Chalcosyrphus eunotus
A Red Data Book hoverfly
Its status, distribution, ecology and conservation

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1 Introduction

Chalcosyrphus eunotus is a seemingly very rare hoverfly associated with a very rare habitat niche (semi-submerged logs in woodland streams). It has recently been recorded in Staffordshire (2004) and since then has been recorded at a number of sites in three main areas of the county. A key area in Staffordshire is the Cannock Chase AONB (Area of Outstanding Natural Beauty). Although a large fly, it is seldom seen and to date, very little is known about its life cycle and habits. This report pulls together existing information about the fly and also attempts to contribute to the known ecology of the fly and provide some information to site mangers and ecologists to safeguard sites and create new habitat. Another key purpose of the report is to add weight and knowledge to the importance of the UKBAP Streams and Rivers Habitat Action plan (UKHAP) and key features that are present within these water systems such as coarse woody debris.

1.1 Woody debris definition

There are two type of woody debris, Large Woody Debris (LWD) and the previously mentioned Coarse Woody Debris (CWD). Large Woody Debris tends to be large trees and branches that have fallen into a stream whereas the Coarse Woody Debris refers to the smaller branches, twigs and leaf accumulation. For purposes of *C.eunotus* conservation no separation between the two is made as thresholds pertaining to log size used for oviposition are still not known.

2 The Status of *Chalcosyrphus eunotus*

2.1 Global and Europe

In Europe, *C.eunotus* is found from the UK in the west to Spain in the south and across to Poland and Romania in the east. In Holland, it has only recently been discovered (2002). It is declining across much of its range with noticeable decreases in population numbers (Speight and Castella, 2001). Globally, this species extends into the “near east” which includes Saudi Arabia, Iran, Iraq, Turkey, Syria and Israel. Information on actual presence or absence in these countries is however currently lacking.

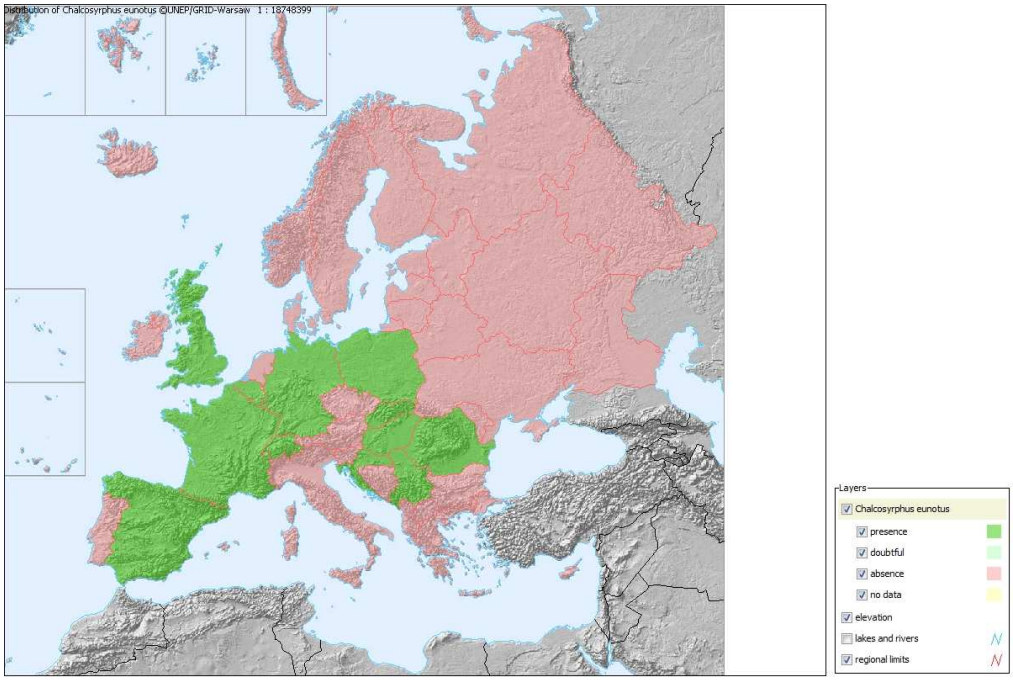

Figure 2.1.1: European distribution. Source: Fauna Europea www.faunaeur.org ©

2.2 UK

Red Data Book 2 – Vulnerable
Definition of RDB Category 2:
"Taxa believed likely to move into the Endangered category in the near future if the casual factors continue operating.
Included are taxa which most or all of all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance…". See Shirt, 1987 for full definition.

C.eunotus is very much biased towards the western parts of England. There is a predominance of records from the Watsonian Vice-Counties of Shropshire, Staffordshire and more historically, Worcestershire. There are some recent records from The Wirral (VC51, 2003) and Wales (VC49, 2005), (Hoverfly Recording Scheme, 2009). However the current stronghold appears to be the two principal counties highlighted.
It is not known from the east, south-east, the north of England or Scotland.

