BeeWalk

Annual Report 2018

Bumblebee Conservation Trust

Contents

BeeWalk Annual Report 2018

About BeeWalk

BeeWalk is a standardised bumblebee-monitoring scheme active across Great Britain since 2008, and this report covers the period 2008-17. The scheme protocol involves volunteer BeeWalkers walking the same fixed route (a transect) at least once a month between March and October (inclusive). This covers the full flight period of the bumblebees, including emergence from overwintering and workers tailing off. Volunteers record the abundance of each bumblebee species seen in a 4m x 4m x 2m 'recording box' in order to standardise between habitats and observers.

It is run by Dr Richard Comont and Helen Dickinson of the Bumblebee Conservation Trust (BBCT). To contact the scheme organisers, please email beewalk@bumblebeeconservation.org.

Acknowledgements

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

We would like to thank the financial contribution by the Redwing Trust, Esmée Fairbairn Foundation, Garfield Weston Foundation and the many other organisations, charitable trusts and individuals who have supported the BeeWalk scheme in particular, and the Bumblebee Conservation Trust in general. In particular, the Biological Records Centre have provided website support, data storage and desk space free of charge.

Finally, we would like to thank the photographers who have allowed their excellent images to be included in our second BeeWalk Annual Report.

Citation

Comont, R. F. & Dickinson, H. 2018. BeeWalk Annual Report 2018. Bumblebee Conservation Trust, Stirling, Scotland UK.

This report can be downloaded from www.bumblebeeconservation.org

Further information on the scheme can be found on the BeeWalk website www.beewalk.org.uk.

Report written and produced by Dr Richard Comont, Science Manager & Helen Dickinson, Surveys & GIS Officer

News and research

449

BeeWalk continues to grow, with a record 449 sites submitting data for 2017

75

75 extra transects were walked during 2016, 20% more than in 2017

1,500

There are now over 1,500 registered users of the BeeWalk website

91,117

The number of records submitted to BeeWalk by the 31 January 2018 – 24,591 for 2017 alone!

291,321

The number of individual bees recorded on BeeWalk so far

24

The number of bumblebee species recorded on BeeWalk transects so far

2009

The three oldest remaining transects in the BeeWalk network were first walked in 2009 – Gray's Farm, Millom Ironworks LNR, and Rockside & Dreemskerry Road, Isle of Man.

BeeWalk Mentoring

2017 saw an initial small trial of our BeeWalk Mentor scheme. Six experienced BeeWalkers volunteered their time to mentor local BeeWalkers, with the aim of increasing availability of on-the-ground support, particularly for new or inexperienced BeeWalkers.

We currently have mentors in Aberdeen, Northumberland, Cardiff, Essex and Suffolk, London, and Maidstone. BeeWalkers registering in 2017 were made aware of any local Mentors, who to date Mentors have assisted with establishing new transects, and building confidence in carrying out surveys.

The scheme will continue in 2018, and will hopefully expand in coming years: we've already had interest in northwest England and the Scottish Highlands. If you would like to be in touch with your local Mentor or would like to offer your assistance as a Mentor please email beewalk@bumblebeeconservation.org.

Adopt-a-transect

Last year we put a call out for BeeWalkers to 'adopt' an un-walked transect. Three transects were adopted, and we would like to say a big thanks to the BeeWalkers involved.

We still have over 100 fully-established transects ready to go and looking for a new BeeWalker. If you could help increase our number of active transects, please see the un-walked transect map later in the report, or contact us on beewalk@bumblebeeconservation.org.

2017 also saw eight previously un-walked transects have data submitted by the original transect owners, so it's never too late to start surveying your transect, no matter how long ago you registered it on the website! An additional 15 transects were reactivated in 2017 after at least one year of no data submissions.

Dates for your diary

Easter 2018 – Bumblebees: An Introduction

It took a bit longer than planned to get it perfect, but the Bumblebee Conservation Trust's first book 'Bumblebees - an Introduction' is now available in time for the main bumblebee season. The book covers bumblebee ecology as well as providing an identification guide to all 25 UK species. The book is available via the Trust website www.bumblebeeconservation.org and www.ypdbooks.com to order.

October 2018 – 12th annual AGM and Members' Day

The Trust's 12th AGM and Members' Day will take place in Cardiff in October and is open to all members of the Trust. Details will be announced in our July edition member magazine 'Buzzword' and the website once the date and programme are confirmed.

Training days

With an increasing number of new projects, this summer is set to be our busiest yet in terms of bumblebee ID and surveying training. We already have many events and training workshops advertised on the Trust website Events Calendar https://www.bumblebeeconservation.org/events-calendar/ and this will be updated throughout the season.

BeeWalk trivia!

- 392 BeeWalkers submitted sightings in 2017!
- 224 new transects set up in 2017, of which 134 submitted data
- Top five counties with new transects in 2017: Kent: 28 (18 submitted data) / Greater London: 16 (11 submitted data) / Argyll and Bute: 13 (12 submitted data) / Essex:12 (5 submitted data) / Midlothian: 8 (7 submitted data)
- Most new transects set up by a single BeeWalker: Andrew Masterman, 16 new transects across Glasgow and Argyll and Bute
- Most remote transect goes to North Uist in the Outer Hebrides!

Photo: BeeWalk volunteers getting to grips with bumblebee ID at a training day in Aberdeen

Research and collaborations

BeeWalk was established with the twin aims of collecting abundance and distribution data on Britain's bumblebees, and using this data as widely as possible to analyse population trends and carry out other research as appropriate. The Trust carry out some of this research in-house, but we also collaborate widely with other researchers on shared projects such as the national Pollinator Monitoring Scheme (PoMS – see more below).

Additionally, we make the BeeWalk data freely available on the National Biodiversity Network (NBN) website for others to use (as long as they acknowledge us as the source of the data), and share our data with the national Bees, Wasps and Ants Recording Society, BWARS.

We are keen to work with students at all levels, and can both help with project ideas and provide data. The Trust are currently collaborating with undergraduate, Masters and PhD students on a range of topics, with BeeWalk projects generally concerned either with elements of phenology (seasonal timings) and flower visitations.

A BeeWalk in progress in Perth

Major ongoing collaborations

UK Pollinator Monitoring Scheme (PoMS)

One of the main take-home messages of the all the National Pollinator Strategy (NPS) has been the lack of available data on wild pollinators. The Trust were part of a Defra-funded group of organisations who established and tested a robust sampling protocol for a national Pollinator Monitoring Scheme in 2015-16. The full findings of the project were published during 2016 and the project report can be downloaded from the DEFRA website.

During 2016, the same group of organisations (funded by the UK, Welsh & Scottish Governments, and JNCC) were commissioned to carry out two years of data gathering, acting on the recommendations of the report. The Trust are again part of the project, which began in January 2017 and will run to the end of 2018. There are opportunities to get involved with PoMS surveying in 2018 – check out the 'Our projects need your help' section for further details.

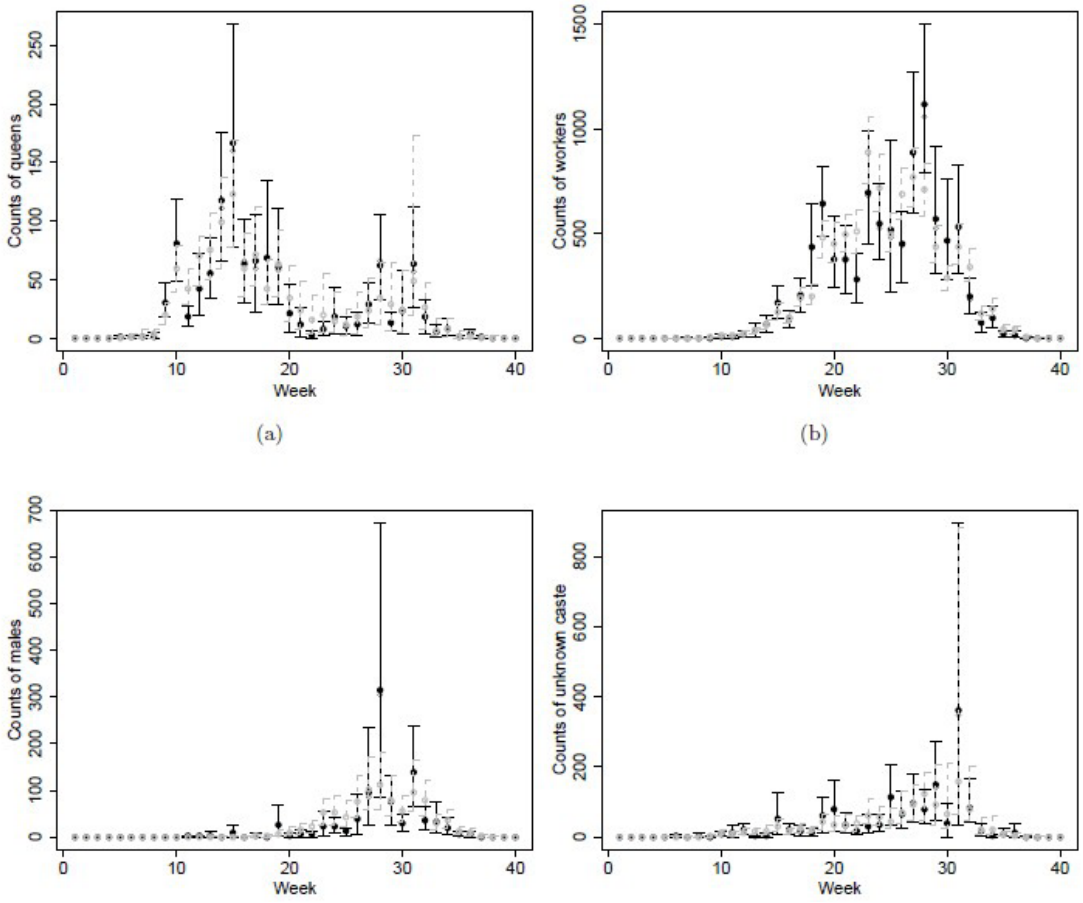
Caste-specific demography and phenology in bumblebees: modelling BeeWalk data

A collaboration between the Trust, Steven Freeman of the Biological Records Centre (BRC), within CEH, and Eleni Matechou of the University of Kent. Records coming into BeeWalk are, where possible, separated into caste (queen, male, worker), and a further category, 'unknown caste'. Being able to reliably split this unclassified group into castes will greatly increase the descriptive power of BeeWalk, as knowledge of the abundance of different castes is much more informative of the state of the colonies than the mere fact of a sighting of a species.

This project set out to investigate the feasibility, and best method, of splitting the 'unknown' caste into males/queens/workers, based on the abundance of those already identified to caste.

An MSc project (Guangxin Feng, 2014, University of Oxford, readable at http://bit.ly/Gaungxin) found that mixture models (probabilistic models which represent the presence of subpopulations within an overall population – here, castes within the overall population of a single species) were suitable for modelling the BeeWalk data by splitting the 'unknown' caste into males/queens/workers, based on the abundance of those already identified to caste.

They also had the advantage that they could also be used to calculate a range of further variables explaining bumblebees' colony dynamics and population size. Consequently we have continued the collaboration and extended it across a greater range of species (*B. pascuorum, B. lapidarius, B. hortorum, B. pratorum & B. hypnorum*) and years (2011-2016). A paper outlining the modelling approach has been accepted for publication, pending a few changes, and we hope to be able to use versions of the models to report on colony dynamics in the future.



Modelling the 2016 BeeWalk records of the Common carder bee, B. pascuorum. Data shows queens (a), workers (b), males (c), and unknown caste (d): actual numbers are in black, model-predicted numbers in grey.

