

West Penwith Moors targeted rare insect species survey

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Perkin's mining bee *Andrena rosae*

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Summary

A targeted rare insect species survey was commissioned by Natural England to support the potential notification of key areas of semi-natural habitat and associated features in the West Penwith Moors area of west Cornwall as a Site of Special Scientific Interest (SSSI).

This report presents the results of survey work carried out between July and September 2014 and from April to August 2015.



Small pearl-bordered fritillary (Patrick Saunders)

Acknowledgements

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Overview of results

Pearl-bordered fritillary *Boloria euphrosyne*

Pearl-bordered fritillary was not found during the survey and is thought to be extinct in the area. Both the habitat quality and micro-climate is poor for this species within the survey area.

Small pearl-bordered fritillary *Boloria serene*

Small pearl-bordered fritillary was found on 4 sites within the West Penwith Moors survey area and one just outside the area. Colonies at all these sites seemed very weak. Although large areas of suitable bracken habitats and mire habitats were found, *Viola* numbers were poor and the sites are in need of management for this species. Landscape scale conservation including linking coastal sites with the West Penwith Moors is needed.

Marsh fritillary *Euphydryas aurinia*

This butterfly was not found during the survey and is probably now extinct in Penwith. There is a small area of suitable habitat spread over 12 sites. However, the combined potential habitat area indicates that the Penwith Moors area could support the species with management interventions.

Narrow-bordered Bee Hawk-moth *Hemaris tityus*

This species was not found. The recent record for this species from the area has been misidentified. However, it is possible it may occur in the Penwith Moors area.

Small scabious bee *Andrena marginata*

This species was not found during the survey and is probably extinct in Penwith. The habitat for this bee was in very good condition at two sites, one outside the West Penwith Moors survey area.

Perkin's mining bee *Andrena rosae*

This bee was found to be widespread within the survey area, recorded at 16 locations within the overall West Penwith Moors survey area. Penwith may have the strongest population of this bee in the UK. The bee was found to be associated with ruderal heathland/scrub edges with abundant *Angelica* *Angelica sylvestris*, flowering mixed sheltered Willow *Salix* sp. and Blackthorn *Prunus spinosa*.

Small red damselfly *Ceriagrion tenellum*

Small red damselfly was found at 4 locations, including one site which it is recommended is included in the project area. The damselfly has a very strong population at Bostraze. All the other potential ponds found within the survey area were unsuitable usually with insufficient open water. A pond restoration plan is recommended for this species.

Cats ear mining bee *Andrena humilis* and Cats ear nomad bee *Nomada integra*

The Cats ear mining bee was found at 3 sites. The much rarer Cats ear nomad bee was found at 2 sites. Grassland and heathland habitats with abundant flowering yellow composites are important for these species.

Black-headed Mining bee *Andrena nigriceps*

This scarce bee was found at 4 sites.

Tormentil mining bee *Andrena tarsata* and Tormentil nomad bee *Nomada roberjeotiana*

The Tormentil mining bee was found at 14 sites in the West Penwith Moors survey area, and an additional 2 sites outside the survey area. The Tormentil nomad bee was found at 3 sites. The Tormentil mining bee is widespread within the Penwith Moors area, occurring on habitats with super-abundant flowering Tormentil, usually lightly grazed acid grassland or heathland. West Penwith has exceptionally strong populations of both bees of national importance.



Tormentil nomad bee *Nomada roberjeotiana* (Patrick Saunders)

General observations

The findings of this survey paint a mixed picture for the species studied. Some species are clearly not doing well, with Pearl-bordered and Marsh fritillaries now probably extinct in the survey area, Small red damselfly populations are very isolated and there are apparently weak populations of Small pearl-bordered fritillary. On the other hand, the survey discovered strong, nationally important bee populations (Perkin's mining bee, Tormentil mining bee and Tormentil nomad bee).

The survey found that many of the sites visited were affected by scrub succession which is reducing the area and quality of key habitats for the species surveyed which, in general, require more open conditions with a varied vegetation structure. In particular, important habitats for the bee species were found to be flower-rich edge or mosaic habitats with taller ruderal plants. It is recommended that conservation management for these rare species should include retention and enhancement of these features. Restoration grazing should be implemented sensitively within Angelica-rich communities and flower rich grassland/heathland edge communities as flower abundance may be affected by stock preferentially grazing these areas during the summer.

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1 Introduction

This field survey was commissioned by Natural England. The aims of the survey are listed in the specification for the West Penwith Moors targeted rare insect species survey.

1.1 Survey Specification

Natural England is gathering evidence to support the potential notification of key areas of semi-natural habitat and associated features in the West Penwith Moors area of west Cornwall as a Site of Special Scientific Interest (SSSI).

Survey work is currently being carried out to underpin Natural England's biodiversity evidence base for the moorland, known locally as roughland. Key semi-natural habitats occurring in the survey area include lowland heathland and associated acid grassland, mires and flushes, scrub and bracken. For the purposes of survey work the area has been divided into 57 separate numbered survey areas, some of which are contiguous, with individual survey areas ranging in size from c.3ha to c.157ha. Some survey areas are currently under positive management while others are unmanaged.

A requirement for up to date information about the current status of the insect species listed below has been identified in order to determine whether they qualify as notified features of the proposed SSSI.

- *Pearl-bordered fritillary *Boloria euphrosyne* – Nationally Scarce, Red List: Endangered, S.41;*
- *Small pearl-bordered fritillary *Boloria serena* – substantial local decline, Red List: Near Threatened, S.41;*
- *Marsh fritillary *Euphydryas aurinia* – Nationally Scarce, Red List: Vulnerable, S.41;*
- *Narrow-bordered Bee Hawk-moth *Hemaris tityus* – Nationally Scarce, S.41.*
- *Small scabious bee *Andrena marginata*- Nationally Scarce, (status under review)*
- *A solitary mining bee *Andrena rosae* – (status under review)*
- *Small red damselfly *Ceragrion tenellum* – Nationally Scarce*

1.2 Objectives

The targeted rare insect species survey was carried out in the summers of 2014 and 2015. The survey focused on the seven species covered by the specification (see section 1.1 Survey Specification), with the aim of recording either adults or larvae and presence of suitable habitat.

An additional five species of conservation importance were found during fieldwork which are included in the report. These are:

- Cats ear mining bee *Andrena humilis*
- Cats ear nomad bee *Nomada integra*
- Black-headed mining bee *Andrena nigriceps*
- Tormentil mining bee *Andrena tarsata*
- Tormentil nomad bee *Nomada roberjeotiana*

1.3 Methodology

A desktop study to collate existing records of the target species was carried out to identify potential locations for field work. This gathered data from a number of sources including:

- Records from ERICA, the digital database for biological records in Cornwall,
- Personal communication with local naturalists,
- National Vegetation Classification (NVC) surveys,
- Google maps.

The field survey was carried out between July to mid-September 2014 and April 2015 until August 2015. Potentially suitable sites identified by the desktop review were visited and supplemented by a “drive through” of the project area stopping where suitable habitats occurred. Fieldwork consisted of spot sampling of sites for the target species in good weather. The 2014 field season had very good weather which greatly assisted getting good coverage on the survey. Species and site details were recorded as appropriate.

Larval searches were conducted at potential Marsh fritillary sites, where individual Devil’s-bit scabious *Succisa pratensis* plants were examined for presence of larval (caterpillar) webs (UK Butterfly Monitoring Scheme 2006).

The Small red damselfly was surveyed by covering as many of the possible ponds within the project area as identified from the desk top review.

The kind permission of land owners and managers in allowing access for surveys is acknowledged. Some locations were visited by a “walk through” on a public right of way.

