Botanical Society of Britain & Ireland

BSBI New Year Plant Hunt 2021

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Summary

- The BSBI's tenth New Year Plant Hunt (NYPH) took place between Friday 1st and Monday 4th January 2021. Volunteers submitted lists of native and non-native plants they found in flower in the wild during a three-hour walk at locations throughout Britain and Ireland. The results were submitted online via smartphones and other electronic devices.
- 1,811 recorders took part in 2021, submitting 21,419 records of 710 plant species in bloom on 1,195 lists. This total includes ten lists where Hunts had yielded no records of plants in flower.
- The four species most frequently recorded in flower in 2021 were identical to previous years: in rank order these were Daisy *Bellis perennis*, Groundsel *Senecio vulgaris*, Dandelion *Taraxacum* agg., and Annual Meadow-grass *Poa annua*.
- In 2021, as in previous years, almost twice as many species recorded were flowering late (53%) rather than early (24%), as opposed to 23% which would either be expected to flower at New Year or are typical 'all-year-rounders'.
- These proportions of species flowering early, late or as expected were similar to previous years, suggesting that the majority of plant species flowering out of season are 'autumn stragglers' that continue to flower in the winter due to mild weather.
- These proportions do not appear to change significantly from year to year although the overall numbers of plants in flower increase during milder winters, most notably in 2016 and to a lesser extent 2015 and 2019, when temperatures were well above average in November and December.

Introduction

Since 2012, the Botanical Society of Britain & Ireland (BSBI) has run an annual hunt for plants in flower during a four-day period over New Year (Marsh, 2015, 2016; Walker & Marsh, 2017, 2018, 2019, 2020). Participation has grown steadily and for the past two years more than 1000 participants recorded lists of flowering plants from over 700 locations across Britain and Ireland (Walker & Marsh, 2019). A very similar scheme (Year End Plant Hunt), run by the Dutch botanical society (FLORON), has been running in The Netherlands since 2015 and has had a similar level of participation (Sparrius, 2019).

Originally the main aim of the New Year Plant Hunt (NYPH) was to provide a fun and engaging project for botanical enthusiasts during the quiet winter months. However, it is now providing valuable insights into how many species normally flower during the winter as well as how species are responding to changing weather patterns as a consequence of climate change. Due to media coverage, NYPH is also raising the profile of the BSBI and introducing its work to new audiences as well as helping BSBI to introduce new technologies such as social media and online recording applications. Here we provide a brief summary of the results of the NYPH 2021.

Method

For NYPH 2021 volunteers picked a day between 1-4 January 2021 and recorded all native and non-native plants, excluding obviously planted species in private and public gardens, that they found in flower on a walk not exceeding three hours, excluding breaks and time travelling between sites. Participants were encouraged to restrict their hunts to a single area/site but in a few cases multiple sites were visited within the three-hour period (for example at stops along a motorway). In many cases recorders followed the same routes that they had taken in previous years. Participants were encouraged to check that plants were actually in flower and not just immature or seeding, for example by checking that catkins were open, that grasses had open florets with stigmas or anthers etc. Conifers were included but all ferns and fern-allies were excluded from lists.

The majority of lists were submitted via a smartphone, tablet or PC, allowing the results to be viewed simultaneously as they came in (Fig. 1). This substantially increased the efficiency of data entry and reduced errors during data processing. Data validation prior to analysis included checking

the completeness of the lists and that the site details submitted were correct, identifying unidentified species from photographs, checking doubtful records and that taxa matched those given by Stace (2010), and removing ferns and fern-allies and taxa identified to family or genus only. Subspecies and varieties (including colour variants, 'flora pleno', etc.) were aggregated to species-level as were microspecies of *Hieracium*, *Rubus* and *Taraxacum*. Aggregates were also used for closely related taxa that are generally not recorded consistently (e.g. *Arenaria leptoclados/serpyllifolia*, *Aphanes arvensis/australis*, *Galanthus* spp., *Galeopsis bifida/tetrahit*, *Hedera helix/hibernica*, *Polygonum aviculare*). Non-native crops with native subspecies (e.g. *Beta vulgaris*, *Brassica rapus*) were not usually differentiated for the purposes of analyses.

