The distribution of *Rhabdomastix laeta* populations

Final Report - September 2007

John Spedan Lewis Foundation

A. Godfrey

ANDY GODFREY
Entomological Consultant
90 Bence Lane
Darton
Barnsley
South Yorkshire
S75 5DA

Tel: 01226 384022
Mobile: 07788696319
Email: andy_godfrey_entomology@hotmail.com

CONTENTS

TABLES

SUMMARY

The cranefly *Rhabdomastix laeta* is a Priority Biodiversity Action Plan species on the UK Biodiversity Action Plan (UK Biodiversity Group 1999). This is a poorly known species and presumably it was considered premature to produce a Species Action Plan and in the process produce specific actions until survey and research had been completed. For these reasons, this species is provided with a Species Statement in the UK Biodiversity Action Plan.

A recent revision of the genus *Rhabdomastix* in Europe (Starý 2003, 2004) was able to show that all British species of *Rhabdomastix laeta* seen by Dr Starý were attributable to *Rhabdomastix japonica*. *Rhabdomastix laeta* and *R. japonica* along with the non-British *R. borealis* and *R. laetoidea* form the *R. laeta*-complex of Starý (2004) and are yellow in colouration in contrast to other *Rhabdomastix* species in the subgenus *Rhabdomastix*. It therefore appeared as if *Rhabdomastix laeta* was not a valid British species. However, Dr Martin Drake found specimens on the River Culm in Devon in 2005 which have recently been confirmed as *R. laeta* by Dr Starý. Despite fieldwork throughout Scotland, England and Wales during which many *Rhabdomastix* vouchers have been collected, this remains the only definite British locality for this species.

The remit of this survey was to locate populations of *R. japonica* large enough to enable autecological studies to be taken, to start to determine the habitat requirements and autecology of the species on one or more selected sites and to continue to investigate and establish the true identity of *Rhabdomastix* '*laeta*' in the UK. *Rhabdomastix* are found on the exposed river sediments of rivers and streams. The larvae of *Rhabdomastix laeta sensu stricto* has been recently described by Podėnienė (2001) who found them in the banks of small rivers, in the open, in areas of sand and silt at a depth of 3-4cm.

The results of surveys conducted on several rivers (including the Spey, Feshie, Nethy, Dorback Burn, Garry, Tummel and Usk) in 2006 are presented. In total 16 sites were visited in 2006. *Rhabdomastix* was found on nine of these with *R. eugeni* on eight sites and *R. japonica* on two. No other *Rhabdomastix* species were recorded by the author. However, Dr Martin Drake recorded *R. japonica* from the River Till, Northumberland in 2006 and Peter Chandler also provided *Rhabdomastix* vouchers for examination. It would therefore appear that true *R. laeta* (sensu Starý 2004) is very localised in Britain whilst *R. japonica* is infrequent. The only British *R. laeta* site is on the River Culm in Devon and which appears to suggest an association with exposed sandy river deposits. *Rhabdomastix japonica* may be associated with riparian trees adjoining exposed river shingle. There is some evidence from Podėnienė (2001) and from Dr Drake's records of *R. laeta* on the River Culm, that riparian trees may be important for this species as well.
Further *Rhabdomastix* material resides in the museums at Edinburgh, Glasgow and Cardiff and proposals to check some of this material have been made. It is suggested that further surveys should take place on sites not covered in 2005 or 2006 and possibly slightly earlier in the season, in order to locate the other *Rhabdomastix* species. Various other recommendations for further work are given.

BACKGROUND

The cranefly *Rhabdomastix laeta* is a Priority Biodiversity Action Plan species on the UK Biodiversity Action Plan (UK Biodiversity Group 1999). This is a poorly known species and presumably it was considered premature to produce a Species Action Plan and in the process produce specific actions until survey and research had been completed. For these reasons, this species is provided with a Species Statement in the UK Biodiversity Action Plan.

A recent revision of the genus *Rhabdomastix* in Europe (Starý 2003, 2004) was able to show that all British species of *Rhabdomastix laeta* seen by Dr Starý were attributable to *Rhabdomastix japonica*. It therefore appeared as if *Rhabdomastix laeta* was not a valid British species. *Rhabdomastix laeta* and *R. japonica* along with *R. borealis* and *R. laetoidea* form the *R. laeta*-complex of Starý (2004) and are yellow in colouration in contrast to other *Rhabdomastix* species. Dr Martin Drake found specimens on the River Culm in Devon in 2005 which have been confirmed as *R. laeta* by Dr Starý.

