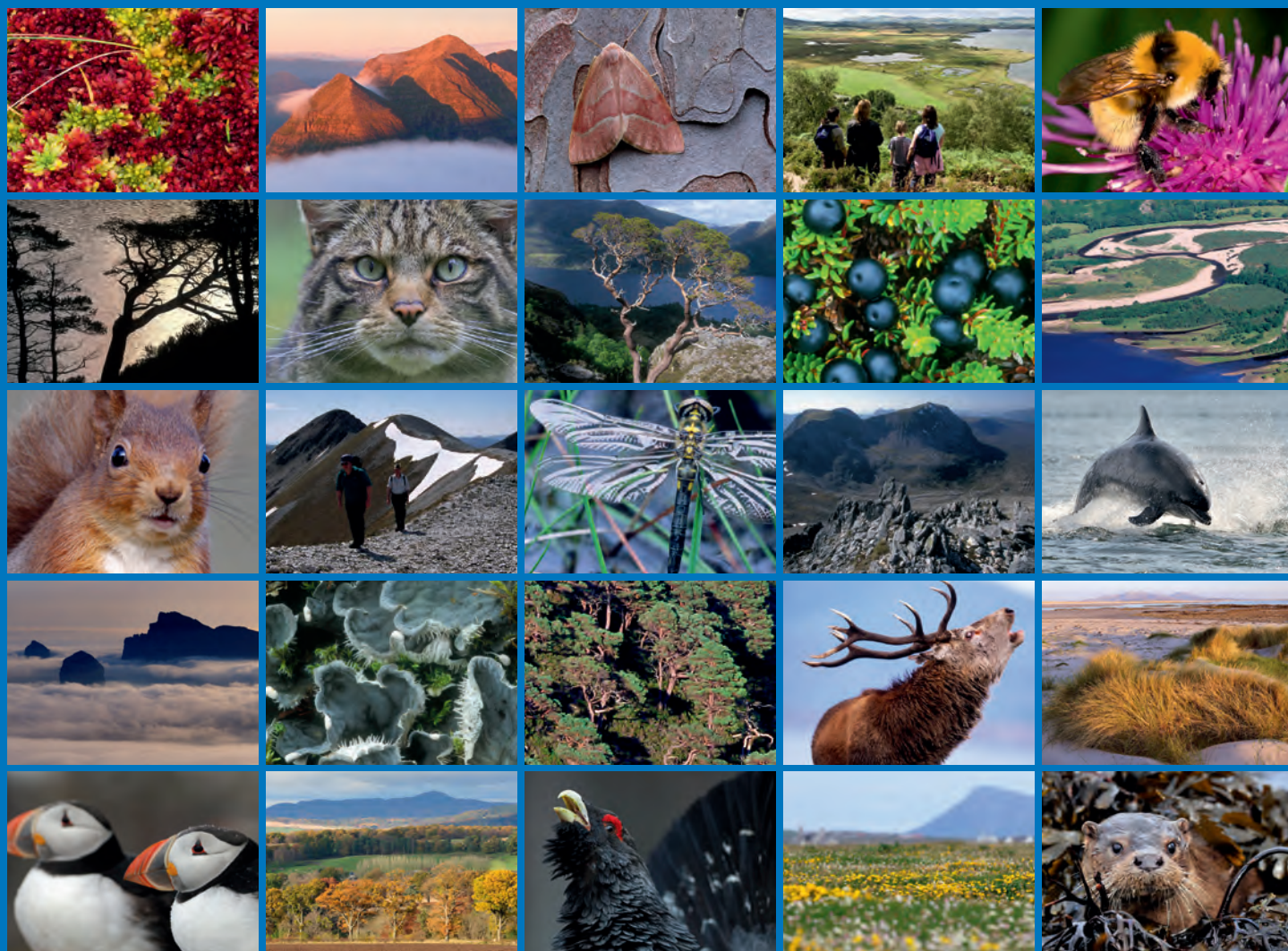


Surveillance of priority terrestrial invertebrates in Scotland





Scottish Natural Heritage
Dualchas Nàdair na h-Alba

All of nature for all of Scotland
Nàdar air fad airson Alba air fad

COMMISSIONED REPORT

Commissioned Report No. 609

Surveillance of priority terrestrial invertebrates in Scotland

For further information on this report please contact:

Athayde Tonhasca
Scottish Natural Heritage
Battleby
Redgorton
PERTH
PH1 3EW
Telephone: 01738 458671
E-mail: athayde.tonhasca@snh.gov.uk

This report should be quoted as:

Littlewood, N.A. & Stockan, J.A. 2013. Surveillance of priority terrestrial invertebrates in Scotland. *Scottish Natural Heritage Commissioned Report No. 609.*

This report, or any part of it, should not be reproduced without the permission of Scottish Natural Heritage. This permission will not be withheld unreasonably. The views expressed by the author(s) of this report should not be taken as the views and policies of Scottish Natural Heritage.

© Scottish Natural Heritage 2013.



COMMISSIONED REPORT

Summary

Surveillance of priority terrestrial invertebrates in Scotland

Commissioned Report No. 609

Contractor: N.A. Littlewood & J.A. Stockan

Year of publication: 2013

Background

Scottish Natural Heritage has been asked by Scottish ministers to implement a strategy for the surveillance of priority habitats and species in Scotland. This report covers the development of such strategies for 55 species of non-marine invertebrates and draws extensively on expert comment from consultees with specialised knowledge of individual species covered.

For each species, a report was written to present background information about the status of the species in Scotland together with issues relevant to surveillance, such as ecology, habitat and threats. This is followed by a Surveillance Methodology, outlining measures that can be taken to monitor the species in such a way as to determine trends in population size, range or status.

Further information is given on five species listed on Annexes II and V of the EC Habitats Directive.

For further information on this project contact:

Athayde Tonhasca, Scottish Natural Heritage, Battleby, Redgorton, Perth, PH1 3EW.

Tel: 01496 810711 or athayde.tonhasca@snh.gov.uk

For further information on the SNH Research & Technical Support Programme contact:

Knowledge & Information Unit, Scottish Natural Heritage, Great Glen House, Inverness, IV3 8NW.

Tel: 01463 725000 or research@snh.gov.uk

Table of Contents	Page
1. INTRODUCTION	1
1.1 Aim	1
1.2 Species covered	1
1.3 Approach	1
2. BACKGROUND TO SPECIES REPORTS	2
2.1 Aims	2
2.2 Distribution maps	2
2.3 References	2
3. BACKGROUND TO SURVEILLANCE METHODOLOGIES	4
3.1 Aims of surveillance methodologies	4
3.2 Development of surveillance methodologies	4
4. CONSULTATION	5
5. HABITAT & SPECIES DIRECTIVE ANNEX II AND V SPECIES	7
5.1 <i>Hirudo medicinalis</i>	8
5.2 <i>Vertigo genesii</i>	10
5.3 <i>Vertigo geyeri</i>	12
5.4 <i>Vertigo angustior</i>	14
5.5 <i>Euphydryas aurinia</i>	16
6. SPECIES OCCURRENCE BY PROTECTED AREA	17
7. KEY AREAS FOR PRIORITY TERRESTRIAL INVERTEBRATES IN SCOTLAND	19
8. SPECIES REPORTS AND SURVEILLANCE METHODOLOGIES	20
<i>Hirudo medicinalis</i>	21
<i>Bidessus minutissimus</i>	25
<i>Calosoma inquisitor</i>	28
<i>Cryptocephalus decemmaculatus</i>	32
<i>Cryptocephalus sexpunctatus</i>	36
<i>Donacia aquatica</i>	40
<i>Hydroporus rufifrons</i>	44
<i>Meloe violaceus</i>	48
<i>Bembidion testaceum</i>	52
<i>Meotica anglica</i>	56
<i>Philorhizus quadrisignatus</i>	60
<i>Euphydryas aurinia</i>	64
<i>Hagenella clathrata</i>	68
<i>Andrena tarsata</i>	72
<i>Bombus distinguendus</i>	76
<i>Bombus muscorum</i>	80
<i>Bombus ruderarius</i>	84
<i>Chrysura hirsuta</i>	88
<i>Colletes floralis</i>	91
<i>Formica exsecta</i>	95
<i>Formicoxenus nitidulus</i>	99
<i>Osmia inermis</i>	103
<i>Osmia parientina</i>	107
<i>Osmia uncinata</i>	111

<i>Megalomus hirtus</i>	115
<i>Baetis niger</i>	119
<i>Brachyptera putata</i>	123
<i>Blera fallax</i>	127
<i>Botanophila fonsecai</i>	131
<i>Clorismia rustica</i>	135
<i>Clusiodes geomyzinus</i>	139
<i>Doros profuges</i>	143
<i>Hammerschmidtia ferriginea</i>	147
<i>Lipsothrix ecucullata</i>	151
<i>Lipsothrix errans</i>	155
<i>Lipsothrix nervosa</i>	159
<i>Lonchaea ragnari</i>	163
<i>Rhabdomastix japonica</i>	167
<i>Rhamphomyia hirtula</i>	170
<i>Vertigo genesii</i>	175
<i>Vertigo geyeri</i>	179
<i>Vertigo angustior</i>	183
<i>Omphiscola glabra</i>	187
<i>Truncatellina cylindrica</i>	191
<i>Vertigo modesta</i>	195
<i>Agroeca cuprea</i>	199
<i>Dictyna pusilla</i>	203
<i>Erigone Welchi</i>	207
<i>Mecopithes peusi</i>	211
<i>Monocephalus castaneipes</i>	215
<i>Notioscopus sarcinatus</i>	219
<i>Philodromus margaritatus</i>	223
<i>Saaristoa firma</i>	227
<i>Semljicola caliginosus</i>	231
<i>Silometopus incurvatus</i>	235

Acknowledgements

This project entailed extensive consultation with specialists in individual species or groups of species. We are extremely grateful to those who responded positively to our queries. The names of these consultees are given on each Species Report and Surveillance Methodology. We have tried to ensure that such consultees are listed fully in the appropriate sections and apologise sincerely if there are any omissions.

Use was made of data from a variety of sources. In particular species records were downloaded from the National Biodiversity Network Gateway. The datasets used and the data provider is listed in section 2.2 and in each Species Report that contains a map.

Further thanks go to Val McAtear, Librarian for the Royal Entomological Society, for responding to multiple requests for article reprints and to Robin Pakeman (The James Hutton Institute) for commenting on a draft of this report.

1 INTRODUCTION

1.1 Aim

Scottish Natural Heritage (SNH) has been asked by Scottish ministers to implement a strategy for the surveillance of priority habitats and species in Scotland. Surveillance in this context refers to measurements, carried out annually or periodically, that describe the conservation status and trends of species and habitats, and their possible role in ecosystem functions. Surveillance and assessment of conservation status are obligations arising from Articles 11 and 17 of the Habitats Directive, and their main results are to be reported to the European Commission every six years. SNH determines how and to what extent surveillance will be carried out in Scotland.

For the purpose of this project, surveillance was approached as a systematic collation of species data in a way that allows the assessment of trends in distribution, area of occurrence, population size or habitat condition for the purposes of reporting on their conservation status.

Species surveillance reporting requirements for Article 17 of the EC Habitats Directive include information on the following parameters:

- Range.
- Population size.
- Habitat.
- Main pressures.
- Main threats.
- Future prospects (as regards to population, range and habitat availability).
- Overall assessment of conservation status.

The aim of this project is to provide methodologies for surveillance of Scottish species listed in Annexes II and V of the EC Habitats Directive and UK Biodiversity Action Plans (UKBAP).

1.2 Species covered

The project covered 55 species of non-marine UK Priority invertebrates, of which five are also listed in Annexes II and V of the EC Habitats Directive. Lepidoptera are the subject of a separate review to this one and were not included in this project with the exception of Marsh fritillary (*Euphydryas aurinia*) which was included as one of the Annex II species.

1.3 Approach

The project has involved extensive consultation with species experts. The species reports and surveillance methodologies were drafted by the authors of this report, primarily from existing literature and survey reports. They were then sent to experts for comments before being finalised. Each Species Account and Surveillance Methodology is laid out such that it can be used as a stand-alone document.

2 BACKGROUND TO SPECIES REPORTS

2.1 Aims

The objective of the species reports was to produce a concise summary for each species, comprising the following information whenever pertinent to surveillance:

- Ecology: Identifying limiting factors, habitats and microhabitats required for all stages of life cycle.
- Distribution (World, UK and Scotland), including number of records and area of distribution, accompanied by range maps.
- Conservation status and rarity.
- Threats.
- Management prescriptions, if applicable.
- Summaries of surveys and research related to surveillance.

2.2 Distribution maps

Distribution maps are mainly based on data from the National Biodiversity Network (NBN) Gateway, accessed between December 2011 and February 2012. Some individual records or datasets were not used following recommendations from species experts as to the likely reliability of records. Further records were sourced from survey reports, published papers and notes, and from personal communications with recorders. In all cases the sources used to assemble the maps are listed. Note that some maps that rely solely or primarily on NBN data are out of date or geographically biased and that more recent records do exist. Furthermore, some dataset access requests were not granted in sufficient time for such records to be included and this too will lead to maps under-representing the actual distribution. For a few species, data available were insufficient for a meaningful map to be constructed.

Table 1 identifies the datasets that were used in construction of the maps. Each is also listed in the relevant Species Report. Please note that the Data Provider and the NBN Trust bear no responsibility for any further analysis or interpretation of that material, data or information.

Maps were compiled by using DMAP Software (Alan Morton, Aberystwyth, UK).

2.3 References

In most cases, efforts were made to check original references. However some compilation sources were used. These included reports from the *UK Priority Species data collation* exercise carried out and published by the Joint Nature Conservation Committee (JNCC) in 2010. These reports are compilations of material from elsewhere and the source of this material is not acknowledged. In many cases, therefore, it has not been possible to trace or acknowledge the original source of information provided and reference is simply to the JNCC report.

References are given within each Species Report and Surveillance Methodology, rather than at the end of the report, to enable each of these to act as a stand-alone document.

Table 1 - Datasets used in the construction of species maps

Dataset	Dataset administrator
Water Beetle Surveys from Britain and Ireland	Balfour-Browne Club
Carabid data for Great Britain	Ground Beetle Recording Scheme held by BRC, provided by Ground Beetle Recording Scheme
Bruchid and Chrysomelid Distributions in Britain and Ireland: pre 1900, 1900-1979, 1980 onwards	Seed and Leaf Beetle Recording Scheme
Records from the RHS insect reference collection	Royal Horticultural Society
HBRG Insects Dataset	Highland Biological Recording Group
Tullie House Museum Natural History Collections	Tullie House Museum
Commissioned surveys and staff surveys and reports for SWT reserves	Scottish Wildlife Trust
Caddisfly (Trichoptera) records from Britain and Ireland to 2003	Biological Records Centre
Bees, Wasps and Ants Recording Society - Trial Dataset	Bees, Wasps and Ants Recording Society
Great Yellow Bumblebee sightings data in the UK, 1990 onwards	RSPB
NE Scotland NTS properties species records	National Trust for Scotland (staff)
Ants: <i>Formica exsecta</i> Records from Abernethy RSPB	Scottish Wildlife Trust
Lacewings and allied insects records from Britain and Ireland to 1999	Biological Records Centre
River macroinvertebrate data for 2005 and 2006	Scottish Environment Protection Agency
Mayfly (Ephemeroptera) Data for Great Britain for 1906-2003	Riverfly Recording Schemes
Scottish river macro-invertebrate records from 2007 collected by SEPA	Scottish Environment Protection Agency
Stonefly (Plecoptera) data for Great Britain for 1955-2005	Riverfly Recording Schemes
Hoverfly Recording Scheme database for Great Britain	Hoverfly Recording Scheme
Crane-fly (Diptera; Tipuloidea) records for Britain to 2007	Biological Records Centre
Mollusc (non-marine) data for Great Britain and Ireland	Conchological Society of Great Britain & Ireland

3 BACKGROUND TO SURVEILLANCE METHODOLOGIES

3.1 Aims of Surveillance Methodologies

The aim of the Surveillance Methodology section was to produce a concise description of the methodology suggested for each species or group of species. Ultimately its purpose is to identify status and trends, thus surveillance plans were based on variables that have the potential to assist with detecting changes such as:

- Number of individuals in a population
- Number of populations/sites
- Geographic range (with details of SSSI coverage)
- Altitudinal distribution
- Habitat availability or potential niche
- Habitat condition

3.2 Development of Surveillance Methodologies

Selected variables and the rationale for relying on them are described and explained. Whenever appropriate, surveillance plans were refined by complementary information such as:

- 'Hot-spots' of abundance.
- Dispersal capability.
- Specific habitat requirements (to identify species that could be monitored indirectly, using habitat as a proxy).
- Population characteristics, i.e., continuous or discrete.
- Evidence for susceptibility to climate change.

For one species, *Chrysura hirsuta*, there is no individual surveillance report. Instead, its information is combined with the reports for *Osmia inermis*, *O. parietina* and *O. uncinata*, species that it parasitizes.

While aiming to maintain scientific rigour, a pragmatic approach was required in order to maximise the number of species covered, keep costs at affordable levels and produce manageable methodologies. Thus proposed surveillance often comprises rapid assessments and only include simple measurements, e.g. presence/absence, number of colonies found in a timed search within a defined area, estimates of size of individual population, or quality of habitat.

4 CONSULTATION

At the outset of the project, a range of species experts were contacted and asked if they would be prepared to assist by reading and commenting on the Species Reports and Surveillance Methodologies. Most were willing to help and the content and accuracy of this report is greatly enhanced by their efforts. For a few species, there was no direct expert input. In such cases the Species Reports and Surveillance Methodologies should be regarded as preliminary statements and additional input or information may be required before surveillance programmes can be implemented.

All species experts are named in the Species Reports and Surveillance Methodologies to which they directly contributed. Table 2 shows which species have received input from at least one expert.

Table 2 - Summary of expert contribution to species accounts. A green cell indicates that the report has received comment from at least one expert whilst an amber cell indicates that it has not.

Scientific Name	Taxon group	Species Report	Surveillance Methodology
<i>Hirudo medicinalis</i>	annelid	Green	Green
<i>Bidessus minutissimus</i>	insect - beetle (Coleoptera)	Green	Amber
<i>Calosoma inquisitor</i>	insect - beetle (Coleoptera)	Green	Green
<i>Cryptocephalus decemmaculatus</i>	insect - beetle (Coleoptera)	Green	Green
<i>Cryptocephalus sexpunctatus</i>	insect - beetle (Coleoptera)	Green	Green
<i>Donacia aquatica</i>	insect - beetle (Coleoptera)	Green	Amber
<i>Hydroporus rufifrons</i>	insect - beetle (Coleoptera)	Green	Amber
<i>Meloe violaceus</i>	insect - beetle (Coleoptera)	Amber	Amber
<i>Bembidion testaceum</i>	insect - beetle (Coleoptera)	Green	Green
<i>Meotica anglica</i>	insect - beetle (Coleoptera)	Amber	Amber
<i>Philorhizus quadrisignatus</i>	insect - beetle (Coleoptera)	Green	Green
<i>Euphydryas aurinia</i>	insect - butterfly	Green	Green
<i>Hagenella clathrata</i>	insect - caddis fly (Trichoptera)	Green	Green
<i>Andrena tarsata</i>	insect - hymenopteran	Green	Green
<i>Bombus distinguendus</i>	insect - hymenopteran	Green	Green
<i>Bombus muscorum</i>	insect - hymenopteran	Green	Green
<i>Bombus ruderarius</i>	insect - hymenopteran	Green	Green
<i>Chrysurus hirsuta</i>	insect - hymenopteran	Green	Green
<i>Colletes floralis</i>	insect - hymenopteran	Green	Green
<i>Formica exsecta</i>	insect - hymenopteran	Green	Green
<i>Formicoxenus nitidulus</i>	insect - hymenopteran	Green	Green
<i>Osmia inermis</i>	insect - hymenopteran	Green	Green
<i>Osmia parietina</i>	insect - hymenopteran	Green	Green
<i>Osmia uncinata</i>	insect - hymenopteran	Green	Green
<i>Megalomus hirtus</i>	insect - lacewing (Neuroptera)	Green	Amber
<i>Baetis niger</i>	insect - mayfly (Ephemeroptera)	Green	Green
<i>Brachyptera putata</i>	insect - stonefly (Plecoptera)	Green	Green
<i>Blera fallax</i>	insect - true fly (Diptera)	Green	Green
<i>Botanophila fonsecai</i>	insect - true fly (Diptera)	Green	Green
<i>Clorismia rustica</i>	insect - true fly (Diptera)	Amber	Amber

<i>Clusiodes geomyzinus</i>	insect - true fly (Diptera)	
<i>Doros profuges</i>	insect - true fly (Diptera)	
<i>Hammerschmidtia ferruginea</i>	insect - true fly (Diptera)	
<i>Lipsothrix ecucullata</i>	insect - true fly (Diptera)	
<i>Lipsothrix errans</i>	insect - true fly (Diptera)	
<i>Lipsothrix nervosa</i>	insect - true fly (Diptera)	
<i>Lonchaea ragnari</i>	insect - true fly (Diptera)	
<i>Rhabdomastix japonica</i>	insect - true fly (Diptera)	
<i>Rhamphomyia hirtula</i>	insect - true fly (Diptera)	
<i>Vertigo genesii</i>	mollusc	
<i>Vertigo geyeri</i>	mollusc	
<i>Vertigo angustior</i>	mollusc	
<i>Omphiscola glabra</i>	mollusc	
<i>Truncatellina cylindrica</i>	mollusc	
<i>Vertigo modesta</i>	mollusc	
<i>Agroeca cuprea</i>	spider (Araneae)	
<i>Dictyna pusilla</i>	spider (Araneae)	
<i>Erigone welchi</i>	spider (Araneae)	
<i>Mecopisthes peusi</i>	spider (Araneae)	
<i>Monocephalus castaneipes</i>	spider (Araneae)	
<i>Notioscopus sarcinatus</i>	spider (Araneae)	
<i>Philodromus margaritatus</i>	spider (Araneae)	
<i>Saaristoa firma</i>	spider (Araneae)	
<i>Semljicola caliginosus</i>	spider (Araneae)	
<i>Silometopus incurvatus</i>	spider (Araneae)	

5 HABITATS DIRECTIVE ANNEX II AND V SPECIES

This section presents information on five species for which SNH has reporting requirements under the Habitats Directive. A significant amount of the information presented duplicates that in the Species Reports.

It should be noted that population estimates are not available for any of these species. For *Vertigo angustior*, *V. geyeri* and *V. genesii* it is recommended instead that surveillance should focus on assessment of species range. Detailed monitoring of *Hirudo medicinalis* may be able to generate population figures although again, range is more likely to be a useful metric. Absolute measures of abundance are possible for *Euphydrias aurinia* over sample areas through larval counts. However, it is not known if these can be scaled up to population counts over wider areas with any degree of accuracy.

5.1 *Hirudo medicinalis*

BACKGROUND

Status: Native.

Surveillance issues: *Hirudo medicinalis* appears not to have been surveyed for since 1996. Numbers detected by standardised surveillance are likely to be variable. Monitoring of sites is likely to be required for a number of years until analysis may reveal robust trends.

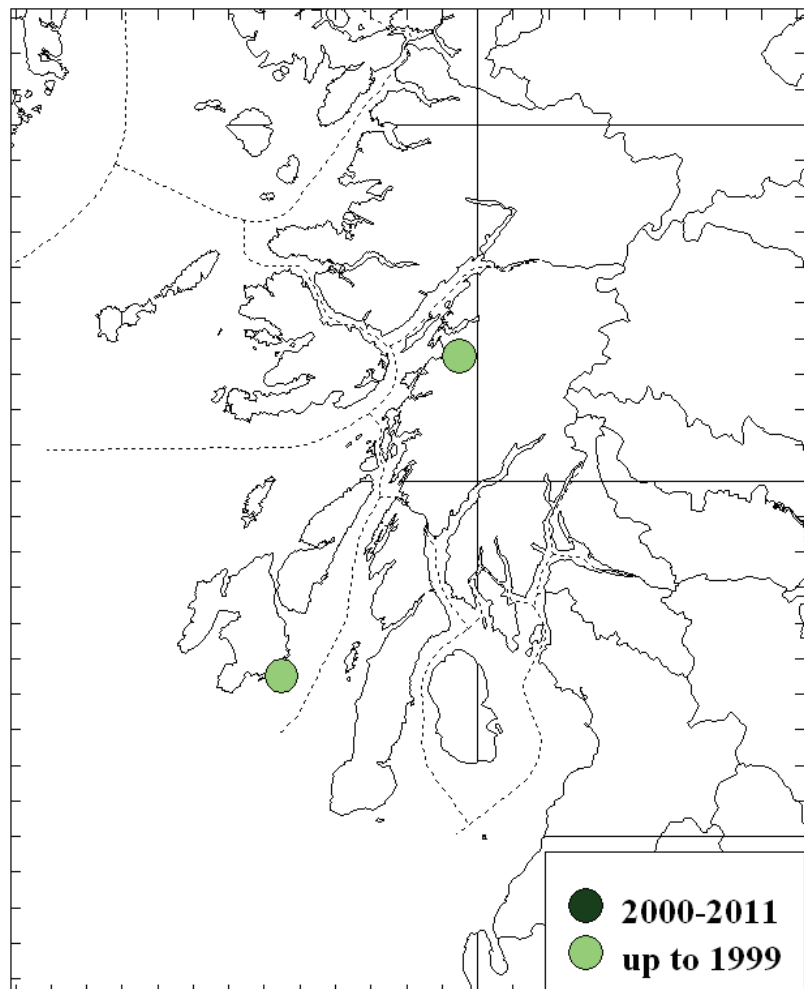
Data sources: See reference below. A wider range of records are also held on the Invertebrate Site Register dataset held on the NBN Gateway and administered by SNH. However this dataset is known to contain errors and we caution against its use in mapping.

References:

Maitland, P.S. 1997. Recovery of the medicinal leech *Hirudo medicinalis* in Scotland, Phase II. *Scottish Natural Heritage HQ Report*.

Distribution map based on published records with no recent sampling.

Year or Period: 1996



SCOTTISH POPULATION SIZE

Population size estimate: unknown.

Year or period: No recent survey (last survey 1996).

Method used – population size: N/A.

Trend – Period: Not known.

Trend – trend direction: Not known.

Trend – method used: N/A.

Habitat: warm, shallow, still water that usually have abundant amphibian populations.

Main Pressures and Threats: Habitat change, especially poor water quality and from the loss of farm ponds and the deepening of small lochs for fish.

5.2 *Vertigo genesii*

BACKGROUND

Status: Native.

Surveillance issues: Distribution can be readily described, albeit based solely on records from between 1995 and 2002, but quantitative surveys reveal very large fluctuations in numbers between samples. Quantitative sampling can also be damaging to the habitat.

Long-term population or range trends cannot be determined with any certainty as this species has only been known from Scotland since 1995.

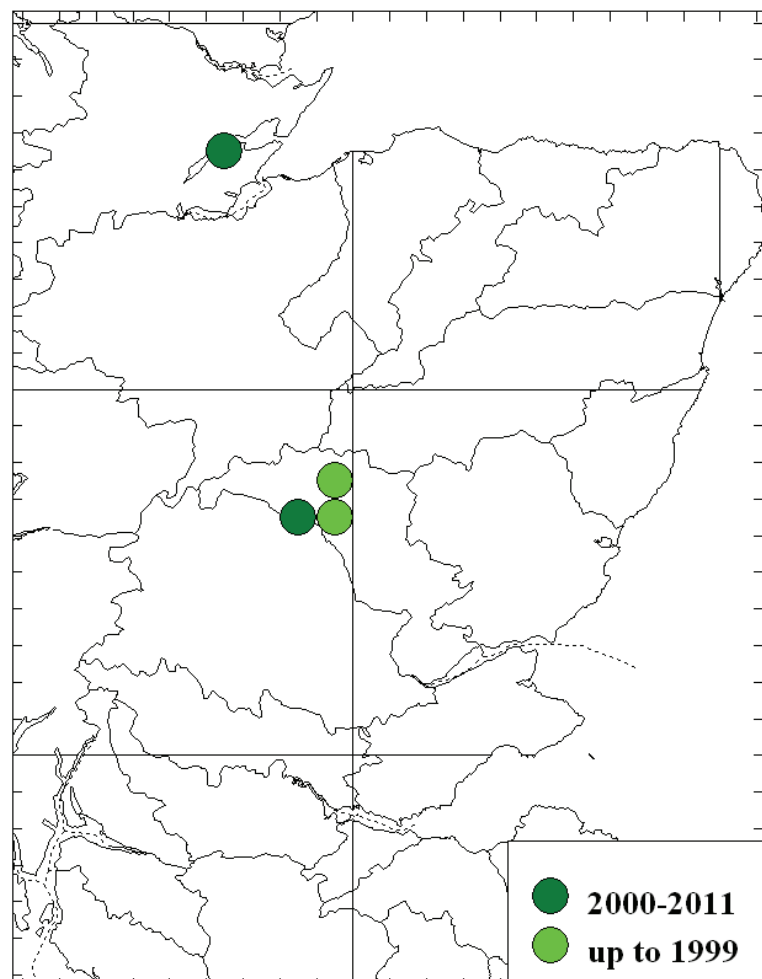
Data sources: Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland); Killeen (2002).

References:

Killeen, I.J. 2002. Monitoring surveys of whorl snails (*Vertigo* spp.) in Scottish Natura sites. *Unpublished report to Scottish Natural Heritage, Edinburgh.*

Distribution map based on published records from surveys in the 1990s and early 2000s.

Year or Period: 1995-2002



SCOTTISH POPULATION SIZE

Population size estimate: Not known.

Year or period: N/A.

Method used – population size: N/A.

Trend – period: Probably stable.

Trend – trend direction: Probably stable.

Trend – method used: Based on expert opinion and there being no evidence of habitat or management change at occupied sites.

Habitat: Dendritic calcareous flushes, between 300 and 500 m altitude, fed by springs where mosses such as *Ctenidium molluscum* and *Cratoneuron* spp. are prominent. Low growing sedge such as *Carex demissa* and *C. viridula* are also present and the snail is found at the base of the sedges. There are a number of plant species associated with the sites such as the bog rushes *Schoenus nigricans* and *S. ferrugineus*. Many of the flushes are also tufa depositing and the vegetation is kept low by grazing sheep and/or cattle.

Main pressures and threats: Damage to the habitat from drainage, eutrophication and afforestation. Livestock can also be a problem from overgrazing and excessive trampling.

5.3 *Vertigo geyeri*

BACKGROUND

Status: Native.

Surveillance issues: Distribution can be readily described, albeit based solely on records from between 1995 and 2002, but quantitative surveys reveal very large fluctuations in numbers between samples. Quantitative sampling can also be damaging to the habitat.

Long-term trends cannot be determined with any certainty as this species has only been known from Scotland since 1995.

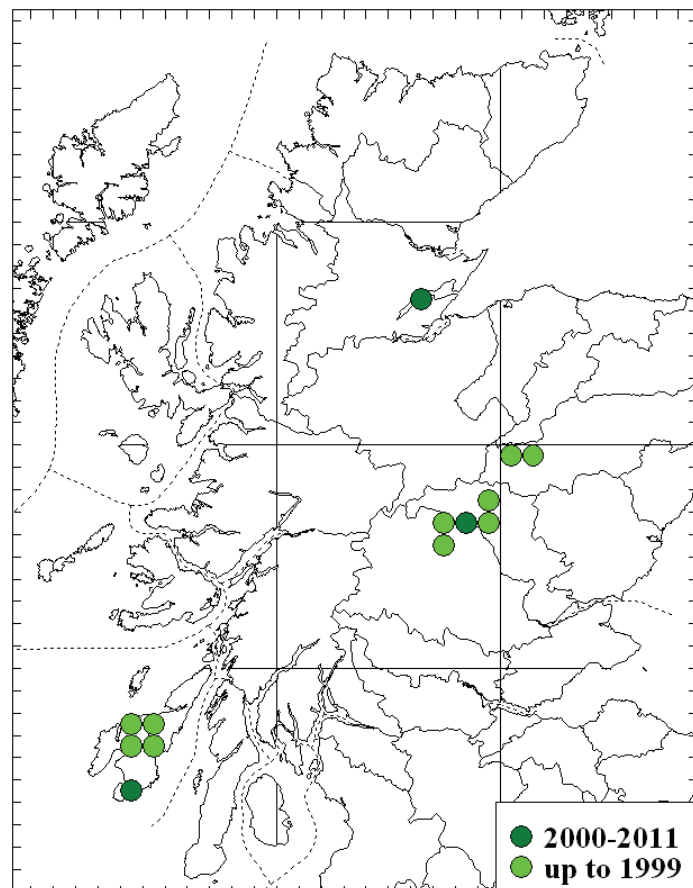
Data sources: Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland).

References:

Killeen, I.J. 2002. Monitoring surveys of whorl snails (*Vertigo* spp.) in Scottish Natura sites. *Unpublished report to Scottish Natural Heritage, Edinburgh.*

Distribution map based on published records from surveys in the 1990s and early 2000s.

Year or Period: 1995-2002



SCOTTISH POPULATION SIZE

Population size estimate: Not known.

Year or period: N/A.

Method used – population size: N/A.

Trend – period: Probably stable.

Trend – trend direction: Probably stable.

Trend – method used: Based on expert opinion and there being no evidence of habitat or management change at occupied sites.

Habitat: Highly calcareous flushes and fens. Most colonies are on permanently wet calcareous flushes on gently sloping, sometimes stony ground. This habitat is dominated by fine-leaved grasses, sedges and other vegetation. All three occupied Deeside flushes are dominated by *Saxifraga aizoides* and an unidentified small *Carex* spp. whilst other plant species typical of Scottish sites for *V. geyeri* include *Schoenus nigricans*, *S. ferrugineus* and *Eleocharis quinqueflora*. Within these sites *V. geyeri* can usually be found at the moist base of the sedges and bog-rushes

Main pressures and threats: Lowering of the water table by ditching and draining for agriculture, water abstraction for domestic or agricultural use and excessive grazing.

5.4 *Vertigo angustior*

BACKGROUND

Status: Native.

Surveillance issues: Distribution can be readily described but quantitative surveys reveal very large fluctuations in numbers between samples. Quantitative sampling can also be damaging to the habitat.

Long-term trends cannot be determined with any certainty as this species has only been known from Scotland since 1995.

Data sources: Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland).

References:

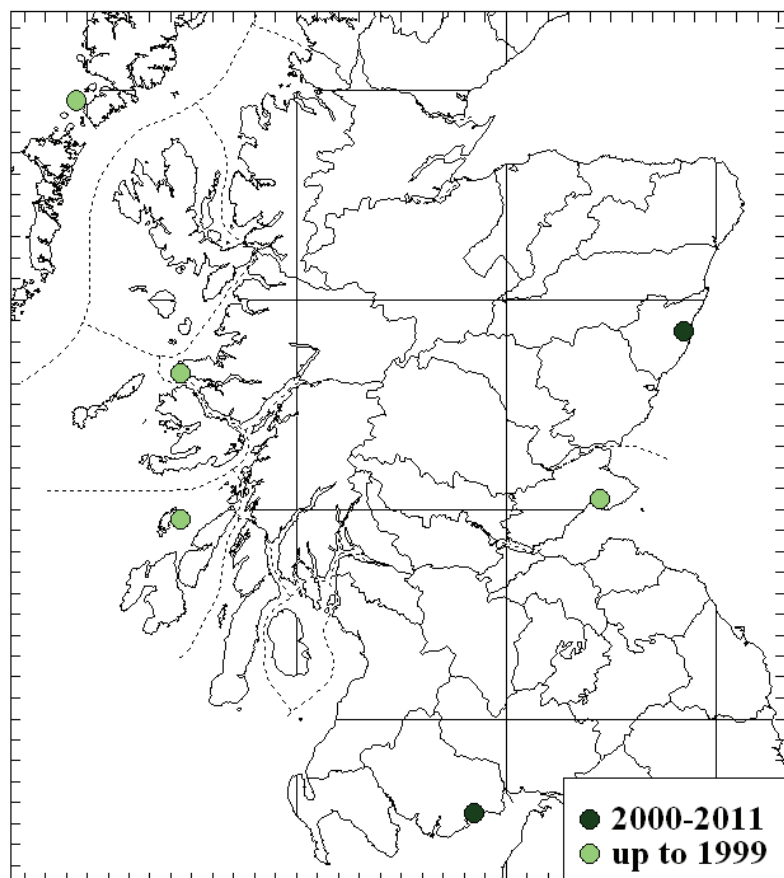
Douglas, G. 2003. Invertebrate species dossier, *Vertigo angustior* Jeffreys, narrow-mouth whorl snail (Mollusca: Vertiginidae). *Unpublished Report to Scottish Natural Heritage, Edinburgh*.

Killeen, I.J. 2002. Monitoring surveys of whorl snails (*Vertigo* spp.) in Scottish Natura sites. *Unpublished report to Scottish Natural Heritage, Edinburgh*.

Marriott, R.W. & Colville, B. 2011. Survey for the narrow mouthed whorl snail (*Vertigo angustior*) at White Port SSSI, Kirkcudbrightshire. *Report to Buglife – The Invertebrate Conservation Trust*.

Distribution map based on published records from surveys in the 1990s and early 2000s.

Year or period: 1992-2012 (for Dumfries & Galloway and Aberdeenshire sites – all other sites are presumed to relate to fossil records).



SCOTTISH POPULATION SIZE

Population size estimate: Not known.

Year or period: N/A.

Method used – population size: N/A.

Trend – period: Probably stable.

Trend – trend direction: Probably stable.

Trend – method used: Estimate based on expert opinion and there being no evidence of habitat or management change at occupied sites.

Habitat: The site at White Port, Dumfries & Galloway, was originally described as a gently sloping dune from beach level (Douglas, 2003). On the lower levels the vegetation comprised sward with mosses and *Thymus* amongst stands of *Juncus*. This changes further up the slope to a mainly grass and low herb zone grazed by rabbits. *Vertigo angustior* was mainly found on the margin between the lower sandy slope and the grazed low herb level midway up the slope. However, the site has been eroding for some years and now has a retreating cliff-like section where the lower dune has fallen away.

At the Stonehaven site, the species is found in two discrete patches approximately 1 km apart from each other. Both are a short way above high water and are likely to be washed by storm tides. One patch is on short grassland on the Highland Boundary Fault where there may be a basic influence in the strata whilst the other is on sparsely grassed shingle, possibly with elevated base levels due to marl and/or limpet shells being washed up (Richard Marriott, *pers. comm.*).

Main pressures and threats: The main threats posed to the populations are from natural changes to the habitat such as succession and erosion. Indeed, the White Port site has suffered serious erosion though the species was still present at a high density with a good proportion of juveniles present in 2010 (Marriott & Colville, 2011). However, the highest density of snails is found on the closest part of the site to the eroding dune margin so this colony is under acute threat (Killeen, 2002).

5.5 *Euphydryas aurinia*

BACKGROUND

Status: Native.

Surveillance issues: The species undergoes large population fluctuations as well as localised colonisation by, and extinctions of, sub-populations within a meta-population. There is likely, therefore, to be considerable uncertainty around trends estimates.

Data sources: The primary data source is the Butterflies for the New Millennium (BNM) project run by Butterfly Conservation in association with the Biological Records Centre.

Distribution map: Data from the above source could not be obtained in sufficient time for use for mapping in this report.

SCOTTISH POPULATION SIZE

Population size estimate: None available.

Year or period: N/A.

Method used – population size: N/A.

Trend – period: N/A.

Trend – trend direction: N/A.

Trend – method used: N/A.

Habitat: Grasslands containing devil's-bit scabious (*Succisa pratensis*). These are typically sites that have been subject to low intensity agriculture and are optimally maintained by low-level livestock grazing. The species appears to benefit in particular from high autumn vegetation that can result from low-intensity grazing although there may be an optimum height above which density of *S. pratensis* declines.

Main pressures and threats: The main threat is habitat loss and degradation such as through overgrazing, ploughing and reseeded to improve grassland productivity.

6 SPECIES OCCURRENCE BY PROTECTED AREA

Table 3 shows the locations of records of four of the species on Annexes II and V of the EC Habitats Directive, indicating whether or not these locations coincide with statutory protected areas. For the fifth Annex II species, *Euphydryas aurinia*, raw data were not available to the project so such an analysis could not be carried out.

Data are drawn from records used to compile maps (sources listed in Species Reports). For the *Vertigo* species, additional, more precise location data were provided by SNH. All records are from post-1995.

Table 3 - Record locations for *H. medicinalis*, *V. genesii*, *V. geyeri* and *V. angustior*

Species	Grid ref	Site name	SSSI	SAC	Notes
<i>Hirudo medicinalis</i>	NM930324	Black Lochs, Argyll	Yes	Yes	Within SSSI and appears to be on the border of the SAC
	NM925316	Black Lochs, Argyll	Yes	Yes	Within SSSI and appears to be on the border of the SAC
	NR431481	Loch nan Dìgl, Islay	Yes	No	around 500 m from SAC boundary
<i>Vertigo genesii</i>	NH688631	Braelangwell Wood	Yes	No	GR also given as NH680637 which is outside the SSSI
	NH688632	Braelangwell Wood	Yes	No	
	NN869642	Tulach Hill	Yes	Yes	
	NN891669	Monzie area	Yes	Yes	
	NN891680	Meall Gruaim	No	No	
	NN895670	Monzie area	Yes	Yes	
	NN898670	Monzie area	Yes	Yes	
	NN8962	above R. Garry, nr. Blair Atholl	Yes	Yes	Square partly within protected area
	NN8963	above R. Garry, nr. Blair Atholl	Yes	Yes	Square partly within protected area
	NN903670	Monzie area	Yes	Yes	
	NN905663	Blair Atholl, Loch Moraig	Yes	No	
	NN905675	Monzie, Blair Atholl	Yes	Yes	
	NN906663	Moraig	Yes	No	
	NN906668	Moraig	Yes	No	
	NN910718	Glen Tilt	Yes	Yes	
	NN942612	Ben Vrackie	Yes	No	
NN943614	Ben Vrackie	Yes	No		
NN991728	1 km S of Loch Loch	Yes	Yes		
<i>Vertigo geyeri</i>	NC039272	Clach Toll	No	No	
	NH680637	Braelangwell Wood	Yes	No	
	NH688631	Braelangwell Wood	Yes	No	
	NH688632	Braelangwell Wood	Yes	No	
	NN714574	Kinloch Rannoch, Schiehallion	Yes	No	
	NN823699	Loch Tummel, N side	No	No	
	NN838644	Invervack	Yes	Yes	
	NN843648	Invervack, Blair Athol	Yes	Yes	
	NN869642	Tulach Hill	Yes	Yes	
	NN891669	Monzie area	Yes	Yes	
	NN895670	Monzie area	Yes	Yes	
	NN898670	Monzie area	Yes	Yes	
	NN890670	Monzie area	Yes	Yes	
	NN903670	Monzie area	Yes	Yes	
	NN904625	Tulach Hill	Yes	Yes	

	NN904672	Monzie area	Yes	Yes
	NN905663	S of Loch Moraig	Yes	No
	NN905668	S of Loch Moraig	Yes	No
	NN906663	S of Loch Moraig	Yes	No
	NN905675	Monzie, Blair Atholl	Yes	Yes
	NN9271	Glen Tilt	Yes	Yes
	NN943614	Ben Vrackie	Yes	No
	NO050926	Glen Lui	Yes	Yes
	NO136903	Morrone Birkwood	Yes	Yes
	NO137903	Morrone Birkwood	Yes	Yes
	NR314431	Loch Ard Achadh	No	No
	NR315433	Loch nan Gillean, Islay	No	No
	NR374675	Loch Finlaggan	No	No
	NR375668	Loch Finlaggan	No	No
	NR377673	Loch Finlaggan	No	No
	NR374683	Ballachlaven	No	No
	NR375678	Ballachlaven	No	No
	NR384758	Loch Smigeadail, Islay	No	No
	NR386747	E, of Margadale River	No	No
	NR401742	Margadale River	No	No
	NR409649	Loch Lossit, Islay	No	No
	NR409655	Loch Lossit, Islay	No	No
<i>Vertigo angustior</i>	NO891887	Red Man Bay, Stonehaven	Yes	Yes
	NO891886	Perthumie Bay, Stonehaven	Yes	Yes
	NX840518	White Port	No	No

These results indicate that most sites for these four species are protected at least as SSSIs with the primary exception of the Islay sites for *Vertigo geyeri*. Two additional *V. geyeri* sites have no statutory protection whilst one site each for *V. genesii* and *V. angustior* are not protected at least by SSSI designation.

7 KEY AREAS FOR PRIORITY TERRESTRIAL INVERTEBRATES IN SCOTLAND

Figure 1 shows the total number of priority species per 10-km square. Note that it is compiled using data presented in the distribution maps in the Species Reports and thus will be subject to data biases discussed in section 2.2. It includes no data for the following species for which maps are not presented in the Species Reports: *Bembidion testaceum*, *Meotica anglica*, *Euphydryas aurinia*, *Doros profuges* and *Lonchaea ragnari*. The concentration of priority species in Strathspey is readily apparent whilst further hot spots include the Blair Atholl area and Loch Rannoch.

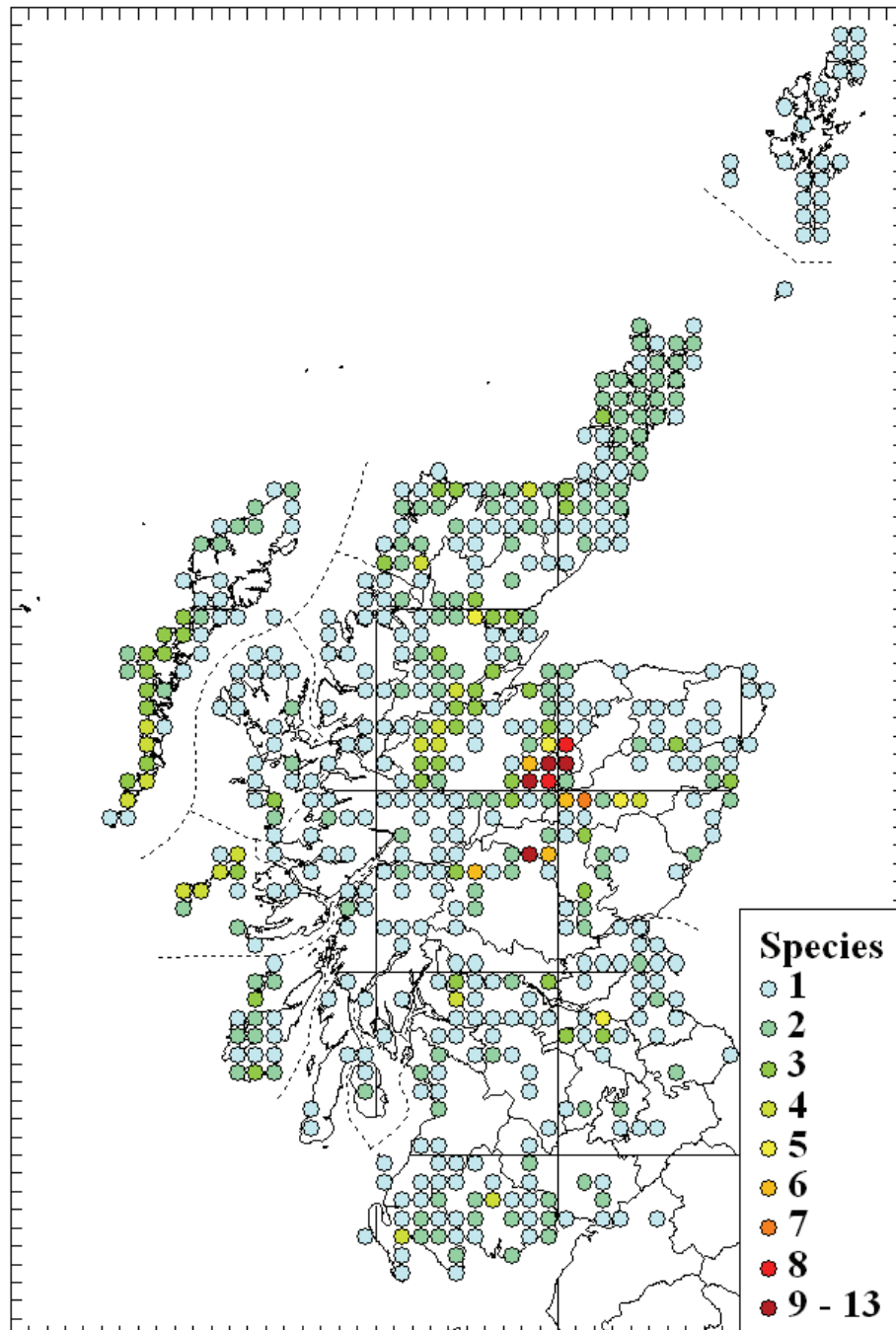


Figure 1. Number of priority species per 10-km square across Scotland.

8 SPECIES REPORTS AND SURVEILLANCE METHODOLOGIES

The following sections, which make up the bulk of this report, are grouped with Species Report and Surveillance Methodology for each species. Note that there is no individual Surveillance Methodology for *Chrysura hirsuta* as it is combined with the reports for species that it parasitizes: *Osmia inermis*, *Osmia parietina* and *Osmia uncinata*.

SPECIES REPORT FOR MEDICINAL LEECH (*Hirudo medicinalis*)

Ecology

Hirudo medicinalis is one of only a handful of the 500 or so leech species that sucks blood from mammals (Ausden *et al.*, 2002). The saliva of the leech contains a wide variety of substances to aid in feeding, including anaesthetics to reduce the pain of the bite and histamines to increase blood flow. The most important compounds are the anti-coagulants which keep the blood flowing smoothly and indeed leech bites may continue to bleed for hours after it has stopped feeding. A single blood meal may take weeks or months to be digested and a leech may need only one or two blood meals a year (Douglas, 2003).

The rate of growth of young leeches is dependent upon the availability of blood meals. They do not start to breed until they reach 2 g in weight and most gravid leeches are 3 g or more. If the food supply is erratic, it may take more than three years to reach this size (Douglas, 2003). Water temperature has a further influence on growth rates.

Egg cocoons are laid in July and August, above the water line, under stones and amongst vegetation or root balls around the water body. After four to 10 weeks, up to 12 young leeches may hatch from each cocoon (Douglas, 2003).

Conservation status and rarity

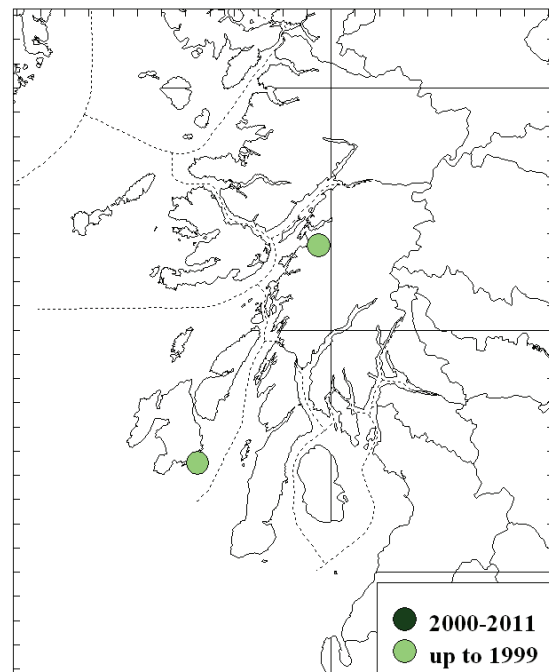
- UK Biodiversity Action Plan Species (BAP): Species of conservation concern.
- UK Red Data Book 2: *Vulnerable*.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: unknown.
- IUCN Status: Status: Lower Risk/near threatened.

Distribution

Hirudo medicinalis was formerly much more common in Great Britain and the rest of Europe. The decline is probably due to loss of shallow water with grazing access and over-collecting during the 19th century. In Scotland, *H. medicinalis* has been recorded from 10 sites scattered between Sutherland to Fife and Argyll (Douglas, 2003). Searches of these sites and neighbouring water bodies have mostly proved fruitless and, in Scotland, the medicinal leech has recently only been found at Loch nan Dìgl on Islay and in two parts of Black Loch, near Oban (Maitland, 1997).

Habitat and management

The medicinal leech is found in warm, shallow, still waters. These usually have abundant amphibian populations, which act as the primary prey for leeches (Maitland, 2011). In England *H. medicinalis* is also found in ditches, gravel pits and marshes (Ausden *et al.*, 2002).



Pressures and threats

In the past, collection for commercial exploitation may have been a factor in the decline of this species. The proportion of each population that are of breeding size is often quite low and removal of large leeches for medicinal use may have had a disproportionate effect. Such exploitation is now illegal in the UK as the medicinal leech is listed in Schedule 5 of the Wildlife & Countryside Act. The main threats now to this species in the UK come from habitat change, especially poor water quality, and from the loss of farm ponds and the deepening of small lochs for fish (Douglas, 2003).

Conservation measures

The Black Loch is a SSSI and the SAC extends down to the east shore. Loch nan Dìgl is a SSSI. Proposals were made in the 1990s for translocation and establishment of new populations in Scotland (Maitland, 1997, 1998) but these have not been progressed in recent years.

Summaries of surveys and research related to surveillance

Visits to known current and previous sites in Argyll and elsewhere in 1995 and 1996 confirmed the continued presence of the species on Islay and at two interconnected sites near Oban (Maitland, 1997). Multiple sampling methods were used in these surveys and the results provide good guidance for planning future surveillance (Maitland, 1997).

Quality of data

There were repeat surveys of known and other potential sites in the 1990s (Maitland, 1997) and thus it is unlikely that the species was significantly under-recorded. There are, though, a number of older records in Scotland that are not mapped here. Some of the old records may have been of leeches that were released after medicinal use and then failed to establish viable populations (Douglas, 2003). At least one previously record was found, on re-examination of the specimen, to be a misidentification.

References

- Ausden, M., Banks, B., Donnison, E., Howe, M., Nixon, A., Phillips, D., Wicks, D. & Wynne, C. 2002. The status, conservation and use of the Medicinal Leech. *British Wildlife*, **13**, 229-238.
- Douglas, G. 2003. Invertebrate species dossier: *Hirudo medicinalis* Linnaeus (Gnathobdellida: Hirundinidae) Medicinal Leech. *Unpublished report to Scottish Natural Heritage, Edinburgh*.
- Maitland, P.S. 1997. Recovery of the medicinal leech *Hirudo medicinalis* in Scotland, Phase II. *Unpublished report to Scottish Natural Heritage*.
- Maitland, P.S. 1998. Developing reserve populations of *Hirudo medicinalis* in Scotland. Phase III. *Unpublished report to Scottish Natural Heritage*.
- Maitland, P.S. 2011. The Medicinal Leech *Hirudo medicinalis* in Scotland. *BRISC Recorder News*, **80**, 1-4.

Map data source

Maitland (1997).

SURVEILLANCE METHODOLOGY FOR MEDICINAL LEECH (*Hirudo medicinalis*)

Aim

To establish a protocol for assessing population trends at known Scottish sites.

Rationale

Hirudo medicinalis is now known from just two areas in western Scotland. There does not appear to have been any systematic and repeatable monitoring carried out at these sites in recent years (Maitland, 2011). It has been suggested that the species could be re-introduced within its former range in Scotland (Maitland, 1997). A similar protocol would need to be established to measure the success of any such scheme.

Approach

There are a number of techniques that have been used to survey for *H. medicinalis*. These include attracting leeches by agitating the water surface and sorting through material where leeches may be found such as birds' nests or artificially created vegetation bundles.

Cocoon searching has been carried out at other sites for the species. This has been primarily to prove breeding at particular sites in situations where leeches may move between a number of water bodies. With the isolated and long-established nature of the water bodies used in this case, there is less necessity to provide evidence that the site is used for breeding. Furthermore the technique is destructive to waterside vegetation and thus is not recommended for use at Scottish sites.

The method recommended is timed counts of *H. medicinalis* whilst splashing with a net. The specific protocol follows that developed as part of the Biodiversity Action Plan for *H. medicinalis*. Leeches are attracted by vibrations and the hope of obtaining a blood meal. The surveyor should stand in the water, in waders, and leeches can be seen and netted as they approach or are found attached to the surveyor's waders. Surveillance elsewhere has found that undertaking such surveys at night by torchlight is particularly effective as leeches are more conspicuous. However given the remote nature of sites in Scotland and the desirability to maintain comparability with standard surveys, this is not recommended here.

Measurements of leech size may be useful to gain an idea of population structure within a site. This is not straightforward as size will vary depending on when the leech last fed. However, measurement of the posterior sucker is not related to time since last meal and may provide a useful unit. For further discussion of this technique, see Nixon (1999).

Equipment

Pond net and waders.

Location

Surveillance should be carried out at the three Scottish sites: Loch nan Digl on Islay (NR431481) and in two parts of Black Loch, near Oban (NM930324 and NM925316) (Maitland, 1997).

Sample units

The surveillance protocol suggested here will provide an index of abundance that can be compared between different survey visits.

Sampling

Using the net splashing technique described above, leeches should be looked for by following this protocol:

- Surveys should be carried out in daytime between May and August when catches are likely to be highest.
- Late afternoon and early evening, when water temperature is highest, are the optimum times.
- The surveyor should splash for 20 min at each of eight localities around the site.
- Splashing should be carried out in vegetation, rather than along bare shore.
- It is not essential to revisit the same point on each visit if pooling counts for each site from multiple sample points. However, the limits of the sample area should be clearly defined and mapped, and photographed on the first visit.
- All leeches found should be netted for identification. Measurements can be taken if required and leeches released at the original site.

Numbers attracted by splash-sampling can vary considerably from day to day. Leeches can also be long-lived. It is therefore recommended that surveillance is carried out three times annually, at least four weeks apart, and population trends only calculated after a number of years of counts have been collected (as an arbitrary figure, a minimum of five years is suggested).

Time

Each visit according to the above protocol will take around 4 h. Nine such visits annually (three each at the three sites) would be required to follow the visit frequency recommended here.

Further notes

Hirudo medicinalis is a Schedule 5 species of the Wildlife & Countryside Act. A license is required to handle this species.

References

- Nixon, A. 1999. A Survey of the medicinal leech (*Hirudo medicinalis*) in the Romney Marsh Natural Area, 1998/99. *Report to Romney Marsh Countryside Project, New Romney, Kent.*
- Maitland, P.S. 1997. Recovery of the medicinal leech *Hirudo medicinalis* in Scotland, Phase II. *Unpublished report to Scottish Natural Heritage.*
- Maitland, P.S. 2011. The Medicinal Leech *Hirudo medicinalis* in Scotland. *BRISC Recorder News*, **80**, 1-4.

SPECIES REPORT FOR MINUTEST DIVING BEETLE (*Bidessus minutissimus*)

Ecology

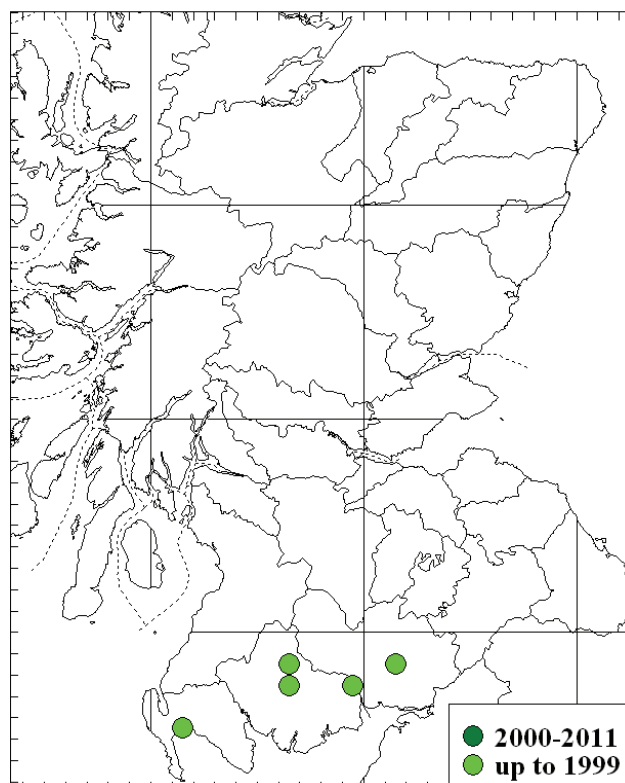
Very little is known about the life-cycle or the larval stages of this rare beetle. In France, the species is known to fly, but this has not been observed in Britain (Douglas, 2003).

Conservation status and rarity

- UK Biodiversity Action Plant (BAP): Species of conservation concern.
- UK Red Data Book 3: *Rare*.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Declining (continuing/accelerating).
- IUCN Status: Not listed.

Distribution

In UK, *B. minutissimus* is only found in western Britain. Old records suggest its former range runs from Devon to the Solway area with a number of sites in eastern Ireland and a large number in Wales. Only 17 10-km squares have been recorded since 1976 and, outwit its Welsh stronghold, it would appear the species is in sharp decline. In Scotland there are old records from the early part of the 1900s from a number of rivers in the Kirkcudbrightshire and Dumfries & Galloway area including the Arran, the Ken, the Nith and the Water of Luce. *Bidessus minutissimus* was recorded up to 1991 (JNCC, 2010) on the River Nith, on a small stretch where there is a high level of disturbance to the habitat (Douglas, 2003). It now appears to be extinct in Scotland (G.N. Foster, *pers. comm.*).



Habitat and management

Bidessus minutissimus inhabits clean, fine silt at the edges of rivers near to estuaries, often among the roots of plants such as reed-grass (*Phalaris arundinacea*). The species can also occur in pools with extensive growths of filamentous algae. There are older records for coastal lakes, and, in one case at least, the species has been found in a river subject to lead pollution in muddy beds of vegetation cut off from the main flow of the river (Foster, 2010). The most recent record in England is from a quarry pond not connected to a river (G.N. Foster, *pers. comm.*).

Pressures and threats

The key threat to this species is river works such as impoundment, bank strengthening, canalisation and other forms of river regulation. There are threats both from point source pollution of lower parts of rivers (e.g. from sewage outfalls) and from diffuse pollution resulting in algal blooms and loss of clean gravel sites in rivers. Intensive use by anglers, pleasure craft and other amenity use may also cause problems for the species (Anon, 1999). This species survived considerable disturbance associated with construction of the Dumfries bypass across its last known site in Scotland, but did not survive bank-strengthening works. It has also been lost from the River Ken, which is subject to fluctuations in level associated with a hydroelectric scheme and from the Water of Luce following the creation of a sewage treatment system (Foster, 2010).

Conservation measures

Programmes for rehabilitation of rivers should take into account the occurrence of this species. In particular, retention or reinstatement of natural river dynamics should be the main aim. Wholesale fish introductions should be avoided but, where angling continues, the species should be able to survive where refuges within a well structured river system provide some protection (Foster, 2010).

Summaries of surveys and research related to surveillance

This species may be extinct in Scotland so any surveys should simply aim to locate extant populations.