To allow an assessment of whether species were flowering early or late, species were allocated to one of four phenological categories based on their 'typical' flowering months as given in standard floras. For this we published the flowering months given in Clapham *et al*. (1987) and Sell & Murrell (1996-2018). Species were categorised as 'expected' if they normally flower at New Year (December-January); 'early' if the number of months from New Year to first flowering month is less than the number of months from the last flowering month to New Year; and 'late' if the number of months from the last flowering month to New Year is less than the number of months from New Year to the first flowering month. Where the number of months from the first and last flowering months to New Year were equal, species were classified as 'early or late'. For a number of non-natives, the normal flowering period was not known.

In previous years, organisers of local group hunts were encouraged to send details to the NYPH organisers so their events could be publicised on the BSBI website and via BSBI social media platforms. These group hunts often attracted large numbers of plant hunters at all skill levels, from beginner to expert, who benefited from the plant identification advice on offer and enjoyed the social aspect of the NYPH. In 2021, government restrictions on social gatherings were imposed in response to the coronavirus; these restrictions varied across Britain, Ireland, the Channel Isles and the Isle of Man. As a result, no organised group hunts were advertised on the BSBI website and plant hunters were instructed to follow their local government guidance closely when planning their hunts.

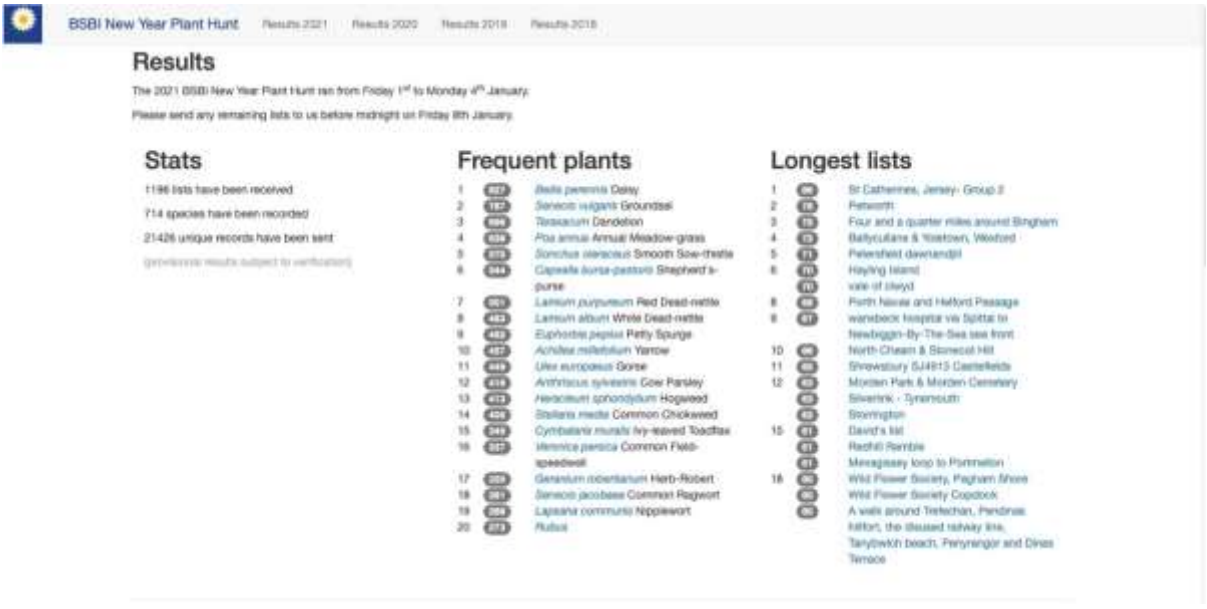

Figure 1. Screenshot of the New Year Plant Hunt 2021 Results webpage.