During the course of survey work in 2005 and 2006 by the author, *Rhabdomastix eugeni* was also confirmed as a British species. This meant that five species were present in the UK compared with the three listed in the recent Diptera checklist (Chandler 1998).

Rhabdomastix are found on the exposed river sediments of rivers and streams. The larvae of *Rhabdomastix laeta sensu stricto* has been recently described by Podėnienė (2001). The larvae were found in the banks of small rivers, in the open, in areas of sand and silt at a depth of 3-4cm.

AIMS

1. To locate populations of *Rhabdomastix 'laeta'* that are large enough to enable autecological studies to be undertaken with confidence in later years.

2. To investigate and establish the true identity of *Rhabdomastix* '*laeta*' in the UK.

3. To continue to investigate and establish the true identity of *Rhabdomastix* '*laeta*' in the UK.

METHODS

The methods stipulated by the contract for the work has been reproduced below:
Sampling - Sites should be searched systematically but not using standardised methods. To establish the presence of the species and likely conditions under which it is found, so separate samples will be kept for different microhabitats. To record habitat information at a detailed enough level so as to enable subsequent analysis of habitat preferences. Only smaller, pale craneflies need to be collected although other craneflies will be of some interest.

Specimens of Rhabdomastix will be examined and compared with preserved material. International taxonomic experts should be consulted if appropriate.

The initial methodology adopted involved the use of sweep netting (16" diameter sweep net purchased from Marris House Nets, Bournemouth and mounted on 3 foot angling pole) and a portable vacuum sampler (a commercially available McCulloch garden blower/vacuum with a net bag inserted into the inlet tube). However, these methods failed to produce any *Rhabdomastix* specimens even though the craneflies were present on the sites where the sweep netting and vacuum sampling had taken place. It was realised that *Rhabdomastix* were present but they were better searched for by crouching or crawling on exposed shingle and best caught with a pooter or tube. Return visits were made to some sites when it was realised that hand searching was necessary to locate the craneflies and where sweep netting and vacuum sampling had been undertaken.

Short descriptions of the sample sites have been provided in Appendix 1. Grid References were taken with an etrex global positioning system. Photographs were also taken of several sample sites but these have not been included in the report.

RESULTS

Searches in 2006

Details of the *Rhabdomastix* and other Diptera recorded from the survey sites in 2006 by the author are provided in Appendix 2. The results of the survey in terms of *Rhabdomastix* species are presented in Table 1. As can be seen from the results, *R. eugeni* was found to be relatively widespread and not infrequent on some sites. This species was found at eight sites and the number of specimens found varied between 1 (Broomhill & River Garry) and 36 (Feshie Fan) with a total of 101 specimens being found in four days survey work. *Rhabdomastix japonica* was only recorded from two sites with a total of eight specimens being collected (5 from Balnagowan and 3 from Doune, both on the River Spey). The Doune site had a continuous fringe of riparian vegetation adjoining fairly small bars of exposed river shingle and unlike the other sites; *Rhabdomastix* was not encountered by searching. It is very possible that *Rhabdomastix japonica* was swept from the riparian vegetation rather than taken on the bare shingle. No other *Rhabdomastix* species were recorded on the survey. The absence of other species may reflect the fact that *Rhabdomastix eugeni* is one of the more frequent and widespread members of the genus (although *R. edwardsi* can also be frequent) and consequently, one of the species most easily encountered. The requirements, habits and/or flight period of the other species may dictate that they require a modification to the survey methods or dates. There is the possibility that the survey concentrated too much on the Cairngorms although the decision to survey here was based on the fact that there are previous records of *R. hilaris* or *R. laeta* from here.

Craneflies other than *Rhabdomastix* were collected on the survey and other invertebrates were also taken. Identification of some of this material has been undertaken but since this was beyond the remit of the survey, only a limited amount of time was spent on this. Other craneflies proved elusive and the total list of only twelve species is disappointing. This may reflect the hot conditions experienced in Britain in July 2006 which may not have favoured craneflies, particularly on open river shingle habitats. The only other scarce cranefly species recorded was the Nationally Scarce *Limnophila apicata*. The BAP and RBD3 therevid *Spiriverpa lunulata* which was the subject of a separate survey in 2006 (Drake et al 2007) was also recorded at three sites (Broomhill, Feshie Fan and Newtonmore). Several other invertebrates of particular nature conservation value were recorded during the survey. These include the large Nationally Scarce spider *Arctosa cinerea*, the RDB3 five-spot ladybird *Coccinella quinquepunctata*, *Tachydromia acklandi* Lower Risk (Near Threatened), *T. halidayi* Lower Risk (Nationally Scarce), *Campsicnemus marginatus* (Nationally Scarce in Falk 1991), *Chrysotus suavis* (Nationally Scarce in Falk 1991) and *Siphonella oscinina* (Nationally Scarce). Much of the material collected remains unidentified.

