one most at risk from climate change as it is so far south and should have special attention paid to it to determine the distribution of the meta-population in that area.

In continental Europe it is considered of 'Least Concern' in the Red List (Clausnitzer, 2009). In general the main threat to this species is habitat destruction; specifically the clear-cutting of forests and changes in management regimes (Clausnitzer, 2009). It is showing decline in some parts of its range, notably in the post-glacial relict populations of central Europe. Hence it is important that habitat restoration and conservation are implemented (Clausnitzer, 2009)

The Future

Work undertaken by the author in 2010-11 has slightly extended the known range of the species in the UK and has found a large area with a significant concentration of breeding pools. Features of the most likely breeding sites, to look for on a map, would be flat expanses of patterned bog (i.e. having many pool systems) around 400-600 metres a.s.l. This altitude is only a guide and would decrease the further north and west one went from the core area in the western central Highlands e.g. Loch Maree and Sutherland have breeding sites much closer to sea level than Inverness-shire.

Another feature to look out for is a combination of relatively open water with strands of *S. cuspidatum* and emergent stems of *Eriophorum* spp. Wherever likely pools were sighted and sampled early instar larvae were nearly always found clinging to *S. cuspidatum* or *Eriophorum* spp. In Glen Torridon sites were sampled in 2011 with *S. cuspidatum* and *Eriophorum* spp. present and they had *A. caerulea* present. These sites differ from some of the bog pools at Loch Maree, which are often quite bare and do not always have much Sphagnum or vegetation cover. It is worth being aware that *A. caerulea* will breed in a variety

of bog pool habitats. It is suggested that the Loch Maree-side population is large and that dispersing adults may be utilising sub-optimal habitats in which to breed.

By identifying a large area of suitable breeding habitat it would mean that there would be potentially a population of *A. caerulea* to discover or survey. Large areas of suitable upland habitat all over the Highlands have still not been surveyed and extrapolating from the surveys of Dundreggan it seems likely that populations of this species would be found there.

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Altitude limits for the occurrence and breeding of some British dragonflies

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Summary

The altitude at which some species of dragonfly occur and/or breed has been determined at two locations in Inverness-shire, in the Central Highlands of Scotland The importance of aspects of temperature, rather than altitude itself, and of the rôle of the microclimate are discussed.

Introduction

Ambient temperature is one of the limiting factors in determining the range of odonate species (Corbet, 1999). From this it follows that there should be a limit to the altitude at which each species occurs and that this 'cut-off altitude' will decrease with increase in latitude. Indeed, the decrease in mean annual air temperature resulting from a 122 m increase in altitude is approximately equivalent to that for a 1^{o} increase in latitude (Danks, 1978; Corbet, 1999). However, it needs to be borne in mind that adults may be found at higher latitudes than their breeding populations for various reasons (Corbet, 1999), including possibly as a result of being transported there by air currents (e.g. Wojtusiak, 1974; Kiauta, 1983; Edwards, 1987). Hence it is important to distinguish between breeding populations and individual adults.

In Scotland, Smith (2004) suggested that, in 2000-2001, at 57^{o} 35' N in Morayshire, his field observations might show that the 'cut-off altitude' for the Blue-tailed Damselfly *Ischnura elegans* (Vander Linden) and the Common Blue Damselfly *Enallagma cyathigerum* (Charpentier), given the right habitat, could be around 150 metres a.s.l. Furthermore, he speculated that the upper altitude limit for the Emerald Damselfly *Lestes sponsa* (Hansemann) in that area could be near to 250 metres a.s.l. and that a similar altitude might apply to two further species, the Four-spotted Chaser *Libellula quadrimaculata* L. and the Black Darter *Sympetrum danae* (Sulzer).

Observations

In Inverness-shire, in the Central Highlands of Scotland, on 9 and 10 August 2012 at 56° 53' N, I determined that, if the required habitat was present, some species occurred at much higher altitudes than observed by Smith (2004).

At 410 metres a.s.l. in the valley of the River Pattack, in similar acidic pools (at NN548820, 545817, 554815 and 544809), adults of Large Red Damselfly *Pyrrhosoma nymphula* (Sulzer) and Emerald Damselfly were observed, while there was evidence of probable breeding (oviposition) for Four-spotted Chaser, Black Darter and Common Hawker *Aeshna juncea* L.

At 420 metres a.s.l. in ditches (NN 544790) and at an old oxbow (NN 539788) draining a peaty catchment and adjacent to Loch Pattack, adults of Large Red Damselfly, Blue-tailed Damselfly, and Black Darter were all present and Emerald Damselfly was seen ovipositing. At a peat hag nearby, at 430 metres a.s.l., Golden-ringed Dragonfly *Cordulegaster boltonii* (Donovan) was observed.

These observations make me wonder at what maximum altitudes the species of Odonata occurring in Britain can be found either as adults or as breeding populations.

Discussion

Of the above species, larvae of *A. juncea* have been recorded at 2000 m a.s.l. in Japan (36°N) (Kurata, 1974) and 2,757 m a.s.l. in Switzerland (46°N) (Keim, 1993). However, data on the other species have not been found. Using the figure of 122 m corresponding to 1° of latitude, the mean annual air temperature at the height recorded in Japan would be higher than at sea level at 57°N, whereas that at the height recorded in Switzerland would equate to an altitude of 1,415 m at 57°N. As noted in the introduction, temperature is almost certainly the limiting factor rather than altitude itself and the results on *A. juncea* indicate that this could be dependent on the local microclimate, which is influenced by a variety of physical factors at the site, including aspect. However, there is no direct evidence for mean annual temperature being a critical factor; there are other possibilities, including winter minimum temperature and duration of periods of frozen water.

Clearly, more data are required; indeed such data could prove helpful in determining the reasons for the distribution of species in the more mountainous regions of the U.K. and which aspects of temperature are of prime importance. It is hoped that this article will stimulate further work in this area.

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Cynthia Evelyn Longfield (1896-1991) – the Irish connection and collections.

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Summary

Cynthia E. Longfield (1896-1991), traveller, explorer and dragonfly expert, was a remarkable woman in many ways. Internationally known as an odonatologist, she travelled throughout the five continents, most importantly sailing with other scientists to the South Pacific on the St George expedition in 1924. She taught herself natural history at home and had wide interests including ornithology and botany. She always regarded herself as Irish, with her family estate in County Cork, to which she was to return on 'retirement' in 1957. She deposited her library and scientific papers at the Royal Irish Academy and a collection of her Odonata was donated to the Natural History Museum in Dublin. She worked for many years at the Natural History Museum in London as a volunteer, where she eventually specialized on African species of dragonflies and was made an Honorary Associate in 1948. Author or co-author of several books on dragonflies, she was elected the first Honorary member of the British Dragonfly Society and is remembered with affection and high regard by those who knew her.

Introduction

"Cynthia Longfield's pioneering work on British dragonflies set the scene for serious studies in London from the 1940s, the birth of the British Dragonfly Society in 1983, and the subsequent wide appreciation of the role of Odonata in matters of conservation significance, especially in relation to habitat management" (Brooks & Anderson, 2009).

Ireland has a long list of eminent women naturalists such as Maude Jane Delap (1866-1953), Annie Massy (1867- 1931), Matilda Knowles (1864-1933) and Mary Ward (1827-1869) but none perhaps had such a long and interesting life as Cynthia Longfield.

As well as being an all round naturalist, Cynthia Longfield (Plate 1) made a significant contribution to the study of dragonflies not only in London, as the above quote indicates, but in other parts of Great Britain, Ireland and worldwide.

She became a world expert on dragonflies but she is also remembered for her work on other insect groups, especially the Lepidoptera, her interests in botany and ornithology and for her travels round the world. It is difficult to categorise her because she was both a professional and an amateur.

After an introduction to her life, travels and work this article considers her connections with Ireland.

Plate 1. Cynthia Evelyn Longfield (1896-1991). Provided by Keith Hyatt and with acknowledgement to the Natural History Museum, London.

Life and travels

Born in Pont Street, Belgravia, London on the 14 August 1896 (Corbet, 1991) to a wealthy family with an estate in Co. Cork, some might think of her as not truly from that country but “she always considered herself to be Irish” (O’Connor, 1997). Her family home was in Cloyne, Co. Cork and as a girl she spent her time between London and Ireland, but “preferred her months in Ireland” (Power, 2000). In 1957 she returned to live there permanently.

Cynthia came from an Anglo-Irish family who had owned the estate since the seventeenth century. Her father was Mountifort Longfield (1858-1929) who married Alice Elizabeth Mason (1865-1946) and they had three girls, Cynthia being the youngest. Their house was called Castle Mary and she always regarded this as home. In Ireland the family can be traced back to John Longfield (1620-1670) who came to Ireland from Wales and his son John Longfield (1653-1730), who purchased the estate, and named it either after his wife or the Queen (Foley, Annmarie - Housetorian website). Castle Mary was built in 1785 but burnt down during The Irish troubles in May 1920 and a smaller house named The Park House was built on the edge of the Upper Park, facing south towards the sea (Hayter-Hames, 1991).

Privately educated, as a teenager Cynthia rebelled against her teaching and, encouraged by her mother, who provided her with suitable books, became interested in natural history, teaching herself zoology. With help initially from her mother’s father James Mason, a chemist and engineer, “she recognized a like mind” (Power, 1997). There was also the wonderful countryside around the house which must have also inspired her when in Ireland.

