Data Submission in Citizen Science Projects

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Executive Summary

Background:

Citizen science, where volunteers and scientists work together to answer scientific questions, is a rapidly growing field, and it is important to understand why people participate in citizen science projects and in particular, why they submit their data or not. This is because as the number of citizen science projects continues to grow (Bonney et al, 2014), those considering using citizen science approaches need to be able to attract and retain participants The Stockholm Environment Institute at the University of York have conducted a study to explore the barriers to data submission in citizen science projects.

Methods:

This study involved two surveys of participants in environmental citizen science projects in the UK (number of respondents = 664), and a review of both peer-reviewed academic and grey (non academic) literature around citizen science to answer the following questions:

1. What are the key motivations for people participating in citizen science projects?
2. Do peoples' motivations for participating influence whether or not they submit their data?
3. What are the barriers to participants submitting data?

Key findings:

- Only a small proportion of the UK population have participated in environmental citizen science projects, so there is potential for many more to become involved. There is a bias towards white, male, middle-aged people with high incomes participating in citizen science.
- Return rates (number of people registering for projects to number of people submitting data) varied between projects, from 10% to around 50%, although our study found much higher return rates.
- Most work in citizen science projects is done by a minority of participants, therefore it is important to keep these participants engaged and submitting data.
- Volunteers are likely to hold multiple motivations for participating, and these motivations may change over time. There may be a shift from egoism motivations to begin with (i.e. wanting to further one's own career) towards more altruistic motivations later (for example, participating in order to help a group of other volunteers or scientists running the project).
- Personal development motivations, such as wanting to learn and to develop a career, can be important for many participants so project organisers should emphasise these benefits.
- There are many tasks in citizen science projects which volunteers can take part in, including things peripheral to the main project, for example, helping to recruit new participants, moderating comments on forums, disseminating key messages etc. These may involve participants with differing motivations to those involved in the data collection, and therefore may help to diversify and increase the participant base.
- Projects which require participants to undertake training appear to have higher submission rates than more casual projects.
- Participants value feedback about what their data is being used for. For some people, feedback gives them a sense of collectivism (a group of people working towards a common good) which can be motivating. Giving feedback can be time-consuming for project staff, but new technologies are being developed which may speed up this essential process.
- Communication with participants is important for keeping them motivated, and together with co-ordination of research, data screening and checking, and data compilation, this makes citizen science costly.

Key recommendations:

- Practitioners should recognise the diverse motivations of participants and communication with volunteers should reflect these varying motivations.
- Online submission systems need to balance simplicity with the need to gain sufficient information from participants, and user testing can help to assess whether this balance has been met. Projects should provide alternative means of data submission in order to maximise return rates and ensure that participants who cannot or do not want to use the internet to submit their data can still take part. If data is recorded ‘in the field’ on paper, then any online submission system needs to replicate paper copies to make it as straightforward as possible for data to be entered.
- Projects should highlight the importance of negative records i.e. where a species is looked for but not seen, in order to motivate participants to continue sending in data.
- Organisations should consider the benefits and costs of the citizen science approach before commencing any projects.

This report looks at people's motivations for participating in citizen science projects, explores the variety of ways participants can submit their data to projects and how this and other factors affect data return rates. The report also explores the role of feedback from scientists to citizen participants in influencing motivation.

Introduction

Citizen science is the collaboration of volunteers and scientists to answer real-world scientific questions (Cornell Lab of Ornithology, 2015). It is used in a wide variety of fields, including monitoring environmental change, classifying objects in space, health research, digitising historic records and many more. Here we report on a study of data submissions by volunteers in environmental citizen science projects conducted in the UK.

The term 'citizen science' has only risen in popularity over the past decade but the concept is not new. Long before the term 'scientist' was first used in the 1830s, people were collecting information about the natural world around them. For example, court records from Japan dating back many thousands of years have documented the flowering times of cherry trees, which allows us now to demonstrate changing climatic conditions (Miller-Rushing et al., 2012). In the UK there is a rich history of amateur naturalists observing and recording species and their habitats.

Governments have obligations to measure and monitor the environment, but in a context of diminishing resources (Mackechnie et al., 2011). In recent years there has been a huge surge of interest in environmental citizen science among various stakeholders, including Government (POST 2014), as they see that it can meet monitoring obligations, generate robust scientific data and have benefits for participants. Sauermann and Franzoni (2015) summarise the six main benefits which can be derived from involving members of the public in scientific research: it can lower project costs as volunteers tend to contribute for social or intrinsic motivations rather than financial reasons; project speed can be increased due to parallel working; it can allow access to diverse skills and knowledge; creative projects in particular can benefit from rich and diverse inputs from the public; it can provide increased temporal and geographic coverage; and lastly, there can be science education and advocacy benefits through participation.

Despite increasing interest in citizen science, some projects are reporting decreasing participation; for example, the long-running Nature's Calendar project notes on their website "the number of records we receive is declining each year" (Woodland Trust, undated), and the California Water Resources Volunteer Climate network, established in the 1950s, currently has the lowest number of participants since it started (Department of Water Resources, 2012). These do not appear to be isolated cases, although it is hard to find concrete evidence about participation rates. However, many authors recognise the 80/20 law: that the majority of the data in citizen science projects is submitted by a very small number of very active users. For example, in a study of seven Galaxy Zoo projects (which crowdsource classification of images from space on the Zooinverse platform for citizen science), the top 10% of contributors provided 79% of contributions (Sauermann and Franzoni, 2015). eBird is an example of an environmental citizen science project which follows this pattern (Wood et al. 2011). Most Galaxy Zoo users do not return to the project a second time, with an average return rate of only 27%. As new users do not compensate enough activity for the loss of effort from original users, projects show declining activity over time (Sauermann and Franzoni, 2015). Within the OPAL project, a UK-based citizen science project running since 2008, approximately 10% of environmental survey packs sent out result in data being submitted (Lakeman-Fraser et al. 2015, forthcoming).

Whilst there are many thousands of published scientific papers which use citizen science data, and many looking at data quality within citizen science, there appears to be a relative lack of published work on the participants in citizen science. As such, there is a relative paucity of publications covering key questions that are central to the design and delivery of

successful citizen science projects, such as: Who are the people who take part? Why do they take part initially and what motivates them to continue taking part? What role does feedback and acknowledgement play in keeping people involved? Many of the limited published papers, conference presentations, reports etc. which do deal with these important questions are not based on empirical evidence but instead rely on the anecdotal experiences of those running citizen science projects. Studies in these areas could help to understand what affects participation and return rates, retention of participants and data return rates. Answers to these questions could help citizen science practitioners when designing and refining projects.

In this study we have conducted an extensive review of both the published academic and grey (non-academic) literature available online about participants in citizen science, and conducted two surveys asking UK residents about their participation in environmental citizen science projects. The study addresses three core questions:

1. What are the key motivations for people participating in citizen science projects?
2. Whether people's reasons for participating influenced whether they submitted their data.
3. What are the barriers to participants submitting data?

At the end of the report, we summarise the key messages from this work and make recommendations for those involved in designing citizen science projects.

Methods

Questionnaires

A very wide range of environmental citizen science projects exist, for example: across geographical scales from large national projects to local site specific projects; from those requiring no prior knowledge to those requiring specialist knowledge; and those requiring activity at a single point in time to those requiring repeated data collection over a period of time. Our questionnaire needed to capture the experience of participants across this range of projects, avoid the bias of a self-selecting sample and to include those participants who had not submitted data and who might, therefore, be more difficult to contact through the citizen science projects themselves. In order to achieve these requirements, we commissioned a national survey. The survey was carried out by TNS Global, and took the form of face-to-face interviews as a part of an 'Omnibus' survey which is run each week using a stratified sample of the UK population. A filtering question was asked to identify respondents who had ever taken part in any type of project that involved collecting environmental scientific information (see Appendix). The question was: "Have you ever taken part in any type of project that involved collecting any environmental scientific information or data?", and then for clarification the interviewer added "By this we mean national projects that help scientists like the RSPB Big Garden Birdwatch, one of the OPAL Surveys on worms, climate, tree health, biodiversity, bugs or water, or a local project". As the percentage of the population who have been involved in environmental citizen science is difficult to estimate, these questions could be included in additional waves of the Omnibus survey to obtain a sufficient sample size. In practice, the survey was included in two waves of the survey on subsequent weeks. The survey used a combination of closed and open questions to explore the motivations of those who had been involved in citizen science, whether they had submitted data or not, the mechanisms used for submitting data, barriers to submitting data and the role of feedback.

A second survey was carried out, initially with participants in the OPAL project, using the Survey Monkey online survey tool. This allowed similar questions to those used in the Omnibus survey, but with the majority of the respondents drawing on their experience of the OPAL project. Having initially been promoted through the OPAL networks, due to staffing issues the return rate was low and in order to increase the sample size this survey was then advertised through wider social media (Twitter and Facebook).
Both surveys asked participants to fit their motivations to pre-defined categories, using categorisations found in the literature (Van den Berg et al 2009, Hobbs and White 2012: these studies were chosen as they specifically looking at participation in environmental volunteering), and from the team's previous work looking at the motivations of participants in the Moors for the Future Community Science Project. Respondents were also given the option of detailing any other motivations that they felt were different from those listed. In the analysis these categories were then grouped into categories with similar underlying motivations. Parallel analyses of the results of the two surveys were made using Excel.

Literature search

The literature search looked at both the academic and grey literature for citizen science projects in general, not just those in the environmental field as this was felt to be too restrictive and we wanted to be able to learn from across the spectrum of projects. The following search terms were used in Web of Science to look for relevant academic papers: "Citizen science" data submit, "citizen science" return rate, "Citizen science" data return, Volunteer "return rate", "citizen science" feedback, "volunteer data" feedback. This yielded 28 papers which were relevant to people's motivations for participating in citizen science projects, what motivates people to submit data and barriers to submitting data. The terms were also used in the search engine Google, and the first fifteen pages were read to search for relevant grey literature. This yielded a further 43 relevant sources, which included project reports and conference presentations. The literature was used to support the discussion section of this report.

