



Motivations and barriers in relation to community participation in biodiversity recording

Sarah J. Hobbs, Piran C.L. White*

Environment Department, University of York, Heslington, York, YO10 5DD, UK

ARTICLE INFO

Article history:

Received 1 February 2012

Received in revised form 5 July 2012

Accepted 15 August 2012

Keywords:

Citizen science

Deprived areas

Monitoring

Nature conservation organisations

NGO

Public participation

Wellbeing

Wildlife monitoring

ABSTRACT

Members of the public are involved increasingly in environmental and wildlife monitoring. This has clear environmental benefits in terms of the contribution to long-term datasets and monitoring, and it also yields social benefits, both to the participants concerned and to the wider community. However, there is concern that participation is not spread evenly across different social or ethnic groups in society, as is the case for other forms of volunteering. In this paper, we seek to develop a better understanding of the motivations and barriers affecting participation in wildlife monitoring, through a study of public participation in wildlife monitoring schemes in the UK. We integrate information from interviews with representatives of organisations running the schemes with the results of surveys of participants to identify organisational and personal perceptions of motivations and barriers, and quantify the socio-economic bias in participation.

Our results show that people from socio-economically deprived areas are under-represented in recording schemes at both the national and local levels. Organisers of the schemes expressed a desire to change this, but felt unable to do so due to limitations of resources and the difficulty of attracting the necessary media coverage. The major motivating factors for current participants in wildlife recording schemes included the chance to make a positive contribution to conservation and personal benefits, which were clearly linked with health and wellbeing. Barriers to involvement include a lack of awareness of opportunities, a lack of motivation, a lack of accessibility of the schemes, both in terms of equipment or facilities and knowledge, and financial costs of participation.

Although there are challenges associated with gathering ecological data through citizen science, including data reliability, our findings show that many recording schemes do indeed provide clear benefits to nature conservation and participants alike. However, biases in representation of participants persist, despite the efforts of many organisations to make their schemes more accessible. More work still needs to be done with groups currently under-represented in such schemes to understand and overcome the remaining barriers to participation, so that the personal and social benefits that arise from participation can be realised.

© 2012 Elsevier GmbH. All rights reserved.

Introduction

Globally, the involvement of local people in gathering biological data is a popular and growing phenomenon. In developing countries, data from the public may be used to inform and reinforce environmental management (e.g. [Martin & Martin, 2011](#); [Mbaiwa, Stronza, & Kreuter, 2011](#)). In North America, data collected by the public are used most frequently for environmental quality and wildlife monitoring (e.g. [Savan, Morgan, & Gore, 2003](#); [Whitelaw, Vaughan, Craig, & Atkinson, 2003](#)), whilst in the UK and Australia, public biological records are largely used in the monitoring of wildlife species distribution and populations (e.g. [Szabo, Veski,](#)

[Baxter, & Possingham, 2010](#); [Toms & Newson, 2006](#)). Although there can be concerns over the reliability of data collected by volunteers, the generation of large datasets through public involvement has clear ecological benefits, such as the development of long-term monitoring to support conservation. However, public involvement as citizen scientists in ecological data collection can also bring social benefits, both to the participants concerned and to the wider community. Participation in environmental activities has been acknowledged to play a role in increasing scientific literacy and social capital in a broader sense ([Conrad & Hilchey, 2010](#)), as well as helping to promote a reconnection between people and nature ([Devictor, Whittaker, & Beltrame, 2010](#)), and raising awareness of environmental issues ([Brossard, Lewenstein, & Bonney, 2005](#); [Devictor et al., 2010](#)). Volunteers may benefit on a personal level by being in contact with nature, and the activities associated with being outside and undertaking nature recording are linked to health

* Corresponding author. Tel.: +44 01904 324062; fax: +44 01904 322998.
E-mail address: piran.white@york.ac.uk (P.C.L. White).

and wellbeing benefits and stress relief (Bird, 2004; CABE, 2005; Hartig, Evans, Jamner, Davis, & Gärling, 2003; Takano, Nakamura, & Watanabe, 2002). In an investigation into the views of volunteers in biological monitoring, Lawrence (2006) found that as well as the social benefits enjoyed through communication with like-minded people, the perceived rigidity of the scientific process gave many individuals a sense of purpose that allowed them the 'excuse' to do an activity that they already enjoyed. In other types of environmental volunteering, for example undertaking practical tasks, key motivational factors have been identified, including the sense of 'giving something back', social benefits (Hibbert, Piacentini, & Dajani, 2003) and learning and career progression (Lawrence, 2006, 2009; O'Brien, Townsend, & Ebdon, 2008; Phillips, 1982).

There is therefore a wide range of benefits, both individually and for society, from encouraging greater participation in wildlife monitoring. However, some of these potential benefits may not be realised in full due to biases in the participant base. Volunteers in wildlife recording schemes are perceived as being predominantly composed of the standard 'volunteer' stereotype, characterised as white, older, affluent males from rural areas (Brodie, Cowling, & Nissen, 2009; O'Brien et al., 2008). Despite the overall increase in public participation in biological monitoring, the participant base for recording activities is therefore unlikely to be representative of a cross-section of societal groups. In particular, individuals from socio-economically deprived, urban communities are among those who are likely to be under-represented.

