# Aculeate Conservation Group/ Hymettus Report for 2006

**1. Background to 2006 Research.**

**1.1** During 2006 a new body, Hymettus Ltd., was constituted. Hymettus will take over and extend the role of the Aculeate Conservation Group. This report deals with research originally agreed at the 2005 ACG Annual Review and funded by English Nature (now also re-incarnated as Natural England), but executed under Hymettus Ltd.. During 2006 work was financially supported by English Nature, Earthwatch, Syngenta and the RSPB in accordance with the relevant Annex a documents, which see for details.

**1.2** 2005 Projects are reported in the following order of taxonomic group: ants, wasps, bees, other projects.

**2. Ant Projects.**

**2.1 Formica exsecta**

**2.1.1** At the 2005 Review meeting Stephen Caroll was asked to enquire of the Devon Trust as to whether they would be prepared to consider looking at the possibility of proposing a landscape project for the Bovey Basin which would include the habitat requirements of Formica exsecta and , if so, whether a contribution from the ACG towards the costs of looking at this would be appropriate.

**2.1.2** The Trust received this request enthusiastically and have submitted a copy of Andrew Taylor's (their Officer) Report. Stephen Caroll will be able to bring us up to date with developments at the Review meting. The Report is presented here (appendices may be obtained from Mike Edwards):

**Landscape-scale habitat work in Devon's Bovey Basin Report to Hymettus Limited, October 2006**

**1. Introduction**

The Bovey Basin is located in the Teignbridge district of South Devon. Its unique assemblage of wildlife habitats encompasses lowland heath, coastal grazing marsh, wet grassland, wet woodland and fresh water (including the rivers Teign and Bovey and an extensive network of man-made ponds).

All of these habitats are subject to such pressures as urban expansion, mineral working and industrial development. Despite this the Bovey Basin is still home to a significant number of local and national wildlife rarities including great crested newts, Dartford warblers, nightjars, plus a number of dragonfly and damselfly species such as the ruddy darter. This is also the only known English home of the narrow-headed ant *Formica exsecta.*

The Bovey Basin has therefore been identified as a priority conservation area in the Regional Spatial Strategy's South West Nature Map. Many organisations – including companies, local authorities and NGOs – are contributing in different ways to the conservation of the area's wildlife. Some are focusing on broad habitats, others on specific species. At present these activities are largely complementary but also largely uncoordinated.

Hymettus Limited has a specific interest in the ant *Formica exsect*a. Chudleigh Knighton Heath nature reserve is currently the only known English home for this species. Meanwhile as manager of the nature reserve, Devon Wildlife Trust is keen to see an increase in both the quality and quantity of lowland heath in the Bovey Basin.

Both Hymettus Limited and Devon Wildlife Trust recognise that to give the best chance of survival to *Formica exsecta*, lowland heath, and all of the Bovey Basin's other key species and habitats, it will be necessary for all interested parties to combine forces and approach wildlife conservation in the Bovey Basin on a landscape scale.

To this end Hymettus Limited kindly facilitated a £500 grant from English Nature. The grant has been put towards the Devon Wildlife Trust's costs in initiating a partnership project, designed to conserve and enhance the full spectrum of the Bovey Basin's wildlife. The following pages summarise DWT's progress to date.

**2. Documentation Review**

Devon Wildlife Trust began this task by compiling a list of the documents that might be of use in planning and delivering future conservation work in the Bovey Basin.

These documents have been reviewed (not all to the same level of detail as yet) and a short list of the most relevant ones prepared. We have subdivided these into four broad categories:

- Strategic documents which will help to guide us in planning and prioritising of future conservation work.
- Survey documents which will provide some of the baseline / historical information needed concerning the status of various habitats and species in the Bovey Basin.
- Documents specifically concerned with the ecology of the ant *Formica exsecta* and its status in the Bovey Basin.
- Management plans for individual wildlife sites in the Bovey Basin.

A summary of the most useful documents appears as Appendix 1 of this report (saved as a separate Microsoft Word file, Bovey Basin Appendix 1 - Documentation Review.doc). (Please note that the hyperlinks appearing in this appendix are for Devon Wildlife Trust internal use, linking to documents stored on our network.)

**3. Engaging with the Bovey Basin planning process**

Unlike the remote pastoral landscapes in other parts of Devon, the Bovey Basin has a wide range of potentially conflicting land use requirements – including mineral extraction, light industry, housing expansion, agriculture, leisure, tourism and flood prevention as well as nature conservation. The wider planning framework will therefore have a very significant impact on future wildlife conservation work in the area.

The South West Regional Assembly (in its role as Regional Planning Body) is developing a Regional Spatial Strategy for 2006 – 2026. Currently available in draft form, this document is scheduled to be approved early in 2008. It will set a regional framework within which Local Authorities must produce generally conforming planning policies for their areas.

The nature conservation aspirations of the Strategy are based on the South West Nature Map, which identifies the best areas in the region to conserve, create and connect wildlife habitats at a landscape scale.

DWT's Planning Officer, Bill Broadbent, has been reviewing the draft Regional Spatial Strategy, and producing proposed amendments to strengthen support for nature conservation in the final version. He has been working with partner organisations to see how the Nature Map's proposals for habitat creation could be incorporated into Local Authority plans (Local Development Documents). Of particular interest are the Nature Map's proposals for habitat creation in the Bovey Basin area, as part of this area is also proposed by Teignbridge District Council for urban development. He will subsequently be discussing, with council planners, ways to evolve plans which recognise the importance of the Basin's wildlife and which will lay the foundations for landscape-scale habitat improvements in the future.

**4. Partners**

In the Bovey Basin we have large areas of land under the management of a comparatively small number of landowners - many of whom have expressed some degree of sympathy to the needs of wildlife conservation. A range of other organisations – such as Natural England and the Environment Agency – also have interests and influence in the Bovey Basin, although they are not directly involved in land management.

Potential partners include:

- Devon County Council
- Clifford Estate (major land owner)
- Dartington Hall Trust (significant land owner)
- English Nature and the Rural Development Service (now Natural England)
- Environment Agency
- Forest Enterprise (manages a sizeable area of land at Great Plantation)
- Imerys Ltd (ball clay mining firm)
- Teignbridge District Council (Local Authority covering the whole of the Bovey Basin)
- Viridor Waste Management (operators of a major landfill site in the Basin)
- WBB Minerals (the more active of the Basin's two ball clay mining firms)

During the summer of 2006 Devon Wildlife Trust has opened discussions with a number of organisations that might potentially join us as partners in future landscape-scale work in the Bovey Basin. At a meeting in July Charlie Taylor (DWT's Havens Manager) raised the possibility of a Basin-wide nature conservation project, and the idea was warmly received. Further discussions will be carried out with a number of potential partners over the coming months.

Appendix 2 to this report (saved as a separate Microsoft Word file, Bovey Basin Appendix 2 – overview of conservation activity and plans.doc) summarises our current knowledge of various partners' activities with respect to nature conservation work in the area.

**5. Project Planning and Delivery**

What we can actually achieve in the Bovey Basin depends heavily upon:

a) the level of in-kind and financial support we are able to secure from local organisations and grant-makers.

b) the amount of co-operation we are able to foster amongst the Bovey Basin's landowners.

Assuming for the moment that funding, in-kind support and landowner co-operation are all forthcoming, what form might the Bovey Basin Project take?

An initial, very provisional answer to this question is outlined below. This does not represent a commitment on behalf of Devon Wildlife Trust or any of its future partners – we are at an early stage in the process and priorities may change.

<u>Geographical Scope</u>

The geographical focus of the Project will be defined by the extent of the Bovey Basin as shown in the South West Nature Map.

In geological terms, the Bovey Basin is a depression in the earth's crust that has been filled to a depth of more than a kilometre with sedimentary layers of sand, gravel, lignite and ball clay. Centuries of ball clay mining have had a major impact on the landscape, creating a patchwork of deep open pits and extensive spoil heaps. Numerous ponds have evolved on the sites of abandoned workings. Quarrying continues on a large scale – the Bovey Basin is still the most important source of ball clay outside China.

The northern boundary of the Bovey Basin begins where the rivers Bovey and Teign complete their descent from Dartmoor to the floodplain, near the towns of Bovey Tracey

and Chudleigh. The rivers then converge, and the southern extent of the Basin lies where their combined waters flow into the Teign Estuary at Newton Abbot.

Our project will attempt influence this entire area, rather than just isolated blocks within it. This is a challenging target but given that the Basin has large areas of land under the management of a comparatively small number of landowners, it is by no means impossible.

Phase 1 – Assess the current resource, formulate targeted action plan

As shown in Appendix 1, existing survey documents give us a reasonable starting point on which to build our picture of the Bovey Basin's current wildlife resource.

The following tasks would help us to consolidate this information. We could obtain up to date SSSI condition assessment data from Natural England, and carry out condition assessments of existing County Wildlife Sites that are due for revisits. We could then carry out a survey to identify new County Wildlife Sites. The surveying of Potential County Sites identified as "P1" (high priority) from aerial photographs has already been funded, and will soon be largely complete. Therefore the focus would be on "P2" and possibly "P3" sites.

We could obtain criteria from Hymettus Limited by which to identify possible sites for the ant *Formica exsecta.* Following on from this, we would then commission surveys of possible sites to establish whether the ant is distributed more widely than is currently known (current records show it as present only at Chudleigh Knighton Heath nature reserve).

"Parish Audits" could be commissioned to engage Bovey Basin communities in the project and initiate a flow of local wildlife records into DBRC. In addition, major landowner audits might be undertaken to raise awareness of existing interest on sites with benevolent ownership and to capture data on those holdings into DBRC. Field surveys could be carried out to assess the potential of routes through the area to act as wildlife corridors, and where possible we would collate information on site topography, aspect, substrate, soil etc..

The above information can then be used to produce an Opportunities Map to inform choice of appropriate sites for habitat creation and improvement work.

We can also create a Constraints Map showing active mineral workings, agreed development zones, flood control areas, sites where architectural / historical / geological / community considerations have to be taken into account, and land holdings where owners cannot be persuaded to participate in the landscape-scale habitat work.

Phase 2 – Delivery of targeted action plan

Having identified opportunities and constraints in Phase 1, Phase 2 would focus on putting the opportunities into practice. Delivery would be carried out by one to three project officers depending on funds secured - but ideally we would have three officers working respectively with farmers, businesses and communities / schools. These officers might be housed with a single employer, or with two or three separate partner organisations.

Delivery tasks could include some or all of the following:

- Advising on / participating in the creation / restoration of various habitats at targeted sites.
- Advising on / participating in specific actions to benefit key species including *Formica exsecta*.
- Providing whole-farm advice and practical assistance to County Wildlife Site owners.
- Advising business owners of the existing wildlife on their land, and advising on / assisting with conservation land management. Also linking with partner organisations such as EnVision to provide energy and materials advice, to improve business efficiency and reduce carbon footprint.
- Providing advice to key targeted landowners to prepare ELS and HLS applications.

• Advising the local authority on the development of Local Development Framework and SAs. Helping to develop the local authority's Green Infrastructure obligations under the Regional Spatial Strategy.

• Advising Parish Councils and Community Groups about managing the environmental assets on their doorsteps – for example by accessing funding for local community projects.

• Working with schools – finding ways to raise awareness of local biodiversity, and encouraging schools' participation in recording and conservation work.

**6. Funding**

Funding for this work will not be easily obtained but we have a number of avenues to explore.

Phase 1: we will seek funding from those local organisations that have an interest in seeing the project progressed. These will include local authorities, the relevant government agencies and the Bovey Basin's land-owning organisations.

Phase 2: we will seek funding from targeted commercial organisations, major charitable trusts with a stated interest in biodiversity work, and in particular from landfill tax credit distributors. A number of specific funders have already been identified.

We will be able to show extensive relevance to Biodiversity Action Plans, as well as pioneering work in the field of landscape-scale conservation. We will also be able to demonstrate support from a wide range of private sector, public sector and community bodies. Thus although fundraising will be a major challenge, we are reasonably optimistic that the challenge is an achievable one.

**2.1.3** During 2006 David Stradling was able to undertake further searches of the verges of the A38 road adjoining the Chudleigh Knighton Heath Reserve, through the good offices of the contractor to the Highways Agency. In a previous survey of these verges David trapped workers of *Formica exsecta* but was unable to locate the nest. This year he was able to find a small nest in the same general area. He feels that it is extremely unlikely that this is an off-shoot of an extent nest and that this indicates a new founding, which is very good news. The Highways Agency have agreed to control the amount of scrub present on this verge, maintaining open conditions for the *Formica*.

**2.1.4** Two other small (new) nests identified in 2005 at the northern end of the Chudleigh Knighton Heath Reserve have maintained themselves effectively.

**2.1.5** In view of the loss of *Formica exsecta* at Bovey Heath it is suggested that an attempt is made to re-establish the species here as a trial for other potential re-establishments in the area. This will need discussion with the Devon Trust, Simon Dunsford at Natural England and David Stradling at Paignton Zoo. The approach suggested is two-fold, with both approaches running in parallel.

**2.1.6** Firstly, it is strongly suspected that *F. exsecta* establishes nests by queens acting as temporary social parasites of nests of the *F. fusca* group. A high density of suitable *F. fusc*a nests may therefore be an essential prerequisite to the establishment of *F. exsecta*. Queens of *F. fusca* establish new nests in relatively large diameter pieces of wood (which is why nests of its other temporary social parasite, *F. sanguine*a, the slave-maker, are often found associated with old pine stumps on cleared heathland in the south-east of England.

**2.1.7** It is proposed that the number of *F. fusca* nests be experimentally elevated through providing nest-founding foci by part-burying old pine posts to emulate tree stumps, both on Bovey and on Chudleigh. On the latter site this should be in an area not currently well populated by *F. exsecta,* in case there are unexpected negative interactions. (One of these potential problems will not happen, there are no *F. sanguinea* present in SW England, in contrast to the situation with *F. rufibarbis* in Surrey.)

**2.1.8** Secondly, using David Stradling's proven method of obtaining mated queens from nests at Chudleigh Knighton, releases of mated queens should be undertaken both on Bovey and in an area of Chudleigh, away from the *F. fusca* experiment. Obtaining stock for this procedure will require special arrangements over grazing stock access to the donor nests during the rearing period (April to July) - the inquisitiveness of the stock makes maintaining the required nest covers and feeding points rather difficult!

**2.1.9** Although it is impossible to say exactly where mated queens will settle - they still have wings at this stage - some idea of the density, location and size of *F. fusca* nests in the vicinity of the release points at the start of both experimental procedures will be required, as will repeat sampling to measure the outcomes including any colonisation by *F. exsecta.*

**2.1.10** Once additional nests of *F. fusc*a are established in the post-areas another release of mated *F. exsecta* should be carried out and monitored as before.

**2.1.11** Hymettus should be able to provide suitably trained recorders for the monitoring requirements, and should in any case be actively seeking funding to support this part of the whole Bovey Basin Project. These recorders could also be used to undertake the wider surveys noted as required in the DWT Report.

**2.1.12** Samples of workers from 24 different nests (10-15 workers each) in the Abernethy area of Scotland were transferred to Mark Brown at Trinity College Dublin in order for his team to begin looking at the levels of polygyny in these nests. Knowing whether nests have more than one egg-laying queen gives vital information regarding the potential life-span of individual nests.

2.1.13 DNA was extracted successfully from the majority of samples. 3 microsatellite loci were analysed: FE13, FE21 and FE49, all of which were highly heterozygous in a Swedish population of F. exsecta (Gyllenstrand et al. 2002).

FE13 – amplified for 22 out of 24 colonies (2-4 individuals per colony), was variable with three alleles (lengths 215, 217, 219bp). Colonies (data so far) are (i) homozygous at 215 (8 colonies) (ii) homozygous at 217 (4 colonies) (iii) heterozygous for 215/217 (5 colonies) (iv) heterozygous for 217/219 (3 colonies) (v) heterozygous for 215/217/219 (2 colonies). One colony has a genotype (data so far) that is consistent with either polgyny or polyandry

FE21 – amplified for all colonies, was fixed for an allele of length 96bp (all individuals, all colonies = 346 individuals)

FE49 – would not amplify for any individual in any colony

FE13 needs to be run for the remaining 300 individuals to score colonies for polygyny/polyandry.

**2.1.14** Initial results suggest that, like the previously sampled nests from Devon, the level of polygyny (or polyandry) is low in these colonies. As the original data from the Devon nests is not available to us (the work was done in Sweden) it is recommended that new tests are run on the Chudleigh population as an extension to this work. Other extensions are considered later in section 7.3.

**2.1.15** A summary report concerned with *F. exsecta* and made to the Scottish Executive confirms that, whilst nests of *F. exsecta* may be found in areas with quite a high density of young trees, these trees do not seem to be highly used foraging areas and may well eventually provide deleterious conditions due to shading as they mature. It is thought that the trees and the ants are there because of the presence of the niche (warm clearings with an amount of germination/nesting space) but are not causatively associated. This would agree with our own observations.

**2.1.16** It is also stated that in interactions between Wood Ant (? implied not *F. lemani*?) species present in the area *F. exsecta* appeared to be the least dominant species.

### 2.3 Formica rufibarbis

**2.3.1** The situation with *Formica rufibarbi*s in Surrey remains very precarious. It is not clear whether the nest at Stickledown is still viable but the one nest at Chobham is still there and the new bare ground management undertaken in the vicinity of the nests looks to be very suitable. John Pontin still has one captive nest, but the queen is getting old. A priority for 2007 must be getting a survey visit in at Stickledown.

**2.3.2** During 2006 the Zoological Society of London, led by Emily Brennan, have been seeking funds to research captive breeding and subsequent release of *Formica rufibarbis.* Emily recently reported that they have been successful in obtaining these. She will report further at the Review meeting.

**2.3.3** During 2006 Ian Beavis visited the Scilly Isles on his normal annual visit. One of the things he has been doing on these visits is looking at the *F. rufibarbis* colonies on the islands. He has agreed to write up his observations for the 2006 visit for Hymettus and these, with an enormous amount of additional background information, are reproduced below.

**Formica rufibarbis in the Scilly Isles.**

**Introduction and historical background.**

*Formica rufibarbis* has been known in mainland Britain since the late nineteenth century, but it was not discovered on the Isles of Scilly until 1940, when at the end of March I. H. H. Yarrow discovered several colonies on St Martin's (Yarrow & Guichard, 1941). However, neither he nor others were able to relocate it in subsequent years, and it began to seem as if the species might be an artificial introduction only temporarily established (Yarrow, 1954; Spooner, 1968). Eventually, G. M. Spooner was able to rediscover the species on a visit to the islands in July 1967 (Spooner, 1968 and journals). He established the species' distribution on St Martin's, noting its curious restriction to the Chapel Down area at the eastern end of the island, and also found a population on the adjacent uninhabited island of Great Ganilly (one of the Eastern Isles group). He observed it again on St Martin's during a visit in July 1970 (Spooner, journals).

*F. rufibarbis* was listed as nationally Rare in the original Red Data Book for insects (Shirt, 1987). It was upgraded to the status of Endangered (RD1) in Falk's subsequent and more detailed account of scarce and threatened aculeates (Falk, 1991). Falk detailed the species' alarming decline in mainland Britain, but lacked up to date information on its status on Scilly.

My experience of the species on Scilly dates back to 1991, when I observed it within Spooner's original range. I subsequently recorded it in 1992, and in every year from 1995 to 2006 (with the exception of 2000, when I did not visit the islands) (Beavis, 2000). In 1999 I rediscovered it on the Eastern Isles, and in 2004 I established that its distribution on St Martin's had not significantly changed since Spooner's visit in 1967 (Beavis, 2005).

**Distribution**

Yarrow's original report did not state where exactly on St Martin's he found his first colonies of *F. rufibarbis.* He later told Spooner that they were 'near one of the landing places' (Spooner, 1968). This is curious since there is no landing place near Chapel Down, and the two regular quays on St Martin's (at Lower Town and Higher Town Bay) are, relatively speaking, some distance away. The Higher Town Quay is about 1 kilometre from the ant's current western limit, while Lower Town is at the opposite end of the island. It is possible that the ant did once occur in, or was temporarily established in, other heathy areas outside Chapel Down, and this might explain why it took so long for it to be refound (because people were looking for it in the wrong part of the island). However, it is equally possible

that Yarrow, writing to Spooner near thirty years after the event, was misremembering.

It was in any case Spooner who first established that *F. rufibarbis* was restricted to Chapel Down and its immediate vicinity, along with Great Ganilly in the adjacent Eastern Isles. His original article defines its distribution on St Martin's as 'firmly established on the eastern limb of St Martin's from Bread and Cheese Cove in the north, over Chapel Down, to English Island Point in the south-east of the island'. This is based on surveys conducted on 3 and 9 July 1967, which are fully described in his journals.

In 2004, I established that, walking along the island's south coast from the west, *F. rufibarbis* first appears at English Island Point, just as Spooner describes, although the ant is restricted to a narrow coastal zone until the open heathy landscape of Chapel Down opens out at Brandy Point, where (especially under suboptimal conditions) the ant generally becomes more numerous and conspicuous. On the north coast, walking west away from Chapel Down, the last *F. rufibarbis* were seen along the eastern side of Burnt Hill, a promontory which projects parallel to the western slopes of Chapel Down. Between Chapel Down and Burnt Hill are two small bays – Bread and Cheese Cove to the east and Stony Porth to the west. Spooner recorded Bread and Cheese Cove as his westernmost limit, so my observations may represent a slight extension of range since his time. However, it is equally possible that he failed to spot the ant in this marginal area, where it is once again limited to a small coastal strip.

