UK Pollinator Monitoring Scheme

Annual Report 2024

UK Centre for Ecology & Hydrology

JNCC

POMS
UK Pollinator Monitoring Scheme

Welcome

Welcome to the third Annual Report of the UK Pollinator Monitoring Scheme (PoMS)! The report provides an overview of survey coverage and progress from the 2024 season, and includes news and updates from the PoMS partnership. It also documents ongoing analyses of trends in different insect pollinator groups from PoMS data collected between 2017 and 2023.

PoMS aims to understand how insect pollinator populations are changing across the UK through implementing two large-scale surveys: the Flower-Insect Timed Count (FIT Count) and the 1 km square survey. These surveys use a combination of dedicated volunteers and professional surveyors, taxonomists and researchers to collect and process data on the abundance and species distribution of flower-visiting insects from a wide range of habitats across the UK. Through continued monitoring at this scale, PoMS will provide evidence for understanding how these insects, which play such a vital role in our countryside, gardens and culture, are responding to changes in our environment. The UK PoMS partnership is coordinated by UKCEH, further details are provided on page 46.

We welcome feedback on any elements of this report or on other types of article you would like to see in future.

Contents

References to publications and websites are indicated with hyperlinks like this [1]. Reference list on pp 44-45

Front: Variable Nomad Bee, *Nomada zonata* © Steven Falk

Back: PoMS report and recording kit during recording of Counting the Earth podcast © Claire Carvell

Discover PoMS

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- Mailing list: ukpoms.org.uk/subscribe
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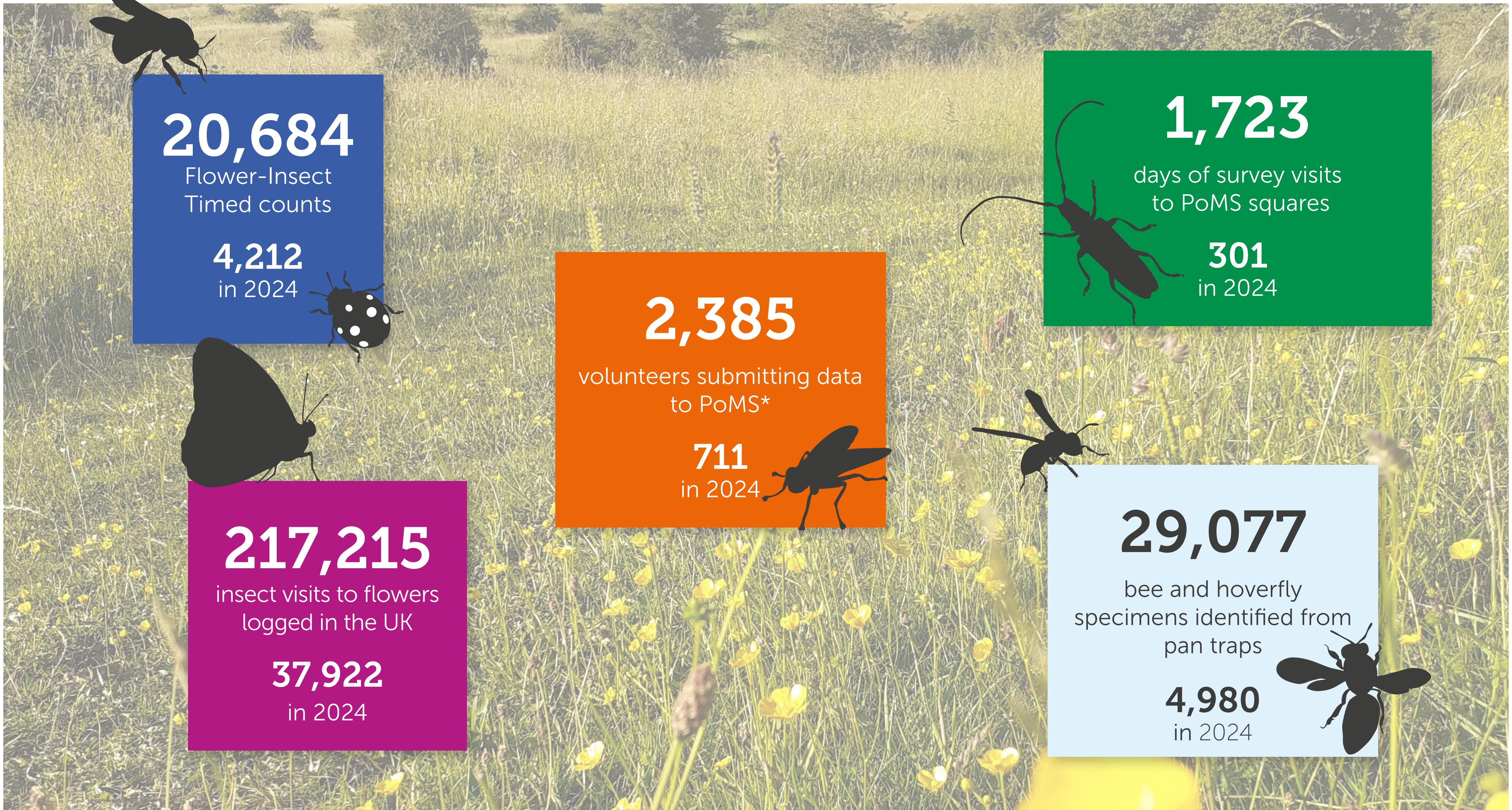


20,684
Flower-Insect Timed counts
4,212
in 2024

1,723
days of survey visits to PoMS squares
301
in 2024

2,385
volunteers submitting data to PoMS*
711
in 2024

217,215
insect visits to flowers logged in the UK
37,922
in 2024

29,077
bee and hoverfly specimens identified from pan traps
4,980
in 2024

PoMS in numbers

In each box, the first value is for all years (2017-2024) whilst the second value is for 2024.

*based on user accounts registered via the FIT Count app and PoMS website.

Latest news from UK PoMS

Claire Carvell and Martin Harvey (UKCEH) provide a round-up of PoMS activities during the past year and look forward to the 2025 season.

The UK Pollinator Monitoring Scheme (PoMS) has continued to thrive in its eighth year. 2024 saw the level of survey effort sustained across both the FIT Count and 1 km square surveys, despite the often cool and damp weather conditions. **Long-term monitoring using a consistent methodology** is key to enabling us to understand the health of our pollinators and their habitats. Whilst all data are important for PoMS, having continuous time series within individual sites will become increasingly valuable to our analyses of change over time. There are now 44 squares in the PoMS 1 km square dataset which have eight years of continuous data, and eight volunteers who have conducted surveys every year since 2018, collecting more than 1000 samples between them! We are incredibly grateful for their continued contribution to the scheme and would like to give **special thanks to three star volunteers: Jane Hewitt** who has conducted the most surveys of any volunteer (34), covering two PoMS squares since 2022, and **Edwina Brugge** and **John Wells** who have each conducted around 25 surveys, and since 2019 have each achieved the maximum possible number of survey visits to their square. We hope that they and all the 1 km square volunteers and landowners will enjoy receiving their annual square report listing the bee and hoverfly species identified from their pan trap samples, as an additional point of interest to taking part in PoMS. Read more about survey coverage on both the FIT Count and 1 km square surveys on pages 7-27.

Alongside this Annual Report comes an updated publication of the PoMS dataset. The **2017 – 2022 dataset is now available for research through the UKCEH Environmental Information Data Centre** [1]. Here you will find complete versions of both the pan trap survey data from PoMS 1 km squares, and the Flower-Insect Timed Count survey data collected on 1 km squares and as part of the wider citizen science FIT Counts from across the UK.

Each dataset is published with a detailed 'metadata' document that describes the data collection methods and processing pipeline, and how PoMS data are presented for wider use. In addition, species occurrence records of bees and hoverflies generated from the pan traps are being shared with the UK's National Biodiversity Network Atlas, enabling them to reach the relevant recording schemes and societies and become available for further research and policy development. We are always keen to hear from researchers interested in making use of PoMS data.

As PoMS is a relatively young scheme, the data and any emerging trends are not yet sufficiently developed to contribute to "official statistics" or indicators in the way that survey results from the longer-running UK biodiversity monitoring schemes do. However, the team is continuing to **develop analytical approaches** and metrics which will, in due course, contribute as indicators that can be used widely to set priorities and inform conservation action. An update on this work is presented in more detail on pages 21-27.

PoMS continues to contribute to the research agenda on **insect DNA barcoding** under our partnership with the BIOSCAN project and Natural History Museum (NHM). Read more in our update on pages 31-32, where we detail how an impressive 3,500+ unique DNA sequences have been recovered from pan trap samples across just four PoMS 1 km squares.

During 2024, various wider collaborations with the PoMS team facilitated some of our ideas for further development of the scheme. As part of the **National Education Nature Park** (NENP) programme [2], a simplified version of the FIT Count survey (named Pollinator Count) was piloted in schools and colleges across England. The programme was commissioned by the Department for Education as part of their Sustainability and Climate Change Strategy, and is being developed by a partnership led by the NHM, including the Royal Horticultural Society (RHS) and UKCEH.

It provides educators with free resources and guidance to embed climate and nature into learning, and to empower young people to develop a connection to nature along with key green skills. The NENP Pollinator Count [3] uses a shorter observation time and simplifies the insect groups counted on FIT Counts. The resources are being further improved for 2025. The data generated will not feed directly into PoMS, but will provide an interesting dataset for comparison and will allow for assessment of the health of pollinators across schools and colleges taking part in the Nature Park.

From experience on other volunteer-led monitoring schemes and feedback from the PoMS questionnaire conducted in 2022, we recognise the importance of providing feedback to participants that is both personalised and motivating. Feedback should recognise

Members of the PoMS 1 km square survey mentor team for 2024 were Miranda Bane, Conor Bush, Richard Dawson, Catherine Jones, Nadine Mitschunas, Fiona Montgomery and Jan Winder. A huge thank you and goodbye to Jan who leaves us to focus on other ecological surveys across Wales.

For 2025 we are delighted to welcome Tana Holmes who will be supporting PoMS surveys in Scotland. Tana has been volunteering across two PoMS squares with her family since 2021, with their efforts altogether totalling 28 surveys!

Volunteering to monitor a 1 km square for PoMS has been a wonderful experience for the whole family. The kids have loved having a focus for a walk and have appreciated the short distances with lots of rests while setting up pan traps and identifying and photographing flowers. We have really enjoyed the rhythm of visiting the same sites for several years, getting to know them and seeing the changes to flora and insects as each summer progresses...

- *Tana Holmes (2024)*

© Tana Holmes

volunteer efforts in the context of the wider scheme, whilst providing an incentive to submit further surveys. This year, the PoMS team worked with data scientists at UKCEH to design a system for providing **personalised feedback** by email to users of survey apps such as the FIT Count, or those submitting biological records of species. This work was supported by the Natural Capital and Ecosystem Assessment [4] programme. Through trialling this feedback with a small group of regular FIT Counters, we now have a template to fine-tune and implement more widely during 2025, for full roll-out in 2026 – look out for feedback on your own counts arriving by email later on in the season!

For 2025, we are delighted to announce that the **Royal Horticultural Society (RHS)** have joined the UK PoMS partnership. Some of you may have followed our updates from visits to various RHS gardens in previous Annual Reports, holding pollinator training days with Helen Bostock (RHS Senior Wildlife Specialist) and teams of staff and volunteers. This year will see the RHS Plants for Pollinators Counts project continue as a great example of applying the FIT Count projects feature to strengthen the evidence base for the RHS lists to help gardeners select the best pollinator-friendly flowers. Read the feature article on pages 39-42 to find out more.

Finally a few reminders, starting with a link to sign up for the PoMS e-newsletter which we aim to release quarterly with the latest updates on PoMS surveys, events hosted across the UK and online by PoMS partners and publications. PoMS remains active on social media through our new Bluesky account (@pomscheme.bsky.social) and other channels including via UKCEH. Remember to check the map on the PoMS website for the current status of survey squares near you, as this may change during the season. Any new volunteers wishing to adopt a square will receive one-to-one training, equipment and everything you need to get going from our team of PoMS survey mentors at a time that suits you.


@RHS

Claire and Helen sampling bee cupcakes on a pollinator training day at RHS Garden Harlow Carr.

Flower-Insect Timed Counts

Flower-Insect Timed Counts (FIT Counts) are simple systematic surveys collecting data on abundance of flower visitors across a variety of habitats and plant groups. Here, Claire Carvell, Robin Hutchinson and Martin Harvey (UKCEH) summarise coverage to date and highlight how the growing dataset is showing differences in the insect assemblages visiting the different target flowers.

FIT Counts were developed with the aim of encouraging a wide range of people to get involved in pollinator monitoring, whilst also generating data on flower visitation and plant-pollinator interactions that is not being collected by any other existing scheme. The recorder spends **10 minutes** counting the insects that visit the flowers of a chosen flower species within a **50 cm quadrat** (ideally from our list of 14 target flowers, although other flowers can be used). Information on flower abundance and habitats surrounding the FIT Count quadrat, and the weather, is also collected to help explain variation in the insect data and explore the effects of changes in these other variables over time, where the data allow.

FIT Count resources include survey guidance, a recording form, insect and flower guides, 2-minute video guides, online forms for data capture and the mobile app that was launched in 2021 with its own integrated guide to the insect groups (see image on page 15). All are available in both English and Welsh through the PoMS website.


Emily Williams © UKCEH

An early April FIT Count on Blackthorn.

Overall, in the eight years since the survey began in 2017, a total of **20,684 FIT Counts** has been submitted, representing an incredible **3,447 hours of observation** and **217,215 flower-insect interactions** (Table 1)! Thanks are due to **more than 2,380 recorders** who have submitted counts from all corners of the UK. Throughout the 2024 season, PoMS released a series of plots through our e-newsletter showing the cumulative increase in counts carried out each month. Counts during 2024 overtook those from all previous years during early May (Figure 1, page 9). This was followed by a slight drop in counts coming in, likely coinciding with the cooler, damp weather conditions in late May and June 2024 meaning that the temperature and sunshine thresholds required for the survey were not being reached. Survey effort from July continued to match that from 2023 however, and by September 2024 a total of 4,212 FIT Counts had been submitted.

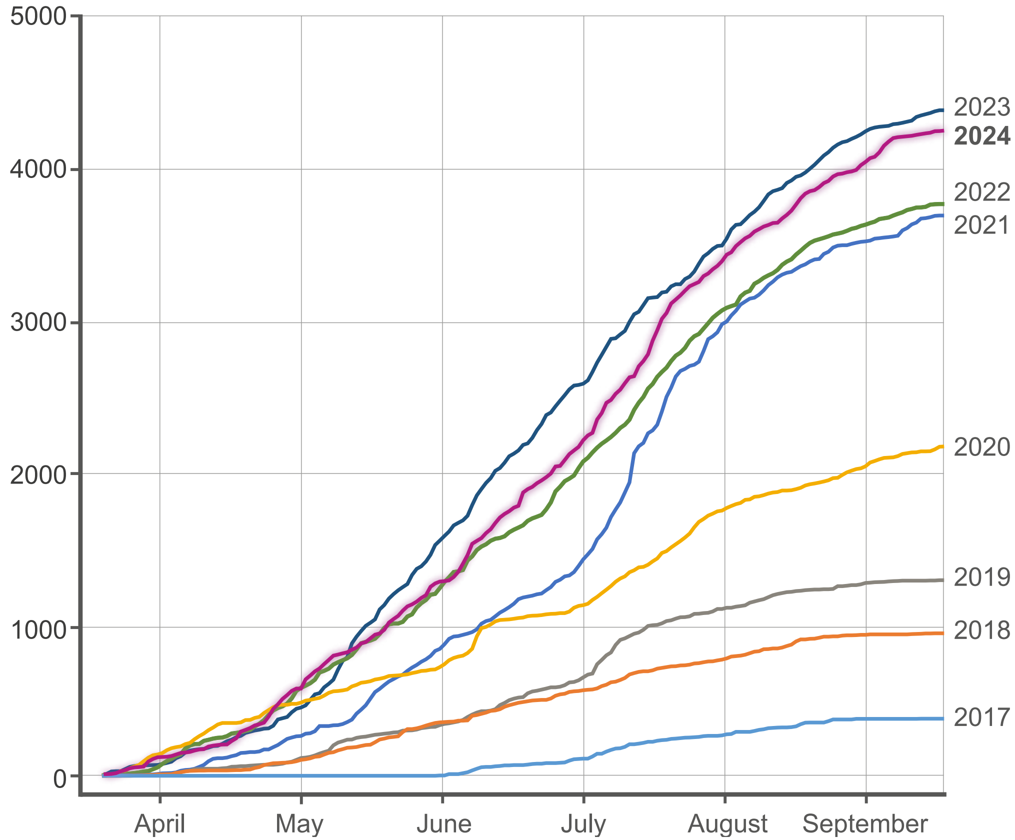
Detail	Years	England	Scotland	Wales	N Ireland	Total UK
Total number of FIT Counts	2017 - 2024	15,387	2,646	1,613	1,038	20,684
	2024	2,937	583	286	406	4,212
Number of FIT Counts submitted by the public	2018 - 2024	13,886	1,536	830	824	17,076
	2024	2,726	448	167	312	3,653
Number of FIT Counts on 1 km square surveys	2017 - 2024	1,501	1,110	783	214	3,608
	2024	211	135	119	94	559
Insect visits to flowers logged	2017 - 2024	171,855	22,321	14,766	8,273	217,215
	2024	28,483	3,533	2,493	3,413	37,922
Total number of recorders (1 km and public)	2017 - 2024	1,906	259	160	100	2,385
	2024	557	77	40	44	711
Total number of public recorders	2017 - 2024	1,872	239	144	98	2,313
	2024	541	66	36	45	678

Table 1. Summary of survey coverage and uptake of Flower-Insect Timed Counts submitted to UK PoMS.