Research into barriers to involvement with some types of environmental volunteering has identified key factors including: a lack of awareness of volunteering opportunities; (Martinez and McMullin 2004; O'Brien et al., 2008); participants being too busy or not having enough time to get involved (Pope, 2005); and not feeling they are confident or capable of contributing (Hibbert et al., 2003). In order for biases in participant bases to be present, barriers must therefore be more likely to affect certain societal groups more than others. Maslow (1943) proposed a theory of motivation, whereby basic physiological requirements must be met before participants can be motivated to fulfil more advanced, psychological needs. Based upon this theory, participation rates are likely to be lower for people living within socio-economically deprived communities because of the challenges they may face relating to their physiological needs. However, other studies have questioned the usefulness of Maslow's theory in participatory research, suggesting instead that a hierarchical approach oversimplifies the human processes (Max-Neef, 1991), and that individuals may seek to participate in social situations even though basic needs have not been met (Mook, 1987). In a study of barriers experienced by volunteers in Australia, Pope (2005) concluded that factors such as financial costs, ill health and lack of confidence play an important role for people from low socio-economic groups. A bias in the participant base may also reflect the recruitment and recording methods utilised by a coordinating organisation. Many schemes are advertised with non-random coverage, particularly through websites and nature-based journals as well as other free or low cost media due to financial implications (Bell et al., 2008; Gaston, Warren, Thompson, & Smith, 2005). Participant recruits are likely to be those exposed to these media, which may therefore target an audience with existing interests and activities relating to gardening and wildlife, and may also exclude other individuals and groups from being aware of participation opportunities. To maximise the ecological representativeness and social benefits of public recording schemes, it is therefore important to understand more fully the motivations and barriers to participation, and whether people living in socio-economically deprived areas are consistently underrepresented in these activities.

The UK has a rich history of nature recording and study which has in recent years shifted in focus towards the conservation of

species and habitats (Bell et al., 2008; Jardine, Secord, & Spary, 1996). In ecological terms, biological data collection is now largely driven by policy and legislation in order to inform conservation management and funding decisions. For example, the UK Biodiversity Action Plan is a piece of national policy which identifies conservation priorities for a number of species and habitats, with action plans and targets set based upon these priorities. Gathering biological data to inform targets and monitor conservation strategy largely falls to the voluntary sector, particularly via non-governmental organisations (NGOs) and local authorities (UKBAP, 2010) who recruit citizen scientists as data gatherers. Organisations engaging citizen scientists to gather records benefit from a coverage and scope of data collection that would simply be impossible from a time and financial aspect, should only professional scientists be used (Bell et al., 2008; McCaffrey, 2005; Newman, Buesching, & Macdonald, 2003; Toms & Newson, 2006). Although much of the current literature relates to participation and health-care (e.g. Pernet, Dejardin, Morlais, Bouvier, & Launoy, 2010; von Wagner et al., 2009), a profile of UK environmental volunteers reveals those most likely to get involved as white, middle class and of retirement age (O'Brien et al., 2008). In a national garden bird recording scheme, the British Trust for Ornithology (BTO) Garden BirdWatch, it was noted that participants were more likely to have 'wildlife friendly' gardens (i.e. actively providing supplementary food and habitats for wildlife). Small and urban gardens were under-represented in the survey, with a bias towards suburban gardens in the southeast of England (Toms & Newson, 2006), suggesting that socio-economically deprived communities may be under-represented.

In the UK there are various phrases used to describe people living in deprived communities. In this study, we focus on groups that are affected by socio-economic deprivation as classified by the Department for Communities and Local Government (DCLG) (Department for Government and Local Communities, 2011). Socio-economic deprivation as measured in the seven domains used by the DCLG cover a broad range of issues due to a lack of resources or services, many of which are not financial. Of course an individual living in an area defined as highly socio-economically deprived may not experience any of these issues, however the classification allows for broad categories of different geographic areas and relative comparisons to be made (Department for Communities and Local Government, 2008).

The objectives of our research are threefold: (1) to determine the features of wildlife recording schemes that affect participation; (2) to determine the motivations and barriers associated with participation; and, (3) to assess the quantitative evidence for the existence of bias in the socio-economic characteristics of participants in wildlife recording schemes. We address these objectives from the combined perspectives of scheme organisers and participants. First, we use semi-structured questionnaires to assess the extent to which organisations responsible for running the schemes actively seek to involve a cross-section of societal groups. We explore their motivations for doing so and the barriers they perceive in achieving this objective. We then use participant surveys of one local and one national recording scheme to consider the motivations and barriers to participation in wildlife recording from the perspective of individual participants, and evaluate any socio-economic bias in participation.

Methods

Review of UK recording schemes

We conducted an internet-based review of current nature recording schemes in the UK using Google UK. Rather than making a

Table 1

Expertise and commitment levels used in the internet-based review of UK-based nature recording schemes.