Research & policy publications 2018

Comont, R.F. & Ashbrook, K.A. (2017). Evaluating promotional approaches for citizen science biological recording: bumblebees as a group versus *Harmonia axyridis* as a flagship for ladybirds. *Biocontrol*, Volume 62, Issue 3, pp 309–318.
This research used BeeWatch data to examine data-collection biases between different types of biological recording projects. Online at https://link.springer.com/article/10.1007/s10526-016-9771-y

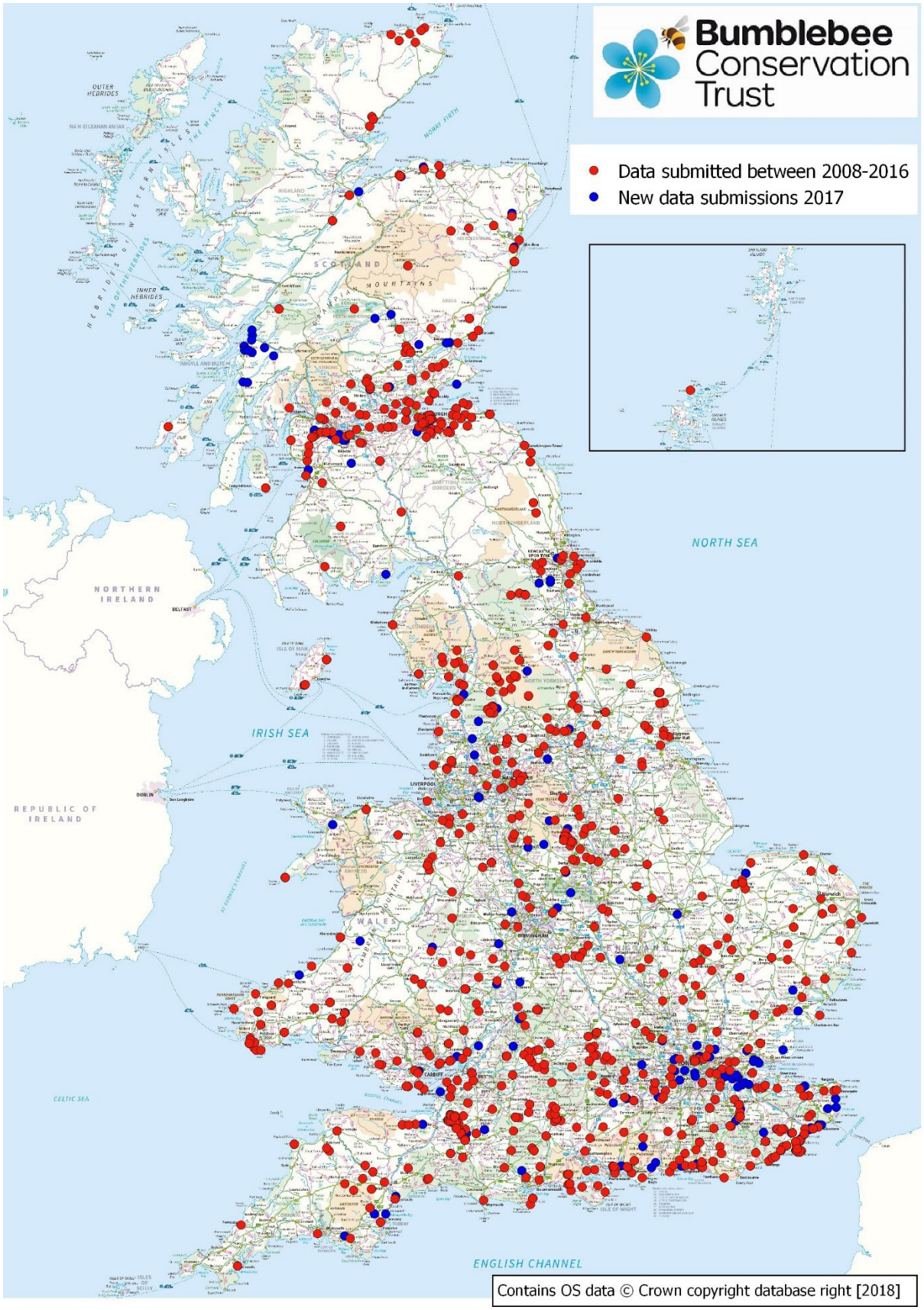
Edmonson C., St. Pierre T., Robinson S. & Powell I. (2017). The rapid response of foraging bumblebees *Bombus* spp. to hay meadow restoration in the Yorkshire Dales and Forest of Bowland, UK. *Conservation Evidence*, Volume 14, Pages 61-66.
This study used BeeWalk transects to monitor the bumblebees present across a network of existing and newly-restored hay meadows in northern England, and to analyse usage and colonisation by bumblebee species. Online at https://www.conservationevidence.com/individual-study/6746

Wibowo, A.T., Siddharthan, A., Anderson, H., Robinson, A., Sharma, N., Bostock, H., Salisbury, A., Comont, R.F., & van der Wal, R. (2017). Bumblebee-friendly planting recommendations with citizen science data. In Proceedings of the International Workshop on Recommender Systems for Citizens (CitRec '17). ACM, New York, NY, USA, Article 4, 6 pages. DOI: https://doi.org/10.1145/3127325.3128330.
This paper used BeeWatch data to establish a system to recommend pollinator-friendly flowers to plant in domestic gardens, taking into account both time of year and bumblebee visitation preferences. Online at http://bit.ly/Wibowo2017

Gammans, N.G., Comont, R.F., Morgan, S.C., & Perkins, G.P (eds), 2018. Bumblebees: an introduction. Biddles, UK. Featuring ecology, history and ID of the 25 British bumblebee species, this is the Bumblebee Conservation Trust's first book. Published in April 2018 and available from www.ypdbooks.com.

Several BeeWalk publications have focused on interactions between bumblebees and flowers

2017 BeeWalk transects



BeeWalk network growth during 2017. Red dots indicate transects where data was first submitted between 2008 and 2016, blue dots show transects which first submitted data in 2017.

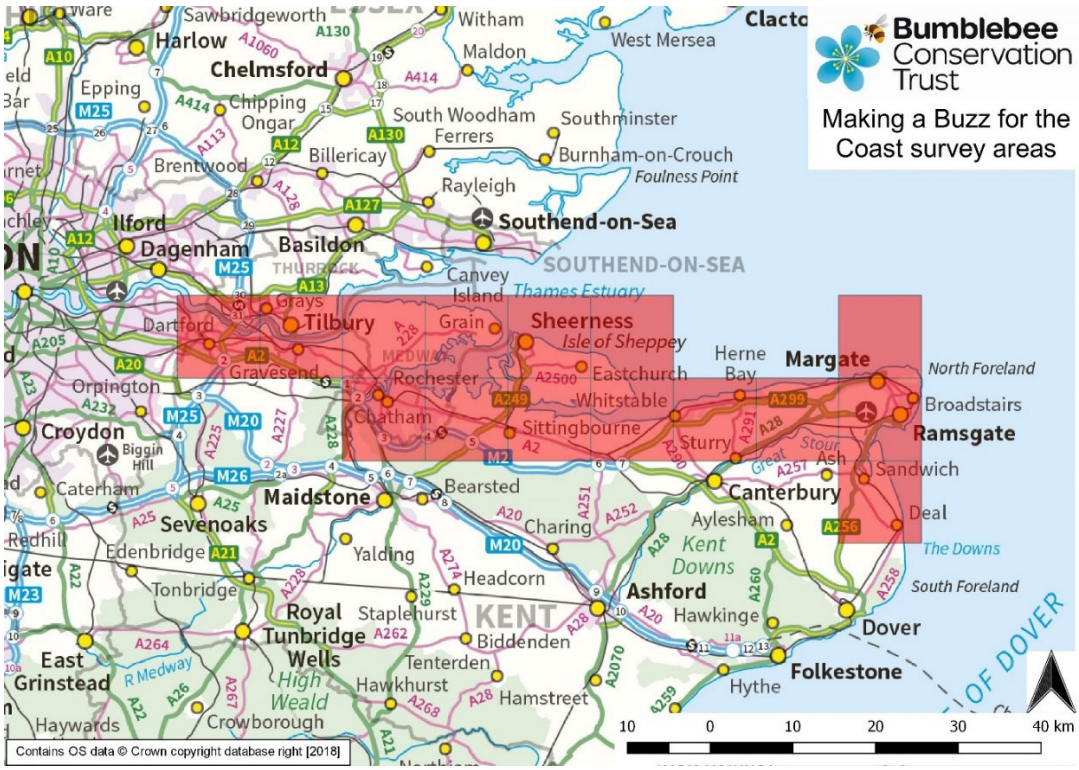
2017 BeeWalk transects with no data

Transects available! Each dot indicates a transect which has been set up on the website but which is not currently being walked and so is available to be taken on by someone else. *See page 4 for further details.*

Our projects need your help

Making a Buzz for the Coast spans 135 miles of Kent coastline from Dartford to Deal and aims to protect and strengthen Kent's wild bee populations. Surveying habitat and bumblebees is an essential part of the project and will enable us to gather better data, evaluate our activities and monitor bumblebee populations along the coast.

The Shrill carder bee (*Bombus sylvarum)* is particularly important to the project. Currently known from scattered sites along the Kent coast, we aim to gain a greater understanding of the species' distribution and abundance. This will let us better target our conservation work to link up fragmented populations. We can offer advice, site suggestions, and a field session with one of our team to prospective BeeWalkers – contact us on mab@bumblebeeconservation.org. For more information on the project, visit: Making a Buzz for the Coast



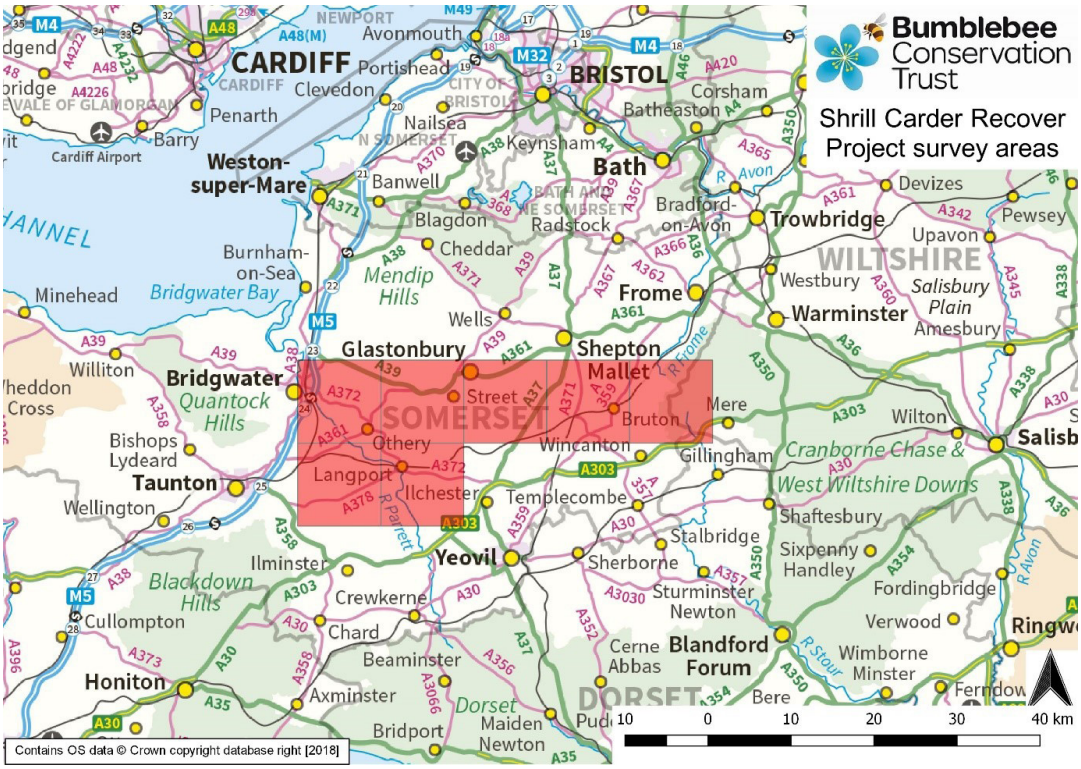
Surveying for the Shrill carder bee at Crossness Pumping Station. Photo credit: Karen Sutton

The Short-haired bumblebee reintroduction programme was established in 2009 with the aims of reintroducing the nationally-extinct Short-haired bumblebee *(Bombus subterraneus)*, and advising farmers and land owners on improving management of flower-rich areas for bumblebees more generally. The project focusses on Dungeness and the surrounding area.

The project provides bespoke habitat-management advice to over 100 landowners, including farmers and conservation organisations. We also have 40 volunteers who carry out practical conservation work including wildflower and bumblebee surveys. We are looking to increase our BeeWalk transects in the project area. If you are interested in starting a BeeWalk in one of these areas, please contact nikki.gammans@bumblebeeconservation.org who can give individual mentoring and discuss specific locations. For more information on the project, visit: Short-haired bumblebee reintroduction programme

A specimen of the Short-haired bumblebee in the Oxford University Museum of Natural History. Hopefully this species will grace British skies once again. Photo credit: Dr Richard Comont.

