BeeWalk Annual Report 2024





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Dr Richard Comont & Helen Dickinson





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#### About BeeWalk

BeeWalk is the standardised bumblebeemonitoring scheme active across Great Britain, running since 2008 (opened to the public from 2011). Volunteer BeeWalkers survey a fixed-route transect once a month between March and October (inclusive), recording the abundance of each bumblebee species seen. This data is submitted via the BeeWalk website (hosted by the Biological Records Centre), enabling population trend analysis to be undertaken. The outputs of BeeWalk are now widely used to inform policy and conservation interventions.

#### The BeeWalk Team

BeeWalk is run by Dr Richard Comont (Science Manager) and Helen Dickinson (Surveys Officer) of the Bumblebee Conservation Trust.

#### Contact us

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BeeWalk recording sheet (photo © Amy Bowman)

#### Acknowledgements

We would like to thank the financial and inkind contributions to the BeeWalk scheme by the many organisations, charitable trusts and individuals who have over the years supported the BeeWalk scheme in particular, and the Bumblebee Conservation Trust in general. Thanks to the Biological Records Centre, who have provided website support and data storage free of charge.

We would also like to thank the photographers who have allowed their images to be used as part of this BeeWalk Annual Report.

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Cover photo: Buff-tailed bumblebee *Bombus terrestris* (photo © Nirvana Davidson)

#### THANK YOU!

We are indebted to the volunteer BeeWalkers and organisations past and present who have contributed data to the scheme or have helped recruit or train others in connection with it. Thanks also to all the individuals and organisations who allow and actively promote access to their land for bumblebee recording.



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## BeeWalk background, aims and methods

## BeeWalk background and aims

The Bees, Wasps and Ants Recording Society (BWARS) has collected distribution data for Hymenoptera since 1978. Whilst providing understanding of the distribution of bumblebee species, there was a lack of data on abundance. Knowing the size of populations and how these change over time is key to monitoring population trends, identifying species at risk and acting as an early warning system for declines. This lack of abundance data, alongside the need to better understand what's happening to all our species, not just the rarest, led to the development of BeeWalk. BeeWalk collects bumblebee abundance data from across Britain to gain an accurate understanding of current bumblebee populations and distributions.

#### Key aims:

- Collect long-term data on bumblebee distribution and abundance across Britain.
- Analyse data to identify population trends and drivers.
- Use the findings to inform policy and conservation interventions, improve understanding of forage plants & identification of management impacts.
- Encourage public understanding of bumblebees.

## BeeWalk survey methods

BeeWalk transects (fixed monitoring routes) are established and monitored by volunteers (BeeWalkers) using a standardised methodology to ensure accurate and comparable data is gathered. Transects are around 1-2 km in length, and walked a minimum of once a month between March and October inclusive (the main bumblebee flight period). BeeWalkers record the abundance of each bumblebee species seen in a 4m x 4m x 2m 'recording box' in order to standardise between habitats and recorders. Bumblebees are identified to species and caste where possible (recorded as 'unknown bumblebee' or 'unknown caste' where not) and the number of each entering the 'recording box' is recorded. Those recorders confident in plant ID also record the flower species bumblebees are visiting. Survey results are submitted via the BeeWalk website www.beewalk.org.uk.

### BeeWalk data verification and analysis

Each year data is downloaded and prepared for analysis; an intensive process of data validation and verification, essential to meet the high standards required for monitoring scheme data to be scientifically robust and reliable. Records of rare & difficult-to-identify species, and species outside known ranges, are queried with the recorder to establish supporting evidence.

Data received provide an annual estimation of the abundance of a species. This is a relative measure which requires statistical interpretation to evaluate changes over time. Estimates of population trends are calculated using statistical modelling. Bumblebee counts submitted by BeeWalkers are summed to produce total counts of each caste of each species, for each month surveyed. These monthly counts are analysed using statistical modelling to work out the monthly counts as a rate; bees seen per kilometre walked. This allows for the fact that the distances walked per month varies between months, years, and species. As all species are not found on all transects, a list is generated of sites each species has ever been recorded on within BeeWalk. This is used to calculate the distance walked each month across the species' range.

