Long-horned Bee (*Eucera longicornis*) 2025 pollen analysis

Patrick Saunders

Image credit: Long-horned Bee (*Eucera longicornis*) © Patrick Saunders

Introduction

Figure 1: Long-horned Bee Male

Patrick Saunders was commissioned by Life on the Edge project and Buglife to investigate the status, habitat and autecological requirements of Long-horned Bee and Six-banded Nomad Bee populations around Prawle Point.

This study aimed to investigate flower resource requirements of the Long-horned Bee to assist conservation targets for the species.

Dr. Judy Webb Palynologist (pollen expert) was commissioned to do the pollen identification.

Methodology.

Pollen sampling and field observations took place between 2023-2025. 35 pollen samples were taken from individual female bees going into the nest sites or occasionally females on flowers near the nests. Individuals were netted and put in Ziplock bags and pollen was smeared into spots by holding and rubbing the legs on the side of the bag which was then highlighted with acrylic pen. This was found to be more effective than the typical method which uses a bee marker cage and then scrape the pollen off with cocktail sticks, which is awkward with an irate female bee and often results with pollen missing the sample tube and blowing into the sea ! The females were then released unharmed (but probably grumpy)

Pollen samples were stored in the freezer and sent to Dr. Judy Webb for analysis down to species or type. This study also includes the results of pollen analysis and field observations in Cornwall from 2015 to present. (Saunders 2018).

Pollen can easily be contaminated by spread by non target insects or potentially wind blown grass pollen. The review excluded pollens found at less than 5% content per sample. Which could represent contamination.

Some pollens were grouped into types based on practicalities of microscope pollen identification as the legume family pollen in particular is very difficult to separate by species. The pollen sampling in Devon mainly occurred in June. This study includes results from Cornish sites (Saunders 2018) to give a more comprehensive picture from a bigger data set.

Results

75 % of total pollen from the Devon 2023-25 samples were from the legume family. 24 % was from non-legume families.

