

This account is a revised version of survey produced for Natural England in 2015. See <http://kernowecology.co.uk/Publications/West%20Penwith%20Moors%20survey%202015.pdf> for original text.

### Species summary

Perkin's mining bee *Andrena rosae* is a RDB2 solitary bee species (Falk 1991) but the status is currently under review. This bee has a very limited distribution in the UK. The BWARS current records indicate a retreat to Exmoor, South Wales and Cornwall (Else & Edwards 2018). The bee may be extinct in Ireland and is threatened or Red Data Book listed in five other EU Countries (Fitzpatrick 2006). Perkin's mining bee has strong populations in the Land's End or West Penwith area, and West Penwith Moors may support the strongest population of this bee in the UK. Spooner (1984) in his Cornish aculeate review notes that this bee "has become scarcer in recent years".

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) (e.g. Westrich, 2018). Genetic studies (Reemer *et al* 2008) and other authors (Else & Edwards 2018) (Van Der Meer *et al* 2006) refute this.



**Picture 1.** Spring brood female Perkin's mining bee *Andrena rosae*

## Foraging Ecology on West Penwith moors

Individuals of the summer brood have been recorded in much greater abundance than those of the spring brood. On one summer brood site 20 females were recorded, whereas the spring brood were usually found as single individuals or occasionally a few. This suggests the spring brood is either less numerous or more dispersed in the landscape.

The spring brood bee has been recorded foraging on various Willows *Salix* sp., Blackthorn *Prunus spinosa*, Hawthorn *Crataegus monogyna* and Sycamore *Acer pseudoplatanus*. The highest spring counts were on the less common Eared willow *Salix aurita*. The Eared willow flowers later than the more common Grey willow *Salix cinerea*. Judy Webb has confirmed pollen from Rosaceae in Cornish spring brood samples, whereas in Holland pollen analysis of the species indicated that pollen had been collected only on *Salix* (Van Der Meer *et al* 2006). Else & Edwards (2018) cite findings of spring brood using pollen from 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 but particularly Eared willow *Salix aurita*, and Blackthorn.

The summer brood appears to be strongly associated with Angelica *Angelica sylvestris*, from which the highest counts and most numerous records come. Spooner has recorded summer brood Perkin's mining bee only on Angelica (Spooners 1984). Other studies have confirmed a strong link to Hogweed *Heracleum sphondylium* (Van Der Meer *et al* 2006). Pollen analysis of six summer brood bees by Judy Webb showed all to be collecting Apiaceae (umbellifer) pollen, and Westrich (2018) regards the summer brood as oligolectic on Apiaceae. The bee has been observed twice collecting pollen on Hogweed, which is probably a forage of secondary importance, as Hogweed tends to flower before the peak flight period. Angelica is more suitable as it flowers slightly later.

Outside the West Penwith Moors area on coastal sites the summer brood bee appears to rely completely on Bramble *Rubus fruticosus* agg. pollen. Bees of the British Isles (Else and Edwards 2018) cite additional summer pollen sources : Asteraceae, Field Eryngo (*Erygium campestre*) and Meadowsweet (*Filipendula ulmaria*). The Cornish survey work suggests sites with only bramble have weaker populations with fewer individuals recorded.