Results

In 2021, a total of 1,195 lists were submitted, an increase of 49.7% compared to 2020 and the highest number of lists ever submitted (Fig. 2). This total includes ten "lists" where plant hunters

found no species in bloom. From these lists 21,419 unique records were used in the analysis, an increase of 43.9% compared to 2020. We also recorded our largest number of participants with 1,811 people taking part and submitting records. This, however, is only an increase of 5.7% on 2020, our previous record year (Table 1). The number of lists submitted broken down by countries reveals changes, with high increases for England, Wales and Scotland and with Wales having a percentage increase of 211.9% in lists being submitted. This contrasts with the Channel Isles and the Isle of Man where we saw decreases in the number of lists (Table. 2).

From the unique records, 710 different species were recorded, the highest number of species in the ten years of the Hunt; however, the relative percentage of native and non-native is roughly even, as it has been in previous years (Table 3). Even though the number of species recorded is roughly even, the number of records shows that natives have comprised roughly two thirds of all of the records submitted since 2015 (Table 4).

Table 1. The number of individuals participating, Number of submitted lists, the number of records submitted in the New Year Plant Hunts, 2015-2021, with increase in percentage shown for 2021 in comparison to 2020.

	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**% increase '21-'20**
Participants	c.300	405	416	>800	1471	1714	1811	5.7
Lists	143	432	460	612	712	798	1195	49.7
Records	2893	9160	7123	9907	14193	14880	21419	43.9

Table 2. The number of New Year Plant Hunt lists submitted 2015-2021 broken down by country, with percentage increase shown for 2021 in comparison to 2020.

Number of lists	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**% increase '20-'21**
England	101	297	282	427	466	538	821	52.6
Wales	10	19	28	33	41	42	132	214.3
Scotland	9	64	43	56	94	102	138	35.3
Ireland	21	50	104	94	99	90	98	8.9
Channel Isles	2	2	3	2	6	7	6	-14.3
Isle of Man	0	0	0	0	6	19	0	-100.0
Total	143	432	460	612	712	798	1195	49.7

Table 3. The number of plant species recorded during the New Year Plant Hunt 2015-2021.

Number of species	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Native	206	313	264	291	327	322	379
Non-native	160	298	228	241	300	293	331
Total	366	611	492	532	627	615	710
% native	56	51	54	55	52	52	53
% non-native	44	49	46	45	48	48	47

Table 4. The number of individual records made during the New Year Plant Hunt 2015-2021.

Number of records	2015	2016	2017	2017	2019	2020	2021
Native	1874	6210	4509	6376	9055	9521	13777
Non-native	1019	2950	2614	3531	5138	5359	7642
Total	2893	9160	7123	9907	14193	14880	21419
% native	65	68	63	64	64	64	64
% non-native	35	32	37	36	36	36	36

