Big Wasp Survey Summary Update 2019

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www.bigwaspsurvey.org

It's been a fabulous three years of Big Wasp Survey! Here's an update of what we've achieved, what we're doing with the data and where we're going next. Huge thanks all our participants and sponsors, for making this project such a success! We hope you find these results interesting and informative, and we look forward to your continued support.

Why We Need the Big Wasp Survey

The Big Wasp Survey is a citizen science project that was set up in the UK in 2017 by Prof Adam Hart (University of Gloucestershire) and Dr Seirian Sumner (UCL). The aim was to engage the public in a project that tackled the negative attitudes people have towards wasps and improved our understanding of wasp biology, diversity and distributions across the UK. Although we had big ambitions for the Big Wasp Survey we weren't really sure how it would all pan out. But the enthusiasm of so many citizen scientists and the spread of #wasplove across the late summer meant our ambitions were exceeded!

Unlike honeybees, social wasps are little studied, and the important ecosystem services they provide – as natural predators that regulate populations of other insects and arthropods – is largely unappreciated. The Big Wasp Survey asked members of the public to make a simple wasp trap, hang it in their garden for seven days, and then send in the trap contents to the scientists in order that the wasps could be identified.

Wasps targetted by the Big Wasp Survey. Vespa crabro *(Patrick Kennedy);* Vespula vulgaris *(FrankHornig_Ownwork_CC BY-SA 3.0)*

Why Killing the Wasps is Necessary and Ok

Wasps are difficult to identify to species level without killing them; it takes a good hand-lens or microscope and a trained eye to distinguish even the nine species we find in the UK. However, the Big Wasp Survey is designed to minimise impact on wasp populations: it is timed so that it attracts only workers – indeed, we have not found a single queen among the thousands of wasps that have now been processed. The traps do not attract males. You can read more about the issues around lethal sampling of insects here and here, or listen to Prof Hart's Radio 4 programme here.

2017 Results

Big Wasp Survey Generates High Quality Data on Wasp Distributions

Thanks to everyone's help, and to some serious wasp sorting over the winter, we were able to publish the first BWS scientific paper in the journal *Insect Conservation and Diversity*. The main findings are summarised below (apologies – we couldn't afford the open access fees for the journal).

The 2017 survey ran from 26th August to 10th Sept; 2377 people registered to take part, and 54.4% (1294) of these people submitted their results. Of these, 551 traps (42.5%) contained wasps, representing 548 postcodes across the UK; 6680 wasps could be identified to species level; a further 180 wasps from 39 traps were too damaged to identify.