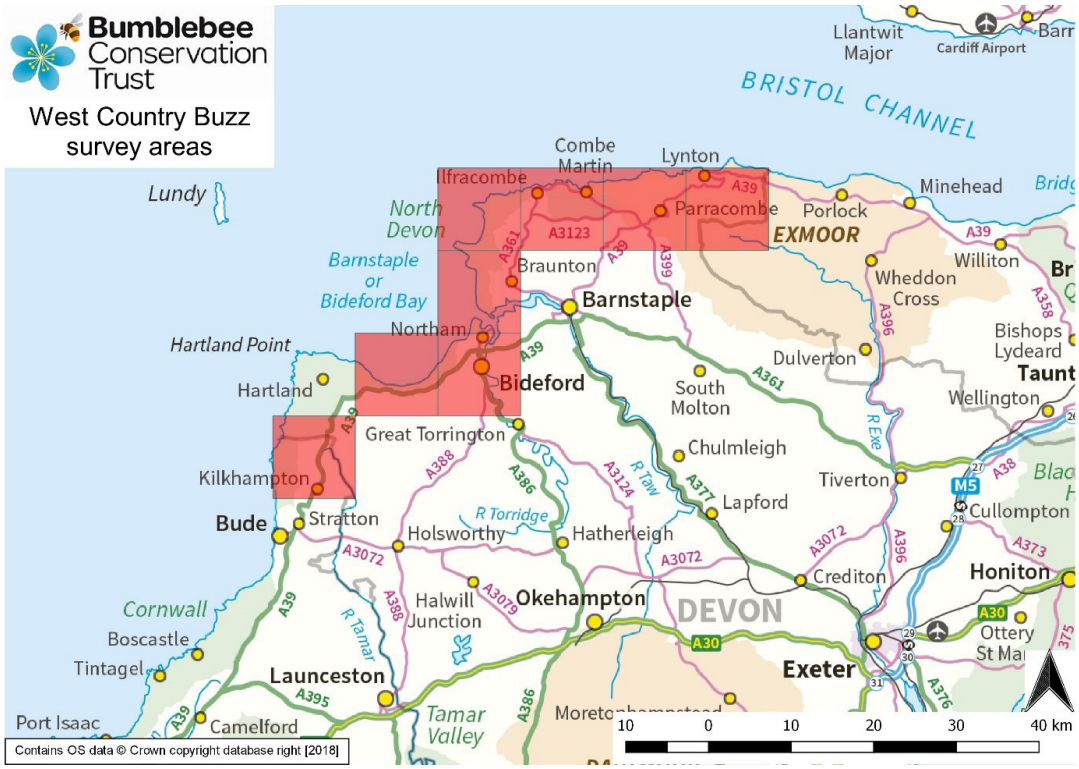
The Shrill Carder Recovery Project is looking for new BeeWalkers and transects in the areas surrounding Somerton and Langport in South Somerset to help in the search for the Shrill carder bee *(Bombus sylvarum)*, one of the UK's rarest and smallest bumblebee species. Once widely distributed across southern Britain they are now found at only a handful of sites across the country, including Somerset, so it is really important to find out more about the distribution of this species, which is currently on the brink of extinction in the UK. If you could walk a transect in this area, please contact daisy.headley@bumblebeeconservation.org. For more on the project, visit: Shrill carder recovery project.



A Shrill carder bee, the focus of the Trust's Somerset work.
Photo credit: Holly & David Harries

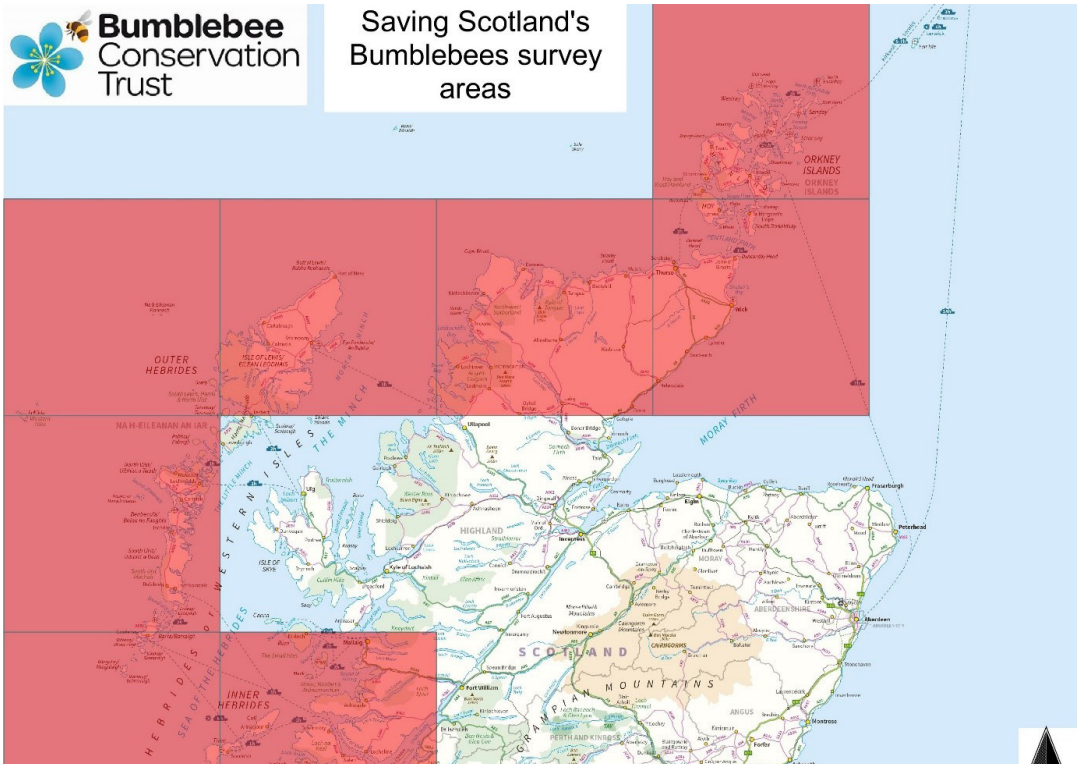
West Country Buzz project is calling for BeeWalkers to help survey and monitor the nationally declining Brown-banded *(Bombus humilis)* and Moss carder *(Bombus muscorum)* bees on the north Devon coast. This is the last remaining area in the county for these two species. They were once found widely across Devon, but sadly they are now mostly confined to coastal grassland. These species need big areas of flower-rich, late-flowering grassland, which has largely been lost from elsewhere in the county. With generous support from the Prince of Wales's Charitable Foundation, we are surveying and monitoring these target species.

The area is big and under-recorded, and we need more BeeWalkers to get involved to help protect these remaining populations. Please contact cathy.horsley@bumblebeeconservation.org if you can help. For more on the project, visit: West Country Buzz.



The Brown-banded carder bee is a West Country Buzz target species. Photo credit: Ray Reeves

Saving Scotland's Bumblebees aims to increase awareness of bumblebees and recording across Scotland, particularly of our rarer species including the Great Yellow bumblebee *(Bombus distinguendus)*. This species now only occurs in a handful of areas on the north and west coast and the Islands. The project would like to increase the number of BeeWalk transects in these vastly under-recorded areas. If you could help us increase recording in these areas, please contact katy.malone@bumblebeeconservation.org. For more on the project, please visit: Saving Scotland's Bumblebees.



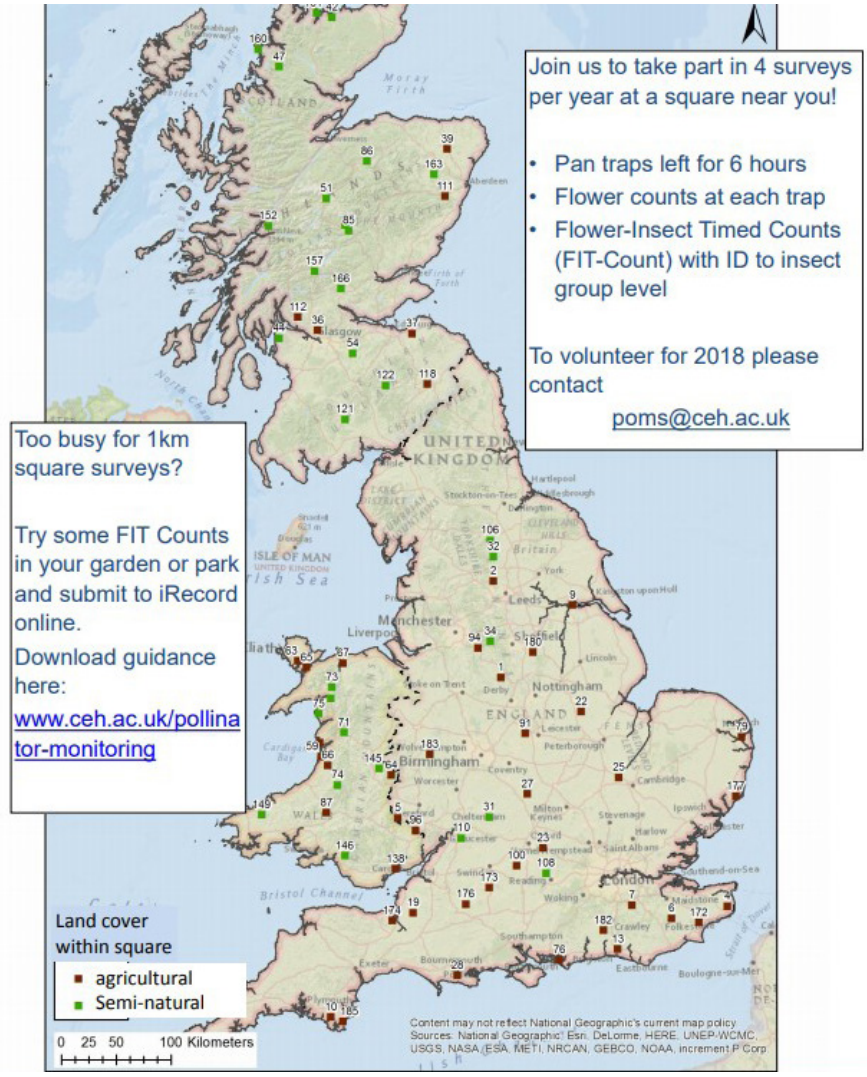
The Great Yellow bumblebee, one of our most endangered bumblebee species. Photo credit: Roxanne Curtis

The UK Pollinator Monitoring Scheme (PoMS) is open and recruiting for 2018!

The PoMS seeks the help of volunteers to collect data on pollinating insects, to help inform their conservation. There are two ways to get involved. One is to carry out a 10-minute Flower-Insect Timed Count. Anyone can take part, at any location where there are flowers and insects, and a full survey guide is provided.

A smaller group of volunteers is required to help with the systematic surveying of random sites across England, Scotland and Wales. This involves 'adopting' a 1km survey square, meeting on site with a PoMS team member and visiting the square on three further occasions during summer to collect insects with water-filled pan traps.

If you'd like to volunteer please email poms@ceh.ac.uk and visit the website for more details www.ceh.ac.uk/pollinator-monitoring.



Backgrounds & methods

Background to BeeWalk

The Bees, Wasps and Ants Recording Society (BWARS) has been collecting data on the distribution of hymenoptera since 1978. This provides a good understanding of the distribution of bumblebee species across the UK, but there has been a significant lack of data on bumblebee abundance. Abundance data, knowing the size of populations and how these change over time, is key to monitoring population trends for bumblebee species, identifying which species are most at risk and acting as an early warning system for significant declines.

The 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 the BeeWalk project. BeeWalk collects bumblebee data from across Britain to gain an accurate understanding of current bumblebee populations and distributions. In particular, the scheme aims to:

- Collect long-term data on bumblebee distribution and abundance.
- Analyse data to identify population trends and drivers thereof.
- Use these and other findings to inform policy and conservation interventions by the Trust and others, including improved understanding of forage plants & identification of management impacts.
- Encourage the public understanding of bumblebees.

BeeWalk transects (fixed monitoring routes) are monitored by volunteers using a standardised methodology to ensure accurate and comparable data is gathered. Most transects are roughly 1-2 km in length and take in some flower rich habitat. Transects are walked a minimum of once a month between March and October (the main bumblebee flight period), ideally between 11am and 5pm on days with minimal wind or rain.

A bumblebee identification and survey training day with Dr Nikki Gammans, Project Manager Short-haired bumblebee reintroduction programme

Bumblebees are identified to species and caste where possible (and recorded as 'unknown bumblebee' or 'unknown caste' where not) and the number of each entering the 'recording box' on each section of the transect is recorded. The recording box covers an area up to four metres in front of the recorder, two metres either side of them (4m wide in total), and between ground level and two metres up. This is employed in order to standardise between habitats, which may have very different levels of visibility, as well as between recorders (different people will be able to identify bees from different distances, depending on experience) and species (more distinctive species can be identified from further away).

Recorders who are confident of their plant ID skills also have the option to record which flower species the bumblebees are visiting. This provides us with a better understanding of the forage preferences of bumblebee species nationwide and across a range of habitat types, which will allow us to better tailor our flower advice to gardeners and landowners. Holding up-to-date national population data allows us to better target our conservation activities and ensure that the advice we provide, including to governmental organisations, results in policies which reflect the current needs of our bumblebees.