As a young woman she frequently spent time travelling abroad, sometimes as a ‘paid up’ member of an expedition, to conferences or even on holidays and she continued to travel extensively into her 70s. Her journeys to five continents are impressive by any standard, considering she was a woman, sometimes travelling alone and in the 1920 and 1930s. They included remote places like the Pacific Islands, Mato Grosso in Brazil, Lake Titicaca, Uganda and other parts of East Africa, as well as more familiar destinations such as Canada, Egypt, France, Greece, Holland, Malta, Russia, South Africa and she travelled as far as Australia to attend an International Entomological Conference in Canberra in 1972. In 1929 she visited South-East Asia, collecting Lepidoptera and Odonata, and in 1934 left for a six-month trip to Africa “collecting widely in the eastern and southern parts of the continent” (Hyatt, 1992), making a further trip to East Africa in 1937. She met Margaret Fountaine (Cater, 1980), another intrepid lady traveller, collector and lepidopterist at Meru in East Africa and by the time Cynthia left Miss Fountaine they had collected 120 butterflies

and 72 dragonflies" (Hayter-Hames, 1991). From one of these visits "she had 58 distinct species and described 6 new species (of Odonata)" (Hayter-Hames, 1991), finally concentrating on African Odonata, which resulted in an important paper in 1936 (Longfield, 1936).

Her most well documented expedition, and the one most far reaching in terms of her training as an entomologist, took place in 1924 when she sailed from Dartmouth, Devon on 9 April as a "paying passenger" on SV St George to the South Seas in the Pacific Ocean. On board were several other scientists: Miss Evelyn Cheesman (entomologist) from the London Zoo, Mr Chubb (geologist), Mr Collenette (entomologist), Mr Johnson (biologist), Lt Colonel Kelsall (ornithologist) and his assistant Mr A. B. Cullingford (a taxidermist). They set sail for Madeira and then Trinidad, along the coast of Venezuela and through the Panama Canal into the Pacific Ocean. They visited the Galapagos Islands, Tahiti, the Moorea Islands, Easter Island, and several other places. During their travels they collected specimens. Cynthia at this time was mainly a lepidopterist (Bennett, 1926).

A large number of photographs were taken (now in the library at the Royal Irish Academy) but by the time they reached Panama, on their return journey, their "photographic plates were old and fogged on development…[and]… no feasible solution has been arrived at" (note in photograph album, Royal Irish Academy, Dublin). By the time the vessel was in reach of Balboa, Panama on the return journey they were becalmed for days, their supplies were exhausted and the situation became serious. The other problem was that urgent repairs were needed to the vessel and, on reaching Balboa, the ship was put in dry dock, in order to examine the damage done to her bottom as a result of striking a coral reef at Rapa. Repairs were also needed to a loose rudder (notes from her photographic album, Royal Irish Academy, Dublin). Cynthia left the St George and returned to England on a cargo boat in the late summer of 1925 (Hyatt, 1992). She came home as an experienced field entomologist and was put in charge of dragonflies, by Douglas Kimmins (Gambles, 1975) at the Natural History Museum, London.

In 1927 she went on another expedition to Brazil's Mato Grosso. By now she was a dragonfly expert and "brought back 38 species" from this area (Power, 1997) including one later to be named after her, *Castoraeschna longfieldae* Kimmins.

A book about her life has been written by her great niece, Jane Hayter-Hames, 'Madam Dragonfly. The life and times of Cynthia Longfield', published in the year of Cynthia's death (Hayter-Hames, 1991). It was reviewed by Keith Hyatt, who knew Cynthia, and he wrote that despite "minor blemishes. It has been a

great pleasure to read" (Hyatt, 1991). The book did not fully cover Cynthia's contribution to science but one subject was raised, that of the conservation and the protection of species of which Cynthia was made well aware during her travels. "No weedkillers were allowed in the garden at The Park House…[and]… "conservation was part of her life" (Hayter-Hames, 1991).

Cynthia Longfield was "possessed of tremendous mental and physical energy… [had]…great generosity of spirit…[and]…was also an enabler and for this will always deserve the respect and gratitude of those who wish to conserve dragonflies" (Corbet, 1991). A kind and generous person, she is remembered with affection and admiration by those who knew her.

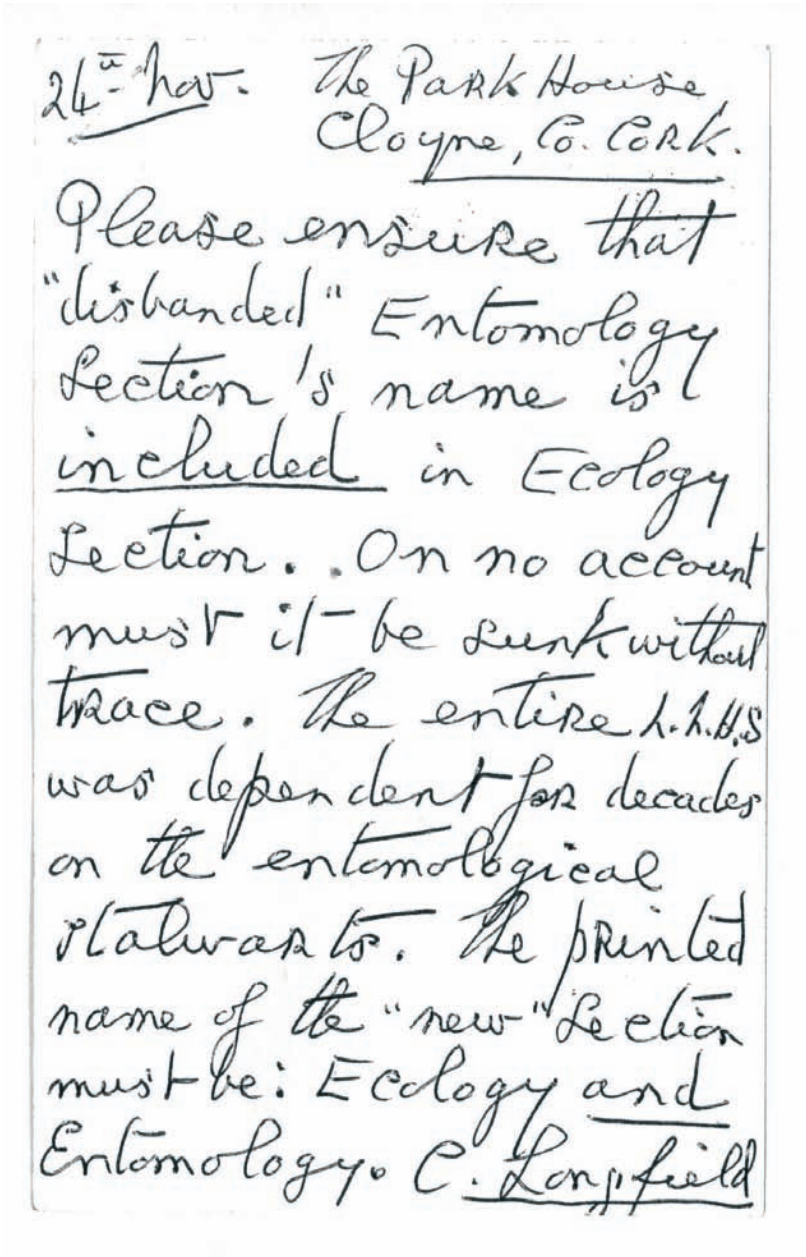
Member of Societies and author

Cynthia Longfield was a member of several societies, including the Royal Entomological Society of London (of which she was a Fellow and the first woman Council member), the Royal Geographical Society and the British Ornithological Union. In Ireland she became involved in the work of the Cork Ornithological Society and botany was another interest. She became President of the London Natural History Society (the first woman in that post) for 1932 and 1933 and Vice- President after that and, on her retirement from London, an honorary Vice-President (Hyatt, 1992). She was particularly concerned about the London Society's future and especially their plans in the 1970s to disband the entomology section and she wrote forcibly about this (Plate 2). A life member of the Botanical Society of the British Isles from 1932, she collected plants for various gardens and museums. Scannell (1992) recalls that, when a meeting to inaugurate a branch in Ireland was held in Dublin in 1963, Cynthia insisted one committee be elected for the whole of Ireland.

The Societas Internationalis Odonatologica (SIO) was formed in 1973 and Cynthia Longfield was one of the earlier members. She attended the 3rd International Symposium in Lancaster, England held in 1975, where she was on the Committee of Honour and presented a paper.

The British Dragonfly Society was founded in 1983 and, soon after the society was formed, Cynthia was made the first Honorary member. The citation reads, 'In recognition of the immense and lasting contribution she has made to the development of interest in and documentation of dragonflies in Britain' (Plate 3).

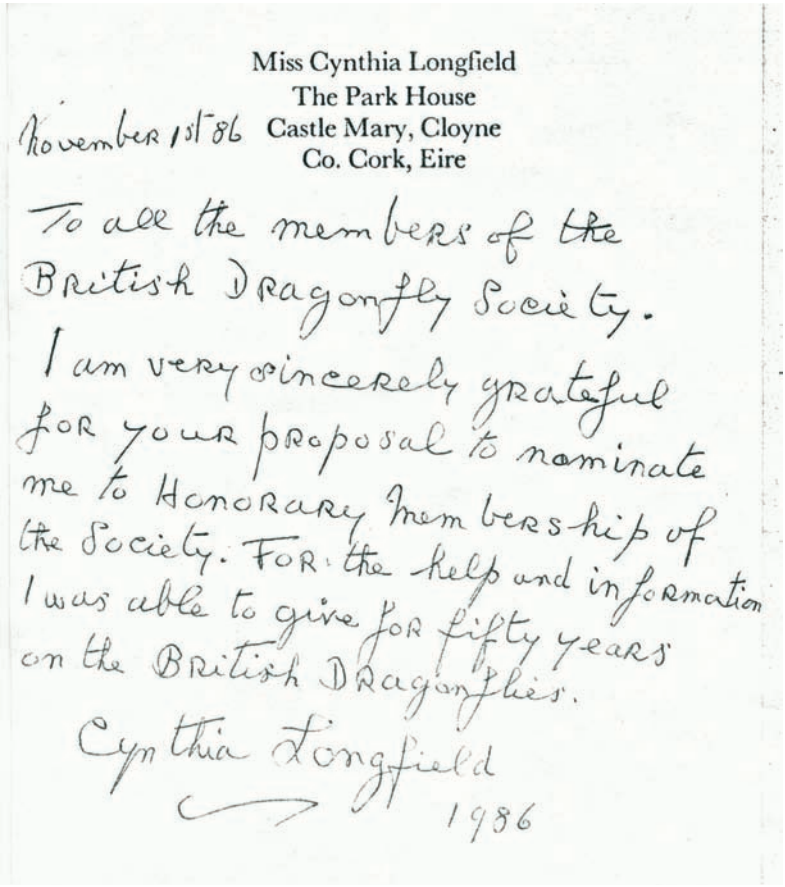
Cynthia was the author or co-author of several books on dragonflies and damselflies of Great Britain and Ireland. Her first was published in 1937 in the



24th Nov. The Park House
Cloyne, Co. Cork.