Levels	Assessment criteria
Low expertise	Complete beginner: accessible to people who have very limited identification and recording skills although may have common knowledge such as being able to identify easily recognisable common garden species
Mid expertise	Necessity to identify less common or more specialist species such as a range of garden birds
High expertise	More specialist identification skills required such as identifying all British amphibians
Low commitment	Recording casual or ad hoc sightings or one-off recording events over short time frame
Mid commitment	Higher amount of time required to participate, e.g. over a number of weekends, or a longer recording process
High commitment	Regular and frequent recording required, e.g. every week over a number of months, recording process requires a higher amount of time, or recording may require travel

comprehensive assessment of all schemes listed on the internet, the purpose of the review was to identify the range of recording schemes available to the public in the UK, providing examples of a cross-section of high, medium and low commitment and expertise levels. The review was then used to explore features across the full range of recording schemes that might affect the participant base.

Google has been acknowledged as an effective information-seeking tool (Brophy & Bawden, 2005; Johnson, Chen, Eng, Makary, & Fishman, 2008; Jamali & Asadi, 2010), with specific advantages of having wide coverage (Brophy & Bawden, 2005) and high precision (Jamali & Asadi, 2010). In addition, as the most popular search engine worldwide and in the UK (Hitwise Pty. Ltd., 2012), Google has an estimated 900,000,000 unique monthly visitors (eBizMBA Inc, 2012) and is therefore likely to be a method in which members of the public might search for recording schemes.

The review was conducted using the following search terms in Google (2009): 'take part wildlife'; 'wildlife survey'; and, 'garden wildlife survey'. Boolean operators were not used in order to maximise the flexibility around these terms ('AND' is a default in Google (2012)). These search terms were chosen as unambiguous free text keywords in order to maximise the search for full website contents (Lee-Smeltzer, 2000). Pages were selected to be included in the review if they contained information about public wildlife recording schemes. We assessed the expertise level based upon the skills required by participants, and evaluated commitment levels according to time commitments required for participation in the schemes (Table 1).

Interviews with recording scheme organisations

All of the national recording schemes found through the review were contacted by email, and six agreed to participate in the interviews. In order to gather data from a cross section of local schemes, four of these which included email addresses in the website were contacted and agreed to take part, representing a cross-section of low, mid and high expertise and commitment levels. Interviews took place between November 2009 and February 2011. We conducted semi-structured telephone and face-to-face interviews with representatives of the organisation who had a working knowledge of the details of the recording scheme. Interview questions were structured around three themes. Theme 1 (objectives for running the scheme) addressed the following topics: (1) the main objective(s) for running the specific recording scheme; (2) whether the objectives had changed over time; and, (3) the perceived benefits (and drawbacks) to the organisation of involving the public in the scheme. Theme 2 (types of participant) focused on: (1) the

Table 2

Questions included in the current scheme participant questionnaire.

Question	Response format
1. What was the main reason(s) for you to get involved in the scheme?	Open
2. What are the benefits of being involved?	Open
3. Are there any ways in which it could be improved for you?	Open
4. Do you participate in any other wildlife recording schemes?	Yes/no tick box. If yes, please give details
5. Have you taken part in a wildlife recording scheme and then stopped?	Yes/no tick box. If yes, please give details
6. Are you a member of any wildlife/environmental/nature related societies or groups e.g. Wildlife Trusts, bird group?	Yes/no tick box. If yes, please specify

reasons for encouraging participation in the scheme; (2) methods for recruitment of participants; and (3) perceptions about any social, economic or cultural biases in their volunteer base. The final theme (motivations and barriers) focused on: (1) procedures for dealing with the results; (2) perceptions around the motivations of participants; and, (3) perceptions concerning any bias in their volunteer base. Interviewees were encouraged to elaborate within and beyond the themes wherever possible. The telephone interviews were conducted by the same researcher (Sarah Hobbs) to minimise error due to interviewer variability (Bryman, 2008).

Prior to commencing the interview, a consent form was provided to participants in order to explain the aims of the study and to seek consent for using participants' viewpoints as part of the piece of research. At the beginning of each interview, the outline of the study was again explained, and verbal consent sought to record the interview. Interviews were recorded using a digital voice recorder and transcribed after the event. We coded the transcripts from each interview according to the three major themes (objectives for running the scheme, types of participant and motivations and barriers) using Atlas-Ti® (ATLAS Ti Scientific Software Development GmbH). Atlas Ti was chosen for exploring interview data because of its suitability for working with small sample sizes (Barry, 1989). Computer-aided qualitative data software such as Atlas Ti is also a useful analytical aid because of the flexibility to visually map out themes in the data, reflect on emerging themes and code key concepts, generating theory that is grounded within the data (Barry, 1989; Basit, 2003). Using a grounded theory approach within the constraints of the three major themes, we identified additional sub-themes emerging from the transcriptions of the interviews.

Current participant questionnaires

A simple questionnaire was designed to explore the motivations and past behaviour of individuals that currently participate in a wildlife recording scheme. The questionnaire was based around three themes: motivations and benefits for involvement with the recording scheme; barriers to involvement; and behaviour regarding other environmental groups or societies (Table 2). Open questions were used as a tool for investigating perceptions and behaviour of participants (White, Jennings, Renwick, & Barker, 2005). Demographic information other than postcodes was not collected from participants in an attempt to maximise response rate.