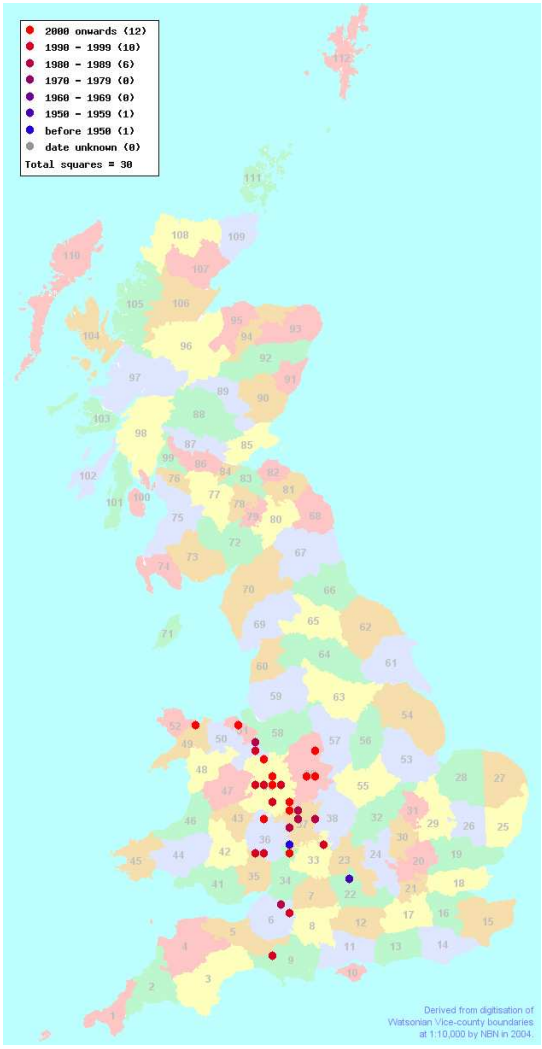

Figure 2.2.1: Known distribution of C.eunotus including historic records.
Hoverfly Recording Scheme ©

2.3 UK history

C.eunotus was first recorded in the UK in 1899 from a single record in a woodland at Ledbury, Herefordshire. C.O. Hammond then recorded it at Cothill Fen, Oxfordshire in 1953. This specimen was recorded flying "back and forth" over a shaded pool. (Stubbs and Falk, 2002). Stubbs (*pers.obs*.) then recorded a specimen in 1977 from the Wyre Forest, Worcestershire sitting on a log in a shaded stream. It was this observation that highlighted this habitat as an area to search for this elusive species. Since then a number of records have come forward. In recent years, due to a combination of the elevation of small woodland streams as a valuable habitat and greater recording effort through promotion of hoverflies as a recording group the number of records submitted to the Hoverfly Recording Scheme for the UK now tops 30 sites for this species. There is a higher incidence of this species being recorded from Staffordshire and Shropshire. Some records are down to the activities of local entomologists but some have been brought about through commissioned surveys looking for another coarse woody debris species (the "Telford cranefly", *Lipsothrix nobilis* (formally *nigristigma*), Andy Godfrey between (2000 and 2006)).

2.4 Chalcosyrphus eunotus habitat (Staffordshire)

C.eunotus is a new addition to Staffordshire's Dipteran fauna. It was first recorded by Nick Mott and Andy Godfrey in 2004 from Cotton Dell, a Staffordshire Wildlife Trust reserve in the north-east of the county. This site is a steep-sided upland valley oak woodland with a small, fast-flowing riffle and pool stream. This first county record was an incidental record whilst searching for the RDB1 (Red Data Book) cranefly *Lipsothrix nobilis* (*nigrostigma*). Since then a number of records have been collected from various parts of the county. The majority of these records have been attained from the Cannock Chase AONB (Area of Outstanding Natural Beauty) during a series of invertebrate surveys looking at the stream habitat quality of the AONB. Also, an aggregation of records from the Churnet Valley SSSI in north-east Staffordshire have been collected in 2008-09 and also an aggregation of records from mid-Staffordshire. All these areas are either continuous woodland or aggregations of small woodland "dingles". The streams within these areas do not characteristically flood or are within floodplain environs that over-top during storm surges or winter. As highlighted by Renema (2001), *C.eunotus* appears to be under-recorded and once initially detected more records follow from the surrounding area. Work in Staffordshire supports this.

All of the records for Staffordshire have come about from surveys undertaken by Staffordshire Wildlife Trust (Andy Jukes and Nick Mott) and A.Jukes as an independent consultant. Many of these records are from the Cannock Chase AONB, where a substantial population has been discovered.

The preceding surveys within the Cannock Chase AONB undertaken by Jukes and Mott have lead to the commissioning of this autecological study to discover further information about the fly. Principally it is to add weight to the importance of Coarse Woody Debris (CWD) as a resource, increase awareness of the Rivers and Streams Habitat Action Plan (UKHAP) and further the ecological understanding of a little studied fly.

The majority of the autecological study has been undertaken on two streams within the Cannock Chase AONB.
The Stafford Brook (SK022192) is located on the south-eastern side of Cannock Chase. It is an alder (*Alnus glutinosa*) and silver birch (*Betula pendula*) lined stream with intermittent sunlight penetration. The total canopy cover is approximately 90% however this is a tree lined stream rather than a woodland stream and therefore sunlight penetrates through the trees with relative ease.

The stream itself is shallow riffle and pool, with gravel substrate and silted pools. Log jams, backing up water to form pools (a kin to a dam), are infrequent but woody debris is occasional to frequent throughout the course of the stream. This woody debris is often lodged in shallow water on gravel bars. The woody debris ranges in diameter from a few centimetres to several and in length from 30cm to 200-300cm.
The Old Brook (SK005199) is located due west of the Stafford Brook (approximately 1.3km).

