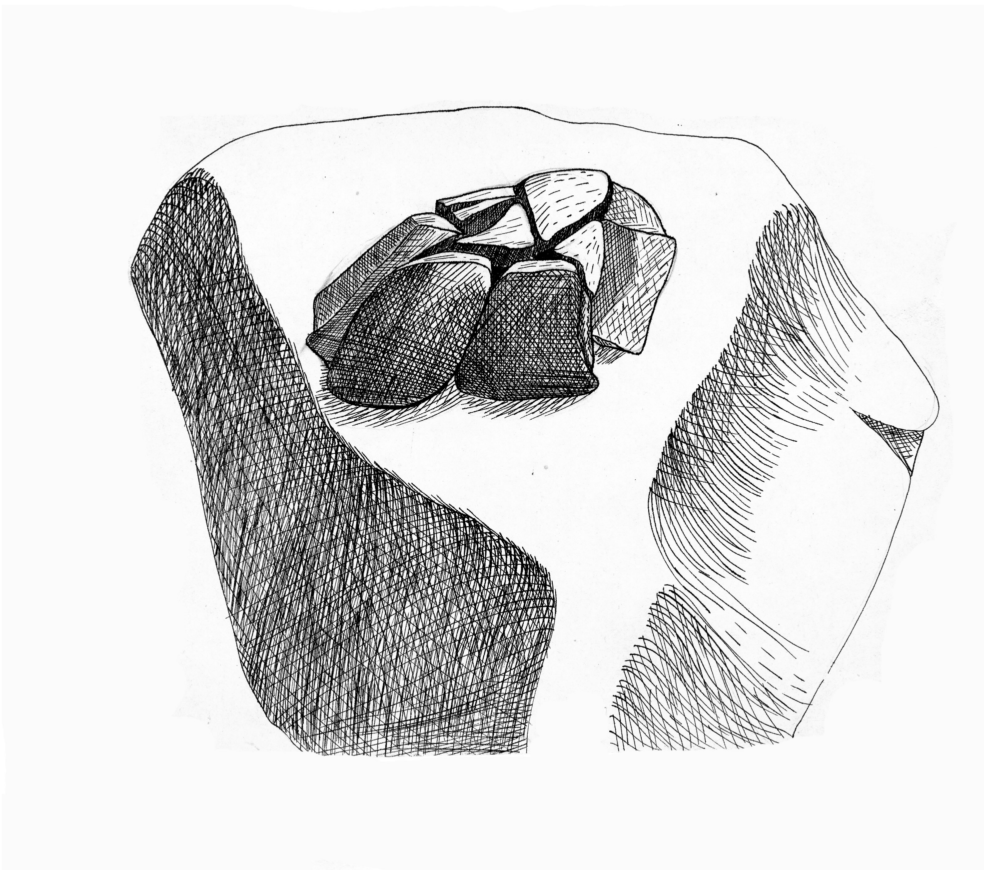
Species dossier:

Glossosoma intermedium

Small grey sedge

July 2011



Glossosoma intermedium Pupal Case

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Species dossier: *Glossosoma intermedium*

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Glossosoma intermedium (Klapalek, 1892)
Small grey sedge
(Trichoptera: Glossosomatidae)

Genus previously *Mystrophora* (Klapalek, 1892)

Introduction

The Small grey sedge (*Glossosoma intermedium*) is a priority species within the UK Biodiversity Action Plan. The purpose of this dossier is to draw together available information on its distribution in the UK and its ecology in order to assist Government Agencies, Planning Authorities, landowners and conservation practitioners with the implementation of action to conserve this species in the UK.

The Small grey sedge was classified as Rare in Shirt (1987) and RDB3 in Wallace (1991). It has no formal legal protection and is not listed in any schedule of the Wildlife and Countryside Act or in annexes to EU directives. The Small grey sedge is a widespread Holarctic species. It is listed as threatened on the red lists of the southern German states of Thuringen and Bayern (Bavarian State Office for Environment, 2011).

Summary

The Small grey sedge (*Glossosoma intermedium)* is one of Britain's rarest caddis flies. There are definite records from only four streams in the English Lake District, but there are several other unconfirmed records.

