Manaaki Whenua
Landcare Research

NZ Garden Bird Survey: participant feedback 2014–18

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NZ Garden Bird Survey: participant feedback 2014–18

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Summary

Objective

To evaluate the findings from the New Zealand Garden Bird Survey (NZGBS) participant surveys (2014–18) to inform future opportunities for the NZGBS and wider Manaaki Whenua – Landcare Research (MWLR) citizen science initiatives.

Results

Over the past 12 years the NZGBS has increased in profile and reach, and a range of supporting educational resources and social media engagement strategies have been developed. Participation in the NZGBS has steadily increased, culminating in the largest number of survey records (4,660) ever completed in 2018. The evaluation of the participant surveys from 2014–18 shows that the NZGBS:

- enables people to participate in a collective, environmentally focused initiative that they care about
- fosters genuine citizen science through learning in an authentic, experiential way that creates a data set the majority of participants engage with
- helps to foster self-reported wellbeing for participants through connecting with nature.

Future opportunities

The findings demonstrate that the NZGBS has become a valued citizen science initiative that has multiple benefits, particularly for urban people. Potential future opportunities include:

- further developing and embedding the NZGBS in the school curriculum as an authentic learning and assessment tool for science (biodiversity monitoring) and maths (statistics)
- promoting the wellbeing benefits of connecting with nature for urban participants through the NZGBS
- working with local councils, the Ministry for Primary Industries, the Department of Conservation and others to explore co-funding opportunities for future NZGBS
- using the NZGBS as a flagship engagement initiative to promote the wider work of MWLR.

1 Introduction

Around the world and within New Zealand, citizen science initiatives are increasingly being used to create data sets, educate and raise public awareness, and help foster transformational changes in people's attitudes and behaviours (Orchard 2018; White 2018). The term 'citizen science' is generally used to describe an initiative that involves professional scientists designing a protocol that non-experts then follow to complete certain tasks. These tasks might include data collection, processing, analysis, and/or dissemination (Doyle et al. 2019). Recent research on citizen science has emphasised four key aspects that characterise meaningful and authentic learning and participation for citizen contributors: catering to a range of knowledge levels; using experiential and authentic learning experiences (rather than simulations); fostering curiosity; and ensuring data/findings are disseminated in meaningful ways (Doyle et al. 2019).

A number of environmentally focused citizen science projects have been initiated in New Zealand in recent years. Many of these enrol people in collecting environmental information to develop more robust data sets; for example, for weather (see NIWA's snow measuring initiative), biodiversity (see Moths and Butterflies of New Zealand Trust), and freshwater (see NIWA's Stream Health Monitoring and Assessment Kit). Alongside these environmentally focused citizen science initiatives, an increasing body of research from epidemiology, neuroscience, geography, psychology and indigenous studies has highlighted the importance of nature for people's wellbeing. The benefits to people of engaging with nature include: improvement in mood and mental health, lower blood pressure, increased immune system function, and better eyesight (see, for example, Browning et al. 2014; Louv 2005; Ryan et al. 2014). Finally, some research suggests that citizen science initiatives can also create wider positive social and economic benefits for communities (see Buchan 2007; Kruger & Shannon 2000).

This report analyses questionnaire data gathered about the New Zealand Garden Bird Survey (NZGBS), a citizen science initiative. Since 2014 participants in the NZGBS have been invited to complete a questionnaire about their motivations for participating, and to give feedback on the supporting resources and dissemination of results.

2 Background

The NZGBS is a citizen science initiative that has been running for 12 years with an increasing number of participants every year. People participate by counting the maximum number of birds they see or hear at one time in their gardens, local parks and schools for 1 hour during a set period of time in winter (Spurr 2012)[1]. Participants then upload their bird counts to an online form that records their observations against their address or location. Participation in the NZGBS has steadily increased, culminating in the largest number of survey records (4,660) ever completed in 2018 (MacLeod 2019a).

[1] To date the reporting of data has only been for people's private gardens.

Over the last 5 years Manaaki Whenua – Landcare Research (MWLR) and its partners have implemented a research programme aligned to the NZGBS, aiming to build engagement in the NZGBS and its resources. This work was initiated as part of a Ministry of Business, Innovation and Employment funded Building Trustworthy Biodiversity Indicators project[2] and had three key goals:

1 to understand what matters to New Zealanders involved in the NZGBS (and beyond) in relation to bird monitoring and reporting, and how best to integrate those values into the NZGBS supporting resources to build engagement in this citizen science initiative

2 to tell a richer story about the state of the environment we live in by making best use of the existing NZGBS data cost-effectively, and tailoring the results for specialist and non-specialist audiences with different interests and needs

3 to reach a wider and more diverse audience of New Zealanders by promoting visually appealing tailored resources via multiple communication channels and improving those resources in response to user feedback.

Various supporting resources were developed to build capability and make it easier for people to participate, including educational videos, bird identification kits, and quizzes. Marketing and social media strategies have also been used to increase awareness and participation (e.g. through the development of an NZGBS Facebook group; Liberatore et al. 2018), and the results of the NZGBS have been disseminated in different ways.

Since 2014, people who completed the NZGBS have been invited to provide feedback through an annual questionnaire. These questionnaire data have been used to inform the ongoing development of supporting resources and NZGBS processes (such as the formatting/presentation of results and effective ways to engage and communicate). This report draws on data from participant questionnaires from 2014 to 2018.

3 Objectives

1 To evaluate questionnaire feedback to identify what matters to NZGBS participants and how best to engage with them.

2 To summarise feedback to understand the impact of the NZGBS on participants' wellbeing and engagement in environmental citizen science initiatives.

3 To identify future opportunities for the NZGBS and wider MWLR citizen science initiatives.

[2] https://www.landcareresearch.co.nz/science/plants-animals-fungi/animals/birds/biodiversity-measures

4 Methods

This report draws primarily on data collected through online surveys (MacLeod 2019b). Since 2014 people who participated in the NZGBS have been invited to complete a questionnaire about their experience. The first two annual surveys (2014 and 2015) focused on understanding what matters to NZGBS participants; specifically why people participated, any barriers to participation, and how they would like results from the NZGBS to be presented. More recent questionnaires (2016 to 2018) focused on obtaining feedback on the usefulness of the NZGBS resources, and the format and presentation of the results (MacLeod et al. 2018, 2019).

The online questionnaires were constructed and administered through SurveyMonkey and generally took between 5 and 10 minutes to complete. From 2014 to 2017 the questions consisted primarily of closed or limited-option responses that were collated using SurveyMonkey and Excel. In 2018 an open-ended question was added, allowing participants to provide further feedback on any aspect of the NZGBS. The responses to this open-ended question were analysed using standard qualitative approaches to identify key themes and their significance (Sarantakos 2013). The questionnaires obtained social ethics approval through Manaaki Whenua – Landcare Research.