Quality of data

Recent surveys have been well-documented.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Douglas, G. 2003. Invertebrate species dossier: *Bidessus minutissimus* Germar, a diving beetle (Coleoptera: Dytiscidae). *Unpublished report to Scottish Natural Heritage, Edinburgh*.
- Foster, G.N. 2010. *A review of the scarce and threatened Coleoptera of Great Britain Part (3): Water beetles of Great Britain. Species Status 1*. Peterborough: Joint Nature Conservation Committee.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/145.pdf> [Accessed 1 November 2011].

Map data sources: Water Beetle Surveys from Britain and Ireland (Balfour-Browne Club).

SURVEILLANCE METHODOLOGY FOR MINUTEST DIVING BEETLE (*Bidessus minutissimus*)

Aim

To determine whether populations of *Bidessus minutissimus* survive at formerly recorded sites in Scotland.

Rationale

Bidessus minutissimus has not been recorded in Scotland since 1991 and may now be extinct. Any surveys should, initially, focus on establishing if any populations survive. Only once presence has been established would it be worthwhile formulating a surveillance programme.

Approach

The species can be searched for simply by netting in suitable habitat.

Equipment

Long-handled pond net.

Location

The Balfour-Browne Club's dataset, Water Beetle Surveys from Britain and Ireland, on the National Biodiversity Network Gateway includes known verified records from Scotland at up to 100 m resolution. Opinions of this club should be sought on the identification of further potential sites to survey.

Sample units

Surveillance should seek simply to establish the number of occupied sites (if any).

Sampling

This species should be surveyed simply by visually searching suitable habitat. Typically, water beetle surveys involve netting in five areas of 1 m² or equivalent around the relevant water body but, for this species, it is suggested that searches are guided by the expert judgement of the surveyor, who should avoid causing site damage by sampling too intensively. The most recent English record was made in July (Watson, 2009). Searches of Scottish sites should aim for similar timing.

Time

No time duration guidelines are given here. However, travel to and location of water bodies is likely to take a greater time than actual sampling.

References

Watson, W.R.C. 2009. *Bidessus minutissimus* in Herefordshire. *Latissimus*, **26**, 1.

SPECIES REPORT FOR LESSER SEARCHER (*Calosoma inquisitor*)

Ecology

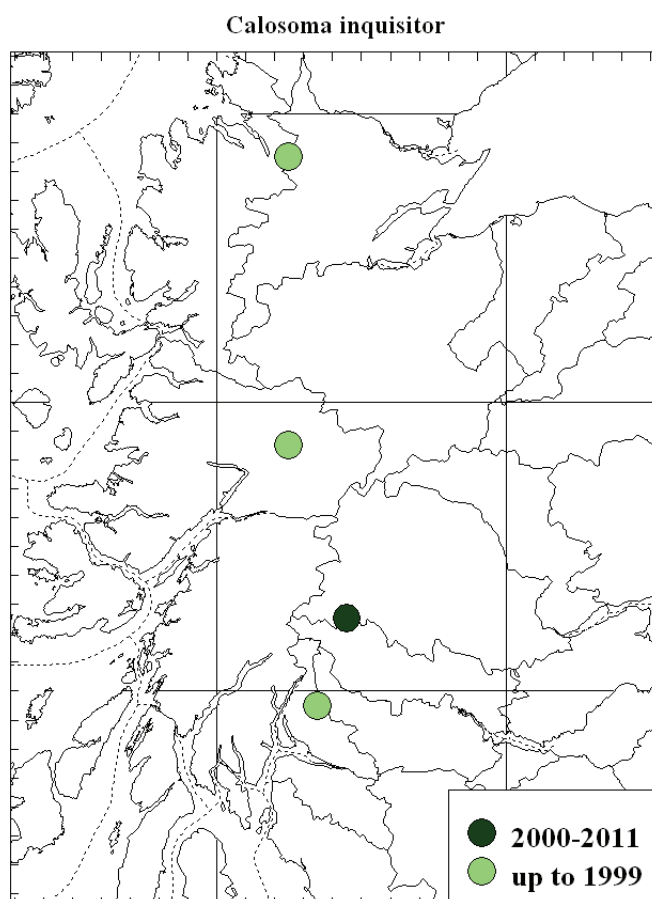
Adult beetles are arboreal and oligophagous, feeding on Lepidoptera larvae particularly of the families Geometridae and Tortricidae (Luff, 1998; Somerville, 2005; JNCC, 2010). At dusk they emerge from the soil and climb into the canopy where they feed on the caterpillars (Boyce, 2004). *Calosoma inquisitor* is never common (Bland, 2005), but they can be abundant following outbreaks of caterpillar prey such as *Tortrix* species (Luff, 2007). This species is fully winged and readily flies (Luff, 1998). Adults are found from mid-May (Boyce, 2004) to early-July (Luff, 2007). This species is a spring breeder with larval development throughout the summer (Luff, 1998). The larvae are ground dwelling (Ghahari *et al.*, 2010).

Conservation status and rarity

- *Nationally Scarce* (A).
- UK Biodiversity Action Plan (BAP): Species of conservation concern – this species has suffered an estimated 63% decline in range over 40 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

A Eurasian-wide temperate species distributed to North Africa (Luff, 1998) and Asia Minor, Iran and the Caucasus, with isolated populations in eastern Siberia and Japan (Ghahari *et al.*, 2010). *Calosoma inquisitor* has only been found at three sites in the west of Scotland. There are older (pre-1970) records for Spean Bridge (Crowson, 1964, 1971) and Inverlael Forest near Ullapool (Luff, 1998); more recent (1984-85) records for Rowardennan, Loch Lomond (JNCC, 2010; M. Telfer, *pers. comm.*), and a current record from Innishewan Oakwood, near Crianlarich, Perthshire (Bland, 2005). Despite substantial effort in 2002-03 in England, populations were found to be restricted to one Devon wood, the New Forest and the Lake District (Boyce, 2004). There are also a number of records for Wales (Boyce, 2004). It is presumed extinct in Ireland.



Habitat and management

This species is associated with oak trees (*Quercus* spp.) and is found in ancient oak woodland and wood pasture (JNCC, 2010). In Scotland it has been found in oak wood and in mixed plantation forest where oak has been incorporated into the planting. Elsewhere in Europe it has been found in other habitats such as fields (Ghahari *et al.*, 2010).

Pressures and threats

The reasons for the apparent decline of *C. inquisitor* are not understood (Boyce, 2004). It may be vulnerable to changes in woodland management, especially the loss of grazing, and to loss of prey due to declines in the abundance of woodland moths (JNCC, 2010).

Conservation measures

Wider countryside measures to conserve ancient oak woodland and wood-pasture should benefit this species (JNCC, 2010). Innishewan Oakwood, near Crianlarich, Perthshire is a SSSI but *C. inquisitor* is not listed on the designation.

Summaries of surveys and research related to surveillance

Survey and monitoring techniques are well understood for this species following work on the Scarce Ground Beetle Project in 2002-03 (Boyce, 2004). Part of this project investigated the distribution and ecology of *C. inquisitor* in England, and further work focused solely on the Devon site (Boyce, 2004).

Quality of data

Good but possibly under-recorded.

References

- Bland, K. 2005. A second Scottish site for *Calosoma inquisitor* (Linnaeus) (Carabidae). *The Coleopterist*, **14** (1), 22.
- Boyce, D. 2004. Scarce Ground Beetle Project: final report on work 2000-2004. *Unpublished report to English Nature*.
- Crowson, R.A. 1964. Additional records of Coleoptera from Scottish oakwood sites. *Glasgow Naturalist*, **18** (7), 371-375.
- Crowson, R.A. 1971. Records of Coleoptera from Roudsea Wood National Nature Reserve. *Entomologist's Monthly Magazine*, **107**, 254-255.
- Ghahari, H., Avgin, S.S. & Ostovan, H. 2010. Carabid beetles (Coleoptera: Carabidae) collected from different ecosystems in Iran with new records. *Türkiye Entomoloji Dergisi*, **34** (2), 179-195.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2120.pdf> [Accessed 1 February 2012].
- Luff, M.L. 1998. *Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain*. Huntingdon: Biological Records Centre.
- Luff, M.L. 2007. *The Carabidae (ground beetles) of Britain and Ireland*. Handbooks for the identification of British insects, volume 4, part 2 (2nd edition). St Albans: Royal Entomological Society.
- Somerville, A. 2005. Biodiversity and ecology of the invertebrates of Atlantic oakwoods. *Botanical Journal of Scotland*, **57** (1-2), 187-195.

Map data sources

Bland, K. (2005).

Carabid data for Great Britain (Ground Beetle Recording Scheme held by BRC, provided by Ground Beetle Recording Scheme).

SURVEILLANCE METHODOLOGY FOR LESSER SEARCHER (*Calosoma inquisitor*)

Aim

To establish the status of *Calosoma inquisitor* in Scotland.

Rationale

Calosoma inquisitor is associated with oak woodland where it feeds on oak-feeding caterpillars (Luff, 1998, 2007; Boyce, 2004; Somerville, 2005; JNCC, 2010). The species has only been found at four sites in Scotland, the last record being in 2005. There has been no targeted sampling for the species.

Approach

Surveillance should focus on confirming the continued presence of the beetle in Scotland by re-surveying all four sites from which the species has been previously recorded.

Survey and monitoring techniques are well understood for this species following work on the Scarce Ground Beetle Project in 2002-03 (Boyce, 2004). This involves direct visual surveying for adult beetles by visiting at dusk with a torch and examining the ground and tree trunks (J. Walter, *pers. comm.*; Boyce, 2004). At this time the adult beetles emerge from the soil and climb up to the tree canopies where they feed on caterpillars (Boyce, 2004). Pitfall traps could be used to supplement visual searching (Crowson, 1964, 1971).

Equipment

No specialist equipment is required.

Location

Calosoma inquisitor has only been found at three sites in the west of Scotland. There are older (pre-1970) records for Spean Bridge and Inverlael Forest near Ullapool and more recent (1984-85) records for Rowardennan, Loch Lomond. The most recent is from Innishewan Oakwood, near Crianlarich, Perthshire (Bland, 2005). All four sites should be investigated for the presence of the beetle. Previous records only give four- or six-figure grid references so surveillance may be required over a larger area identifying suitable trees within this area. Additional sites with suitable habitat could be surveyed as a secondary objective.

Sample units

The primary sample unit will be the number of occupied sites. If the beetles are present, then typically between two and 10 should be visible on any one night (up to a maximum of 60) (J. Walters, *pers. comm.*) thus also providing an indication of relative population sizes.

Sampling

Adult beetles can be found on the ground and on the trunks of oak trees (*Quercus* spp.) as they ascend to feed at dusk (J. Walters, *pers. comm.*). A provisional survey of oak trees in the locations mentioned may be helpful for assessing habitat suitability and identifying areas to target for nocturnal surveillance.

Direct visual searching could be supplemented with pitfall trapping which is a commonly used sampling technique for ground beetles. Pitfall traps should be used dry without any

preservative. The traps should be plastic cups (suggested 11.5 cm diameter and 1 L volume) placed in suitable areas (e.g. around the bases of oak trees) and separated from each other by 10 m. Traps should be checked daily and any captured beetles noted and released. Further details on this sampling method can be found in Woodcock (2005). This species is readily identifiable in the field due to its large size and characteristically shaped pronotum (Luff, 2007).

Following consideration of published information and expert opinion, the following guidelines on sampling protocol are recommended:

- Field sampling should be undertaken between mid-May and mid-June but crucially as soon as the oak leaves expand (J. Walters, *pers. comm.*).
- The optimal time for surveillance is during the first hour of darkness (J. Walters, *pers. comm.*).
- Sampling should be carried out on warm, dry nights when the beetles are more likely to be active.
- More than one visit may be required to establish the beetle's presence.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record details of changes in management, ratio of oak trees to other species, and evidence of succession to assess the potential replacement of older trees in the future. Positive locations should be monitored every five years unless there are anticipated threats to the species in the shorter term.

Time

Surveying for this species can be time consuming. Surveys at known locations in England failed to find beetles after four consecutive sampling nights (Boyce, 2004). A return visit will be required if pitfall trapping is deployed.

References

- Bland, K. 2005. A second Scottish site for *Calosoma inquisitor* (Linnaeus) (Carabidae). *The Coleopterist*, **14** (1), 22.
- Boyce, D. 2004. Scarce Ground Beetle Project: final report on work 2000-2004. *Unpublished report to English Nature*.
- Crowson, R.A. 1964. Additional records of Coleoptera from Scottish oakwood sites. *Glasgow Naturalist*, **18** (7), 371-375.
- Crowson, R.A. 1971. Records of Coleoptera from Roudsea Wood National Nature Reserve. *Entomologist's Monthly Magazine*, **107**, 254-255.
- JNCC, 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2120.pdf> [Accessed 1 February 2012].
- Luff, M.L. 1998. *Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain*. Huntingdon: Biological Records Centre.
- Luff, M.L. 2007. *The Carabidae (ground beetles) of Britain and Ireland*. Handbooks for the identification of British insects, volume 4, part 2 (2nd edition). St Albans: Royal Entomological Society.
- Somerville, A. 2005. Biodiversity and ecology of the invertebrates of Atlantic oakwoods. *Botanical Journal of Scotland*, **57** (1-2), 187-195.
- Woodcock, B. 2005. Pitfall trapping in ecological studies. In: Leather, S. (ed.) *Insect Sampling in Forest Ecosystems*. Blackwell Publishing, Oxford. pp. 37-57.

SPECIES REPORT FOR TEN-SPOTTED POT BEETLE (*Cryptocephalus decemmaculatus*)

Ecology

The leaf beetle *Cryptocephalus decemmaculatus* feeds on willow and birch (Douglas, 2003). The species has a two-year life cycle in Scotland with highly synchronized adult emergence (Piper, 2002; Douglas, 2003). Warm conditions are required by the adults to facilitate feeding and movement (Piper, 2002). Adults have been found in May and June although singletons can be found as late as August. Eggs are dropped to the ground and the cased larvae live and feed in the leaf litter beneath the adult host plants (Piper, 2002; Douglas, 2003). The species is very elusive (Owen, 2005) and has always been considered rare (Piper, 2002).

Conservation status and rarity

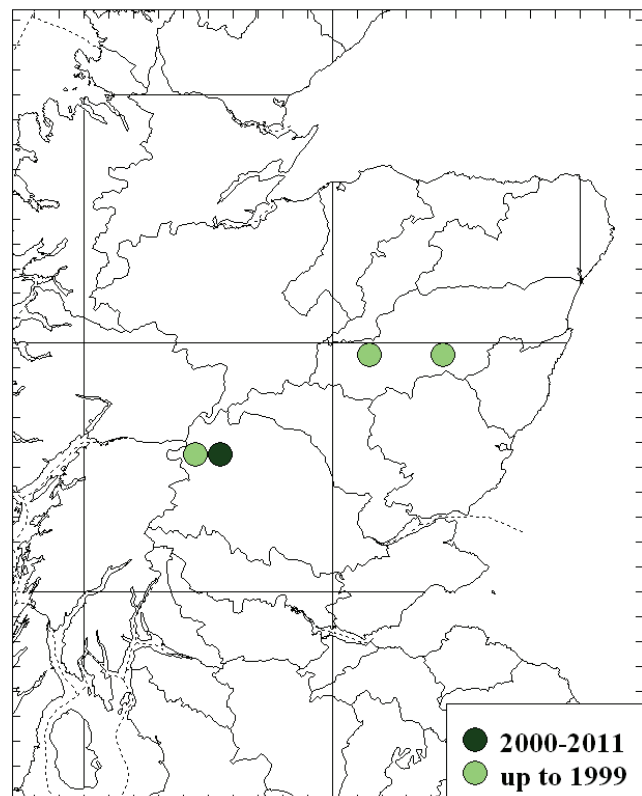
- UK Red Data Book 2: *Vulnerable*.
- UK Biodiversity Action Plan (BAP): Species of conservation concern – this species has suffered 60% decline over 25 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

This species has a highly disjunct distribution across Britain (Douglas, 2003). In Scotland it has only been recorded from three areas. There is a historic (pre-1970) record for Braemar, Aberdeenshire, and two records from Loch Davan, Muir of Dinnet (Piper, 2002); the most recent of these in 1986. The only site with multiple records is Camghouran, near Loch Rannoch in Perthshire where there have been sporadic records over many years including the latest one in 2000 (Douglas, 2003). On this occasion only larvae were found (Piper, 2003). It is widely distributed across northern and central Europe from the Pyrenees and Scandinavia to Siberia (Douglas, 2003).

Habitat and management

Cryptocephalus decemmaculatus is found in damp, deciduous woodland and is specifically associated with dwarf or eared willows (*Salix aurita*) growing in sphagnum moss on wet hillsides, in birch (*Betula spp.*) or in areas of quaking bog (Douglas, 2003; Owen, 2005). The adults are partial to small, isolated bushes in sheltered spots, but with a south-facing aspect (Piper, 2002).



Pressures and threats

This species may be affected by the loss of deciduous woodland habitat through clear-felling or replacement by conifers (Hyman & Parsons, 1992). Drainage leading to drier conditions and subsequent scrub growth may constitute another threat (Piper, 2002). Adults are predated by spiders (Araneae) but the mortality rate is believed to be low (Piper, 2002). The synchronized nature of adult emergence and their extreme dependence on warm conditions to feed and move, may mean the species is vulnerable to bad weather (Piper, 2002). In captivity at least, the number of eggs laid is low and the mortality rate high compared with other *Cryptocephalus* species (Piper, 2002).

Conservation measures

It has been suggested that cutting on rotation to maintain a variety of vegetation structures within deciduous woodland should benefit the species (Douglas, 2003). Drainage should be avoided. The potential area suitable for this species at Camghouran is small: just 60 m² (Piper, 2002). Some areas around Loch Rannoch are SSSIs/NNRs (Douglas, 2003).

Summaries of surveys and research related to surveillance

This species was the subject of a PhD thesis in 2001-02; however, only the Camghouran site in Scotland was surveyed (Piper, 2002). This was largely due to lack of detailed information on the localities within the other sites.

Quality of data

This species is possibly under-recorded.

References

- Douglas, G. 2003. Invertebrate species dossier: *Cryptocephalus decemmaculatus* Linnaeus, a leaf beetle (Coleoptera, Chrysomelidae). *Unpublished report to Scottish Natural Heritage, Edinburgh*.
- Hyman, P.S. & Parsons, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain, Part 1. UK Nature Conservation No. 3*. Peterborough: Joint Nature Conservation Committee.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/247.pdf> [Accessed 1 February 2012].
- Owen, J. 2005. *Cryptocephalus decemmaculatus* (Linnaeus) (Chrysomelidae) in Aberdeenshire. *The Coleopterist*, **14** (3), 138-139.
- Piper, R. 2002. *Conservation of Cryptocephalus species and other threatened UK beetles*. PhD. Thesis. Leeds University.

Map data sources

Bruchid and Chrysomelid Distributions in Britain and Ireland: pre 1900, 1900-1979, 1980 onwards (Seed and Leaf Beetle Recording Scheme).
Douglas, G. 2003.

SURVEILLANCE METHODOLOGY FOR TEN-SPOTTED POT BEETLE (*Cryptocephalus decemmaculatus*)

Aim

To establish the status and distribution of *Cryptocephalus decemmaculatus* in Scotland.

Rationale

Cryptocephalus decemmaculatus is a phytophagous beetle found on willow (*Salix* spp.) and birch (*Betula* spp.) in damp woodland (Piper, 2002; Douglas, 2003; Owen, 2005). The species is elusive (Owen, 2005) and has been considered rare across its range (Warchalowski, 1991). Of the three Scottish sites, the only one yielding more than one specimen is Camghouran, Loch Rannoch, Perthshire (Piper, 2002).

Approach

All three known areas should be surveyed for both adult beetles and larvae. The adults are more readily identifiable but the last sighting of the species at Camghouran was of larvae only. Both are found on willow or birch trees or in the litter below.

Methods for the survey and monitoring of this species are described in detail by Piper (2002). These methods are outlined briefly here and include timed hand searching, foliage beating and sweep netting.

Equipment

Beating tray, sweep net.

Location

Cryptocephalus decemmaculatus has been found at two sites in Aberdeenshire, near Braemar and at Loch Davan, Muir of Dinnet. There are only four-figure grid references for these sites and it may take some time to locate suitable habitat. The precise location of the Camghouran, Loch Rannoch, Perthshire, is better known. The species has also been found in an adjacent 10-km square in Perthshire though the precise location is not known. Again, it may take time to find suitable habitat within this area.

Sample units

The sample units will be the number of sites occupied and the number of adult beetles or larvae found. The latter of these may be small and not conducive to estimating population numbers.

Sampling

Each of the sites should be visited in turn and sampled using direct search techniques as described in Piper (2002).

The adult beetle is very variable but relatively straightforward to identify, being characterised by five black spots on each elytron with a distinctive yellow mark on the pronotum (Piper, 2002). It should be possible to confirm identification of the adults on site and these should then be released back onto the foliage from which they were captured. The cased-larvae are brownish-white with a black sclerotised head capsule and prothorax. Larvae could be retained for breeding before being released back onto the site from which they were taken.

Following consideration of published information and expert opinion, the following guidelines on sampling protocol are recommended:

- Field sampling should be undertaken in June, between 10:00 and 15:00 h.
- Rainy and windy days should be avoided.
- The surveyor should focus on willow and birch foliage in sheltered spots with a south-facing aspect.
- Hand searching should be supplemented by beating and sweeping the foliage and examining any dislodged beetles on a beating tray. Beetles should be captured using an aspirator before being released back onto the foliage from which they were collected.
- Searches should be made in the litter beneath the adult host trees by using a beating tray to sort through moss and litter debris. Larvae could be retained for breeding to confirm identification.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to note any changes in management particularly in relation to scrub encroachment, drainage, and the availability of suitable trees. Positive locations should be monitored every five years.

Time

Surveying at the Camghouran site should only take one day. Searches elsewhere may take longer as the precise locations are not known.

References

- Douglas, G. 2003. Invertebrate species dossier: *Cryptocephalus decemmaculatus* Linnaeus, a leaf beetle (Coleoptera, Chrysomelidae). *Unpublished report to Scottish Natural Heritage, Edinburgh*.
- Owen, J. 2005. *Cryptocephalus decemmaculatus* (Linnaeus) (Chrysomelidae) in Aberdeenshire. *The Coleopterist*, **14** (3), 138-139.
- Piper, R. 2002. *Conservation of Cryptocephalus species and other threatened UK beetles*. PhD. Thesis. Leeds University.
- Warchalowski, A. 1991. L'établissement d'un nouveau sous-genre *Homalopus* Chevrolat, 1837 (Coleoptera, Chrysomelidae, Cryptocephalinae). *Polskie Pismo Entomologiczne*, **61**, 75-78.

SPECIES REPORT FOR SIX-SPOTTED POT BEETLE (*Cryptocephalus sexpunctatus*)

Ecology

Cryptocephalus sexpunctatus is a phytophagous beetle that has been found on a range of deciduous trees. In the UK it has been most commonly associated with hazel (*Corylus* sp.), aspen (*Populus tremula*), and crack willow (*Salix fragilis*) (Cox, 1948). On the continent it has also been recorded on hawthorn (*Crataegus* sp.) and young oak (*Quercus* sp.) (Koch, 1992). Historically the largest numbers of this species have occurred in areas of hazel (*Corylus avellana*). Adult beetles have also been collected from the blossoms of wood spurge (*Euphorbia amygdaloids*) (Piper, 2002). The adults are active from May to early July (Piper, 2002; Douglas, 2003). Faeces-encased eggs are laid in late June or early July (Douglas, 2003). Larval development takes place within the same case to which the larvae continually adds (Douglas, 2003). In captivity larval development takes 12 to 21 months (Owen, 1997). The larvae are also believed to be phytophagous, and their reputed association with ants is unfounded (G. Pozsgai, *pers. comm.*).

Conservation status and rarity

- UK Red Data Book 2: *Vulnerable*.
- UK Biodiversity Action Plan (BAP): Species of conservation concern – this species has suffered a 93% decline in site occupancy. Critically endangered in England.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

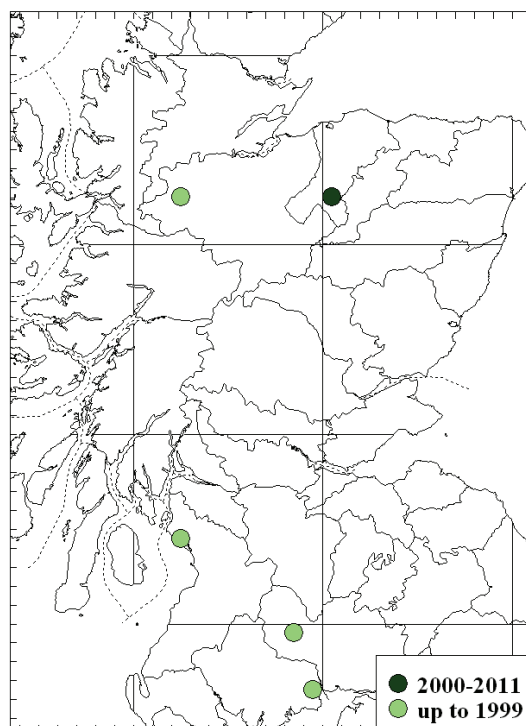
This species was once widely distributed in the UK, but records are vague (Douglas, 2003). In Scotland the species has had a disjunct distribution. Historic records exist from Scarwater in Dumfries & Galloway, Glen Affric area, Midlothian and Dalry Wood (Douglas, 2003). Kirkconnell Flow NNR in Kirkcudbrightshire has a 1996 record (Anon, 1999). There was a 2008 record of the species near Grantown-on-Spey, Moray, but the site name has been protected and the recorder unknown. In England, it was more widespread, but is now reduced to one site at Stockbridge Down in Hampshire (JNCC, 2010). This species occurs throughout northern, central and southern Europe (Douglas, 2003).

Habitat and management

Cryptocephalus sexpunctatus is associated with deciduous woodland (Douglas, 2003) and lowland raised bogs, particularly in areas with hazel (Piper, 2002).

Pressures and threats

The reasons for the decline of *C. sexpunctatus* are not understood. It may have suffered from a loss of natural broad leaved woodland through replacement by conifers, development



or agricultural reclamation, or from inappropriate woodland management (Hyman & Parsons, 1992; Anon, 1999). The decline in coppicing in particular may have contributed to the species decline, as well as grazing by large animals (Piper, 2002). Reproductive viability at the last remaining English site has been questioned. Ova obtained in 2002 and 2003 were sterile, suggesting that inbreeding may now be affecting this critically small population (JNCC, 2010).

Conservation measures

Open glades should be maintained (Hyman & Parsons, 1992). If populations are confirmed as suffering from inbreeding, then only a captive breeding or re-introduction programme may safeguard the species in the UK.

Summaries of surveys and research related to surveillance

Notes on the ecology and distribution of this species were included in a doctoral thesis but no actual surveying took place (Piper, 2002).

Quality of data

Existing information is reliable, although little is known of the species ecology, apart from host plant information.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Cox, D. 1948. Food-plants of *Cryptocephalus 6-punctatus* L. (Col., Chrysomelidae). *Entomologist's Monthly Magazine*, **84**, 185.
- Douglas, G. 2003. Invertebrate species dossier: *Cryptocephalus sexpunctatus* Linnaeus, a leaf beetle (Coleoptera, Chrysomelidae). *Unpublished report to Scottish Natural Heritage, Edinburgh*.
- Hyman, P.S. & Parsons, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain, Part 1. UK Nature Conservation No. 3*. Peterborough: Joint Nature Conservation Committee.
- JNCC, 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/251.pdf> [Accessed 1 February 2012].
- Koch, K. 1992. *Die Käfer Mitteleuropas Oekologie. Band 3*. Goecke & Evers, Krefeld, Germany.
- Owen, J.A. 1997. Some notes on the life history of *Cryptocephalus 6-punctatus*. *Entomologist's Record*, **109**, 43-48.
- Piper, R. 2002. *Conservation of Cryptocephalus species and other threatened UK beetles*. PhD. Thesis. Leeds University.

Map data sources

Bruchid and Chrysomelid Distributions in Britain and Ireland: pre 1900, 1900-1979, 1980 onwards (Seed and Leaf Beetle Recording Scheme).
Records from the RHS insect reference collection (Royal Horticultural Society).

Species Consultants: Dave Hubble and Gabor Pozsgai

SURVEILLANCE METHODOLOGY FOR SIX-SPOTTED POT BEETLE (*Cryptocephalus sexpunctatus*)

Aim

To establish the status and distribution of *Cryptocephalus sexpunctatus* in Scotland.

Rationale

Cryptocephalus sexpunctatus is a phytophagous leaf beetle found on a range of deciduous trees. The species is believed to persist at only two UK sites and the English one has been classed as critically endangered with questions raised over reproductive viability (JNCC, 2010). The status of the Scottish population remains unknown. This species is only rarely captured and in small numbers (Warchalowski, 1991).

Approach

All previous locations should be re-surveyed to establish the status and distribution of the species in Scotland. Both adults and larvae should be looked for, given the elusive nature of the beetle and the potential for both life stages to occur simultaneously. Methods for the survey and monitoring of *Cryptocephalus* species are described in detail by Piper (2002) and outlined in brief here.

Equipment

Beating tray, sweep net.

Location

A population of *C. sexpunctatus* is believed to persist at Kirkconnell Flow NNR in Kirkcudbrightshire, although the last record was from 1996. A more recent record has been obtained from the Grantown-on-Spey area, Moray, although details are not publicly available. Historically it has been recorded from Scarwater in Dumfries & Galloway, Glen Affric area, Midlothian and Dalry Wood (Douglas, 2003) but all these records are vague. All previous locations should be surveyed to establish the species status in Scotland.

Sample units

The sample units will be the number of occupied sites. The species is only captured in small numbers, making population estimates difficult.

Sampling

Each of the sites should be visited in turn and sampled by direct search techniques as described in Piper (2002). The species should be searched among known host plants: hazel (*Corylus* sp.), aspen (*Populus tremula*), crack willow (*Salix fragilis*), hawthorn (*Crataegus* sp.) and oak (*Quercus* sp.). Damp areas may be more suitable given the presence of the species on lowland raised bog.

The adult beetle is very variable but characterised by three black spots on each elytron (Kaszab, 1962; Piper, 2002). The pronotum is black with a t-shaped yellow-orange pattern in the centre. Field identification is possible if the surveyor is familiar with the species. Following consideration of published information and expert opinion, the following guidelines on sampling protocol are recommended:

- Field sampling should be undertaken from May to early July, between 10:00 and 15:00 h.
- Rainy and windy days should be avoided.
- The surveyor should focus on searching small, isolated bushes in sheltered spots, with a south-facing aspect.
- Hand searching should be supplemented by beating and sweeping the foliage and examining any dislodged beetles on a tray. Beetles should be captured by using an aspirator before being released back onto the foliage from which they were collected. Cased larvae could be retained for breeding to confirm identification.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to note any changes in management particularly in relation to scrub encroachment, drainage, and the availability of suitable trees. Positive locations should be monitored every three years.

Time

Surveying for this species may be time consuming given the vague nature of many of the sites.

References

- Douglas, G. 2003. Invertebrate species dossier: *Cryptocephalus decemmaculatus* Linnaeus, a leaf beetle (Coleoptera, Chrysomelidae). *Unpublished report to Scottish Natural Heritage, Edinburgh*.
- JNCC, 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/251.pdf> [Accessed 1 February 2012].
- Kaszab, Z. 1962. Chrysomelidae – Levélbogarak. *Magyarország Állatvilága IX*, Akadémiai Kiadó, Budapest.
- Piper, R. 2002. *Conservation of Cryptocephalus species and other threatened UK beetles*. PhD. Thesis. Leeds University.
- Warchalowski, A. 1991. L'établissement d'un nouveau sous-genre *Homalopus* Chevrolat, 1837 (Coleoptera, Chrysomelidae, Cryptocephalinae). *Polskie Pismo Entomologiczne*, **61**, 75-78.

SPECIES REPORT FOR ZIRCON REED BEETLE (*Donacia aquatica*)

Ecology

The larvae are aquatic, feeding below the surface on the submerged parts of emergent vegetation. The adults are active in good weather during May and June. Food may include leaf material, seed coats and pollen (Foster *et al.*, 2007).

Conservation status and rarity

- Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Fluctuating - probably stable.
- IUCN Status: Not listed.
- Would appear to qualify for vulnerable status in GB (Foster *et al.*, 2007).

Distribution

In Britain, *D. aquatica* was recorded from 59 10-km squares prior to 1980 and in 14 from 1980 onwards. In Scotland, healthy populations exist on Speyside and there is an isolated population at Loch Fiart, which is unusual in that it lies on limestone (Foster *et al.*, 2007). It is likely that other sites remain undiscovered. Two new sites were located in East Inverness-shire in 2009 (Foster & Nelson, 2010) and the most recent record is from the Endrick Mouth marshes in Loch Lomond, in 2011 (G.N. Foster, *pers. comm.*).

Habitat and management

Adult reed beetles usually occur in small numbers on emergent aquatic vegetation at the margins of still and slow-moving water.

These habitats are often dominated by sedges, such as lesser pond-sedge (*Carex acutiformis*), reed sweet grass (*Glyceria maxima*) and bur-reeds (*Sparganium* spp.)

Pressures and threats

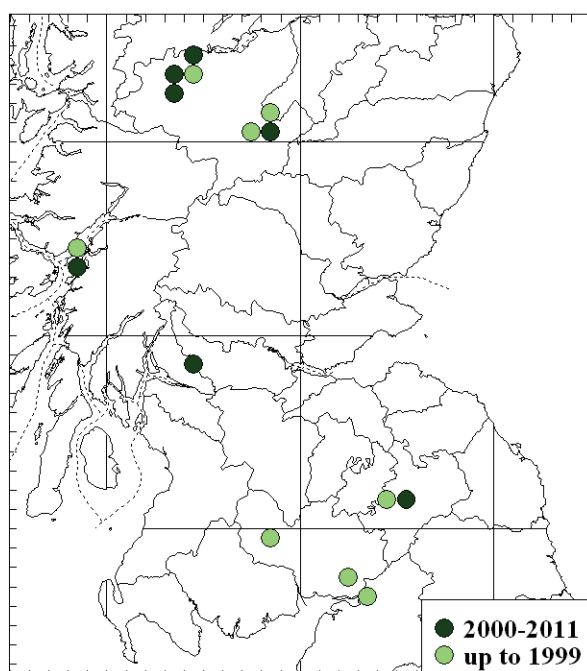
The threats to this species come mainly from water abstraction, disturbance to marginal vegetation, infilling of lakes and ponds, eutrophication (Anon, 1999) and encroachment by scrub (G.N. Foster, *pers. comm.*).

Conservation measures

Probably little in the way of specific conservation measures is carried out in Scotland. In England, encroachment by carr is kept in regular check on at least one site (Foster *et al.*, 2007).

Summaries of surveys and research related to surveillance

Surveys in 2005 of most sites with post 1980 records in Scotland revealed presence in Argyll and east-Inverness-shire (Foster *et al.*, 2007).



References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume IV: Invertebrates*. London: HMSO.
- Foster, G.N., Bratton, J.H., Ewing, A.W., Hodge, P.J. & Nobes, G. 2007. Current status of *Donacia aquatica* Linnaeus (Chrysomelidae) in Britain and Ireland. *The Coleopterist*, **16**, 25-34.
- Foster, G. & Nelson, B. 2010. Some recent records of Donaciinae in Britain and Ireland. *The Coleopterist*, **19**, 15-19.

Map data sources

- Water Beetle Surveys from Britain and Ireland (Balfour-Browne Club).
- Bruchid and Chrysomelid Distributions in Britain and Ireland: pre 1900, 1900-1979, 1980 onwards (Seed and Leaf Beetle Recording Scheme).
- HBRG Insects Dataset (Highland Biological Recording Group).
- Tullie House Museum Natural History Collections (Tullie House Museum).
- G.N. Foster (*pers. comm.*).
- Foster *et al.* (2007).
- Foster & Nelson (2010).

SURVEILLANCE METHODOLOGY FOR ZIRCON REED BEETLE (*Donacia aquatica*)

Aim

To establish surveillance suitable for determining distribution trends and presence of *Donacia aquatica* at a range of sites across Scotland. Searches of new sites should also be undertaken to give a better indication of the species' range in Scotland.

Rationale

Recent surveys have confirmed the continued presence of *D. aquatica* at a number of Scottish sites (Foster *et al.*, 2007). However, not all sites with reported records were checked. Numbers of *D. aquatica* can vary considerably due to factors such as weather conditions and whether sampling has encountered a local aggregation. Therefore site-based measures are more suitable than within-site population measures for assessing long-term trends. Nonetheless, standardising surveillance methodology will enable at least a broad assessment of population levels.

Approach

Adult *D. aquatica* are usually surveyed by a combination of searching and sweep-netting. There has been some work on associations with different sedge species. This has demonstrated apparent preferences for bottle sedge (*Carex rostrata*), bladder sedge (*C. vesicaria*) and lesser pond-sedge (*C. acutiformis*) (Foster *et al.*, 2007).

Equipment

Stiff-framed sweep net, specimen containers.

Location

Location data are contained in a number of data sets on the National Biodiversity Network Gateway while Foster *et al.* (2007) and Foster & Nelson (2010) provide some up to date locations with six figure grid references. These comprise 16 10-km squares though some may contain multiple sites. A list of all reported sites should be drawn up and, for those not visited recently, satellite imagery should be used to identify likely presence of suitable habitat. Further potential sites should be identified by consultation with aquatic Coleoptera experts or local naturalists.

Sample units

Surveillance should aim to assess temporal trends in the number of occupied sites. Standardisation of sampling will also allow broad comparisons between sites and between sampling visits.

Sampling

The usual survey method for *D. aquatica* is to search for adults in the beds of sedges followed by vigorous sweep-netting with each sample taking 15 to 20 min (Foster *et al.*, 2007). To standardize further, it is suggested that the following protocol be adopted:

- Samples should consist of 15 min searches by hand followed by 5 min of sweep-netting.

- Sampling to be carried out within the areas judged by the surveyor to be the optimum along a 50 m section area of waterside and associated water bank vegetation. At large sites, sampling should be carried out in two or more areas
- The peak months for records of *D. aquatica* are May and June (Foster *et al.*, 2007).
- Sample locations should be defined with GPS coordinates and photographs to enable relocation.

All reported *D. aquatica* sites should be visited on an initial survey. Sites where the species is recorded and other sites where the habitat is judged to be potentially suitable should then be revisited at set intervals to check for continuity of occupancy. Counts are likely to be highly variable, depending on such factors as weather conditions. For assessing continuity of presence it is suggested that the surveillance described here be repeated at three to five year intervals.

Searches further afield will primarily be speculative visits. However it is suggested that the same sampling approach is used to enable at least some comparability of numbers should *D. aquatica* be found.

Time

Each site visit may take no longer than an hour of fieldwork though larger sites where multiple areas are searched will take longer. Depending on location and accessibility, potentially several sites could be surveyed in a day.

References

- Foster, G.N., Bratton, J.H., Ewing, A.W., Hodge, P.J. & Nobes, G. 2007. Current status of *Donacia aquatica* Linnaeus (Chrysomelidae) in Britain and Ireland. *The Coleopterist*, **16**, 25-34.
- Foster, G. & Nelson, B. 2010. Some recent records of Donaciinae in Britain and Ireland. *The Coleopterist*, **19**, 15-19.

SPECIES REPORT FOR OXBOW DIVING BEETLE (*Hydroporus rufifrons*)

Ecology

Hydroporus rufifrons is a small, shiny water beetle. It is a very poor disperser and whilst flight tests have proved negative, occurrence in isolated man-made pools suggests that at least some individuals are capable of flight (Douglas, 2003; Foster, 2010). Very little is known regarding its life history. It may be under-recorded due to its very brief period of adult activity in the autumn and spring.

Conservation status and rarity

- UK BAP Priority Species.
- Scottish Biodiversity List.
- Great Britain Status: Endangered.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Declining (continuing/accelerating).
- IUCN Status: Not listed.

Distribution

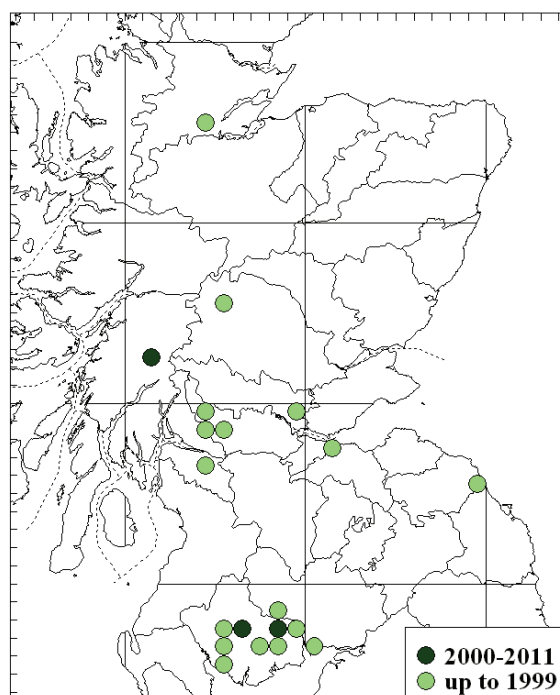
There are post-1980 records in Britain for Ceredigion, North Lincolnshire, Mid-west Yorkshire, Westmorland, North Northumberland, Kirkcudbright, Dumfries, Stirling, Mid Perth and Argyll. However the species is reported to have suffered a very high decline rate. It was recently thought to be confined to Galloway and the southern Lake District (Foster *et al.*, 2008) but was also rediscovered at the former Ceredigion site in 2011 (G.N. Foster, *pers. comm.*). The last specimens in the southern Highlands were found in 2001 (Douglas, 2003).

Further afield there are populations scattered throughout northern and central Europe from France in the West across to western Siberia.

Habitat and management

Hydroporus rufifrons occurs in shallow and temporary or fluctuating pools in unimproved pasture. It is often found in old oxbow systems, usually in association with rushes and submerged vegetation such as mosses. Key features of the sites known to support large populations are water level fluctuation, marginal sedge or rush tussocks and abundant pleurocarpous mosses and fine grasses (Foster, 2010).

Hydroporus rufifrons has apparently been lost from several sites receiving protection for their insect fauna, but has survived at sites where its value is less well regarded. Recognition of the importance of relict temporary pool systems is essential, in particular the value of isolated oxbow systems in agricultural land. Scrub clearance may aid persistence at some sites (Foster, 2010).



Pressures and threats

The habitat for *H. rufifrons* is vulnerable to agricultural intensification through such activities as floodplain drainage and eutrophication caused by fertilizer or manure application (Foster *et al.*, 2007). Sites might also be destroyed by inundation, and it is suspected that some former sites have been lost through construction of reservoirs for hydroelectric schemes and drinking water supplies. One site in Scotland is on the edge of a golf course and may, therefore, be at risk from habitat damage by eutrophication and works to 'tidy up' such water bodies. A former site in Wales, Kidwelly Castle, has been lost through such works. Lack of grazing, leading to overgrowth by scrub, has also destroyed some habitats (Foster, 2010). A further risk is that sites for this species are frequently too small to benefit from any statutory designation such as SSSI status (G.N. Foster, *pers. comm.*).

Conservation measures

Reintroduction work is in progress at sites in England (Foster, 2009) and lessons learnt may be useful should such action be carried out at Scottish sites.

Summaries of surveys and research related to surveillance

Six of the known Scottish sites in Dumfries & Galloway were investigated in 2004-06 and three of these were found to be occupied (Douglas, 2003).

References

- Douglas, G. 2003. Invertebrate species dossier: *Hydroporus rufifrons* Mueller, A water beetle (Coleoptera: Dytiscidae). *Unpublished report to Scottish Natural Heritage, Edinburgh*.
- Foster, G.N. 2009. Update on the UK biodiversity action plan. *Latissimus*, **25**, 31-32.
- Foster, G.N. 2010. *A review of the scarce and threatened Coleoptera of Great Britain Part (3): Water beetles of Great Britain. Species Status 1*. Peterborough: Joint Nature Conservation Committee.
- Foster, G.N., Bilton, D.T. & Routledge, S. 2007. Further notes on *Synaptus filiformis* Fabricius (Elateridae) and *Hydroporus rufifrons* (Müller) (Dytiscidae) in Westmorland. *The Coleopterist*, **16**, 135-137.
- Foster, G.N., Bilton, D.T., Routledge, S. & Eyre, M.D. 2008. The past and present statuses of *Hydroporus rufifrons* (Müller) (Dytiscidae) in Great Britain. *The Coleopterist*, **17**, 51-63.

Map data sources

Water Beetle Surveys from Britain and Ireland (Balfour-Browne Club).
Foster *et al.* (2008).

SURVEILLANCE METHODOLOGY FOR OXBOW DIVING BEETLE (*Hydroporus rufifrons*)

Aim

The main aim is to monitor continuity of occupation at the few remaining Scottish sites and to establish if further sites are occupied.

Rationale

Although formerly more widespread, in Scotland *Hydroporus rufifrons* is now thought to be restricted to Galloway. Three of six sites checked in 2004-06 were found to be occupied. Given the serious apparent decline and small number of remaining sites, it is important that these locations are closely and regularly monitored.

This species can be overlooked, given its small size and brief activity period. Although a number of promising sites have been searched in recent years (Foster *et al.*, 2008), further checks are justified of these and other potential sites, especially those with old records.

Approach

The range of this species in Scotland now appears to be very restricted. All sites with recent records should be regularly monitored to ensure continuity of occupancy. Survey is principally carried out simply by searching likely areas with a pond net. This beetle is easily missed, so it should not be assumed to be absent if not recorded on a particular survey. There are a handful of records in England from newly constructed ponds (Foster, 2010). Hence it is recommended that all potential sites within a 1 km radius of occupied sites are also visited.

Equipment

Long-handled pond net.

Location

A register of all sites with reports of this species should be assembled. There are 20 10-km squares mapped in the species report though some of these may contain multiple sites. Data for these squares are held by the Balfour-Browne Club and available through the National Biodiversity Network Gateway and supplemented by Foster *et al.* (2008). There are a few further reports on the NBN Gateway but these must be considered to be unverified.

It is suggested that satellite images are viewed to identify further potentially suitable water bodies within a 1 km radius of sites with records of the species.

Sample units

The surveillance described here is aimed at establishing the number of occupied Scottish sites for *H. rufifrons*.

Sampling

Hydroporus rufifrons is not easy to find so site visits are mainly geared towards simply establishing presence. There is a danger of causing damage to waterside habitat so expert judgement should be used in site visits to determine how much searching is appropriate. The following principles should guide searches for the species

- *Hydroporus rufifrons* has short activity periods; it is best searched for in April or September (Foster *et al.*, 2008).
- Shallow water should be searched with a pond net.
- Occupied sites should be revisited every three to five years.
- Sites without recent records should be visited on at least two of these cycles, before absence of the species is assumed to be likely, unless the habitat has been judged to have changed and to be no longer suitable.
- Potentially suitable sites near occupied sites should be examined in a similar way.

Time

Depending on site location and the number of additional water bodies in the vicinity, it is likely that surveys will cover one to two sites per day.

References

- Foster, G.N. 2010. Some additional records of *Hydroporus rufifrons* (Müller) (Dytiscidae) in England and Scotland. *The Coleopterist*, **19**, 151-153.
- Foster, G.N., Bilton, D.T., Routledge, S. & Eyre, M.D. 2008. The past and present statuses of *Hydroporus rufifrons* (Müller) (Dytiscidae) in Great Britain. *The Coleopterist*, **17**, 51-63.

SPECIES REPORT FOR VIOLET OIL-BEETLE (*Meloe violaceus*)

Ecology

The larvae of *M. violaceus* are parasitic, requiring bee nests of a sufficient size as hosts, and the bees themselves must be of a certain size to support their oil beetle parasites (Ramsay, 2002). Bees of the genera *Andrena*, *Anthophora*, *Osmia* are likely hosts (JNCC, 2010) and possibly *Lassioglossum* (Ramsay, 2002).

Adult beetles are active from late March to June (Ramsay, 2002) and feed on the leaves and petals of spring flowering plants such as buttercups (*Ranunculus* spp.), (Smith, 1992) and grasses (Buglife, 2011). There is no evidence that the adult beetles can fly (Owen, 1992). Females dig nest burrows in bare ground into which they lay eggs (Buglife, 2011); this is one of the reasons they are commonly found on paths (Ramsay, 2002). Once hatched, the larvae climb onto flowers to await a suitable bee which they hook onto. In the host nest, they feed on their eggs and on pollen and nectar stores (Buglife, 2011).

Conservation status and rarity

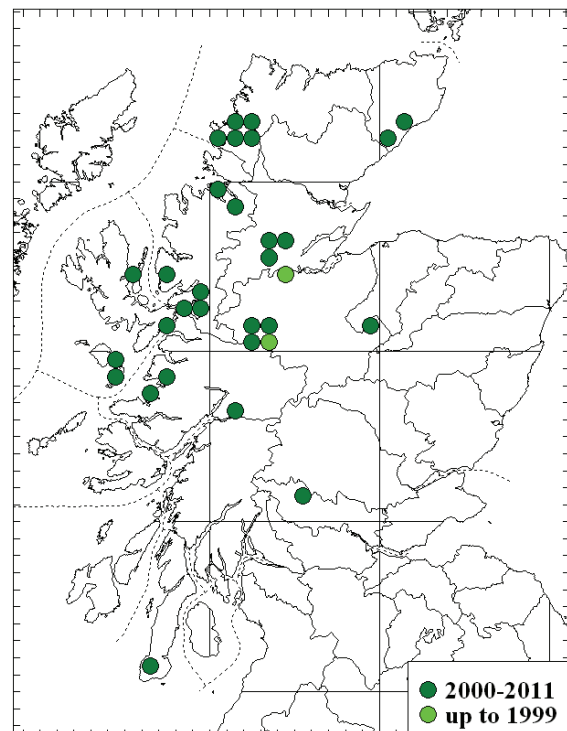
- *Notable* (Hyman & Parsons, 1992).
- UK Biodiversity Action Plan (BAP): Species of conservation concern – this species has suffered an estimated 25-30% decline in range between 1985 and 2005.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

In Scotland, the beetle has a north-westerly distribution occurring as far north as Sutherland (Ramsay, 2002), Campbeltown in the south, and Mar Lodge in the east (Owen, 1992). However, this is likely to be an artefact of recording efforts by the Highland Biological Recording Group. A number of recent records are held with Buglife following a public awareness campaign in 2011. These records confirmed the beetle's presence at sites such as Mar Lodge (H. Wiswell, *pers. comm.*), and added new sites such as Glen Finglas (N. Littlewood, *pers. obs.*). It has a scattered distribution throughout England.

Habitat and management

Meloe violaceus prefers sunny, dry areas with plenty of flowering plants. It is found primarily on sandy areas in moorland, but also on coastal grassland, heathland, open woodland (Ramsay, 2002) and in pine woods (J. Stockan, *pers. obs.*). It has been found from sea level to 796 m altitude (Owen, 1992). In England, it has regularly been found on lower heathland and rough high pasture on sheltered *Juncus/Sphagnum* patches (Smith, 1992).



Pressures and threats

Meloe violaceus is reliant on the health and diversity of wild bees, which are threatened by the loss and degradation of suitable habitat (JNCC, 2010). In particular, the loss of grassland and heath to arable and forestry, agricultural improvement and stabilization of cliff grasslands may adversely affect the bees. High altitude sites may be affected by climate changes (Ramsay, 2002).

Conservation measures

Research to establish host species (not known in many areas) would help ensure the habitat is managed correctly.

Summaries of surveys and research related to surveillance

Buglife carried out a public campaign in 2011 to raise awareness and request sightings of oil beetles.

Quality of data

This species is likely to be under-recorded and the distribution pattern biased to those areas where efforts have been focused (e.g. Highland region).

References

- Buglife. 2011. *Join the hunt for amazing oil beetles*. Publicity leaflet.
- Hyman, P.S. & Parsons, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain, Part 1. UK Nature Conservation No. 3*. Peterborough: Joint Nature Conservation Committee.
- JNCC, 2010. *UK Priority Species data collation*. [online] Available at: http://jncc.defra.gov.uk/_speciespages/2423.pdf [Accessed 1 February 2012].
- Owen, J.A. 1992. High-altitude *Meloe* with presumed high-altitude host. *The Coleopterist*, **1** (1), 5.
- Ramsay, A. 2002. British Oil Beetles. *British Wildlife*, **14** (1), 27-30.
- Smith, E.J. 1992. *Meloe violaceus* Marsham (Meloidae). *The Coleopterist*, **1** (2), 18.

Map data sources

- HBRG Insects Dataset (Highland Biological Recording Group).
- Commissioned surveys and staff surveys and reports for SWT reserves (Scottish Wildlife Trust).
- Haley Wiswell (*pers. comm.*).
- Nick Littlewood (*pers. obs.*).

SURVEILLANCE METHODOLOGY FOR VIOLET OIL-BEETLE (*Meloe violaceus*)

Aim

To establish the distribution of *Meloe violaceus* in Scotland.

Rationale

Meloe violaceus is parasitic in its larval stage, requiring spring nesting bees of the genera *Andrena*, *Anthophora*, *Osmia* (JNCC, 2010) and possibly *Lassioglossum* (Ramsay, 2002) as hosts. The current distribution of *M. violaceus* is likely, to some extent, to reflect recording effort biased towards the area covered by the Highland Biological Recording Group. The majority of these records are current. In 2011, Buglife initiated a publicity campaign to raise awareness of the beetle and to request records, which were not available at the time of the report. It is possible that this beetle is under-recorded and it is likely to occur at further sites.

Approach

Surveillance should focus on re-surveying sites with older records and surveying new areas with the potential to host *M. violaceus* populations. Sites with records from the last five years need not be checked in the initial phase of surveying. Survey and monitoring should focus on visual searching and pitfall trapping.

Equipment

Pitfall traps - plastic cups (suggested 11.5 cm diameter and 1 L volume).

Location

This species has been found at numerous locations across Scotland, particularly in the north and west. Surveillance should begin at those sites for which there are older records and then be extended to include selected areas south and east of its current range that contain suitable habitat and host species.

Sample units

The sample units will be the number of occupied sites. Given the fairly widespread distribution of this species, population estimates may be time consuming but could be focused on one or two key locations. Population size could be estimated from a fixed number of pitfall traps over a set area, or from walking fixed-line transects.

Sampling

Adult beetles can be found by visual searching or by pitfall trapping. Visual searching should be carried out by scanning footpaths and searching near patches of flowering plants, especially buttercup (*Ranunculus* spp.). Also search indirectly by looking for potential host bees and nest sites as the beetles may be present nearby.

Pitfall traps should be used dry without any preservative. A few leaves of buttercup should be added to provide food and shelter. Traps should be placed in suitable areas (e.g. among flowering plants, in sandy soils) and distanced from each other by 10 m. Traps should be checked daily and any captured beetles noted and released. Further details on this sampling method can be found in Woodcock (2005).

Following consideration of published information, the following guidelines on sampling protocol are recommended:

- Field sampling should be undertaken in spring, from late March to June.
- Sampling should be carried out on warm, sunny days between 10:00 and 15:00 h, when the beetles are more active.
- This species is relatively straightforward to identify in the field due to its large size, colour and characteristically shaped pronotum. Specimens should not be taken.
- Care must be taken when handling this species because of the toxic oil they produce as a defence mechanism.
- More than one visit may be required to confirm the species' presence.

The surveyor should make some assessment of the quality and condition of the habitat for both the beetle and its hosts. It would be useful to record any changes to sites that may reduce the suitability for the host bees such as changes in management or succession. The presence of suitable hosts should be recorded if possible. Positive locations should be monitored every five to 10 years.

Time

Each site could be surveyed in one day. An additional day would be required to check pitfall traps.

References

- Buglife. 2011. *Join the hunt for amazing oil beetles*. Publicity leaflet.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2423.pdf> [Accessed 1 February 2012].
- Ramsay, A. 2002. British Oil Beetles. *British Wildlife*, **14** (1), 27-30.
- Woodcock, B.A. 2005. Pitfall trapping in ecological studies. *In*: Leather, S. (ed) *Insect sampling in forest ecosystems*. Oxford: Blackwell Publishing, pp. 37-57.

SPECIES REPORT FOR PALE PIN-PALP (*Bembidion testaceum*)

Ecology

Bembidion testaceum is a predaceous ground beetle that inhabits exposed riverine sediments (ERS) (Luff, 1998; Anon, 1999; Sadler *et al.*, 2005). It is fully winged and readily flies (Sadler *et al.*, 2005). This is a spring breeding species (Luff, 1998) that undergoes larval development and pupation during the summer, emerging in late summer and overwintering as a first year imago (Turin, 2000). Peak abundance of adults occurs in mid-summer (July) but a reasonable number of individuals are still active by September. It has not been recorded at over 80 m in the UK, tending to frequent the mid to lower reaches of rivers (Sadler *et al.*, 2005).

Conservation status and rarity

- *Nationally Scarce* (B) (Hyman & Parsons, 1992).
- UK Biodiversity Action Plan (BAP): Species of conservation concern – this species has suffered significant declines over the last 50-100 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Fluctuating - probably declining.
- IUCN Status: Not listed.

Distribution

There is one historic and unconfirmed record on the River Irvine (Fowler, 1887; Luff, 1998; Sadler *et al.*, 2005). It has a restricted, patchy distribution with a western bias elsewhere in Britain (Sadler *et al.*, 2005). Populations persist on the Rivers Usk and Monnow in Wales, and the Rivers Teme, South Tyne, Devil's Water and Tyne in England (Sadler *et al.*, 2005). Generally it occurs in low numbers (Sadler *et al.*, 2005). Britain is the northern and western limits of its range, but it is widely distributed in mainland Europe (Anon, 1999).

Habitat and management

The habitat of the species is relatively well known: unconsolidated, non-vegetated sediment of varying sizes ranging from pebbles to cobbles underlying coarse and clean sands (Sadler *et al.*, 2005). It is typically found alongside small to medium rivers and always tied to catchments with hard rock that erodes to produce coarse sandy sediments (Sadler *et al.*, 2005). It is also found in sand and gravel by slow running or standing water, gravel pits and at the base of river cliffs (Anon, 1999; Sadler *et al.*, 2005).

Pressures and threats

Habitat loss and degradation, agricultural practices and invasive species have been identified as factors contributing to this species' decline. *Bembidion testaceum* is likely to have been affected by land use changes and development on riparian habitats (Anon, 1999). Riparian habitats have been lost or degraded through river engineering, e.g., straightening, dredging, damming, flood management schemes, sand and gravel removal and water abstraction (Anon, 1999; JNCC, 2010). Furthermore, agricultural intensification resulting in drainage, nutrient enrichment and siltation (Sadler *et al.*, 2005) on riverside shingle and other river-bank features will further degrade habitats.(Anon, 1999). Heavy trampling by livestock will have a deleterious impact on the sediments, causing compaction and possibly additional siltation via enhanced erosion. These areas are subsequently vulnerable to colonisation by non-native invasive species such as Himalayan balsam (*Impatiens glandulifera*) (Anon, 1999).

Conservation measures

Sites should be appropriately managed to conserve functional ERS (JNCC, 2010) including the maintenance or restoration of appropriate flow regimes (Anon, 1999). The following engineering works should be avoided: damming, impoundment, embankments, revetment (and other flood defence techniques that effect river banks) and weirs (Sadler *et al.*, 2005). Catchment management plans should consider the implications of land use changes (e.g. increases in hard surfaces, stocking densities, etc.) and the effect these may have on river sedimentation and nutrient enrichment. It may be necessary to restrict livestock access to the riparian margin (Sadler *et al.*, 2005).

Summaries of surveys and research related to surveillance

While substantial efforts were made to survey English populations during 2004, no surveys have been carried out in Scotland for this species. The carabid recording group have received no records from Scotland (Luff, 1998).

Quality of data

It is difficult to distinguish this species from some other *Bembidion*, and older records may be unreliable. There is evidence that some museum specimens have been misidentified (Sadler *et al.*, 2005).

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Fowler, W.W. 1887. *The Coleoptera of the British Isles*. Vol. 1. London: Reeve.
- Hyman, P.S. & Parsons, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain, Part 1. UK Nature Conservation No. 3*. Peterborough: Joint Nature Conservation Committee.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/143.pdf> [Accessed 1 February 2012].
- Luff, M.L. 1998. *Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain*. Huntingdon: Biological Records Centre.
- Sadler, J.P., Bell, D. & Hammond, P.M. 2005. *Assessment of the distribution of Bembidion testaceum and reasons for its decline*. Bristol: Environment Agency.
- Turin, H. 2000. *De Nederlandse loopevers, verspreiding en oecologie (Coleoptera: Carabidae)*. Leiden: KNNV Publishing.

SURVEILLANCE METHODOLOGY FOR PALE PIN-PALP (*Bembidion testaceum*)

Aim

To establish the presence of *Bembidion testaceum* in Scotland.

Rationale

Bembidion testaceum is a ground beetle living on exposed riverine sediments (ERS) (Sadler *et al.*, 2005). There are few records for the species in the UK and only one unconfirmed historical record for south-west Scotland.

Approach

Given the date and nature of the only Scottish record, it would be advisable to confirm the record by locating a specimen, before pursuing any surveillance work. Several older museum specimens of *B. testaceum* have been misidentified (Sadler *et al.*, 2005) and this possibility should be considered.

If identification is confirmed, then surveillance can focus on establishing continued presence of the species in Scotland by re-surveying the last and only known location at Irvine together with adjacent locations along the same stretch of river.

Methods for the survey and monitoring are described in detail following a survey of English and Welsh sites in 2002-03 (Sadler *et al.*, 2005). These methods are summarized below and comprise timed hand searching and sieving of sediments. Hand searches should be carried out by the procedure outlined by Anderson (1969) and adapted by Plachter (1986) and Fowles (1989). For sediment sieving refer to Sadler *et al.* (2005).

Equipment

Microscope, fine mesh sieve.

Location

The only Scottish record for this species is on the River Irvine at Irvine (Sadler *et al.*, 2005), but more precise details are not available. Suitable locations on this river should be selected based on known habitat preferences and expert judgment.

Sample units

The sample units will simply be the presence or absence of the species. If the species occurs in reasonable numbers then timed hand searching could provide an estimate of abundance.

Sampling

In England and Wales the species is found on sand and gravel by slow running or standing water, gravel pits and at the base of river cliffs. At the microhabitat scale it is found on unconsolidated, non-vegetated sediment of varying sizes ranging from pebbles to cobbles underlying coarse and clean sands (Anon, 1999; Sadler *et al.*, 2005).