Please ensure that "disbanded" Entomology Section's name is included in Ecology Section. On no account must it be sunk without trace. The entire L.N.H.S was dependent for decades on the entomological stalwarts. The printed name of the "new" Section must be: Ecology and Entomology. C. Longfield

Plate 2. Post-card sent from Ireland, in 1974 to Keith H. Hyatt, at that time President of the London Natural History Society, indicating the importance of entomology to the society. The card shows her handwriting and signature. With permission of Keith Hyatt.



Miss Cynthia Longfield
The Park House
Castle Mary, Cloyne
Co. Cork, Eire

November 1st 86

To all the members of the
British Dragonfly Society.
I am very sincerely grateful
for your proposal to nominate
me to Honorary membership of
the Society. For the help and information
I was able to give for fifty years
on the British Dragonflies.

Cynthia Longfield

1986

Plate 3. Letter from Cynthia Longfield thanking the BDS for making her an Honorary member.

Wayside and Woodland series by Warne, entitled 'The Dragonflies of the British Isles', which included Ireland's Odonata (Longfield, 1937). This book was the standard handbook and quickly made the subject popular amongst amateurs as well as professional workers and encouraged many to take up the subject. A second, enlarged edition was published in 1949 (Longfield, 1949). She later collaborated with Philip Corbet and Norman Moore to produce 'Dragonflies' in 1960, in the New Naturalist Series published by Collins (Corbet *et al*., 1960). Described by the editors as a naturalist of "world repute and esteem…[and]… an enthusiastic all-rounder", Cynthia wrote the chapters on the British species, their distribution and the history of the subject as well as providing the maps of distribution and the "commissioning and inclusion of colour photographs" (Corbet, 1991).

Table 1. Species described by Cynthia Longfield in chronological order.

Species	Date	Location
Sapho fumosa	1932	Sierra Leone
Urothemis thomasi	1932	Arabia
Umma distincta	1933	Rhodesia
Umma electa	1933	Congo
**Enallagma pseudelongatum*	1936	East Africa
***Paragomphus moka*	1936	Cameroons
Aciagrion rarum	1945	Southwest Africa
Orthetrum macrostigma	1945	Angola
Umma femina	1947	Angola
Microgomphus camerunensis	1951	Cameroons
Orthetrum machadoi	1955	Africa

* syn. *E. elongatum* Martin, 1906; ** syn. *P. abnormis* Karsch, 1890.

The book was referred to by Marren (1995) as “A scarce and famous book, always in great demand by dragonfly enthusiasts…but I fear that the days when you could discover one at your local jumble sale are over”. Her books are described in some detail by Corbet (1991), including reference to the monochrome reprint in 1985 of ‘Dragonflies’ (1960) (Corbet *et al.*, 1985), of which “Cynthia was ambivalent” (Corbet, 1991). Her books provided most of the records for a ‘Provisional Atlas of the Dragonflies in Ireland’ (Lamhna, 1977, 1978). A new volume in the New Naturalist Series ‘Dragonflies’, written by Philip Corbet and Steve Brooks, was published in 2008 (Corbet & Brooks, 2008). Cynthia also published notes and papers on Irish Odonata in The Irish Naturalists’ Journal (Longfield, 1929, 1948).

In total she described six zygopteran and five anisopteran species, all from Africa (Table 1), two of which were later synonymised with other species. No fewer than five odonatologists (Kimmins, Lieftinck, Fraser, Gambles & Legrand) named species after her – one zygopteran and five anisopterans (Table 2).

Table 2. Species named in honour of Cynthia Longfield in chronological order.

Species	Authority	Location
Castoraeschna longfieldae	Kimmins 1929	Brasil
Agrionopter cynthiae (*Agrionopter insignis cynthiae)*	Lieftinck 1942	Tanimbar Islands – between East Timor and New Guinea.
Enallagma (*Africallagma*) *longfieldae*	Fraser 1947	East Africa
Heliaeschna longfieldae	Gambles 1967	Cameroons
Tetrathemis longfieldae	Legrand 1977	Gabon and The Democratic Republic of the Congo

Back home in Ireland

When she reached the age of 60, “she began to think of retirement. That meant going home, and home was Ireland” (Power, 2000). In 1957 she returned to live permanently on her family estate but continued to travel and correspond worldwide. Prior to ‘going home’, she produced a ‘flyer’ (Plate 4) issued from her London address informing former colleagues, relatives, friends and “Odonatists” of her decision, including her new address from June 1957. As stated, she intended to “carry out some biological studies, and to catalogue her large library of books and papers on the dragonflies of the World”. After her return to Ireland she continued to work on dragonflies, write about them and correspond with workers around the world. Cynthia also assisted local workers on the Irish Odonate fauna as the following quote indicates, “In compiling this list I have been favoured by having Miss Cynthia Longfield F.R.E.S., send me particulars of all Irish reports received by her since she wrote the first edition of her book, The Dragonflies of the British Isles, as well as indicate in the cases of sub-divided counties to which divisions the Irish County reports in that book should be referred. For this invaluable help and for much other assistance in the study of the Odonata I am deeply indebted to her” (MacNeill, 1949). MacNeill (1949, 1950) and others described the distribution of Irish Odonates in the 1940s and 1950s and, more recently, Nelson & Thompson (2004) have written about Ireland’s dragonflies. There were also short expeditions in Ireland when, “she

11 IVERNA GARDENS,
KENSINGTON, W.8.
LONDON, ENGLAND.

CHANGE OF ADDRESS

Miss CYNTHIA LONGFIELD is retiring this year from active work on taxonomy in the British Museum (Natural History), after thirty years work on the Odonata.

She is returning to live on the family estate of Castle Mary in Ireland. There she intends to carry out some biological studies, and to catalogue her large library of books and papers on the dragonflies of the World. When a Subject Index has been compiled, she will be able to supply references to all enquirers. She also hopes to continue writing the biennial "Notes" on the British species, and so would ask all those interested to continue sending her their records.

If you are touring Ireland, be sure to look her up. Her house is only a short distance from the beautiful coast road from Rosslare, or Waterford, to Kerry via Cork, which is only 18 miles away. If you can spare the time, better still, come and stay. In any case all relations, friends, Museum colleagues and Odonatists everywhere, please call in at

THE PARK HOUSE,
CLOYNE,
CO. CORK,
EIRE.
Telephone and Telegram: CLOYNE 22.

This will be the new address from **June 15th, 1957.**

Plate 4. 'Flyer' sent to colleagues, family and friends regarding Cynthia Longfield's move to Ireland in 1957. With permission of Keith Hyatt.

Table 3. List of the Cynthia Longfield Odonata (families and genera) held at the Natural History Museum in Dublin. Supplied by Leona McArdle (pers. comm. 21 November 2012),

	Genera
AESHNIDAE	Aeshna, Brachytron
AGRIIDAE	*Agrion*
CALOPTERYGIDAE	*Umma, Calopteryx*
CHLOROCYPHIDAE	*Chlorocypha, Libellago, Platycypha, Rhinocypha*
COENAGRIONIDAE	*Pseudagrion, Ischnura, Erythromma, Enallagma, Coenagrion, Agriocnemis, Aciagrion*
CORDULEGASTRIDAE	*Cordulegaster*
CORDULIIDAE	*Hemicordulia, Cordulia, Oxygastra, Somatochlora*
GOMPHIDAE	*Gomphidia, Gomphus, Ictinogomphus, Onychogomphus, Phyllogomphus*
LESTIDAE	*Lestes*
LIBELLULIDAE	*Zygonyx, Urothemis, Trithemis, Sympetrum, Pseudomacromia, Potamarcha, Pantala, Palpopleura, Hemistigma, Orthetra, Notiothemis, Neurothemis, Micromacromia, Libellula, Leucorrhina, Lathrecista, Diplocodes, Cracothemis, Cratilla, Aeiosoma, Acisoma, Brachythemis, Brachydiplax, Agrionoptera, Aethriomanta*
MACROMIIDAE	*Macromia, Phyllomacromia*
PLATYCNEMIDAE	*Platycnemis, Mesocnemis*
PSEUDOSTIGMATIDAE	*Meistogaster*
PROTONEURIDAE	*Caconeura, Chlorocnemis, Disparaneura, Elattaneura*

would set off in her Austin, her kit including butterfly net, binoculars and walking stick" (Hayter-Hames, 1991). She continued to travel when in her seventies and her last paper was published in 1979 (Longfield, 1979). She died on 27 June 1991 at the age of 94 in Cloyne, Co. Cork and is buried at St Coleman's Church of Ireland Cathedral at Cloyne, Co. Cork.