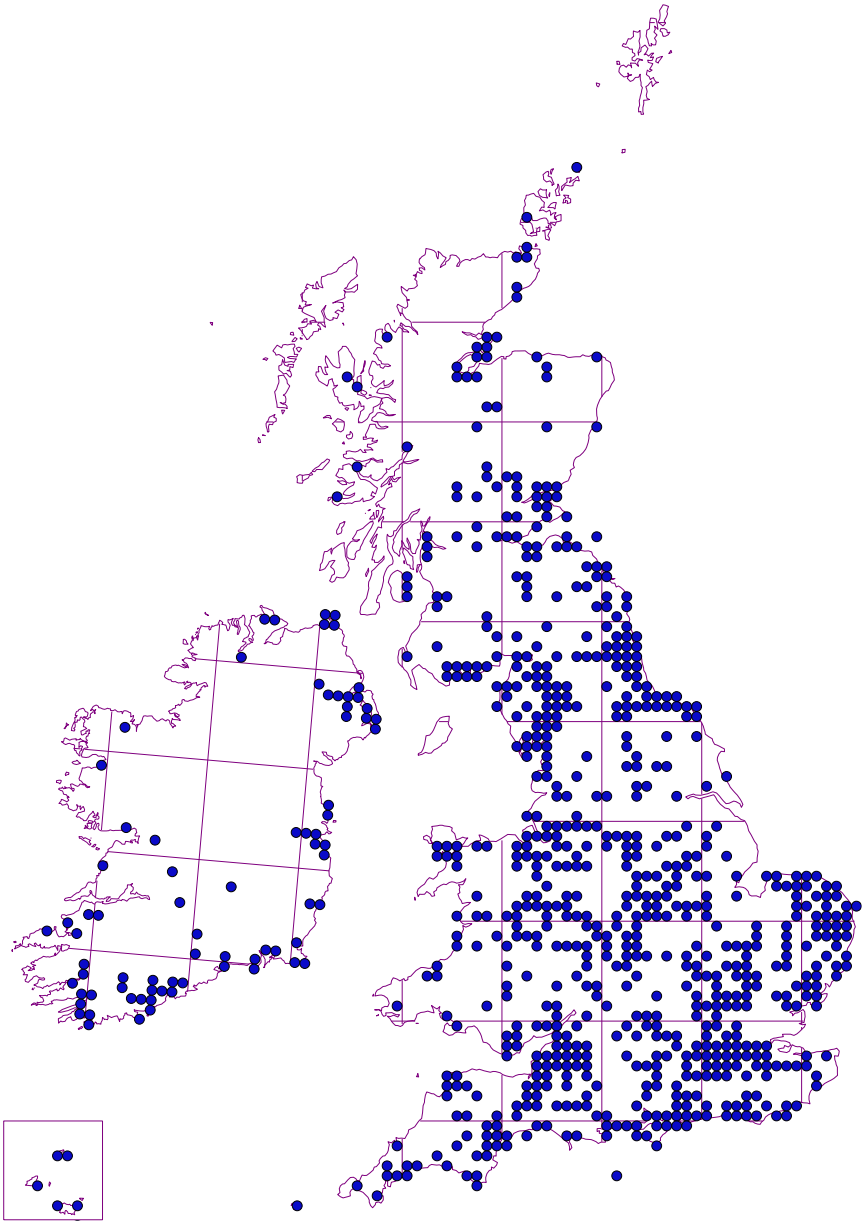

Figure 2. Map of the New Year Plant Hunt Lists received in 2021 (each dot represents a 10 x 10 km grid square in which at least one New Year Plant Hunt list was recorded).

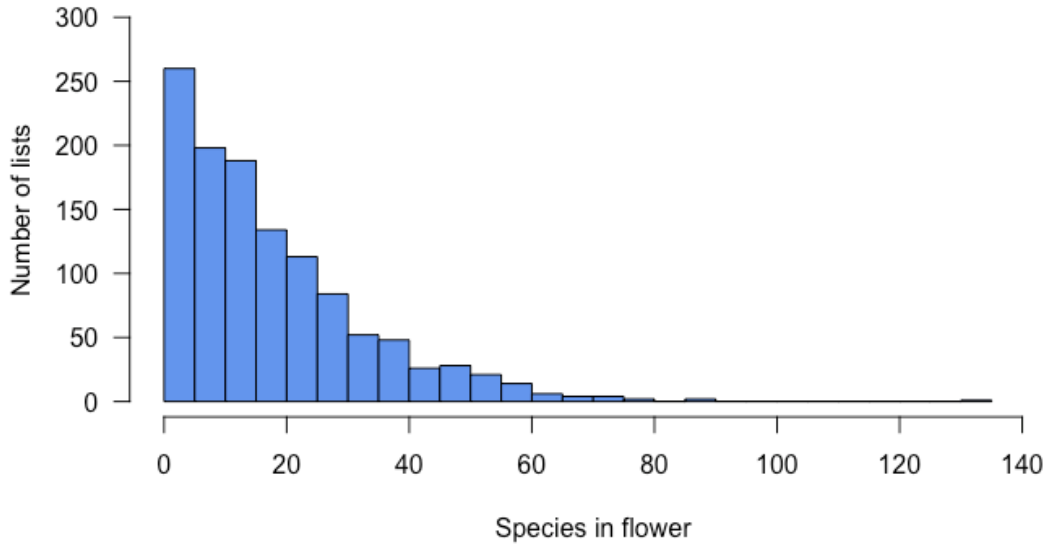

Figure 3. Histogram of the number of species recorded in flower per visit (list length) in the New Year Plant Hunt 2021.

