Bugs Matter citizen science survey County Report 2022: Kent

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Since 2021, a total of 551 citizen scientists in Kent have signed up to the Bugs Matter app and recorded 2084 journeys. Compared to 2004, the results show a decrease in the number of insect splats in Kent of 66.9% in 2019, 71.3% in 2021, and 73.8% in 2022.

Journeys

In 2004, 7747 insects were sampled over 632 journeys comprising 34270 miles. In 2019, 1018 insects were sampled over 518 journeys comprising 9100.30 miles. In 2021, 560 insects were sampled over 378 journeys comprising 8890.04 miles. In 2022, 818 insects were sampled over 556 journeys comprising 11854.95 miles (Figures 1-3).

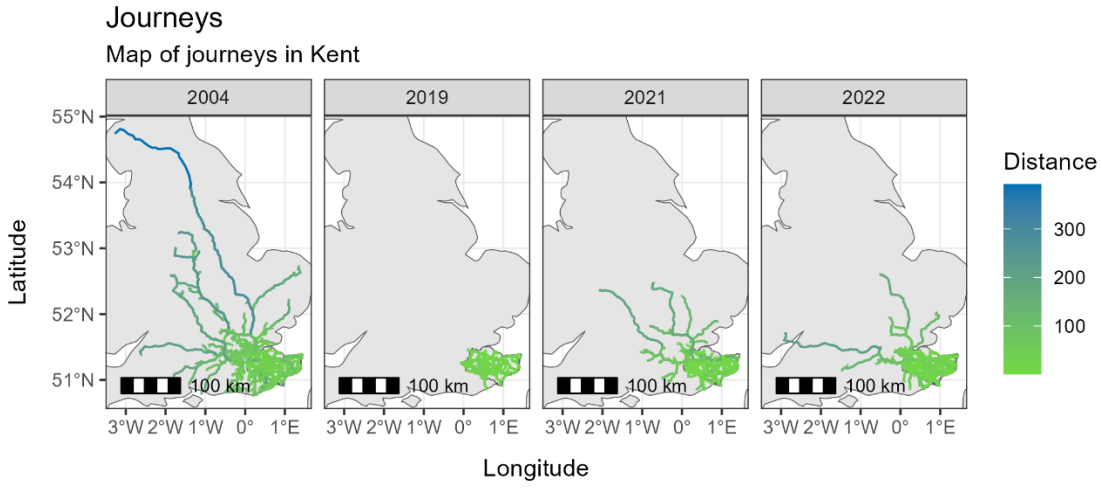

Figure 1

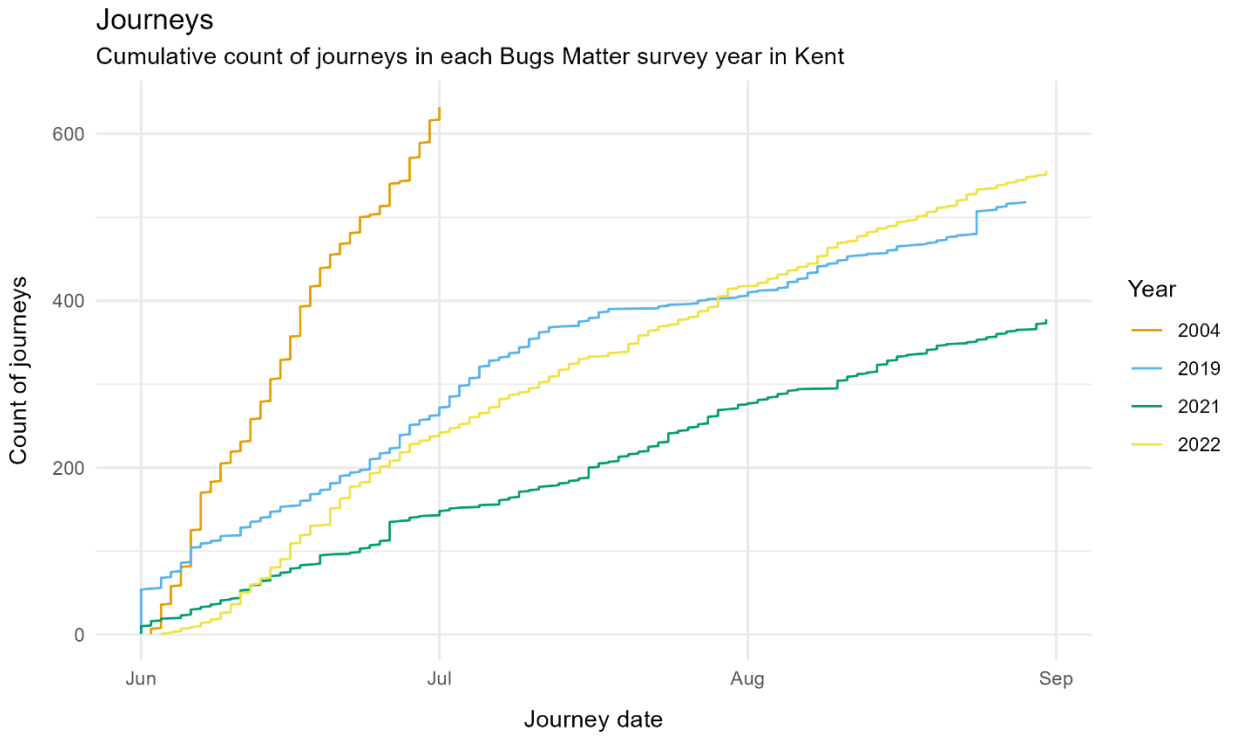

Figure 2

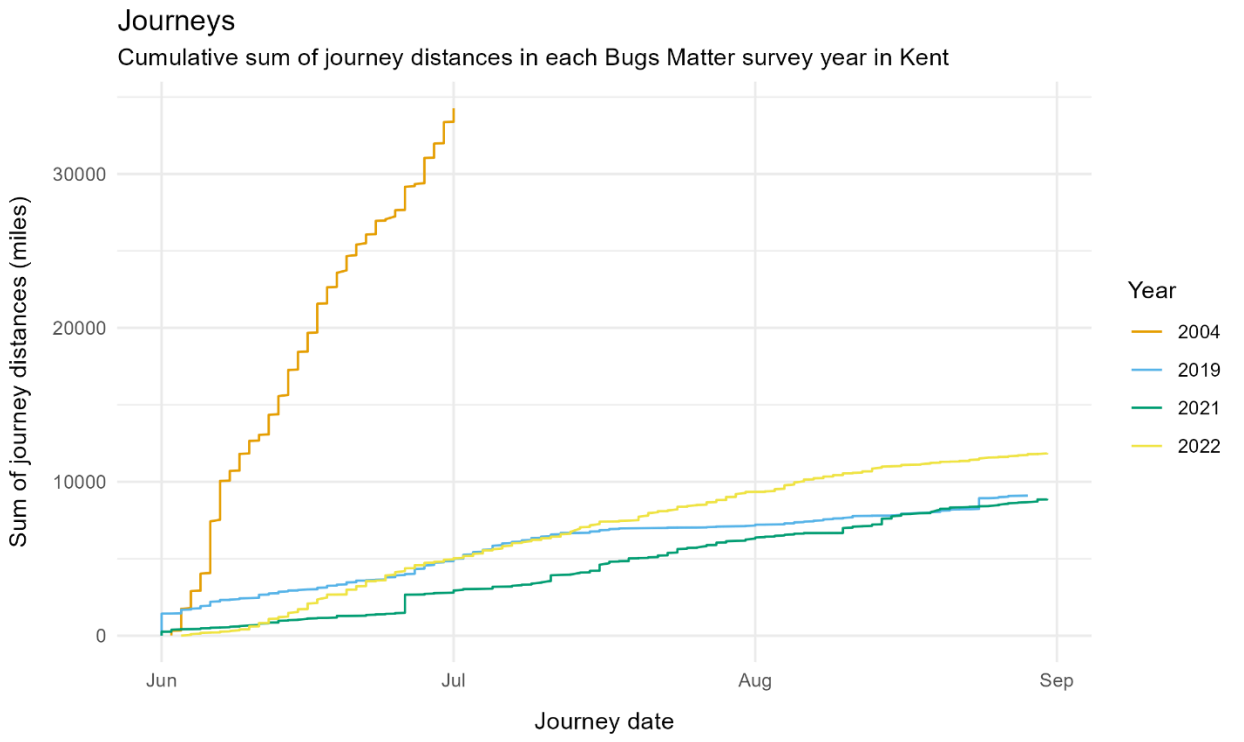

Figure 3

The number of journeys recorded in each UK county via the Bugs Matter app are shown in Table1. The most journeys were recorded in Kent (934), followed by Gwent (522), and then Essex (519). These were counties where Kent Wildlife trust had partnered with the local Wildlife Trusts to promote the survey, highlighting the effectiveness of these collaborations. Both Kent and Gwent saw the highest increases in the number of journeys between 2021 and 2022 (178 cumulatively), followed by Cambridgeshire (117). Journeys are yet to be recorded in six counties. Whilst journeys of all distances are valuable, short journeys can help to build a better picture of insect population trends at the county scale, especially if they cover a variety of land-use types

Table 1. The number of journeys recorded in each UK county via the Bugs Matter app

County	2004	2019	2021	2022	bugsmattertotal
Aberdeenshire	65	NA	6	40	46
Angus	15	NA	0	0	0
Argyll and Bute	22	NA	14	8	22
Ayrshire and Arran	31	NA	7	4	11
Banffshire	2	NA	0	7	7
Bedfordshire	177	NA	19	36	55