This brook is a wooded stream valley. At its northern end are numerous seepage lines and boggy, silted margins with small, tributaries running through these muddy margins creating a braided stream channel. The canopy is approximately 80% and dominated by alder. Upstream, the canopy changes to conifer and 100% dense cover then opens to extensive sunlit areas where tree felling of broad-leaved and coniferous trees has taken place over successive years.
The steam at this upstream point, is narrow (<1m wide) and has a very open canopy. There are no log jams in this section but does have frequent large (>20cm wide) logs deposited into the stream by the Forest Commission.

3 Chalcosyrphus eunotus: Morphology and ecology

3.1 Taxonomic Information

Chalcosyrphus eunotus (Loew, 1873)
In the UK, *C.eunotus* is similar in appearance to *Brachypalpus laphriformis*, to the point of having been classed within the same genus. Recently (1978), Hippa made the decision to move *C.eunotus* from *Brachypalpus* to *Chalcosyrphus*. *Chalcosyrphus*, in the UK, includes *C.nemorum*, a smaller, visually dissimilar species to *C.eunotus* (see fig 3.1.1). *C.nemorum* is placed within a specific sub-genus of *Chalcosyrphus*, *Xylotina*, and *eunotus* was, in 1978, placed in a new *Chalcosyrphus* sub-genus, *Xylotodes*.

Figure 3.1.1 Chalcosyrphus nemorum

In the UK there are therefore two species within the genus *Chalcosyrphus*. 12 are currently represented in Europe (Speight, 2008) and worldwide the group would appear to currently consist of 103 species (Catalogue of Life: 2009 annual checklist).

3.1.1 Similar UK species

Brachypalpus laphriformis

Figure 3.1.1.1: Brachypalpus laphriformis (male)

3.1.2 Similar European species

Chalcosyrphus jacobsoni is very similar to *C.eunotus* on the near continent. It is broadly a shorter-haired species on body and scutellum. A key listing full differences to separate these two similar species can be found in Speight and Sarthou (2008).

3.2 Egg

The egg is broadly cylindrical with rounded ends, circa 2mm long by ± 0.6mm wide with a milky white complexion that appears to turn brown after a few days.
The eggs hatch somewhere between 2-4weeks after laying.

Figure 3.2.1: C.eunotus egg (laid 12/05/09)

Wood (all deciduous) species used or possibly used for egg laying include:
Birch (*Betula* species) observed oviposition
Alder (*Alnus glutinosa*) observed investigation
Oak (*Quercus* species) - likely
Beech (*Fraxinus excelsior*) – likely
Other species are possible

3.3 Larvae

Chalcosyrphus larvae are short-tailed larvae that are slightly dorso-ventrally flattened with two sets of 1-2 black hooks on the thorax. The *Chalcosyrphus* larvae are described in detail by Rotheray (1993).

The larvae is ±22mm long (in the preserved, extended state) and 4.5mm at its widest point. The live larvae are a creamy yellow colour turning duller in a preserved state.

Figure 3.3.1: Dorsal view of preserved larvae

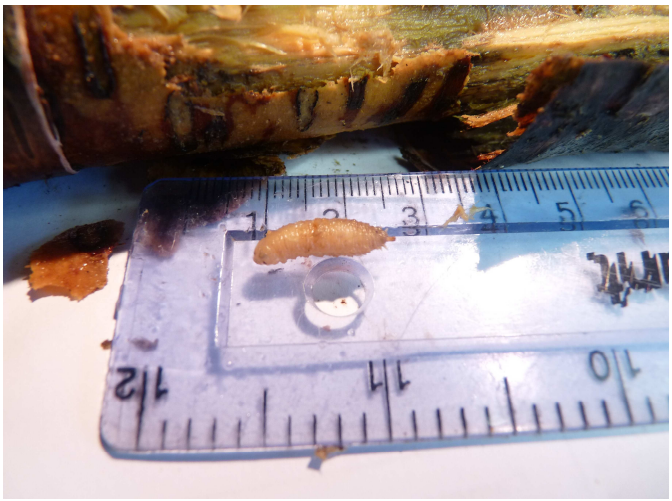

Figure 3.3.2: Live larvae

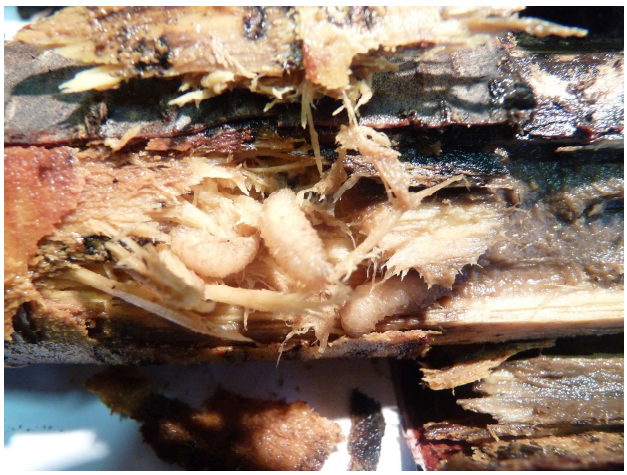

Figure 3.3.3: Aggregation of larvae in saturated wood (Betula sp*)*

3.3.1 Ecology of larvae

There is very little existing information available on the larvae. Rotheray (1993) makes notes on the genus *Chalcosyrphus*, suggesting that the dorso-ventrally flattening of the *Chalcosyrphus* body type is presumably for life under the bark and within accumulations of decaying sap. Godfrey and Middleton (2006) states that the larval ecology of *eunotus* is still not understood.