Updated results for 2005

The opportunity to update the results for 2005 (Godfrey 2006) has been taken. The most important development following submission of the previous report was the fact that Dr Drake's material from the River Culm is *Rhabdomastix laeta* (identified/confirmed by Dr Starý). These are therefore the first confirmed records for Britain for this species. All previous British records of *R. laeta* examined by Dr Starý for his revision (Starý 2004) proved to be *R. japonica* and so it briefly appeared that true *R. laeta* might not be a British species. The acceptance of *R. laeta* back on the British list meant that four *Rhabdomastix* species were present in Britain. The identification of *Rhabdomastix eugeni* initially from surveys of river shingle Diptera in the Yorkshire Dales in 2005 by the author meant that a fifth species was present in the UK. Subsequent work, notably reported in the present report has shown that this species is relatively widespread.

An updated invertebrate species list for the sites surveyed in 2005 is presented in Appendix 4. Only ten cranefly species were recorded in 2005 which is similar in number to the twelve recorded in 2006. The low species richness probably reflects, as suggested above, the apparent barren nature of the exposed riverine sediments sampled as well as the lack of cover and resulting hot, dry conditions (*Rhabdomastix* and *Hoplolabis* which appear to be particularly associated with exposed riverine sediments may escape this by resting under cobbles and pebbles). The updated list includes several species of particular nature conservation value. Some of the taxa in the list (notably the hybotid genus *Tachydromia*) would repay further examination.

DISCUSSION

Rhabdomastix laeta larvae

As mentioned above, the larvae of *Rhabdomastix laeta* has been recently described by Podėnienė (2001). Because this paper pre-dated Starý's revision of the genus (2003, 2004) it is correct to question which species Podėnienė was dealing with. Starý (2004) however, treated this paper as dealing with *Rhabdomastix laeta* and not *R. japonica* or the other *R. laeta*-complex species. Whilst this article was published several years ago, it was done so in a Lithuanian zoological journal that few British entomologists would probably see but fortunately it appeared recently (possibly in 2006) to have been placed on the internet as a pdf document and in doing so has become more widely available. The larvae were found in the banks of small rivers, in the open, in areas of sand and silt at a depth of 3-4cm. Podėnienė (ibid) took 25^2cm soil samples which were dug up and washed through a 1mm mesh screen. The larvae were small (13.4 to 17.5mm in length) and slender (0.4 to 0.5mm wide). Some larvae were retained for rearing whilst others were killed with hot water and preserved in 70% alcohol for later study. Three larval sites are described in the article (Numbered 1 to 3 on page 387). It may be significant that all adults were collected near river banks in *Alnetun fluviale-urticosum*, deciduous forests and shrubs, covering river banks. Usually the adults were not found in the same places where larvae were developing since they hid in nearby vegetation. This description may be similar to that on the River Culm where Dr Drake recorded adult *Rhabdomastix laeta* in July 2005 (he found a few individuals in slightly willow-shaded places only).

Other *Rhabdomastix* material

The author contacted the Royal Scottish Museums in June 2006 to request all records of *Rhabdomastix* specimens in the collections and records on the Scottish Invertebrate Records Index (SIRI). Richard Lyszkowski kindly provided details of the records and material held by the Museum. These records are reproduced in Appendices 4 & 5. The author has suggested to Dr Graham Rotheray (Keeper of Natural History, RSM) that he would like to visit the RSM in order to examine the material in late winter/early spring 2007.

The author recorded *Rhabdomastix eugeni* from coarse river shingle at Caton on the River Lune, Lancashire on 20 July 2007. This was recorded on a general Diptera survey of exposed river sediments (Drake et al 2007).

In November 2006, the author met Geoff Hancock (Hunterian Museum, Glasgow) at an annual Dipterists Forum meeting at Oxford. Geoff Hancock was asked about the *Rhabdomastix* material held in the Museum. He has suggested that he will identify the material in his care in due course.

Dr Martin Drake provided vouchers of *Rhabdomastix 'laeta'* to the author in January 2007 (Table 1).