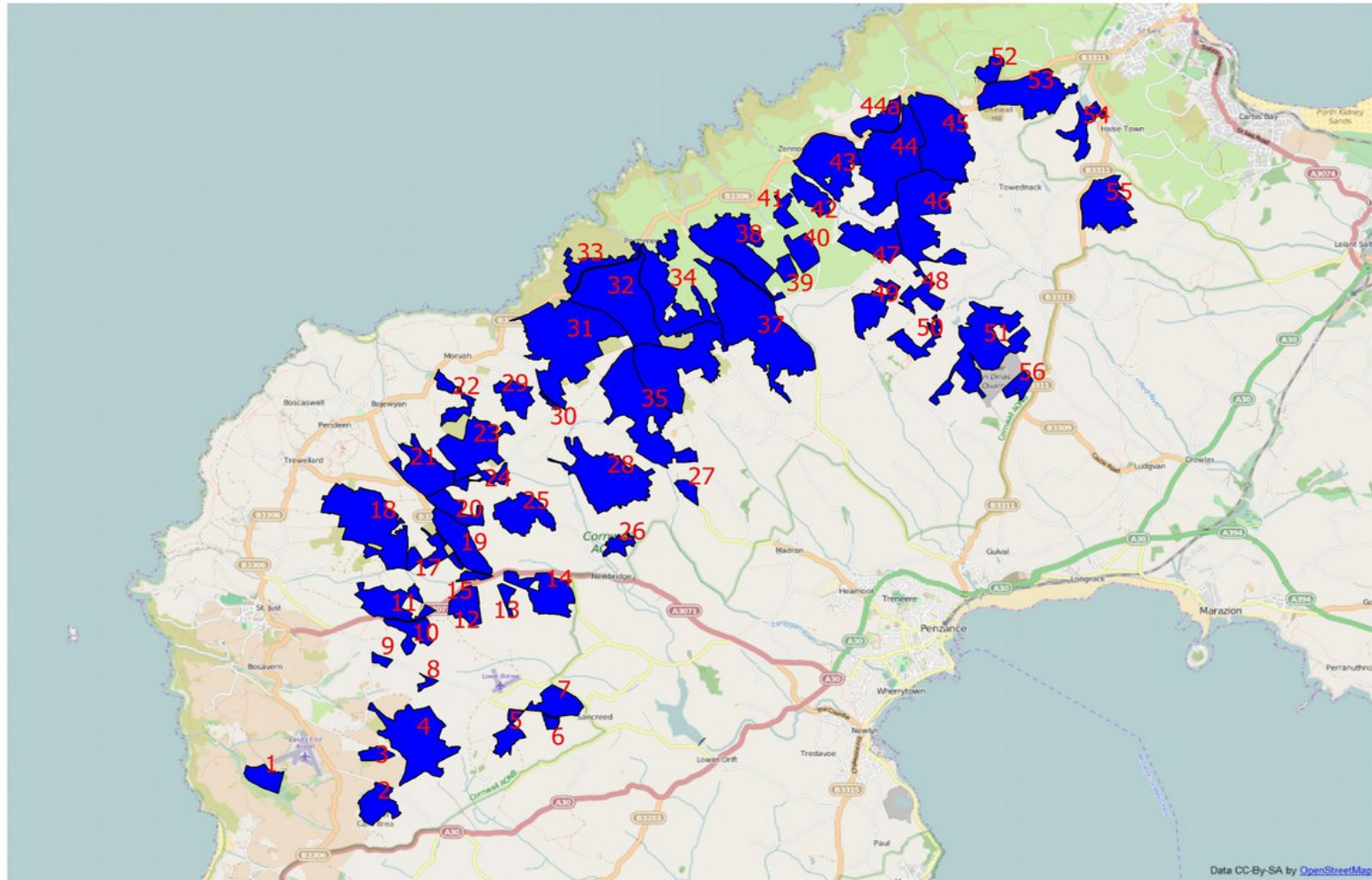


Figure 1. West Penwith Moors (WPM) survey area

2 Results by species

2.1. Pearl-bordered fritillary *Boloria euphrosyne*

2.1.1 Species summary

The Pearl-bordered fritillary *Boloria euphrosyne* is Nationally Scarce, Red List: Endangered, and S.41. It has greatly declined in Cornwall now occurring only on about 4 sites. Mis-identification and confusion with the very similar Small pearl-bordered fritillary is suspected. It is most likely that the recent Penwith records below are not valid (P. Harris pers. comm.).

The Pearl-bordered fritillary occurs on sheltered dry sites with abundant Dog violet *Viola riviniana* surrounded by a leaf litter layer. Typically these are Bracken *Pteridium aquilinum* slopes with a very warm micro-climate or historically coppiced woodland. The butterfly is more “fussy” than the Small pearl bordered fritillary and is very specific in its needs for the right combination of micro-climate, leaf litter and bare ground.

2.1.2 Status on West Penwith Moors

The butterfly was not found during the survey and is thought to be extinct in the area. Although large areas of bracken occur throughout the survey area the habitat quality is poor for this species. The Atlantic dominated West Penwith climate is also unfavourable for this species, which is likely to mean only the rarer most sheltered dry areas are suitable. Only one site with flower rich sheltered bracken with Dog violet was found at Rosemorran (43)

The Pearl-bordered fritillary has been recorded on 2 sites within the project area, Pennance Farm (38) 1987 and Foage Farm (44) 1989. There is a cluster of other Penwith coastal records in the 1980's and 2 recent additional sites in Penwith. The butterfly is very difficult to separate from the Small pearl-bordered fritillary and confusion even by experienced naturalists is common. One of the recent Penwith records is in August and is almost certainly not Pearl-bordered as the butterfly normally appears between late April and early June and very rarely occurs as a second brood even on sites where it is abundant.

2.1.3 Survey results

Table 1: Pearl-bordered fritillary *Boloria Euphrosyne*

Survey area / location	Survey area no.	Grid reference	Date of visit	Observations about habitat condition at time of survey
Rosemorran	43	SW 46073 37872	12/05/15	Sheltered suitable flower rich Bracken, lightly grazed, abundant <i>Viola riviniana</i> .
Rosemorran	43	SW 46159 37831	08/04/15 21/04/15	Sheltered suitable flower rich Bracken, lightly grazed, abundant <i>Viola riviniana</i> .

2.2. Small pearl-bordered fritillary *Boloria selene*

2.2.1 Species summary

This species is listed as substantial local decline, Red List: Near Threatened, S.41.

Small pearl-bordered fritillary *Boloria selene* is still quite widespread on coastal sites in Cornwall, although this butterfly has declined greatly in other parts of the UK. The strong Cornish population offers an opportunity for halting a decline here before the population is restricted to small habitat islands which are more vulnerable to extinctions.

The species occurs on a range of sites with sheltered Violet *Viola* sp. In Cornwall these sites are typically sheltered Bracken dominated scrub or grassland habitats with the main larval food plant Dog violet *Viola riviniana*, although the butterfly can also occur on wet grassland with Marsh violet *Viola palustris*. The species can occur on colder and wetter sites than Pearl-bordered fritillary but sustains better populations on sheltered slopes with a warm micro-climate.

2.2.2 Status on West Penwith Moors

Since 1990 this species has been recorded on 10 sites within the project area. However, during this survey the butterfly was only found on 4 sites and one just outside the project area. Colonies at all these sites seemed very weak with only between 1 and 5 individuals recorded. Although large areas of suitable bracken habitats and mire habitats were found, *Viola* numbers were poor and the sites appear to be in need of management for this species.

The strongest populations of this butterfly during the survey occurred in mires, where Marsh violet was abundant in *Molina* dominated habitats. These were relatively sheltered areas with a favourable micro-climate. Egg laying was observed around a thatch of dead *Molina*. The occupied sites had some light management which was important as it increases the structural diversity of the vegetation, a requirement of this butterfly.

On 3 other sites the butterfly was observed to occur around sheltered bracken slopes with Dog violet.

The butterfly was not found at 3 sites with apparently very good habitat for this species: Rosemorran (43), Boswarva Carn (28) and Bussow Moor (24), although Bussow Moor is a more isolated site making colonisation difficult.

The meta-population dynamics of the Marsh fritillary has been more widely studied (Bulman 2007), but it seems likely that Small pearl-bordered fritillary populations behave in a similar way. This species may be at the margins of landscape scale extinction within the survey area as the small inland populations become weaker through habitat fragmentation and isolation, as has already happened to the Marsh fritillary. The butterfly was recorded on 3 coastal sites near the survey area. The second brood butterfly was abundant on 2 sites near Sennen. Further studies of the coastal colonies of this butterfly are needed, as strong coastal colonies are likely to buffer the inland sites through dispersal.

2.2.3 Survey results

Table 2: Small pearl-bordered fritillary *Boloria selene*

Survey area / location	Survey area no.	Grid reference	Date of visit	Count	Habitat
Nine Maidens Common	36	SW 44104 35489	09/06/15	5	<i>Molina</i> mire with abundant <i>Viola</i> sp., some sheltered trackways flailed and some thatch.
Mulfra Hill	37	SW 45063 34825	09/06/15	1	Sheltered suitable Bracken, some light grazing, <i>Viola</i> sp. rare.
Mulfra Hill	37	SW 45102 34788	21/06/15	1	Sheltered suitable Bracken, some light grazing, <i>Viola</i> sp. rare.
Beagletodn Downs	45	SW 48055 37966	25/06/15	1	Ungrazed thick Bracken, <i>Viola</i> sp. rare.
Amalveor Downs	46	SW 47969 37904	03/06/15	4	Butterfly occurs in small lightly grazed mire with abundant <i>V. palustris</i> , nearby sheltered suitable Bracken, lightly grazed, abundant <i>V. riviniana</i> may also be used.
Sites with strong potential for SPBF					
Chapel Carn Brea	2	SW 38489 27826	22/04/15	0	Suitable flower rich Bracken, Some <i>Viola</i> sp.
Chapel Carn Brea	2	SW 383 280	26/05/15	0	Suitable flower rich Bracken, Some <i>Viola</i> sp.
Chapel Carn Brea	2	SW 384 279	08/06/15	0	Sheltered suitable Bracken .
Bostraze Bog	17	SW 39349 32426	10/06/15	0	Some suitable patches <i>V. palustris</i> .
Carnyorth Common	18	SW 39170 32176	10/06/15	0	Small suitable patches of <i>V. palustris</i> , although over large area, under grazed.
Boswarva Carn	28	SW 43275 33508	23/06/15	0	Patches of abundant <i>V. palustris</i> in tussocky <i>Molina</i> .
Boswarva Carn	28	SW 42384 33456	07/06/15	0	Patches of abundant <i>V. palustris</i> in tussocky <i>Molina</i> , and some areas of <i>V. riviniana</i> .
Rosemorran	43	SW 46159 37831	08/04/15	0	Sheltered suitable Bracken, lightly grazed, <i>Viola</i> sp. abundant.