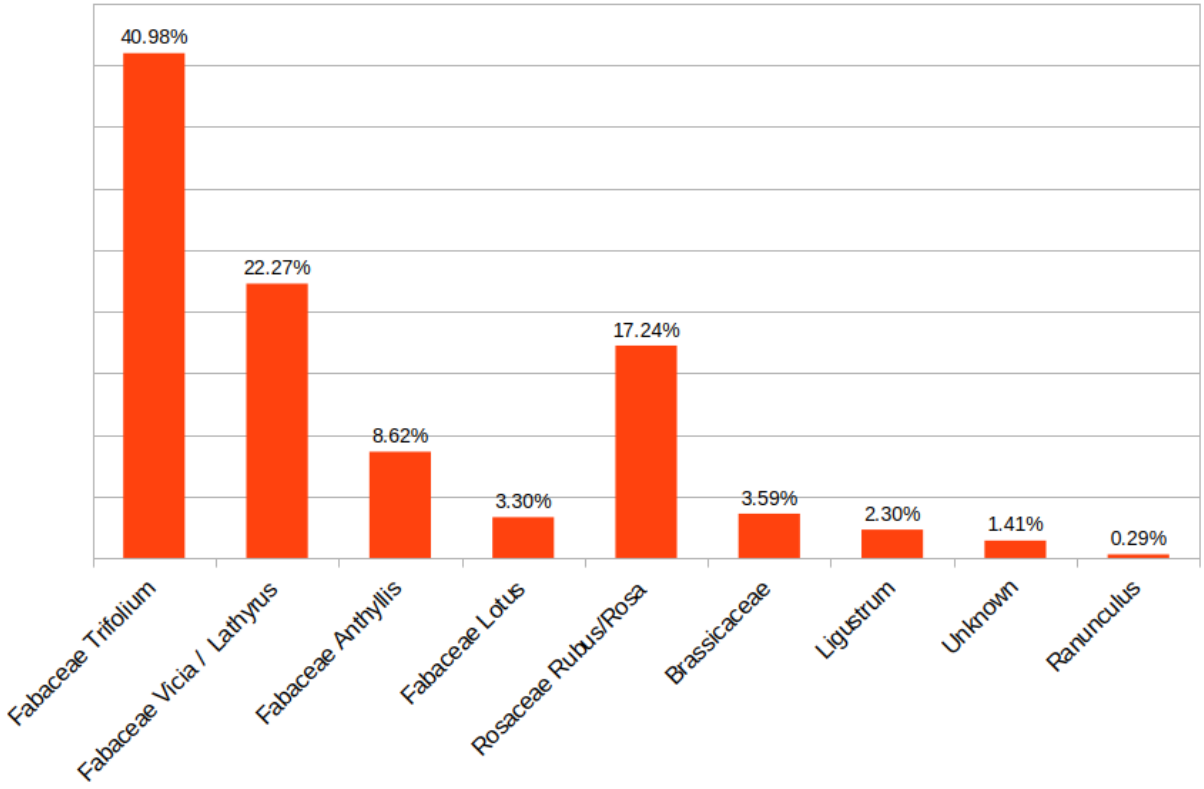

Figure 2: Graph of South Devon pollen samples. Total percentage content of all samples. Pollen < 5% content excluded.

The main legume (or Fabaceae) type was Trifolium (40%) with *Lathyrus/Vicia* type being the second most frequent at 22% (Fig. 1.). Within the Trifolium type almost half of this was classed as small/medium type which is likely to be White clover (Trifolium repans) probably the most abundant Trifolium at the sampling sites and the other half was in the small type category which potentially represent a range of common small Medicago and Trifolium species, including Lesser Trefoil (Trifolium dubium), Black Medick (Medicago lupulina) or Spotted medick (Medicago arabica). Of the *Lathyrus/Vicia* type almost half was classed as small / medium type. The small / medium type could include Tufted Vetch (Vicia cracca), but given the sampling was quite early it is most or all is likely to be Common vetch (Vicia sativa) which was more common at Prawle. the rest classed as *Lathyrus/Vicia* is difficult to assign to genera, but is likely to include Meadow Vetchling (*Lathyrus pratensis), Bush Vetch* (Vicia sepium) and Narrow-leaved Everlasting-pea (*Lathyrus sylvestris).*