5 Results

5.1 Demographic information of participants

From 2014 to 2018 the questionnaires asked participants to describe the type of role/position that best applied to them. Table 1 provides an overview of how participants self-identified in terms of their role/position[3]. Since 2014 at least half of participants considered themselves bird watchers, naturalists or citizen scientists. Since 2017, however, the proportion of total participants that felt this description applied to them has decreased. Similarly, there has been a reduction in the proportion of participants who identify as members of a non-government organisation (NGO) or environmental group.

Broadly speaking, the percentage of participants who identify as a member of either a garden or horticultural club, a student or teacher, or employed in conservation, environmental management or biological sciences has remained relatively similar. However, the percentage of people who do not identify with any of the specified roles/positions has increased from 23% in 2014 to 31% in 2018. This corresponds with the reduction in the percentage of people who identify as an amateur bird watcher, naturalist or 'citizen scientist', suggesting that the NZGBS has begun to attract a wider range of participants from beyond the original core supportive demographic.

[3] Throughout this report percentages have been rounded to the nearest 0.1% so they may not equal 100%.

Table 1. How participants self-identified (participants could tick more than one option)

Answer options	Response percent					Response count				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
An amateur bird watcher, naturalist, or 'citizen scientist'	**60%**	**61%**	**62%**	**55%**	**50%**	1,280	1,386	933	1,282	2,008
A member of a non-governmental conservation, environmental, or similar organisation or society (e.g. Forest & Bird)	**31%**	**29%**	**31%**	**32%**	**26%**	673	662	463	762	1,045
A member of a garden or horticultural club or society	8%	8%	9%	**10%**	**10%**	172	189	136	231	387
Employed in the field of conservation, environment, or resource management	8%	7%	6%	8%	6%	167	169	85	184	261
Employed in the biological sciences	3%	4%	3%	4%	3%	72	87	39	84	102
A student in a school or tertiary institution (university, polytech, etc)	3%	3%	3%	4%	4%	69	71	47	90	155
A teacher in a school[a]	-	-	4%	5%	6%	-	-	66	117	255
None of the above	**23%**	**23%**	**21%**	**25%**	**31%**	496	525	316	593	1,231

[a] This option was only available from 2016 onwards.

* No. of respondents each year: 2014 (*n* = 2,146); 2015 (*n* = 2,272); 2016 (*n* = 1,501); 2017 (*n* = 2,347); 2018 (*n* = 4,035).

From 2016 to 2018 the questionnaires asked participants about demographic information, including geographical location, ethnicity, gender, age, and frequency of participation in the NZGBS. Table 2 shows that the majority of respondents (between 58 and 65%) from 2016 onwards have been from regions with large urban populations: Auckland, Wellington, Canterbury and Otago.

Table 2. Region of residence

Region	Response percent			Response count		
	2016	2017	2018	2016	2017	2018
Auckland	**25%**	**21%**	**21%**	367	486	817
Wellington	**16%**	**14%**	**10%**	231	328	410
Canterbury	**15%**	**15%**	**15%**	222	335	573
Otago	9%	**14%**	**12%**	131	310	484
Bay of Plenty	6%	6%	6%	91	126	217
Waikato	6%	7%	7%	88	148	291
Northland	5%	3%	4%	68	77	144
Hawke's Bay	5%	5%	4%	69	104	161
Manawatū–Wanganui	4%	4%	5%	61	97	197
Tasman	2%	2%	2%	34	51	64
Taranaki	2%	2%	5%	33	45	204
Nelson	2%	2%	2%	29	36	76
Marlborough	2%	1%	1%	22	33	45
Southland	1%	2%	4%	15	39	144
West Coast	1%	1%	1%	12	16	31
Gisborne	1%	1%	1%	8	21	35
Area outside regions	0%	1%	1%	3	13	26

* No. of respondents each year: 2016 (*n* = 1,484); 2017 (*n* = 2,265); 2018 (*n* = 3,919).

Table 3 provides an overview of the ethnicity of participants from 2016 to 2018 and shows that the majority of participants (>93%) identify as European/Pākehā. While Table 3 shows a slight increase in the number of participants who identify as non-European/Pākehā over time, this is still less than representative compared to the wider New Zealand population.

Table 3. Ethnic group[a]

Answer choices	Response percent			Response count			NZ Population
	2016	2017	2018	2016	2017	2018	2013[b]
European/Pākehā	**96.2%**	**94.9%**	**93.8%**	1,434	2,213	3,763	74%
Māori	0.8%	1.2%	1.7%	12	29	68	15%
Asian	0.7%	1.0%	0.9%	10	23	34	12%
Pacific peoples	0.1%	0.2%	0.2%	2	5	8	7%
Middle Eastern / Latin American / African	0.1%	0.3%	0.2%	2	6	7	1%
Other ethnicity	2.0%	2.4%	3.3%	30	57	131	-

[a] Participants could select only *one* ethnic group. This has been changed for future years to allow selection of multiple groups (as was originally intended). This inability to select more than one ethnic group may have resulted in higher European/Pākehā participant numbers.

[b] Source: Statistics New Zealand 2019.

* No. of respondents each year: 2016 (n = 1,490); 2017 (n = 2,333); 2018 (n = 4,011).

The questionnaire asked participants to note the number, age and gender of people who helped them collect their garden bird survey data. Table 4 provides an overview of responses in age and gender categories. The responses indicate that the largest groups of people who have participated are aged either under 18 or over 50. In terms of gender, overall more females than males participate in the NZGBS. This is most pronounced in the age range from 40 to 69 years. The fewer participants in the 20-49 age ranges may be because some parents get their children to either help or complete the survey, but they do not include themselves when completing the questionnaire.

Table 4. Gender[a] **and ages of NZGBS participants**

Answer choices	Response percent			Response count		
	2016	2017	2018	2016	2017	2018
<18 Male	9.1%	**13%**	**13.8%**	198	489	898
<18 Female	**10.5%**	**16.7%**	**14.9%**	228	628	975
18–19 Male	0.04%	0.5%	0.1%	1	22	7
18–19 Female	0.1%	0.2%	0.06%	3	10	4
20–29 Male	1.6%	0.4%	0.8%	35	17	54
20–29 Female	0.5%	1.4%	2.2%	13	56	144
30–39 Male	3%	1.4%	1.1%	66	53	76
30–39 Female	2.5%	2.1%	2.7%	55	79	177
40–49 Male	2.6%	2.7%	2.2%	57	104	146
40–49 Female	4.9%	5.2%	5.4%	107	197	352
50–59 Male	4.7%	4.4%	3.5%	102	167	228
50–59 Female	9.7%	8.2%	8%	211	310	524
60–69 Male	9.2%	7.4%	7.6%	200	279	496
60–69 Female	**16.7%**	**13.8%**	**11.6%**	364	519	757
70+ Male	**10.4%**	**10.4%**	**12.3%**	226	391	802
70+ Female	**10.7%**	**10.5%**	**12.6%**	233	396	825
Total				**2,169**	**3,758**	**6,507**

[a] Participants could select 'other' as an option for gender, but we have not included the responses for 'other' in this table as they were not statistically significant (<1%).