Berkshire	325	NA	19	33	52
Berwickshire	11	NA	3	0	3
Bristol	1	NA	7	5	12
Buckinghamshire	143	NA	20	45	65
Caithness	10	NA	1	1	2
Cambridgeshire	508	NA	69	186	255
Cheshire	245	NA	27	59	86
City of Aberdeen	6	NA	0	3	3
City of Dundee	2	NA	0	3	3
City of Edinburgh	34	NA	0	3	3
City of Glasgow	5	NA	10	16	26
Clackmannan	18	NA	0	0	0
Clwyd	171	NA	32	34	66
Cornwall	168	NA	44	64	108
Cumbria	271	NA	91	33	124
Derbyshire	188	NA	47	73	120
Devon	536	NA	116	74	190
Dorset	305	NA	22	33	55
Dumfries	16	NA	0	3	3
Dunbartonshire	26	NA	4	3	7
Durham	120	NA	7	49	56
Dyfed	156	NA	53	31	84
East Lothian	33	NA	5	2	7
East Riding of Yorkshire	163	NA	11	35	46
East Sussex	171	1	36	36	72
Essex	569	NA	242	277	519
Fife	43	NA	8	4	12

Gloucestershire	411	NA	157	68	225
Greater London	83	NA	30	47	77
Greater Manchester	79	NA	49	80	129
Gwent	111	NA	172	350	522
Gwynedd	100	NA	10	10	20
Hampshire	1055	NA	111	115	226
Herefordshire	71	NA	28	36	64
Hertfordshire	390	NA	45	73	118
Inverness	29	NA	15	36	51
Isle of Wight	23	NA	3	4	7
Kent	632	518	378	556	934
Kincardineshire	24	NA	0	5	5
Lanarkshire	71	NA	10	7	17
Lancashire	259	NA	25	38	63
Leicestershire	264	NA	73	55	128
Lincolnshire	271	NA	50	59	109
Merseyside	46	NA	8	17	25
Mid Glamorgan	26	NA	6	13	19
Midlothian	4	NA	0	0	0
Moray	17	NA	0	5	5
Norfolk	535	NA	75	166	241
North Yorkshire	486	NA	76	101	177
Northamptonshire	289	NA	65	23	88
Northumberland	138	NA	19	34	53
Nottinghamshire	168	NA	19	15	34
Orkney	4	NA	0	0	0
Oxfordshire	415	NA	158	95	253
Perth and Kinross	172	NA	14	19	33
Powys	130	NA	17	34	51
Renfrewshire	11	NA	2	0	2
Ross and Cromarty	41	NA	19	11	30
Roxburgh, Ettrick and Lauderdale	28	NA	12	9	21
Rutland	5	NA	0	4	4
Shetland	1	NA	0	0	0
Shropshire	205	NA	24	63	87
Somerset	459	NA	113	104	217
South Glamorgan	9	NA	14	17	31
South Yorkshire	94	NA	27	81	108
Staffordshire	268	NA	41	72	113
Stirling and Falkirk	53	NA	14	30	44
Suffolk	229	NA	83	112	195
Surrey	527	NA	48	69	117

