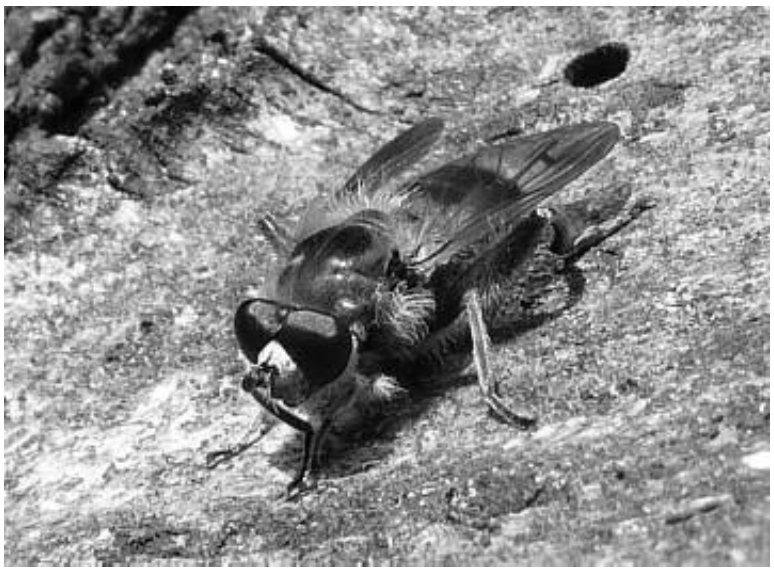
Chalcosyrphus eunotus

Year 2 - Investigation into species' mobility and metapopulations



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Report title: *Chalcosyrphus eunotus* – year 2
Investigation into species' mobility and metapopulations

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Contents

1 Introduction

1.1 Background

Until 2000,*Chalcosyrphus eunotus* was considered a very scarce hoverfly that was poorly understood. However, recent, significant developments in the identification of key features important to its lifecycle (woodland streams and woody debris) have generated an increase in records and knowledge. Initial work by Godfrey (2000) and subsequent work by Jukes and Mott (2007-2009) and latterly Jukes (2010) have all added significant data to the ecology and distribution of this fly. Annex I details the most significant findings of this report.

In 2010 *Chalcosyrphuseunotus* was downgraded to Nationally Scarce (NS) in the UK from its former Red Data Book 2 (RDB) status. Much of this is due to the increased recording of the species in Staffordshire and Shropshire predominantly by the above authors. Even though the species has been downgraded, it is nonetheless an important, and still scarce, indicator species of Coarse Woody Debris (CWD) and headwater streams. It's presence on predominantly high quality woodland streams, particularly those connected to other streams and/or in extensive woodland blocks is important and understanding the fly's mobility may be key in understanding the species association with these large connected pieces of habitat (Jukes, 2010). There may be valuable links to be made between this fly and "landscape scale" management. Loss of corridors or links to other woodlands may inhibit the mobility of *eunotus* and add to the importance of retaining and restoring woodland connectivity to prevent this fragmentation and isolation of individual populations.

1.2 Brief

This project on *eunotus* is the second year of study and seeks to investigate the autecology of *C.eunotus* further with an emphasis on attempting to discover whether the fly is found at the metapopulation* scale.

***Metapopulations**

A metapopulation is a group or population of the same species that interacts with another group or population of the same species at some geographical level. In the instance of *C.eunotus* it is theorised that the fly interacts with other populations on other stream courses. The importance of metapopualtions is that it allows genetic mixing, and in some species this is essential to prevent interbreeding and reduce disease and parasite susceptibility.

2.0 Methodology

2.1 Field work

Fieldwork was undertaken between 26th April– 18th May, 2010:

Fieldwork focussed on:

- Marking flies with white liquid marker (such as Tipp-Ex) (on a hind leg) for the investigation of movement along a stream or between streams.

3 Mobility of *Chalcosyrphus eunotus*

To understand whether *Chalcosyrphus eunotus* has high mobility, and therefore likely to operate on a metapopulation scale, it is necessary to attempt to mark, release and recapture (MRR) as many flies as possible. The method chosen was to catch and mark flies from one stream and search for them on another, nearby similar stream. Any fly marked from the first stream can then be easily noted and indicate strongly that this species has a high mobility between streams.

3.1 Principal sample sites

The two watercourses identified as being of most potential to discover if the fly moves between sites are two streams on Cannock Chase, central Staffordshire. These two streams have been the subject of previous invertebrate surveys by Jukes and Mott (2006-7) and highlighted as high quality headwater streams on Cannock Chase and therefore ideal candidates for this study.