Note: The FIT Count was launched to 'the public' across GB in 2018 and opened in N Ireland in 2020. It runs every year between 1st April and 30th September. FIT Counts have also been carried out as part of the PoMS 1 km square survey protocol since 2017 and are included here. Counts for England include the Isle of Man. Note data for 2024 are still subject to further final processing and hence minor adjustments may be required prior to data publication.

Solitary mining bee (*Andrena cineraria*) visiting Blackthorn during an April FIT Count.

Figure 1. Cumulative total number of FIT Counts submitted each year, shown through the season from April to September.



Note: Chart based on data from all FIT Counts submitted from the UK and Isle of Man between 1 April and 30 September from 2017 to 2024. PoMS data are subject to review and totals shown here may differ from our published datasets and reports.

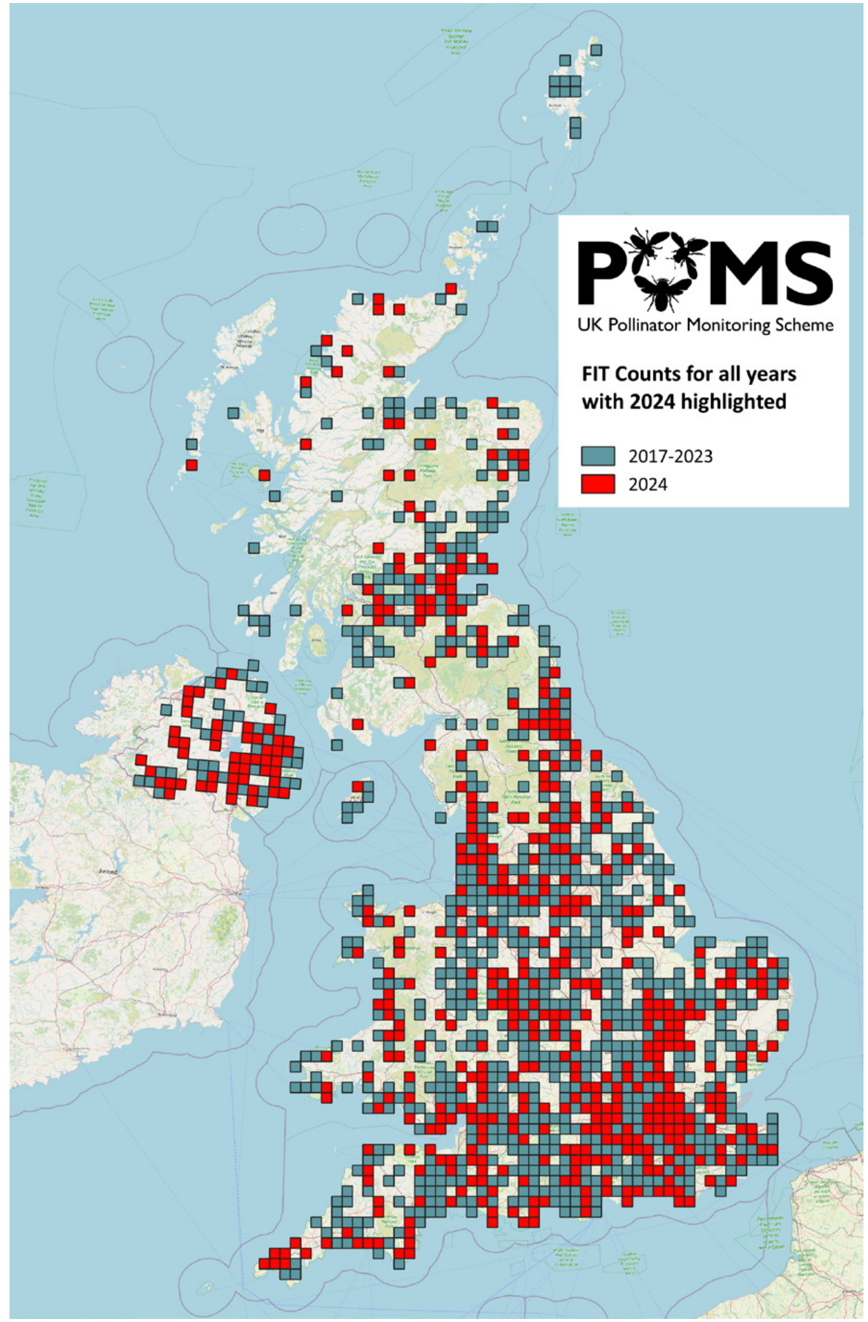


Figure 2. Map showing the location of 10 km squares in which one or more FIT Counts have taken place across the UK since 2017, both submitted by the public and on 1 km square surveys. Counts from 2024 are shown in red.

Across the four countries, 2024 saw an **increase of 20% in the number of recorders taking part** compared to 2023, especially in England and Northern Ireland (Table 1). This did not translate to an increase in number of FIT Counts received, with an average of six FIT Counts being submitted per recorder in 2024 compared to the overall average of nine counts per recorder across all years to date. Read more about applications of our new FIT Count projects feature on pages 36-38, and work to design effective personalised recorder feedback (Latest news), continuing in 2025, which we hope will support the recruitment and retention of new volunteers.

FIT Count target flowers and habitats

Across all FIT Counts to date, 65% have been carried out on target flowers from our recommended list and 35% from other flower types. For analysis purposes we classify all target flowers into plant family and flower structure (open or closed florets) to standardise across species.

Our league table featuring the 14 focal target flowers has been updated for this year's report (Table 2, overleaf), showing Buttercup, Ragwort and Lavender still remaining the top three target flowers selected by FIT Count recorders, followed closely by Dandelion and Thistle.

Ivy and Hogweed remain clear favourites for the insects, overall receiving the highest average number of visits per count, though it is important to note that these data are based on the raw counts, not corrected for target flower number within the quadrat. The results also continue to demonstrate the value of different flowers for different insect groups. For example the most common insect visitors to open flowers with short corollae are the

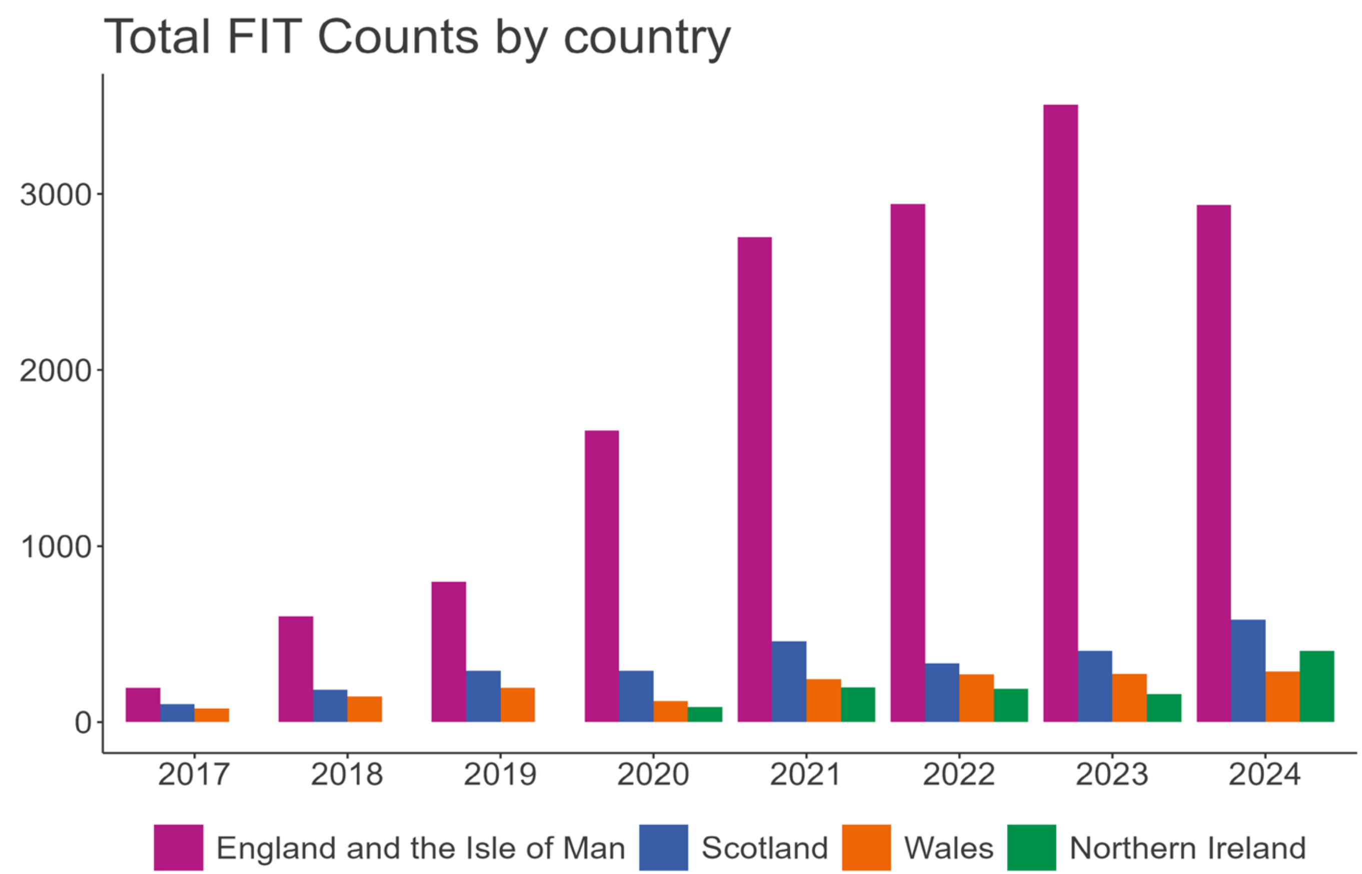


Figure 3. Total number of FIT Counts submitted in each country over the years.

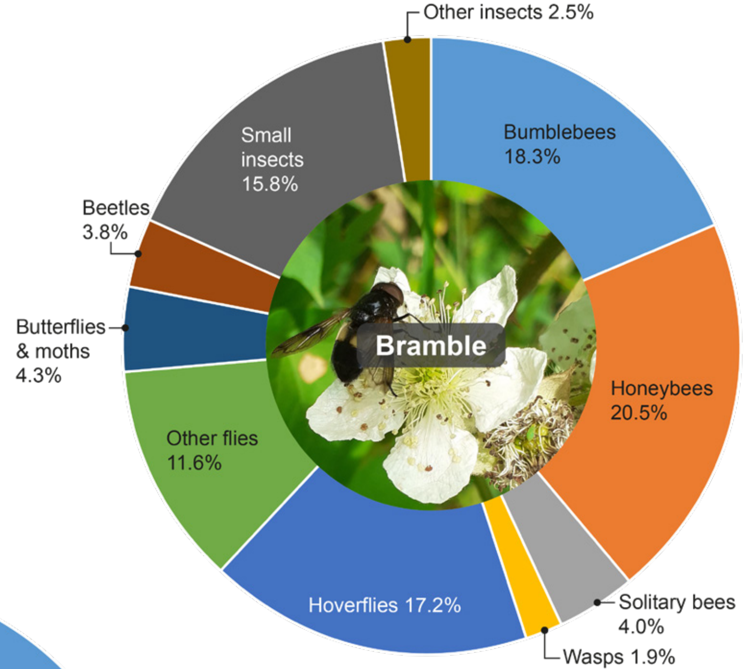
hoverflies, other flies and small insects with short mouthparts, whereas flowers with more complex structure or long corollae receive a higher proportion of visits from the bees. These are not new findings, but help to demonstrate that the FIT Count is picking up on patterns of insect flower visitation that we would expect to see in a large citizen science survey of this nature.

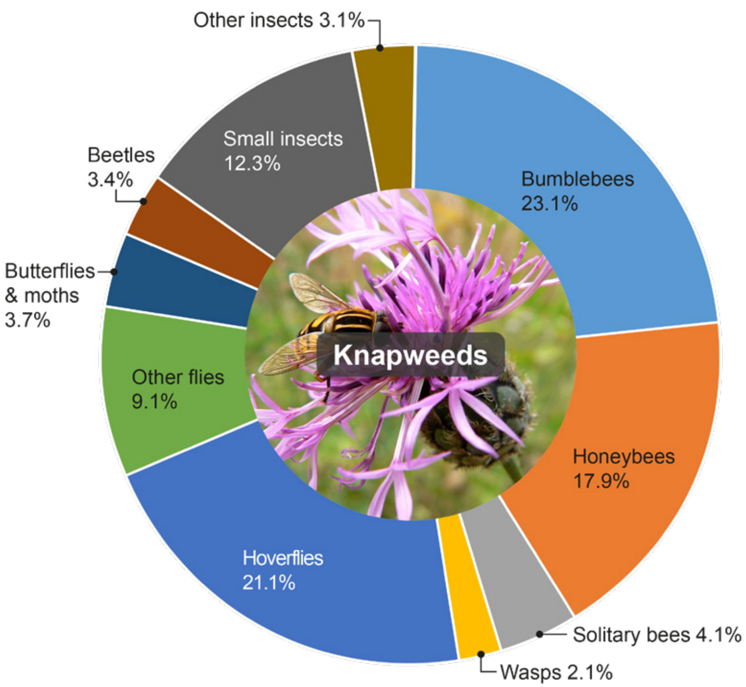
A series of interactive charts is available on the PoMS website to showcase these data by target flower, and we have selected six examples (Figure 4a, b on the following pages).