Collections

A small collection of Cynthia Longfield's books on botany from her private library, some signed by her and one with the Longfield bookplate, are held in the library at University College Cork (Sheyeda Allen pers. comm. 19 November 2012).

Library and photographs in the Royal Irish Academy, Dublin

Cynthia deposited an enormous collection of books, pamphlets and papers (in the Longfield Roberts collection), amounting to 619 items, together with 790 photographs, in the library of the Royal Irish Academy (details and websites provided by Petra Schnabel, 7 November 2012). The photographs were taken during the St George Expedition to the South Sea Islands (1924-25) and illustrate the fauna and flora of the Pacific Islands as well as people and life on board. The books and papers on the Odonata must be amongst the best collection on the subject of Odonatology in the world. Foreign authors include Frederick Brauer, Louis Cabot, Philip Powell Calvert (large number of entries from 1895 to 1899), Hermann Hagen, F. Karsch, R. Rene Martin, M. P. Rambur and Edmund Selys-Longchamps (a very large number of entries). The books and papers of English workers are also well represented and, for example, include F.W. Campion (10 joint entries with Herbert Campion from 1906 to 1914), Herbert Campion (27 single author entries from 1912 to 1924), John Curtis (1791-1862), Edward Donovan (1768-1837), William Forsell Kirby (1844-1912), Robert MacLachlan (1837-1904), W. J Lucas and Robert J. Tillyard (Tillyard emigrated to Australia). The details of the collection can be found on the websites given below. Clearly some of these older publications were of great help to her when she wrote the chapter on the 'History of British dragonflies' in 1960 (Corbet *et al*., 1960). In the twentieth century familiar names are Philip S. Corbet, Friedrich Foerster, M. A. Lieftinck and Friedrich Ris.

Her papers, photographs and diaries were deposited at the Royal Irish Academy in 1979.

Dragonflies at the Natural History Museum, Dublin

Much of her material is housed at the Natural History Museum in London, where she worked on Odonata as a volunteer under D. E. Kimmins in the Department of Entomology, where she was made an Honorary Associate in 1948.

However, in the Natural History Museum in Dublin there are three entomology cabinets, two boxes and a couple of slides donated by Cynthia Longfield (Museum catalogue NH: 1980.21.). One of the cabinets has nine drawers of pinned Odonata and the other two cabinets contain storage boxes, tubes and pinned insects with, additionally, specimens in envelopes. There is also a bound catalogue containing, in alphabetical order, a list of all the species donated, compiled by Dr Jim O'Connor and Dora Murphy (pers. com. Leona McArdle 19 and 21 November 2012). Table 3 includes a list of the families and genera held in the Longfield cabinet collection in Dublin.

Conclusions

Although Cynthia is well known amongst Odonatologists world wide, and much has been written about her life and her contribution to work on dragonflies, her life and work in Ireland is perhaps less well known. Her decision to donate some botanical books to University College Cork, her library of books, pamphlets and reprints to the Royal Irish Academy and some of her biological collections to the Natural History Museum, Dublin, is perhaps an indication of her desire to be remembered as Irish and indicates where her priorities and affections lay.

Acknowledgements

I am especially grateful to Keith Hyatt (retired from the Natural History Museum, London) who read a draft, made useful comments and supplied the figures used. Leona McArdle (Natural History Museum, Dublin) and Petra Schnabel (Deputy librarian, the Royal Irish Academy library, Dublin) have been especially helpful in supplying information from Ireland and I thank them for their time, offers of help and attention to detail. I also wish to thank the following: Brian McGee (archivist at Cork City and County Archives), Emer Twomey and Sheyeda Allen (Archives and Special Collections, University College Cork).

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The Large White-faced Darter *Leucorrhinia pectoralis* (Charp.) in Britain during 2012

Adrian J. Parr

10 Orchard Way, Barrow, Bury St Edmunds, Suffolk IP29 5BX

Summary

The Large White-faced Darter *Leucorrhinia pectoralis* was noted in England on two occasions in 2012, these constituting only the second- and third-ever confirmed UK records of the species. This is discussed in the light of the migratory capabilities of *Leucorrhinia* species and the possibility that some earlier unexpected sightings from eastern England originally ascribed to White-faced Darter *L. dubia* may have been either Large White-faced Darter or Northern White-faced Darter *L. rubicunda*.

Introduction

The Large White-faced Darter *Leucorrhinia pectoralis* (also sometimes referred to as the Yellow-spotted Whiteface) (Plate 1) is a close relative of the White-faced Darter *L. dubia* that typically frequents rather less acidic and more nutrient-rich habitats than the latter species. It favours clear waters with floating plants and well-developed marginal vegetation, and can thus be found in well-vegetated forest lakes, marshes and fenlands in addition to peatlands (Dijkstra & Lewington, 2006). Prior to 2012, its place on the British List was based on a specimen (now lost) from “near Sheerness, Kent” taken in June 1859. The exact locality is unknown, but is believed by some to have been on board a boat in the Thames Estuary (Lucas, 1900); if this is correct then this individual never strictly reached British soil. During spring 2012, the species reappeared in Britain, again on the east coast.

Observations

The following records have been accepted by the national Odonata Records Committee:

27 May 2012 – mature male sighted at Landguard, Suffolk; TM2831 (G. Bennett) (possibly associated with a small influx of Four-spotted Chaser *Libellula quadrimaculata*).

Plate 1. Male Large White-faced Darter *Leucorrhinia pectoralis*; Dunwich Heath, Suffolk, 17 June 2012. Photograph by Clive Ireland.

16-19 June 2012 – mature male photographed at Dockwra's Dyke, Dunwich Heath, Suffolk; TM4767 (E. Beaumont, C. Ireland *et al*.). For further details see Beaumont & Beaumont (2012).

The normal range of Large White-faced Darter covers the area from Western Siberia to Central Europe, reaching as far west as The Netherlands and parts of France. It has a somewhat more southerly distribution than other European *Leucorrhinia* species, occurring in Scandinavia only in the southern parts, and having isolated populations as far south as the Balkans (Dijkstra & Lewington, 2006). It has for some years been considered a rare and declining species in many areas of Europe, and is listed in Annexes II and IV of the European Union Habitats Directive. Various conservation measures are now in place (e.g. Conze & Bouwman, 2010), and there is currently a EU funded project to assist its survival in Denmark and Estonia (Anon., 2013).

Given the species' localised nature in western Europe and its absence from Britain

for over 150 years, the events of spring 2012 are perhaps a little unexpected. Two additional factors, however, need to be taken into consideration. Firstly, population declines in some areas have seemingly been reversed in recent years. In The Netherlands the trend has been strongly positive since the turn of the century (Termaat *et al*., 2010; Waarneming.nl, 2013a) and the species may even stand to benefit from climate warming (Jaeschke *et al*., 2013). Secondly, Large White-faced Darter is known to have dispersive / migratory capabilities (Fraenkel, 1932; Haritonov & Popova, 2011), particularly when local population levels are high.

Observations from other countries in northwest Europe have revealed that a large movement of *Leucorrhinia* species seemingly took place during late May/early June 2012. This was dominated by Large White-faced Darter, but Northern White-faced Darter *L. rubicunda* and possibly small numbers of other *Leucorrhinia* species in addition to Four-spotted Chaser *Libellula quadrimaculata* were also involved. Large numbers of unexpected sightings were made in western Germany (K-J. Conze, pers. comm.; Hein, 2012; Ott, 2012), Belgium (Motte & Goffart, 2012) and northeast France (Ternois *et al*., 2012; OPIE, 2012). Numbers of Large White-faced Darter observed in The Netherlands were also high (Marcel Wasscher, pers. comm.; Waarneming.nl, 2013a), with several sightings from the coastal dunes (Waarneming.nl, 2013b). It is possible that some of these unusual sightings in NW Europe may relate to locally-bred individuals that were present in far higher numbers than expected due to good breeding success over the last few years. The large numbers of extra-limital sightings, including those of Large White-faced Darter from the UK, however imply that migration must also have been involved, and that Britain was just on the periphery of this movement. The migration wave may have been assisted by a period of hot weather in late May, with north-easterly to easterly winds over much of NW Europe during the period 24-27 May (WeatherOnline, 2013). The precise origins of dragonflies involved in the movement are currently unknown but, given the wind and weather conditions, might include eastern Germany, Poland and Russia.

Although the finding of Large White-faced Darter in eastern England is interesting in its own right, there are additional repercussions. The confirmation that continental *Leucorrhinia* can reach the east coast of Britain as migrants thus throws light on various unexpected twentieth century reports of the genus from eastern England. These have all typically been ascribed to White-faced Darter *L. dubia*, but apparently mainly because this was ‘the only British species and thus the most obvious candidate’. With records being out of typical habitat for *L. dubia*, it seems plausible that many (or maybe even all?) may however refer to migrants of other species. The best documented historic record from eastern England refers to small numbers of individuals seen at Walberswick, Suffolk,

from 24 May to 10 June 1992 (Mendel, 1992). Discussions with one of the original observers (S. Piotrowski) indicate that these were not Large White-faced Darter, which is usually a fairly distinctive species if seen well. There is, however, a very real possibility that the dragonflies could have been Northern White-faced Darter *L. rubicunda*, which also has known dispersive abilities (Fraenkel, 1932; Haritonov & Popova, 2011) and which closely resembles White-faced Darter in appearance. Although photographs are known to have been taken at the time by a visiting member of the Press, these cannot presently be traced; efforts are, however, continuing to track them down and so allow conclusive identification of the dragonflies involved. It should be noted that the illustration in Mendel (1992) does not relate to one of the Suffolk individuals.