Participants recorded an average of 18.0 species within the three-hour period although there was a very large range in the length of lists across the country, with some participants recording over 70 species in flower! (Fig. 3). In 2021 the average number of native species recorded was 11.2 native whereas the average number of non-natives was 6.3 (Fig. 4). These results resemble the results in 2020 and are slightly lower than 2019 but relatively average when compared to previous years (Fig. 4). The total number of species recorded was higher than 2017 and 2018 (but not significantly so) and slightly less than 2015, 2016 and 2019, but only significantly less than 2016 (Fig 4a). This pattern was the same for both native and alien species although the overall differences were less marked for non-native species (Figs 4b and 4c). Across all three we are seeing very similar results to those in 2020 (Fig. 4).

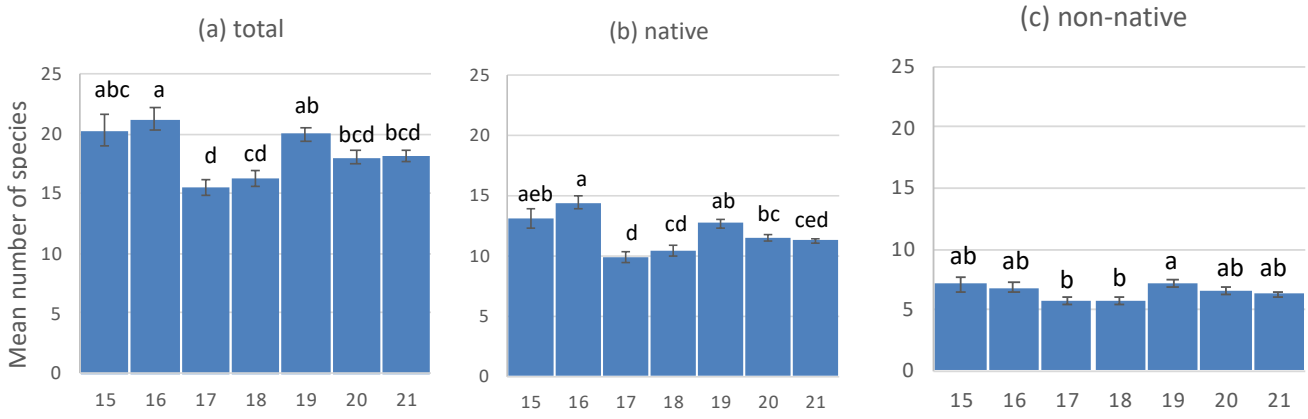

Figure 4. The mean number of species recorded in flower at New Year, 2015-2020. The significance of the differences between years was tested using a One-way ANOVA with Tukey's HSD used to test for significant differences between means: (a) total species, F = 7.732, P<0.001; (b) native species, F= 12.68, P<0.001; (c) non-native species, F= 3.398, P<0.01. Means that share the same letter on each graph are not significantly different from one another.

The top four recorded plant species have remained constant since 2015, however, the order has fluctuated: Daisy (*Bellis perennis*), Groundsel (*Senecio vulgaris*), Dandelion (*Taraxacum* agg.) and Annual Meadow-grass (*Poa annua*), were all recorded in more than 50% of the lists submitted this year.

Scientific name	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**% in lists**
Bellis perennis	1	1	1	1	1	1	1	69.6
Senecio vulgaris	3	3	2	2	2	2	2	66.4
Taraxacum agg.	1	2	3	3	3	4	3	58.6
Poa annua	4	4	4	4	4	3	4	53.7
Sonchus oleraceus	7	6	11	14	8	6	5	48.1
Capsella bursa-pastoris	6	11	6	7	5	9	6	45.8
Lamium purpureum	13	8	9	6	7	7	7	42.1
Lamium album	9	10	16	9	13	9	8	39.1
Euphorbia peplus	8	14	7	10	9	11	9	38.9
Achillea millefolium	14	15	12	13	12	12	10	38.6
Ulex europaeus	5	5	5	5	11	8	11	37.7
Anthriscus sylvestris	31	31	61	30	85	19	12	35.2
Heracleum sphondylium	10	12	18	11	19	15	13	34.7
Stellaria media	10	29	8	8	5	5	14	34.2
Cymbalaria muralis	19	21	13	15	18	16	15	29.0

Table 5. The 15 species recorded most frequently in flower during the New Year Plant Hunt 2021. Species are listed in their rank order in 2021 and shown against their position in 2015-2020. The top ranked species are shaded dark (1-5) and light grey (6-10).