Table 5 shows that the percentage of people participating in the NZGBS for the first time increased from c. 25% in 2016 and 2017 to c. 44% in 2018. The proportion of returning participants decreased in 2018 relative to the two preceding years, when the return rates were comparable. However, compared to 2016, the actual number of returning participants increased by 60% in 2017 and 117% in 2018. The reduction in returning participants may be linked to the relative high proportion of participants aged 70+. Feedback to the NZGBS organisers suggests that some in this age range may stop participating due to difficulty navigating online reporting, poor health, and death.

Table 5. Previous participation in the NZGBS

Answer choices	Response percent			Response count		
	2016	2017	2018	2016	2017	2018
No, this was my first time	24%	26%	44%	360	654	1,910
Yes, once	11%	12%	12%	164	290	535
Yes, a few times	40%	39%	27%	596	973	1,203
Yes, many times	25%	23%	17%	378	575	738

* No. of respondents each year: 2016 (*n* = 1,498); 2017 (*n* = 2,492); 2018 (*n* = 4,386).

Overall, these demographic data indicate that uptake and participation in major urban centres have been strong, particularly amongst European/Pākehā women aged between 50 and 70-plus years, and people under 18 years. Initially the survey involved more people who either self-identified as bird watchers or were connected to conservation NGOs, or to garden or horticultural groups. This is not surprising given the NZGBS was initially promoted through bird watching, conservation, gardening and horticultural groups. However, as the NZGBS has evolved and more resources have been directed at increasing awareness – particularly through social media campaigns, targeted marketing, and the development of cultural and educational resources – both the number of people participating and the number of people who do not identify as bird watchers or as members of a conservation, gardening or horticulture group have increased. This emphasis on educational resources is also correlated with an increase in the number of participants aged under 18. While participation by non-European/Pākehā is still not representative of the wider population, from 2016 to 2018 the actual number of these participants (especially Māori) has significantly increased.

5.2 Motivations for participating

From 2014 to 2016 the questionnaires asked participants why they participated in the NZGBS. Figure 1 provides an overview of the combined responses across these 3 years[4]. The results show that the highest-rated motivation was that participants *enjoy watching birds*. The next most important motivations (in order of significance) were *helping improve understanding of garden birds*, *concern about the health of garden birds*, and *contribution towards a citizen science initiative*. For many participants, engaging children in an education activity was either *neutral* or *not important* compared to other motivations. While participants specified a number of other motivating reasons, these were generally classified as *not important* or *neutral*.

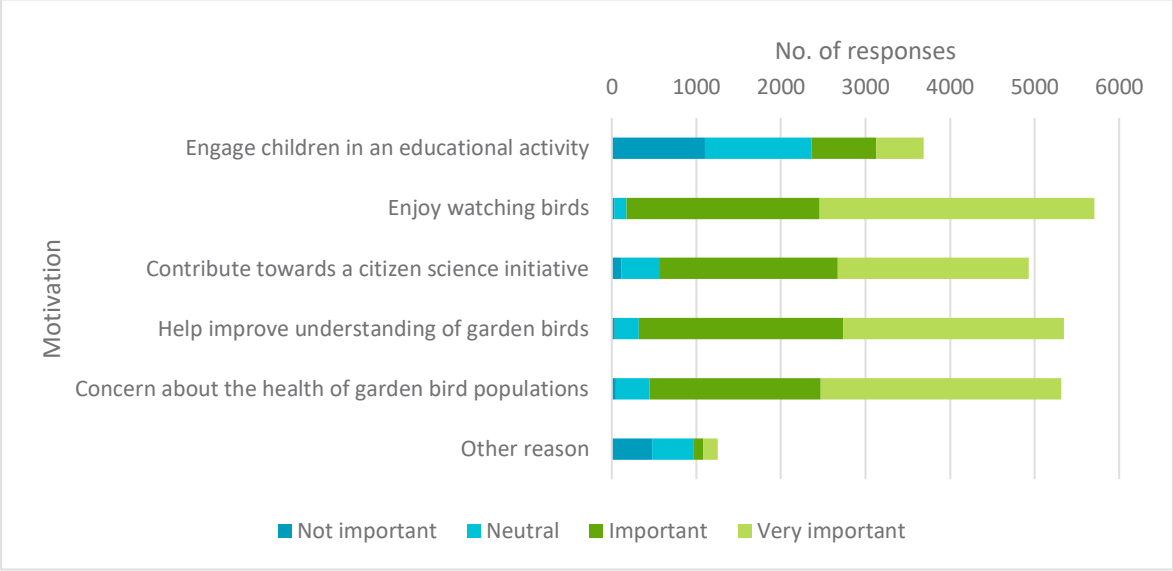

Figure 1. Motivations for participating, 2014–2016. * No. of respondents each year: 2014 (*n* = 2,146); 2015 (*n* = 2,272); 2016 (*n* = 1,501).

5.3 Marketing and promotion

Table 6 outlines how participants found out about the NZGBS. In 2014 the three most common ways were email message from the survey organiser (60%), newspaper (25%), and Forest and Bird (20%). Over time these three sources have decreased in importance, with Facebook, radio, friends and family all becoming more important. These findings suggest that as of 2018 the five most important avenues for finding out about the NZGBS are email (32%), newspaper (22%), friends and family (14%), Forest and Bird (12%), and Facebook (11%).

[4] The data have been combined across the 3 years as the results for each year were generally within 1–3% of the averaged combined data when calculated as a percentage.