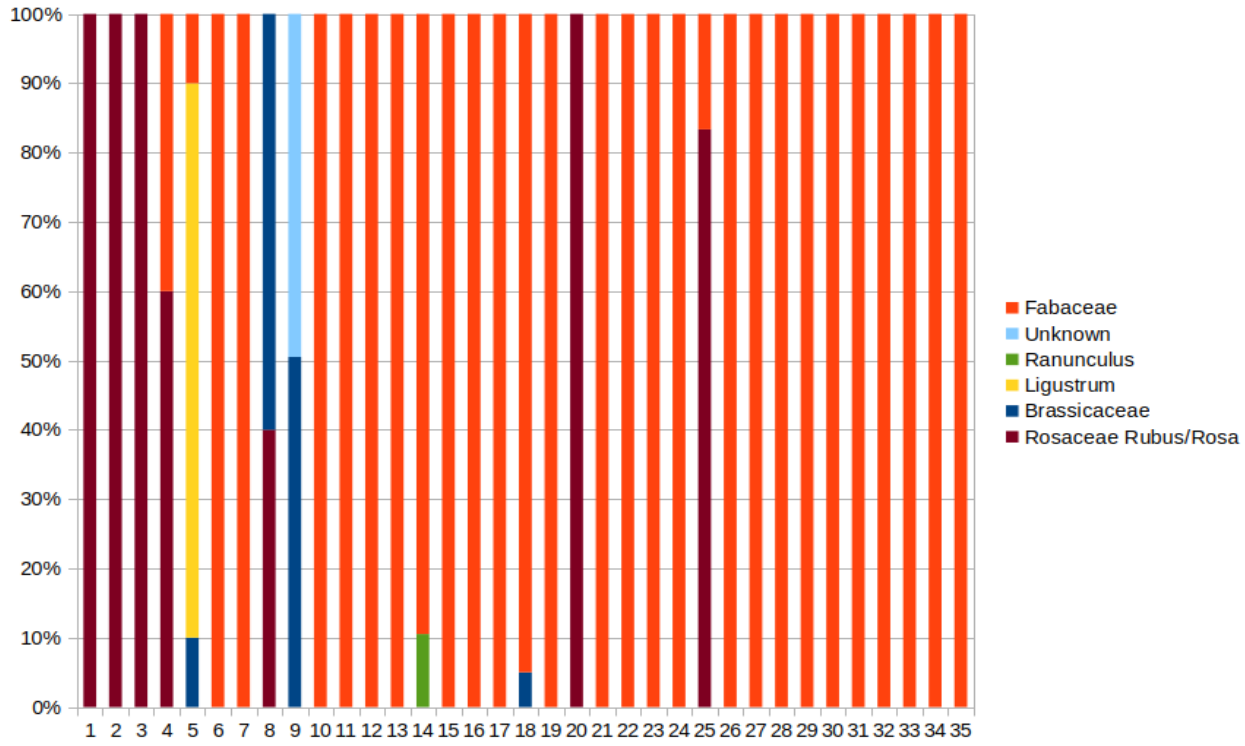

Figure 3: Percentage content of individual Devon samples. Content at < 5% was excluded. Nine samples (n=35) were dominated (or > 60%) with pollen from non-legume families. This was mostly Bramble (which dominated six samples).

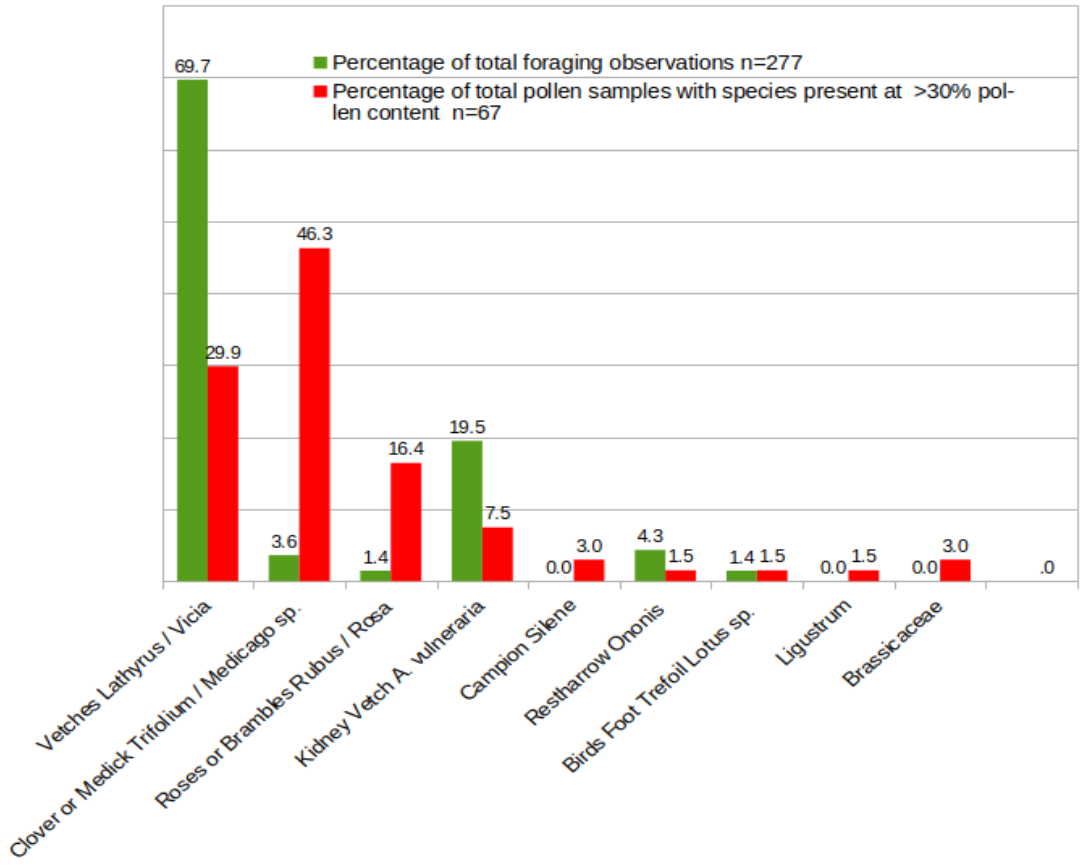

Figure 4: Observations and Pollen samples 2015-2025 Devon and Cornwall. The combined results had Fabaceae in 98 % of foraging observations and 73 % of pollen samples. The main Fabaceae with 69.7% of the observations was Lathyrus/Vicia.

Discussion

Most authors infer that flower specialism in solitary bees is driven by pollen rather than nectar as pollen is the primary source of nutrition for larvae (Vaudo 2020). Nectar usually mainly fuels adult activity but can contain compounds of importance for larval nutrition and could contribute partly to specialism in some bee species (Barda et al. 2024).