Sites with strong potential for SPBF	Survey area no.	Grid reference	Date of visit	Count	Habitat
Rosemorran	43	SW 46159 37831	24/06/15	0	Sheltered suitable Bracken, lightly grazed, <i>Viola</i> sp. abundant.
Rosemorran	43	SW 46073 37872	27/05/15	0	Sheltered suitable Bracken, lightly grazed, <i>Viola</i> sp. abundant.
Rosemorran	43	SW 46034 37931	08/06/15	0	Sheltered suitable Bracken, lightly grazed, <i>Viola</i> sp. abundant.
Rosewall Hill	53	SW 497 393	06/06/15	0	Trackways with some <i>Viola</i> sp. and suitable Bracken scrub.
Bussow Moor	54	SW 50123 38898	11/06/15	0	Patches of abundant <i>V. palustris</i> in tussocky <i>Molina</i> .
Sites with small area of suitable habitat for SPBF					
Caer Bran	5	SW 391 288	23/06/15	0	Small area of sheltered Bracken with occasional <i>Viola</i> sp.
Sancreed Beacon	7	SW 4134 2960	23/06/15	0	Suitable trackside <i>Viola</i> sp. with Bracken mosaic.
Boswens North	24	SW 40758 33390	24/06/15	0	Suitable <i>V. palustris</i> , then poorer <i>Molina</i> heath.
Lower Trewern	26	SW 430 316	08/06/15	0	Small amount of suitable <i>V. palustris</i> .
Carn Galver	32	SW 43137 36726	24/06/15	0	Some Bracken mosaic, <i>Viola</i> sp. present but very rare.
Bosporthennis	34	SW 44155 35744	09/06/15	0	Small <i>Molina</i> mire with abundant <i>V. palustris</i> , ungrazed.
Men-an-Tol Croft	35	SW 43300 33581	23/06/15	0	Mire ungrazed with some patches of <i>V. palustris</i> .
Trewey Hill East	42	SW 457 379	08/06/15	0	Sheltered suitable Bracken.
Trink Hill	55	SW 50539 37115	11/06/15	0	Suitable Bracken, <i>Viola</i> sp. present but very rare, exposed.

2.3 Marsh fritillary *Euphydryas aurinia*

2.3.1 Species summary

The Marsh Fritillary *Euphydryas aurinia* is a threatened European species that is protected under the Bern Convention and listed on Annex II of the EC Habitats Directive (Barnett and Warren 1995). It is also Biodiversity Action Plan and Section 41 species.

In Cornwall key populations occur on Bodmin Moor, The Lizard and the Mid Cornwall moors. It has declined greatly outside these core areas. Penwith is potentially a key area as there are recent records (2010).

The Marsh fritillary requires Devil's-bit scabious *Succisa pratensis* as the larval food plant. The butterfly occurs typically on rush pastures such as with M25/M24 NVC communities (Barnett and Warren 1995). The species generally requires abundant Devil's-bit scabious and a sward height of 12-25cm (Ellis *et al* 2012).

Within Marsh fritillary populations there is a high turnover of individual sites or populations, through extinctions and colonisations. The species is typically used as an example of meta-population dynamics. The species is only viable long term by having a network of high quality core sites within flight distance of weaker sites (Ellis 2012). Studies have shown that the species needs a network of between 80 and 142 hectares of habitat (5-9%) in suitable condition within a 1600ha habitat area (Bulman 2007).

2.3.2 Status on West Penwith Moors

Field work during this survey did not find Marsh fritillary but found a number of sites with suitable habitat. The last recorded site for this species within the survey area at Penhale Trewern is small (8ha). The nearest suitable site is to the north at Boswarva. This has a large area of potential habitat (14ha), although the area with some Devil's-bit scabious was only about 2ha.

The estimated total area of potential Marsh fritillary habitat within the West Penwith Moors area is around 66ha, although of this about 17ha is presently in suitable condition with sufficient food-plant. The small area of suitable habitat currently available is likely to explain the extinction of this species in the area.

It has been estimated that between 80 and 142ha of suitable habitat is needed for a viable Marsh fritillary meta-population (Bulman 2007). The potential habitat area in the West Penwith Moors is close to the minimum required and suggests that, with management interventions, the area could support the species.

It has been estimated that natural re-colonisation of suitable habitat can only take place when the nearest population is less than 20km away (Bulman 2007). Penhale Trewern is about 28km from the nearest colony on the Lizard over the sea in a straight-line so natural re-colonisation is unlikely to occur.

Lightly grazed rush pastures with abundant Devil's-bit scabious are potentially important for Narrow-bordered Bee Hawk-moth *Hemaris tityus* and Small scabious bee *Andrena marginata* as well as for a range of invertebrate species. They should be considered as important habitats even without Marsh fritillary.

2.3.3 Survey results

Table 3: Marsh fritillary *Euphydryas aurinia*

Survey area	Survey area no.	Grid reference	Date of visit	Estimated area (ha) of habitat currently suitable for Marsh fritillary	Total estimated area (ha) of habitat potentially suitable for Marsh fritillary	Observations about habitat condition at time of survey Note: <i>Molinia caerulea</i> (<i>Molinia</i>) = Purple moor grass <i>Succisa pratensis</i> (<i>Succisa</i>) = Devil's-bit scabious
Bosvargus and Tregeseal Common	11	SW 393 315	10/07/14	0.5	1.7	About 0.5 ha of <i>Molinia</i> with <i>Succisa</i> . Total 1.7 ha could become suitable with management.
Bostraze Bog to Boslow	17	SW 393 323	04/09/14	1.8	7	1.8 <i>Molinia</i> /rush pasture with frequent <i>Succisa</i> , including (ungrazed?) <i>Molinia</i> with rare <i>Succisa</i> .
Caryorth Common to Bostraze Bog	18	SW 391 326	04/09/14	2	11	About 2ha of suitable <i>Molinia</i> with <i>Succisa</i> . Total 11ha could become suitable with management. Large part of the habitat scrubbing over.
Boswens North	24	SW 4065 3339	31/07/14	1	5	<i>Succisa</i> and suitable <i>Molinia</i> . Total 5ha. of <i>Molinia</i> may become suitable with management.
Penhale Trewern	26	SW 426 322	23/08/14	0.7	2	Site of most recent (2010) record for Marsh fritillary. Frequent suitable <i>Succisa</i> in small parts of the site. Some good management by rotational cutting and burns but the site appears largely scrubbed over with only occasional <i>Succisa</i> .
Trewern Moor	26	SW 430 316	08/06/15	1.1	1.1	A small area with very good <i>Succisa</i> and suitable <i>Molinia</i> . Grazed.
Boswarva Carn to Great Bosullow	28	SW 422 335	22/08/14	2	14	About 2ha of suitable <i>Molinia</i> with occasional <i>Succisa</i> . Total 14 ha could become suitable with further management. Light grazing delivering good results although <i>Succisa</i> regeneration appears poor at present.

Survey area	Survey area no.	Grid reference	Date of visit	Estimated area (ha) of habitat currently suitable for Marsh fritillary	Total estimated area (ha) of habitat potentially suitable for Marsh fritillary	Observations about habitat condition at time of survey Note: <i>Molinia caerulea</i> (<i>Molinia</i>) = Purple moor grass <i>Succisa pratensis</i> (<i>Succisa</i>) = Devil's-bit scabious
Bosporthennis to Hannibal's Carn	34	SW 433 368	12/08/14	0	0.5	Small area of M25 scrubbed over.
Men-an-Tol Croft, Lanyon Croft and Bosilliack	35	SW 43300 33581	23/06/15	0.5	7	Mostly ungrazed <i>Molinia</i> mire, <i>Succisa</i> rare.
Nine Maidens Common	36	SW 442 357	05/09/14	3	11	3ha with very good <i>Molinia</i> and <i>Succisa</i> . Total 11ha could be suitable with management.
Mulfra Hill	37	SW 451 347	09/06/15	0.5	0.5	A small area with some <i>Succisa</i> and suitable <i>Molinia</i> .
Bussow Moor	54	SW 499 385	03/09/14	4	6	About 4ha <i>Molinia</i> with patches of abundant <i>Succisa</i> . Some areas with light grazing and some scrubbing over. The site is very isolated from any other suitable sites.
TOTAL				17.1	66.8	
Estimated overall area of habitat within the survey area potentially suitable for Marsh fritillary (including habitat currently suitable) is approximately 66ha.						



Picture 1. Nine Maidens Common (36) SW 44244 35711

Area with tussocks of Purple moor grass and Devil's-bit scabious with a vegetation structure suitable for Marsh fritillary.



Picture 2. Bussow Moor (54) SW 50071 38835

Area with tussocks of Purple moor grass and Devil's-bit scabious unsuitable for Marsh fritillary as the Purple moor grass is dominating and preventing Devil's-bit scabious regenerating. Other areas of the site were in more suitable condition.

2.4. Narrow-bordered Bee Hawk-moth *Hemaris tityus*

This Nationally Scarce, S.41 day flying moth was reported from Gwenver near Nanquidno in 2013. Subsequent conversations with the recorder indicate this record is not valid. There are no other records for this species in Penwith and it was not found during this survey. Unimproved grassland is a key habitat with Devil's-bit scabious the main larval food plant. The species may possibly occur or colonise, but it is a difficult species to survey.

The species normally occurs on the same sites as Marsh fritillaries but likely to use subtly different micro-habitats. The previous section on Marsh fritillary can be broadly applied to this species. This species should be considered a possible species on any of the sites listed above.

2.5. Small scabious bee *Andrena marginata*

2.5.1 Species summary

The Small scabious bee *Andrena marginata* is Nationally Scarce (Na), (Falk 1991). It appears to have been lost from sites its former range in Devon and Cornwall (author's observations). The species is declining elsewhere in Europe (Larsson 2006).