In addition to the Walberswick individuals referred to above, there are rumours of other 'White-faced Darters' having been seen in Suffolk in recent times (most recently in 2001). However, these are even less well documented and so cannot presently be considered as acceptable records. Away from Suffolk, there also exists a curious report of large numbers of White-faced Darter *L. dubia* seen along the foreshore and cliffs at Scarborough, Yorkshire, during one day in spring 1900, at least some of which were observed flying in from over the sea (Imms, 1900). Although White-faced Darter is occasionally reported from unexpected, extra-limital, areas on the near Continent (Goffart *et al*., 2006; Cédric Vanappelghem, pers. comm.), these instances do not typically involve large numbers of individuals. Assuming that a *Leucorrhinia* species was involved, perhaps a more-strongly dispersive species such as Large White-faced Darter or Northern White-faced Darter might instead have been implicated in the Scarborough sightings, or maybe it was a mixed immigration containing one or more *Leucorrhinia* species in amongst aggregations of another similarly-sized migrant species. Mixed migrations of Four-spotted Chaser and Large White-faced Darter / Northern White-faced Darter have indeed been reported elsewhere (Haritonov & Popova, 2011).

Discussion

Over the years there have been several rather curious reports of 'White-faced Darter' from eastern England. While some of these may result from mis-identifications, others do appear to relate to a *Leucorrhinia* species, though the exact specific identifications are open to debate. The discovery of two male Large White-faced Darters on the Suffolk coast during late May/June 2012, representing the first UK records of this species for over 150 years, demonstrates that migrant *Leucorrhinia* spp. do have the ability to reach Britain from the Continent. This gives added weight to some of the less well documented historic sightings of 'White-faced Darter', yet also implies that the range of possible

species that could be involved is perhaps larger than previously thought. Now that observers' attention has been drawn to the phenomenon, it will be interesting to see just how frequently the arrival of migrant *Leucorrhinia* species occurs on the east coast of England, and whether the potential for colonisation by species such as the Large White-faced Darter may now exist.

Acknowledgements

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The occurrence of the Copper Emerald *Calopteryx haemorrhoidalis* (Vander Linden, 1825), records of rare species, changing population trends of some hitherto common species and recent colonisers in the Maltese Islands.

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Summary

The first record of *Calopteryx haemorrhoidalis* (Odonata, Calopterygidae), Vander Linden, 1825 from the Maltese Islands is reported. Historical and modern records for the Maltese Islands of the rare species, *Calopteryx virgo*, *Aeshna mixta* and *Selysiothemis nigra* are discussed. Also discussed are the changing population trends of hitherto common species such as *Orthetrum coerulescens anseps, Sympetrum fonscolombii* and *Sympetrum striolatum*.

Introduction

At present the Odonata fauna of the Maltese Islands (Fig. 1) consists of 18 species. These records were compiled over a period of 114 years (McLachlan, 1899; Cowley, 1940; Valletta, 1949, 1951, 1957; Sciberras *et al*., 2007; Ebejer *et al*.; 2008; Sciberras 2008 a, b; Sciberras & Sammut, 2008; Sciberras *et al*., 2010; Gauci & Sciberras, 2010; Sciberras 2011a, b.). The Maltese species list includes: *Calopteryx* (x1), *Ischnura* (x1)*, Aeshna* (x1), *Anax* (x3), *Crocothemis* (x1), *Selysiothemis* (x1), *Orthetrum* (x6), *Sympetrum* (x2) and *Trithemis* (x1). From 2009 to date one of the authors (AS) has been studying the remaining collection and works of the late Anthony Valletta (1908-1988) for a separate publication. From this study several unpublished records were discovered. This paper records the presence of the nineteenth species for the Maltese Islands, namely *Calopteryx haemorrhoidalis* and further documents historical and modern records of rare species for the Maltese Islands. Identification for most specimens was done by the authors consulting Dijkstra & Lewington (2006) and images available on the web. Mr Bernd Kunz contributed where particularly difficult species were involved and where further expertise was felt necessary to confirm a particular species.

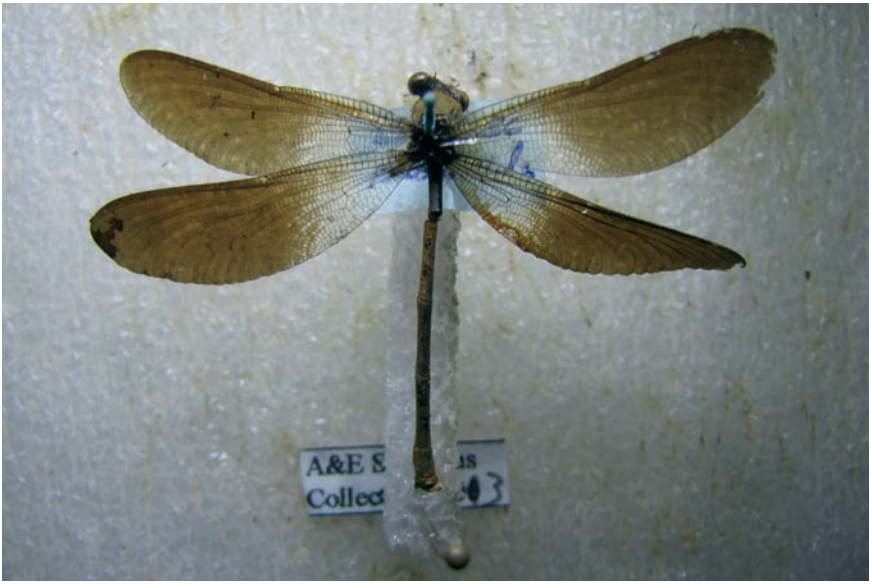
Fig. 1. The layout of the Maltese Islands.

Zygoptera

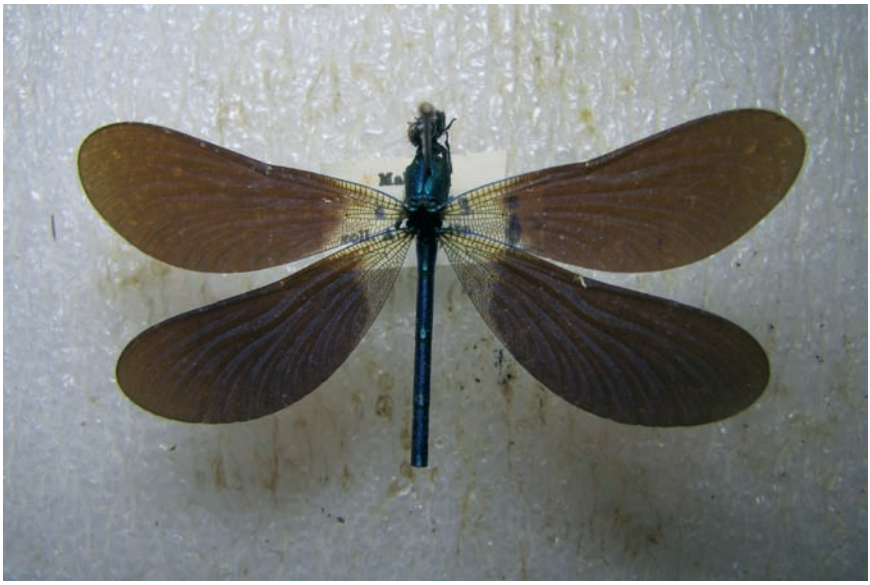
Calopterygidae

Calopteryx haemorrhoidalis (Vander Linden, 1825) The genus *Calopteryx* was represented in the Maltese islands by scattered records of *Calopteryx virgo meridionalis* (Sciberras & Sammut, 2008). A number of specimens still in paper envelopes and one small box with two severely damaged *Calopteryx* specimens were discovered in Valletta`s house in 2011. One of these remains was of a specimen (21 pieces) that, when almost completely assembled by (AS), turned out to be a male of *C. haemorrhoidalis* (Plate 1A). There was a data label associated with the head and the thorax and this reads “Marsascala 28.vii.1986” (Fig. 2A). This specimen was collected by Anthony and Carmen Sammut and passed to Valletta. The specimen was identified by Bernd Kunz. This is the first record of *C. haemorrhoidalis* for the Maltese Islands.

Calopteryx virgo (Linnaeus, 1758) The subspecies *Calopteryx virgo meridionalis,* was recorded from a single dead specimen found between 1987-1988 in Marsascala by MS (Sciberras & Sammut 2008). The same work lists two unconfirmed records, one from a dead specimen found in 1985 in a reservoir at Zebbug, Gozo and another dead one in 1997 from Nadur, Gozo (Fig. 2C). The former specimen consisted of just a forewing and the latter was of a dead complete specimen. Unfortunately, both had been badly damaged by pests (*Lepisma* sp., Lepismatidae) as they had not been preserved properly.



A



B

Plate 1. (A) *Calopteryx haemorrhoidalis* specimen collected on 28 July 1986 from Marsascala, (B) *Calopteryx virgo meridionalis* specimen collected on 11 March 1973 from Dwejra (Gozo).

Figure. 2. (A) Malta, (B) Comino, (C) Gozo showing the localities indicated in the text.

A

B

C

D

Plate 2. *Aeshna mixta*. (A) collected on 26 April 1976 from Balzan, (B) collected on 12 May 1948 from San Anton Gardens, (C) observed on 25 May 2012 from Comino Island, (D) observed on 1 November 2012 from Ghadira Nature Reserve. Photographs (A, B) by A. Sciberras, (C) by M. Sammut, (D) by C. Gauci.

The Zebbug specimen is still existent and is of good enough quality for identification and has been confirmed by AS and is identical to the Marsascala 1987-88 specimen, i.e. it is *C. virgo meridionalis*. The same small box that contained the *C. haemorrhoidalis* specimen, also had the fragments of a specimen (7 pieces) that, when assembled (by AS), proved to be a male *C. virgo meridionalis* (Plate 1B). The data label, which was attached to the thorax and one wing, reads “Malta, Dwejra (Gozo) 11.iii.1973 Leg. A. Valletta” making this the first record of this species collected from the Maltese Islands (Fig. 2C). During 2011 AS discovered a single male specimen of this species in a Tunisian collection with a data label reading: “Malta 17.viii.1982 Leg: G. Taipan.”