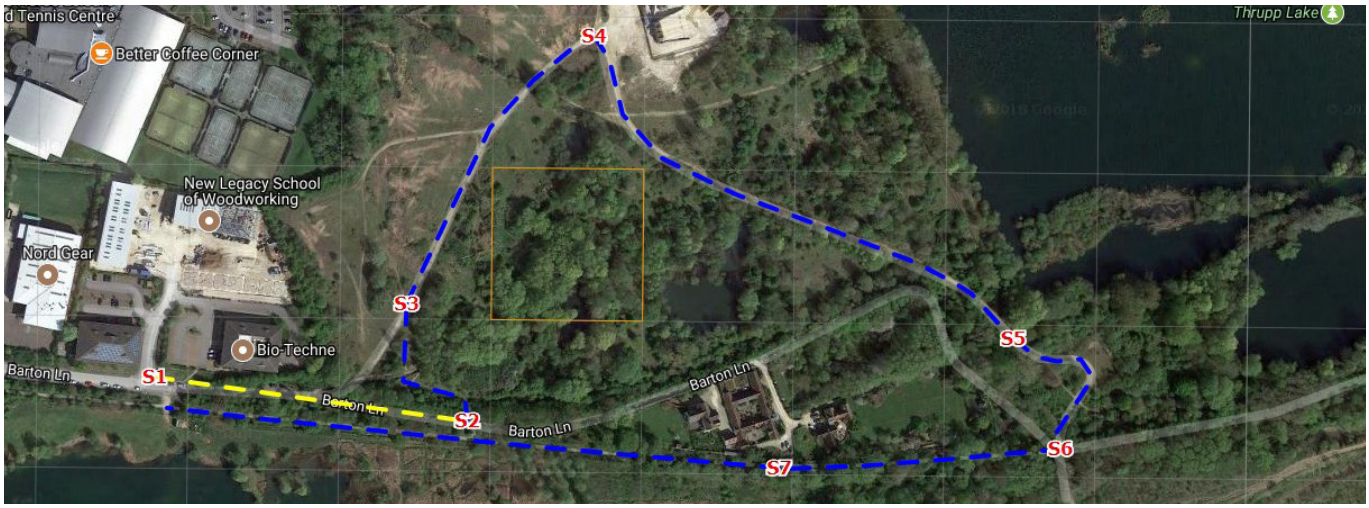
BeeWalk from the beginning

The survey methodology for the BeeWalk scheme is based on existing transect-walking schemes such as the UK Butterfly Monitoring Scheme, with minor changes to reflect the facts that bumblebees are harder to identify than butterflies (so the recording box was made slightly smaller) and that bumblebees are less reliant on good weather to be flying (so the weather criteria were relaxed slightly). Transects are registered and records submitted directly on the BeeWalk website www.beewalk.org.uk, hosted by the Biological Records Centre.

The project was trialled during 2008 and 2009, opened to Trust members in 2010, and launched as a scheme for the general public in 2011. In these early years the scheme was run as part of a University of Stirling PhD project, undertaken by Leanne Casey (supervised by Professor Dave Goulson). Following this research project, the scheme was run as an entirely Trust-led project from 2013 onwards, and continued to grow through funding by the Esmée Fairburn and Garfield Weston foundations.

The scheme has a high degree of focus on accuracy, validation and verification in order to meet the high standards required for monitoring scheme data to be viewed as scientifically robust and reliable. After three scoping years and seven in operation as a public recording scheme, the BeeWalk dataset now stands at 91,117 validated records of 22 bumblebee species (records of the *Bombus lucorum* group are aggregated as *B.lucorum* aggregate for analysis: *B.subterraneus* has not yet been recorded on the transect network).

A typical BeeWalk transect (Radley Lakes, Oxfordshire)



Bumblebee population trends

The central goal of the BeeWalk programme is to be able to reliably evaluate the trends in British bumblebee populations. Transect counts provide an annual estimation of the abundance of a species. They do not provide an absolute measure of the total abundance, but a relative measure which requires statistical interpretation to evaluate changes over time. This is complicated by the fact that transect locations change over time, allied to the effects of short-term weather conditions, etc.

Estimates of population trends across the 2010-17 period were calculated using a method similar to the analysis methodologies used by the UKBMS and the BTO's Breeding Bird Survey. First, a list is generated of the sites that each species has ever been recorded on within BeeWalk. This is used to establish the distance walked each month where each species could be expected to be seen, in order to act as a measure of the area surveyed whilst improving analyses for more range-limited species.

Next the bumblebee counts submitted by BeeWalkers were added up to produce total counts of each caste of each species per month surveyed. The resulting monthly counts were then analysed using a log-linear model. This works out the monthly counts as a rate (count/distance), which allows for the fact that the distances walked per month varies between months, years, and species. The model estimated abundance trends across the 2010-2017 period.

These data were also used to demonstrate the abundance of each of the 23 species or species aggregates in 2017 against the 2010-16 mean monthly abundance per kilometre surveyed, in order to see whether 2017 was statistically a 'good', 'bad', or 'standard' year for each species.

Early bumblebees, like this worker, will be affected enormously by changing spring conditions and so different years will have differing emergence times, amongst much else.

Bumblebee Population & Phenology Trends

Population trends were positive for nine species and two species aggregates. This included total bumblebees, one cuckoo bumblebee *(B. vestalis)* and four conservation-priority species *(B. ruderarius, B. humilis, B. monticola & B. sylvarum)*. Conversely, population trends are negative for 11 species and one aggregate species. This includes the remaining five cuckoo species and two conservation-priority species, *B. muscorum* and *B. ruderatus*. Unsurprisingly, the range-expanding Tree bumblebee (*B. hypnorum)* continues to increase.

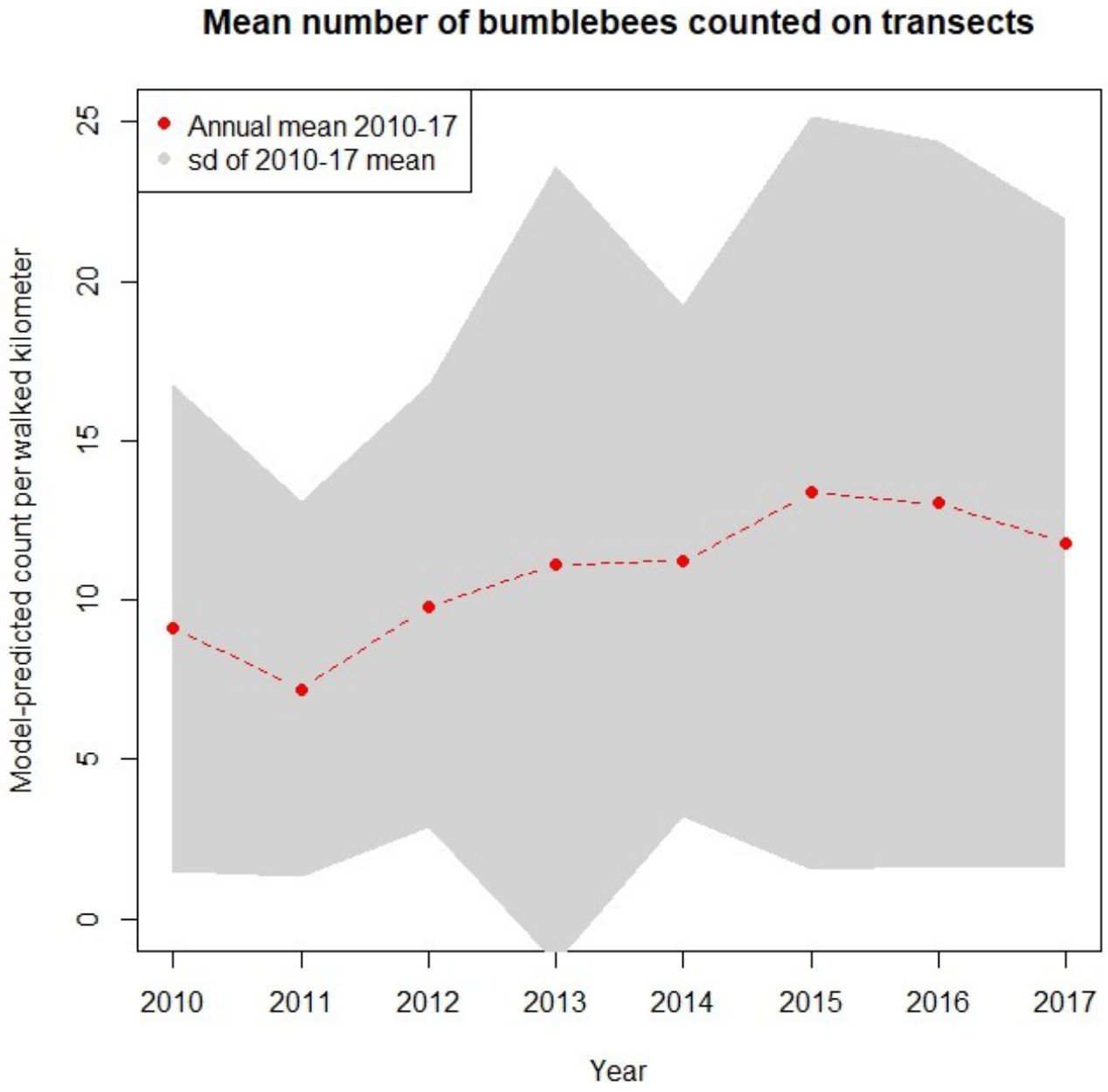
The inability to reliably discriminate between all castes of *B. lucorum* sensu stricto, *B. magnus* and *B. cryptarum*, and between workers of *B. lucorum* sensu lato and of *B. terrestris* make interpretation of these taxa problematic. In general, there is an increase in the number of workers but a slight decrease in the number of reproductive individuals (queens and males) recorded, with a slight increase overall if both taxa are combined.

It is important to note that this year's analysis methodology is significantly improved from the 2017 report so the two sets of figures are not directly comparable.

2010-2017 population trends for the 20 bumblebee species and 3 species aggregates with sufficient records in the BeeWalk dataset. Species showing population increases are on the left of the table, those showing decreases are on the right. Both groups are ordered from the top down, most to least change. Conservation priority species have been highlighted in blue and cuckoo species in red.

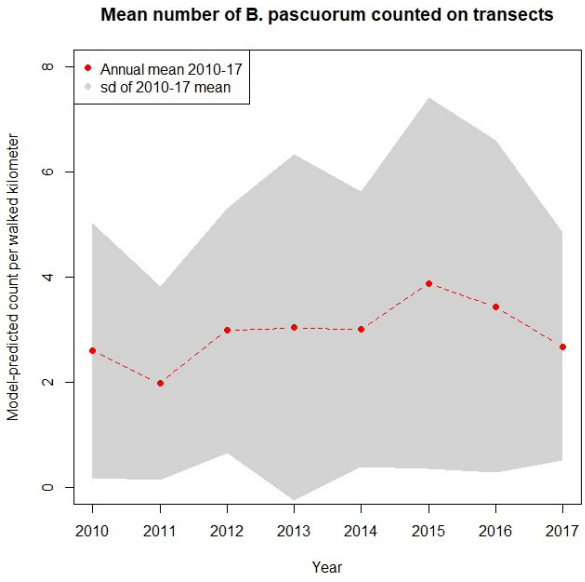
Species	Records	Trend
B. ruderarius	105	0.42572
B. lucorum/terrestris workers	27,998	0.217157
B. humilis	457	0.12863
B. monticola	168	0.105991
B. hypnorum	7,924	0.075109
B. vestalis	1,388	0.068388
B. sylvarum	123	0.053367
B. jonellus	429	0.045686
***TOTAL** bumblebees*	217,926	0.038208
B. lapidarius	34,287	0.01415
B. pascuorum	52,944	0.014071

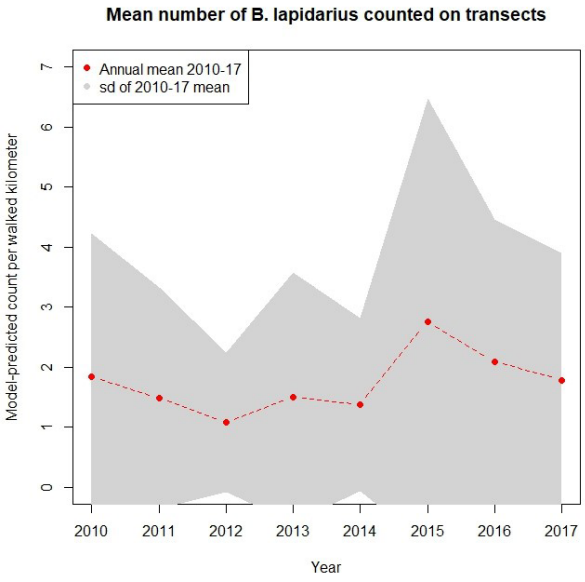
Species	Records	Trend
B. muscorum	156	-0.24757
B. campestris	413	-0.17259
B. soroeensis	31	-0.14758
B. barbutellus	86	-0.13692
B. sylvestris	766	-0.11037
B. rupestris	373	-0.08743
B. ruderatus	47	-0.06689
B. bohemicus	710	-0.05281
B. lucorum agg	23,491	-0.03116
B. hortorum	6,957	-0.01369
B. pratorum	12,451	-0.01327
B. terrestris	32,654	-0.00603