What Spooner says in his published article about the ant's occurrence in the Eastern Isles is confusing and has misled subsequent authors unfamiliar with the geography of Scilly. He talks about 'a close examination of two of the Eastern Isles' and then adds 'it occurred on two sites on Great Ganilly'. Falk's (1991) interpretation of Spooner's words is that 'he recorded it… on two of the Eastern Islands and two sites on Great Ganilly'. The Cornish Red Data Book (Spalding, 1997) also fails to appreciate that Great Ganilly is one of the Eastern Isles. Examination of Spooner's journals makes clear what happened. The 'two of the Eastern Islands' that he visited (on 12 July 1967) were Great Ganilly and Nornour, and he found it at two sites on the former. The small uninhabited Eastern Isles are close to the south-east coast of St Martin's and the Chapel Down site, to which they would have been linked as recently as Roman times (Thomas, 1985), so the existence of *F. rufibarbis* here is not especially surprising.

On my visit to the Eastern Isles on 9 August 1999, I found workers active among short turf and granite rocks on the south-west coast of Great Ganilly, as well as along the adjacent coast of Nornour, which is linked to Great Ganilly at low tide. None could be found on Little Ganilly (which is mostly covered with bracken and currently has little suitable open habitat) or Great Arthur (which does have open heathy ground). Spooner visited Great and Little Arthur in 1970, but similarly failed to find *F. rufibarbis*.

In July 2002 Rosemary Parslow collected workers (whose identity I was able to confirm) on the uninhabited island of Tean off the east coast of St Martin's (Beavis, 2005). This is at the opposite end of St Martin's from Chapel Down and thus at a relatively long distance from the previously known population. Since Tean has been regularly visited by entomologists in the past, the presence of *F. rufibarbis* may be the result of recent colonisation by a queen flying from the Chapel Down site. It is notable that Spooner himself visited Tean on 5 July 1967, i.e. in between his two surveys of St Martin's. Judging from the other sun-loving aculeates that he saw, he had optimal conditions throughout this period, but nonetheless he did not find *F. rufibarbis* on that island. Staff of the Isles of Scilly Wildlife Trust have informed me that they have looked for the ant in the years following the 2002 record, but without success.

**Habitat**

Chapel Down, which accounts for most of territory occupied by *F. rufibarbis* on St Martin's, is that island's most extensive area of maritime or 'waved' heathland. Lousley

(1971) describes this characteristic Scillonian habitat as 'a western type developed in places subject to frequent gales and very different from the usual Callunetum of the mainland. Less than 15 cm high, knotted and gnarled, windpruned and eroded, there are fine examples on Castle Down, Tresco; Shipman Head Down, Bryher; and Chapel Down, St Martin's. There are many acres of it on St Mary's and St Agnes and it occurs also on Samson, St Helen's and Great Ganilly.' Chapel Down consists of a flat windswept and particularly barren looking plateau, surrounded on all but its western boundary by steep rocky slopes and cliffs dropping down to the sea. The coastal fringe is interspersed with high exposed granite outcrops (carns) and sheltered hollows. The slopes are mostly occupied by heathland or a heather and grassland mosaic, but there are also areas of maritime grassland including thrift and birdsfoot trefoil, as well as patches of mixed bracken and bramble. The slopes are clearly more sheltered than the plateau, and the heather exhibits in a correspondingly less extreme fashion the characteristics described by Lousley. On its western, inland, side Chapel Down grades into rough grassland and dense thickets of gorse and bramble, some of which are now beginning to be cleared. Historically, the Down would have served as a 'common', outside the regular agricultural landscape but available for informal grazing by a hardy, and long extinct, insular breed of sheep (Thomas, 1985).

In terms of the specific requirements of *F. rufibarbis,* which is a strongly thermophilic species, the plateau seems relatively inhospitable. Not only is it windswept, it is also subject to becoming waterlogged. Rainwater fills up and remains standing in hollows among the heather, instead of rapidly draining away as it does on the slopes. It is evident that, although workers can sometimes be found foraging on the central plateau, they do not actually nest here and most of their activity is limited to the slopes. However, even a slight incline can make a considerable difference to an area's habitat potential, as it does to the relative luxuriance of the heather, so nests have in a number of cases been found right on the edge of the plateau.

It is evident that for nesting, and for foraging under suboptimal conditions (optimal being hot, sunny, and relatively still), *F. rufibarbis* requires a balance between exposure and shelter. While the plateau is too exposed, the grassland and dense stands of gorse on the landward side of Chapel Down are too shady, as are the occasional patches of bracken and bramble on the coastal slopes (although where granite rocks rise out of the bracken and bramble cover, the ants can still thrive). The core habitat may therefore be defined as a mosaic of sheltered maritime heathland and grassland with scattered granite outcrops.

On both north and south coasts of St Martin's, the distribution of *F. rufibarbis* extends westward beyond the slopes of Chapel Down in a coastal strip where the ant is hemmed in by less hospitable terrain on the landward side. This linear habitat eventually peters out as the coastal terrain becomes first marginal and then entirely unsuitable. On the south coast, the situation is more clear-cut than on the north. West of Brandy Point (the westernmost granite carn at the extremity of Chapel Down), the coastal path drops to a wide bay known as Perpitch, backed by gently sloping small fields containing rough grassland, bracken and abundant *Heracleum*. Between the fields and the sea is a very narrow strip of maritime grassland which is threatened both by erosion and by encroachment from rough vegetation spreading from the fields. Under less than ideal conditions, *F. rufibarbis* may be difficult to find here, as for example in September 2004, when only a few workers were seen, active over sparsely vegetated sandy patches at the extreme edge of the final drop to the stony beach. Under warm sunny conditions, as in June 2005, workers may be more evident, foraging conspicuously on *Heracleum* umbels in the fields.

Continuing west beyond Perpitch, the coastal path rises again to rocky terrain which is topographically not dissimilar to the slopes of Chapel Down, but where heathland and grassland have been largely suppressed by bracken and bramble and confined to a narrow coastal strip on the cliff edge. Workers of *F. rufibarbis* have been regularly seen here, active

over sunlit rocks, the coastal path itself, and the heather and short turf beside the path. This habitat continues as far as English Island Point, where there is a sudden transition as the coastal path drops toward the kilometre-long Higher Town Bay and maritime heath and grassland give way altogether to bracken and bramble, rough grassland with *Heracleum*, and dune vegetation. Along the bay itself, where extensive sand dunes are backed by small fields, *Formica fusca* is well established and *F. rufibarbis* does not occur. In September 2004, *Formica fusca* was found to occupy the lower (western) slopes of English Island Point, where bracken and brambles dominate with prolific *Heracleum*, with smaller numbers of workers extending their foraging for another thirty or so yards along the coastal path onto the heath and grassland zone. No interaction could be observed between *F. fusca* and *F. rufibarbis:* indeed there seemed to be a thirty yard gap along the coastal path between the zone of activity of the two species.

On the north coast of St Martin's, west of Bread and Cheese Cove, *F. rufibarbis* once again begins to diminish in numbers as it is confined to a narrow coastal strip. At Stony Porth, between the Cove and Burnt Hill, there is a stone boundary wall running south from the coast to meet a small walled enclosure that in turn adjoins the system of small fields that stretches across the remaining width of the island to Higher Town Bay. This wall seems to mark a historical line of demarcation between regular grazing land and the 'common' of Chapel Down, whose slope begins to rise on the eastern side of the wall. To the west of the wall and south of the coast path the vegetation consists of coarse grassland with bracken, unsuitable habitat for *F. rufibarbis,* which is therefore restricted at this point to a small strip of maritime grassland that lies to the north of the coast path. This grassland strip continues up the east side of Burnt Hill, becoming intermittent and gradually petering out, at which point *F. rufibarbis* ceases to be seen. On the hill itself, the strip is hemmed in and to some extent encroached upon by bracken and bramble, above which is more exposed waved heath resembling the Chapel Down plateau. It seems that the exposed north-south ridge of Burnt Hill, which grades at its landward end into dense areas of bracken, bramble and gorse, constitutes a barrier to the westward extension of the ant's range.

On the eastern side of Burnt Hill, exposed waved heath reaches right down to the sea. No *Formica* species have been observed in this area, but on the western side of the next bay – Bull's Porth – a more sheltered coastal strip of mixed grassland and heathland begins, and here *F. fusca* makes its first appearance on the coast path. *F. fusca* has also been recorded along a mown footpath running north-south through the bracken, bramble and gorse that occupy the land to the south of Burnt Hill. As on the south coast, there seems to be no point at which the activity of the two *Formica* species overlaps.

On the Eastern Isle of Great Ganilly, *F. rufibarbis* appeared, on my visit in 1999, to be restricted to short turf and granite rocks on the sheltered south-west coast of the north-west half of the island, plus the adjacent coast of Nornour, which is joined to Great Ganilly at low tide. None could be seen on the more exposed heathland ridge above, or on the opposite coast, or the other half of the island. Little Ganilly proved to be mostly covered with bracken, with little suitable open habitat and no *F. rufibarbis* in evidence. Great Arthur did have some open heathy ground, but no *F. rufibarbis* could be found. No *F. fusca* were found on the Eastern Islands (none were recorded here by Spooner either).

Although the limits of the range of *F. rufibarbis* on and around Chapel Down are explicable in terms of the availability of suitable habitat, there is currently no obvious explanation for its absence from apparently similar areas of coastal heath and grassland elsewhere on the islands. Even on St Martin's itself, such areas, accompanied by granite outcrops, exist at the western end of the island. Although these areas are less extensive than Chapel Down, maritime heaths on a similar scale, with the same combination of exposed and more sheltered zones and grassland components, occur on Tresco, Bryher, St Agnes, and to a lesser extent on St Mary's. Sites such as Castle Down on Tresco, Shipman Head Down on Bryher, and Wingletang Down on St Agnes appear remarkably similar to Chapel

Down. It is also the case that there are no other aculeate species that are restricted to Chapel Down, or indeed to St Martin's, and for the most part the insect fauna of corresponding habitats on different islands is very similar. Although there may be competition from *F. fusca,* which behaves very similarly on the heaths of Tresco, Bryher and St Mary's (and the western part of St Martin's), this does not explain the absence of *F. rufibarbis* from St Agnes, where neither species is found. The answer must presumably lie in the details of microclimate and the ant's need for sheltered sunny terrain: the other heathland areas must be subtly less suitable in terms of warmth and degree of exposure.

**Nature and location of nests**

The nests of *F. rufibarbis* are unfortunately difficult to locate, as there is very little visible on the surface. They tend to occupy the undersides of partially buried granite rocks emerging from the turf, or deep clefts in the larger outcrops. Under suboptimal conditions, known nests can be relocated, but warm sunny conditions are necessary for spotting fresh ones. On such occasions, a concentration of activity at the nest entrance may cause them to stand out.

Yarrow's original account of the discovery of the species on Scilly notes that he found 'several' nests 'situated beneath small lumps of rock sunk into the turf'. On 9 July 1967, under optimal conditions, Spooner (journal) found eleven colonies between English Island Point and Southward Bight (on the east coast of Chapel Down): two around English Island Point, including one 'on the edge of a granite boulder'; three at Perpitch, including 'a populous colony distributed under stones in grassy patch, by Hogweed plants on loose sand'; two at Brandy Point; three 'on heathy slopes on north side of Middle Bight'; and one 'under stone on plateau, edge of Chapel Down overlooking Pope's Hole [a cave at Southward Bight]'. He also found two colonies at Bread and Cheese Cove, presumably the same two that he mentions six days earlier as being found 'in low head cliff' (head or ram is the decayed granite that regularly forms 'soft cliffs' around the coasts of Scilly).

I first observed a nest on 16 August 1995, under warm still conditions with the ants very active. This was on the western edge of the plateau, near the Daymark. Its visible part consisted of a low half-tussock, backed up against a rock and only a few inches high, made mainly of dried heather debris (pieces of dried stems, leaves, flowers etc.). Having live heather growing all over it, it was not distinguishable from a natural heather tussock without close inspection.

On 18 July 2003, also on the western edge of the plateau, I located a nest in soil filling the gap between two horizontal granite rocks emerging from heather turf. Workers were coming and going through several entrances. This nest was relocated in September 2004.

On 13 June 2005, under optimal conditions, three nests were found. One was in a patch of maritime grassland on the north-east side of Carn Wethers, between the coast path and the cliff top. Several entrances were noted between a thrift cushion and a large flat granite rock which the cushion overtopped at its landward edge. Another was on the edge of the plateau, beside the coast path near Southward Bight, with several entrances under a heather cushion overlapping the corner of a large rock. The third nest was on the west side of Chapel Down, on the edge of the plateau looking towards Burnt Hill. Here there was a single entrance in a heather cushion growing around a small rock hummock protruding from the bare ground of the coastal path. In all three cases, nest entrances were made evident by a concentration of worker activity on adjacent bare rock surfaces.

It was my intention in 2006 to conduct a more systematic search for nests than hitherto, in an effort to estimate the overall population. Unfortunately, conditions were poor or relatively poor on all three visits to Chapel Down, and ant activity was insufficient to readily locate new colonies. Of the three nest sites found in 2005, no clear sign of activity could be found at the latter two: a few workers were active in the vicinity, but entrances

could not be located. However, the first nest at Carn Wethers was successfully relocated. On 16 May, under cool and overcast conditions, there was very little visible activity. No foraging was observed, but a few workers were active in the immediate vicinity of nest entrances. There were six visible entrances, very small and inconspicuous, about 3mm in diameter under a small thrift clump and a fringe of bare or lichen-covered black soil overlapping the rock. Lifting the thrift clump and soil fringe revealed wider galleries of over 1cm diameter just under the surface, with several workers in evidence. These galleries were leading up the slope into the deeper soil in which the landward end of the rock was embedded.

On the same day, searching of heather and thrift clumps did reveal one new nest situated about twenty-five yards seaward of the second 2005 nest. The nest was under clumps of thrift growing in soil filling a diagonal cleft in a large flat sloping rock at the foot of the granite carn on the north side of Southward Bight. When the thrift was lifted, centimetre wide galleries were revealed running deeper into the cleft, with numerous workers in evidence.

**Foraging and other behaviour**

The literature from Donisthorpe (1927) onwards repeatedly describes *F. rufibarbis* as an aggressive species, but these remarks are based upon the behaviour of the Surrey population and do not accurately characterise those on Scilly. Yarrow (1954) says that if their nest is disturbed they 'swarm out and attack the intruder after the manner of wood ants'. This is clearly not the case on Scilly, where the workers seem relatively indifferent to disturbance. When sub-surface galleries have been exposed, the workers, if they have reacted at all, have simply retreated out of view.

The need of *F. rufibarbis* for warm, sunny and relatively still conditions to stimulate activity is one of the species' most characteristic features. Although I have never failed to find it on visits in every month of the year from April to September, even on days like 25 May 2006 which was overcast and drizzly, it is often active only minimally in the immediate vicinity of its nests. Sunshine alone is insufficient if temperatures are lowered by wind: 23 May 2006, which was sunny but cool with strong westerly winds, saw no more activity than cloudy days. It may readily be imagined that on a coastal site on a small island in the Atlantic (the effects of Scilly's famously mild climate really only operate inland in the presence of trees and windbreak hedges), the number of optimal days for the ant to be fully active above ground must be relatively few over the course of a year. For example, during my fortnight's visit in May 2006, there were no optimal days. Even in late spring and summer, the ant must necessarily alternate between quite long periods of relative inactivity and sudden bursts of surface activity, taking advantage of suitable conditions for as long as they may last.

Looking for the ant under suboptimal conditions could give the impression that its population is relatively small and potentially vulnerable, while on a good day, with numerous workers running in sunshine over heather, short turf, bare ground and rocks, it can be seen to be thriving. It is possible that earlier pessimistic assessments of the species' status on Scilly were due to this phenomenon. Falk (1991) speaks of its having 'apparently not been seen at St Martin's since about 1980 when colonies were found to be weak', and I have heard other anecdotal information to that effect from the same period. It is possible that climatic circumstances such as the 1976 drought put the population under temporary stress, from which it subsequently recovered, but it is equally possible these accounts derive from visits on cooler days. Curiously, on the occasions when nests were observed under cool conditions in May 2006, it was noted that it was the small gracile workers that were still active outside their nest entrances, while the larger more robust ones were only visible when turf was partially lifted to look inside the nest. If this represents the general pattern of behaviour, it could also give a mistaken impression of declining vigour in the population.

The variety in size of workers is mentioned as early as Yarrow's first report: they range from individuals that are close to wood ant (*F. rufa*) size to others that are nearer to *F. fusca*.

Observation of foraging activity confirms that *F. rufibarbis* is mainly dependent on small or medium-sized invertebrates. The tussocks of heather, along with other plants such as thrift, that characterise its habitat conceal a rich invertebrate fauna, with large populations of woodlice, terrestrial amphipods, centipedes, millipedes, earwigs, lygaeid bugs, springtails, spiders, mites, small annelids, etc.. On 13 June 2005, prey being brought into the nest at Carn Wethers included a small lepidopterous larva, various lycosid and other spiders, an elaterid beetle (Athous) and an amphipod. Plant material including thrift seeds was also being gathered (on 18 July 2003, what appeared to be tiny green heather shoots were being brought into a nest). On 16 August 1995, workers were seen capturing *Myrmica* alates, although generally they seem to ignore the many other ants that inhabit Chapel Down. Workers have also been observed visiting the flowers of umbellifers, a behaviour generally more characteristic of *F. fusca*, but such flowers are not widely available in the ant's core habitat. Spooner (journal) saw 'large workers at *Heracleum* and *Daucus'* at Perpitch on 9 July 1967, and again on 25 July 1970. On two occasions in June 2005 I observed workers at *Heracleum* umbels at this same spot, in the rough grassy fields behind the coastal strip which at this point provides the ant's primary habitat.

**Relations with other ant species**

*F. rufibarbis* shares Chapel Down with a variety of other ant species comprising most of the Scillonian fauna. Leaving aside secretive species like *Myrmecina graminicola* which are rarely seen, there are large populations of *Lasius flavus, L. psammophilus, Myrmica scabrinodis, M. ruginodis, M. sabuleti* and *Tetramorium caespitum* nesting under stones and heather or thrift tussocks. The population density of these species is considerably greater than that of *F. rufibarbis*, with up to one in three tussocks on the southern slopes of Chapel Down disclosing an ant nest beneath.

For the most part, there appears to be no obvious interaction between *F. rufibarbis* and these other species. Even where, as is usually the case, they are nesting in close proximity, each colony apparently ignores the other. On 18 July 2003, *Myrmica scabrinodis* was nesting in soil between two rocks, alongside *F. rufibarbis*: workers of both species were actively foraging, but without reacting to each other. On 16 May 2006, it was noted that *F. rufibarbis* nest entrances at Carn Wethers and Southward Bight were situated within a few centimetres of nests of *Lasius flavus*. The latter were in soil beneath thrift tussocks but, unlike *F. rufibarbis*, with brood chambers close to the surface and disclosed to view when the tussocks were lifted. At Carn Wethers on 23 May, when turf was raised to look inside the *F. rufibarbis* nest, workers from the nearby *L. flavus* nest were walking about among the *rufibarbis* workers, neither paying any attention to the other.

However, that *F. rufibarbis* does, at least occasionally, prey on other ants is indicated by events observed on 16 May 1995. On this warm still day, a combined nuptial flight of the site's three *Myrmica* species was in progress, and *F. rufibarbis* workers were running up heather stems on which *Myrmica* alates were settled, seizing them, and carrying them down into their nest.

The most interesting and enigmatic relationship is that between *F. rufibarbis* and *F. fusca.* Certainly, the two species are mutually exclusive in their distribution on St Martin's (and on the Eastern Isles, where *F. fusca* does not occur). *F. rufibarbis* has sole possession of Chapel Down and additional coastal strips on the island's north and south coasts, while *F. fusca* occupies similar coastal heathland and grassland at the western end of the island, as well as on the other inhabited islands with the exception of St Agnes (*F. fusca* does, of course, have a much wider range of habitats, both on St Martin's and elsewhere, including sand dunes, agricultural land and gardens). At other maritime heathland sites, *F. fusca*

behaves similarly to *F. rufibarbis*, and appears to be occupying an identical ecological niche. On the coasts of St Martin's west of Chapel Down, the foraging ranges of the two species come quite close together (at English Island Point no more than thirty yards), but no interaction has been observed. Further observation is required to determine if, as seems to be the case, there really is a 'zone of separation' which neither species ventures into: on the north coast, there appears to be a barrier of inhospitable terrain, but that is not the case at English Island Point.

The perhaps only temporary colonisation around 2002 of the uninhabited island of Tean at the western end of St Martin's is interesting in this regard, as *F. fusca* does occur on this island. If *F. rufibarbis* attempted but failed to establish itself, this might be seen as providing evidence for inter-specific competition. If such competition is the explanation for the two species' distribution on St Martin's, we must presume that only in the context of the microclimate of Chapel Down and its immediate environs does *F. rufibarbis* have an advantage over the other species.