Results

<u>Questionnaires</u>

The Omnibus survey asked a total of 8220 people if they had ever taken part in any type of project that involved collecting environmental scientific information or data. 613 (7.5%) responded yes and went on to complete subsequent questions.
The Survey Monkey questionnaire was completed by 51 people who had taken part in any type of project that involved collecting environmental scientific information or data.

Table 1. *Demographics of survey respondents. For the Omnibus survey, the table shows the percentage of all survey respondents in each demographic category and the percentage of each group that had taken part in the citizen science project. For the Survey Monkey survey, all respondents had taken part in a citizen science project so the percentage of all respondents in each demographic group is given. BME = black and minority ethnic groups. Social Grades are AB: higher & intermediate managerial, administrative, professional occupations; C1: supervisory, clerical & junior managerial, administrative, professional occupations; C2: skilled manual occupations; DE: semi-skilled & unskilled manual occupations, unemployed and lowest grade occupations (Market Research Society 2015). No Social Grade information was available for participants in the Survey Monkey survey.*

	% total sample	% taken part in CS project	% total sample
	Omnibus		Survey Monkey
Gender			
Male	47.8	8.2	23.4
Female	52.2	6.8	76.6
Age			
16-24	15.1	7.1	6.4
25-34	17.5	4.0	25.5
35-44	14.6	9.1	25.5
45-54	14.8	8.2	23.4
55-64	12.5	9.2	19.1
65+	25.6	7.8	0
Ethnicity			
White	86.2	8.0	93.6
BME	13.8	4.0	6.4
Social Grade			
AB	17.4	16.5	
C1	26.4	8.8	
C2	20.8	5.3	
DE	35.5	3.3	

Data from the Omnibus survey (Table 1) show that men were more likely to participate in citizen science projects than women ($\chi^2 = 6.3$, d.f. = 1, $P = 0.012$); and white people were more likely to participate than those from black and minority ethnic groups ($\chi^2 = 23.1$, d.f. = 1, $P < 0.001$). There was a significant difference in the likelihood of people from different Social Grades taking part in citizen science projects ($\chi^2 = 257.7$, d.f. = 3, $P < 0.001$). People from Grade AB (higher & intermediate managerial, administrative, professional occupations) were most likely to participate (16.5% of the group had taken part in a citizen science project), followed by those from Grade C1 (supervisory, clerical & junior managerial, administrative, professional occupations) (8.8% of the group had participated in a citizen science project). A smaller percentage (5.3%) of those from Grade C2 (skilled manual occupations) had taken part in citizen science projects; and people from Grade DE (semi-skilled & unskilled manual occupations, unemployed and lowest grade occupations) were least likely to have participated in citizen science (3.3% of the group). There was also a significant difference in the likelihood of people from different age groups participating in citizen science projects ($\chi^2 = 33.9$, d.f. = 5, $P < 0.001$). 7.1% of 16-24 year olds had participated in citizen science compared with 4% of 25-34 year olds, perhaps because people in the younger age group participated as part of school, college or university studies. People aged between 35 and 64 were most likely to have participated in citizen science projects (8.8% of people in this age group had participated). There was a decline in

participation in the over 65 age group (7.8% of the group had participated), perhaps due to mobility and health issues.

Motivations for participation in citizen science

Respondents to both surveys were presented with a number of options for motivations for taking part in environmental citizen science projects which had been derived from the literature. Responses are shown in Figure 1 (note that respondents could select more than one response).

The different motivations could be aggregated into categories as follows (Figure 2):

- **Altruistic**: To help wildlife in general, to contribute to scientific knowledge, it's a valuable thing to do, wanted to help a specific site
- **Personal development**: To learn something new, want to enhance my own development, want to help my future career
- **Personal**: To meet people/for fun, to get exercise and fresh air
- **To share my knowledge**
- **Someone else wanted me to do it**
- **Other, don't know/can't remember**

The most common responses to both surveys were altruistic motivations, either to help wildlife in general (42% Omnibus, 75% Survey Monkey), to contribute to scientific knowledge (28% Omnibus, 80% Survey Monkey) or because it's a valuable thing to do (24% Omnibus, 65% Survey Monkey). The other altruistic motivation, to help a specific site, was a far less common response (8% Omnibus, 16% Survey Monkey). In both surveys, personal development motivations were second most common, including the motivation to learn something new (18% Omnibus, 57% Survey Monkey), to help their future career (10% Omnibus, 18% Survey Monkey) and to enhance their own development (7% Omnibus, 35% Survey Monkey).

Other personal motivations, not related to development – to get exercise/fresh air and to meet people/for fun – were the least common responses in the Omnibus survey (5%, 4%, respectively) and were also fairly uncommon in the Survey Monkey survey (25%, 12%, respectively). To share personal knowledge was the fifth most common response in the Survey Monkey survey (41%) and the seventh most common response in the Omnibus survey (11%). Being asked by someone else to participate was the fifth most common response in the Omnibus survey (15%) the least common response in the Survey Monkey survey (8%).

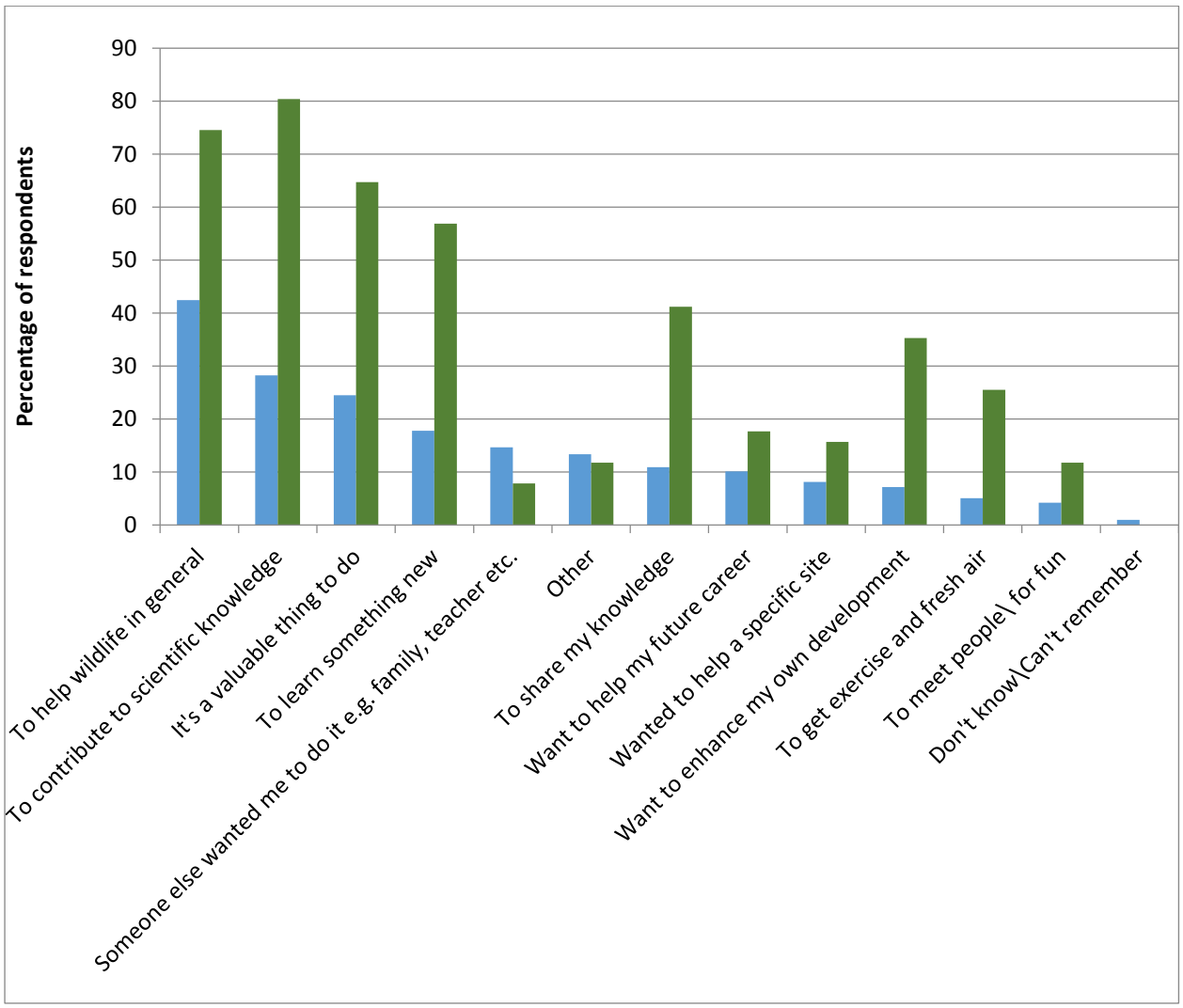

Figure 1. *Motivations of participants in citizen science projects from responses to the Omnibus survey (blue; 613 respondents) and the Survey Monkey survey (orange; 51 respondents). One person could state they have multiple motivations.*

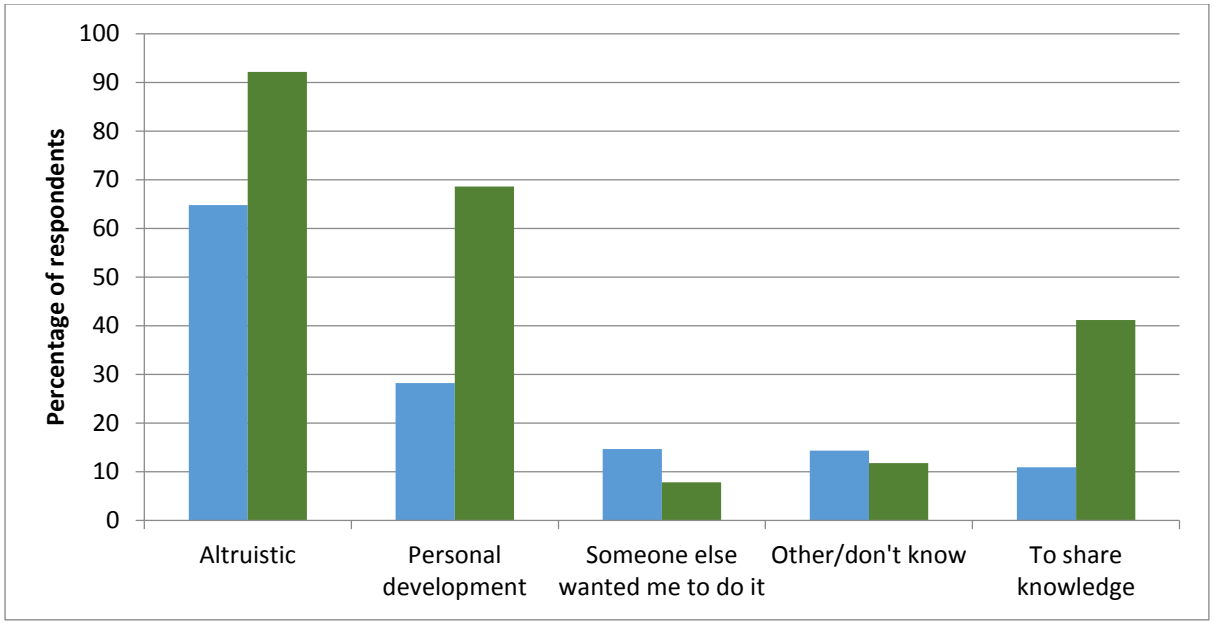

Figure 2. *Percentage of respondents who said they had any of the motivations within the motivation groupings.*