We posted the participant questionnaires to a random sample of participants in the British Trust for Ornithology (BTO) Garden BirdWatch (a national scheme; 300 participants contacted) and all the participants in the Leeds Garden Pond Survey (LGPS; a local scheme; 120 participants contacted). Participants received two cover letters, one from the scheme organiser and one from the researcher introducing the research and giving respondents the opportunity to opt out of having their words included as quotes.

Table 3
UK-based recording schemes found during the internet search.

Scale of scheme	Expertise Level	Commitment level	Schemes found and species recorded
National	Low	Low	British Waterways Wildlife Survey (all wildlife on any waterway) RSPB Big Garden BirdWatch NARRS Garden schemes (amphibians and slow worms) PTES, Living with Mammals (any wild mammals). Not currently running Pond Conservation, Big Pond Survey (pond wildlife)
	Low	Mid	Buglife Spider Hunt 2009 (Spiders)
	Mid	Low	Butterfly Conservation Migrant Watch (specific species of migrant butterfly)
	Low–mid	High	BTO Garden BirdWatch (garden birds and other wildlife)
	High	High	NARRS National Amphibian and Reptile Survey (amphibians and reptiles) Mammal Society What the Cat Brought In (all small animals, particularly mammals brought in by cats). Not currently running
Local	Low	Low	Cardiff Wildlife Survey (garden wildlife) Tower Hamlets Wildlife Survey (any wildlife) Great Comp, Kent, Wildlife Survey (any wildlife) Durham Wildlife Trust Riverside Wildlife Survey (grass snake and kingfisher). Not currently running CONE, Garden nettle patch survey (any wildlife in nettle patch) Woking Borough Council Garden Wildlife Watch London Borough of Islington Garden Survey (garden wildlife) Not currently running Northampton, SW & NW Hants Badger group Brockwatch (badgers in garden). Leicestershire Barn Owl box scheme (barn owls)
	Low–mid	Mid	Derbyshire Mammal Group Garden Mammal Survey (garden mammals) Leeds Great Garden Pond Survey (amphibians and spawn in garden pond) Cheshire Wildlife Trust Wildlife-Friendly Garden Scheme (garden wildlife and features)
	Mid	Low	Ellisfield Bird and Wildlife Survey (garden birds and wildlife) Cambridgeshire and Peterborough Biological Records Centre Pond Survey 2008 (Amphibians, dragon and damselflies and pond plants) Vincent Wildlife Trust Polecat Survey (Polecats on roads). Not currently running
	Mid	Mid	Norfolk Wildlife Trust Coastal Wildlife Survey (five species of coastal wildlife) Lincolnshire Bird Club Garden Bird Survey (garden birds)
	Mid	High	Henfield BirdWatch (various bird surveys) Herefordshire Ornithological Club Garden Bird Survey (garden birds)

A freepost envelope and an online response option were provided for all participants.

Socio-economic status of current participants

We collected postcode data from participants of both recording schemes and assigned each participant a score based on the Indices of Multiple Deprivation (IMD) which is allocated to the Lower Super Output area to which each postcode belongs. The postcodes were converted to the IMD 2007 score using the Geoconvert website, which uses the National Statistics Postcode Directory 2010 ([Geoconvert, no date](#)). Higher scores represent relatively more deprived areas than lower scores. The IMD is a combined score containing weighted data from seven domains of deprivation, one of more of which may be experienced by people living in each area. The domains are: income deprivation; employment deprivation; health deprivation and disability; education, skills and training deprivation; barriers to housing and services; living environment deprivation; and, crime. The IMD is a standardised tool to allow each area to be ranked relative to others, and to describe deprivation in a particular geographic location ([Department for Communities and Local Government, 2008](#); [The Scottish Government, 2011](#)). Although using postcode data alone for classification of areas has limitations (e.g. [Hyndman et al., 1995](#)), it was used in this instance as a simple and practical tool for gathering broad demographic information whilst attempting to maximise response rate by avoiding the need to request more personal information from participants.

In order to investigate the distribution of respondents' postcodes in comparison to the general population, we downloaded the full national data on IMD scores from the Data for Neighbourhoods and Regeneration website ([Data for Neighbourhoods and Regeneration, 2008](#)). We then re-sampled, with replacement, equivalent-sized samples from the national and relevant local areas using Re-sampling Stats for Excel 2007 (v. 4, 2011). We then

compared the IMD scores for our scheme respondents with the mean, median and 95% confidence intervals of national and local IMD scores based on 1000 iterations of the re-sampled datasets.