Anisoptera

Aeshnidae

Aeshna mixta (Latreille, 1805) This species was only recorded in the Maltese Islands from a single female specimen collected from Balzan on 26.iv.1976 by M.J. Ebejer (Ebejer et al. 2008; Sciberras 2008b) (Plate 2A; Fig. 2A). Since then the specimens on which Valletta (1949) based his work have been re-examined by AS and while some specimens are missing, a single male of *A. mixta* was identified by AS and confirmed by Bernd Kunz. It had been misidentified as *Anax imperator* (Leach, 1815). The label data states that the specimen was collected from San Anton Gardens on 12.vi.1948 by Valletta himself, making it not only the first *A. mixta* to be collected in the Maltese Islands, but one of the oldest surviving Maltese Odonata specimens (Plate 2B; Fig. 2A). From 1976 until 2009 there were no further records for this species. Then, on 28.August 2009 a single male specimen was sighted for over one minute by AS at Sarraflu Pond in Gozo (Fig. 2C). Another specimen was sighted in 2011 by G. Degabrielle, but no other data has been provided as this record is being published elsewhere (Degabrielle pers. comm.) On 25 May 2012 a female specimen was photographed at the Helipad on Comino Island by MS (Plate 2C; Fig. 2B). On 27 May 2012 another specimen, probably a male, was sighted at a site known as 'Tar-Rummien' on Comino Island by one of the authors (MS) and Joseph Grech (Fig. 2B). On 1 November 2012 a male specimen was photographed at Ghadira Nature reserve, Malta by Charles Gauci (Plate 2D; Fig. 2A).

Libellulidae

Selysiothemis nigra (Vander linden, 1825)
This species was first recorded in the Maltese islands by Valletta (Valletta,1957), from two specimens collected in 1952 and was not seen again until 1996, so these records make a total of three individuals being recorded up to that date. (Ebejer *et al*., 2008). In 2007, one specimen was collected in July from Ramla Bay in Gozo and, in August, five female specimens were observed in a burnt field in an area known as tas-Sellun in Xaghra, Gozo (Fig. 2C). Shortly afterwards a permanent population was noted at two large artificial reservoirs in a valley at Marfa, Malta (Fig. 2A). In 2008 AS and some other observers at L-Ahrax and Ghadira nature reserves spotted a number of individuals (Fig. 2A). From 19 July to 22 August 2008 this species was observed on a daily basis, with records ranging from a single individual up to 15 in a single day (Sciberras 2008b). On 12 August 2009, 15 specimens were located at Il-Balluta in the village of Marsaxlokk (Fig. 2A) and exuviae were found on vegetation above brackish water. From 2010 – 2012 over 112 specimens were recorded by AS and several other observers, including three specimens from Comino Island and one specimen from Fungus Rock, Gozo (Fig. 2C).

It is presumed that, in the past, this species was overlooked and may have been more regular. This is likely due to its elusive behaviour - a tendency to fly very low, combined with its small size, makes it more difficult to detect than other Odonata. From 2009, it has been regularly observed in small numbers in other areas including Buskett and Dingli, Malta especially from August - September (MS) and at Cirkewwa (AS) (Fig. 2A).

Discussion

Historical records often cause problems when it comes to recording and identification, since most voucher specimens are in poor, or even very bad, condition and data labels are often unclear or lack information. The specimen of *C. haemorrhoidalis* is published here because of the excellent reputation of the collector and, since the handwriting on the label matches that of Valletta, the specimen must have been either caught or mounted by him, making this a trustworthy specimen for study. It is of interest to question why the 1973 record of *C. virgo meridionalis* and the 1986 record of *C. haemorrhoidalis* were never published by Valletta himself as he a was a prolific publisher, as his works indicate. Few or no studies have been carried out on his collection after his death and some of the boxes in his collection were not examined until 2011. Neither of these important specimens possessed any species determination label and this must have delayed any publication. The 1948 *A. mixta* specimen must have been a simple misidentification, either by the collector or by the individual determining the specimens, which in this case Valletta consulted mostly with Odonatologist J. Cowley. The lack of records of *A. mixta* between 1976 and 2009 could be attributed to lack of observation and/or misidentification despite the species being locally rare.

Whilst records of rare species are on the increase, one must also note that previously common species such as *Orthetrum coerulescens anseps* (Fabricius, 1798), *Sympetrum fonscolombii* (Selys, 1840) and *Sympetrum striolatum* (Charpentier, 1840) are showing a fast decline in population numbers. Though still common, the distribution of *O. coerulescens anseps* has been greatly restricted to a couple of valleys, although until late 2000 it was widespread and on the increase (Sciberras 2008a). *Sympetrum fonscolombii* was regarded as very common but recently numbers have decreased drastically, especially in the last eight years. This may be attributed to the population increase of *Orthethrum trinacria* (Selys, 1841), which is normally accompanied by a decline in populations of *S. fonscolombii* (Sciberras pers. obs.). This trend is further supported by the fact that most of the sites where *S. fonscolombii* is still occasionally recorded tend to be coastal sites, which do not support *O. trinacria* populations. The last *S. striolatum* observed by the authors was on 18

August 2008. *Orthetrum brunneum* (Fonscolombe, 1837) was known only in the late 1990`s to 2000`s from a pond close to the Roman Villa at Rabat and was last sighted on 20 July 2010 by AS. In late 2012 this site was undergoing a restoration project, which unfortunately will destroy the stable vegetation and microhabitat this species prefers. Recent colonisers such as *O. trinacria* have taken over most ponds on the islands accompanied by *Crocothemis erythraea* (Brullé, 1832) while *O. trinacria* has established a more permanent residence in the island of Gozo while being spotted occasionally both on the island of Malta and on Comino. Four sightings of *Orthetrum nitidinerve* (Selys, 1841) were also noted at wied Rihan in the village of Burmarrad, Malta, presumably showing an increase in population since its first sighting in 2010. However, this could also be the result of another migration influx.

The proposal of "Damigella Tar-Ram" for the Maltese vernacular name for *Calopteryx haemorrhoidalis* is derived from the suborder level name in Maltese (adapted after Sultana & Falzon 1996, 2002, Sciberras 2008a) and the morphological characteristics of the species. The English vernacular name is Copper Demoiselle.

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The Brilliant Emerald *Somatochlora metallica* (Vander Linden) in Scotland, with particular reference to the Argyll sites and to larval habitat

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Summary

Since 2000, new *Somatochlora metallica* sites have been found in the Loch a' Chrion-doire area in Argyll. The sites are described. The apparent range expansion is likely to be the result of increased recording in the area. Larvae were first found in Scotland in 2000. Their habitat is discussed. They are found in water 20-40 cm deep, underneath heather or sphagnum banks amongst sparse fibrous detritus. The banks are at water level and overhanging or undercut for between 30 and 150 cm. Larvae have also been found under stones in Slovenia.

Introduction

Somatochlora metallica is found in three separate areas in Scotland (Smith & Smith 1995):

a) Strathglass. 15 sites in Glen Affric and the hills above Strathglass plus three post-2000 sites near Lochan Dubh and in Glen Strathfarrar.
b) Loch Bran area. 14 sites plus two post-2000 sites (a new lochan and a newly found site near Fort Augustus).
c) Loch Awe area in Argyll.

This paper concentrates on the Loch Awe area, where apparent range expansion is shown in Mill (2012). *S. metallica* was originally recorded from Loch a' Chrion-doire by J. K. Morton in 1922 and not recorded there again until Smith & Smith (1995). Since 2000 it has been seen at 14 sites, six with breeding evidence, on the hills on both sides of Loch Awe (Table 1; Fig. 1) plus three additional sites to the north and south.

The Loch Awe area

Hilly ground from 250 m to 400 m a.s.l., which is dotted with over 150 lochs of various sizes, lies above the 37 km long Loch Awe on both sides. In some areas there are now extensive conifer plantations of various ages but open hill ground also remains.

West Loch Awe

On the west side, *Somatochlora metallica* has been seen from Lochan na Goirt in the south stretching 28 km to Loch Tromlee in the north. However, its main breeding area is a tract of hill ground in the north-west between Loch Avich and Glen Lonan. The sites form the corners of a triangle with Loch a' Chrion-doire in the east, the Sonachan Lochs, 6.5 km to its west, and Loch a' Ghlinne, 10km to its south (Table 1; Fig. 1).

Loch a' Chrion-doire and the neighbouring Loch nan Losgann lie in a rocky afforested area at 225 m a.s.l. *S. metallica* been seen in this area regularly since 1995. Loch a' Chrion-doire is a main breeding site, with exuviae and larvae having been found.

The Sonachan Lochs are three lochs on open hill ground at 280 m a.s.l., two of which are 300 m x 100 m, while the third is larger at 450 x 100 m. They are different in nature from each other. The largest loch is more open with heather banks but with two sheltered bays, the south-east loch is sheltered with heather banks, sphagnum lawns and has aquatic vegetation, whilst the south-west loch is very stony with shelving sides and high peat banks some distance above the water. The two smaller lochs are breeding sites.

S. metallica was first seen at Loch a' Ghlinne in 2001. The area consists of three lochs at 270 m to 330 m a.s.l. They are mainly in open ground but conifers have been planted to the south. The two main breeding sites are Loch a' Ghlinne itself and Loch nan Caorach. They are similar in size, 250 m x 150 m, and sheltered by the topography. Loch nan Criathraich is much larger with a small sheltered well vegetated arm.