Observations made in 2009 suggest that the larvae hatch between 2-4 weeks after laying when they will presumably make their way into the host material. They may lie under the surface of the bark and eat accumulations of decaying sap when young as suggested by Rotheray (1993) however, larvae extracted on 27/10/09 were all recorded from the near-centre of the log. The material from which 6 out of 7 larvae extracted was moderately-saturated white, fibrous wood (see figures). One larvae was extracted from near the end of the log which is at a higher state of decay with greater saturation, possibly due to the degradation of the material. Large amounts of wet frass was found in this area suggesting high activity in this location in the past by the larvae. This singleton larvae was again, not found under the bark, but under approximately 5mm of wood fibres. All the larvae were found within excavated channels in the wood [1] (see figures 3.3.3).

[1] A tip for finding larvae may be to feel a logs surface, particularly from late summer onwards when the larvae are larger and evidence is therefore easier to locate. Where the log gives slightly if pressed indicates a sub-surface, excavated channel and will be a good place to excavate to search of larvae. Choose logs that are not totally submerged but have at least 1/3 of the circumference exposed above the water line. This will obviously only work with thin barked species such as birch or logs from young trees that do not have a thick or well developed periderm (outer bark).

As the larvae prefer a moderate-saturation of wood (not complete saturation or total emersion in water) then the local, relative humidity is a highly probable factor in determining the success of larval development and recruitment to adulthood. Logs that have retained a bark covering are probably important for oviposition as these retain moisture more efficiently than wood stripped of its outer layers. The larvae only have a short-tail (for breathing) reinforcing the theory that they do not live in totally saturated or immersed wood, as they would not be able to breath under such, submerged conditions.

From investigations and observations undertaken, *Chalcosyrphus* larvae (both *eunotus* and *nemorum*) would appear to prefer the upper sides and top of saturated and semi-saturated logs. No syrphid (hoverfly) larvae have been found below the water line.

3.4 Adult

C.eunotus is a honeybee (*Apis mellifera*) mimicking hoverfly. Generally, the adult fly has a dark brown body with golden brown to brown hairs and grey dust spots on its abdomen (see figure 3.4.3). The face is slivery white haired. This is a good visual queue in field observation for the species resting on in-channel logs.
Males are approximately 10mm in body length, individual wing length is 9mm giving a total wingspan of the fly of ±21mm. *B.laphriformis* males are very similar, but *C.eunotus* males have a pair of faint, large, greyish semi-rectangular bars on tergite 2 (second abdominal segment) and the hind femur is strongly arched in *laphriformis (see figures 3.4.1 and 3.4.2).* The abdomen is also slightly shorter than that of

laphriformis. The top of the thorax (dorsum) is faintly striped and dull in appearance whereas *B.laphriformis* is less striped but shining (figure 3.4.3).
The wings are similar to *laphriformis* save a slightly stronger clouded mark at approximately half way along the wing (Stubbs, and Falk, 2002).
Females are very similar to the males but are broader with rectangular grey spots on tergites 2 and 3 (Stubbs and Falk, 2002). The female *eunotus* has a wing length of ±9.5-10.5mm (Stubbs and Falk). Some female *Chalcosyrphus* have a slight orange hue towards the base of the wing fading out completely after approximately ¼ of the wing length or up to the wing cloud. This character is however not consistent in all specimens but when it does occur is stronger than that of *Brachypalpus*.

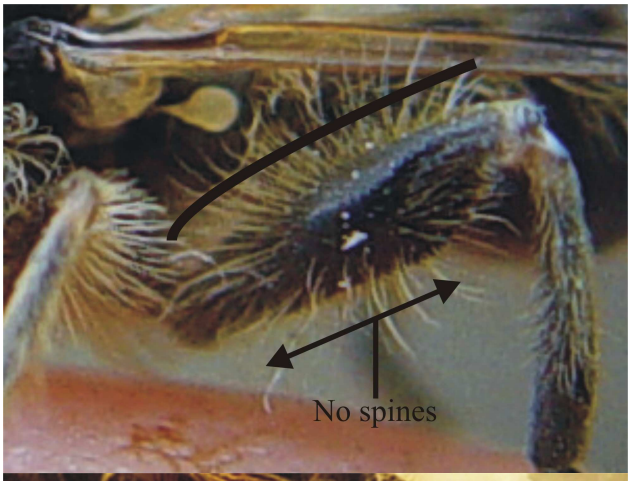

Figure 3.4.1: Chalcosyrphus eunotus male leg showing lack of spines and straight femur

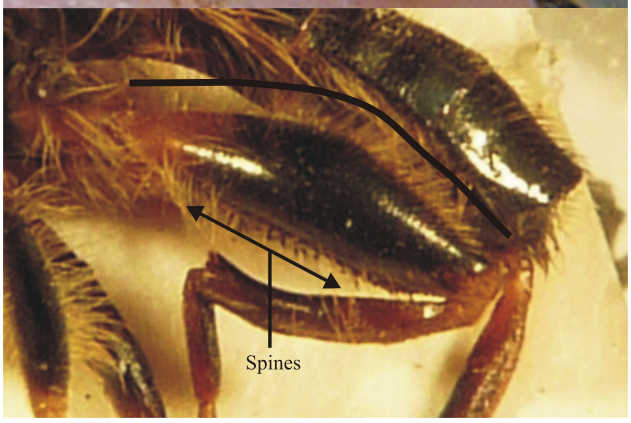

Figure 3.4.2: Brachypalpus laphriformis male showing spines on ventral side of femur and arched femur

Figure 3.4.3: Brachypalpus laphriformis (left) and Chalcosyrphus eunotus (right) females illustrating the differences in body shape, mesonotum (top of thorax) patterning and grey dusting on abdomen. S.Falk ©

3.4.1 Ecology of adult

C.eunotus is on the wing from April to June with the majority of records being attained from May. The earliest known record is 16th April and latest 29th June (NBN Gateway, 2009) although Stubbs and Falk (2002) lists the flight period extending through to July, any July records will be aberrations and this is not a reliable month to search for this species.