The Old Brook (SK005199) is a small, spring–fed woodland stream with numerous seepages with an alder (*Alnus glutinosa*) canopy that casts light to medium shade in spring (40-70%). One stretch of the stream also runs through a small coniferous plantation. There is a regular input of coarse woody debris though not in large quantities. Most *eunotus* activity is recorded on the lower part of this stream in the alder carr and on the seepage lines. The second stream, Lower Sher Brook (SJ985207), is the lower reach of a long stream (Sher Brook). This steam flows through a variety of habitats from wet heath and valley mire to alder carr. This lower section is dominated by alder carr and at its lower stretch, the stream becomes extensively braided with seepages, light-heavy (30-90%) canopy cover (though the shading is light in early spring) and large inputs of a range of woody debris from small CWD to Large Woody Debris (LWD). The two streams are less than one kilometre apart and linked by woodland (broad-leaved and coniferous). There is no direct connectivity via the stream courses, but this is a similar situation to many sites where *eunotus* is found. The sites are most commonly connected by woodland rather than converging stream channels.

Figure 3.1: The Old Brook – high quality C.eunotus habitat with light dappled shade and coarse woody debris

Figure 3.2: Lower Sher Brook – excellent C.eunotus habitat with large amounts of woody debris and light shade. This debris is the result of management works to create small pearl-bordered fritillary habitat further upstream in 2001. The debris was put into the channel and has collected here to from a woody debris dam.

3.2 Method of marking

The flies are marked on the hind femur and/or tibia. The MRR (Mark, Release, Recapture) took place on the Lower Sher Brook where the greatest population of flies occur. MRR was not thought worthwhile on the Old Brook as this population is relatively small and there was insufficient time to mark flies on both streams and attempt to re-find them again.

Figure 3.3: Fly marked with liquid marker – although this looks as though the fly is being harmed, it is being held very delicately and is able to fly off and carry on normal activities immediately after marking has taken place.

4 Results

The Lower Sher Brook (LSB)
Old Brook (OB)
LSB: 26th April - 0 flies
LSB: 5th May – Fist adult observed (male)
LSB: 12th May – 22 adults tagged (males and females)
LSB: 13th May – 10 adults tagged, one of which was re caught.
LSB 15th May – 9 tagged, all male, on re-tagged from 13th May.
LSB 17th May – 5 tagged, 1 female

OB17th May – 6 tagged, 2 female
OB18th May – no evidence of species movement

5 Discussion

Flies were tagged in varying numbers along the Lower Sher Brook and Old Brook. As suspected, the Lower Sher Brook consistently produced higher numbers of individuals than the Old Brook. One count of 22 was undertaken in one day, however this was attained through increased recording effort (use of two surveyors).

5.1 Saproxylic resource

The Lower Sher Brook possesses a large amount of CWD of varying sizes, though is generally quite large in diameter, up to 15-20cm and more than a metre long. There is also LWD in the form of fallen trees, such as a recently fallen oak tree (*Quercus robur*). The Old Brook has a significantly smaller resource of CWD and of an average diameter of less than 15cm. Lengths vary widely but they are generally of a shorted length than those in the Lower Sherbrook.

The Lower Sherbrook has a very healthy population of *eunotus*. Previous studies (Jukes, 2010) highlight oviposition in small material of 8cm diameter however this is a scarce resource in the Lower Sher Brook, where larger CWD and LWD predominates. It is unclear whether there is a connection between the diameter of material as well as saturation levels for optimal oviposition sites. Most headwater streams in woodlands do not have large diameter woody debris material with small branches contributing to the majority of the log jams in these stream systems. The larger debris is primarily the result of active management along the Sher Brook where material has been left to fall into the stream or gets washed into it during flood events. The apparent size of the *eunotus* population suggests that it may be linked, at least in apart, to the length of stream and the overall availability of material along its entire, uninterrupted length rather than the localised availability of the resource in a stream section as indicated by the successive capture and release of new individuals throughout a day on the Lower Sher Brook. All of the flies marked could not be on the stream section at any one time as they would have been recorded much earlier in the day. It suggests that individuals are coming in from outside the stream section, either from upstream or from other streams.