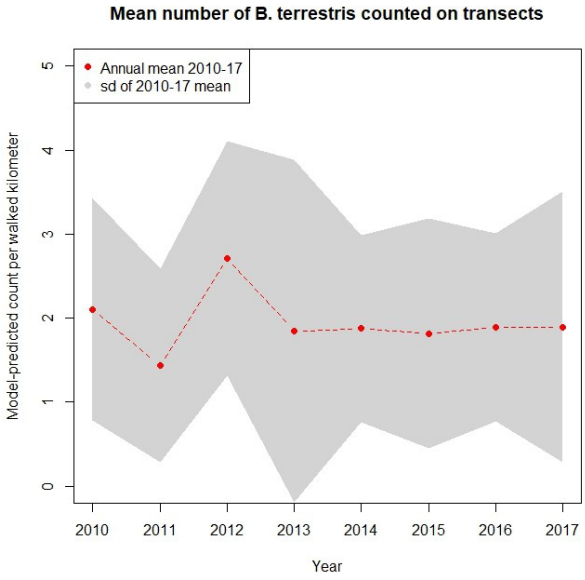


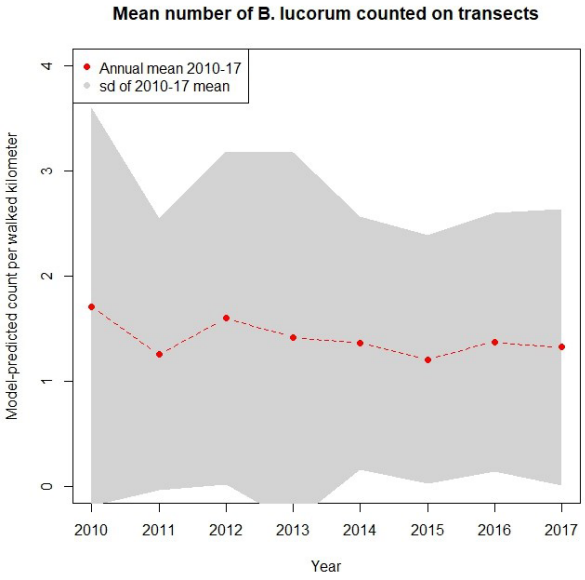
The abundance trend of all bumblebees recorded on BeeWalk transects between 2010 and 2017, including individuals not identified to caste or to species. This is shown as the mean number of bumblebees counted per kilometre walked each year (red line). The grey cloud is a measure of the annual variation around this average (standard deviation)

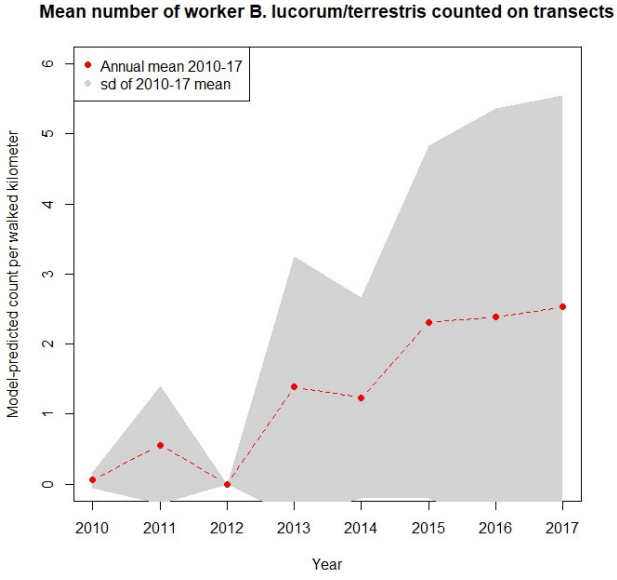
Widespread bumblebee species









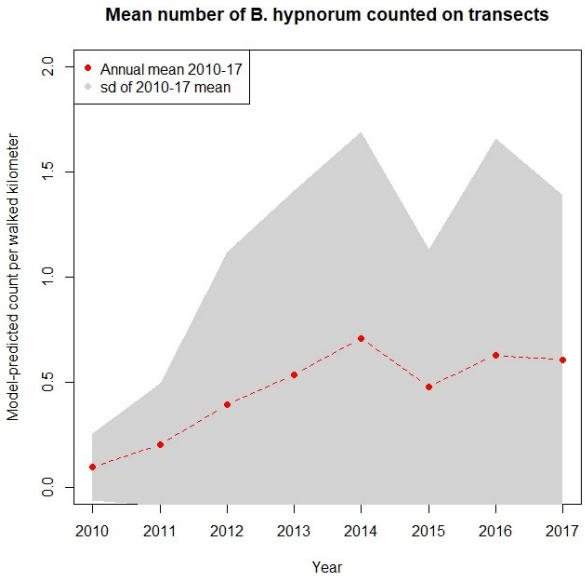


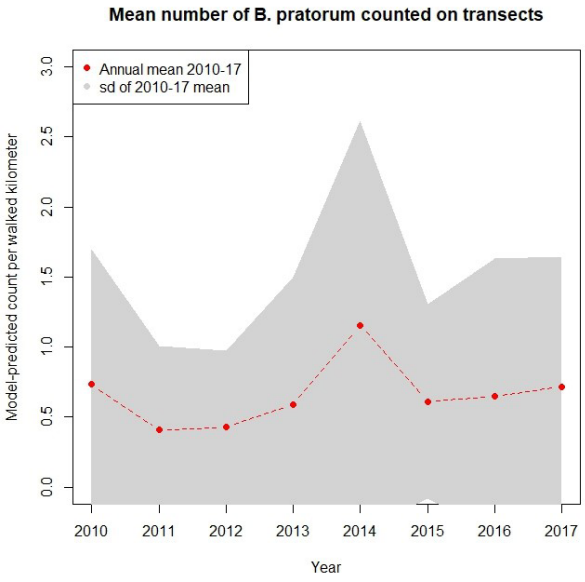
Abundance trends for widespread British bumblebee species 2010-17, shown as the mean number of bumblebees of that species counted per kilometre walked each year on transects where the species has ever been recorded (red line). The grey cloud is a measure of variability (standard deviation).

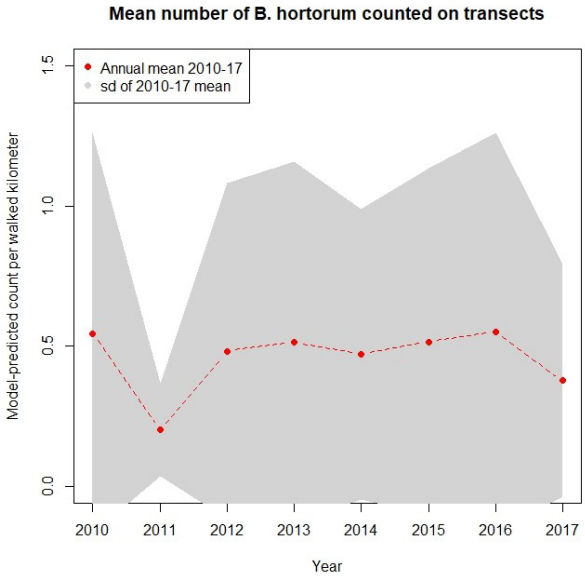
Note: *the vertical axis varies with species' abundance and thus differs between plots*

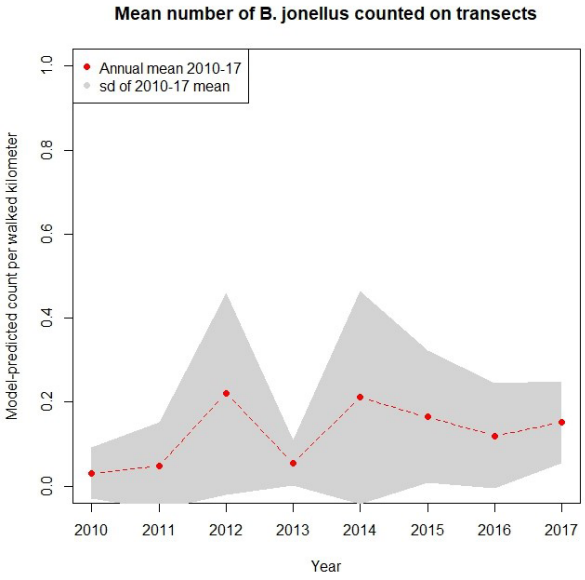
Bombus lucorum & B. terrestris often cannot be reliably split as workers, so records submitted as 'B. lucorum/terrestris workers' are plotted in addition to both species.