The nutritional quality of pollen influences the body size of solitary bees (Müller et al. 2006) but dietary specialisms can relate to a range of quite complex adaptions including physiological constraints related to pollen digestion of specific plant taxons (Sedivy et al. 2012) and physiological adaptions such a specialised hairs or other body features for pollen harvesting on certain flowers.

The approach of combining field observations alongside pollen analysis was used in this review to get a more holistic view. Observations of flower use alone can be quite unreliable as it is difficult to assess in the field how much a flower visit is for pollen or nectar. The pollen samples are also not a complete solution as it is difficult (and expensive) to do a lot of samples and they may show what's available rather than what's preferred.

The Long-horned Bee is described to be oligolectic (specialising in pollen from a small number of very closely related plants) on the flowers of legumes (Westrich 2016). Legumes (Fabaceae) are known to be important for bees, including the rare bumblebees (Goulson & Darvill 2004), probably because the family produces high-quality pollen with high protein content (Hanley et al. 2008) and high protein to lipid ratio (Vaudo et al. 2024). Jeannerod et.al (2022) found legumes had deficiencies in one or several essential amino acids. Specialist bee species can be associated with rarer plant sterols (Baker 2025a). Trifolium and Vicia have similar sterol profiles (Baker 2025b).

This study confirmed the importance of legumes as previously found in Cornwall (Saunders 2018). Hennessy et al. (2020) at Gatwick airport found Fabaceae pollen made up over 90% of the pollen (n=113) . This study in Devon found frequent use of non-legumes, particularly Bramble (Rubus fruticosus), (which was also found the Gatwick study).

Cornish sites with abundant legumes had no Bramble in the samples, whereas the two other Cornish sites with Bramble in the samples had little available Lathryus or Vicia at the time of sampling. One (Lowland Point) was heavily grazed when the samples were taken with much reduced legume flowering. It seems likely Bramble is being used in Devon as is it is more available when other legume resources are poorer. This is likely to be more of an issue after early July when probably even Clover abundance drops off.

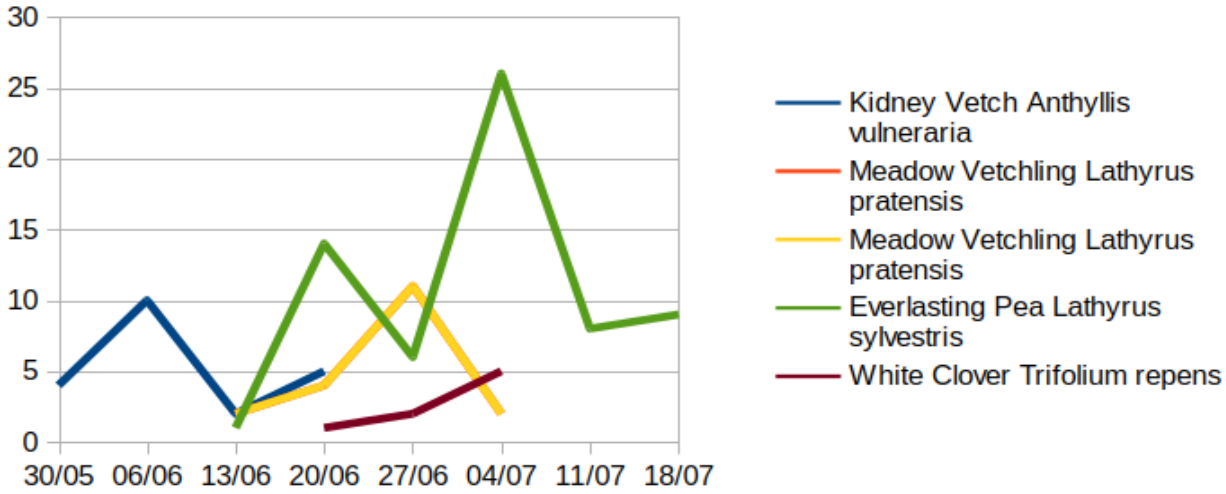

Figure 5: Observed Legume use in Cornwall by week (Saunders 2018)

Long horned bee has a long flight period in some years from mid-may until early august. The Cornish study (figure 5.). highlighted the importance of a using a range of species even just amongst the Vicia and Lathyrus over the flight period.