Results

Review of UK recording schemes

A total of 28 public recording schemes were found through the internet review, representing the different levels of commitment and expertise required for participation in the schemes. Of these, ten were run on a national level, and nineteen on a local level. Two of the national schemes and five of the local ones were not currently running. Analysis of the schemes revealed that there is a wide range of expertise and commitment levels required to participate in wildlife recording schemes on both the national and local scale, and for many different wildlife taxa ([Table 3](#)). At the simplest end of the scale, the British Waterways wildlife survey gathers ad hoc sightings of any wildlife from waterways ([Waterscape, 2011](#)). On a more structured basis, the Royal Society for the Protection of Birds (RSPB) Garden BirdWatch (GBW) requires participants to record birds during one hour of a specific weekend, with results submitted soon after ([RSPB, 2010](#)). The highest commitment was required from participants of the National Amphibian and Reptile Recording Scheme (NARRS). Participants in the NARRS scheme are encouraged to attend identification training events, and are then assigned a random Ordnance Survey grid square on a map and asked to conduct a survey with several repeat visits on the site, having arranged their own transport, equipment and landowner access ([NARRS, no date](#)).

Interviews with recording scheme organisations

Details of the schemes that were included in the interviews were collected from online information and through discussion with interviewees, in order to make a summary ([Table 4](#)) based on

Table 4
Summary of recording schemes that interviews were based upon.

Geographic scale	Name of scheme and organisation	Description	Expertise level required	Commitment Level required
National	Big Garden BirdWatch (BGBW). RSPB	Record the highest number of each bird species seen in garden over one hour on a specific weekend in January every year	Low – Bird ID support given by fact sheet	Low-medium. Small time commitment (one hour)
	Big Pond Dip (BPD), Pond Conservation	Record plant and invertebrate species seen in garden pond	Low – the required species/taxa and their identifying features are provided on a fact sheet	Low. One-off survey
	Garden BirdWatch (GBW). British Trust for Ornithology	Record numbers of garden bird (and other wildlife if desired) species on a weekly basis in Spring, Summer and Autumn. Costs £15 to participate	Med – the recording sheet requires identification of a large range of bird species. However identification support is provided by provision of a book	High, weekly records required (approx an hour a week recording)
	What the Cat Brought In (WCBI). Mammal Society	This survey was a one-off event, which asked families to record the mammals that their cat brought in over a specified period. Advertised to Mammal Society Youth members through their member magazine	Med-high, identification of different small mammals required	Low, ad-hoc recording if cats brought in wildlife during the survey period
	Migrant Watch (MW). Butterfly Conservation	The scheme asks for ad hoc records of two migratory species; the peacock butterfly and the hummingbird hawkmoth	Low – identification of the species is provided. Low species number considered to have a lower expertise requirement	Low, ad-hoc recording
	British Waterways Wildlife Survey (BWWS). British Waterways	The scheme asks for records of wildlife seen on any waterway in the UK. Photos for identification are available on the website	Low – participants are required to send in ad hoc records of wildlife they have seen. ID support is provided	Low, ad-hoc recording
Local	Barn owl recording scheme and nest box installation (BO). Run by an individual enthusiast in Leicestershire	The scheme asks for volunteers to get involved on a local scale to collect records of barn owls, and install and monitor barn owl nest boxes	Low – a single, straightforward species, and volunteer help required	Low-med, time and physical work required to install and monitor the nest boxes
	Leeds Garden Pond Survey (LGPS). Leeds City Council, West Yorkshire	Records of amphibians seen in garden ponds in Leeds collected	Low-med. Ability to identify different British amphibians (i.e. frog/toad/newt) required	Low, ad-hoc recording
	Amphibian Record Collection. Amphibian and Reptile Group of South Lancashire (ARGSL)	Records of amphibians collected across the county	Low-med. Any amphibian records collected	Low, ad-hoc recording
	Henfield BirdWatch (HBW). Run by the Henfield BirdWatch, West Sussex	Garden bird records, collected as well as transect data, miscellaneous records and other surveys	Low-high. All records taken. Transects require a high level of identification expertise	Low-high. Ad hoc records received, but transects require regular time commitment

the criteria used for the internet-based review (Table 1). Acronyms for organisations used in the following section are also provided in Table 4.

With only one exception (Barn Owl; BO), all interviewees acknowledged that their scheme was run in order to both collect data and to engage with the public on some level. Data collection as the clear primary objective was stated by representatives of four schemes (BO, GBW, What the Cat Brought In (WCBI), Amphibian Record Collection Lancashire (ARGSL)). Engagement as a primary objective was stated by three organisations (Leeds Garden Pond Survey (LGPS), British Waterways Wildlife Survey (BWWS), Migrant Watch (MW)) and an equal balance of both was described by three organisations (Big Garden Bird Watch (BGBW), Big Pond Dip (BPD), Henfield BirdWatch (HBW)). For schemes that are run primarily to collect data, there is a range of geographic scales, expertise/commitment levels and wildlife species recorded. However, schemes that are primarily aimed at engaging with the public are understandably simpler and easier to participate in (with lower expertise and commitment levels), thus being more likely to attract a wider range of participants. Data are used in various ways:

eight of the schemes (BO, BGBW, BPD, GBW, BWWS, MW, WCBI, HBW) reported they feed results back to contributors through letters or through organisational magazines; five (BGBW, BPD, GBW, BWWS, WCBI) report results through press releases and seven (BGBW, BPD, LPS, GBW, BWWS, MW, ARGSL, HBW) stated that data are fed into national or local datasets. Only one scheme (MW) stated that data would be published in peer-reviewed scientific media.