5.2 Mobility

22 flies were recorded on a single day along the Lower Sher Brook at peak period. Although this is biased by the use of two surveyors (all other counts were done by a single surveyor) this shows that there are substantially greater numbers of individuals along a stream at any one time than previously thought. These flies were also infrequently re-captured (one was re-captured two days after initial capture). There are a few possible reasons for this. The white liquid marker may make the flies more visible to predators inhibiting their survival chances or the flies only live for one-two days resulting in the flies dying before they can be re-captured or observed on other streams. It isn't thought that the flies are any more susceptible to predators with or without the marker as this does not show up too clearly (to human eyes at least) until very close to the individual. The flies are thought to live for

much longer than 1-2 days given the length of the fly's flight period. It is suggested by Smart (2010, *pers. com*.) that the flies may live up to 2 weeks.

As noted in section 5.2 (Saproxylic resource), due to the number of new flies being recorded throughout the day on a single stretch of stream, it would appear that flies are entering the sampling compartment from outside the area. This is either from up/downstream of the survey section or from another stream in the area, such as the Old Brook. It is more likely though, given the evidence to date, that the flies are showing high levels of mobility along a single stream course. This also indicates that the success of a population of flies may in part be connected to the length of that stream course.

For example, the Old Brook is a small (3.39 km) stream with limited input of material whereas the Sher Brook is 7.36 km long. It has also previously been noted in Jukes (2010) that marked *eunotus* individuals would disappear from a stream section for long periods of time suggesting high mobility. It is perhaps that individuals are moving over long stretches of stream looking for suitable resources in which to breed. Short streams have a naturally smaller carrying capacity of resource and therefore less individuals than a large, healthy stream that will have more resources and a greater amount of optimal material in which to breed resulting in a lager overall population size.

5.3 Flight period and climate change

Like many insects, it would appear that the fly's flight period is influenced by temperature. In 2009 the first fly was observed on 23rd April, in 2010 it was not until 05th May. The early spring (late March) of 2009 was on average quite warm (6.7°C) with a settled high pressure over the UK from the 15th March (Met Office, 2011) whereas late March 2010 was noted for it's cold weather (average 5.9°C) (Met Office, 2011). Late March is also the pupation period for *eunotus* (Jukes, 2010) and as temperatures could be one of the catalysts for initiating pupation, unseasonably cold or warm weather around this time would influence the pupation of the fly.

Whatever the reason, the flight time of *eunotus* was delayed by approximately two weeks in 2010 based on previous surveys for the fly and also surveys undertaken by Jukes and Mott (2007-2009). The overdue emergence of adults did not however simply shift the flight time of the insect by two weeks. No flies were observed after 18th May whereas in 2009 and in previous years to this, records were still being taken for early June as normal high pressure and stabilised, sunny spells settle across the UK. Early to mid-May in 2010 was cold and wet (10.7°C) then there was a change in the weather patterns as high pressure descended on the UK and weather stabilised and temperatures increased significantly to around 15°C by the end of the month (Met Office, 2011). However, only a long term field and desk study of all records and weather temperatures will be able to shed more light on this aspect of the fly's biology and ecology.

If the flight period were constricted by adverse weather (either too hot or cold) then there would be less available days in which to fly, find a mate and reproduce. Some years would be productive having many suitable warm days on which to fly, but some years would be poor, with very few days that are suitable for flying. This would negatively affect the fly and its populations when poor years were successive. The need for robust populations and connectivity (although still not proven) would then become ever important.

5.4 Limiting factors

No flies were conclusively discovered to move between the two streams although there is strong evidence of intra-stream mobility. More time and effort is required to substantiate the theory that this species requires a number of closely associated headwater streams with suitable habitat to maintain viable populations and to discover other factors determining population size and robustness. To make the connection between the flies mobility and use of other streams, a much larger sample of flies needs to be used. To do this, more time is required with more resources (surveyors and therefore project costs) to catch, mark and release the flies then search surrounding streams to see if the flies

have moved. Only having a large sample of marked flies provides the opportunities and chance to show movement from one stream to another.

Although no conclusions for inter-stream mobility can be made, the MRR exercise exposed more information regarding the populations and mobility of the fly. The results show a high number of flies using a given stretch of suitable habitat. Although only small numbers of flies are seen at any one time, through the MRR, it proves that there are many more flies in the area. This is very encouraging when looking to manage sites with an abundance of coarse woody debris. It is not uncommon to only see one or two flies during a survey, but this exercise shows that this is not necessarily the total number of flies to that site and that many more are moving around the area and only settling intermittently, which is the only time they are recorded.