In the Omnibus survey, 15 of the 82 respondents who replied “Other” to this question provided more detail with their response. These responses fell into the following categories:

- **Personal interest**: Four stated it was because of their interest in wildlife and another said it was in connection with another hobby, photography
- **To raise awareness:** one respondent stated it was to encourage children’s interest
- **Had to**: Three replied that they were required to take part in such studies for their degree course, job or part of government agricultural support schemes.
- **Personal reasons**: One took part because they were bored, one because they wanted to lose weight and one because of a financial incentive
- **Other responses**: The three other responses were “collecting data”, “linked to a TV project”, “for recycling”.

In the Survey Monkey Survey, reasons were given by 5 of the 6 respondents who answered “Other”. These were:

- **To raise awareness**: this reason with given by four respondents, including: “To engage my learners in the bigger picture”, “To raise awareness of issues to the general public” and “To teach my children the value of community involvement”
- **Personal development:** One said they wanted to improve their CV
- **Conservation and adding to scientific knowledge:** “To add to information required for conservation efforts as well as data on invasive species and phenology”

These ‘Other’ responses have not been incorporated into future analysis because the respondents felt that the motivations they stated under ‘Other’ were different to those given as multiple-choice options.

Respondents were able to select more than one motivation. The majority of Omnibus survey respondents only selected one motivation, but the majority of Survey Monkey respondents had multiple motivations (Figure 3), but this difference may be as a result of the format of the survey, see Limitations section.

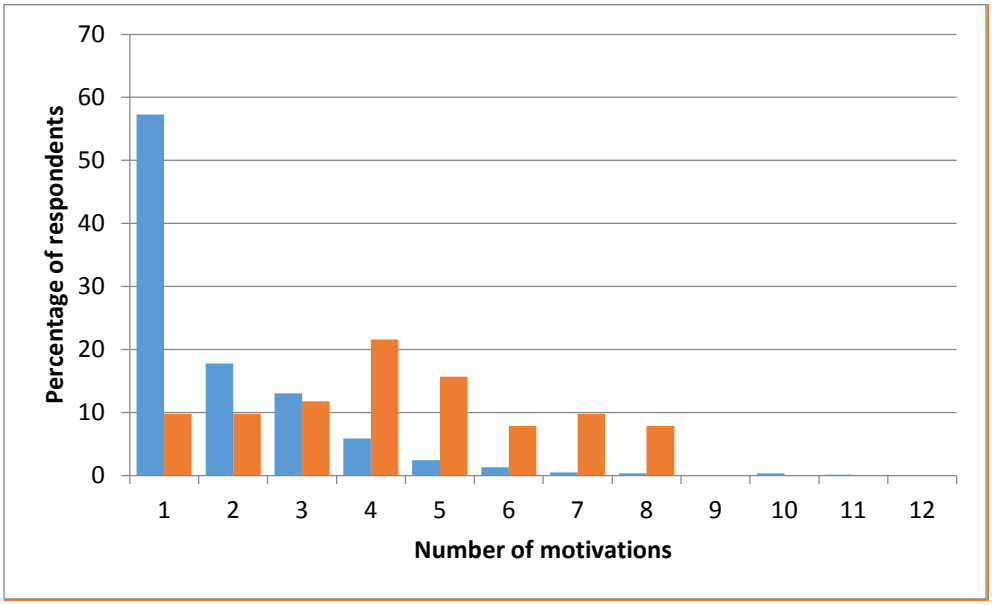

Figure 3. *Percentage of respondents who stated multiple motivations. Blue = Omnibus survey (613 respondents). Orange = Survey Monkey (51 respondents).*

Data submission

Of the 613 respondents to the Omnibus survey who said they had taken part in a CS survey, 93% (572 respondents) said they submitted the data to the organisation running the project.

72% (442 respondents) submitted the data personally and 21% (130 respondents) said someone else submitted the data.
Of the 51 respondents to the Survey Monkey survey who had taken part in a CS survey, 92% (47 respondents) had submitted their data and 8% (4 respondents) had not. (They were not asked if they submitted the data themselves or if someone else submitted the data).

Motivations for submitting data

We examined whether submission rates varied between people with different motivations for participating in citizen science (Figure 4). We only used the Omnibus data as the data submission rates were too high in respondents to the Survey Monkey data for us to draw any meaningful conclusions. We analysed the data using the aggregated motivation categories for ease of interpretation. Submission rates were generally high but the highest submission rates were amongst people who had altruistic motivations (97%), closely followed by those who had taken part because someone else wanted them to (97%). The lowest submission rates were in people with personal motivations (to have fun, get fresh air/exercise) (91%).

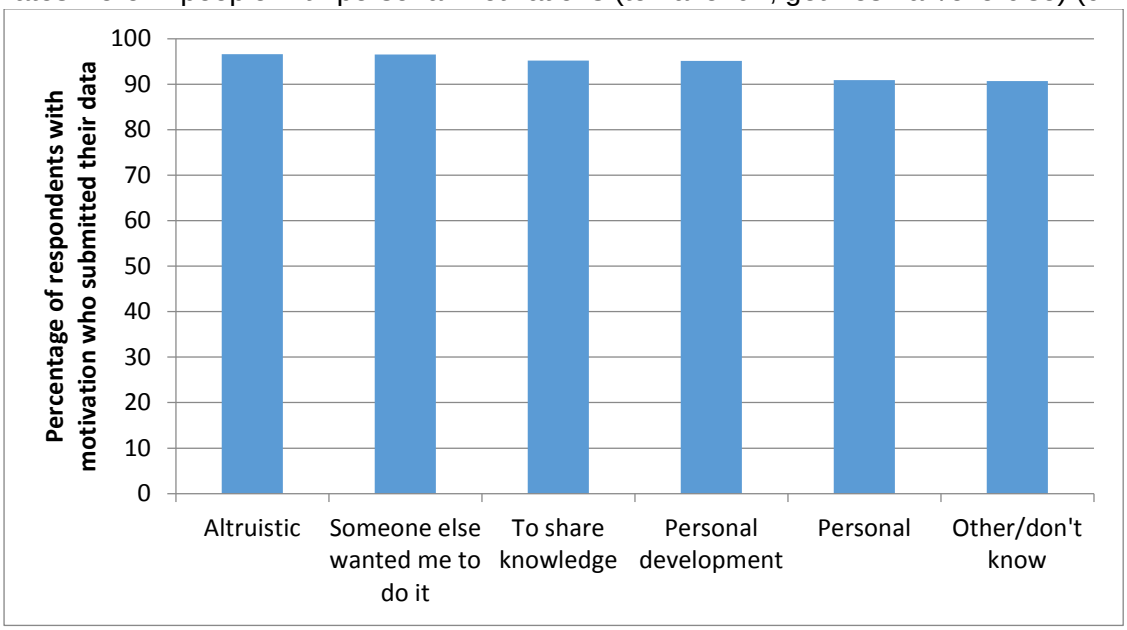

Figure 4. *Submission rates in respondents with different motivations for participating in citizen science projects*

Barriers to submission

In order to explore the barriers to data submission, we used a multiple choice question to ask people why they did not submit their data (Figure 5). Response options were derived from the literature. The sample size for this question was small, as only 41 respondents said they did not submit their data.

17% of the 41 respondents did not submit their data because they did not complete the project. 10% didn't have the time, 3% forgot and 3% found the method of submitting data difficult. No respondents said that they did not submit their data because they were worried about the quality. Most commonly, respondents (60%) stated that there were other reasons that they did not submit their data. Four of these respondents provided further details: one stated that they were part of a group and someone else submitted the data, one said the data is not due yet, one said the data was for personal use and one said they did not need to enter the data.