It can be found along small to very small woodland streams with semi-submerged wood in the stream, most often observed on sunlit vegetation or in-channel logs. Stubbs and Falk (2002) suggest that males hold small territories though this can now be elaborated on. Stubbs and Falk (2002) also state that semi-submerged wood is the habitat of the larvae " a niche apparently not occupied by other British hoverflies with the exception of *Xylota florum*". More information is now available to suggest that more than just these species utilise semi-submerged/saturated wood in streams (see chapter 4.4) on this.

Territoriality

Stubbs and Falk (2002) state that the males hold small territories, presumably refering to males sitting in well positioned situations along the stream such as on logs, sunlit vegetation and any other in-channel features. Old drinks cans and tyres have been observed as being just as suitable as more natural perches for the males. These objects, elevated above the water line, serve as a vantage point from which a male can see passing females or other males. A male "returning" to the territory perch after seeing off another male or investigating a passing female was always thought to be the same individual, but new work to clarify this clearly suggests different. Through a mark, release, recapture exercise (MRR) looking into this territoriality of males, the author discovered that males do not have exclusivity to perch sites. A male would appear to only hold the territory space for a short period of time then for one of a number of reasons moves on to another location along the stream course.

This may be either through its own fruition or displaced by another *eunotus* male. During a 2 week MRR experiment, only one male from several (on each day) that were tagged returned to the same location as it was captured. This return was also marked by a 3 hour absence. This may indicate to high mobility of male *eunotus* since others were never recorded again at the capture site. Whether this suggested mobility extends to other stream courses is still not known though further investigation hopes to shed light on this.

Mating

Mating was observed on many occasions on the Stafford Brook. Mating was first observed on 29/04/09. The initiation to each mating varied slightly but a few observations appear to be consistent.

All matings observed have been initiated by a male from a vantage point (log etc). The female either actively focuses in to investigate the log on which the male is perched or is passively flying along the stream, past the log. If this is within a radius of "control" by the male fly he will launch into the female and grapple with her in flight. If the coupling is successful the pair fly off with one fly carrying the other. The coupled flies normally leave the stream and head towards bankside scrub or other vegetation (witnessed up to 10 metres away). The mating is no more than 10-15 seconds in duration, after which it is normally the male that flies off leaving the female to sunbathe on the vegetation for a few minutes.

Oviposition

Two females have been observed egg-laying on 12/05/09 along the Stafford Brook (SK022192). The oviposition material in both instances was birch, (*Betula* spp). The oviposition site was on an in-channel semi-saturated log.

Investigation of suitable egg-laying sites by females has also been observed on the Old Brook (SK005199), also on Cannock Chase, where a female was observed investigating alder (*Alnus glutinosa*) from the main stream channel and also tributary, braided channels derived primarily from seepages. During all these instances the females exhibited the same behaviour.

The behaviour of site investigation is vey conspicuous and the individuals are easily approached under such circumstances. Their preoccupation in finding suitable sites seems to be over whelming to the exclusion of even primary predator awareness's and flight responses.

Females are very active during this behaviour and rapidly move from one part of the log to another crossing all areas looking for suitable locations to oviposit. Females will also undertake this activity moving rapidly from one log to another and back again. If a log appears suitable the female initiates a "bobbing" action, touching the tip of the abdomen on the surface twice or more per second. Possible factors that may raise an oviposition site's potential could include its optimal saturation, state of sap decay and accumulation, temperature, aspect and position, entrenchment into sediment and also the species of wood. If a site is suitable, the bobbing behaviour may then develop with the extension of the ovipositor. The ovipositor is held re-curved forward underneath the abdomen and thorax of the fly and is probed into suitable crevices and cracks in the wood. Suitable positions for investigation include lifted bark, broken ends of the log, cracks in the bark or the thin rolls of outer "paper" bark on birch (figure 3.4.1.1c).

The eggs appear to be laid in small batches, pairs or singularly above the water line within cracks, crevices or other imperfections within the surface of suitably saturated wood.

Size of wood material may not be of paramount importance rather the state of saturation of the material, though this will tend towards smaller diameter material as this is more readily available at the higher saturation levels within a small woodland stream. The wood used by two females on the Stafford Brook (12/05/09) was a small piece of birch (*Betula* spp), 50mm diameter by 750mm long located at the side of the brook (figures 3.4.1.1a-d).

Suitable oviposition sites probably exclude those logs that do not have a bark covering as these are more prone to desiccation, even those that are semi-submerged as the exposed portion can exhibit some drying during the summer months.