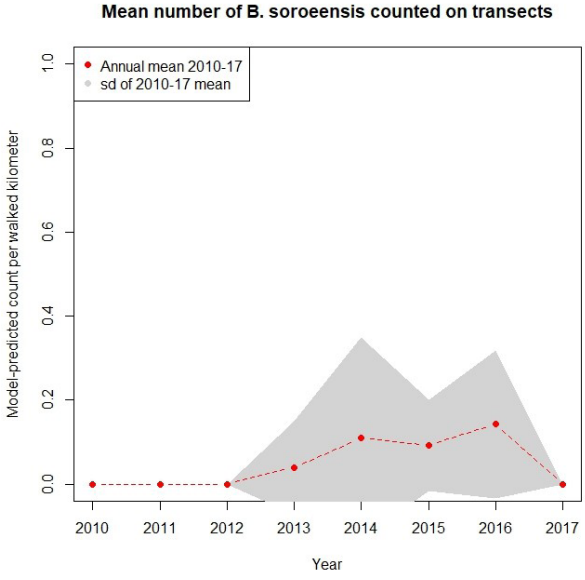
Widespread bumblebee species



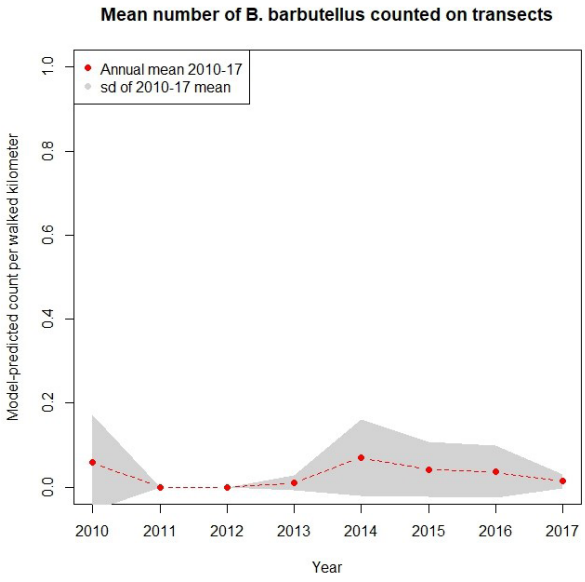


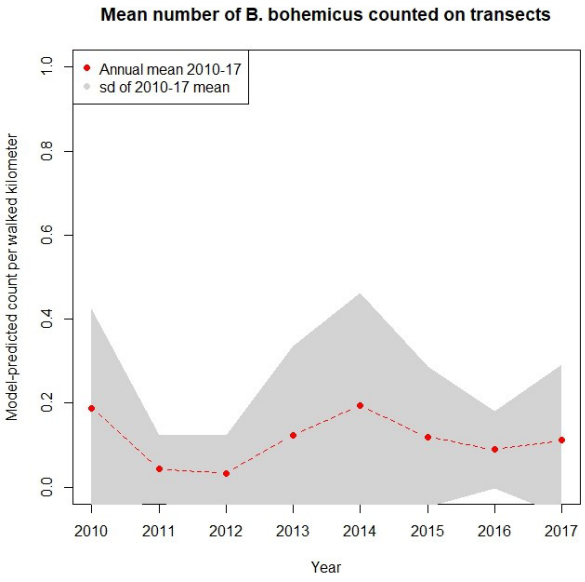


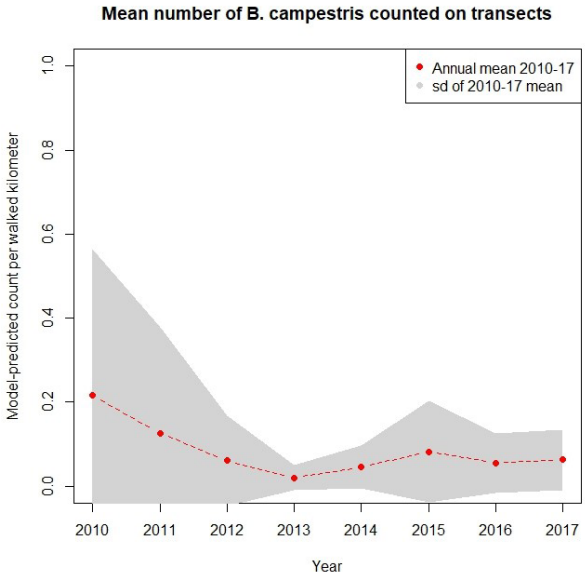


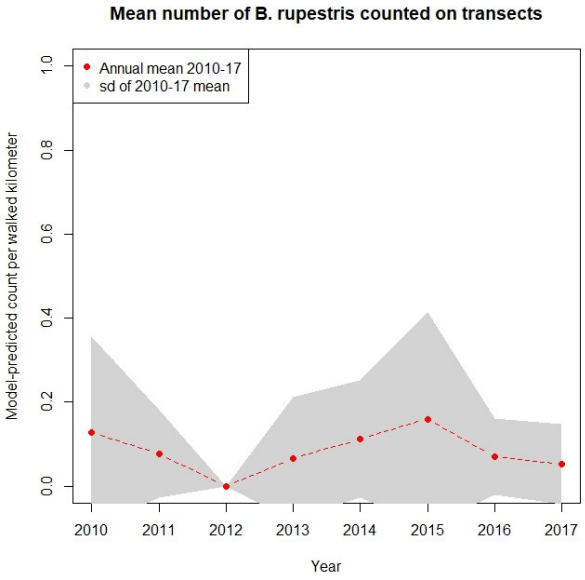


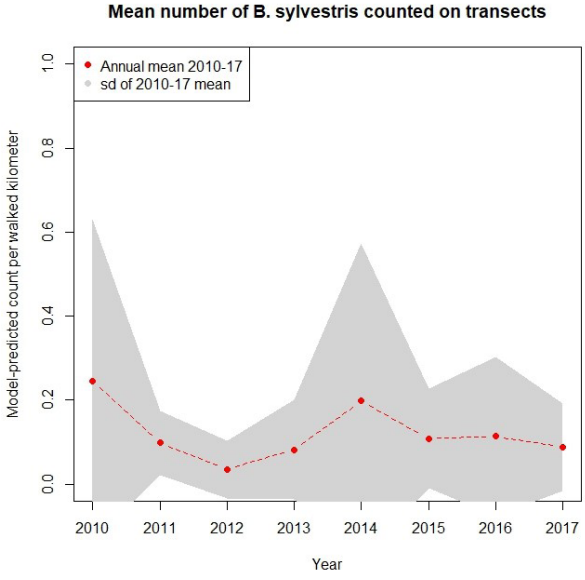
Cuckoo bumblebees

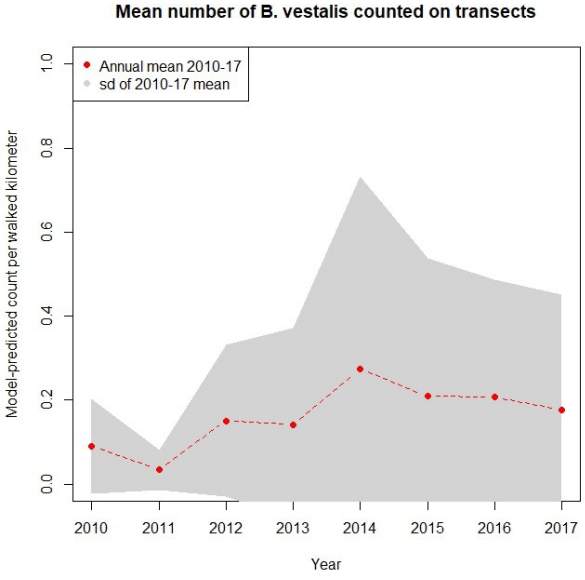






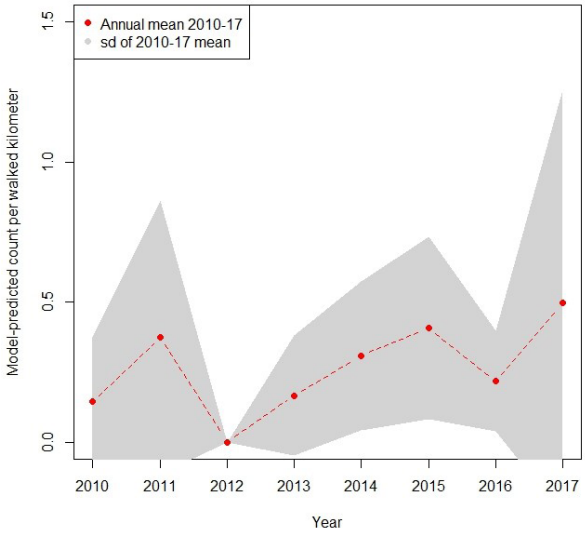




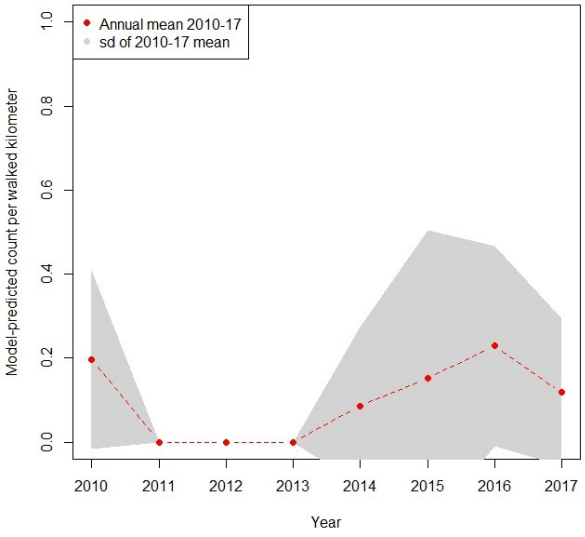


Conservation priority bumblebee species

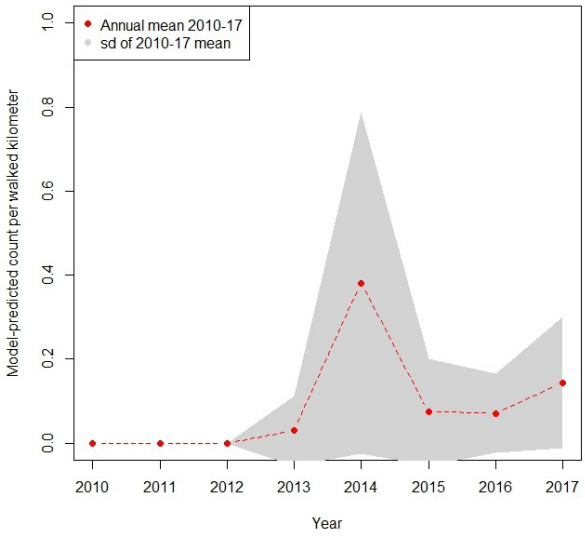
Mean number of B. humilis counted on transects



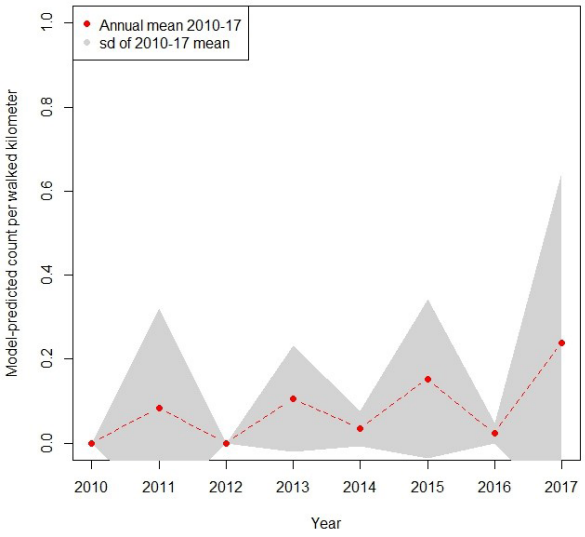
Mean number of B. monticola counted on transects



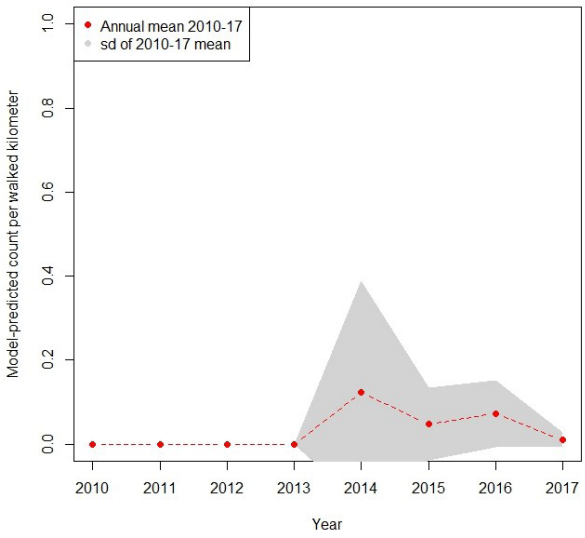
Mean number of B. muscorum counted on transects



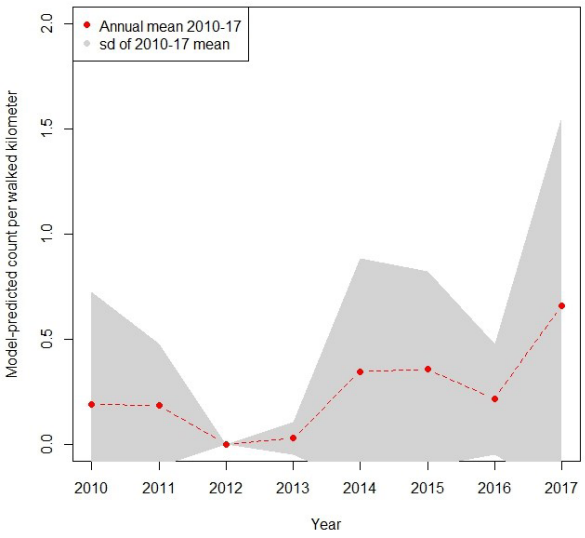
Mean number of B. ruderarius counted on transects