The late flowering Narrow-leaved Everlasting-pea and Tufted Vetch (Vicia cracca*)* were observed to be commonly used at Prawle in July 2023 was the top overall forage plant in the combined observations (Fig.4.) with 118 (n=277) (Fig.4.), but about twice as many of Devon pollen samples were Clover as Lathyrus / Vicia (Fig.2.). It is thought that this discrepancy is probably as the sampling occurred before the July flowering peak of Narrow-leaved Everlasting-pea.

Difficulties in pollen identification make unpicking the Trifolium species difficult. White Clover (Trifolium repens) is probably the most abundant or available legume. Perranthuoe in Cornwall the bee was observed to be commonly using White Clover in the middle part of the season and pollen samples confirmed med-size Trifolium from this site.

Figure 6: Long-horned Bee

Birds-foot Trefoil (Lotus corniculatus) was quite abundant at Garah, it is perhaps surprising that that only 3 % of samples consisted of it. It rarely appeared in Cornwall samples but was found in a high proportion of samples at Gatwick Hennsey Et. al. (2020).

Kidney Vetch (Anthyillis) was only found in 8% of pollen, but in all the earliest pollen samples (22/5/25). Kidney Vetch finishes before the main flight period, but is a important resource when the females first emerge.

A female (or possibly 2 females) was found on two occasions foraging on Meadow Vetchling in the same road verge near East Prawle at approx 1.1km/1.2km from the nearest 3 nest sites. This was very interesting and useful indication of foraging range. Most Long-horned Bee females were recorded within 800m of the coast which was consistent with Cornish observations (Saunders 2020). Another large solitary bee (Anthrophora plumipes) has been found to frequently forage at long distances (1389m) (Saunders & Hocking 2026).

The effect of different pollen species on larval productivity and survival are likely to be quite complex. Specialized solitary bees have been found to fail to develop on non-host pollen (praz 2008), even very generalist bumblebees' offspring productivity can be variable on different pollen diets (Vanderplanck 2018). Research suggest mixing pollen is a possible strategy to optimize larval food quality when flower resources are poor. (Eckhardt 2014). Without a study measuring Long-horn Bee offspring performance or survival on different diets its very hard to establish nuances in the diet such as is a 20% Bramble diet fine?. It seems very likely that the probable recent extinction of Six-banded Nomad Bee (Nomada sexifasciata) at Prawle is due to reduced host population due to reduced or poor flower resources (Saunders 2024).

Different genera of bees vary in how "wet" or dry" the larval cells are. The Long-horned Bee has been observed to mix pollen with nectar while foraging, possibly to 'make it more sticky, allowing larger quantities to be carried' (Falk & Lewington 2015) and have pollen in the cells mixed "wet" with nectar (Peeters 2012). Ten of the samples contained "yellow globules". Soaking pollen in nectar may loosen the outer lipid layer, known as the pollenkitt, potentially aiding preservation or larval digestion (many of the pollen samples collected from Cornwall were found to contain an unidentified yellow substance. Its very likely that "oily" pollen is important and there could be other aspects of this which could warrant research.

Solitary bees also consume pollen alongside nectar in the crop, which is thought to be essential to aid egg development (Cane 2016). Gruter & Hayes (2022) suggest social bees fly 3 times further than similar size solitary bees. Social bees are more associated with nectar collection than solitary species, but there could be a link between greater foraging distances and solitary species able to use more nectar to fuel flight (Saunders & Hocking 2026). Direct consumption by females of pollen and nectar is likely to be less critical requirement than stored pollen for larvae but could be an additional resource factor for research.

Conclusions

This review recommends that the Vetches Vicia and Lathyrus species are the most important priority for habitat restoration. These resources are also clearly rarer in the landscape particularly later in flight season when other legume resources are rarer. A Broad range of Fabaceae is also important including both semi-improved grassland and clover rich agricultural grassland alongside unimproved grassland and maritime grassland including other legumes such as Birdsfoot trefoils, Restharrow and Kidney Vetch to provide spread of resources both for Long-horned bee and to support a rich fauna of other bee species.

References

Barda, M., Karamaouna, F., Kasiotis, K. M., Baira, E., Papadopoulos, G. K., Bebeli, P. J., & Perdikis, D. (2024). Flower morphology and nectar quality traits in faba bean affect attraction to bees. *Journal of Applied Entomology*, *148*(1), 57-73.

Baker, E.C., Lamborn, E., Berry, K., Wright, G.A., Stevenson, P.C., 2025a. Specialization and adaptation in pollen sterol use by wild bees. bioRxiv. https://doi.org/10.1101/2025.07.31.667884, 2025.2007.2031.667884.