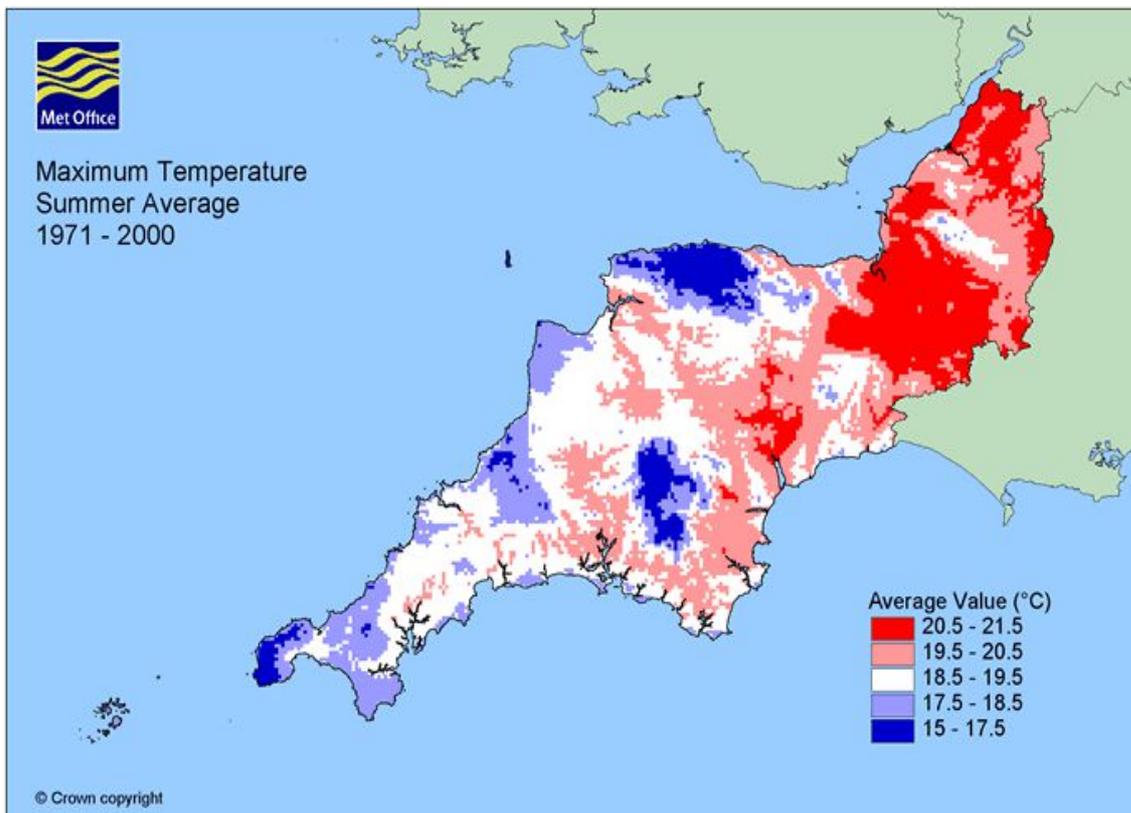
The spring foraging requirements are all abundant in Cornwall and are probably not limiting, but the summer brood's requirements are more likely to be.

## Nest ecology and climatic niche

Nest sites are an additional requirement. Van Der Meer (Van Der Meer *et al* 2006) found solitary females nesting on clay dyke banks, facing south, west or southeast and with short, grassy vegetation. Bees of British Isles (Else and Edwards 2018) cite observations of the bee nesting in bare ground and compacted paths either solitarily or in small aggregations.

Perkin's Mining bee is generally associated with coastal sites and western moorlands with a cooler atlantic climatic. The cooler wetter sites in the far west of Cornwall possibly provide a more suitable thermal niche for nesting and for later-flowering *Angelica*.

Spoooner does not comment on the status of Trimmer's Mining Bee *Andrena trimmerana*, but there are hardly any records for this species in his 1984 review, whereas now it is widely recorded in Cornwall and frequent on coastal sites. The bee is probably expanding in the Midlands (Falk 2015). I suspect that Trimmer's Mining Bee *Andrena trimmerana* has an advantage on warmer sites and with climate change is expanding and may be outcompeteing Perkin's Mining Bee on some former sites. Two sites (Roseland and Rosemullion) with recent records on the South Cornish Coast may be on the edge of the climatic niche and may either prove or disprove this hypothesis over time.



**Fig 1. Mean maximum temperature map.** The Blue areas have some match with the modern distribution of Perkin's Mining Bee *Andrena rosae*, West Penwith Moors, The Lizard, North Cornwall, Bodmin Moor and Exmoor. The bee has historically been recorded on Dartmoor.



**Picture 2. Rosemorran valley (43) SW 46212 37722**

Perkin's mining bee *Andrena rosae* site: un-grazed wet grassland with flowers for both broods, an abundance of Angelica and spring flowering Willow and Blackthorn. The bee needs scrub edge habitats with low grazing pressure, but some management to maintain open grassland.



**Picture 3. Woon Gumpus Common (21) SW 39488 33450**

Perkin's mining bee *Andrena rosae* site: dry heathland edge with abundant Angelica and other ruderal plants. In Cornwall the lack of Angelica is probably more of a limiting factor than lack of Willow and Blackthorn. Angelica may be reduced by preferential grazing, it is liked by cattle, although probably not by rabbits which were providing very good conditions for this bee at one site.