Following published information and expert opinion, the following guidelines on sampling protocol are recommended:

- Field sampling should be undertaken in mid-summer (July) when adult numbers are at peak abundance.
- Hand searches should concentrate on turning stones and capturing beetles with an aspirator.
- Coverage of sediment types across the ERS should start at the waterside and progress laterally towards the upper bank.
- Two searches should be carried out on two locations, 20 min each.
- Timed hand searching should be supplemented by sieving of sediments at intervals along the site. Dislodged beetles can be collected with a fine sieve.
- This species is difficult to identify and easily confused with other *Bembidion* beetles, particularly *B. decorum* and *B. fluviatile*. Identification should be carried out on site with the use of a microscope. Specimens should be returned and released at the site of collection.

The surveyor should make some assessment of the quality and condition of the habitat. It is important to record details of changes in surrounding land use, river modifications, livestock numbers and evidence of succession including the presence of invasive non-native plant species. Positive locations should be monitored every three years.

Time

Surveillance would be expected to take one to two days.

References

- Anderson, J. 1969. Habitat choice and life history of *Bembidion* (Col., Carabidae) on river banks in central and northern Norway. *Norsk Entomologisk Tidsskrift*, **17**, 17-65.
- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Fowles, A.P. 1989. The Coleoptera of shingle banks on the River Ystwyth, Dyfed. *Entomologist's Record*, **101**, 209-221.
- Plachter, H. 1986. Composition of the carabid beetle fauna of natural riverbanks and of man-made secondary habitats. In: den Boer, P.J., Luff, M.L., Mossakowski, D. & Weber, F. (eds) *Carabids: Their Adaptations and Dynamics*. Stuttgart: Gustav Fisher, pp. 509-535.
- Sadler, J.P., Bell, D. & Hammond, P.M. 2005. *Assessment of the distribution of *Bembidion testaceum* and reasons for its decline*. Bristol: Environment Agency.

SPECIES REPORT FOR SHINGLE ROVE BEETLE (*Meotica anglica*)

Ecology

Meotica anglica is a rove beetle living under stones on exposed riverine sediments (ERS). It is mainly subterranean, rarely seen on the surface. The species has been recorded from February to August (Douglas, 2003).

Conservation status and rarity

- *Nationally scarce* (Hyman & Parsons, 1992), possibly endemic.
- UK Biodiversity Action Plan (BAP).
- UK 2008 Biodiversity Reporting Round, Scottish trend: no clear trend.
- IUCN Status: Not listed.

Distribution

This is a very local species. In Scotland, there are records from one site from 1981 to 1987. This site is adjacent to the Northhouse burn, a tributary of the River Teviot upstream of Hawick in the Scottish Borders, grid reference NT4406 (Douglas, 2003). These records derive from the Scottish Invertebrate Site Register dataset which contains errors. However, at least one of the four records appears credible.

Meotica anglica is also known from scattered locations in south west England and Wales (Douglas, 2003). Although a suspected endemic species, there is a possible record from Holland (JNCC, 2010).

Habitat and management

Meotica anglica is found under stones on ERS ranging from sand to fine shingle on river and stream sides (Douglas, 2003; JNCC, 2010). There are single records from a sandy, grassy bank up to 10 m from the water and from the nest of a mole (Owen, 1992).

Pressures and threats

As with other riparian specialists, *M. anglica* is likely to have been affected by land use changes that impact upon ERS habitats. Habitat loss and degradation can be attributed to river engineering (e.g. straightening, flood management schemes), sand and gravel removal, and water abstraction. Agricultural intensification resulting in drainage, pollution, nutrient enrichment and siltation together with livestock encroachment on riverside shingle will have further degraded habitats. Alteration of the natural flood dynamics leaves these habitats vulnerable to colonisation by non-native invasive species such as Himalayan balsam (*Impatiens glandulifera*) (Douglas, 2003).

Conservation measures

This species will benefit from more sympathetic management of rivers, preserving the functional integrity of its ERS habitats (Douglas, 2003; JNCC, 2010).

Summaries of surveys and research related to surveillance

There have been no targeted surveys for this species in Scotland. A work programme was initiated in 2010 to establish suitable sampling methods for monitoring populations and

determine environmental factors affecting populations that could be translated into habitat conservation objectives (JNCC, 2010).

Quality of data

Almost certainly under-recorded because of its subterranean habit and small size (1.3-1.5 mm) (Joy, 1932).

References

- Douglas, G. 2003. *Invertebrate species dossier: Meotica anglica Benick. A rove beetle. (Coleoptera, Staphylinidae). Scottish Natural Heritage unpublished report, Edinburgh.*
- Hyman, P.S. & Parsons, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain, Part 1. UK Nature Conservation No. 3.* Peterborough: Joint Nature Conservation Committee.
- JNCC. 2010. *UK Priority Species data collation.* [online] Available at: <http://jncc.defra.gov.uk/_speciespages/448.pdf> [Accessed 1 February 2012].
- Joy, N.H. 1932. *British Beetles.* London: H. F. & G. Witherby.
- Owen, J. A. 1992. *Meotica anglica* Benick (Col.: Staphylinidae) in Surrey. *Entomologist's Record*, **104**, 69-70.

SURVEILLANCE METHODOLOGY FOR SHINGLE ROVE BEETLE (*Meotica anglica*)

Aim

To establish the status of *Meotica anglica* in Scotland.

Rationale

Meotica anglica is a tiny (1.3-1.5 mm) beetle that lives under stones on exposed riverine sediments (ERS) (Anon, 1999; JNCC, 2010). It has been recorded from one site in Scotland and there are no recent records, possibly due to the difficulty of finding the beetle. This species is almost certainly under-recorded because of its subterranean habit and small size (Joy, 1932).

Approach

Initially attempts should be made to find and locate the original source of the records for this species and, if possible, a specimen. Thus confirmed, surveillance should focus primarily on establishing whether the species occurs in Scotland by re-surveying the last and only known location together with adjacent areas of suitable habitat.

Riverine beetles are effectively sampled by a variation of the quadrat search method (Anderson, 1995). This method has the advantage of enabling an estimate of the density of beetles by using a fixed sample area.

Equipment

Fine mesh sieve, 1.5 x 1.5 m quadrat.

Location

The only Scottish record for this species is on the Northhouse burn tributary of the River Teviot upstream of Hawick in the Scottish Borders (Douglas, 2003). This location should be surveyed as well as nearby areas (within 3 km) with similar characteristics.

Sample units

The sample units should be the number of individuals estimated from fixed area searches and multiplied to the total area of suitable habitat.

Sampling

Adult beetles can be by the quadrat hand search method. Further details are given in Anderson (1995) but summarized here. It involves searching a known area of sediments, removing all surface armour (top layer of gravel or pebbles) and dousing the sediments with water in the process.

Following published information, the following guidelines on sampling protocol are recommended:

- Field sampling should be undertaken between February and July.
- Sampling should commence as close to the previously recorded locations as possible and be extended 3 km up and downstream.

- Each sediment bar should be sampled twice with a 1.5 x 1.5 m quadrat in areas with fine sediment.
- The surface armour should be removed and the sediments doused with water.
- Dislodged beetles can be collected in a fine sieve.
- The total area of suitable habitat should be estimated.
- This species is difficult to identify and specimens are likely to require microscopic examination.

The surveyor should make some assessment of the quality and condition of the habitat. It is important to record details of changes in surrounding land use, river modifications, livestock numbers and evidence of succession including the presence of invasive non-native plant species. Positive locations should be monitored every five years.

Time

Surveying the small area described should only take one to two days; however, identification of specimens may take longer.

References

- Anderson, J. 1995. A comparison of pitfall trapping and quadrat sampling of Carabidae (Coleoptera) on river banks. *Entomologica Fennica*, **6**, 65–77.
- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Douglas, G. 2003. Invertebrate species dossier: *Meotica anglica* Benick. A rove beetle. (Coleoptera, Staphylinidae). *Scottish Natural Heritage unpublished report, Edinburgh*.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/448.pdf> [Accessed 1 February 2012].
- Joy, N.H. 1932. *British Beetles*. London: H. F. & G. Witherby.
- Owen, J.A. 1992. *Meotica anglica* Benick (Col.: Staphylinidae) in Surrey. *Entomologist's Record*, **104**, 69-70.

SPECIES REPORT FOR MAB'S LANTERN (*Phylorhizus quadrisignatus*)

Ecology

This small arboreal and nocturnal beetle lives on broadleaved trees. It is fully winged and breeds in spring or early summer (Luff, 1998, 2007).

Conservation status and rarity

- UK Red Data Book 1: *Endangered*.
- UK Biodiversity Action Plan (BAP): Species of conservation concern – this species has suffered a 63% decline over 40 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

There is one historic (1943) Scottish record from St. Andrews (Luff, 1998) but its validity has been questioned (M. Telfer, *pers. comm.*). Elsewhere in Britain it is known from scattered records from south and central England (Luff, 1998). It was last found at Bushy Park, London, in 2006 (M. Telfer, *pers. comm.*). It occurs across central and southern Europe (Luff, 1998) but also from Sweden (Dufberg, 1969).

Habitat and management

The species is found in broadleaved and pasture woodlands (Luff, 1998), and shrubby land (Luff, 2007). It occurs under bark on deciduous trees or amongst dead twigs, shrubs, branches and litter on slightly damp ground (Luff, 1998; 2007; JNCC, 2010).

Pressures and threats

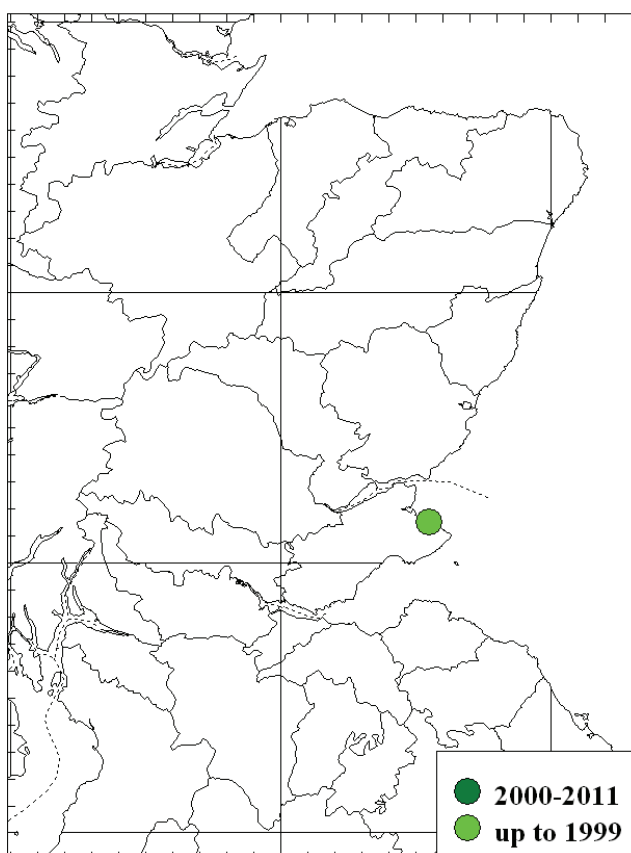
Eucantharomyces introflexus is a known parasite in Europe (Santamaria, 1994).

Conservation measures

Wider countryside measures to conserve functional broadleaved woodlands and pasture woodlands should benefit this species.

Summaries of surveys and research related to surveillance

There has been no targeted surveillance for the species in Scotland.



Quality of data

Good.

References

Dufberg, A. 1969. *Dromius quadrisignatus* Coleoptera Carabidae new for Sweden. *Opuscula Entomologica*, **34**, 131-132.

JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/272.pdf> [Accessed 1 February 2012].

Luff, M.L. 1998. *Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain*. Huntingdon: Biological Records Centre.

Luff, M.L. 2007. The Carabidae (ground beetles) of Britain and Ireland. In: *Handbooks for the identification of British insects*, volume 4, part 2 (2nd edition). St Albans: Royal Entomological Society.

Santamaria, S. 1994. New species and records of *Eucantharomyces*, with remarks on their perithecial apex. *Mycological Research*, **98**, 1303-1308.

Map data sources

Carabid data for Great Britain from the Ground Beetle Recording Scheme held by BRC (Ground Beetle Recording Scheme).

SURVEILLANCE METHODOLOGY FOR MAB'S LANTERN (*Philorhizus quadrisignatus*)

Aim

To establish the status of *Philorhizus quadrisignatus* in Scotland.

Rationale

This arboreal species has not been seen in the UK since 1987 (JNCC, 2010). A record from near St. Andrews (Luff, 1998) has been questioned (M. Telfer, *pers. comm.*). There has been no targeted surveying for this species and very little known about its ecology.

Approach

Before surveillance commences, the original Scottish record for this species should be sought and the specimen's identification verified. If the record can be confirmed, then the original location should be re-surveyed together with areas of suitable habitat nearby.

By analogy to related arboreal species, it is believed that nocturnal torching of tree trunks is the best survey method (JNCC, 2010). Pitfall trapping may prove productive.

Equipment

Beating tray and stick.

Location

The historic Scottish record for this species from St. Andrews (Luff, 1998) should act as a starting point. However, there is only a four-figure grid reference, some time may be needed for searching suitable habitat. If surveillance confirms the existence of the species, then search could be extended to other sites with similar habitats characteristics.

Sample units

The sample units will be the number of individuals found per site based on timed searching or fixed pitfall traps.

Sampling

Adult beetles could be expected to be found under bark on deciduous trees, and on the ground amongst dead twigs, shrubs, branches and litter on slightly damp ground (Luff, 1998; 2007; JNCC, 2010). Sites should be sampled by visual searching and pitfall trapping. Both nocturnal and daytime sampling may be required. This species is readily identifiable in the field.

Pitfall trapping is a commonly used sampling technique for ground beetles. Given the presumed rarity of the species, and the fact that it can be identified in the field, pitfall traps should not contain preservatives. The traps should be plastic cups (suggested 11.5 cm diameter and 1 L volume) placed in suitable areas close to deciduous trees and emptied daily.

Following published information and expert opinion, the following guidelines on sampling protocol are recommended:

- Field sampling should be undertaken during late spring and summer (May until July) when adult numbers are likely to be at peak abundance.
- Deciduous trees should be searched at night with a torch. Care should be exercised not to damage the habitat when looking for this beetle under bark.
- Each tree should be searched for 15 min.
- Sampling should be carried out on warm, dry nights when the beetles are more likely to be active.
- During the day searches should be made amongst litter and woody ground debris. Beetles can be collected with an aspirator to confirm identification before being released.
- Voucher specimens should be collected from new sites.

Positive locations should be monitored every five years. The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record details of changes in management or succession. Details of the microhabitats in which the beetles are found should be noted and could provide valuable information for future monitoring.

Time

Two days should be sufficient to survey the original site. Following positive confirmation of the species at its previous location, further sites would require more time.

References

- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/272.pdf> [Accessed 1 February 2012].
- Luff, M.L. 1998. *Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain*. Huntingdon: Biological Records Centre.
- Luff, M.L. 2007. *The Carabidae (ground beetles) of Britain and Ireland*. Handbooks for the identification of British insects, volume 4, part 2 (2nd edition). St Albans: Royal Entomological Society.

SPECIES REPORT FOR MARSH FRITILLARY (*Euphydryas aurinia*)

Ecology

Eggs are laid on the larval food plant, devil's-bit scabious (*Succisa pratensis*), in May and June. Caterpillars emerge after three weeks and live inside a communal silk web that they spin on or adjacent to the food plant. Caterpillars overwinter in a small hibernaculum web, usually placed within or under a tussock, which provides insulation. The caterpillars emerge again in early spring and bask communally on top of the vegetation. They begin to disperse in their fifth instar, usually in April, and are solitary by the sixth and final instar. They pupate close to the ground in May. Adults emerge from late May or early June with the flight period lasting until mid-July (Fox *et al.*, 2006). *Euphydryas aurinia* populations fluctuate greatly, occasionally reaching high densities. These fluctuations appear to be driven by parasitic braconid wasps (*Cotesia* spp.) as well as by the weather. Large fluctuations can cause extinction of small, isolated colonies and greatly reduce numbers even at large well-connected colonies.

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- Annex II of the EC Habitats Directive.
- Appendix II of the Bern Convention.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Increasing.
- IUCN Status: Not listed.

Distribution

In Scotland, *E. aurinia* is found primarily on Islay, Jura, Lismore and Mull and adjacent parts of mainland Argyll from Whitehouse north to Duror with a handful of colonies on Morvern (Fox *et al.*, 2006). Most other British colonies are in SW and central England and west Wales, with isolated reintroduced colonies in Cumbria. The species occurs fairly widely through Ireland (form *hibernica*) and, further afield, from Western Europe to Korea. The species was formerly much more widespread in Britain. It experienced a 46% decline between the periods 1970-82 and 1995-2004, with a 73% population decline from 1983 to 2004 (Fox *et al.*, 2006).

Habitat and management

As the *E. aurinia* larvae spend most of their lives in communal webs, they require pockets of abundant *S. pratensis*, ideally in a patchwork of short and tall vegetation. These sites typically have been subject to low intensity agriculture and are optimally maintained by low-level livestock grazing. Due to the varied nature of *E. aurinia* sites in Scotland, a generic grazing regime does not suit all sites. Generally cattle and ponies are better than sheep at maintaining sites in suitable condition. The species may benefit from taller autumn vegetation resulting from low-intensity grazing although there may be an optimum height above which density of *S. pratensis* declines (Smee *et al.*, 2011).

Pressures and threats

The main threat is habitat loss and degradation mainly through over- and under-grazing but also draining, ploughing, topping and reseeded to improve grassland productivity. Due to the metapopulation structure of *E. aurinia*, landscape scale habitat degradation may threaten colonies where conditions remain suitable (Fowles & Smith, 2006). Indeed it is thought likely

that colony isolation can lead to loss of genetic diversity and ultimately cause colony loss (Porter & Ellis, 2011). Furthermore, the species is likely to require higher quality habitat patches where populations are more fragmented (Botham *et al.*, 2011).

Conservation measures

Butterfly Conservation Scotland has provided specialist advice to farmers, landowners and their agents for managing land for this species under SRDP. From 2008 to 2011, almost 200 sites covering over 300 ha came under management (mostly extensive light grazing) (Noake *et al.*, 2011). Reintroductions are under way at formerly occupied sites in Cumbria (Porter & Ellis, 2011).

Summaries of surveys and research related to surveillance

Larval surveys are likely to give a better indication of population size than adult surveys (Lewis & Hurford, 1997). Methods used in several surveys on Islay, for example in 2007, (Ravenscroft & McKay, 2007) provide a good basis from which to plan future surveillance. The most recent systematic survey in Scotland was carried out in 2002. This coincided with a low point in the large population fluctuations that are typical of this species. Surveillance methodologies must take account of such variability (Ravenscroft, 2003).

Quality of data

The discovery of several new colonies recently by personnel undertaking SRDP site advisory visits demonstrates that this species remains under-recorded and a national survey to determine the current status of *E. aurinia* in Scotland is long overdue.

References

- Botham, M.S., Ash, D., Aspey, N., Bourn, N.A.D., Bulman, C.R., Roy, D.B., Swain, J., Zannese, A. & Pywell, R.F. 2011. The effects of habitat fragmentation on niche requirements of the marsh fritillary, *Euphydryas aurinia*, (Rottemburg, 1775) on calcareous grasslands in southern UK. *Journal of Insect Conservation*, **15**, 269-277.
- Fowles, A.P. & Smith, R.G. 2006. Mapping the habitat quality of patch networks for the marsh fritillary *Euphydryas aurinia* (Rottemburg, 1775) (Lepidoptera, Nymphalidae) in Wales. *Journal of Insect Conservation*, **10**, 161-177.
- Fox, R., Asher, J., Brereton, T., Roy, D. & Warren, M. 2006. *The State of Butterflies in Britain and Ireland*. Newbury: Pices Publications.
- Lewis, O. & Hurford, C. 1997. Assessing the status of the marsh fritillary butterfly (*Eurodryas aurinia*): An example from Glamorgan. *Journal of Insect Conservation*, **1**, 159-166.
- Noake, B., Rosenthal, A., Parsons, M. & Bourn, N. 2011. Lepidoptera Conservation Bulletin Number 11, April 2010–March 2011. *Report No. S11-13, Butterfly Conservation*.
- Porter, K. & Ellis, S. 2011. Securing viable metapopulations of the marsh fritillary butterfly, *Euphydryas aurinia*, (Lepidoptera: Nymphalidae) in Northern England. *Journal of Insect Conservation*, **15**, 111-119.
- Ravenscroft, N. 2003. Status of Marsh Fritillary (*Eurodryas aurinia*) in Scotland. *Scottish Natural Heritage Commissioned Report F01AC303*.
- Ravenscroft, N.A.M. & McKay, C.R. 2007. The distribution and abundance of the Marsh Fritillary on Islay, 2007. *Report from Wildside Ecology, Butterfly Conservation Scotland*.
- Smee, M., Smyth, W., Tunmore, M., French-Constant, R. & Hodgson, D. 2011. Butterflies on the brink: habitat requirements for declining populations of the marsh fritillary (*Euphydryas aurinia*) in SW England. *Journal of Insect Conservation*, **15**, 153-163.

SURVEILLANCE METHODOLOGY FOR MARSH FRITILLARY (*Euphydryas aurinia*)

Aim

To measure long-term population and distribution trends of *Euphydryas aurinia* in Scotland.

Rationale

Euphydryas aurinia is only found on Islay, Jura, Lismore, Colonsay and Mull and on adjacent parts of mainland Argyll and the south-west parts of Highland. Although it is one of the more-studied species covered by this report, much remains to be learned about long-term population and distribution trends. The species is famed for large population fluctuations, thus single year results may be very misleading. For example in the 10 years to 2009, the species underwent a 9% decline in the number of occupied squares in the UK but a 71% population trend increase (Fox *et al.*, 2011).

Approach

Distribution: Butterfly distributions have been well monitored for many years with data being collated and published by Butterfly Conservation. Whilst there are fewer recorders in the range of this species, it would be difficult to better the volume and quality of data collated as part of the Butterflies for the New Millennium scheme (Butterfly Conservation, 2012). However it may be possible to complement this scheme by targeting searches for *E. aurinia* in under-monitored areas of potential habitat. Ravenscroft & McKay (2007) described a method for assessing distribution and abundance across Islay. Such a method could be adapted to searching other areas of *E. aurinia* occurrence.

Population: Standardised quantitative surveillance is normally carried out by searches of larval webs. Butterfly transects for adults (e.g. Pollard, 1977), as part of the long-running UK Butterfly Monitoring Scheme, may also provide insight into population trends.

Location

Distribution: Surveys of *E. aurinia* distribution should be guided by existing maps as generated by Butterflies for the New Millennium. Advice should be sought from Butterfly Conservation and from local recorders, local people and land owners/managers as to where particular areas of suitable habitat may exist in unmonitored or under-monitored areas.

Population: Population trend surveillance should be carried out by using butterfly transects (Pollard, 1977). These can, if necessary, cover just the flight period of this species. A similar transect approach could be adopted for assessing larval densities.

Sample units

Distribution: Most data collated as part of the Butterflies for the New Millennium scheme are based on distribution at the 10-km square scale. Given the small region now occupied by this species, consideration should be given to calculating Scottish trends at a 5 or 2 km square level, though a decision on this should be guided by the level of coverage achieved at a local scale.

Population: The use of standardised, regularly-monitored transects for adult butterflies and larval tents will produce population level indices.

Sampling

It is recommended that reference is made to Butterfly Conservation before embarking on a surveillance programme for this species. Transect methodology is well established though power analysis may be useful to determine the number of transects required for robust results. If larval counts are planned, reference should again be made to Butterfly Conservation, who has recently developed a standard methodology for undertaking *E. aurinia* larval web counts.

Time

Butterfly transects typically take a couple of hours to complete. Weekly transect visits during the flight period would entail around eight visits to each site. As *E. aurinia* undergoes large population fluctuations, transect monitoring should ideally be carried out annually.

Further notes

Ravenscroft & McKay (2007) recommend that monitoring of *E. aurinia* should incorporate studies of the impacts of changing stock densities on vegetation structure and composition in order to help improve the quality of management advice under agri-environment schemes. Butterfly Conservation Scotland has also developed a survey form to assess habitat suitability by a structured walk and recording specific attributes, both positive and negative.

References

- Butterfly Conservation. 2012. *Butterflies for the New Millennium*. [online] Available at: <http://butterfly-conservation.org/text/64/butterfly_distribution.html> [accessed 6 February 2012].
- Fox, R., Brereton, T.M., Asher, J., Botham, M.S., Middlebrook, I., Roy, D.B. & Warren, M.S. 2011. *The State of the UK's Butterflies 2011*. Wareham: Butterfly Conservation and the Centre for Ecology & Hydrology.
- Pollard, E. 1977. A method for assessing changes in abundance of butterflies. *Biological Conservation*, **12**, 115-134.
- Ravenscroft, N.A.M. & McKay, C.R. 2007. The distribution and abundance of the marsh fritillary on Islay, 2007. *Report from Wildside Ecology, Butterfly Conservation Scotland*.

SPECIES REPORT FOR WINDOW WINGED SEDGE (*Hagenella clathrata*)

Ecology

Adults emerge and fly between June and early July in the northern part of UK, resting on vegetation and being active on warm afternoons. Egg masses are laid in soggy areas under the litter layer. Larvae hatch after a few weeks and hide in damp leaf litter. In water, larvae grow quite rapidly and are fully grown by spring (Anon, 2011).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

The species was first discovered in Scotland near Corsemalze, Wigtownshire, in 1903. A Strathspey site was found in 1967 and a second colony was found in 1982 (Wallace, 2011). There are no records from elsewhere in Scotland.

Elsewhere in the UK there are two sites on the Shropshire Welsh border, three sites in Staffordshire, one in Greater London and three sites in Surrey (Anon, 2011). Further afield, the species is found in northern, central and eastern Europe (Wallace, 2011).

Habitat and management

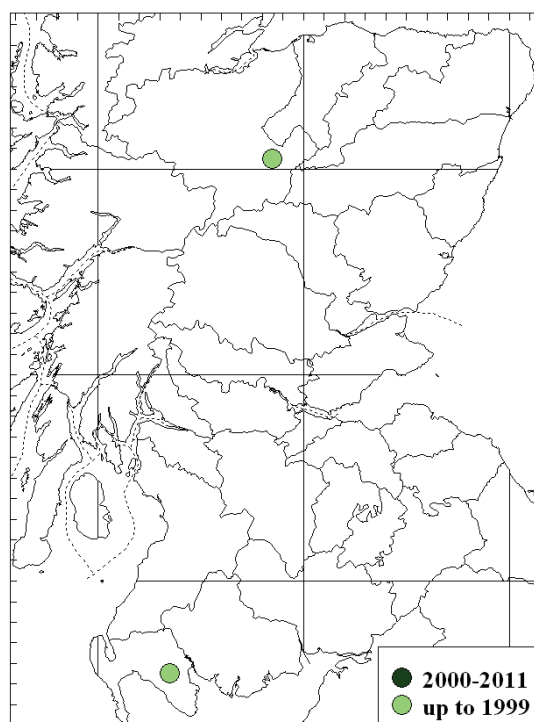
In the UK, *H. clathrata* lives in pools on bogs and heathland. These sites contain areas of well-developed tussocks, principally purple moor grass (*Molinia caerulea*). It utilises small, shallow pools between tussocks which contain water from autumn to early summer. These pools are often shaded by plants and litter with no surface water apparent. They become damp areas by midsummer when the adults fly. Trees and shrubs appear to be an important element in the habitat as they provide food and case-making material and sites for adults to swarm and meet (Anon, 2011).

Pressures and threats

The main threats are drying out of habitat, encroachment of trees, opening up tussocks by trampling of livestock and wildfires. In addition, overgrazing, pond creation and re-wetting of peatlands may be detrimental to this species (Anon, 2011).

Conservation measures

Habitat for this species has declined due to loss of bog areas. Conservation therefore focuses on protecting bogs and restoring areas of previous peat extraction. Due to the risk from conventional re-wetting techniques, management of sites should be planned so as not to cause rapid change to habitat or hydrology. Principal management considerations should include reducing abstraction and managing tree encroachment on pool habitat. Maintaining



wet pools requires control of succession in surrounding habitats whilst maintaining some birch habitat nearby (Anon, 2011).

Summaries of surveys and research related to surveillance

The vicinity of the Wigtonshire record was visited in 1985 but there had been significant habitat change and no *H. clathrata* were found (Wallace, 2011). There have been no recent searches made of Scottish sites (L. Kitchen & I. Wallace, *pers. comm.*).

References

Anon. 2011. *Species management sheet, Window winged sedge (Hagenella clathrata)*: Peterborough: Buglife.

Wallace, I. 2011. *Species dossier: Hagenella clathrata window winged sedge*. Peterborough: Buglife.

Map data sources

Caddisfly (Trichoptera) records from Britain and Ireland to 2003 (Biological Records Centre).

SURVEILLANCE METHODOLOGY FOR WINDOW WINGED SEDGE (*Hagenella clathrata*)

Aim

To establish whether *Hagenella clathrata* is extant in Scotland.

Rationale

As *H. clathrata* has not been searched for in Scotland since the 1980s, any surveillance would be rather limited in scope. Establishing whether the species remains at sites with former records sites is clearly crucial before any trend monitoring can be put in place.

Approach

In general caddisflies can be surveyed as larvae and as adults. However for this species, searching for larvae may be damaging to the habitat features such as overhanging litter, which is easily disturbed (Wallace, 2011).

The adult is fairly distinctive. It is pictured in some popular guides, e.g. Greenhalgh & Ovenden (2007), and formal keys.

Equipment

Butterfly net, close focus binoculars.

Location

It is not clear precisely where the Corsemalzie (Wigtownshire) record was made and recent searches in that area have drawn a blank (Wallace, 2011).

Given the more recent records, attention should initially be focused on the Strathspey sites. At Kinrara, near Aviemore, the grid reference is NH883097, and the Insh Marshes grid reference is NH7902. It is not known how accurate these references are.

Sample units

The initial focus should be on establishing the number of extant sites. If sites are found to be occupied, they can be monitored by a simple population index.

Sampling

Initial searches of areas with former records should follow this general protocol:

- A preliminary visit should be made to the vicinity of the Speyside sites prior to the flight season to identify likely habitat.
- Suitable habitat may represent succession from bog to woodland. Hence searches should be expanded if visits to the vicinities of the original records fail to find likely areas.
- For visits in the flight season, the surveyor should use expert judgment to decide which sites to prioritise and the proportional allocation of time to each site.
- Searches for adults should be carried out in June or early July, preferably on warm afternoons when the adults are most active.

- The species should be searched for simply by slowly walking back and forth across the habitat. Searches can include disturbance of the vegetation using a stick or cane with insects captured with a butterfly or sweep net for closer examination.
- The location of individuals encountered should be recorded by GPS.
- Swarming around particular bushes has been observed elsewhere, and such event should be recorded.

If occupied sites are found, it has been suggested that a butterfly transect approach could be modified to derive an indication of population trends (Wallace, 2011). This would involve walking slowly along a fixed route in fine, warm weather and counting all *H. clathrata* that are observed or netted within 2.5 m either side of the observer and up to 2.5 m in front. The transect walk would have to be carried out regularly, ideally weekly, through the flight period to account for variations in the detection rate of the species that might be caused by weather differences between the surveys.

Time

Site visits will take around a half day (afternoon) each. Thus one day for initial searches for potentially suitable habitat followed by two or more afternoons for actual surveys would be required for an initial assessment of the status of the species in Strathspey.

Further notes

Professional surveys are clearly preferable, especially for establishing presence or apparent absence at previously recorded sites. However, this is a relatively easy species to identify and large parts of Scotland have the potential to hold undiscovered sites. The Riverfly Partnership and Buglife – The Invertebrate Conservation Trust have promoted this species as one to look out for. Such initiatives should be firmly encouraged in areas that hold potentially suitable habitat.

References

Greenhalgh, M. & Ovenden, D. 2007. *Collins pocket guide, freshwater life in Britain and Northern Europe*. London: HarperCollins.
 Wallace, I. 2011. *Species dossier: Hagenella clathrata window winged sedge*. Peterborough: Buglife.

SPECIES REPORT FOR TORMENTIL MINING BEE (*Andrena tarsata*)

Ecology

This bee is mainly oligolectic (specialist-feeder) on tormentil (*Potentilla erecta*) (Edwards & Broad, 2005) but occasionally visits other plants including bridewort (*Spirea salicifolia*), (Chambers, 1968), bramble (*Rubus* spp.) (Lee, 2010), harebell (*Campanula rotundifolia*), heather (*Calluna vulgaris*), wild angelica (*Angelica sylvestris*), and yarrow (*Achillea millefolium*) (Edwards & Broad, 2005). The bee nests in compact aggregations (Perkins, 1919) on nearly flat to very steep slopes but always with a more or less south-facing aspect. The entrance holes are around 4 mm in diameter (J. Crossley, *pers. comm.*). *Andrena tarsata* is active from mid June until late August (Edwards & Broad, 2005) although its season is considerably shorter towards the northern edge of its range (J. Crossley, *pers. comm.*).

Conservation status and rarity

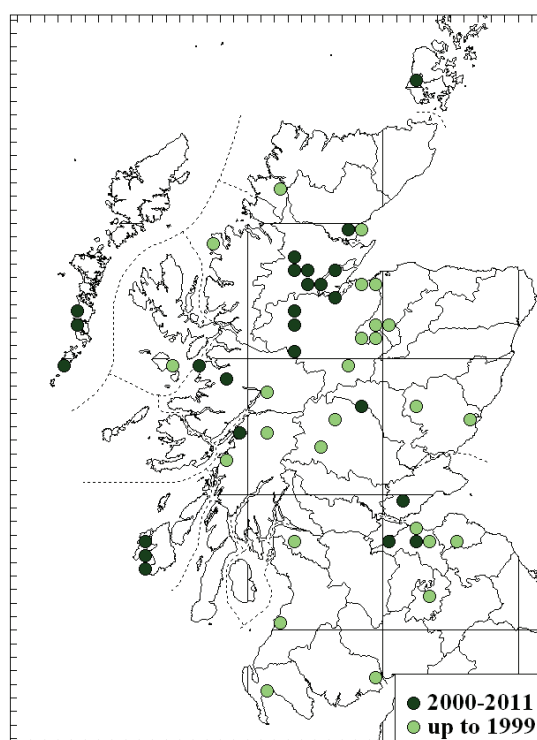
- UK Biodiversity Action Plan (BAP): Species of conservation concern – anecdotal evidence of a 50% decline in range since 1970s.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

The species is widely distributed throughout Scotland from as far north as Hoy, Orkney (J. Crossley, *pers. comm.*), to Montrose, Angus, in the east, and to South Uist, Outer Hebrides in the west. There are equally widely distributed records from across England, Isle of Man and Ireland (Edwards & Broad, 2005). Generally a scarce species, *Andrena tarsata* is only rarely locally common and is becoming scarcer further south (Edwards & Broad, 2005). Its range extends from central Fennoscandia south to Spain, and eastwards to Russia (Edwards & Broad, 2005).

Habitat and management

Andrena tarsata is found on heathlands and moorland, and rarely on open woodland (Edwards & Broad, 2005). Nests are found on bare, well-drained clay surfaces where peat has eroded (e.g. sides of ditches, ditch spoil, roadside banks, paths) (J. Crossley, *pers. comm.*).



Pressures and threats

This species is likely to be affected by changes in management that reduce the availability of flowering tormentil. Excessive sheep grazing in particular can be a problem because sheep trample or rub on vertical surfaces, disrupting or destroying nest holes (J. Crossley, *pers. comm.*). *Nomada roberjeotiana* is a cleptoparasite of this species (Perkins, 1919).

Conservation measures

Maintain areas with high levels of flowering tormentil.

Summaries of surveys and research related to surveillance

Breeding aggregations in excess of 1000 individuals were observed in Orkney in 2011 (Crossley, 2011). There has been general recording by BWARS members, particularly in the post-1980s period.

Quality of data

Good but lacking recent records towards the south and east of its range.

References

- Chambers, V. H. 1968. Pollens collected by species of *Andrena* (Hymenoptera: Apidae). *Proceedings of the Royal Society of London (A)*, **43**, 155-160.
- Crossley, J. 2011. Solitary bee sightings. *Orkney Field Club newsletter Autumn/Winter*.
- Edwards, R. & Broad, G. 2005. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland Part 5*. Huntingdon: Centre for Ecology and Hydrology.
- Lee, P. 2010. Research report for 2010. *West Sussex: Hymettus Ltd*.
- Perkins, R. C. L. 1919. The British species of *Andrena* and *Nomada*. *Transactions of the Entomological Society of London*, **67**, 218-319.

Map data sources

- Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).
- HBRG Insects Dataset (Highland Biological Recording Group).

SURVEILLANCE METHODOLOGY FOR TORMENTIL MINING BEE (*Andrena tarsata*)

Aim

To establish the status and distribution of *Andrena tarsata* in Scotland.

Rationale

Andrena tarsata is found on heathland, moorland and occasionally on open woodland (Edwards & Broad, 2005). It is mainly oligolectic on tormentil (*Potentilla erecta*) (Edwards & Broad, 2005) and requires bare, well-drained clay surfaces to nest (J. Crossley, *pers. comm.*).

Anecdotal evidence suggests there has been a dramatic decline in the site occupancy of this species which, although still widespread, its status at many sites is unknown. There has been some limited ad hoc recording, largely by Bees, Wasps & Ants Recording Society (BWARS) members at specific locations, but no widespread or coordinated survey.

Approach

The most appropriate survey and monitoring technique for this bee is direct visual searching. Locating nest burrows is the simplest way to determine the presence of the bee but individual bees can also be found on flowering plants, particularly tormentil. Surveillance should focus on confirming the continued presence of the species at existing and older sites.

Equipment

No specialist equipment required.

Location

The species is widespread at scattered locations across mainland Scotland and also on Orkney, South Uist and Islay. Recent records have been received mainly from the Highland region and the islands. Surveillance should begin by surveying sites with older records first.

Sample units

The sample units will be the number of occupied sites and the approximate number of nests per site.

Sampling

This bee can be found by searching for nests in suitable areas and also by looking for foraging bees on flowering plants. The bee nests on nearly flat to very steep slopes, but always with a more or less south-facing aspect. Nests are found on bare, well-drained clay surfaces where peat has eroded, for example at the sides of ditches, ditch spoils, roadside banks, and paths. The entrance holes are around 4 mm in diameter (J. Crossley, *pers. comm.*). Bees are often found on tormentil but also bridewort (*Spirea salicifolia*), (Chambers, 1968), bramble (*Rubus* spp.) (Lee, 2010), harebell (*Campanula rotundifolia*), heather (*Calluna vulgaris*), wild angelica (*Angelica sylvestris*), and yarrow (*Achillea millefolium*) (Edwards & Broad, 2005).

Following published information and expert opinion, these guidelines on sampling protocol are recommended:

- Field sampling should be undertaken between the first three weeks of July when bee numbers are at peak abundance.
- Optimal weather conditions are days of full sunshine with little or no wind. Days that are preceded by wet and cold weather should be avoided as these conditions reduce bee activity.
- Surveys should be carried out between 10:00 and 16:00 h.
- If active-looking *Andrena* nest burrows are discovered, the surveyor should watch for 10-20 min for bee activity.
- The surveyor should look for foraging bees on flowering plants.
- Details of nest locations and flowers visited should be recorded.
- This species is relatively straightforward to identify in the field with the use of a hand lens.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record details of changes in management, shrub encroachment or excessive grazing, number of grazing animals, and the availability of flowering tormentil. Positive sites should be surveyed every five years.

Time

Each site could be surveyed in one day. The number of sites and flying preferences may require staggering surveillance over several years.

References

- Chambers, V. H. 1968. Pollens collected by species of *Andrena* (Hymenoptera: Apidae). *Proceedings of the Royal Society of London (A)*, **43**, 155-160.
- Edwards, R. & Broad, G. 2005. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland Part 5*. Huntingdon: Centre for Ecology and Hydrology.
- Lee, P. 2010. Research report for 2010. *West Sussex: Hymettus Ltd.*

SPECIES REPORT FOR GREAT YELLOW BUMBLEBEE (*Bombus distinguendus*)

Ecology

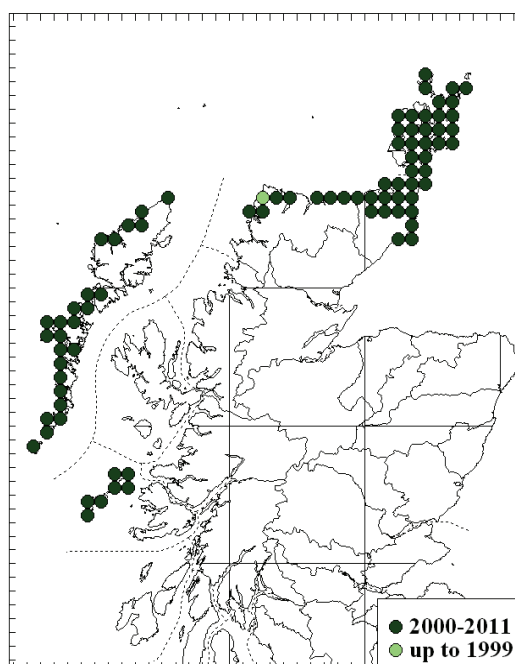
Bombus distinguendus has a short breeding cycle, allowing colony formation within the short northern summer. Most activity on Orkney and the mainland is from June to September, but may be earlier in the Western Isles (Douglas, 2003). Nests are constructed underground (Anon, 1999), in rough grass and often in old mouse nests (Douglas, 2003). Colonies are relatively small; at two nests in South Uist, the numbers of workers were 23 and 45, respectively (Hughes; 1998; Edwards & Telfer, 2001). A range of forage plants are used, especially Fabaceae (e.g. *Trifolium repens*), Lamiaceae (*Stachys* spp.) and purple Asteraceae (*Cirsium* and *Centaurea* spp.) (Douglas, 2003)

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern – this species has suffered a 70% decline in population since the 1970s.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Stable.
- IUCN Status: Not listed.

Distribution

Once scattered throughout Britain, *B. distinguendus* now only occurs in western and northern Scotland (Douglas, 2003). It is well established on North and South Uist, Benbecula and Barra, Coll, Tiree, Lewis and Harris. In Orkney it has been found on 12 of the larger islands and three smaller ones (J. Crossley, *pers. comm.*). On the mainland it occurs at scattered sites in Sutherland and Caithness (Douglas, 2003). *Bombus distinguendus* occurs across northern Eurasia (Anon, 1999), is widespread and local in Scandinavia but rare in southern Germany (Edwards & Telfer, 2001).



Habitat and management

This bee has been associated with extensive areas of meadowland (Anon, 1999) but it occupies at least four distinct habitats in different areas (Douglas, 2003). Typically it is associated with clover-rich successional stages of machair meadows of the Western Isles, and with winter-grazed cattle pasture. In Sutherland and Caithness it occurs on less rich duneland and coastal cliffs and inland on verges and flower-rich sites (M. Macdonald, *pers. comm.*). On Orkney, it occurs in a range of improved and semi-improved grassland, coastal grassland, and crops such as red clover and 'bird crops' (J. Crossley, *pers. comm.*). Generally its habitat has plenty of white clover (*Trifolium pratense*).

Pressures and threats

This bee is threatened by land use intensification leading to loss or fragmentation of herb-rich grasslands (Anon, 1999). This includes heavy summer grazing, reduction in rotation period, fertilisation, adoption of silage or monoculture grass crops and loss of uncultivated

herb-rich borders and verges. Traditional Hebridean cattle rearing and rotational machair cropping provide suitable habitat (Douglas, 2003).

Conservation measures

Management should aim to provide forage continuously from May or June to the end of September through cutting or grazing (Douglas, 2003; Charman *et al.*, 2009) and rank grassland for nesting sites (Hancock, 2009). For the Western Isles, management options are the use of seaweed and occasionally manure as fertilizer, crop rotation that includes at least one year of fallow (long enough to allow the establishment of *T. pratense*), natural regeneration in fallow year rather than seed application and cutting in late summer, and grazing over the winter (Hancock, 2009).

Summaries of surveys and research related to surveillance

Recent surveys in the Hebrides have recorded low nesting densities, limited dispersal ability and above average travelling distance to forage plants (Redpath *et al.*, 2009; Charman *et al.*, 2010). RSPB surveys indicate a declining trend (Lee, 2007). In 2010-11, Hymettus coordinated a project under the Species Action Framework (SAF) that involved monitoring on the Western Isles, Caithness, Sutherland and Orkney. Additionally, Hymettus and RSPB has established a single database for all *B. distinguendus* records.

Quality of data

Distribution and ecology are well known but there is no information on population densities and trends.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Charman, T.G., Sears, J., Bourke, A.F.G. & Green, R.E. 2009. Phenology of *Bombus distinguendus* in the Outer Hebrides. *The Glasgow Naturalist*, **25**, 35-42.
- Charman, T.G., Sears, J., Green, R.E. & Bourke, A.F.G. 2010. Conservation genetics, foraging distance and nest density of the scarce Great Yellow Bumblebee (*Bombus distinguendus*). *Molecular Ecology*, **19**, 2661-2674.
- Douglas, G. 2003. Invertebrate species dossier: *Bombus distinguendus* Morawitz, great yellow bumble Bee (Hymenoptera: Apidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Edwards R & Telfer, M. 2001. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland Part 3*. Huntingdon: Centre for Ecology and Hydrology.
- Hancock, L. 2009. Habitat management survey for conservation of the great yellow bumblebee *Bombus distinguendus* in the Outer Hebrides. *The Glasgow Naturalist*, **25**, 73-78.
- Hughes, L. 1998. The Great Yellow Bumblebee, *Bombus distinguendus* (Morawitz): aspects of habitat use, phenology and conservation on the machair of the Outer Hebrides, UK. *Oilthigh Lunnainn: Tràchdas MSc neo-fhoillsichte*.
- Lee, P. 2007. Research Report for 2007. *West Sussex: Hymettus Ltd*.
- Redpath, N., Osgathorpe, L.M., Park, K. & Goulson, D. 2009. Crofting and bumblebee conservation: the impact of land management practices on bumblebee populations in northwest Scotland. *Biological Conservation*, **143**, 492-500.

Map data sources

Great Yellow Bumblebee sightings data in the UK, 1990 onwards (RSPB).

Species Consultants: John Crossley, Murdo Macdonald and Ben Darvill

SURVEILLANCE METHODOLOGY FOR GREAT YELLOW BUMBLE BEE (*Bombus distinguendus*)

Aim

To monitor the status of *Bombus distinguendus* in Scotland.

Rationale

This species has been the subject of a number of local action plans and as such is relatively well studied and its ecology and current distribution are well known. However, information on population densities and trends is lacking. An attempt was made in 2010-11 by Hymettus Ltd, under the Species Action Framework, to coordinate population monitoring across four population centres on the Western Isles, Caithness, Sutherland and Orkney. This involved the use of trained volunteers.

Approach

Given the time and effort invested by Hymettus in establishing a monitoring programme across the Western Isles, Caithness, Sutherland and Orkney, it would be beneficial and desirable to continue this project and to extend it to include other major population centres. *Bombus distinguendus*, in line with other bumblebees, is surveyed by counts of individuals along fixed line transects. The surveying approach outlined here is a modified version of the butterfly transect method (Pollard, 1977) adjusted for weather conditions.

Equipment

No specialist equipment is required but the success of the work would depend on volunteers adequately trained in field methods and species identification.

Location

Surveillance should focus on selected sites on the Western Isles, Caithness, Sutherland and Orkney, in addition to Coll and Tiree. If possible, sites previously used for monitoring by Hymettus should be used.

Sample units

The main sample units will be the number of occupied sites. The number of bees per site will also be recorded. However as population sizes are more often thought of as the number of nests, this may not be a reliable indicator of abundance. Numbers in general will be small and there will be a suite of uncontrollable factors.

Sampling

Bombus distinguendus is found by counting individual bees along fixed line transects running through areas of suitable habitat. The method described here is based on the standard protocol for butterfly recording (Pollard, 1977), adapted for geographic location (Redpath *et al.*, 2009).

- At each location, at least three sites should be selected for surveillance.
- Each site should be visited in turn on three occasions between early June and mid-August.

- Surveys should take place between 10:00 and 16:00 h, in dry weather and when temperatures exceed 12°C. Surveys should be conducted along fixed transect lines of 300 m, spaced 25 m apart to ensure coverage of the area and minimize multiple records of the same bee.
- All actively foraging *B. distinguendus* observed within 2 m on either side of each transect should be recorded.
- The sex of the bees should also be recorded.
- This species is relatively easy to identify in the field but care should be taken if using volunteers to ensure that they are adequately trained.

The surveyor should make some assessment of habitat quality and condition. It would be useful to record details of changes in management, numbers of grazing animals and the availability of forage plants. Surveying should be carried out annually as numbers will be extremely variable.

Time

The minimum time required for field work will be approximately 36 days.

References

Pollard, E. 1977. A method for assessing changes in abundance of butterflies. *Biological Conservation*, **12**, 115-134.

Redpath, N., Osgathorpe, L.M., Park, K. & Goulson, D. 2009. Crofting and bumblebee conservation: the impact of land management practices on bumblebee populations in northwest Scotland. *Biological Conservation*, **143**, 492-500.

SPECIES REPORT FOR MOSS CARDER BEE (*Bombus muscorum*)

Ecology

Bombus muscorum is active from May to September. It nests in rank grassland (J. Crossley, *pers. comm.*) using moss and leaf litter for nest material. The off-shore islands support morphologically distinctive forms (JNCC, 2010); at least six subspecies are known. There is weak evidence that *B. muscorum* colonies are smaller than more common bumblebee species (Darvill *et al.*, 2010).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern – this species was added to the UK BAP in 2007 following declines in range and density.
- Added to UK BAP in 2007.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

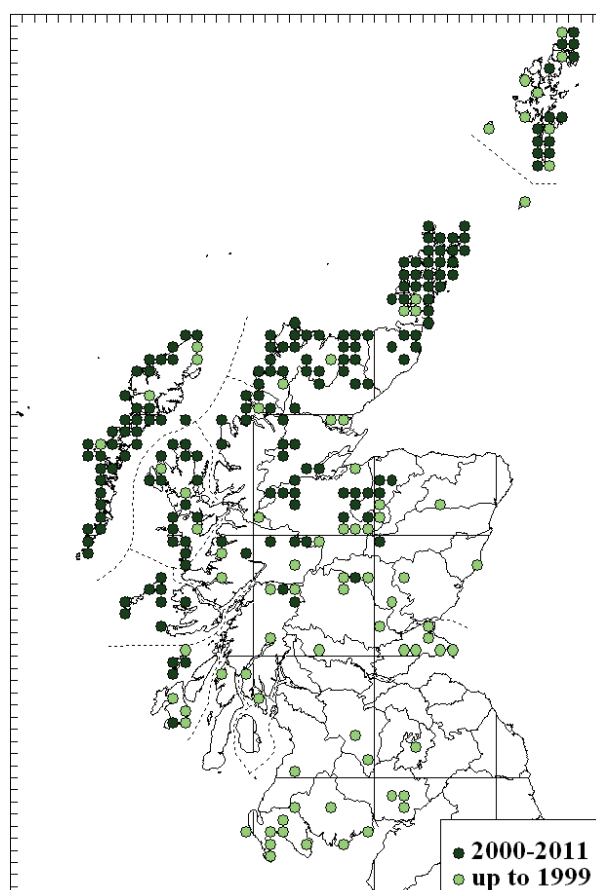
This species is widely distributed throughout Scotland but occurs in small numbers. It has suffered a rapid (Darvill *et al.*, 2010) and marked decline in range and density in Britain since the 1970s (JNCC, 2010). Populations in the Hebrides appear to be large and stable (Benton, 2006; Macdonald & Nisbet, 2006). It has a northerly distribution throughout Europe being montane at its southerly range (JNCC, 2010).

Habitat and management

This bumblebee is closely associated with tall herb-rich grasslands which are only cut or grazed intermittently (JNCC, 2010; J. Crossley, *pers. comm.*). It is often found in linear habitats (JNCC, 2010). On islands it is found in a range of habitats including machair, gardens and moorland. On the mainland, it is mainly coastal (Darvill *et al.*, 2010) although inland wet moorland areas are well used in Scotland.

Pressures and threats

Agricultural intensification (JNCC, 2010) leading to habitat fragmentation (Darvill *et al.*, 2010) appear to be the main threats to the species. Low genetic diversity and higher parasite prevalence may also be causes of decline (Darvill *et al.*, 2010; Whitehorn *et al.*, 2011). It is a species that may be affected by climate change (J. Crossley, *pers. comm.*).



Conservation measures

Management of sward height to maintain optimal flower levels (JNCC, 2010).

Summaries of surveys and research related to surveillance

Bombus muscorum has been the subject of scientific research investigating dispersal ability and genetic diversity (Darvill *et al.*, 2010; Whitehorn *et al.*, 2011). The species can be confused with the common carder bee. Adequate training of volunteers is therefore important.

Quality of data

Good.

References

- Benton, T. 2006. *Bumblebees*. London: Collins New Naturalists.
- Darvill, B., O'Connor, S., Lye, G.C., Waters, J., Lepais, O. & Goulson, D. 2010. Cryptic differences in dispersal lead to differential sensitivity to habitat fragmentation in two bumblebee species. *Molecular Ecology* **19**: 53-63.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2089.pdf> [Accessed 1 February 2012].
- Macdonald, M. & Nisbet, G. 2006. *Highland Bumblebees*. Highland Biological Recording Group, Inverness.
- Whitehorn, P.R., Tinsley, M.C., Brown, M.J.F., Darvill, B. & Goulson, D. 2011. Genetic diversity, parasite prevalence and immunity in wild bumblebees. *Proceedings of the Royal Society B – Biological Sciences*, **278**, 1195-1202.

Map data sources

- Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).
- HBRG Insects Dataset (Highland Biological Recording Group).

SURVEILLANCE METHODOLOGY FOR MOSS CARDER BEE (*Bombus muscorum*)

Aim

To establish the status and distribution of *Bombus muscorum* in Scotland.

Rationale

This once widely distributed bumblebee has suffered a marked decline in its population in the last 30 years (JNCC, 2010). In particular, the range of the species in Scotland appears to have retracted, now largely confined to the north and west. Suggestions that *B. muscorum* is being replaced in the south and east of its range by *B. pascuorum* (Plowright & Plowright, 2009) are unfounded (J. Crossley, *pers. comm.*). Populations of *B. muscorum* in the Hebrides are believed to be stable (Benton, 2006; Macdonald & Nisbet, 2006), but elsewhere the status of the species is unknown.

Approach

A two-tier approach will be required to establish both the status and distribution of *B. muscorum* in Scotland. Firstly, to confirm the apparent distribution of the bee from the south and east of its range, a number of sites with older records should be checked simply on a presence / absence basis. It may be worth investigating whether records generated by the Bumblebee Conservation Trust's Beewatch scheme, where volunteer participants carry out a fixed walk monthly throughout the summer, could be used for this purpose. Secondly, to confirm that populations are stable, annual monitoring should be conducted in four key population centres. It would be more cost-effective to do this in conjunction with the surveillance for *B. distinguendus* since the sites and methods would be the same.

Bombus muscorum, in line with other bumblebees, is surveyed by counting individuals along fixed line transects. The surveying approach outlined here is a modified version of the butterfly transect method (Pollard, 1977) adjusted for weather conditions.

Equipment

No specialist equipment is required but the success of the work would depend on volunteers adequately trained in field methods and species identification.

Location

Surveillance should focus on sites within the four population centres of the Western Isles, Sutherland, Orkney and Caithness.

Sample units

The main sample units will be the number of occupied sites. The number of bees per site will also be recorded but may or may not be reliable abundance estimates due to a variety of factors. Numbers in general will be small and there will be a suite of uncontrollable factors.

Sampling

Bombus muscorum is found by counting individual bees along fixed line transects running through areas of suitable habitat. The method described here is based on the standard protocol for butterfly recording (Pollard, 1977), adapted for geographic location (Redpath *et al.*, 2009).

- At each location, at least three sites should be selected for surveillance.
- Each site should be visited in turn on three occasions between early June and mid-August.
- Surveys should take place between 10:00 and 16:00 h, in dry weather and when temperatures exceed 12°C. Surveys should be conducted along fixed transect lines of 300 m, spaced 25 m apart to ensure coverage of the area and minimize multiple records of the same individual bee.
- All actively foraging *B. muscorum* observed within 2 m on either side of each transect should be recorded.
- The sex of the bees should also be recorded.
- This species is relatively easy to identify in the field but care should be taken if using volunteers to ensure that they are adequately trained.

The surveyor should make some assessment of habitat quality and condition. It would be useful to record details of changes in management, numbers of grazing animals and the availability of forage plants. Surveying should be carried out annually as numbers will be extremely variable.

Time

The minimum time required for field work will be approximately 36 days.

References

- Benton, T. 2006. *Bumblebees*. London: Collins New Naturalists.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2089.pdf> [Accessed 1 February 2012].
- Macdonald, M. & Nisbet, G. 2006. *Highland Bumblebees*. Highland Biological Recording Group, Inverness.
- Plowright, C.M.S. & Plowright, R.C. 2009. Further evidence of replacement of *Bombus muscorum* (L.) by *Bombus pascuorum* (Scop) in northern Britain. *Entomologist's Monthly Magazine*, **145**, 985-990.
- Pollard, E. 1977. A method for assessing changes in abundance of butterflies. *Biological Conservation*, **12**, 115-134.
- Redpath, N., Osgathorpe, L.M., Park, K. & Goulson, D. 2009. Crofting and bumblebee conservation: the impact of land management practices on bumblebee populations in northwest Scotland. *Biological Conservation*, **143**, 492-500.

SPECIES REPORT FOR RED-SHANKED CARDER BEE (*Bombus ruderarius*)

Ecology

Bombus ruderarius queens leave their hibernation sites from mid to late April onwards (Edwards & Telfer, 2001) and establish new nesting sites. The nest is usually on, or just below, the ground surface, made of grass-clippings and mosses, and often founded in an old mouse or vole nest (Edwards & Telfer, 2001; Goulson *et al.*, 2005). Colony size is small compared with other bumblebees; approximately 20-50 individuals (Goulson *et al.*, 2005). Once the new sexual forms have hatched (from July onwards) the nest disintegrates; the newly mated queens go into hibernation in unknown sites whilst the workers and males eventually die (Edwards & Telfer, 2001).

A wide range of flowers are visited for nectar (Edwards & Telfer, 2001; Goulson *et al.*, 2005). For pollen, plants of the families Fabaceae, Lamiaceae and Scrophulariaceae are particularly favoured (Edwards & Telfer, 2001).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

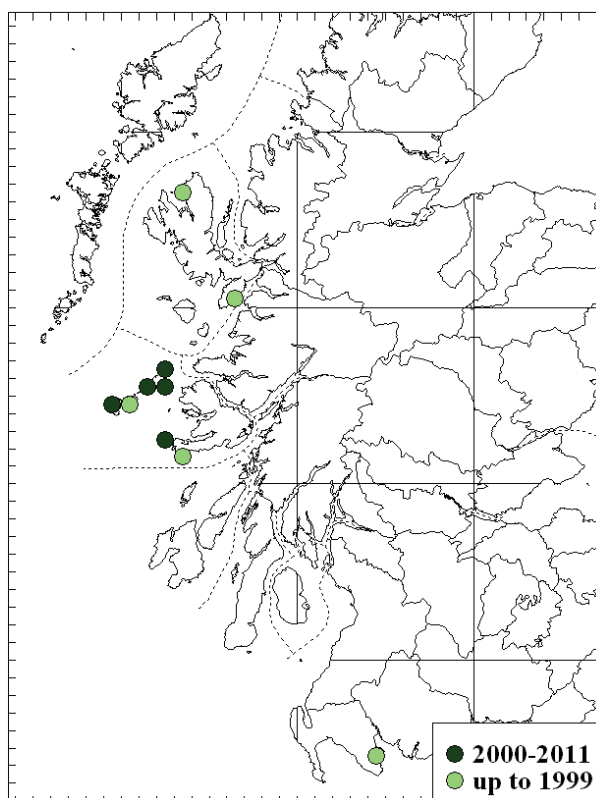
Distribution

This bee has shown a significant decline in its abundance and range during the 20th century, particularly between 1980 and 2000. There are historic records along the north and west coast, and on Skye. The only modern Scottish populations occur on the Island of Tiree (Edwards & Telfer, 2001) and Mull.

In the UK *B. ruderarius* has a southern distribution. Across its Eurasian range it is found from southern Fennoscandia south to the Mediterranean, and east to western Siberia and northern Kazakhstan (Benton, 2008).

Habitat and management

The species is found in a wide range of habitats including open flower-rich grassland, coastal and wetland, vegetated dunes, flower-rich grassland, riverside meadow, grazing marshes, gardens (urban and suburban), brownfield sites, less intensified agriculture such as hedgerows bordering cereal fields (Goulson *et al.*, 2005; Benton, 2008). Nesting habitat is generally tall, tussocky grassland, often close to scrub or woodland edge. For foraging it is reliant on extensive areas supporting a variety of flowering plant species, typically from the plant families Fabaceae and Lamiaceae (Edwards & Telfer, 2001).



Pressures and threats

Habitat loss due to agricultural intensification is believed to be a key factor in the decline of this species. It is also vulnerable to agricultural practices such as early hay cutting and agrochemicals (Benton, 2008). Additionally, there is limited evidence that the species is more vulnerable to parasitism by wax moths (Sladen, 1912), and conopid and tachinid flies (Cumber, 1949) than other carder bumblebees.

Conservation measures

This species requires management of sward height to maintain optimum flower levels (JNCC, 2010). It is vital that suitable forage is available throughout the flight period of the colony (mid-April to early September) (Edwards & Telfer, 2001). Conservation strips comprising bumblebee forage plants on otherwise intensively farmed land are unlikely to benefit this species. However, experimental provision of suitable foraging habitat in conjunction with other changes in land management might well prove to be of benefit (Benton, 2008). Attention should be paid to both nesting and foraging requirements.

Summaries of surveys and research related to surveillance

There has been no targeted surveying work carried out for this species.

Quality of data

Possible recorder errors (Benton, 2008).

References

- Benton, T. 2008. *Bombus ruderarius* (Müller, 1776): Current knowledge of its autecology and reasons for decline. *Unpublished report. West Sussex: Hymettus Ltd.*
- Cumber, R. A. 1949. Humble-bee parasites and commensals found within a thirty mile radius of London. *Transactions of the Royal Entomological Society of London (A)*, **24**, 119-127.
- Edwards, R. & Telfer, M. 2001. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland Part 3*. Huntingdon: Centre for Ecology and Hydrology.
- Goulson, D., Hanley, M.E., Darvill, B., Ellis, J.S. & Knight, M.E. 2005. Causes of rarity in bumblebees. *Biological Conservation*, **122**, 1-8.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2090.pdf> [Accessed 1 February 2012].
- Sladen, F.W.L. 1912. *The humble-bee, its life history and how to domesticate it, with descriptions of all the British species of Bombus and Psithyrus*. London: Macmillan.

Map data sources

- Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).
- HBRG Insects Dataset (Highland Biological Recording Group).