The Small scabious bee is a scabious specialist. The bee occurs as two forms which some authors suggest may be two separate species (Lee 2007). One form reportedly uses Field scabious *Knautia arvensis* or Small scabious *Scabiosa columbaria*, the other using Devil's-bit scabious *Succisa pratensis* pollen to provision its larvae. In this survey the form (or species) using Devil's-bit scabious was surveyed for.

The Small scabious bee is likely to need sites with high abundance of flowering scabious. It has been calculated that 780 or more individual flowers within a discrete area are needed for 10 adults of a similar *Andrena* species (Larsson 2006).

It is a ground nesting bee. In Sweden its nesting preferences are exposed sandy patches such as river embankments, disturbed patches created by cattle, paths or road banks (Larsson 2006). In Scotland similar sandy bare ground features are used but also squashed mole-hills on a lawn (Bowman & Macdonald 2011).

2.5.2 Status on West Penwith Moors

The bee was previously recorded within the project area at Woon Gumpus Common in 1990 and 2007.

The bee was not found during this survey. It seems most likely the bee is extinct in West Penwith as the areas with abundant flowering Devil's-bit scabious are now small and isolated. At Woon Gumpus Common there was still a fairly big stand of Devil's-bit scabious but the overall amount flowering was small. Further survey is recommended at Bussow Moor (survey area 54).

Devil's-bit scabious occurred at other sites across the project area, particularly at Bostraze although here summer grazing was reducing the abundance of flowers. Mass flowering scabious is very vulnerable to even conservation grazing and cutting practices. Further survey is recommended.

It is unlikely that lack of nest sites is a limiting factor on any of the best sites with Devil's-bit scabious, although on some of the mire areas the availability of suitable nest sites may be an limiting factor.

2.5.3 Survey results

Table 4: Small scabious bee *Andrena marginata*

Survey area / location	Survey area no.	Grid reference	Date of visit	Observations about habitat condition at time of survey
Woon Gumpus Common	21	SW 3930 3351	22/08/14	Last recorded site for this species in West Penwith Moors area. Some stands of scabious although probably not enough.
Bussow Moor	54	SW 50139 38758	03/09/14	Large patch of scabious + smaller patches. Further survey is recommended.

Picture 3. Bussow Moor (54) SW 50139 38758



Abundant tall flowering scabious in sheltered site with some shorter grassland areas. Good habitat for the Small scabious bee but none were found here.

2.6 Perkin's mining bee *Andrena rosae*

2.6.1 Species summary

Perkin's mining bee *Andrena rosae* is RDB2 (Falk 1991) but the status is currently under review. The bee may be extinct in Ireland and is threatened / Red Data Book listed in five other EU Countries (Fitzpatrick 2006).

This bee has a very limited distribution in the UK. The current records indicate a retreat to Exmoor, South Wales and Cornwall (Else 2014). Spooner in his Cornish Aculeate review notes that this bee “has become scarcer in recent years” (Spooner 1984). It is likely there is under recording, but the bee is very restricted and declining and the Penwith population is important.

The species occurs in two broods. Some authors have considered the two broods to be two separate species as *Andrena rosae* (summer) and *Andrena strangulata* (spring). Genetic studies (Reemer *et al* 2008) and other field work (Van Der Meer *et al* 2006) refute this.

2.6.2 Status on West Penwith moors

Perkin's mining bee has strong populations across the West Penwith Moors, occurring within 12 of the survey areas and a further 3 sites. Penwith may support the strongest population of this bee in the UK.

The summer brood bee appears to be strongly associated with Angelica *Angelica sylvestris*, the main pollen preference observed for this species on the West Penwith Moors. Spooner has only recorded summer brood Perkin's mining bee on Angelica (Spooner 1984). Other studies have confirmed a strong link to Hogweed *Heracleum sphondylium* (Van Der Meer *et al* 2006). The bee was observed collecting pollen once on Hogweed which is probably a secondary forage of importance, although much of the Hogweed was in peak flowering before most of the observations of the bee.

The bee was observed collecting pollen on Bramble *Rubus fruticosus* once during the survey. Outside the project area on two coastal sites the summer brood bee appears to completely reliant on Bramble pollen.

The spring brood bee was recorded on various Willows *Salix* sp., Blackthorn *Prunus spinosa*, Hawthorn *Crataegus monogyna* and Sycamore *Acer pseudoplatanus*. In 2015 very few females were observed, it seemed likely that both windy cool weather and the huge abundance of flowering Willow and Blackthorn, made finding individuals difficult. The species probably also occurs at low density. In West Penwith, most of the observations of pollen collection were on the less common Eared willow *Salix aurita*. The Eared willow was later flowering than the more common Grey willow *Salix cinerea*. The bee was also observed probably collecting pollen from Hawthorn and Sycamore. In Holland spring brood females of *A. rosae* were observed on *Salix* sp. and *Prunus spinosa*, but pollen analysis indicated that pollen had only been collected on *Salix* (Van Der Meer *et al* 2006). Westrich (1989) reports that the spring brood collects pollen on the flowers of Asteraceae, Rosaceae and Salicaceae. It seems most likely that the species needs a mixed range of pollen sources throughout the spring season to include various Willow sp., particularly Eared willow *Salix aurita*, and Blackthorn.

Nest sites are an additional requirement. Van Der Meer (Van Der Meer *et al* 2006) found solitary females nesting on south facing banks with short grass, others refer to the bee using bare ground and compacted paths (Else 2014).

This species is associated with a range of habitats including ruderal and scrubby edges of wet and dry heathland, hedgerows and Willow/Blackthorn scrub. The connectivity of suitable habitats is likely to be important to provide foraging resources for both broods, i.e. the presence of both species of flowering Willow and/or Blackthorn in spring and tall ruderal habitats with abundant Angelica and Hogweed in summer is required.

The bee is likely to need a high abundance of flowers within 200 - 500m of nest sites. The large summer colony near Men-an-Tol Croft was 0.9km from the nearest spring individual recorded, with the only other spring flowering scrub 500m, from the nest site while at a number of other sites both broods were recorded. The dynamics of the relationship between the two broods needs more research.

In the West Penwith Moors area the lack of Angelica is probably more of limiting factor than lack of Willow and Blackthorn. Suitable sites are often in valleys which offer better micro-climates and both wet and dry scrub types.

This species is likely to benefit from edge habitats under low intensity management, although many sites are scrubbing over and are in need of light conservation grazing or scrub control. Angelica may be reduced by preferential grazing, although probably not by rabbits which were providing very good conditions for this bee at one site. Some disturbance is needed to maintain biennial ruderal species such as Angelica and to maintain short turf or bare ground for nesting. In West Penwith Moors the bee is associated with road/tracksides habitats and some rotational cutting regimes may work well for this species.

2.6.3 Survey results

Table 5: Perkin's mining bee *Andrena rosae*

Survey area / location * not in survey area	Survey area no.	Grid reference	Date of visit	Count: number of individuals seen, male or female and food plant	Habitat
Grumbla*	5 (Near)	SW 40596 29578	02/08/15	1m Angelica 1f Angelica	Good site – rabbit grazed lawns with abundant Angelica and various scrub edge habitats, important for populations in 5 and 7.
Caer Bran	5	SW 406 291	11/05/15	1m Willow	Eared willow flowering.
Sancreed Beacon road	(6)	SW 41323 29435	31/07/14	1f Angelica	Road verge with Angelica, larger areas of suitable scrub habitats within survey area 6.
Sancreed Beacon	7	SW 4100 2953	02/08/15	3f Angelica	Angelica on road verge and small amount in ruderal heathland.
Sancreed Beacon road	(7)	SW 41322 29434	31/07/14	1f Angelica	Road verge with Angelica and scrub edge, potentially suitable habitat within survey area 7.
Sancreed Beacon road	(7)	SW 41067 29522	31/07/14	1f Angelica	Road verge with Angelica and scrub edge, potentially suitable habitat within survey area 7.
Bosvenning & Roskennals Common	14	SW 412 317	22/04/15	1m Blackthorn	Sheltered stand of flowering Blackthorn, also small amount of Willow.
Bostraze to Boslow	17	SW 39470 32587	13/08/14	1f Angelica	Small area of un-cut wet grassland, other areas currently unsuitable.
Caryorth Common	18	SW 3852 3243	16/08/15	1f Angelica	Various areas of tall flower-rich ruderal habitats and bare ground with Angelica.
Woon Gumpus Common	21	SW 39488 33450	31/07/14	1f Angelica	Various areas of tall flower-rich ruderal habitats.
Tor Noon and Hale Downs (Rose Valley)	22	SW 39906 35140	12/08/14	2f Angelica	Small area of wet grassland and Willow scrub, under rotational cut.