East Loch Awe

S. metallica has been seen since 2005 at two lochans on the east side of Loch Awe, 17 km south of Loch a' Chrion-doire (Plate 1A, B). The area is now extensively planted though the main breeding site, a small lochan 100 m x 70 m above Lochan Dubh-Ghlas, is set in a hollow amongst heather moorland. It is fairly shallow but has little vegetation. The second site, Camas Daoine Loch, is

Table 1. Brilliant Emerald sites. Numbers refer to the position on Figure 1. The Isle of Lismore is not on the map because it is not in the Loch Awe area.

Map no.	Site	Breeding evidence
1	Lochan na Goirt	No
2	Ford Clachandubh Burn	No
3	Loch Sonachan group, SW pool	No
4	Loch Sonachan group, SE pool	Yes
5	Loch Sonachan group, N pool	No
6	Loch a Ghlinne	Yes
7	Lochan nan Caorach	Yes
8	Musdale, Loch na Criathaich	No
9	Loch nan Losgann	Yes
10	Loch a Chrion-doire	Yes
11	Eredine hill, Lochan Dubh Glas SE, Lochan	Yes
12	Loch Daoine above Auchindrain	No
13	Loch Tromlee	No
14	Beinn Donachain	No
	Isle of Lismore – Kilcheran Loch	No

1 km to the north-east on the same ridge (Table 1; Fig. 1).

Additional sightings of *S. metallica*

A pair in cop was photographed by Carl Farmer at 620 m a.s.l. near Beinn Donachain west of Glen Orchy. This high ground has a number of lochans and is above remnants of old Caledonian pine forest and forestry plantations.

A male was also seen patrolling the Clachan Dubh burn to the south of Loch Awe. The river is about 1.5 m wide and has sections that are shallow and fast moving; a Beautiful Demoiselle *Calopteryx virgo* breeding site. It also has deep, slow moving areas with overhanging banks. A male *S. metallica* was observed patrolling one of these sections on the 14 and 17 June 2006. The area has been

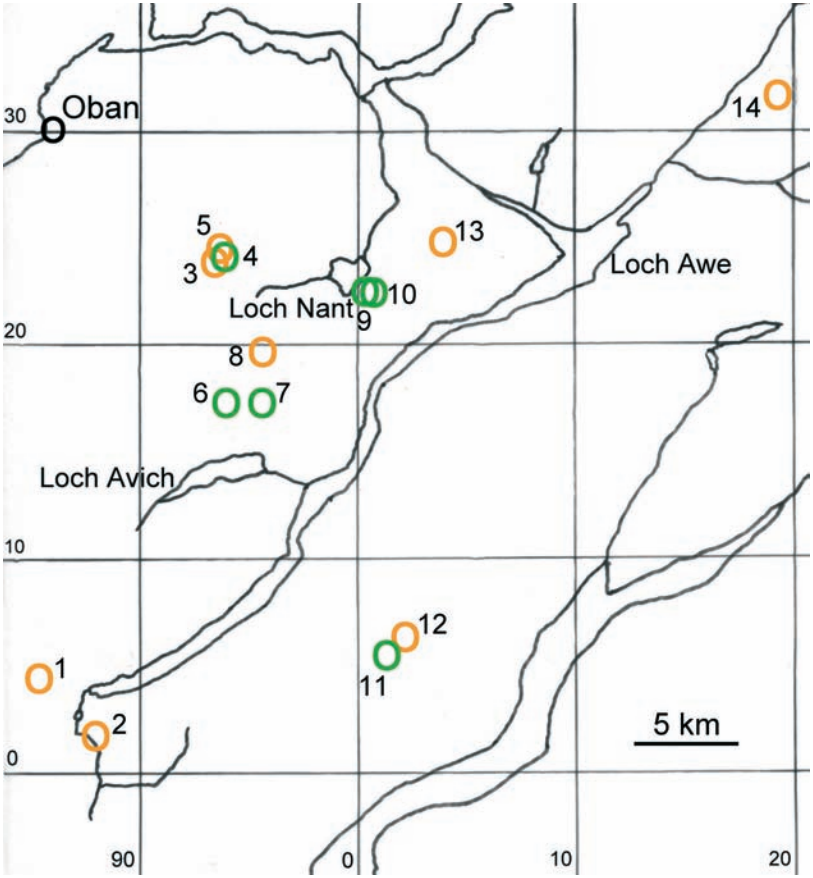

Figure 1. Distribution of *Somatochlora metallica* in the Loch Awe area, Argyll, Scotland. Green circles: Sites where breeding has been observed (adults ovipositing, larvae or exuviae found); orange circles: Sites where adults only were seen and no breeding behaviour.

visited in later years but there have been no other sightings of the species.

Another casual sighting was on the Isle of Lismore at Kilcheran Loch, 20 m a.s.l. and 18 km northwest across the sea from the Sonachan sites. The island is mainly limestone and the loch is eutrophic with tall emergent vegetation. However, there are open shallow areas. *S. metallica* was seen just south of the outflowing burn.

A

B

Plate 1. Hill lochan at NN01260552 above Lochan Dubh Ghlas on the east side of Loch Awe. *Somatochlora metallica* breeding site. (A) general view of the lochan, (B) undercut banks of the lochan, where *S. metallica* larvae have been found.

Plate 2. Loch a'Ghlinne - searching for larvae with a colander.

Habitat

The main habitat where *S. metallica* has been seen in Argyll is similar to that at other Scottish sites (Smith & Smith, 1995); small to medium sized lochans, generally at 200-400 m a.s.l., not deep, and sheltered by the undulating nature of the ground. Forestry plantations provide addition shelter and feeding areas. However, trees are not essential. Several of the sites are on open hill ground some distance from woodland. Most of these sites would have been open before the forestry.

The lochs have heather or sphagnum banks that overhang the water's edge or are undercut with the water level up to the edge of the bank or sphagnum lawns Plates 1B, 2). Many lochs are open with little vegetation whilst others have White Water Lily *Nymphaea alba,* Broad-leaved Pondweed *Potamogeton natans,* Bogbean *Menyanthes trifoliata,* Sharp-flowered Rush *Juncus acutiflorus* and the sedges *Carex rostrata, C. nigra* and *C. lasiocarpa.* However, the south-west Loch Sonach is open with little vegetation, has gently shelving edges with few banks but is shallow with large flat stones. Ovipositing was seen at this loch on a peat spit that was exposed due to low water levels.

Larvae

S. metallica larvae are distinctive, with large curved dorsal spines (Cham, 2007; Mill, 2012). Previous attempts to locate larvae had been unsuccessful (Smith & Smith, 1995). They were found in Scotland for the first time at Loch Sonachan in 2000 by P.Batty and E.M. & R.W.J Smith. The larvae were found under heather or sphagnum banks that were undercut and extending out over the water for 30 to 150 cm, in water depths of 20 to 40 cm (Plate 1B). A special technique is needed. This involves lying or kneeling on the bank at the edge of the water and making several sweeps underneath the bank with a colander at arm's length or using a long handled net (Plate 2). The larvae are tucked under the bank and are often in fine fibrous material or *Chara sp.* but not dense peat.

At the south-east Sonachan loch on the 2 August 2000 seven larvae were found of sizes 6 mm to 20 mm. On 5 July 2001 at Loch a' Chrion-doire five larvae were found sized 6 mm to 10 mm. They were under a 5 m stretch of bank near a small inlet where sphagnum lawns provide access to the bank. In the same area on the 22 June 2003 six larvae were found of sizes 10 to 24 mm. *S. metallica* was also emerging and five exuviae were found on heather on high banks two metres away from this edge of the loch.

Larvae have now been found at seven lochs in Argyll and in Strathglass. On the 15 June 2003, P.Batty and E.M. Smith found seven larvae at Loch Carn na Ghlas Leitre in Glen Affric, at 350 m a.s.l. They were 8 mm to17 mm long. The best area was to the north of the loch under sphagnum banks, some of which were undercut for 50 cm. Five exuviae were also found there on heather. The more sheltered Loch an Amair at 300m a.s.l. was also searched. Six larvae of the Downy Emerald *Cordulia aenea*, sized 6 to 20 mm, were found under heather banks in a similar situation to *S. metallica*. The site has lots of emergent and floating vegetation. However, no *S. metallica* larvae or exuviae were found. Both species have been recorded from this site. Smith & Smith (1995) discuss the habitat preferences of the two species noting that *C. aenea* prefer smaller, well vegetated, lochs and *S. metallica* the larger, deeper and more open lochs.

Above Cannich are Lochan na Craoibhe-fearna and Lochan Dubh at 230 m and 210 m a.s.l. respectively. *S. metallica* larvae of 17 mm and 18 mm were found here on 26 September 2005. They were beneath deeply undercut banks in water 50 cm deep. In both lochs Southern Hawker *Aeshna cyanea* larvae were found in the same situation and in one instance on the same sweep of the net. A fresh exuvia of *Somatochlora metallica* was also found, indicating emergence very late in the season. The Loch Bran sites have not been searched for larvae.

In July 2000, whilst on holiday in Slovenia, the author noticed *S. metallica*

males patrolling a small bay on the east side of Lake Bohinj, 525 m a.s.l. near the outflowing river. Lake Bohinj is a large limestone lake, 4 km long by 1 km wide, with very clear water. There was little vegetation and the only place for larvae to hide is under a small number of limestone rocks on the floor of the lake. One *S. metallica* larva was under one of these. It was in a shallow scoop of fine gravel that it had hollowed out.

A. cyanea larvae have also been found under rocks in Scotland. They cling to the underside of the rocks. Attempts have been made to find *S. metallica* larvae under rocks in Scotland but there are numerous rocks and often a fine sediment is disturbed when a rock is lifted. This takes time to settle, giving larvae the chance to scuttle away before they are seen. Several lochs do have flat stones that could provide a hiding place for larvae.