Table 6. How people learnt about the NZGBS (participants could tick more than one option)

Source type	Answer options	Percent responses					Count responses				
		2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Email	Email message from survey organiser	**60%**	**62%**	**61%**	**48%**	**32%**	1,266	1,387	905	1,139	1,346
Leaflet	NZGBS leaflet	-	-	7%	5%	5%	-	-	108	130	219
Web pages	NZGBS web page[a]	5%	5%	6%	5%	5%	95	107	81	112	193
	NZGBS internet blog	2%	3%	-	-	-	47	65	-	-	-
	Stuff website	2%	2%	-	-	-	36	50	-	-	-
	Other website	1%	1%	4%	2%	2%	22	24	51	51	84
Social media	NZGBS Facebook group	-	-	7%	8%	6%	-	-	98	178	247
	NZGBS Facebook page	-	-	-	-	8%	-	-	-	-	339
	Other Facebook source[b]	7%	8%	5%	7%	**11%**	144	181	71	173	478
	Twitter	-	-	1%	1%	1%	-	-	12	23	37
Media	Newspaper	**25%**	**22%**	**14%**	**17%**	**22%**	520	491	212	391	931
	Radio	3%	2%	7%	6%	9%	61	53	103	152	361
	TV	0%	0%	4%	1%	2%	9	6	55	12	103
	Magazine	-	-	5%	4%	7%	-	-	71	105	299
Partners	Forest & Bird	**20%**	**17%**	**19%**	**14%**	**12%**	420	387	283	337	487
	Birds New Zealand	4%	4%	3%	3%	3%	93	79	47	81	123
	Topflite bird feeds	1%	1%	1%	1%	1%	19	19	7	15	38
	LEARNZ website or newsletter	-	-	1%	0%	0%	-	-	16	6	4
	Department of Conservation	-	-	2%	2%	3%	-	-	29	58	137
	Local council	-	-	1%	2%	2%	-	-	16	37	92
	School	-	-	2%	3%	3%	-	-	23	81	120
	Air NZ Green Team	1%	0%	-	0%	0%	11	6	-	2	8
Personal networks	Friend or family member	-	-	**10%**	**11%**	**14%**	-	-	147	257	591
Other	Other website, newspaper, etc.						349	336	109	234	515

[a] In 2014 and 2015 this answer was labelled 'Landcare Research website'.

[b] In 2014 and 2015 this answer was labelled 'Facebook source' as the NZGBS Facebook group and pages were launched in 2015 and 2018, respectively.

* No. of respondents each year: 2014 (*n* = 2,103); 2015 (*n* = 2,222); 2016 (*n* = 1,474); 2017: (*n* = 2,370); 2018 (*n* = 4 183).

5.4 Accessing NZGBS information

From 2014 to 2015 the questionnaire asked participants what media they would *most like* to use to access information about the NZGBS. From 2016 to 2018 we asked what media they *had used* to access information about the NZGBS. Table 7 outlines the responses, indicating the ongoing preference for and importance of the web page as the single most important source of information. From 2015 to 2018 there was a marked decrease in the preference for, and use of, email, newspaper and magazine articles, printed leaflets and other newsletters via community groups or societies. From 2016 to 2018 there was an increase in the preference for and use of Facebook, but Facebook users were still only 16% of all participants in 2018.

These findings and additional comments from participants suggest that while the newspaper, magazine articles and newsletters via community groups/societies raise awareness about the NZGBS and attract new participants, the website and email reminders are the two most preferred and most used media for finding out how to actually participate in the NZGBS.

Table 7. The type of media that respondents would most like to use (2014 and 2015) or had used (2016 to 2018) to access information about the NZGBS

Answer choices	Response percent					Response count				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Web page	**71%**	**66%**	**65%**	**61%**	**66%**	1,515	1,508	962	1,458	2,834
Email	**70%**	**71%**	**47%**	**39%**	**29%**	1,492	1,622	693	930	1,219
Newspaper or magazine articles	**27%**	**26%**	**10%**	9%	**11%**	573	153	149	220	483
Printed leaflet	9%	9%	6%	7%	7%	193	211	94	169	294
Facebook	9%	**15%**	**10%**	**11%**	**16%**	195	350	140	270	680
Newsletter articles via a community group or society	7%	7%	2%	1%	2%	159	153	31	31	80
Blog	7%	7%	0%	0%	0%	149	151	0	2	5
Video clip	6%	6%	2%	1%	1%	117	128	26	31	44
Seminar or public briefing meeting	3%	2%	1%	1%	0%	63	55	8	12	18
Twitter	1%	1%	1%	0%	0%	11	21	11	10	21
Other (please specify)						42	43	37	54	95
Answered						2,145	2,272	1,474	2,389	4,276

5.5 Supporting resources: awareness and interest

As the supporting educational resources and materials were developed each year, questionnaires asked participants whether they were aware of them and found them interesting. The responses are summarised in Tables 8 and 9. Table 8 shows that the tally sheet and identification guide were the two resources participants were most aware of and interested in, with between 59 and 66% of participants saying they were 'very interested' or 'loved it'. The Q&A resource was the next most popular, with between 36 and 41% of participants choosing 'very interested' or 'loved it'. The instruction videos were the least viewed. These findings are not surprising given that tally sheets and identification guides are the most important for being able to complete the NZGBS, while the instruction videos and Q&A provide additional, optional information that some participants may not need.

Table 9 shows that participants were less aware of the educational and engagement resources targeted at younger people than the general resources in Table 8. Of note is that the Māori bird name quizzes were the most popular of these resources. The limited awareness of and interest in these resources is perhaps not surprising given the age and demographic of the majority of participants. While we have seen an increase in the number of younger people (<18 years) participating in more recent years, since 2016 over 54% of participants have been 50 years or older and many were simply unaware of these educational resources.

Table 8. Awareness of and interest in supporting resources developed for the NZGBS

		Response percent					Response count					
		Not aware of it	**Aware of it but not looked at it**	**Looked at it, but not really interested**	**Looked at it and very interested**	**Looked at it and loved it**	**Not aware of it**	**Aware of it but not looked at it**	**Looked at it, but not really interested**	**Looked at it and very interested**	**Looked at it and loved it**	**Total**
Instructions videos	2016	**38%**	**29%**	3%	**20%**	**10%**	527	407	48	274	133	1,389
	2017	**48%**	**27%**	4%	**15%**	6%	1,088	604	83	347	137	2,259
	2018	**41%**	**31%**	3%	**18%**	7%	1,632	1,244	137	710	263	3,986
Tally sheet	2016	**14%**	**14%**	6%	**38%**	**28%**	194	201	81	522	393	1,391
	2017	**13%**	**22%**	7%	**31%**	**28%**	297	497	153	708	652	2,307
	2018	**13%**	**17%**	7%	**31%**	**32%**	504	689	278	1,248	1,308	4,027
Identification guide[a]	2017	**15%**	**19%**	4%	**36%**	**26%**	345	443	98	829	606	2,321
	2018	**16%**	**18%**	3%	**35%**	**29%**	646	712	129	1,400	1,167	4,054
Q&A[a]	2017	**35%**	**24%**	6%	**26%**	**10%**	761	522	131	574	212	2,200
	2018	**31%**	**22%**	6%	**29%**	**12%**	1,194	843	215	1,116	457	3,825

[a] Only asked about these in 2017 and 2018.