Spooner (1968) speculated that *F. rufibarbis* was the original indigenous member of its genus on Scilly, and that *F. fusca* might have been accidentally introduced through human agency, competing with the native species and eventually displacing it everywhere except St Martin's and the Eastern Isles. However, this scenario fails to explain the absence of *F. rufibarbis* from apparently suitable habitat on St Agnes, where F. fusca does not occur.

**Nuptial activity and colony founding**

John Pontin (2002, 2005) has described the remarkable courtship behaviour of *F. rufibarbis* at its Surrey colonies, with the alate females climbing tall vegetation to call the males through the emission of pheromones. It would be of great interest to discover if this behaviour is replicated on Scilly, but no one has yet been in the right place at the right time to observe it. As calling is likely to be spread over at least a couple of weeks, as in Surrey, it is at first sight surprising that it has not yet been seen (considering, for example, that I have visited the site in every month of the year from April to September, including three visits in July and one in June). However, the erratic weather of Scilly presents considerable obstacles.

On 9 July 2001, I found a dealated female running over the footpath at Brandy Point, indicating that a period of nuptial activity had recently taken place. At the time I postulated that this was likely to have happened during a period of unusually hot weather on the islands which peaked around 24 June. Curiously, Spooner (journals) found two dealated females at exactly the same time of year (9 July 1967), during his survey of the ant's range on and around Chapel Down.

It is reasonable to assume that courtship activity is highly dependent on suitable weather conditions, i.e. those that I have characterised as 'optimal' for the species' activity in general. Although both my and Spooner's observations indicate the second half of June as the most likely time to see the females calling, the timing could well vary greatly from year to year, making it difficult for a non-resident observer to be sure of catching the event. A continuous spell of warm, sunny and relatively windless weather, as occurred in June 2001, would present perfect conditions, but odd suitable days interspersed by less ideal weather might also be taken advantage of, with the females emerging from and retreating to cover according to the prevailing conditions. The possibility should also be borne in mind that some years might be 'skipped' altogether, as Donisthorpe (1927) seems to imply.

No information is currently available on colony founding, but the discovery of a population on the uninhabited island of Tean in 2002, which appeared to be a relatively recent arrival (and may subsequently have died out), may indicate an at least temporarily successful colonisation event. If that is the case, it would indicate that fertilised females can and do disperse to sites at a relatively long distance from Chapel Down. Similarly, if Yarrow really did find his first nests 'near one of the landing places', that too might have

been a case of temporary establishment by females dispersing west from Chapel Down.

**Conservation**

Documentary evidence demonstrates that the range of *F. rufibarbis* on St Martin's and the Eastern Islands has remained constant since at least 1967, when Spooner first charted its habitat. Spooner thought it might be in the process of retreating before the advance of *F. fusca*, but if this was ever the case the process has now ceased and the two species have reached a stable balance. So far as Chapel Down and its coastal slopes is concerned, it is likely that the ant's population has also remained constant. However, in marginal areas such as Perpitch and English Island Point, the area of usable habitat will have been pushed back over the last four or five decades by the encroachment of bracken, bramble, gorse and other coarse vegetation, confining the ant to a narrow coastal strip. On all the more sheltered coasts of Scilly, such encroachment is in evidence, caused by the decline of informal grazing and the cessation of older agricultural practices such as the harvesting of bracken as winter bedding for cattle. As has been mentioned above, there are also stands of bracken in sheltered hollows on the slopes of Chapel Down, but the spread of these elsewhere on the Down will generally be prevented naturally by a combination of thin soils, rocky terrain and exposure.

The entire area occupied by *F. rufibarbis* on St Martin's (and on the Eastern Isles) forms part of the untenanted land leased by the Isles of Scilly Wildlife Trust from the Duchy of Cornwall. The current management plan emphasises the maintenance and expansion of heathland and maritime grassland, including progressive removal of encroaching bracken, bramble and gorse. Such a policy would ensure the survival of the ant within its current range and also open the possibility of expansion in marginal areas on the north and south coasts such as Perpitch, English Island Point and Burnt Hill. It is possible the landward end of the plateau, with its dense stands of gorse, would be sheltered enough to support nesting if it were restored to heathland.

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**References**

Beavis, I C, 2000. Aculeate Hymenoptera on the Isles of Scilly. Entomologist's Gazette, 51, 59-68.

Beavis, I C, 2005. Aculeate Hymenoptera on the Isles of Scilly – first supplement. Entomologist's Gazette, 56, 189-204.

Donisthorpe, H St.J K, 1927. British ants, their life-history and classification. London: George Routledge & Sons Ltd.

Falk, S J, 1991. A review of the scarce and threatened bees, wasps and ants of Great Britain. Peterborough: Nature Conservancy Council.

Lousley, J E, 1971. The Flora of the Isles of Scilly. Newton Abbot: David & Charles.

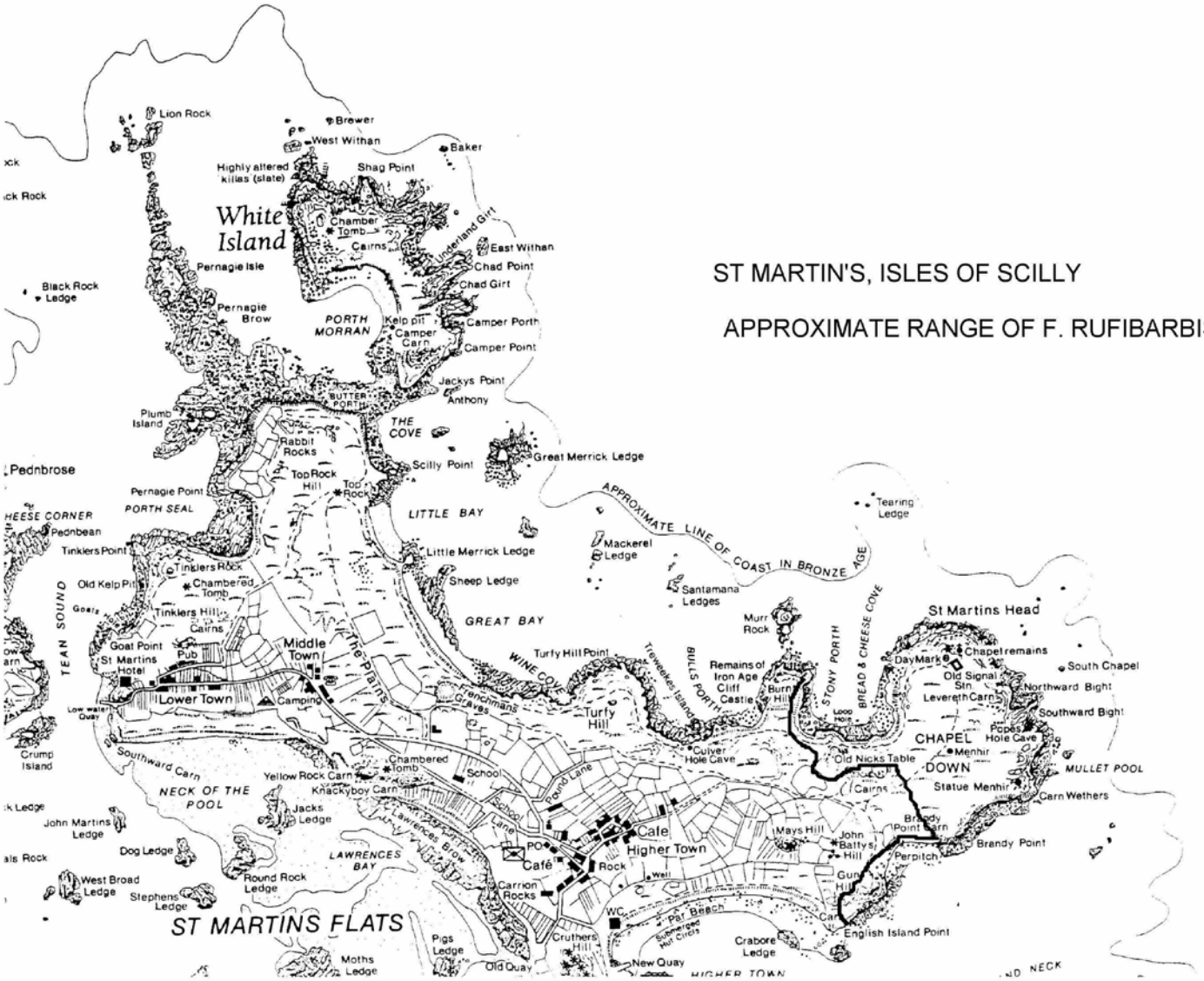
Pontin, J, 2002, in Edwards, R & Telfer, M, eds. Provisional atlas of the aculeate Hymenoptera of Britain and Ireland. Part 4. Huntingdon: Biological Records Centre.

Pontin, J, 2005. Ants of Surrey. Woking: Surrey Wildlife Trust.

Shirt, D B, ed. 1987. British Red Data Books: 2. Insects. Peterborough: Nature Conservancy Council.

Spalding, A, ed. 1997. Red Data Book for Cornwall and the Isles of Scilly. Praze-an-Beeble: Croceago Press.

Spooner, G M, 1968. Records of three uncommon Formica species. Entomologist's


ST MARTIN'S, ISLES OF SCILLY
APPROXIMATE RANGE OF F. RUFIBARBIS
White Island
Lion Rock
Brower
West Withan
Baker
Highly altered killas (slate)
Shag Point
Chamber Tomb
Cairns
Underland Girt
East Withan
Chad Point
Chad Girt
Pernagie Isle
Black Rock Ledge
Pernagie Brow
PORTH MORRAN
Kelp pit
Camper Carn
Camper Porth
Camper Point
Jackys Point
Anthony
BUTTER PORTH
Plumb Island
THE COVE
Rabbit Rocks
Great Merrick Ledge
Pednbrose
Top Rock Hill
Top Rock
Scilly Point
Pernagie Point
PORTH SEAL
LITTLE BAY
APPROXIMATE LINE OF COAST IN BRONZE AGE
Tearing Ledge
HEESE CORNER
Pednbean
Tinklers Point
Tinklers Rock
Chambered Tomb
Little Merrick Ledge
Mackerel Ledge
Old Kelp Pit
Goats
Tinklers Hill Cairns
Sheep Ledge
Santamana Ledges
TEAN SOUND
GREAT BAY
Murr Rock
St Martins Head
Goat Point
St Martins Hotel
Pub
Middle Town
The Plains
Turfy Hill Point
WINE COVE
Trewekes Island
BULLS PORTH
Remains of Iron Age Cliff Castle
Burnt Hill
STONY PORTH
BREAD & CHEESE COVE
Day Mark
Chapel remains
South Chapel
Old Signal Stn
Northward Bight
Levereth Carn
Southward Bight
Lower Town
Camping
Low water Quay
Franchmans Graves
Turfy Hill
Culver Hole Cave
Popes Hole Cave
CHAPEL DOWN
Menhir
Old Nicks Table
Cairns
MULLET POOL
Statue Menhir
Carn Wethers
Crump Island
Southward Carn
Chambered Tomb
Yellow Rock Carn
School
Pound Lane
NECK OF THE POOL
Knackyboy Carn
Jacks Ledge
John Martins Ledge
Dog Ledge
Lawrences Brow
Cafe
Higher Town
PO
Café
Rock
well
Mays Hill
John Batty's Hill
Brandy Point
Perpitch
Gun Hill
LAWRENCES BAY
West Broad Ledge
Stephens Ledge
Round Rock Ledge
Carrion Rocks
WC
Par Beach
Submerged Hut Circles
Cruthers Hill
Crabore Ledge
English Island Point
ST MARTINS FLATS
Pigs Ledge
Moths Ledge
Old Quay
New Quay
HIGHER TOWN

Monthly Magazine, 104, 130-131.

Spooner, G M. Unpublished journals. Natural History Museum, London.

Thomas, C, 1985. Exploration of a drowned landscape, archaeology and history of the Isles of Scilly. London: B T Batsford Ltd.

Yarrow, I H H & Guichard, K M, 1941. Some rare Hymenoptera Aculeata, with two species new to Britain. Entomologist's Monthly Magazine, 77, 2-13.

Yarrow, I H H, 1954. The British ants allied to Formica fusca L. Transactions of the Society for British Entomology, 11, 229-244.

**2.3.4** Clearly there is much autecological and habitat management research which could be followed up from this excellent account and Hymettus should be actively engaged with the other conservation organisations with interests in the Scillies. It would also be worth testing Scillies' nests for mono- or poly -gyny. However, the exact nature of the contribution to work on this species should await the outcome of the proposed meeting for the ZSL project.

## 3. Eumenid wasps.

### 3.1 Euodynerus quadrifasciatus

**3.1.1** This project was undertaken by George Else and Stuart Roberts, George's report follows, again this contains very valuable background information, vital to future research:-

### 3.1.2 Provisional observations on the autecology of *Euodynerus quadrifasciatus* (Fabricius, 1793) (Hymenoptera, Vespidae, Eumeninae) at the Isle of Portland, Dorset, June 2006

**Introduction**

The eumenid wasp *Euodynerus quadrifasciatus* (Fabricius, 1793) is the only representative of its genus in Britain and is one of the rarest and enigmatic of British aculeates. It has been accorded RDB Category 3 (i.e. Rare) status in the Red Data Book (Shirt, 1987), though revised to Vulnerable by Falk (1991). However, in view of the species great rarity and extreme localisation in Britain, consideration should be given to raising this to RDB1 (Endangered) should a revised edition of the RDB be published in the future. Currently the species is known from just three British localities: Isle of Portland (west coast), Dorset; East Prawle, Devon; Thursley Common, Surrey. There are old, confirmed records from Burghfield Common, Berkshire, and Sidmouth, Devon. In addition, there are three unconfirmed records: Bagshot Heath, Surrey; Silwood Park (near Ascot), Surrey, and several specimens probably from the Bristol district (see notes in Appendix below). An annotated list of all known British records for the species is presented in the Appendix to this report. A map of its known British distribution has been presented by Archer (2003). The species is widely distributed in the Palaearctic, the range extending from Fennoscandia south to Morocco, east to Mongolia and Japan (Archer *in* Edwards & Telfer, 2001).

Virtually nothing is known about the species' nesting behaviour, prey and nectar preferences. To elucidate further information on these topics we were asked at the Aculeate Conservation Group (Hymettus) Annual Meeting in January 2006 to undertake a survey in a known site for the wasp the following summer.

**Habitats in Britain**

We selected the north-west area of the Isle of Portland, Dorset, for the survey. This had the advantages that we had previously found the species in local abundance there (eighteen specimens of both sexes) on May 29th, 1990, and the locality was nearer to home than East Prawle (where we had also recorded the species in 1990). Accordingly three visits were made to Portland in 2006: June 6th, June 17th and June 30th. On the first two dates we concentrated solely on West Cliff. This site mainly comprises an abandoned limestone quarry, much overgrown, particularly by *Cotoneaster horizontalis* and *Rubus fruticosus* agg. Amongst the rubble are areas of open calcareous grassland supporting a flora typical of such habitat, especially vetches such as *Hippocrepis comosa* and *Lotus corniculatus* (photo. 1). On our 1990 visit we had observed some *Euodynerus* visiting the flowers of the *Cotoneaster* (Else, 1992) and, accordingly, much time was spent on all three visits in 2006 examining these flowers (particularly in the area of our previous success) but without result. No *Euodynerus* were recorded at West Cliff on the three dates in June this year despite very favourable weather conditions (hot with unbroken sunshine). M.E. Archer, who independently recorded aculeates at West Cliff on several days in late June, did, however, find one specimen of *Euodynerus*. However, other eumenid wasps were found by us on the Cliff: *Odynerus melanocephalus* (common), *Ancistrocerus gazella* (common) and *A. oviventris* (a few). The latter species caused one enduring problem for us, as it very closely resembles *E. quadrifasciatus* in the field, both in size and colour. Indeed, it was necessary for us to retain such specimens and confirm their identity at home, beneath a binocular microscope. Both the *Euodynerus* and *A. oviventris* have often been found flying together on Portland by us and, on an earlier occasion, by G.M. Spooner (Spooner, 1929, as *A. pictus*). The two species also occurred together at East Prawle (pers. obs.).

Photo 1. Limeston boulders together with the flowers of *Lotus* and *Hippocrepis* characterise the West Cliff Quarry.

In June of this year GRE was able to loan the collecting diaries of the late G.M. Spooner who had bequeathed them to the Entomology Library of the Natural History Museum, London. From these (and from his material of *E. quadrifasciatus* in the Museum's collection) it was learnt that Spooner visited Portland to record aculeates on many occasions between 1929 and 1965. He often found the wasp at Church Ope Cove (sometimes spelt Cope Cove)

and West Weare. The slope from West Cliff to the shore below is known as West Weare and has been designated a SSSI. It is strewn with dislodged boulders and, on the lower sections, is largely overgrown (photo. 2). Access to these slopes is possible from the public footpath that skirts the shore but is not easy. Exactly where Spooner had found the wasp remains a mystery but, according to his diary, most was apparently collected "in usual place". Some of his records refer to the wasp flying over the beach. We visited West Weare on the morning of June 30th (the afternoon being spent on West Cliff). It was here that we at last found four specimens of the *Euodynerus*: two females and two males, three of which were flying about the accumulated talus on the lower slopes, the fourth on the shore. *A. oviventris* was present both in this site and, later in the day, on West Cliff.

Photo 2. The boulder-strewn beach area at West Wear, (West Cliff top left).

**Photo 3. Close-up of the beach area in photo 2, with holes in pebbles marked x and y.**

Other habitats exist elsewhere in Britain. At East Prawle, Devon, the wasp has been found flying about the low sandy cliffs at Langerstone Point, also in company with *A. oviventris* (pers. obs.). At Sidmouth, in the same county, the species nested in pebbles on the beach (Spooner, 1943). On two consecutive days in July 2002 D. Baldock (pers. comm.) found the wasp at Thursley Common (Shrike Hill), Surrey, for the first time. The devastating fire in July 2006 destroyed much of the Common and it remains to be seen if the wasp survived.

**Nesting requirements and prey**

R.C.L. Perkins is apparently the only person to have located nests of *E. quadrifasciatus* in Britain. The wasp was reported to have been nesting in cavities in beach pebbles at Sidmouth, Devon (Spooner, 1943). The nest, however, is not described and it is possible that only an individual was seen to enter such a cavity. Spooner observed a female entering a hole in a pebble on the shore at West Weare on June 17th 1962. Finally, on June 30th 2006 GRE encountered a female hovering about two neighbouring rocks on the shore. At this point the footpath traversed a small section of beach, this consisting entirely of large pebbles. One of the rocks contained numerous natural holes, presumably ideal as prospective nesting sites (fig. 3).

Witt (1998) illustrates a female *E. quadrifasciatus* nest-building. The specimen is shown holding a mud pellet in its mandibles. However, he not does describe the nest in any detail, only reporting that nests are established in old mortar bee nests (such as *Megachile parietina*) and some other Eumeninae (including *Odynerus spinipes*). GRE wrote to Witt for further details but received no reply. On Thursley Common, Surrey, D. Baldock (pers. comm.) watched two female *Euodynerus*, in company with several female *Eumenes coarctatus*, collecting clay pellets from a patch of exposed soil on the open heath. Interestingly, M.E. Archer, while engaged in recording aculeates on West Cliff in late June 2006, came across a large rock in which a number of natural holes had been plugged with mud. These would seem to accord with the published description of the nest of *E. quadrifasciatus*. Unfortunately, *A. oviventris* builds a similar nest from mud but, on available evidence, is a "dauber" building exposed nests on the surfaces of rocks and other substrates, though crevices may be used. In contrast, *E. quadrifasciatus* apparently only utilises cavities of appropriate sizes as nest sites.

In Germany, C. Schmid-Egger (pers. comm.), in quoting from one of his papers, reports that nests of *E. quadrifasciatus* were found in dry wood, but also in old nests of *Odynerus spinipes* and *Chalicodoma*. This would appear to be the basis for Witt's remarks on nest sites for the wasp. Schmid-Egger further states that Schrameyer found nests in a wooden stake and that Westrich found males in a trap-nest (probably artificial holes in wood, but there is no detailed description of the trap-nest).

The only prey items recorded (on mainland Europe) for *E. quadrifasciatus* are the larvae of Tortricidae and Chrysomelidae (Witt, 1998).

**Nectar sources**

*E. quadrifasciatus* has been observed imbibing nectar from the flowers of *C. horizontalis* (pers. obs). Spooner, in his diaries, lists the flowers of *Taraxacum officinalis* agg. as nectar sources on Portland.

**Summary**

Clearly *E. quadrifasciatus* still survives at West Weare, Portland, though it is very local and the population would seem to be small and vulnerable. There is anecdotal evidence that in Britain the wasp nests in suitable cavities in rocks. The prey in Britain is unknown.

**References**

ARCHER, M.E. 2003. *The British Potter and Mason Wasps. A Handbook.* Bees, Wasps and Ants Recording Society.

EDWARDS, R. & TELFER, M.G. [Eds.]. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland. Part 3.* Biological Records Centre, Huntingdon.

ELSE, G.R. 1992. Two little-known wasps: *Homonotus sanguinolentus* (F.) and *Euodynerus quadrifasciatus* (F.) (Hym., Aculeata) in southern England in 1990 and a review of their occurrence in Britain. *Entomologist's Monthly Magazine.* **128**: 67-68.