When asked about who they would like to take part in the scheme, most of the interviewees reacted initially with the response that everybody is invited to take part. Three interviewees stated that they are trying to target some groups in particular, for example younger people and families (BGBW, GBW, HBW), people new to wildlife recording, and those living in urban areas: 'we would really like people from urban areas to take part more.. not just because we think we can engage with them and get them inspired about nature but because their gardens are actually really important' (BGBW).

Although all of the interviewees stated that they are open to all to participate, four gave specific expectations of potential participants. Understandably, the garden pond recording schemes (BPD,

LGPS,) required participants who have garden ponds. The ARGSL scheme sets out a requirement as 'anybody who can identify an amphibian.. especially people with garden ponds', and the Garden BirdWatch, which was identified as a higher commitment scheme, expects a significant input from participants over time: 'what we're looking for is commitment... what we're really interested in is consistency of effort over time' (GBW).

The amount of data received, the coverage for data collection and the financial benefit of involving the public was acknowledged by five of the nine organisations interviewed (BGBW, GBW, MW, WCBI, ARGSL): 'we're gaining information about the status of our butterflies and moths that we otherwise simply wouldn't have... we can only afford to do it... because it's done by citizens' (MW). Raising awareness of the organisation and potentially recruiting more members or volunteers was also described by the majority of interviewees: 'we hope that we'll get supporters out of it, and spread the message, but in particular get supporters' (BPD).

All of the organisations interviewed stated that they use the media to promote their recording scheme. For the national organisations, national media coverage through press releases was also described. The role of the press and the decisions made by individual newspapers in promoting the conservation message was discussed in many cases: 'the media play a massive role' (BGBW). Some interviewees expressed a frustration at the demands of the media for exciting stories (ARGSL, MW, GBW): e.g. 'it's got to be an interesting story and.. is wildlife interesting? The media don't seem to think so.. it's really hard to get stuff in' (ARGSL).

Many of the perceptions held by the interviewees regarding the motivations and barriers for people to take part in recording schemes mirror the motivations described for practical environmental volunteers. For example, the idea of participation being a continuation of an activity already enjoyed by participants was mentioned by six interviewees (BO, BGBW, LGPS, GBW, BWWS); 'I think.. people might be.. just be going out and doing that anyway' (BWWS). Participation as a social event was identified as a motivating factor by five interviewees (BGBW, LGPS, BWWS, HBW, WCBI), particularly within families; 'a lot of grandparents do it with their [grand]children.. that's why they do it' (BGBW), or as an activity for which you can compare results between friends (GBW).

The motivating factor of contributing to an important cause, and gaining satisfaction from this, particularly through participants 'doing their bit' was described by five interviewees (BO, LGPS, ARSL, BGBW, HBW). This was linked to a sense of empowerment by the ARGSL representative: 'there is so little people feel they can do, you know everybody else makes all the big decisions and people do feel, I think, quite disempowered and disconnected from.. the whole policy making process that affects wildlife and conservation' (ARGSL).

In terms of a lack of awareness as a barrier to participation, the role of the media was identified by several interviewees. For example: 'we were much more likely to get coverage in the.. broadsheet papers than we were in the tabloids,.. we're much more likely to get.. coverage on Radio 4 than we were on Radio 1, so.. some people.. might be interested, but they won't hear about them because.. the media that they consume is different to the media that's.. picking up and publicising our story' (MW). Another awareness issue, that of conveying the importance of the scheme to the public, was mentioned by two interviewees, both of whom represented schemes that have a primary objective of data collection (MW, ARGSL): 'I would say general awareness is low.. of conservation generally.. that is I think a barrier.. people don't see the relevance, they don't see its important' (ARGSL).

Confidence barriers, in terms of having the skills or knowledge to get involved (BO), the ability to contribute (LGPS), to identify the wildlife involved (MW) and to understand the terminology (LGPS) were mentioned, for example: 'people are embarrassed to come

forward, they want to help but they don't know whether they've got any particular skills' (BO). The fact that some people might not identify themselves as potential participants for a scheme was also described by the GBW representative: 'people look at BTO and think it's very highbrow, you know it's lots of bearded experts... and that's a problem for us... we're not accessible in that sense'. Resource-based barriers were discussed by many of the interviewees, such as having enough time to participate (BGBW, GBW, ARGSL) or, for two of the schemes that require an online response, access to the internet was identified as a potential barrier (BWWS, MW).

Most interviewees explained that their organisations were not aware specifically of the current participant profile as they do not gather personal information about their respondents. However, the idea that certain societal or age groups might be missing were expressed by all, even though it was made clear in many cases that the scheme is open and welcoming to all groups. That data received might be affected by an unrepresentative participant base was discussed by one organisation representative (BPD), 'keen people have more wildlife-friendly ponds I suspect'.