SURVEILLANCE METHODOLOGY FOR RED-SHANKED CARDER BEE (*Bombus ruderarius*)

Aim

To investigate the status of the population of *Bombus ruderarius* in Scotland.

Rationale

This widely distributed species has suffered a marked decline in its abundance and range. The only remaining substantial Scottish populations are on the islands of Tiree and Mull. Recent records from Iona suggest the possibility of a population here. The statuses of these populations are unknown.

Approach

Bombus ruderarius, in line with other bumblebees, is surveyed by counting individual along fixed line transects. The surveying approach outlined here is a modified version of the butterfly transect method (Pollard, 1977) adjusted for weather conditions.

Equipment

No specialist equipment required.

Location

Surveying should be carried out on the islands of Mull and Tiree.

Sample units

The main sample units will be the number of occupied sites. The number of bees per site will also be recorded, but abundance estimates may not be reliable due to a variety of factors. Numbers in general will be small and there will be a suite of uncontrollable factors.

Sampling

Bombus ruderarius is found by counting individual bees along fixed line transects running through areas of suitable habitat. The method described here is based on the standard protocol for butterfly recording (Pollard, 1977), adapted for geographic location (Redpath *et al.*, 2009).

- At each location, at least three sites should be selected for surveillance.
- Each site should be visited in turn on three occasions between early June and mid-August.
- Surveys should take place between 10:00 and 16:00 h, in dry weather and when temperatures exceed 12°C. Surveys should be conducted along fixed transect lines of 300 m, spaced 25 m apart to ensure coverage of the area and minimize multiple records of the same individual bee.
- All actively foraging *B. ruderarius* observed within 2 m on either side of each transect should be recorded.
- The sex of the bees should also be recorded.
- This species is relatively easy to identify in the field but care should be taken if using volunteers to ensure that they are adequately trained.

The surveyor should make some assessment of habitat quality and condition. It would be useful to record details of changes in management, numbers of grazing animals and the availability of forage plants. Surveying should be carried out annually as numbers will be extremely variable.

Time

Six days would be required to carry out this work.

References

Pollard, E. 1977. A method for assessing changes in abundance of butterflies. *Biological Conservation*, **12**, 115-134.

Redpath, N., Osgathorpe, L.M., Park, K. & Goulson, D. 2009. Crofting and bumblebee conservation: the impact of land management practices on bumblebee populations in northwest Scotland. *Biological Conservation*, **143**, 492-500.

SPECIES REPORT FOR NORTHERN OSMIA RUBY-TAILED WASP (*Chrysura hirsuta*)

Ecology

Chrysura hirsuta is a specialist parasitoid of the larvae of mason bees, and the potential host species in Britain (*Osmia inermis*, *O. uncinata* and *O. parietina*) are classified as rare or vulnerable (Douglas, 2003). *Chrysura hirsuta* consumes *Osmia* larvae before spinning their own cocoon inside the bee; both host and parasitoid appear to have an obligate two-year life cycle (Douglas, 2003). The flight period of the adult extends from late May until the end of July (Edwards & Telfer, 2002; Douglas, 2003).

Conservation status and rarity

- UK Red Data Book 3: Rare (RDB3).
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed. European threat is probably high (JNCC, 2010).

Distribution

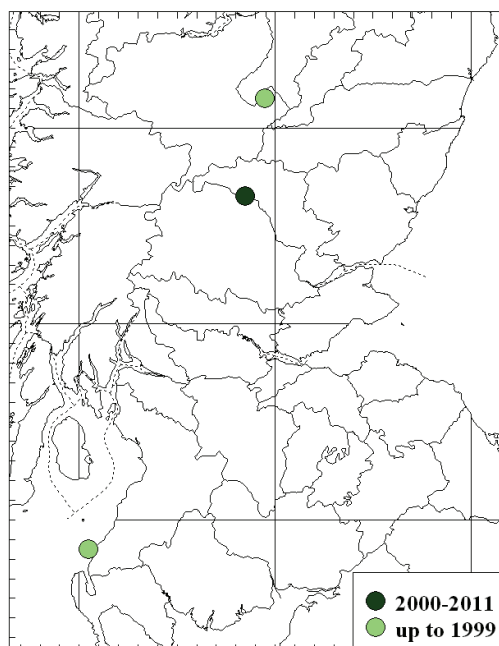
Chrysura hirsuta has been recorded from three distinct parts of Scotland; Kirkcudbrightshire (presumed host is *O. parietina*), Blair Atholl in East Perthshire (confirmed host is *O. inermis*) and the Mid Spey valley including the Aviemore area, the RSPB Loch Garten reserve and the surrounding Abernethy Forest (presumed host is *O. uncinata*). There are modern records only for Blair Atholl. *Chrysura hirsuta* is not found elsewhere on the British Isles, despite the presence of its hosts in other areas (e.g. Cumbria). *Chrysura hirsuta* has a boreo-alpine distribution across the Palaearctic (Douglas, 2003).

Habitat and management

Chrysura hirsuta has been recorded from three distinct habitat types of their hosts; *O. inermis* is found on upland base-rich grassland under which lie areas of limestone or schist deposits, *O. uncinata* is found in Caledonian pine woodland (Douglas, 2003) and less intensively managed plantations (S. Taylor, *pers. comm.*) where it nests in dead wood but requires open areas suitable for forage plants. *Osmia parietina* occurs on upland pasture with stone walls or rocky outcrops where they nest in their crevices (Douglas, 2003).

Pressures and threats

Chrysura hirsuta suffers the same threats of their hosts, especially habitat loss with special reference to their main pollen source, bird's-foot trefoil (*Lotus corniculatus*) (Douglas, 2003). Afforestation will shade out *L. corniculatus* and for this reason pine woods in particular must retain their sunny glades and upland habitat must remain free of shade (Douglas, 2003; JNCC, 2010). Intensification of grassland management poses a similar threat (JNCC, 2010). Unfortunately the habitat types where *Osmia* can be found are relatively uncommon in



Scotland (Douglas, 2003). It is likely this species would be vulnerable to climate change (JNCC, 2010).

Conservation measures

The host species require sward management to provide suitable nectar sources (JNCC, 2010); this includes maintaining open areas within Caledonian pinewood and the provision of dead wood. Some of the records of this species are from SSSIs and it also occurs on the RSPB reserve at Abernethy Forest (Anon, 1999).

Summaries of surveys and research related to surveillance

There have been no targeted surveys for this species.

Quality of data

Good but limited data.

References

Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.

Douglas, G. 2003. Invertebrate species dossier: *Chrysura hirsuta*, Gerstacker: A ruby-tailed wasp (Hymenoptera: Colletidae). *Unpublished Report*. Edinburgh: Scottish Natural Heritage.

Edwards, R. & Telfer, M. 2002. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland Part 4*. Huntingdon: Centre for Ecology and Hydrology.

JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/215.pdf> [Accessed 1 February 2012].

Map data sources

Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).

**SURVEILLANCE METHODOLOGY FOR NORTHERN OSMIA RUBY-TAILED WASP
(*Chrysura hirsuta*)**

Surveillance of this species is combined into the methodologies for *Osmia inermis*, *Osmia parietina* and *Osmia uncinata*.

SPECIES REPORT FOR NORTHERN COLLETES (*Colletes floralis*)

Ecology

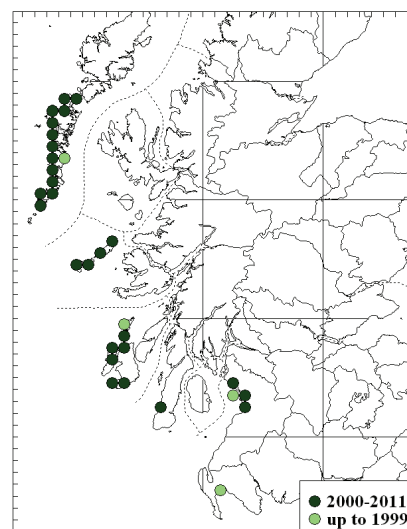
This bee nests in aggregations of burrows in light sandy substrates on gently-sloping hillocks with a general southerly aspect where vegetation is short and sparse (Anon, 1999; Bowler *et al.*, 2009). Burrows are present from mid June to early August, and can be locally abundant (Anon, 1999; Bowler *et al.*, 2009). The species is known to forage on a wide range of flowers (Douglas, 2003; Bowler *et al.*, 2009), but typically it can only fly around 500 m between burrows and food resources (Anon, 2006).

Conservation status and rarity

- UK Red Data Book 3: Rare.
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Fluctuating - probably stable.
- IUCN Status: Not listed.

Distribution

This species has a highly fragmented range (Bowler *et al.*, 2009). On the Scottish mainland it is present at Machrihanish in Kintyre (Hunter, 2008), Irvine in Ayrshire (Little, 2007), and in the Hebrides on Colonsay/Oronsay (Wynde, 2002), Tiree/Coll (Hunter, 2002; Wellock 2004; Bowler, 2008), Vatersay to Berneray in the Sound of Harris (Edwards, 1998, 2001; Neill, 2001 and Islay (Hunter, 2006). Historically it appears to have been more widespread through the Inner/Outer Hebrides and west coast mainland. The species has a Palearctic distribution. It is found at low altitudes to the north and in montane areas further south (Anon, 1999).



Habitat and management

On the mainland it is associated with the marram zone of coastal sand dunes (Douglas, 2003). Island colonies are found on machair (Douglas, 2003). On the RSPB Reef reserve on Tiree, four of the 11 nesting aggregations were associated with coastal dunes while the remaining seven were associated with man-made features (e.g. slopes at the edge of old pits, rubble piles and ditches) (Bowler *et al.*, 2009).

Pressures and threats

The main threat to this species is changes in land use due to agricultural intensification, afforestation, under-grazing and over-grazing (Anon, 1999; Douglas, 2003; Bowler *et al.*, 2009) which has led to a loss of herb-rich dune grasslands. Habitat fragmentation may reduce the potential for migration into adjacent sites. As a boreo-alpine species, it is likely to be negatively affected by warming of the UK climate (Anon, 1999). The bee *Epeolus variegates* is a known kleptoparasite of *C. floralis* (Douglas, 2003).

Conservation measures

The current management regime on RSPB Reef reserve, Tiree, appears to suit the species

with winter cattle grazing between November and March, light grazing from April to May and then no grazing between May and November. This system maintains a short sward but allows a full set of machair plants to flower and seed whilst the poaching creates suitable nesting habitat for the bee (Bowler *et al.*, 2009).

Summaries of surveys / research related to surveillance

Between 2000 and 2008 UK-wide surveys, carried out by RSPB and Hymettus Ltd., failed to find the bee at pre-1999 locations on Lewis/Harris, Skye, Rum, Mull and Iona, and mainland coasts of Sutherland, Wester Ross and Torrs Warren in Dumfries and Galloway. Since 2001, nesting aggregations have been monitored annually on the RSPB Reef reserve on the Isle of Tiree in the Inner Hebrides (Bowler *et al.*, 2009).

Quality of data

Good, reliable.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Anon. 2006. *Northern Ireland Species Action Plan Colletes floralis*. Belfast: Department of Environment, Environment and Heritage Services.
- Bowler, J. 2008. Monitoring of the Northern colletes *Colletes floralis* on The Reef RSPB reserve, Tiree. *Unpublished report*. Edinburgh: Scottish Natural Heritage and RSPB.
- Bowler, J., Sears, J. & Hunter, J. 2009. Recent research on the northern colletes mining bee *Colletes floralis* Eversmann. *The Glasgow Naturalist*, **25**, 43-49.
- Douglas, G. 2003. Invertebrate species dossier: *Colletes floralis* Eversmann, a mining bee (Hymenoptera: Colletidae). *Unpublished Report*. Edinburgh: Scottish Natural Heritage.
- Edwards, M. 1998. Reports of searches for the Biodiversity Action Plan (second list) bees *Colletes floralis* Eversmann and *Osmia inermis* Zetterstedt (Hymenoptera: Apidae) in Scotland. June to July 1998. *Unpublished report*. Edinburgh: Scottish Natural Heritage.
- Edwards, M. 2001. Survey of three Biodiversity Action Plan bee species (*Colletes floralis*, *Osmia inermis*, *O. uncinata*) in Scotland. *Unpublished report*. Edinburgh: Scottish Natural Heritage and RSPB.
- Hunter, J. 2002. Surveys of *Colletes* on Tiree and Coll June-August 2002. *Unpublished report*. Edinburgh: RSPB.
- Hunter, J. 2006. Searches for the Northern colletes *Colletes floralis* on Islay, July 2006. *Unpublished report*. Edinburgh: RSPB.
- Hunter, J. 2008. Searches for *Colletes floralis* on Islay, Machrihanish, Ross of Mull & Iona, July, 2008. *Unpublished report*. Edinburgh: RSPB.
- Little, B.H. 2007. Report on *Colletes floralis* survey in Ayrshire, July 2007. *Unpublished report*. West Sussex: Hymettus Ltd.
- Neill, B. 2001. *Colletes floralis* (Eversmann) Survey of North Uist, Benbecula, south Uist, Eriskay, Fuday, Barra and Vatersay, 2001. *Unpublished report*. Edinburgh: Scottish Natural Heritage and RSPB.
- Wellock, S. 2004. Monitoring of the Northern colletes *Colletes floralis* on the Isle of Coll in 2004. *Unpublished report*. Edinburgh: RSPB.
- Wynde, R. 2002. A survey of potential sites for *Colletes floralis* in Oronsay and Colonsay, July 2002. *Unpublished report*. Edinburgh: RSPB.

Map data sources

Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society), HBRG Insects Dataset (Highland Biological Recording Group).

Species Consultants: John Bowler and Janet Hunter

SURVEILLANCE METHODOLOGY FOR NORTHERN COLLETES (*Colletes floralis*)

Aim

To establish the status of *Colletes floralis* at its current locations.

Rationale

Colletes floralis is a small mining bee found on coastal dunes and machair. Historically more widespread, it now has a fragmented distribution (Bowler *et al.*, 2009). The population is believed to be stable.

Between 2000 and 2008 UK-wide surveys were carried out by RSPB and Hymettus Ltd. These surveys failed to find the bee at historical (pre-1999) locations on Lewis/Harris, Skye, Rum, Mull and Iona, and mainland coasts of Sutherland, Wester Ross and Torrs Warren in Dumfries and Galloway (Bowler *et al.*, 2009). Surveillance for this species should therefore focus on extending the current monitoring which is ongoing at the RSPB Reef reserve on the Isle of Tiree, to other known current locations.

Approach

The methodology described here is based on comprehensive surveys carried out by RSPB and Hymettus Ltd. between 2000 and 2008 and published in Bowler *et al.* (2009). Locating burrows is the simplest way to determine the presence of the bee. Recently used (active) burrows can be identified from their size, shape, habitat and presence of freshly discarded soil in front of the burrow entrances (Hunter, 2003).

Equipment

No specialist equipment required.

Location

On the Scottish mainland the bee is present at Machrihanish in Kintyre (Hunter, 2008), Irvine in Ayrshire (Little, 2007), and in the Hebrides on Colonsay/Oronsay (Wynde, 2002), Tiree/Coll (Hunter, 2002; Wellock, 2004; Bowler, 2008), Vatersay to Berneray (Sound of Harris) in the Outer Hebrides (Edwards, 2001; Neill, 2001; Douglas, 2003) and Islay (Hunter, 2006).

Sample units

The sample units will be the number of active burrows per site.

Sampling

Each of the survey areas should be visited in turn and sampled using direct search techniques as described in Bowler *et al.* (2009). Areas of suitable nesting habitat should be targeted, i.e. gently-sloping hillocks with a general southerly aspect and where vegetation is short and sparse (Anon, 1999; Bowler *et al.*, 2009). With experience, this species is identifiable in the field.

Following consideration of published information and expert opinion, the following guidelines on sampling protocol are recommended:

- If active-looking *Colletes*-type burrows are discovered, watch for 10-20 minutes for bee activity.

- The location of nest burrows should be recorded using a GPS.
- Surveys should be carried out between 10:00 and 16:00 h, in full sunshine and when the wind is force 3 or less.
- Areas can be surveyed between late June and early August but ideally during the second week of July when bees have been found to be most active.
- Days preceded by wet or cold weather should be avoided as these conditions may reduce bee activity (Douglas, 2003).

Surveys should be carried out every five years.

Time

Field surveying would take approximately 10 days.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Bowler, J. 2008. Monitoring of the Northern colletes *Colletes floralis* on The Reef RSPB reserve, Tiree. *Unpublished report. Edinburgh: Scottish Natural Heritage and RSPB*.
- Bowler, J., Sears, J. & Hunter, J. 2009. Recent research on the northern colletes mining bee *Colletes floralis* Eversmann. *The Glasgow Naturalist*, **25**, 43-49.
- Douglas, G. 2003. Invertebrate species dossier: *Colletes floralis* Eversmann, a mining bee (Hymenoptera: Colletidae). *Unpublished Report. Edinburgh: Scottish Natural Heritage*.
- Edwards, M. 2001. Survey of three Biodiversity Action Plan bee species (*Colletes floralis*, *Osmia inermis*, *O. uncinata*) in Scotland. *Unpublished report. Edinburgh: Scottish Natural Heritage and RSPB*.
- Hunter, J. 2002. Surveys of *Colletes* on Tiree and Coll June-August 2002. *Unpublished report. Edinburgh: RSPB*.
- Hunter, J. 2003. Management recommendations for the Northern colletes mining bee *C. floralis* in Northern Ireland. *Unpublished report. Bedfordshire: RSPB*.
- Hunter, J. 2006. Searches for the Northern colletes *Colletes floralis* on Islay, July 2006. *Unpublished report. Edinburgh: RSPB*.
- Hunter, J. 2008. Searches for *Colletes floralis* on Islay, Machrihanish, Ross of Mull & Iona, July, 2008. *Unpublished report. Edinburgh: RSPB*.
- Little, B.H. 2007. Report on *Colletes floralis* survey in Ayrshire, July 2007. *Unpublished report. West Sussex: Hymettus Ltd*.
- Neill, B. 2001. *Colletes floralis* (Eversmann) Survey of North Uist, Benbecula, south Uist, Eriskay, Fuday, Barra and Vatersay, 2001. *Unpublished report. Edinburgh: Scottish Natural Heritage and RSPB*.
- Wellock, S. 2004. Monitoring of the Northern colletes *Colletes floralis* on the Isle of Coll in 2004. *Unpublished report. Edinburgh: RSPB*.
- Wynde, R. 2002. A survey of potential sites for *Colletes floralis* in Oronsay and Colonsay, July 2002. *Unpublished report. Edinburgh: RSPB*.

SPECIES REPORT FOR NARROW-HEADED ANT (*Formica exsecta*)

Ecology

Formica exsecta is related to the wood ants with a similar, but smaller, appearance. It is a mound-building species but the mounds are typically small (around 25 cm diameter) (J. Stockan, *pers. obs.*) and with a pale thatch composed of grasses, heather, pine needles, moss and sometimes lichens (Wiswell, 2011). Nest mounds require high insolation for brood development as, unlike true wood ants, *F. exsecta* cannot increase the temperature within the nest by means of metabolic heat (Hughes, 2006). The sexual forms are produced in June (J. Stockan, *pers. obs.*). New nests are commonly founded through budding or temporary social parasitism of queenless nests of *Formica lemani* and *F. fusca* (Hughes, 2006), and dispersal is believed to be limited to around 5 m. The ant forages on shrubs and small trees collecting aphid honeydew and other invertebrates as prey.

Conservation status and rarity

- UK Biodiversity Action Plan: Species of conservation concern.
- UK Red Data Book 1: Endangered.
- On Scottish Biodiversity List.
- IUCN Status: Not listed.
- 2008 Reporting Round UK: declining slowly.
- 2010 *UK Priority Species data collation* – declining.
- 8% decline between 1997 and 2008 (Jones, 2009).

Distribution

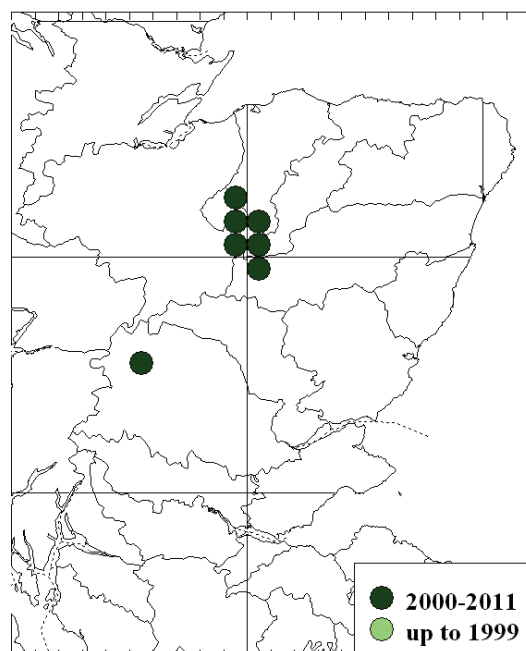
Localised but widely distributed through Europe and western Asia. Within the UK *F. exsecta* has a highly disjunct distribution, having never been recorded outside south and south west England and the Highlands of Scotland. Around 90% of the UK population is found in Scotland, mainly within the Abernethy-Glenmore-Rothiemurchus complex where there are around 380 nests. Outlying populations exist at Rannoch (7 nests) (Gallagher, 2010), Mar (17 nests) (Wiswell, 2011) and Carrbridge. Nests are found at altitudes between 200 and 400 m.

Habitat and management

Formica exsecta is strongly associated with open canopy woodland with scattered trees and shrubs (Hughes, 2006). Nests have been found on grassland, heathland, birchwood, on the edges of mires, and native pine forest on south-facing slopes (J. Stockan, *pers. obs.*; Hughes, 2006; Wiswell, 2011). Within forests there is a preference for open woodland, clearings, alongside tracks, along power lines and woodland-edge habitats (Hughes, 2006).

Pressures and threats

The most serious threats are habitat loss, fragmentation and inappropriate habitat management. Increased forest cover and undergrazing, due to large deer culling programmes, will cause encroachment by scrub, trees and bracken which may lead to



shading out of nests. *Formica exsecta* queens have poor dispersal ability and cannot cross non-suitable habitat. Therefore they may be unable to adapt or disperse adequately in the face of rapid ecological change (Hughes, 2006). The lack of potential nest sites at Mar Lodge has been raised as a particular concern (Stockan *et al.*, 2010). Afforestation also encourages invasion by the wood ants *F. aquilonia* and *F. lugubris* which out-compete the smaller *F. exsecta*. The Carrbridge population is threatened with development. Climate change may adversely affect populations by increasing wintertime mortality (Sorvari *et al.*, 2011).

Conservation measures

The ant benefits from maintaining areas of early successional woodland cover. Mar Lodge and Glenmore Forest currently have monitoring plans in operation. Abernethy is an RSPB reserve and part SSSI.

Summaries of surveys and research related to surveillance

A recent survey of Tulloch Moor in Abernethy Forest located more than 90 nests (Wiswell, 2011). RSPB plan to manage this area fairly intensely as it has considerable floral interest. The three-year repeat survey of the Mar Lodge population in 2011 located one new nest and the relocation of three others which had been perceived as being threatened by overgrown vegetation (Wiswell, 2011). The Rannoch population has been surveyed on an ad-hoc basis by SWT and was last surveyed in 2010. Five-year repeat monitoring of a core population within Glenmore Forest is due to be carried out in 2013.

References

- Gallagher, P. 2010. Narrow-headed ant (*Formica exsecta*) Black Wood of Rannoch (Camghouran) site survey. *Unpublished report. Edinburgh: Scottish Wildlife Trust.*
- Hughes, J. 2006. A review of wood ants (Hymenoptera; Formicidae) in Scotland. *Scottish Natural Heritage Commissioned Report No. 178 (ROAME No. F04AC319).*
- Jones, S. 2009. *Distribution pattern and the effect of density on survival and resource capture in the narrow-headed ant, Formica exsecta Nyl.* BSc (Hons) thesis, University of East Anglia.
- Sorvari, J., Haatanen, M-K. & Vesterlund, S-R. 2011. Combined effects of overwintering temperatures and habitat degradation on the survival of boreal wood ant. *Journal of Insect Conservation*, **15**, 727-731.
- Stockan, J. A., Rao, S. & Pakeman, R. 2010. Nesting preferences of the threatened wood ant *Formica exsecta* (Hymenoptera: Formicidae); implications for conservation in Scotland. *Journal of Insect Conservation*, **14**, 269-276.
- Wiswell, H. 2011. Methodology for surveying and monitoring the narrow-headed ant, *Formica exsecta* (Hymenoptera: Formicidae). *Unpublished report. Stirling: UK Wood Ant Steering Group.*

Map data sources

- Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).
- Ants: *Formica Exsecta* Records from Abernethy RSPB (Scottish Wildlife Trust).
- HBRG Insects Dataset (Highland Biological Recording Group).
- NE Scotland NTS properties species records (National Trust for Scotland).

Species Consultants: Murdo Macdonald and Jenni Stockan

SURVEILLANCE METHODOLOGY FOR NARROW-HEADED ANT (*Formica exsecta*)

Aim

To establish the population trends of *Formica exsecta* in Scotland.

Rationale

There has been much interest in this species over the last 10-15 years particularly by students carrying out research projects, and the UK Wood Ant Steering Group. Many individual nests have been found but only a small proportion has been resurveyed, and of those which have, most are within Glenmore Forest.

Monitoring programmes are in place at Glenmore and Mar Lodge. At Mar Lodge monitoring involves measuring all nests every three years and establishing their status. This is practicable because of the small number of nests involved. At Glenmore a similar protocol is being implemented but focusing on a small proportion of the nests within a set area. While these monitoring programmes are still in their infancy, they will provide valuable data in the future. However, Mar Lodge is perhaps of limited use when considering the population of *F. exsecta* across Scotland as a whole. For this reason it would be desirable to add one or two new localities to those already being monitored.

Abernethy is suggested because this is part of the core area containing the stronghold of the population in the UK and Scotland. Carrbridge is one further locality which should perhaps be monitored because of the short term risk of substantial land use change.

Approach

Many of the nests at Abernethy have been mapped and a simple modelling approach (Wiswell, 2011) identified those nests which may be most at risk of abandonment given future management plans. Using this information, a fixed route through the forest could be identified traversing areas with a mix of perceived future scenarios. The surveyor would walk this route recording all active and abandoned nests within sight. At Carrbridge a similar transect approach could be established.

The monitoring programmes at Mar Lodge and Glenmore use protocols which include detailed measurements of nest dimensions, vegetation height and composition, and the number, height and position of trees in relation to *F. exsecta* nests (Stockan & Dennis, 2005; Stockan, 2006; Stockan *et al.*, 2010; Wiswell, 2011). For the purposes of this surveillance a rapid assessment approach can be employed.

Equipment

No specialist equipment required.

Location

The National Trust for Scotland monitor the Mar Lodge population and Forestry Commission Scotland monitor part of the Glenmore population. Within Abernethy there are records for a number of nests with 10-figure grid references which should make relocation possible. Gus Jones (Badenoch & Strathspey Conservation Group) has details of the locations of the nests at Carrbridge.

Sample units

The sample units will be the number of occupied nests present within a fixed area.

Sampling

In order to identify the number of occupied nests, as opposed to those which have been abandoned, survey work should be carried out when the ants are active (from April until September in reasonably warm and sunny weather). Nests are smaller than wood ant nest mounds (Hughes, 2006) and with pale thatch composed of grasses, heather, pine needles, moss and sometimes lichens (Wiswell, 2011). They are often located on the south side of grassy tussocks and therefore not visible from all angles. Because of the difficulty in finding the nests, particularly when small, it would be advisable for this work to be carried out by someone familiar with the species and its nesting habits. Note that this species frequently relocates its nest as a matter of course (J. Hughes, *pers. comm.*). Therefore, if any abandoned nest mounds are found, then a careful search of the surrounding area (within 5 m) should be made for a potential relocation site.

Surrounding habitat characteristics should be rapidly assessed by estimating the vegetation height, and noting any trees close to the nest, particularly to the south side, that are at risk of causing shading to the nest in the future. Photographs of the nest taken from multiple angles often help with relocation of nests.

Time

Searching for the nests of this ant can be time-consuming particularly if the nests are small. An estimated five days would be needed to carry out the additional surveillance suggested in this report in addition to that already carried out.

References

- Hughes, J. 2006. A review of wood ants (Hymenoptera; Formicidae) in Scotland. *Scottish Natural Heritage Commissioned Report No. 178 (ROAME No. F04AC319)*.
- Stockan, J. 2006. Foraging behaviour, ant competition and nest site selection in narrow-headed ants (*Formica exsecta*). *Unpublished report, Edinburgh: National Trust for Scotland*.
- Stockan, J. & Dennis, P. 2005. Foraging behaviour and ant competition in narrow-headed ants (*Formica exsecta*). *Unpublished report, Edinburgh: National Trust for Scotland*.
- Stockan, J.A., Rao, S. & Pakeman, R. 2010. Nesting preferences of the threatened wood ant *Formica exsecta* (Hymenoptera: Formicidae); implications for conservation in Scotland. *Journal of Insect Conservation*, **14**, 269-276.
- Wiswell, H. 2011. Methodology for surveying and monitoring the narrow-headed ant, *Formica exsecta* (Hymenoptera: Formicidae). *Unpublished report, Stirling: UK Wood Ant Steering Group*.

SPECIES REPORT FOR SHINING GUEST ANT (*Formicoxenus nitidulus*)

Ecology

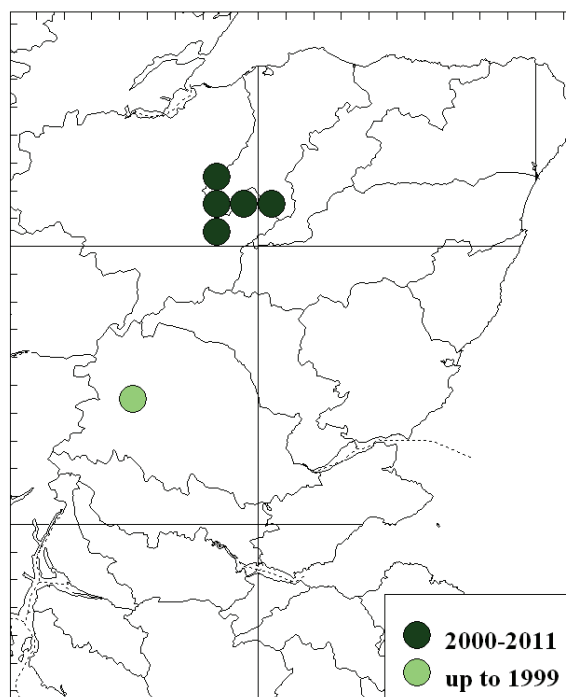
This tiny ant lives in the nests of wood ants (*Formica aquilonia* and *F. lugubris* in Scotland) (Anon, 1999) as a commensal (Elgert & Rosengren, 1977; Busch, 2001) or a trophic parasite (Buschinger, 1976; Czechowski & Czechowski, 1999). In Scotland it is often found on small nests (M. Macdonald, *pers. comm.*) but elsewhere it has shown a preference for large nests in good condition (Buschinger, 1976). It can relocate to another host nest (Robinson, 2005). Colonies consist of up to 150 individuals (Busch, 2001) and are often found in a piece of wood or bracken frond buried within the mound. There can be more than one guest ant colony per wood ant nest mound (Anon, 1999). They are often seen wandering across the surface of the nest mound but their small size means they are easily overlooked (M. Macdonald, *pers. comm.*). In Scotland they have been from mid-June until September (Anon, 1999) but are easiest to observe in autumn when the wingless males are active (Robinson, 2005).

Conservation status and rarity

- UK BAP Priority Species.
- On Scottish Biodiversity List.
- Listed by the IUCN (1996) as globally *Vulnerable*.

Distribution

In Scotland several recent records (not all mapped opposite) exist from Strathspey in Highland, Loch Ard in Stirlingshire (2008), Plockton area, Ross and Cromarty, and Mudalach birch wood on Skye (M. Macdonald, *pers. comm.*). However, it has not been seen at the latter of these sites since 1984 (M. Macdonald, *pers. comm.*). Older records exist for Mar Lodge, Black Wood of Rannoch, and from parts of Argyll including North Knapdale and Kintyre (Godden & Cosens, 1987). None of these sites have been surveyed recently. Anecdotal evidence suggests it may not be uncommon in southern Scotland. In the Highland region of Scotland it probably does not occur in more than 1% of wood ant nest mounds (M. Macdonald, *pers. comm.*). It is likely to occur in Deeside, Perthshire, Stirling and Argyll & Bute (M. Macdonald, *pers. comm.*) but little survey work has been carried out. There are scattered records across England. The species is found across the Palaearctic but is less prevalent in warmer Mediterranean climates (Anon, 1999).



Habitat and management

Management of woodland appropriate for the species of wood ants will benefit *F. nitidulus* (JNCC, 2010). Mature old woodlands should be maintained and damage to wood ant nests avoided during forest operations.

Pressures and threats

Due to lack of data it is not possible to state whether the shining guest ant is actually in decline (Anon, 1999). However, as its fate is interlinked with that of its hosts, it is likely to be affected by the same factors adversely affecting wood ants including loss of suitable woodland habitat and inappropriate management (Anon, 1999). The most northern site is at immediate risk from careless forestry practices (M. Macdonald, *pers. comm.*).

Conservation measures

Some sites supporting populations of the shining guest ant are SSSIs or NNRs. Developers must be made more aware of practices to minimize damage during road building operations. All nests of *Formica lugubris* and *F. aquilonia* should be considered potential habitat for *F. nitidulus*.

Summaries of surveys and research related to surveillance

The Highland region has been surveyed in reasonable detail by the Highland Biological Recording Group but elsewhere there has been only ad hoc recording or none at all.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO
- Busch, T. 2001. Verbreitung der Gastameise *Formicoxenus nitidulus* (Nyl.) in Mecklenburg-Vorpommern (Nordostdeutschland) sowie bemerkenswerte Beobachtungen (Hymenoptera, Formicidae). *Amiesenschutz aktuell*, **15**, 69-86.
- Buschinger, A. 1976. Eine methode zur zucht der Gastameise *Formicoxenus nitidulus* (Nyl.) mit *Leptothorax acervorum* (Fabr.) als wirtsameise (Hym., Form.). *Insectes Sociaux*, **23**, 205-214.
- Czechowski, W. & Czechowski, W. 1999. New sites in Poland and notes on the biology of socially parasitic ants *Formicoxenus nitidulus* (NYL.) and *Harpagoxenus sublaevis* (NYL.) (Hymenoptera, Formicidae). *Fragmenta Faunistica*, **42**, 1-6.
- Elgert, B. & Rosengren, R. 1977. The guest ant *Formicoxenus nitidulus* follows the scent trail of its wood ant hosts (Hymenoptera, Formicidae). *Memoranda Societatis pro Fauna et Flora Fennica*, **53**, 35-38.
- Godden, C. & Cosens, D. 1987. Ant species (Hym., Formicidae) native to north knapdale, Argyllshire. *Entomologist's Monthly Magazine*, **123**, 209-216.
- JNCC., 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2223.pdf> [Accessed 1 February 2012].
- Robinson, N. 2005. The 'Uninvited Guest Ant' *Formicoxenus nitidulus* (Nylander) in North West England. *Bulletin of the Amateur Entomologists' Society*, **64**, 128-128.

Map data sources

- Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).
- HBRG Insects Dataset (Highland Biological Recording Group).

SURVEILLANCE METHODOLOGY FOR THE SHINING GUEST ANT (*Formicoxenus nitidulus*)

Aim

To establish the distribution of the shining guest ant, *Formicoxenus nitidulus*, in Scotland.

Rationale

Formicoxenus nitidulus nests within wood ant nest mounds (*Formica aquilonia* and *F. lugubris*). The small size of this ant, and the rarity with which it appears outside the nest mound, mean that it is probably under-recorded in Scotland. The Highland region has been surveyed in reasonable detail by the Highland Biological Recording Group but some of these populations are now under immediate threat from road building (M. Macdonald, *pers. comm.*). Elsewhere there has been only ad hoc recording or none at all.

Approach

The ant can be found by watching the surface of wood ant nest mounds at specific times of year and in particular weather conditions. In Scotland they have been seen on the surface of nest mounds from mid-June until September (Anon, 1999) although they may be present in October given suitable weather (E. Robinson, *pers. comm.*). They are often easiest to observe in autumn when the wingless males are active on the surface of the nest mound (Robinson, 2005a). The ant is predominantly visible on humid, sunny days when the air temperature exceeds 14°C (E. Robinson, *pers. comm.*; Busch, 2001) and when the wood ant nest is in full sun (E. Robinson, *pers. comm.*). Where the nest is built around a stone or if there is a branch protruding from the nest, *F. nitidulus* males will often be found on them (E. Robinson, *pers. comm.*).

The surveyor should be familiar with the identification of *F. nitidulus*, which is a tiny ant, 2-3 mm in length, and conspicuously shiny ((Bolton & Collingwood, 1975; Skinner & Allen, 1996; Robinson, 2005b). They walk in a characteristic way at a constant steady pace (Robinson, 2005b). There does not appear to be a preference for nest mound size (E. Robinson, *pers. comm.*; M. Macdonald, *pers. comm.*).

Old sites should be resurveyed together with additional sites where the species is likely to be found. Caution is urged, for even if the ant is present one cannot generally rely on seeing it on the same nest from year to year (Robinson, 2005b). The ant should therefore not be recorded as absent until it has not been observed for 10 years.

Equipment

No specialist equipment is required.

Location

Surveying should target known locations around Carrbridge, Abernethy Forest and Glenmore Forest in Speyside, Plockton, Ross & Cromarty and areas with high densities of wood ant nest mounds such as Ballochbuie Forest, Glen Tanar and Mar Lodge in Deeside, and Culbin Forest in Moray. In the Highland region the precise locations of nest mounds containing *F. nitidulus* populations are known.

Sample units

The sample units will be a simple presence or absence; presence indicating at least one colony is resident.

Sampling

Surveying should be carried out between mid-June and October in warm, sunny and humid conditions, and when the wood ant nest mounds are in full exposure to the sun. The ants are more easily observed on thatch which is thinning or missing, or when there is less host ant activity. Special attention should be paid to any protruding branches or stones upon which the ant is often observed.

For areas where the species has been previously recorded, the same nest should be observed. At potential new sites, a random selection of 10 nests should be surveyed.

Each nest mound will be observed for 20 minutes during which the presence or absence of *F. nitidulus* should be noted. The nearest nests should also be searched. Additional information on the number and sex of ants observed, and the immediate habitat characteristics would be helpful for future monitoring. Photographs would aid relocation. Sites should be re-surveyed every five years.

Time

Surveillance for this species is likely to be time consuming and is one of the reasons why this species is perhaps under-recorded.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Bolton, B. & Collingwood, C.A. 1975. Hymenoptera, Formicidae. Handbooks for the identification of British insects Vol. VI part 3(c). Royal Entomological Society of London.
- Busch, T. 2001. Verbreitung der Gastameise *Formicoxenus nitidulus* (Nyl.) in Mecklenburg-Vorpommern (Nordostdeutschland) sowie bemerkenswerte Beobachtungen (Hymenoptera, Formicidae). *Amiesenschutz aktuell*, **15**, 69-86.
- Robinson, N. 2005a. The red wood ant – the AONB's special ant. *Journal of the Arnside/Silverdale Area of National Beauty Landscape Trust*, issue 57.
- Robinson, N. 2005b. The 'Uninvited Guest Ant' *Formicoxenus nitidulus* (Nylander) in North West England. *Bulletin of the Amateur Entomologists' Society*, **64**, 128-128.
- Skinner, G.J. & Allen, G.W. 1996. *Ants*. Naturalists Handbooks 24. The Richmond Publishing Co. Ltd.

SPECIES REPORT FOR MASON BEE (*Osmia inermis*)

Ecology

Osmia inermis shows a preference for bird's-foot trefoil (*Lotus corniculatus*) as a pollen source (Douglas, 2003; JNCC, 2010), but bugle (*Ajuga reptans*) and bilberry (*Vaccinium* spp.) may also be used (Edwards, 1997). Nests are built on the underside of rocks lying over shallow depressions (Edwards, 1997; Douglas, 2003), and in rock crevices (Anon, 1999). Nesting sites need to be in full exposure to the sun, and more than one bee may share a nest (Anon, 1999). This bee has a two to four-year life cycle (Douglas, 2003). The flight period is from late May to the end of July (Else & Edwards, 1996; Edwards, 1997; Douglas, 2003).

Conservation status and rarity

- UK Red Data Book 2: *Vulnerable*.
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: No clear trend.
- IUCN Status: Not listed.
- Recent surveys by Hymettus indicate a downward trend.

Distribution

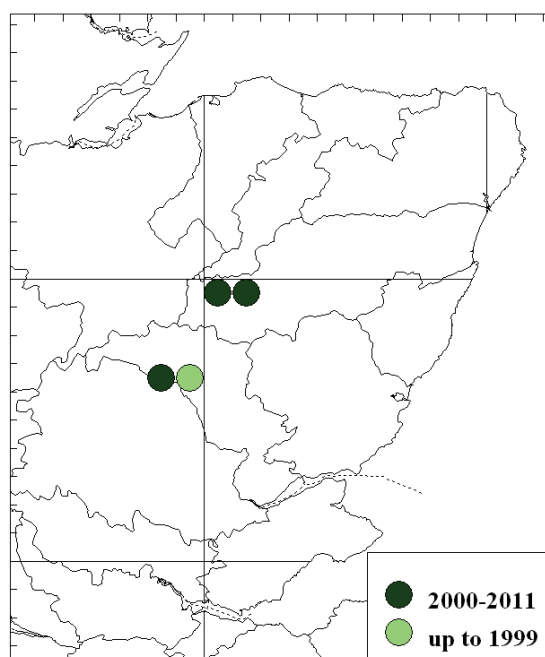
In the UK, the species is only found in Scotland. There are old records of *O. inermis* from Speyside but most recent records are from Perthshire around the Blair Atholl area (Anon, 1999; Douglas, 2003). The stronghold is at Little Lude in Glen Fender (Else & Edwards, 1996; Douglas, 2003). This bee has a circumpolar distribution being found at lower altitudes in the arctic circle and at montane locations further south in its range (Anon, 1999; Douglas, 2003).

Habitat and management

Osmia inermis is typically found on exposed, base-rich uplands (Edwards, 1997; Anon, 1999; Douglas, 2003; JNCC, 2010) in short, dry, heathery turf which is closely grazed and has a high proportion of moss and lichens (Edwards, 1997; Anon, 1999). It is found at between 300 and 600 m elevation in Scotland (Douglas, 2003) although there are some earlier records from lower levels (Anon, 1999). The Blair Atholl site consists of exposed, winter-grazed sheep pasture on low, dry hillocks on south-facing mica-schist escarpment. The vegetation is heavily grazed heather, with lichen and moss predominating (Douglas, 2003).

Pressures and threats

This species is threatened by land use changes through afforestation or agricultural improvement resulting in the loss of herb-rich grasslands. It is likely to be negatively affected by climate change (Anon, 1999; Douglas, 2003; JNCC, 2010). The chrysidid wasp *Chrysura hirsuta* is a parasitoid.



Conservation measures

Suitable habitat can be maintained through winter grazing (JNCC, 2010) to prevent scrub encroachment and allow *Lotus* to flower and set seed. Summer grazing intensity should be reduced (Lee, 2008). The availability of breeding habitat can be maintained by ensuring a supply of loose rock (Douglas, 2003). Tulach Hill is part of the Tulach Hill SSSI and Glen Fender Meadows is a SAC but *O. inermis* is not mentioned in either designation.

Summaries of surveys / research related to surveillance

Hymettus Ltd has carried out several surveys since 1983 particularly around the Meall Ghruaim site. At Meall Ghruaim itself no nests or bees were found in 2007 and, although the habitat was still suitable, there was evidence of summer grazing and recreational use. In 2008 the vegetation was considered to be in excellent condition, but only one nest was found and the number of potential nesting sites was found to be limiting largely due to a decrease in the number of stones on the surface. The nearby site of Glen Tilt shows potential to provide the right habitat for the bee now that sheep numbers have been reduced, but so far the bee has not been found. A possible sighting at the River Garry appears to be a misidentification and the habitat is no longer suitable. Tulach Hill was still suitable habitat but no bees/nests were found in 2007. This site was not visited in 2008 and 2009. There appear to have been no surveys carried out in 2010.

Quality of data

Recent records are excellent but past records may have incorrectly identified the species as *O. parietina* or *O. uncinata* (Edwards, 1997).

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Douglas, G. 2003. Invertebrate species dossier: *Osmia inermis* Zetterstedt, a mason bee (Hymenoptera: Megachilidae). *Unpublished Report*. Edinburgh: Scottish Natural Heritage.
- Edwards, M. 1997. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland. Part 1*. Bees, Ants and Wasps Recording Society. Huntington: Biological Records Centre.
- Else, G.R. & Edwards, M. 1996. Observations on *Osmia inermis* (Zetterstedt) and *O. uncinata* Gerstaecker (Hym., Apidae) in the central Scottish Highlands. *Entomologists Monthly Magazine*, **132**, 291-298.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/235.pdf> [Accessed 1 February 2012].
- Lee, P. 2008. Research Report for 2007. *West Sussex: Hymettus Ltd*.

Map data sources

Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).

SURVEILLANCE METHODOLOGY FOR MASON BEE (*Osmia inermis*) & NORTHERN OSMIA RUBY-TAILED WASP (*Chrysura hirsuta*)

Aim

To establish the status of *Osmia inermis* at its current locations, and to investigate the status of its parasitoid *Chrysura hirsuta*.

Rationale

Hymettus Ltd have been surveying for this species since 1983, and searches were made by George E. Else and Michael Edwards in 1996.

The last record for the bee appears to be from 2008. As well as known sites, a number of adjacent sites have been investigated for their habitat potential, but there were no positive results. For sites where the bee has been found, concerns have been raised over changes in management, in particular summer grazing and recreational use (Lee, 2008). Consequently the availability of the main forage plant, bird's-foot trefoil (*Lotus corniculatus*), and potential nesting sites (loose rock) have been reduced (Lee, 2008).

Chrysura hirsuta is a confirmed parasitoid of *O. inermis*. Their ranges overlap in the mid Spey valley and the Blair Atholl area in Perthshire (Douglas, 2003a). The latter site is the only one from which there are recent records for *C. hirsuta* in Scotland.

Approach

The approach should follow methods used by Hymettus Ltd. *Osmia inermis* is most effectively found by visual searches of adult bees and nests in areas of suitable nesting and foraging habitat. The adults, though rarely seen, can be found by searching for foraging bees on *L. corniculatus*. *Osmia inermis* will only fly on warm, sunny days. Nests can be found on the underside of rocks and in rock crevices (Edwards, 1997; Douglas, 2003b). Nest cells are oval, approximately 10-12 mm long and 8 mm wide (Else & Edwards, 1996).

The parasitoid *C. hirsuta* has been found in the host's nest cells but given the extremely vulnerable nature of both species, it would not be advised to open cells. The surveyor should remain vigilant for the presence of *C. hirsuta* on the wing, resting on rocks, or foraging for pollen.

Equipment

No specialist equipment is required.

Location

There are old records of *O. inermis* from Speyside but the most recent are from east Perthside around the Blair Atholl area (Anon, 1999; Douglas, 2003b). The precise locations are well known and comprise Glen Fender, Meall Ghruaim, Tulach Hill and Glen Tilt (Else & Edwards, 1996; Lee, 2008). *Chrysura hirsuta* has been found in the Blair Atholl area in Perthshire and the mid Spey valley including the Aviemore area, the RSPB Loch Garten reserve and the surrounding Abernethy Forest (Douglas, 2003a). For both species surveillance should focus on the Blair Atholl area.

Sample units

The sample units for *O. inermis* will be the number of occupied sites. If nests are found, then the number of cells should be used. *Chrysura hirsuta* should simply be recorded as present or absent.

Sampling

Sampling should focus on exposed, low, dry hillocks on south-facing mica-schist, with short heathery turf comprising a high proportion of moss and lichens, between 300 and 600 m altitude. Identification of this bee is difficult and therefore surveys should be carried out by a hymenopterist familiar with the species.

Following consideration of published information and expert opinion, the following guidelines on sampling protocol are recommended:

- The adult bee should be looked for in patches of *L. corniculatus*.
- Turning over rocks and stones, and looking in crevices in drystone walls may reveal the characteristic nest cells.
- If nests are found the number of cells, including whether occupied or empty, should be counted.
- All sites where the bee is present should be recorded using a GPS.
- Any *Chrysura* wasps seen should be collected in an aspirator to establish their identity.
- Surveys should be carried out between 10:00 and 16:00 h, in full sunshine and when the temperature exceeds 18°C.
- Areas should be surveyed between late May and the end of June (only continuing into July if the weather remains suitable) when both the bee and its potential parasitoid are present.

The surveyor should make a brief assessment of habitat quality and condition, particularly any changes in management, number of grazing animals or evidence of grazing, and the availability of nesting and forage resource. Surveys should be carried out every five years.

Time

This work would be expected to take two days.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Douglas, G. 2003a. Invertebrate species dossier: *Chrysura hirsuta*, Gerstaecker: A ruby-tailed wasp (Hymenoptera: Colletidae). *Unpublished Report. Edinburgh: Scottish Natural Heritage*.
- Douglas, G. 2003b. Invertebrate species dossier: *Osmia inermis* Zetterstedt, a mason bee (Hymenoptera: Megachilidae). *Unpublished Report. Edinburgh: Scottish Natural Heritage*.
- Edwards, M. 1997. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland. Part 1. Bees, Ants and Wasps* Recording Society. Huntingdon: Biological Records Centre.
- Else, G.R. & Edwards, M. 1996. Observations on *Osmia inermis* (Zetterstedt) and *O. uncinata* Gerstaecker (Hym., Apidae) in the central Scottish Highlands. *Entomologists Monthly Magazine*, **132**, 291-298.
- Lee, P. 2008. Research Report for 2007. *West Sussex: Hymettus Ltd*.

SPECIES REPORT FOR WALL OR WESTERN MASON BEE (*Osmia parietina*)

Ecology

Osmia parietina is a solitary bee closely associated with birds' foot trefoil (*Lotus corniculatus*) from which it collects pollen and nectar (Robinson, 1996; Anon, 1999). It may also visit bugle (*Ajuga reptans*) and bramble (*Rubus* spp.) for nectar (Edwards & Telfer, 2002). The bee nests in crevices in stones, drystone walls and dead wood (Robinson, 1996; Anon, 1999; Edwards & Telfer, 2002). Nest sites need to be located in full sun without shading (Robinson, 1996). The bee only flies on very hot, sunny days (Anon, 1999) from May until July (Edwards & Telfer, 2002). It appears to occur at very low population densities (JNCC, 2010); only one or two bees are ever seen on a site (Robinson, 1996).

Conservation status and rarity

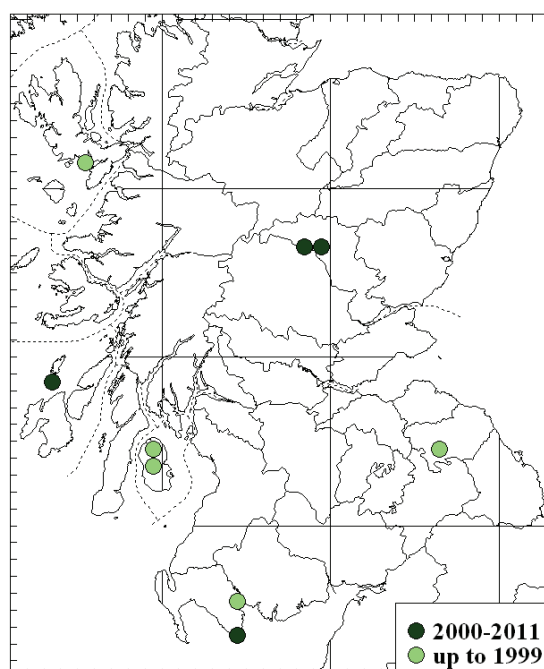
- UK Red Data Book 3: *Rare*.
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: *Stable*.
- IUCN Status: Not listed.

Distribution

In Scotland it now appears to be restricted to Colonsay in the Inner Hebrides, Whithorn in Dumfries and Galloway, and Killiecrankie, Perthshire. There are numerous historic records from Skye, Arran, Dumfries and Galloway, and the Borders. It is widespread in Eurasia but with a boreo-alpine distribution (Anon, 1999).

Habitat and management

This species is associated with areas of unimproved mesotrophic grasslands and clearings in woodlands where *L. corniculatus* grows, including machair (Edwards & Telfer, 2002; JNCC, 2010).



Pressures and threats

Osmia parietina is threatened by the agricultural intensification of upland herb-rich pastures, the destruction of drystone walls, and inappropriate management of pasture woodlands. The chrysidid wasp *Chrysura hirsuta* is presumed to be a parasitoid (Anon, 1999).

Conservation measures

Management is required to maintain early successional habitat containing high populations of flowering *L. corniculatus* and other Fabaceae (JNCC, 2010) and bare stones (Robinson, 1996). The preservation of drystone walls would benefit the species (Robinson, 1996). The Killiecrankie site is a RSPB reserve (Anon, 1999).

Summaries of surveys and research related to surveillance

There have been no targeted surveys for this species in Scotland. The low density at which it occurs together with its preference for flying in only warm, sunny conditions means that it is possibly under-recorded (Anon, 1999). In 2007 Murdo Macdonald, on behalf of Hymettus Ltd, located one site that could possibly be suitable for this species at Black Island, Blair Atholl.

Quality of data

Good.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Edwards, M. & Telfer, M. 2002. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland Part 4*. Bees, Ants and Wasps Recording Society. Huntingdon: Biological Records Centre.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/492.pdf> [Accessed 1 February 2012].
- Robinson, N. 1996. Observations on *Osmia parientina* Curtis (Hym., Megachilidae) in Lancashire. *Entomologist's Monthly Magazine*, **132**, 1580-1583.

Map data sources

Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).

SURVEILLANCE METHODOLOGY FOR WALL OR WESTERN MASON BEE (*Osmia parietina*) & NORTHERN OSMIA RUBY-TAILED WASP (*Chrysura hirsuta*)

Aim

To establish the status and distribution of *Osmia parietina* in Scotland, and to investigate the status of *Chrysura hirsuta* which is believed to its parasitoid.

Rationale

The ecology of the mason bee *O. parietina* is not well known. The bee nests in stones, drystone walls and dead wood in full sun (Robinson, 1996; Anon, 1999; Edwards & Telfer, 2002). It is reliant on bird's-foot trefoil (*Lotus corniculatus*) as a pollen and nectar source (Robinson, 1996; Anon, 1999). There have been no targeted surveys for this species and only three sites have current records. *Chrysura hirsuta* is believed to be a parasitoid of *O. parietina* but this has yet to be confirmed. Their ranges overlap at Killiecrankie in Perthshire. There are recent records for *C. hirsuta* from this site.

Approach

Osmia parietina is most effectively found by visual search of adult bees in areas of suitable nesting and foraging habitat. Specifically it can be found by looking for foraging bees on *L. corniculatus*. As with other *Osmia* bees, *O. parietina* is likely only to fly on warm, sunny days and therefore it is crucial to survey during periods of suitable weather. All recent and old locations should be surveyed to establish the current status and distribution of the species. Whilst carrying out surveillance for *O. parietina* the surveyor should also remain vigilant for the presence of *C. hirsuta* on the wing, resting on rocks, or foraging for pollen on flowers.

Equipment

No specialist equipment is required.

Location

The current locations of Colonsay in the Inner Hebrides, and Whithorn, in Dumfries and Galloway, should be surveyed together with historic sites on Skye, Arran, Dumfries and Galloway, Borders and Killiecrankie, Perthshire. Of these, *C. hirsuta* has only been recorded from Killiecrankie in Perthshire (Douglas, 2003).

Sample units

The sample units for *O. parietina* will be the number of occupied sites. *C. hirsuta* should simply be recorded as present or absent.

Sampling

Foraging areas can be found by searching for suitable habitat and identifying areas where flowering *L. corniculatus* is present. As this bee appears to occur at very low population densities (JNCC, 2010), multiple visits may be required. Identification of this bee is difficult and therefore surveys should be carried out by a hymenopterist familiar with the species.

Following consideration of published information and expert opinion, the following guidelines on sampling protocol are recommended:

- The adult bee should be looked for in patches of *L. corniculatus*.

- Looking in crevices in drystone walls may reveal the characteristic nest cells.
- If nests are found the number of cells, including whether occupied, should be counted.
- All sites where the bee is present should be recorded using a GPS.
- Any *Chrysura* wasps seen should be collected in an aspirator to establish their identity.
- Surveys should be carried out between 10:00 and 16:00 h, in full sunshine and when the temperature exceeds 18°C.
- Areas should be surveyed between late May and the end of June (only continuing into July if the weather remains suitable) when both the bee and its potential parasitoid are present.

The surveyor should make a brief assessment of the quality and condition of the habitat, particularly any changes in management, number of grazing animals or evidence of grazing, and the availability of nesting and forage resource. Surveys should be carried out every five years.

Time

This work would be expected to take between 10 and 20 days.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Douglas, G. 2003. Invertebrate species dossier: *Osmia parietina* Curtis, 1828. Wall mason bee (Hymenoptera: Megachilidae). *Unpublished report*. Edinburgh: Scottish Natural Heritage.
- Edwards, M. & Telfer, M. 2002. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland. Part 4. Bees, Ants and Wasps* Recording Society. Huntingdon: Biological Records Centre.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/215.pdf> [Accessed 1 February 2012].
- Robinson, N. 1996. Observations on *Osmia parientina* Curtis (Hym., Megachilidae) in Lancashire. *Entomologist's Monthly Magazine*, **132**, 1580-1583.

SPECIES REPORT FOR MASON BEE (*Osmia uncinata*)

Ecology

The mason bee *Osmia uncinata* nests in the dead wood of Scots pine (*Pinus sylvestris*) that grow in full exposure to the sun (Douglas, 2003; Sears *et al.*, 2007). The bee may use the old galleries left by beetles (Sears *et al.*, 2007). Bird's-foot trefoil (*Lotus corniculatus*) is the main forage plant (Douglas, 2003). It has been seen on broom (*Cytisus scoparius*), *Vaccinium* spp. and rowan (*Sorbus aucuparia*), but these may be nectar sources only (Else & Edwards, 1996). *Osmia uncinata* only flies in sunny weather when the temperature exceeds 18°C (S. Taylor, *pers. comm.*). The flight period is from late May until early July (S. Taylor, *pers. comm.*).

Conservation status and rarity

- UK Red Data Book 2: *Vulnerable*.
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Stable.
- IUCN Status: Not listed.

Distribution

Confined to central Scotland but very localized with records only from Highland region: Speyside (Kincaig to Nethy Bridge), Ardersier and Bonar Bridge (Else & Edwards, 1996). It was discovered on Deeside at Mar Lodge and Ballater in 2001 (Sears *et al.*, 2007). Occasionally it is locally numerous.

Habitat and management

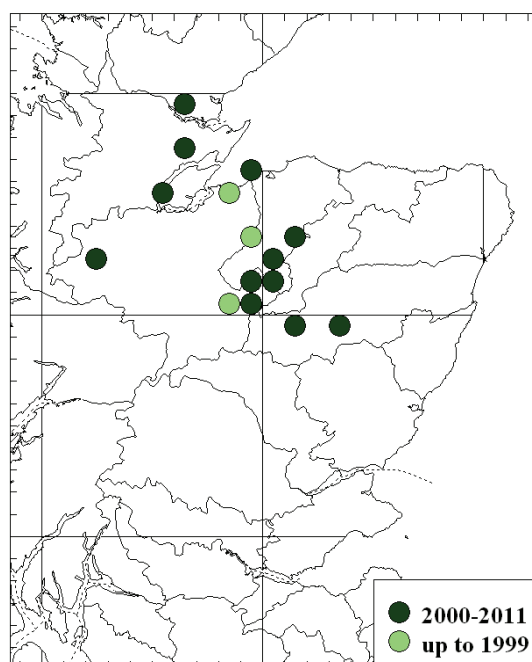
This species is associated with clearings and open areas in native pinewoods (JNCC, 2010) or less intensively managed plantations with lightly vegetated track verges (S. Taylor, *pers. comm.*). These are areas that support the main forage plant *L. corniculatus* (JNCC, 2010).

Pressures and threats

Shading out of the forage plant *L. corniculatus* by heather and other vegetation is likely to be the main threat to the bee. The chrysidid wasp *Chrysura hirsuta* is a likely parasitoid (Anon, 1999).

Conservation measures

The early successional stage of meadows and glades within pine woods must be maintained (Douglas, 2003; Sears *et al.*, 2007; JNCC, 2010). Disturbance to track-side verges every five to 10 years is probably important in the Strathspey area (S. Taylor, *pers. comm.*) to allow *L. corniculatus* to thrive. Work is being undertaken at Abernethy by cutting out verge regeneration. Maintenance of patches of bare ground is required so that *L. corniculatus* has new areas to grow (S. Taylor, *pers. comm.*).



Summaries of surveys and research related to surveillance

The last major survey for this species was carried out by Stewart Taylor (Speyside) and Murdo Macdonald (Black Isle) (Sears *et al.*, 2007). The presence of foraging bees was also recorded during a bee nest box project in 2010 (Taylor, 2011).

Quality of data

Recent records are excellent. There may be misidentifications in older records.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Douglas, G. 2003. Invertebrate species dossier: *Osmia uncinata* Gerstaecker, 1828. A mason bee (Hymenoptera: Megachilidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Else, G.R. & Edwards, M. 1996. Observations on *Osmia inermis* (Zetterstedt) and *O. uncinata* Gerstaecker (Hym., Apidae) in the central Scottish Highlands. *Entomologists Monthly Magazine*, **132**, 291-298.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/493.pdf> [Accessed 1 February 2012].
- Sears, J., Amphlett, A., Macdonald, M. & Taylor, S. 2007. An investigation into the importance of open edges in Caledonian pine woodlands for the mason bee *Osmia uncinata* and evaluation of its status in semi-natural Scots pine plantations in 2006-07. *Unpublished report. Edinburgh: RSPB & Scottish Natural Heritage*.
- Taylor, S. 2011. Evaluation of artificial nests for *Osmia uncinata* bees. *Unpublished report. Edinburgh: Scottish Natural Heritage*.

Map data sources

Bees, Wasps and Ants Recording Society - Trial Dataset (Bees, Wasps and Ants Recording Society).

SURVEILLANCE METHODOLOGY FOR MASON BEE (*Osmia uncinata*) & NORTHERN OSMIA RUBY-TAILED WASP (*Chrysura hirsuta*)

Aim

To establish the status of *Osmia uncinata* at its current locations, and to investigate the status of its possible parasitoid *Chrysura hirsuta*.