Sutherland	12	NA	9	6	15
The Stewartry of Kirkcudbright	8	NA	1	1	2
Tweeddale	6	NA	1	1	2
Tyne & Wear	29	NA	0	0	0
Warwickshire	220	NA	30	42	72
West Glamorgan	37	NA	2	11	13
West Lothian	6	NA	3	3	6
West Midlands	88	NA	35	7	42
West Sussex	320	NA	27	18	45
West Yorkshire	256	NA	82	43	125
Western Isles	1	NA	0	2	2
Wigtown	3	NA	1	1	2
Wiltshire	258	NA	31	55	86
Worcestershire	287	NA	31	34	65

Splat counts

Across all years in Kent, 38.9% of journeys recorded zero insect splats. Zero insect splats were sampled in 10.4% of journeys in 2004, 51.4% of journeys in 2019, 51.9% of journeys in 2021, and 50.9% of journeys in 2022. Across the Bugs Matter survey years, 51.3% of journeys recorded zero insect splats, 19.1% of journeys recorded one insect splat, 9.3% of journeys recorded two insect splats, and 6.6% of journeys recorded three insect splats, whilst 13.7% of journeys recorded four or more insect splats (Figure 4).

The proportion of journeys that record zero insect splats in a given year is likely to be related to the abundance or activity of insects, such that low insect abundance or activity will result in more journeys that record zero insect splats. This has implications for the Bugs Matter sampling approach, because at low insect abundances, the probability of insects colliding with number plates decreases. Therefore, the sensitivity of the sampling approach must be increased in order to detect changes in the abundance of small or reduced insect populations, which may continue to shrink under current rates of biodiversity loss. The sensitivity of the sampling approach can be increased simply by increasing the sampling area of the number plate. For this reason, the Bugs Matter survey will discontinue the use of splatometers, and instead utilize the entire number plate as the sampling area, which is a standard size in the UK and approximately four times the size of the sampling area when using a splatometer. Custom number plates, or number plates in other countries which have different dimensions, can still be used, but the dimensions of the number plate must be submitted via the app.

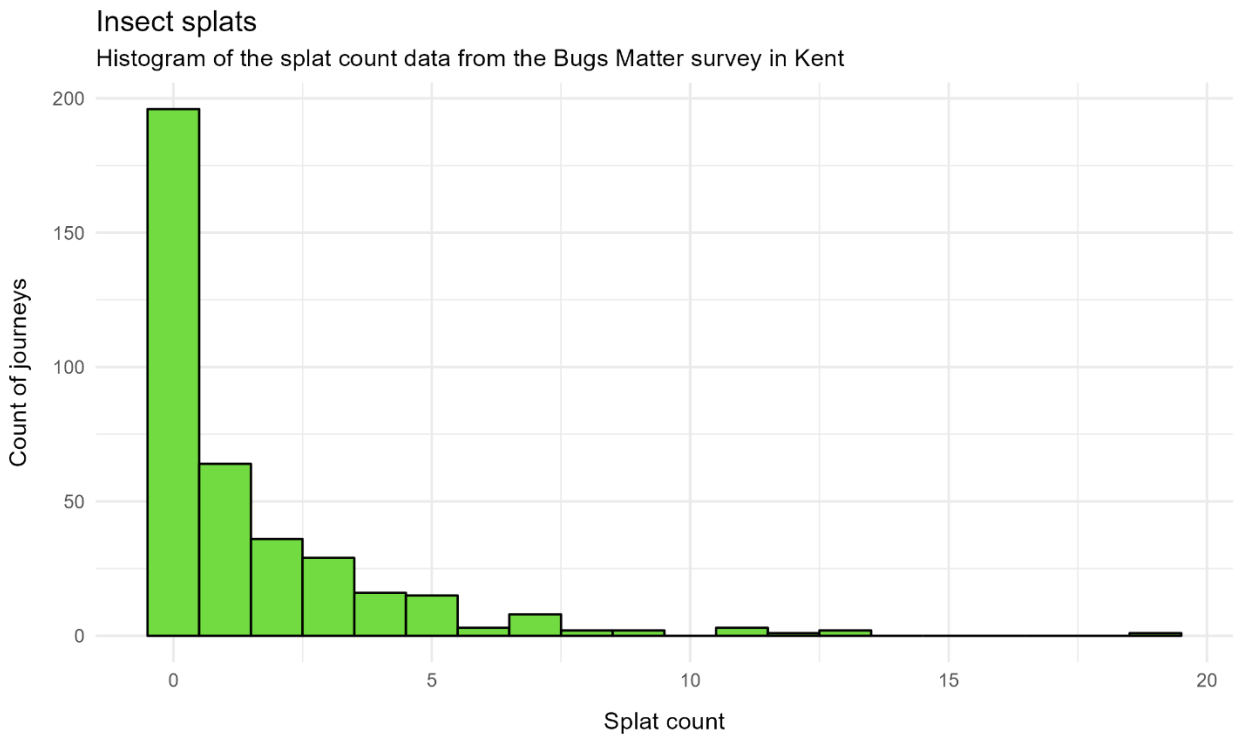

Figure 4

Splat rates

In Kent, the average splat rate was 0.226 splats per mile in 2004, 0.108 splats per mile in 2019, 0.093 splats per mile in 2021 and 0.062 splats per mile in 2022 (Figure 5). The overall spread of the insect splat rate data is shown in Figure 6, and the high proportion of journeys with very few bug splats can be clearly seen. The spread of the insect splat rate data for each year is shown in Figure 7. A heat map shows mean splat rates for each year by county (Figure 8). It is important to note that simply comparing mean splat rates over time or between countries is not analytically sufficient to draw conclusions, because a range of other climatic and environmental factors, as well as those associated with the sampling methods, are not taken into account. This is one key reason that using statistical modelling for this analysis is important.