Three species dominated: the common yellowjacket wasp *Vespula vulgaris* accounted for 44% of wasps (2942 wasps in 407 traps); the German yellowjacket wasp *Vespula germanica* accounted for a further 44%. (2974 wasps in 251 traps); and the European hornet *Vespa crabro* accounted for 6% of the sample (395 wasps in 100 traps) (see Fig 1). We also detected small number of *Vespula rufa* (2 in 2 traps) and *Dolichovespula media* (9 wasps in 6 traps).
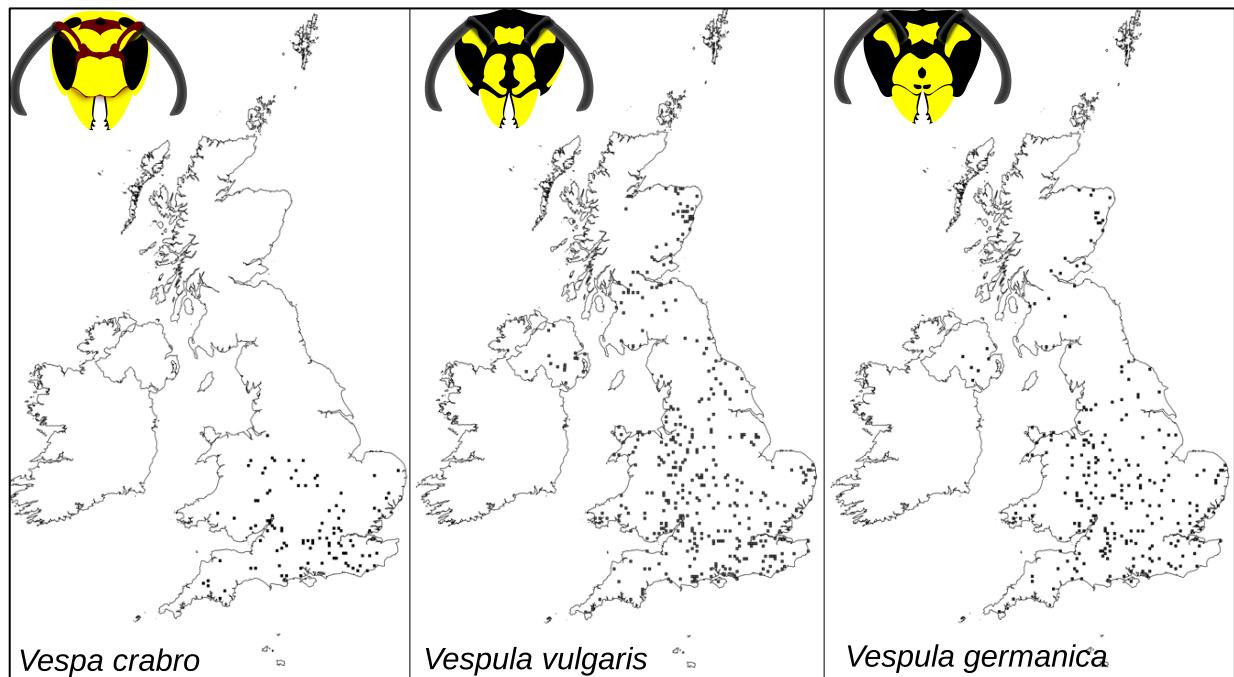

Vespa crabro   *Vespula vulgaris*   *Vespula germanica*

Figure 1: Plots of species distribution from 2017 sampling

By comparing with a long-term dataset of the same species collected by members of the Bees, Wasps and Ants Recording Scheme (BWARS), we were able to show that the quality of the data being generated by the Big Wasp Survey is excellent. It is less spatially biased than BWARS data (meaning that Big Wasp Survey is sampling wasps more evenly across the UK), and the species distribution maps obtained from just two weeks Big Wasp Survey sampling generated similar maps to the long-term dataset, suggesting that our data make biological sense.

2018 Results

More Citizen Scientists and More Wasps!

The 2018 survey ran from 25th August to 8th Sept; 4956 people registered to take part, and 51.69% (2562) of these people submitted their results; 73 records contained missing information (e.g. no/incorrect postcode). Of the remaining 2486 records (representing 2258 unique postcodes); 1779 traps (71.53%) contained wasps. To date 17,933 wasps from 1263 traps have been identified to species level; thanks to the efforts of our volunteers (see acknowledgements) the remaining 516 traps will be finished by the end of August 2019; we will then report on the number of species recorded and their abundances.