Rationale

The ecology of the mason bee *O. uncinata* is not well known. However, it does have a prescriptive set of habitat requirements. Nest sites require dead Scots pine (*Pinus sylvestris*) trees in open areas (Douglas, 2003a; Sears *et al.*, 2007) while bare ground and early successional vegetation provides conditions for the forage plant bird's-foot trefoil (*Lotus corniculatus*) (S. Taylor, *pers. comm.*; Douglas, 2003a; JNCC, 2010).

The distribution of the species in Strathspey is now relatively well known but the bee may exist at additional sites on Deeside where it was discovered in 2001. Data from the last major survey (Sears *et al.*, 2007) provide a baseline against which to compare the results of future surveillance. However, this survey only covered Strathspey and the Black Isle and future monitoring should be extended to include the other sites at which *O. uncinata* is known. This will give a more comprehensive assessment of the population trends, which currently are considered to be stable.

Chrysura hirsuta is believed to be a parasitoid of *O. uncinata* but this has yet to be confirmed. Their ranges overlap in the mid Spey valley (Douglas, 2003b). The last record for *C. hirsuta* in this area was at Loch Garten in 1985 (S. Taylor, *pers. comm.*).

Approach

Osmia uncinata is most effectively found by visual searches of adult bees in areas of suitable nesting and foraging habitat. Specifically it can be found by looking for foraging bees on *L. corniculatus*. Further details can be found in Sears *et al.* (2007). Whilst carrying out surveillance for *O. uncinata*, the surveyor should also remain vigilant for the presence of *C. hirsuta* on the wing, resting on rocks, or foraging for pollen.

Equipment

No specialist equipment is required.

Location

The bee is found at various sites in Highland region: Speyside (Kincraig to Nethy Bridge), Ardersier and Bonar Bridge (Else & Edwards, 1996), and on Deeside at Mar Lodge and Ballater (Sears *et al.*, 2007). It has also recently been found at Glenmore (Sears *et al.*, 2007). All sites should be surveyed.

Chrysura hirsuta is found in the mid Spey valley including the Aviemore area, the RSPB Loch Garten reserve and the surrounding Abernethy Forest (Douglas, 2003b).

Sample units

The sample units for *O. uncinata* will be the number of occupied sites, while *C. hirsuta* should simply be recorded as either present or absent.

Sampling

Foraging areas can be found by walking tracks in suitable habitat and identifying areas where *Lotus corniculatus* is present on roadside verges. Identification of this bee is difficult and therefore surveys should be carried out by a hymenopterist familiar with the species.

Following consideration of published information and expert opinion, the following guidelines on sampling protocol are recommended:

- The adult bee should be looked for in patches of *L. corniculatus*.
- Suitable areas should be watched for 10-20 min for foraging bees on *L. corniculatus* flowers.
- All sites where the bee is present should be recorded using a GPS.
- Any *Chrysura* wasps seen should be collected with an aspirator to establish their identity.
- Surveys should be carried out between 10:00 and 16:00 h, with the *L. corniculatus* in full sunshine and when the temperature exceeds 18°C.
- Areas should be surveyed between late May and the end of June (only continuing into July if the weather remains suitable) when both the bee and its potential parasitoid are present.

The surveyor should make a brief assessment of the quality and condition of the habitat, particularly any changes in management, and the availability of forage resource. Surveys should be carried out every five years.

Time

This work would be expected to take between 10 and 20 days.

References

- Douglas, G. 2003a. Invertebrate species dossier: *Osmia uncinata* Gerstaecker, 1828. A mason bee (Hymenoptera: Megachilidae). *Unpublished report*. Edinburgh: Scottish Natural Heritage.
- Douglas, G. 2003b. Invertebrate species dossier: *Chrysura hirsuta*, Gerstaecker: A ruby-tailed wasp (Hymenoptera: Colletidae). *Unpublished report*. Edinburgh: Scottish Natural Heritage.
- Else, G.R. & Edwards, M. 1996. Observations on *Osmia inermis* (Zetterstedt) and *O. uncinata* Gerstaecker (Hym., Apidae) in the central Scottish Highlands. *Entomologist's Monthly Magazine*, **132**, 291-298.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/493.pdf> [Accessed Feb 2012].
- Sears, J., Amphlett, A., Macdonald, M. & Taylor, S. 2007. An investigation into the importance of open edges in Caledonian pine woodlands for the mason bee *Osmia uncinata* and evaluation of its status in semi-natural Scots pine plantations in 2006-07. *Unpublished report*. Edinburgh: RSPB & Scottish Natural Heritage.

SPECIES REPORT FOR BORDERED BROWN LACEWING (*Megalomus hirtus*)

Ecology

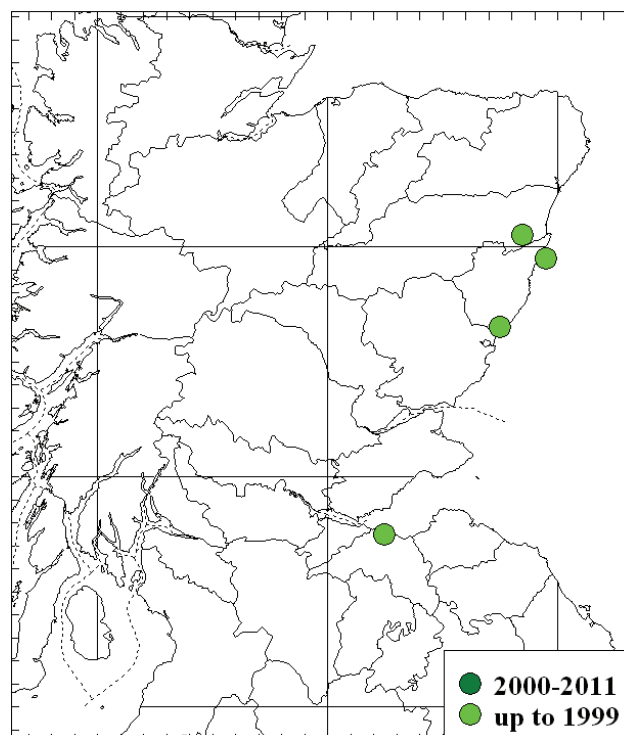
At its single UK site, *Megalomus hirtus* is associated with wood sage (*Teucrium scorodonia*) (JNCC, 2010) and is likely to predate aphids or other small invertebrates. The species has been recorded from June to August (Plant, 1994).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

Possibly restricted to a single UK locality (Arthur's Seat, Edinburgh). It was reported to be quite numerous and under no apparent immediate threat in 1980. It was not then reported until August 1995 when a single specimen was found by sweeping stands of wood sage (A. Ramsay, *pers. comm.*). Several old literature records are considered to be erroneous. Other accepted records come from near Aberdeen in 1873, Muchalls, nr. Stonehaven, in 1935 and St. Cyrus, nr. Montrose, in 1935 (Plant, 1994). The species is certainly absent from at least one of these previously reported Scottish sites (JNCC, 2010) whilst its status at other sites is unknown.



Habitat and management

In Scotland, *M. hirtus* is typically found on rocky, exposed slopes. It may not be confined to wood sage in Scotland and continental Europe (Plant, 1994).

Pressures and threats

Megalomus hirtus is likely to be vulnerable to land management changes such as introduction of sheep grazing at formerly non-grazed sites (JNCC, 2010).

Conservation measures

None have been undertaken.

Summaries of surveys and research related to surveillance

There have been no formal surveys or monitoring of this species in Scotland.

References

- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2409.pdf> [Accessed 1 November 2011].
- Plant, C.W. 1994. *Provisional atlas of the lacewings and allied insects (Neuroptera, Megaloptera, Raphidioptera and Mecoptera) of Britain and Ireland*. Huntingdon: Biological Records Centre.

Map data source

Lacewings and allied insects records from Britain and Ireland to 1999 (Biological Records Centre).

SURVEILLANCE METHODOLOGY FOR BORDERED BROWN LACEWING (*Megalomus hirtus*)

Aim

To establish if *Megalomus hirtus* is extant in Scotland and, if so, to introduce a surveillance programme to monitor population trends.

Rationale

Megalomus hirtus has not been recorded in Scotland since 1995. This may be due to lack of surveillance or may represent a genuine absence. A first priority of any surveillance is to establish the current status of the species, with emphasis on the most recently recorded site, Arthur's Seat in Edinburgh. Other older sites would be worth searching as would apparently suitable habitat in the vicinity.

Approach

Megalomus hirtus is associated with wood sage (*Teucrium scorodonia*) (but may not be restricted to this plant) and the initial stages of a site visit should concentrate on finding apparently suitable habitat. Once habitat is located, two main methods might be suitable for searches for the species; sweep-netting and light-trapping. Day-time searches with sweep nets cover large areas of habitat and will probably be the method of choice for entomologists specifically seeking this species. Light-trapping should be considered a complementary method. Lacewings are frequently attracted to light traps and, until more is known about *M. hirtus*, the two methods are recommended in combination. *Megalomus hirtus* is small and inconspicuous; identification can be made by reference to Plant (1997).

Equipment

Sweep net, MV light trap plus power supply (or actinic light trap with battery), specimen tubes.

Location

The only site with recent records is Arthur's Seat in Edinburgh. Location details for older records are somewhat vague. However, it is specifically recommended that abundant wood sage on the coastal slopes in the approximate vicinity of one old record at Muchalls, south of Aberdeen (NO9091), are searched for the species. All known records are from Aberdeen down to Edinburgh, so other areas of potentially suitable habitat in this region could be identified by consultation with local naturalists.

Sample units

Surveillance should first seek to establish the number of occupied sites. If *M. hirtus* is found, monitoring should then seek an indication of relative abundance so that populations can be compared between years.

Sampling

The specific design of day-time searches to reconfirm species presence at Arthur's Seat and other potential sites should be guided by the surveyor's expert judgement. It is recommended that half a day is spent searching in daytime with light-trapping carried out if practical.

Once discovered, the extent of any colony should be assessed by expanding the search area. Any plant associations should be noted. The approximate extent of wood sage should be mapped. Surveillance of population levels should then be assessed by standardised searches. Although relative population levels or difficulty of detection may require some changes to these methods, the following guidelines are suggested:

- Surveys should take place from June to August.
- It is recommended that surveys be carried out in calm, dry weather on three dates through the season – one around the end of June, one in mid-July and one at the start of August.
- Ten minutes should be spent searching for every 10 × 10 m area that contains a significant coverage of *T. scorodonia* and the number of *M. hirtus* either potted directly or collected by sweep nets should be recorded. Time taken inspecting specimens should be disregarded in timing this count.
- Surveillance of occupied sites should be repeated every three to five years.

If light-trapping reveals better numbers than day-time searching, then consideration should be given to developing surveillance based on this method instead.

Time

The duration of initial searches and subsequent surveillance will be determined by site size. However a half day per site on three days during the flight period is suggested in the first instance.

Further notes

Given the potential for *M. hirtus* to be recorded at light traps, there is merit in encouraging Lepidopterists to run traps in areas of wood sage with a view to seeking the species.

References

Plant, C. 1997. *Key to the adults of British lacewings and their allies*. Shrewsbury: Field Studies Council.

SPECIES REPORT FOR IRON BLUE MAYFLY (*Baetis niger*)

Ecology

The larvae of *Baetis niger* typically crawl amongst in-stream vegetation in riffle areas of rivers and streams or swim in short, darting bursts amongst the substrate. They feed by scraping algae from submerged stones and other structures, or by gathering or collecting fine particulate organic detritus from the sediment (Macadam, 2011a).

There are two generations per year - a slow growing winter generation and a much faster summer generation. This results in a fairly long flight period, with adults being present between April and October (Macadam, 2011a).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

Baetis niger is a widespread, though localised species. It is found in running waters in England, Scotland and Wales with records from 126 hectads being held by The Ephemeroptera Recording Scheme (Macadam, 2011a). Elsewhere in Europe, the species ranges from Scandinavia and Russia to the Iberian peninsula in the south (Macadam, 2011a).

Habitat and management

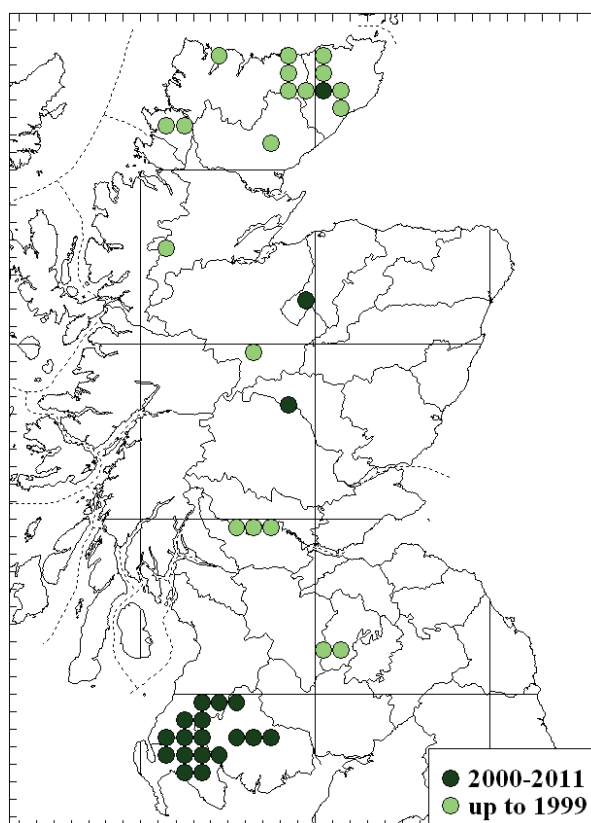
The larvae of this mayfly are chiefly found among aquatic macrophytes in running waters (Macadam, 2011b).

Pressures and threats

Threats are generally related to habitat quality and include persistent and catastrophic pollution events, high levels of suspended silt, engineering works, significant alterations to the riparian habitat or to aquatic vegetation structure such as weed cutting and low flows caused by abstraction (Macadam, 2011b).

Conservation measures

The most important conservation measure is maintenance of good water quality. The aquatic habitat can be further conserved by reducing siltation and abstraction. Installation of an uncultivated buffer strip that is not excessively grazed by livestock may be beneficial, although the overall biodiversity benefits of such management are currently disputed (Alexander *et al.*, 2010). The river-bank habitat can be maintained by carrying out sympathetically planned management. For example, work likely to damage riverside vegetation should be carried out only on one side of the river and on short stretches. Any



necessary engineering work should be planned to avoid change to river morphology where possible (Macadam, 2011b).

Summaries of surveys and research related to surveillance

The Ephemeroptera Recording Scheme maintains a database of verified records. Populations have been reported to have declined from surveys in southern England but systematic monitoring from which trends can be detected has not been carried out in Scotland.

References

- Alexander, K., Foster, G. & Sanderson, N. 2010. Comment 'Good Ecological Status' of inland waterbodies – fencing of riverbanks is not 'good for biodiversity'. *British Wildlife*, **21**, 326-332.
- Macadam, C. 2011a. Species dossier: *Baetis niger*, Southern iron blue. *Stirling: Buglife*.
- Macadam, C. 2011b. Species management sheet, Southern iron blue (*Baetis niger*). *Peterborough: Buglife*.

Map data sources

River macroinvertebrate data for 2005 and 2006 (Scottish Environment Protection Agency).
Mayfly (Ephemeroptera) Data for Great Britain for 1906-2003 (Riverfly Recording Schemes).
Scottish river macro-invertebrate records from 2007 collected by SEPA (Scottish Environment Protection Agency).

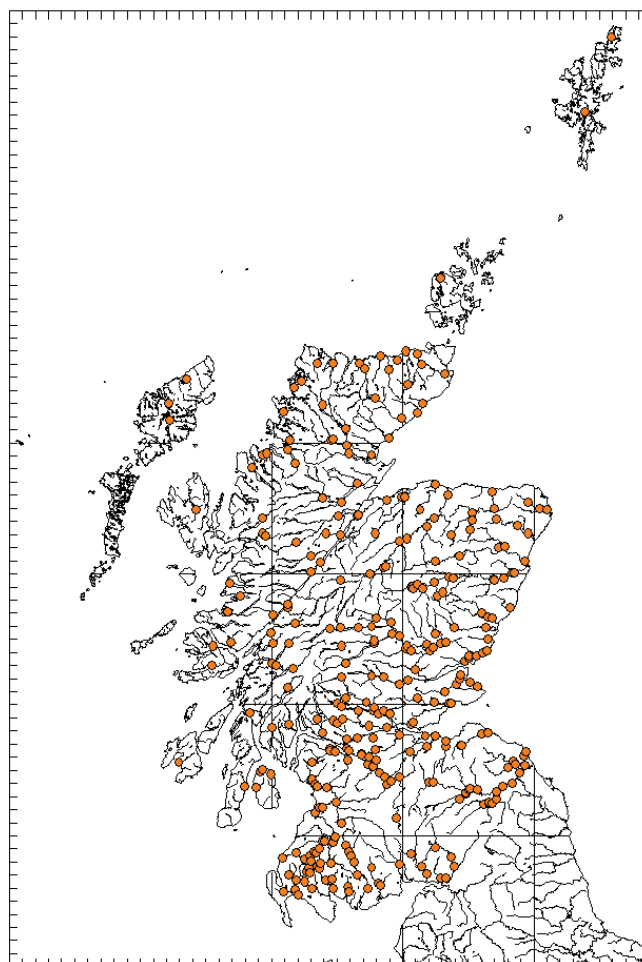
SURVEILLANCE METHODOLOGY FOR IRON BLUE MAYFLY (*Baetis niger*)

Aim

The primary aim is to establish population trends of *Baetis niger* from standardised monitoring of river sites. A secondary aim is to establish more clearly the Scottish range of this species.

Rationale

Freshwater macro-invertebrates are widely sampled in water quality monitoring. The Scottish Environment Protection Agency (SEPA) identifies species of larval Ephemeroptera from samples collected at 327 of its long-term monitoring sites on rivers (shown on the map opposite). The frequency of sampling varies but, for some sites, species identification is carried out just once every six years (I. Milne, *pers. comm.*). Samples are also collected as part of ECN monitoring of freshwater sites (UK Environmental Change Network, 2012). The majority of records held by the Ephemeroptera Recording Scheme come from such sampling by agencies and research organisations. Given this level of ongoing sampling, the potential to use these data for long-term population trend monitoring should be investigated.



Approach

The larvae of this species can be collected by kick-sampling along suitable stretches of river. This entails using one's foot to disturb a section of the river bed. Invertebrates are dislodged and collected in a water net held just downstream for a unit time, typically 3 min (Macadam, 2011). An example of a full protocol is given on the ECN website (UK Environmental Change Network, 2012).

Efforts should be made to determine further sites, beyond regularly monitored locations (Macadam, 2011). This can be done either by searching for larvae following similar methods to those used in standardise freshwater macro-invertebrate monitoring or by searches for adults, which can be collected by examining bank side trees and other vegetation or can be caught as they swarm near the water (Macadam, 2011).

Equipment

Long-handled pond net, white tray for examining catches, waders, butterfly net (for adult searches).

Location

Locations for sampling freshwater macro-invertebrates as part of water quality monitoring exercises are determined by SEPA and ECN.

Locations for wider searches should be determined in consultation with appropriate specialists such as aquatic invertebrate biologists at SEPA and the Ephemeroptera Recording Scheme. Areas likely to merit further attention include upland areas where SEPA does not routinely sample.

Sample units

The number of *B. niger* larvae per standardised sample will yield trend monitoring.

Sampling

Sampling to determine population trends is carried out by SEPA and ECN as part of freshwater macro-invertebrate diversity monitoring to indicate water quality and follows set protocols.

Baetis niger is bivoltine. It is not clear if standardised sampling by SEPA is carried out at optimum times for this species. Hence sampling date should be included as a variable in population trend analysis. ECN protocols recommend sampling three times yearly but with twice per year as a minimum (UK Environmental Change Network, 2012).

Adults can be found at any time between April and October. The phenology of this species is complex and peak emergence may vary from site to site (Macadam, 2011). It is therefore difficult to recommend an ideal time for adult searches, though the spring generation, emerging from April to June, is larger in at least some locations (Macadam, 2011).

Time

If current sampling by SEPA and ECN prove effective for monitoring this species, then the only extra time required should be that needed to report and analyse data.

Further notes

If surveys or searches of sites are carried out by volunteers who are not confident of identification of this species, Buglife (The Invertebrate Conservation Trust) has offered to arrange for identifications to be checked by an expert (Macadam, 2011).

References

Macadam, C. 2011. Species dossier: *Baetis niger*, Southern iron blue. *Stirling: Buglife*.
UK Environmental Change Network (ECN). 2012. *Macro-invertebrates*. [online] Available at: <<http://www.ecn.ac.uk/measurements/freshwater/fin>> [Accessed 6 February 2012].

SPECIES REPORT FOR NORTHERN FEBRUARY RED (*Brachyptera putata*)

Ecology

Adult *Brachyptera putata* emerge from February to April. The male is short-winged and unable to fly. Larvae feed on various species of filamentous algae and detritus in the substrate. They may migrate downstream but the return journey can only be completed by an adult female (Douglas, 2003; Buglife, 2011).

Conservation status and rarity

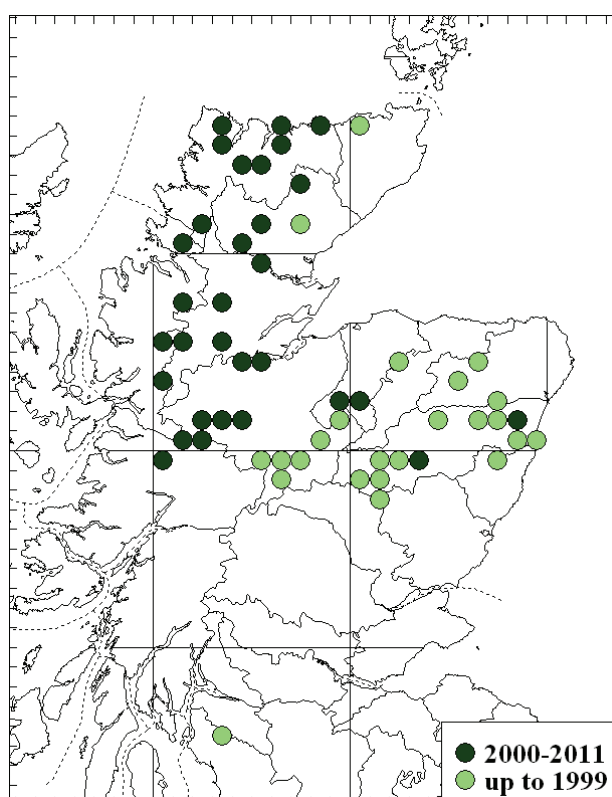
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Stable.
- IUCN Status: Not listed.

Distribution

In Scotland the species seems to be widely distributed where suitable habitat exists (Buglife, 2011). Recent Scottish records have been concentrated on Class 1 unpolluted status rivers such as the Dee, the Don, the Spey and the Deveron in North-East Scotland, and the Mudale, the Halladale, Forss Water and the Brora in the Highlands. There are historic records from the Clyde in Lanarkshire, Rannoch in Mid-Perthshire and Strath Oykell in Sutherland (Douglas, 2003).

Elsewhere in Britain the species has only ever been found in the River Usk in Wales and the Wye near Hereford (Buglife, 2011).

NOTE: *B. putata* is endemic to Britain. It had been suggested that it is co-specific with *B. starmachi* from central and eastern Europe, but adults have recently been found to be quite different (Macadam, 2011).



Habitat and management

Brachyptera putata is found in the middle and lower reaches of medium to large-sized rivers with good water quality (Douglas, 2003). The species is most prevalent in highly oxygenated rivers with a shallow or moderate gradient on open heaths or upland pastures. Larvae are generally found during winter amongst loose large stones and cobbles, usually below riffles where water flow is moderate. Adults can be found sheltering under stones and on vegetation at the river side, on stones on gravel bars and along the banks of the watercourse. Exposure to winter sunshine is an important habitat requirement (Buglife, 2011). The most important management practice is the maintenance and improvement of water quality.

Pressures and threats

The main threats revolve around damage to watercourses and water quality. In particular the species' habitat may deteriorate through livestock entering streams in heavily grazed lowland pasture areas causing disturbance of the river bed and potential eutrophication or pollution of the water. Further threats come from channel engineering such as dredging and channel modification, gravel removal and coniferous plantations in riparian areas (Buglife, 2011).

Conservation measures

Protective riparian fencing, especially in lowland areas, can stop excessive disturbance and pollution from livestock, although the biodiversity benefits of such management are disputed (Alexander *et al.*, 2010). Encouraging deciduous riparian woodland rather than conifer plantations can help ensure exposure of the river and its banks to winter sunshine. Any necessary maintenance and engineering works, including dredging, need to be planned sympathetically to avoid change to river morphology, habitat loss and excessive river-bed disturbance. Any habitat loss should be mitigated by habitat enhancements and creation (Buglife, 2011).

Summaries of surveys and research related to surveillance

A 2001 survey, commissioned as part of Action for Invertebrates, recorded the species from 27 of 54 sites that were visited. These included 19 of 30 sites visited in the eastern Highlands though none were found on the Deveron or the Don in Aberdeenshire where there had been modern records (Macadam, 2011). A survey in 2003 targeted the northern and central Highlands, finding the species at 21 sites in 12 catchments including smaller rivers with no previous records (Macadam, 2011).

References

- Alexander, K., Foster, G. & Sanderson, N. 2010. Comment 'Good Ecological Status' of inland waterbodies – fencing of riverbanks is not 'good for biodiversity'. *British Wildlife*, **21**, 326-332.
- Buglife. 2011. *Species Management sheet: northern February red (Brachyptera putata)*. Peterborough: Buglife.
- Douglas, G. 2003. Invertebrate site dossier, *Brachyptera putata* Newman, a stonefly (Plecoptera: Taeniopterygidae). *Unpublished Report. Edinburgh: Scottish Natural Heritage*.
- Macadam, C. 2011. Species dossier: *Brachyptera putata*, Northern February red. *Stirling: Buglife*.

Map data sources

- River macroinvertebrate data for 2005 and 2006 (Scottish Environment Protection Agency) HBRG Insects Dataset (Highland Biological Recording Group).
- Stonefly (Plecoptera) Data for Great Britain for 1955-2005 (Riverfly Recording Schemes).
- Scottish river macro-invertebrate records from 2007 collected by SEPA (Scottish Environment Protection Agency).

SURVEILLANCE METHODOLOGY FOR NORTHERN FEBRUARY RED (*Brachyptera putata*)

Aim

The primary aim is to establish population trends of *Brachyptera putata* from standardised monitoring of river sites. A secondary aim is to establish, more clearly than is currently known, the Scottish range of this species.

Rationale

Freshwater macro-invertebrates are widely sampled in water quality monitoring. The Scottish Environment Protection Agency (SEPA) identifies species of larval Plecoptera from samples collected at 327 of its long-term monitoring sites (shown on the map opposite). The frequency of sampling varies but, for some sites, species identification is carried out just once every six years (I. Milne, *pers. comm.*). Samples are also collected as part of ECN monitoring of freshwater sites (UK Environmental Change Network, 2012). The suitability of these data for population trend monitoring should be investigated.

Approach

Kick-sampling for aquatic invertebrates entails disturbing a section of the river bed. Invertebrates are dislodged and collected in a water net held downstream. Adaptation of the technique is required to make it optimal for surveys aimed specifically at *B. putata*. In particular, large stones on the river bed at sites for this species would not be displaced by casual 'kicking'. These must be dislodged to disturb smaller material underneath (Macadam, 2011).

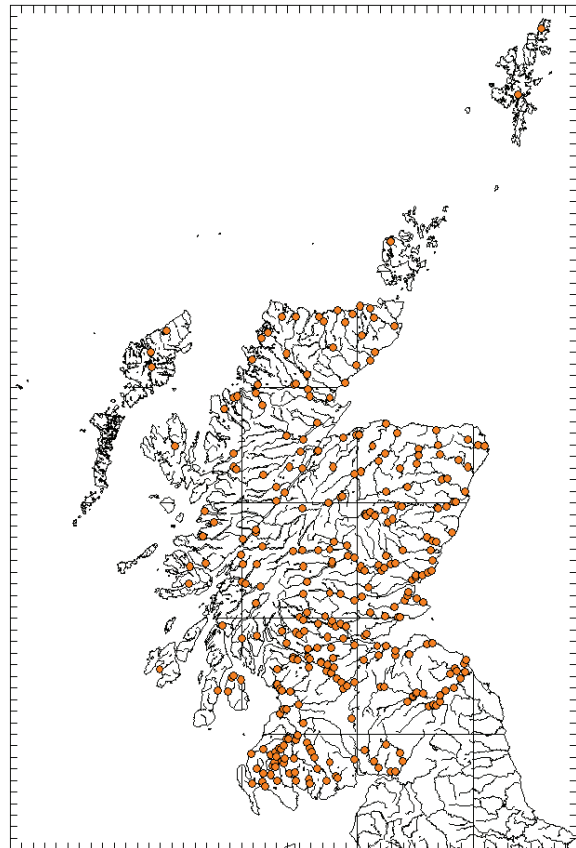
Efforts should continue to determine sites where the species occur beyond regularly monitored locations. This can be done either by searching for larvae by kick-sampling or by searches for adults. Adult males can be found by turning over stones on gravel bars and along the banks of the watercourse (Macadam, 2011).

Equipment

Long-handled pond net, white tray for examining catches, waders, butterfly net (for adult searches).

Location

SEPA and ECN determine locations for sampling freshwater macro-invertebrates as part of water quality monitoring. These and other data should guide a selection of sites that regularly host the species with sites stratified across a range of occupied catchments. Locations for wider searches should be determined in consultation with appropriate specialists such as aquatic invertebrate biologists at SEPA and the Riverfly Recording Schemes. Areas thought likely to repay further attention include rivers in the Cairngorms, Aberdeenshire, Sutherland and north-west Scotland (C. Macadam, *pers. comm.*).



Sample units

Kick sampling will give counts that act as an index of population levels. Distribution is best assessed initially on a catchment level. Monitoring at regular intervals along a waterway may then give an indication of the length of the waterway occupied.

Sampling

Due to the likely influence of localised factors on *B. putata* populations, it is suggested that up to four sites each in a wide range of catchments are included in a long-term monitoring scheme. An investigation of the suitability of data from existing macro-invertebrate surveying should be considered. However, if these surveys prove to be unsuited, consideration should be given to a separate surveillance programme. This should be based on kick-sampling, including turning over of stones as described above. The standard duration for kick-sampling is 3 min and a pilot study should be carried out to determine whether this is optimal for *B. putata*. Fluctuations in water flow may affect numbers so sampling should be carried out frequently – ideally annually. Larvae can be found during the winter and the optimum time for such survey is January, when larvae will be large and obvious.

Searches should be carried out wider afield to provide further information on the species' range. Within occupied catchments, sampling should be carried out at multiple positions to try to determine occupancy on a sub-catchment scale. These wider surveys can be based on kick-sampling for larvae or searches for adults, depending on surveyor expertise and availability. Adults emerge from February to April when casual searches can be conducted. More records would also be likely to be forthcoming if SEPA routinely identified all Taeniopterygidae collected during routine monitoring to species.

Time

If current sampling by SEPA and ECN prove effective for monitoring this species, then the only extra time required should be that needed to report and analyse data. If additional fieldwork is required, then sampling four sites in a catchment should be achievable in a day. Additional laboratory time is needed for identifying the catch.

Further notes

If surveys or searches of sites are carried out by volunteers who are not confident of identification of this species, Buglife (The Invertebrate Conservation Trust) have offered to arrange for identifications to be checked by an expert (Macadam, 2011).

This species can be attracted with artificial light at night (Pryce, 2010). Although this method has not been used specifically to search for *B. putata*, it would be worth further investigating for future surveys (Macadam, 2011).

References

- Macadam, C. 2011. *Species dossier: Brachyptera putata, northern February red*. Stirling: Buglife.
- Pryce, D.J. 2010. A survey for the stonefly *Brachyptera putata* (Northern February Red). Unpublished contract report. *Peterborough: The Riverfly Partnerships & Buglife*.
- UK Environmental Change Network (ECN). 2012. *Macro-invertebrates*. [online] Available at: <<http://www.ecn.ac.uk/measurements/freshwater/fin>> [Accessed 6 February 2012].

SPECIES REPORT FOR PINE HOVERFLY (*Blera fallax*)

Ecology

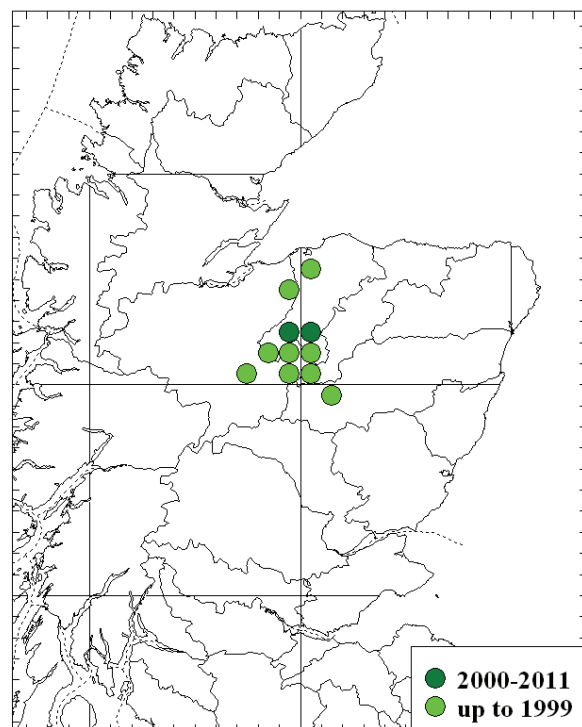
Blera fallax is a species characteristic of boreal coniferous forest. Its larvae develop in wet pockets of secondary decay of Scots pine (*Pinus sylvestris*) heartwood caused by the fungus *Phaeolus schweinitzi*. In general tree stumps wider than 40 cm diameter are required for these conditions to develop and persist (Ball *et al.*, 2011; Malloch Society, 2011a). In suitable conditions the life cycle is completed in one year, but larvae can overwinter twice or more in sub-optimal conditions. Larvae that are ready to pupate will often leave the development site in the autumn, making estimates of population size more difficult. Adults are found from June to early August (Ball *et al.*, 2011).

Conservation status and rarity

- Proposed addition to Schedule 5 of the WCA, Section 9, Part 4 (a).
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Stable.
- IUCN Status: Not listed.

Distribution

A century ago *B. fallax* was more widespread, though all recent records are from just eight sites in Strathspey (Ball & Morris, 2000; Rotheray & MacGowan, 2000). The species was regularly recorded until the 1940s but has been observed infrequently in recent years. Surveys during the 1990s and 2000s have shown that distribution has apparently declined with the only remaining populations in mature pine woods at Dulnain Bridge and Granttown-on-Spey (Rotheray & MacGowan, 2000; Malloch Society, 2011a). At Nethy Bridge (where records date back to 1900), an adult was found in 1991 but the area now lacks suitable habitat. Very recently, the species has been re-established at Rothiemurchus, Abernethy (Loch Garten) and Inshriach. In Europe, *B. fallax* is declining and probably under threat (Douglas, 2003).



Habitat and management

Most tree stumps of suitable size lack suitable pockets of secondary decay and many stumps with holes of suitable size are dry (Rotheray & MacGowan, 2000). Each tree is suitable only for a limited time (generally up to 10 years) so there is a constant need for new breeding sites (Rotheray & MacGowan, 2000). Artificial holes can be created and have been successfully used to rear this species from egg to adult.

Pressures and threats

Threats to this species include a lack of breeding sites and inappropriate woodland management. Extensive felling in the last 100 years has left few large pines that could form

new habitat and it will be some time before such large trees can start to again enhance the potential habitat. There are few trees or stumps of sufficient size in the remaining breeding sites where new pockets of decay might occur (Malloch Society, 2011a).

Conservation measures

This species has been the subject of extensive research and conservation management under the auspices of the SNH Species Action Framework. Felling of mature conifer crops leads to the production of new stumps that could potentially be made suitable for this species. The process can be accelerated by chain sawing a hole in the centre of a pine stump. One hundred such holes were created in 2003, 2006 and 2008, 36 of which had been used as breeding sites between 2008 and 2010 (Malloch Society, 2011b).

Using these techniques, reintroduction has been carried out at Rothiemurchus, Abernethy Forest and Inshriach Forest (Malloch Society, 2011b).

Summaries of surveys and research related to surveillance

Surveys of saproxylic Diptera were carried out in over 300 woodlands in Scotland between 1988 and 1998 (Rotheray *et al.*, 2011). Following discovery of an empty *Blera* puparium in 1996, larvae were first found in 1997 at Dulnain Bridge and at Grantown. Searches at this time at other suitable locations including all other sites with previous records failed to turn up any more (Rotheray & MacGowan, 2000).

Quality of data

Although small populations could be overlooked, the recent focus of attention on this species means that any such populations are unlikely to be large.

References

- Ball, S.G. & Morris, R.K.A. 2000. *Provisional Atlas of British Hoverflies (Diptera, Syrphidae)*. Huntingdon: Biological Records Centre.
- Ball, S.G., Morris, R.K.A., Rotheray, G.E. & Watt, K.R. 2011. *Atlas of the Hoverflies of Great Britain (Diptera, Syrphidae)*. Wallingford: Biological Records Centre.
- Douglas, G. 2003. Invertebrate species dossier, *Blera fallax* Linnaeus, A hoverfly (Diptera: Syrphidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Malloch Society. 2011a. [online] Available at: <<http://www.mallochsociety.org.uk/blera-overview/>> [Accessed 24 November 2011].
- Malloch Society. 2011b. *SNH Species Action Framework: Pine Hoverfly*. [online] Available at: <<http://mallochsociety.squarespace.com/blera-2006-status/>> [Accessed 29 November 2011].
- Rotheray, G.E., Hancock, G., Hewitt, S., Horsfield, D., MacGowan, I., Robertson, D. & Watt, K. 2001. The biodiversity and conservation of saproxylic Diptera in Scotland. *Journal of Insect Conservation*, **5**, 77-85.
- Rotheray, G.E. & MacGowan, I. 2000. Status and breeding sites of three presumed endangered Scottish saproxylic syrphids (Diptera, Syrphidae). *Journal of Insect Conservation*, **4**, 215-223.

Map data sources

Hoverfly Recording Scheme database for Great Britain (Hoverfly Recording Scheme)
Ball *et al.* (2011)

Species Consultants: Iain MacGowan and Kenn Watt

SURVEILLANCE METHODOLOGY FOR PINE HOVERFLY (*Blera fallax*)

Aim

To monitor *Blera fallax* population trends and range extent at the five known Scottish sites.

Rationale

Following extensive fieldwork looking at saproxylic Diptera between 1988 and 1998, during which over 250 localities were visited (Rotheray *et al.*, 2001), there is good knowledge of the range of this species. It is restricted to two natural sites and three sites where it has been reintroduced as part of the Species Action Framework project. The goal now is to carry out surveillance at these sites and in adjoining suitable habitat that is sufficient for establishing population trends which, if they become unfavourable, can act as a catalyst for further conservation management.

Approach

Looking for early stages (larvae and puparium) is more productive than searching for adults (Rotheray & MacGowan, 2000). Furthermore as such methods will be less directly affected by weather conditions than adult counts, it should be easier to provide more reliable comparisons between sites.

Identification of *B. fallax* larvae is a specialist task and should be carried out by a skilled dipterist to avoid the risk of confusion with similar species. Rotheray & MacGowan (2000) described the larvae and puparium. In most cases identification will involve hand lens or even microscopic examination. However, it does not require killing the larvae so, unless being retained for rearing, they can be returned to the stump from where they were found.

Equipment

Specimen tubes or other suitable containers for storing larvae, hand lens or microscope.

Location

The two long-occupied sites in Scotland are Dulnain Bridge and Grantown-on-Spey whilst reintroduction has been carried out at Rothiemurchus Estate (2009), Abernethy Forest (2010) and Inshriach Forest (2011). The Malloch Society holds precise location information.

Sample units

Sampling will provide an assessment of potentially suitable habitat at the five occupied sites and will provide an absolute population estimate for larvae in each area of woodland (which should be regarded as a minimum). Any nearby suitable habitat or further newly created habitats should also be examined.

Sampling

Blera fallax occurs in planted woodlands where management is usually uniform across a woodland block. It should, therefore, be possible to fairly accurately assess the area of potentially suitable habitat at each site simply by walking the area and mapping forest management boundaries. This can be done at any time of year.

- At each site, the approximate area of suitable habitat should be defined by looking for Scots pine (*Pinus sylvestris*) stumps that retain water in decaying heartwood (note

that most stumps are likely to be dry). Such water pockets can have a diameter of anything from 2 cm to over 30 cm (Rotheray & MacGowan, 2000).

- The number of potentially suitable *P. sylvestris* stumps in this area should be recorded, either by a direct count or, if they are numerous, by samples.
- It is recommended that sampling be carried out in the autumn, when larvae are most easily found in good quantity and before they leave the water pockets for the winter.
- Water in potentially suitable stumps should be inspected by stirring it with a small stick. Syrphid larvae coming to the surface can be removed for identification.
- If the water pocket contains dense wood chips or sawdust, these can be removed by hand and spread on white paper to search further for larvae, before returning the matter to the hole.
- It is unclear what proportion of larvae is detected by this method and so the number counted should be regarded as a minimum.
- Each site should be visited for one day to survey larvae. If not all suitable stumps can be searched for larvae, a stratified sample should be inspected, to enable scaling up the population estimate.
- It would also be beneficial to note the habitat that may become available in future years, by counting fresh stumps in a unit area, as management work could increase the number of available stumps if they were not occurring naturally.

Given the precarious nature of this species in the UK, sampling should ideally be carried out annually until re-introduced populations have been shown to be self-supporting for at least five years. Thereafter relaxation of sampling frequency to two or three years might be acceptable.

Time

One day annually should be spent surveying larvae at each site.

Further notes

This species has been subject to considerable research and conservation effort by the Malloch Society with funding from the SNH Species Action Framework. The Malloch Society is best placed to continue this work and plans for surveillance should be drawn up in consultation with the society's Syrphid experts.

References

- Rotheray, G.E., Hancock, G., Hewitt, S., Horsfield, D., MacGowan, I., Robertson, D. & Watt, K. 2001. The biodiversity and conservation of saproxylic Diptera in Scotland. *Journal of Insect Conservation*, **5**, 77-85.
- Rotheray, G.E. & MacGowan, I. 2000. Status and breeding sites of three presumed endangered Scottish saproxylic syrphids (Diptera, Syrphidae). *Journal of Insect Conservation* **4**: 215-223.

SPECIES REPORT FOR FONSECA'S SEED FLY (*Botanophila fonsecai*)

Ecology

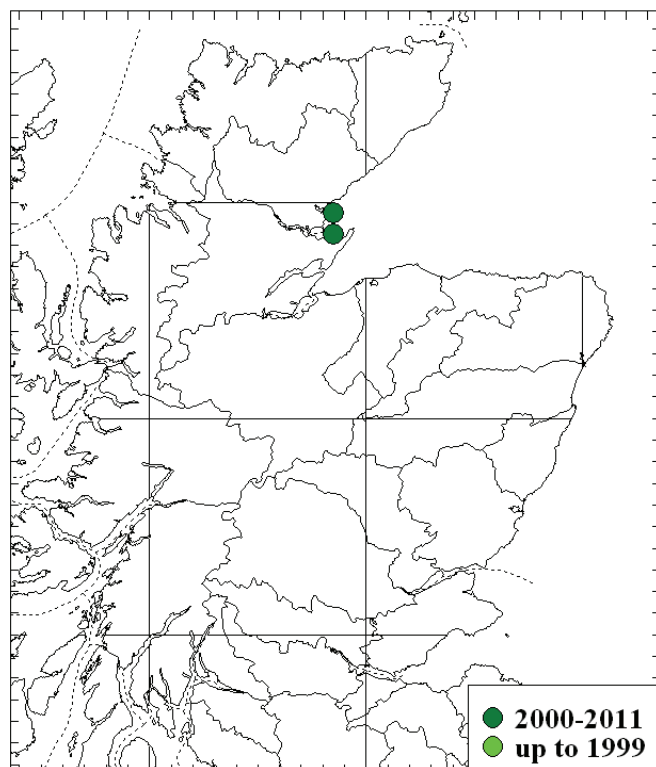
This UK endemic species is known from just one small stretch of the east Sutherland coast. All records of adults are from mid-June. Little is known about its ecology but adults have been caught in circumstances suggesting an association with bare sand amongst lyme grass (*Leymus arenarius*) at the accreting foredune. It is suggested that this accreting dune front area might be important for courtship and/or mating with larvae being more likely to occupy more stable dune areas inland of the dune edge. The larval food plant is not known but, based on host-plant selection by related species, is thought likely to be Compositae, possibly ragwort (*Senecio jacobaea*) (Gibbs, 2010).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

Until recently, the species was known from just one site globally, beside a caravan park at Dornoch Sands, Sutherland (Ackland, 1989; JNCC, 2010). Specimens were taken here in 1965 (one male collected) and 1971 (40 males and 35 females collected) (Ackland, 1989). On 11 June 1984, individuals of both sexes were found flying freely (Ackland, 1989) and on June 1996, two females were collected (Gibbs, 2010). In 2010 the species was also found at Dornoch Point, Dornoch north dunes and at Embo so the known distribution now extends along 6.3 km of shore. It was suggested that the species was likely also to occur on Coul Links up to Loch Fleet (giving a likely range of 8.1 km of shore) though this area has not been searched. Ferry Links, north of Loch Fleet, was searched in 2010 although the habitat and Diptera assemblages were somewhat different from those south of Loch Fleet and the species was not found. During these surveys, only a single individual was found at the Dornoch Sands locality and further survey may be required to establish if this is a seasonal effect or a true decline (Gibbs, 2010).



Habitat and management

Botanophila fonsecai is restricted to narrow strips of sand and sparse herbage along the coastal range. It is found both in sparsely-vegetated accreting foredunes and in more stable dunes inland. No active management prescriptions have been suggested but clearly maintenance of active dune systems is likely to benefit this species.

Pressures and threats

This species is only known from one area and so it is intrinsically threatened on account of its small range. The original Dornoch Sands site is thought to be highly threatened by trampling linked to recreational activity (Gibbs, 2010) and also by natural geomorphologic processes. The species may be adversely affected by rising sea levels due to global warming (JNCC, 2010).

Conservation measures

Current conservation priorities relate to understanding the species' ecology, securing appropriate management at the known sites and determining its full range (JNCC, 2010).

Summaries of surveys and research related to surveillance

The 2010 survey work for this species provides the most comprehensive assessment of its status. Gibbs (2010) made recommendations of work for future population trend and distribution surveillance.

Quality of data

The species is difficult to identify (virtually impossible in the field). The 2010 work found several new populations. It is likely that the species may be overlooked elsewhere.

References

Ackland, D.M. 1989. Anthomyiidae (Dipt.) new to Britain, with a description of a new species of *Botanophila* Lioy. *Entomologist's Monthly Magazine*, **125**, 211-230.

Gibbs, D. 2010. Survey of *Botanophila fonsecai* Ackland (Diptera, Anthomyiidae), a seed-fly endemic to Eastern Sutherland; including investigations into ecology. *Unpublished report. Edinburgh: Scottish Natural Heritage.*

JNCC. 2010. *UK Priority Species data collation*: [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2091.pdf> [Accessed 1 November 2011].

Map data sources

Gibbs (2010).

SURVEILLANCE METHODOLOGY FOR FONSECA'S SEED FLY (*Botanophila fonsecai*)

Aim

To establish the distribution of *Botanophila fonsecai* and its conservation status within its range.

Rationale

Botanophila fonsecai is known globally from a few kilometres of coast in east Sutherland where it was first found in 1965. Up to 2010 there were no records away from an area of shore of 100 m long and a few metres wide. A SNH commissioned survey in 2010 found the species at several points along a 6.3 km stretch of coast. An area of potentially suitable habitat to the north was not checked because access was not granted. Gibbs (2010), reporting on this work, suggested that the species could be searched further afield, and that it was much less in evidence at the original site, a possible indication of lower population level. Given the potential extreme global rarity of *B. fonsecai*, it is important to generate a measure of population level trends within the known range.

There is much to be discovered about the ecology of *B. fonsecai*. It has not been reared from larvae so the food plant is still unknown. Surveillance should be linked to research into habitat use to enable appropriate action, should monitoring reveal unfavourable population or range trends.

Approach

Field identification of *B. fonsecai* is virtually impossible. Microscopic distinguishing features are illustrated by Ackland (1989).

The habitat usage and, larval food plant are unknown. Gibbs (2010) described the most detailed surveillance so far and should be closely referred to in conjunction with these recommendations. In particular he found sweep-netting to be the most effective means of sampling and although the numbers found were too low to ascertain plant associations, he made suggestions as to the likely environment used by adults and possible larval food plants. Recommendations for surveillance protocols here closely follow those

Equipment

Sweep net, microscope, specimen containers, ethyl acetate, ethanol.

Location

The species has only been found along the coast of east Sutherland between NH8088 on Dornoch Point in the south and NH8193, just north of Embo, to the north. Gibbs (2010) should be consulted for detailed maps depicting the areas.

Searches for new sites should follow the locations and order of priority as listed by Gibbs (2010). These are Coul Links; Morrich More; dunes north and south of Brora; Culbin dunes, Whiteness Head and Findhorn Dunes; Keiss Links and north coast sites west to Durness; dunes from Lossiemouth to Aberdeen; dunes Aberdeen southwards.

Sample units

Because on the linear nature of the habitat for this species, it is not meaningful to refer to number of sites. A more suitable unit, unless the species is found to be considerably more

widespread, would be the number of occupied 1 km squares. For assessing population level, the sampling unit is the number of flies per timed search in each search location.

Sampling

Expert judgment should initially be employed when searching for new sites for *B. fonsecai*. Samples collected by sweep net for subsequent identification should be restricted to small areas of ground, with sampling location noted by GPS.

Population level monitoring would ideally be carried out regularly to counteract likely population fluctuations due to survey timing and weather conditions. However given the apparent rarity of this species a balance needs to be maintained between the numbers of flies killed for identification and the potential impact that this could have on the population size. Surveillance should follow these guidelines:

- Dornoch Point is the most suitable location for regular monitoring of population levels as it had the strongest population found in the most recent survey (Gibbs, 2010).
- Searches for new sites should be carried out within one week before and after the peak of the adult flight period, thought to be around mid-June.
- Samples should be taken by sweep-netting for a unit time or over unit ground surface area in each of the habitat compartments identified by Gibbs (2010).
- Sweeping vigorously along a 20 × 0.5 m transect (entailing approximately 80 sweeps) with a 45 cm diameter net may be a suitable protocol. Anthomyid flies should be retained in ethanol and identified microscopically.
- The number of samples from each compartment should be determined from the time available. However it is suggested that sampling does not cover more than 1% of the area of each compartment so as to minimise risks of negatively impacting the population.
- Sampling should be carried out weekly from the beginning of May to the end of July and repeated every five to six years.

Ecological research should also be carried out, following on from that done by Gibbs (2010). In particular, identifying the host plants will help to focus searches at new sites.

Time

Half a day each week for around 13 weeks should be allowed for fieldwork at Dornoch Point, with additional time for microscopic identifications.

References

- Ackland, D.M. 1989. Anthomyiidae (Dipt.) new to Britain, with a description of a new species of *Botanophila* Liou. *Entomologist's Monthly Magazine* **125**: 211-230.
- Gibbs, D. 2010. Survey of *Botanophila fonsecai* Ackland (Diptera, Anthomyiidae), a seed-fly endemic to Eastern Sutherland; including investigations into ecology. *Unpublished report. Edinburgh: Scottish Natural Heritage.*

SPECIES REPORT FOR SOUTHERN SILVER STILETTO-FLY (*Clorismia rustica*)

Ecology

Larvae of stiletto flies are terrestrial soil predators and those of *Clorismia rustica* are assumed to live in loose sand, either in sunny situations or in the shade (Anon, 1999). They avoid damp sand at the water's edge and are scarce in closed turf in pasture, but are most common in bare and sparsely vegetated dry sand between these limits (Drake *et al.*, 2010). In particular they inhabit sand dumped high on the sides and tops of river banks in flood events (Hewitt & Parker, 2008a).

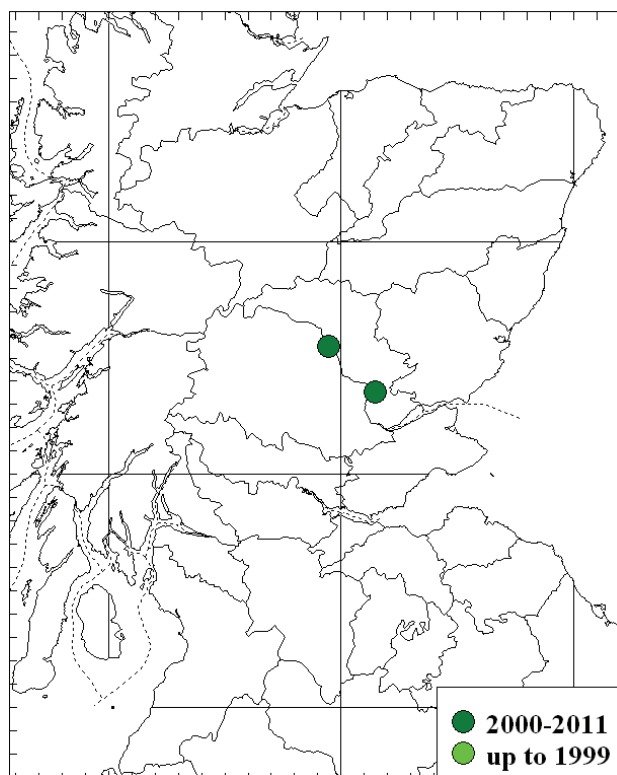
Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Fluctuating - probably stable.
- IUCN Status: Not listed.

Distribution

In Scotland, this species is known from two sites on the River Tay in Perthshire. One adult was collected at Ballinluig in the 1990s (S. Hewitt, *pers. comm.*). In 2006, a male was swept up from a small, vegetated, sandy spit in the same area at Ballinluig Shingle Island and a female was found at Kercock among loose, dry sand deposited well up on the river bank (Drake *et al.*, 2007).

Elsewhere in the UK *C. rustica* has been recorded from the Welsh Marches of England and Wales, including the River Monnow and the River Usk, plus localities in West Sussex, north-east Yorkshire, Northumberland, Cumbria and Cheshire (Anon, 1999; Drake *et al.*, 2010). Despite greatly increased recording effort in recent years, few new localities have been found, and the presence of the fly at some of its older localities has not been confirmed. The species has a wide distribution in Europe, but its status in most countries is largely unspecified.



Habitat and management

Clorismia rustica is a species of lowland rivers where the adults are associated with sandy river banks, especially where sand shoals have built up at flood level. Shading alders (*Alnus glutinosa*) or other trees and bushes are generally present, but bare sand in open sunny conditions is usually part of the habitat mosaic (Anon, 1999).

Pressures and threats

The species is threatened by removal of sandy sediment from rivers and river banks for aggregate and the deepening and canalisation of watercourses and by reductions in river flow as a result of water abstraction (Anon, 1999).

Conservation measures

As a species of Exposed Riverine Sediments (ERS) *C. rustica* should benefit from actions that promote and protect undisturbed river processes (Drake *et al.*, 2010).

Summaries of surveys and research related to surveillance

Surveys of Diptera on exposed riverine sediments were carried out in July 2006 on the Tay and the Spey. These surveys resulted in the first Scottish records of *C. rustica* (Drake *et al.*, 2007). Recent surveys in England have helped to refine survey methods (Hewitt & Parker, 2008 a, b).

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Drake, C.M., Godfrey, A., Hewitt, S.M. & Parker, J. 2007. Fly assemblages of sandy exposed riverine sediment. *Unpublished report. Peterborough: Buglife*.
- Drake, C.M., Hewitt, S.M. & Godfrey, A. 2010. Flies of exposed riverine sediments. *British Wildlife*, **21**, 320-325.
- Hewitt, S. & Parker, J. 2008a. Distribution of the UK BAP Southern Silver Stiletto-fly (*Clorismia rustica*) on the River Eden in Cumbria. *Unpublished report. Penrith: Environment Agency*.
- Hewitt, S. & Parker, J. 2008b. Distribution of the stiletto-fly *Clorismia rustica* on Cheshire rivers. *Unpublished report. Peterborough: Buglife*.

Map data sources

Drake *et al.* (2007).

SURVEILLANCE METHODOLOGY FOR SOUTHERN SILVER STILETTO-FLY (*Clorismia rustica*)

Aim

To establish presence of *Clorismia rustica* at known Scottish sites and to identify and search further potential sites.

Rationale

Clorismia rustica is known from just three Scottish records, at two sites, both on the River Tay. Although the potential value of exposed riverine sediments for biodiversity are being increasingly recognized, there has been only limited survey in Scotland for the associated Diptera. The potential for further sites to be found must, therefore, be high.

Previous surveys have generally recorded *C. rustica* in very low numbers so site habitat monitoring may be a proxy indication of population health in addition to establishing species presence.

Approach

Clorismia rustica has been recorded at English sites during both adult and larval surveys. Larvae cannot be identified specifically and must be reared through the adult stage. Hewitt and Parker (2008) gave detailed instructions on how to do this.

The methods described here broadly follow the approach used by Hewitt & Parker (2008) and by Drake *et al.* (2007), who documented the two records in 2006, which came from a single day of searching for adults at three sites on the Tay.

Equipment

Sweep net, larval rearing equipment as described by Hewitt & Parker (2008).

Location

Precise grid references of the previous Scottish records are not given by Drake *et al.* (2007). However initial work to establish continued presence should be centred on suitable habitat in the general vicinities of Ballinluig and Kercock on the River Tay. Further surveys should then be carried out in adjacent catchments, such as the Forth and the Esk.

Sample units

This species has currently only be found in Scotland as singletons and tends to be found in very low numbers at English sites. Unless fieldwork methods can be refined to increase the chances of encountering *C. rustica*, it will prove very difficult to gather meaningful population information for a site. Given this fact and that there exists much potential for the discovery of new sites, surveillance should concentrate on establishing the number of occupied catchments and, within these, the number of occupied sites.

Sampling

Searches for *C. rustica* should be guided by the following protocols:

- In the first instance, satellite photographs should be examined or local naturalists consulted to advise on where likely habitat may be found.

- Searches for adults should be carried out in fine, dry weather between June and August. Larvae can be found all year but are most easily found from April to August (Hewitt & Parker, 2008).
- Larval searches should focus on areas of undamaged, coarse, loose sand, deposited high up river banks by winter floods. Reference should be made to previous surveys for further habitat features associated with *C. rustica* (Drake *et al.*, 2007; Hewitt & Parker, 2008).
- Therevid larvae should be searched by hand-sifting potentially suitable sandy deposits on river banks.
- Sweep-netting of vegetation should be used to search for adults. It can be carried out on the same visit as larval searches.

For both types of search, several site photographs should be taken from defined points to allow identification of sampling areas and broad habitat changes between visits. Subsequent surveys can be designed to examine more closely any catchments that may generate new records.

Time

It is recommended that half a day is allocated per site, or 1 day for a string of sites that are close together along a single river. In total, it is suggested that at least two days of searches for adults be carried out per catchment, covering approximately six locations.

Further notes

Although not recorded from the same locations, there is the potential for finding *Rhabdomastix japonica* along *C. rustica*. The same sampling regime is recommended for both species, so searches could be combined.

References

Drake, C.M., Godfrey, A., Hewitt, S.M. & Parker, J. 2007. Fly assemblages of sandy exposed riverine sediment. *Unpublished report. Peterborough: Buglife.*

Hewitt, S. & Parker, J. 2008. Distribution of the UK BAP Southern Silver Stiletto-fly (*Clorismia rustica*) on the River Eden in Cumbria. *Unpublished report. Penrith: Environment Agency.*

SPECIES REPORT FOR STRATHSPEY CLUSIID FLY (*Clusiodes geomyzinus*)

Ecology

This is a saproxylic insect, its larvae are believed to develop in decaying pine (*Pinus* spp.) stumps (Malloch Society, 2011).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

This species has shown a marked decline during the 20th century. The only recent UK records come from Abernethy Forest in Strathspey (Malloch Society, 2011).

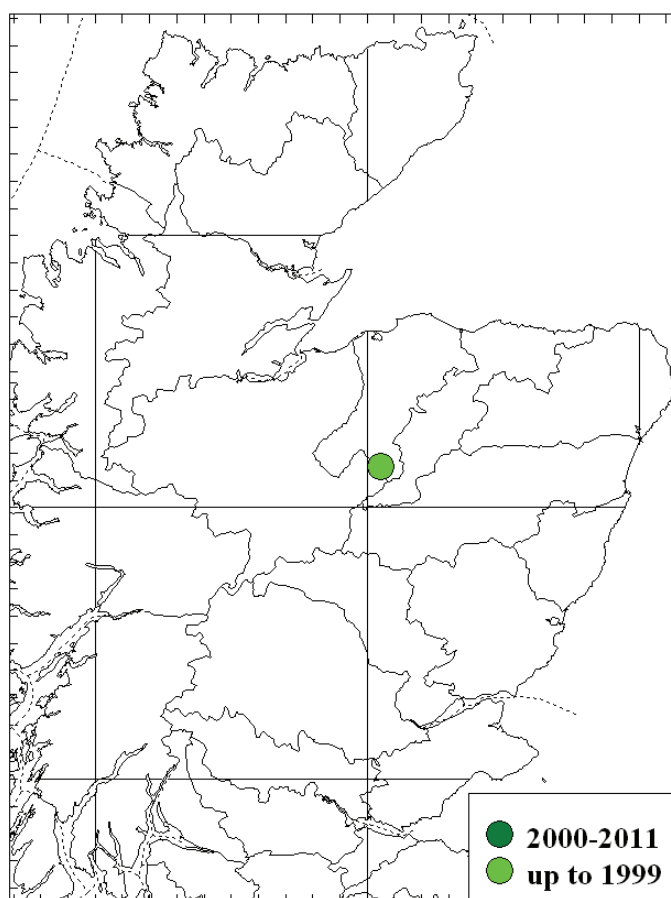
Elsewhere, this is a boreal species extending from Europe to the Eastern Palearctic (JNCC, 2010).

Habitat and management

The species is closely associated with Caledonian pinewoods and old pine plantations (Malloch Society, 2011).

Pressures and threats

Clusiodes geomyzinus suffers where there is a lack of dead wood input in the forest. Some former UK populations occur in plantations outwith protected areas. However, these are sometimes prone to being destroyed by forestry machinery or treated with antifungal agents (Malloch Society, 2011) and most pine plantations are now too young to host the species (JNCC, 2010).



Conservation measures

Research is required to understand the species' ecology and to develop any possible management treatments (Malloch Society, 2011).

Summaries of surveys and research related to surveillance

Survey is needed to find any new sites and monitoring is needed to understand the status of the species at existing sites.

Quality of data

Scant data are available and the species must be regarded as poorly known.