Species	Site	Date	No. & sex	Coll./Det.
R. japonica	Doddington 7, River Till	15/7/2006	2 males	Det. *laeta* Dr. C.M.Drake, re-determined as *japonica* by Dr J. Starý

Table 1: Details of Dr Drake's voucher specimens

The author examined these vouchers without further dissection of the genitalia (the male genitalia had been dissected and placed on a coverslip with the vouchers). Re-emersion of the genitalia and further examination in alcohol or on a slide would have been necessary for positive identifications since the crucial parts were not easily visible. The antennal characters used by Dr Starý in his key to separate *R. japonica* from *R. laeta* (and non-British) *R. laetoidea* are difficult to use in the author's experience. The material appeared to represent *R. laeta* and these were submitted to Dr Starý for his opinion. Dr Starý identified this material as *Rhabdomastix japonica*.

John Kramer visited the National Museum of Wales and has examined the specimens held there. Four specimens in two groups are present and details of two known to the author are presented in table 2.

Species	Site	Date	No. & sex	Coll./Det.
Identified by collector as *R.*	Glen Aros, Mull NM529453	30/5/1991	1 female	Peter Skidmore

inclinata. This is incorrect since R3 is not inclined and the specimen belongs to the subgenus *Rhabdomastix* not *Lurdia*. Species identification requires examination of the insect.				
Identified by the collector as *R. edwardsi*. Confirmation requires examination of the insect.	Cussop Dingle, Hay on Wye SO2341	9/6/1997	1 male	John Deeming

Table 2: Details of specimens in the National Museum of Wales

John Kramer has photographed the wings of two specimens mentioned above. Copies of the photographs have been sent to Dr Starý who stated that the former is not *R. inclinata* and that the insects would need to be examined for positive identifications to be made.

Peter Chandler was initially contacted because it was thought that he was the collector of *Rhabdomastix laeta* from the River Rother, West Sussex (see Falk 1991). These records are unusual because they are from a lowland river and are well separated from the other British *R. 'laeta'* records. Peter Chandler stated that the Rother records are not his. However, he has supplied three specimens belonging to the subgenus *Rhabdomastix* from his collection (Table 3).

Species	Site	Date	No. & Sex	Coll./Det.
R. eugeni	Aberdeen, Invercauld Bridge, rocks by river	11/7/1977	1 male	Coll. & det. *R. edwardsi* P.J.Chandler. Redetermined A.Godfrey
R. japonica	Scotland, Perthshire, Bridge of Ericht by Loch Rannoch	16/7/1977	1 male	Coll. & det. *R. laeta* P.J.Chandler Redetermined J.Stary
R. japonica	Aberdeen, Ballater, bank of Dee	16/7/1977	1 male	Coll. & det. *R. laeta* P. J. Chandler Redetermined as *R. japonica* by PJC, AG & J. Stary.

Table 3: Details of Peter Chandler's specimens

Some time was spent examining the vouchers from Peter Chandler because the material was not straight forward to identify. The specimen of *R. edwardsi* which was redetermined as *R. eugeni* lacks antenna and will not therefore run through the key. It was redetermined by a process of elimination (*R. edwardsi* was eliminated because it has a spine on the outer gonostylus). Peter Chandler correctly pointed out that the outer gonostylus is clubbed in his specimen and this is unlike the genitalia diagrams in Starý (2004). However, the author examined named material of *R. eugeni* in his collection and these are often clubbed. It was initially thought that Peter Chandler's material from Loch Rannoch may represent *R. laeta* and it was necessary for Dr Starý to confirm these. There appeared to be differences between the two *R. japonica* vouchers supplied by Peter Chandler and this would suggest that there is variation within this species at least and particular care is needed in determination.

The author has been on the National Biodiversity Network (NBN) Gateway in order to check the details of the Rother records of *Rhabdomastix laeta*. The recorder and determiner are given as unknown, see Table 4. These records clearly refer to the *R. laeta*-group and need to be confirmed.

Species	Site	Date	No. & sex	Coll./Det.
R. laeta	Fyning Moor SSSI, Rogate	25/8/1974	Not given	Unknown
R. laeta	Rogate, River Rother	25/7/1974	Not given	Unknown

Table 4: Details of NBN gateway *Rhabdomastix laeta* records

During the course of 2006 the author obtained a copy of the latest instalment of 'The Craneflies of Ireland' (Ashe et al 2005) which deals with two limoniid subfamilies, namely the Dactylolabinae and the Limnophilinae. The next part may deal with the Chioneinae to which *Rhabdomastix* belong). Unfortunately, there appear to be no Irish records of any *Rhabdomastix* species (Chandler 1998) but it would be worth confirming this with Dr Ashe. There would appear to be suitable habitat in Ireland (based on records of other river shingle invertebrates) and it may be worth surveying suitable Irish sites for this genus in order to determine whether the absence is real.