FALK, S.J. 1991. *A review of the scarce and threatened bees, wasps and ants of Great Britain*. Research and Survey in Nature Conservation, no. 35, Nature Conservancy Council, Peterborough.

PERKINS, R.C.L. 1900. *Odynerus tomentosus,* Thoms., a species new to Britain, and some remarks on the Walcott Collection of Aculeate Hymenoptera. *Entomologist's Monthly Magazine.* **36**: 172-174.

RICHARDS, O.W. 1958. Two rare species of *Odynerus s.l.* (Hym., Vespidae). *Entomologist's Monthly Magazine.* **94**: 192.

SHIRT, D.B. [Ed.]. 1987. *Insects*. British Red Data Books, 2. Nature Conservancy Council, Peterborough.

SPOONER, G.M. 1929. *Leionotus tomentosus* Thoms. in Dorset. *Entomologist's Monthly Magazine.* **65**: 262.

SPOONER, G.M. 1943. The Hymenoptera Aculeata in the Dale Collection. II. Notes on the Bethylidae, Chrysididae, Vespidae and Sphecidae (Part). *Entomologist's Monthly Magazine*. **79**: 64-77.

WITT, R. 1998. *Wespen beobachten, bestimmen*. Naturbuch-Verlag, Augsburg.

## Appendix

Annotated list of British records of *E. quadrifasciatus* arranged under counties.
"NHML" = Natural History Museum, London, collection.

**Berkshire**

Burghfield Common. 1 m vi.1931. E. Burtt. (NHML).

**Devon**

Sidmouth (near). 1 f 1929. R.C.L. Perkins (Spooner, 1929).

Sidmouth. 1 f 27.v.1930. R.C.L. Perkins. (NHML).

East Prawle Langerstone Point. SX784354. Several (both sexes) 30.v.1978. M. Edwards, G.R. Else and G.M. Spooner. One individual of the wasp was covered in *Meloe* triungulins.

East Prawle, Langerstone Point. 27.v.1990. G.R. Else.

**Dorset**

Isle of Portland (information in square brackets obtained from the G.M. Spooner collecting diaries held by the Entomology Library, NHML):

Portland. 1 31.v.1842. J.C. Dale. (Spooner, 1943).

Portland. 1 m 26.vi.1929. G.M. Spooner. (NHML). [Church Hope Cove.]

Fortunes. 1 m 21,vi.1939. K.M. White. (NHML). Probably Fortuneswell and likely to have been either West Cliff or West Weare.

W. Weare. 2 f 14.vii.1950. G.M. Spooner. (NHML). [West Weares [sic] with C.D. Day. Over stones on edge of shore]

W. Wear. 1 m 27.vi.1951. C.D. Day. (NHML).

W. Wear. 1 f, 1 m 14.vi.1952. G.M. Spooner. (NHML).

Ope Cove. 1 f, 2 m 10.vi.1957. G.M. Spooner. (NHML). [Hope Cove and Quarries…. after 6 p.m. Flying over bramble bush behind 2 huts, on N. side of Cove….]

W. Wear. 1 m 29.vi.1958. G.M. Spooner. (NHML). […southerly of gulley.]

W. Wear. 2 f 13.vii.1959. G.M. Spooner. (NHML). […over *Rubus* in usual place. One at *Rubus* fl. ….]

W. Wear. 2 f, 8 m 17.vi.1962. G.M. Spooner. (NHML). [m were flying over bramble (not in flower), and other vegetation also over beach of large pebbles. One f was actually taken after entering her "burrow" – a hole in one of the large stones on the beach – many stones have holes.]

W. Wear. 2 f 17.viii.1962. G.M. Spooner. (NHML).

W. Wear. 2 f, 2 m 23.vi.1963. G.M. Spooner. (NHML).

W. Wear. 1 f, 6 m 7.vi.1965. G.M. Spooner. (NHML). [Flying over edge of beach and on low brambles……One f at dandelion.]

West Cliff. 5 f, 13 m 29.v.1990. G.R. Else.

West Wear SSSI. 2 f, 2 m 30.vi.2006. G.R. Else & S.P.M. Roberts.

Church Ope Cove: SY696706.

West Cliff: SY683721.

West Weare: SY681726.

**Surrey**

North of Thursley, Thursley Common. 1 f 16.vii.2002. Collecting clay. D. Baldock. (NHML). 1 f 17.vii.2002. Collecting clay. D. Baldock. [Latter not collected.] Both at SU902412.

**Unconfirmed records or where exact provenance uncertain.**

**Berkshire**

Silwood Park (near Ascot). 1 m.vii.1956. R. Smith. Record published (Richards, 1958) but the specimen is either lost or was possibly misidentified.

**Gloucestershire**

There are several specimens in the Walcott Collection, University Museum, Cambridge, which lack locality data but are considered to have been collected near Bristol. Some of the specimens carry labels marked May 28th, 1841 (Perkins, 1900).

**Surrey**

Bagshot Heath. 1 f 20.vi.1950. O.W. Richards. Flying over heather. Record published (Richards, 1958) but the specimen is either lost or was misidentified. Richards' collection was passed to the NHML during his lifetime.

### 3.2 Odynerus melanocephalus

**3.2.1** Following on from the very successful research on this species in Warwickshire, undertaken by Steven Falk during 2005 (20005 ACG Report), we decided to investigate whether the conclusion that *O. melanocephalus* exclusively hunts larvae of the beetle *Hypera postica* holds in different localities. Accordingly we asked John Hunnisett to investigate on the west Dorset Coast around Eype Mouth. John's Report is reproduced below:

#### 1. Summary

During the summer of 2006 an investigation was carried out to discover how the biology of the Nationally Scarce Mason Wasp *Odynerus melanocephalus* (Gemelin) (Hymenoptera: Vespidae: Euminae) on the Dorset coastal soft cliffs compared to that discovered by S. Falk for the same species on the post industrial sites Warwickshire (Falk.2005).

Discovery and excavation of a nesting burrow confirmed that O.melanocephalus was using partially paralysed larvae of the weevil *Hypera postica* (Gyllenhall) (Coleoptera: Curculionidaeas) taken from Black Medick *Medicago lupulina* as a food source for its larvae.

A new inland site within an old brickworks at Crookhill Brick Pit near Weymouth has been discovered, and the extent of previously know sites along the soft cliffs in the region of Eype Mouth have been increased.

Territorial action of males was observed for a period of approximately twenty minutes at each of two sites.

The chrysidid wasp *Pseudospinolia neglecta* (Schuckard) was found in close proximity to the areas being used by *O.melanocephalus* at the three sites under observation.

## 2. Introduction

During 2005 a project was commissioned by the Aculeate Conservation Group to investigate the autecology of *Odynerus melanocephalus* and *O. spinipes* in Warwickshire. Valuable information was discovered regarding the larvae of *Hypera postica* being used as the food prey of *O. melanocephalus*.

This study, to check if those findings using a population within a different type of habitat, i.e. the soft clays of the Dorset coast held true was commissioned by Hymettus Ltd, using funding by English Nature.

All available historically records for *O. melonocephalus* in Dorset are shown in Table 1. From this it can be seen that there were very few sightings between the late 1980's and early 2005 probably due to lack of recorders rather than lack of insects. The recorded sites for *O. melanocephalus* in Dorset can be separated into three time periods i.e. early and mid 1900's, the 70's and 80's and post 2004. Information on the early sites consists of a date and rough location whilst that of the later sightings gives an ordinance grid reference and some data regarding habitat. The most prolific area for all time periods is the coast between Lyme Regis and Eype Mouth all of which is covered by Open Access or belongs to The National Trust. Although historically West Weare appears to be the site with the most records there have been no available records of sightings since 1962. Therefore that part of the coast westward of Eype Mouth was chosen as a start point as *O.melanocephalus* was found here during a study on soft cliffs carried out by DERC on behalf of Buglife in 2005.

Whilst they were not chosen as specific sites at the beginning of the study sites at West Weare, Portland and Crookhill Brick Pit, near Weymouth were also investigated.

| | | |
|---|---|---|
| Glanvilles Wootton<br>Grid Ref not given (ST6708) | 03.vi.1901 | Inland site, exact type of habitat unknown |
| Monmouth Beach<br>SY334915 | vii.1986 | Coastal soft cliffs |
| Lyme Regis<br>Grid Ref not given (SY3492) | vii.1905 | Coastal soft cliffs |
| Charmouth to Lyme Regis coastal cliffs<br>SY3593 | 4.vi.1951, 10.vi.51, 27.vi.1956, 22.vi.1975, 6.v.1980, 18.vi.1983, 16.vi.1984, vii.1986. | Coastal soft cliffs<br>Middle and Lower lias |
| St Gabriels<br>SY398922 | 18.v.2005 | Coastal soft cliffs<br>Middle and Lower Lias |
| Eype Mouth<br>SY4491 | 17.v.2005, 27.v.2005, 8.vi.2005, | Coastal soft cliffs<br>Middle and Lower Lias |
| Chideock<br>SY415919 | 27.v.1978<br>02.vi.1978 | Coastal soft cliffs |
| Abbotsbury<br>Grid Ref not given<br>(SY5785) | 22.vii.1956 | Coastal shingle |
| Smallmouth, Weymouth<br>Grid Ref not given<br>(SY6676) | 21.vi.1929 | Low coastal cliffs now developed |
| Wyke Regis | 23.vi.1874 | Habitat unknown |
| Radipole Lake, Weymouth<br>Grid Ref not given<br>(SY6680) | 11.vi.1925<br>to<br>28.vii.1948 | Originally estuary, now inland lake with controlled level |
| Two Mile Copse, Weymouth<br>Grid Ref not given<br>(SY6721) | 23.v.1943 | Inland site adjacent to Lorton Meadows. Dorset Wildlife Trust Reserve. Neutral grassland |
| Gad Cliff | 3.vii.1937 | Coastal soft cliffs |
| Clay Ope, Portland<br>Grid Ref not given<br>(SY6872) | 22.vi.1946 | Coastal cliffs with some soft cliffs, now more or less scrubbed over |
| West Weare, Portland<br>Grid Ref not given<br>(SY6872) | 23.vi.1932, 22.vi.1945, 20.vi.1950, 14.vi.1952, 29.vi.1958, 17.vi.1962 | Coastal cliffs with some soft cliffs, now more or less scrubbed over. Kimmeridge Clay topped with limestone quarry waste |
| West Cliff<br>SY683725 | 5.vi.1993 | Basic calcareous unimproved lowland grassland |
| Lulworth. Grid ref not given (SY8280 | 7.viii.1878 | Possibly coastal site with unknown habitat |
| Wood Street. Grid ref not given (SY8685) | 22.vi.1924; 24.vi.1924 | Inland site with unknown habitat |
| Houns Tout<br>SY953770 | 7.vi.2005 | Coastal soft cliffs |
| Chapman's Pool<br>SY957769 | 26.vi.1983 | Coastal soft cliffs<br>Kimmeridge Clay |
| Harman's Cross. Grid ref not given (SY9880) | 17.vi.1943; 22.vi.1943; 23.vi.1945 | Inland site with unknown habitat |
| Swanage. Grid ref nor given (SZ0278) | vi.1900 | Possibly coastal site with unknown habitat |

**Table I. Historical Dorset records of *Odynerus melanocephalus***

**2. Observations**

**Eype Mouth. Grid Ref SY445910. 7/6/06. 10:00 – 13:00**

The weather was warm and sunny with a slight breeze off the sea. The area being surveyed was a length of coastal soft cliffs stretching from Eype Mouth to approximately 300 metres to the west all of which is classified as an SSSI and which is owned by The National Trust. The overall gradient was approximately $45^0$, although there were many gentle sloping or flat ledges suitable for the wasp to excavate its burrow. (Photo 4). The first *O. melanocephalus* were found within five minutes of beginning the search, alternately flying over a large patch of *Lotus corniculatus* and exploring nearby bare areas of soil, small mats of *Medicago lupulina* were also present but there was no signs obvious signs of feeding larvae. By slowly progressing along the cliff (approximately half way up) at least 8 individuals were seen all carrying out the same procedure. Despite a careful search of area no nesting burrows could be found and none were seen carrying prey. Those 'resting' on bare soil were extremely skittish and would fly off at the slightest hint of approach hence making photography impossible. One female was observed nectaring on the flowers of *Armeria maritime*, Thrift.

**Photo 4. The coastal cliffs at Eype.**

**Crookhill Brick Pit. Grid Ref SY643807. 9/6/06. 10:00 – 12:30.**

The Crookhill Brick Pit is a site classified as an SSSI with an area of 4.77 hectares and is under the control of the Weymouth & Portland Borough Council as a Nature Reserve. It comprises clays and shale from the Middle Jurassic specifically the Middle and Lower Oxford Clays. I am in the process of carrying our an invertebrate survey for the site and on a prior visit two weeks earlier I found a single male *O.melanocephalus* (taken as a voucher specimen for the site) flying back and forth along a bank of sparse vegetation intermingled with partially exposed bricks. Other aculeates have been taken from this bank including *Andrena thoracia, A.flavipes, A.clarkella and Nomada marshamella* and there were many nesting burrows present. Also taken in a water trap on the same day were two specimens of *O.spinipes,* however, these were not taken from the bank but from an area close by enclosed by sallow and brambles.

On this occasion the weather was warm and sunny with slight breeze and the first *O. melanocephalus* was found flying low over a flat sparsely vegetated area on the edge of a recently formed pond. Despite a careful search no obvious *O. melanocephalus* burrows could be found although many burrows were being used *by Lasioglossums*. Two further specimens were found in a small clearing a short distance away and were intermittently followed for a period approximately 20 minutes. In each case they would fly off for approx. a minute and come back to the same prominent stone where they would stop for approx. ten seconds and again fly off. When returning to the clearing they would make efforts to drive away any other bees/wasps in the immediate vicinity. Present in the immediate vicinity were various *Trifoliums* but no *Medicago* or *Lotus* although both of these plants are recorded from other parts of the site.

**West Weare, Portland. Grid Ref SY683731. 10/6/06. 11:00 – 14:00.**

West Weare is an area within the Isle of Portland SSSI with a southern aspect. It has a base of Kimmeridge clay that is in many areas is topped by tipped limestone waste from the quarries above. The weather was warm and sunny with breeze off the sea. At least three individual *O. melanocephalus* were seen displaying the same routine as those seen at Crookhill Brick Pit but instead of prominent stones large leaves were being used. One was taken as a voucher. The action of patrolling took place over an area of sparse vegetation bounded by brambles and Hemp Agrimony, but at no time were any seen carrying prey. A Chrysid was seen flying low over the area but it was not captured. *Lotus*, *Trifolium* and *Medicago* were all found in the area.

**Eype Mouth. 16/6/06. 10:00 – 12:00.**

Very warm and still. There was not as much activity as on the last visit, however one female was seen nectaring on Smooth Hawk's-beard *Crepis capillaris*. An attempt was made to follow it but the steep cliff on the sea side and the ruggedness of the surface made this a precarious action and it was soon lost. *Pseudospinolia neglecta* was seen patrolling the area where *O. melanocephalus* was seen on the previous occasion. One was taken for positive identification.

**Crookhill Quarry. 16/6/06. 14:00 – 15:00.**

Warm and still. Called in at the quarry on the way back from Eype but no activity here either.

**West Weare, Portland. 17/6/06. 15:00 – 17:00.**

Warm and Sunny with breeze off the sea. Only two *O. melanocephalus* were seen, both were seen flying low over the sparsely vegetated area but none were seen carrying prey. *O. spinipes* was found and taken on *Eupatorium cannabinum* Hemp agrimony in the same area.

*Pseudospinolia neglecta* was seen rapidly running over the bare patches and exploring the many burrows, one of which had a small almost imperceptible entrance rim. This was excavated to approximately 3 cm but no larvae were found.

**Seatown. Grid Ref SY413918. 23/6/06. 10:00 – 15:00.**

Warm and sunny with slight breeze from the south-west. The morning was spent looking for both the wasp and evidence of nesting to the east of Seatown. Although fleeting glimpses of possible specimens were seen, none were approachable. A possible nest site was found and excavated but no sign of larvae, there were plenty of large mats of Black Medick but without any evidence of potential prey it was thought time wasting to examine them for any larvae as *Hypera* has previously been recorded from here. At about 14:00 to the west of Seatown a female *O. melanocephalus* was seen to emerge from a burrow at the edge of a mat of Black Medick (Photo 5) and was quickly caught. On examination of the mat there

**Photo 5. Area around nest, west of Seatown. Site of nest shown with a red spot.**

was plenty of evidence of feeding (Photo 6). Towards the base of the plant there were some larvae looking like those described by Falk (2005), two were taken for comparison but no cocoons could be found. The burrow, situated on area of gently sloping cliff had only the hint of an entrance tube. It was excavated and approximately 4 cm below the surface a larvae similar to those seen on the plant above was discovered (Photo 7), although still alive it did not appear as active as those taken on the plant.

Both wasp and larvae were brought home, the wasp as a voucher specimen and the larvae for closer examination. Despite further searching no more nests or wasps could be found.

**Photo 6. Feeding damage caused by larvae of *Hypera postica* on Black Medick *Medicago lupulina***

**Photo 7. Excavated burrow, with larva below (arrowed).**

On arriving home all larvae were offered a choice of *Lotus* and *Trifolium* as no *Medicago lupulina* was immediately available. After searching around for approximately five minutes the more active two fixed on the broken stem of *Lotus*, possibly attracted to the sap flow, where it started feeding. By the following morning the two healthy larvae had transferred to the *Trifolium* where they were feeding on the leaves but the one taken from the burrow, although still partially active, was not feeding. All larvae were green with a well-defined white dorsal stripe and no lateral stripes (Photo 8) There are transverse rows of black tubercles on each segment topped by expanding white setae. The hope was that these larvae would eventually pupate and hence give the prey species.

Two days later all larvae were given *M. lupuline*. The active ones fed successfully for four days although they died before pupating. The larvae taken from the bottom of the burrow failed to start feeding and appeared to be partially paralysed although it lived for another two days before showing no visible signs of life.

## Discussion.

Morris (2002) states that two of the fifteen species of *Hypera* found in Great Britain are confirmed as feeding on *Medicago* sp, these being *Hypera postica* and *Hypera fuscocinerea*. *H. postica* has also been associated with *Trifolium* sp. as discovered above, but as the larvae were found under *M. lupulina* this link was not followed up in the field. In addition Shuhrovec (2005) states that the larvae of *H. meles* and *H. nigrirostris*, *H. suspiciona* and *H. zoila* also use *Medicago* as a food plant, although he does not state which species. According to Brian Edwards (per comm.) the only species of *Medicago* likely to be found in the area on the coastal cliffs at Seatown is *M. lupulina*.

*H. zoila* is not a British species and both *H. suspiciosa* and *H. fuscocinerea* have only been recorded once in Dorset, *H. suspiciosa* has been recorded well away from the coast and *H. fuscocinerea* at Hengistbury head in the far east of the county. The Dorset coast is a well-worked area for coleopterist, particularly the area around Eype, and it is unlikely that either of the above species, if at all common, would have been missed. Although *H. meles* has been found once in the study area, it appears to be quite rare.

The two most likely candidates for the larvae confirmed by M. Morris as being *Hypera* sp are *H. postica* and *H. nigrirostris*. For the separation of the larvae of these two species Shuhrovec (2004) gives both a key and excellent drawings of setae size, shape, colour and positioning. Both the key and the diagrams point to the discovered larvae both in the excavated burrow and under the food plant being *H. postica.*

**Acknowledgements**

My thanks go to Stuart Roberts for providing me with a list of all Dorset records of *O. melanocephalus* to date and to Mike Morris for guiding me in the direction of larvae keys for *Hypera* species.

**References**

Falk, S. 2005. *A study of the Mason Wasp Odynerus melanocephalus in Warwickshire* Report funded by English Nature (unpublished)

Morris, M.G. 2002. *True Weevils (Part I). Coleoptera: Curculionidae (Subfamilies Raymondionyminae to Smicronychinae.* Handbooks for the Identification of British Insects Vol.5, Part 17b.Field Studies Council.

Skuhrovec, J. 2005. *Host plants of weevils of the genus Hypera (Coleoptera:Curculionidae) occurring in the Chez Republic*. Klapalekiana 41: 215 – 255

Skuhrovec, J. 2004. *Descriptions of larvae of the tribe Hyperini (Coleoptera: Curculionidae): I. Mature larvae of the nominotypical subgenus Hypera.* Acta.Soc.Zool.Bohem. 68: 245 – 280.

**Photo 8. Larva of ?*Hypera postic*a from Seatown.**

### 3.3 Pseudepipona herrichii

**3.3.1** Having for some years spent a considerable proportion of the ACG research budget yearly on extensive monitoring of *P. herrichii,* including visiting outlying and small sites, sometimes for several years with no evidence of the presence wasps, it was decided that for 2006 we would reduce the level of surveillance. Nevertheless, most of the known sites were visited within the available budget and all the trial plots were monitored. Rob Neal's Report is reproduced below, many thanks to him and the Dorset Heathland Project.

## Summary

All known sites in Dorset were visited during the flight season (mid May to end of August). Each visit was between 9.30am and 2.30pm on warm sunny days.