Survey area / location * not in survey area	Survey area no.	Grid reference	Date of visit	Count: number of individuals seen, male or female and food plant	Habitat
Boswens North	24	SW 40651 33391	31/07/14	1f Angelica	Large area of ungrazed wet grassland/M25 with Angelica and Willow scrub, bigger numbers likely.
Little Bosullow*	28 (Near)	SW 41930 34163	21/04/15	1m Blackthorn	Nice stand of sheltered flowering Blackthorn. Willow gone over at date of visit. Important habitat for populations occurring in 28 and 35.
Boswarva Carn to Great Bosullow	28	SW 42290 33555	22/08/14	5f Angelica	Lightly grazed wet grassland/M25 with Angelica, other Willow scrub present.
Bosullow Common	31	SW 4175 3450	15/08/15	1f Angelica	Road edge. Further larger area of Angelica within compartment.
Bosigran	33	SW 43130 36978	12/08/14	1f Angelica	Road verge with tall Angelica and scrub edge, other habitats currently unsuitable.
Bosigran	33	SW 43063 36860	12/08/14	1f Angelica	Road verge with tall Angelica and scrub edge, other habitats currently unsuitable.
Burnt Downs*	35 (Near)	SW 424 348	12/08/14	10f Angelica	Trackside with tall Angelica. Important habitat for populations occurring in 35 and 28.
Burnt Downs*	35 (Near)	SW 424 348	30/07/14	20f Angelica	Trackside with tall Angelica. Important habitat for populations occurring in 35 and 28.
Burnt Downs*	35 (Near)	SW 424 348	02/08/15	5f Angelica 1f Hogweed	Trackside with tall Angelica. Important habitat for populations occurring in 35 and 28.
North west of Lanyon Farm (Lanyon stream)	35	SW 4250 3421	12/08/14	1f Angelica	Scrub and wetland edge with tall Angelica, appears unmanaged.
Men-an-Tol Croft, Lanyon Croft	35	SW 43362 33469	21/04/15	1m Willow	Mixed scrub 1 male on unknown Willow, some Blackthorn on high moor.
Nine Maidens Common	36	SW 44138 35740	12/05/15	1f Willow	Eared willow flowering, <i>A. rosae</i> collecting pollen.

Survey area / location * not in survey area	Survey area no.	Grid reference	Date of visit	Count: number of individuals seen, male or female and food plant	Habitat
Nine Maidens Common	36	SW 44101 35559	12/05/15	1f Willow	Eared willow flowering, <i>A. rosae</i> collecting pollen.
Nine Maidens Common	36	SW 442 354	12/05/15	1f Willow	Eared willow flowering, <i>A. rosae</i> collecting pollen.
Mulfra hill	37	SW 4522 3578	02/08/15	3f Angelica	Heathland edge ruderal habitat with Angelica.
Treen Common	37	SW 44364 36770	30/07/14	1f Angelica	Small area of taller ruderal/scrub on open heathland.
Zennor Hill and Rosemorran (valley)	43	SW 46212 37722	03/08/15	4f Angelica 1f Bramble	Scrubby wet grassland/M25 field with abundant Angelica.
Zennor Hill and Rosemorran (valley)	43	SW 45828 38103	12/08/14	1f Angelica	Track side Angelica and scrub edges, other suitable areas off the track but extremely Bracken dominated.
Zennor Hill and Rosemorran (valley)	43	SW 46212 37722	12/08/14	12f Angelica	Scrubby wet grassland/M25 field with abundant Angelica.
Rosemorran	43	SW 460 378	27/05/15	1m Hawthorn	Sheltered flowering Hawthorn, <i>A. rosae</i> 1f observed, probably collecting pollen.
Rosemorran	43	SW 46159 37831	21/04/15	1 Blackthorn	Abundant flowering Blackthorn 1 <i>A. rosae</i> on Blackthorn. Some Willow left none observed.
Rosemorran	43	SW 46030 37963	16/04/15	1m Blackthorn	1 male near Blackthorn, Frequent flowering Blackthorn, Abundant flowering Willow.
Rosemorran	43	SW 46207 37823	12/05/15	3f Willow and 1m	Eared willow collecting pollen and nectaring, <i>A. rosae</i> 3f and 1m.
Zennor Hill and Rosemorran (valley)	43	SW 46183 37760	12/08/14	4f Angelica	Compartment dominated by Bracken scrub with abundant Angelica and on tracksides.
Eagle's Nest	44A	SW 4703 3875	03/08/15	1f Angelica	Heathland edge ruderal habitat with Angelica.
Rosewall Hill	53	SW 497 393	03/08/15	1f Angelica	Pathside Angelica.

Suitable habitat for <i>A. rosae</i> was noted at the following locations although no <i>A. rosae</i> were seen.	Survey area no.	Grid reference	Date of visit	Habitat
Chapel Carn Brea	2	SW 38489 27826	22/04/15	Small patch Blackthorn.
Bartinney Downs	4	SW 391 288	22/04/15	Eared willows in flower, Small area, exposed.
Tredinney Common	4	SW 39038 28531	10/07/14	Some suitable scrub edge habitats and Angelica.
Busvargus and Tregeseal Common	11	SW 393 315	10/07/14	Some suitable scrub edge habitats and Angelica.
Wheal Buller South	15	SW 403 317	22/04/15	Some mixed scrub in flower, not visited.
Carnyorth Common	18	SW 39166 32664	22/04/15	Suitable Blackthorn patch, some Willow in bog not checked, likely to be present.
Penhale Trewern	26	SW 42465 32154	23/08/14	Some suitable scrub edge habitats and Angelica.
Pedn Venton	27	SW 436 331	21/04/15	Blackthorn stand flowering, suitable, but not checked.
Beagletodn Downs	45	SW 48055 37966	25/06/15	Suitable mixed scrub, but no Angelica.
Bussow Moor	54	SW 50019 38550	11/06/15	Angelica and suitable mixed scrub.



Picture 4. Rosemorran valley (43) SW 46212 37722

Perkin's mining bee *Andrena rosae* key site: wet grassland with Purple moor grass, an abundance of Angelica and spring flowering Willow and Blackthorn. Scrub succession is likely to reduce the habitat quality. On grazed sites preferential grazing may reduce the abundance of Angelica.



Picture 5. Woon Gumpus Common (21) SW 39488 33450

Perkin's mining bee *Andrena rosae* site: dry heathland edge with abundant Angelica and other ruderal plants. These edges can be quite species-rich with Bramble, Common knapweed, Red campion and others. This habitat is also important for Black-headed mining bee *Andrena nigriceps*.

2.7 Small red damselfly *Ceriagrion tenellum*

2.7.1 Species summary

This damselfly is widespread on acid bogs and mires in Cornwall. Small Red Damselfly *Ceriagrion tenellum* though not considered to be under threat is nationally scarce (occurring in less than 100 10-km squares)(British Dragonfly Society 2014).

"Small Red Damselfly *Ceriagrion tenellum* is a small, weak-flying damselfly restricted to mires, heathland and bogs in southern England and Wales. In the UK it is believed to prefer shallow, unshaded acid bog pools, small streams and calcareous valley mires and is often associated with Marsh St. John's-wort *Hypericum elodes* and with bog mosses *Sphagnum* spp." (Rouquette 2007).

2.7.2 Status in West Penwith Moors

Small red damselfly was found at three sites, including a new site on Lanyon stream to the north of Lanyon Farm currently outside the West Penwith Moors survey area. A very strong population was recorded at Bostraze with small numbers recorded at the other two sites.

The species occurred on a range of open acid water courses within the project area similar to the sites studied in Wales (Rouquette 2007). The occupied sites usually had open water present alongside areas with a high cover of floating emergent plants, mainly *Sphagnum* sp. and Marsh St. John's-wort.

At Bostraze the ponds were in good condition. However, they are threatened by large scale succession of Bracken and Willow scrub, particularly in vicinity of the Bog Inn site. Peripheral habitats such as open heathland/ grassland needed for the damselfly also appear to be affected by succession. Agricultural improvement works on adjacent land within the Bostraze catchment may have (or be having) negative impacts on this site, through altering the pH and, potentially, lowering the water table. Further assessment of the potential effects of these works by a water quality specialist is recommended.

At Nanquidno the damselfly occurred in a very atypical setting on *Crassula helmsi* on the edge of large open water-body. There appeared to be more suitable habitat at another pond nearby at SW 36778 28372 although it was not seen there.

All the other ponds found within the survey area usually contained no open water. With the loss of suitable habitat for this species it is at risk of being confined to a small site network.

Rouquette (2007) describes the key habitat requirements for Small red damselfly. The water body should hold water throughout the year with more than 10cm depth in summer. Emergent vegetation should be less than 20% cover. Submerged, emergent and floating *Sphagnum*, an essential habitat requirement where the eggs are laid and which forms the main larval habitat, should be greater than 20%.

The three occupied areas are widely dispersed which gives scope for widening and providing a more resilient population across the project area. The unoccupied historic ponds surveyed generally had some *Sphagnum* and Marsh St John's-wort. Careful recreation of some open water at these sites may result in colonisation by Small red damselfly as well as benefitting other species.

2.7.3 Survey results

Table 6: Small red damselfly *Ceriagrion tenellum*

Survey area / location * not in survey area	Survey area no.	Grid reference	Date of visit	Count: number of individuals seen	Observations about habitat condition at time of survey
Nanquidno Downs	1	SW 36778 28372	18/09/14	1	Large pool with some floating <i>Crassula helmsii</i> . May also utilise another pool SW 36737 28499.
Bostraze	17	SW 39287 32014	09/07/14	20	Large pool with lots of suitable floating <i>Sphagnum</i> and Marsh St John's-wort also using small pool / marshy edges.
Bostraze	17	SW 39291 32026	17/07/14	30	Habitat in good condition.
Bostraze	18	SW 39098 32064	17/07/14	50	Large pools with lots of suitable floating <i>Sphagnum</i> and Marsh St John's-wort.
Bostraze	18	SW 39188 32029	17/07/14	2	Small open pool, no <i>Sphagnum</i> or Marsh St John's-wort.
Bostraze	18	SW 39205 32051	17/07/14	20	Fen/rush area with suitable emergent vegetation. Starting to scrub over.
Bostraze	18	SW 39235 32043	17/07/14	2	Suitable emergent vegetation. Scrubbing over.
North west of Lanyon Farm (Lanyon stream)*	Near 35	SW 42244 34235	30/07/14	1	Seepage / pool with <i>Sphagnum</i> and Marsh St John's wort mats.