2018 outputs

In 2017, we were largely interested in finding out how good the survey was at generating high quality data in large enough amounts to be useful. The answer is: it's brilliant, thanks to you! We are using the 2018 datasets to improve on the methods and to maximise scientific output from the survey. Here are some of the problems we have identified, and how we're working this year to solve them.
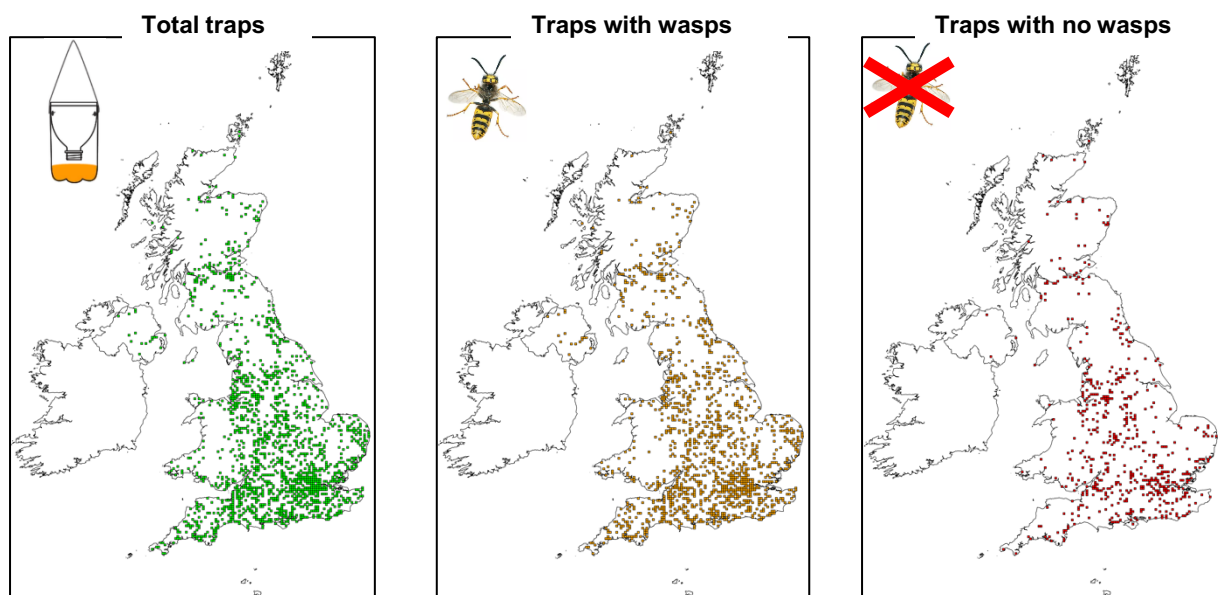

Figure 2: 2018 data: All traps; traps that caught wasps; traps that did not catch any wasps

Under-represented Areas of the UK: Wales, Ireland and Rural Areas

Although the Big Wasp Survey is generating data that is dispersed across the UK more evenly than other recording schemes, we still have a long way to go before we can use the data to determine what type of habitats different wasp species like, and how land use (e.g. farming, pesticides, urban pollutants) are affecting their populations. Our analyses now clearly identify three areas that are going un-sampled. These are Wales, Northern Ireland and the more remote wild spaces around the UK (e.g. Peak District, Lake District, Highlands) (see Fig 2). The latter is understandable as we have previously requested that people place traps in their gardens: indeed the vast majority of samples in 2017 and 2018 were in built-up areas. But the lack of sampling in Wales and Northern Island, and to some extent Scotland, suggests that our media campaigns are not reaching those areas, and/or we are failing to engage with the right messages.

In 2019 we actively tried to address these issues. Samplers were asked to check on our website prior to placing a trap to see if samples from their postcodes are required. We also set up new collaborations with organisations like the National Trust, with the hope of increasing the number of traps in more remote regions. Finally, we asked some of our long-standing samplers to place an extra trap in a wild place, near to their home. We hope that these approaches will help us improve the spatial sampling of wasps across all land types and regions of the UK.

Sampling to Improve the Data Analysis

Having collected wasps in your garden tells us that specific wasps are present in your area. However, the absence of a wasp species in your garden could mean that species is not there, or that your trap simply didn't catch it (this is called a non-detection error). Another problem is how to use the abundance data (i.e. how many wasps of each species you caught in your trap). To address this problem, we are asking a subset of our samplers to place out two or more traps in the same location: this will allow us to calculate the statistical likelihood that the absence of a wasp is a true absence, or just a non-detection error.