Figure 3.4.1.1c shows eggs laid within a thin roll of paper bark on a log from a birch tree. There are clearly 2 maybe 3 eggs within this roll. One egg is white and the other 1-2 appear to be yellow in colour. It could be speculated, and is highly likely, that these 2 darker eggs were laid on a previous visit by this or another female. If this is the case, then females would appear to seek to exploit optimal locations to provide the greatest opportunities for their genetic line regardless of previous oviposition from other females. Females therefore may not have exclusivity to sites and their eggs and subsequent larvae are left to fend for themselves, possibly against another females offspring in a typical Darwinian "survival of the fittest" scenario.

Figure 3.4.1.1a: Log position on Stafford Brook

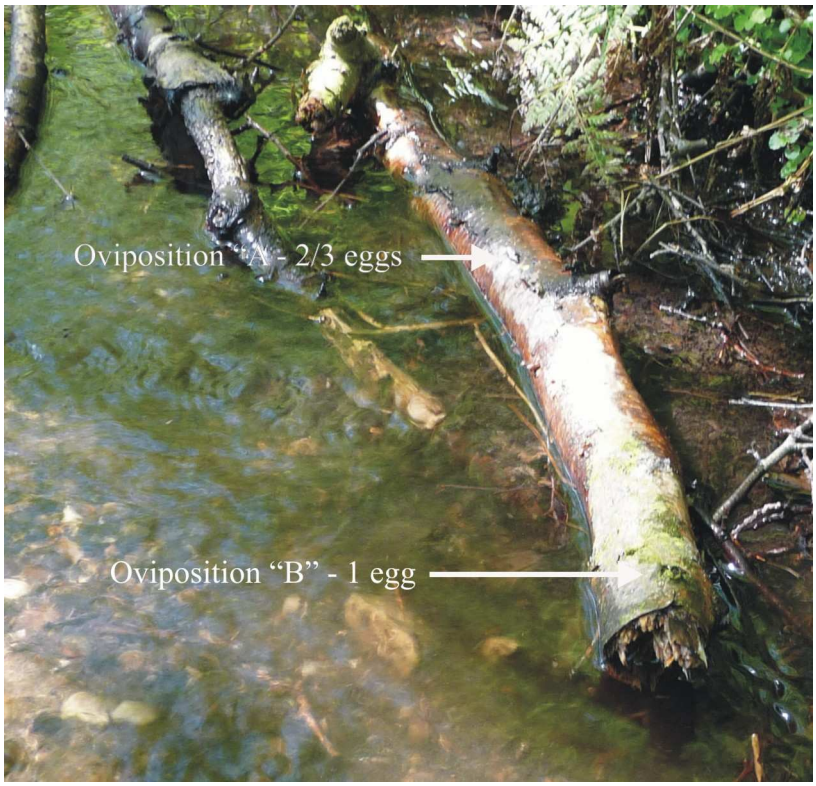

Figure 3.4.1.1b: Egg-laying points "A" and "B" both well above water level

Figure 3.4.1.1c: Close-up of oviposition point “A” clearly showing two but maybe three or more eggs in the roll of bark.

Figure 3.4.1.1d: Close-up of oviposition point “B”, a single egg

Adult feeding

Unfortunately, no feeding by adults has been observed or any observations in literature found. The lack of feeding signs is interesting. One habit that was observed is that the flies have a tendency to fly straight up into the canopy. This could be a defensive "flight response" to predators or the flies are feeding on tree flowers or aphid honeydew in the canopy.

3.5 Other species associated with Coarse Woody Debris (CWD)

There are a number of other hoverflies that are associated with CWD. *Chalcosyrphus nemorum* has been reared from an in-channel birch log (A.Jukes, *per obs*. 2008). 3 individuals were raised to adulthood. *C.nemorum* was also observed egg-laying on a Large Woody Debris (LWD) dam on the Stafford Brook (06/05/09) consisting of birch and willow (*Salix fragilis*).

Figure 3.5.1: Chalcosyrphus nemorum female, ovipositing on CWD

Xylota florum has also been collected from CWD. A newly emerged teneral specimen was collected from the underside of a log (tree species not known) from Coombs Valley RSPB reserve by Nick Mott of Staffordshire Wildlife Trust (12/06/2008). The site is a steep-sided valley woodland with a plentiful supply of in-channel, semi-saturated wood.

Godfrey and Middleton (2006) list *Sphegina* species (small hoverflies) as also utilising CWD. These have also been encountered on woodland streams in Staffordshire, particularly small streams with ample shade and overhanging branches. *Sphegina sibirica* was observed on several occasions around water mint (*Mentha aquatica*). It appears to show a preference for this flowering plant over others in and around the streams.

Figure 3.5.2: Sphegina sibirica on water mint (Mentha aquatica) on a small, woodland stream in Staffordshire

Other non-hoverfly species associated with CWD include the important cranefly family *Lipsothrix*. This is a family with a strong fidelity to CWD having a number of scarce and very scarce species associated with it including 4 UKBAP species (UKBAP, 2007). *L.nobilis* (formally *nigristigma*) is the most important species within this family. For more details on this species and other *Lipsothrix* species see

Suggested Reading at the end of this report. The UKBAP native, white-clawed crayfish (*Austropotamobius pallipes*) is also strongly associated with CWD aswell as other in-channel features.

4 Conservation

4.1 Reasons for decline

4.1.1 Removal of woody debris

C.eunotus breeds in semi-saturated wood in small streams, a feature that has historically been removed from watercourses (both large and small) to improve water flow. Although oftern undertaken with well-meaning intention, it has had detrimental impacts to woodland stream fauna. *C.eunotus*, *Lipsothrix* species and also the native white-clawed crayfish (*Austropotamobius pallipes*) to name only a few have all suffered from this practice.