Table 9. Awareness of educational supporting resources targeting younger people

Option	Year	Response percent					Response count					Total responses
		Not aware of it	Aware of it but not looked at it	Looked at it, but not really interested	Looked at it and very interested	Looked at it and loved it	Not aware of it	Aware of it but not looked at it	Looked at it, but not really interested	Looked at it and very interested	Looked at it and loved it	
Quizzes (Māori bird names or bird identification)	2016[a]	**67%**	**12%**	4%	**12%**	5%	874	160	47	156	66	1,303
	2016[b]	**60%**	**11%**	2%	**17%**	**10%**	787	144	27	224	133	1,315
	2017	**69%**	**17%**	3%	6%	5%	1,611	392	75	149	105	2,332
	2018	**73%**	**16%**	3%	5%	3%	2,974	656	132	210	129	4,101
Colouring competition	2016	**74%**	**14%**	5%	3%	2%	952	185	69	43	32	1,281
	2017	**67%**	**21%**	5%	5%	3%	1,528	471	120	103	63	2,285
	2018	**67%**	**20%**	5%	4%	3%	2,698	813	208	172	131	4,022
Bird masks	2016	**70%**	**17%**	6%	3%	3%	898	217	82	44	43	1,284
	2017	**68%**	**19%**	6%	4%	3%	1,539	430	141	96	69	2,275
	2018	**71%**	**17%**	5%	4%	3%	2,823	692	193	164	126	3,998
Chocolate fish or garden layers videos	2016[c]	**80%**	**12%**	3%	3%	2%	1,024	148	38	44	27	1,281
	2017	**75%**	**15%**	4%	4%	3%	1,701	351	80	81	60	2,273
	2018	**78%**	**13%**	3%	3%	2%	3,123	529	121	120	87	3,980

[a] Māori bird names quiz

[b] Bird identification quiz

[c] Chocolate fish video only

5.6 Reporting results: State of NZ Garden Birds report

Reporting on results from the NZGBS has been an iterative process that has developed in response to participants' feedback. From 2014 to 2015 the questionnaires asked participants what they would like to know more about in terms of results (for instance, what locations, what kind of format and what level of detail). In 2015 results from the NZBGS were released (see 'The story so far') and consisted primarily of fact sheets of bird count species by geographical area. These results were the precursor to our *State of NZ Garden Birds* reports, which were first released in 2017.

Table 10 provides a summary of participants' feedback on the 2017 and 2018 results. The percentage of participants aware of our *State of NZ Garden Birds* reports increased from 45% in 2017 (n = 2,381) to 49% in 2018 (n = 4,213). The majority of participants (70–80%) were aware of and interested in the species maps, regional and species graphs, and regional reports (note: the latter were only available in 2018). Over 50% of participants were aware of, and interested in, the interactive maps (on the Shiny app) and the technical reports (only released in 2018). Open box comments relating to these resources also conveyed strong interest in them, with some participants noting how the results spurred them on to participate in the NZGBS and encourage others to do the same. As noted, disseminating results in a way that is meaningful to participants is a key part of citizen science. The relatively high level of participant engagement with results (over 75% of participants have engaged with results in some way) confirms that the results are used and valued by participants.

Table 10. Awareness of and interest in the range of *State of NZ Garden Birds* report resources developed in 2017 and 2018

Resources		Response percent				Response count				
		Aware of it but not looked at it	Looked at it, but not really interested	Looked at it and very interested	Looked at it and loved it	Aware of it but not looked at it	Looked at it, but not really interested	Looked at it and very interested	Looked at it and loved it	Total
Species maps	2017	**16%**	4%	**66%**	**14%**	168	36	682	142	1,028
	2018	**18%**	2%	**64%**	**17%**	337	32	1,222	320	1,911
Regional and species graphs	2017	**18%**	3%	**64%**	**14%**	185	32	646	141	1,004
	2018	**21%**	3%	**60%**	**17%**	381	47	1,106	318	1,852
Interactive maps for exploring your suburb	2017	**40%**	6%	**42%**	**12%**	386	60	404	115	965
	2018	**44%**	7%	**36%**	**14%**	766	121	623	241	1,751
Regional summary reports	2018	**27%**	3%	**55%**	**15%**	504	62	1,001	267	1,834
Regional technical reports	2018	**43%**	9%	**37%**	**11%**	749	164	641	183	1,737

5.7 Participating in the NZGBS Facebook group

In 2015 an NZGBS Facebook group was started, followed by an NZGBS Facebook page in 2018. As of the 15 July 2019 the Facebook group had 4,312 members and the Facebook page had 3,297 thousand likes. As noted earlier, although from 2016 to 2018 there was an increase in the preference for and use of Facebook, only 16% of all participants in 2018 were members of the Facebook group. Of those participants who were not NZGBS Facebook group members, during 2017/18 there was an increase in awareness of and interest in joining. For instance, in 2017, 16% of all participants were aware of the group (*n* = 2,061 respondents) and 28% were interested in joining it (*n* = 2,095). In 2018, 20% of all participants were aware (*n* = 3,578 respondents) and 30% were interested in joining (*n* = 3,649).

The 2017 and 2018 questionnaires asked participants about the effect that involvement in the NZGBS Facebook group had on their participation in the NZGBS. When asked whether they used Facebook to encourage other people to participate, in 2017 35% said yes and in 2018 44% said yes. These data, along with the data in Table 11, show that the Facebook group does play some role in attracting new participants and reminding past participants to engage again.

Table 11. Impact of NZGBS Facebook group membership on participation in the NZGBS in 2017 (*n* = 262 respondents) and 2018 (*n* = 488)

Answer choices	Response percent		Response count	
	2017	2018	2017	2018
No, I would have participated even without my involvement in the Facebook group	**54%**	**45%**	142	220
Yes, I learned about the survey because of the Facebook group	**11%**	**25%**	29	120
Yes, I was reminded to participate through the Facebook group	**41%**	**41%**	108	201
Yes, Facebook group members answered my questions about participating.	2%	1%	6	7

5.8 Open comments from the 2018 survey

In 2018 an open-ended question was added to the questionnaire, enabling participants to provide further feedback about any aspect of the NZGBS. This open-ended question received a total of 946 responses (total *n* = 4,183). The responses were analysed and coded into four categories:

1 general support for the NZGBS, outlining the reasons why people valued it

2 suggestions for how the NZGBS processes and resources could be improved

3 specific additional information about local bird/habitat patterns

4 questions or concerns about the process of data gathering and validity of the data.

Figure 2 provides an overview of the significance of these four categories. Of note is that 'general support' for the NZGBS accounted for approximately 66% of the total open-ended responses.