Ecology

This species lives in stony streams and rivers in Europe, northern Asia and North America. *Glossosoma* larvae graze algae from stones (Scott, 1958, Kovalek, 1976, Kohler, 1992). There can be competition for this resource and the larvae may graze the algae that grows on each others cases (Cavanaugh *et al*, 2004). Shortage of food may be one reasons for the 'drifting' of larvae. This phenomenon occurs when larvae abandon their cases, let go of the bottom and get carried downstream for a short while by the current. It is mentioned in several studies, e.g. Waters (1962) and Krueger *et al* (1984) and is also the stage at which large numbers are taken by fish (LaFontaine, 1981).

Life history and behaviour have been studied by several authors. In this country, in 1985, I.D. & B. Wallace observed that the larvae grew rapidly in the late spring and sealed themselves into their pupal cases in July. Rapid growth, followed by a long period as a quiescent larva in a pupal case is a general feature. In western Norway, first instar larvae appear in July, and at a site warmed by power station cooling water the majority of the population was fully grown by September; at a colder up-river site the majority were not fully grown until November, (Fjellheim *et al* 1998). The life cycle is similar in Finland (Aki Rinne, pers.comms.), and in Swedish Lapland (Ulfstrand, 1968). In Minnesota there was a univoltine and a bivoltine cohort, with the univoltine cohort having the usual rapid summer growth and winter quiescence (Krueger & Cooke, 1984).

In England the larvae were found in areas of moderate flow and not in fast-flowing sections; this is also mentioned by Fjellheim *et al* (1998) in western Norway. Cobb *et al* 1992 describe this species hiding under stones during spates, presumably to avoid involuntary down-stream drift. In Alberta (University of Alberta web-site) this is given as a species of small moderately flowing creeks, and in Saskatchewan its habitat is described as cold fast-flowing midland streams, but also in slower flowing waters (Smith, 1984)

This is a common species in North America and is cited in many surveys. It is numerous enough to be significant for angling on some streams. LaFontaine (1981) gives the genus the name of Little Tan Short-horn Sedges, but this is not appropriate for the generally dark grey *G. intermedium* so another name for it is the Little Black Short-horn Sedge.

The adults have been reported in studies that involve use of light traps and interception traps. Morton (1925) mentions that the adult is difficult to catch as it flies close to the emergent stones in the evening. American fly-fishing web sites describe it as nervous and skittering over rocks and shrubs. They say that when the adult is ready to emerge the pupa cuts its way out of the pupal shelter and swims ashore or climbs on to an emergent rock. The skin splits and the adult emerges. The egg stage is not known but is likely to be laid underwater in small groups. American anglers say it dives in and swims down to paste its eggs to a rock, but it may also walk underwater. After laying a batch the adult will probably just let go, bob up to the surface, break through the film and fly away; this is the behaviour of the related *Agapetus fuscipes* Curtis (Anderson,1974).

An unusual aspect of their biology is that in North America they have been found to be an intermediate host for a mermithid nematode of social wasps, Molloy *et al* (1999).

Wallace (1991) awarded this species only RDB3 status as he confidently expected it would be in many more Lake District streams. As later surveys proved unsuccessful, clues were sought as to unique features of its streams. A clue came from Butler (1956). The Pull Beck has raised levels of Calcium due to it flowing from the Coniston Limestone beds; Hayeswater inflow comes from the base-rich volcanic rocks above High Street, and the Troutbeck also arises from that range. Although the chemistry of the rocks around the Hoathwaite Beck is not known, it is thought that raised levels of Calcium and other minerals is a feature of the streams it inhabits. The reason is not known, but they may have more nutrients and grow more diatoms and algae, or grow them earlier.

History in Britain

The species was added to the British list by Kenneth Morton, who found adults at the mouth of the Hoathwaite Beck, Coniston on 22.4.1925. He collected more on the 25th and 26th (Morton, 1925). He took it again there in the following year on the 21st, 22nd, and 25th. D.E. Kimmins took adults from the same site on 25.4.1942 and on May 1st and 5th of the same year (Kimmins, 1943a & b). Jean.Mackareth took adults and pupae from the same site on 3.4.1953 that year. Adults and pupae were found there on 11.5.1954 and larvae in 1956. (Mackareth, 1956). Since that date it has not been collected from the site despite searches by Brenda and Ian Wallace in 1985 and again in 2003 and 2009.