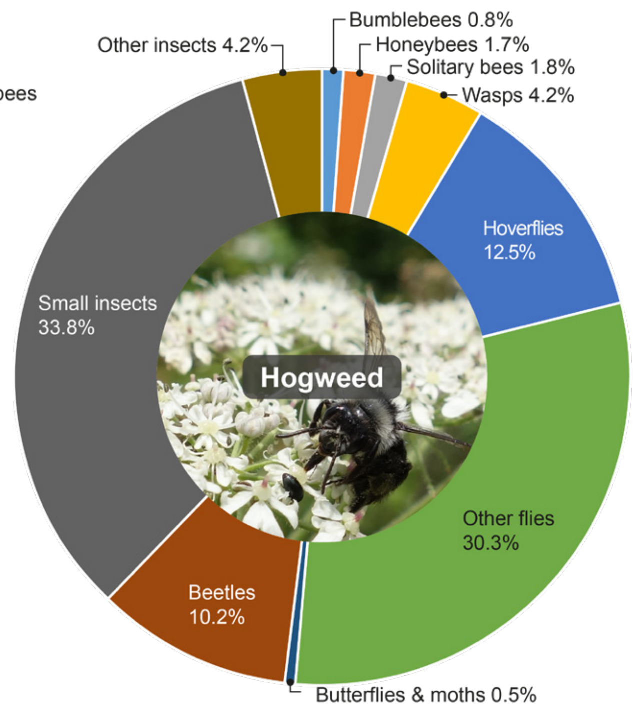
Target flower	Total insects	Total counts	Average per 10-min count	Most common insect visitors
Ivy *Hedera helix*	6,680	301	22	Other flies; honeybees
Hogweed *Heracleum sphondylium*	14,979	731	20	Small insects; other flies
Bramble (Blackberry) *Rubus fruticosus* agg.	11,606	847	14	Honeybees; bumblebees
Buddleja *Buddleja davidii*	10,255	763	13	Honeybees; bumblebees
Knapweeds (Common or Greater) *Centaurea nigra* or *scabiosa*	13,231	987	13	Bumblebees; hoverflies
Thistle *Cirsium* or *Carduus*	14,495	1,098	13	Small insects; other flies
Lavender (English) *Lavandula angustifolia*	16,653	1,240	13	Bumblebees; honeybees
Ragwort *Jacobaea/Senecio* species	15,459	1,289	12	Hoverflies; other flies
Hawthorn *Crataegus monogyna* or *laevigata*	2,617	357	7	Other flies; small insects
Heathers *Calluna* or *Erica* species	1,877	358	5	Other flies; small insects
White Dead-nettle *Lamium album*	1,690	339	5	Bumblebees; small insects
White Clover *Trifolium repens*	5,122	1,090	5	Small insects; other flies
Dandelion *Taraxacum officinale* agg.	5,870	1,199	5	Small insects; other flies
Buttercup *Ranunculus* species	9,737	2,013	5	Other flies; small insects

Table 2. Summary of FIT Count results by target flower, showing the average total number of insect visits per 10-minute count across all years of the survey (2017-2024). Note these figures are derived from the verified raw data rather than from modelled counts.

Figure 4a. Insects counted on selected target flowers, showing the proportion from each group across all years of the survey (2017-2024). These figures are derived from the raw data presented in Table 2, including FIT Counts submitted by the public and from PoMS 1 km squares.

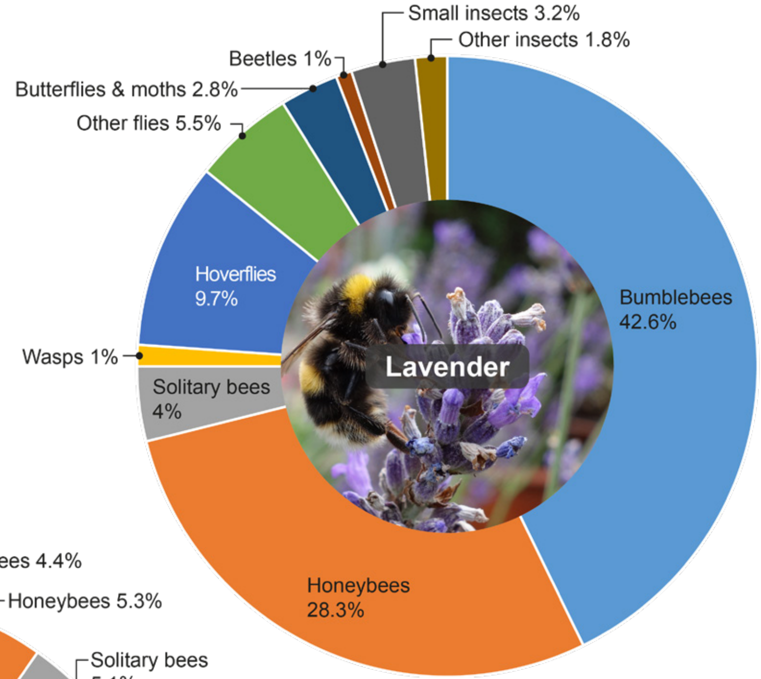


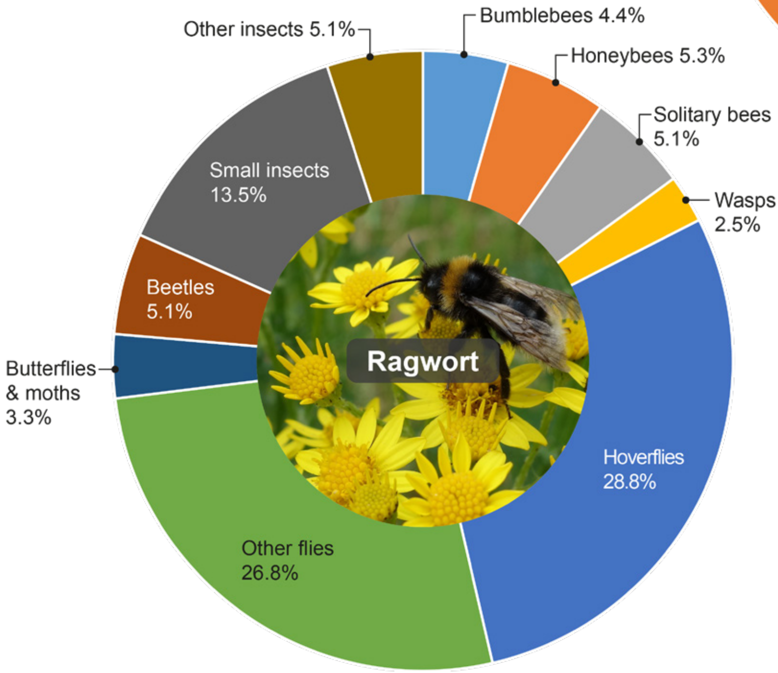


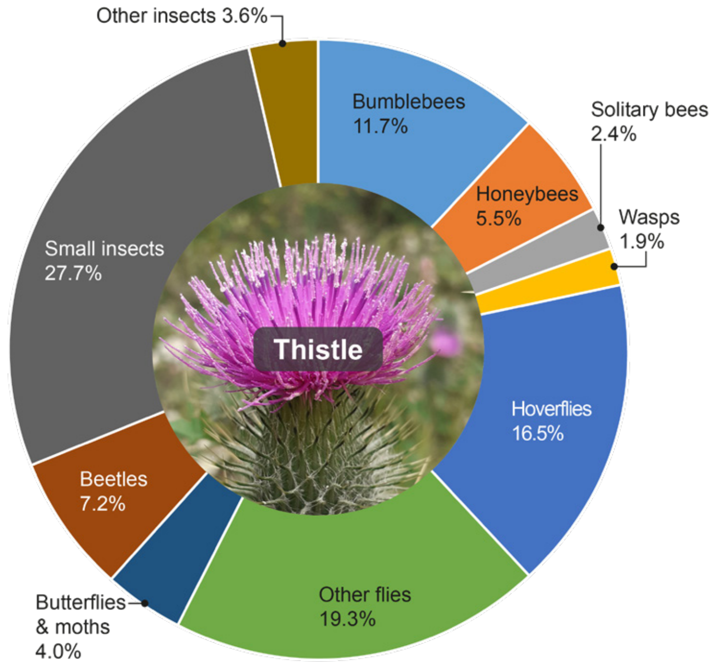


Photos, left to right: Lucy Hulmes © UKCEH; © Andy Sier; Nadine Mitschunas © UKCEH

Figure 4b. Insects counted on selected target flowers, showing the proportion from each group across all years of the survey (2017-2024). These figures are derived from the raw data presented in Table 2, including FIT Counts submitted by the public and from PoMS 1 km squares.







Photos, left to right: Nadine Mitschunas © UKCEH; Nadine Mitschunas © UKCEH; © Andy Sier

A key consideration in any long-term biodiversity monitoring scheme is to understand how sampling effort is maintained over time and space, and whether it remains representative across habitats in the UK landscape. How have the FIT Count surveys fared in terms of the habitats covered over the years? As shown in Figure 5, habitat coverage in both the public FIT Counts and 1 km square FIT Counts has remained fairly consistent. While a high proportion of public FIT Counts tend to be carried out in gardens (average 48%), a high proportion of counts in 1 km squares are carried out in semi-natural habitats (average 73%). Aside from the increased focus on counts in gardens during 2020, these proportions have remained relatively similar, allowing for a more robust comparison of the data between years. As the dataset expands, we look forward to reporting on FIT Count results from within habitats or different target flowers, to investigate whether they may be changing at different rates.

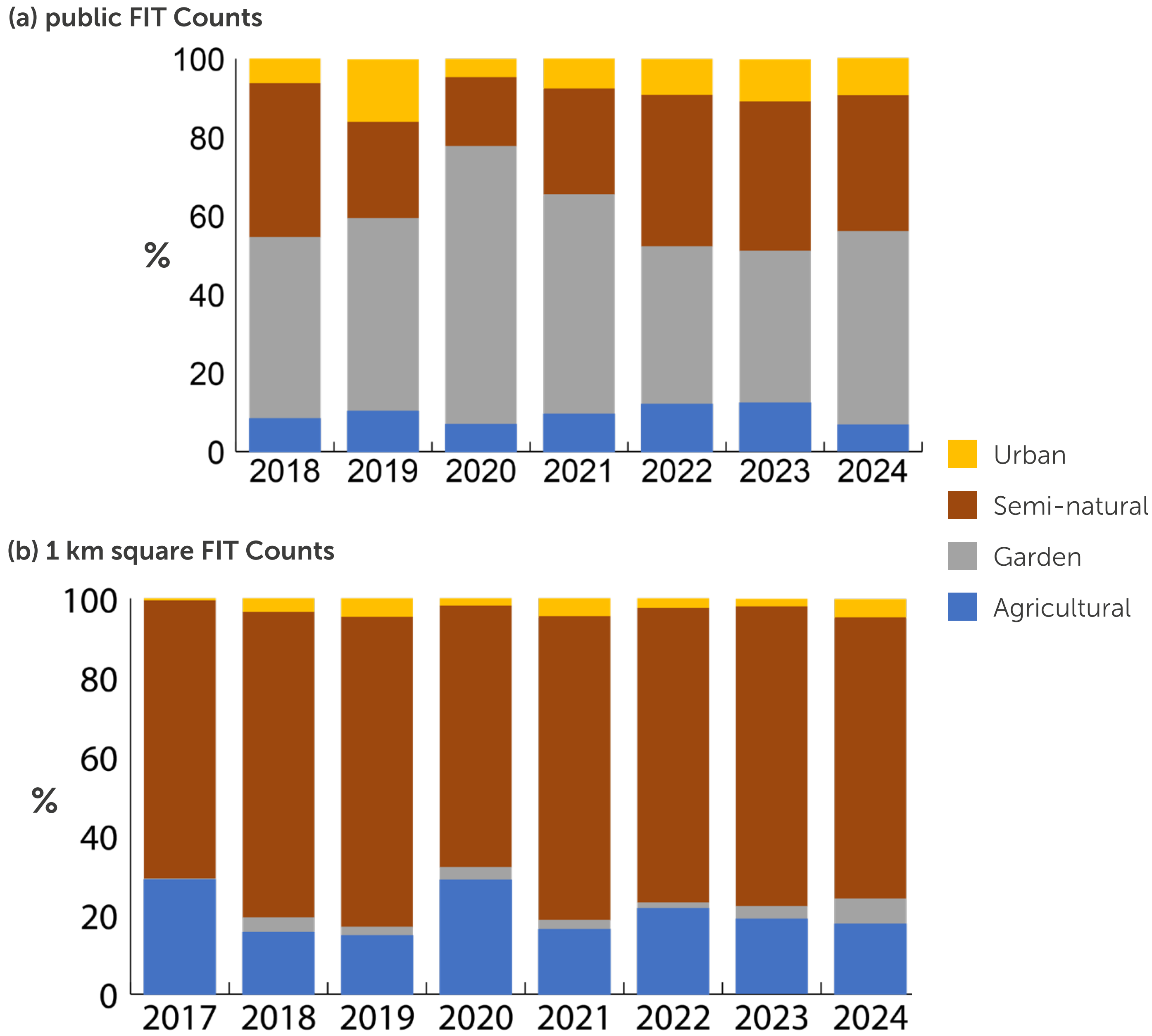


Figure 5. The proportion of habitats in which (a) public FIT Counts and (b) 1 km square FIT Counts have been carried out since 2017. Agricultural habitats include arable crops and intensive grass pasture; semi-natural habitats include unimproved or upland grasslands, woodland, heathland and moorland; urban habitats include amenity grassland, school grounds, churchyards and brownfield sites; garden habitats include gardens and allotments.

The FIT Count app was launched in 2021 with English and Welsh languages, and is available to download from Google Play or the App Store. The app includes a handy ID guide to the insect groups, taking you through the key features of each, found by clicking on the beetle icon at the bottom of the home screen.

Visit ukpoms.org.uk/fit-count-app for more details.

In the app, click this icon for the ID guide

The PoMS 1 km square survey

The PoMS 1 km square survey is a systematic survey of pollinators and floral resources from a core set of sites across the UK. It generates species-level data for bees and hoverflies using pan traps, providing new records of occupancy and distribution, as well as data to detect changes in abundance of key groups across a range of insect taxa. Here, Claire Carvell, Martin Harvey and Robin Hutchinson (UKCEH) summarise coverage up to and including 2024, our eighth consecutive year of sampling across the network!

The PoMS 1 km square survey was set up in 2017 across 75 randomly selected 1 km squares in Great Britain, stratified to represent the relative cover of agricultural and semi-natural land use in each country [5]. There are 36 squares in England, 22 in Scotland and 17 in Wales. In 2021, 20 squares were set up in Northern Ireland to expand the overall network to 95 squares (Figure 6). Sampling is conducted on up to four visits from May to September each year by a combination of volunteers and PoMS team surveyors. The 'one-person-one-day' protocol was designed to be implemented by non-experts and involves setting out five pan trap stations (each with three bowls painted UV-bright yellow, blue and white, mounted at vegetation height and filled with water) along a diagonal of each square for six hours. During this time the surveyor collects data on floral resources (number of flowers within a 2m radius of the trap station) and habitats surrounding the pan traps and undertakes at least two FIT Counts. Collected samples are sent back to UKCEH for sorting and identification, and surveyors enter their other survey data online via the PoMS website.

Top left: Claire Carvell © UKCEH. Top right & bottom left: © Catherine Jones
Bottom right: © Katty Baird

Pan trap stations are set in a variety of habitats but always in the same position within a square on each survey. Bowls are attached using supporting wires and wing nuts to meet the height of the surrounding vegetation.