Visits consisted of

- Counting wasps seen.
- Looking for nest burrows.
- The presents of *Acleris hyemana.*
- Evidence of nectar raiding.
- General suitability of the site, in order to support a sustainable population of *Pseudepipona herrichii.*

Six vegetation transects, as in previous years were completed for sites: Stoborough EN & RSPB, Grange RSPB and Godlingston N.T. These results have not been statistically analysed, but are present in the appendix. (The appendix to this report can be obtained from Mike Edwards.)

**Site Descriptions**

Bloxworth Heath 2006

The site was visited several times during the flight period in favourable weather conditions. The observations confirm the absence of *Pseudepipona herrichii* at the site for the eighth consecutive season. Despite the failure of the reintroduction programme at this site, conditions for the wasp remain reasonable and it is proposed to continue monitoring the site for 2007.

Godlingston Heath NNR 2006

All the known nesting aggregations on Godlingston Heath were visited a number of times during the flight period. Good numbers of wasps could be found on each visit, easily counting up to 30 or more.

Once again, Godlingston Heath had a remarkably good year for the moth *Acleris hyemana,* being found in extremely good numbers over the whole site and with the overall habitat remaining in favourable condition.

Newton Heath 2006

This site was only visited twice during 2006 and again, no nest burrows or individuals were seen. However, the site remains in good condition and should be re-visited in 2007.

Newton Gulley 2006

Once again in 2006, the site was visited a number of times and no nest burrows or individuals were seen. The site still remains in good condition and should be revisited in 2007

Soldiers Road boundary 2006

No individuals or nesting burrows were seen in 2006, but the site remains in good condition and favourable for the wasp.

Slepe Heath boundary 2006

Two visits were made in 2006, when in-excess of a 60 wasps and well over fifty active nests were found on each occasion, stretching the whole length of the firebreak wherever any exposed clay could be found. The surrounding site, helped by the firebreak management, remains in good condition proving to once again, have the highest concentration of wasps found in any one location in 2006.

Hartland Moor (Tramway)

The Tramway was visited many times in 2006, throughout the flight period in favourable weather conditions. The observations again confirm that there appears to be a reduction in the number of wasps compared to previous years. However, a few individuals were present.

Stoborough Heath (EN). 2006

This site was visited twice in 2006. Despite it having very high numbers of *Acleris hyemana* as it did in 2005 and suitable conditions, no wasps or nests were found.

Stoborough Heath (RSPB).2006

Stoborough Heath had the biggest increase from any one site in 2006, with only a few individuals seen in 2005, there were up to 30 wasps seen in 2006. The site remains in good condition to sustain a healthy population. Few *Acleris hyemana* were recorded in the quadrats but a healthy number were present on the site.

Morden Heath.2006

One visit was made to the site in 2005. There were no sightings of the wasp or any nests. However, the site remains in favourable condition to support them, so monitoring should continue.

Grange Heath 2006

Grange Heath was visited twice during the flight period and a number of nests and a few wasps were found This is a marked improvement on last year, as no wasps were seen, the site remains in good condition to support *Pseudepipona herrichii.*

Arne Heath 2006

The RSPB Arne staff kept an eye open for *Pseudepipona herrichii* through out the summer, but no sightings were recorded. The grazing pressure from sika deer are continuing to decrease, as the culling program steps up a gear in 2006/07. There should also be some heathland burning taking place during the winter of 2006/07 which should help with the age structure and *Acleris hyemana* numbers in future years.

Povington Heath 2006

Povington Heath and the surrounding area was visited several times through the flight season in 2006 and it was encouraging to once again find a good number of wasps, upwards to 10 in one visit. And at least a dozen active nests in the clay. The heather regeneration in this area is still coming under considerable grazing pressure - mainly from Sika deer. A new culling program aims to take out a further 640 of these during the winter of 2006/07, which should help reduce some of the grazing pressures. There were still *Acleris hyemana* found in odd pockets, but numbers were even lower than 2005. We also had

unconfirmed reports from M.O.D. rangers that potential wasps and nests were found along the railway tracks SY875835 approximately 1 km from the existing site. RSPB staff searched this area and found no solid evidence of Pseudepipona *herrichii*, however the surrounding habitat is suitable with all the requirements to support a large population, especially with the mosaic of age structure in the heather caused through random M.O.D burning.

## Conclusion For 2006

2006 has been a good year for *Pseudepipona herrichii* in comparison to 2005. Three sites had a significant increase in numbers; these were Godlingston Heath, Stoborough Heath (RSPB) and Grange Heath. Sleep Heath Boundary still had the largest population with a very healthy density of wasps and active nests on both visits, over 60 wasps seen in one visit.

One of the reasons for this marked improvement is probably down to the high number of *Acleris hyemana* found in 2005. This is pleasing, as an equally high number has been seen through out 2006 on most of the sites, except Povington, which still shows signs of grazing pressure.

All The sites visited remain in favourable condition to support *Pseudepipona herrichii,* even if there were none actually present. The only exception to this is Bloxworth, where the density of scrub and pine is slowly increasing.

No confirmed new sites were found for *Pseudepipona herrichii in* 2006. However, it is encouraging that all present sites, many of the historical and potential new sites remain in favourable condition. This along with the fact that the moth *Acleris hyemana* has once again had an extremely good year, has put the wasp in good stead, so that if the correct environmental restraints prevail the wasp has all the habitat requirements to support any future population fluctuations.

**3.3.2** The decision to reduce the intensity of surveillance/monitoring was taken because we feel satisfied that we understand the ecological requirements of the species well enough to recommend management action to provide occupiable habitat. Key to this is the provision of suitable areas of bare clay which are exposed to the sun and a high number of larvae of the moth *Acleris hyemana.* Whether such suitable habitat, provided it is within the potential occupiable area, is occupied is down to a number of factors generally out of our control, most notably the weather conditions of the previous and current years.

**3.3.3** The most important on-going management research connected with *P. herichii* is undoubtedly that concerned with the effects of large-scale management of heathland areas by burning.

**3.3.4** A key driver to setting up this project was the observation that small areas of heathland which were regenerating following burning (100$m^2$ )were readily colonised by larvae of *Acleris*. However, if the site was also grazed by larger herbivores (domestic or wild) during the winter period, there was highly significant competition for the growing tips of the heather, competition which was usually lost by the *Acleris* larvae.

**3.3.5** Accordingly a much bigger area, about 8 hectares, was burnt on Godlingston to see whether this competition for the resource (young growing points of heathers) could be dealt with just by increasing the amount of resource present at any one time. Exclosures, proof against one or more of the potential grazing animals, were also set up at the same time (photo 9).

**3.3.6** Set sample plots within all exclosures and the control have been monitored over the past two years by The National Trust Staff. They have been looking at both rate of re-growth of heathers and presence of *Acleris* larval webs. Whilst there have been interesting variations in the growth and form of the heathers on the different sample plots, according to the grazing pressure present, the most significant effect has been to confirm that the

resource competition between the grazing animals and the *Acleris* larvae can be (at the current stocking densities), compensated for by increasing the amount of resource available: the number of *Acleris* webs on all areas has steadily increased. There are still a number of questions which the experimental set up will allow investigation and the monitoring will be continued. Further large burn areas are being considered for creation on a yearly basis.

**3.3.7** A full review meeting for this project, which is being largely run by the local site managers and conservation bodies in Dorset, will be held in late January 2007.

**Photo 8. The burnt area of Godlingston Heath, two summers after the burn. The grazing exclosures can be seen in the middle ground.**

**4. Chrysidid wasps**

**4.1 Chrysis fulgida.**

**4.1.1** Following on from the discovery of *C. fulgida* by Mick Parker at Goathorn Plantation, Dorset in 2002, where it appeared to be associated with a Creeping Willow-based population of *Chysolina populi*/*Symmorphus crassicornis*, a second locality for such an association has been recorded, this time in Wales.

**4.1.2** *Symmorphus crassicornis* has been known to Mark Pavett at Pembrey Dunes (SS4199) for some time. At this location it is associated with its prey, the larvae of the beetle *Chrysolina populi,* feeding on Creeping Willow *Salix repens*. During the Welsh Dune Survey (2002-2005) Carl Clee took a specimen of a chrysidid wasp which he identified as *Chrysis fulgida* at Pembrey. Mark found a second specimen from Wales during 2006, also at Pembrey. This represents a considerable extension of range for this species and underlines the need to search localities in the light of new autecological knowledge.

**5. Pompilid wasps.**

**5.1 *Homonotus sanguinolentus***

**5.1.1** The likely presence of *Homonotus sanguinolentus* on the Godlingston/Newton Heath complex was noted in the 2005 ACG Report when Mark Pavett found two webs of the spider *Cheiracanthium erraticum* with spiders and hymenopterous larvae present. Mark took the two spiders and has been able to rear *Homonotus* adults from these, confirming this area as another occupied region within the overall potential habitat.

**5.1.2** During 2006 advantage was taken of the low water-levels to inspect the, usually uncrossable, floating mires of Godlingston, looking for webs of *Cheiracanthium* in the seed heads of the bog-cotton. This is the location which we have long suspected would be the most likely place to find *Homonotus* on Godlingston, which is similar to the habitat at the higher reaches of Vales Moor in the New Forest, reported in an earlier ACG Report.

**5.1.3** Two days were spent in this way by a small team of four, with the eventual discovery of one spider + larva in a grass-head at almost the same spot as Mark's initial discovery on Newton Heath and three spiders + larvae in cotton-grass heads on Godlingston.

**5.1.4** Numbers of both spider and pompilid have been very low, even at the formerly abundant Bloxworth sites, so this result probably signifies a good population here, especially with regard to the large amount of potential habitat which was not searched.

**6. Sphecid wasps.**

**6.1 Ammophila pubescens**

**6.1.1** Research on the nesting habits and foraging preferences of the wasp *Ammophila pubescens* was initiated in the 2005 ACG programme. An extension to the 2006 field season was agreed at the 2005 Review meeting. This was primarily to get more information on the prey species composition. A preliminary summary report from this work appears below:

The foraging preferences of *A. pubescens* were investigated during Summer 2006 with the help of undergraduate students. Graham Collins kindly helped by identifying caterpillars and showing us ways to sample them. Our aim was to compare prey captured by the wasps with the potential prey available on plants at 2 sites: Thursley Common in Surrey, and Kelling Heath Norfolk, a site discovered during a previous ACG project. Both sites have large populations of *A. pubescens.*

In the event, we were forced to switch from Thursley to Black Heath in Surrey in the middle of the project, after the major fire at Thursley. We also had a sample of prey captured by the wasps available from a previous study in 2004. In prey samples (>500 prey) captured by the wasps from both sites in both years, the major prey item (>50% of prey) was the Common Heath (*Ematurga atomaria*). Other common prey (>10% of sample) were *Anarta myrtilli* at both sites, and the double-striped pug at Thursley in 2004.

The most important result was that although other prey foodplants were available, >99% of prey were caterpillars that can feed on heather, including some heather specialists such as *A. myrtilli.* Few prey were available from early in the nesting period (June), however. Comparison of caterpillars available on the heather with prey captured by the wasps is not yet completed, but suggests that *A. pubescens* does not collect prey at random with respect to either prey species or size.

5**.1.2** This research goes a long way towards confirming our practical experience that *A. pubescens* is restricted to heather heathland and that this is associated with the nature of the prey collected by the wasp. It has additional implications for the conservation of the Bee Fly

*Thryidanthrax fenestratus*, which is known to be parasitic on *A. pubescens.* We await a final report with interest.

### 6.2 Cerceris quadricincta

**6.2.1** Whilst no specific autecological research has been carried out on this species during 2005, we have been involved in advising The National Trust and Natural England regarding ongoing negotiations for the works required to bring an electricity cable ashore in the Pegwell Bay area. This is at the largest known nesting aggregation of this wasp in the UK.

**6.2.2** On a positive note, a visit was made to the site in connection with the electricity landing issue and it was noted that the new exposures made for displaying the geological SSSI features were being colonised by *C. quadricincta.* This augers well for any future disturbance to the major nesting site, which could well be in the path of the cable. The biggest remaining issue is the maintenance of sufficient foraging habitat as both the small area of dune and the old loading ramps are very vulnerable to civil engineering works, either in connection with the cable landing or attempts to restore the site.

**6.2.2** This later issue has longer-term implications for the whole of the foraging and nesting area for this wasp at Pegwell as the site is the old Hoverport Terminal and this may involve restoration over what is now considered toxic waste, being coal spoil infill on which the terminal was built in the 1960s.

### 6.3 Cerceris quinquefasciata

**6.3.1** Again no further autecological works, but a need to note that this species continues to spread over most of its historical range. It has now been reported nesting at two localities in Surrey, where all previous records have been pre-1970. This spread is likely to be a response to the run of warmer late summers since the 1980s as its prey (various small weevils) are very widespread and common.

## 7. Bees

### 7.1 Andrena marginata/Nomada argentata

**7.1.1** When some initial distribution research on the bee *Andrena marginat*a in the UK was undertaken in order to assess whether this was a species which should be considered for any review of BAP status, it was initially concluded that, although this was a scarce bee (and its parasite, *Nomada argentata,* even scarcer) there was no evidence of recent significant decline in its UK populations.

**7.1.2** However, a closer look at the data suggested that it was possible that this species pair exist in two, reproductively isolated, populations. One of these flies in late July and is based on calcareous soils where the major pollen source plant is Small Scabious *Scabiosa columbaria* and the other flies in late August and is based on acidic soils where the major pollen source plant is Devil's-bit Scabious *Succisa pratensis.* If the UK population really is two discrete ones, then the conservation of these may become more pressing.

**7.1.3** This was underlined when research by Stuart Roberts and George Else (reported at the 2005 Review meeting) on the European conservation status of *A. marginata* showed this to be a highly re-listed species throughout the continent, with a significant role for the UK population and an even greater urgency to investigate the nature of the two populations.

**7.1.4** Accordingly the ACG asked Phil Watts, based at Liverpool University, to start an investigation into the genetics of these two populations. Material for this project was collected by George Else during 2005 and sent to Phil for analysis. Results so far are not conclusive, but have thrown up several important issues which require further elucidation and which form the basis of an extension project discussed further in section 8. 3.

**7.1.5** Meanwhile, Phil's informative report on the project so far is presented below and forms essential reading for understanding section 8.3.

### Genetic Analysis of *Andrena marginata* and *Nomada argentata*.


**Summary**

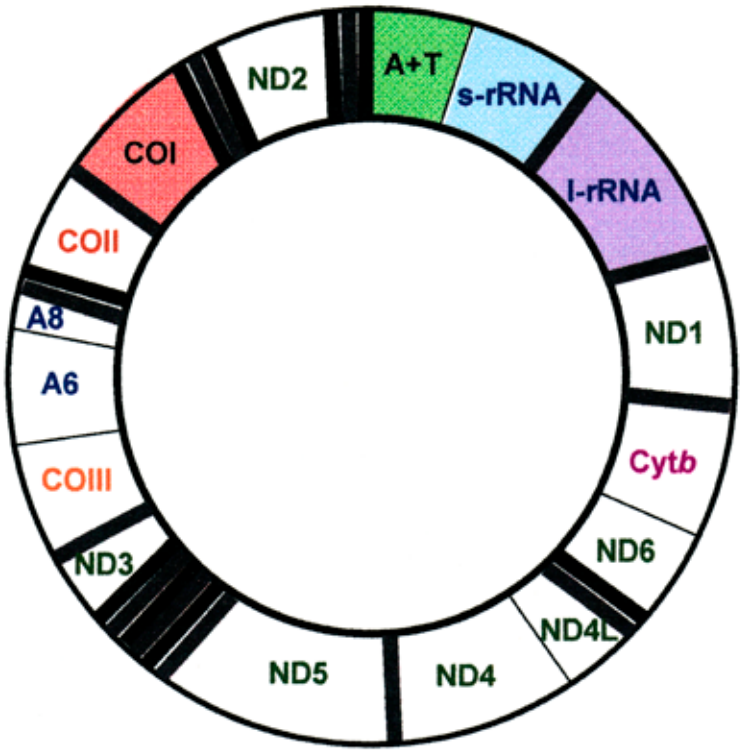
1. Conserved 'insect primers' were examined for ability to PCR-amplify gene fragments from the mitochondrial- (cytochrome *c* oxidase, small subunit rRNA, large subunit rRNA, AT-rich region) and nuclear- (ITS region) genomes of *Andrena marginata* and *Nomada argentata*.
2. Cytochrome *c* oxidase (COI) and small subunit rRNA both amplified single PCR products in *A. marginata* that were suitable for sequencing.
3. Only COI varied among samples of *A. marginata*.
4. Specimens of *Andrena marginata* (*n*=63) from 4 locations in southern England sequenced for a fragment of the COI gene formed 2 clusters that separated individuals from (1) Corfe Common and Figheldean Down with those from (2) Century Range and Brookwood Cemetary. This phylogeographic structure does not support the hypothesis that *A. marginata* is a complex of 2 species that are defined by autecological variation.
5. Because COI was not particularly polymorphic, further work is underway to characterise sequence variation at other genes that may better define phylogeographic and taxonomic relationships.


**Background**

The natural history of DNA, its Mendelian transmission from generation to generation, leaves a historical trail of information that reflects those individuals that successfully interbreed and leave progeny. In essence, individuals, populations or species that share recent ancestry should be genetically more alike than those which do not. This suggests that the level of similarities or differences at an appropriate *genetic marker* (a sequence of DNA or the product of a gene sequence, such as a protein) can be exploited to inform on the phylogenetic relationships among a group of individuals, populations or species.

Clearly, any survey of genetic interrelationships must make a decision regarding the appropriate genetic marker(s), which is determined by the genealogical timescale separating the genetic units being studied; for example, is the goal of the study to determine parentage of individuals (variation at 1 generation), determine the population of origin of an individual (*ca*. 1-10s of generations), or differentiate among a race or species (*ca*. 1-10s-1,000+s of generations)? With this in mind, it is important to recognise that it is equally possible for a genetic marker to provide too much information (that is, the genetic marker different so widely among units that there is no commonality with which to establish a relationship *per se*) as well as too little information (where there is insufficient variation to discriminate among genetic units). The extent to which regions of DNA differ among genetic units – *i.e*. the amount of 'information' that determines our ability to discriminate between individuals, populations or species - depends upon (1) the rate of change in the DNA sequence, its mutation rate, and (2) the time since the genetic units diverged. Highly variable markers such as microsatellites are typically used for parentage or population-genetic analyses, while variation at functional genes is typically used to reconstruct the relationships among species and higher taxa.

With regard to the problem of identifying biological species, 'DNA barcoding' has been advocated as a rapid and reliable method of species' identification (Hebert *et al*. 2003). Briefly, DNA barcoding exploits the extent of differences at a specific gene sequence to discriminate among species. The idea of using sequence information to identify species is not novel, however, the view that the same gene can be used to delineate species across a range of taxa is; Hebert *et al*. (2003) argued that the mitochondrial (mt) gene, cytochrome *c* oxidase subunit I (COI or COXI) (see **Box 1**) can be used as the core gene for the global identification of new animal species. Proponents of the barcoding approach have argued that it offers a standardised, reliable, rapid and cost-effective method of taxonomy that reduces ambiguity and, since the raw sequence data can be transferred readily among laboratories, and it democratises access to information about taxonomic delineation.




Mitochondria are cellular organelles containing circular molecules of DNA (*ca*. 16-17 Kbp in size) that are usually maternally inherited (mother to offspring). The mtDNA molecule codes for genes that control cell metabolism (oxidative phosphorylation). Genes are tightly packed and consequently there is no non-coding DNA except at one region, the A-T rich region (in insects) where replication begins and which is typically highly variable.

COI, cytochrome oxidase *c* subunit I; COII, cytochrome oxidase *c* subunit II; COIII, cytochrome oxidase *c* subunit III; Cyt*b*, Cytochrome *b*; ND1, NADH dehydrogenase subunit 1; ND2, NADH dehydrogenase subunit 2; ND3, NADH dehydrogenase subunit 3; ND4, NADH dehydrogenase subunit 4; ND4L, NADH dehydrogenase subunit 4L; ND5, NADH dehydrogenase subunit 5; ND6, NADH dehydrogenase subunit 6; A6, ATPase subunit 6; A8, ATPase subunit 8; A+T, AT-rich ("control") region; s-rRNA, small ribosomal subunit; l-rRNA, large ribosomal subunit; black and grey bars indicate transfer (t) RNA genes. Genes examined in *Andrena marginata* are coloured.

**Box 1**. Generalised structure of insect mitochondrial (mt) DNA (redrawn from Clary & Wolstenholme 1985).

Accordingly, a number of large-scale barcoding projects are underway to characterise the level of variation in COI sequence for certain major animal groups (*e.g.* Lepidopteran barcoding project, http://www.lepbarcoding.org/; Fish barcoding project, http://www.fishbol.org/; Bird barcoding project; http://barcoding.si.edu/AllBirds.htm, Canadian barcoding project, http://www.bolnet.ca/). Despite its popularity, COI is not the only gene that can discriminate among species and other DNA barcoding projects have advocated use of sequence variation at nuclear genes (such as the large ribosomal subunit) to make taxonomic assignments within a sample of unknown species composition (*e.g.* Markmann & Tautz 2005).