Mackareth had collected a larva at Troutbeck, place or river, on 29.6.1949. (Mackareth, 1956). Ian Wallace had correspondence with T.T. Macan, who supervised Mackareth's work. Macan stated that the record was from the Troutbeck itself and not from a stream at the village, which might have been suitable as in 2003 it was found to be supporting a good population of *Glossosoma boltoni* Curtis. Ian Wallace has checked the specimen, now in the FBA collections at Windermere, using modern characters in Wallace *et al* (2003). Brenda and Ian Wallace could not find any material of this species in a survey of the river at, and above Troutbeck village in spring 2003.

Mackareth collected adults from the Hayeswater inflow between 2.4.1954 and 29.6.1954, and took pupae there on the 4.5.1954. (Mackareth, 1956). A member of the Freshwater Biological Assciation staff took adults at the site in 1968. Brenda and Ian Wallace took pupal cases containing larvae there on 5.3.1985. Steve Hewitt took a pre-pupa from a side stream of the main inflow in March 2003, and that remains the last record of the species for the UK. Ian Wallace was unable to find larvae there in 2004 and Andrew Dixon has looked for the species at this site at various times of the year in 2009 and 2010, without success.

W.D. Hincks took adults at the Pull Beck on 28.5.1955 (Butler, 1956). Brenda and Ian Wallace took pre-pupae there on 2.3.1985 and growing larvae on 6th July of that year. They were unable to find any evidence of the species in 2003, 2004 or 2009.

Mackareth used her material to write an identification key for larvae of the family (Mackareth, 1956). Whilst there is no evidence that she mis-identified material, her key has characters that are vague enough to allow some larvae of *G. boltoni*, to be mis-identified as *G. intermedium*. The Caddis Recording Scheme has received many records that it feels must be questioned. Unfortunately most are not accompanied by voucher specimens to prove the case one way or another. The author has found five of these that have been published, but there may be more in local journals:- R. Wye (University of Cardiff, undated); Afon Rheidol (Brooker & Morris, 1978); Shireoaks Quarry Pond, Rotherham (Twigg, 1979); Golspie Burn in Sutherlandshire (Joyce, 1984); Gregynog, Montgomeryshire (Morgan, 1996). The Gregynog record, an adult, is backed by a specimen - which proved to be *Agapetus delicatulus* McLachlan, on re-examination. The R. Wye records are particularly intriguing. The survey collected adult insects to back up larval records. They recorded *G. intermedium* as larvae, but only as *G intermedium?* as adults, along with adults of both *G. boltoni* Curtis & *G. conformis* Neboiss. It can be presumed that Macan (1973) was available to them. That certainly does not easily separate females of *G. conformis* and *G. boltoni* but gives no serious problems with *G. intermedium*. This tends to re-inforce the view that the larvae were misidentified but it is intriguing what their *G. intermedium?* actually were. Wallace *et al* (1990, now superseded by 2003 edition) provided clear characters to distinguish this species from its two relatives, and dubious records seem to have ceased.

European distribution

The Fauna Europaea website lists this species from the following countries and major regions, listed alphabetically: Austria; Bulgaria; Czech Republic; Finland; Germany; Norway; Poland; Romania; Russia (East); Russia (North); Slovakia; Slovenia; Sweden; United Kingdom. This species is also found in Japan and across Northern USA and Canada.

Recent Survey Work

All its previous sites have been investigated, often many times, in the past few years, without success. Andrew Dixon has surveyed many streams in the Eden catchment as part of a long-term survey of caddis of the catchment, without success. Ian Wallace has looked for streams that might have raised calcium levels in the central Lake District in 2004 and again in 2009 and 2010. He has found many hopeful sites but all have been populated by only the two common species *G. boltoni* Curtis and *G. conformis* Neboiss. It should be noted *G. intermedium* co-existed with other *Glossosoma* species in the 1985 survey. It is unfortunate that these hopeful sites were not surveyed in the 1980s as various factors may have caused the species to decline generally in the Lake District and these sites may well have at one time held *G. intermedium*. Wallace identified likely streams to survey by using a geological map to find where the Coniston limestone band occurred. In addition, the Flora of Cumbria (Halliday, 1997) indicated where base-rich volcanic rocks out-cropped and the National Biodiversity Network supplied recent records of white-clawed crayfish (*Austropotamobius pallipes* (Lereboullet) which were used to suggest calcium enriched streams to survey.