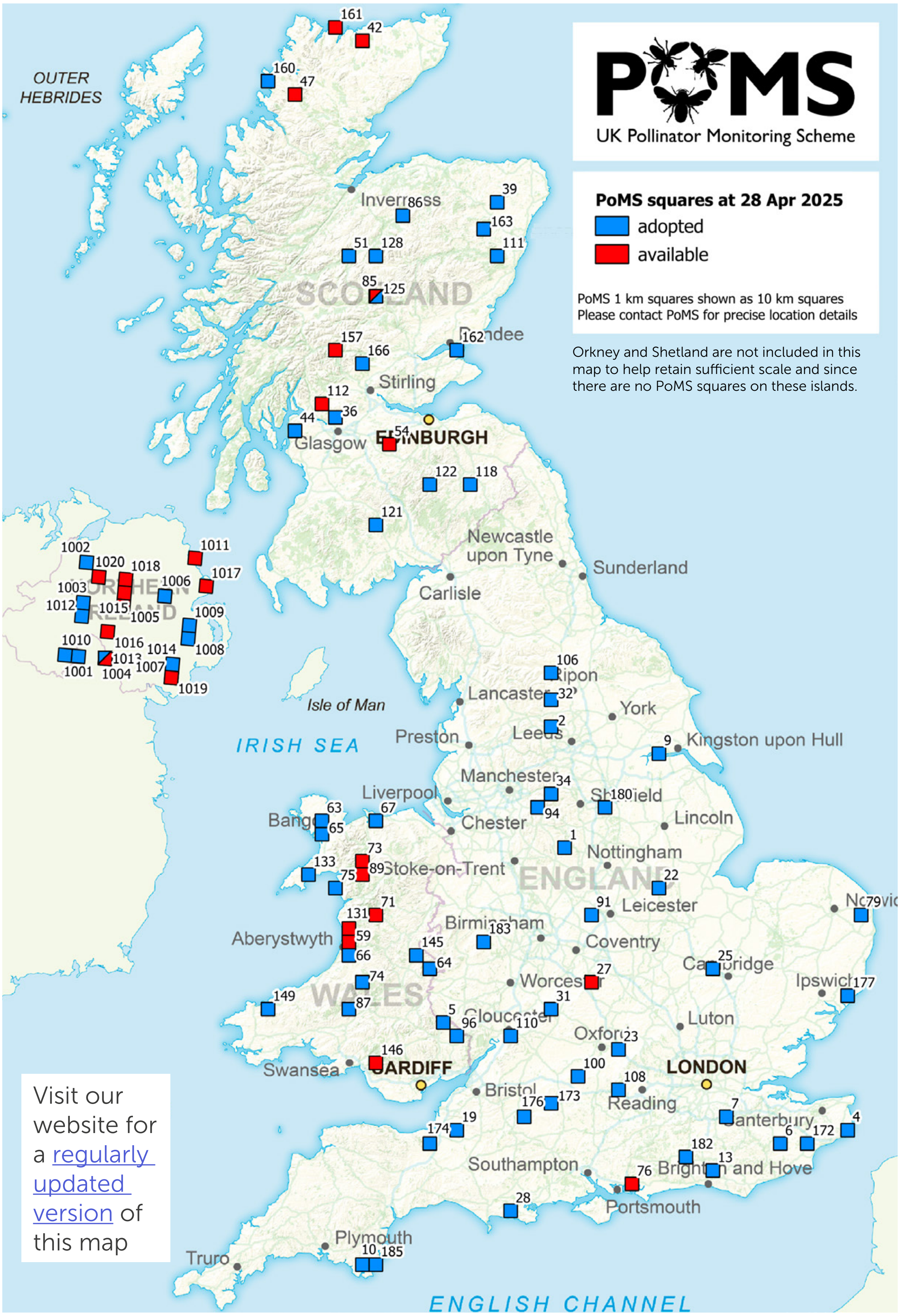


Figure 6. Location of 1 km square survey sites across the UK. Surveys on 'available' squares in red are covered by the PoMS survey team each year until they are adopted by volunteers. We are extremely grateful to the landowners who allow access for PoMS surveys, and to the volunteers who undertake them. Each year they receive a bespoke report which lists the bee and hoverfly species sampled and the flowering plants spotted in their 1 km square.

Survey coverage 2017-2024

In 2024, a total of 301 survey visits were made to 86 PoMS 1 km squares generating 1,494 samples (Table 3). Volunteers were allocated to 63 squares across the UK, with new volunteers introduced to at least 15 squares during 2024. This year saw a notable increase in survey effort in Northern Ireland, a slight increase in England and a small decrease in survey effort in Scotland and Wales. The latter is likely due to the cool and damp weather conditions during 2024, making it more challenging to reach the temperature thresholds for conducting surveys at higher latitudes and coastal areas in particular.

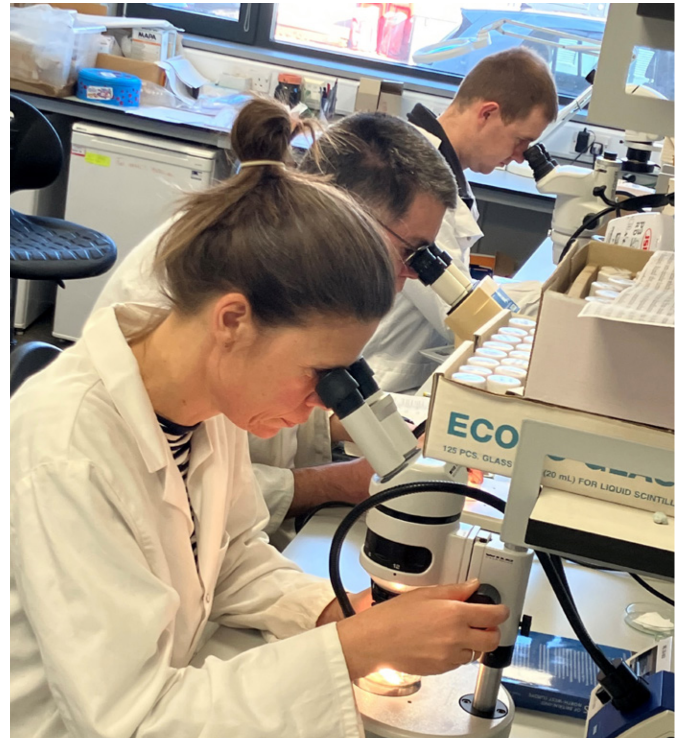
Overall this brings the total number of PoMS 1 km square surveys undertaken since 2017 to 1,723, with an incredible 8,543 samples having been collected and processed.

Detail	Year	England	Scotland	Wales	Northern Ireland	Total UK
Number of 1 km survey days	2017	59	35	33		127
	2018	94	32	22		148
	2019	108	62	64		234
	2020	54	24	12		90
	2021	119	61	57	6	243
	2022	119	76	60	32	287
	2023	126	71	61	35	293
	2024	128	66	55	52	301
Number of squares surveyed	2017	36	19	17		72
	2018	33	17	15		65
	2019	33	21	17		71
	2020	32	18	11		61
	2021	33	18	15	5	71
	2022	34	21	17	13	85
	2023	36	22	17	18	93
	2024	34	21	16	15	86
Number of samples processed (One sample is from three bowls at a pan trap station)	2017	295	175	165		635
	2018	465	156	110		731
	2019	540	305	313		1,158
	2020	270	120	60		450
	2021	593	305	284	30	1,212
	2022	591	364	296	157	1,408
	2023	628	355	297	175	1,455
	2024	637	322	275	260	1,494

Table 3. Coverage of the PoMS 1 km survey and samples processed from 2017-2024.

Note: Surveys started in June and July 2017 following set up of the squares, and were suspended from April to early July 2020 due to the restrictions imposed during the COVID-19 pandemic. Figures for 2024 may be subject to minor changes following final processing and data cleaning.

As noted in our *Latest news* (page 4), 44 squares now have eight years of continuous data and 52 squares have data from 20 or more surveys. This level of survey coverage is only made possible by the collective contributions of both our long-standing and more recent volunteers, the fabulous PoMS 1 km survey team, taxonomists and data processors who have the unenviable but critical task of ensuring all the incoming survey data are matched with samples and specimens to provide accurate datasets that are analysis-ready. It is the complexity of this process which effectively means we are only able to report on survey coverage within a year of data collection, with analyses and results from the 1 km surveys being available within two years.



Claire Carvell © UKCEH

PoMS taxonomists carry out detailed examinations to identify all bee and hoverfly specimens from the pan traps , cross-checking a proportion of each others' IDs for quality assurance.

What's in a pan trap?

The PoMS pan trapping protocol has been carefully designed to minimise the number of insects caught, while still sampling enough individuals to measure changes over time [6]. Typically the traps catch three to four bees and hoverflies per set of three pans during a 6-hour survey, though these numbers vary considerably depending on factors including location and time of year.

Once the insect samples are returned (Freepost) to the UKCEH labs for processing, we undertake a full count of all insects in each sample, broken down by species group. All bees and hoverflies are then identified to species level by expert taxonomists, while other groups are stored as 'by-catch' for potential downstream identification. In 2024 we have identified a total of around 4,980 bee and hoverfly specimens from across all 1 km square surveys, bringing the total number of identified specimens to 29,077. As in previous reports, some of the more interesting species recorded are described on pages 28-30.

The pie charts on the next page (Figure 7) show the average composition of PoMS pan trap samples by insect group (up to 2023). Here, we have presented the data according to whether pan traps were located in squares with predominantly agricultural (e.g. arable crops and intensive grassland) or predominantly semi-natural land-use (eg. unimproved or upland grasslands, woodland, moorland). In both land-use types, samples are dominated by the 'other' non-hoverfly flies, but with a suggestion of higher proportions of bumblebees, hoverflies and wasps in semi-natural squares. The high proportion of beetles in agricultural squares is likely due to the contribution of small pollen beetles in these samples. The follow-on DNA work carried out in 2024-25 has allowed us to explore in much more depth the species community composition of a sub-set of these samples, and we provide an update on this research on pages 31-32.

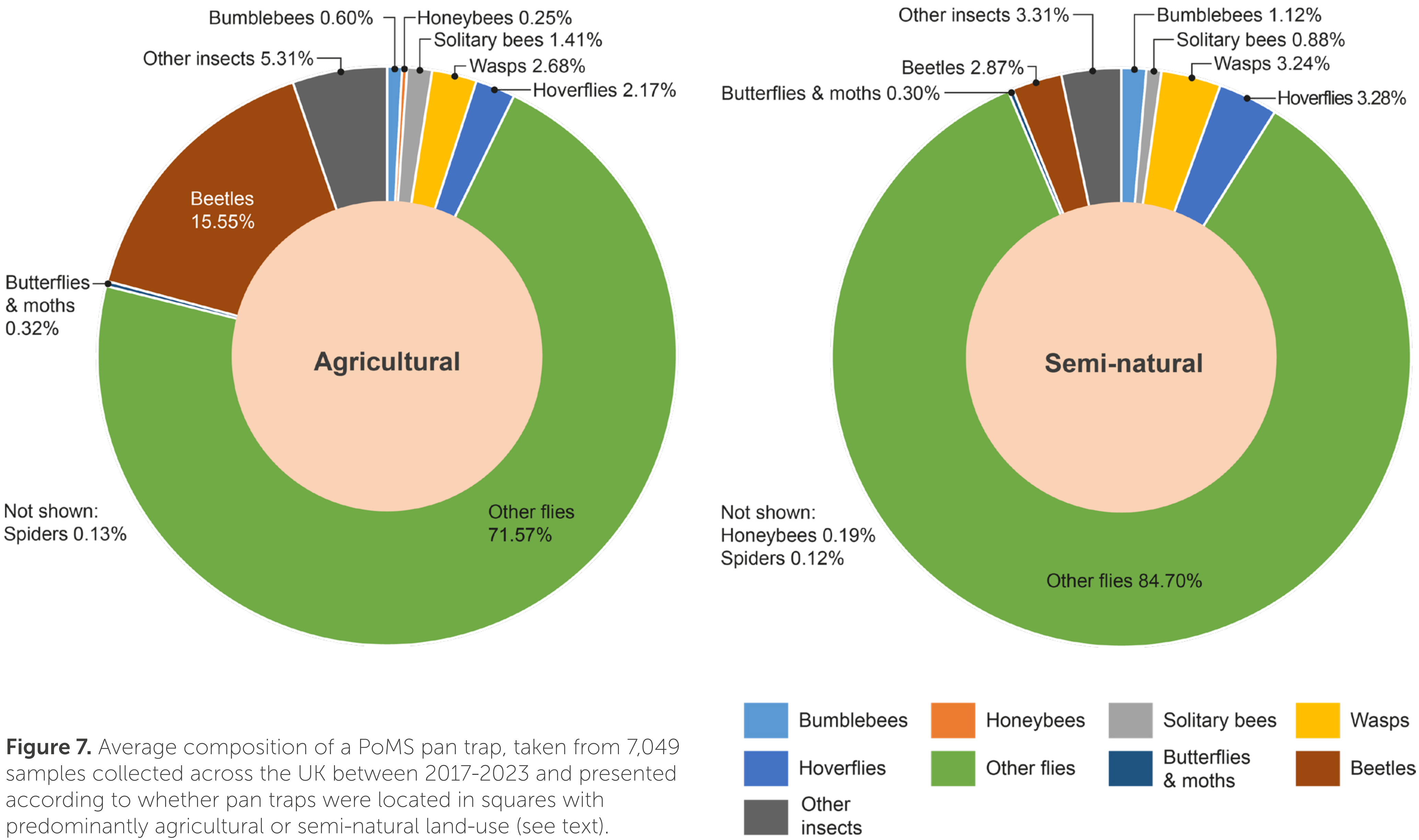


Figure 7. Average composition of a PoMS pan trap, taken from 7,049 samples collected across the UK between 2017-2023 and presented according to whether pan traps were located in squares with predominantly agricultural or semi-natural land-use (see text).

Seven-year results from PoMS

PoMS surveys continue to provide a growing dataset that will enable us to study the abundance and species richness of pollinating insects through time across the UK. The current seven-year time series from the 1 km survey and six years for public FIT Counts (which started in 2018) is still relatively short, making it challenging to detect trends with sufficient confidence. Insect numbers can vary from year to year for many different reasons, including changes in local and seasonal weather or other environmental factors. Nevertheless, the modelled annual estimates of abundance and richness allow us to explore patterns of change across the different surveys and insect groups as we continue to develop more official statistics to report on results from PoMS. Claire Carvell and Francesca Mancini (UKCEH) provide an update on the analytical work going on behind the scenes.

Here we report on the results for Great Britain using the data generated from England, Scotland and Wales between 2017 and 2023, for the more commonly recorded insect groups and an "all insects" metric (representing the summed total across all insect groups) in each of the PoMS surveys. Although the data from 2024 are available, they are still going through cleaning and quality assurance pipelines and are not ready to be included in the analysis.

Modelling the data and interpreting graphs

We use statistical models to account for variation in insect numbers due to some of the more local environmental factors measured on PoMS surveys and produce robust annual estimates of abundance and species richness. We model data from the 'public' FIT Counts, 1 km square FIT Counts and pan trap surveys separately and we include the following variables: year; month; site; flower count in the quadrat, floral context of the survey quadrat and flower structure of the target flower (categorised as open or closed) for FIT Counts, or total flower count and species richness of plants in flower around the pan trap, broad habitat type, wind speed and amount of sunshine during the survey (see the technical details box on p. 22).

Graphs are plotted showing the counts (or species richness) estimated by the model (on the y axis) for each year (the x axis) (Figure 8). Each graph shows the trend in average number of insects or number of species counted per survey as a line with the associated uncertainty as shaded areas (representing the 95% confidence interval). We also present plots showing the average predicted FIT Count results across GB for 2023 against the average annual counts from across all previous years by insect group (Figure 9), to begin to assess whether 2023 was a notably "good" or "bad" year for pollinators.

Martin Harvey © UKCEH

A FIT Count survey. Recorders collect information on environmental factors such as flower abundance, habitat type and weather conditions during the survey which can be included in models to account for variation in insect numbers.

In order to describe the results shown, we refer to the percentage changes in predicted abundance or richness between the first and last year of each time series, and between the latest year (2023) and year before this (2022). Some significant changes were detected where the lower and upper confidence intervals of the change did not overlap zero. The changes we describe in the following text are all therefore significant according to this criterion. The metrics of percentage change between the first and the last year of PoMS surveys depend partly on whether there is a genuine underlying trend, but also on how "good" or "bad" those two specific years were for insect numbers. However, our model reduces much of that interannual variability by using a statistical tool (a spline) to smooth interannual fluctuations, and by accounting for a number of environmental variables that have an effect on insect abundance (e.g. weather conditions and flower resources).

Overall, we continue to see pollinator numbers fluctuating across the PoMS time series (Figure 8 a-d). Often changes between individual years can be of greater magnitude than the overall trend. Most notably in 2023, several insect groups and especially the flies showed an increase compared with the lower counts and species richness recorded in 2022 across both the FIT Count and pan trap datasets.