We use the results to demonstrate the abundance of each species in a given year against the mean monthly abundance across previous years, in order to see whether a given year was statistically 'good', 'bad', or 'standard' for each species.



## BeeWalk 2023 highlights in numbers









# Mapping BeeWalk



New (blue) transects showing the growth of the BeeWalk network during 2023

## **Bumblebee Population & Phenology Trends**

## 2023 season

Spring 2023 was notable mostly for how sparse the insect life was across most of the country, with even BBC Springwatch picking up on the empty moth traps and silent meadows being reported across the country. Bumblebees were no different, with numbers well below average until at least the end of May. Early runs of the BeeWalk models in May and June saw spring specialists like the Early and Tree bumblebees (*Bombus pratorum & B. hypnorum*) running at 5-15% of their normal levels.

Yet, meteorologically, spring was almost unusually average overall - slightly colder than average in March, wetter than normal in the south, drier in the north, slightly less sunshine than the 1990-2020 average. So what was the cause of the missing insects? In short – nobody knows for sure. But the fact that it directly followed the summer 2022 heatwave seems too much of a coincidence to ignore. For bumblebees, the lack of forage during July and August 2022 (too hot to fly and most plants droughted and not producing nectar or pollen) is likely to have led to smaller numbers of queens entering hibernation, with a greater proportion of underweight queens (more likely to die during the winter).

Once we reached June, the weather took a turn for the better and bumblebee numbers rapidly increased. The hottest June on record was followed by a July and August which were mild and damp, and the warmest September on record. Most bumblebees were able to catch up to their normal level, and many had some of their highest July numbers in the BeeWalk series. This wasn't all necessarily good news – it's likely that July counts were high because all the workers were out at the same time, rather than numbers being spread out across May, June and July. Records of *B. lucorum, B. magnus and B. cryptarum* are combined as the *B. lucorum* aggregate for analysis as they can only be reliably separated by DNA analysis. Additionally, workers of the *B. lucorum* aggregate cannot be reliably separated from workers of *B. terrestris* in many cases, so a further aggregate, *B. terrestris/lucorum* is used which potentially contains workers of all four species. We do not currently receive enough records of Great Yellow bumblebee *B. distinguendus* to calculate an index.

This four-month spell of good bumblebee weather did enable late-peaking species to have a great year. Species such as the Common carder (*B. pascuorum*) and Buff-tailed (*B. terrestris*) bumblebees which typically reach maximum numbers in late July and August did well, as did the rare, warmth-loving, late-flying Brown-banded (*B. humilis*) and Shrill carder (*B. sylvarum*) bumblebees. The Common carder in particular had one of its best years on record.

By contrast, the early-peaking species, which generally reach their maximum numbers in June - spring specialists such as the Early (B. pratorum) and Tree bumblebees (B. hypnorum), as well as the Garden bumblebee (B. hortorum) which has a longer flight season overall - had a poor year. Beyond bumblebees, most springflying species tend to be quite resilient to cold or wet weather in spring, and are able to wait it out or take advantage of the handful of warm days. Bumblebees are more limited on this front as they need enough time (and food) to construct a nest and raise a colony of workers as well as the males and new queens. In 2023, it feels like those species which were reliant on spring just got timed out - spring was a bit too damp and a bit too dull, and the warm weather arrived just too late for the majority of the overwintered queens. All three species had very poor years – the worst on record for the Garden and Early bumblebees, the worst in a decade for the Tree bumblebee.

## Long-term trends

Overall, 2023 was a year of contrasts. Many of the rarer bumblebee species have a preference for warmer conditions, and several of these showed an increase in the long-term time series analysis. As well as the Shrill and Brownbanded carder bumblebees mentioned previously, the Bilberry bumblebee (*B. monticola*) and Moss carder (*B. muscorum*) both had good years. The Moss carder is a lateflying species which seems to prefer the cooler, damper conditions that were prevalent in July and August 2023 so perhaps it should be unsurprising to see it continue the run of small year-on-year increases that it has maintained since 2020.