Survey methods

Morton (1925) notes that the adults were actively flying about the stones at the mouth of the beck in the evening and were difficult to see and catch. A US anglers site described the adult as skittering over rocks and vegetation and quite difficult to see due to their dark colour. They can presumably be swept from vegetation in the day time and can be caught at light (Monson, 1994) and presumably also interception type traps. While they can be recognised at the genus level, they will need at the least immobilising with anaesthetic to be examined and identified. They are comparatively small and fragile caddis and it is not known if live capture identification and release would be successful. Examination and release of live larvae is also thought to be impractical. *Glossosoma* larvae leave their cases readily and are difficult to successfully re-instate whilst anaesthetised, so that they will remain in their cases when replaced in the habitat. They can be a significant element in the natural drift, i.e. larvae that leave the bottom to be carried downstream, to re-settle after a while. However it is not know how many artificially released larvae would survive to make a new case.

The most successful method is probably to collect empty pupal shelters. These can usually be distinguished from full ones, and if the stones are replaced as they were, then minimal damage will have been done to the population. Note that if empty pupal cases are being collected, it is strongly recommended that they are not transported in fluid as this encourages the sclerites to be washed out.

It obviously remains a possibility that the species will be found in other parts of the UK, notably Scotland. The early flight period means that it would probably have been missed by people like J.J.F.X. King and K.J Morton who undertook extensive sampling there in July and August at the end of the 19th and start of the 20th century. *Glossosoma* larvae are regarded as difficult to identify to species and have not been separated from samples used in the extensive work by the Centre for Ecology since 1977 that led to the RIVPACS water quality assessment method.
http://www.ceh.ac.uk/products/software/ObtainingtheRIVPACSDatabase.html
Investigation of those samples might be worthwhile.

A desk survey to locate base-rich streams in Scotland, might suggest sites worth investigating in Scotland.

The flight period seems to stretch from April to June, with a likely peak in early May. It is suggested that caddis recorders bear this species in mind and examine *Glossosoma* adults they encounter in spring. Similarly larval recorders should consider collecting larvae in pupal cases found over-winter, if they come from previously un-examined sites. Resilience will be required in the face of the large number of *G. boltoni* that will be encountered!

Identification

Glossosoma larvae and pupae are easy to recognise as such in the field. With experience, adults can also be recognised to genus but characters have not been refined to enable field identification to species. Currently, adults can be identified using Macan (1973) or Malicky (2004); a new key to adult UK caddis, authored by Peter Barnard and Emma Ross is expected to be published in 2011.

Wallace et al (2003) provide features to enable the certain identification of preserved larvae, and that feature can be used to identify intact pupae using the larval exuviae. However, after the adult has emerged the exuviae are free to be washed out of the case and it is pot luck if the definitive sclerite, the 9th abdominal dorsal plate, is retained in a case that is collected.

The pupal stage is described by Kimmins (1943b) but not in sufficient detail to enable it to be separated from other *Glossosoma* either intact or as a cast exuviae left on a rock. *Glossosoma* pupae can be separated from other pupae using the key in Lepneva (1964) or Ross (1944).

Cases and larva *Glossosoma* sp. © James C. Hodges Jr

***Glossosoma nylanderi* –similar caddisfly as no adult photos available © Aki Renni**

What caused the species to decline?

It is possible that this was a victim of Cypermethrin Sheep dips. The true toxicity of these was not appreciated (Shardlow, 2006), but it is gratifying that their use is now banned. The streams may not have experienced catastrophic pollution events but sheep surround the catchments of all its sites and in tests, sheep continued to lose Cypermethrin when they waded streams (Ramwell *et* al, 2007) and could cause the astonishingly small EQS (Ecological Quality Standard) of 0.06 mg per 100 metres of stream to be exceeded. Sites which supported white-clawed crayfish were thought unlikely to have suffered serious pesticide pollution, which was another reason for their selection for survey for *G. intermedium* in 2010.