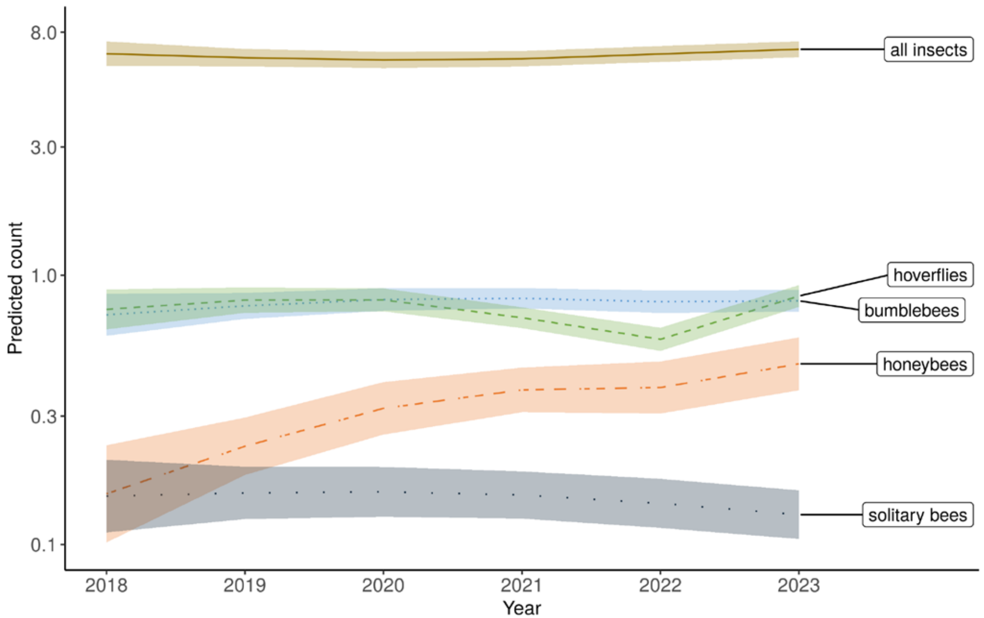
From the public FIT Count dataset, predicted counts of the "all insects" group increased by 3.9% between 2018 and 2023, from 6.65 to 6.91 insects per FIT Count, and between 2022 and 2023, despite lower predicted counts between 2019 and 2021 (Figure 8a). For the hoverflies, although the overall trend was not significant, numbers increased by 31% between 2022 and 2023. While Figure 8a suggests that honeybees on public FIT Counts appear to have increased over the time series, this change is not significant either from the first to last year or from the latest year, likely as a result of large variability in honeybee numbers between sites and surveys.

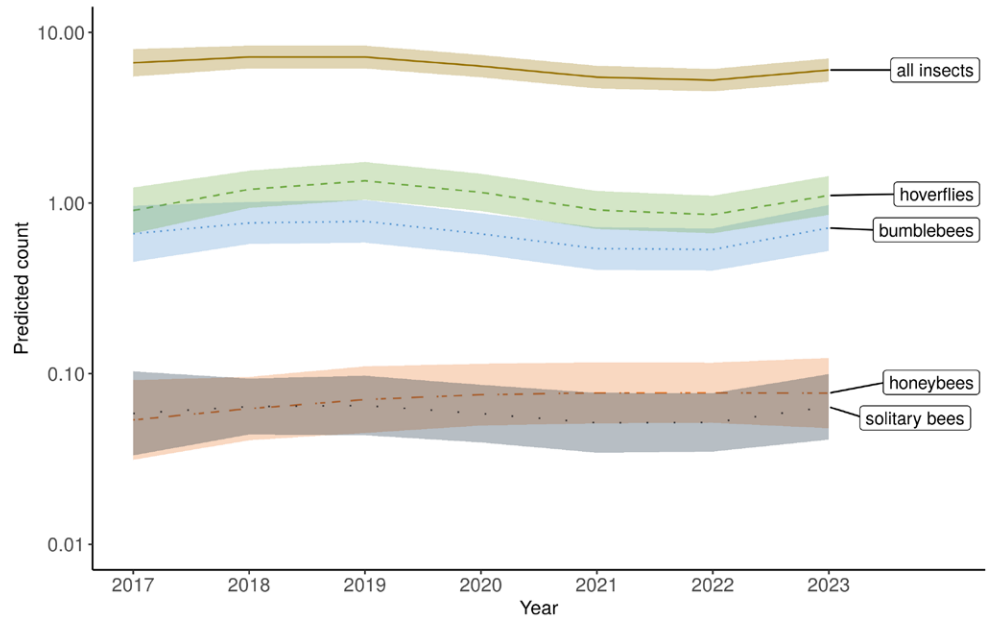
FIT Counts on the 1 km squares showed a significant decrease in "all insects" of -9.3%, with a predicted count of 6.64 in 2017 and 6.02 insects per FIT Count in 2023, but an increase of 12.8% between 2022 and 2023, again suggesting a partial recovery in overall numbers since 2022 (Figure 8b).

From the pan trap dataset on 1 km squares, the total abundance of all insects was 9% lower, from 60.2 in 2017 to 54.25 insects per sample in 2023 (Figure 8c). However, abundance was 20.5% higher in 2023 than in 2022 during which the lowest total insect counts were recorded. Hoverfly abundance in the pan traps decreased by 0.43 insects per sample from 1.32 in 2017 to 0.89 hoverflies per sample in 2023 (representing a significant decrease of -32%), and did not increase significantly between 2022 and 2023. While the other flies showed a small but significant decrease of 0.61% between the first and last years, their abundance increased by 24% between 2022 and 2023. Abundance and species richness of bumblebees and solitary bees were not found to have changed significantly over time, but total predicted counts of all bees (including honeybees) increased by 34% from 0.76 in 2017 to 1.03 bees per sample in 2023. *(text continues on p.26)*

The technical details

We use generalised linear mixed models with a negative binomial distribution to model counts and/or species richness of different insect groups. The effect of year is modelled as a natural spline with three degrees of freedom. We include a random effect for site for FIT Counts and a nested random effect for pan trap station within 1 km square for the pan trap data, to account for between site variation in insect numbers that is not accounted for by the variables in the model. The counts presented in the plots are estimated marginal means from the final model, which are averaged over all levels of the categorical variables in the model and weighted by the number of observations within each level, with continuous variables kept at the mean.



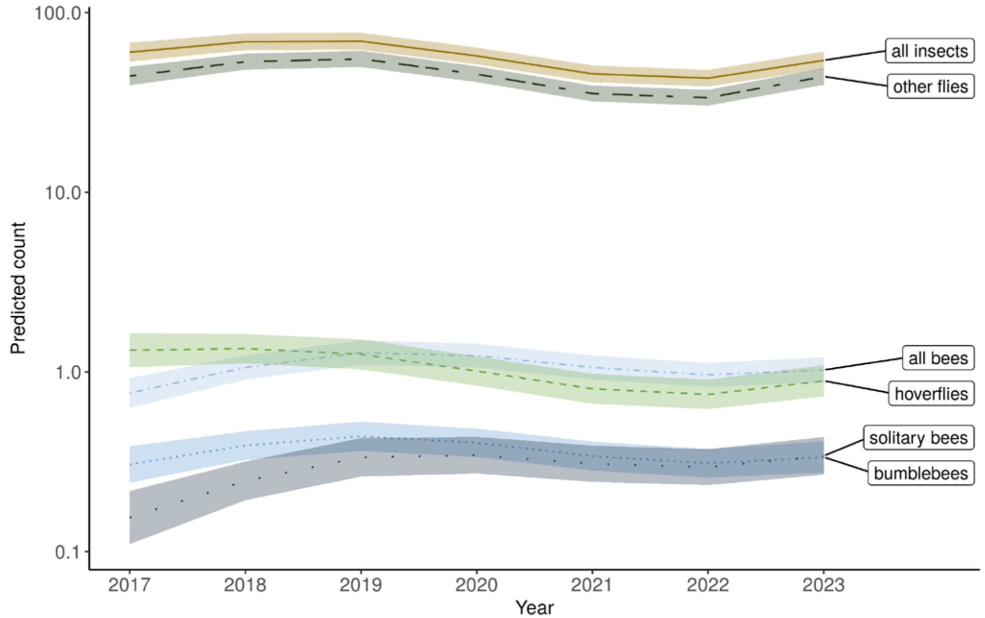


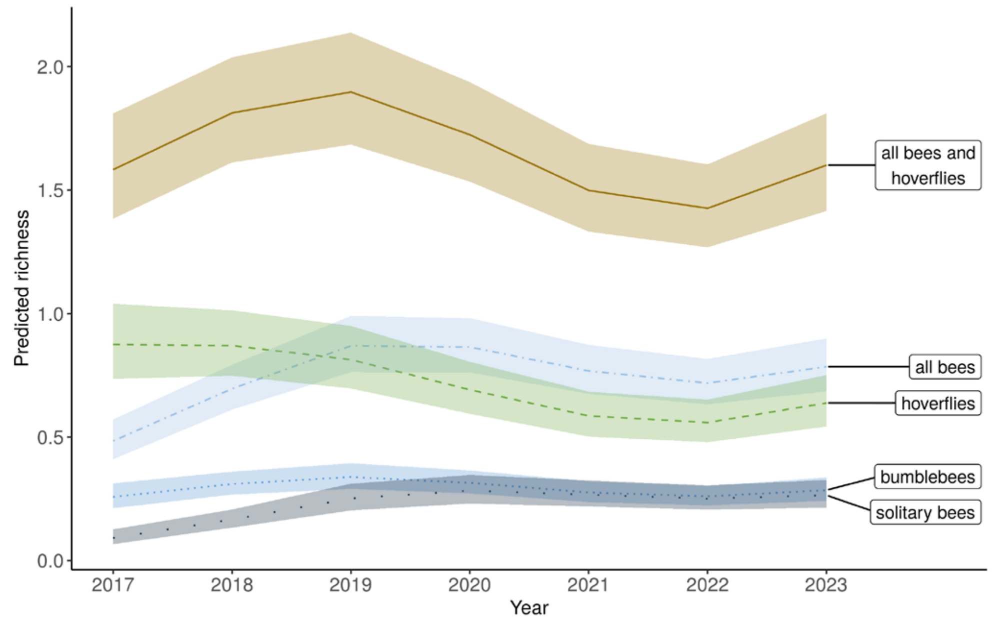
a) Insect abundance per 10-minute count from the public FIT Counts

b) Insect abundance per 10-minute count from the 1 km square FIT Counts

Figure 8 a,b. Results showing predicted counts from statistical models on PoMS FIT Count datasets between 2017/2018 and 2023.

Note: where predicted counts are shown, numbers on the y axis represent the predicted number of insects per FIT Count, plotted on a log-10 scale to allow presentation of the overall trend alongside trends for each insect group. The associated uncertainty around the trend (the 95% confidence interval) is shown as shaded areas.





c) Insect abundance per pan trap station per survey visit

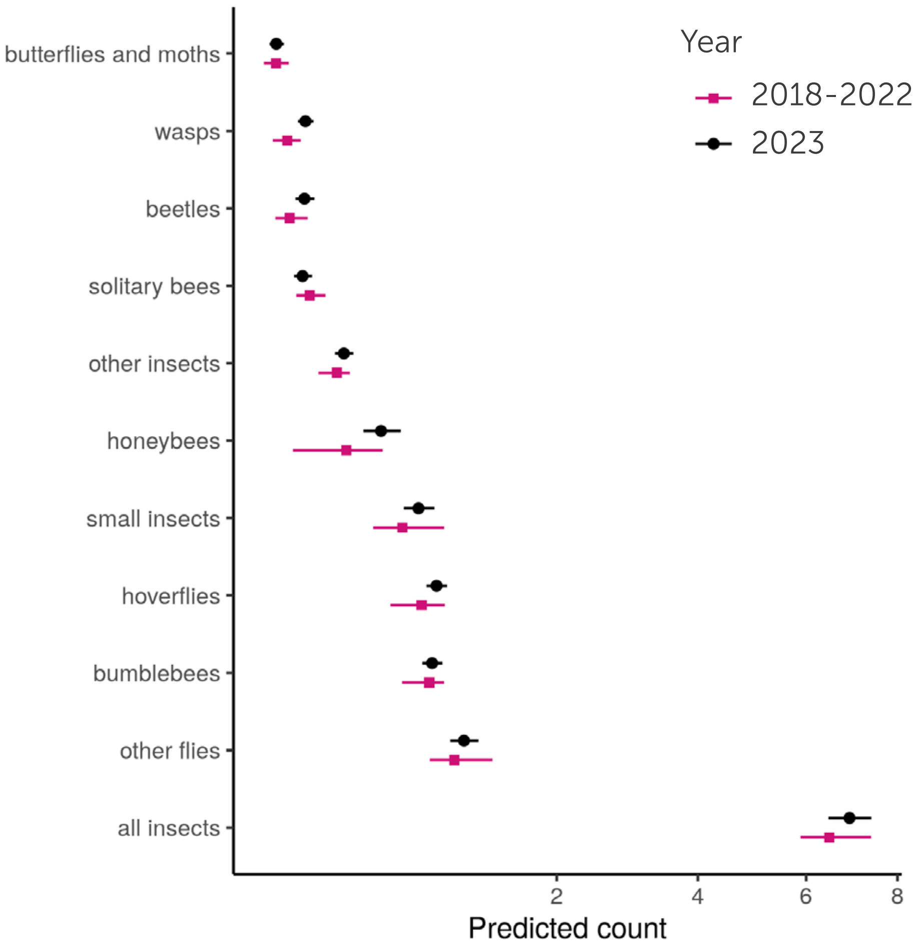
d) Richness of bee and hoverfly species per pan trap station per survey visit

Figure 8 c, d. Results showing predicted counts and species richness (number of bee or hoverfly species) from statistical models on PoMS pan trap datasets between 2017 and 2023.

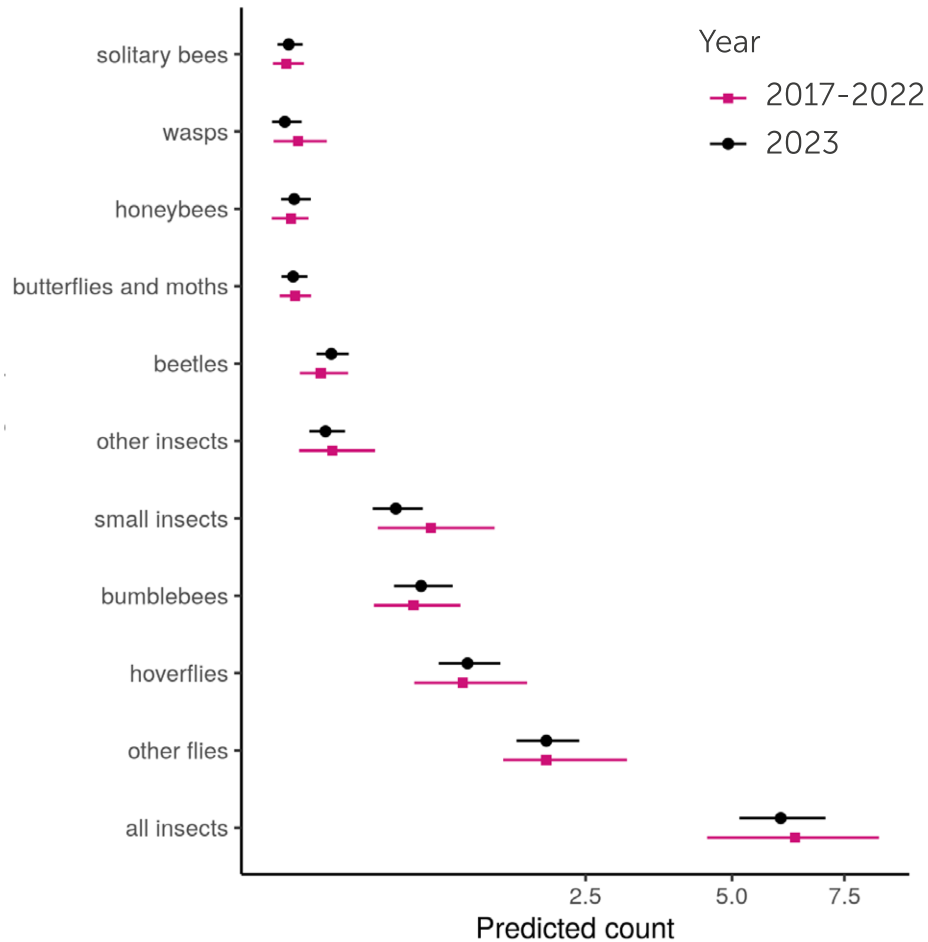
Note where predicted counts are shown, numbers on the y axis represent the predicted number of insects per trap station, plotted on a log-10 scale to allow presentation of the overall trend alongside trends for each insect group. Species richness is plotted on a normal scale. The associated uncertainty around the trend (the 95% confidence interval) is shown as shaded areas.