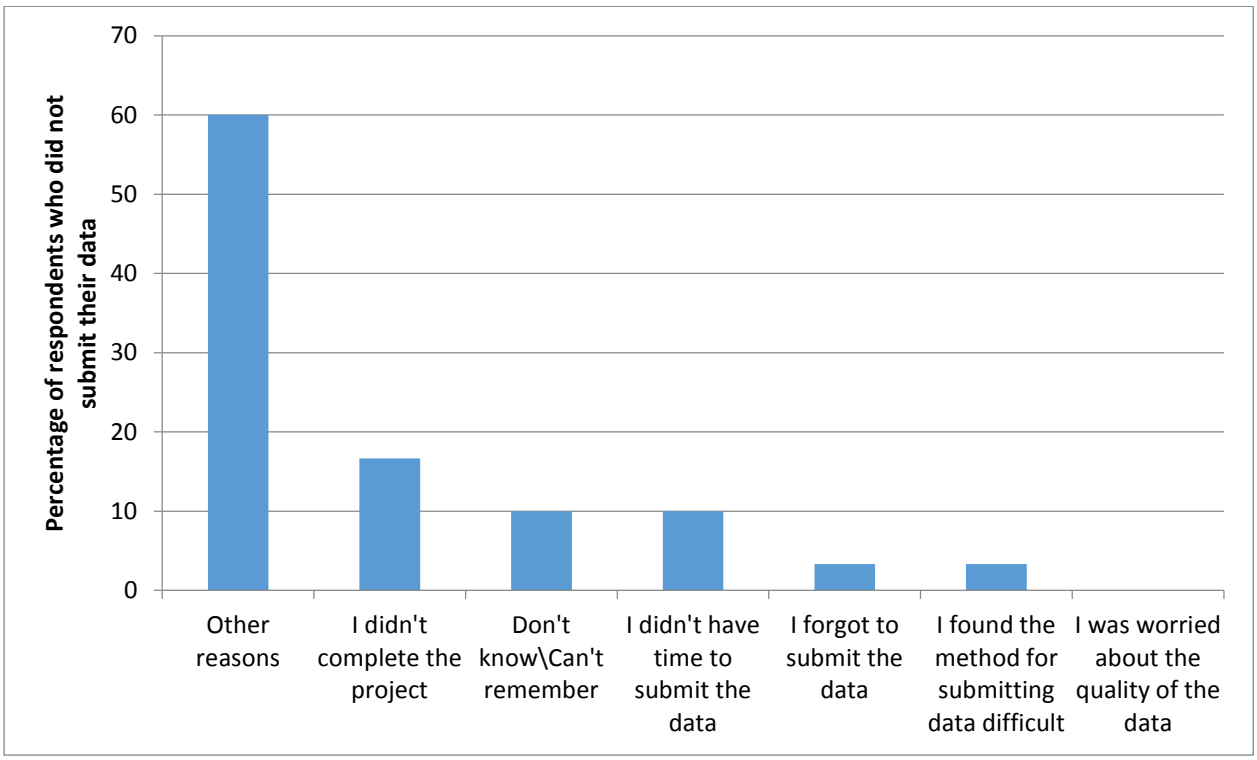

Figure 5. *Reasons why respondents did not submit their data.*

Of the four people in the Survey Monkey survey who had not submitted their data, one forgot to submit it, one didn't have the time and one found the method for submitting data difficult. The fourth did not provide a reason.

We examined a range of other factors that might affect submission rates, including what submission methods were available, whether people had internet access, whether they participated alone or as part of a group, and participant demographics.

Submission methods available

We explored whether the methods available for data submission affected the rates of submission. Participants were asked which methods of data submission were available and could provide multiple responses. Again, as submission rates were so high it is difficult to draw any firm conclusions. However, if postal submission or mobile phone apps were available, submission rates were 100%. Online submission yielded the next highest return rates followed by in person data submission (Figure 6).

There appears to be a positive relationship between the number of ways of submitting data available and submission rates (Figure 7). If three methods of submission were available then submission rates rose to 100%.

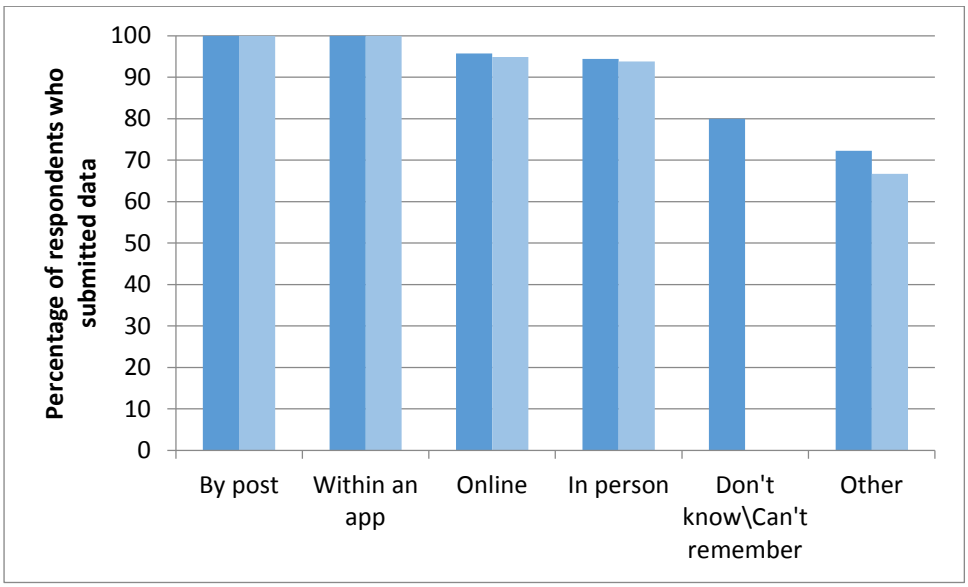

Figure 6. *Percentage of respondents who submitted data when different methods of data submission were available. The dark bars show rates when these methods were available, potentially alongside other methods. Pale bars show submission rates when only this method was available.*

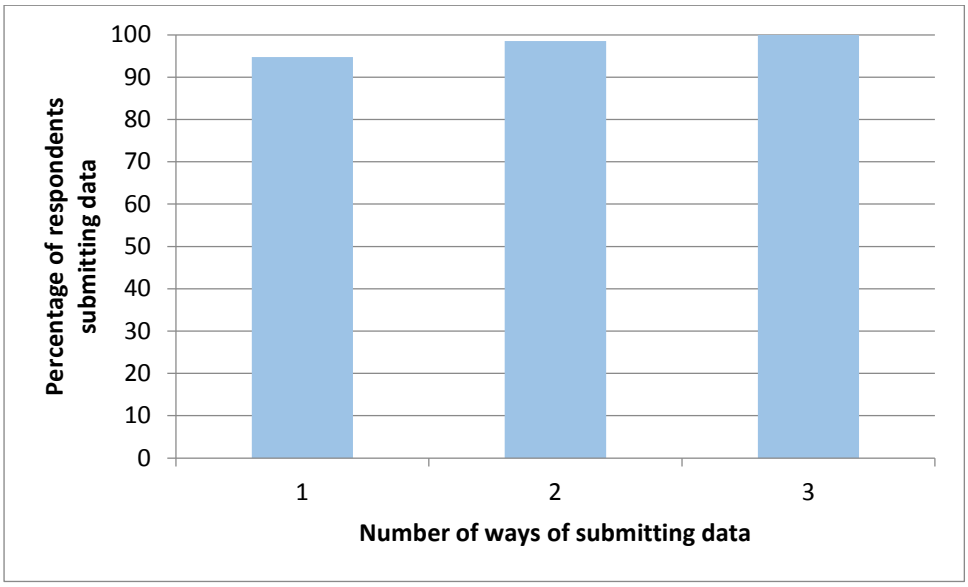

Figure 7. *Data submission rates according to the number of different methods available for submitting data.*

Internet access

We examined whether having access to the internet affected submission rates (Figure 8). We found no significant difference in likelihood of results being submitted if respondents had internet access or not (χ^2 = 0.882, d.f. = 1, P = 0.348). Amongst those with internet access, data was submitted on 95% of occasions; amongst those without internet access, data was submitted on 98% of occasions.

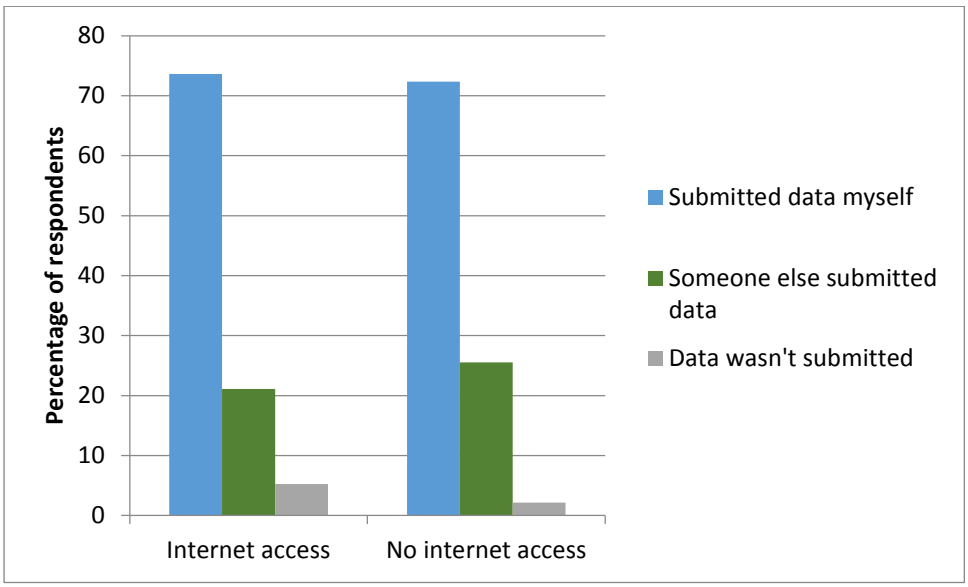

Figure 8. *Data submission rates amongst respondents who do and do not have access to the internet.*

Participating as part of a group

We examined whether participating in CS individually or part of a group affected submission rates (Figure 9). We found no significant difference in likelihood of results being submitted if the activity was done as part or group or individually (χ^2 = 0.296, d.f. = 1, P = 0.587). If participants were part of a group, data was submitted on 96% of occasions; individually, data was submitted on 95% of occasions.