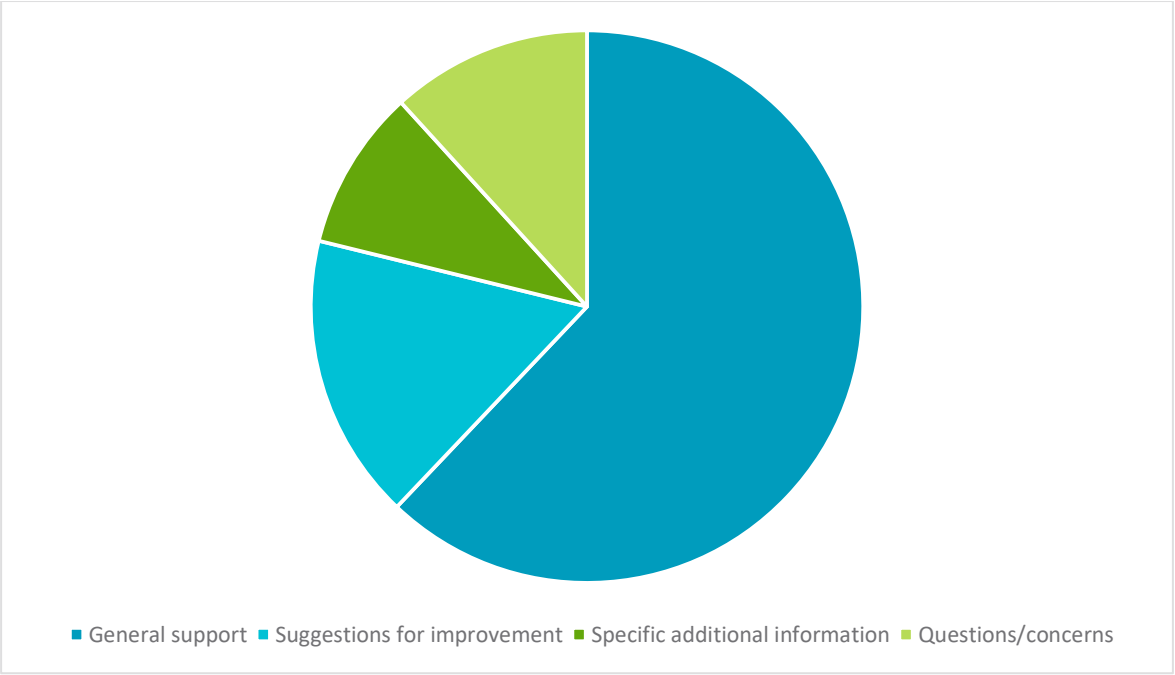

Figure 2. Breakdown of responses to open-ended question, 2018.

Figures 3 to 5 provide further detail on the sub-themes that emerged for three of the four[5] categories: general support, suggestions for improvement, and questions or concerns about the NZGBS.

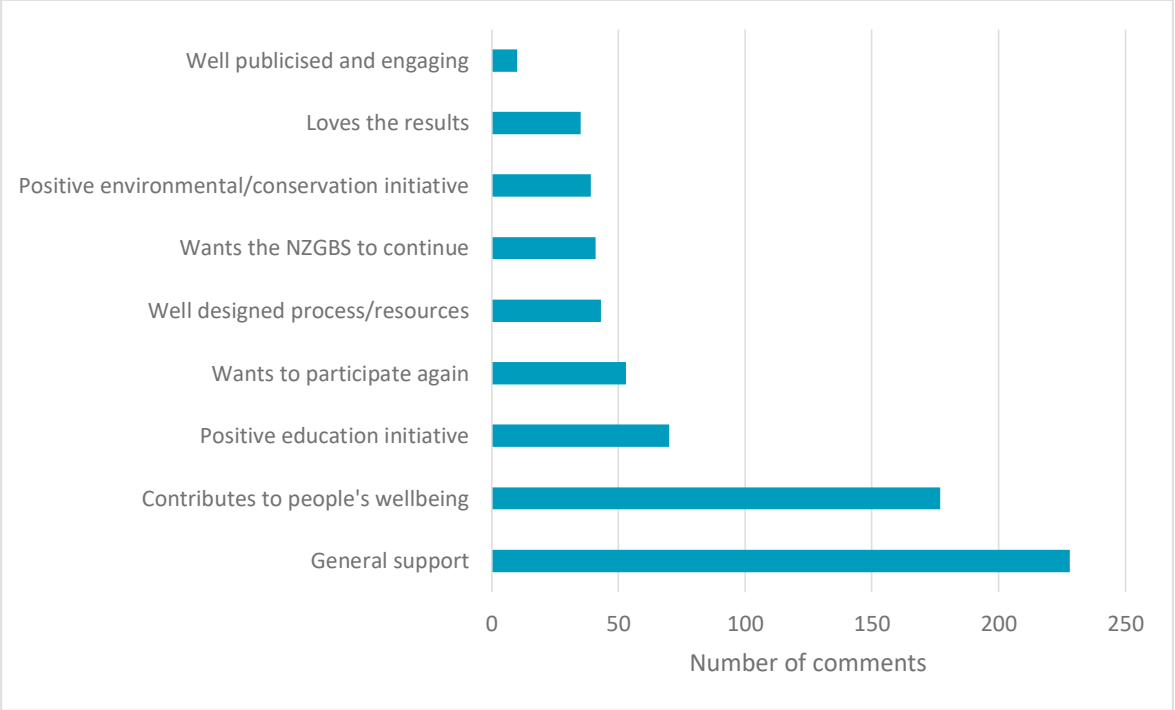

Figure 3. Supportive comments about the NZGBS 2018.

[5] Specific additional information about local bird/habitat patterns has not been included here because no significant sub-themes emerged.