Debris in streams has only recently been highlighted as a valuable resource for invertebrates and fish fry. Mott (2005) and Godfrey and Middleton (2007) all bias increased woodland stream diversity in the direction of LWD and CWD, particularly in terms of scarce and threatened species. The practice of woody debris removal is still however undertaken and it is only a minority of streams and sites that retain a continuous resource.

4.1.2 Metapopulations

Although only a very small sample of flies were marked for this work with more to be undertaken in 2010 if funding allows, it can be suggested, as flies disappear for long periods from capture sites, that they may move between streams during the course of a day. It may not be any coincidence that where one fly is recorded numerous records can be attained from that same location and other streams in the immediate vicinity (Renema, 2001). Fragmentation and isolation of small woodland streams may have detrimental impacts on *C.eunotus* as with other species that require substantial genetic mixing and highly specific niches to prosper. Woody debris, even along a high quality stream with intact features, may not all be at the right stage of saturation, aspect, humidity or other factor to suit oviposition. Along the Stafford Brook for example, there is not a huge resource of suitably saturated wood to sustain a large population of flies. Therefore the flies may be moving from one stream to another in search of suitably saturated material for oviposition, or to find a mate. A network of linked sites may be important to this species, explaining why there are often groups of records from a localised, wooded area.

Sites in Worcestershire, Staffordshire and Shropshire are all from well-wooded districts or areas with linked or narrowly separated dingle woodlands, not isolated sites. Any known isolated sites with extant populations are highly likely to have once been part of a larger complex of woodlands. Such populations within isolated sites are likely not to persist for any substantial length of time as resources within a small woodland will not replenish the semi-saturated wood niche resource required by *C.eunotus* sufficiently on a regular basis.

More investigative work is required to substantiate the above but, as reasoned, is a likely scenario for this species given the information available.

4.2 Features of importance

- *C.eunotus* is a species of deciduously wooded streams that contain woody debris. It is not exclusively a woodland stream but can be a tree lined stream. They are small to very small streams, more often as riffle a pool types.
- As mentioned, they are more likely to be found in areas with a number of connected or near connected wooded streams that contain woody debris rather than isolated sites.
- The flies require in-channel logs that are semi-saturated and semi-submerged in which to lay their eggs. Small logs maybe more often used over large logs as these will become saturated more quickly than larger ones. Length of log may not be a critical factor.
- Their needs to be a continual supply of logs year after year to replenish the resource.
- Streams with in-channel features other than oviposition sites and bankside vegetation on which to perch and bask are important.
- The canopy is often loose with dappled light that creates localised sun patches on the bankside vegetation and in-channel logs. NB> These are also the best places to search for adult flies.

Maintaining and enhancing sites for *eunotus* will seek to fulfil these criteria.

4.3 Conserving C.eunotus

The simplest way to increase a site's potential for *C.eunotus* is to increase the input of woody debris to a woodland/tree lined stream. Diameter and length may not be important. Material of a smaller diameter will become saturated quicker than larger logs and these may be more practical to place into streams as they will become suitable oviposition sites within a tighter manageable timeframe the larger logs.
The material type is likely to include the following species:
alder (*Alnus glutinosa*)
birch species (*Betula* spp)
beech (*Fraxinus excelsior*)
oak (*Quercus* spp)
Others are possible.

The woody debris can be simply felled into a stream or left in channel after natural wind fall. Much of this material will drift downstream until it collects to form a woody debris dam. These points are often loci for flies to congregate as this produces a large accumulation of material.

4.3.1 Sites to consider active management to encourage eunotus

To see whether actively managing sites can be used to encourage *C.eunotus*, a site manager can consult any number of databases or societies. The Hoverfly Recording Scheme (www.hoverfly.org.uk) contains and manages the greatest quantity of hoverfly records in the UK and consultation with on-line maps will quickly highlight areas that contain *eunotus* sitings.
Other avenues to pursue will be through the local Biological Records Centre or if a local invertebrate group exists this can be consulted. Contacts can often be found via the local Wildlife Trust.

If records are apparent to the area in question then any sites with the above requirements (4.2) can be enhanced through input of woody debris. Prior to input of material, a quick survey of the current invertebrate interest would be useful in order to assess successes in the future.
Where regions do not contain *eunotus* records, this does not mean that the fly is absent. It is a much overlooked species and is highly likely to be in other areas of the UK, particularly in the west. If an area contains a number of small woodlands or is part of a woodland block or "quarter" then if the woodlands are devoid of debris seek to encourage natural processes of input or artificially fell or pollard trees to initiate a cycle of woody debris accumulation.
Trees should be allowed to fall into the streams and embed along the channel and branches float down stream to collect and form dams. These woody debris dams, as highlighted, are valuable resources for many scarce invertebrates but also higher organisms such as brook lamprey (*Lampetra planeri*) and fish fry.
It may take a few years for the wood to become suitable (depending upon diameter and species) for *C.eunotus* but in the interim period many other species will utilise the added resource. Management or in some cases the intentional lack of it over a number of adjacent woodland streams will add to the value and should be encouraged wherever possible.