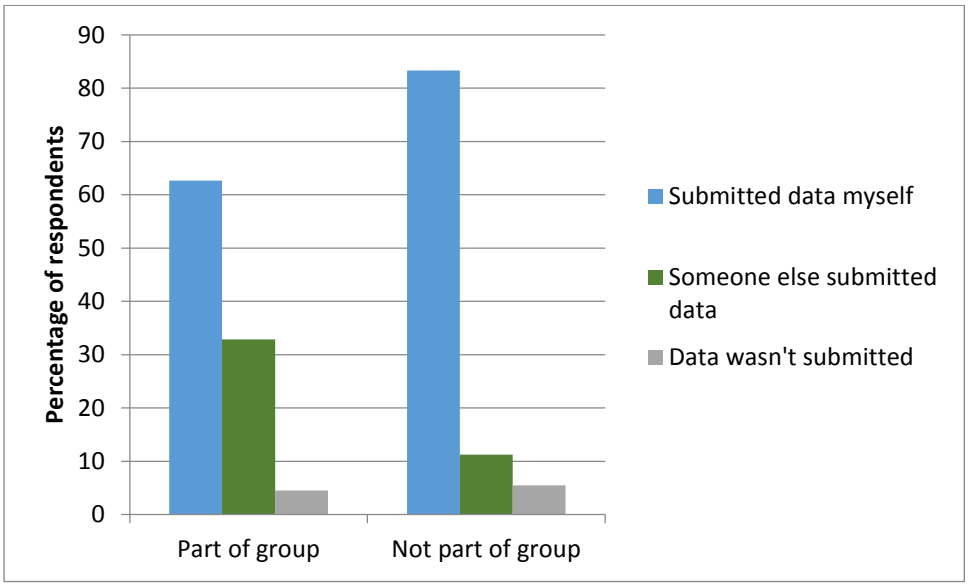

Figure 9. *Data submission rates according to whether respondents participated in CS individually or as part of a group.*

Demographics of participants

We examined whether the socio-demographic characteristics of respondents affected submission rates. Firstly, we examined the gender of respondents. Initially we explored whether, if data were submitted, there was a difference in the gender of the person collecting the data. We found no difference in the likelihood of data being submitted if collected by a man (94%, 299/318 said data was submitted) or woman (96%, 273/284 said data was submitted) (χ^2 = 3.57, d.f. = 1, P = 0.060). Next, we looked at whether there was a difference in genders between who submitted the data (the person collecting the data or

someone else). There was no significant difference in the likelihood of data being submitted personally or by someone else if collected by a man (75.6%, 226/299 respondents submitted data personally) or by a woman (79%, 216/273 submitted data personally) (χ^2 = 1.02, d.f. = 1, P = 0.313).

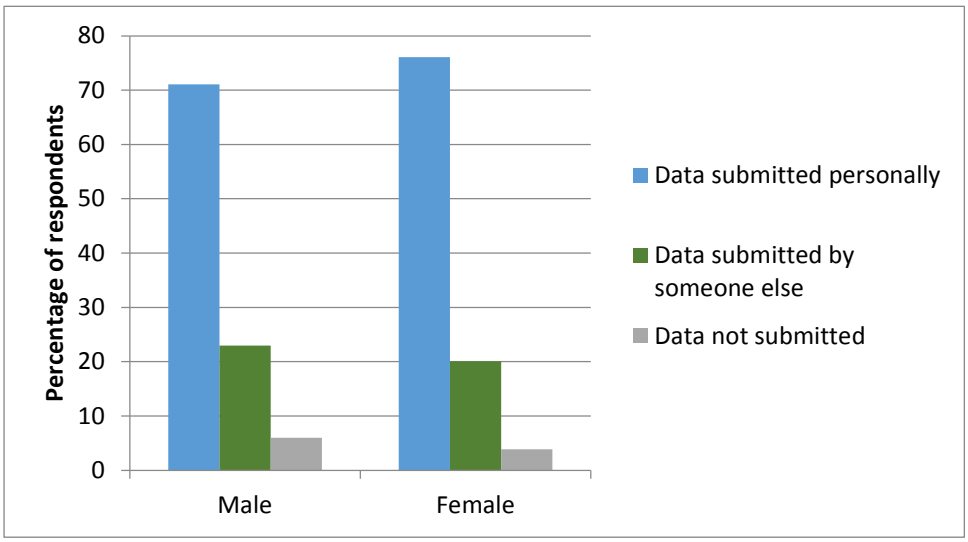

Figure 10. *Data submission rates in male and female respondents*.

Secondly, we examined the age of respondents (Figure 11). There was a significant difference in the likelihood of data being submitted when collected by people of different ages (two-tailed Fisher exact test, $P < 0.001$). Submission rates were lowest amongst the youngest respondents (data collected by 16-24 year olds was submitted in 88.6%, 78/88, cases). Submission rates rise with age up to 35-44 year olds (data submitted in 98.2%, 96/98, cases) and then decline again with age to submission rates of 93.7% (148/158) in those aged 65 and over. We also examined the rate of data being submitted personally by the respondent or by someone else and again found a significant difference between age groups (χ^2 = 30.298, d.f. = 1, $P < 0.001$). This appears to be due to the rates of data being submitted by someone else rather than personally by the respondent steadily declined as age increased, from data collected by 16-24 year olds being submitted by someone else in 43.6% (34/88) cases to data collected by those over 65 being submitted by someone else in 14.2% (21/148) cases.

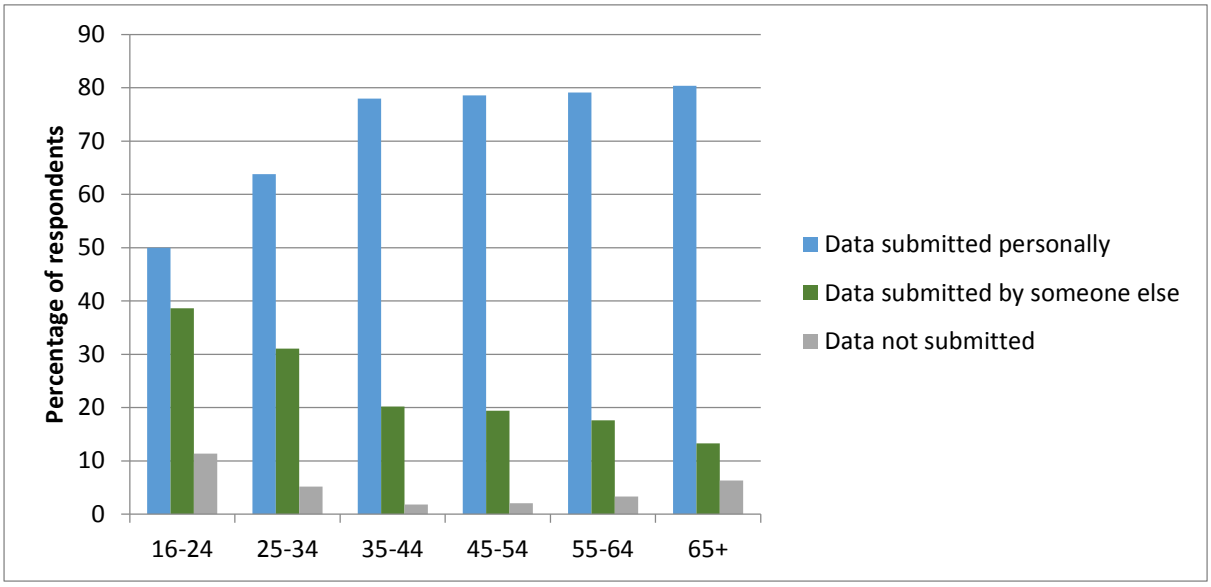

Figure 11. *Data submission rates amongst different age groups.*

We also examined whether the ethnicity of participants affected data return rates. We found submission rates were higher amongst white respondents (96%, 530/555 respondents, submitted data) compared with BME (black and minority ethnic) respondents (89%, 39/44 respondents, submitted data) (Figure 12), although the difference was not significant (two-tailed Fisher exact test, $P = 0.06$). In cases where data was submitted, this was more likely to have been done by someone else if the respondent was from a BME background (21.9%, 116/530 cases) than a white background (33.3%, 13/39 cases), although again the difference was not significant ($\chi^2 = 2.715$, d.f. = 1, $P = 0.10$).

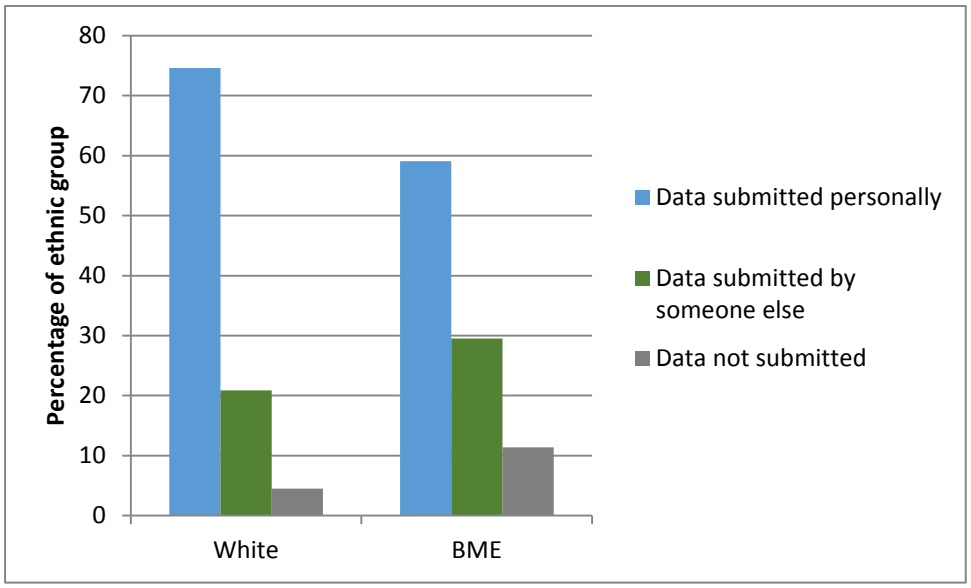

Figure 12. *Data submission rates amongst different ethnic groups.*

We also asked people who had submitted data whether or not they had received a response to this. The majority had received a response (63% Omnibus, 72% Survey Monkey), and for most of these it was through email, although a wide range of mechanisms were mentioned, including through data being displayed on maps or graphics, receiving text messages and through social media.

Literature review

Motivations and maintaining participants

Our review of the literature has revealed a fairly small number of papers which have empirically studied volunteer motivation. There were a larger number of papers or reports written by citizen science practitioners about their projects where they have made assumptions about the motivations of their participants, rather than conducting empirical research into this.

The literature reveals several different ways of classifying motivations. Rotman et al. (2012) explored 142 participants' and scientists' motivations using the following categories: egoism (participation to increase own welfare), altruism (increasing welfare of another individual or group of others), collectivism (increasing welfare of a group of which the participant is part of) and principlism (upholding personal principles). Many participants held multiple motivations. Rotman et al.'s research showed that volunteers' motivations shifted over time, with egoism motivations generally the initial motivating factor, but collectivism and altruism were secondary motivations and helped encourage long-term engagement. They recommend that 'motivational probes' should be emphasised at points where participation tends to decline, e.g. at the end of a task. This is in order to recognise people's motivations

in order to encourage them to actively contribute to projects (Rotman et al 2012). This is important because Measham and Barnett (2007) found that fulfilling people's motivations for participating in environmental volunteering projects encouraged prolonged engagement. Rotman et al (2012) suggest that breaking tasks into smaller projects can help volunteers to find tasks that appeal to their specific interests.