For an analysis of variation among insect taxa, one of the major benefits to using sequence variation at mtDNA is that much of the information required to identify genetic variation is readily available for many species (Simon *et al*. 1994). It must be noted, however, that mtDNA only traces the female line of descent and because mtDNA is a single, maternally inherited unit it represents just a 'single-locus'. Inferences about phylogenetic relationships are more reliable if several genes, particularly those in both mtDNA and nuclear DNA, provide similar patterns.

The approach taken for this study, therefore, was to undertake a sequence analysis of samples of *Andrena marginata* and *Nomada argentata* at various mitochondrial and nuclear genes, but making particular reference to COI as it is the most widely used gene region for DNA barcoding projects. Concordant patterns of genetic variation within and among sites at several genes will inform on whether the pattern of spatial genetic structure among populations correlates with either geographic separation or the type of host flower.

**Methods**

Samples of *Andrena marginata* and *Nomada argentata* were collected by George Else (Natural History Museum) from 4 locations in southern England (see **Figure 1** for summary of sample numbers and locations) and stored whole in absolute ethanol. Flight muscle was dissected from individual samples and total genomic DNA was extracted using a standard proteinase-K-salt-extraction protocol (Aljanabi & Martinez 1997). Quality and quantity of DNA was quantified by gel electrophoresis on a 2% agarose gel.

Appropriate literature was reviewed for 'conserved' insect primers (those that will amplify across a broad taxonomic range) that could be used to PCR (polymerase chain reaction)-amplify a range of nuclear and mitochondrial genes that are used commonly to delineate among species. Candidate genes included cytochrome *c* oxidase subunit I (COI), small subunit rRNA (ssu rRNA) and large subunit rRNA (lsu rRNA) encoding genes, internal transcribed spacer regions (ITS) and the A-T rich region (see **Table 2**). Conserved primers were synthesised (MWG Biotech) and tested for suitability to PCR-amplify genes in both *A. marginata* and *N. argentata*.

Initial PCR conditions, to identify whether the conserved primers would amplify a single gene sequence in *A. marginata* and *N. argentata*, used 10-50 ng of DNA in a 10 μl PCR containing 75 mM Tris-HCl pH 8.9, 20 mM $(NH_4)_2SO_4$, 0.01% v/v Tween-20, 0.2 mM each dNTP, 3.0 mM $MgCl_2$, 20 pmol forward primer, 20 pmol reverse primer and 0.25 U *Taq* polymerase (ABgene). Thermal cycling conditions were 94°C for 3 min, 5 x [94°C, 30s; 45°C, 30s; 72°C, 55 s], 30 x [92°C, 30s; 45°C, 30s; 72°C, 45 s], 72°C, 10 min, hold @ 10°C. Amplifications that were successful but produced multiple products were repeated but with the annealing temperature (45°C in the test PCR) increased along a gradient between 50-60°C and the $MgCl_2$ concentration varied from 1.5 to 3.0 mM, in an attempt to improve stringency of the PCR reaction and amplify a single gene region.

Gene regions that could be amplified as a single PCR product following the optimisation procedure described above were treated with ExoSAP (Amersham Biosciences) to remove excess primer and then cycle sequenced in both directions using Big Dye™ chemistry (PE Applied Biosystems) and electrophoresis on an ABI3100 according to

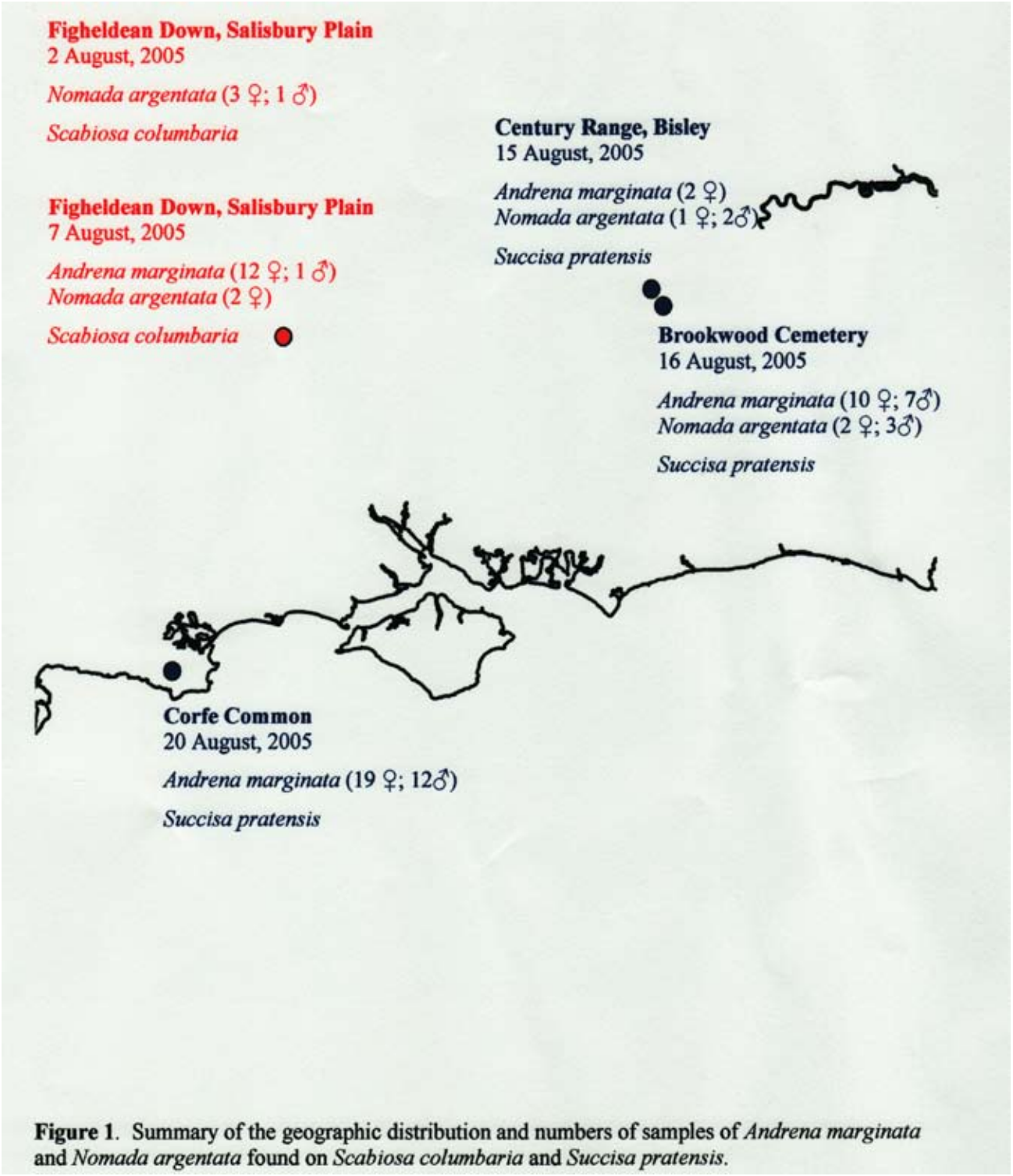


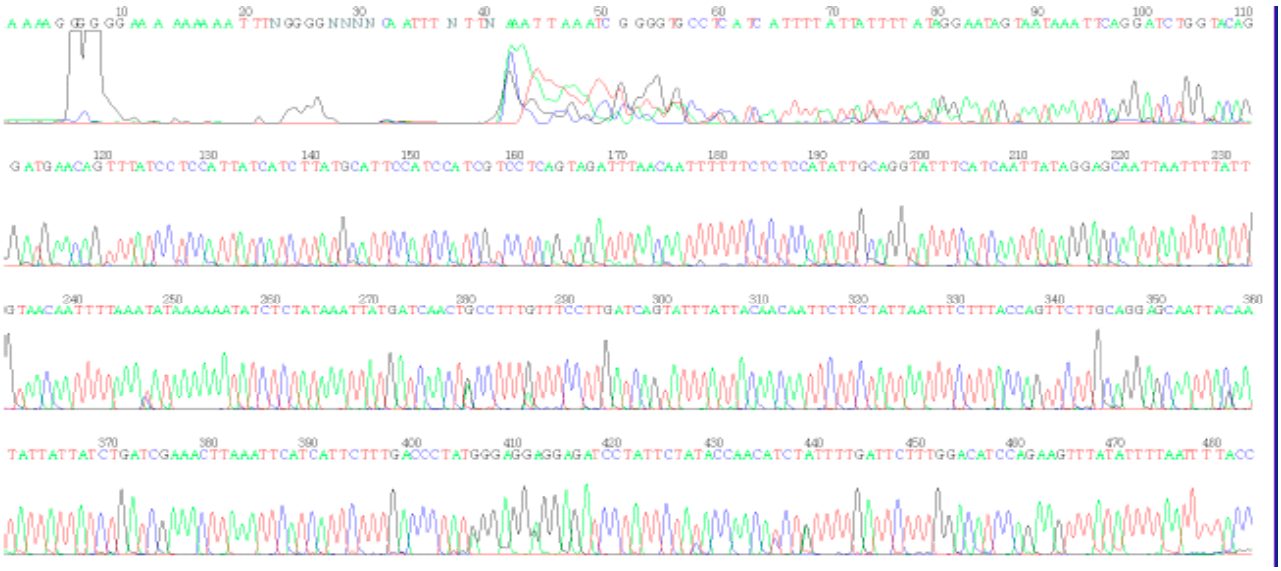

**Figure 1**. Summary of the geographic distribution and numbers of samples of *Andrena marginata* and *Nomada argentata* found on *Scabiosa columbaria* and *Succisa pratensis*.

manufacturer's recommended protocols.

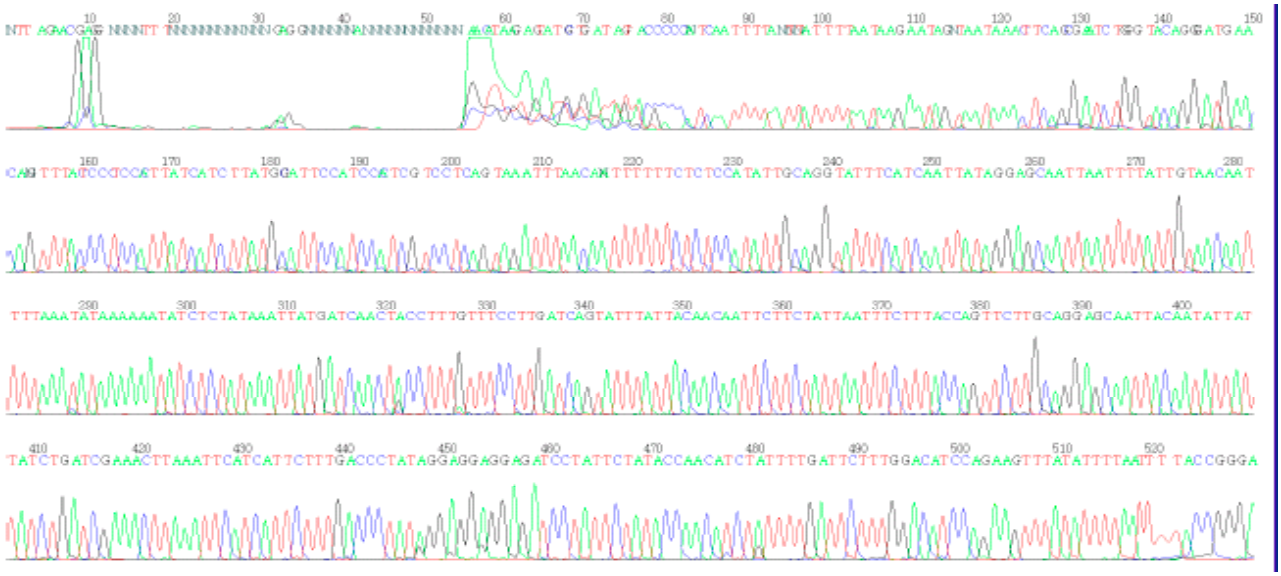
Forward and reverse sequences were aligned to generate consensus sequences and remove possible sequence ambiguity. Phylogeographic structure of the consensus sequences was made by Neighbour-Joining cluster analysis of the sequences using PAUP (Swofford 2002).

| Primer Name | Primer sequence (5′-3′) | Gene | Reference |
|---|---|---|---|
| TI-N-4 | TAATATTTTATCAAAATAT | AT-rich | Simon et al (1994) |
| C1-J-1751 | GGATCACCTGATATAGCATTCCC | CO1 | |
| C1-N-2191 | CCCGGTAAAATTAAAATATAAACTTC | | |
| C1-J-1718 | GGAGGATTTGGAAATTGGCTTATTCC | | |
| C1-N-2329 | ACTGTAAATATGTGATGTGCTCA | | |
| C1-J-2183 | CAACATTTATTTTGATTTTTTGG | | |
| C1-N-1460 | TGATCCTAGTATTCCAGATCA | | |
| TL2-N-3014 | TTCAATGCACTTATTCTGCCATATTA | | |
| C1-N-2659 | AATAATCCAGTAATTAATGG | | |
| LR-J-12887 | TCGATTTGAACTCAAATCATGT | lsu rRNA | |
| LR-N-13398 | CACCTGTTTAACAAAAACAT | | |
| SR-J-14233 | GAAATTGACGGGCGATTTGT | ssu rRNA | |
| SR-N-14588 | AAACTAGGATTAGATACCCTACTAT | | |
| H16SA | GCTACCTTTGCAGAGTTAGGATACTGCG-GCC | lsu (long) | Barau et al. (2005) |
| H16SB | CATATCGATAAAAAAGATTGCGACCTC-GATGTTG | | |
| H16SC | GAACTCTCCAAAAAAATTACGCTGTTATC-CCT | | |
| H16SCR | AGGGATAACAGCGTAATTTTTTTGGA-GAGTTCA | | |
| HCOII | GGTCATCAATGATATTGAAGTTATGAATAT-TC | | |
| HCOIII | TTCTGAAAAAATAAATAAAATTATTCCTCA | | |
| CAS18sF1 | TACACACCGCCCGTCGCTACTA | ITS | Ji et al. (2003) |
| CAS5p8sB1d | ATGTGCGTTCRAAATGTCGATGTTCA | | |
| CAS5p8sFt | TGAACATCGACATTTYGAACGCATAT | | |
| CAS5p8sFc | TGAACATCGACATTTYGAACGCACAT | | |
| CAS28sB1d | TTCTTTTCCTCCSCTTAYTRATATGCTTAA | | |
| LCO1490 | GGTCAACAAATCATAAAGATATTGG | COI | Hebert et al (2003) |
| HCO2198 | TAAACTTCAGGGTGACCAAAAAATCA | | |
| | | | |

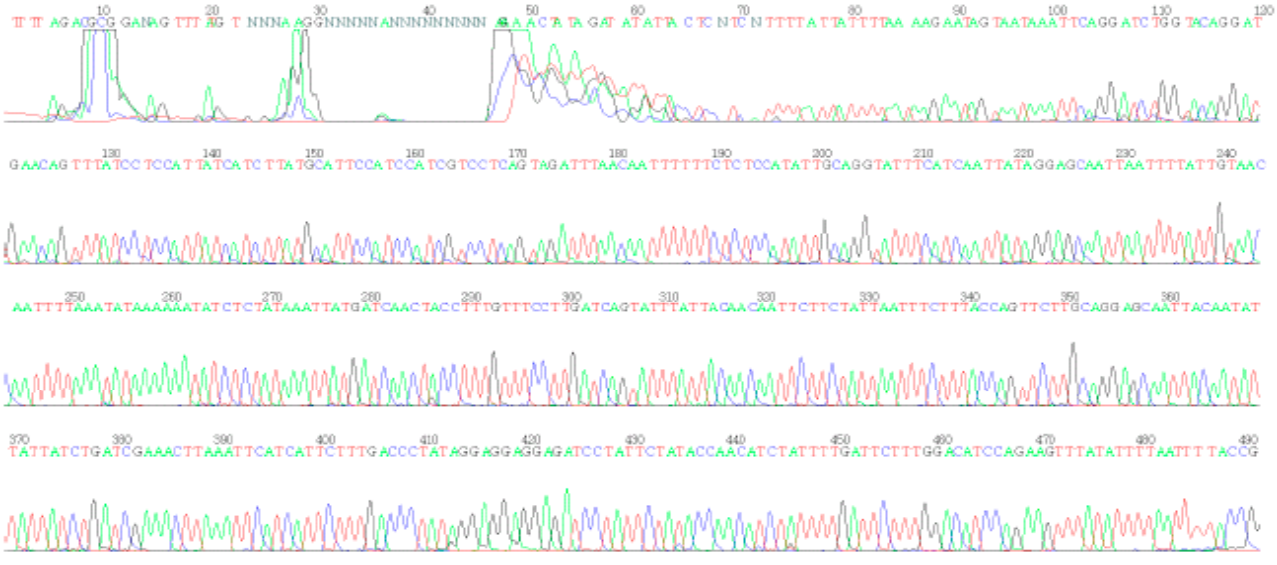
**Table 2. Summary of the different primers used to potentially amplify genes in *Andrena marginata* and *Nomada argentata*.**



a) Andrena marginata A2.01



b) Andrena marginata C2.01



c) Andrena marginata C2.02

Figure 2a, b ,c. Examples electropherograms of a fragment of COI region in three samples of Andrena marginata. A = Fighledean Down; C = Century Range.

**Results**

High quality total genomic DNA has been extracted from all 63 specimens of *A. marginata* and 2 test individuals of *N. argentata*. COI, ssu rRNA, lsu rRNA and the ITS regions produced products at low annealing temperatures in *A .marginata*, but not *N. argentata*. During subsequent optimisation of these genes in *A. marginata*, however, only COI and ssu rRNA produced single PCR products that could be sequenced. Initial sequencing of a subset of *A. marginata* (from each site) demonstrated that COI was polymorphic (see **Figure 2a, b, c** for example COI sequences), but the ssu rRNA did not vary (*i.e.* was not informative). Therefore, all *A. marginata* specimens were sequenced at COI only.

Consensus sequences of COI for *A. marginata* revealed little genetic variation among all samples, with the exception of the two individuals at Century Range. Cluster analysis reveals two general groupings: (1) Corfe Common and Figheldean Down and (2) Century Range and Brookwood Cemetery (**Figure 3**).

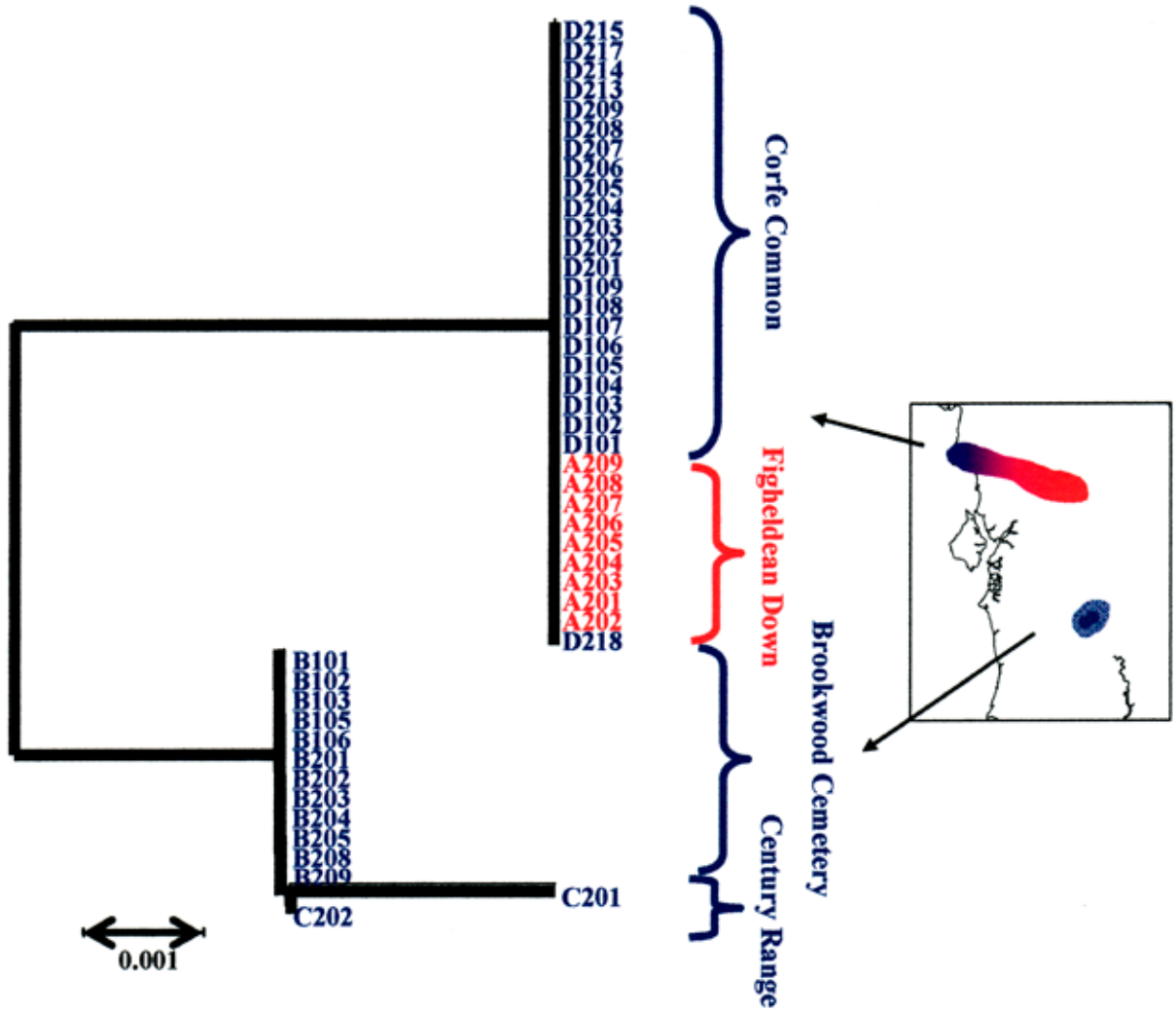



**Figure 3**. Cluster analysis: neighbour-joining dendrogram of relationships among samples of *Andrena marginata*.

**Discussion**

Present phylogeographic structure of *A. marginata* based on variation at COI does not support the existence of two genetically differentiated species defined by host plant exploitation, but does identify spatial genetic structure between samples from Wiltshire-Dorset and those from Surrey. A more detailed population genetic analysis, using higher resolution genetic markers such as microsatellites, would be required to identify the landscape features that generate this pattern of spatial genetic structure.