It is possible that a series of warm winters have had a deleterious effect, and that global warming generally may have an effect. It could be characterised as a northern and eastern species, and the UK may have an Atlantic influenced climate that is more mild over winter than this species normally encounters. In North America it is also a species mentioned as coming from cool sites, e.g. Ross (1944).
In 1985, in the search for Lakes District sites, few larvae of *G. boltoni* were found sealed in pupal cases in early spring, but this was general in 2003. Presuming that they now both emerge as adults at about the same time, it means growing larvae of *G. intermedium* and *G, boltoni* could thus now be at the same size, rather than *intermedium* being slightly ahead. In Western Norway and Finland it is the only species in the streams, though there is a possibility it shares the habitat with *G. nylanderi* Nybom (Aki Rinne, pers.comms.).

It is possible that the random genetic drift may have robbed the founding UK population of valuable alleles that assist it cope with variable regimes, or that it has subsequently lost them.

Threats

The main threats include:

1. Pollution events
2. Unsympathetic dredging and engineering works
3. Marginal and riparian vegetation may be important to adults for shelter or mating. Large changes in areas where it lives could be detrimental.

Action plan for the Small Grey Sedge (*Glossosoma intermedium*)

1 Engage with planning authorities and the Environment Agency to ensure that this species is taken into account in developments.

2 Ensure that the species is represented on all relevant LBAPs; the only one of its sites to have any statutory protection is the Troutbeck, part of the River Kent tributaries SSSI.

3 Encourage surveyors to identify to species *Glossosoma* adults taken in spring and larvae found sealed in pupal cases over-winter, especially if they are from productive but upland streams.

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Appendix 1 Records of (Glossosoma intermedium) from the UK

Locality	Grid reference	Vice County	Source	Stage	Recorder name	Determiner name	DAY	MONTH	YEAR
Coniston	SD3--9--	69	Tolson Memorial Museum, Huddersfield	adult	Morton, K.J.	Morton, K.J.	22-26	4	1925
Coniston	SD3--9--	69	Natural History Museum London	adult	Morton, K.J.	Morton, K.J.	25	4	1925
Coniston	SD3--9--	69	Manchester Museum	adult	Morton, K.J.	Morton, K.J.	26	4	1925
Coniston	SD3--9--	69	National Museums of Scotland	adult	Morton, K.J.	Morton, K.J.		4	1925
Coniston Hall, beck south of	SD30-95-	69	Morton (1925)	adult	Morton, K.J.	Morton, K.J.	25	4	1925
Hoathwaite Beck	SD30-95-	69	Natural History Museum London	adult	Morton, K.J.	Morton, K.J.	25	4	1925
Coniston	SD3--9--	69	Tolson Memorial Museum, Huddersfield	adult	Morton, K.J.	Morton, K.J.	25-26	4	1926
Coniston	SD3--9--	69	Tolson Memorial Museum, Huddersfield	adult	Morton, K.J.	Morton, K.J.	21-24	4	1926
Coniston	SD3--9--	69	Manchester Museum	adult	Morton, K.J.	Morton, K.J.	22-26	4	1926
Coniston, Hoathwaite Beck	SD30-95-	69	Kimmins (1943)	adult	Kimmins, D.E.	Kimmins, D.E.		5	1942
Hoathwaite Beck	SD30-95-	69	Freshwater Biological Association Collections	adult	Kimmins, D.E. & China, W.E.	Kimmins, D.E.	5	5	1942
Hoathwaite Beck	SD30-95-	69	Natural History Museum London	adult	Kimmins & China	Kimmins, D.E.	1	5	1942
Hoathwaite Beck	SD30-95-	69	Natural History Museum London	adult	Kimmins & China	Kimmins, D.E.	5	5	1942