## Spatial relationship between spring and summer broods

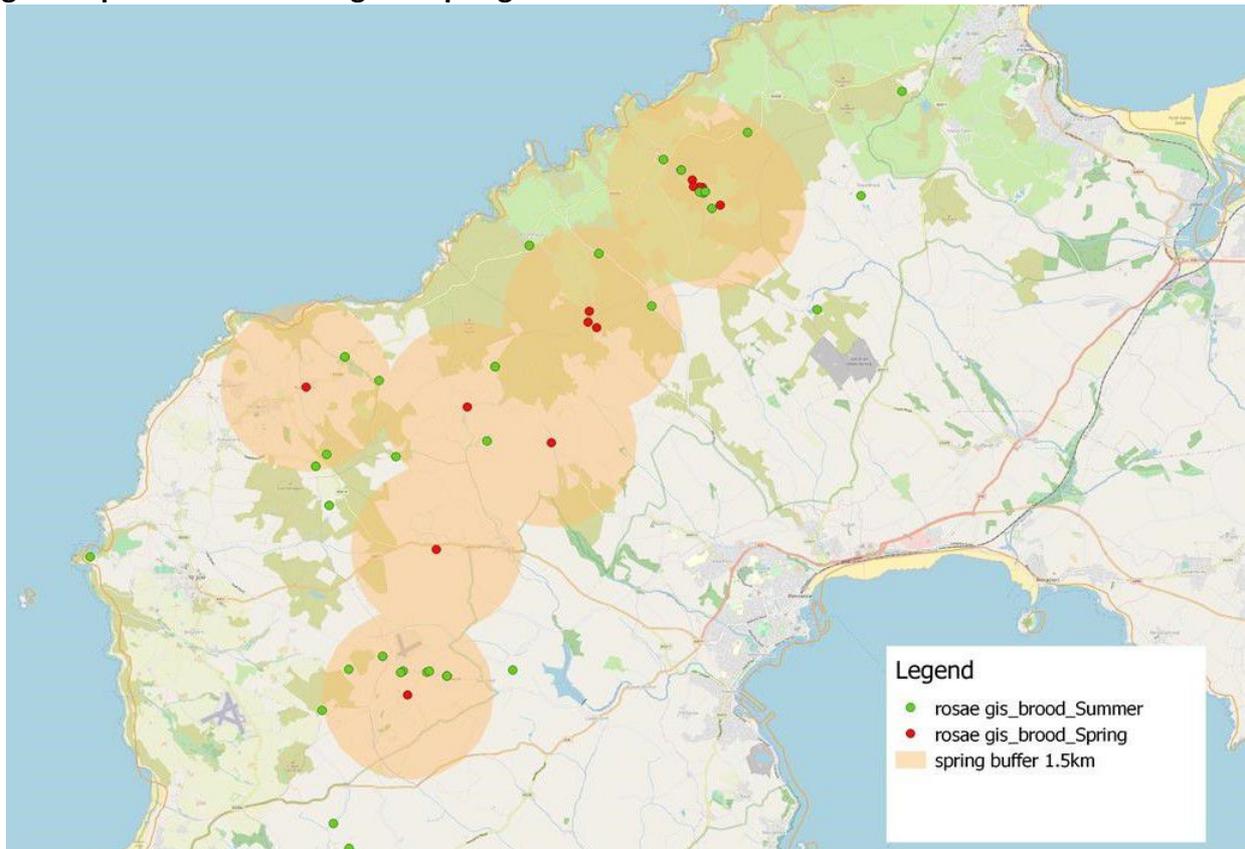
It is difficult to find studies of the relationship between different generations of bivoltine (double-brooded) bees. I have done a brief analysis of the spatial relationship between spring brood and summer brood sites. This included sites with 6- or 8-figure grid references and reasonable survey effort (visited at least once both in spring and summer), mostly in the West Penwith Moors area. Some duplicates and other sites with limited survey effort were excluded. The mean distance between a spring-brood record (N=19) and the nearest two summer-brood records (N=57) was 687m with an error of 100m either side as some records are 6-figure grid references.

Both broods were recorded only once within the same 6-figure grid reference in this study, although the mean distance is well within the 900m maximum foraging distance of *Andrena hattofiana* (Franzen *et al* 2009), which is similar sized. Over the survey period I spent some time looking for nests unsuccessfully. The data and lack of nest observations suggest the bee probably nests singly or possibly very small aggregations dispersed in the landscape.