The proportions of species flowering early or late were very similar to previous years with 53% of species flowering late, 24% flowering early, and 6% flowering as expected at New Year (Fig. 5a). These percentages were almost identical to previous years, the only notable difference being the slightly higher proportion of species flowering early in 2016. When considering just native species, however, it is clear that a greater proportion flowered early (21%) in 2021 and (23%) 2020 as opposed to late (59%) when compared to previous years (Fig. 5b). The reason for this is currently unknown and more research would need to be undertaken to understand why we are seeing these differences in flowering times.

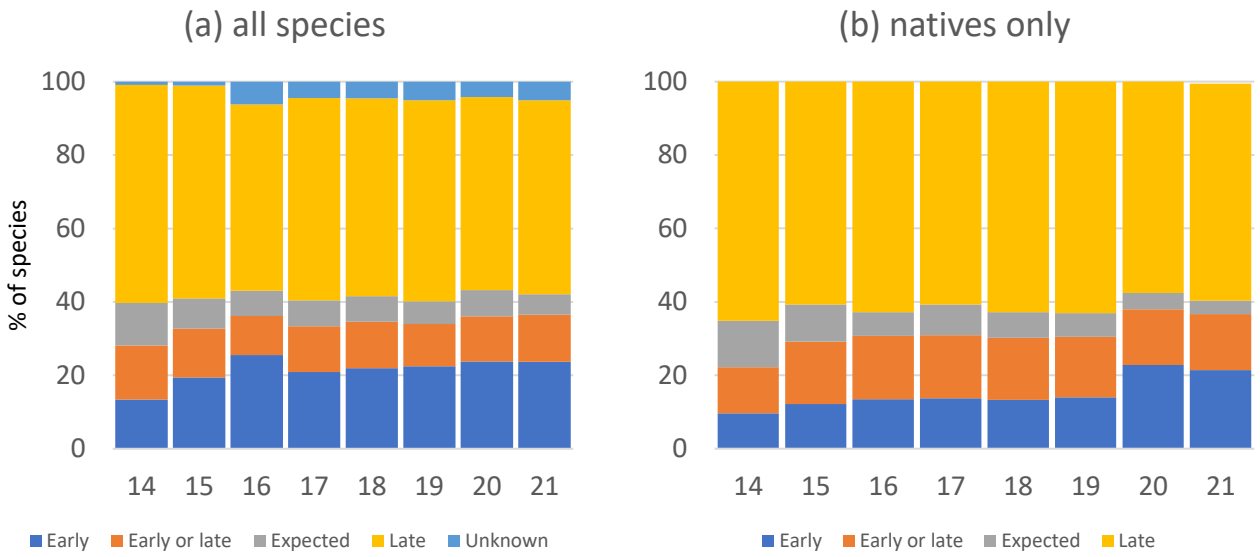

Figure 5. The proportion of plant species flowering early, early or late, late or as expected at New Year, 2014-2020. (a) all species and (b) native species only.

When the same figures are presented in terms of the total number of records of flowering a slightly different pattern emerges with most occurrences of flowering belonging to species flowering late (42%) or as expected (33%) (Fig. 6a). In comparison, only 14% of flowering occurrences were species flowering early, highlighting their relative insignificance when compared to winter flowerers and autumn stragglers.