Hoathwaite Beck	SD30-95-	69	Natural History Museum London	adult	Kimmins & China	Kimmins, D.E.	25-26	4	1942
Hoathwaite Beck, Coniston	SD30-95-	69	Freshwater Biological Association Collections	adult	not listed	Kimmins, D.E.	5	5	1942
Troutbeck, river	NY4--0--	69	Freshwater Biological Association Collections	Larva	Macan, T.T.	(checked) Wallace, I.D.	26	9	1949
Hayeswater inflow	NY43-11-	69	Freshwater Biological Association Collections	adult	FBA staff & associates	Mackareth, J.C.	2.4.195 3	to	29.6.1953
Hayeswater, inflow	NY43-11-	69	Freshwater Biological Association Collections	pre-pupal	Macan, T.T.	Mackareth, J.C.	4	5	1953
Hoathwaite Beck	SD30-95-	69	Freshwater Biological Association Collections	pre-pupal	FBA staff & associates	Mackareth, J.C.	3	4	1953
Hoathwaite Beck	SD30-95-	69	Freshwater Biological Association Collections	adult	FBA staff & associates	Mackareth, J.C.	3	4	1953
Hoathwaite Beck	SD30-95-	69	Freshwater Biological Association Collections	adult and pre-pupal	FBA staff & associates	Mackareth, J.C.	11	5	1954
Pull Beck	NY346016	69	Manchester Museum	adult	Hincks, W.D.	Hincks, W.D.	28	5	1955
Pull Beck	NY34-60-	69	Butler (1956)	adult	Hincks, W.D.	Hincks, W.D.		5	1955
Hayeswater, inflow	NY43-11-	69	Mackareth (1956)	larval	Mackareth, J.C.	Mackareth, J.C			pre 1956
Hoathwaite Beck, Coniston	SD30-95-	69	Mackareth (1956)	larval	Mackareth, J.C.	Mackareth, J.C			pre 1956
Troutbeck	NY4--0--	69	Mackareth (1956)	larval	Mackareth, J.C.	Mackareth, J.C			pre 1956
Hayeswater, inflow	NY43-11-	69	Freshwater Biological Association Collections	adult	not listed	Macan, T.T.			1968
Hayeswater, inflow	NY433116	69	World Museum Liverpool	pre-pupal	Wallace, B. & I.D.	Wallace, B. & I.D.	5	3	1985

Pull Beck	NY359021	69	World Museum Liverpool	larval	Wallace, B. & I.D.	Wallace, B. & I.D	2	3	1985
Pull Beck at road bridge	NY359021	69	World Museum Liverpool	larval	Wallace, B. & I.D.	Wallace, B. & I.D	6	7	1985
Hayeswater, inflow	NY43-11-	69	World Museum Liverpool	pre-pupal	Hewitt, S.	Wallace, I.D.		3	2003

Fig. 1 Distribution of confirmed records in UK (Dark green = recent records (after 1980), light green = historic records (before 1980))

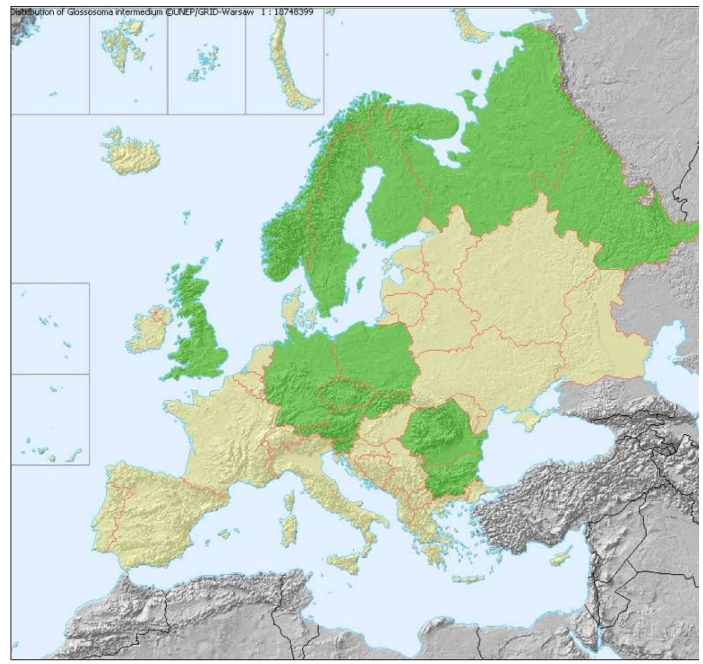

Fig. 2 Distribution of *G. intermedium* in Europe (from Fauna Europaea) (Green = Present Beige = No data)