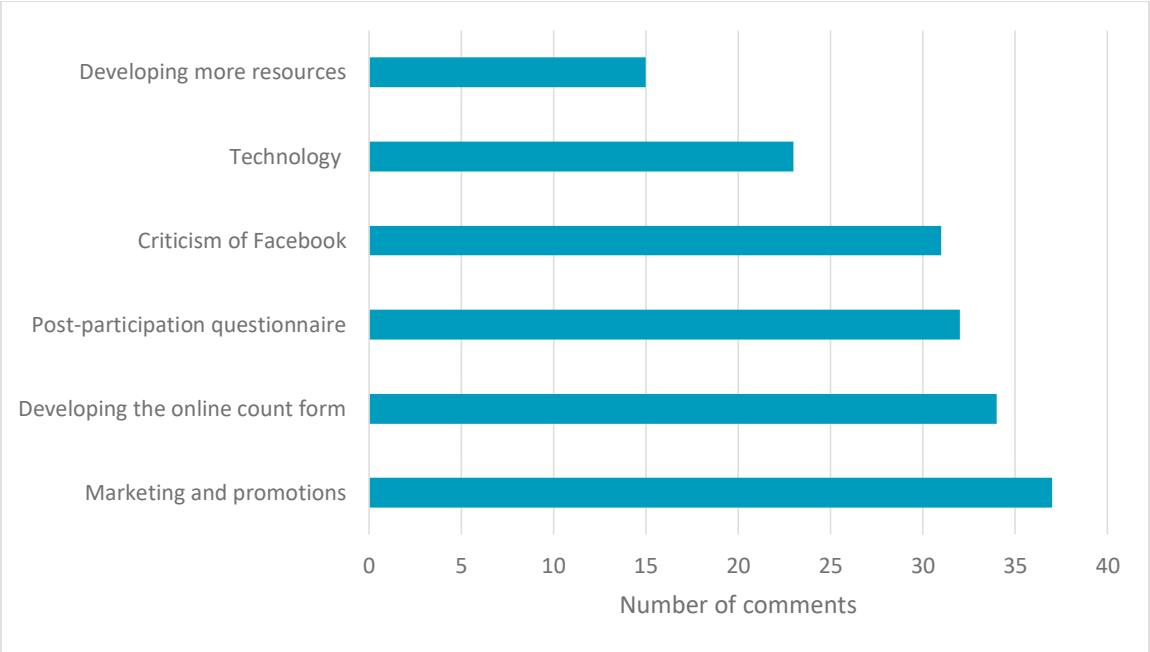

Figure 4. Suggestions for improving the NZGBS 2018.

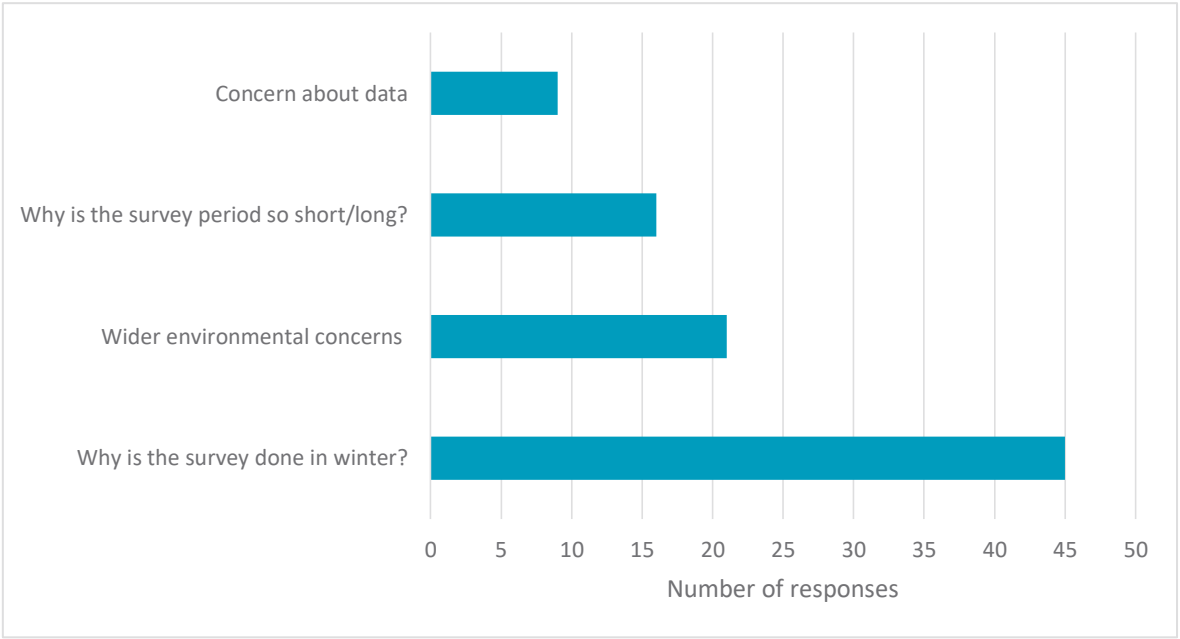

Figure 5. Questions/concerns about the NZGBS 2018.

The responses outlined in Figure 4 provide a number of useful suggestions. Some of these have already been actioned (such as suggestions for how to improve the participant questionnaire), while others may be useful going forward. Figure 5 identifies a number of questions and concerns participants have about the validity of the data and the timing or duration of the bird count that could easily be answered through promotion and marketing material, or frequently asked questions on the website.

What is striking about Figure 3 is the number of participants who wanted to tell us why they supported and valued the NZGBS. In what follows we outline three key themes that emerged from across both the open supportive comments and the data discussed earlier. These three themes are:

- the NZGBS enables people to participate in a collective environmental initiative on an issue they care about
- the NZGBS fosters genuine citizen science by enabling learning in an authentic, experiential way that contributes to a useful data set
- the NZGBS helps to foster wellbeing for participants through connecting with nature.

5.8.1 Participating in a collective care effort

Recent research on pro-environmental values and behaviour has indicated that more work is needed to understand what motivates (particularly urban) people to care about and take action on environmental issues (Shanahan et al. 2018). Coming from a slightly different perspective, emerging work on care ethics has emphasised how humans are essentially plural, 'caring people', and that foregrounding the way people already care for each other and the non-human world is an important way to promote pro-environmental behaviour (Tronto 2017).

Tronto (1993) identifies several phases of care ethics to describe how people move from just caring about something to taking action:

- caring about
- taking care of
- caregiving
- care-receiving.

'Caring about' something puts the focus on care as a disposition that identifies there is a concern or need, but this may not involve taking action. 'Taking care of' involves people changing their behaviour or doing something to move towards 'caregiving', which involves some kind of deeper relationship and ongoing interaction. 'Care-receiving' involves reflecting on how the care is received and whether it meets the needs of the recipient/s. These phases rely on four core ethical values: attentiveness, responsibility, competence to provide good care, and responsiveness of the care-receiver to the care.

Participants' responses in support of the NZGBS illustrate these four phases of care ethics. Many participants thanked the NZGBS organisers for setting up a survey that enabled them to participate in a collective effort to better understand and take care of birds and our wider environment. For example, '[t]hanks for the opportunity & caring for our environment & birdlife'. Other participants described how through participating they had begun noticing birds, learnt about them, and started care-giving behaviours, such as planting bird-friendly habitat, making bird baths, and advocating for predator control. Finally, some participants described the final phase of Tronto's care ethic, reflecting on whether their care-giving behaviours were meeting birds' needs or having positive effects on bird numbers. This was

evidenced by some participants describing how they had changed what they did in response to birds' behaviour (such as habitat protection and advocating for predator control). These findings demonstrate how the NZGBS enables people who care about something (birds and the environment) to do something practical and contribute to a care-taking initiative.

An important point that emerged through participants' responses is that involvement in the NZGBS does not necessarily require them to join any 'groups', or commit to something beyond their means, but still involves contribution to a collective effort. The flexibility, place-based, and social nature of the NZGBS was something participants valued, and many noted how they recruited friends, family and whānau to help. For example, 'It's a fantastic way to feel involved in a bigger collective and meaningfully involved (without too much hassle or needing to join anything)'. Many responses iterated this point about how the NZGBS enabled them to contribute to something positive and meaningful, especially when there is so much negative news about environmental issues, particularly biodiversity. Participants noted how they valued the NZGBS because it was both a collective effort of care while highlighting wider biodiversity concerns in a proactive way.