One problem with traditional barcoding approaches to define species is insufficient time for recent species to diverge at coding (*i.e*. relatively low resolution) gene loci. A more powerful approach to uncovering cryptic speciation is a genetic analysis of sympatric populations using highly variable markers (*e.g*. microsatellite loci), as used by Maingon *et al*. (2004) in the sandfly *Lutzomyia longipalpis*. Samples of sympatric populations of *Andrena marginata* that utilise different host plants are not available for the present study. However, since there were few differences among samples at COI, further investigation of the phylogeographic structure based on other, hopefully more polymorphic, gene sequences will be undertaken. The pattern of geographic variation at these genes may alter the conclusions presented above.

**Future work**

1. Optimisation of PCR conditions for *N. argentata* genes and then complete the DNA extraction and sequence analysis of the remaining samples of this species.

2. Since the initial literature review when the project was discussed there have been 2 publications that use gene sequences to characterise phylogenetic relationships among hymenopteran taxa (Danforth *et al*. 2006, Larkin *et al*. 2006). The former study constructed a family-level phylogeny using sequence variation at several genes, including elongation factor 1α, RNA polymerase II, LW rhodopsin, lsu rRNA and ssu rRNA, while the latter study focussed on the relationships among the *Callandrena* subgenus of *Andrena* and was based on variation at two genes, COI and elongation factor 1α. Examination of sequence variation at elongation factor 1α in *A. marginata* and *N. argentata* may provide further insights into the evolutionary relationships of these samples.

3. Further attempts to optimise and then sequence the ITS region in both *A. marginata* and *N. argentata* may also provide increased phylogeographic resolution.

**References**


Aljanabi SM, Martinez I (1997) Universal and rapid salt-extraction of high quality genomic DNA for PCR-based techniques. *Nucleic Acids Research*. **25**, 4692-4693.

Barau JG, de Azerro-Espin AML, Lessinger AC (2005) Conservation and versatility of a new set of primers for long-PCR amplification of complete insect mitochondrial genomes based on *Haematobia irritans* mtDNA sequences. *Molecular Ecology Notes*. **5**, 885-887.

Clary DO, Wolstenholme DR (1985) The mitochondrial DNA molecule of *Drosophila yakuba*: nucleotide sequence, gene organization, and genetic code. *Journal of Molecular Evolution*. **22**, 252-271.

Danforth BN, Sipes S, Fang J, Brady SG (2006) The history of early bee diversification based on five genes plus morphology. *Proceedings of the National Academy of Sciences, USA*. **103**, 15118-15123.

Hebert, PDN, Cywinska A, Ball SL, de Waard JR (2003) Biological identifications through DNA barcodes. *Proceedings of the Royal Society of London, B*. **270**, 313-321.

Ji Y-J, Zhang D-X, He L-J (2003) Evolutionary conservation and versatility of a new set of primers for amplifying the ribosomal internal transcribed spacer regions in insects and other invertebrates. *Molecular Ecology Notes*. **3**, 581-585.

Larkin LL, Neff JL, Simpson BB (2006) Phylogeny of the *Callandrena* subgenus of *Andrena* (Hymenoptera: Andrenidae) based on mitochondrial and nuclear DNA data: Polyphyly and convergent evolution. *Molecular Phylogenetics and Evolution*. **38**, 330-343.

Markmann M, Tautz D (2005) Reverse taxonomy: an approach towards determining the diversity of meiobenthic organisms based on ribosomal RNA signature sequences. *Proceedings of the Royal Society of London, B*. **360**, 1917-1924.

Maingon RDC, Ward RD, Hamilton JGC, Noyes HA, de Souza N, Kemp SJ, Watts PC (2003) Genetic identification of two sibling species of *Lutzomyia longipalpis* (Diptera: Psychodidae) that produce distinct male sex pheromones in Sobral, Ceará State, Brazil. *Molecular Ecology*. **12**, 1879-1894.

Simon C, Frati F, Beckenbach, Crespi B, Liu H, Flook P. (1994) Evolution, weighting, and phylogenetic utility of mitochondrial gene sequences and a compilation of conserved polymerase chain reaction primers. *Annals of the Entomological Society of America*. **87**, 651-701.

Swofford DL (2002) PAUP* Phylogenetic Analysis Using Parsimony (* and other methods). 4. Sinauer Associates, Sunderland, MA.

### 7.2 Colletes floralis

**7.2.1** Neil Robinson Reports:

#### 7.2.2. Cumbria

After establishing in 2004 that there was was a small but active colony at Sandscale and two females were seen at Haverigg Haws, no *Colletes floralis* were seen at either site in 2005, apparently due to prolonged cold weather in May and June. A large colony of *Andrena barbilabris* in Trowbarrow Quarry in Lancashire also failed to emerge in 2005. In 2006 the weather went to extremes; cold conditions in June were followed by a heatwave in July. The Trowbarrow Quarry *A. barbilabris* colony had some holes open in April, but in June the majority were found to be topped by piles of partly ejected sand without exit holes, which never did open. At a rough guess I would estimate that the colony was reduced to about 10% of its former activity. At Sandscale I saw only two males and two females of *C. floralis*, which suggests that the population has survived, but has been depleted. However, Peter Burton did find a nest site. Nothing was seen at Haverigg Dunes.

**Sandscale Haws NNR**

**10 June** (during a Kendal Natural History Society visit). The Hemlock Water Dropwort was only beginning to flower. No *Colletes* were seen.

**15 June** Sun but cool breeze, 18 deg. Dropwort 75% in flower, 25 % seed. *A. barbilabris, A. scotica, A. chrysosceles* were seen foraging, but in one hour of observation only two male *C. floralis* (one of which was taken for confirmation), no females.

I had anticipated that during the next few weeks some females would appear, but the rest of the month was cold, cloudy, windy, not 'solitary aculeate' weather and I did not visit. However, during this period Peter Burton, the National Trust Warden, saw a female going to a hole in the nearby trackside bank (see below).

**3 July** Hazy sun, but now over-hot: 26 deg. Dropwort 90% over,only four patches still had flowers. Watched for one hour but only saw one *A. chrysosceles*, no other *Andrena* or *Colletes*. Watched the side of the nearby track where Peter Burton had reported seeing a female for 30 minutes, but saw nothing except a female *Epeolus variegatus* prowling. Then went to **Haverigg Haws**, temperature now 28 deg., occasional *Bombus sp*., one *Megachile*, but no *Andrena* or *Colletes* - too hot for the bees (and me!).

**11 July** Sun but cool NW wind, 16 deg. Dropwort 95% over, flowers still on four clumps, but only one in the gully was healthy enough to be attracting hoverflies. After

one hour, on the point of giving up, I was surprised to see, catch and release, a female *C. floralis,* which was scrambling over and collecting pollen from the adjacent Meadowsweet *Filipendula ulmaria* (**Photo 1**). It was completely dusted with pollen. Meadowsweet has not been reported before as a forage flower. I then watched with Peter Burton the side of the track where he has seen the female (**Photo 2**). In half an hour we saw one *C. floralis* female flying towards the overhanging edge of turf above the loose sand (the situation in which I saw two females at Haverigg in 2004). To be sure of what it was I had to intercept it and release it, which meant that I could not locate its hole. This made the total sightings of *C. floralis* in 2006 two males and two females.

I then went to **Haverigg,** now 19 deg., but found nothing. In spite of flowers of yellow Asteraceae, Sheep's-bit and Harebell (foraged by *Melitta haemorrhoidalis* in 2004), there was a total absence of solitary aculeates (including wasps). The small erosion hollow where I saw the female *C. floralis* in 2004 is now becoming vegetated over, but there is plenty of other suitable nesting habitat.

### 7.2.3. Dumfries and Galloway

I took advantage of a holiday with my wife in Kirkcudbright 21-26 July to investigate sites that I had recce'd last year and which are described in detail in my 2005 report. A problem about surveying in this area is that, as it turns out, *C. succinctus* is present at Sandyhills Bay and *C. fodiens* at Torrs Warren. Male *Colletes spp*. are readily identified by the sub-genital plate, but neither males nor females can be identified (by me) in the field. I took photographs and specimens which I identified when I returned home, but I was not sure what I was seeing at the time.

**21 July Sandyhills Bay** NX8955.

The two clumps of Hemlock Water Dropwort *Oenanthe crocata* that I had noticed in 2005 were over and the partly vegetated sandy arc on the east side of the bay is now covered by Alder, but I found several male *C. succinctus* patrolling over a patch of Ragwort. Conditions were cloudy, with sea mist, and cool, 17 deg. This site was revisited on our way home.

**22 July Brighouse Bay** NX6345

This flower-rich SSSI calcareous dune system was disappointingly devoid of solitary bees, in spite of what looked like megachilid burrows in one place. The Dropwort flowers were completely over, but, in addition to the large inaccessible stand at the east end which was noted last year, we found a long strip extending westwards from the car park, backing the sand/shingle shoreline. This would definitely be worth scrutinising when in flower on some future occasion, as the situation could well support *C. floralis.*

**24 July MOD Torrs Warren.**

Permission to visit was obtained from Brian Paul QuinetiQ and Joy Burns MOD Rosyth. Access is usually only possible at weekends, but on this occasion it was extended to Monday and Tuesday because the Range was not in use that week. Conditions were sunny when the visit was made on Monday 24th, but fortunately a cool breeze kept the temperature down at 20 deg., avoiding the heatwave conditions that had been found to prevent *C. floralis.* from flying at Sandscale. Attention was concentrated on the ditch forming the south west boundary of the Range at Clayshant (**Photo 3**), where the Dropwort had been noted in June 2005 (NX112523). However, the Dropwort was largely past flowering; only a few patches still had flowers (Photo 4) and these were inaccessible due to the steep banks and dense growth of bracken and bramble. The extremely hot preceding weather had probably caused the Dropwort to go over earlier than normal. (I had in any case hoped to make the visit earlier in July, but we had other commitments at that time.) No sightings were made of *C. floralis,* which was recorded on the Warren by A.B.Duncan in the 1980s. I still think that if it still exists on the site it is most likely to be found in this area.

## Photographs

1.Sansdcale:
Meadowsweet (& Dropwort over)

2. Sandscale nest site

3. Torrs Warren: Clayshant ditch

4. Clayshant Dropwort ± over

5. Clayshant Ragwort
(*Colletes fodiens*)

6. Sandyhills Bay Ragwort
(*Colletes succinctus*)

**Photo 9. Illustrations for Neil Robinson's *Colletes Floralis* Report.**

Information from George else has shown that Duncan also collected *C. floralis* at another site not far away in Galloway (see below).

Entry at this end of the Range is by a track to an Observation Tower, round which a security fence (the gate of which seems to be permanently open) blocks access to the shore and the ditch. It is necessary to force one's way round the fence through dense bracken and bramble. While doing this, we found male and female *Colletes sp*. visiting a patch of Ragwort (Photo 5). Photographs and specimens were taken, but they proved to be *C. fodiens*. This species was recorded by A.B.Duncan at Torrs Warren in 1982. It is common in England, but apparently reaching its northern limit in Dumfries and Galloway. George Else's draft account states that records for this area (apart from Torrs Warren) require confirmation, so it appears the the Warren is the only location in Scotland where its existence is confirmed by specimens.

The high central viewpoint was also visited. In 2005 the sides of the track had a rich flora, but in 2006 had been mown and held no interest.

An hour was spent at **FC Torrs Warren**, accessed from their car park at NX143561. This sheltered fringe of conifer plantation has excellent aculeate habitat, with eroded dune faces, a flower-rich felled area that has not been replanted, and damp places. A good range of solitary aculeates was found, but nothing outstanding.

After the visit, details kindly provided by George Else about Duncan's specimens in **NHML** provided valuable information about his collecting sites:

i) the records from Torrs Warren show that on four visits between 1979 and 1984, at dates ranging from 8 June (earlier than I have ever seen it) to 19 July, Duncan found it evidently quite easily on the fixed and frontal dunes. This could certainly not be the situation now. The fixed dunes present a vista of impenetrable bracken, gorse and bramble, but I think there are still possibilities in the frontal dunes around the Clayshant ditch.

ii) on 31 July 1982 he took 13 specimens '**near Sandhead** among open pines'. Sandhead is a hamlet about 3 km south of the Warren, at the southern tip of Luce Sands at NX 099501. The fact that he took 13 specimens, including both sexes, indicates that there must have been a good population. The OS Landranger map does not give any indication as to where the 'open pines' might be (or have been), but I intend to have a look on some future visit.

**26 July Sandyhills Bay.**

Temperature elsewhere up to 23 deg., but again sea mist and cloud impaled on Criffel kept it down to 19 deg. on this part of the coast, in spite of which the beach was thronged with holidaymakers. Numerous *C. succinctus* were flying around the same patch of Ragwort where they had been seen on 21 July (**Photo 6**). Photographs and specimens confirmed that they were all males. Some were hovering at the bare sand face of a nearby bank, and one was seen to enter a hole, but as there were numerous holes of *Mellinus arvensis* this may simply have been an error. As no females were seen it was not possible to establish where they were nesting, but their adherence to Ragwort suggests that this may have been a population of the form (or species?) that forages yellow Asteraceae. As we left I also found males at Ragwort around the car park, so there evidently is a sizeable population.

### 7.2.4 Recommendations for further work

**Cumbria**

I propose to continue to visit **Sandscale** in June/July to monitor the *C. floralis* population and to find out more about the nest site. I do not intend to continue visiting **Haverigg Haws** as adding this to Sandscale turns it into a 100 mile drive, and I have not added anything to the sighting of two females in 2004. The same applies to **Eskmeals**, which is even further and has not produced anything.

**Dumfries and Galloway**

Sites which I shall try to visit in early July are **Brighouse Bay**, **Torrs Warren** (**Clayshant ditch only**) and **Sandhead**. However, there is no escaping the possibility that, even if populations still exist at these sites, they may have been depleted by the cold weather in May-June 2005, as was the Sandscale colony, and hence even more difficult to find.

**7.2.5** Jane Sears, on behalf of Janet Hunter and the RSPB, reports that:

It has long been considered that the Northern Colletes mining bee *Colletes floralis* might be present on the island of Islay, as several areas of habitat are thought to be suitable and populations of the bee were recorded on the neighbouring islands of Colonsay and Oronsay in 2002. It is also known to have bred further south in Dumfries and Galloway (Torrs Warren, 1982) and in Cumbria (1994, 1997, 2003 and 2004). In May 2006, the Royal Society for the Protection of Birds commissioned a search of Islay for the species.

Areas of potentially suitable breeding habitat were identified in the northwest and southwest of the island using Ordinance Survey maps and through suggestions by Andy Schofield (RSPB Islay). These were systematically searched for evidence of bee activity during 13-16 July 2006. The weather was ideal for *C. floralis* activity, being warm, dry and sunny, with wind speeds of force 3 or less throughout.

Bees and active burrows were found at six sites, with a seventh site that looked suitable, and where a *Colletes* sp was subsequently seen, but is yet to be confirmed as *C. floralis.*

| **Location** | **Grid reference** | Habitat[1] | **Active burrows** | **Bees seen** |
|---|---|---|---|---|
| Machir Bay | NR 200 630 | 3 | Yes | Yes |
| Killinallan | NR 300 720 | 3 | Yes | Yes |
| Machrie golf course | NR 320 490 | 3 | Yes | Yes |
| Ardnave | NR 290 730 | 2 | Yes | Yes |
| Sanaigmore | NR 230 700 | 2 | Yes | No |
| Saligo Bay | NR 200 660 | 1 | Yes | Yes |
| Lower Killeyan | NR 270 430 | 1 | Yes? | Yes?[2] |
| Kintra | NR 320 490 | 1 | No | No |
| Smaull Farm | NR 210 680 | 0 | No | No |

[1] Habitat is graded from 3 - typically good habitat, to 0 - no suitable habitat.

[2] Bees and active burrows reported by A. Schofield (RSPB Islay) at Lower Killeyan in July 2006, are very likely to have been of C. floralis. To be confirmed in 2007.

**Table 3. Summary of results of searches for *Colletes floralis* on Islay, July 2006.**

*C. floralis* burrowing habitat on Islay was found to be similar to burrowing habitat on the islands of Tiree and Coll, and included similar communities of flowering plants. Burrow densities ranged from 33.0 - 5.1 $m^{-2}$. Other bees species encountered were *Bombus lucorum* and *B. muscorum.*

Parts of Islay support some of the most extensive and best quality *C. floralis* nesting habitat, and the most active burrow aggregations, recently encountered in the Scottish Islands and Northern Ireland. So long as current management regimes persist, Islay's *C. floralis* population is thought to be stable, making the island one of the species' most important strongholds in the UK. Management recommendations have been made for Smaull Farm, Ardnave, Sanaigmore and Lower Killeyan.

**7.2.3** A new location, on the Scottish Mainland - just - was recorded during 2006. Stephen Miles, whilst on holiday, discovered a population of *C. floralis* at the southern end of Kintyre near Macrihanish.

### 7.3 Osmia parietina

**7.3.1** Mike Howe reports that attempts to initiate autecological studies of *Osmia parietina* on Anglesey have been thwarted by problems with access.

### 7.4 Osmia uncinata

**7.4.1**. SNH/RSPB and ACG/Hymettus have been collaborating on a project to investigate the distribution of *Osmia uncinata* in the North-eastern Highlands. It is hoped that trap-nesting may help considerably with survey for this rather elusive, but apparently widespread species.

**7.4.2** After several trials with trap-nest designs, which had to be robust, yet cheap to make, a number were set out in apparently suitable locations, including some with modern records of *O. uncinata.* Unfortunately, not one of the trap nests were occupied by *O. uncinata* during 2006 .

**7.4.3** Jane Sears will update the meeting on this project.

### 7.5 Osmia xanthomelana

**7.5.1** Mike Howe reports that monitoring of *Osmia xanthomelana* at Porth Ceiriad and Porth Neigwl continued in 2006 and some additional work may be carried out in 2007 to assess current status and distribution.

### 7.6 Bumblebees

**7.6.1** During 2006 the ACG did not fund any bumblebee-specific projects. However, there have been a number of developments in the bumblebee world which should be noted here.

**7.6.2** Thanks to the continual efforts of Murdo Macdonald and the Highland Biological Recording Group the profile of *Bombus distinguendus* is considerably higher with communities within its modern range than it was previously. It is now well recognised as important by all the relevant Scottish LBAPS, except Argyll and Bute, who seem reluctant to acknowledge the importance of their area for any aculeates. As this includes the Argyll Islands, with modern populations of *Bombus distinguendus, B. muscorum* (new BAP), *B. ruderarius* (new BAP), *Osmia parietina* and *Colletes floralis,* this is rather a surprising attitude.

**7.6.3** During August Murdo attended the inauguration of a local community project funded by Leader, and implemented by SNH and the Highland Council, to conserve the area of flowery grassland at the small village of Farr in Sunderland and spread the message about the need for active habitat conservation to protect the dispersed population of this bee along the northern coast of Scotland.

**7.6.4** Also based in Scotland, but with a national remit, the Bumblebee Conservation Trust was established during 2006. The Trust is based at Stirling University, under the leadership of Dave Goulson, who is no stranger to the ACG. The Trust is concerned with the conservation of all bumblebee species. For more information please visit its web-site: www.bumblebeeconservationtrust.co.uk

**7.6.5** Two years ago this report mentioned a trial workshop for Bumblebee Identification run in conjunction with Earthwatch. One of the participants in this workshop, Pat Stuart, a teacher in Kelso, has produced a Science Project Classroom Guide based on bumblebees and foraging. If anyone is interested in a copy of this please contact Mike Edwards in the first instance.

**7.6.6** This same Earthwatch Project has undergone its own development, with two four-day courses on Bumblebee Conservation on Working Farms being run in 2006 by Earthwatch in conjunction with Syngenta Crop Protection at the Upton Estate Farm on the Oxfordshire/Warwickshire border. It is proposed to develop this further, looking at conserving farmland wildlife on a working farm, also based at Upton.