The Bilberry bumblebee is more surprising, as it is closely related to the Early and Tree bumblebees and, like them, is a June-peaking species. However, unlike those two generalist species, the Bilberry bumblebee is a species of upland areas and moorland, and is distributed mostly in the north and west. It may therefore have suffered less from the 2022 heatwave, or be better able to thrive in the damp, dull spring conditions of 2023. It is striking that the yearby-year trends of the Bilberry and Moss carder bumblebees are remarkably similar, possibly suggesting that the two species thrive in similar conditions.

The Ruderal bumblebee (*B. ruderatus*) showed a decrease from the 2022 average, but 2023 was still a better-than-average year for the species, its 4<sup>th</sup>-highest since 2010. Another late-flying warmth-loving species, it is found mostly in the south-east and East Anglia.

Of the 'Big 8' common species, the Buff-tail's good year has already been mentioned, and the White-tailed bumblebee (*B. lucorum s.l.*) had a better year than in 2022, albeit in a declining series. The Red-tailed bumblebee (*B. lapidarius*) had an almost entirely average year overall, a poor spring being counterbalanced by a good July. Interestingly, the Heath bumblebee (*B. jonellus*) showed strong signs of having a second generation, with numbers peaking in June, declining in July, and then peaking again at the same level in August. Again, this is a more northern and western species, thriving in acidic areas such as heath and moorland.

|   | 2023 vs |      |   | 202  | 3 vs |
|---|---------|------|---|------|------|
|   | 2010    | 2022 |   | 2010 | 2022 |
| Apis mellifera European honeybee        |         |      | Bombus muscorum Moss carder             |      |      |
| Bombus barbutellus Barbut's cuckoo      |         |      | Bombus pascuorum Common carder          |      |      |
| Bombus bohemicus Gypsy cuckoo           |         |      | Bombus pratorum Early bumblebee         |      |      |
| Bombus campestris Field cuckoo          |         |      | Bombus ruderarius* Ruderal bumblebee    |      |      |
| Bombus hortorum Garden bumblebee        |         |      | Bombus ruderatus* Red-shanked carder    |      |      |
| Bombus humilis Brown-banded carder      |         |      | Bombus rupestris Red-tailed cuckoo      |      |      |
| Bombus hypnorum Tree bumblebee          |         |      | Bombus soroeensis* Broken belted        |      |      |
| Bombus jonellus Heath bumblebee         |         |      | Bombus sylvarum Shrill carder           |      |      |
| Bombus lapidarius Red-tailed bumblebee  |         |      | Bombus sylvestris Forest cuckoo         |      |      |
| Bombus lucorum agg White-tailed complex |         |      | Bombus terrestris Buff-tailed bumblebee |      |      |
| Bombus lucorum/terrestris workers       |         |      | Bombus vestalis Southern cuckoo         |      |      |
| White/Buff-tailed workers               |         |      |   |      |      |
| Bombus monticola Bilberry Bumblebee     |         |      | Total bumblebee numbers                 |      |      |

Table. 1 Winners and losers: species which have increased (green) or decreased (red) in terms of individual bees seen per km walked in 2023, compared to the start of the scheme in 2010 and the previous survey year, 2022. All species only calculated on transects with records of that species.

## Research and collaborations - how BeeWalk data is used

BeeWalk was established with the aims of collecting abundance and distribution data on all Britain's bumblebee species and using this data as widely as possible (particularly to analyse population trends). The Trust carry out some research in-house, but also collaborate widely with other researchers on shared projects. The BeeWalk dataset has grown over the past decade into one of the largest bumblebee datasets in the world. Because it includes abundance as well as distribution, it can be used for estimation of population trends, as well as range change analysis. This lets us see what's happening with bumblebee populations now, or over the past few years, much more clearly than looking at range changes over the same period. This means BeeWalk can function as an early warning for bumblebee declines, detecting declines in the abundance of populations, before the species is lost from large enough areas that declines can be seen in their inhabited range sizes.

The data are made widely available: once cleaned, validated, and verified, the dataset is added to the online data-sharing platform Figshare, where it is available for anyone to use as long the scheme is credited as the source. The dataset is also added to the National Biodiversity Network (NBN) Atlas and the Global Biodiversity Information Facility (GBIF).