Other sites checked for Small red damselfly

Survey area / location	Survey area no.	Grid reference	Date of visit	Number of individuals	Observations about habitat condition at time of survey
Nanquidno Downs	1	SW 36737 28499	18/09/14	0	Small pool with suitable open water and Sphagnum and Marsh St John's-wort mats.
Tredinney Common	4	SW 39203 28782	10/07/14	0	Dried up pool with Sphagnum mats.
Tredinney Common	4	SW 39203 28782	24/06/15	0	Pool now re-landscaped, open water may become suitable if floating vegetation develops.
Tredinney Common	4	SW 39449 28745	10/07/14	0	Open water in disused china clay working. Unsuitable for Small red damselfly.
Bartinney Downs	4	SW 39061 28934	10/07/14	0	Dried up pool with Sphagnum mats.
Bostraze	17	SW 39312 32002	17/07/14	0	Suitable emergent vegetation. Scrubbing over.
Bostraze	17	SW 39312 32003	17/07/14	0	Suitable emergent vegetation. Water level too low.
Bostraze (Bog Inn)	18	SW 39095 32102	17/07/14	0	Large pool, no emergent vegetation. Unsuitable for Small red damselfly.
Carnyorth Common	18	SW 38515 33207	17/07/14	0	Dried up pool with Sphagnum mats.
Carnyorth Common	18	SW 38608 33122	17/07/14	0	Dried up pool with Sphagnum mats.
Woon Gumpus Common	21	SW 39791 33306	08/07/14	0	A range of bog pools with Sphagnum, too small and water levels too low for Small red damselfly.
Woon Gumpus Common	21	SW 398 336	08/07/14	0	Large pool, some open water but unsuitable emergent vegetation. Probably too eutrophic.
Woon Gumpus Common	21	SW 399 333	08/07/14	0	Dried up pool with Sphagnum mats.
Higher Downs (Lidden)	23	SW 39957 33893	31/07/14	0	Dried up pool with Sphagnum mats.

Survey area / location	Survey area no.	Grid reference	Date of visit	Number of individuals	Observations about habitat condition at time of survey
Boswarva Carn	28	SW 42576 32919	22/08/14	0	Dried up pool with Sphagnum mats.
Nine Maidens Common	36	SW 44169 35603	05/09/14	0	Dried and scrubbed over pool.
Mulfra Hill to Treen Common	37	SW 44833 36138	10/07/14	0	Mostly dried up bog pool with some Sphagnum mats, no suitable emergent vegetation.
Chykembro Common	38	SW 45006 36377	10/07/14	0	Dried up pool with Sphagnum mats.



Picture 6. Bostraze (17) SW 39291 32026

Open water with floating *Sphagnum* and *Hypericum elodes*: good habitat for Small red damselfly.



Picture 7. Higher Downs, Lidden pool (23) SW 39957 33893

Dried up pond with *Sphagnum*, no open water. This may have been suitable for Small red damselfly and is similar to many of the historic pond sites visited for the survey.

3. Other species of importance

The species described in this section were not included within the survey specification. They were found whilst surveying for other species and given their conservation significance the results have been included in this report.

3.1 Cats ear mining bee *Andrena humilis* and Cats ear nomad bee *Nomada integra*

3.1.1 Species summary

The Cats ear nomad bee *Nomada integra* is Nationally notable A (Falk 1991) and its host Cats ear mining bee *Andrena humilis* is Nationally notable B (Falk 1991). The nomad bee is very scarce and has very few recent records in Cornwall.

3.1.2 Status on West Penwith Moors

The Cats ear mining bee was recorded at 3 locations on sites with abundant yellow composites. The Cats ear nomad bee is a clepto-parasite which needs an abundant host population of Cats ear mining bee. This was found on two sites on track-side bare ground presumably near nesting aggregations of Cats ear mining bee. Both could be associated with edge habitats and dry grassland rather than true heathland.

3.1.3 Survey results

Table 7: Cats ear mining bee *Andrena humilis* and Cats ear nomad bee *Nomada integra*

Survey area / location	Survey area no.	Grid reference	Date of visit	Count	Habitat
Bartinney Downs	4	SW 391 288	24/06/15	Ah 3m	Grassland with abundant yellow composites. <i>A. humilis</i> recorded.
Caer Bran	5	SW 407 290	23/06/15	Ah 1f	Frequent yellow composites. <i>A. humilis</i> recorded
Carnyorth Common	18	SW 38584 32418	11/07/15	Ni 1f	Nesting area, Track area with sloping sheltered bare ground, 1 <i>N. integra</i> recorded.
Carnyorth Common	18	SW 38502 32475	11/07/15	Ah 1f	Area of yellow composites, trackside bare ground and other scrub heath mosaics. <i>A. humilis</i> recorded.
Woon Gumpus Common	21	SW 395 339	27/06/15	Ni 1f	Trackway bare ground/heath, 1 <i>N. integra</i> recorded.

3.2 Black-headed mining bee *Andrena nigriceps*

3.2.1 Species summary

The Black-headed Mining bee *Andrena nigriceps* is a scarce bee Nationally notable B (Falk 1991).

3.2.2 Status on West Penwith Moors

The bee was recorded at four locations on flower-rich edges of heathland. It was twice found on Bramble, although it is likely to use a broader range of flowers. The species is probably another good indicator of the value of the flower-rich heathland edge habitats within the West Penwith Moors area.

3.2.3 Survey results

Table 8: Black-headed mining bee *Andrena nigriceps*

Survey area / location * not in survey area	Survey area no.	Grid reference	Date of visit	Count	Habitat
Bartinney Downs	4	SW 391 289	29/07/14	1	Flower rich scrub edge habitats.
Carnyorth Common	18	SW 38502 32475	11/07/15	1	On bare ground.
Woon Gumpus Common	21	SW 393 335	13/08/14	1	Flower rich scrub edge habitats.
Burnt Downs*	35 (Near)	SW 424 348	28/07/14	1	Found on track to Men-an-Tol although likely to occur in 35. Flower rich scrub edge habitats.

3.4 Tormentil mining bee *Andrena tarsata* and Tormentil nomad bee *Nomada roberjeotiana*

3.4.1 Species summary

The Tormentil mining bee *Andrena tarsata* is an UK Biodiversity Action Plan (UKBAP) Priority Species and Section 41 Conservation Priority Species. Nationally the species has declined with the number of occupied 10km. squares post 1970 now about half the total number of known 10km squares (JNCC 2010). The Tormentil nomad bee *Nomada roberjeotiana* is a RDB3 (Falk 1991). The Penwith population of this bee is nationally significant with three of the five sites with recent records in the UK. Another current population of both species occurs on Bodmin Moor.

The Tormentil mining bee is a ground nesting bee which forages exclusively on Tormentil *Potentilla erecta* to provision its offspring. In Europe it has been observed utilising other related plants. The Tormentil nomad bee *Nomada roberjeotiana* is a clepto-parasite which usurps the nest and provisions stored by the Tormentil mining bee. The nomad bee relies on a strong host population of the Tormentil mining bee (which is why it is such a rare bee).

The Tormentil mining bee occurs on a range of sites including acid grassland, heathland, woodland rides and brownfield sites with high abundance and density of Tormentil flowers probably being the most critical factor.

The Tormentil mining bee nests in small aggregations in warm sheltered areas. It utilises sheltered banks and/or bare ground features for nesting, either in level ground or vertical, in a range of substrates from compacted clay to loose sandy peaty soil (Little & Jarman 2007).

3.4.2 Status on West Penwith Moors

During the survey the Tormentil mining bee was found at thirteen sites across the West Penwith Moors survey area. At three of these sites both the Tormentil mining bee and the Tormentil nomad bee were recorded. The Bartinney Downs site had excellent quality habitat, with very high abundance of Tormentil within acid grassland where over 20 females were recorded. This site had the highest number of Tormentil mining bees the author has recorded at any site in Cornwall.

Nest sites of both the Tormentil mining bee and the Tormentil nomad bee were found on two sites. Both were on the south east facing side of a low (1-3 ft) hedgebank, occurring within the steeper slopes of the bank or on almost flat patches of bare ground where the bank had collapsed, where there was either a thin cover of grass or bare ground, although within areas of these banks a range of aspects were used for nesting. One Tormentil mining bee and the Tormentil nomad bee were found on a north facing bare ground feature.

In Scotland (Little & Jarman 2007) 40 - 50 nest burrows were recorded in an area of bare ground 2m sq. which suggests quite small areas of suitable nest sites may be needed compared to the area of flowering Tormentil.

The Tormentil mining bee was found on open heathland and acid grassland sites during this survey. On Woon Gumpus Common, Chykembro Common and Mulfra Hill to Treen Common the bee occurred on heathland with patches of taller Tormentil, often on tracksides.

At Sancreed Beacon the bee occurred on short grazed lawns of Tormentil within mosaics of gorse or bracken dominated heathland.

A number of sites including Mulfra Hill to Treen Common (37) and Men-an-Tol Croft (35) had been burnt probably 3-5 yrs ago and had very good Tormentil regeneration. Tormentil has seed that can have a long dormancy (Peterkin 2013). Controlled burning appears to be a good management tool on neglected sites for this species.