**7.6.7** One fascinating outcome from this year's courses was the observation that *Bombus lapidarius* workers appeared to favour the legume mixes for pollen gathering, but to forage for nectar on other, shorter-corolla flowers in the adjacent non-legume flower-margins.

**7.6.8** Both *B. ruderatus* and *B. ruderarius* were known to be present in within 20Km. of the farm (in Warwickshire) and both species were recorded on these margins during the 2006 project. Before the establishment of the margins there was very little foraging habitat for any bumblebees on the farm.

**7.6.9** The Syngenta Operation Bumblebee Project is now in its second year, with fourteen farms involved. The results show a massive response of bumblebee numbers to the presence of Environmental Stewardship Pollen and Nectar mix on a farm, as summarized in the pie charts opposite (figure 4). For more details contact Mike Edwards.

**7.6.10** Further development of the Environmental Stewardship Pollen and Nectar mix has been undertaken by Marek Nowakowski of the Wildlife Farming Company. This has tackled the unsuitablilty of the grass component originally included in this mix. The problem is that the grass eventually dominates, removing the legume component altogether, however the margin is managed. Consequently, the new seed mix will be without grasses, but will include a few useful, non-legume species, such as knapweed.

**7.6.11 Monitoring at Dungeness RSPB.** Bumblebee numbers on the RSPB reserve at Dungeness have been the subject of ongoing monitoring/surveillance for over ten years. The management of the grasslands on the Reserve has been altered to take account of the foraging needs of bumblebees, with very encouraging results.

**7.6.12** The major difference between this project and the Pollen and Nectar margins instigated under Stewardship is that this project aims to restore/encourage the original legume-rich plant communities, using surviving plants or locally-sourced hay which contains local-provenance seed, especially rhizomatus forms of Red Clover, *Trifolium pratense*. Other legumes which have proved to be valuable forage sources under these conditions are Yellow Vetchling *Lathyrus pratensis* and Tufted Vetch *Vicia cracca*. The ditch flora, notably Yellow Flag *Iris pseudecorus* and Marsh Woundwort *Stachys palustris*, has also played a strong part.

**7.6.13**. Although there has been some form of monitoring/surveillance at dungeness for more than ten years, the form and areas over which this has taken place have not been changed at times in response to local conditions. Since 2002 the form of the monitoring has been fixed and undertaken for the past two years by Brian Banks, previously by Bryan Pinchen, our thanks to Brian and Bryan. The results from this time period show a steady increase in the overall numbers of bumblebees (all species) on the Reserve. These

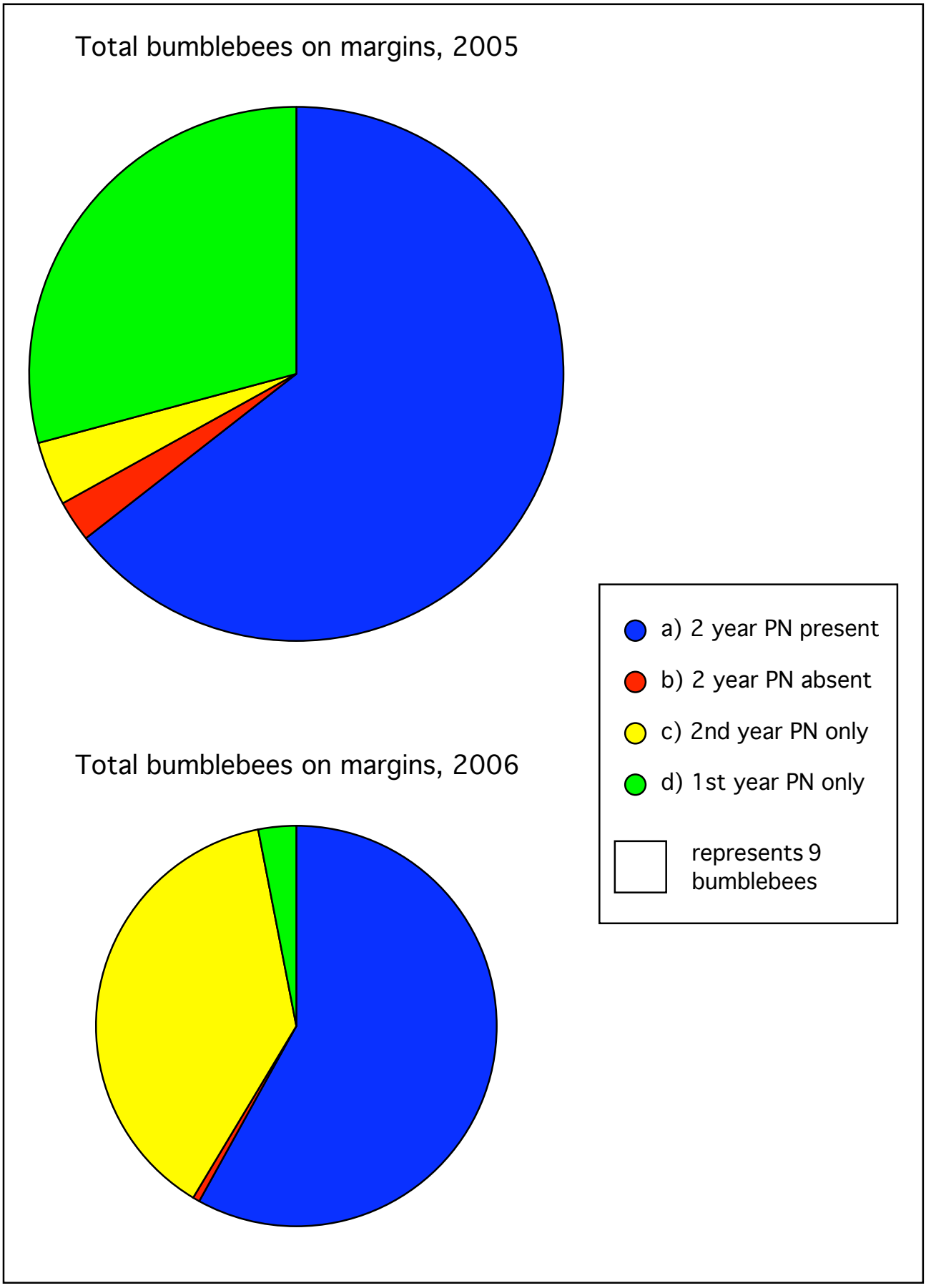



**Figure 4. Data from the Syngenta Operation Bumblebee Project represented as pie charts. The area of each 'pie' is proportional to the total number of worker bees recorded in that year.**

results form table 4. It should be noted that there are fluctuations in both directions within indivdual species.

**7.6.14**. It is reassuring that the overall trend in bumblebee numbers as a result of the steady provision of suitable forage resources in both the Syngenta Operation Bumblebee Margins and at RSPB Dungeness is similar in both cases, although there is much less continuity of data for the Syngenta margins at the moment.

**7.6.15** Interestingly, the RSPB numbers show an overall increase over previous years, although the trend in the wider countryside was for fewer bumblebees compared with 2005 (Syngenta data). This may be the beginnings of an indication that continuity of forage resources over a period of years helps buffer populations from random climatic effects. It will be interesting to see what the longer-term outcomes of the Syngenta project are.

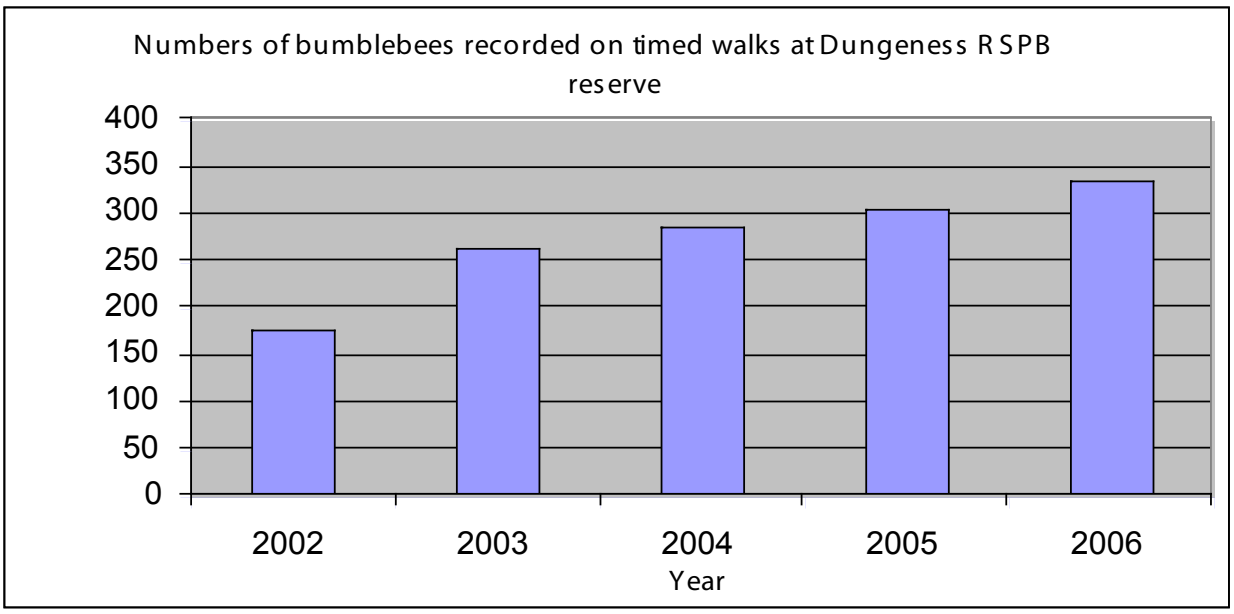



**Table 3. Changes in total bumblebee numbers recorded on transect walks at Dungeness RSPB, 2002 - 2006**

**8. Other Projects.**

**8.1 Interpretation leaflets and visits to HAP groups**

**8.1.1** Stuart Roberts has made two further visit to the Grasslands HAP group and we have received comments on the draft information leaflets for bumblebees and *Nomada armata*. These comments, which mainly concern style and consistency will be considered before final versions of these leaflets are produced.

**8.1.2** No further responses to our request for invitations to attend HAP Groups have been received, despite a second request. The Heathland and Grassland HAP groups remain, therefore, the only ones with which we have been able to establish contact.

**8.1.3** A German aculeate Hymenoptera study group recently asked, via Paul Westrich, to see our *Nomada armata* and Bumblebee leaflets as they were trying to produce similar information leaflets. Paul reports that the group found these very helpful.

**8.1.4** Although things connected with setting up Hymettus have rather interfered with the production of further leaflets ones concerned with *Andrena ferox, Homonotus sanguinolentus, Pseudepipona herrichii* and *Colletes hallophilus* are in the pipeline.

**8.2 BAP Species Review - draft new species list.**

**8.2.1** After considerable deliberation and several draft versions of the revised BAP Species List it appears that there will be a number of new aculeate species included in this list. Surprisingly, our advice that several species should not be maintained on the BAP list was rejected.

**8.2.2** Our submission that BAP species should be considered within species groups according to broad habitat requirements was also initially rejected and each species subsequently considered in isolation. This destroyed the argument for several species, in particular those which we had placed in a 'mesotrophic grassland' association. Many of these species were therefore rejected. The final list, however, requested that species should be considered in associated groups. David Sheppard, as representative of one of our Joint Lead Partners, volunteered to look at this for the listed aculeates.

**8.2.3** The new species apparently agreed (as of 27/12/2006) are:

*Andrena tarsata, Bombus muscorum, Bombus ruderarius, Colletes hallophilus, Odynerus melanocephalus, Odynerus simillimus, Tapinoma erraticum, Temnothorax interruptus.*

**8.3 Genetic profiling**

**8.3.1** As reported earlier (Sections 2.1.12, *Formica exsecta* and 6.1.5 *Andrena marginata*) two projects which involve the genetic analysis of insects have been run during 2006. Both these projects have been restricted by the potential amount of sample material available; we are often working with scarce species and finding 30+ samples of freshly caught material , preserved in ethanol is not always possible.

**8.3.2** During the end of the 2006/7 year Hymettus is looking to develop a project which will evaluate protocols for extraction and testing of DNA sequences to resolve such issues and to find out whether using small pieces of specimens from extant collections is a viable approach when fresh material is scarce. Using the output of this project it is then hoped to extend the work presented earlier in this report and add some preliminary work on the *Andrena scotica* group.

**8.3.3** Accordingly, Hymettus has applied to Natural England for financial support in the form of a contribution to the project.

**9. Development of Hymettus Ltd.**

**9.1** Hymettus Ltd was formally registered with Companies House on 29th March, 2006 and successfully applied to English Nature the funds used to support the current year's research. As from the current review meeting (January, 2007) all future reference to the Aculeate Conservation Group should be replaced by reference to Hymettus Ltd..

**9.2** The Board of Hymettus currently consists of three persons. Chairman of the Board: Geoff Trevis; Treasurer to the Board: Rosemary Winnall and Secretary to the Board: Mike Edwards. In Geoff and Rosemary we are especially fortunate to have found two willing volunteers, with good background experience in both aculeates and business. The Board will be looking to invite at least a further member to join it during 2007. The old ACG Steering Group have agreed to become the Steering Group for Hymettus Ltd., performing the same duty of guidance to the Board as they did to the ACG.

**9.3** During much of 2006 Murdo Macdonald continued to execute his duties of setting up Hymettus by applying to the Esmée Fairbairn Foundation for funds to support a co-ordinator. This application was successful, with funding obtained for three years. This funding is on a reducing programme, with £33,880 in year 1, £26,058 in year 2 and £17,806 in year three. Funding for years 2 and 3 is dependent upon acceptable progress being made towards becoming self-supporting during year 1.

**9.4** Whereas we had initially hoped to be able to fund a full-time employee for three years minimum, the nature of the support obtained required that we re-think this. Indications from suitably qualified and experienced persons implied that there was insufficient job security to attract suitable candidates.

**9.5** We did, however, consider that offering a self-employed contract to provide the co-ordinator services would make an attractive and viable option to a ecological consultant. It is considered that this approach targets the same catchment as a full-time post would have done. Preliminary details of the proposed contract have been circulated within the aculeate community, as agreed with Esmée Fairbairn, and potential contractors invited to attend the January 2007 meeting. It is intended to award the contract by the beginning of February.

**9.6** The position with funding for research from the new body, Natural England, for 2007 is currently uncertain. The new co-ordinator will be able to undertake some of the desired research during 2007 themselves, further funding avenues will be high on the list of priorities for this contract.

## 10. Research for 2007 and on

**10.1** This section is in the nature of a discussion paper. We hope to award the contract for a new co-ordinator in the near future and they will have their own ideas of future directions. The level of funding is uncertain, CCW is not likely to be able to offer funding support during 2007. The position with SNH and NE is not clear.

### 10.2 Genetic Matters

**10.2.1** One area which is currently topical concerns the so-called bar-coding approach to determination where genetic differences are evaluated using DNA markers. During the past years we have funded three projects with connections to this approach.

**10.2.2** Two of them (*Bombus ruderatus/hortorum* and *Andrena marginata/A. scotica* group) have concerned the provision of evidence as to whether species-pairs should be considered as separate entities or are more closely related than this. In all cases genetic evidence should form only one part of the information required to make a rational decision.

**10.2.3** In the third case we have been interested to see whether genetic information can provide clues as to whether ant colonies contain one or more egg-laying queens. This fact has vital consequences for the potential longevity of individual colonies.

**10.2.4** In all cases work would be greatly helped by the possibility to reliably extract genetic material from dead specimens and we have, at the moment, an ongoing project to look at developing protocols for this.

**10.2.5** We need to consider whether there are situations within the aculeates where genetic information would greatly assist prioritising conservation research or actions and what kind of support Hymettus is able to offer to Institutions and researchers engaged on such Bar-coding projects and whether there are financial implications to this support.

### 10.3 Continuation of current projects.

**10.3.1** 2006 was deliberately short on projects which would need continuing as it was known that it was likely to be a turning point in the development of the ACG.

**10.3.2** Nevertheless, both current projects concerned with Eumenids, *Odynerus melanocephalus/O. spinipes* and *Euodynerus quadrifasciatus* need further work to provide informed habitat management advice for these species

**10.3.3** Similarly there are further research requirements for two ant projects, *Formica exsecta* in Devon and *Formica rufibarbis.* Both these projects will be reported on, and discussed, in the 2007 review meeting.

### 10.4 New, and old, BAP species

**10.4.1** Once the definitive list of BAP species is published there will be a need to review the research requirements of these. We have already provided one assessment for the original set of species. This is reproduced here to aid review of how Hymettus sees itself involved in the future. Action Plans will need writing for the new species and suitable research directions deciding as well as funding obtaining.

**10.4.2** (From 2004 Review Meeting minutes) Considerable discussion was held over how to categorise the current species. Eventually it was decided to adapt those in the discussion paper. The following categories were made:

a) Delete. Species where research had shown there to be no demonstrable decline; or which are widespread on a European basis and an erratic and temporary colonists to the UK. Such species are probably affected by factors outside direct human control, such as temperature regimes. This group also includes species where it is now considered extinct and re-introduction is not a high priority, or feasibility.

b) Phase 1 BAP Active Autecology. Species believed to meet the BAP criteria (UK decline, European importance) where autecological research is required to ascertain the factors affecting them and the habitat features required.

c) Phase 2 BAP Habitat-associated Action. Demonstrated to met BAP criteria through decline or European importance. The autecology of the species is well-enough known to inform HAP groups. ACG action should concentrate on raising awareness within the HAP groups of the habitat features which are required for these species. It is not intended to tell HAP groups how to provide these, unless asked for further information or collaboration. Groups of associated species may be represented by a single Action Plan where appropriate.

The final agreed lists are as follows:

1. Current BAP species

a) Delete: *Andrena gravida; Andrena lathyri; Evagetes pectinipes; Formica pratensis* (still present on Channel Islands, where it appears to be OK); *Nomada errans; Nomada ferruginata.*

b) Phase 1 BAP Active Autecology. *Formica exsecta* (not Lead Partner for this species, but with involvement in England population); *Formica rufibarbis; Lasioglossum angusticeps.*

c) Phase 2 BAP Habitat-associated Action. *Andrena ferox; Bombus* species group *distinguendus, humilis, ruderatus, subterraneus, sylvarum*; (*B. subterraneus* extinct in UK, but still exists as UK-originated population in New Zealand which could be re-introduced when habitat is favourable.); *Cerceris quadricincta; Cerceris quinquefasciata; Chrysis fulgida; Chrysis hirsuta; Colletes floralis; Formica picea* (ex candida) (other Lead Partners need consultation); Wood Ant species group: *Formica rufa; Formica lugubris; Formicoxenus nitidulus* (other Lead Partners need consultation); *Homonotus sanguinolenta; Nomada armata; Osmia inermis; Osmia parietina; Osmia uncinata; Osmia xanthomelana; Pseudepipona herrichii.*

### 10.5 Future projects possibly of a rather larger scale than those which we have been traditionally involved in.

**10.5.1** There are several themes which require a considerable amount of additional research if we are to maintain the position of ACG/Hymettus at the front of ecological thinking.

**10.5.2** One of the major strengths of Hymettus is the ability to tap into a large body of experienced and reliable aculeate enthusiasts. These are mostly amateurs where their involvement with aculeates is required, but their pooled knowledge and understanding of aculeate ecology is second to none in the UK.

**10.5.3** We have already provided joint supervision for three Masters students working on Bumblebee Projects. Each of these was successful both for the students concerned and for the improvement of the body of knowledge about bumblebees. Using the body of expertise to provide essential field and identification services to support larger projects could be a valuable extension of the work done by Hymettus.

**10.5.4** For instance, we have supported Steering Group member Jeremy Field's researches into the sphecid wasp *Ammophila pubescens*, both financially and by providing appropriate expertise. Jeremy suggests that he would be interested in, and would consider an efficient use of funding, setting up a Ph.D studentship.

**10.5.5** Under this it would be possible to carry out some much more detailed work and train the student up so that they'd become independent. Two possible topics are:-

a) Which UK wasps are truly declining and which are increasing using literature/ BWARS data, plus resampling Breckland sites that Jeremy sampled back in the 1980s using traps? (This has connections with the ACG project on monitoring, led by Glenda Orledge, which reported at the 2004 Review Meeting.)

b) The autecology of a specific threatened species/group and the factors affecting its/ their ecology. This could be extended into providing models to assess population ranges, number of discrete populations and how this relates to known areas of occupancy. These last issues relate directly with many of the discussions which took place at previous Review Meeting and were concerned with reviewing BAP targets. The outcomes could provide good, scientific guidance for the writing of future action plans and setting of targets.

**10.5.6** Clearly, this would need considerable funding (£60k+ at standard university funding levels). If the Hymettus officer found some possible sources to fund such a project, Jeremy would be happy to provide significant help with writing the proposal, and to think about possible projects in more detail.

**10.5.7** We have also been involved as a partner in the development of a number of habitat management and /or surveillance related projects, for instance the Grazing Risk Assessment for Heathlands with the Hampshire Grazing Project and English Nature Heathlands Team. There are many other situations where the lack of suitable, or ill-considered, management leads to major impacts on aculeates.

**10.5.8** Finally, there is a lot of information gathered as a result of ACG/Hymettus projects. Much of this has become buried in the accumulated dust of past Project Reports. There is an urgent need to collate this information and provide ready access to it. Effectively publicising our past work can only lead to improved publicity and possibilities for future funding.