Significance of the work
Rhabdomastix laeta has so far been confirmed only from the River Culm in Devon. The site includes significant exposed sandy deposits (Dr Martin Drake pers. comm.) which may be key to understanding the ecology of this species. Unfortunately, exposed sandy river sediments are uncommon and this may partly explain why *R. laeta* is also uncommon. The paper on the larval ecology of *R. laeta* by Podėnienė (2001) might also suggest an association with sand and silt (at least for the larvae).

The small number of *R. japonica* collected by the author in 2006 might indicate that the adults rest in riparian trees and scrub such as overhanging willows and alders. There is some evidence from Podėnienė (2001) and from Dr Drake's records of *R. laeta* on the River Culm, that riparian trees may be important for this species as well. Further surveys should make more of an effort to collect from riparian trees such as willows and alders adjoining exposed river sediments.

In a recent paper Ujvárosi (2005) has described the cranefly assemblages (including two *Rhabdomastix* species) from montane streams in the Carpathians. His sampling methods were sweep netting and lamping (light trapping). Light trapping might be attempted on the UK *Rhabdomastix* sites in order to see how successful it is in attracting members of this genus.

RECOMMENDATIONS FOR FURTHER WORK

- Check the identity of the four *Rhabdomastix* vouchers in Cardiff Museum.
- Check the identity of the *Rhabdomastix* material held at the Royal Museum of Scotland
- Contact Dr Paddy Ashe to confirm the lack of Irish *Rhabdomastix* records. Consider survey work in Ireland to determine whether the genus is really absent there?
- Await the results of Geoff Hancock's determinations of material in Glasgow Museum.
- Any future surveys should be done in new areas and/or earlier in the year compared with 2005 & 2006. Sweep netting riparian vegetation adjacent to exposed riverine sediments should be undertaken as well as searching the exposed sediments.
- Search for larvae on the River Culm. *Rhabdomastix japonica* sites could also be searched. Use the method employed by Podėnienė (2001). This survey should be undertaken before the flight season (May or June).
- Light trapping might be attempted to see how successful it is in attracting *Rhabdomastix* species. Craneflies are often caught in light traps and this method has been used elsewhere to record this group.
- The author should obtain environmental data regarding the River Culm site from Dr Drake where *R. laeta* has been recorded in recent years. The author has data on 12-15 sites for *R. eugeni* and some data on *R. edwardsi* and *R. japonica*. With more surveys and more records, it should be possible to

work out more about the ecology of the different *Rhabdomastix* species in Britain.

CONCLUSIONS

The results of survey work undertaken in 2006 for *Rhabdomastix laeta* are provided in the report. *Rhabdomastix eugeni* was found in half of the sites surveyed. Most of the survey sites were located in the Cairngorms but three sites were also surveyed in South Wales, although no material was found in the Welsh sites. *Rhabdomastix japonica* was also recorded from two sites and may be associated with riparian trees adjoining exposed river shingle. Lists are provided of the other craneflies, some other Diptera and some invertebrates also recorded on the survey. Cranefly species richness was generally low (12 species recorded in 4 days) but this may reflect the concentration of effort on generally bare exposed river shingle at the height of the season. *Rhabdomastix* vouchers have also been provided by other entomologists. Dr Drake recorded *japonica* from the River Till in Northumberland and Peter Chandler provided singletons of *R. eugeni* and *R. japonica* from the Highlands of Scotland. *Rhabdomastix laeta* is still only known from one British site (River Culm in Devon) and there seems to be an association with exposed sandy river deposits. There is some evidence from Podėnienė (2001) and from Dr Drake's records of *R. laeta* on the River Culm, that riparian trees may be important for this species as well. Proposals to examine material in museum collections (Edinburgh, Glasgow) have also been made which might result in new records. Material is also present in Cardiff Museum which should be checked.

ACKNOWLEDGEMENTS

The author would like to thank the landowners, estate managers and Scottish Natural Heritage who were contacted and gave permission for the survey to take place. Virtually all the landowners , estate managers and SNH staff provided useful advice regarding access, car-parking, suitable survey areas, etc and often gave permission for vehicular access along estate tracks which helped maximise time in the field. The author would also like to thank Dr Martin Drake, Matt Shardlow, Dr Jaroslav Starý and Alan Stubbs in particular for particular help with the survey. Peter Chandler, Geoff Hancock, Stephen Hewitt, John Kramer, Richard Lyskowski and Dr Graham Rotheray also provided material or useful information or offered help in other ways which was gratefully received.