Mean number of B. ruderatus counted on transects



Mean number of B. sylvarum counted on transects

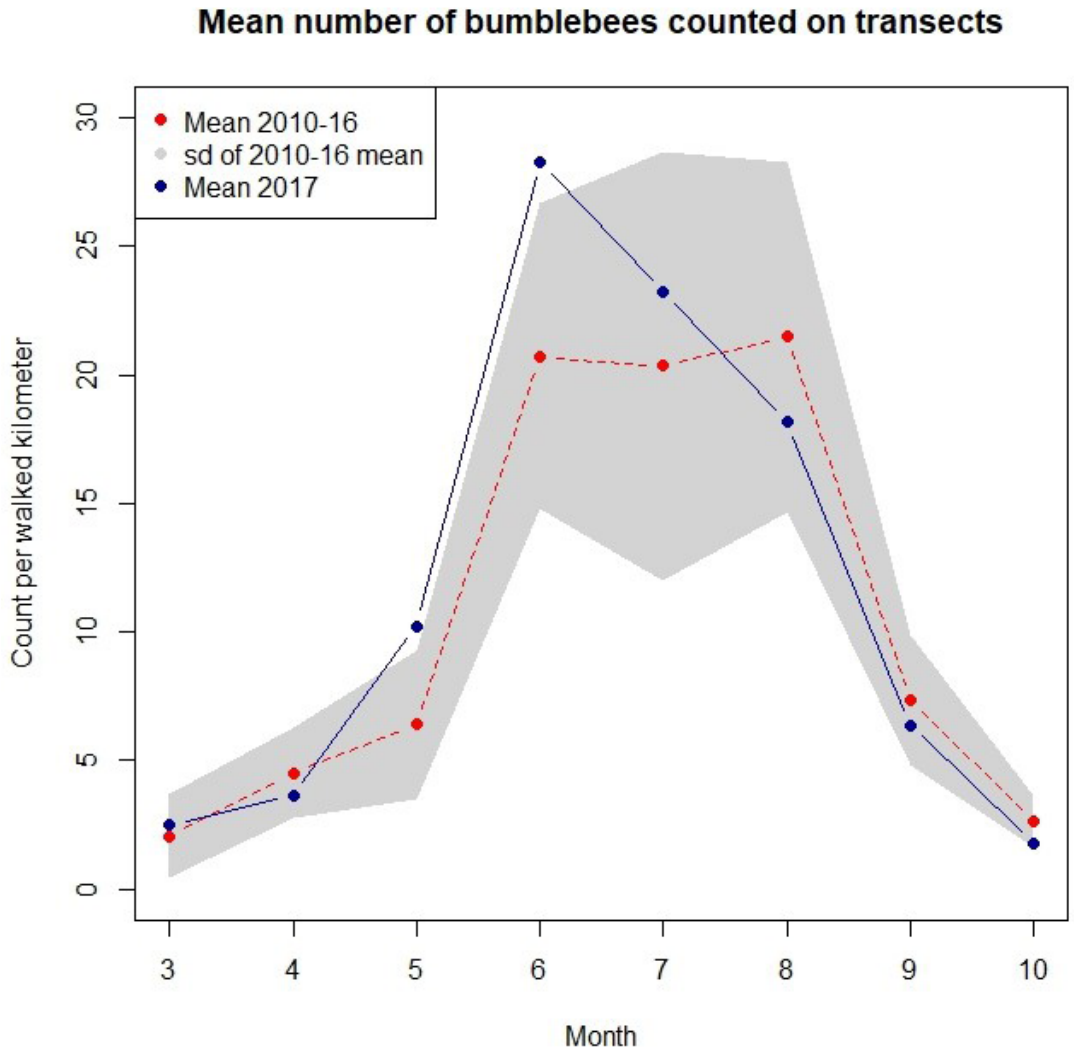


26

2017

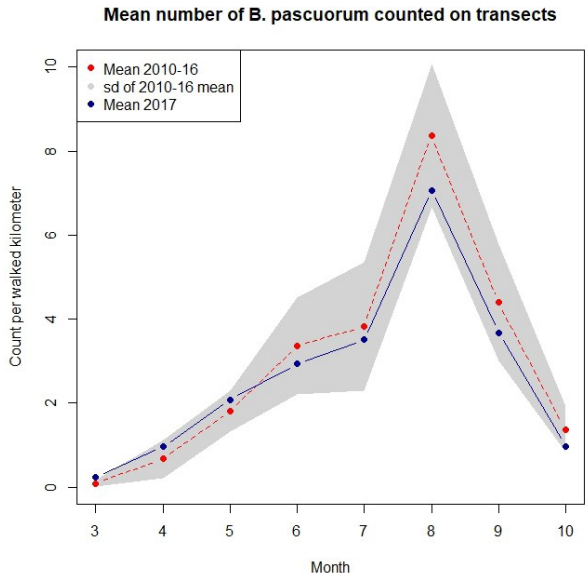
For most bumblebee species, the warm spring and stupendously hot June saw an above-average late spring and early summer period. Most species then slumped to a below-average late-summer period, though this trend was reversed for some late-emerging conservation priority species: *B. humilis, B. ruderatus* and *B. sylvarum* all had unusually high August abundances.

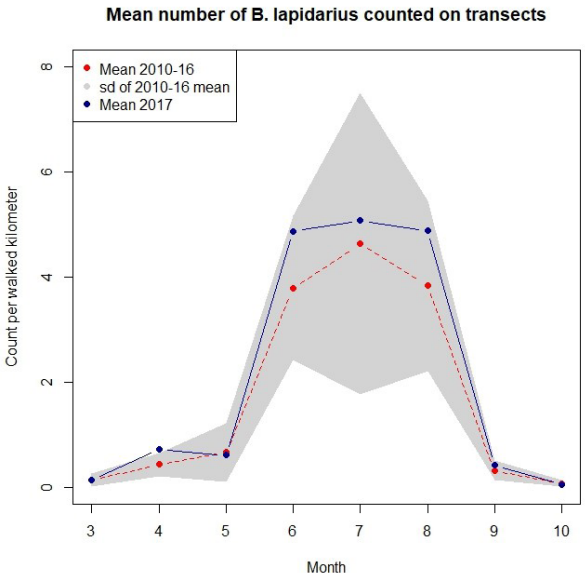
Both *B. hypnorum* and *B. lapidarius* had almost completely above-average years: by contrast, *B. hortorum* and *B. pascuorum* rarely reached their average monthly counts from previous years. Both these latter two are mid- to late-emerging species, and it may be that their vital colony-establishment times coincided with a lack of flowers during the June hot spell.

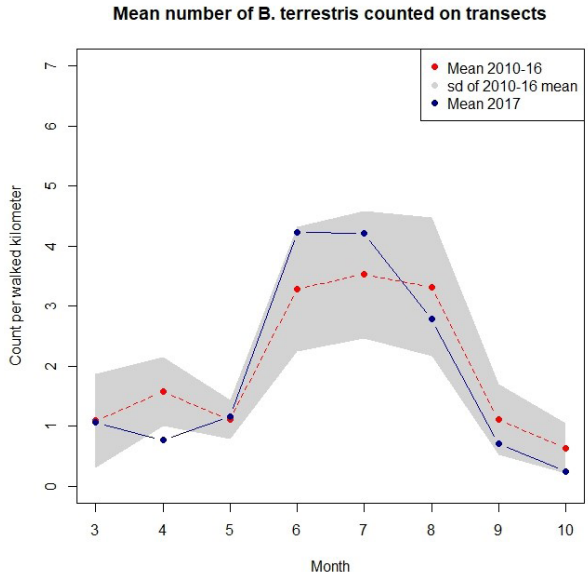


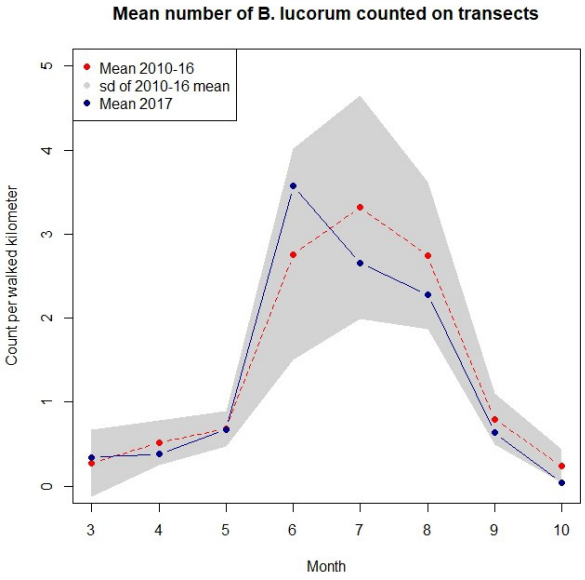
The mean number of total bumblebees per kilometre per month between March and October 2017 (blue line), plotted against the average monthly abundance for the seven-year period 2010-16 (red line). The grey cloud indicates the variability of the 2010-16 average – where the blue (2017) line is outside this grey area the count is significantly different to what would be expected.

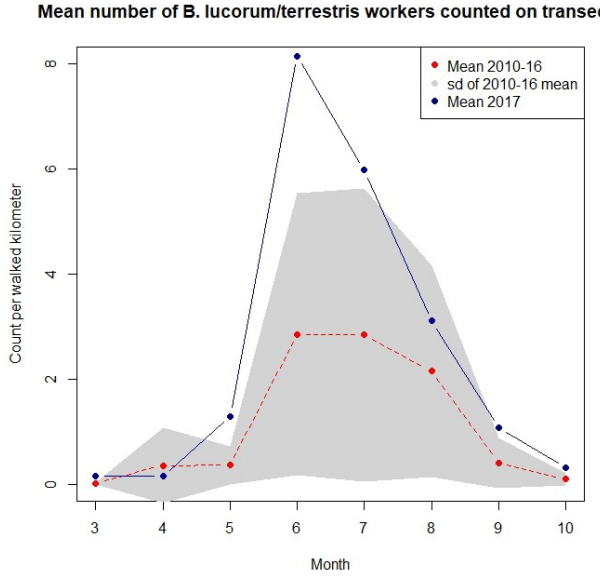
Widespread bumblebee species











Abundance trends for widespread British bumblebee species 2010-17, 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).

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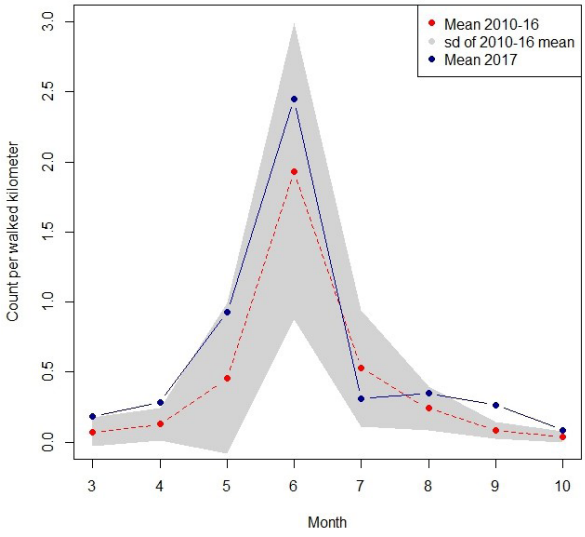
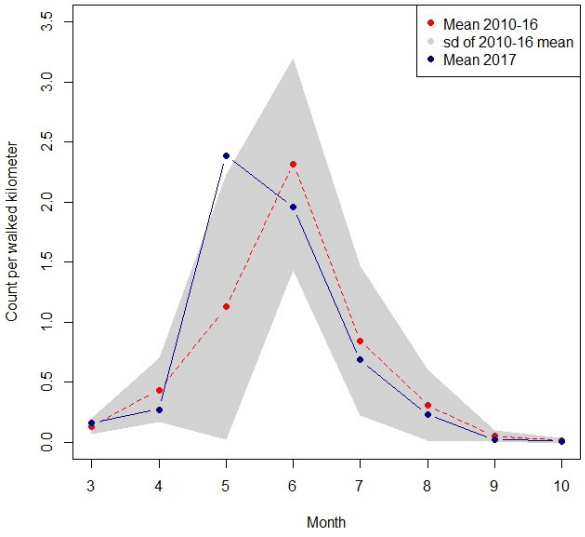
Bombus lucorum & B. terrestris often cannot be reliably split as workers, so records submitted as 'B. lucorum/terrestris workers' are plotted in addition to both species.

Widespread bumblebee species

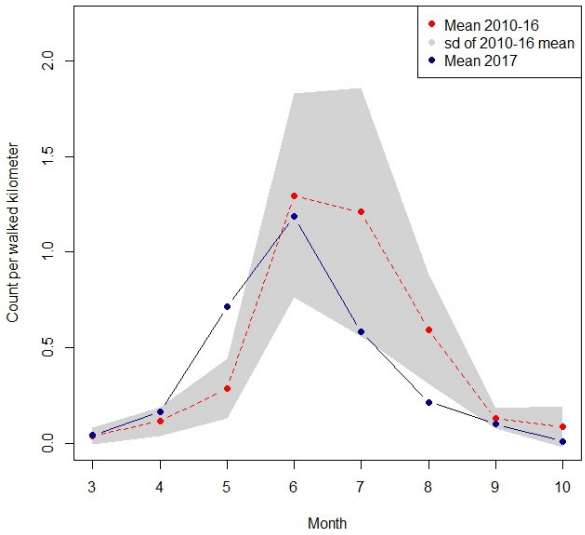
Mean number of B. hypnorum counted on transects



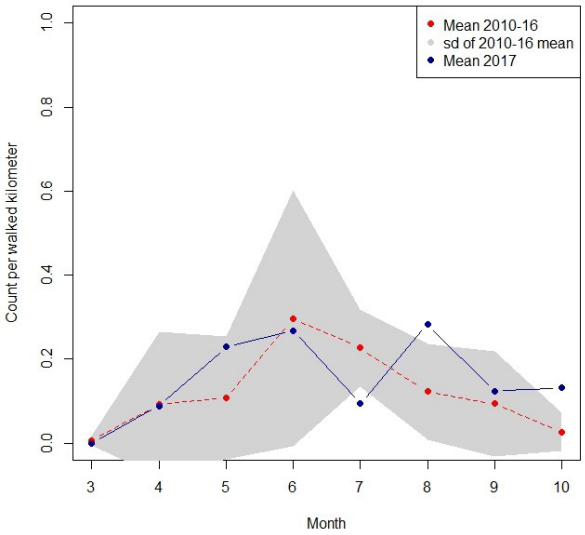
Mean number of B. pratorum counted on transects



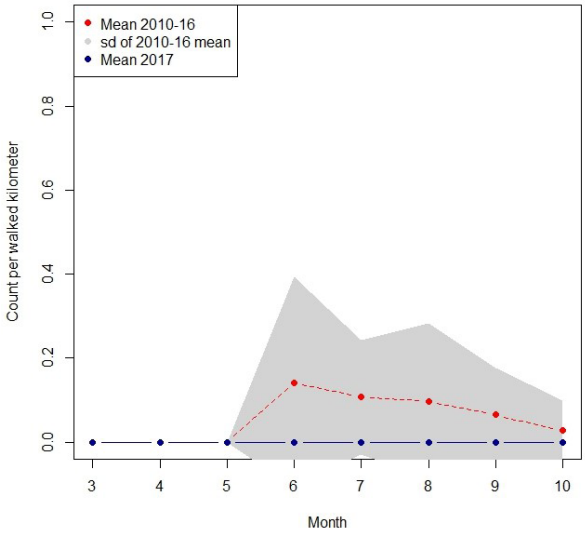
Mean number of B. hortorum counted on transects