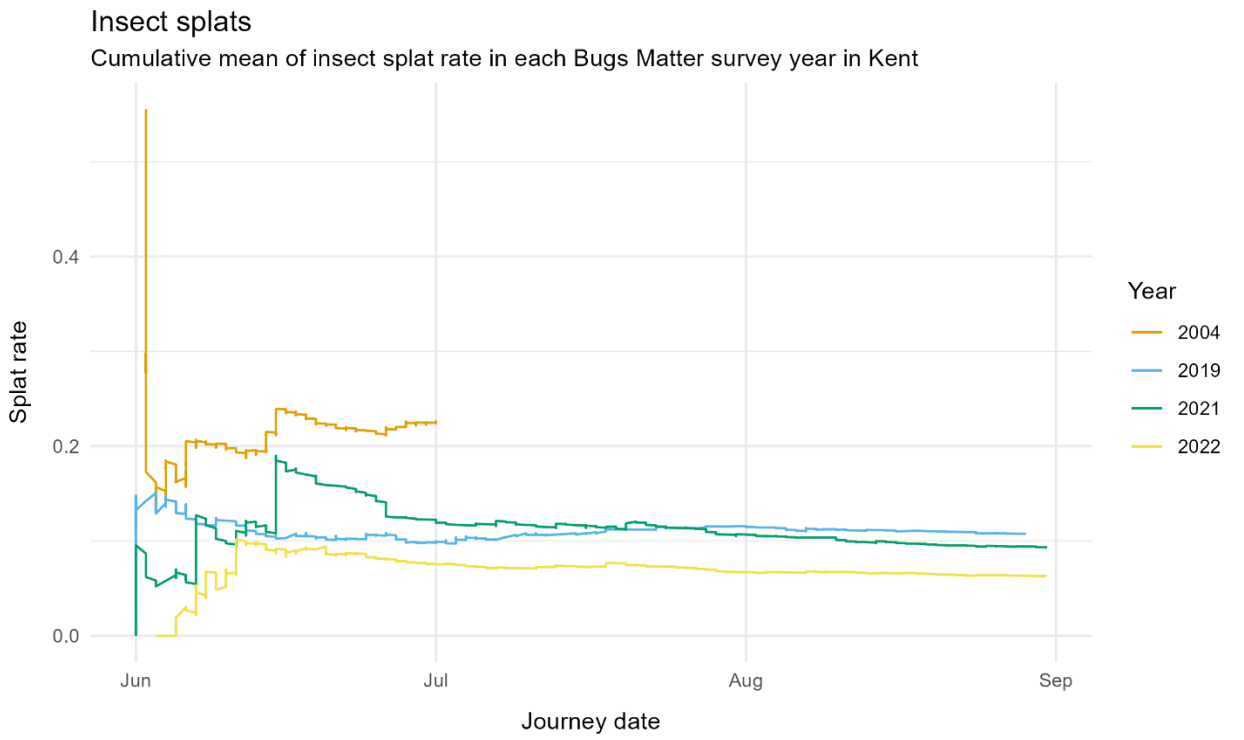

Figure 5

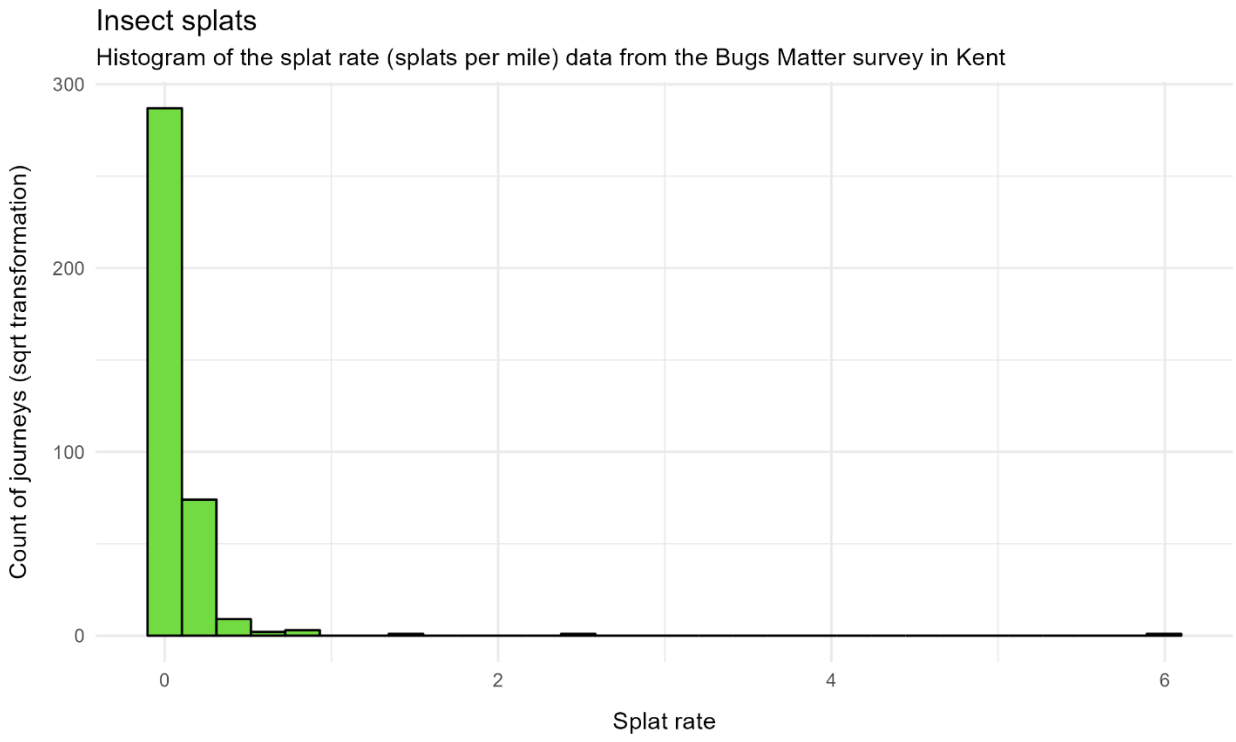

Figure 6

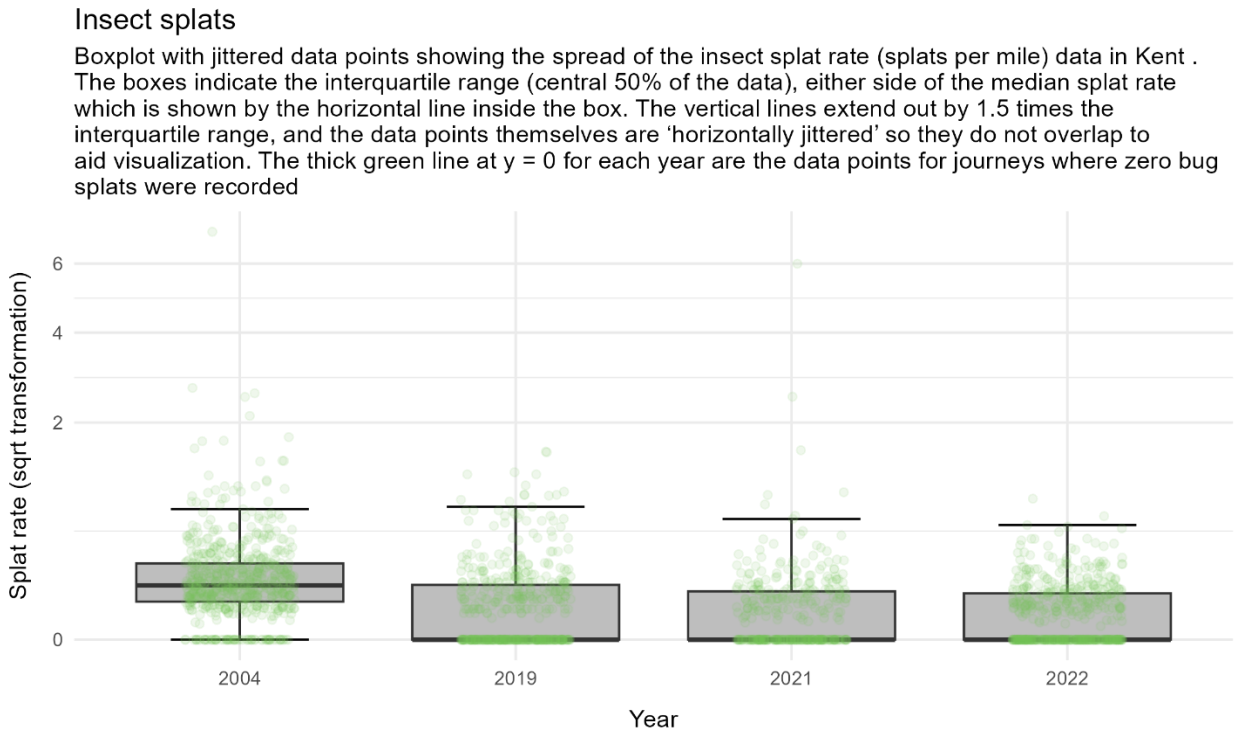

Figure 7

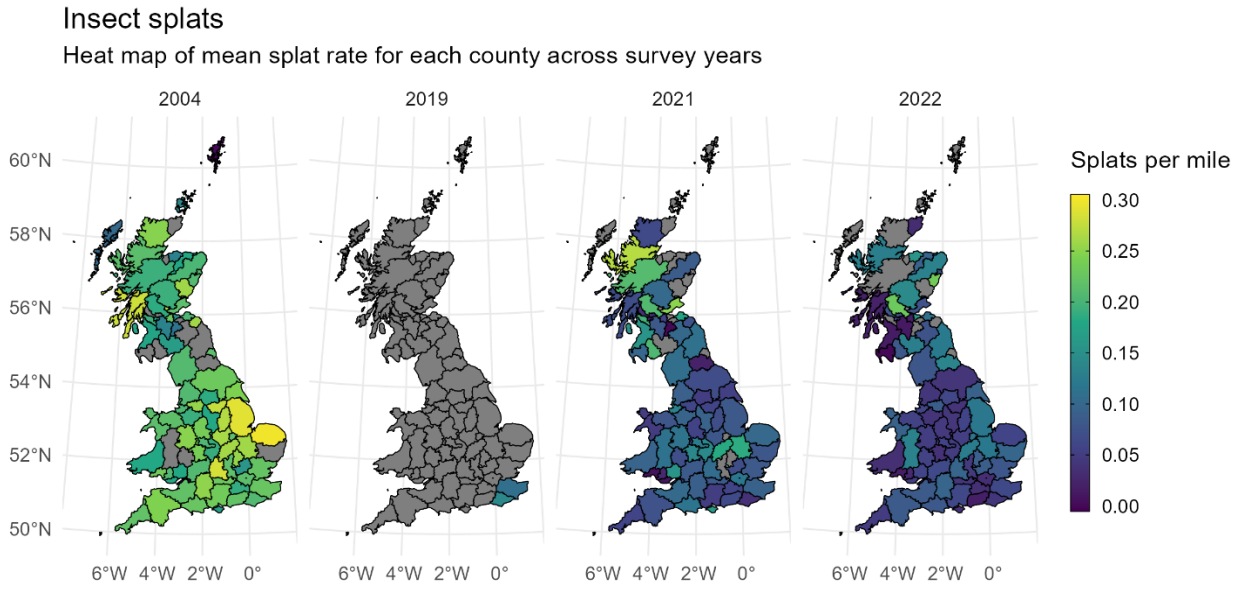

Figure 8

Vehicle types

The majority of journeys in Kent (97.4%) were undertaken in a car with the remainder being undertaken in HGVs, SUVs, or vans (Table 2).