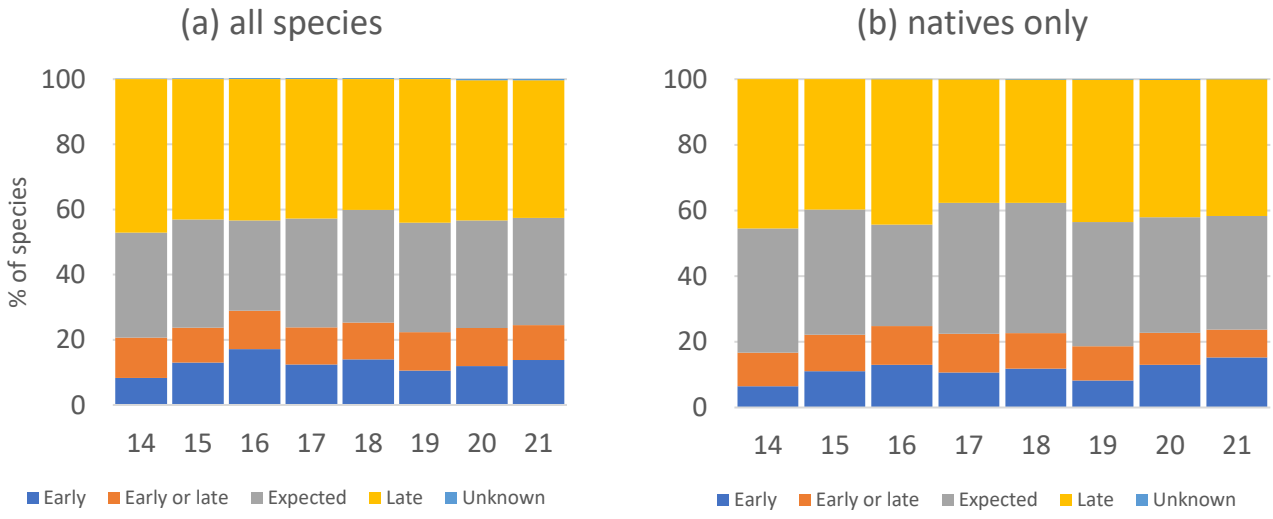

Figure 6. The proportion of records of species flowering early, early of late, late or as expected at New year, 2014-2021. (a) all species and (b) native species only.

Discussion

2021 has provided the largest number of flowering species to be recorded during the New Year Plant Hunts so far. This could be for a variety of reasons: firstly, we have received the highest number of lists so far this year at 1195 lists; with more lists submitted, there is a higher probability of new species being recorded. Due to the coronavirus restrictions that were in place, the usual programme of group hunts could not take place this year; with more hunts undertaken by individuals and small family groups, the total number of lists increased by almost 50% without a similar increase in participant numbers (c5%). With these restrictions, it is also likely that people were undertaking their plant hunts closer to home and, therefore, there may be an increase in urban lists (which tend to have higher numbers recorded). The role of the coronavirus may go beyond that of changing the way people have participated. This year has seen a drastic change in the way we interact with wildlife, with reduced maintenance (weed control, mowing etc.) potentially increasing the amount of wild and/or naturalised plants, especially in urban areas.

Secondly, the temperatures leading up to the NYPH in 2021 were 2.7 degrees above average, the same as in 2015 2019 (Fig. 7). December alone was only half a degree above average with a lot of wet and wintery weather across the north of the UK. These temperature anomalies are taken as an average from the whole of the UK so there may be regional differences, especially this year where a lot of people were out sampling in snow. This could explain why there is an increase in the number of lists that have between 1-5 species (Fig. 3). The lack of organised group hunts may have influenced list numbers additionally, as trained botanists usually provide training and guidance to people new to Botanical surveying. Advice on places to look for flowers can dramatically influence the number of flowering species found. Even with the increase in the number of lists and unique records that have been submitted this year it is interesting to note that the percentages of native to non-native species has remained very steady throughout 2014-2021.

Due to the lack of systematic records, we can't tell whether plants are flowering more often now than in the past but what the results from NYPH clearly show is how many plants respond to 'unseasonal' weather, for example the exceptionally warm weather experienced in late 2015 when temperatures were more than 4°C above average. Such conditions allow plants to continue flowering well into the winter, presumably because of the absence of severe frosts which would normally kill any late-flowering shoots. The implications of this for plant performance are far from clear. The premature spring growth of some arctic-alpine plants during warmer winters (as many gardeners will know) can weaken some plants due to the depletion of carbohydrate reserves and damage to tender plant parts such as buds and flowers from snow and frost (Crawford, 1997, 2000). Shifts in flowering time may also cause asynchrony between flowering and associated pollinators with potential knock-on effects for plant and insect productivity (Solga *et al*., 2014).