Two of the local schemes described the participant base as a reflection of the local demographic (BO, HBW); 'we get what reflects the general population of this area' (HBW), or through the acknowledgement of there being a stereotype of participants to recording activities: 'It's pretty obvious the kind of people they are I'm afraid.. the general stereotype which we're all probably aware of.. white middle class people' (ARGSL). An under-representation of ethnic-minority groups in the schemes was described by five interviewees (BO, GBW, MW, ARGSL, HBW). In several cases, this was elaborated upon by interviewees, and the emphasis was placed more on the idea that ethnic minority groups are less likely to become involved in nature-related activities, particularly through unrelated reasons such as cultural factors, rather than a reflection of these groups not being targeted.

When asked about whether interviewees felt that any socio-economic groups were less well represented in their scheme, six expressed a perception that groups at the lower end of the socio-economic spectrum were less likely to be involved (BGBW, BO, LGPS, MW, ARGSL, HBW). However as before, this was based upon a general impression than data gathered about participants: 'my impression is that there's probably all sorts of middle class kids with interested parents' (WCBI).

Finally, the strain that running these schemes puts upon the organisations themselves was described by six of the interviewees (BGBW, LGPS, GBW, MW, WCBI, ARGSL). Discussions around this were linked to the organisations reporting that they want to be in a position to give more individual feedback to participants, and to provide better IT resources. All of the interviewees that mentioned these factors described that the reasons behind them were principally financial ones, (particularly in terms of shortages of staffing and IT resources). The resource limitations were seen as a barrier to recruitment of more participants in many cases, as outlined by one (MW): 'for us that's an economic thing... we would love.. to engage everyone, irrespective of whether they.. have access to a computer, and have the ability or confidence to work online, but we simply can't afford to.'

Current participant questionnaires

Coding of the questionnaire responses revealed seven main themes for motivations for participating in the scheme in the first place (Table 5). For both recording schemes (Leeds Garden Pond Survey (LGPS) and BTO Garden BirdWatch (GBW)), the most popular reason was that of a personal interest in wildlife (LGPS 38%, GBW 53%), followed by the provision of data in order to help conservation in some way (LGPS 23%, GBW 18%), for example 'collection of data for greater understanding of bird life influences in UK leading

Table 5

Proportions of questionnaire responses for the Leeds Garden Pond Survey (LGPS) and BTO Garden BirdWatch (GBW).

Question	Response	Proportion	
		LGPS (n = 69)	BTO (n = 215)
Reason to get involved in the scheme	Interest in wildlife	0.38	0.53
	Saw the wildlife	0.07	0.03
	As a response to a request	0.12	0.03
	Learning	0.04	0.05
	To provide data for/help conservation	0.23	0.18
	Social reason/asked by a friend or family member	0.07	0.02
	Was doing activity anyway/to give purpose to recording	0.03	0.14
	Other/not specified	0.06	0.02
		(n = 69)	(n = 215)
Benefits of participation	Personal enjoyment/gives purpose	0.19	0.31
	Learning from results about bigger picture	0.29	0.11
	Personal learning; about wildlife or own garden	0.23	0.35
	Helping wildlife	0.13	0.04
	Contributing	0.06	0.18
	Other/not specified	0.10	0.01
		(n = 10)	(n = 98)
Of those that have stopped, reasons why	Recording process (e.g. Forms, Timings, Sites)	0.30	0.10
	Project completed	0.10	0.14
	Species/habitat related	0.10	0.04
	Personal reasons (e.g. Old age, having enough time)	0.30	0.43
	Forgot	0.10	0.00
	Not specified/other	0.10	0.29

to better protection/creation of suitable/favourable habitats' (GBW participant). For the LGPS, the next most popularly stated reason centred on participation as a response to a request, e.g. 'I responded to a newspaper appeal for people to take part' (LGPS participant), although this reason was described by only 3% of GBW participants. The third most popular response for the GBW (14%) was that it was an extension of an activity that participants were already doing, as reported by one participant: 'I had for some years kept an informal record (in diary form) of birds.. visiting our garden and this was a welcome opportunity to give such records a practical purpose'. A number of these respondents reported that their participation acted as a justification for watching birds, e.g. 'to be able to stand idly watching.. the birds without feeling guilty', reflecting the findings described by Lawrence (2006) with voluntary biological monitoring participants. Conversely, for LGPS participants this was the least stated response, which suggests that they were less likely to have been making records of their garden amphibians prior to the survey.

The other three themes for participation were mentioned by few participants for both schemes. These are that seeing the wildlife in the garden was the primary reason for getting involved (LGPS 7%, GBW 3%), e.g. 'the number and variety of birds coming into my garden' (BTO participant). A social reason, e.g. 'we have a young child.. and we thought it was beneficial for him to appreciate the environment and wildlife' (LGPS participant), was stated by some participants of both schemes (LGPS 7%, GBW 2%), and participating initially as a learning experience was reported by 4% (LGPS), and 5% (GBW) of participants.

The benefits of participation described by respondents were coded into six main categories (Table 5). For LGPS participants, the most popular benefit stated was that of learning from the results on a scale larger than that of their own garden (29%). As this is a local recording scheme, these participants were therefore expressing an interest in results from their local area. Of course, for GBW participants, this larger scale would include national results, and was less often stated, being the fourth most popular benefit described (11%). However, the most popular benefit described by GBW participants was also that of learning on a local scale, that of within

their own gardens (35%), implying that the process of participating in the survey allows participants to learn more about the birds they are observing, e.g. 'I have become more aware of the birds using my garden... I am learning all the time!' (GBW participant). Learning on this scale was the second most popular benefit described by LGPS participants (23%).