Baker, E.C., Lamborn, E., Quiñonez, J., Karlsdottir, S., Sheppard, A., Moore, E., Kunin, W., Wright, G.A., Stevenson, P.C., 2025b. Pollen sterols are highly diverse but phylogeneti

Cane, J. H. (2016). Adult pollen diet essential for egg maturation by a solitary Osmia bee. *Journal of insect physiology*, *95*, 105-109.

Eckhardt, M., Haider, M., Dorn, S., & Müller, A. 2014. Pollen mixing in pollen generalist solitary bees: a possible strategy to complement or mitigate unfavourable pollen properties? *Journal of Animal Ecology* 83(3): 588–597.

Falk, S. J., & Lewington, R. 2015. *Field Guide to the Bees of Great Britain and Ireland*. British Wildlife Publishing, Oxford.

Grüter, C., & Hayes, L. (2022). Sociality is a key driver of foraging ranges in bees. *Current Biology*, *32*(24), 5390-5397.

Goulson, D., & Darvill, B. 2004. Niche overlap and diet breadth in bumblebees: are rare species more specialized in their choice of flowers? *Apidologie* 35: 55–63.

Hanley, M. E., Franco, M., Pichon, S., Darvill, B., & Goulson, D. 2008. Breeding system, pollinator choice and variation in pollen quality in British herbaceous plants. *Functional Ecology* 22(4): 592–598.

Hennessy, G., Goulson, D., & Ratnieks, F. L. (2020). Population assessment and foraging ecology of nest aggregations of the rare solitary bee, Eucera longicornis at Gatwick Airport, and implications for their management. *Journal of Insect Conservation*, *24*(6), 947-960.

Jeannerod, L., Carlier, A., Schatz, B., Daise, C., Richel, A., Agnan, Y., ... & Jacquemart, A. L. (2022). Some bee-pollinated plants provide nutritionally incomplete pollen amino acid resources to their pollinators. *Plos one*, *17*(8), e0269992.

Müller, A., Diener, S., Schnyder, S., Stutz, K., Sedivy, C., & Dorn, S. 2006. Quantitative pollen requirements of solitary bees: Implications for bee conservation and the evolution of bee–flower relationships. *Biological Conservation* 130(4): 604–615.

Peeters, T. M. 2012. Bijen: Eucera langhoornbijen. *Natuur van Nederland* 11(1): 307–309.

Praz, C. J., Müller, A., & Dorn, S. 2008. Specialized bees fail to develop on non-host pollen: do plants chemically protect their pollen? *Ecology* 89(3): 795–804.

Westrich, P. 2016. Langhornbienen: *Eucera longicornis* [online]. Available at http://www.wildbienen.de/eb-elong.htm

Saunders, P (2018) The long horned bee in Cornwall, Published on http://kernowecology.co.uk/Publications/Long%20horn%20bee%20ps%202017.pdf

Saunders, P. & Hocking, B. (2026) Landscape use of the Hairy-footed Flower Bee (Anthophora plumipes) in West Cornwall (unpublished/ in prep).

Saunders, P (2024) Six-banded Nomad Bee at Prawle Point (Devon), Buglife report. (unpublished).

Sedivy, C., Dorn, S., Widmer, A., & Müller, A. (2013). Host range evolution in a selected group of osmiine bees (Hymenoptera: Megachilidae): the Boraginaceae-Fabaceae paradox. *Biological Journal of the Linnean Society*, *108*(1), 35-54.

Vanderplanck, Maryse, et al. "Is non-host pollen suitable for generalist bumblebees?." *Insect Science* 25.2 (2018): 259-272.

Vaudo, A. D., Tooker, J. F., Patch, H. M., Biddinger, D. J., Coccia, M., Crone, M. K., ... & Grozinger, C. M. (2020). Pollen protein: lipid macronutrient ratios may guide broad patterns of bee species floral preferences. *Insects*, *11*(2), 132.

Vaudo, A. D., Dyer, L. A., & Leonard, A. S. (2024). Pollen nutrition structures bee and plant community interactions. *Proceedings of the National Academy of Sciences*, *121*(3), e2317228120.