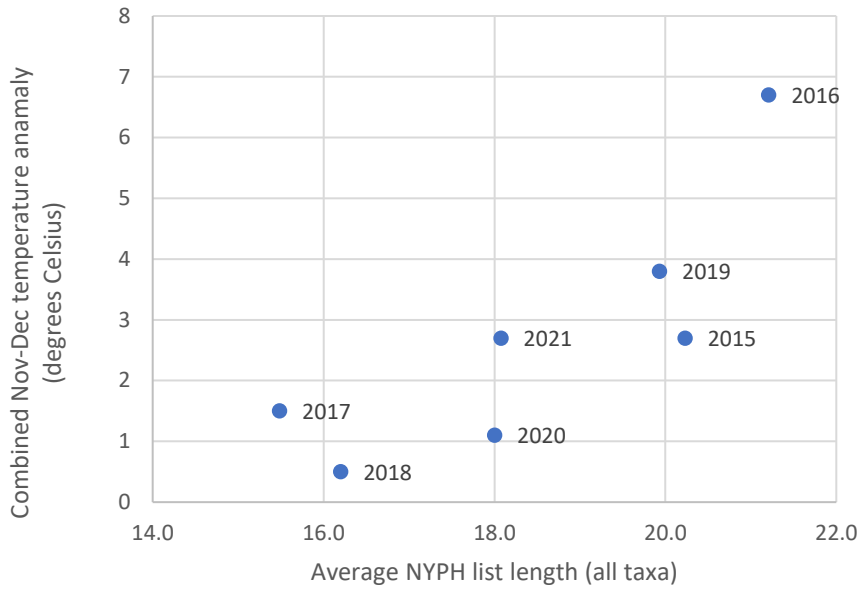

Figure 7. The combined UK mean temperature anomalies for November and December plotted against the average New Year Plant Hunt list lengths, 2015-2021. Temperature data from the UK Met Office (https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-temperature-rainfall-and-sunshine-anomaly-graphs)

A number of studies have shown that many plant species now flower earlier than in the past as a result of warmer winter and spring temperatures (Fitter & Fitter, 2002; Amano *et al*., 2010). However, the evidence from the New Year Plant Hunt is less marked with relatively few species flowering earlier rather than late, presumably because very large advances in flowering would be needed for them to be in flower at New Year. In addition, many spring-flowering (vernal) species require periods of freezing temperatures (stratification) to break dormancy and stimulate growth; consequently, phenological responses to warming will not be straightforward to predict (Crawford, 1997, 2000).

One of the most intriguing findings of the NYPH has been the sheer number of species in flower at New Year. Standard British floras (e.g. Clapham et al., 1987) lead us to expect around 2% will be in flower in December and January. The numbers have been significantly higher than this in each year of this survey and suggests that a radical reassessment of flowering is needed, ideally based on observations at multiple sites across the whole of Great Britain and Ireland in each month.

The large numbers of non-native plants in flower at New Year has also been a notable feature of the survey largely because the majority of lists take place in urban and suburban areas where alien plant diversity is highest. In these areas aliens as well as natives benefit from the elevated temperatures found in towns and cities (the so-called 'urban heat island-effect').

Acknowledgments

2021 saw both the highest ever number of NYPH participants and the highest ever number of volunteer members of BSBI's Events & Communications committee working with BSBI staff members to support those participants. Ryan Clark, Ciara Dwyer, George Garnett, Ellen Goddard, Isobel Girvan, Louise Marsh, Moira O'Donnell and April Webb provided support on the Help Desk over the busy New Year period; Ryan, Ellen, Louise, Moira and April also worked alongside Joshua Ajowele, Leif Bersweden and Rebecca Wheeler to promote the NYPH across social media; Moira, Louise, Jo Parmenter (Secretary, BSBI Science & Data Committee) and Paul Green (BSBI Ireland Officer) advised

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