## BeeWalk data use in 2023

Over the past year, 287,985,070 records from the BeeWalk dataset have been downloaded across 3,756 individual downloads from the NBN Atlas and GBIF. It has been used worldwide for a range of purposes, principally research, but also by the UK statutory agencies for nature conservation (Natural England, Naturescot, and Natural Resources Wales), by Local Environmental Records Centres, and for use in planning. As well as this general use, the data has been key in the following:

- BeeWalk Annual Report population analysis.
- The Office for National Statistics. *Extent and Condition of Natural Capital* publications
- Monitoring of multiple conservation sites across Britain, by a variety of environmental organisations, including the RSPB, National Trust and numerous local Wildlife Trusts.
- Included as part of a DEFRA wildlife abundance indicator for assessing progress against the targets in the 2021 Environment Act.

- Flower visitation data included in the Database of Pollinator Interactions (University of Sussex)
- 36 scientific papers published since the start of 2023 which reference the BeeWalk dataset on GBIF

## **Ongoing collaborations**

The BeeWalk team collaborate with a range of colleagues both inside and outside the Trust. Internally, the data guides our strategic planning – which species should we be prioritising? – while our external collaborations tend to focus on extracting more information from the dataset. In particular we have a long-running collaboration with the Durrell Institute for Conservation and Ecology to develop better methods of modelling the dataset.

#### In-progress PhDs

The Trust support and collaborate with a range of PhD students; most, though not all of these will use the BeeWalk dataset.

- University of Worcester
  - Joe Leaper biological sustainability of vineyards
  - Andrea Claudia Tapia-Arenas use of drones to undertake bumblebee habitat assessments
- University of Cambridge
  - Jacqui James Bombus sylvarum genetic diversity
  - Sofia Dartnell Interactions between social and cuckoo bumblebee species
  - Nynke Blömer Interactions between bumblebees and honeybees
- University of Aberdeen
  - Tegan Gaetano Machair of the Outer Hebrides
- University of Bristol
  - Tori Mallinson pesticide impacts on bumblebees

## UK Pollinator Monitoring Scheme (PoMS)

The UK Pollinator monitoring Scheme has been running every year since 2017, with the aim of generating systematic data on the abundance of bees, hoverflies and other flower visiting insects at a national scale.

BeeWalk data is used as part of a PoMS analysis project aiming to pull together all pollinator data that is currently collected separately, to provide a better picture of pollinators as a whole across the UK.

The scheme runs two fixed monitoring surveys;

### Flower-Insect Timed Counts (FIT count)

Watch a small patch of flowers (ideally from the PoMS species list, though any flowers are acceptable) for 10 minutes and record the insects that visit the flowers, and identify them to broad groups (butterfly, beetle, bumblebee, hoverfly etc).

### 1km square survey

A selection of 1km grid squares across the country have been picked to be monitored in depth for their pollinators. These sites are monitored for additional reasons, to track pollinator numbers and changes against other wildlife, plants and abiotic factors such as rainfall. This survey involves up to four day-long site visits across the field season, carrying out FIT counts and pan trapping to get a full understanding of the pollinator species present.

For full details of how to join in with either survey, please visit: <u>https://ukpoms.org.uk</u> /. The National Pollinator Monitoring Scheme is funded by JNCC and the UK, Northern Irish, Welsh & Scottish Governments.



## Our projects

## **Skills for Bees**

Significant parts of Britain have very few bumblebee records and little to no coverage in terms of BeeWalk transects. As a result, there are huge gaps in our knowledge, including of locations which potentially hold populations of rare and scare bumblebees.

Our Skills for Bees projects aim to increase bumblebee recording, both through BeeWalk and ad hoc records, through focused training and mentoring in under these recorded areas. We hope to provide a legacy of skilled bumblebee recorders who will continue to monitor in these unique areas.

#### Skills for Bees key aims:

- Raising awareness of bumblebees and the need for recording
- Building partnerships with key organisations, groups and individuals
- Training and transferring skills, knowledge, and confidence to a wider group of people
- Data improving distribution and abundance data for bumblebees.
- Mentoring volunteers to maintain action for bumblebees beyond the end of the project

Our Skills for Bees projects continue in Scotland, whilst the Cymru project ended in early 2024. Both Projects have offered a range of virtual and field-based sessions within their target areas, open to all, whilst working with local landowners and partner organisations to increase BeeWalk transects and ad-hoc recording.