Currently unmanaged sites such as Woon Gumpus Common had large stands of Tormentil used by this bee. Summer extensive grazing of heathland is at risk of damaging these stands of Tormentil even at low stocking densities whereby the stock preferentially graze the edges and create short lawns round ungrazed gorse, bracken and scrub. Existing rabbit populations may then further amplify this effect. This appeared to be happening at Sancreed and perhaps Carnyorth Common. Conservation grazing whilst very necessary for these sites also requires care to avoid inadvertent impacts on stands of flowering Tormentil.

It is very likely the bee occurs outside the recorded sites and should be considered as a landscape scale population. Further surveys are recommended.

3.4.3 Survey results

Table 9: Tormentil bee *Andrena tarsata* and Tormentil nomad bee *Nomada roberjeotiana*

Survey area / location	Survey area no.	Grid reference	Date of visit	Count	Habitat
Bartinney Downs	4	SW 391 288	24/06/15	At 5f	Acid grassland with abundant Tormentil
Bartinney Downs	4	SW 39152 28920	10/07/14	At 20f & Nr 1	Acid grassland with abundant Tormentil, excellent habitat. Both <i>A. tarsata</i> and <i>N. roberjeotiana</i> were recorded.
Caer Bran	5	SW 406 291	23/06/15	At 1f	Hedgebank with abundant ungrazed Tormentil.
Sancreed Beacon	7	SW 41656 29458	31/07/14	At 2f	Lawns of Tormentil between regenerating heathland or Bracken. Open areas appear heavily grazed by ponies and rabbits, the surrounding Bracken and Bramble scrub is dense.
Bostraze Bog	17	SW 396 324	11/07/15	At 1f	<i>A. tarsata</i> exploring possible nest area, flat bare ground. Tormentil rich habitats used by the bee outside CWT
Carnyorth Common	18	SW 38520 32493	11/07/15	At 4f & Nr 1	<i>N. roberjeotiana</i> and 4 f <i>A. tarsata</i> recorded on small area of abundant short Tormentil . Other patches present on tracksides and edge of burnt heath.
Woon Gumpus Common	21	SW 39996 33512	09/07/14	At 10	Patches of trackside Tormentil on heathland and some patches in previously burnt areas.
Men-an-Tol Croft	35	SW 42558 34984	15/08/15	At 1f	Abundant Tormentil on tracksides and in mosaics of burnt heath.
Nine Maidens Common	36	SW 443 353	21/06/15	At 2f	Patches of Tormentil in heath scrub edge habitats.
Mulfra Hill to Treen Common	37	SW 44944 36249	10/07/14	At 1	Previously burnt heath with regenerating grass and gorse and high abundance of Tormentil.
Chykembro Common	38	SW 45021 36333	10/07/14	At 1	Tormentil along tracksides in taller ungrazed heath.
Foage Farm	44	SW 47455 38049	10/07/15	At 1f	Track/Fire break with abundant ungrazed Tormentil, 1f <i>A. tarsata</i> .

Survey area / location	Survey area no.	Grid reference	Date of visit	Count	Habitat
Trendrine Hill and Beagletodn Downs	45	SW 48150 38013	25/06/15	At 1f	Patches of ungrazed tall Tormentil in breaks of Bracken scrub.
Trendrine Hill and Beagletodn Downs	45	SW 48298 38241	25/06/15	At 1f	Patches of ungrazed tall Tormentil in breaks of Bracken scrub.
Amalveor Downs	46	SW 47820 38001	10/07/15	At 1f & Nr 1	Nest site 2? North east facing bare ground bank, 1 <i>N. roberjeotiana</i> seen and 1 and <i>A. tarsata</i> .
Amalveor Downs	46	SW 48018 37769	10/07/15	At 10f & Nr 1	Nest site. <i>A. tarsata</i> females only, laden with pollen. 1 <i>N. roberjeotiana</i> . Nesting in aggregation very close together on bank in bare sandy soil with small cliff and short grassland with compacted soil, range of aspects used, but bank faces SE.
Amalveor Downs	46	SW 48020 37769	25/06/15	At 5f	Nest site. Females and some males seen around nest.
Amalveor Downs	46	SW 48009 37819	25/06/15	At 3f	<i>A. tarsata</i> 3f.
Trenowin Downs	51	SW 48838 35631	10/07/15	At 1f	Small area of acid grassland with abundant Tormentil.
Noon Digery CWT	51	SW 4876 3566	10/07/15	At 1f	Trackside Tormentil, little Tormentil away from track.
Noon Digery CWT	51	SW 4845 3578	10/07/15	At 4f	Trackside abundant Tormentil, suitable nesting features.

Suitable habitat for <i>A. tarsata</i> was noted at the following locations although no <i>A. tarsata</i> were seen. Survey is recommended.	Survey area no.	Grid reference	Date of visit	Count	Habitat
Busvargus and Tregeseal Common	11	SW 39129 31283	10/07/14	0	Trackside Tormentil.
Penhale Trewern	26	SW 42610 32211	11/07/15	0	Small area of abundant Tormentil, possibly one <i>A. tarsata</i> seen.



Picture 8. Bartinney Downs (4) SW 39152 28920

Tormentil bee *Andrena tarsata* site: extremely high abundance of Tormentil including large ungrazed hummocks, close to nest feature, not summer grazed.



Picture 9. Amalveor Downs (46) SW 48018 37769

Tormentil mining bee *Andrena tarsata* and Tormentil nomad bee *Nomada roberjeotiana* nest site: SE facing bank with short vegetation and/or bare ground.

4 Results by survey area

Table 10: Summary of species by survey area

Key: PBF H = Pear-bordered fritillary *Boloria euphrosyne* – none recorded, some habitat present
 SPBF = Small pearl-bordered fritillary *Boloria selene* site
 SPBF H = Small pearl-bordered fritillary *Boloria selene* – none recorded, some habitat present
 MF H = Marsh fritillary *Euphydryas aurinia* - none recorded, some habitat present
 Am H = Small scabious bee *Andrena marginata* – none recorded, some habitat present
 Ar = Perkin’s mining bee *Andrena rosae* site
 Ar H = Perkin’s mining bee *Andrena rosae* – none recorded, some habitat present
 Ah = Cats ear mining bee *Andrena humilis* site (*Ni* = Cats ear nomad bee *Nomada integra*)
 An = Black-headed mining bee *Andrena nigriceps* site
 At = Tormentil mining bee *Andrena tarsata* site (*Nr* = Tormentil nomad bee *Nomada roberjeotiana*)
 At H = Tormentil mining bee *Andrena tarsata* – none recorded, some habitat present
 SRD = Small red damselfly *Ceriagrion tenellum* site
 SRD 0 = Pond site surveyed - no Small red damselfly recorded

Survey area / location	Survey area number	Pearl-bordered fritillary	Small pearl-bordered fritillary	Marsh fritillary	Small scabious bee	Perkin’s mining bee	Small red damselfly	Cats ear mining bee and Cats ear nomad bee	Black-headed mining bee	Tormentil mining bee and Tormentil nomad bee
Nanquidno Downs	1						SRD			
Chapel Carn Brea	2		SPBF H							
Bartinney Downs / Tredinney Common	4					Ar H	SRD 0	Ah	An	At & Nr
Caer Bran	5					Ar		Ah		At
South of Sancreed Beacon	6					Ar H				

Survey area / location	Survey area number	Pearl-bordered fritillary	Small pearl-bordered fritillary	Marsh fritillary	Small scabious bee	Perkin's mining bee	Small red damselfly	Cats ear mining bee and Cats ear nomad bee	Black-headed mining bee	Tormentil mining bee and Tormentil nomad bee
Sancreed Beacon	7		SPBF H			<i>Ar</i>				<i>At</i>
Busvargus and Tregeseal Common	11			MF H		<i>Ar H</i>				<i>At H</i>
Bosvenning & Roskennals Common	14					<i>Ar</i>				
South of Wheal Buller	15					<i>Ar H</i>				
Bostraze to Boslow	17		SPBF H	MF H		<i>Ar</i>	SRD			<i>At</i>
Carnyorth Common to Bostraze Bog	18		SPBF H	MF H		<i>Ar</i>	SRD	<i>Ah & Ni</i>	<i>An</i>	<i>At & Nr</i>
Woon Gumpus Common	21				<i>Am H</i>	<i>Ar</i>	SRD 0	<i>Ni</i>	<i>An</i>	<i>At</i>
Tor Noon and Hale Downs (Rose valley)	22					<i>Ar</i>				
Higher Downs and Chun Downs (Lidden)	23						SRD 0			
Boswens North	24		SPBF H	MF H		<i>Ar</i>				
Penhale Trewern	26		SPBF H	MF H		<i>Ar H</i>				<i>At H</i>
Boswarva Carn to Great Bosulow	28		SPBF H	MF H		<i>Ar</i>	SRD 0			
Bosulow Common	31					<i>Ar</i>				
Carn Galver	32		SPBF H							

Survey area / location	Survey area number	Pearl-bordered fritillary	Small pearl-bordered fritillary	Marsh fritillary	Small scabious bee	Perkin's mining bee	Small red damselfly	Cats ear mining bee and Cats ear nomad bee	Black-headed mining bee	Tormentil mining bee and Tormentil nomad bee
Bosigran	33					<i>Ar</i>				
Bosporthenis to Hannibal's Carn	34		SPBF H	MF H						
Men-an-Tol Croft (Burnt Downs)	35		SPBF H	MF H		<i>Ar</i>			<i>An</i>	<i>At</i>
Nine Maidens Common	36		SPBF	MF H		<i>Ar</i>	SRD 0			<i>At</i>
Mulfra Hill to Treen Common	37		SPBF			<i>Ar</i>	SRD 0			<i>At</i>
Chykembro Common	38						SRD 0			<i>At</i>
Trewey Hill East	42		SPBF H							
Zennor Hill and Rosemorran (Rosemorran valley)	43	PBF H	SPBF H			<i>Ar</i>				
Foage Farm	44		SPBF H							<i>At H</i>
Eagle's Nest and Wicca Croft	44A					<i>Ar</i>				
Beagletodn Downs	45		SPBF							<i>At</i>
Amalveor Downs	46		SPBF							<i>At & Nr</i>
Trenowin Downs	51									<i>At</i>
Rosewall Hill	53		SPBF H			<i>Ar</i>				
Bussow Moor	54		SPBF H	MF H	<i>Am H</i>	<i>Ar H</i>				

5 Recommendations for future survey and further work

Following completion of the targeted rare insect species survey in the West Penwith Moors area, further work to build on the survey findings is recommended.