6 Future work

Although much has been discovered of this scarce hoverfly in 2 years there are still gaps in our knowledge of its lifecycle such as adult foraging and mobility that would help complete the picture of how *Chalcosyrphus eunotus* uses its landscape. Identifying whether *eunotus* is operating on a metapopulation scale would not only assist this fly's conservation but lead on to indicate that other similar species may do the same and strengthen the case for better landscape scale management. A desk study looking at the flight periods and emergence of *eunotus* compared to monthly temperatures may also shed light on the fly's phenology. The principle concern however is the conservation of landscapes. As long as conservation bodies understand the value of linked habitats and connectivity, then issues such as the mobility of *Chalcosyrphus eunotus* may never become an issue whereby it is placed back on the Red Data Brook list of threatened and endangered insects.

7 Further reading

Invertebrates associated with coarse woody debris in streams and rivers in Britain by Godfrey and Middlebrook (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 on Cannock Chase by Jukes and Mott (2007-08) and Jukes (2009) can be requested from the Staffordshire Wildlife Trust. Contact Nick Mott at the Staffordshire Wildlife Trust for details.

(Jukes, 2010). There is now a composite report on this species undertaken by Jukes (2010) commissioned by the Staffordshire Wildlife Trust. Key information has been presented in Annex I of this report. The full report can be downloaded via the Staffordshire Wildlife Trust (www.staffs-wildlife.org.uk) website or from the Conops Entomology Ltd website (www.conopsenotmology.co.uk).

8 Acknowledgements

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Annex I: Supplementary information (taken from Jukes, 2010).

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)).

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* (*nigristigma*). 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 (UK HAP) and further the ecological understanding of a little studied fly.

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 (*Alnusglutinosa*) 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 very 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 (May, 2009)

Figure 3.4.1.1b: Egg-laying points "A" and "B" both well above water level (May, 2009)

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 (May, 2009)

Figure 3.4.1.1d: Close-up of oviposition point "B", a single egg (May, 2009)

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.

Conservation

- *Reasons for decline*

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* cranefly 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 Middlebrook (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.

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.

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. These are also the best places to search for adult flies.

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

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.

Appendix

Appendix I: Additional Chalcosyrphus eunotus records in 2010
Appendix II: Additional photographs

Appendix I: Additonal Chalcosyrphus eunotus records in 2010.

Additional records supplied by Nick Mott (Senior Ecologist) – Staffordshire Wildlife Trust

Taxon	Status	Date	Grid Ref(s)	Location	#	Habitat
Chalcosyrphus eunotus	Nationally Scarce	21/05/2010	SK 04650 45224	Cotton Dell NR	1 female	Cotton Brook. On ERS near log jam.
Chalcosyrphus eunotus	Nationally Scarce	24/05/2010	SK 00653 49687	Crowgutter Brook (RSPB)	1 male	CWD in channel
Chalcosyrphus eunotus	Nationally Scarce	19/05/2010	SK 05900 14180	Shropshire Brook	3 males	CWD and on sunlit marginal vegetation
Chalcosyrphus eunotus	Nationally Scarce	19/05/2010	SK 00806 20622	Lower Old Brook	1 male	Log Jams created in February'08
Chalcosyrphus eunotus	Nationally Scarce	18/05/2010	SJ 94590 63606	Dane Trib. Thompson	1 male	Sunlit Marginal vegetation next to drumble.
Chalcosyrphus eunotus	Nationally Scarce	17/05/2010	SJ 98550 20830	Lower Sher Brook	22 (m+f)	With AJ, CWD & Seepage lines
Chalcosyrphus eunotus	Nationally Scarce	17/05/2010	SK 00540 19740	Upper Old Brook	4m:2f	With AJ, CWD
		May-10	Negative	Vermin Valley SSSI		
		May-10	Negative	Gayton Brook		
		May-10	Negative	Churnet - Tittesworth		
		May-10	Negative	Dimminsdale 1		
		May-10	Negative	Dimminsdale 2		
		May-10	Negative	Collyhole Brook		
		May-10	Negative	Stony Brook		
		May-10	Negative	Fallow Stream		
		May-10	Negative	Rising Brook		
		May-10	Negative	Scotch Brook		
		May-10	Negative	Swarbourn		
		May-10	Negative	Wash Dale Brook / Down's Banks		

Appendix II: Additional photos

Chalcosyrphus eunotus

Large Woody Debris – a fallen oak tree on the Lower Sherbrook