We soon expect to have a Skills for BeeWalk Manager in post. This position will build on the success of Skills for Bees: Cymru and Scotland by developing further regional Skills for Bees projects over the coming years. The role will also take a lead on the Trust's bumblebee identification and monitoring training, developing an online modular training curriculum (in bumblebee identification and monitoring), available to all BeeWalkers.

### Skills for Bees: Scotland 2023

Focusing on the Cairngorms in the Scottish Highlands, Skills for Bees: Scotland is now in its third year continuing to build and support a network of new bumblebee recorders and BeeWalk transects. The project also includes target survey days to look for some of rare species associated with the area. These are particularly focused on the Bilberry, Brokenbelted, and Moss Carder bumblebees (*Bombus monticola, B. soroeensis, & B. muscorum* respectively).

2023 was a fantastic year for the project, with over 300 people directly engaged with bumblebee identification and recording;

- 10 beginner work shops
- 1 intermediate workshop
- 8 target species survey days
- 5 BeeWalk demo/bumblebee recording training events
- 9 other project engagement events

Partnerships have continued to grow from small community groups to larger organisations, estates, and professional ranger services.

As well as the six BeeWalk transects set up on Heritage Horizons farms in partnership with the Cairngorms National Park Authority, the project has established new BeeWalk transects in partnership with local ranger services at Glenlivet Estate Visitor Centre & Muir of Dinnet National Nature Reserve, bringing the total new in the project area to 11 (of which 8 have received data). Ad hoc recording through iRecord (looking at preliminary data) shows an increase from just 46 records in 2021 to 246 in 2023. This is already showing us the rewards of this style of on the ground training and support.

If you are within the Cairngorms and would like to get involved please email annie.ives@bumblebeeconservation.org

Project webpage:

https://www.bumblebeeconservation.org/whatwe-do/our-projects/current-projects/trust-ledprojects/skills-for-bees-scotland/

### Skills for Bees: Cymru

Our first Skills for Bees project, came to an end in March 2024. The project was developed due to awareness that seven rare and scare species have important, but not fully understood populations across Wales. The coverage of BeeWalks and ad hoc recording throughout Wales has been relatively low.

Project Officers Clare Flynn (2021-2023) and Tom Bucher-Flynn (2023-2024, no relation) offered in-person and online training, mentoring and support sessions, alongside field follow up sessions, to provide the best level of guidance and support for new bumblebee recorders. Key partnerships were developed with a range of organisations including National Trust for Wales, National Park Authorities, County Councils, and other NGOs including Buglife and RSPB. As a result, BeeWalk transects were established at key sites, with identification and monitoring training provided for organisation volunteer teams.

Through the lifetime of the project 75 new BeeWalk transects were established and over 400 ad hoc records were submitted, for 16 of the 23 bumblebee species seen in Wales.

Across the 3 years of the project over 50 online events were held and 372 volunteers visited 72 sites to improve ID skills and survey for bumblebees;

- 1025 attendees at online events
- 366 attendees at in-person events
- 44 target species survey days
- 19 BeeWalk demo/bumblebee recording training events
- 11 other project engagement events



BeeWalk transect increase across Wales (purple squares indicate transects established in 2021, 22 & 23).

We will continue to evaluate the success of Skills for Bees: Cymru by monitoring the data flow from those BeeWalk transects set up as part of the project. We hope to have set the foundation for a continued increase in bumblebee monitoring across key areas of Wales.

We would like to thank the Moondance Foundation for funding the project.



## Conservation and Engagement projects

The Trust have a range of conservation and engagement projects across Britain, and monitoring bumblebees using BeeWalk is built into almost all of them. If you'd like to know more about any of them or to get involved, please see the Projects page on the main BBCT website for more details at <a href="https://www.bumblebeeconservation.org/what-we-do/our-projects/current-projects/">https://www.bumblebeeconservation.org/what-we-do/our-projects/</a>



Bumblebee Conservation Trust local project locations, 2023.