REFERENCES

Ashe, P. et al (2005) The craneflies (Diptera) of Ireland. Part 3. Limoniidae: Dactylolabinae and Limnophilinae. Bull. Ir. Biogeog. Soc. No. 29: 312-343

Chandler, P.J. (1998) Checklists of Insects of the British Isles (New Series). Volume 12, Part 1: Diptera. Handbooks for the Identification of British Insects. Royal Entomological Society.

Drake, C.M., Godfrey, A. & Hewitt, S. (2007) Flies of Sandy ERS. Unpublished report, February 2007

Falk. S.J. (1991) A review of the scarce and threatened flies of Great Britain (Part 1). Research & Survey in Nature Conservation No. 39. Nature Conservancy Council.

Godfrey, A. (2006) Location of populations of *Rhabdomastix* '*laeta*'. Unpublished report, January 2006

Podėnienė, V. (2001) Notes on the larva of *Rhabdomastix* (*Sacandaga*) *laeta* (Loew, 1873) (Diptera, Limoniidae). Acta Zoologica Lithuanica, Volumen 11, Numerus 4: 385-387

Starý, J. (2003) Revision of European species of the genus *Rhabdomastix* (Diptera: Limoniidae). Part 1: Introduction and subgenus *Lurdia* subgen. n. *Eur. J. Entomol.* **100**: 587-608

Starý, J. (2004) Revision of European species of the genus *Rhabdomastix* (Diptera: Limoniidae). Part 2: Subgenus *Rhabdomastix* s.str. *Eur. J. Entomol.* **101**: 657-687

UK Biodiversity Group (1999) Tranche 2 Action Plans. Volume IV – Invertebrates.

Ujvárosi, L. (2005) Limoniidae and Pediciidae (Insecta: Diptera) assemblages along mountainous streams: additions to assess the biodiversity in wet habitats in Carpathians, Romania. Acta Biol. Debr. Hung. 13: 233-248 [Available as a pdf file on the Internet]

APPENDICES

Appendix 1: *Rhabdomastix* species recorded in 2006

Sites	*R. eugeni*	*R. japonica*
Broomhill	+	
Balnagowan (Feshie Fan)	+	+
Dorback Burn		
Feshie Fan	+	
Dulnain Bridge	+	
Doune		+
Newtonmore	+	
Lagganlia (airfield)	+	
Feshiebridge		
Cuaich	+	
River Garry	+	
Pass of Killiecrankie		
Ballinluig Shingle Island		
The Bryn, Wales		
Newbridge on Usk, Wales	Survey abandoned	Survey abandoned
Monmouth Cap, Wales		
Number of sites found =	8	2

Appendix 2: Short description of the survey sites

Broomhill
Survey Date: 11/7/2006
Open areas of sand and shingle sampled alongside River Nethy just before confluence with the River Spey at NH99282202. Alder (and willow) woodland inland of sand and shingle. Ground vegetation included ragwort, selfheal, broom, harebell, yarrow, grasses, etc. The weather was sunny and warm but with a strong breeze. Sampled by sweep netting and vacuum sampling.

Sampled second area (NH99352218) towards the Spey. This was similar to the above with sand and shingle both vegetated and bare.

Balnagowan (Feshie Fan)
Survey Date: 11/7/2006
Very bare shingle with vehicle tracks in part. Fringed by a grass strip, ruderal vegetation and scrub including lupins, white campion, colt's-foot, lady's bedstraw, devils bit scabious, etc with an alder fringe behind. Sunny and warm weather. Sandy patches were present. Sampled by sweep netting and vacuum sampling.

Dorback Burn
Survey Date: 12/7/2006
Exposed sediment comprised cobbles to gravel. The survey commenced at NJ07631646 and proceeded downstream. The Dorback Burn itself was 1-2m wide, 8-10cm deep and had clear water and fast flow. The following measurements were made:
pH: 6.78
Conductivity: 68
Dissolved solids: 34ppm
Water temperature: 15.4ºC
Vegetation included grasses, selfheal, thyme, nettle, thistles, conifer saplings, and with heather away from the channels. The land was sheep, rabbit (and deer?) grazed. The weather was sunny but a strong wind was present. Sampled by sweep netting and vacuum sampling.

Feshie Fan
Survey Date: 12/7/2006
Rhabdomastix (later identified as *R. eugeni*) was found on the Feshie Fan at NH84400612 by hand searching. Damp sand was bordering onto dry sand here approximately 1.5m from the river. Cobbles set in sand were also present here.

