

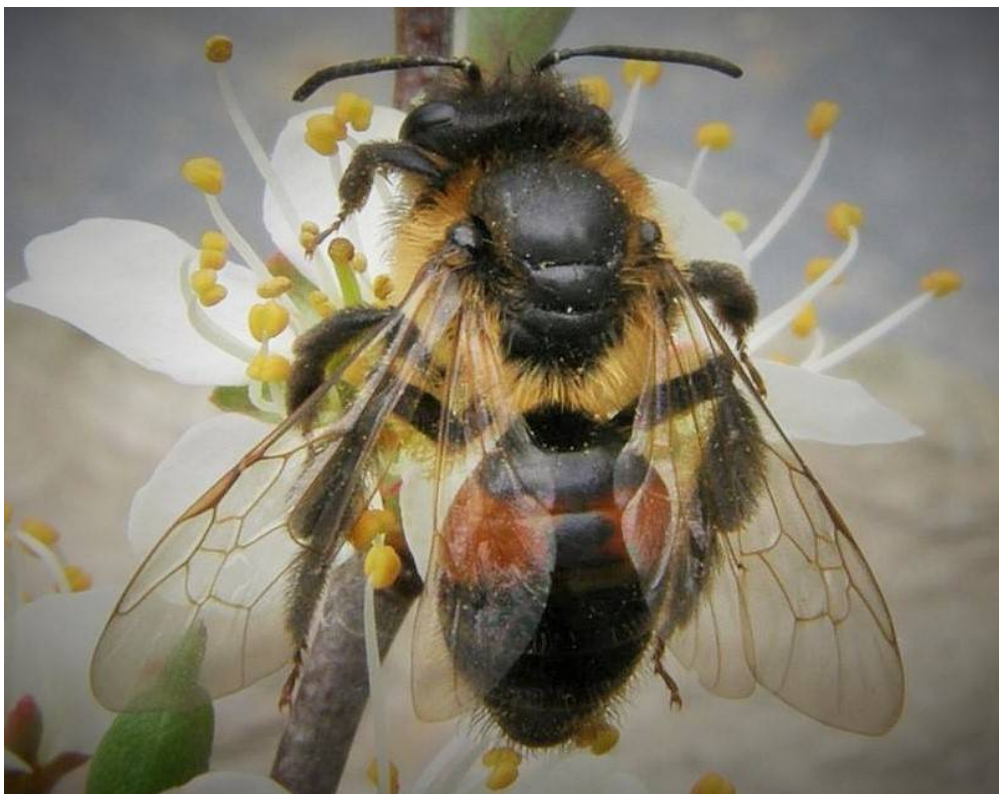
This account is a revised version of survey produced for Natural England in 2015. See <http://kernowecology.co.uk/Publications/West%20Penwith%20Moors%20survey%202015.pdf> for original text.

Species summary

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

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). Perkin's mining bee has strong populations in the Land's End or West Penwith area, West Penwith Moors may support the strongest population of this bee in the UK. Spooner in his Cornish Aculeate review notes that this bee "has become scarcer in recent years" (Spooner 1984).

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 authors (Else & Edwards 2018) (Van Der Meer *et al* 2006) refute this.



Spring brood female Perkin's mining bee *Andrena rosae*

Perkin's Mining Bee *Andrena rosae* on Land's End

Foraging Ecology on West Penwith moors

Summer brood populations were recorded in much greater abundance than spring brood individuals. With 20 females recorded on one summer brood site, whereas spring brood bees were usually recorded as individuals occasionally as a few.

The spring brood bee was recorded foraging on various Willows *Salix* sp., Blackthorn *Prunus spinosa*, Hawthorn *Crataegus monogyna* and Sycamore *Acer pseudoplatanus*. The spring brood probably is more dispersed in the landscape or has a lower abundance, the highest spring counts were on the less common Eared willow *Salix aurita*. The Eared willow was later flowering than the more common Grey willow *Salix cinerea*. Judy Webb confirmed pollen from Rosaceae in Cornish samples. In Holland pollen analysis of the species indicated that pollen had only been collected 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 bee appears to be strongly associated with Angelica *Angelica sylvestris*, the highest counts and most numerous records are from individuals on Angelica. 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). Pollen analysis of 6 summer brood bees by Judy Webb all were found to be collecting Apiaceae (umbellifer) pollen,. The bee was observed collecting pollen twice on Hogweed which is probably a secondary forage of importance, as Hogweed tends to flower earlier than the peak flight period, Angelica is more suitable as flowers slightly later.