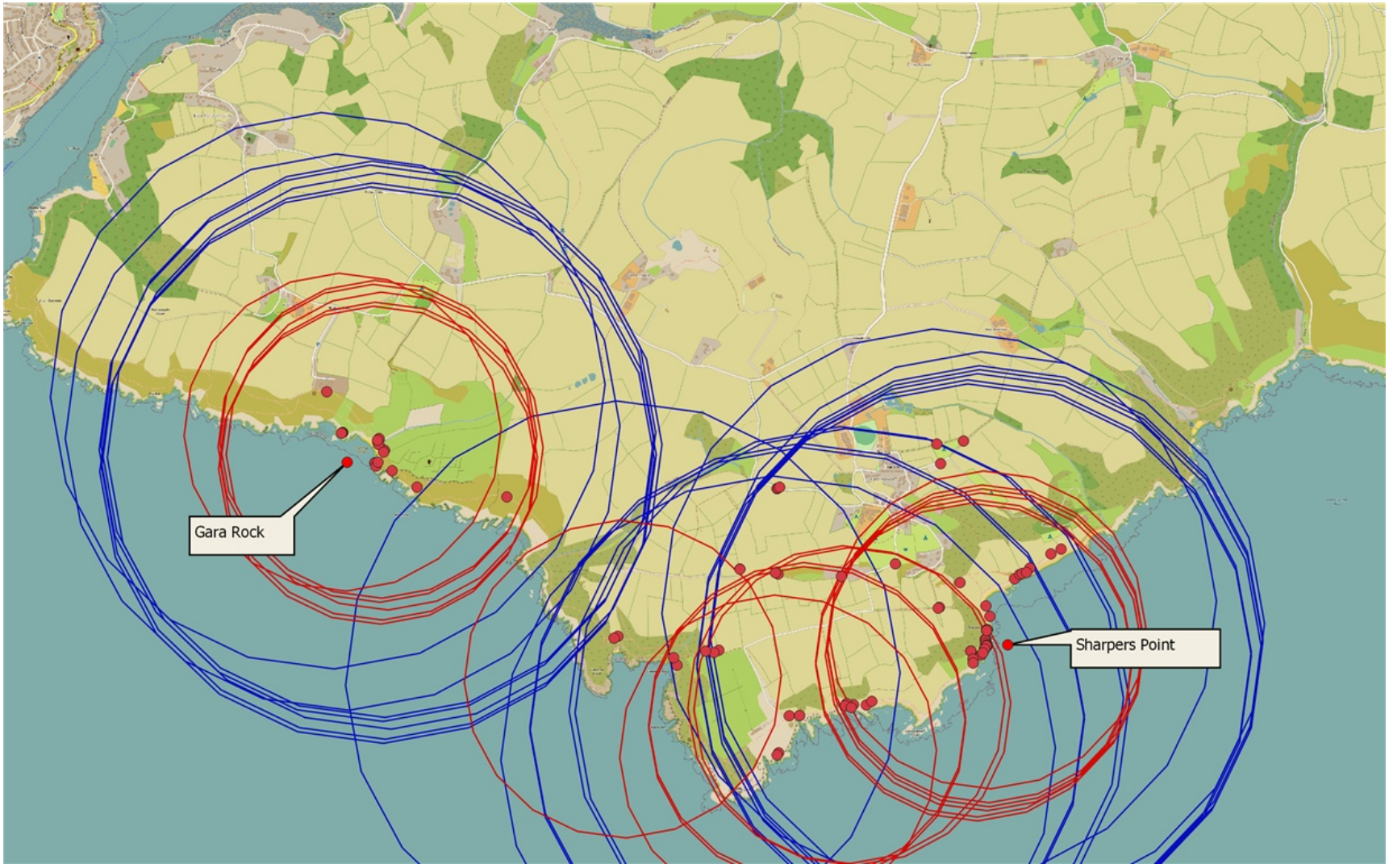

Figure 7 ***2023 Locations of Long-horn Bee records with 800m (Red) and 1.4km buffer (Blue).***

Long-horned Bee (*Eucera longicornis*) 2025 pollen analysis

Patrick Saunders

If you have any queries please contact:

Laura Krusin
Species Recovery Officer
laura.krusin@buglife.org.uk

buglife.org.uk
0300 102 7375

Find us on:

Buglife - The Invertebrate Conservation Trust is a company limited by guarantee
Registered in England at Allia Future Business Centre, London Road, Peterborough, PE2 8AN
Company No. 4132695 | Registered Charity No. 1092293 | Scottish Charity No.SC040004