Figure 9. Comparison of FIT Counts from 2023 with the average across all previous years.

(a) public FIT Counts



(b) 1 km square FIT Counts



Note: Plots show average predicted counts per insect group for 2023 (black dot) and the 95% confidence interval (black error bar), alongside the average annual count across all the other years (2018-2022 for the public FIT Counts and 2017-2022 for the 1km FIT Counts, pink square). Pink error bars represent the highest upper and lowest lower confidence intervals for those modelled estimates across the years. Although this is not a statistical test, where the confidence intervals for 2023 do not overlap with those for the other years, this indicates that numbers in 2023 were likely different from counts in the previous years. X axis is plotted on a square root scale.

Richness of the “all bees” metric increased by 0.3 species per pan trap sample across the time series, an increase of 62% since 2017, but richness of hoverflies decreased overall by -27% from a predicted richness of 0.87 in 2017 to 0.64 species per pan trap sample in 2023. Finally, for the combined species richness of all bees and hoverflies, despite no significant change between the first and last years, we detected an increase of 11% between 2022 and 2023.

Given the large uncertainty and high inter-annual variability typical of insect numbers, we should be cautious about interpreting these plots in terms of overall declines or increases over this time period. As we collect more data in the next few years we will be better able to detect longer-term trends in insect numbers beyond annual fluctuations.

Effects of environmental variables collected during PoMS surveys

Many of the environmental variables included in our initial models have remained relevant through the model selection process. Similar findings have been described in other studies, providing a valuable independent confirmation on the reliability of the data and helping to demonstrate the importance of the environmental measures collected by PoMS volunteers and surveyors for interpreting the results:

From FIT Counts:

- The number of floral units in a FIT Count quadrat has a positive effect on the number of insects seen, across nearly all groups, with this effect being more notable on the public FIT Counts.
- Overall, more insects (and hoverflies and other flies in particular) are recorded visiting ‘open’ structure flowers, such as Hogweed and Bramble, than ‘closed’ structure flowers, but bumblebee numbers are higher on ‘closed’ flowers with long flower tubes, such as Lavender and Dead-nettle.
- From the ‘public’ FIT Counts, insects in all groups tend to be more abundant in garden habitats than in countryside locations. This pattern was shown but was less consistent from counts in PoMS 1 km squares.
- More insects are counted on FIT Counts where the quadrat is ‘entirely in sunshine’ and when there is just a light wind, and fewest where the quadrat is entirely shaded and/or in windier conditions.

Helen Bostock © RHS

RHS staff and volunteers at the Bridgewater gardens conducting FIT Counts on *Phacelia*.

- Flower patches that are more or less isolated from other flowers tend to have lower numbers of insect visitors on FIT Counts than those patches that are within a larger patch of flowers.
- Most insect groups increase in abundance on FIT Counts through the early summer to reach a peak in July, August and September.

From PoMS pan traps:

- The number of insects sampled does not appear to be significantly affected by the number of flowers (measured as floral units) within a 2m radius of the pan trap, however the total number and species richness of bees, and of bumblebees, is positively related to the flower richness (number of plant species in flower) around the pan trap.
- Overall insect abundance and abundance of bumblebees and hoverflies in the pan traps increased through the season to a peak in August. As with last year, solitary bee abundance and richness were highest in May, gradually decreasing towards September, as we would expect given that many solitary bee species have spring flight periods.
- Our models suggest that there are differences in abundance of some insect groups sampled in pan traps in 1 km squares dominated by agriculture vs squares dominated by semi-natural habitats. Further research will explore the extent of these differences, as well as the value of including larger-scale environmental variables in our models of PoMS survey data.

What's next

A key goal for PoMS is to see the data and trends become an important part of the evidence base that helps us understand how, where, and why pollinator populations are (or are not) changing. This will take time not only because of the need to look beyond annual fluctuations, but because of the need for some important development tasks that we are working on together with the PoMS Steering Group:

1. The modelling methods, metrics and statistics we are using are provisional, and we are aiming to publish this development work in an academic scientific journal in the next year. We are also keen to ensure that these outputs are useful and interesting to volunteers and others taking part in PoMS. Please do send us any feedback on the way PoMS results are presented.
2. We need to better understand the statistical 'power' of the PoMS dataset and analyses to detect changes. A very gradual increase or decrease will generally require a lot of data over a long period of time, whereas an abrupt change will be more obvious. We are currently analysing how well the PoMS datasets will be able to pick up different sizes of change, and at what spatial and temporal scales.

Species highlights from the PoMS 1 km square survey

Martin Harvey (UKCEH) highlights four species found during the 1 km square surveys in 2024, all of which are new to the PoMS dataset, having not been seen previously in our surveys during 2017-2023. Although the main aim of the PoMS 1 km pan trap surveys is to gather consistent data on the abundance of common hoverflies and bees, it's always interesting to find some of the more unusual species, and this adds to our knowledge of species distributions.

Little Blue Carpenter Bee, *Ceratina cyanea*

The metallic dark blue colours of this attractive bee are distinctive, but it is a small species that is confined to south-east England and not often seen during its flight period. It has an intriguing life history: it is one of a group of solitary bees that nest in hollowed out plant stems. Little Blue Carpenter Bee most frequently uses bramble or rose stems for its nest site, searching for a stem that has been broken or cut, and then digging out the pith to construct a hollow tube around 1 cm into the stem. Once the stem has been excavated the female bee partitions the tube into a number of cells, divided by partitions constructed from compacted fragments from the pith. Each cell is provided with a block of pollen (referred to as a "pollen loaf"), and a single egg is laid. When the egg hatches, the larva feeds on the pollen that its mother has left for it.

Unusually for solitary bees, the female Little Blue Carpenter Bee sometimes remains at the burrow after completing the egg-laying process, and will guard the nest as the larvae develop. The new generation of bees emerges in late summer, and soon after that the bees will find another plant stem in which to hibernate over winter. It is possible to find the bees asleep in their stems in winter, and this can be an easier way of recording them than looking for the free-flying adults in summer.

Little Blue Carpenter Bee, *Ceratina cyanea.*

Note: The square numbers mentioned in the species accounts refer to the numbers shown on the 1 km square survey map, see page 17.

There is evidence that some females of Little Blue Carpenter Bee can overwinter twice [7], a very unusual pattern for solitary bees in the UK.

Little Blue Carpenter Bees live in warm, dry habitats such as chalk downlands and heathlands, and can also be found on some brownfield sites. They visit a wide range of flowers for nectar and pollen. The PoMS specimen was from square 13 in East Sussex, on 17 July 2024.

Variable Nomad Bee, *Nomada zonata*

Nomad bees are solitary bees that have evolved to be cleptoparasites of other solitary bees – the nomad bee will lay her eggs into nests of other solitary bees, and the nomad bee larvae will then consume both the host bee's egg/larva and the pollen supply intended for the host. Nomad bees have a very wasp-like appearance, but they are genuine bees! Many have striking red, yellow and black colour patterns, and while the genus as a whole is distinctive once you have realised they aren't wasps, identification of the individual species can be challenging.


© Steven Falk

Variable Nomad Bee, *Nomada zonata.*

This is partly because a number of species have been added to the UK list in recent years, and the Variable Nomad Bee is an example of this. It was first found in the UK in 2016 (in Kent and Essex), having previously been known from the Channel Islands. Since then it has spread quite widely across south-east England [8] and in 2024 reached as far north as Lancashire. It has also been spreading on other parts of north-west Europe.

The host for the Variable Nomad Bee is the Short-fringed Mining Bee, *Andrena dorsata*, which is widespread over the southern half of England and parts of Wales, and regularly recorded in PoMS surveys. The first PoMS record of Variable Nomad Bee was from square 177 in East Suffolk on 10 May 2024.

Golf-club Duckfly hoverfly, *Anasimyia transfuga*

The intriguing 'duckfly' English name that has been given to this hoverfly genus refers to the distinctive shape of the head, which has an extended 'snout' that can look like a duck's bill. (The scientific name *Anasimyia* is also a reference to this snout, probably deriving from the Greek for "snub-nosed".) And the 'golf-club' part refers to the marking on the abdomen.

This hoverfly is associated with wetland habitats, especially marshes and river valleys where emergent plants such as Sea Club Rush, Branched Bur-reed or Reed Sweet Grass grow at the edges of water bodies. Its life history is not well known, but larvae probably develop among rotting material at the base of the wetland plants – this is one of a group of hoverfly species that have 'rat-tailed maggot' larvae, with a long breathing tube extending from their tail end.

Golf-club Duckfly is fairly widespread in Britain but is localised and not very common. The PoMS specimen was from square 19 in North Somerset on 15 May 2024.

© Steven Falk

Golf-club Duckfly hoverfly, *Anasimyia transfuga.*

Variable Pufftail hoverfly, *Sphegina sibirica*

This is another species that was added to the British list relatively recently, from specimens found in Scotland in 1991. Since 1991 it has been found to be quite widespread in the UK and was found for the first time in the Republic of Ireland in 2008 [9].

Hoverflies in genus *Sphegina* have saproxylic larvae that develop on old trees, where there are sap runs or damaged bark with decaying sap and fungi. Elsewhere in Europe the Variable Pufftail has been recorded as laying eggs on fallen logs of Spruce trees, and it is likely that the spread of conifer plantations in the UK has provided suitable habitat for the hoverfly. It is sometimes found at locations well away from conifer plantations, but these may represent dispersing individuals and it is not known whether it can also breed in broadleaved trees.

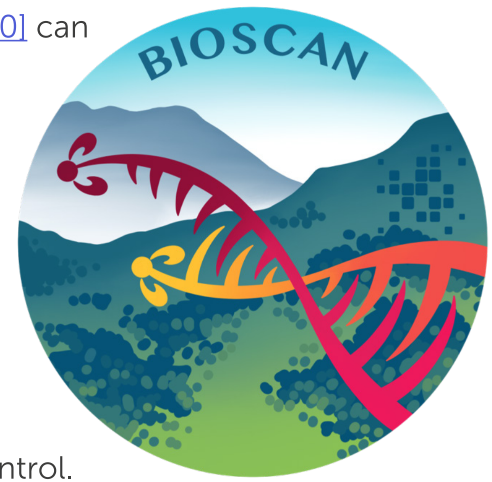
Adults of Variable Pufftail visit a range of flowers including Rowan, Elder and various umbellifers, and the hoverflies can sometimes be found in large numbers around a particularly suitable spot. The PoMS record was from square 128 in East Inverness-shire on 25 May 2024.

© Steven Falk

Variable Pufftail hoverfly, *Sphegina sibirica.*

DNA barcoding research demonstrates the power of PoMS samples

In our last Annual Report (2023 [12]), we introduced the research being undertaken to understand the value of newly emerging techniques in molecular DNA barcoding for identifying the many insect specimens captured in PoMS pan trap surveys. Here, Claire Carvell and Robin Hutchinson (UKCEH) provide a short update on this research and our collaboration with teams at the Sanger Institute (Tree of Life: BIOSCAN) and the NHM. We think these approaches have real potential for large-scale insect community biomonitoring.

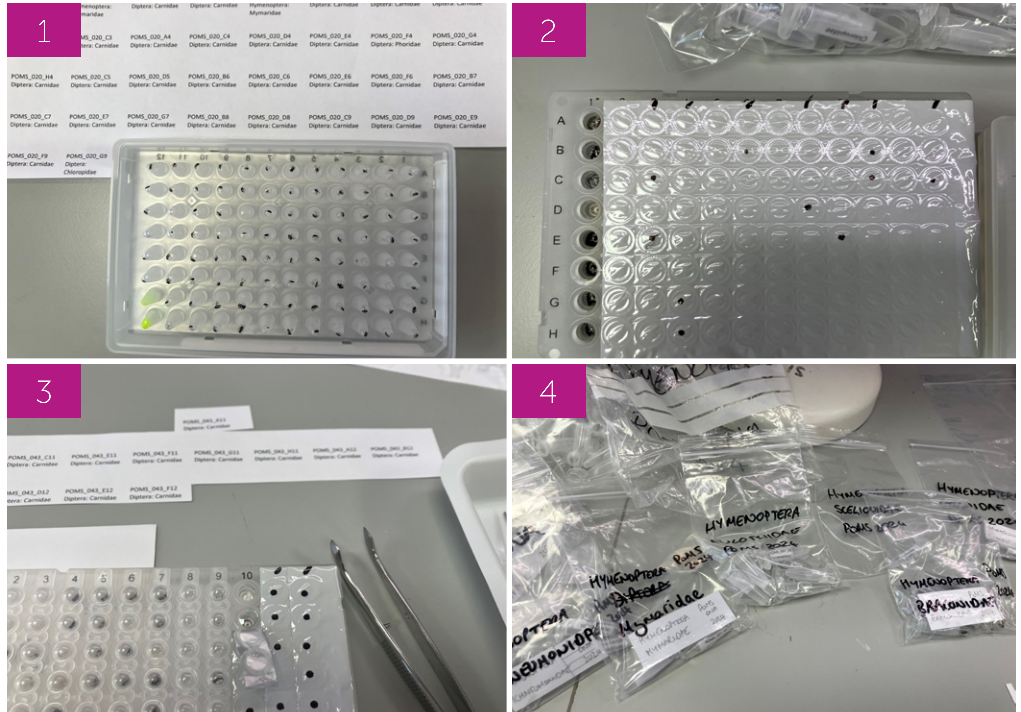


Our latest research aims to test whether the DNA barcoding approach developed by the BIOSCAN project [10] can be used to identify PoMS pan trap specimens from their DNA sequences. We also explored a variety of DNA-based metrics from these data. Here is a summary of what we found so far, based on specimens collected in PoMS pan traps from four sites over six years:

- From 9,295 insects plated from 154 pan trap samples, DNA sequence data were returned for 8,614 specimens. Importantly, this high success rate (~92%) confirms that the quality of DNA within PoMS samples dating back to 2017 is compatible with BIOSCAN's protocol, and was not compromised by short-term water exposure during sampling or by the preservation of samples in alcohol.
- Remarkably, we recovered information on 128 insect families and more than 3,500 unique DNA sequences within the dataset! These included many understudied species within the flies and parasitic wasps that may play key roles in ecosystem functions like pollination, decomposition and natural pest control.
- However, many of the sequences could not be identified down to genus or species level because they may not yet be confidently represented in reference databases that are used for matching DNA sequences to a named species. To help address this, 667 of the specimens falling into these categories were determined by expert taxonomists. We can now add sequences for these species to the reference databases, including the Barcode of Life Data System (BOLD), enabling anyone using DNA methods to more accurately identify collected insect specimens in future.

- Looking specifically at the bees and hoverflies, we found the identification with DNA methods nearly always agreed with the earlier identifications of PoMS taxonomists. However, the DNA assignments have provided a useful check for species pairs known to be difficult to separate using morphological features alone (and which are commonly aggregated for monitoring purposes).
- Because DNA methods have the ability to detect so many species, they can open up lots of possibilities for producing better descriptions of insect communities and how these may be changing over time. For example, metrics describing the DNA-based species richness or diversity of each pan trap sample are revealing differences in the insect assemblages over time and space, both between years and seasons across the four PoMS sites from Achanlochy in the far north of Scotland to Goring Heath in southern England. Our results suggest huge future potential for DNA barcoding combined with traditional taxonomy to enable large-scale insect community biomonitoring.

This research was funded by the Defra DNA Centre of Excellence [11]. DNA sequencing and initial bioinformatics were kindly provided by the Wellcome Sanger Institute. The research team included scientists from the PoMS team (Robin Hutchinson, Nadine Mitschunas, Claire Carvell), the Molecular Ecology Group at UKCEH Wallingford (Joe Taylor, Susheel Bhanu Busi, Ellie Grove, Daniel Read), the Wellcome Sanger Institute (Mara Lawniczak, Jemma Salmon and Lyndall Pereira da Conceicoa) leading the BIOSCAN project [10], and the Natural History Museum, London (Ben Price, Duncan Sivell, Erica McAlister and Gavin Broad). We are extremely grateful for the involvement of Paul Woodcock (JNCC), and the consultant taxonomists (Dave Brice, Steven Falk, Paula Riccardi) for their expert and rapid identification of specimens in early 2025.