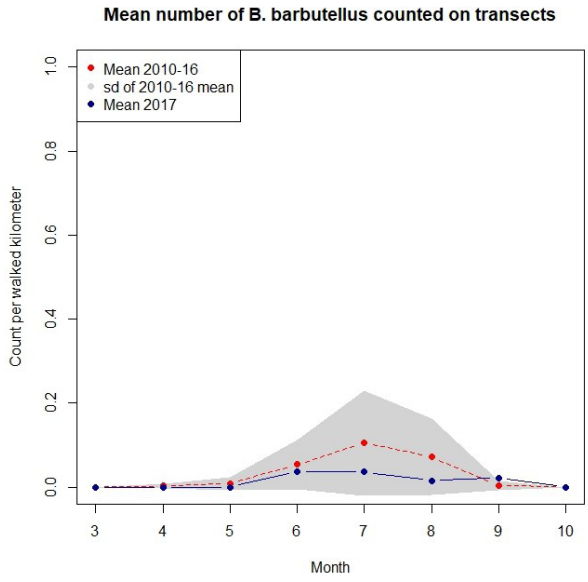
Mean number of B. jonellus counted on transects

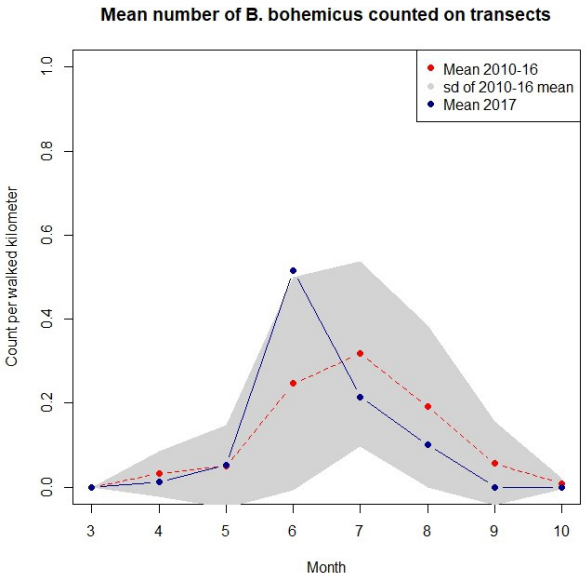


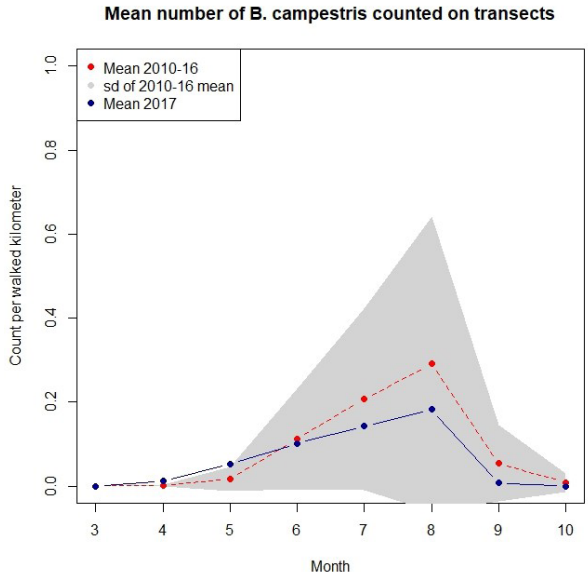
Mean number of B. soroeensis counted on transects

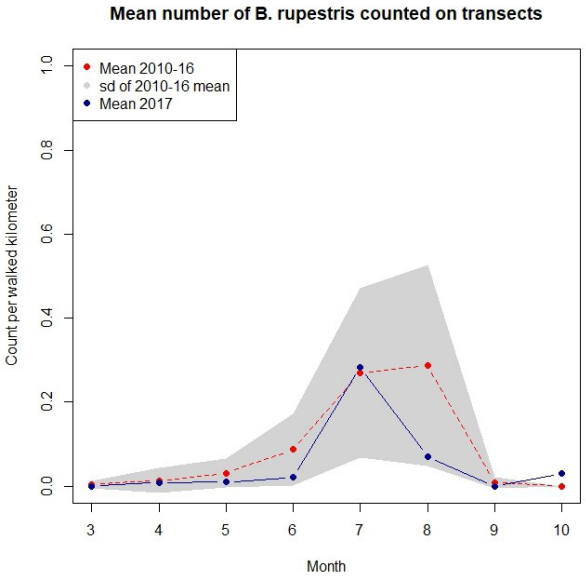


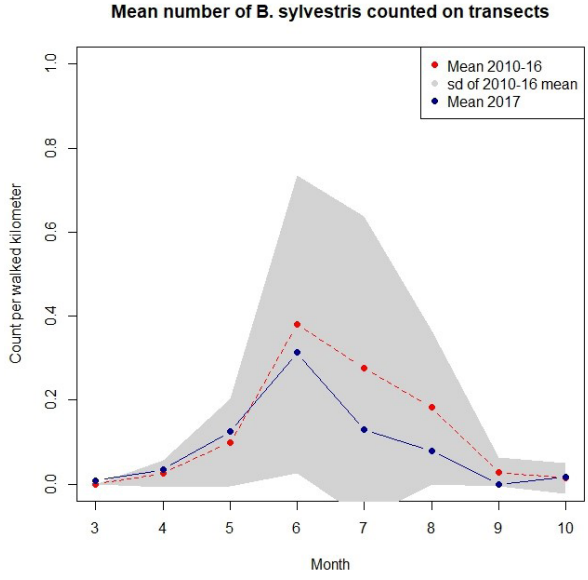
Cuckoo bumblebees

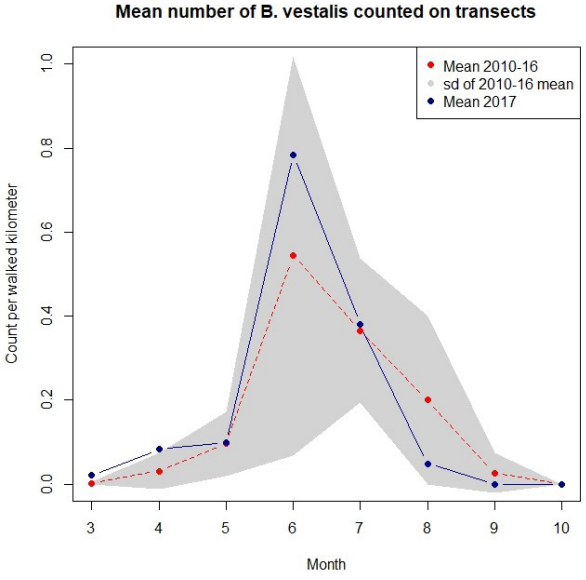






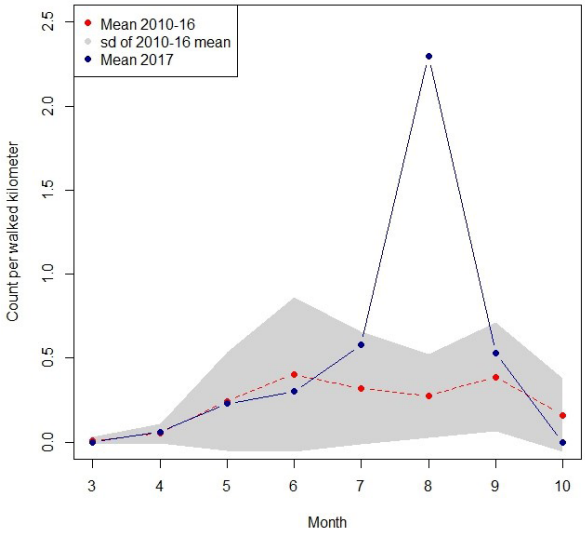




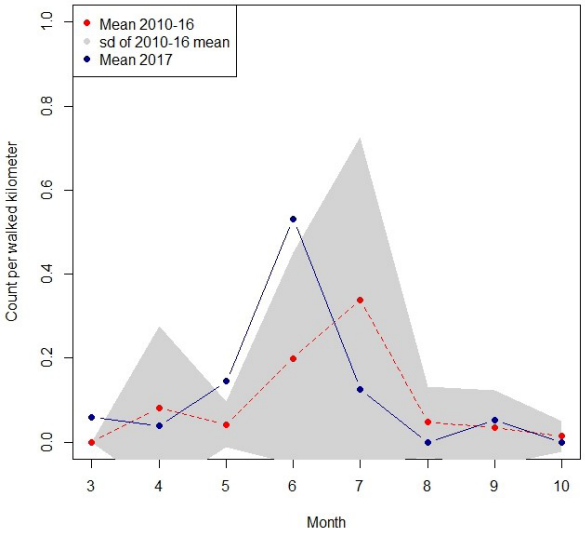


Conservation priority species

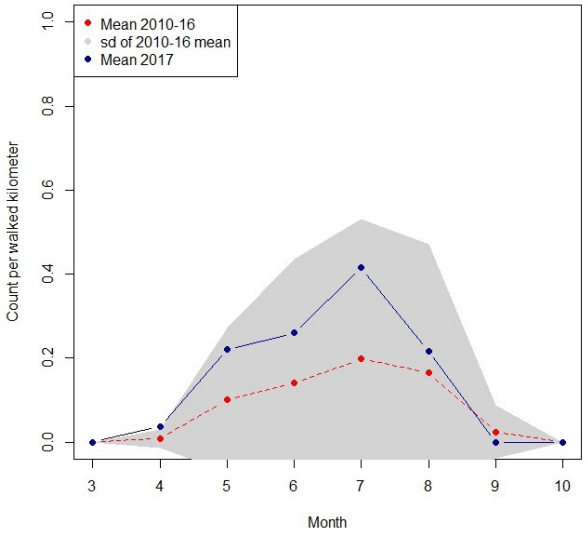
Mean number of B. humilis counted on transects



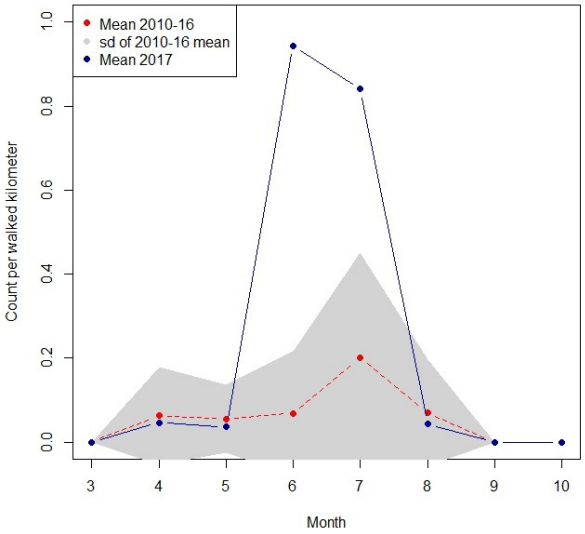
Mean number of B. monticola counted on transects



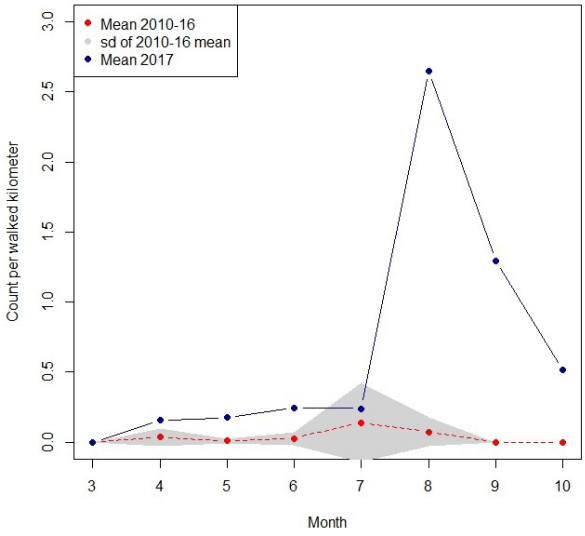
Mean number of B. muscorum counted on transects



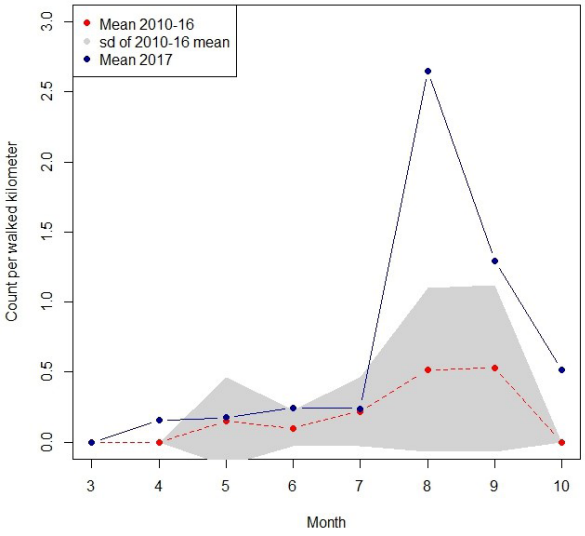
Mean number of B. ruderarius counted on transects



Mean number of B. ruderatus counted on transects



Mean number of B. sylvarum counted on transects



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