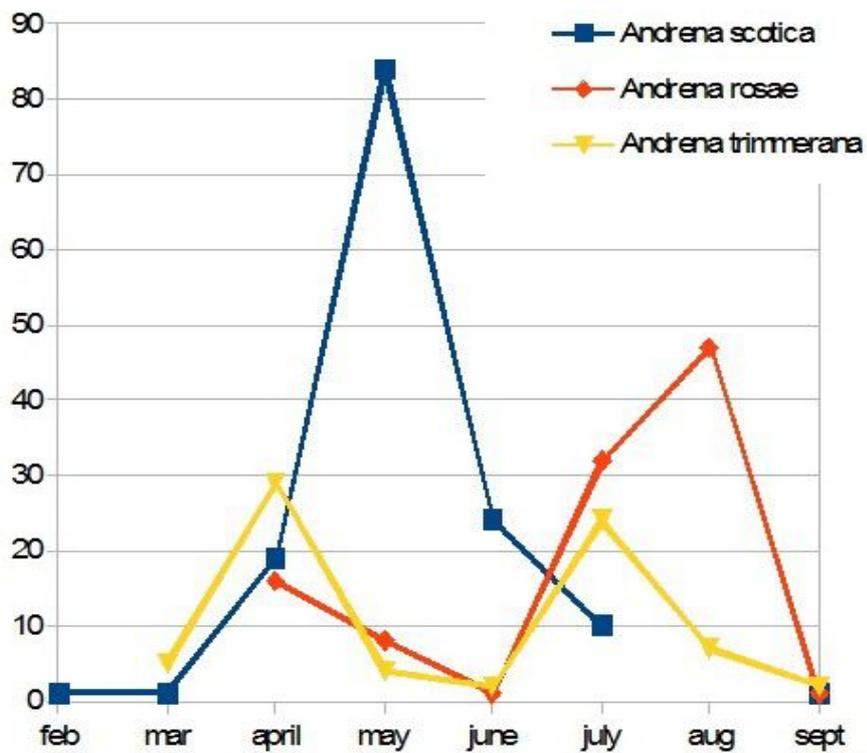
Habitats with abundant Angelica are less common than flowering scrub habitats in West Cornwall, so what determines successful nesting? If the bee nests near a good patch of habitat in spring, does it risk a lack of summer forage and a very high failure rate? or do spring-emerging bees wander more widely on emergence looking for nest sites near Angelica? Does this mean they are not faithful to nest sites? Van Der Meer (Van Der Meer *et al* 2006) was unable to find summer individuals at the nest sites he found in spring. Genetic studies (Reemer *et al* 2008) suggest both broods are within one population. More research is needed to establish the relationship between spring and summer broods, are spring females' offspring always summer females?. Could a proportion of each brood be bivoltine and a proportion univoltine ? I would suggest that this bee is more mobile, more dispersed in the landscape and less faithful to nest aggregations than single-brooded summer meadow specialists.

There are many questions, but not many answers!

**Fig 2. Map of Perkin's Mining Bee spring and summer-brood sites within West Penwith Moors**



**Fig 3. Phenology of Perkins' Mining Bee records in comparison with other related species. Total abundance records by month of all records on ERICA database.**



Perkin's Mining Bee on Land's End

**Fig 4. Spatial relationship between spring and summer brood**

<b>InputID</b>	<b>MEAN</b>	<b>MIN</b>	<b>MAX</b>
Stannon Lake sww	521.48	291.29	751.66
Foage valley	158.11	158.11	158.11
Forrabury, Boscastle	294.32	141.42	447.21
Caer Bran	412.31	412.31	412.31
Nine Maidens Common	1194.36	1143.37	1219.86
Nine Maidens Common	1027.74	1027.74	1027.74
Nine Maidens Common	1212.88	1030.95	1303.84
Rosemorran	87.46	87.46	87.46
Porthcurno	446.6	412.31	480.88
Rosemorran	257.18	243.82	261.63
Grower gut boscastle	291.55	0	583.1
TREVALGA	1778.84	1487.39	2070.29
Little Busulow	815.49	690.98	857
Men-an-Tol Croft	1524.52	1118.24	1659.95
Rosemorran	105.22	85.15	125.3
Bosvenning & Roskennals Common	1939.22	1778.44	2019.62
Rosemorran	174.21	141.42	207
Higher Bojewyan	860.23	860.23	860.23
<b>Total</b>	<b>689.57</b>	<b>584.77</b>	<b>764.91</b>

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