References

JNCC. 2010. *UK Priority Species data collation*, *Clusiodes geomyzinus*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2180.pdf> [Accessed 1 November 2011].
Malloch Society. 2011. [online] Available at: <<http://www.mallochsociety.org.uk/geomyzinus/>> [Accessed 27 November 2011].

Map data sources

HBRG Insects Dataset (Highland Biological Recording Group).

SURVEILLANCE METHODOLOGY FOR STRATHSPEY CLUSIID FLY (*Clusiodes geomyzinus*)

Aim

To establish whether this species is extant in Scotland and, if so, its approximate range.

Rationale

Clusiodes geomyzinus is a poorly known species in Scotland. Although the data may be incomplete, the NBN Gateway shows records only from 1982 to 1991 within Abernethy Forest. It is vulnerable to habitat degradation (lack of dead wood input) and new searches are required to establish whether it remains present.

Approach

As *C. geomyzinus* is so poorly known in Scotland, setting precise survey methodology is not appropriate. The following sections should act only as a guideline and be adapted with expert judgement and through fieldwork experience.

Larval ecology is especially poorly understood. They are thought to develop in decaying pine stumps (Malloch Society, 2011) and this should help guide for search areas. However, to avoid the risk of looking in the wrong microhabitats, sampling and surveillance are more likely to be effective if focused on searches for the adults.

Equipment

Sweep net, specimen pots.

Location

The species has been recorded in Abernethy Forest. Although NJ007160 and NJ0216 are given as grid references on the NBN Gateway, it is not known if these are accurate locations or if they have been estimated after the event. In any case, searches should be carried out across the entire area in Caledonian pinewoods or old pine plantations that have ongoing supplies of dead wood.

Sample units

As so little is known about this species, any records represent valid sampling units. However if it is shown to be widespread across Abernethy Forest and perhaps beyond, it might be more appropriate to record by the number of occupied 1 km squares.

Sampling

The dates of previous records, and hence the flight period in Scotland, are unclear. Advice should be sought from those with experience of the species overseas. Areas of Caledonian pine woods or old pine plantations with a steady input of dead wood should be identified in consultation with local reserve or estate staff. If the species is found, pine stumps in the vicinity can then be investigated for the early stages and it may be possible then to draw up quantitative methods for assessing relative population sizes.

Time

The duration of searches should be determined simply by observer availability.

Further notes

The hoverfly *Blera fallax* occupies similar habitats and its larval site, decaying pine stumps, is the same as that suggested for *C. geomyzinus*. There may be merit in investigating if contract surveys for *B. fallax* could also target this species.

Literature searches should be conducted annually to keep up to date of any published work on this species in a European context.

References

Malloch Society. 2011. [online] Available at:
<<http://www.mallochsociety.org.uk/geomyzinus/>> [Accessed 27 November 2011].

SPECIES REPORT FOR PHANTOM HOVERFLY (*Doros profuges*)

Ecology

The life history of *Doros profuges* is uncertain but may be complex and highly specialised. Its relatively large larvae were believed to have a commensal relationship within the nests of the ant *Lasius fuliginosus*, but there is now a growing consensus that the larvae feed on aphids which are herded by *L. fuliginosus* and they may supplement their food with caterpillars (Douglas, 2003; Ball *et al.*, 2011).

Adults are recorded from mid-May to early July (Ball *et al.*, 2011) usually resting on or flying around bramble (*Rubus* spp.) (Ball & Morris, 2000). On the chalk downs in Surrey, a female was observed ovipositing low down on the trunk of an isolated ash tree on chalk grassland, suggesting the turf around tree trunks as a developmental site (Falk, 1991). Most records of this species are of females, suggesting the species is arboreal with only females descending to ground level to lay eggs (Douglas, 2003).

Many of the sites are on sunny slopes, suggesting that *D. profuges* is a thermophilic species as is the solitary wasp *Argogorytes mystaceus* which it mimics (Douglas, 2003).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: listed as “Not relevant for this country”.
- IUCN Status: Not listed.

Distribution

There are two Scottish records. One specimen was found on the Ardmeanch Peninsula on the Isle of Mull on 12 June 1991 (Ravenscroft & Barbour, 1992) and there is a record from Arran (Ball *et al.*, 2011).

Elsewhere in Britain, *D. profuges* is mainly restricted to southern England although there are records from north-west England and old ones from Wales (Ball & Morris, 2000; Ball *et al.*, 2011). Its range extends eastwards to the Pacific coast including Japan and parts of China (Douglas, 2003).

Habitat and management

The Scottish specimen was found close to bramble and under the partial shelter of some small oaks (*Quercus robur*) at the base of a slope covered in bracken. There is a conifer plantation around 30 m away. Most of the embankment is open, non-shaded and covered with heather and bird's-foot trefoil (*Lotus corniculatus*) which is colonising the bank but remains well grazed by rabbits. This grazing has left areas of the ground exposed (Ravenscroft & Barbour, 1992).

Elsewhere in Britain, *D. profuges* is generally found on calcareous grassland and scrub, especially near woodland edges. As with the Scottish site, most locations are close to woodland edge and have brambles present (Falk, 1991).

Pressures and threats

The species is threatened by habitat loss through afforestation or agricultural improvement and also by changes in grazing management with scrub invasion and loss of floristic richness and diversity (Falk, 1991).

Conservation measures

The generic advice for British sites is to maintain a mosaic of vegetation types, including some limited scrub, by employing rotational grazing policies if necessary (Falk, 1991). The conservation priority in Scotland must be to assess the status and range of the species.

Summaries of surveys and research related to surveillance

Some recent English records refer to adults caught in Malaise traps from areas where the species has otherwise been unrecorded (Ball & Morris, 2000). Trialling of this method for surveillance might be worthy.

Quality of data

Given that there are just two records in Scotland, knowledge of this species' status must be considered poor.

References

- Ball, S.G. & Morris, R.K.A. 2000. *Provisional atlas of British hoverflies (Diptera, Syrphidae)*. Huntingdon: Biological Records Centre.
- Ball, S.G., Morris, R.K.A., Rotheray, G.E. & Watt, K.R. 2011. *Atlas of the hoverflies of Great Britain (Diptera, Syrphidae)*. Wallingford: Biological Records Centre.
- Douglas, G. 2003. Invertebrate species dossier, *Doros profuges* Harris, a hoverfly (Diptera: Syrphidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Falk, S.J. 1991. A review of the scarce and threatened flies of Great Britain. *Research and Survey in Nature Conservation no. 39. Peterborough: Nature Conservancy Council*.
- Ravenscroft, N.O.M. & Barbour, D.A. 1992. *Doros conopseus* (Diptera: Syrphidae) on the Isle of Mull, Scotland. *Entomologist's Gazette*, **43**, 72-73.

SURVEILLANCE METHODOLOGY FOR PHANTOM HOVERFLY (*Doros profuges*)

Aim

Establish the status of *Doros profuges* in Scotland.

Rationale

There are just two Scottish records and there is some doubt among dipterists as to whether this species is resident or whether these records refer to migrant or adventive individuals. However, the habitat in which the Mull specimen was found is not inconsistent with that used in England, so searches should be made of potentially suitable sites close to the original record.

Approach

Given that the knowledge of this species in Scotland is based on just two specimens, and that only one of these is well documented (Ravenscroft & Barbour, 1992), there may be dangers in being too prescriptive about the approach taken to establishing its status. Instead, a large degree of expert judgment should be used in directing search for *D. profuges*.

The life habits of larvae are not well known so surveying should concentrate on searches for the distinctive adult.

Equipment

Butterfly/sweep net.

Location

The Mull specimen was taken on the Ardmeanach peninsula and initial searches for suitable sites should be carried out in and close to this area.

Sample units

Initial surveillance should be aimed at establishing whether the species is resident in Scotland and, if so, the minimum number of occupied sites.

Sampling

Expert judgment should be used to identify sites that are potentially suitable. Such searches should concentrate on finding areas at the edge of scrub or woodland that contain *Rubus*. The species has also been recorded sitting on a rotten tree trunk, around sap-runs and on reeds. The flight period in England is from mid-May to early July (Ball *et al.*, 2011). It may be sensible to concentrate Scottish searches towards the latter part of this period, especially the middle and second half of June.

Time

The duration of searches should be determined simply by observer availability.

Further notes

The Mull specimen was discovered by entomologists carrying out fieldwork connected with the slender Scotch burnet moth (*Zygaena loti*). It may be worthwhile publicising the species to entomologists carrying out future work at sites for Slender Scotch Burnet.

References

- Ball, S.G., Morris, R.K.A., Rotheray, G.E. & Watt, K.R. 2011. *Atlas of the hoverflies of Great Britain (Diptera, Syrphidae)*. Wallingford: Biological Records Centre.
- Ravenscroft, N.O.M. & Barbour, D.A. 1992. *Doros conopseus* (Diptera: Syrphidae) on the Isle of Mull, Scotland. *Entomologist's Gazette*, **43**, 72-73.

SPECIES REPORT FOR ASPEN HOVERFLY (*Hammerschmidtia ferruginea*)

Ecology

Hammerschmidtia ferruginea is found in association with large, boreal aspen (*Populus tremula*) stands of the Scottish Highlands. The breeding requirements are exceptionally specific and there are often very few suitable aspen trees within these small woodlands. Larvae are found under bark of dead aspen trunks or branches >75 cm circumference, in accumulations of decaying sap and cambium. Larvae have also been found in lower numbers in the sap runs. It takes around two years for the dead tree or branch to become a suitable site for *H. ferruginea* larvae, and they remain so for around one to three years before drying out (Rotheray *et al.*, 2009). Larval development takes one or more years. Mature larvae move to the drier parts of the wood in late spring to pupate. Adults are on the wing from late May to early August (Ball & Morris, 2000) and feed at flowers of rowan (*Sorbus aucuparia*), bird cherry (*Prunus padus*) and hawthorn (*Crataegus monogyna*) (Ball *et al.*, 2011). Population size and distribution can vary greatly between years depending on the availability of suitable dead aspen. At low cycle points local populations may not be detectable. Trend and status estimates can therefore only be assessed over a long time period.

Conservation status and rarity

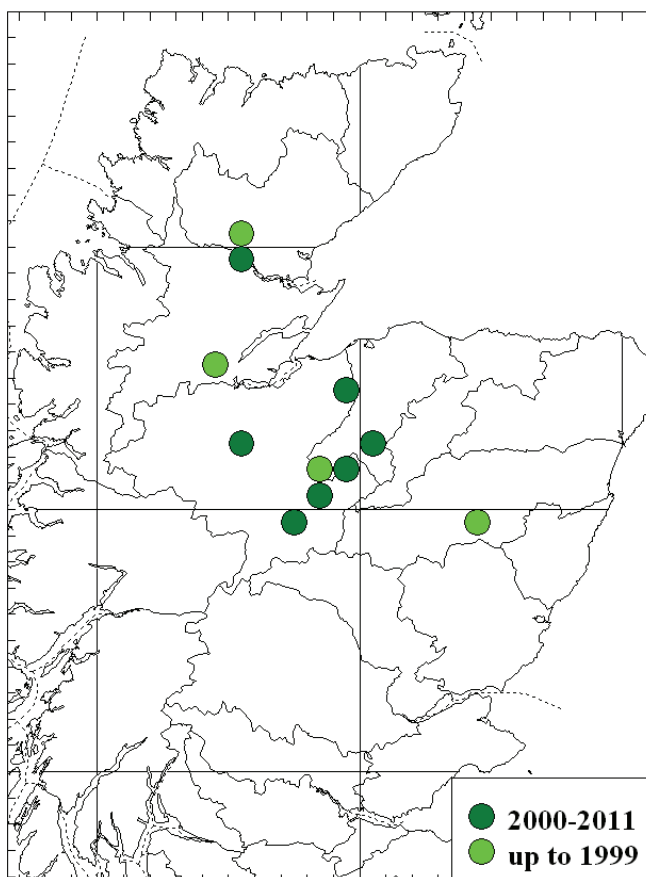
- Proposed for addition to Schedule 5 of the WCA, Section 9, Part 4 (a).
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Declining (continuing/accelerating).
- IUCN Status: Not listed.

Distribution

Hammerschmidtia ferruginea is confined to a small number of sites, mainly at Strathspey (between Newtonmore and Grantown), Nairn (Findhorn) and Sutherland (Achany). The status at sites in Deeside, Rosshire, and Inverness is unknown. This species is rare and endangered across its European range, which extend from Russia across much of northern and central Europe. It is also known from North America (Douglas, 2003).

Habitat and management

The extent of aspen in 12 of the 13 sites known to be occupied by *H. ferruginea* in 1999 is >5 ha (Rotheray & MacGowan, 2000). For *H. ferruginea*, optimal management should aim to create woodland with significant structural variety for there to be a



sustainable supply of large freshly dead branches or trees (Rotheray, 2008; Rotheray *et al.*, 2009).

Pressures and threats

Hammerschmidtia ferruginea is threatened by the loss of aspen, for example through road and building development. The small size and isolation of existing aspen stands also pose problems, as even in aspen woodlands >5 ha, survival of *H. ferruginea* is not ensured (Rotheray *et al.*, 2009). It may be possible to maintain populations in smaller aspen stands that are close enough to each other to allow movement of individuals between them and recent work is helping to determine dispersal distances (Rotheray, 2008).

Conservation measures

Extend and protect existing aspen stands. This may require protection of new saplings and cutting surrounding vegetation. Dead and fallen aspen should be left undisturbed and protected from deer and rabbit grazing. This is a rare resource, and its removal may prove catastrophic for the species. Where dead aspen is in short supply, populations can be aided by supplementary felling of branches and trees (Rotheray, 2008; Rotheray *et al.*, 2009).

Summaries of surveys and research related to surveillance

Surveys of saproxylic Diptera were carried out extensively in Scotland between 1988 and 1998 and the methods used should aid future surveillance (Rotheray *et al.*, 2001). More recently, a PhD project has studied ecology and conservation needs of *H. ferruginea*.

Quality of data

Knowledge of distribution is generally good following on from extensive surveys in the 1990s (Rotheray *et al.*, 2001) and between 2003 and 2006 (Rotheray *et al.*, 2009).

References

- Ball, S.G. & Morris, R.K.A. 2000. *Provisional atlas of British Hoverflies (Diptera, Syrphidae)*. Huntingdon: Biological Records Centre.
- Ball, S.G., Morris, R.K.A., Rotheray, G.E. & Watt, K.R. 2011. *Atlas of the hoverflies of Great Britain (Diptera, Syrphidae)*. Wallingford: Biological Records Centre.
- Douglas, G. 2003. Invertebrate species dossier, *Hammerschmidtia ferruginea* Fallen, A hoverfly (Diptera: Syrphidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Rotheray, E. 2008. The ecology and conservation of the Aspen Hoverfly. In: Parrott, J. & MacKenzie, N. (eds.) *Aspen in Scotland: biodiversity and management*. Highland Aspen Group, pp 12-14.
- Rotheray, G.E. & MacGowan, I. 2000. Status and breeding sites of three presumed endangered Scottish saproxylic syrphids (Diptera, Syrphidae). *Journal of Insect Conservation*, **4**, 215-223.
- Rotheray, G.E., Hancock, G., Hewitt, S., Horsfield, D. & MacGowan, I. 2001. The biodiversity and conservation of saproxylic Diptera in Scotland. *Journal of Insect Conservation*, **5**, 77-85.
- Rotheray, E.L., MacGowan, I., Rotheray, G.E., Sears, J. & Elliott, A. 2009. The conservation requirements of an endangered hoverfly, *Hammerschmidtia ferruginea* (Diptera, Syrphidae) in the British Isles. *Journal of Insect Conservation*, **13**, 569-574.

Map data sources

Hoverfly Recording Scheme database for Great Britain (Hoverfly Recording Scheme). Rotheray *et al* (2009).

SURVEILLANCE METHODOLOGY FOR ASPEN HOVERFLY (*Hammerschmidtia ferruginea*)

Aim

To establish the current distribution of *Hammerschmidtia ferruginea* and to continue monitoring that is suitable for establishing population trends.

Rationale

There has been considerable interest in the fate of saproxylic Diptera in Scotland and surveys have been carried out at a wide range of sites. *Hammerschmidtia ferruginea* is one of a few species that have received particular attention and has been subject to detailed ecological research including conservation and habitat requirements. Data from monitoring of sites on several occasions since 1999 provide a baseline against which to compare the results of future surveillance. There are other sites with older records where species survives is uncertain. For these locations surveys to establish presence is a priority and, if found to persist, the conservation status of these populations should be assessed.

Approach

As with many other saproxylic syrphids, surveys of the early stages (larvae and puparia) are more profitable than surveys of adults. Early stages are best located under the bark of fallen aspen (*Populus tremula*) by using the blunt point of a knife. Attention should be focused on branches over 25 cm in diameter on live trees (Rotheray & MacGowan, 2000; Rotheray *et al.*, 2009). Sampling for larvae can cause damage to the tree so should be done sparingly. Occasionally larvae may also be found in aspen sap runs.

Identification of *H. ferruginea* larvae is a relatively specialist task and should be carried out by a skilled dipterist to avoid the risk of confusion with similar species. Rotheray & MacGowan (2000) described the larvae and puparium. Identification may involve removal of larvae for hand lens examination but does not require killing, so unless retaining the larvae for rearing, they can be returned to their stumps. Knowledge of saproxylic Diptera likely to be encountered on aspen may reduce the need to remove larvae for identification.

As well as establishing an index of population levels, some measures on habitat condition should also be obtained. Estimations of population health can be made by the volume of suitable fallen aspen. Such data may act as an early warning of reductions in the resource.

Equipment

Specimen tubes or other suitable containers for storing larvae, hand lens and/or microscope.

Location

Rotheray *et al.* (2009) list 10 sites from where the species was detected between 2003 and 2006 with four-figure grid references. The authors and the Malloch Society hold details of these locations. Due to the cyclical nature of *H. ferruginea* populations (Rotheray *et al.*, 2009) long-term trends can only be garnered if surveillance is carried out at many, and preferably all, of the currently known or recently occupied sites, at a two-year intervals.

Sample units

Surveillance should focus on recording the number of occupied sites and the number of occupied fallen trees, branches or sap runs per standardized site search.

Sampling

Sampling should follow the methods used for establishing distribution and potential habitat resource as described by Rotheray *et al.* (2009). Briefly, this entails the following procedures:

- Surveys should take place in spring before the larvae emerge, when they are at their largest size and hence easiest to find (Rotheray *et al.*, 2009).
- Sampling should be carried out on a 10 m wide strip running across the longest site axis.
- Aspens above 20 cm circumference at breast height should be counted and their bases examined for sap runs.
- Dead trees and branches over a diameter of 25 cm should be counted and point-sampled for wet decay and *H. ferruginea* larvae.

Time

One day per site should be allocated.

Further notes

This species has been subject to considerable research and conservation effort by the Malloch Society, funded under the SNH Species Action Framework. It is highly desirable that future monitoring is carried out either by, or in cooperation with, the Malloch Society. However as identification of the adult is fairly straightforward, and there is currently considerable interest in the biodiversity of native aspen woodlands, there is also the potential for new sites to be discovered by competent naturalists who are not syrphid specialists. Such reports should, of course, be followed up promptly.

References

- Rotheray, G.E. & MacGowan, I. 2000. Status and breeding sites of three presumed endangered Scottish saproxylic syrphids (Diptera, Syrphidae). *Journal of Insect Conservation*, **4**, 215-223.
- Rotheray, E.L., MacGowan, I., Rotheray, G.E., Sears, J. & Elliott, A. 2009. The conservation requirements of an endangered hoverfly, *Hammerschmidtia ferruginea* (Diptera, Syrphidae) in the British Isles. *Journal of Insect Conservation*, **13**, 569-574.

SPECIES REPORT FOR SCOTTISH YELLOW SPLINTER (*Lipsothrix ecucullata*)

Ecology

Lipsothrix ecucullata is a pale yellow cranefly which has been reared from rotted logs of birch, alder and oak. Larvae feed in a band of wood above the surface of the water. They occupy shallow excavated tunnels just under the surface of the wood and are thought to feed on bacteria and other microorganisms (Rotheray, 2000). Adults are found in June and July with a possible second generation in August and September. They have been observed swarming around low-growing plants within stream-side vegetation such as dog's mercury (*Mercurialis perennis*) and ramsons (*Allium ursinum*) (Douglas, 2003).

Conservation status and rarity

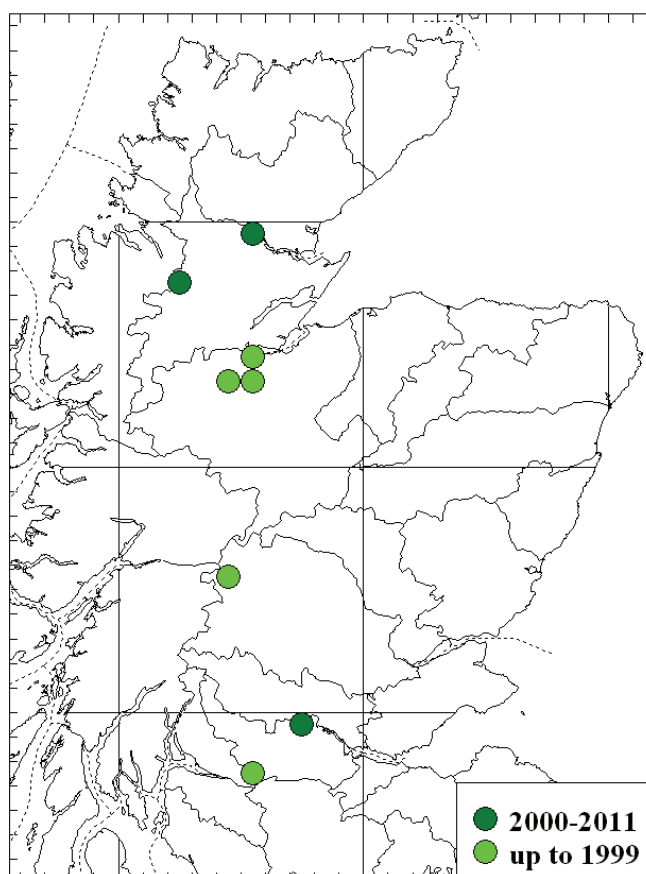
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Stable.
- IUCN Status: Not listed.

Distribution

There are records from around 15 British sites, all in the Scottish Highlands and fringes (Dipterists' Forum, 2008). Six sites (in Stirlingshire, Perthshire and Moray) have post-1972 records (Rotheray, 2000). Other records are from Easterness, West Ross and Sutherland (Douglas, 2003). Recent records are of larvae, collected in 1999-2000, from Kippenrait (Stirlingshire), Inveran and Achany Glen (Sutherland) and Corrieshalloch Gorge NNR (Ross and Cromarty) (Rotheray, 2000) - these records are shown in the 2000-2011 category on the map opposite). Further surveys in 2002 recorded adults at Kippenrait. In Europe, this is a typically northern species though is only rarely recorded (Douglas, 2003).

Habitat and management

This species inhabits damp deciduous woodland though not in areas with acidic soils. One specimen was found in seepage on a clay bank and another in seepage above some woods. At the Kyle of Sutherland Marshes, the species has been found in seepage scrubby woodland (Douglas, 2003). Recent observations suggest that areas of undisturbed mixed woodland with seepages and small streams are most likely to occur in steep sided valleys but that the species can also be found in less steep woodlands where management is light.



Pressures and threats

Although factors causing a perceived historical decline are not known (Anon, 1999), pollution caused by agricultural run-off could have a negative impact, as well as clearance of damp woodland for intensive forestry (Douglas, 2003).

Conservation measures

Lipsothrix ecucullata depends on the continuing protection and sympathetic management of native broad-leaved woodlands. The clearance of damp woodland for intensive forestry should be avoided. In particular, the continuous presence of dead wood lying immersed or partly immersed in seepages is essential. Seepage water quality is also an important factor. As far as possible flushes and seepages should be maintained in a natural state with no ditching or excessive poaching by stock (Douglas, 2003).

Of the recorded Scottish sites, three are designated SSSIs: Kippenrait Glen (last recorded in 1999-2000), Bridge of Garten (1982), and Corrieshalloch Gorge (1999-2000). The latter site is a National Nature Reserve as well.

Summaries of surveys and research related to surveillance

Between September 1999 and January 2000 visits were made to eight sites from where *L. ecucullata* had been recorded and the fly was reared from larvae collected from three of these (Rotheray, 2000). Survey techniques used should inform future surveillance.

Quality of data

With little recent survey, the current distribution or range and population trends of this species are poorly known.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats*. London: HMSO.
- Dipterists' Forum. 2008. [online] Available at: <http://www.dipteristsforum.org.uk/wiki/bap:existing:lipsothrix_ecucullata> [Accessed 28 November 2011].
- Douglas, G. 2003. Invertebrate species dossier, *Lipsothrix ecucullata* Edwards, a crane fly (Diptera: Tipulidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Rotheray G.E. 2000. Search for the larva of the Priority Crane fly *Lipsothrix ecucullata* (Diptera, Tipulidae). *Scottish Natural Heritage Commissioned Report (ROAME No. F99AC309)*.

Map data sources

- Crane fly (Diptera; Tipuloidea) records for Britain to 2007 (Biological Records Centre).
- HBRG Insects Dataset (Highland Biological Recording Group).
- Rotheray (2000).

SURVEILLANCE METHODOLOGY FOR SCOTTISH YELLOW SPLINTER (*Lipsothrix ecucullata*)

Aim

To carry out searches for *Lipsothrix ecucullata* beyond the currently known range and develop a surveillance protocol to be used at key sites for assessing population trends.

Rationale

Falk (1991) suggested that this species may be more widespread than current records demonstrate. Rotheray (2000) stated that there are records from eight Scottish sites and it is recommended that all are checked.

As there are good descriptions of three sites known to be occupied in 1999/2000 (Rotheray, 2000) it should be possible to develop a surveillance protocol for long-term population monitoring with suitable descriptors of habitat quality at these locations.

Approach

Sites with records should be checked for continued occupancy by the species, primarily those visited by Rotheray (2000). A selection of these sites should be used for long-term population monitoring. Although the larvae are difficult to identify, Rotheray (2000) suggested that survey is best done by searching them in early spring.

Equipment

25x75 mm corked glass tube, knife.

Location

Rotheray (2000) described eight sites along with four-figure grid references and maps. Given the currently known distribution, anywhere from the Central Belt north to the Cromarty Firth and probably beyond would be worth checking for additional populations. Potential sites should be identified by circulating a description of the required habitat characteristics to local SNH staff and wider networks of entomologists and other naturalists.

In the first instance, trend monitoring is best carried out at sites where Rotheray (2000) found the species, namely Kippenrait, Invervan & Glen Shin and Corrieshalloch Gorge.

Sample units

It would be desirable and realistic to seek data on both the number of extant sites and population trends at a sample of these sites.

Sampling

For searches to establish the status of the species, the following protocol is proposed:

- Following Rotheray (2000), two person-days should be spent searching each of the sites with known records.
- Larval surveys should take place in early spring, when larvae are large and more easily found prior to pupation.

- Each site should be slowly walked through, noting wet areas such as seepages, bogs and burns.
- Fallen wood associated with wet areas should be searched for soft decay.
- Decayed soft wood should be searched on-site with a knife or stick and any tipulid larvae removed into a suitable container, such as a 25 x 75 mm corked glass tube or a 250 ml plastic container along with small amounts of the decayed wood.
- Methods for rearing larvae to adulthood are given by Rotheray (2000).
- A reduced search regime (one day/site) can be employed at a wider variety of potential sites that do not have currently have records for the species.

For population monitoring, it is suggested that Kippenrait, Invervan & Glen Shin and Corrieshalloch Gorge be visited and searched for a unit time. As *L. ecucullata* was not found abundantly at any of those sites (e.g. only two at Corrieshalloch Gorge), it is suggested that the search time be the same as for looking at other sites with old records (two days). Although subject to a number of potential biases, this would enable very broad comparisons across all the sites. Surveys should be repeated at five-year intervals to determine long-term trends. Alongside this survey, habitat quality should be assessed. A form should be developed that includes notes of site threats, such as wood clearance activities, and an assessment of fallen wood that is currently thought to be suitable for the species or may become so in future years.

The location of areas of suitable habitat and locations from which larvae have been retained should be logged with GPS and photographed. This would enable their rapid location should a less comprehensive point survey be carried out in the future.

Time

Two days per site are required for the population monitoring. The same time is recommended for site searches to establish status but these can be shortened for small sites or to cover a wider range of sites.

Further notes

Rotheray (2000) suggested that *L. ecucullata* could possibly be monitored by pupae remains. This would have the advantage of keeping intact breeding sites. Further work would be highly desirable to examine if this is indeed a viable mean of monitoring. If this method is found to be effective, it could replace larval monitoring at key sites although it should initially be carried out alongside larval surveys for calibration purposes.

References

- Falk, S.J. 1991. *A review of the scarce and threatened flies of Great Britain*. Research and Survey in Nature Conservation no. 39. Peterborough: Nature Conservancy Council.
- Rotheray G.E. 2000. Search for the larva of the priority crane fly *Lipsothrix ecucullata* (Diptera, Tipulidae). *Scottish Natural Heritage Commissioned (Report ROAME No. F99AC309)*.

SPECIES REPORT FOR NORTHERN YELLOW SPLINTER (*Lipsothrix errans*)

Ecology

Lipsothrix errans is a pale yellow cranefly. Larvae are xylophagous, living in saturated rotten wood in shaded streams (Douglas, 2003; Stubbs, 2003). The adults have been recorded from May to July. The Welsh specimens were reared from quite large pieces of wood lying in flowing water. The adults are unlikely to feed (Falk, 1991; Stubbs, 2003).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: not listed.

Distribution

In the British Isles, *L. errans* is essentially a northern species. It is widespread across Scotland and has also been recorded in County Durham and North Yorkshire in England and Cardiganshire, Breconshire and Merionethshire in Wales. There have been 18 sites found since 1960 with relatively few prior records. *Lipsothrix errans* has a wide distribution across the temperate belt of central Europe but is generally scarce (Douglas, 2003).

Habitat and management

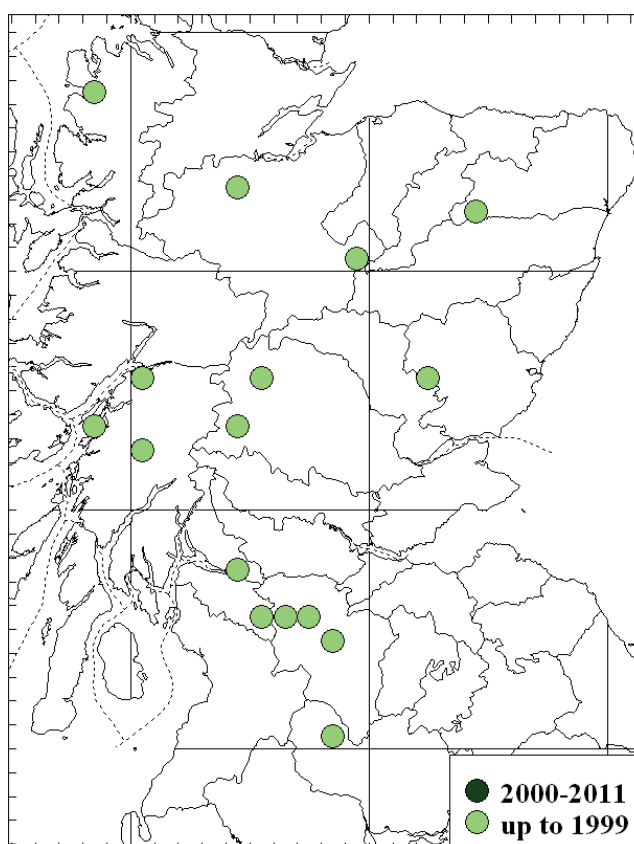
L. errans is found around shaded, wooded streams in upland areas.

Pressures and threats

Rotten dead wood lying in water is a particularly rare and vulnerable habitat. Thus the removal of log jams and fallen timber and branches from streams forms a particular threat to this species (Anon, 1999). The species has suffered in particular where management plans for forestry, woodland amenity, conservation and catchments aimed at tidiness and keeping woodland streams free of fallen wood (Falk, 1991; Stubbs, 2003). Pollution caused by agricultural practices also has the potential to have a negative impact (Douglas, 2003; Falk, 1991).

Conservation measures

Lipsothrix errans depends upon the continuing protection and sympathetic management of native broad-leaved woodlands. In particular water bodies should be maintained in a natural state with retention of dead wood and marshy areas (Falk, 1991). It is important to prevent pollution by agricultural run-off, drainage, ditching, excessive poaching by stock and



clearance of damp woodland for intensive forestry (Douglas, 2003). Furthermore, it may be possible to enhance populations by placing supplies of logs and branches in waterways within the species' range (Stubbs, 2003).

Summaries of surveys and research related to surveillance

No recent surveys or surveillance are known.

Quality of data

Although there is a wide distribution of records associated with surveys in the late twentieth century, there is a distinct lack of recent monitoring.

References

- Anon. 1999. *UK Biodiversity Group Tranche 2 Action Plans - Volume IV: Invertebrates*. Nature Conservancy Council. London: HMSO.
- Douglas, G. 2003. Invertebrate species dossier, *Lipsothrix errans* Walker, a crane fly (Diptera: Tipulidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Falk, S.J. 1991. *A review of the scarce and threatened flies of Great Britain*. Research and Survey in Nature Conservation no. 39. Peterborough: Nature Conservancy Council.
- Stubbs, A. 2003. *Managing priority habitats for invertebrates, Volume 17, Tipulidae and Allies – Crane flies*. Peterborough: Buglife.

Map data sources

Crane fly (Diptera; Tipuloidea) records for Britain to 2007 (Biological Records Centre).

SURVEILLANCE METHODOLOGY FOR NORTHERN YELLOW SPLINTER (*Lipsothrix errans*)

Aim

To broadly establish the extent of the current range of *Lipsothrix errans* in Scotland and to carry out population monitoring at key sites.

Rationale

Although widely recorded in Scotland, there are few recent records of *L. errans* and little or no systematic survey. The methods set out below draw to a large extent on those proposed for *L. ecucullata*. As there are records from a wide range of sites (at least 25 10-km squares), they seek not to establish the full range so much as to gather data that may indicate if populations are threatened in particular parts of the distribution.

Approach

It is assumed here that the survey methods that are optimal for *L. ecucullata* are also best for this species. This means that surveillance should entail carrying out searches for the larvae in early spring.

Equipment

25x75 mm corked glass tube, knife.

Location

Data with varying degrees of resolution from the National Biodiversity Network Gateway should be examined to identify sites suitable for initial investigation. Due to the wide geographic spread of these sites, a geographical stratification of sites is suggested. These may include, for example, three to four sites from each of the following three areas: NW of the Great Glen, Perthshire and Grampian, and south of the Central Belt.

Sample units

This species appears to be widespread, at least historically. It may not be feasible to seek precise knowledge of all possible sites through formal surveys but the broad geographic spread should be established. Subsequent periodic survey would be for the number of larvae located in a uniform time, as an indication of population level.

Sampling

For site searches to establish the status of the species, the following protocol is proposed:

- Two person-days should be spent searching each of the sites selected for investigation.
- Larval surveys should take place in early spring. This is the best time for *L. ecucullata* (Rotheray, 2000), with larvae being large prior to pupation and more easily found.
- Each site should be slowly walked through, looking for rotten wood lying in water.
- Soft decay on dead wood should be searched with a knife or stick.

- Any tipulid larvae found should be removed into a suitable container such as a 25 x 75 mm corked glass tube or a 250 ml plastic vial along with small amounts of the decayed wood.
- Methods for rearing larvae of *L. ecucullata* to adulthood are given by Rotheray (2000) and may also be suitable for this species.
- For population monitoring, it is suggested that, following an initial search of old sites, at least three occupied sites (one in each of the regions listed under "Location") are selected for periodic population level monitoring by timed searches. The initial survey would help guide the appropriate length of time to search and enable location of a sufficient number of specimens. If it proves to be found only in small numbers, as appears to be the case for *L. ecucullata*, then a 2-day search per site is recommended. Surveys should be repeated at five-year intervals to determine long-term trends.

The location of areas containing suitable habitat and locations from which larvae have been retained should be logged with GPS and photographed. This would enable their rapid location should a less comprehensive point survey be carried out in the future.

Time

Up to two days should be allocated per site searched.

Further notes

Rotheray (2000) suggested that *L. ecucullata* could be monitored by pupae remains. If this is also possible for *L. errans*, breeding sites would not be damaged or destroyed by surveillance. Further work would be highly desirable to examine if this is indeed a viable method. If so, it could replace larval monitoring at key sites although it should initially be carried out alongside larval surveys for calibration purposes.

References

Rotheray G.E. 2000. Search for the larva of the priority crane fly *Lipsothrix ecucullata* (Diptera, Tipulidae). *Scottish Natural Heritage Commissioned Report (ROAME No. F99AC309)*.

SPECIES REPORT FOR SOUTHERN YELLOW SPLINTER (*Lipsothrix nervosa*)

Ecology

Lipsothrix nervosa is a cranefly that can be found on or around rotten twigs and branches. Larvae are xylophagous, living in saturated rotten wood, primarily on small branches on seepages (Douglas, 2003; Stubbs, 2003). Adults are unlikely to feed.

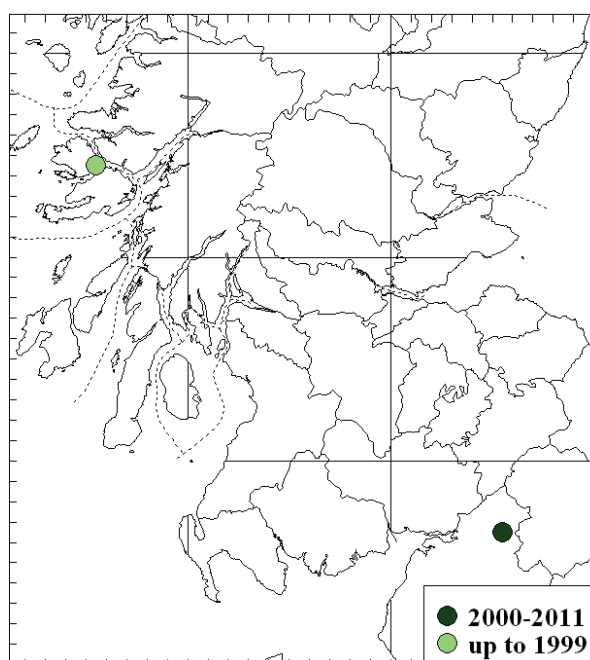
Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: No clear trend.
- IUCN Status: Not listed.

Distribution

There is just one Scottish record, taken on the Isle of Mull by Alan Stubbs in 1983. Although it may be climatically possible for it to occur on Mull, this record may need further validation (Douglas, 2003).

Lipsothrix nervosa was believed to be endemic to Great Britain, where it is very much a southern species, but has been found to be synonymous with *Lipsothrix nobilis* on the continent of Europe (Stubbs, 2003). It has a wide distribution in southern England, the southern Midlands and southern Wales though is very local and seldom found in significant numbers (Douglas, 2003). The closest English record to the Scottish border is from 2003 at north Cumbria, shown on the map opposite.



Habitat and management

The species is found around rotten twigs and branches lying in seepages in deciduous woodland. It favours alder carr woodland and woodland with ash and various other trees (Douglas, 2003; Stubbs, 2003).

Pressures and threats

This habitat occupied by *L. nervosa* is vulnerable to drainage, ground-water extraction, pollution, trampling and any break in the shade or the wood supply. The loss of deciduous woodland has been blamed for the species decline in England. In addition, *L. nervosa* has become markedly less abundant in England since the drought of 1975/76 and during dry years in the 1990s. Many previously known sites have dried out altogether (Douglas, 2003).

Conservation measures

It is important to maintain a constant supply of shade, water and fallen timber (Douglas, 2003). Stubbs (2003) suggested that populations may be enhanced by placing small pieces of branches on seepages.

Summaries of surveys and research related to surveillance

There has been no surveillance in Scotland.

Quality of data

The status of *L. nervosa* species in Scotland is unclear.

References

Douglas, G. 2003. Invertebrate species dossier, *Lipsothrix nervosa* Edwards, a crane fly (Diptera: Tipulidae). *Unpublished report. Edinburgh: Scottish Natural Heritage.*

Stubbs, A. 2003. *Managing priority habitats for invertebrates, Volume 17, Tipulidae and Allies – Craneflies.* Peterborough: Buglife.

Map data sources

Crane fly (Diptera; Tipuloidea) records for Britain to 2007 (Biological Records Centre).

SURVEILLANCE METHODOLOGY FOR SOUTHERN YELLOW SPLINTER (*Lipsothrix nervosa*)

Aim

To establish if *Lipsothrix nervosa* is an extant Scottish species.

Rationale

There is just one report of *L. nervosa* in Scotland and it has been suggested that this needs validation. There is a more recent record (2003) from just over the border into Cumbria. The possibility remains, therefore, of finding further Scottish sites and establishing the species' status is the main priority.

Any surveillance cannot be considered as more than speculative searches. Such searches should not be constrained by fixed protocols but rather be guided by the judgement of experts.

Approach

The species should be searched in deciduous woodland containing seepages with lying rotten twigs and branches. *Lipsothrix nervosa* particularly favours alder carr woodland and woodland with ash and various other trees (Douglas, 2003; Stubbs, 2003). Such sites could be identified by consultation with local naturalists or SNH staff. Due to the loss of dead wood from many woodlands, it is possible that potential sites may already have come to the attention of entomologists due to their importance of their saproxylic invertebrate fauna and that guidance is available on specific locals that appear to meet the necessary habitat criteria.

Equipment

25x75 mm corked glass tube, knife.

Location

The Mull record was from Killiechronan Alders with a NM543412 grid reference at the Biological Records Centre and crane fly dataset on the National Biodiversity Network Gateway. This location should be checked first as well as other damp woodlands in that area.

Sample units

The sample units will be the number of occupied sites.

Sampling

It is possible that, like *L. ecucullata*, this species is most efficiently searched as larvae. In this case, searches should be guided by techniques for finding and rearing *L. ecucullata* as described by Rotheray (2000). Most English records, though, appear to be of adults. The Mull specimen was taken on 9 June whilst the record from Cumbria in 2003 is dated as May. Other English records span from May to July so searches for adults should focus on the central portion of this period. Sampling of Scottish sites for adults should simply be searches of the habitat with a sweep net by a skilled dipterist.

Time

The time spent searching for *L. nervosa* should be dictated by resource availability and surveyor interest in the species.

Further notes

The species' habitat is similar to that for *L. ecucullata*. Surveyors working on that species should be alert to the possibility of finding *L. nervosa*.

References

- Douglas, G. 2003. Invertebrate species dossier, *Lipsothrix nervosa* Edwards, a crane fly (Diptera: Tipulidae). *Unpublished report. Edinburgh: Scottish Natural Heritage.*
- Rotheray, G.E. 2000. Search for the larva of the priority crane fly *Lipsothrix ecucullata* (Diptera, Tipulidae). *Scottish Natural Heritage Commissioned Report (ROAME No. F99AC309).*
- Stubbs, A. 2003. *Managing Priority Habitats for Invertebrates, Volume 17, Tipulidae and Allies – Craneflies.* Peterborough: Buglife.

SPECIES REPORT FOR LARGE BIRCH LANCE-FLY (*Lonchaea ragnari*)

Ecology

This is a species of mature birch woodland in the Scottish highlands. Larvae are associated with large, old, fungus-infested birch (*Betula* spp.) trees where they develop in softened sap wood which has already been infested by the birch polypore (Lonchaeidae Online, 2010). Development can take place in fallen or dead or partly dead standing timber. Adults are on the wing during June and July (Lonchaeidae Online, 2011). Identification is covered by MacGowan & Rotheray (2008).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

Lonchaea ragnari was found as new to Britain with records from five Scottish sites between 1988 and 1998 (Rotheray *et al.*, 2001). It has now been recorded in eight 10-km squares (JNCC, 2010).

Elsewhere, this is essentially a boreal species, with records from Sweden, Finland and Russia, extending to 68° N in the Murmansk region of north-west Russia (Lonchaeidae Online, 2011).

Habitat and management

This species occurs in ancient boreal birch woodland with a healthy population of wood rotting fungi (Malloch Society, 2007).

Pressures and threats

Little is known about this species in Britain. Given its apparent preference for fungus-infected decaying sap (Rotheray *et al.*, 2001), it must be assumed that the species is vulnerable to generic threats from intensive woodland management and, especially, removal of fungus-infected trees.

Conservation measures

No specific conservation measures have been proposed for *L. ragnari* but protection of mature birch woods in a natural or near-natural state seems appropriate.

Summaries of surveys and research related to surveillance

Surveys of saproxylic Diptera were carried out in over 300 woodlands in Scotland between 1988 and 1998, with *L. ragnari* being found at five sites (Rotheray *et al.*, 2001).

Quality of data

The status of *L. nervosa* species in Scotland is unclear.

References

- JNCC. 2010. *UK Priority Species data collation* [online] Available at: http://jncc.defra.gov.uk/_speciespages/2390.pdf [Accessed 1 November 2011].
- Lonchaeidae Online. 2010. [online] Available at: <http://lonchaeidae.myspecies.info/lonchaea-ragnari-1> [Accessed 29 November 2011].
- MacGowan, I. & Rotheray, G.E. 2008. British Lonchaeidae. Diptera, Cyclorrhapha, Acalyptratae. *Handbooks for the Identification of British Insects, Vol. 10 (15)*. London: Royal Entomological Society.
- Malloch Society. 2007. [online] Available at: <http://www.mallochsociety.org.uk/ragnari/2007/7/18/lonchaea-ragnari.html> [Accessed 29 November 2011].
- Rotheray, G.E., Hancock, G., Hewitt, S., Horsfield, D., MacGowan, I., Robertson, D. & Watt, K. 2001. The biodiversity and conservation of saproxylic Diptera in Scotland. *Journal of Insect Conservation*, **5**, 77-85.

SURVEILLANCE METHODOLOGY FOR LARGE BIRCH LANCE-FLY (*Lonchaea ragnari*)

Aim

To establish the Scottish distribution more fully and to initiate population monitoring based on standardized search methods.

Rationale

Lonchaea ragnari is a recent addition to the known Scottish fauna. The species depends on old bracket fungus-infected birch (*Betula* spp.) trees, either standing or fallen, in which the larvae develop. Although birchwoods are widespread, they vary considerably in quality and, in particular, in the quantity of dead or dying wood. This species exists only in those with sufficient veteran trees. It has been suggested that this species is a flagship for saproxylic insects that occur in ancient boreal birch woodland (Malloch Society, 2007). A greater knowledge of its distribution may, therefore, help to safeguard some of the more important mature birchwoods.

No data currently exist about population trends in Scotland and the methods suggested should provide baseline information from repeatable surveillance.

Approach

Lonchaea ragnari is most effectively surveyed by searching larvae or puparia. Larvae can be found in decaying birch although they need to be bred through to confirm the identification. Given that the species occupies what are, in some cases, extensive habitat areas, a standardized sampling approach for larvae is suggested, with methods similar to those proposed for the hoverfly *Hammerschmidtia ferruginea* in aspen woodland (Rotheray *et al.*, 2009).

Equipment

Specimen tubes or other suitable containers for storing larvae, knife, tape measure.

Location

The Malloch Society holds information on known sites. Knowledge of these sites and further expert judgement should guide selection of sites for sampling.

Sample units

The same sampling method is proposed for regular surveillance of known sites and for searches of additional sites. It is aimed at providing data on the number of occupied sites as well as a baseline indication of relative abundance from which to monitor population levels.

Sampling

The suggested sample method is based on that of Rotheray *et al.* (2009) for *H. ferruginea*:

- Expert advice should be sought over the optimum sampling time for *L. ragnari* larvae.
- Sampling should be carried out from a 10 m wide strip running across the longest site axis.

- Birches above 20 cm circumference at breast height should be counted and examined for softened sap wood which has already been infested by the birch polypore.
- Dead trees and branches over 25 cm diameter should be counted and point sampled for softened sap wood and *L. ragnari* larvae.
- Larvae that may be *L. ragnari* should be retained for rearing to adults for formal identification.

If the habitat block is too large to be surveyed by its entire longest axis, shorter sections should be investigated to ensure that any subtle variation across the site is covered. The objective in all cases is to record the area searched and to provide information on the number of birches in a suitable state of decay. Surveillance should be carried out at three to five year intervals.

Time

It is anticipated that fieldwork should take between half and one day per site.

Further note

As little has been published on this species in Scotland, surveillance should be carried out either by or in close association with members of the Malloch Society who are most familiar with the current sites.

Lonchaea ragnari has turned up in Malaise traps. The possibility of encountering this species should be brought to the attention of anyone operating Malaise traps in likely habitat. The relative effectiveness of this sampling method is unknown, but could be investigated as a way of sampling a greater range of sites without the need to rear larvae.

References

- Malloch Society. 2007. [online] Available at: <<http://www.mallochsociety.org.uk/ragnari/2007/7/18/lonchaea-ragnari.html>> [Accessed 29 November 2011].
- Rotheray, E.L., MacGowan, I., Rotheray, G.E., Sears, J. & Elliott, A. 2009. The conservation requirements of an endangered hoverfly, *Hammerschmidtia ferruginea* (Diptera, Syrphidae) in the British Isles. *Journal of Insect Conservation*, **13**, 569-574.

SPECIES REPORT FOR RIVER-SHORE CRANEFLY (*Rhabdomastix japonica*)

Ecology

Rhabdomastix japonica is a yellow cranefly that forms a species complex with *R. laeta*. Their larvae have been found in the banks of small rivers in the open, in areas of sand and silt at a depth of 3-4 cm (Godfrey, 2007). However, details of *R japonica* life history are largely unknown (JNCC, 2010). Adults may rest in riparian trees and scrub such as overhanging willows and alders (Godfrey, 2007).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

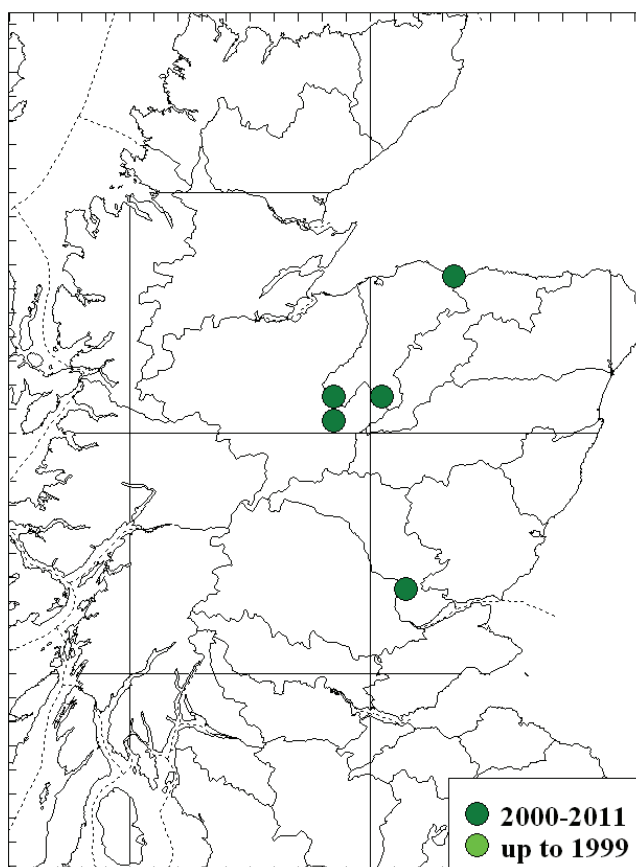
Distribution

Taxonomic confusion has clouded knowledge of the range of *R. japonica* with some previous records of *R. laeta* now being ascribed to this species (Godfrey, 2007). Recent Scottish records (2006) include one area on the Tay (Westhaugh) and four on the Spey (Dorback Burn, Feshie Fan, Fochabers and Inverdrue) (Drake *et al.*, 2007). The distribution map opposite must be considered approximate as the precise locations of some records are unclear.

Elsewhere the species is widespread in temperate zone and mountains but probably scarce or rare in much of its range (JNCC, 2010).

Habitat and management

Found in unmodified rivers. It is assumed that the larvae needs wet sands of river banks. It belongs to an assemblage of Diptera specialists of exposed riverine sediment (Drake *et al.*, 2007; Dipterists' Forum, 2008).



Pressures and threats

The species is threatened on account of being restricted to a highly specialised habitat. It is likely to be highly vulnerable to river margin and sand shoals modification (JNCC, 2010).

Conservation measures

No specific actions are being undertaken.

Summaries of surveys and research related to surveillance

Survey work of Diptera of exposed riverine sediment in 2005 and 2006 resulted in records of *R. japonica* from the Tay and the Spey (Drake *et al.*, 2007; Godfrey, 2007). The methods used in these surveys should help shape future surveillance and monitoring together with methods developed in Europe for monitoring this genus (Podéienė, 2001).

References

- Dipterists' Forum. 2008. [online] Available at: <http://www.dipteristsforum.org.uk/wiki/bap:new:rhabdomastix_japonica> [Accessed 1 December 2011].
- Drake, C.M., Godfrey, A., Hewitt, S.M. & Parker, J. 2007. Fly assemblages of sandy exposed riverine sediment. *Unpublished report. Peterborough: Buglife.*
- Godfrey, A. 2007. The distribution of *Rhabdomastix laeta* populations. *Unpublished report. Peterborough: Buglife.*
- JNCC. 2010. *UK Priority Species data collation.* [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2563.pdf> [Accessed 1 November 2011].
- Podéienė, V. 2001. Notes on the larva of *Rhabdomastix (Sacandaga) laeta* (Loew, 1873) (Diptera, Limoniidae). *Acta Zoologica Lituanica*, **11**, 385-387.

Map data sources

Drake *et al.*, (2007).

SURVEILLANCE METHODOLOGY FOR RIVER-SHORE CRANEFLY (*Rhabdomastix japonica*)

Aim

To investigate the distribution of *Rhabdomastix japonica* and to establish long-term monitoring of a representative site in each occupied catchment.

Rationale

The true range of *R. japonica* has long been clouded by taxonomic confusion with *R. laeta*. Only in recent years have some specimens been critically re-examined (Godfrey, 2007) and it seems likely that further Scottish sites exist. The first priority is, therefore, establishing the true status of the species at a variety of potential rivers. Some recent surveys have succeeded in finding the species, especially on the River Spey. These surveys can guide a systematic surveillance programme.

Approach

Surveillance should include both field survey, broadly following methods used by Drake *et al.* (2007), and examination of material held by museums. *Rhabdomastix* specimens exist in Glasgow and Edinburgh museums (Godfrey, 2007) and their determination should be prioritized.

Equipment

Sweep net, camera.

Location

Drake *et al.* (2007) listed up to eight figure grid references of sampling points at sites from where the species was recorded. Godfrey (2007) reported the species from two of the same locations on the River Spey, with five found at Feshie Fan and three at Inverdrue. It is suggested in the first instance monitoring Feshie Fan for population trends along with Westhaugh on the River Tay. Searches for new sites should be guided by suggestions from SNH staff, SEPA staff and local naturalists.

Sample units

The surveillance described here is aimed at determining the number of occupied catchments and occupied sites.

Sampling

Searches for new sites should be by sweep-netting of vegetation for adults. Previous records of *R. japonica* have suggested an association with riparian trees (Godfrey, 2007). It is recommended two to three days of searches for adults per catchment, covering approximately six locations. Subsequent surveys can then be designed to examine more closely any catchments with records.

For each site searched, several site photographs should be taken from defined points to allow location of sampling areas and also to identify broad habitat changes between survey visits.

For population monitoring, the following protocol is suggested:

- A minimum of one site per occupied catchment (see above for suggestions for Tay and Spey catchments).
- This species was found between 15 and 23 July during 2006 surveys (Drake *et al.*, 2007). It is not clear if this would be optimum timing in Scotland and advice should be sought from those with more familiarity with the species in England.
- At each sampling site, 50 m sections of river bank judged to contain optimum habitat should be defined by GPS co-ordinates and site photographs.
- These stretches should be searched for adult *R. japonica* for 1 h each in fine dry weather in mid-July.
- The number of 50 m sections will vary with habitat availability and the selection should be guided by what can be achieved in one day of sampling at each monitored site.
- Surveillance should be carried out at three to five year intervals.

Time

It is suggested that one day per site be allocated for sampling. Two smaller adjacent sites could be covered on the same day.

Further notes

Although not recorded from the same locations, this species may be found on *Clorismia rustica* sites. The same sampling regime is recommended for searches for both species.

References

Drake, C.M., Godfrey, A., Hewitt, S.M. & Parker, J. 2007. Fly assemblages of sandy exposed riverine sediment. *Unpublished report. Peterborough: Buglife.*
Godfrey, A. 2007. The distribution of *Rhabdomastix laeta* populations. *Unpublished report. Peterborough: Buglife.*

SPECIES REPORT FOR MOUNTAIN DANCE-FLY (*Rhamphomyia hirtula*)

Ecology

Adults of this mountain species fly from mid-June to mid-July (Malloch Society, 2007) and have been recorded visiting flowers (the species were not noted) (Horsfield, 2002).

Conservation status and rarity

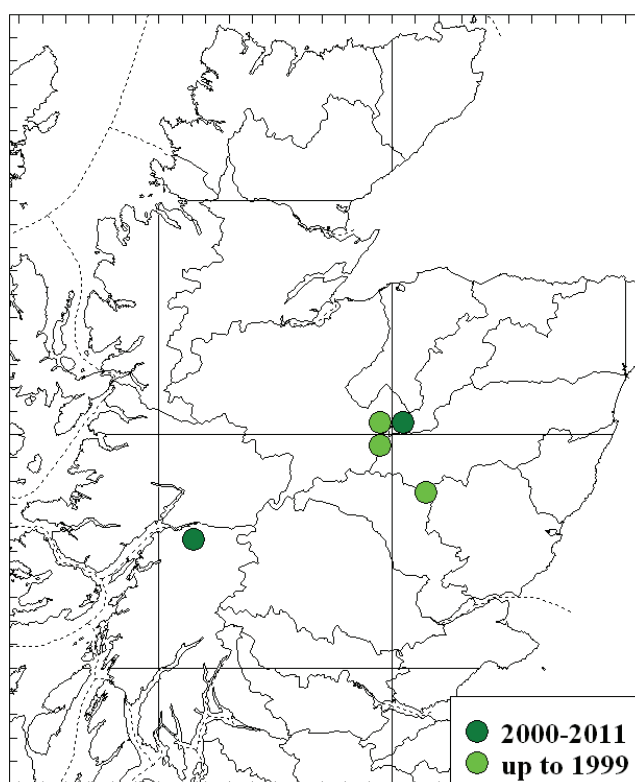
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

In Britain, this species is found only in Scotland and around 40 specimens are known. It has been recorded from six 10-km squares in the vice counties of Argyll, South Aberdeen, Banff, Easternness and Forfar (Malloch Society, 2007). There are records up to 2000 at least from the Cairngorm and Caenlochan-Glen Clova ranges in the eastern Highlands and from Bidean nam Bian in Argyll (Horsfield & MacGowan, 1997; Horsfield, 2002).

Further exploration may reveal that this species is present at some of the Grampians hills between the known areas of distribution and with a similar range of habitats to those on Bidean nam Bian (Horsfield, 2002).

Beyond Scotland, *R. hirtula* is known only from Iceland and Greenland (Horsfield & MacGowan, 1997; JNCC, 2010).



Habitat and management

The species is only found on the highest of the Scottish mountains, between 800 and 1100 m. Records are from a range of montane vegetation including *Racomitrium lanuginosum* moss-heaths, *Racomitrium-Empetrum* heaths, *Deschampsia cespitosa* and *Nardus stricta* grasslands, *Carex biglowii* sedge heath and tall-herb ledges (Horsfield & MacGowan, 1997; Horsfield, 2002).

Pressures and threats

This fly is vulnerable to the potential effects of climatic change, in particular to rises in annual temperatures (Malloch Society, 2007). It has been suggested that the species will become extinct in the UK over the next 25 years due to global warming (JNCC, 2010).

Conservation measures

None have been specifically proposed for this species.

Summaries of surveys and research related to surveillance

This fly has the potential of a flagship species for monitoring climate change due to the fact that there is detailed baseline data on distribution and altitude range from work carried out in the Scottish highlands during the 1990s (Malloch Society, 2007). Records from that survey came from a variety of techniques with the largest numbers being recorded in water-trap bowls (Horsfield, 2002).

Quality of data

Given the remoteness of occupied areas, the species may very well be overlooked. However a good number of records to date have come from systematic surveys and are well documented.

References

- Horsfield, D. 2002. New records of *Rhamphomyia hirtula* Zett. (Dipt., Empididae) in the Scottish Highlands. *Entomologist's Monthly Magazine*, **138**, 16.
- Horsfield, D. & MacGowan, I. 1997. A preliminary assessment of the distribution and status of montane Brachycera and Cyclorrhapha (Diptera) in Scotland. *Unpublished report: The Malloch Society*.
- Malloch Society. 2007. [online] Available at: <<http://www.mallochsociety.org.uk/hirtula/2007/7/18/rhamphomyia-hirtula.html>> [Accessed 1 December 2011].
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2564.pdf> [Accessed 1 November 2011].

Map data sources

Horsfield (2002).

SURVEILLANCE METHODOLOGY FOR MOUNTAIN DANCE-FLY (*Rhamphomyia hirtula*)

Aim

Monitoring should aim to establish the full extent of the distribution of *Rhamphomyia hirtula* and to assess how populations are responding to climate change.

Rationale

This species occurs on high mountains and is potentially at risk from climate change. As well as its immediate conservation interest, it provides an opportunity to examine the potential impact of climate change on altitudinal use of the habitat by a mountain insect.

Approach

Surveillance should involve surveys of potentially suitable habitats together with regular monitoring of a range of known sites.

Equipment

Water-trap bowls (14-23 cm diameter), formalin, ethanol.

Location

The species is known from three mountain ranges. Searches for new sites should concentrate on the mountains between the three currently known areas of occurrence. Ben Alder and Ben Nevis in particular have a similar range of habitats to those on Bidean nam Bian.

Sites where good numbers of specimens were found and therefore are possibly suitable for long-term population monitoring are Braeriach in the Cairngorms (NN957998), among tall herbs on a cliff at the eastern side of Glas Maol (NO174767) and Bidean nam Bian in Glen Coe (NN143549) (Horsfield, 2002).

Sample units

It may be difficult to define 'sites' for this species. However, as all sites thus far have been above 800 m altitude, the number of occupied Munros (peaks over 3,000 feet high) and Corbetts (peaks between 2,500 and 3,000 feet high) is proposed as the unit to describe range. For long-term monitoring at known sites, individual flies can be counted from water-bowl traps and related to trap position and altitude.