Claire Carvell © UKCEH

Specimens from PoMS pan traps were initially plated into 96-well plates for DNA sequencing, each traceable to its position in the plate (1). To retrieve selected specimens for the taxonomy work in 2024/25, their positions were marked and the foil plate seal carefully removed to access the specimen (2). Plates were then re-capped to preserve remaining specimens (3) before the labelled specimen tubes were bagged and dispatched to a team of five taxonomists with expertise in the relevant insect family (4).

A volunteer's view from the field

PoMS volunteer and beekeeper Peter Stevenson shares reflections on his first PoMS survey of one of the Scottish squares in the Borders last year. A version of Peters' article was published in the Scottish Beekeepers magazine, September 2024 Vol 101 No 9.

Wooden stakes, mallet, wire rings, coloured cups, water, detergent, paper, pencils (not pens) – then more to be left in the car but used later – sample pots, tea strainer, labelled bags. Miranda is packing the equipment efficiently and patiently explaining what each is for. I'm starting to lose track and wonder what I've let myself in for.

I retired from my "proper" job this month. I'm looking for things to do to keep me out of mischief. I come across an interesting sounding citizen science project that might fit the bill. "PoMS aims to collect robust data on the distribution and numbers of pollinating insects, to help inform research into the conservation of this vitally important group of species." I contact ukpoms.org.uk when I spot a vacant 1 km survey square near to me that needs a volunteer. Very quickly after my initial email Miranda calls me and suggests we can do some training.

Peter in the field.

© Peter Stevenson

So here we are, packing the field equipment, ready to record my first PoMS data. Grey, damp cloud is sitting down on the Borders hills, and a cool wind whips along the valley. It doesn't seem the best day to look for insects. Miranda jokes that pollinator researchers like her, get ribbed by their colleagues because her fieldwork is all done in the summer months and that a still, warm, sunny day is best for a day out surveying. But because a sample needs to be taken once each calendar month, and we are nearly at the end of July - in this summer that has never arrived – this cool, damp and breezy day just meets the required criteria and is going to have to do if we want to get some data this month.

The stakes, pots and so on metamorphose into pan traps, set out roughly in a transect across the kilometre sampling square. It's an up and down hike across the wet grass and heather to position the traps and then we circle back to the cars. It's "down time" now because the traps need to be left for six hours to see what they will tempt in.

The pans are covered in blue, white or yellow UV paint. The theory is that any pollinators won't be able to resist these giant blobs of colour that have suddenly appeared on their patch.

Miranda and I chat about pollinators and of course its not long before beekeeping comes up. I'm well aware of the feelings amongst some environmentalists that honeybees are over-indulged, cosseted creatures that are artificially fed and medicated by their human keepers and therefore at an advantage over other less fortunate wild pollinators. Does our sweet tooth and our fascination with the social organisation of honeybees mean that we inadvertently draw attention, and more importantly food resource, from other equally valuable and interesting pollinators. It is me putting up these arguments while Miranda stays professionally neutral. I find myself feeling defensive towards my beekeeping craft. I put up my usual defence about how introducing newcomers to beekeeping can act as a "way in" to engage folk about the wider importance of insects and pollination. I believe in both sides of these arguments. Maybe I secretly want Miranda to arbitrate and give me a definitive answer. Sensibly she doesn't do that, like all good scientists she wants the data to provide the answers.

I recount a "when I was a lad" anecdote about family outings to the countryside in the summer and how we would be tormented by clouds of flies that would buzz incessantly round your head, landing on your face and crawling over your skin. Where are all of those flies now? These days I'm surprised when one appears and tries to emulate its forebears by crawling in my mouth. But I also know that my memory is fallible, that I might not be comparing like with like. Maybe my parents deliberately took us on especially fly ridden outings? How do we smooth out these biases and influences and get to the facts? Well, hopefully, by doing the sort of long-term monitoring that the PoMS project is trying to achieve. A volunteer will go to the exact same spot regularly and consistently. They will set out the traps, count the flowers in bloom, record the weather and other conditions at the site, collect the insects that fall in the traps and send them to the laboratory to be identified and counted.

Miranda demonstrating the pan trap set up.

When this gets done over a reasonable length of time we can see if numbers are rising or falling, which species are affected, what factors might be influencing the trend. Without the data we are just guessing and telling stories.

As part of the full survey protocol we also need to undertake at least two Flower-Insect Timed Counts (FIT Counts) on patches of flowers within the survey square to record their insect visitors. The FIT Counts are a great way for anyone to feed data into PoMS. There is a paper recording form or, even better, a phone app that takes you through the process. Basically, you stare hard at a specific target species of flower – clover and then heather in our case - in a 50cm square for 10 minutes and tally up the number of insects that land on those flowers. The insects are divided into broad categories – bumblebees, beetles, etc. So you don't need to be any sort of expert – thankfully for me. Miranda gives me some tips anyway – a hoverfly will hover in front of the flower before it lands (who knew?).If it doesn't do that, it's likely in the "Other flies" group – broad categories you see. On a better weather day than we are having, this would be a nice relaxing way to appreciate the insects and flowers up close. As it is, peak excitement is to be able to tick off just a few "Small insects less than 3mm long".

After another tramp across the moor to collect in the traps, it's time to head home. I have really enjoyed the day and am enthusiastic to carry on. I ask Miranda if I have secured a new job and it seems that I have.

And what did we catch? Given the poor weather, I had thought there might be nothing at all. But there were a few… flies. The flies are still around! Fewer than in the past I'm sure of it, but the data will now be there to compare in the future. And hopefully when I go back next, on a warm, still sunny day, there will be many more insect pollinators to marvel at and enjoy - bees, wasps, hoverflies, butterflies, moths, beetles, bugs and even flies. These days I'm grateful for a few flies.

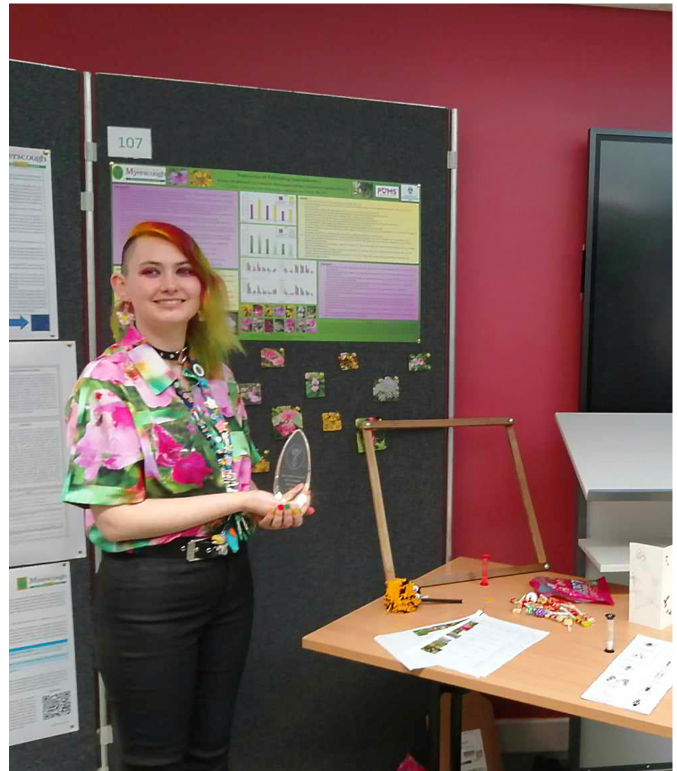
FIT Count being undertaken between pan trap stations on the 1 km survey square.

Using the FIT Count app projects feature to study pollinators on Himalayan balsam

BSc Zoology student Radhika Bradley shares her experience of using the FIT Count app for a dissertation project looking at insect visitors to Himalayan balsam and nearby native wildflowers.

I first learned about the UK Pollinator Monitoring Scheme from the 2022 Cumbria Big Buzz conference during my second year of BSc Zoology. It was through this that I was introduced to the FIT Count app. I had been thinking about what to do for my dissertation project, and knew I wanted to get invertebrates in there somewhere! I was inspired by this talk and decided to survey pollinators using the app to do so. I loved the idea that not only could I collect data for my own project, but that it would also be going towards a larger scale project and could help other people.

I settled on the idea of trying to find out if pollinators had any preference between UK native wildflowers and the invasive Himalayan balsam (*Impatiens glandulifera*) flowers. For this I performed a total of 120 FIT Count surveys over three months, conducting 40 per month in July, August, and September of 2023. These surveys were completed at three different site 'types': those with just wildflowers, sites with just Himalayan balsam, and sites where the two grew together in proximity. Using the FIT Count app meant that I did not have to carry a large amount of equipment (just a 50x50cm collapsible quadrat!), and that I was using the same standardised method, and collecting the same general information at each survey without the worry of forgetting to take down notes or missing something. The app itself was great to use, everything is nicely laid out with no overwhelming displays or confusing sections, just easy to move through steps, and having the ID guide for each insect category easily accessible was very convenient! I also liked the fact that I didn't have to worry about a consistent internet connection, as I could save the completed surveys to be uploaded later. Once each month's data had been collected and uploaded, being able to access all of it and see a map with the location of each survey was very satisfying as well as helpful.



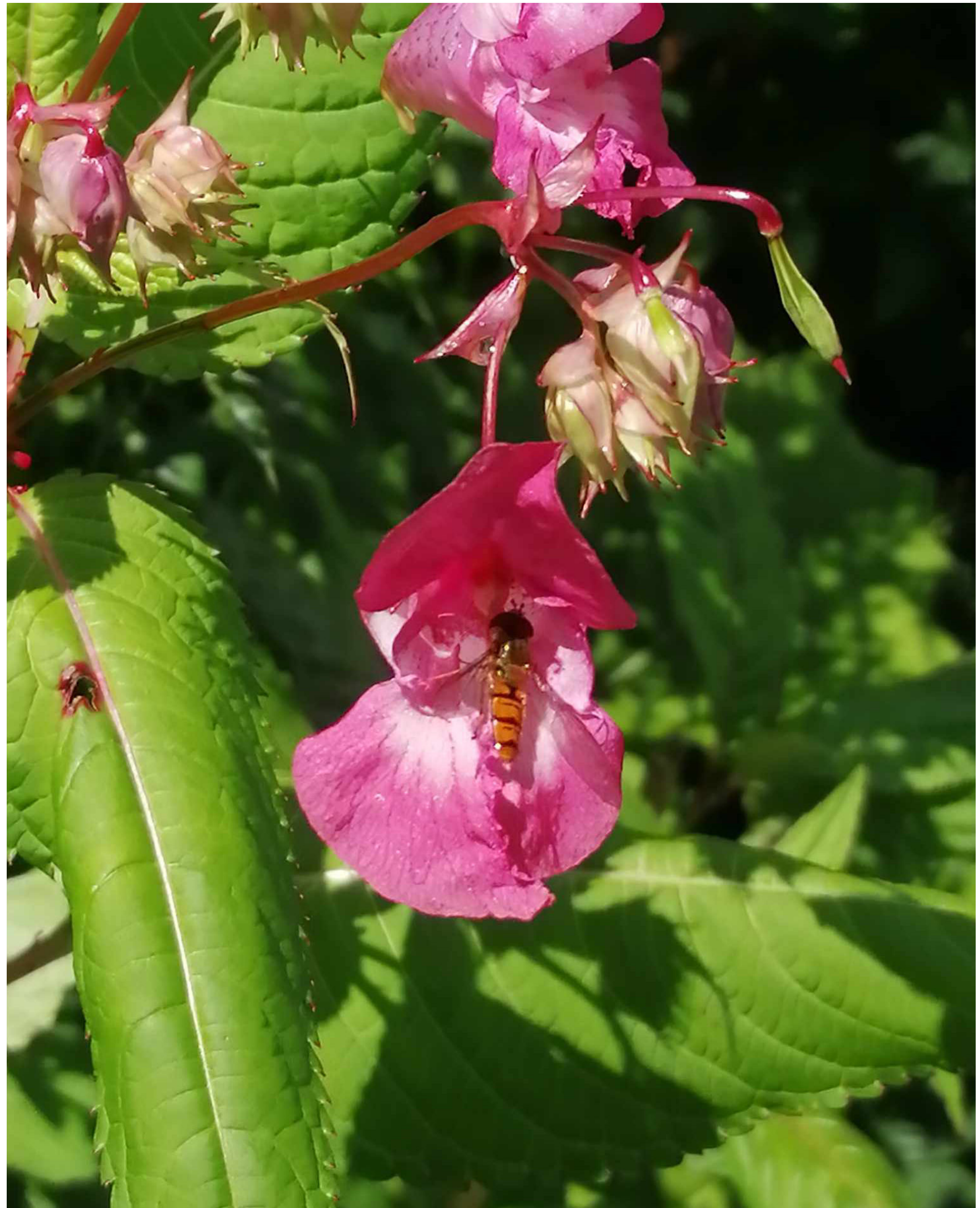
Radhika presenting her project poster wearing a fabulous Himalayan balsam shirt!

Further, having a downloadable spreadsheet that I could edit made the data analysis side of my project smoother to handle.

The results from this study showed that there were more visits from pollinators to native wildflowers (WF) at the 'pure' sites, compared to the pure Himalayan balsam (HB) sites, especially in July when differences in total abundance per FIT Count between these two site types were significant. However, at the mixed sites there were more visits to Himalayan balsam than to the wildflowers, apart from in July when the wildflowers received more visits, although this difference was not significant.

Six insect groups were most frequently observed out of the ten groups used on FIT Count surveys:

- Bumblebees visited HB more frequently than WF at both pure and mixed sites across all three months
- There was no difference between the number of honeybee visits to WF at both site types in July, however, pure WF sites were visited most frequently in August and mixed WF sites were visited most frequently in September
- There was no difference in overall number of hoverfly visits across all sites in July, but more visits occurred at WF than HB on both pure and mixed sites in September
- There were most visits from 'other flies' during July across all site types compared to August and September, and there were significantly more visits to WF in both pure and mixed sites, compared to HB
- 'Small insects' made a higher number of visits to flowers at WF sites, both pure and mixed, compared to both types of HB site
- HB was visited more often than WF by wasps in September at both site types.



Hoverfly visiting a Himalayan balsam flower.

Overall, it appears that when the 'choice' is provided some pollinators, such as bumblebees and wasps, opt for the higher rewards gained from visiting Himalayan balsam, but that also depends on factors such as the time of year (which month in this case). The hoverflies, other flies and small insects tended to be more abundant on native wildflowers than Himalayan balsam at all site types. As this study involved a relatively small sample size it would be interesting to expand it to start the surveys before Himalayan balsam comes into flower, to see more directly how pollinator behaviour changes when balsam becomes available, and whether there is a more obvious disregard for native wildflowers.

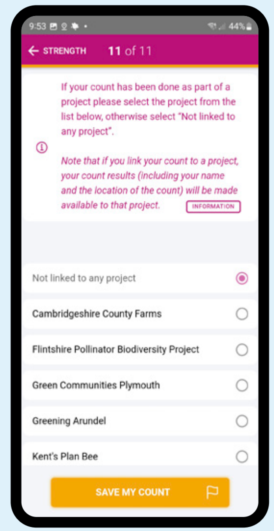
Himalayan balsam is considered a highly invasive plant which can rapidly out-compete native flora due to its ability to reproduce and grow in dense stands. The plant produces a large amount of nectar and as this study found, can attract high numbers of some pollinators, which may result in less pollination of native species and a subsequent loss of biodiversity. It was also concluded that an important measure for future conservation work would be to make sure that if Himalayan balsam is removed from a site, it must be replanted with native wildflowers so as to avoid further habitat fragmentation.