5.8.2 Authentic citizen science

The citizen science approach seeks to counter the knowledge-deficit theory of change that, as Duncan and Robson-Williams (2019) point out, tends to dominate New Zealand's science funding. The knowledge-deficit theory of change assumes that conservation and environmental issues arise from a lack of (usually) biophysical knowledge, which sets up the solution as the need for more 'knowledge'. The assumption with this approach is that the new knowledge will then somehow lead to pro-environmental behaviour change. This model tends to be premised on 'experts' telling the wider public 'facts' in the hope that this will foster social change. As noted in the introduction, a citizen science approach uses authentic learning to generate knowledge and social engagement by catering to a range of knowledge levels, using experiential and authentic learning experiences, fostering curiosity, and ensuring the data and findings are disseminated in meaningful ways (Doyle et al. 2019). The pedagogy underpinning citizen science shifts the emphasis from 'experts telling', to 'people doing'.

Responses from NZGBS participants indicate that these four key aspects of citizen science are being met. For example, participants described how watching birds is a very accessible and enjoyable activity: 'Great idea, appeals to young, old and those in between'. Other participants described how the resources were well designed and the overall process was 'fun' and 'interesting' because it required them to use their eyes and ears to identify and count birds. While there have been a range of supporting resources developed by the NZGBS to help prepare participants, these do not necessarily provide participants with the 'answer' at the moment of counting. Rather, the process encourages people to notice and develop their own expertise (with support) to identify and categorise birds.

Participants' responses also indicate that the NZGBS is fostering ongoing curiosity and interest in birds and the wider environment beyond just the hour of participation. Participants noted how the NZGBS had increased their awareness of birds and the wider environment, and how they had started noticing things and become disseminators of knowledge. For example:

'[t]he students in the class have become much more interested in the birds around the school and at home and have made bird feeders and some are doing the survey at home with parents. Been very educational for them and entering the data together has shown them how to be global and digital citizens'.

'Makes me appreciate and learn about the things in my backyard by taking the time to observe'.

Many participants wanted to tell us about changes they had observed in bird life, the effects of weather on their bird count, and other changes they had observed outside the survey period.

Finally, the NZGBS uses participants' data to create a useful and robust data source that is then shared with participants. As Doyle et al. (2019) note, this final step is vital because it completes the loop and encourages ongoing engagement through viewing results and observing trends. Many participants noted the importance of this final step, describing how they valued the data set and reviewed it each year to understand trends, and that it reminded them to participate again. For example, '[b]ecoming really interesting to see the trends and possible reasons. There have been definite positive results from local pest control for some species esp. Tui'.

Overall, these findings align with research in education (see Donovan et al. 1999; Lombardi 2007) that advocates for authentic and experiential learning to build a sense of agency and confidence: 'I can do science'. The findings illustrate how participation in the NZGBS requires people to learn through experience, develop and exercise their own judgement, and contribute to the final data set, thereby helping participants to see the value of their contribution. Participants' responses, particularly from the open-ended question in 2018, demonstrate that the NZGBS is meeting key citizen science goals, which Doyle et al. (2019, p. 6) describe as helping foster 'informed, critical and responsible citizens'.

5.8.3 Fostering well-being through connection with nature

As noted in the introduction, an expanding body of evidence suggests that there are multiple health and social benefits for people who engage with nature. Some of this research has highlighted the adverse health effects of both increased urbanisation and digitally focused cultures, as people spend less time outdoors interacting with nature than previous generations (Turner et al. 2004). Some researchers also highlight how this disconnect from nature is leading to people's increasing apathy and lack of interest in how human activities affect nature and the environment (Louv 2005).

The single most positive reason (12%) given for participating in the NZGBS in the open-ended comments in the 2018 questionnaire related to positive health and wellbeing benefits. Participants voluntarily described how much they enjoyed participating in the NZGBS because it was 'relaxing', 'peaceful', enabled them to 'slow down and just observe and listen to nature', was 'enforced but focused resting', enabled them to 'enjoy' birds, and helped them reconnect with what was happening in their gardens. Other participants described how doing the survey was a welcome 'break' and a 'rest' from their busy lives because it required them to 'watch quietly'.

These responses indicate that many participants experience positive wellbeing through involvement, and that through slowing down and observing they notice other changes in the environment that help them to connect and understand some of the effects human activity is having on the non-human world. As Shanihan et al. (2018) note, delivering outcomes for people is a key motivator for supporting many urban biodiversity strategies. The NZGBS provides a useful way both to promote people's wellbeing and to encourage greater connection with nature, particularly for urban people.

6 Conclusions

The findings from the NZGBS participant surveys demonstrate that the NZGBS enables people to participate in a collective environmental initiative on an issue they care about, meets the criteria for genuine citizen science, and is helping to foster wellbeing for participants (primarily urban people) through connecting with nature. Participation numbers have increased every year since 2014, and recent data suggest that the demographic of participants is expanding to include people who haven't traditionally engaged, particularly younger people (<18 years old). Given these multiple benefits, the NZGBS represents a unique opportunity for MWLR and potential partner organisations to build on and expand the initiative. The NZGBS could be MWLR's flagship citizen science initiative that specifically provides urban New Zealanders with an accessible way to collectively contribute to monitoring and engaging with nature that fosters authentic learning while providing positive well-being benefits for participants.

7 Recommendations

The NZGBS is a valuable citizen science initiative and from our associated participant survey, is providing the benefits we would hope to see with a successful citizen science initiative. For the NZGBS to continue to provide these benefits, increase reach, and improve data validity we recommend:

- MWLR continue to support the annual running of the survey
- we initiate and continue conversations with major local councils (Auckland, Wellington, Canterbury and Otago) and Enviroschools networks to promote the NZGBS and explore co-funding and extension opportunities. We have started these conversations but like any new relationship it takes time to develop these, and from a funding perspective, for these agencies to agree to support funding the survey
- we initiate and continue conversations with central government agencies (Ministry for Primary Industries, Department of Conservation, Ministry for the Environment) to explore co-funding opportunities relating to biosecurity and monitoring in urban areas
- further promote the NZGBS by targeting schools, education providers and other networks, including Scouts New Zealand, National Council of Home Educators New Zealand, LEARNZ, Core Education

- initiate conversations with Predator Free New Zealand to explore how the NZGBS could connect with predator eradication efforts and networks
- explore whether/how the NZGBS could connect with Curious Minds projects and funding sources
- continue existing social media strategies, but monitor perceptions of Facebook following recent developments and increasing national/international concerns about the platform.

8 Acknowledgements

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