Sampling

Water-trap bowls have proved effective for collecting (Horsfield & MacGowan, 1997) and the following protocol is suggested for regular monitoring:

- Sampling should cover the adult flight period which is from mid-June to mid-July.
- White water-trap bowls of 20 cm diameter should be placed among boulders or on cliffs to protect them from disturbance by deer or sheep.
- Traps should be filled to within 3-5 cm of the rim with 2-4% formalin and a few drops of detergent to reduce the surface tension and thus facilitate capture of specimens.

- At least five bowls should be positioned on a hillside with uniform aspect at approximately every 100 m from around 750 m upwards.
- If resources allow, replication of this trapping transect within site would help to overcome the potential influence of habitat variation between sample points.
- The bowls should be left in position for four weeks.
- Collected material can be stored in 70% alcohol until identification.

In searching for new sites, expert judgement should be used to select positions for installing water-trap bowls. Several bowls can be used per site with time necessary to process and identify the contents as the main limiting factor. Searches for adults can also be carried out and have potential to provide new locations that can then be followed up by more systematic water trap monitoring.

Balancing potential year to year population fluctuations and imminent climate-driven declines with the fact that sampling removes individuals from the remaining population, it is recommended that sampling of long-term monitoring sites should take place at around four to five year intervals.

Time

One day is needed to set traps at each site and another to empty them. Further time should be allocated for sorting and identifying the trap contents.

Further notes

This species may lend itself to research into the impact of climate change on montane biodiversity. This could be promoted through, for example, the SNH/SEPA PhD studentship scheme.

References

Horsfield, D. 2002. New records of *Rhamphomyia hirtula* Zett. (Dipt., Empididae) In the Scottish Highlands. *Entomologist's Monthly Magazine*, **138**, 16.

Horsfield, D. & MacGowan, I. 1997. A preliminary assessment of the distribution and status of montane Brachycera and Cyclorrhapha (Diptera) in Scotland. *Unpublished report. The Malloch Society.*

SPECIES REPORT FOR ROUND-MOUTHED WHORL SNAIL (*Vertigo genesii*)

Ecology

The ecology of this species is very little known.

Conservation status and rarity

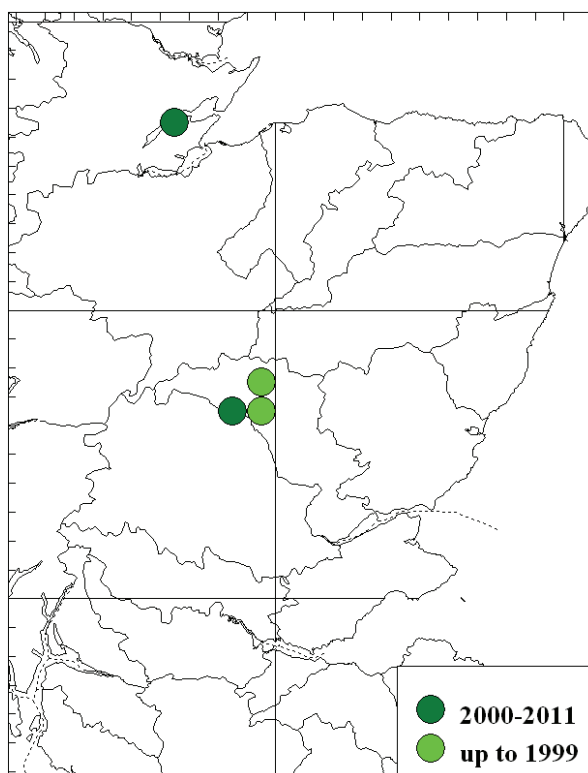
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Stable.
- IUCN Status: Lower Risk/conservation dependent.

Distribution

Fossil evidence has shown that *Vertigo genesii* was once abundant in lowland England. These colonies would have become rapidly extinct in postglacial times due to climatic change, forestation and drainage by man. Today, *V. genesii* is found in two areas of Scotland. There are four known sites within existing SSSIs in upland central Perthshire that were discovered in 1995 and one at Braelangwell Wood SSSI on the Black Isle. In 1999 potential sites on Islay, Lismore, at the Tayvallich peninsula and the area to the south-east of Loch Awe were searched by Martin Willing. Despite the discovery of *V. geyeri* at some of these sites, *V. genesii* was not found. Seven sites on Deeside were also searched in 1998 but no colonies of *V. genesii* were discovered (Killeen & Colville, 1999a).

Elsewhere in Britain, one colony is known from County Durham, England, which was discovered in 1980. On the continent this

snail is an Arctic-Alpine species recorded from northern and central Europe, mainly in central Scandinavia and from the Alps, where it has been found at altitudes of up to 2000 m. It is very local throughout its range (Killeen & Colville, 1999a; Douglas, 2003).



Habitat and management

All known Scottish sites comprise dendritic calcareous flushes fed by springs where mosses such as *Ctenidium molluscum* and *Cratoneuron* spp. are prominent. Low growing sedge such as yellow sedge (*Carex demissa* and *C. viridula*) are also present and the snail is found at the base of the sedges. There are a number of plant species associated with the sites such as the bog rushes, *Schoenus nigricans* and *S. ferrugineus*. Many of the flushes are also tufa depositing and the vegetation is kept low by grazing sheep or cattle. At several of the sites *Vertigo geyeri* is also present. The known sites are all between 300-500 m and it appears to be no specific preference for aspect. These sites are likely to have been relatively unchanged in postglacial times, and their hydrological balance must remain very stable (Douglas, 2003).

Pressures and threats

Potential threats are mainly damage to the habitat from drainage, eutrophication and afforestation. Livestock can also be a problem from overgrazing and excessive trampling (Douglas, 2003).

Conservation measures

No specific conservation measures have been proposed for this species though clearly caution should be taken against changes in management at known sites.

Summaries of surveys and research related to surveillance

Survey work was carried out in August and October 1996 on populations on the Special Area of Conservation sites at Tulach Hill & Glen Fender Meadows, Perthshire, to develop minimally destructive monitoring methods and provide guidance on habitat and species monitoring (Killeen & Colville, 1999b). Recommendations from this work should form the basis of future surveillance methodology. Subsequent monitoring at the same sites in 2001 showed that this species was thriving but was less abundant and less widely distributed than *V. geyeri*. Sampling transects would be suitable for long-term population trend monitoring (Killeen, 2002).

References

- Douglas, G. 2003. Invertebrate species dossier, *Vertigo genesii* Gredler, round-mouthed whorl snail (Mollusca: Vertiginidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Killeen, I.J. 2002. Monitoring surveys of whorl snails (*Vertigo* spp.) in Scottish Natura sites. *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Killeen, I.J. & Colville, B. 1999a. A survey of the Deeside area, Scotland for the terrestrial molluscs *Vertigo geyeri* and *Vertigo genesii*. *Scottish Natural Heritage Commissioned Report (ROAME No. F99AC332)*.
- Killeen, I.J. & Colville, B. 1999b. Distribution and monitoring of *Vertigo geyeri* and *Vertigo genesii* in Perthshire. *Scottish Natural Heritage Commissioned Report (ROAME No. F97AC309)*.

Map data sources

Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland).
Killeen (2002).

SURVEILLANCE METHODOLOGY FOR ROUND-MOUTHED WHORL SNAIL (*Vertigo genesii*)

Aim

The primary aim is to assess long-term population levels at known sites. A secondary aim is to investigate sites that may hold the species.

Rationale

Vertigo genesii has only been known in Scotland since 1995. It appears to have particular habitat requirements and is restricted to discrete colonies in calcareous flushes in four sites in upland Perthshire. Baseline monitoring of these sites in 1998 and of two of them in 2001 has established good population data (Killeen & Colville, 1999) and continuation of this monitoring is desirable to investigate longer-term population trends.

Approach

There is a well described protocol for carrying out this sampling (Killeen & Colville, 1999), which should be followed to ensure comparability of results. This involves field sampling of vegetation and subsequent indoor sorting of the samples. The protocol can be followed by SNH personnel or skilled volunteers. The services of a skilled malacologist may be required for checking specimens.

Equipment

Sieves, plastic boxes or polythene bags, gelatine capsules or collecting tubes, forceps (soft tip type).

Location

Vertigo genesii occurs at Glen Fender (Monzie), Tulach Hill, Loch Moraig and Ben Vrackie. It is recommended that surveillance of this species along with *V. geyeri* carried out at the Tulach Hill and Glen Fender Meadows cSAC be continued. However *V. genesii* is much less widespread in these areas and it is recommended that surveillance be extended to all other known Scottish sites.

Sites beyond the current range have been searched for *V. genesii* without success. It seems likely that the range will extend beyond that currently known but is difficult to make recommendations for where to carry out future searches. Expert judgement and advice from other naturalists should therefore be sought to guide future searches. In particular it would be worth concentrating on more stony flushes, especially those with tufa deposits, which have long-stalked yellow sedge (*Carex lepidocarpa*), lesser clubmoss (*Selaginella selaginoides*), variegated horsetail (*Equisetum variegatum*) and cushions of mosses such as *Palustriella commutata* and *Campylium stellatum*.

Sample units

Data from the quantitative sampling methods described by Killeen & Colville (1999) give estimated numbers of snails per unit area of ground. The protocol described will generate counts that are directly comparable with previous surveillance.

Sampling

The full procedure is described by Killeen & Colville (1999). Between August and October is the optimum time for finding good numbers of adult snails. The protocol entails establishing

transects along flushes and removing all vegetation from 20 × 20 cm quadrats at intervals along the transect. The vegetation is dried, sieved and examined for snails which are then identified. This protocol recommends that all future monitoring sites be clearly identified with permanent markers such as sturdy wooden stakes. However there is a risk that wooden stakes may 'float' out from a flush. Hence GPS co-ordinates (and their accuracy levels) should be noted for all monitoring sites and a range of photographs taken to enable that they can be located on subsequent surveys.

Killeen & Colville (1999) also describe semi-quantitative methods that are especially suitable for establishing species presence/absence. These should be employed in the first instance when investigating new sites. It is recommended that surveillance be carried out every two to three years (Killeen, 2002).

Time

Around one week should be allowed for fieldwork across the Scottish range. Further time is required for subsequent processing and identification of samples.

Further notes

This species shares sites with the more widespread *V. geyeri*. The sampling strategy proposed for that species is identical to this one so surveillance can be combined where the species co-occur.

References

- Killeen, I.J. 2002. Monitoring surveys of whorl snails (*Vertigo* spp.) in Scottish Natura sites. *Unpublished report. Edinburgh: Scottish Natural Heritage.*
- Killeen, I.J. & Colville, B. 1999. Distribution and monitoring of *Vertigo geyeri* and *Vertigo genesii* in Perthshire. *Scottish Natural Heritage Commissioned Report (ROAME No. F97AC309).*

SPECIES REPORT FOR GEYER'S WHORL SNAIL (*Vertigo geyeri*)

Ecology

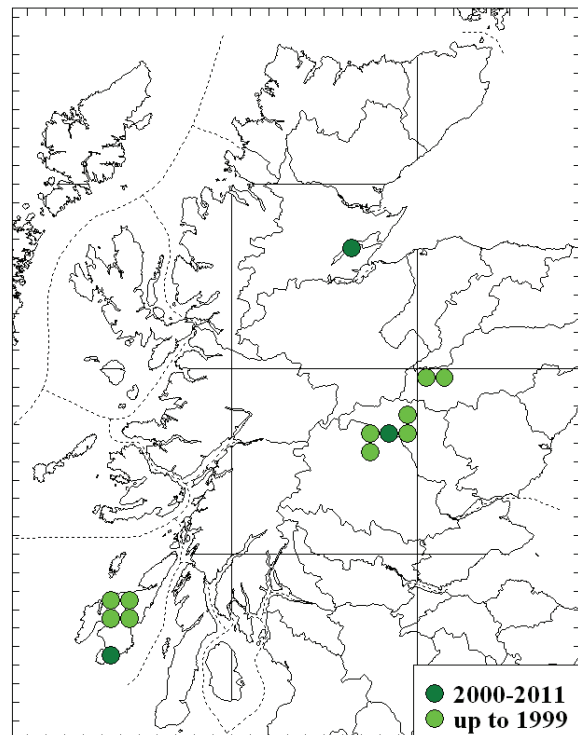
The lifecycle and reproductive biology of *V. geyeri* is poorly known. A lifespan of 12 to 18 months is likely (Douglas, 2003).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Stable.
- IUCN Status: Lower Risk/conservation dependent.

Distribution

Vertigo geyeri was first found in Scotland in 1995 at eight sites, all in central Perthshire. These sites are flushes on Dalradian limestone within a 24 km band of central Perthshire at altitudes of 170-350 m. In 1996 a survey of Durness limestone sites on Skye and north of the Great Glen found no populations. The species was discovered on Islay in 1996 and sampled again in 1998, being found in five 10-km squares (Willing, 2000). Further sampling in 1997, at Tayvallich Peninsula, Lismore and Loch Awe, did not reveal further populations. New populations were found at Glen Lui and Morrone Birkwood in 1998 (Killeen & Colville, 1999a). The species is also recorded from Braelangwell Wood on the Black Isle. Further afield, live specimens were first reported in England in 1979 (Coles & Colville, 1979) whilst globally, *V. geyeri* is a Boreo-Alpine species, found from Ireland to Russia (Killeen & Colville, 1999a).



Habitat and management

In Scotland, this snail inhabits highly calcareous flushes and fens. Most colonies are on permanently wet calcareous flushes on gently sloping, sometimes stony ground dominated by fine-leaved grasses, sedges and other vegetation. All three occupied Deeside flushes are dominated by yellow mountain saxifrage (*Saxifraga aizoides*) and an unidentified small *Carex* sp. (Killeen & Colville, 1999a). Other plant species typical of Scottish sites include black bog-rush (*Schoenus nigricans*), brown bog-rush (*S. ferrugineus*) and few-flowered spike-rush (*Eleocharis quinqueflora*). Within these sites *V. geyeri* can usually be found at the moist base of the sedges and bog-rushes (Douglas, 2003). Habitat requirements are reported to be uniform across most of the species' geographic range (Vavrová *et al.*, 2009). A detailed study on microhabitat requirements at an Irish site revealed that the species requires specific hydrological and meteorological conditions. In particular soil moisture around 80% (helped by vegetation shading) and a water table with a mean of no more than 0.1 m below ground level (Kuczyńska & Moorkens, 2010). Most Scottish *V. geyeri* sites are grazed by cattle. Grazing helps to maintain open conditions and prevent enclosing by birch.

Pressures and threats

The most serious threats to *Vertigo geyeri* sites are lowering of the water table by ditching and draining for agriculture, water abstraction for domestic or agricultural use and excessive grazing (Killeen & Colville, 1999a).

Conservation measures

As *V. geyeri* sites are naturally occurring habitats in areas with low human pressure, survival of this species relies on maintaining the status quo at the sites (Killeen & Colville, 1999a).

Summaries of surveys and research related to surveillance

Surveys were carried out in 1996 on populations at Tulach Hill & Glen Fender Meadows SAC, Perthshire, to develop minimally destructive monitoring methods and provide guidance on habitat and species monitoring (Killeen & Colville, 1999b). Recommendations from this work should form the basis of future surveillance methodology. Subsequent monitoring at the same sites in 2001 showed that this species was thriving and was more abundant and more widely distributed than *V. genesii*. Sampling transects established there would be suitable for long-term population trend monitoring (Killeen, 2002). Surveys of seven potential sites in Deeside in August 1998 revealed the species in two flushes in Morrone Birkwood and one site in Glen Lui (Killeen & Colville, 1999a).

References

- Coles, B., & Colville, B. 1979. *Catinella arenaria* (Bouchard-Chantereux) and *Vertigo geyeri* Lindholm, from a base-rich fen in north-west England. *Journal of Conchology*, **30**, 99-100.
- Douglas, G. 2003. Invertebrate species dossier, *Vertigo geyeri* Lindholm, a whorl snail (Mollusca: Vertiginidae). *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Killeen, I.J. 2002. Monitoring surveys of whorl snails (*Vertigo* spp.) in Scottish Natura sites. *Unpublished report. Edinburgh: Scottish Natural Heritage*.
- Killeen, I.J. & Colville, B. 1999a. A survey of the Deeside area, Scotland for the terrestrial molluscs *Vertigo geyeri* and *Vertigo genesii*. *Scottish Natural Heritage Commissioned Report (ROAME No. F99AC332)*.
- Killeen, I.J. & Colville, B. 1999b. Distribution and monitoring of *Vertigo geyeri* and *Vertigo genesii* in Perthshire. *Scottish Natural Heritage Commissioned Report (ROAME No. F97AC309)*.
- Kuczyńska, A. & Moorkens, E. 2010. Micro-hydrological and micro-meteorological controls on survival and population growth of the whorl snail *Vertigo geyeri* Lindholm, 1925 in groundwater fed wetlands. *Biological Conservation*, **143**, 1868-1875.
- Vavrová, L., Horsák, M., Šteffek, J. & Čejka, T. 2009. Ecology, distribution and conservation of *Vertigo* species of European importance in Slovakia. *Journal of Conchology*, **40**, 61-71.
- Willing, M.J. 2000. A molluscan survey for *Vertigo geyeri* and *Vertigo genesii* on Islay, Tayvallich. Lismore and Loch Awe, July-August 1998. *Scottish Natural Heritage Commissioned Report (ROAME No. F99AC608)*.

Map data sources

- Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland).
- Killeen (2002).
- Killeen & Colville (1999a).

SURVEILLANCE METHODOLOGY FOR GEYER'S WHORL SNAIL (*Vertigo geyeri*)

Aim

To monitor population trends at a sample of occupied sites.

Rationale

A series of surveys in the second half of the 1990s revealed this species to be present in calcareous flushes and fens at some widely separated locations. These surveys are well documented and those reports should enable the location of colonies that may be suitable for long-term population monitoring.

Approach

There is a well described protocol for carrying out this sampling (Killeen & Colville, 1999a), which should be followed to ensure comparability of results. This involves field sampling of vegetation and subsequent indoor sorting of the samples. The protocol can be followed by SNH personnel or skilled volunteers. The services of a skilled malacologist will be required for checking specimens if the field surveyor does not have the necessary snail identification skills.

Equipment

Sieves, plastic boxes or polythene bags, gelatine capsule or collecting tubes, forceps (soft tip type).

Location

It is recommended that the surveillance of *V. geyeri* and *V. genesii* that has been carried out at the Tulach Hill and Glen Fender Meadows cSAC be continued. Further monitoring should be carried out at a sample of sites from across the species' range. It is recommended that at least one representative site from each of the main areas within the species' range are monitored. The following sites have had good counts on at least one occasion and should, therefore, be considered for monitoring (in each case reference should be made to the associated report for further site details and maps):

Site Name	Region	Grid ref	Reference	Site code in cited reference
Tulach Hill and Glen Fender Meadows SAC	Perthshire	See reference for list of site options	Killeen & Colville (1999a)	
Morrone Birkwood, Braemar	Aberdeenshire	NO13729032 & NO13609035	Killeen & Colville (1999b)	flushes 2 & 3
Head of Loch Ard Achadh, The Oa	Islay	NR315431	Willing (2000)	Islay Site 1
Margadale River, NW of Bunnahabhain	Islay	NR401742	Willing (2000)	Islay Site 10

Further colonies of *V. geyeri* may well await discovery. In particular it has been recommended that a wide-ranging survey of potential sites be carried out on the limestone in

the Blair Atholl area to the north of the River Garry and that further surveys be carried out within Glen Tilt and on Ben Vrackie and other sites around Glen Fender and Loch Moraig, Glen Girnaig and Loch Loch (Killeen & Colville, 1999a).

Sample units

Data from the quantitative sampling methods described by Killeen & Colville (1999a) give estimated numbers of snails per unit area of ground. Carefully following the protocol described will generate counts that are directly comparable with previous surveillance.

Sampling

The full procedure is described by Killeen & Colville (1999). Between August and October is the optimum time for finding good numbers of adult snails. The protocol entails establishing transects along flushes and removing all vegetation from 20 × 20 cm quadrats at intervals along the transect. The vegetation is dried, sieved and examined for snails which are then identified. This protocol recommends that all future monitoring sites be clearly identified with permanent markers such as sturdy wooden stakes. However there is a risk that wooden stakes may 'float' out from a flush. Hence GPS co-ordinates (and their accuracy levels) should be noted for all monitoring sites and a range of photographs taken to enable that they can be located on subsequent surveys.

Killeen & Colville (1999a) also describe semi-quantitative methods that are especially suitable for establishing species presence/absence. These should be employed in the first instance when investigating new sites. It is recommended that surveillance be carried out every two to three years (Killeen, 2002).

Time

At least a week should be allowed for sampling a range of sites in each part of the species' range on each sampling round. Further time is required for subsequent processing and identification of samples

Further notes

This species shares sites with the less widespread *V. genesii*. The sampling strategy proposed for that species is identical to this one so surveillance can be combined where the species co-occur.

References

- Killeen, I.J. 2002. Monitoring surveys of whorl snails (*Vertigo* spp.) in Scottish Natura sites. Unpublished report. *Edinburgh: Scottish Natural Heritage*.
- Killeen, I.J. & Colville, B. 1999a. Distribution and monitoring of *Vertigo geyeri* and *Vertigo genesii* in Perthshire. *Scottish Natural Heritage Commissioned Report F97AC309*.
- Killeen, I.J. & Colville, B. 1999b. A survey of the Deeside area, Scotland for the terrestrial molluscs *Vertigo geyeri* and *Vertigo genesii*. *Scottish Natural Heritage Commissioned Report F99AC332*.
- Willing, M.J. 2000. A molluscan survey for *Vertigo geyeri* and *Vertigo genesii* on Islay, Tayvallich, Lismore and Loch Awe, July-August 1998. *SNH Report (ROAME No. F99AC608)*.

SPECIES REPORT FOR NARROW-MOUTHED WHORL SNAIL (*Vertigo angustior*)

Ecology

The lifecycle of *V. angustior* remains relatively unknown, but its lifespan is relatively short (Pokryszko, 1990). The ratio of adults to juveniles varies throughout the year, with adults and juveniles more prominent from August to October and from June to July, respectively (Douglas, 2003). Given the lower concentration of juveniles from August to October, it is presumed that they take less than a year to mature. It is also known that the adults lay large eggs relative to their body size, but it is unclear whether this affects their fecundity (Pokryszko, 1990).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: Stable.
- IUCN Status: Lower Risk/conservation dependent.

Distribution

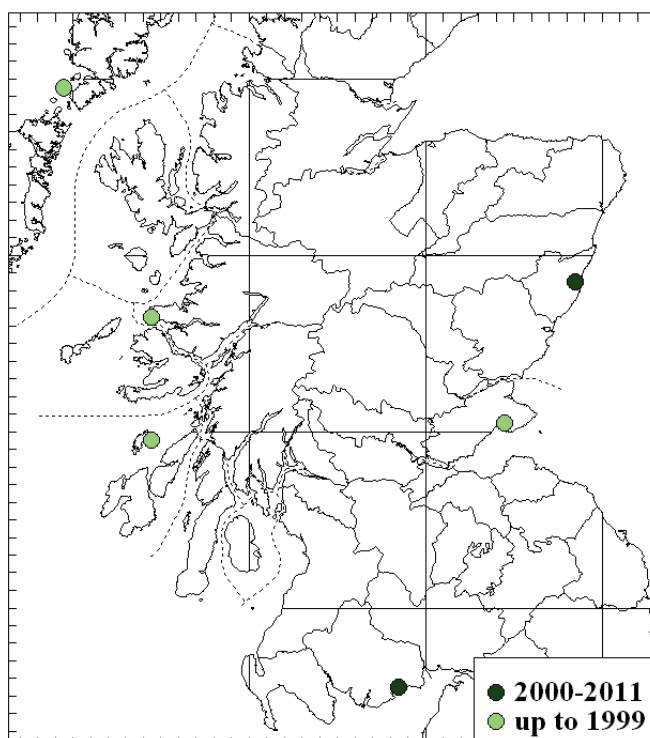
In Scotland, *V. angustior* is found at just two sites. It was first found in 1992 on coastal dunes at White Port, Solway, then in 2000 on the shore of Perthumie Bay, north of Stonehaven (Douglas, 2003). Both sites remain occupied. All other records on the map opposite are undated but are presumed to be fossil records.

Elsewhere in the UK the species is found at seven sites in Britain and one in Northern Ireland (Douglas, 2003).

Habitat and management

The site at White Port was originally described as a gently sloping dune from beach level. On the lower levels the vegetation comprises grass sward with mosses and thyme (*Thymus* spp.) amongst stands of rushes (*Juncus* spp.). This changes further up the slope to a mainly grass and low herb zone grazed by rabbits. *Vertigo angustior* was mainly found on the margin between the lower sandy slope and the grazed low herb level midway up the slope. However the site has been eroding for some years and now has a retreating cliff-like section where the lower dune has fallen away (Douglas, 2003).

At the Stonehaven site, the species is found in two discrete patches approximately 1 km apart. Both are a short way above high water and are likely to be washed by storm tides. One patch is on short grassland on the Highland Boundary Fault where there may be a basic influence in the strata whilst the other is on sparsely grassed shingle, possibly with elevated base levels due to marl or limpet shells washed up (R. Marriott, *pers. comm.*).



Pressures and threats

The main threats posed to the populations are from natural changes to the habitat such as succession and erosion. Indeed the White Port site has suffered serious erosion though snails were still present at a high density with a good proportion of juveniles in 2010 (Marriott & Colville, 2011). However, the highest density of snails is found on the part closest to the eroding dune margin, so this colony is under acute threat (Killeen, 2002).

Conservation measures

Both Scottish sites are designated Special Areas of Conservation. Removal of inland scrub at the White Port colony may make the area more suitable for this species (Marriott & Colville, 2011).

Summaries of surveys and research related to surveillance

A number of sites with similar physical characteristics and plant species to White Port were sampled along the Solway coast. Only one came close in species composition of molluscs but still lacked *V. angustior* (Killeen & Colville, 2000).

Monitoring was carried out on the White Port site in 1999, 2000 and 2001 (Killeen, 2002) and in 2010 (Marriott & Colville, 2011).

References

- Douglas, G. 2003. Invertebrate species dossier, *Vertigo angustior* Jeffreys, narrow-mouth whorl snail (Mollusca: Vertiginidae). *Unpublished report. Edinburgh: Scottish Natural Heritage.*
- Killeen, I.J. 2002. Monitoring surveys of whorl snails (*Vertigo* spp.) in Scottish Natura Sites. *Unpublished report. Edinburgh: Scottish Natural Heritage.*
- Killeen, I.J. & Colville, B. 2000. Survey for the whorl snail *Vertigo angustior* on the Solway coast. *Unpublished report. Edinburgh: Scottish Natural Heritage.*
- Marriott, R.W. & Colville, B. 2011. Survey for the narrow mouthed whorl snail (*Vertigo angustior*) at White Port SSSI, Kirkcudbrightshire. *Unpublished report. Peterborough: Buglife.*
- Pokryszko, B.M. 1990. The Vertiginidae of Poland (Gastropoda: Pulmonata: Pupilloidea) – a systematic monograph. *Annales Zoologici*, **43**, 133-257.

Map data source

Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland).

SURVEILLANCE METHODOLOGY FOR NARROW-MOUTHED WHORL SNAIL (*Vertigo angustior*)

Aim

To establish surveillance for monitoring the area of occurrence and the relative abundance of *Vertigo angustior* at the two known sites.

Rationale

Vertigo angustior is known from just two sites in Scotland. One site was discovered in 1992 and remained occupied in 2010. The other was discovered in 2000 and was still occupied in 2011. One of these sites is threatened by coastal erosion and both are vulnerable on account of small size and isolation. Monitoring of both these sites is, therefore, desirable to assess the long-term health of these populations.

Approach

The small and potentially fragile nature of the populations means that decisions about monitoring methods are not straightforward. Monitoring involves removal of snails which could impact on population sizes. However, surveillance that involves removing samples has been carried out several times at White Point with the most recent survey (2010) showing strong population levels. Continuing the same methodology would ensure comparability of further surveillance at this site. A similar method has been used at Garron Point, though taking smaller samples, and it is suggested that this, too, is repeated.

Equipment

Plastic samples bags and labels, trowel, 25 × 25 cm quadrat, measuring tape, small knife, small white tray, secateurs, bulb planter (7 cm diameter).

Location

Vertigo angustior occurs at White Port on the shores of the Solway Firth and at Garron Point, north of Stonehaven in Aberdeenshire. Precise location details and maps are given by Marriott & Colville (2011) and Marriott (2004).

Sample units

The sample methods recommended here give quantitative data on the number of snails per unit area.

Sampling

Sampling methodology should follow the procedures described by Marriott & Colville (2011) and Marriott (2004). For White Point, reference to Killeen & Colville (2000) would also be useful. Surveillance at White Point has ordinarily been carried out in October and this should be continued. For Garron Point, Marriott (2004) recommended that surveillance is carried out in spring or autumn, in warm weather in damp but not wet conditions. His survey was carried out in June and August and yielded relatively low numbers of snails, possibly due to the prevailing dry conditions. Carrying out surveys in October would increase comparability of results with White Point.

At White Point, the method described involves cutting vegetation to ground level from a 25 × 25 cm quadrat. At Garron Point, the method is to collect vegetation and soil to 5 cm depth

using a bulb planter of 7 cm diameter. Vegetation and soil are collected into a plastic bag, samples are dried for several days and sieved to reveal the snails. Surveillance visits to both sites should be carried out every three to five years.

Time

Sampling is likely to involve one-two days of fieldwork at each site with sample sorting then taking several additional days.

Further notes

A trial of bulb-planter sampling was carried out at White Point in 2010 (Marriott & Colville, 2011). With the smaller sampling area, the number of *V. angustior* caught was, naturally, smaller and the report did not recommend substituting the larger quadrat approach with bulb-planter sampling. However, there may be merit in investigating whether multiple bulb-planter samples could replace the larger quadrat samples. Even with a similar aggregate surface area, the vegetation gaps left by the bulb-planter may recover faster than the larger quadrat gaps. Adopting this method would also increase comparability of results between the two sites.

References

- Killeen, I.J. & Colville, B. 2000. Survey for the whorl snail *Vertigo angustior* on the Solway Coast. *Unpublished report. Edinburgh: Scottish Natural Heritage.*
- Marriott, R.W. 2004. Site condition monitoring of molluscs on SSSIs; *Vertigo angustior* at Garron Point, Stonehaven, Grampian. *Unpublished report. Edinburgh: Scottish Natural Heritage.*
- Marriott, R.W. & Colville, B. 2011. Survey for the Narrow mouthed whorl snail (*Vertigo angustior*) at White Port SSSI, Kircudbrightshire. *Unpublished report. Peterborough: Buglife.*

SPECIES REPORT FOR MUD POND SNAIL (*Omphiscola glabra*)

Ecology

Omphiscola glabra is a drought tolerant freshwater mollusc typically found in soft, nutrient poor waters with few other aquatic animals or plants. These sites include freshwater marshes, small ditches, temporary pools or seepages that dry up or significantly diminish in summer. During such dry periods the snail may burrow into mud and become dormant (Anon, 2005).

Conservation status and rarity

- UK Red Data Book 2 (vulnerable – likely to become endangered if current threats continue).
- UK Biodiversity Action Plan (BAP): Species of conservation.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: no available.
- IUCN Status: Not listed.

Distribution

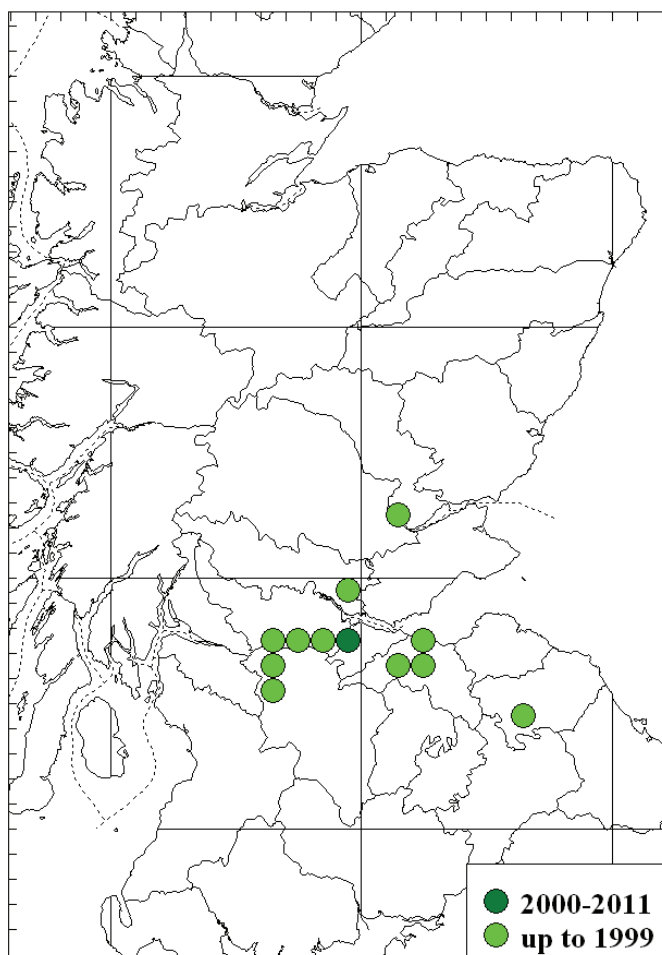
There are Scottish records from 14 10-km squares. Most of these date from the late 19th/early 20th century. Post 1970 records come from East Dunbartonshire (2002 and 2005), North Lanarkshire (1995) the Scottish Borders (1973 and 1988), Falkirk (1993), West Lothian (2000) and Clackmannanshire (2004). There is uncertainty over some of these records and a review would be appropriate (Anon, 2005).

Elsewhere in Britain, the species is now found primarily in South Yorkshire and SW England. The British range has declined by over 60% when comparing recorded 10-km squares with post-1965 records, and the number of sites is thought to still be in decline (JNCC, 2010).

Beyond Britain, the species is locally distributed in Western Europe and southern Scandinavia (Anon, 2005).

Habitat and management

Found almost exclusively in soft water of temporary ponds and ditches (Willing, 1997). Most populations are found on uncultivated land with acidic, sandy or gravelly soils, such as heaths and commons, or other unimproved grasslands (Anon, 2005).



Pressures and threats

The majority of British populations have been lost due to habitat loss. Many sites formerly occupied by *O. glabra* have in the past been regarded as inferior wildlife habitats. Such 'untidy wet areas' have been converted into productive agricultural land through drainage of marginal lands or through land improvement schemes. Additionally some sites have been lost through land improvement for visual landscape reasons (Willing, 1997; Anon, 2005).

Where ponds have not been removed, the species can suffer from agricultural activities leading to eutrophication or to pollutant run-off and to lack of grazing which may lead to vegetation succession. Habitat fragmentation can then limit recolonisation possibilities (Anon, 2005).

Conservation measures

An action plan for *O. glabra* has been established by the Mud Snail Group which makes a series of recommendations for safeguarding the species. A captive breeding population has been established at Milngavie Water Treatment complex (Anon, 2005).

Summaries of surveys and research related to surveillance

There has been insufficient recent recording to accurately document the decline of this species (JNCC, 2010).

References

- Anon. 2005. *An action plan for the Mud Snail - Omphiscola glabra (Müller, 1774)*. Larbert: Mud Snail Study Group, Bradan Aquasurveys Ltd.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2464.pdf> [Accessed 1 November 2011].
- Willing, M. 1997. Fresh- and brackish-water molluscs: some current conservation issues. *British Wildlife*, **8**, 151-159.

Map data source

Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland).

SURVEILLANCE METHODOLOGY FOR MUD POND SNAIL (*Omphiscola glabra*)

Aim

To establish the continued presence of *Omphiscola glabra* at known sites and to search for further occupied ponds.

Rationale

It is expected that the number of individuals present at each site will fluctuate from year to year, possibly quite dramatically. This means that any estimate of the population size is likely to be unrealistic (Anon, 2005). Therefore surveillance should concentrate primarily on establishing presence/absence and also assessing site condition.

Approach

All sites with recent records should be surveyed for continued presence. Identification of juveniles especially is not straightforward so surveys should be carried out by skilled personnel. In the absence of suitable methodology for generating quantitative data, the survey approach is essentially the same for established populations and for seeking new sites, and is as described by Killeen (2008).

Given that the surveillance method does not provide an indication of abundance, it would be desirable to assess some measure of the condition of the colony. The Mud Snail Study Group is developing a standardised monitoring protocol to allow workers to assess whether populations of this species are in 'favourable conservation status' (Anon, 2005).

Equipment

Aluminium-framed pond net (handle & frame 2.4 m in length, equipped with a 0.1 mm nylon mesh bag), white plastic tray.

Location

The Mud Snail Study Group (www.ephemeroptera.pwp.blueyonder.co.uk/mssg/) should be contacted for details of sites thought to hold this species. The group would also be best placed to make recommendations as to potentially new ponds for the species which would warrant survey. Specifically, they have recommended survey in all potentially suitable habitat within 1 km of known existing sites.

Sample units

Surveillance will measure the number of occupied ponds.

Sampling

Sampling at each site should be carried out by using the following basic principles:

- Surveillance should be carried out in spring (Anon, 2005; Killeen, 2008).
- Snails should be collected with a robust, aluminium-framed pond net
- Samples should be obtained from the weeds and at the interface between the sediment and the aquatic vegetation.
- Many of the ponds have little standing water and it is necessary to get down on hands and knees to search through the mud and emergent marsh vegetation directly.

- A metal kitchen sieve attached to a broom handle is a useful alternative to a net. This allows the surveyor to 'dig' in to the substrate and scoop out material (the standard pond net bag tends to close over if one tries this in marshy areas).
- Each site should be sampled at two or more places in the same water body.
- Samples should be tipped into a white plastic tray agitated to release snails from the weed, allowed to settle, and then snail-free vegetation and detritus can be tipped off.
- It is suggested that sites be sampled for up to 2 h or until *O. glabra* is found.

The Mud Snail Study Group recommends that surveillance of known sites is carried out biennially (Anon, 2005).

Time

Two close-together sites could be covered in a day.

Further notes

It is recommended that any work on this species if devised in co-operation with the Mud Pond Snail Group.

References

Anon. 2005. *An action plan for the Mud Snail - Omphiscola glabra (Müller, 1774)*. Larbert: Mud Snail Study Group, Bradan Aquasurveys Ltd.

Killeen, I. 2008. A survey to determine the present status of the mud snail *Omphiscola glabra* at sites in County Durham. *Unpublished report. Ian Killeen Malacological Services*.

SPECIES REPORT FOR CYLINDRICAL WHORL SNAIL (*Truncatellina cylindrica*)

Ecology

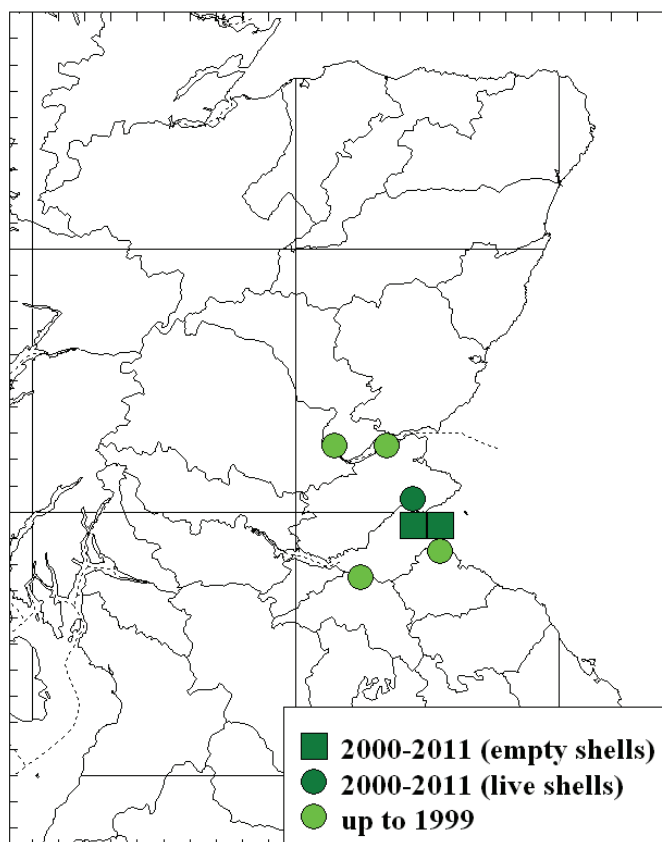
Truncatellina cylindrica is a minute snail of up to 2 mm in length that inhabits dry short calcareous grassland (Lawrence, 2002).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

Truncatellina cylindrica was found by Gordon Corbet at Dumbarrie Links Reserve, Fife, in November 1999 (Corbet, 2000). A search of sand from within rabbit burrows revealed fresh empty shells. Subsequent searches revealed shells throughout the reserve and on 5 January 2001 three live shells were found. These were in grass divots growing against a south facing concrete and brick wall of a WW II pill-box (Corbet, 2000). These were the first records in Scotland since the 1930s (Corbet, 2011). Dumbarrie Links remains the only current Scottish site with live specimens although empty shells have been found to the east, between Elie and St. Monans (Corbet, 2000). Other Scottish records comprise a shell found at Kinnoull Hill, Perth, on 14 August 1910; at Arthur's Seat, Edinburgh, some time between 1836 and the 1930s; at North Berwick Law (date not known), and at Balmerino, Fife in 1813 (G. Corbet, *pers. comm.*).



Just two other extant British populations are known, in Yorkshire and a recently re-discovered population in Durham (Willing, 2006). The species has not been found during recent surveys of a formerly occupied site in Bedfordshire (Lawrence, 2005). The species was formerly more widespread with records (including fossil records) from 43 10-km squares (Lawrence, 2002). The global range is from southern Europe into Scandinavia (JNCC, 2010).

Habitat and management

The species is generally restricted to very dry, short calcareous grassland in sandy or stony ground, screes, rocks and at the base of stone walls, typically among stonecrop (*Sedum* spp.), thyme (*Thymus* spp.) or mugwort (*Artemisia* spp.) (Lawrence, 2002). The Dumbarrie Links site is stable calcareous dune habitat consisting of sparse marram (*Ammophila*

arenaria) mixed with red fescue (*Festuca rubra*) and sand sedge (*Carex arenaria*) (Corbett, 2000).

Pressures and threats

This species is highly vulnerable to disturbance and habitat destruction (JNCC, 2010).

Conservation measures

The Dumbarnie Links site is a Scottish Wildlife Trust reserve and part of the Firth of Forth SSSI. The primary conservation action is simply maintenance of the existing dry, short calcareous grassland.

Summaries of surveys and research related to surveillance

Results from recent surveys of the Bedfordshire population, in particular relative successes of different search methods, should help future monitoring (Lawrence, 2002, 2003). Unsuccessful searches have been made several times in recent years at Arthur's Seat and once each at North Berwick Law and Balmerino. Also, at 18 sites on the Fife coast between Lundin Links and Tentsmuir (not counting Dumbarnie Links reserve), samples from divots and rabbit burrows were examined in 2000 without success (G. Corbet, *pers. comm.*).

Quality of data

The Fife site has been closely monitored in recent years though there is very clearly a potential to overlook this tiny mollusc elsewhere.

References

- Corbet, G. 2000. *Truncatellina cylindrica* in Fife. *The Conchologist's Newsletter*, **152**, 281-282.
- Corbet, G. 2011. Life on the links – a perspective on biodiversity. *British Wildlife*, **23**, 104-109.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2675.pdf> [Accessed 1 November 2011].
- Lawrence, R. 2002. The habitat, ecology, distribution and conservation of *Truncatellina cylindrica* (Férussac) the cylindrical whorl snail, with particular emphasis on the Bedfordshire population. *Unpublished report. The Ivel and Ouse Countryside Project*.
- Lawrence, R. 2003. A search for *Truncatellina cylindrica* (Férussac) the cylindrical whorl snail in East Bedfordshire. *Unpublished report. The Ivel and Ouse Countryside Project*.
- Lawrence, R. 2005. A search for *Truncatellina cylindrica* (Férussac) the cylindrical whorl snail in East Bedfordshire. *Unpublished report. The Ivel and Ouse Countryside Project*.
- Willing, M.J. 2006. Wildlife reports: molluscs. *British Wildlife*, **17** (5), 364-365.

Map data sources

Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland).
Gordon Corbet (*pers. comm.*).

SURVEILLANCE METHODOLOGY FOR CYLINDRICAL WHORL SNAIL (*Truncatellina cylindrica*)

Aim

To establish population trends of this species at its only known current site in Scotland.

Rationale

Truncatellina cylindrica is known in Scotland solely from Dumbarnie Links SWT Reserve in Fife although dead shells have also been found nearby to the east. It has been found in grass divots and by sieving sand from inside rabbit burrows. The protocol suggested here involves carrying out searches in a systematic repeatable way to enable population trends to be determined.

Due to its tiny size, there is a good chance that *T. cylindrica* may be discovered elsewhere in Scotland and, indeed, there are old records from four further locations. However, these have been revisited and a series of other sites on the Fife coast have been checked without success. Any searches further afield would be highly speculative and it is not appropriate to suggest a protocol for such fieldwork.

Approach

A sampling approach similar to that used for *Vertigo* snails is suggested. It entails establishing transects across the study sites and then collecting vegetation and sand or soil from a defined unit area at regular intervals. The material collected is then searched for *T. cylindrica* shells. The initial survey should be regarded as a pilot, which should provide sufficient information about appropriate sample sizes and distances between samples.

Equipment

Bulb-planter, sieves, tape measure, plastic sample bags and labels, bulb planter (7 cm diameter).

Location

Dumbarnie Links SWT Reserve is the primary location for surveillance, where *T. cylindrica* has been found throughout.

Empty shells have also been found in recent years between Elie and St Monans. If this site proves to have a living colony, the protocol suggested here for Dumbarnie Links should, if it turns out to be successful, be extended to this site.

Sample units

The surveillance proposed here will give an indication of abundance per unit surface area of sand. As the depth of sand to which snails retreat is not known, this should be treated as a relative figure.

Sampling

The following initial sampling design is proposed. It should be reviewed for suitability after an initial session of data collection.

- Live shells were first found in January, but it is not clear if this is the best time to sample. It is possible that dry summer weather cause the species to retreat deeper in the sand.
- Two transects should be established, one along the longest axis of the reserve and a second perpendicular to the first.
- A bulb-planter (diameter approx. 7 cm) should be used to cut vegetation and remove soil and sand to a depth of about 5 cm. Vegetation above a height of 5 cm can be discarded as the specimens are likely to be very close to ground level.
- Material collected should be passed through a series of sieves and extracted snails should be examined with a low-powered microscope or a hand lens. Typically shells of *T. cylindrica* are held by a 1 mm mesh and occasionally by a 2 mm mesh size.
- A large amount of vegetation will require drying for several days before sieving and sorting.
- Occupied shells can be distinguished from empty ones by placing them in water: empty shells float, live ones sink and start to crawl. With practice this process can be done in the field and material then returned to the site (Lawrence, 2002).
- A pilot study should assess the likely number of samples required for useful data. In the first instance, samples should be taken at 10 m intervals along transects. Distances can be increased or decreased depending on the number of *T. cylindrica*.
- The start and end coordinates and the orientation of the transects should be recorded, and photographs should be taken. However, as the species is found across the reserve, the emphasis should be on taking a large number of small samples which would make precise location of individual sample points less important.

Once a suitable sampling strategy is firmed up, sampling should ideally be carried out at three to five year intervals in order to determine population trends.

Time

A day should be allowed for initial sampling though sample processing may take several days.

References

Lawrence, R. 2002. The habitat, ecology, distribution and conservation of *Truncatellina cylindrica* (Férussac) the cylindrical whorl snail, with particular emphasis on the Bedfordshire population. *Unpublished report. The Ivel and Ouse Countryside Project.*

SPECIES REPORT FOR CROSS WHORL SNAIL (*Vertigo modesta*)

Ecology

This is a small arctic alpine snail. Very little is known of its ecology in the UK.

Conservation status and rarity

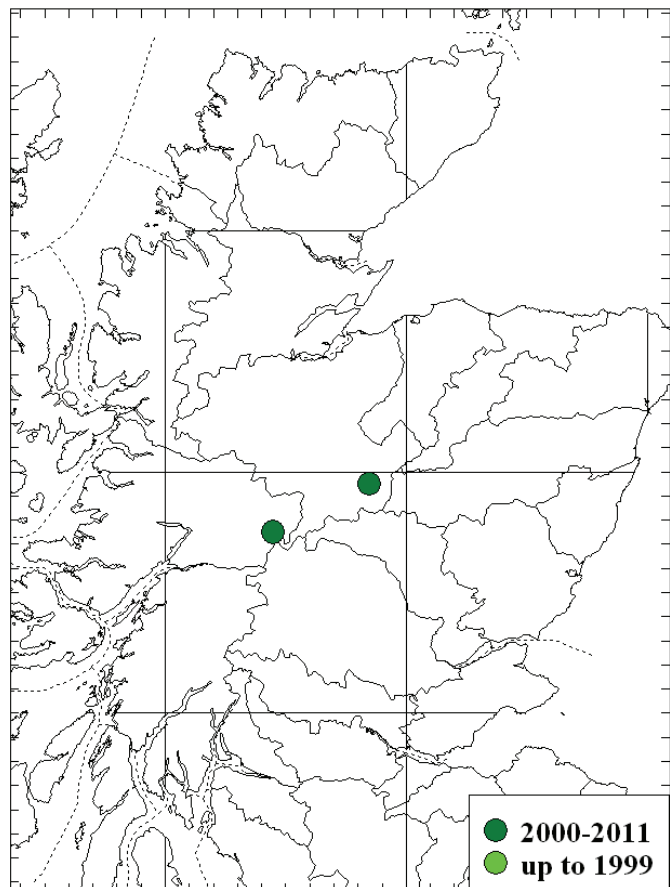
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- On Scottish Biodiversity List.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

In the UK, this species was discovered in 1987 on Geal Charn (south Inverness-shire) (Marriott & Marriott, 1988) and was still present in 2009 (Marriott, 2010). A second British site, Coire Garbhach, was discovered in 1993, with the species still being present in 2008 (Marriott, 2010). These two small areas of high mountain summit in the central Highlands of Scotland remain the only UK sites (JNCC, 2010). Further afield, the species occurs in mountain areas from the Pyrenees to Siberia (JNCC, 2010).

Habitat and management

Records from Geal Charn are from an altitude of around 980 m on limestone outcrops on a north-east facing slope. Two areas, approximately 50 m apart, held *V. modesta* in 1988; one is a short turf rich in arctic alpines and the other is an un-grazed ledge of taller growth that is dominated by woolly willow (*Salix lanata*) (Marriott & Marriott, 1988). Subsequently it has been found in association with *S. lanata* at a range of outcrops on this slope (Marriott, 2010).



Pressures and threats

Vertigo modesta occupies a very specific habitat which is highly vulnerable (Marriott, 2010). It has the potential to be threatened by collection or habitat destruction by excessive field sampling by conchologists (one Scottish site has been badly affected) (JNCC, 2010). The Scottish sites are subject to very severe weather and the species must be considered to be threatened by changes in vegetation cover or diversity as a result of changes in grazing levels or climatic changes (JNCC, 2010; Marriott, 2010). In particular, a reduction in snow

cover would expose one site to increased grazing by red deer (*Cervus elaphus*) and the likelihood of severe erosion and indeed this may already have started.

Conservation measures

No specific conservation measures for *V. modesta* have been proposed but it is likely that action to conserve the *S. lanata* may be beneficial to the species. Both sites are within SSSIs.

Summaries of surveys and research related to surveillance

The results of recent searches for the species at both UK sites, and recommendations pertaining to monitoring (Marriott, 2010), should inform future surveillance plans. Some further sites considered to have likely habitat and conditions for the species, have been searched without success (Marriott & Marriott, 1992).

Quality of data

Good quality recent information is available for both UK populations (JNCC, 2010).

References

- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2691.pdf> [Accessed 1 November 2011].
- Marriott, R.W. 2010. Observations on Woolly willow *Salix lanata* and the whorl snail *Vertigo modesta* at Coire Cheap on 6th to 7th July 2009. *Unpublished report*. Edinburgh: Scottish Natural Heritage.
- Marriott, R.W. & Marriott, D.K. 1988. *Vertigo modesta*, a snail new to the British Isles. *Journal of Conchology*, **33**, 51-52.
- Marriott, R.W. & Marriott, D.K. 1992. A search for the snail *Vertigo modesta* in Beinn Dearg SSSI and Creag Meagaidh NNR. *Joint Nature Conservation Committee Report (ROAME No. 57)*.

Map data sources

Mollusc (non-marine) data for Great Britain and Ireland (Conchological Society of Great Britain & Ireland).
Marriott (2010).

SURVEILLANCE METHODOLOGY FOR CROSS WHORL SNAIL (*Vertigo modesta*)

Aim

To establish a protocol for monitoring area of occurrence and the relative abundance of *Vertigo modesta* at the two known sites.

Rationale

Vertigo modesta is known from just two areas in the UK, both in Scotland. One site was discovered in 1987 and still occupied in 2009. The other was discovered in 1993 and still occupied in 2008. These sites are high in the mountains and the species may be threatened by climate change. Monitoring of both these sites is, therefore, desirable to assess the long-term health of these populations.

Approach

The small and potentially fragile nature of the populations means that decisions about monitoring methods are not straightforward. Marriott (2010) recommended that monitoring of *V. modesta* should concentrate on local distribution rather than any attempt at estimating population size. Using quantitative methods, such as described for other *Vertigo* spp. by Killeen & Colville (1999), would risk unacceptable damage to the rich flora at the sites where they occur.

Here we suggest a monitoring protocol based on establishing presence/absence with a standard timed search at intervals. The method is similar to that recommended for *V. angustior* and it takes advantage of the fact that *V. modesta* has proved straightforward to find in the field. This, though, does mean that it relies on being carried out by skilled personnel. The trialling of the use of refugia for providing more quantitative data is also recommended. The two known sites are both on SSSIs and it is further suggested that routine site condition monitoring includes measurements relevant to *V. modesta*.

Equipment

Mountain walking gear, clear plastic beer glasses, clear plastic dishes and cardboard for refugia (Killeen & Colville, 1999).

Location

The Coire Cheap location was well described by Marriott (2010). As well as the sections shown in Figure 1 of that report, *V. modesta* was found in an isolated 5 x 3 m whorled-leaved willow (*Salix myrsinites*) clump on the left side of the gully at NN4725575523. Marriott (2010) further suggested that *V. modesta* be searched at a woolly willow (*Salix lanata*) site very close to its known area, at NN4765675136. The Coire Garbhloch site is extremely small and requires roped access. Richard Marriott holds precise details of the location.

Sample units

The suggested protocol will enable monitoring of the number of occupied pre-defined compartments. If effective, the refugia methods will enable comparison of relative abundances.

Sampling

At Coire Cheap, the eight compartments referred to by Marriott (2010) along with the original site of occurrence and the further site suggested above (see Location), should each be carefully searched by hand for up to 10-15 min or however long it takes to locate *V. modesta*, whichever is shorter. The species can be readily found by the practised eye by carefully parting the moss growing amongst the willows. Implementation of a similar monitoring regime should be considered at Coire Garbhlach. GPS accuracy is low here due to the site being positioned under crags so again areas of occurrence should be clearly recorded on annotated photographs. However, because of limited access to this site, which requires ropes, simply confirming continued presence and inspecting periodically for signs of habitat disturbance or damage may be all that can be realistically achieved.

The refugia methods described by Killeen & Colville (1999) could be trialled alongside these surveys at Coire Cheap. However, caution is required due to the delicate nature of the site and the risk from repeated trampling to set and inspect traps. It may be preferable, therefore, to await the results of refugia trials on other *Vertigo* species before devising a limited protocol for Coire Cheap. If refugia do prove to be effective for attracting *V. modesta*, a sampling regime that incorporates refugia locations across site compartments may enable comparison of relative abundances across the site and between years.

Non-invasive habitat monitoring could be carried out more regularly than snail searches and could act as an early-warning of potential site deterioration. In particular Site Condition Monitoring should include regular assessment of snow cover through fixed point photography, deer activity and especially any associated erosion.

The remote sites occupied by *V. modesta* are best visited in summer to reduce the chance of snow cover and maximize surveyor safety. It is suggested that surveillance is carried out at five to seven year intervals.

Time

Each survey will involve a minimum of two days per site.

Further notes

This species has low mobility and occurs in small and discrete colonies. It may thus be a potential candidate for research on the impact of climate change on montane species. It may be an appropriate study species, for example, for promoting through the SNH/SEPA PhD studentship scheme.

References

Killeen I.J. & Colville B. 1999. Distribution and monitoring of *Vertigo geyeri* and *Vertigo genesii* in Perthshire. *Scottish Natural Heritage Commissioned Report (ROAME No. F97AC309)*.

Marriott, R.W. 2010. Observations on Woolly willow *Salix lanata* and the whorl snail *Vertigo modesta* at Coire Cheap on 6th to 7th July 2009. *Unpublished report. Edinburgh: Scottish Natural Heritage*.

SPECIES REPORT FOR GOLDEN LANTERN-SPIDER (*Agroeca cuprea*)

Ecology

Agroeca cuprea is a dune dwelling species (JNCC, 2010). Its phenology is possibly similar to that of most other *Agroeca* species, of which males mature in September and October, while females persist for most of the year. The species has been found from April until October with the majority of records of both species from September and October (British Arachnological Society, 2012).

Conservation status and rarity

- UK Red Data Book 1: Endangered.
- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species has suffered a 79% decline in site occupancy over the last 25 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

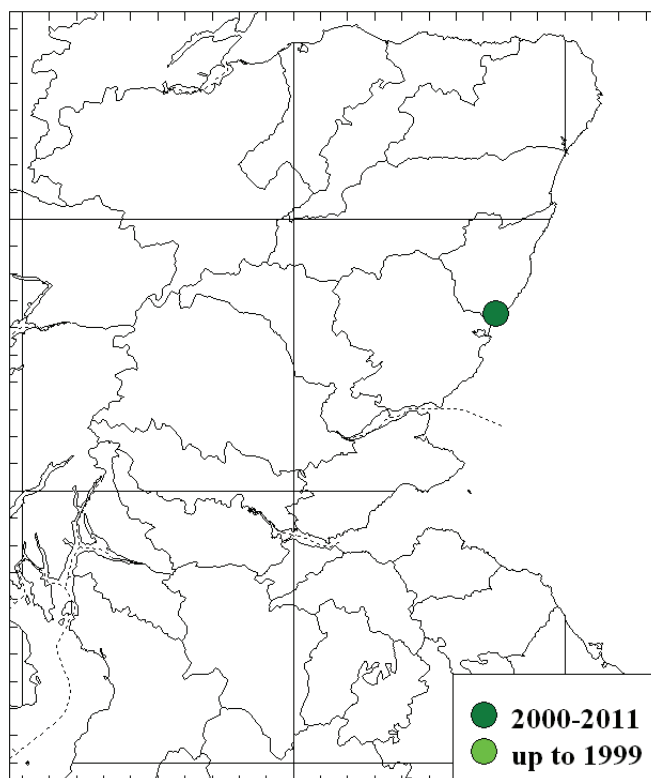
This spider may be numerous where it is found, but apparently is very local (British Arachnological Society, 2012). It has been recorded from one site in Scotland, at St Cyrus National Nature Reserve. It was first recorded in 1976 and again in 1991 (M. Davidson, *pers. comm.*). Its continued presence was confirmed in 2009 (Davidson, 2010). It has a scattered distribution in England (British Arachnological Society, 2012), from Cumbria to Cornwall, Devon, Sussex and Kent. It is widespread in north-western and central Europe, but has not been recorded from Ireland, Denmark or Finland (British Arachnological Society, 2012).

Habitat and management

Research is needed to establish which zones of the dune system are utilized by this species and to determine what features are essential for its long-term survival (JNCC, 2010). In England *A. cuprea* is found in a variety of dry sandy habitats, e.g. heathland, sand dunes, dry grassland. With one exception all sites are coastal (British Arachnological Society, 2012). The only Scottish site includes sand dunes backing onto the base of cliffs (M. Davidson, *pers. comm.*).

Pressures and threats

Wider countryside measures are needed to prevent loss of dry, coastal grassland and in particular dune systems. The primary threats are those of habitat loss to development, erosion and changes in site condition (JNCC, 2010). There is possibly little threat to its coastal cliff-top sites, but its sand dune sites are likely to be threatened by holiday development and golf courses (British Arachnological Society, 2012). The specific threats at



St. Cyrus are from recreation and in particular, from excessive trampling that may be damaging the habitat (M. Davidson, *pers. comm.*). The site is a NNR.

Conservation measures

Initial discussions have taken place with Scottish Natural Heritage regarding possible future monitoring and management at St. Cyrus (Mike Davidson & Therese Alampo).

Summaries of surveys and research related to surveillance

Targeted pitfall trapping was carried out for the species in 2009 but it was eventually found only by hand collection. This species probably occurs at other Scottish dunes, and targeted survey is required to establish this (Davidson, 2010).

Quality of data

Good but possibly under recorded.

References

- British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Agroeca+cuprea>> [Accessed 1 February 2012].
- Davidson, M. 2010. *Agroeca cuprea* Menge in Scotland. S.R.S. News. No. 66. *Newsletter of the British Arachnological Society*. **117**, 14.
- JNCC. 2010. *UK Priority Species data collation*. [online] Available at: <http://jncc.defra.gov.uk/_speciespages/2010.pdf> [Accessed 1 February 2012].

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR GOLDEN LANTERN-SPIDER (*Agroeca cuprea*)

Aim

To establish the status of *Agroeca cuprea* at St. Cyrus and to investigate its distribution beyond this site.

Rationale

The only known Scottish location for *A. cuprea* is at St. Cyrus NNR (British Arachnological Society, 2012). Targeted sampling has located only six specimens over 40 years (M. Davidson, *pers. comm.*). It is likely that the spider may exist at other localities but no targeted sampling has been carried out to date.

Approach

At St. Cyrus the spider is known from two areas. Both should be re-surveyed and searches made more widely using expert judgement to determine suitable habitat. Pitfall trapping has been tried but only hand collection has proved to be successful (M. Davidson, *pers. comm.*).

Equipment

No specialist equipment required.

Location

Initially survey should be concentrated at St. Cyrus and to the south of it, where the climate may be most suitable. South-west Scotland may also prove suitable, given the discovery of the species in Cumbria (M. Davidson, *pers. comm.*) but it would be a secondary priority.

Sample units

The sample units should be the number of occupied sites given the extremely low densities at which the spider appears to occur.

Sampling

Hand collection has been the only successful means of sampling the species (M. Davidson, *pers. comm.*). This method involves capturing spiders by hand and with an aspirator. Open, sunny sites with short vegetation (grassy/mossy) are likely to be favoured at these northern sites where temperature may be a limiting factor. Sampling should be carried out during daylight hours in warm, sunny weather when the spider is more likely to be active. Expert knowledge may allow for field identification at St. Cyrus, but for new sites voucher specimens would be required (M. Davidson, *pers. comm.*).