Table 2. The number of journeys undertaken in each vehicle type in each survey year in Kent.

Vehicle type	2004	2021	2022
Car	600	373	551
HGV	12	0	0
SUV	0	2	3
Van	20	3	1

Results of the negative binomial (NB) statistical modelling

The results of the NB model for Kent show a 66.9% (95% CI [59.1%, 96.1%]) reduction in the number of insect splats in 2019 (44.6%/decade), a 71.3% (95% CI [64.9%, 76.6%]) reduction in the number of insect splats in 2021 (41.9%/ decade), and a 73.8% (95% CI [68.6%, 78.2%]) reduction in 2022 (41%/ decade), compared to 2004 (Figure 9). A 8.7% decrease in insect splats was observed between 2021 and 2022, but this result was not statistically significant.

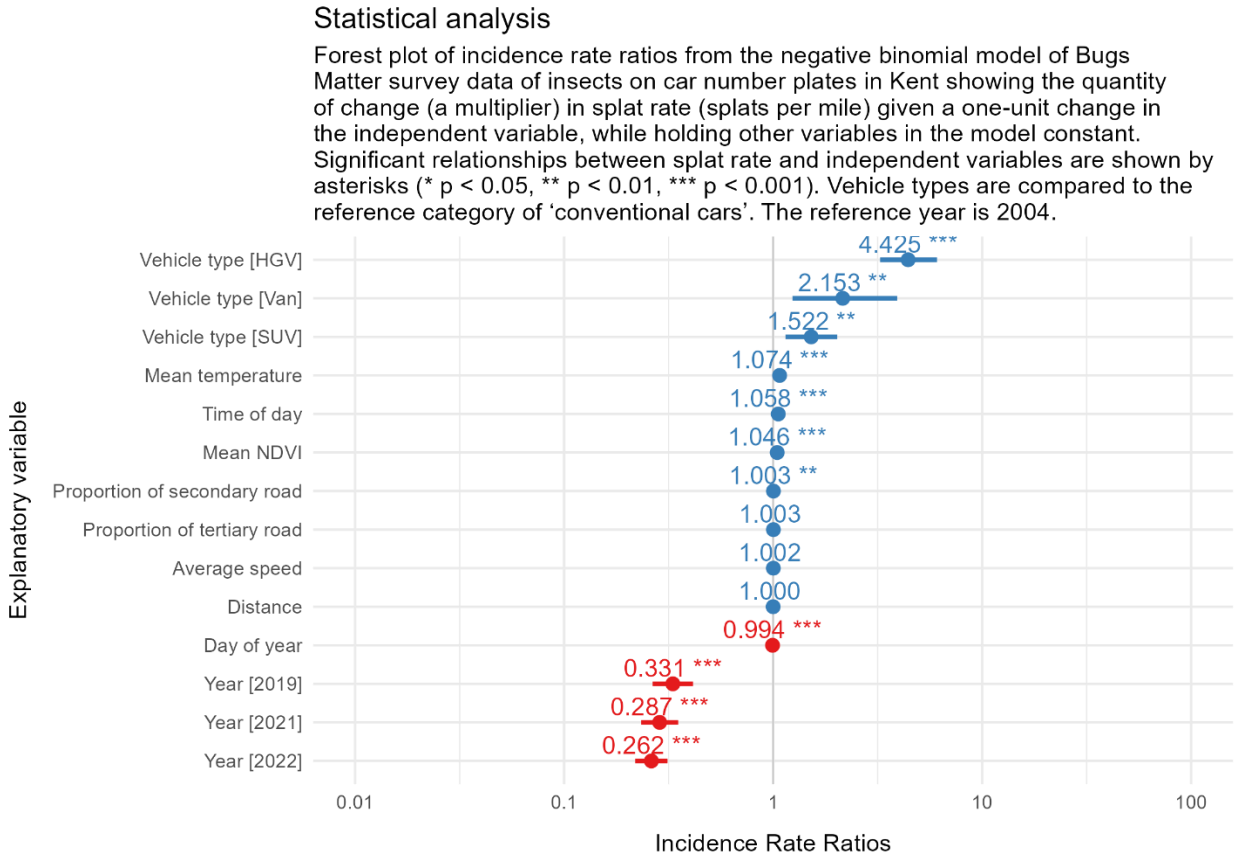

Figure 9

The purpose of the NB statistical model is to predict splat count while taking into account all the independent variables such as journey temperature, average speed, and road types. By including journey distance as an offset term, it also corrects the splat count for the journey distance, and effectively models the splat rate (splats per mile). This is best practice, as we explicitly model the splat count as a function of journey distance, however it means our results are in a unit of 'splat counts (corrected for journey distance)' rather than the slightly more interpretable 'splat rate (splats per mile)'. The predictions of splat count are 4.4 in 2004, 1.5 in 2019, 1.3 in 2021, and 1.2 in 2022 (Figure 10).