5 Conclusions

Chalcosyrphus eunotus is an RDB2 hoverfly with a highly specialised lifestyle. As more is discovered about its habits and behaviour then more can be done to protect the species and bring it out of its "vulnerable" status. There are a number of key areas for the fly in the western part of the UK, mainly Staffordshire and Shropshire, and to a lesser extent Worcestershire (to date). It is highly likely that other strongholds in other wooded areas have yet to be recorded, particularly in the Welsh valley woodlands.
The main focus for managers or ecologists who wish to raise the profile of this species or coarse woody debris as a habitat in their geographical areas is to lever emphasis of it through the UKBAP and it is the Rivers and Streams HAP that should be used in order to initiate changes in county management, coupling this with any other UKBAPs such as white-clawed crayfish and other applicable species for a county.
The increased awareness of coarse woody debris as a valuable woodland stream resource for wildlife will help the fly and others that depend upon this niche environ. However, it is still a low status conservation objective for woodland/waterway management that requires readdressing. As with deadwood in parklands, the process of deeper knowledge and wider awareness will take time, but through high profile "flagship" species such as *C.eunotus* and also *Lipsothrix nobilis*, the resource should eventually receive wider attention and due recognition.

5.1 Further research

More work is required to understand how the adult flies utilise their habitat and whether they move between streams, corroborating the theory that a network of wooded streams are required for a viable population of this species.
Further work on the oviposition of the females is required including whether this species will oviposit in saturated wood away form a stream course as with some continental species of this genus. Adult foraging has yet to be observed and there is still much work to understand the larvae and describe this stage of the lifecycle.

6 Further reading

Invertebrates associated with coarse woody debris in streams and rivers in Britain by Godfrey and Middleton (2006) looks into this resource and collates much information about the species that utilise the reference.

A leaflet by Staffordshire Wildlife Trust (2005) is a very good visual awareness raising leaflet that sets out woody debris and how important it is to a functioning watercourse system and the species that live amongst it.

The series of woodland stream quality surveys using invertebrates in their assessment streams on Cannock Chase by Jukes and Mott (2007-08) and Jukes (2009) can be obtained through the Staffordshire Wildlife Trust. Contact Nick Mott at the Staffordshire Wildlife Trust for details.

7 References

Burgio, G., Sommaggio, D. (2007) *Syrphids as landscape bioindicators in Italian agroecosystems*. Agriculture, Ecosystems and Environment 120, p416–422

Fauna Europaea Web Service (2004) *Fauna Europaea version 1.1*, Available online at http://www.faunaeur.org

Godfrey, A., Middleton I. (2006) *Invertebrates associated with coarse woody debris in streams and rivers in Britain*. British Wildlife.

Godfrey, A. (2000) *Survey for the cranefly Lipsothrix nigristigma*. English Nature Research Reports No. 351 and No. 410. English Nature.

Godfrey, A. (2003) *A review of the invertebrate interest of coarse woody debris in England* - English Nature research reports, No 513. English Nature.

Hippa, H. (1978) *Classification of the genera Xylota Meigen and Xylotomima Shannon (Diptera, Syrphidae).* Ann zool. Fenn. 156: 1-153

Hoverfly Recording Scheme. www.hoverfly.org.uk (accessed October, 2009)

Jukes, A., Mott, M (2007) *AONB streams project, year 1*. Unpublished report for Cannock Chase AONB Unit.

Jukes, A., Mott (2008) *AONB streams project, year 2*. Unpublished report for Cannock Chase AONB Unit.

Jukes, A. (2009, *in prep*) *AONB streams project, year 3.* Unpublished report for Cannock Chase AONB Unit.

Kleijna, D., Langeveldeb, F. van (2006*) Interacting effects of landscape context and habitat quality on flower visiting insects in agricultural landscapes* Basic and Applied Ecology 7, p201—214.

Mott, N. (2005) *Managing Woody Debris in Rivers and Streams*. Staffordshire Wildlife Trust. George Street Press.

Renema, W. (2001) *Drie maal is scheepsrecht, de zweefvlieg Chalcosyrphus eunotus terug op de Nederlandse lijst (Diptera: Syrphidae).* Nedelandse Faunistiche Mededelingen

Rotheray, G. E. (1993) *Colour guide to hoverfly larvae*. Dipterists Digest.

Speight, M.C.D. (2008) Species accounts of European Syrphidae (Diptera) 2008. In: Speight, M.C.D., Castella, E., Sarthou, J.-P. and Monteil, C. (eds.) *Syrph the Net, the database of European Syrphidae*, vol. 55, 262 pp., Syrph the Net publications, Dublin.

Speight, M.C.D., J.-P.Sarthou (2008) StN keys for the identification of adult European Syrphidae (2008). In Speight, M.C.D., Castella, E., Sarthou, J.-P. and Monteil, C. (eds.) *Syrph the Net, the database of European Syrphidae*, vol. 55, 262 pp., Syrph the Net publications, Dublin

Stubbs, A. (1977) *Personal observation*. Ex-English Nature (Natural England) invertebrate specialist.

Stubbs, A., Falk, S. (2002) *British hoverflies*. British Entomological and Natural History Society.

Stubbs, A (2009) *Personal Communication*. Ex-English Nature (Natural England) invertebrate specialist.

Vujic, A.A., Šimić, S.D., Radenković, S.R. (2002*) New data on hoverflies diversity (Insecta: Diptera: Syrphidae) on the Fruska Gora mountain (Serbia)*. Preceedings for Natural Sciences Matia Srpska Novi Sad, No 103, 91-106.