Other researchers have also highlighted a temporal dimension, that volunteers' initial motivations and longer term motivations may be different. Jackson C et al. (2015) explored the motivations of three volunteers engaged in the Planet Hunters project (on the Zooniverse platform), specifically engagement in tasks which are important but peripheral to the main project e.g. moderating comments on forums, responding to newcomers etc. Such tasks are important for the sustainability of the project, but may also help advance participants' contributions, allowing them to move from initial participation to more sustained engagement. As people became sustained participants, they moved towards the middle of the community, becoming increasingly fluent in the culture of the community, including its language, organisational principles etc. Having more established volunteers working on more 'mature practices' can help to show newcomers what they might expect if they continue to be involved. This helps them to form an identity as a volunteer (Jackson C et al., 2015), which Penner's (2002) theory of volunteerism highlights as one of the factors leading to sustained participation. Importantly, the authors believe that the visibility of other volunteers doing tasks helps to form the volunteer identity of new participants (Jackson C et al., 2015). Although this is only a small sample size, it is one of the few studies that has looked at motivations of participants in citizen science over time.

Shifting motivations of volunteers is not unique to citizen science, with TCV reporting that their conservation volunteers generally begin by wanting to help the environment, but after ten sessions, motivations such as wanting to meet people and enjoying working outdoors become more important (TCV, undated).

Gamification

'Gamification' is thought to help attract, engage and retain participants who are motivated by competition, and can include things like digital badges, reputation points, leader boards etc. (Azavea and SciStarter, 2014). Foldit, a complex online multiplayer game where people help solve protein structure predictions, facilitates competition and collaboration between players, creating a social aspect to the game, with some people playing as teams. A survey found that many players are motived by wanting to contribute to science, but others were also attracted by the competitive nature of the game (Cooper et al., 2010).

Other citizen science projects have also appealed to the competitive nature of some volunteers, to varying degrees. The Notes from Nature project, which crowdsources transcription of museum specimen labels, relies on dynamic feedback, interactivity and rewards such as badges to continue to motivate participants (Hill et al., 2012). The eBird network provides a resource of the most comprehensive and up-to-date information about bird distribution in the world. The recording system is simple, collecting data which those who like observing birds record anyway, i.e. the species, the date and the location, plus any additional information the recorder wishes to add, such as age, sex etc. (Wood et al., 2011). The web portal appeals to those who like the competitive aspect of recording by allowing them to keep track of their records, share lists of species with others, make maps of their data and, importantly, to see how they, and their region, compare to other people and other areas. After modifying the web portal to allow this additional functionality and competitive element, participation in the network increased (Hochachka et al., 2012). This redevelopment of the data entry platform used feedback from participants to shape its development, and as well as ensuring it was user-friendly, this consultation helped to invest participants in the project, increasing the volume of data they provided (Sullivan et al., 2014).

Few studies have empirically tested the efficacy of 'gamification' for motivating volunteers. One study which has done this, Massung et al. (2013), looked at mobile data collection apps

for pro-environmental data collection, and investigated the impact of different ways of motivating participants. They compared pointification (a type of gamification) with financial incentives and a control which was not designed to appeal to any particular motivations. The case study was a group in the UK called Close the Door, which aims to encourage shop owners to close their doors in cold weather in order to prevent heat loss, and 'casual participants' were encouraged to use mobile apps to monitor which shops had open doors. There were 16 participants in each app group, and they found that pointification increased return rates but not significantly, whereas financial rewards saw a significant increase in the amount of data collected. Some participants were actually put-off by the competitive element, because it demotivated those who were not the leaders (Massung et al., 2013). Any gamification elements, therefore, need to be well thought through and well-integrated and not just added on to the project as this can be confusing for participants (Azavea and SciStarter, 2014)

Technological advances may permit individuals and their 'journey' through citizen science projects to be tracked, providing an understanding of people's interests over time (Newman et al., 2012), which may be useful for allowing those running citizen science projects to tailor communications to individual volunteers and their differing motivations.

Data submission

Many citizen science projects require large quantities of data, for example, those analysing species distributions over large geographical areas, and so data returns need to be maximised. To achieve this, data collection protocols need to be as uncomplicated as possible, and volunteers need to be rewarded for their data (Hochachka et al., 2012). One of the motivations for starting this work was that our experience of citizen science projects suggests that many people collect data but then do not submit it, with only about 10% of surveys used in the OPAL project resulting in data submission (Lakeman-Fraser et al., 2015). In this section, we explore the factors that might affect submission rates, looking at the types of projects, whether or not people participate as a group, methods of data submission, and other barriers to submission.

Type of project
Here we consider how the type of citizen science project and the ways that participants are involved with the project may affect submission rates, in order to explore why some projects achieve high return rates whilst others have very low return rates. We use ten examples from the literature which have published information on their return rates.

SoundCitizen is a community-based water sampling network running in the US. This project involves participants applying online for a water sampling kit, conducting a series of chemical tests and then posting samples of the water to a laboratory for further analysis. In their first year, 60% of those who were sent a sampling kit returned their data (Kimball et al., 2009). This relatively high return rate (compared to, for example, the OPAL project) could partly be due to the fact that participants have to be motivated enough to request a pack online and the organisers are quite specific about places they are wanting data to be collected from. This may deter more casual participants who may be less likely to return their data.

Projects which require participants to undergo some sort of training may also achieve high return rates. For example, the Scottish Badger Distribution Survey had a return rate of 90% after training a network of 600 volunteer surveyors (Scottish Badgers, undated). In PondNet, a pond surveillance network in the UK, 49% of those who signed up to survey ponds returned data. This project found even higher return rates in areas where there was a greater level of volunteer support (Ewald et al., 2013). Gallo and Waitt (2011) report that the highest return rates for their programme monitoring invasive species in Texas come from volunteers who have had attended a workshop training course (43%) compared to those who had online training (9%). They ascribe these 'low retention rates' to the fact that they recruited participants to the training course from an existing pool of volunteers who need to

attend courses in order to maintain accreditation. The UK-based Big Sea Survey trained 357 volunteers, 53% of whom went on to report sightings of species (Delany, 2014), also suggesting that providing training for participants can lead to relatively high return rates.

Some projects require particularly high levels of commitment, for example, the US-based CoCoRaHS project (community precipitation monitoring network) requires volunteers to have a standard-sized rain gauge and submit precipitation measurements taken at the same time each day. Project organisers report an 80% drop off in volunteers after the first year, but those who do stay tend to be highly committed and submit data regularly (Reges et al., 2015). Therefore, “high barrier to entry” citizen science projects such as this can succeed, but project organisers may need to put extra resources in place for supporting and encouraging volunteers. In the case of CoCoRaHS, they have a network of community co-ordinators who help encourage continued participation (Reges et al., 2015).

Projects with a lower barrier to entry, such as only requiring online registration, tend to have high numbers of registered participants but can have a lower ‘return rate’ i.e. lower percentage of active participants. For example, the Australian phenology project ClimateWatch had nearly 1500 registered users in 2010 but less than half had recorded an observation (Donnelly et al., 2011). Similarly, Evolution MegaLab, a European project had over 6000 registrations but only 38% of them submitted any data (Worthington et al 2012). Large media campaigns can be effective at gaining new registrations, but such wide promotion can also lead to a lower return rate than more targeted advertising, for example, after a large media campaign on ClimateWatch, registrations increased but only 10% went on to became active users and recorded observations online (Donnelly et al., 2011).

An example of a more casual citizen science project with much lower return rates asked for sightings of tagged black swan and kangaroo in urban areas of Australia. Mulder et al. (2010) tagged these species and conducted an extensive information campaign about the tags including distribution of postcards and posters to encourage people to report sightings. One park, which has 5 million visitors a year, only received 20 sightings in the year. This project is interesting, because the public submitting results seemed to have different motivations than the scientists. The initial reason for reporting was that people were concerned about the animals wearing neck collars, e.g. tightness of collar. Once reassured, however, most did not make further reports (Mulder et al., 2010). This may suggest that such ‘opportunistic’ citizen science projects, where postcards or posters ask people to simply submit sightings, can expect much lower return rates than ones where there is a greater level of engagement with those running the projects. The other disadvantage with this approach is that data quality can be compromised if instructions are unclear. For example, a citizen science project on ptarmigan on Vancouver Island also used notices to ask hikers for their sightings, and although this gave a wide coverage of data, nearly half the data had to be discarded due to high levels of imprecise location data (Jackson M et al., 2015).

Group versus individual working

Crimmins et al. (2015) looked at whether members of organised groups submit more and better quality data than individual participants to a US-based phenology project. They looked at the quantity of observations, frequency of observations within the year and continuity of observations between years. They found that when looking at per-capita observations, individuals submitted significantly more than groups, but there was no significant difference in observation dates per plant, and little difference in year-to-year continuity between groups/individuals. As differences are not very large, the authors recommended that both engagement models are valuable for generating data (Crimmins et al., 2015). This is a sensible approach because as well as generating data, citizen science projects where volunteers work in groups can help to fulfil the more social motivations that some participants hold, such as wanting to share their knowledge with others and to meet new people.

Methods of data submission

Online submission appears to be the most commonly used way of citizen science projects collecting data. Roy et al. (2012) reviewed citizen science projects and found 80% of them collect data via a website, with formats such as apps being less popular. Kim et al. (2013) reviewed 340 citizen science projects listed on an online repository, and found that only 11% had mobile apps to collect data. However, these can be very important for some projects: nearly a fifth of eBird data are submitted via mobile devices in the field (Sullivan et al., 2014), emphasising the importance of this as a mechanism for submitting data.