Visits between April and October at St. Cyrus would help in the assimilation of ecological data about the species. Population size is likely to be low so more than one visit may be necessary to establish presence. New sites would be best targeted from July until September to ensure the highest chance of success.

Surveyors should make some assessment of the quality and condition of the habitat particularly in terms of the management and use of the reserve, such as recreational pressures. Care should be exercised not to damage existing populations during the course of surveillance. Surveys should be carried out every three years.

Time

It will take an estimated 12 days to re-survey St. Cyrus and suitable areas to the south.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Agroeca+cuprea>> [accessed 1 February 2012].

SPECIES REPORT FOR SMALL MESH-WEAVER (*Dictyna pusilla*)

Ecology

Dictyna pusilla is found on low, dry or dead vegetation where it spins an irregular retreat. It is mature in spring through to late summer. The species has been found from April until September with most records from May until July (British Arachnological Society, 2012).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species has suffered a 75% decline over 25 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

Most recent UK records are from Scotland where the species is fairly widespread in the central eastern area. It has been found around Strathspey, Deeside, on the Moray coast, Huntly and Blairgowrie. There are a few widely scattered records from England and Wales. The species has shown a significant decline in the south, and is generally very uncommon (M. Davidson, *pers. comm.*).

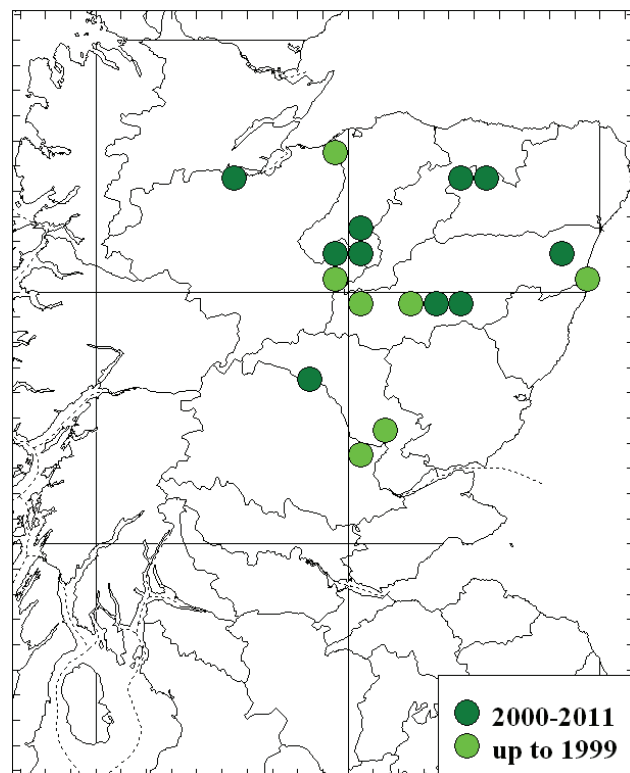
This is a Palearctic species, widely distributed in Europe but not recorded from Ireland and more frequent in the north of the region (M. Davidson, *pers. comm.*).

Habitat and management

Dictyna pusilla is frequent on heather (*Calluna vulgaris*), juniper (*Juniperus communis*) and young pine (*Pinus sylvestris*) in open areas of forest (M. Davidson, *pers. comm.*). A significant number of recent Scottish records are from monitoring churchyard yews (*Taxus baccata*) (Davidson, 2009). It is likely that pine woodland - with a range of age classes, open areas and juniper - is its normal habitat (M. Davidson, *pers. comm.*).

Pressures and threats

There is insufficient knowledge of the habitat and other ecological requirements of this species to ascertain specific threats (British Arachnological Society, 2012). It may be affected by afforestation and inappropriate woodland management.



Conservation measures

The restoration of native pine forest with open glades at Abernethy appears to suit this species (British Arachnological Society, 2010). Actions to improve the status of juniper are likely to benefit *D. pusilla*, as would action to conserve churchyard yews (M. Davidson, *pers. comm.*).

Summaries of surveys and research related to surveillance

Most recent records (post 2000) are from targeted monitoring of pine, juniper and churchyard yews. A recent visit to Darnaway in November 2011, to check a record from E.A. Crowson in 1965, proved negative. This is probably because of significant habitat change at this site. An additional record was obtained at Nethy Bridge in Nov. 2011 (M. Davidson, *pers. comm.*).

Quality of data

Good.

References

- British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Dictyna+pusilla>> [Accessed 1 February 2012].
- Davidson, M. 2009. The arachnids of Dunbennan Cemetery, Aberdeenshire. Part 1. S.R.S. News. No. 63. *Newsletter of the British Arachnological Society*, **114**, 10-11.

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR SMALL MESH-WEAVER (*Dictyna pusilla*)

Aim

To establish the status of *Dictyna pusilla* in Scotland.

Rationale

There has been considerable effort put into targeted monitoring for this species in recent years by Mike Davidson and the British Arachnological Society (British Arachnological Society, 2012).

New sites have been located and sites with older records have been re-surveyed. Therefore, this surveillance should be a continuation and extension of this work.

Approach

The recent survey by Mike Davidson and the British Arachnological Society should be continued. It may be possible to combine surveillance for *D. pusilla* with that of juniper *Juniperus communis*, on which the species is very often found.

Beating of bushes and sweeping of low vegetation can be productive, but direct searching for the silk retreats has yielded a number of recent records (M. Davidson, *pers. comm.*). Therefore a combination of sampling methods should be used.

Location

Re-surveying should continue at previously known locations around Strathspey, Deeside, on the Moray coast, Huntly and Blairgowrie. It is likely to be more common than previously thought (M. Davidson, *pers. comm.*) therefore any site with plenty of pine (*Pinus sylvestris*) and juniper could prove productive.

Sample units

The sample units will be the number of occupied sites.

Sampling

A combination of vegetation beating, sweeping and hand collection should be used and may depend to some extent on the nature of the vegetation. Hand collection involves capturing spiders by hand and with an aspirator.

Searches should be made in the heads of grasses and heather (*Calluna vulgaris*) and on the branches of juniper and pine. The spider requires a fairly dense vegetation structure in which to make its web. In churchyards search yew (*Taxus baccata*) by hand or by beating (M. Davidson, *pers. comm.*).

A single visit between May and August should be sufficient to establish the presence of the species. Rainy and windy days should be avoided to prevent a reduction in the efficiency of the sampling method. This species is very variable in colour and depending on habitat, may require microscopic identification.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record any changes to the sites in relation to management and succession. Surveys should be repeated every five to 10 years.

Time

This species is relatively easy to find and its presence could be established in a few hours of targeted sampling at each site.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Dictyna+pusilla>> [accessed 1 February 2012].

SPECIES REPORT FOR WELCHI'S MONEY SPIDER (*Erigone welchi*)

Ecology

Erigone welchi is a ground level, wetland species (M. Davidson, *pers. comm.*). Adult females have been found from February to July and males only in May, but both are probably found throughout most of the year (British Arachnological Society, 2012).

Conservation status and rarity

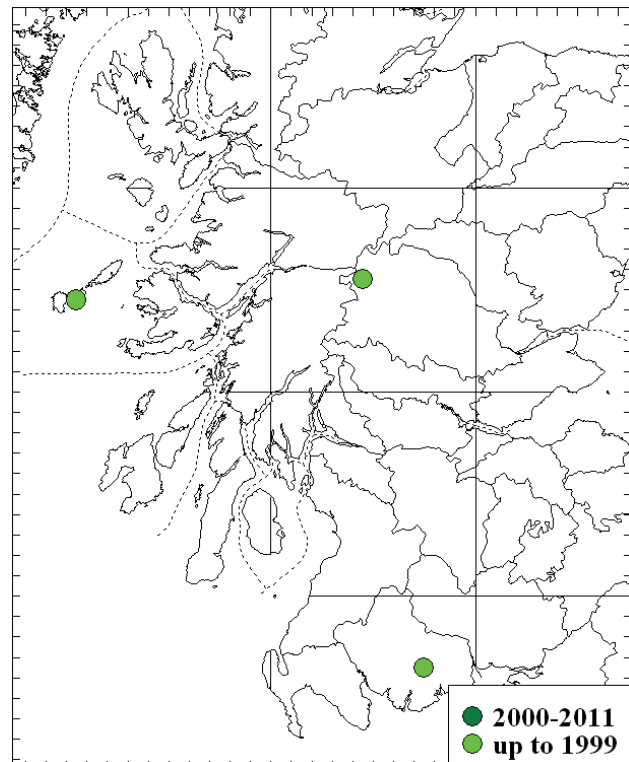
- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species has suffered a 100% decline over 25 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

Erigone welchi is extremely locally distributed. Only three Scottish sites are known for this species: Kirkcudbrightshire (Loch Ken), Perthshire (Rannoch Moor), and Tiree, and their last record is from 1988 (M. Davidson, *pers. comm.*). Throughout England it has an equally scattered distribution, but it has been found abundantly at some sites (British Arachnological Society, 2012). In Europe it has been recorded from Ireland, France and Scandinavia (British Arachnological Society, 2012).

Habitat and management

Erigone welchi is found on very wet acid bogs (M. Davidson, *pers. comm.*), usually on *Sphagnum*, with small webs spun just above the water level, but also among wet moss and grass, and among *Carex* tussocks. It is found from near sea level to about 500 m (British Arachnological Society, 2012).



Pressure and threats

All of its known sites are in remote boggy areas, but the threat of drainage or afforestation is probably less now than in the past (British Arachnological Society, 2012).

Conservation measures

Maintain wet conditions of the bogs where it occurs (British Arachnological Society, 2012).

Summaries of surveys and research related to surveillance

There are no recent Scottish records and no known effects to verify its continued presence at previous localities. It is likely that the physical difficulties accessing sites has limited the frequency of its collection and it may well be more widespread in Scotland (M. Davidson, *pers. comm.*).

Quality of data

Good but possibly under-recorded due to physical difficulties of accessing sites.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Erigone+welchi>> [Accessed 1 February 2012].

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR WELCHI'S MONEY SPIDER (*Erigone welchi*)

Aim

To establish the status and distribution of *Erigone welchi* in Scotland.

Rationale

Erigone welchi is a ground level wetland species (M. Davidson, *pers. comm.*) that has only been found at three sites in Scotland (British Arachnological Society, 2012). The last record was in 1988 but the species is probably under-recorded (M. Davidson, *pers. comm.*). The lack of records is largely due to the physical difficulties of accessing the sites. There has been no targeted surveying and therefore the priority for surveillance is to establish the continued existence of the species.

Approach

The priority should be to establish the continued existence of the species at previously known sites and to target the areas around the original grid references and similar habitats nearby. A combination of hand searching and pitfall trapping should be used but the surveyor should be prepared to focus on one method alone if this proves more successful.

Equipment

Pitfall traps.

Location

The species has previously been recorded from Loch Ken in Kirkcudbrightshire, Rannoch Moor in Perthshire, and on the island of Tiree. It would be worth looking at other sites with suitable habitat in the western half of Scotland, both on the mainland and on the islands.

Sample units

The sample units will be the number of occupied sites.

Sampling

The spider is found in small webs spun just above the water level in wet *Sphagnum*, and also among wet moss and grass, and among *Carex* tussocks (M. Davidson, *pers. comm.*). Care should be taken not to damage existing populations.

Hand collection involves capturing spiders by hand and with an aspirator. Rainy and windy days should be avoided in order to prevent a reduction in the efficiency of sampling. This is a small species which would require microscope identification and therefore specimens should be retained.

Pitfall traps comprising plastic cups (suggested 11.5 cm diameter and 1 L volume) should be placed in a 10-m grid and partially filled with ethylene glycol and a few drops of detergent to break the surface tension to prevent the spiders from escaping.

Sampling should be carried out between February and July.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record changes in management particularly in terms of scrub encroachment, amount of *Sphagnum*, drainage and grazing.

Sites should be resurveyed every three years to inform management.

Time

A minimum of three days would be required to revisit all three historic sites. More than one visit per site may be required to establish the species presence. Visits to additional adjacent areas would require more time.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Erigone+welchi>> [Accessed 1 February 2012].

SPECIES REPORT FOR PEUS'S LONG BACK-SPIDER (*Mecopisthes peusi*)

Ecology

Adults of *Mecopisthes peusi* are present from October to July, but the main period of activity is from March to May (British Arachnological Society, 2012). This is a ground-dwelling species.

Conservation status and rarity

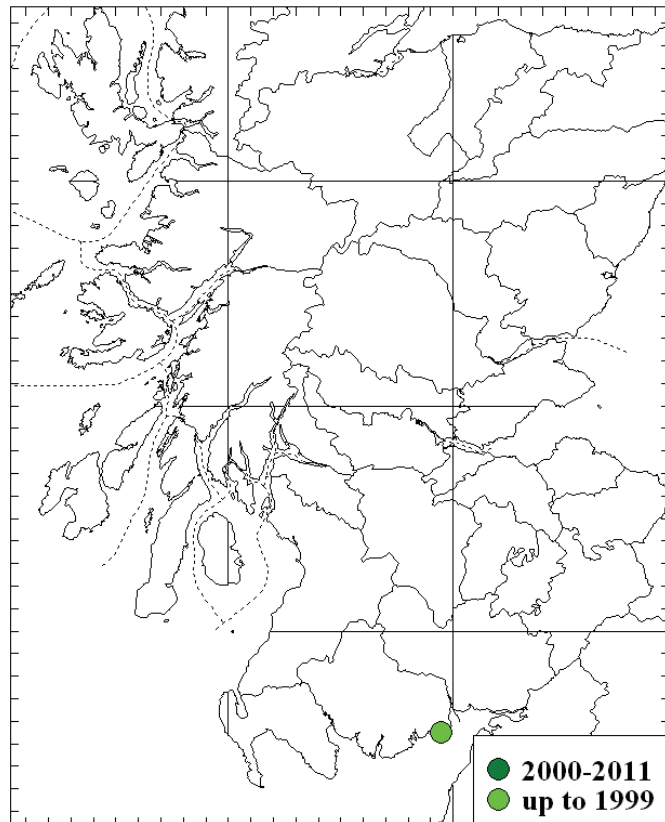
- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species has suffered a 85% decline over the last 25 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

This species has only recently been recorded from Scotland. It was found in pitfall material from Mersehead, Dumfries and Galloway in 1994. Elsewhere in the UK it is mainly confined to central southern England, Wales, Cheshire and Lancashire, where it is scarce. A European species, it has been recorded from Ireland, France, Germany and Austria (British Arachnological Society, 2012).

Habitat and management

The Mersehead specimens were found in pitfall traps on sand-dunes and grassland. In Wales, Cheshire and Lancashire, the spider is also found on sand dunes and dune slacks on the coast (M. Davidson, *pers. comm.*). In the south, *M. peusi* occurs on dry heathland, reaching maximum densities between five and 10 years after fire. It lives in the thin layer of litter around the base of heather plants at the edge of patches of bare ground (M. Davidson, *pers. comm.*).



Pressures and threats

This species has been affected by the loss of heathland to agriculture, forestry and development (British Arachnological Society, 2012).

Conservation measures

Protection of its coastal grassland, dune or dune slack habitat should benefit *M. peusi*.

Summaries of surveys and research related to surveillance

There has been no known targeted monitoring since its 1994 discovery at Mersehead.

Quality of data

Good but limited data.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Mecopisthes+peusi>> [Accessed 1 February 2012].

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR PEUS'S LONG BACK-SPIDER (*Mecopisthes peusi*)

Aim

To establish the status of *Mecopisthes peusi* at its only known location and to investigate the distribution of the species beyond this site.

Rationale

The presence of *Mecopisthes peusi* in Scotland was only discovered in 1994 when specimens were found in pitfall traps at Mersehead in Dumfries and Galloway. There have been no known targeted surveys for the species since. The priority for the species is to establish its continued presence at Mersehead. Further work could investigate the species distribution beyond this site.

Approach

A complementary approach using three sampling techniques should be used initially to locate the species. The surveyor should be prepared to revise the techniques used should one prove more effective than the others. The original discovery of the species in pitfall traps means this may be the preferred sampling method, but hand collection and vacuum sampling should also be used.

Vacuum or suction sampling collects animals from a defined area (Duffey, 1980; Topping & Sunderland, 1992), which is the advantage over methods such as pitfall traps and sweep nets (Saunders & Entling, 2011). Suction sampling catches arthropods living on the vegetation and near the ground surface (Saunders & Entling, 2011). This has been shown to be a reliable method for the assessment of abundances of certain arthropod groups including spiders (Samu *et al.*, 1997) particularly for spiders on the vegetation rather than near the soil surface (Saunders & Entling, 2011). Despite relatively high efficiency rates, individuals are still missed and the abundances obtained should therefore be regarded as an underestimation of the true population.

Equipment

Pitfall traps, vacuum sampler.

Location

Sampling should be carried out in the first instance at Mersehead in Dumfries and Galloway. Further surveying of adjacent sites with similar habitat should be carried out to establish the spider's further distribution. Sites in the south-west of Scotland around the Solway coast should be targeted first.

Sample units

The sample units will be the number of occupied sites. From pitfall trapping and vacuum sampling it would be possible to estimate abundance based on samples taken from a fixed area. However, numbers are likely to be low.

Sampling

Hand searching, pitfall trapping and vacuum sampling may be productive sampling techniques. The Mersehead samples were collected in April and May but the spider is found

throughout the year with peak abundance occurring in February and March (British Arachnological Society, 2012). Rainy and windy days should be avoided in order to prevent a reduction in the efficiency of the sampling method.

Hand collection involves capturing spiders by hand and with an aspirator. The species is found in coastal grassland, heath and sand-dune habitats (M. Davidson, *pers. comm.*). The microhabitat is not known but is likely to be litter. This is a small species that would require microscopic identification and therefore specimens will need to be retained for confirmation.

Pitfall traps should consist of plastic cups of a fixed size (suggested 11.5 cm diameter and 1 L volume) placed in a 10-m grid and partially filled with ethylene glycol and a few drops of detergent to break the surface tension to prevent the spiders from escaping.

The same vacuum sampler should be used across sites and sampling dates. A metallic sampling cylinder with a lid (suggested 0.036 m² and height 45 cm), should be driven into the ground with a hammer to a depth of 7 cm to define the sampling area and to prevent the escape of any spiders. The diameter of the cylinder should be larger than the diameter of the suction sampler to allow air to be drawn up from the bottom so that spiders can be collected efficiently. Spiders should be intercepted in a fine mesh sack within the nozzle of the sampler. A standard sized mesh, maximum 2 mm, should be used for all samples. The lid should be removed immediately prior to sampling and the area within the cylinder immediately vacuumed for 30 s with the throttle of the sampler set to full. The sample must be transferred immediately from the mesh sack to a "zip lock" plastic bag and frozen before the contents are examined.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record any changes in management. Positive sites should be re-surveyed every three years.

Time

Hand collection could be carried out within half a day. Pitfall trapping would require a return visit. Vacuum sampling would require additional processing time.

References

- British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/summary/s/Mecopisthes%20peusi>> [Accessed 1 February 2012].
- Duffey, E. 1980. The efficiency of the Dietrick Vacuum Sampler (D-Vac) for invertebrate population studies in different types of grassland. *Bulletin d'Ecologie*, **11**, 421-431.
- Samu, F., Németh, J. & Kiss, B. 1997. Assessment of the efficiency of a hand-held suction device for sampling spiders: improved density estimation or oversampling? *Annals of Applied Biology*, **130**, 371–378.
- Saunders, D. & Entling, M.H. 2011. Large variation of suction sampling efficiency depending on arthropod groups, species traits, and habitat properties. *Entomologia Experimentalis et Applicata*, **138**, 234-243.
- Topping, C.J. & Sunderland, K.D. 1992. Limitations to the use of pitfall traps in ecological studies exemplified by a study of spiders in a field of winter wheat. *Journal of Applied Ecology*, **29**, 485-491.

SPECIES REPORT FOR MONEY SPIDER (*Monocephalus castaneipes*)

Ecology

Monocephalus castaneipes adult females have been recorded in most months of the year. Adult males have been found in the autumn and again peaking from January and February until April (British Arachnological Society, 2012).

Conservation status and rarity

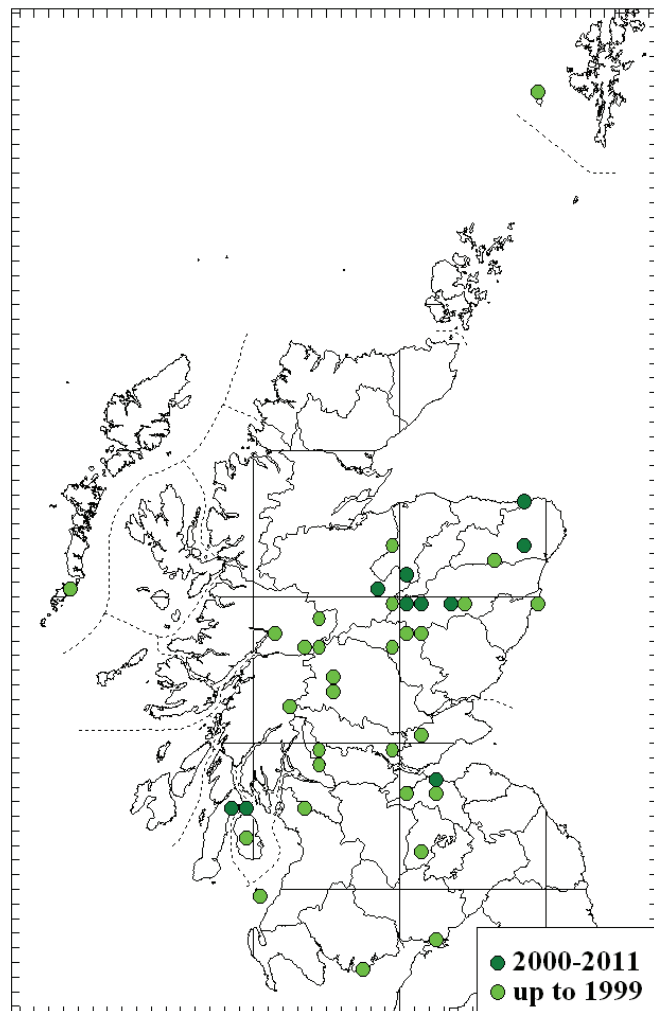
- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species has suffered a substantial long term decline.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

Monocephalus castaneipes has a local distribution. It is widespread but scattered throughout most of western and northern Britain as well as south of the Thames. It seems to be largely absent from the Midlands and eastern England between Yorkshire and Kent including some well worked areas (British Arachnological Society, 2012). It is also widespread in Scotland but so far largely absent north and west of the Great Glen (this may reflect surveyor bias, i.e., not sampling the correct microhabitat). There are recent records from Moray, Deeside, Strathspey, Lothian, Spittal of Glenshee (M. Davidson, *pers. comm.*; British Arachnological Society, 2012; Logunov, 2005). This spider is restricted to northern Europe (Platnick, 1998).

Habitat and management

Monocephalus castaneipes inhabits two habitats in Britain (British Arachnological Society, 2012). It has been found abundantly amongst moss growing on the trunks and lower branches of standing trees in the south (Merrett, 1979). In the north, in addition to moss on tree trunks and rocks, it associates with open uplands and mountains, where it lives beneath rocks (British Arachnological Society, 2012). The spider has also recently been found in litter in pinewoods (M. Davidson, *pers. comm.*). It has previously been suggested that *M. castaneipes* is predominantly an upland species in Scotland but this is not borne out by recent records which are predominantly from woodland across a range of altitudes. Its use of open upland sites may be opportunistic, taking advantage of cool, dark microhabitats on land that was once wooded (M. Davidson, *pers. comm.*).



Pressures and threats

Though evidence suggests a substantial long term decline, the causes of this are unknown (British Arachnological Society, 2012).

Conservation measures

Management should aim to provide a continuity of the existing habitat mosaic (British Arachnological Society, 2012).

Summaries of surveys and research related to surveillance

No known targeted monitoring has been carried out for this species.

Quality of data

Good but lacking recent records for many sites.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Mecopisthes+peusi>> [Accessed 1 February 2012].

Logunov, D. 2005. New data for spiders and harvestmen from Scotland. *Newsletter of the British Arachnological Society*, **102**, 3-4.

Merrett, P. 1979. Changes in the distribution of British spiders and recent advances in knowledge of distribution, *Bulletin of the British Arachnological Society*, **4** (8), 366-376.

Platnick, N.I. 1998. *Advances in spider taxonomy 1992-1995: with redescrptions 1940-1980*. New York: New York Entomological Society & The American Museum of Natural History.

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR MONEY SPIDER (*Monocephalus castaneipes*)

Aim

To establish the status and distribution of the money spider, *Monocephalus castaneipes*, in Scotland.

Rationale

This species has been recorded from a number of sites across Scotland over a number of years. Many of these records are pre-1992. No targeted monitoring has been carried out and failure to search its precise microhabitat within woodlands may have led to the species being overlooked.

Approach

In order to establish the current status of the species, all sites should be re-surveyed. Only a few sites have recent records. The number of sites surveyed should be extended to include potentially new areas and thus determine the true distribution of the species.

Hand searching is probably the most productive sampling technique but this can be potentially damaging to the sensitive microhabitat. Ground and tree trapping provide alternative sampling techniques but have yet to be trialled for this species. A combination of sampling techniques should therefore be used until it can be established which is the most productive, not only for locating the species, but also for protecting the microhabitat.

Equipment

Pitfall traps, tree traps.

Location

The spider has been found at numerous scattered locations across Scotland. Furthermore, it is surprising that it has not been recorded in the 'ancient' woods of north-west Scotland. These areas should be included in the surveillance.

Sample units

The sampling method prohibits any estimation of population size and therefore the sample units should be the number of occupied sites.

Sampling

The species should be sampled with a variety of techniques including hand collection, ground trapping and tree trapping.

Hand collection involves capturing spiders by hand and with an aspirator. It is important to look for the spider in the correct microhabitat, which in deciduous woodland is moss on tree trunks and rocks, and beneath rocks on open uplands and mountains (British Arachnological Society, 2012), and litter in pinewoods (M. Davidson, *pers. comm.*). An experienced person may identify this species in the field, but generally microscopic confirmation is required. For new sites, specimens should be taken.

Care should be exercised not to damage exciting populations and the sensitive tree trunk microhabitat. For this reason, it may be more appropriate to sample deciduous woodland by

ground and tree trapping techniques. These should be trialled to establish their efficiency. The traps should be plastic cups of a fixed size (suggested 11.5 cm diameter and 1 L volume), placed in a 10-m grid and filled with ethylene glycol and a few drops of detergent to break the surface tension to prevent the spiders from escaping. Tree traps, essentially arboreal pitfall traps, consist of plastic cups, partially filled with ethylene glycol, and stapled to suitable trees. Plastic strips can be placed on either side to direct spiders down into the traps (Pinzón & Spence, 2008).

Sampling should be carried out in September to October to coincide with peak abundance. Periods of cold weather should be avoided as these may affect sampling efficiency.

Surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record any changes in management, particularly regeneration, succession, and the availability of the microhabitat. Key sites should be visited every five to 10 years.

Time

Hand sampling should only take a few hours per site. Deploying ground or tree traps will require a repeat visit.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Mecopisthes+peusi>> [Accessed 1 February 2012].

Pinzón, J. & Spence, J. 2008. Performance of two arboreal pitfall trap designs in sampling cursorial spiders from tree trunks. *The Journal of Arachnology*, **36**, 280-286.

SPECIES REPORT FOR SWAMP LOOKOUT SPIDER (*Notioscopus sarcinatus*)

Ecology

Both sexes of *Notioscopus sarcinatus* reach maturity from autumn to spring (British Arachnological Society, 2012).

Conservation status and rarity

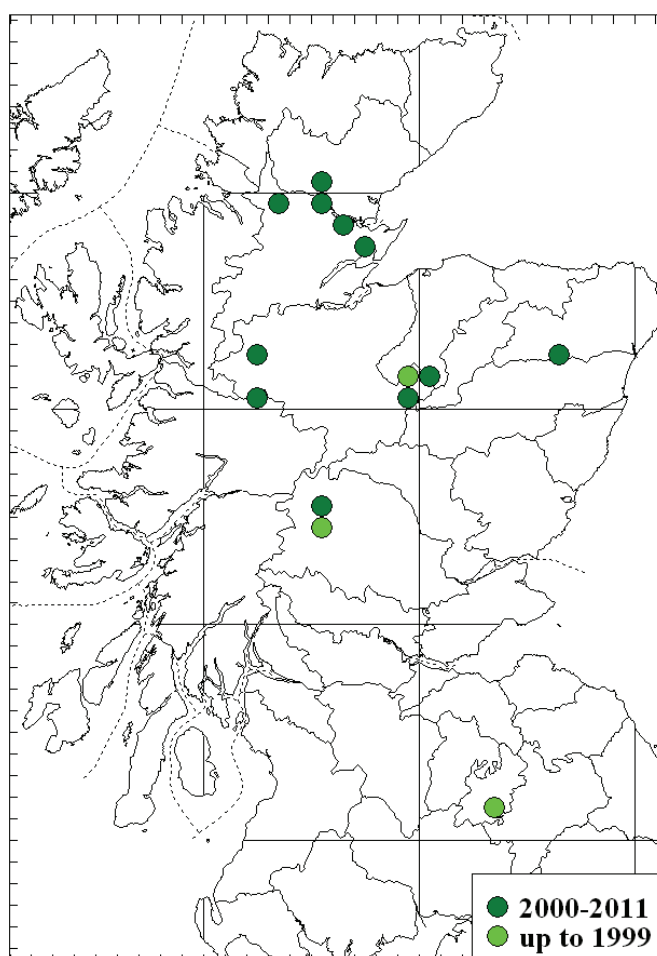
- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species has suffered a 60% decline over 25 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

The spider has been common at some sites, but locally distributed. It has scattered and patchy records in England, Wales and Scotland and is apparently absent from some parts of the country that appear to contain suitable habitat (British Arachnological Society, 2012). In Scotland, its key locations are the ancient pinewoods such as the Black Wood of Rannoch, Abernethy and Einig, but it extends east to Bennachie (M. Davidson, *pers. comm.*). The most recent Scottish record is from Gleann Dadhain, the Struie (April 2011). The species is widespread in northern and central Europe (British Arachnological Society, 2012).

Habitat and management

Notioscopus sarcinatus occurs among wet, usually tall, moss (*Sphagnum*, *Polytrichum*, etc.), often under pine or other trees in swampy places, often in heathland areas, or sometimes in fens (British Arachnological Society, 2012).



Pressures and threats

The loss or drainage of heathland for agriculture, forestry or development is a threat to this species. Although often found in wooded areas, it is less likely to survive in the drier and more disturbed conditions under forestry plantations (British Arachnological Society, 2012).

Conservation measures

Maintaining swampy areas with trees on heathland should benefit the species (British Arachnological Society, 2012), but a range of wet woodland and some open habitats are used (M. Davidson, *pers. comm.*).

Summaries of surveys and research related to surveillance

A 2008 survey at the Bennachie location established its continued presence (M. Davidson, *pers. comm.*). It is believed that this area was subject to a new native pinewood grant and may be worth monitoring (M. Davidson, *pers. comm.*). General survey work by Duncan Williams (*pers. comm.*) has produced a number of new sites in the north, usually in wet or damp situations in old native birch/pine woodland (M. Davidson, *pers. comm.*).

Quality of data

Good.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Notioscopus+sarcinatus>> [Accessed 1 February 2012].

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR SWAMP LOOKOUT SPIDER (*Notioscopus sarcinatus*)

Aim

To monitor the status of *Notioscopus sarcinatus* at its current locations and to investigate its distribution beyond these sites.

Rationale

There has been relatively recent targeted sampling and therefore records for the majority of the sites for this species and a number of new sites in the north. The Bennachie site may be subject to change due to a new native pinewood grant and expert opinion suggests this site should be closely monitored.

Approach

It would be beneficial to continue and expand the monitoring already being carried out by The British Arachnological Society and Mike Davidson. Known sites should be re-surveyed after an appropriate time period and potential new sites in the north and south-west should be explored. Vacuum sampling has produced some records but hand searching and pitfall trapping are likely to be the most productive sampling techniques.

Equipment

Pitfall traps, sieves.

Location

The ancient pinewoods such as the Black Wood of Rannoch, Abernethy and Einig are the main locations, but its range extends east to Bennachie (British Arachnological Society, 2012). The species may occur at further sites in the north and in the south-west (M. Davidson, *pers. comm.*).

Sample units

Population monitoring could potentially damage the habitat and therefore the sampling units should be the number of occupied sites.

Sampling

Hand collection is an efficient sampling method for this species, which can be supplemented by pitfall trapping. The species is found in wet, usually tall moss under pine or birch trees and is possibly linked with groundwater (M. Davidson, *pers. comm.*). Hand collection involves sieving moss litter and capturing spiders by hand and with an aspirator. There is the potential for damage to sensitive bryophyte microhabitats and therefore care should be taken when searching for this species. An experienced person may be able to identify this species in the field, but generally microscopic confirmation will be required. For new sites, voucher specimens should be retained.

Adults are found throughout the year; however, most records have been obtained during winter and spring months and therefore sampling should target the period between November and April. It is probably best to survey for this species on cool, damp (but not wet) days. Rainy and windy days should be avoided to prevent a reduction in the efficiency of the sampling method, and very dry periods may affect the microhabitat.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record any changes in management at sites. This is particularly pertinent to the Bennachie site which is at risk of substantial change.

Pitfall traps should comprise plastic cups (suggested 11.5 cm diameter and 1 L volume). Pitfall traps should be placed in a 10-m grid and partially filled with an ethylene glycol solution and a few drops of detergent to break the surface tension to prevent the spiders from escaping. Sites at risk of substantial change should be monitored every three years. Other sites should be visited every five to 10 years.

Time

Hand collection can be carried out within a few hours at each site. Pitfall trapping will require a return visit.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Notioscopus+sarcinatus>> [Accessed 1 February 2012].

SPECIES REPORT FOR LICHEN RUNNING-SPIDER (*Philodromus margaritatus*)

Ecology

Philodromus margaritatus is camouflaged to resemble the lichen on which it sits and can change its colour to match its background (M. Davidson, *pers. comm.*). It is usually found on the trunks of trees, both pine and broad-leaved, especially when these are covered in lichens (M. Davidson, *pers. comm.*). Adults are found in May and June (British Arachnological Society, 2012).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species appears to have undergone major long-term decline.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

This spider is very local. It has a highly disjunct distribution in the UK. It is known from scattered localities in the south of England (mainly deciduous woodland) and the pinewood areas of Scotland (M. Davidson, *pers. comm.*). Recent records (2005 onwards) have come from Einig, Glen Affric, Glen Morriston and the Black Wood of Rannoch (M. Davidson, *pers. comm.*). It is widespread in western and central Europe, but has not been recorded from Ireland (British Arachnological Society, 2012).

Habitat and management

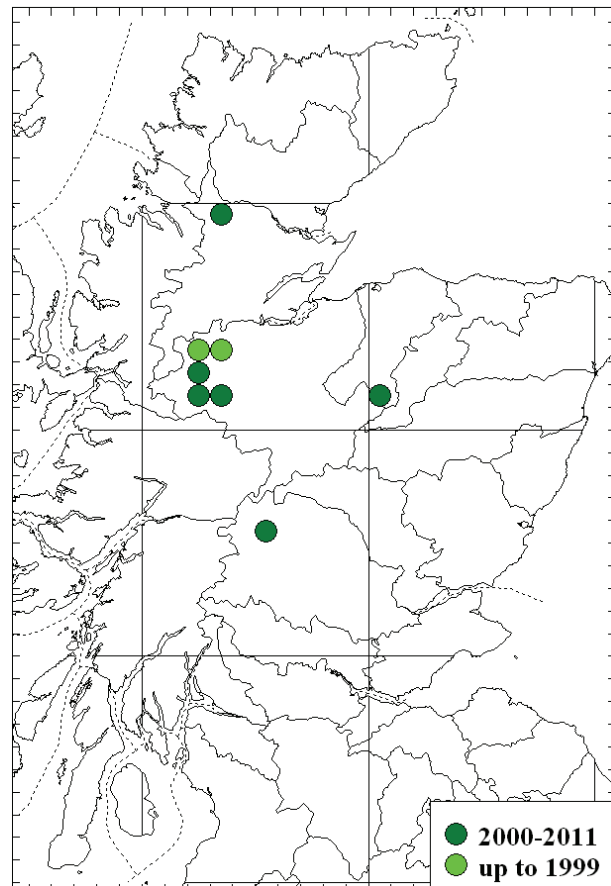
This species is found in broadleaved and pine woodlands where it is found on lichen-covered tree trunks. It has also been found on electricity pylons near pine trees and sometimes in gardens on apple trees (British Arachnological Society, 2012).

Pressures and threats

Felling and degradation of old, lichen-covered trees are specific threats (British Arachnological Society, 2012).

Conservation measures

Management should ensure that old lichen-covered trees are given adequate protection, and at sites where they occur, ensure a succession of younger trees to replace dead ones (M. Davidson, *pers. comm.*).



Summaries of surveys and research related to surveillance

Recent records have come from general collection (Duncan Williams), specific pinewood habitat surveys (A. Lavery), field courses (M. Davidson) and casual observations by members of the public (Bowman, 2008, 2009). Although this spider has excellent camouflage, its microhabitat is targeted by arachnologists and it may expect to be collected if present. However, it can move very quickly and avoid capture (M. Davidson, *pers. comm.*).

Quality of data

Good.

References

- British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Philodromus+margaritatus>> [Accessed 1 February 2012].
- Bowman, J. 2008. *Philodromus margaritatus* in Glen Moriston, Inverness-shire, S.R.S. News. No. 62. *Newsletter of the British Arachnological Society*, **113**, 18-19.
- Bowman, J. 2009. *Philodromus margaritatus* in Glen Moriston, Inverness-shire: 2009 Update. S.R.S. News. No. 66. *Newsletter of the British Arachnological Society*, **117**, 17-18.

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR LICHEN RUNNING-SPIDER (*Philodromus margaritatus*)

Aim

To establish the status and distribution of *Philodromus margaritatus* in Scotland.

Rationale

Philodromus margaritatus is found on lichen-covered tree trunks. It is camouflaged to resemble the lichen on which it sits and can change colour to match its background. It is also a very fast moving species. Despite this, its microhabitat would be searched by arachnologists and it may be expected to be collected if present (M. Davidson, *pers. comm.*). There are a number of recent records of the species derived from general collection, habitat surveys, field courses and casual observations by the public. However, there has been no target sampling for the species and there are a number of sites at which the species could occur.

Approach

Re-survey known locations and investigate potential new ones. Additional survey in Deeside and other ancient woodland areas with pine and oak may prove profitable. Beating of branches, brushing tree-trunks and direct observation are likely to be the most productive techniques for finding this well camouflaged and fast moving species (M. Davidson, *pers. comm.*).

Equipment

Beating tray and stick.

Location

The species is found in pinewood areas of Scotland including Einig, Glen Affric, Glen Morrison, and the Blackwood of Rannoch (M. Davidson, *pers. comm.*). New potential sites on Deeside where there is suitable habitat, for example, Glen Tanar, should be included in the surveillance.

Sample units

This species is often only found singly, although it may be possible to target a fixed number of trees to estimate abundance. The sampling units should be the number of occupied sites.

Sampling

Sampling should be conducted between May and September when the adults are present; however, the months of May and June may be most productive (British Arachnological Society, 2012). Warm, dry (but not under drought) conditions are preferable for maximizing sampling efficiency.

It is important to target the correct microhabitat, i.e., lichen-covered tree trunks. These should initially be searched visually and any specimens removed with an aspirator. If this technique proves unsuccessful then the surveyor should try brushing the tree trunk, beating the lower branches to dislodge any specimens, or use bark traps. These are corrugated cardboard wrapped around tree trunks and left for several weeks before removed for examination for spiders (Roberts, 1985).

This species is cryptically coloured and is able to vary its colour to blend into its background. Therefore colour and pattern are unreliable characteristics for identification (M. Davidson, *pers. comm.*). However, it is possible, with experience, to identify it in the field. For new sites voucher specimens should be retained for confirmation.

The surveyor should make some assessment of the quality and condition of the habitat, and any changes in relation to management, succession, etc. Old lichen-covered trees are particularly important, as well as maintaining a succession of younger trees to replace those that die (M. Davidson, *pers. comm.*). Sites should be surveyed every five to 10 years.

Time

Each site can be visited within one day but trapping will require a return visit.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Philodromus+margaritatus>> [Accessed 1 February 2012].

Roberts, M.J. 1985. *The spiders of Great Britain and Ireland Volume I*. Colchester: Harley Books.

SPECIES REPORT FOR TRIANGLE HAMMOCK SPIDER (*Saaristoa firma*)

Ecology

Saaristoa firma adult females have been found throughout the year, whereas adult males are found from August to September (Locket & Millidge, 1951) and April to June (British Arachnological Society, 2012).

Conservation status and rarity

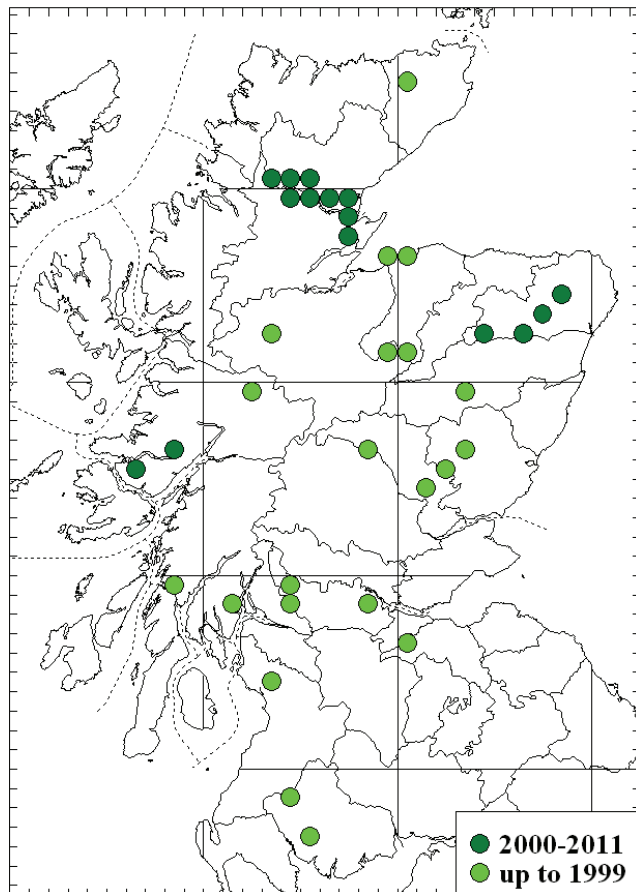
- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species has suffered a 62% decline over 25 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

The species has a widespread but very scattered distribution throughout Britain, and is apparently absent from many areas (British Arachnological Society, 2012). Of particular note is the rash of recent records in northern Scotland (Duncan Williams & M. Davidson, *pers. comm.*). It is widespread in much of north-western and central Europe (British Arachnological Society, 2012).

Habitat and management

This spider has generally been recorded from damp situations amongst moss, *Sphagnum*, leaf litter, pine needles and heather in woodland, scrub, peat bog, fen and heathland (British Arachnological Society, 2012). Duncan Williams (*pers. comm.*) reported that most of his records are from damper parts of woodland (often conifer plantations) either in mosses and litter on the forest floor, or among mosses and low vegetation in gorges or shaded burns, but also in open situations like blanket bog, wet heath and poor fen (M. Davidson, *pers. comm.*).



Pressures and threats

Given the relatively broad habitat requirements of this species, the apparent recent decline is difficult to explain. However, drainage of wetlands may have contributed (British Arachnological Society, 2012).

Conservation measures

Avoid drainage of wetland and other damp/wet habitats. Further research is needed to determine the conservation requirements of this species (M. Davidson, *pers. comm.*).

Summaries of surveys and research related to surveillance

General survey work in 2004-05 produced a significant number of new sites in northern Scotland (Duncan Williams). A recent visit (2011) to the Bennachie site (damp conifer woodland) confirmed its presence (M. Davidson/Grampian Spider Group).

Quality of data

Excellent.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Saaristoa+firma>> [Accessed 1 February 2012].

Locket, G.H. & Millidge, A.F. 1951. *British Spiders, Volume I*. London: Ray Society.

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR TRIANGLE HAMMOCK SPIDER (*Saaristoa firma*)

Aim

To establish the status and distribution of *Saaristoa firma* in Scotland.

Rationale

There has been no targeted sampling for this species but general survey work during 2004-05 produced a significant number of new sites in northern Scotland (Duncan Williams & M. Davidson *pers. comm.*). Monitoring of old sites, particularly in the south and east of Scotland, is still required.

Approach

A complementary approach by three sampling techniques should be used initially to locate the species. The surveyor should be prepared to revise the techniques should one prove overwhelmingly more successful than the others.

Suction sampling collects animals from a defined area (Duffey, 1980; Topping & Sunderland, 1992), which is an advantage over methods such as pitfall traps and sweep nets (Saunders & Entling, 2011). Suction sampling catches arthropods living on the vegetation and near the ground surface (Saunders & Entling, 2011). This has been shown to be a reliable method for the assessment of abundances of certain arthropod groups including spiders (Samu *et al.*, 1997) particularly when they live in the vegetation rather than near the soil surface (Saunders & Entling, 2011). Despite relatively high efficiency rates, individuals are still missed and the abundances obtained should therefore be regarded as an underestimation of the true population.

Equipment

Pitfall traps, vacuum sampler.

Location

This species has scattered records from across Scotland. Surveillance should initially focus on re-surveying sites for which there are older records. This species may occur at further sites across Scotland where there is suitable habitat.

Sample units

The sampling units will be the number of occupied sites, but where pitfall and vacuum sampling are used, some estimate of the relative abundances will be possible.

Sampling

Hand searching, pitfall trapping and vacuum sampling may be productive sampling techniques. Sampling should be carried out during the winter months when the spider is likely to be most abundant (M. Davidson, *pers. comm.*). It is probably best to survey on cool, damp (but not wet) days. Very dry periods may affect the microhabitat while rainy and windy days may reduce the efficiency of sampling (Henderson & Whitaker, 1977).

The species is found mostly within wet woodland including open conifer plantations. Moss (e.g. *Sphagnum*), or leaf/pine litter layers are the microhabitats (M. Davidson, *pers. comm.*).

Hand collection involves capturing spiders by hand and with an aspirator. It may be possible for an experienced person to identify this species in the field but generally microscopic confirmation is required. For new sites, voucher specimens should be retained.

Vacuum sampling should be carried out with the same sampler across sites and sampling dates. A metallic sampling cylinder with a lid (suggested 0.036 m² and 45 cm high), should be driven with a hammer into the ground to a depth of 7 cm to define the sampling area and to prevent the escape of any spiders. The diameter of the cylinder should be larger than the diameter of the suction sampler to allow air to be drawn up from the bottom so that spiders can be collected efficiently. Spiders should be intercepted in a fine mesh sack within the nozzle of the sampler. A standard sized mesh, maximum 2 mm, should be used for all samples. The lid should be removed immediately prior to sampling and the area within the cylinder immediately vacuumed for 30 s with the throttle of the sampler set to full. The sample must be transferred immediately from the mesh sack to a "zip lock" plastic bag and frozen before the contents are examined.

The pitfall traps should be plastic cups (suggested 11.5 cm diameter and 1 L volume) placed in a 10-m grid and partially filled with ethylene glycol and a few drops of detergent to break the surface tension to prevent the spiders from escaping.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record any changes to the sites in terms of management, succession or drainage. Positive sites should be surveyed every five to 10 years.

Time

Hand collection can be done within a few hours at each site. Vacuum sampling will require subsequent time in the laboratory to process samples. Pitfall trapping requires a return visit.

References

- Duffey, E. 1980. The efficiency of the Dietrick Vacuum Sampler (D-Vac) for invertebrate population studies in different types of grassland. *Bulletin d'Ecologie*, **11**, 421-431.
- Henderson, I.F. & Whittaker, T.M. 1977. The efficiency of an insect suction sampler in grassland. *Ecological Entomology*, **2**, 57-60.
- Samu, F., Németh, J. & Kiss, B. 1997. Assessment of the efficiency of a hand-held suction device for sampling spiders: improved density estimation or oversampling? *Annals of Applied Biology*, **130**, 371–378.
- Saunders, D. & Entling, M.H. 2011. Large variation of suction sampling efficiency depending on arthropod groups, species traits, and habitat properties. *Entomologia Experimentalis et Applicata*, **138**, 234-243.
- Topping, C.J. & Sunderland, K.D. 1992. Limitations to the use of pitfall traps in ecological studies exemplified by a study of spiders in a field of winter wheat. *Journal of Applied Ecology*, **29**, 485-491.

SPECIES REPORT FOR CLOUD-LIVING SPIDER (*Semljicola caliginosus*)

Ecology

Semljicola caliginosus adults occur for most of the year; however, they have been found mainly in early spring and again from June to September (British Arachnological Society, 2012).

Conservation status and rarity

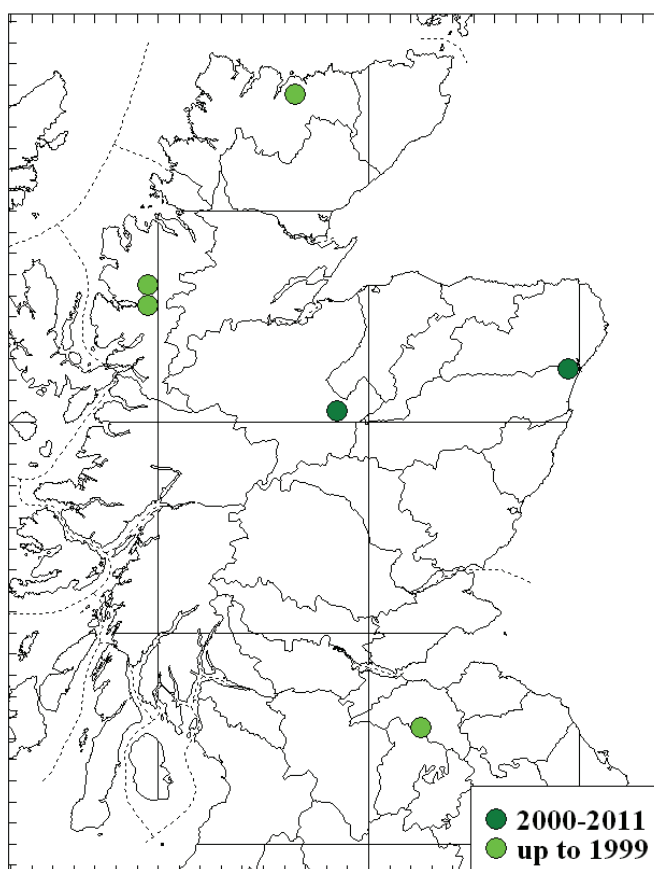
- UK Biodiversity Action Plan (BAP): Species of conservation concern.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

This spider is local and never particularly common. It is widespread in northern England but scattered in Scotland (M. Davidson, *pers. comm.*). The only recent Scottish records are from the Insh Marshes (RSPB) and the Ythan Estuary. *Semljicola caliginosus* was thought to be endemic to Britain but has recently been recorded in Siberia. Nevertheless, UK populations are globally important (M. Davidson, *pers. comm.*).

Habitat and management

Semljicola caliginosus occurs in wet places, among *Sphagnum*, *Juncus*, and other grasses and moss, mostly on high ground (British Arachnological Society, 2012). However, in March 2011 the species turned up in large numbers in the reed-beds on the Ythan Estuary in Aberdeenshire (M. Davidson), a new habitat at sea level.



Pressures and threats

Some sites might be threatened by drainage for afforestation (British Arachnological Society, 2012).

Conservation measures

Ensuring that suitable wetlands are protected from drainage for forestry or other land use should benefit this species (M. Davidson, *pers. comm.*).

Summaries of surveys and research related to surveillance

There have been no known surveys specifically for this species.

Quality of data

Good.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Semlijicola+caliginosus>> [Accessed 1 February 2012].

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR CLOUD-LIVING SPIDER (*Semljicola caliginosus*)

Aim

To establish the status and distribution of *Semljicola caliginosus* in Scotland.

Rationale

This wetland-dwelling spider has been previously recorded at scattered locations across Scotland. However, most of these are old records (pre-1992). There has been no targeted surveying for this species and all records are ad-hoc. One of the more recent records located the spider in large numbers in reed-beds on the Ythan Estuary. This has been a previously overlooked habitat and therefore some effort should be focused on surveying reed-beds in other locations.

Approach

In the first instance, surveillance should focus on visiting previously known locations throughout Scotland. Further survey could be carried out in reed beds at locations close to those where the spider is currently present, and where the habitat is thought to be suitable.

A combination of methods will need to be employed and selection will depend on the characteristics of the habitat. In wetlands where the spider is found among moss and grass sampling should be by hand collection. Among reed beds, a combination of hand collection and sweeping should be used until the microhabitat can be established. Thereafter the method may need to be altered.

Equipment

Sweep net.

Location

The most recent records are from Insh Marshes and the Ythan Estuary but in the past the species has also been found near Tongue in Sutherland, around Loch Shieldaig in Wester Ross, and near Peebles in the Scottish Borders. These sites should all be re-surveyed. The species was previously thought to be restricted to more upland sites but a recent discovery in an estuarine reed-bed opens up new possibilities. It is perhaps worth targeting reed-beds at a range of altitudes in early spring (M. Davidson, *pers. comm.*).

Sample units

The sample units will be the number of occupied sites. It may be possible to estimate abundance in reed beds by sweeping a fixed area.

Sampling

On wetlands this species is found amongst moss (*Sphagnum*) and graminoids (*Juncus* and others) (British Arachnological Society, 2012). The microhabitat within reed beds is not yet clear. Care must be taken not to damage existing populations. Sampling should be carried out between March and July, based on existing records. Rainy and windy days should be avoided to prevent a reduction in the efficiency of sampling.

This species requires microscopic identification and therefore specimens should be retained for confirmation.

At wetland sites, sampling should be carried out by hand collection and aspirator. In reed beds, a combination of hand collection and sweeping should be used. Information on the location of spiders in reed beds would help establish microhabitats.

The surveyor should make some assessment of the quality and condition of the habitat, and any changes to the sites in terms of management particularly drainage. Positive sites should be surveyed every five to 10 years.

Time

A single day visit to each site will confirm continued presence. A return visit will be required if traps are deployed.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Semlilijicola+caliginosus>> [Accessed 1 February 2012].

SPECIES REPORT FOR BEND-BEARING BLUNT-BROW SPIDER (*Silometopus incurvatus*)

Ecology

Silometopus incurvatus adults have been found throughout the year (M. Davidson, *pers. comm.*).

Conservation status and rarity

- UK Biodiversity Action Plan (BAP): Species of conservation concern. This species has suffered a 69% decline over 25 years.
- UK 2008 Biodiversity Reporting Round, Scottish trend: not available.
- IUCN Status: Not listed.

Distribution

The species is apparently restricted to sand dunes in the northern half of Britain, on the coast of North Yorkshire, Northumberland, East Lothian, Aberdeenshire, Moray, Ayrshire and Islay (British Arachnological Society, 2012). In Europe it has been recorded from Belgium, the Netherlands, Germany and Scandinavia (British Arachnological Society, 2012). It can be abundant at some sites (M. Davidson, *pers. comm.*).

Habitat and management

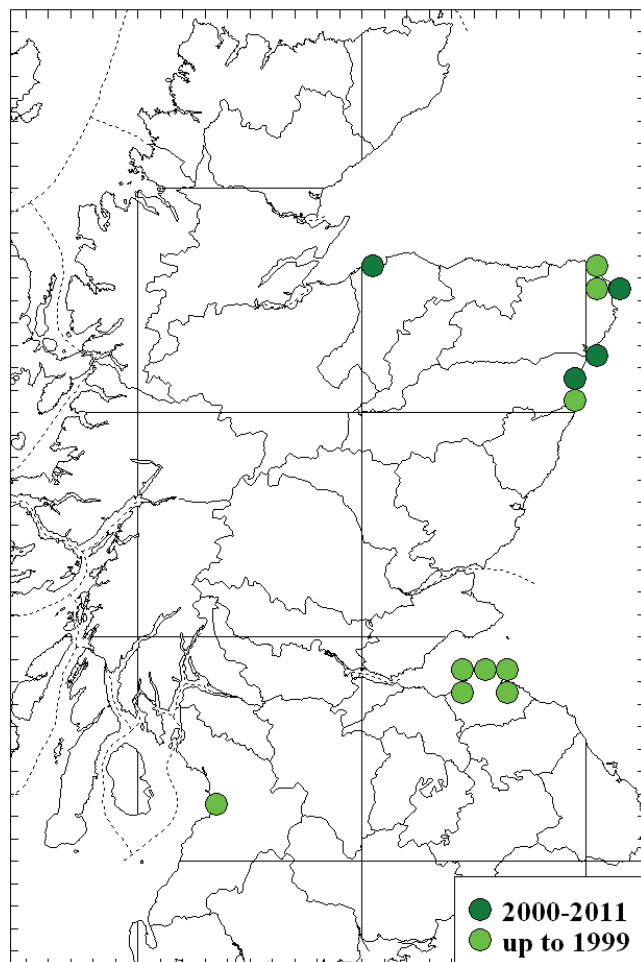
Silometopus incurvatus occurs on sand dunes, amongst marram litter 8-20 cm above ground level (British Arachnological Society, 2012) and occasionally in other coastal grasslands and salt marsh (M. Davidson, *pers. comm.*).

Pressures and threats

The Aberdeenshire dune system between Aberdeen and Fraserburgh has been the subject of much recent publicity regarding a major golf course development that may threaten the geomorphologic integrity of the system, the habitat and habitat connectivity for species such as *S. incurvatus* (M. Davidson, *pers. comm.*).

Conservation measures

Consideration should be given to enhancing the protection of the remaining areas of Aberdeenshire to ensure the continued existence of a dynamic dune system (M. Davidson, *pers. comm.*). Ensuring that suitable wetlands are protected from drainage for forestry or other land-use (British Arachnological Society, 2012) should benefit this species.



Summaries of surveys and research related to surveillance

A recent survey (Nov. 2011, M. Davidson/Grampian Spider Group) confirmed the presence of *S. incurvatus* at St. Fergus Links near Peterhead, where it was recorded during an ITE sand-dune survey in 1976 (M. Davidson, *pers. comm.*). *Silometopus incurvatus* was also found in salt marsh at Findhorn Bay in November 2011, the first record since 1914 (M. Davidson, *pers. comm.*).

Quality of data

Good.

References

British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Silometopus+incurvatus>> [Accessed 1 February 2012].

Map data sources

The distribution data for Scottish BAP Priority Spiders has been provided by the Spider Recording Scheme with some recent additions by M. Davidson.

SURVEILLANCE METHODOLOGY FOR BEND-BEARING BLUNT-BROW SPIDER (*Silometopus incurvatus*)

Aim

To establish the status of *Silometopus incurvatus* at its current and previously known locations, and to investigate possible new sites.

Rationale

This species has previously been found only on sand dunes in coastal locations but a recent record from Findhorn Bay shows it also inhabits salt marshes. This is a previously overlooked habitat. There has been no targeted surveying for the species.

Approach

With only two recent (post-1992) records, survey previously known locations should be a priority. Other areas with suitable salt marsh habitat could be surveyed to establish possible new locations.

Hand sampling has proved to be an effective method for finding the species amongst marram stems on sand dunes. Therefore, this method should be continued in coastal locations. For inland salt marshes, a combination of vacuum sampling and hand collection should be trialled until the more effective method can be established. While adults species are probably present throughout the year, the best time to sample is from January until March.

Vacuum or suction sampling collects animals from a defined area (Duffey, 1980; Topping & Sunderland, 1992), which is the advantage over methods such as pitfall traps and sweep nets (Saunders & Entling, 2011). Suction sampling catches arthropods living on the vegetation and near the ground surface (Saunders & Entling, 2011). This has been shown to be a reliable method for the assessment of abundances of certain arthropod groups including spiders (Samu *et al.*, 1997) particularly for spiders on the vegetation rather than near the soil surface (Saunders & Entling, 2011). Despite relatively high efficiency rates, individuals are still missed and the abundances obtained should therefore be regarded as an underestimation of the true population.

Equipment

Vacuum sampler.

Location

Sand dunes on the coasts of East Lothian, Aberdeenshire, Moray, Ayrshire and Islay (British Arachnological Society, 2012). Any sand-dune system is likely to harbour this species.

Sample units

The sample units will be the number of occupied sites.

Sampling

Hand searching and vacuum sampling may be productive sampling techniques. Sampling should be carried out during the winter months (January to March) when the spider is likely

to be most abundant (M. Davidson, *pers. comm.*). Rainy and windy days should be avoided as these are likely to affect sampling.

Hand collection involves capturing spiders by hand and with an aspirator. This species will require microscopic examination and specimens should be retained.

The same vacuum sampler should be used across sites and sampling dates. A metallic sampling cylinder with a lid (suggested 0.036 m² and height 45 cm), should be driven into the ground with a hammer to a depth of 7 cm to define the sampling area and to prevent the escape of any spiders. The diameter of the cylinder should be larger than the diameter of the suction sampler to allow air to be drawn up from the bottom so that spiders can be collected efficiently. Spiders should be intercepted in a fine mesh sack within the nozzle of the sampler. A standard sized mesh, maximum 2 mm, should be used for all samples. The lid should be removed immediately prior to sampling and the area within the cylinder immediately vacuumed for 30 s with the throttle of the sampler set to full. The sample must be transferred immediately from the mesh sack to a "zip lock" plastic bag and frozen before the contents are examined.

The surveyor should make some assessment of the quality and condition of the habitat. It would be useful to record any changes to the sites in terms of management or succession.

Time

A single visit should be adequate to confirm continued presence.

References

- British Arachnological Society. 2012. *Spider and harvestman recording scheme website*. [online] Available at: <<http://srs.britishspiders.org.uk/portal.php/p/Summary/s/Silometopus+incurvatus>> [Accessed 1 February 2012].
- Duffey, E. 1980. The efficiency of the Dietrick vacuum sampler (D-vac) for invertebrate population studies in different types of grassland. *Bulletin of Ecology*, **11**, 421-431.
- Samu, F., Nemeth, J. & Kiss, B. 1997. Assessment of the efficiency of a hand-held suction device for sampling spiders: improved density estimation or oversampling? *Annals of Applied Biology*, **130**, 371-378.
- Saunders, D. & Entling, M.H. 2011. Large variation of suction sampling efficiency depending on arthropod groups, species traits, and habitat properties. *Entomologia, Experimentalis et Applicata*, **138**, 234-243.

www.snh.gov.uk

© Scottish Natural Heritage 2013
ISBN: 978-1-85397-997-2

Policy and Advice Directorate, Great Glen House,
Leachkin Road, Inverness IV3 8NW
T: 01463 725000

You can download a copy of this publication from the SNH website.



Scottish Natural Heritage
Dualchas Nàdair na h-Alba

All of nature for all of Scotland
Nàdar air fad airson Alba air fad