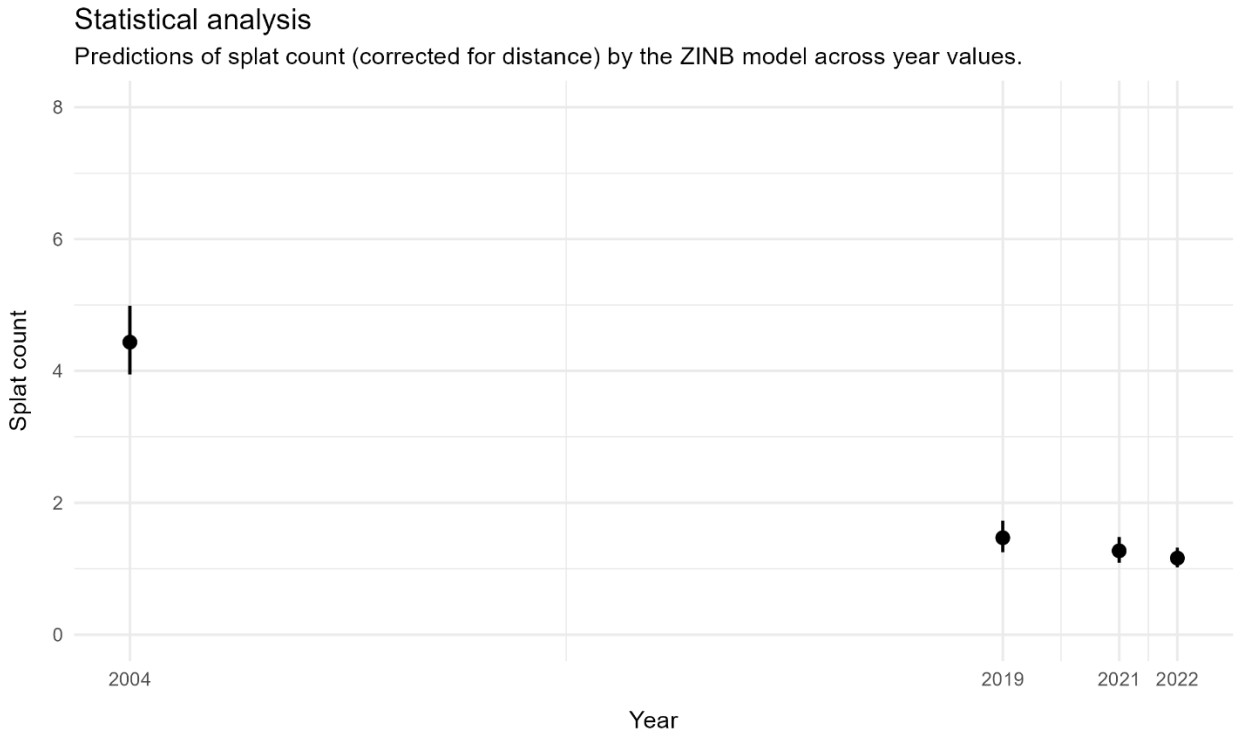

Figure 10

Participation

A total of 413 citizen scientists in Kent signed up to the Bugs Matter app in 2021 or prior, of which 83 (20.1%) recorded one or more journeys that year. A further 138 citizen scientists in Kent signed up to the Bugs Matter app in 2022, of which 21 (15.2%) recorded one or more journeys in 2022 (Figures 11-12). Of the 413 citizen scientists that signed up to the Bugs Matter app in 2021, 42 recorded one or more journeys in 2022 (Table 3). This means a total of 83 users participated in 2021 whilst 63 users participated in 2022. The overall conversion rate, which is the proportion of users in Kent that signed up and completed one or more journeys across the lifetime of the Bugs Matter app, was 21.42%. The average number of journeys recorded per user was 9.02. In 2021 it was 10.4 whilst in 2022 it was 13.43.