You might have caught 10 *V. vulgaris* in your trap, but the garden down the road only caught 1: is this because you have more wasps in your garden (e.g. you have the right prey available for them/you have a nest nearby), or is it something to do with the type of bottle or capture fluid you used? Standardising methods is a key challenge for citizen science projects: we want it to be easy for you to take part – using whatever bottle/beer/juice you have available will make it easy. This summer we are conducting a controlled experiment to determine how the type of fluid used in your trap affects the attractiveness/effectiveness of capturing wasps. Watch this space…

Minimising by-catch (non-wasps)

You may have noticed that your trap perhaps caught some insects that were not social wasps. This is called the 'by-catch' – the stuff that we catch by accident and that we don't really want. We've analysed the by-catch from 2017 and are pleased to say that the vast majority of it consists of scavenging flies (the type you swat in your kitchen everyday). We caught hardly any pollinators (bees, hover flies), and we had just a splattering of moths. Where possible, we have passed on our by-catch to other specialist insect researchers so they have not gone to waste. Whilst we can reassure ourselves that our methods are not adversely affecting the insect populations, we would rather improve our method so it is more specific to wasp-catch, and minimises by-catch. We are addressing this exact question in controlled experiments this year to find out which fluid type maximises wasp-catch and minimises by-catch. Watch this space…

Public Workshops to Help Identify the Wasps

As an unfunded project, we do not have a large team of experts to process and identify the thousands of insects you send us. To help us process the large sample sizes in 2018, we engaged members of the public in wasp identification and sorting workshops, hosted at UCL, the Natural History Museum, The Field Studies Centre (Bushy Park), and Dinton Pastures (see acknowledgements).

Ten workshops were held, each with 10-20 members of the public. We provided a training session for the participants before letting them loose on the wasp samples. Collectively, they helped identify 11,223 wasps from 644 traps. We checked the wasp IDs from 115 of these traps, to estimate the error rates in identification; we were delighted to find that the public are generally very good at their wasp identification, after training. Only 4% of *V. vulgaris* and 16% of *V. germanica* were misidentified. All of the hornets were correctly identified. We are working on improving our workshop training tools for the public, to reduce these errors further. These workshops have enriched the degree to which we are dressing some of our key aims of the Big Wasp Survey: to engage the public with social wasps and improve the public's perception and appreciation of wasps and their role in the ecosystem.

Fig. 3: Big Wasp Survey public insect sorting and identification workshops, 2018

2019 Survey Data - Ongoing

This year BWS took a different approach. We contacted those of you that took part in 2017 and/or 2018 and asked you to be "super samplers". We then opened up registration to people in specific postcodes: you could check if your postcode was needed, online. This sampling approach gave us better data for fewer wasps, which is an important consideration for BWS, and also allows us to be more targeted in where we sample across the UK. We apologise to those of you who wanted to take part, but didn't quality as a 'super sampler' and/or you're not in one of our under-represented postcodes for 2019 - we hope you understand that we need to sample only what is needed. Please continue to spread the *#wasplove*, and look out for our call for wider participation in future years of the Big Wasp Survey!

Here's a summary of 2019 participation – we're still sorting the wasps!

Added Scientific Value from Big Wasp Survey

We could never have anticipated the enthusiasm and success of the Big Wasp Survey when we set it up in 2017. Citizen science projects which involve considerable input like this, rarely retain 50% of those who sign up to it; this is especially surprising for an uncharismatic organism like the wasp! The credit goes to the public for making this such an unprecedented success.

Whilst our original scientific aim was to set up a recording scheme to map the diversity and distributions of social wasps in the UK, several other projects are now in progress, using these samples. We've successfully extracted DNA from the wasps you sent us, and are now using genetic methods to study the population genetic structure of the three main species across the UK. This will tell us how far wasps travel from their natal nest, how much populations are mixing and whether land-use affects wasp movements and populations; a subset of wasps was sent to New Zealand for them to use in a comparison with the invasive populations of British wasps they have there. An exciting collaboration with a team in Finland is using your wasps to determine their usefulness as biological indicators of pollutants (e.g. heavy metals).

Student projects on the Big Wasp Survey (from top LHS, clockwise): Sarah Raby Buck, Preslava Michorova, Peggy Bevan, Shaughn Anderson, Elo Wilkinson-Rowe and Theo Isaac (aged 2).

Acknowledgments

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Wasp art by the littlest wasp-fans of the Big Wasp Survey
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