Balnagowan
Survey Date: 12/7/2006
Rhabdomastix (later identified as *R. eugeni*) was taken on shingle at NH84730649 (photograph taken but not included in the report). The method used was hand searching. This was taken within 1-2m of the river on exposed cobbles. The width of the river here was 6m, flow was fast and the water colour was clear brown. The following measurements were made:
pH: 6.83
Conductivity: 33
Dissolved solids: 17ppm
Water temperature: 16.4ºC
There was no vegetation on the exposed river sediments and no sand. There was also no shade.

Broomhill
Survey Date: 12/7/2006
A return visit was made to search by hand since the earlier visit had employed sweep netting and vacuum sampling but not found any *Rhabdomastix*. The following measurements were also made:
pH: 6.74
Conductivity: 51
Dissolved solids: 26ppm
Water temperature: 14.5ºC

Dulnain Bridge
Survey Date: 13/7/2006
The survey was based around NJ00402381 where the River Dulnain meets the River Spey. Brown algae

was present on the cobbles. Flow was moderate in the riffles. The submerged and exposed sediment comprised shingle and cobbles. The following measurements were made:
pH: 6.79
Conductivity: 90
Dissolved solids: 44ppm
Water temperature: 15ºC
The River Dulnain here was approximately 10m wide and up to 0.5m deep. There was a bare mid-channel bar and a side bar. Bank vegetation included alder, crack willow, sallow, monkeyflower, forget-me-not, bramble, sweet cicely and meadowsweet. The weather was mild and sunny.

A sewage treatment works was observed above the road.

Dorback Burn
Survey Date: 13/7/2006
A return visit was made to handsearch for *Rhabdomastix*. No specimens were found. The weather was mild and sunny.

Doune
Survey Date: 13/7/2006
This site on the River Spey comprises intermittent small side bars with a wooded river bank. Bank vegetation included alder, reed canary grass, sedge and spearwort above and occasional rushes on the shingle. Water depth in the shallows was about 10cm and the river width was about 10m. The weather was mild and sunny. The following measurements were made:
pH: 7.01
Conductivity: 45
Dissolved solids: 25ppm
Water temperature: 19.2ºC

Newtonmore Golf Course
Survey Date: 13/7/2006
Rhabdomastix (later identified as *R. eugeni*) was found to be frequent mainly on the island bars. These comprised cobbles and pebbles. Water flow in the River Spey here was slow. The weather was mild and sunny. The following measurements were made:
pH: 7.15
Conductivity: Not measured
Dissolved solids: 22ppm
Water temperature: 20.3ºC

Lagganlia (Airstrip)
Survey Date: 13/7/2006
The channel was 4-5m wide and water depth about 40cm. Flow was fast and riffles were present. Water clarity was good. The exposed sediment comprised cobbles and shingle. The weather was mild and sunny. The survey was centred around NH85140254. The following measurements were made:
pH: 6.76
Conductivity: 26
Dissolved solids: 14ppm
Water temperature: 11.5ºC

Feshiebridge
Survey Date: 14/7/2006
The River Feshie here was about 5m wide, up to 0.5m deep and had fast flow. The following measurements were made:
pH: 6.96
Conductivity: 34
Dissolved solids: 8ppm
Water temperature: 12.8ºC
A large side bar of exposed shingle was searched at NH84990466 (no sand was present). The weather was sunny and very mild with no cloud. Bank vegetation comprised alder, hazel, grasses, etc.

Cuaich
Survey Date: 14/7/2006
The watercourse was 1-2m wide and 4-8cm deep with moderate flow. The survey commenced at NH65728699 and continued upstream. The exposed sediment comprised cobbles (no sand was present).

Brown algae was present on the cobbles. Shade was also absent. Hill pasture adjoined the watercourse. The following measurements were made:
pH: 6.87
Conductivity: 70
Dissolved solids: 35ppm
Water temperature: 17.5ºC

River Garry
Survey Date: 14/7/2006
The watercourse was 5m wide and up to 1m deep. Exposed cobbles were extensive on the east bank. On the west bank, grassland was present above the channel. Flow in the River Garry was fast. The survey centred around NN83896573 and the disused bridge was used to cross the river. There was no sand, no vegetation and no shade on the exposed cobbles. The following measurements were made:
pH: 7.01
Conductivity: 51
Dissolved solids: 25ppm
Water temperature: 15.7ºC

Pass of Killiecrankie
Survey Date: 14/7/2006
The river was 3-6m wide, less than 0.5m deep and flow was strong. Water colour was clear brown. The survey centred around NN91616252. There was no sand, no vegetation and virtually no shade on the exposed shingle. The shingle was banked up into a ridge. The following measurements were made:
pH: 6.97
Conductivity: 91
Dissolved solids: 45ppm
Water temperature: 16.4ºC