Outside the West Penwith Moors area on coastal sites the summer brood bee appears to completely reliant on Bramble pollen. (Else and Edwards 2018) refers to additional summer pollen sources : Asteraceae, Field Eryngo (*Erygium campestre*) and Meadow sweet (*Filipendula ulmaria*). The sites with bramble only records probably have a weaker population with fewer individuals recorded.

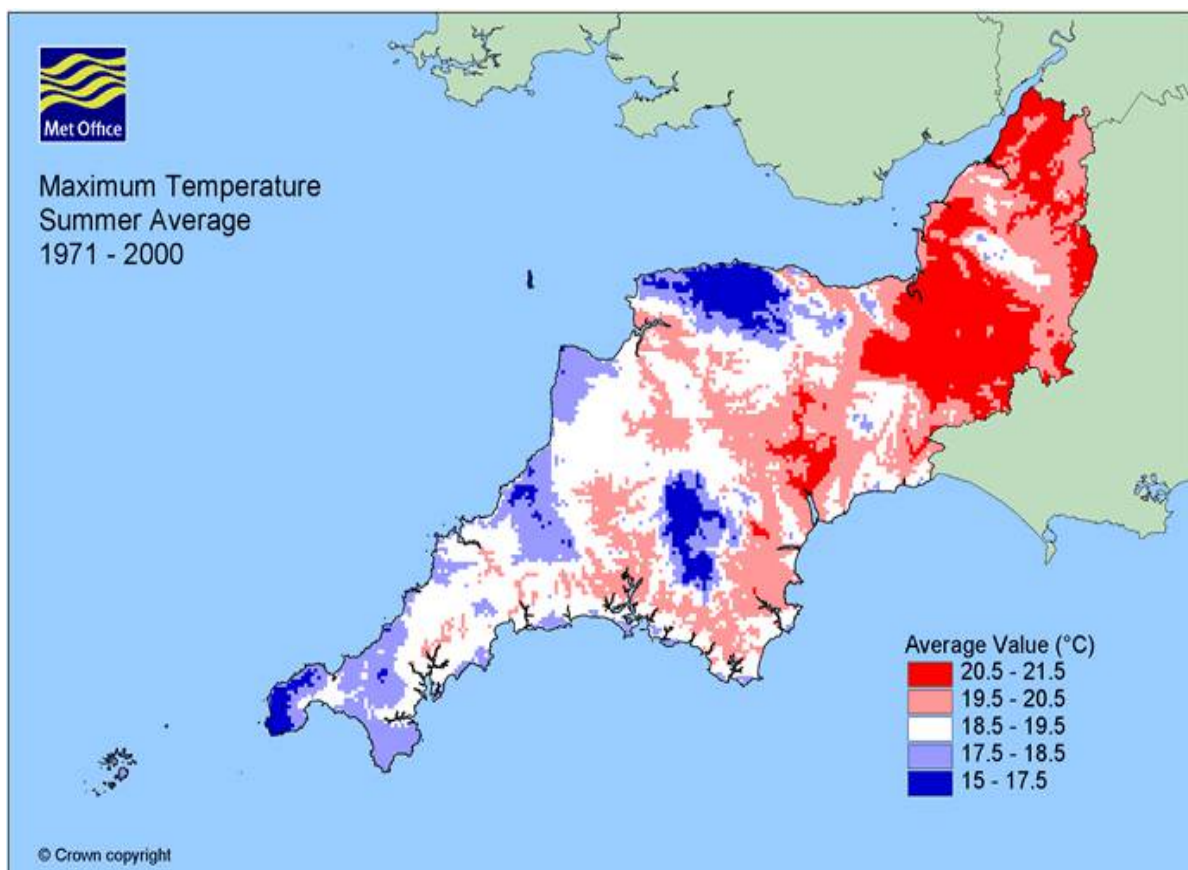
The spring foraging requirements are probably not limiting but the summer requirements are likely to be.

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, with south, west or southeast-oriented aspect and with a short, grassy vegetation, others refer to the bee using bare ground and compacted paths (Else and Edwards 2018). (Else and Edwards 2018) refer to observations of the bee nesting 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 have more suitable thermal niche for nesting requirements and for later flowering *Angelica*.

Spooner does not comment on the status of Trimmer's Mining Bee *Andrena trimmerana*, but there are hardly any records for this species on 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 outcompeting Perkin's Mining Bee on some former sites.



Average 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 was historically recorded on Dartmoor.