Small pearl-bordered fritillary *Boloria selene*

- Extend survey and monitoring to include coastal sites.
- Identify a Penwith key sites network for the species.
- Formulate a landscape scale and site based habitat management and restoration plan.

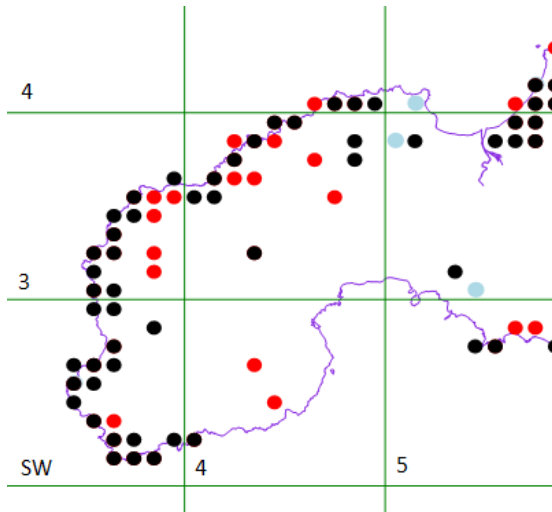


Figure 2. Small pearl-bordered fritillary *Boloria selene* West Penwith 1km ERICA records

KEY: Blue-before 1950
Red-1950-99
Black-post 99

Marsh fritillary *Euphydryas aurinia*

Research and liaison with partner bodies to establish if Marsh fritillary reintroduction could be viable and /or a desirable objective.

Grayling *Hipparchia semele*

Records indicate that this section 41 butterfly may be present in the West Penwith Moors survey area although none were noted during this survey. Targeted survey for this species is therefore recommended.

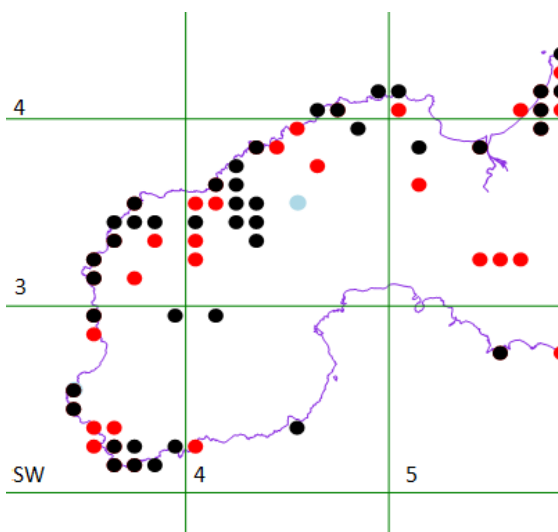


Figure 3. Grayling *Hipparchia semele* West Penwith 1km ERICA records

KEY: Blue-before 1950
Red-1950-99
Black-post 99

Rare bee species

Targeted survey of suitable habitat to confirm the presence of Small scabious bee *Andrena marginata*.
Habitat and abundance monitoring of threatened pollinators is recommended as follows:

- Establish a monitoring regime for Tormentil mining bee and Perkin's mining bee within West Penwith Moors area.
- Establish best practice for management of ruderal habitats.
- Establish best practice for management of Tormentil-rich habitats
- Establish management recommendations for key sites.

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Appendix 1.

Species recorded at locations outside the West Penwith Moors survey area. Note that these locations are likely to be important for sites within West Penwith Moors area as many of these species disperse widely and landscape scale conservation of suitable habitat is therefore necessary for their effective conservation.

Small scabious bee *Andrena marginata*

Location	Grid reference	Date of visit	Observations about habitat condition at time of survey
Near Georgia, Nancledra	SW 48748 36059	05/09/14	Large area of extremely abundant scabious apparently managed more as a hay meadow. Merits survey.



Picture 10. Near Georgia, Nancledra SW 48748 36059

Meadow very rich in scabious outside the survey area. This sort of unimproved hay meadow habitat is likely to have been common in Penwith 50 - 100 years ago. The loss of this flower abundance has probably contributed to the extinction of Small scabious bee in Cornwall. Further surveys for this species are recommended, including the north coast of Penwith as it is likely the species formerly occurred on the coast.

Small pearl-bordered fritillary *Boloria selene*

Survey area / location	Grid reference	Date of visit	Count	Habitat
Boscawen-un	SW 409 276	08/06/15	4	Suitable flower rich Bracken, <i>Viola</i> sp. occasional.
Sennen cove	SW 361 265	16/08/15	7	Abundant second brood, probably more present, In mozaics of dune grassland and bracken rich heathland with abundant <i>Viola</i> sp.
Gwynver beach	SW 363 274	17/08/15	10	Abundant second brood, probably more present, In mozaics of dune grassland and bracken rich heathland with abundant <i>Viola</i> sp.
Kenidjack valley	SW 35 32	06/08/15	4	Reported by B.Hocking.
Sites with strong potential for SPBF				
Outside Beagletodn Downs	SW 4834 3818	03/06/15	0	Sheltered suitable Bracken, abundant <i>Viola</i> sp., light grazing.
Trengwainton Carn	SW 39339 32015	10/06/15	0	Small suitable patches <i>V. palustris</i> , under grazed. Patches of suitable Bracken but no <i>Viola</i> sp.
Trengwainton Carn	SW 43915 32286	07/06/15	0	Suitable flower rich Bracken, rare <i>Viola</i> sp.
Sites with some potential for SPBF				
Kelynack moor	SW 27887 54282	22/04/15	0	Sheltered Bracken, may be suitable.

Perkin's mining bee *Andrena rosae*

Survey area / location * not in survey area	Grid reference	Date of visit	Count: number of individuals seen, male or female and food plant	Habitat
Higher Bojewyan	SW 391 346	27/06/15	1f Sycamore	Sycamore tree in garden, 1 <i>A. rosae</i> female obs. with pollen.
Grumbla	SW 40596 29578	31/07/14	3 Angelica	Good site – rabbit grazed lawns with abundant Angelica and various scrub edge habitats
Lower Trevarthen	SW 40256 29828	31/07/14	1 Bramble	Hedgerow
Track east of Carnyorth Common	SW 39204 33295	13/08/14	1 Angelica	Trackside ruderal habitats with Angelica
Track east of Carnyorth Common	SW 39204 33297	13/08/14	2 Angelica	Trackside ruderal habitats with Angelica
Rose valley	SW 39886 35156	12/08/14	1 Angelica	Patch of unmanaged ruderal scrub and road verge with Angelica
Track to Men-an-Tol	SW 422 345	30/07/14	5 Angelica	Trackside ruderal habitats with abundant Angelica
Zennor (Trewey)	SW 455 383	12/08/14	1 Angelica	Patch of unmanaged ruderal scrub and road verge with Angelica
Foage Farm	SW 46388 37470	12/08/14	4 Angelica	Patch of unmanaged ruderal scrub and road verge with Angelica
Lower Amalwhidden	SW 48976 37502	03/09/14	1 Angelica	Unmanaged wet grassland with Angelica

Suitable habitat for <i>A. rosae</i> was noted at the following locations although no <i>A. rosae</i> were seen.	Grid reference	Date of visit	Habitat
Higher Grumbla	SW 405 294	11/05/15	Nice stand of sheltered Blackthorn, still flowering.
Kelynack moor	SW 381 303	22/04/15	Sheltered flowering Blackthorn.
Trendrine Hill and Beagletodn Downs	SW 48336 38743	03/06/15	Suitable Blackthorn and Hawthorn.
Trengwainton Carn	SW 41624 28805	22/04/15	Sheltered flowering Blackthorn.
Brane	SW 42461 29082	22/04/15	Good area of sheltered Blackthorn flowers and Willow.
Near New Mill	SW 45917 34452	30/07/14	Scrub edge road verge

Tormentil mining bee *Andrena tarsata* and Tormentil nomad bee *Nomada roberjeotiana*

Survey area / location	Grid reference	Date of visit	Count	Habitat
Trengwainton Carn	SW 43764 32214	07/06/15	5f	Patchy Tormentil, bare ground and other Bracken scrub.
Trengwainton Carn	SW 44128 31918	07/06/15	1f	Trackside abundant Tormentil and bare ground.
Boswarthen, Sancreed	SW 41147 29153	31/07/14	2	Excellent quality Tormentil-rich acid grassland though some scrub encroachment. The site looked potentially important, possibly good enough to sustain the nomad bee as well. This location would merit future survey.