Ballinluig Shingle Island
Survey Date: 14/7/2006
The River Tummel was about 20m wide here and of unknown depth. Flow was moderate and water clarity clear brown. Bank vegetation included sallow, mint, tall grasses, forget-me-not, etc. The survey was based around NN97345351. There was no sand and no shade on the exposed shingle. The following measurements were made:
pH: 7.94
Conductivity: 45
Dissolved solids: 22ppm
Water temperature: 20.8ºC

The Bryn
Survey Date: 27/7/2006
This site is immediately upstream from Llanvihangel Gobion (surveyed in 2005) on the River Usk in South Wales. It was selected instead of Llanvihangel Gobion presumably because of ease of public access. The survey was based around SO33340961 and concentrated on exposed shingle on the north bank.

Newbridge on Usk
Survey Date: 27/7/2006
This site was also surveyed in 2005 (Godfrey 2006). The shingle bar however had been totally washed away and/or submerged since and survey work was aborted.

Monmouth Cap
Survey Date: 27/7/2006
This site was also surveyed in 2005 and a habitat description was provided in the previous report (Godfrey 2006).

Appendix 3: Invertebrates recorded from the survey sites in 2006 (see spreadsheet)

Appendix 4: Updated invertebrates list for sites surveyed in 2005 (see spreadsheet)

Appendix 5: Details of *Rhabdomastix* held in the Royal Scottish Museum

Species	Site	Date	No. & sex	Coll/Det.
R. edwardsi	Kirkbog [Kirkconnell Bog?], Dumfries	7/6/1954	1 male 1 female	Coll. A.B.Duncan Det. P.J.Chandler
R. edwardsi	The Nith, Dumfries	16/6/1968	8 male	Det. P.J.Chandler
R. laeta	Aberdeen, Ballater, Bank of Dee	16/7/1967	10 male	Coll. & det. |P.J.Chandler
R. laeta	By stream, Dorback Burn, Inverness	17/6/1982	1 male	Coll. & det. |P.J.Chandler

Some of the RSM *Rhabdomastix* material is with Geoff Hancock at Glasgow Museum (R. Lyskowski *pers. comm*.). There are no specimens of *Rhabdomastix inclinata* in the Royal Scottish Museums.

Appendix 6: Records of *Rhabdomastix* held in the Royal Scottish Museum

NMS SCOTTISH RECORDS								
Genus	**Species**	**Journal**	**Volume No'**	**Page No' (from)**	**Year of Publication**	**Author**	**Location**	**Vice County**
Rhabdomastix	hilaris	Handbook for the Identification of British Insects	IX (2)	53	1950		Inverness-shire	
Rhabdomastix	hilaris	Handbook for the Identification of British Insects	IX (2)	53	1950		Perthshire	
Rhabdomastix	hilaris	Transactions Society of British Entomology	5	114	1938		Inverness	
Rhabdomastix	hilaris	Transactions Society of British Entomology	5	114	1938		Perth	
Rhabdomastix	hilaris	Handbook for the Identification of British Insects	IX (2)	53	1950		Perth	
Rhabdomastix	hilaris	Handbook for the Identification of British Insects	IX (2)	53	1950		Aviemore	
Rhabdomastix	hilaris	Handbook for the Identification of British Insects	IX (2)	53	1950		Inverness	
Rhabdomastix	laeta	Entomologist's Monthly Magazine		32	1926		Inverness	
Rhabdomastix	parva	Transactions Society of British Entomology	5	115	1938		Glasgow	
Rhabdomastix	parva	Transactions Society of British Entomology	5	115	1938		Perth	
Rhabdomastix	schistacea	Entomologist		2	1926		Milngavie	
Rhabdomastix	schistacea	Entomologist		2	1926		Glasgow district	
Rhabdomastix	schistacea	Entomologist		2	1926		Clyde	
Rhabdomastix	schistacea	Entomologist		272	1929		Clyde district	
Rhabdomastix	schistacea	Scottish Naturalist		114	1933		Perthshire	
Rhabdomastix	edwardsi	Glasgow Naturalist	21	5	1990			Lanarkshire
Rhabdomastix	edwardsi	Glasgow	21	79	1990			Lanarkshire

NMS SCOTTISH RECORDS								
Genus	**Species**	**Journal**	**Volume No'**	**Page No' (from)**	**Year of Publication**	**Author**	**Location**	**Vice County**
		Naturalist						
Rhabdomastix	laeta	Dipterist's Digest	6	63	1999	Andrew Godfrey	Feshie Fen	
Rhabdomastix	laeta	Dipterist's Digest	6	63	1999	Andrew Godfrey	Feshie/Spey	