In 2000, a small number of *S. metallica* larvae were taken and reared in captivity by L. Fairweather (pers. comm.). The aim was to observe larval behaviour. They were fed water fleas and other small water creatures. The *S. metallica* larvae grew and developed but they were never seen feeding. They stayed under cover and ate later (possibly during the night). As well as the water fleas they ate Water Slaters *Gammarus sp.* and Freshwater Shrimps *Asellus aquaticus*; also Large Red Damselfly *Pyrrhosoma nymphula* larvae. In contrast to this, Northern Emerald *Somatochlora arctica* larvae, reared separately, were often seen feeding. Both species were released back into the areas they were taken from when in the final instar.

Discussion

Smith & Smith (1995) mention larvae being in bottom detritus composed of fine fibrous peaty material. Larvae have now been found in this material but it is not certain if they were in bottom detritus or under the surface of the bank. In Scotland, overhanging or deeply undercut banks provide dark recesses for larvae to hide. Larvae at various stages of development were found in this situation. This also links to where adult males have been seen patrolling (Smith & Smith, 1995; Vick, 2004) and where ovipositing takes place (Smith & Smith 1995; Fox 1991)

Many lochs where *S. metallica* is present also have sphagnum lawns into which ovipositing has been seen and exuviae found (Richards,1996; Smith & Smith, 1995). These are wobbly and unstable, making it difficult to sample under them for larvae. However, since the lawns grow out over the loch surface they will have dark recesses underneath them. In some lochs there are no overhanging banks and stones may provide a hiding place, as in Slovenia.

The Scottish situation differs from that in England, where the water is shaded by overhanging trees and there is decaying debris such as leaves and twigs in the water (Vick 2004; Cham, 2007; Mill 2012). Argyll sites are on open hilly ground and few have mature trees nearby; thus tree cover is not essential. However, what all sites have in common are dark places for larvae to hide. In England *S. metallica* has also been found in rivers Vick (2004), hence the Clachan Dubh Burn could become, or already be, a breeding site.

S. metallica has been recorded up to 2000 m a.s.l. in France (Grand & Boudot, 2006). However, the highest recorded in Scotland was at 620 m a.s.l. A pair was seen in cop on Beinn Donachain, which could indicate there is a breeding population in this area, and thus the lochs here need investigation. Of particular interest is the sighting on the Isle of Lismore in an unusual habitat for Scotland. Although at a lower altitude, it is not unlike the Slovenian site.

Mill (2012) indicates apparent range expansion in the Loch a' Chrion-doire area, though caution should be exercised as recorder effort may have played a part. Indeed, this is likely to be the case. The new sites found since 2000 are in a remote upland area, with few tracks, in rough ground. It is little visited and has over 150 lochs. The new records are a mixture of chance sightings and greater recorder knowledge of the habitats used and knowing where to look for larvae. All the areas in Scotland where *S. metallica* has been found need further investigation.

The author would be interested in any information about where larvae are found in other areas.

Acknowledgements

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A change in status of the Willow Emerald Damselfly *Lestes viridis* (Vander Linden) in the United Kingdom.

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Summary

The revised list of Odonata in the United Kingdom produced by Taylor *et al*. (2009) contained 42 species in Category A, a further 12 species in Category B and three species in Category C (former breeding species not recorded since 1970). This list was subsequently revised again (Taylor & Smallshire, 2010) following the discovery of Dainty Damselfly *Coenagrion scitulum* in Kent during June and July 2010 - this discovery necessitating a move for the species from Category C to Category B (vagrant species). The sustained colonisation of Willow Emerald Damselfly *Lestes viridis* since 2009 now requires this species be moved from Category B to Category A (resident and/or migrant species recorded since 1970).

Observations

Before 2009, *Lestes viridis* (Plate 1) had only been recorded in Britain a few times. An exuvia had been discovered at Cliffe Marshes in Kent, during 1992, but no adults seen. The only adults recorded prior to 2009 were from near Polgate, Sussex in 1979 and from Trimley, Suffolk in 2007. An old specimen, reputedly taken from Hertfordshire in 1899, is thought possibly mislabeled (Parr, 2009).

On 1 August 2009 an adult *Lestes viridis* was again found near Trimley and the next day several individuals were located at Staverton Lakes, also in south-east Suffolk. During the following week observers found more sites for the species in the same general area, including Alton Water and several locations along the River Deben. By early October there were thirty-five known sites, with the main centre of distribution around the Wickham Market, Ipswich and Felixstowe region of Suffolk (Parr, 2009). At many locations, counts reached double figures and the species seemed well established. Although no records were received during 2008, numbers found in 2009 suggest the species might well have been present that year, but unobserved, at least in some locations. This conclusion was later supported by the presence of teneral individuals at Alton Water and

A

B

Plate 1. *Lestes viridis*. (A) female, (B) male. Photographs (A) by Dave Smallshire, (B) by Peter Kitchener.

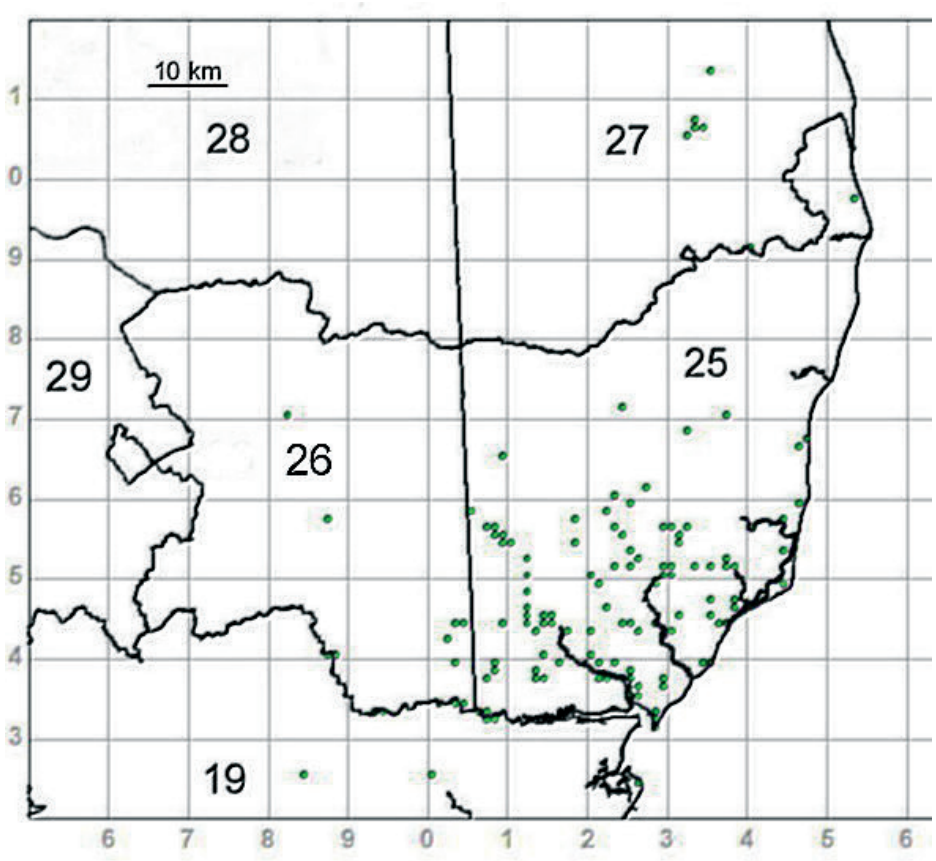

Figure 1. Map showing records of *Lestes viridis* for East Anglia. Numbers indicate Watsonian vice-counties: 19, North Essex; 25, East Suffolk; 26, West Suffolk; 27, East Norfolk; 28, West Norfolk; 29, Cambridgeshire.

Staverton Lakes.

Away from Suffolk, during 2009, *Lestes viridis* was found at three sites in north Essex. It appeared at Fingringhoe Wick, on 27 August, at Colchester in mid-September and at Marks Hall on 20 September (Parr, 2009). An individual was also photographed at Strumpshaw Fen, Norfolk on 15 September and another record from the same site was made on 4 October.

During 2010, the newly established breeding colonies of *Lestes viridis* in south-east Suffolk continued to support numerous individuals. There was evidence of local wandering within this general area and the first records for west Suffolk were made in early September. Other new locations discovered during 2010

included sites around the Thames Estuary and at least two places in north Kent; also at Hadleigh Park in Essex, where oviposition scars were also found at the end of the season (Parr, 2011). The species was again recorded at Strumpshaw Fen in Norfolk during late August and early September, with three pairs seen and ovipositing noted on 5 September.

Lestes viridis had another good year in 2011, particularly at breeding strongholds within Suffolk. With new records from Minsmere and Thorpeness, the species distribution in that county now stretched from Sudbury and Stowmarket to the coast. In addition to this, further records continued from known sites in both Essex and north Kent (Parr, 2012), whilst in Norfolk records show the species had moved across the River Yare from Strumpshaw Fen to Wheatfen. A further lone male was photographed near the north Norfolk coast at Overstrand in October.

Lestes viridis continued to thrive and spread in 2012, with new sites found in several areas including one near South Walsham in the Norfolk Broads and another at Dunburgh in south Norfolk close to the Suffolk border. With the species now clearly established in parts of East Anglia (Fig. 1) and north Kent, and with outlying records continuing elsewhere, it has been moved from Category B (vagrant species) to Category A (resident and/or migrant species recorded since 1970).

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Corrigendum

Mill, Peter J. **28:** 75-91. With reference to figure 1 on page 81, please note that the record to the east of the Loch Bran sites has now been removed from the NBN Gateway. My thanks to Ron Youngman and Pat Batty for pointing out a potential problem with this 'record'.