If project organisers want to solely or mainly receive data online, then the web portals need to be user friendly. Feedback from ClimateWatch users suggested process of data entry was unwieldy, despite the website having received recognition through several industry awards (Donnelly et al., 2011). ClimateWatch, like many other citizen science projects, requires a recording system which is sophisticated enough to capture all data needed, but not too daunting for people to complete. The organisers found that running introductory events where people were asked to submit data before they left the training had better returns than large media campaigns (Donnelly et al., 2011), and this is something that could be used by other projects to increase return rates.

Other projects rely on other means of submitting data, for example, the REEF project which monitors reefs in the US asks respondents to send paper copies of recording forms to the project headquarters which are then scanned in (Pattengill-Semmens and Semmens, 2003). The Eye on the Reef project, on the other hand, moved away from freepost forms to an online system because the forms were often returned incomplete or illegible (Beeden et al., 2014). The disadvantage of moving to an online system is that for some users, for example, anglers in a scheme to report catches to the Environment Agency in England, use of the internet is a barrier (Blossom 2012). Participants involved in a Citizen Lake Monitoring programme in Minnesota, USA, also preferred to send results in by post, despite the majority having internet access (Minnesota Pollution Control Agency, 2011). In our study, we found no significant difference in likelihood of submitting results for respondents who had internet compared to those who did not, suggesting that this is not an important barrier.

If participants are expected to transfer data from field recording sheets to an online system, it is important that the recording form is laid out identically to the field recording sheet to make data input as easy as possible (Worthington et al., 2012, Beeden et al., 2014). A report into the Australian ClimateWatch phenology project found that projects ideally need to use mobile recording systems so that data input is as user friendly as possible and can be done on site (Donnelly et al., 2011).

As Bonter and Cooper (2012) point out, there may be many months between someone submitting data and it becoming analysed. They note that that this is problematic if project organisers want to follow up an observation or report for any reason, e.g. if they suspect it to be erroneous. Automated smart filters which give an error message to the person entering data can help reduce this problem (Bonter and Cooper 2012). In addition to the issues this time-lag may have for data analysis, it may also lead to a delay in giving feedback to participants.

Barriers to submission

The actual design of the citizen science survey can act as a barrier to data submission. Asking for too much detail from participants can be intimidating, and simpler systems have been shown to increase the number of observations (Gallo and Waitt, 2011).

Another barrier to submission could be that participants do not see the importance of negative records (e.g. where a species was looked for but not seen) or records where numbers of a particular species are low (Lee, 2012; Monarch Joint Venture, 2015), or where

observations do not change over time (as in the Minnesota Volunteer Nitrate Monitoring Network (Minnesota Department of Health, 2012)). Not seeing the species of concern can also be a barrier to retention of participants, with Beirne and Lambin (2013) showing that volunteers were more likely to continue participating in a mink eradication programme if they had caught mink in the previous 6 months.

One of the problems with the Australian ClimateWatch was that there was a disconnect (temporally and physically) between collecting data in field and the process of data entry. Consequently, the project team decided to create online field data entry sheets alongside the field guides to reduce this disconnect (Donnelly et al., 2011). CoralWatch in the US reports that although volunteers enthusiastically survey the reef, there is less enthusiasm for submitting the results, although regular communication increases return rates (Marshall et al., 2012). Similarly, a survey of diving groups collecting data on fish species found that whilst most participants enjoyed collecting data, there was much less interest in data entry (Dalton and Smith, 2009). Blossom (2012) reports that key barriers for anglers reporting catches to the Environment Agency are apathy, concerns about data privacy, and lack of trust in the organisation asking for data. Issues of apathy may be partially addressed through information campaigns about the importance of data submission. However, if surveys of potential participants do find concerns about data privacy or trust, then more research may needed to explore the reasons behind these concerns in order to try and rectify any issues.

It may be that some people who use citizen science resources would not consider themselves to be taking part in citizen science projects. For example, the OPAL project produced and distributed 230,000 copies of ‘Survey Packs’ and a further 100,000 were downloaded from the OPAL website (OPAL, 2013), but the number of surveys actually submitted was about 10% of this amount (Lakeman-Fraser et al, 2015). From our experience working on the OPAL project, we know that many school teachers, university lecturers, parents, community group leaders etc. use the packs not as part of a citizen science survey, but as identification resources. For projects which have a strong educational remit, this may not be an issue, but for projects which require higher return rates, promotion of the benefits to science of using the resources as they were intended may be needed.

Feedback

Roy et al. (2012) researched 30 citizen science projects and found that all those running the projects highlighted the importance of feedback and engagement with participants. This is because many practitioners believe that the level of participation is partly related to the richness of the information that they get back from the project over time (Blake et al., 2012). Lack of feedback can be an important factor in long-term declines of volunteer programmes, such as California’s network of weather observers, although a small number of volunteers will continue to send data despite not getting feedback (Department of Water Resources, 2012).

Feedback, such as information about what data are being used for, can help to give participants a feeling of collectivism, which can be important for sustaining them over the longer term (Rotman et al., 2012). The difference between practitioners such as those involved in Roy et al.’s study emphasising the importance of feedback, and 30% of participants not receiving a response is interesting. It may be that there is a difference between what organisers and participants see as feedback. For example, many projects use maps and charts to display a person’s contribution, and it may be that practitioners see this as feedback but perhaps participants do not. Indeed, Rotman et al. (2012) interviewed citizen science participants and found that they saw acknowledgement and feedback as two different things, with acknowledgement relating to the overall contribution and feedback being related to a specific contribution or individual.

There is little empirical evidence about the importance of feedback for maintaining participation over time. An exception to this was published by Blake et al. (2012), who used

the UK-based BeeWatch project to explore different methods of giving feedback and how this affected data submission. Users (48 biology undergraduates) were given detailed or less detailed computer-generated feedback when they incorrectly identify a species of bumblebee, highlighting the features they got right and wrong. Feedback was also given to those who correctly identify bumblebees, reinforcing the correct identification. They found that the group who had the more detailed feedback improved their identification more, and more quickly, than the group who did not have such detailed feedback, and users rated the detailed feedback as more useful. This system is now being used by the Bumblebee Conservation Trust, allowing experts to speed up the verification process by automating at least some of the feedback emails.

Segal et al. (2015) looked at participation within the Zooniverse platform, and designed an intervention strategy with the aim of increasing people's engagement with the system. A survey of users found that the key reasons for disengaging were classification anxiety (where people over-estimate the effect that their mistakes have on their data), competing demands on their time, and boredom. Interestingly, 82% of respondents indicated that they had experienced classification anxiety, and a quarter of those disengaged from the projects. Volunteers who had disengaged from the project were emailed with text which addressed the causes of disengagement found in the survey. A control group with similar participation rates did not receive any email notification. Those who had the email intervention were more likely to return to doing activities (9.7% returned) than those in the control group (6.7% returned). In such projects, therefore, people may be encouraged back into participation by emails thanking them for their time and explicitly addressing any known causes of disengagement, in this case, reassuring those with classification anxiety that multiple people see each image and that the occasional error does not affect the overall results (Segal et al., 2015). Similarly, in the Old Weather project, also on the Zooniverse platform, emails sent to low contributors (or 'dabblers') explaining the outcomes from the project were valued highly by these volunteers, who in some cases felt encouraged back into participation (Eveleigh et al. 2014).

Discussion

In this section, we draw together our surveys and the literature review to compare and contrast the findings. At the end of the section we make some recommendations for practitioners running, or considering running, citizen science projects.

Motivations and maintaining participants

Our results show a wide range of different motivations for participation, from wanting to help wildlife or a specific site, wanting to share knowledge with others, developing future career opportunities, to wanting to meet new people. 13% of respondents selected 'Other', suggesting their motivations did not fit into any of the categories, but unfortunately only fifteen (of 82) expanded upon this answer. These motivations were wider than those suggested by some of the existing literature, for example, participating in order to "share my knowledge" is not commonly mentioned in the literature (an exception being Bell et al. 2008), but this was an important motivator for 11 % of Omnibus respondents and 41 % of Survey Monkey respondents.

As in Rotman et al. (2012), we found that many volunteers appeared to hold multiple motivations. In our study, the most common motivations according to the classifications used by Rotman et al. were altruistic: wanting to help wildlife, science in general, or because it was a valuable thing to do. Egoism motivations (31.6% Omnibus respondents and 76.5% of Survey Monkey respondents), such as personal development, were less common than the altruistic motivations (64.8% of Omnibus respondents and 92.2% Survey Monkey respondents) in our study. According to the literature, for some volunteers, competition can

be an important motivator, and although this is not something we explored in our study, it does seem to be used by citizen science projects to varying degrees.

In contrast with the limited literature on return rates, our research found very high rates of submission, with projects which had both postal returns and an app achieving a 100% submission rate. Although there was some variation in submission rates for people with differing motivations, all had high percentage submission rates making conclusions difficult to draw. Unfortunately, few projects publish the return rates of their projects, either in the grey or academic literature, which makes it difficult to compare our results with those of others, although OPAL's 10% may be at the lower end of response rates (see USGS, 2012). The difference between this value and the high submission rate in our survey may be due to the way that respondents interpreted the initial screening question. It may be that those who did not submit their data did not answer 'Yes' to our question "Have you ever taken part in any type of project that involved collecting any environmental scientific information or data?", potentially because they did not consider it to be helping scientists, or they had forgotten that they had taken part. Another reason could be that they had a different interpretation of what it means to submit data (see Appendices for the questions used in the survey).

Group versus individual working

We explored whether there was any difference in data return rates if people were working individually or as part of a group, and found no significant difference. This supports the work of Crimmins et al (2015), who found that although individuals submitted significantly more than groups on a per-capita basis, there was no difference in observation dates per plant and little difference in whether or not people continued participating.

Methods of data submission

The majority of respondents to our surveys said that data could be submitted online, although nearly a third also said that their data could be submitted in person, and a quarter by post (Omnibus responses). For the Survey Monkey survey, 80% said that online submission was possible, which is not surprising given that the primary route of advertising this survey was through OPAL, which encourages submission online (although it also has a freepost address).