Early bumblebee *B. pratorum* (photo © Bex Cartwright)

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# Appendix

## Species distributions on BeeWalk transects

Each dot represents an on-transect record of the species, and so may not represent the full range of the species within Britain.

#### Widespread bumblebees

Distribution of B. pascuorum on BeeWalk transects

Distribution of B. lapidarius on BeeWalk transects





Distribution of B. terrestris on BeeWalk transects



Distribution of B. lucorum s.l. on BeeWalk transects



## Widespread bumblebees



Distribution of B. hypnorum on BeeWalk transects



Distribution of B. pratorum on BeeWalk transects

Distribution of B. hortorum on BeeWalk transects

Distribution of B. jonellus on BeeWalk transects



## Cuckoo bumblebees

Distribution of B. barbutellus on BeeWalk transects

Distribution of B. bohemicus on BeeWalk transects





Distribution of B. campestris on BeeWalk transects







## Cuckoo bumblebees

Distribution of B. sylvestris on BeeWalk transects

Distribution of B. vestalis on BeeWalk transects





## Conservation priority bumblebee species

Distribution of B. humilis on BeeWalk transects

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Distribution of B. monticola on BeeWalk transects



## Conservation priority bumblebee species



Distribution of B. muscorum on BeeWalk transects



Distribution of B. ruderatus on BeeWalk transects



Distribution of B. sylvarum on BeeWalk transects



Distribution of B. distinguendus on BeeWalk transects



## Conservation priority bumblebee species



Distribution of B. soroeensis on BeeWalk transects

Distribution of B. ruderarius on BeeWalk transects



## Yearly Abundance trends



#### Mean number of bumblebees counted on transects

The abundance trend of all bumblebees recorded on BeeWalk transects between 2010 and 2023, including individuals not identified to caste or to species. This is shown as the mean number of bumblebees counted per kilometre walked each year (red line). The grey cloud is a measure of the annual variation around this average (standard deviation)

### Widespread bumblebees



#### Widespread bumblebee species





Abundance trends for the eight widespread British bumblebee species 2010-23, shown as the mean number of bumblebees of that species counted per kilometre walked each year on transects where the species has ever been recorded (red line). The grey cloud is a measure of variability (standard deviation).

Note: the vertical axis varies with species' abundance and thus differs between plots

Bombus lucorum & B. terrestris often cannot be reliably split as workers, so records submitted as 'B. lucorum/terrestris workers' are plotted in addition to both species.

#### Cuckoo bumblebees



#### Conservation priority bumblebee species





Abundance trends for five rare or scarce British bumblebee species 2010-23, shown as the mean number of bumblebees of that species counted per kilometre walked each year on transects where the species has ever been recorded (red line). The grey cloud is a measure of variability (standard deviation).

Note: the vertical axis varies with species' abundance and thus differs between plots

## Phenology trends



Mean number of bumblebees counted on transects

The mean number of bumblebees per kilometre recorded per month (March-October) for each year the BeeWalk survey has been in operation.



The mean number of bumblebees per kilometre recorded per month (March-October). Results for 2023 (blue line) are plotted against the average monthly abundance for the nineyear period 2010-22 (red line). The grey cloud indicates the variability of the 2010-22 average where the blue (2023) line is outside this grey area the count is significantly different to what would be expected.

### Widespread bumblebee species



#### Widespread bumblebee species





Mean number of B. hortorum counted on transects



The mean number of bumblebees per kilometre per month between March and October 2023(blue line), plotted against the average monthly abundance for the nine-year period 2010-22 (red line). The grey cloud indicates the variability of the 2010-22 average (standard deviation.

Note: the vertical axis varies with species' abundance and thus differs between plots

Bombus lucorum & B. terrestris often cannot be reliably split as workers, so records submitted as 'B. lucorum/terrestris workers' are plotted in addition to both species.

#### Cuckoo bumblebees



29

#### Conservation priority bumblebee species



Count per 0.5

0.0



The mean number of bumblebees per kilometre per month between March and October 2023 (blue line), plotted against the average monthly abundance for the nine-year period 2010-22 (red line). The grey cloud indicates the variability of the 2010-22 average (standard deviation.

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Note: the vertical axis varies with species' abundance and thus differs between plots.