Picture 1. 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 2. Woon Gumpus Common (21) SW 39488 33450

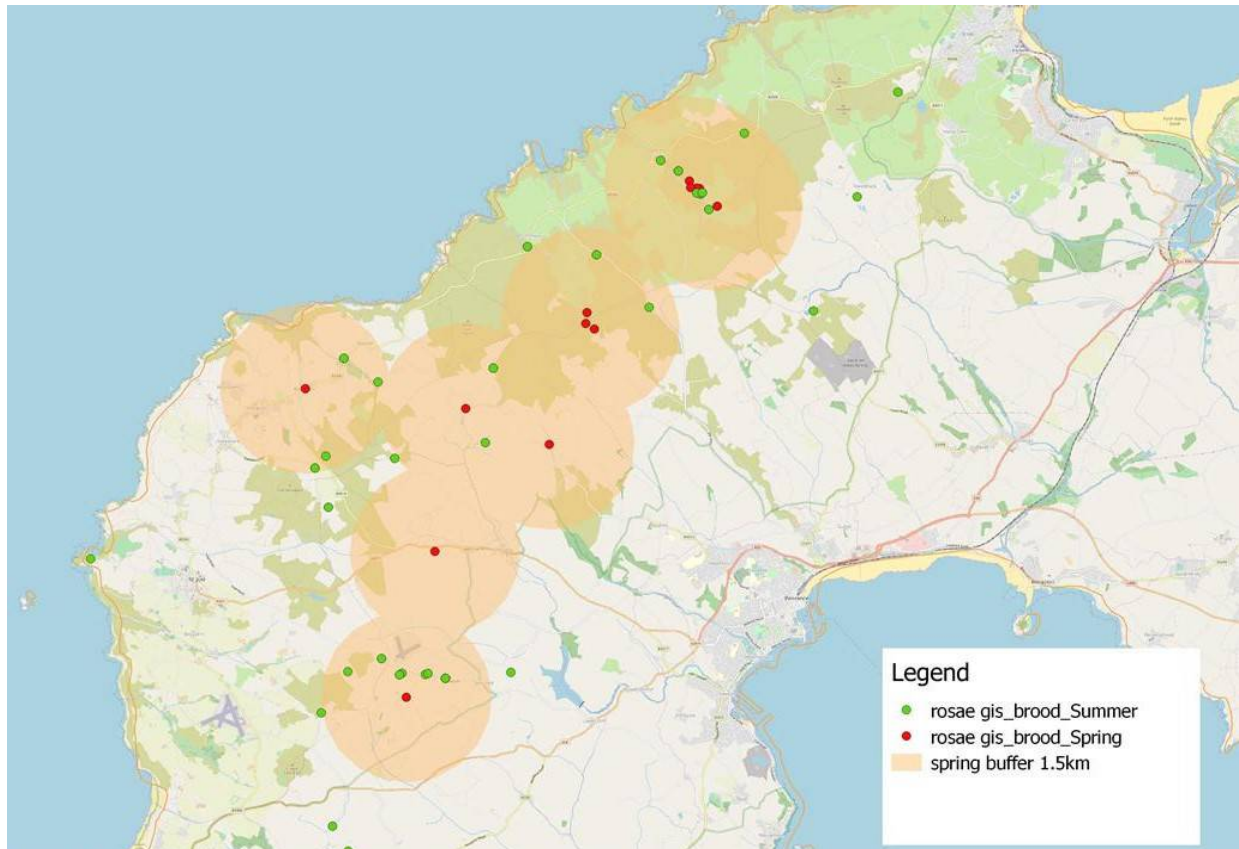
Perkin's mining bee *Andrena rosae* site: dry heathland edge with abundant Angelica and other ruderal plants. In Cornwall the lack of Angelica is probably more of a limiting factor than lack of Willow and Blackthorn. Angelica may be reduced by preferential grazing, it is liked by cattle, although probably 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. Spring brood sites (N=19) were analysed for mean distance to nearest 2 summer brood site records (N=57). The mean distance was 687m with an error of 100m either side as some records are 6 figure grid references.

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

Hot spots of Angelica are less common than flowering scrub habitats in West Cornwall, so what decides successful nesting? If the bee nests near a decent patch of habitat in spring does it risk no summer forage and very high failure rate? or do spring offspring have to wander more 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 found in spring. It seems likely that this bee is much more mobile and less faithful to nest sites than single brooded summer meadow specialists. Many questions not many answers!



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Appendice spatial relationship between spring and summer brood

InputID	MEAN	MIN	MAX
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
Total	689.57	584.77	764.91