Other barriers to submission

We explored whether the gender, age and ethnicity of participants affect submission rate. This is a particularly important issue as there is nothing reported in the literature about differences in submission between social groups. We found that submission rates were lowest amongst respondents aged 16-25, which was also the age bracket which had the greatest proportion of data being submitted by someone other than the respondent. This suggests that many people of this age are participating as part of a group, perhaps a school or university group, where a teacher submits data on their behalf. In terms of ethnicity, we found that submission rates were higher for white respondents compared to BME respondents (though the statistical relationship between these factors in this study was not significant). We also found that BME respondents were more likely to have had their data submitted by someone else rather than submitting it personally. It is unclear why there are these differences, and more research is needed in this area, as we could find no mention of ethnicity affecting submission rate in the literature. As there were a relatively small number of BME participants in the survey, increasing the sample size would help to clarify statistical trends.

Feedback

Our study found that whilst the majority of respondents received some kind of response to submitting their data, around 30% did not receive a response. Roy et al. (2012) found that all

those running environmental citizen science projects felt feedback was important, so it is surprising that nearly a third of respondents to our survey did not receive a response. It may be that there is a difference between what participants and organisers perceive as sufficient feedback.

Key messages

- Only a small proportion of the UK population (7.5% of our Omnibus sample) have participated in environmental citizen science projects, so there is potential for many more to become involved.
- The white, male, and higher social grade population is over-represented within citizen science projects, whilst BME participants, under 35s, over 65s and lower social grade participants are under-represented.
- Return rates (number of people registering for projects to number of people submitting data) varies between projects, from 10% to around 50% according to the literature, although our surveys found much higher response rates. We found that although there was some variation in submission rates for people with differing motivations, all response rates were high. However, this may be partly due to the questionnaire design.
- The majority of citizen science projects use online systems for participants to submit their data, these systems need to balance simplicity with the need to gain sufficient information from participants, and user testing can help to assess whether this balance has been met.

Implications of findings: Recommendations for citizen science practitioners

- Most work in citizen science projects is done by a minority of participants, therefore it is important to keep these participants engaged and submitting data.
- Volunteers are likely to hold multiple motivations for participating, and these motivations may change over time. There may be a shift from egoism motivations to begin with (e.g. wanting to further ones own career) towards more altruistic motivations later (e.g. participating in order to help a group, for example, of other volunteers or scientists running the project). Practitioners should recognise this and communication with volunteers should reflect these varying motivations.
- If volunteers' motivations are recognised, they are likely to continue to actively contribute to projects. If these motivations are ignored (intentionally or not), then participation is likely to decline.
- Personal development motivations, such as wanting to learn and to develop a career, can be important for many participants so project organisers should emphasise these benefits.
- There are many tasks in citizen science projects which volunteers can take part in, including things peripheral to the main project, for example, helping to recruit new participants, moderating comments on forums, disseminating key messages etc. These may involve participants with differing motivations to those involved in the data collection, and therefore may help to diversify and increase the participant base.
- User testing of online submission systems can help to assess whether the submission process is user-friendly. Projects should provide alternative means of data submission in order to maximise return rates and ensure that participants who cannot or do not want to use the internet to submit their data can still take part. If data is recorded 'in the field' on paper, then any online submission system needs to replicate paper copies to make it as straightforward as possible for data to be entered.
- Projects should highlight the importance of negative records i.e. where a species is looked for but not seen, in order to motivate participants to continue sending in data.

- Some projects require participants to undertake training. Those which do require this appear to have higher submission rates than more casual projects.
- Participants value feedback about what their data is being used for. For some people, feedback gives them a sense of collectivism (a group of people working towards a common good) which can be motivating. Giving feedback can be time-consuming for project staff, but new technologies (such as Natural Language Generation programs) are being developed which may speed up this essential process.
- Communication with participants is important for keeping them motivated, and together with co-ordination of research, data screening and checking, data compilation, this makes citizen science costly. Organisations should consider the benefits and costs of the citizen science approach before commencing any projects.

Limitations of research

Although using the Omnibus survey allowed us to access a wide range of citizen science participants, there are several disadvantages to this approach. One is that responses are not as rich and detailed as we had expected. This may be because of the nature of the survey: a stratified sample of the UK population is asked to respond to the survey, and this request may come at a time when they are busy doing other things. In contrast, the Survey Monkey respondents are self-selecting, they choose to click on the link to respond at a time which suits them, and therefore may have more time to think about their answers. This difference has some implications for interpreting results. For example, the majority of Omnibus respondents appear to only have one motivation for participation in citizen science projects, whereas the majority of Survey Monkey respondents had multiple motivations. This is more likely to reflect the difference in survey method rather than an actual difference in respondents, with Survey Monkey respondents perhaps taking more time to consider their answers and some Omnibus respondents just selecting their primary motivation. The other disadvantage of the Omnibus approach is that the answers to the open questions are less detailed than those we received in response to the Survey Monkey questionnaire. This has particular implications for our understanding of why a small percentage of respondents did not submit their data to the projects, although 60% of the 41 Omnibus respondents did not choose one of our multiple choice responses to this question, only four gave any reason why. The disadvantage of using the Survey Monkey questionnaire is that respondents are self-selecting, and therefore may bring with them biases, as those who respond to such surveys may also be those who are more likely to submit their data. This means that from both surveys we can draw limited conclusions about barriers to submission, instead having to rely on the literature to infer why these people may not have submitted their data.

Further research could also consider why people do not take part in citizen science projects, as a limitation of using the Omnibus survey was that we were limited in the number of questions we could ask. Therefore, those who answered ‘no’ to the initial screening question were not asked any further questions about their lack of participation in citizen science.

Future research

Based on our review of the literature and the research presented here, we recommend the following areas for future empirical research:
The efficacy of different mechanisms for ensuring high return rates of data, given the discrepancies between the high rates of submission found in our study and those reported in the literature.
The efficacy of different feedback mechanisms (e.g. personalised email, data presented on a map, face-to-face, generic newsletter) for encouraging return participation.

We also recommend that further research is conducted to investigate the relationship between ethnicity and submission of results, as our research indicates that relationships may be present but did not find evidence from the literature to explain this.
Our study only looked at motivations for participation at one point in time, and further research should be conducted to track participants' motivations over time to observe whether they shift.

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APPENDICES

Omnibus Survey Questions

Q.1 Have you ever taken part in any type of project that involved collecting any environmental scientific information or data?
INTERVIEWER ADD: By this we mean national projects that help scientists like the RSPB Big Garden Birdwatch, one of the OPAL Surveys on worms, climate, tree health, biodiversity, bugs or water, or a local project.

A.1 Yes – Once (GO TO Q2)
Yes- More than once (GO TO Q2)
No - I have never done this (GO TO END QUESTIONNAIRE)
Don't know\Can't remember (GO TO END QUESTIONNAIRE)

Q.2 And thinking back to when you collected the data, were you part of an organised group?
INTERVIEWER ADD IF REQUIRED: If you have taken part in more than one project please think back to the one that you can remember most clearly

A.2 Yes
No
Don't know\Can't remember

Q.3 (IF A1,1) Why did you decide to take part in this project? / (IF A1,2) And still thinking about the same project, why did you decide to take part?
INTERVIEWER ADD: Please select all that apply
PROBE: Anything else?

A.3 To help wildlife in general
Wanted to help a specific site
To contribute to scientific knowledge
To meet people\ for fun
It's a valuable thing to do
To learn something new
To get exercise and fresh air
To share my knowledge
Someone else wanted me to do it e.g. family, teacher etc.
Want to enhance my own development
Want to help my future career
Other PEN WRITE IN

Q.4 In which of the following ways could you submit the data you had collected? / (IF A1,2) And in which if the following ways could you submit the data you had collected for this most recent project?

A.4 In person
Online
By post
Within an app
Other PEN WRITE IN

Q.5 And did you submit the data you had collected to the organisation who were running the project

A.5 Yes - I personally submitted my data myself (GO TO Q7)

Yes - Someone else submitted my data (e.g. teacher etc.) (GO TO Q7)
No - I didn't (GO TO Q6)
Don’t know\Can’t remember

Q.6 Why did you not submit the data you had collected?
INTERVIEWER ADD: Please select all that apply
PROBE: Any other reason?

A.6 I forgot to submit the data
I didn’t have time to submit the data
I was worried about the quality of the data
I found the method for submitting data difficult
I didn’t complete the project
Other reasons PEN WRITE IN
Don’t know\Can’t remember

Q.7 After you had submitted your data did you receive any kind of response from the organisation running the project?

A.7 Yes (GO TO Q8)
No
Don’t know\Can’t remember

Q.8 How did you receive this response? If it was in more than one way please select all that apply.
PROBE: In any other ways?

A.8 Received an email
Received a text
My data was displayed on a map or graphic
Other (please specify)
Don’t know\Can’t remember

<u>Survey Monkey questions</u>

Q.1 Have you taken part in any project that involved collecting any environmental scientific information or data? By this we mean national projects like the RSPB Big Garden Birdwatch, one of the OPAL Surveys on worms, climate, tree health, biodiversity, bugs or water, or a local project.

A.1 Yes (GO TO Q2)
No (GO TO END)

Q.2 Did you do the survey as part of an organised group?

A.2 Yes
No

Q.3 Why did you decide to take part? (Tick as many as apply)

A.4 To help wildlife in general
Wanted to help a specific site

To contribute to scientific knowledge
To meet people\ for fun
It’s a valuable thing to do
To learn something new
To get exercise and fresh air
To share my knowledge
Someone else wanted me to do it e.g. family, teacher etc.
Want to enhance my own development
Want to help my future career
Other (please specify)

Q.4 How were you supposed to submit the data?

A.4 In person
Online
By post
Within an app
Unknown

Q.5 Did you submit your data?

A.5 Yes (GO TO Q7)
No (GO TO Q6)
Someone else submitted the data

Q.6 If no, why did you not submit the data?

A.6 I forgot to submit the data
I didn’t have time to submit the data
I was worried about the quality of the data
I found the method for submitting data difficult
Other reasons (please specify)

Q.7 Did you have any response to submitting data?

A.7 Yes (GO TO Q8)
No

Q.8 If yes, how did you receive a response?

A.8 Received an email
Received a text
My data was displayed on a map or graphic
Other (please specify)

Q.9 If you did receive a response, was this important to you and why?

A.9 Not important
It’s good to know what the data I collected means
It’s good to know how my data fits with the other data that has been collected
I wanted to use that data myself
I liked having feedback on how to improve the data I had collected
Other (please specify)