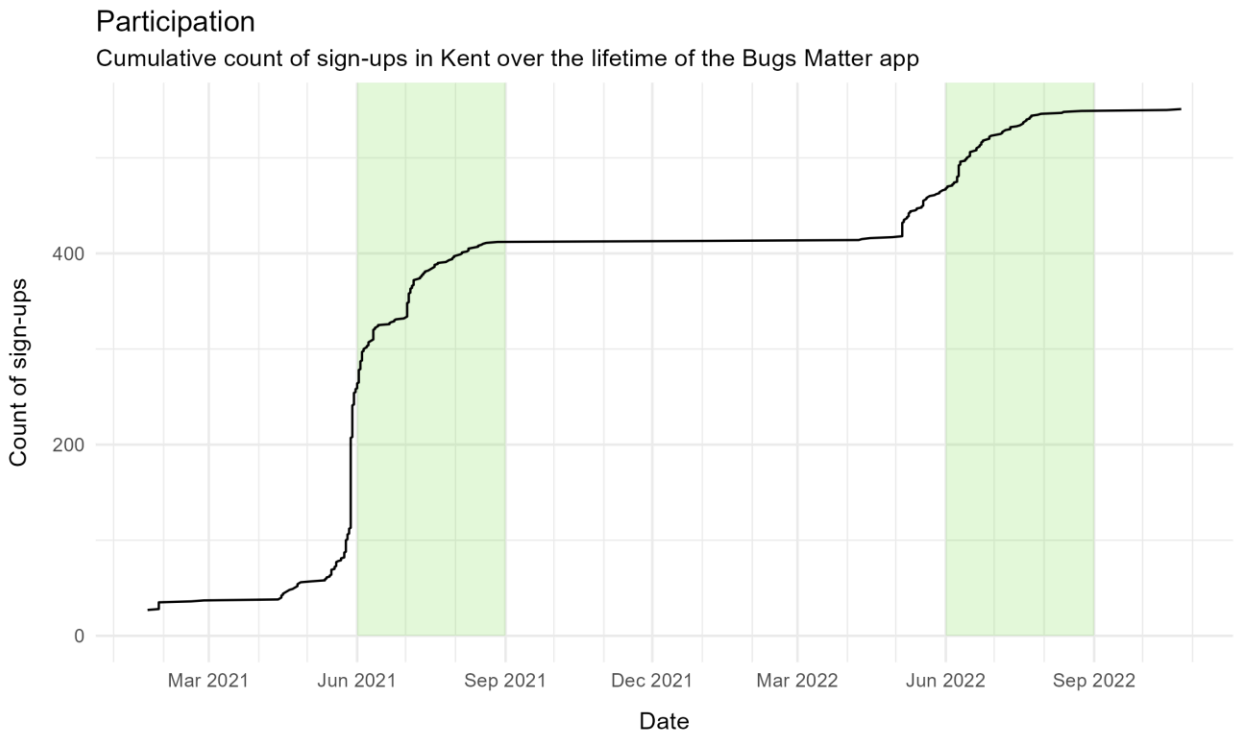

Figure 11

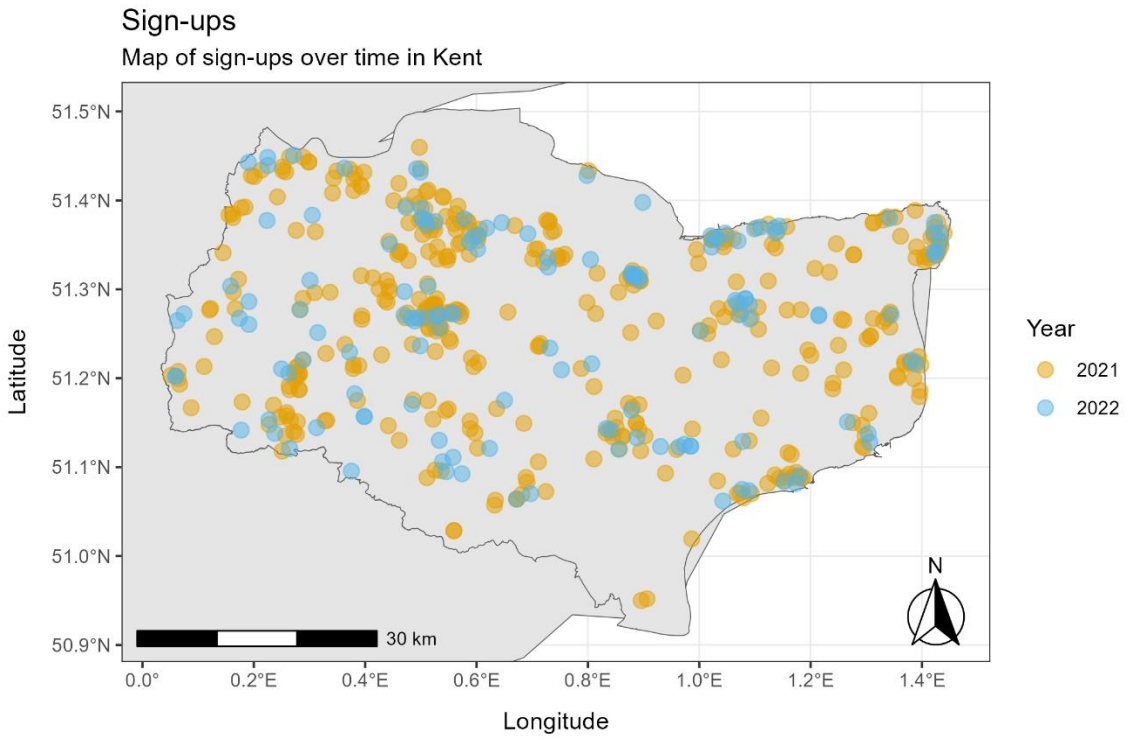

Figure 12

Table 3

Step	Signed up in 2021 or previous	Signed up in 2022
Number of new sign-ups	413	138
Number of participants in 2021 survey	83	NA
Number of participants in 2022 survey	42	21
Conversion rate (proportion of users that signed up and did one or more journeys in the same year)	20.1%	15.2%

Figure 13 shows a heat map of sign-ups by county. A large number of sign-ups were in Kent and Essex, followed by London and then Hampshire (Figure 13). Besides Gwent, who is an active partner in the Bugs Matter survey, Wales had relatively few sign-ups. It should be noted that the number of sign-ups is not a fair metric to compare between geographic regions with different population densities. However, these results can help target marketing efforts to increase participation in regions and/or counties with the lowest numbers of sign-ups.

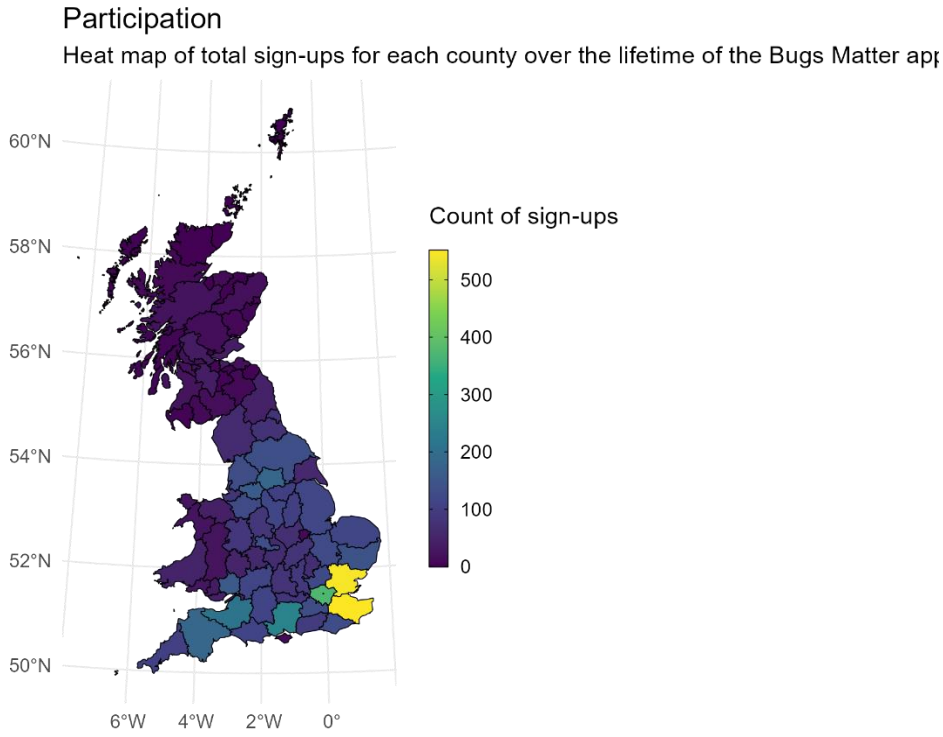

Figure 13