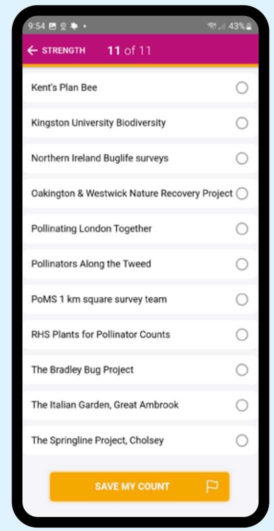
Since the completion of that project, I have continued to use the app for my own personal enjoyment, and look forward to the start of the next FIT Count survey season! After using the app for multiple years I like that I can easily flip through the output from my online PoMS account and see everything I have done so far all in one place. I have since been involved in local wildlife events leading family-friendly FIT Counts on paper and used it as an opportunity to show the app to more people to spread the word! I have also gone back to my University to talk to current classes about the importance of these surveys, and to lead FIT Counts using the app. This will be continuing in the new year, hopefully alongside projects such as the design and establishment of pollinator gardens on campus.

I enjoy how user-friendly the FIT Count app is, and that I have found it easy to explain to others. It is such a good way to encourage participation in citizen science and has many other benefits including the wonderful feeling of being involved in grander things! I look forward in anticipation of all further developments.

The FIT Count projects feature

Learn more about the FIT Count app projects feature and find a list of current projects on the PoMS website.





The FIT Count app is available for Apple and Android systems.

Monitoring at RHS Gardens to improve pollinator plant lists

Helen Bostock, Senior Wildlife Specialist at the Royal Horticultural Society, reveals how volunteers are helping boost confidence in RHS Plants for Pollinators.

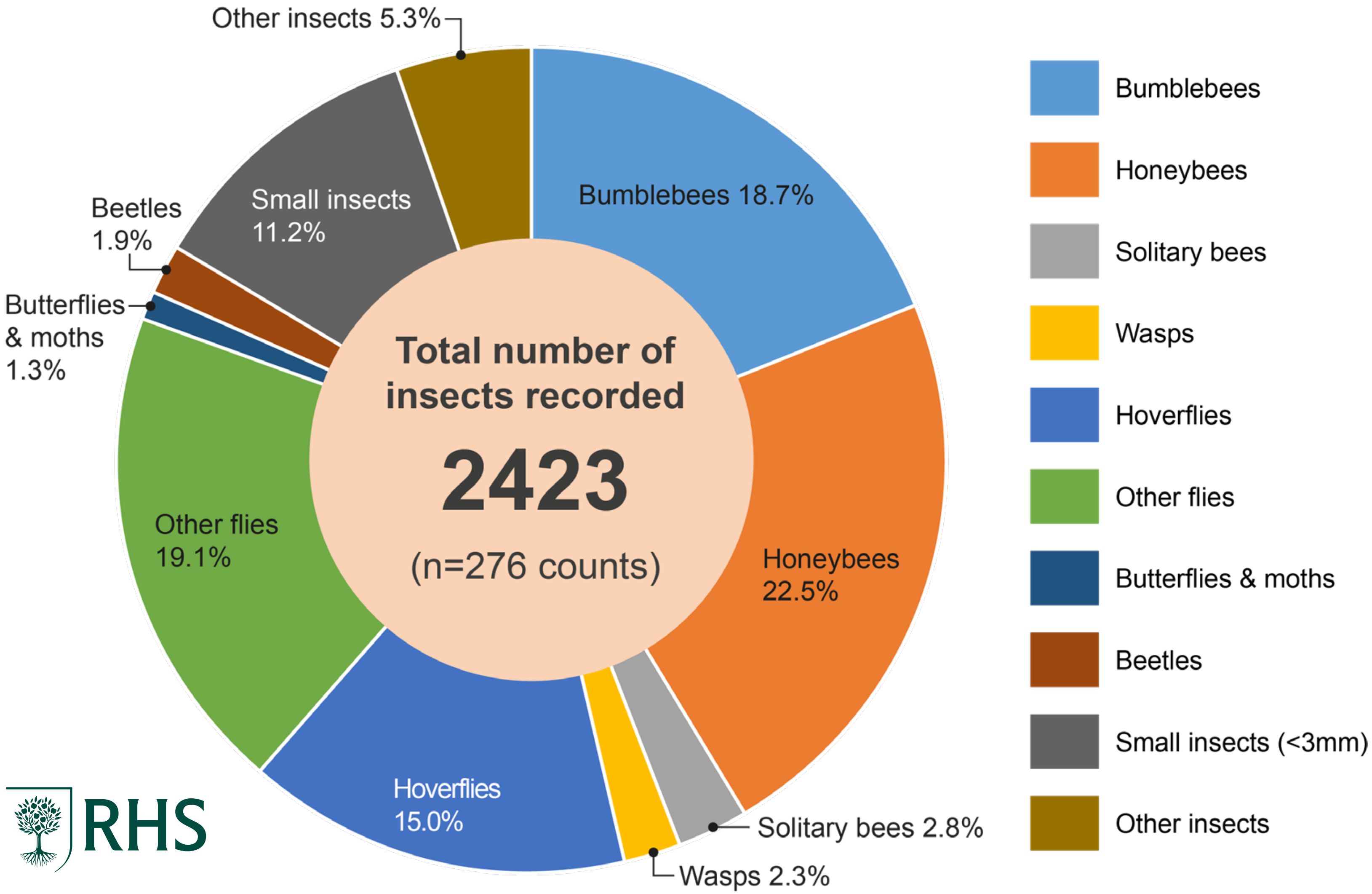
Since 2011, the RHS has published RHS Plants for Pollinators lists to help gardeners select the best pollinator-friendly flowers. This has been one of the leading lists of its type, greatly improving pollinator plantings in gardens and community green spaces across the UK. However, a review of the lists in 2022 identified that a system was needed to help gather data to strengthen the evidence base for a small number of plants on the lists, and also to provide data for plants which we may wish to add.

By teaming up with the UKCEH PoMS team, the RHS Plants for Pollinator Counts project, piloted at the end of 2023, is utilising the living collections at the five RHS gardens to help capture these data. Open to volunteers at the gardens, FIT Counts are undertaken on cultivated plants of interest ('target flowers') as well as plants with high levels of evidence ('benchmark flowers') that overlap in flowering time to allow assessment.

Helen Bostock © RHS

What have we found so far?

Despite a wet year and staggered recording as each new RHS garden came on board with the project, an impressive total of 2,423 insects was recorded from 276 FIT Counts and 34 different plants were surveyed.



Thanks to these records we can now be more confident that **Autumn ox-eye (*Leucanthemella serotina*)** merits its inclusion on the RHS Plants for Pollinators list – this is a plant where previously evidence had been lacking. Gardeners growing this may find it especially attractive to flies ('other flies') and honeybees.

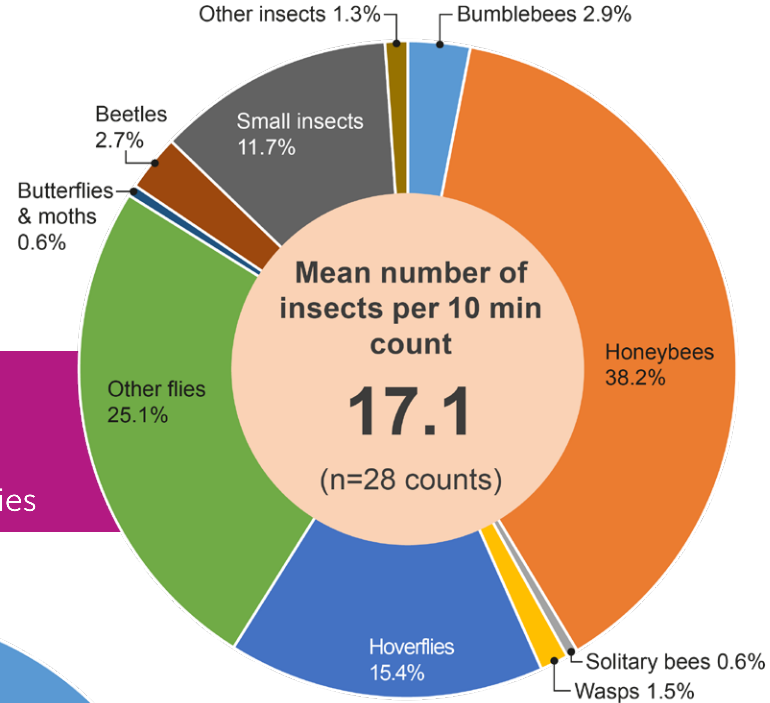
Records from **Barberry (*Berberis*) species** not currently listed on the Plants for Pollinators lists performed well, so we will now be considering including the whole genus for the list. They proved popular with bumblebees (nearly one third of the recorded insects on this target flower).

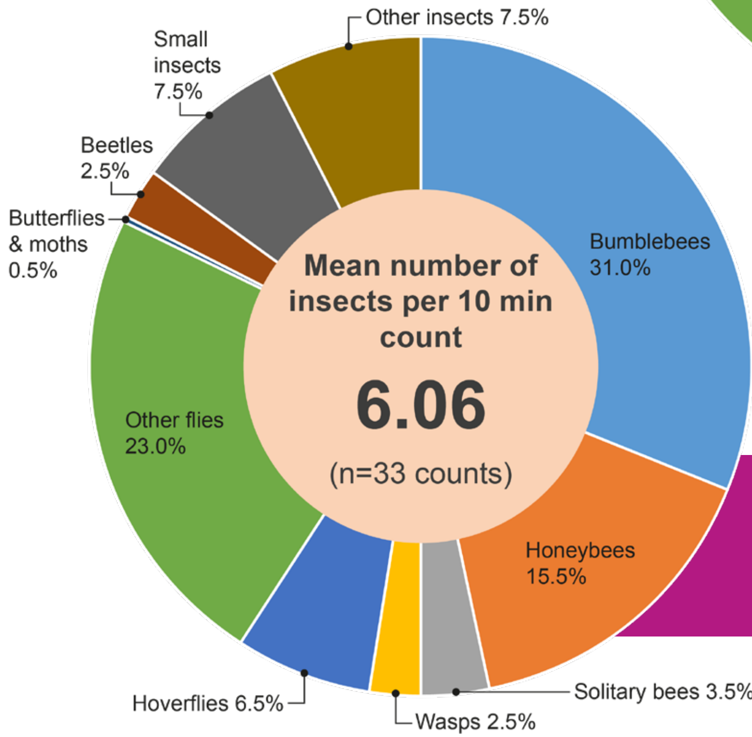
Privet (*Ligustrum*), like Barberry, was another plant taxon we are considering widening to cover the whole genus. Volunteers recorded data from two species not currently listed; results from 2024 indicate they do provide a good resource for pollinating insects.

Plants we will be keen to collect more data on in 2025 include **Climbing hydrangea (*Hydrangea viburnoides*)**, ***Stachyurus chinensis*** and **X *Fatshedera lizei***. We are also working with our garden teams to sow some of the annuals of interest for pollinator recording in 2025.

Autumn ox-eye
Leucanthemella serotina

Good for honeybees & other flies





Barberry
Berberis species

Good for bumblebees & other flies

What do project volunteers think?

No prior knowledge is required from project volunteers – just an enthusiasm for learning and a smartphone. We currently have around 30 volunteers participating at the RHS gardens. They carry out FIT Counts around their normal volunteering duties which can be very varied; some work in our main gardens or learning gardens, others in our science department, libraries or visitor services. Learning new skills and the knowledge that their efforts are helping to better our understanding of planting for pollinators are some of the key benefits reported in feedback from our project volunteers.

Visit the RHS website for more information about the Plants for Pollinators project and a full copy of the 2024 RHS report.

Helen Bostock © RHS

RHS volunteers at a FIT Count training session.

Thank you for your workshop, it was very helpful and gave us just the right amount of information. I've also gone on to look at videos about sawflies. This is the added bonus of getting involved, it stimulates a thirst for more research and learning.

- *Margaret Gul, Pollinator Counts volunteer, RHS Garden Bridgewater*

The most enjoyable part of being involved in the Pollinator Counts project has been learning how to identify the different pollinator groups and now not being able to pass a flowering plant on a walk without stopping to check out the visitors!

- *Michaela Goldberg, Pollinator Counts volunteer, RHS Garden Wisley*

I am delighted to be able to be part of the pollinator counting project... This and the other excerpts on [tv about] pollinators have made me even more determined to do what I can in my small garden... Very much a case of 'every little helps'.

- *Elizabeth Cairns, Pollinator Counts volunteer, RHS Garden Wisley*

PoMS volunteer engagement and training

This year we provide a summary of the number of volunteer engagement events delivered collectively across the PoMS partnership during 2024, with thanks to the hosts or partner organisations leading them.

PoMS on tour

- **55** training and engagement events
- **8** meetings attended and presentations given
- Estimated audience reached: at least **3,500**

Emma Sheppard © UKCEH

PoMS on podcast

What's the buzz: 1500 [13] explored how citizen science through PoMS is enhancing what we know about pollinators, and how the RHS have been getting involved

PoMS one-to-one training

- Number of training days for new 1 km survey volunteers in 2024: **14**
  - England: **6**
  - Scotland: **4**
  - Wales: **3**
  - N Ireland: **1**
- Total training days provided since 2018: **118**

PoMS in print

- **10** articles in print or online
- Total estimate of audience reached: at least **147,000**

PoMS in videos

Video views since May 2021:

- Flower-Insect Timed Count (FIT Count): **3,062**
- Getting familiar with the FIT Count insect groups: **1,586**
- PoMS 1 km square survey: **1,054**

All how-to videos (in English and Welsh) and key training webinars are on YouTube [14] and the PoMS website.

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Thank you

The UK PoMS Partnership

The UK Pollinator Monitoring Scheme (UK PoMS) is a partnership funded jointly by the UK Centre for Ecology & Hydrology (UKCEH) and Joint Nature Conservation Committee (JNCC) (through funding from the Department for Environment, Food & Rural Affairs, Scottish Government, Welsh Government and Department of Agriculture, Environment and Rural Affairs for Northern Ireland). UKCEH's contribution is part-funded by the Natural Environment Research Council formerly as part of the UK-SCAPE programme (award NE/R016429/1) and now as part of the NC-UK programme (award NE/Y006208/1) delivering National Capability. UK PoMS is co-ordinated by UKCEH, with the following delivery partners: Bumblebee Conservation Trust, Butterfly Conservation, British Trust for Ornithology, Buglife, the Royal Horticultural Society, DAERA and Hymettus, and academic partners the Natural History Museum, the University of Reading and University of Leeds.

The members of the PoMS Steering Group in 2024 were Paul Woodcock and Azra Gordy (JNCC), Pauline Campbell (DAERA), Stephanie Maher, Eleanor Andrews and Hannah Hoskins (Defra), Richard Smith (Natural England), Athayde Tonhasca and Jim Jeffrey (NatureScot), Kathleen Carroll (Welsh Government), Liz Halliwell and Bethan Beech (Natural Resources Wales), Una FitzPatrick (National Biodiversity Data Centre, Ireland), Fiona Highet (Science and Advice for Scottish Agriculture) and Simon Potts (University of Reading).

The UK PoMS team

Martin Harvey is the PoMS co-ordinator at UKCEH and first point of contact for queries via email. Claire Carvell is project manager for PoMS, also based at UKCEH Wallingford and responsible for strategic direction, overseeing delivery of surveys, data management and reporting, and liaising with JNCC and other partners. Nadine Mitschunas leads the field team with Chris Andrews and Angus Garbutt, and Francesca Mancini leads on statistical analysis of PoMS data, with Robin Hutchinson working on data management and communications. Other UKCEH team members are Nick Isaac, Lucy Ridding, Marc Botham, Michael Pocock, Abigail Lowe and Helen Roy. Our partners are represented by Richard Comont and Bex Cartwright (BBCT), Richard Fox and Jo Milborrow (BC), Dawn Balmer, Susan Jones and Santiago Cárdenas (BTO), Rachel Richards and Jamie Robins (Buglife), Helen Bostock and Andy Salisbury (RHS), Conor Bush (DAERA), Rowan Edwards (Hymettus), Mike Garratt and Simon Potts (Reading University), Bill Kunin (Leeds University) and Alfried Vogler (Natural History Museum).

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PoMS

UK Pollinator Monitoring Scheme

UK Pollinator Monitoring Scheme (2025).
The UK PoMS Annual report 2024
UK Centre for Ecology & Hydrology and
Joint Nature Conservation Committee

ukpoms.org.uk
Email: poms@ceh.ac.uk
Bluesky: @pomscheme.bsky.social
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