Expressions of personal enjoyment and/or giving a purpose to recording activities was the next most popular benefit described by participants (LGPS 19%, GBW 31%), for example; 'it is rewarding and fun' (GBW participant) and 'I still get the excitement' (LGPS participant). Other benefits described were that of helping wildlife (LGPS 13%, GBW 4%), and the benefit of contributing to a cause (LGPS 6%, GBW 18%).

Alongside other responses, health and wellbeing benefits or reasons for participation were reported upon by a number of participants of the GBW scheme, for example 'good for my mental health – watching birds alleviates depression', and 'my husband had a heart attack and was very depressed so I suggested watching the birds in the garden and then saw an advert'. Many participants also commented upon the positive impact being a participant of the scheme has had in their life, e.g. 'signing up for the GBW surveys was probably one of the best decisions I've ever made and it is an important part of my life' (GBW participant).

For both the LGPS and the GBW, the majority of participants suggested no improvements for the scheme (LGPS 84%, GBW 85%), either through writing this, or by leaving the question blank. Of those that did give reasons these were centred on three themes: suggestions about changes in the species recorded (e.g. the capacity to record more details, or to record additional species) (LGPS 1%, GBW 5%); that more information should be made available (e.g. via results of the study, or enabling social interactions) (LGPS 9%, GBW 5%); and a technical aspect such as the online recording system (LGPS 6%, GBW 6%).

Most LGPS participants (86% of those who answered the question) had not ceased participation in a scheme once they had started. However, for GBW participants, just under half of all participants (46%) had ceased participation some time after starting. The reasons stated for ceasing participation fell into six categories

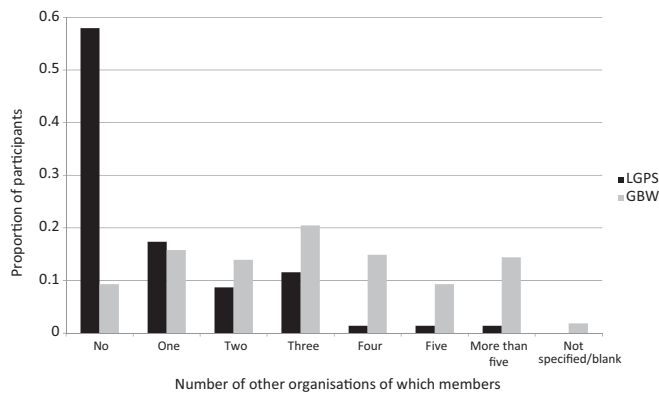


Fig. 1. Proportion (vertical axis) of participants in the Leeds Garden Pond Survey (LGPS) and the Garden BirdWatch (GBW) who were members of different numbers of other environmental organisations, groups or societies (horizontal axis). Numbers of participants: LGPS, 69; GBW, 215.

(Table 5). Among those participants who had ceased to participate in either scheme, the most popularly stated reason for ceasing participation for both schemes was a personal reason, such as old age, or no longer having enough time to participate (LGPS 30%, GBW 43%). A factor relating to the recording process itself, such as details of the recording forms, or timing of the survey, was also mentioned by 30% of LGPS responses, although this was less frequently described by GBW participants (10%). Another reason for withdrawal was that the recording project itself ended (LGPS 10%, GBW 14%). Finally, reasons relating to the wildlife or habitat were stated by some respondents (LGPS 10%, GBW 4%), for example 'our pond sprang a leak' (LGPS participant).

Membership of other environmental organisations was more frequently reported for participants in the national scheme (GBW) than the local one (LGPS) (Fig. 1). Over half of the LGPS participants (58%) were not a member of other groups in comparison to 9% of GBW participants. The most frequently reported number of organisations to be a member of was one for LGPS participants (17%), and three for GBW participants (20%). The fact that the BTO, who run the GBW are a national member-based organisation may explain that the GBW participants are already aware of, and participate in membership activities. On the other hand, the LGPS is run by the Local Authority and therefore participants may be less likely to be linked to other membership activities.

Socio-economic status of current participants

Some participants did not fill in their postcode, resulting in the total number of postcodes received from LGPS participants being 59, and 179 from BTO participants. Scottish and Welsh postcode scores were not used in this analysis due to the small sample size from these countries. Mean and median postcode scores for both the Leeds Garden Pond Survey (LGPS) and BTO Garden BirdWatch (GBW) schemes fell below the 95% confidence intervals calculated from resampled national datasets (Leeds and all England data respectively) (Table 6). As higher IMD scores represent relatively more deprived areas than lower scores, this indicates that participants of these schemes live in postcode areas that are relatively less deprived than the local and national dataset as a whole (Fig. 2).

Discussion

The role of nature recording schemes in the UK

The importance of citizen scientists for gathering important biological data is widely acknowledged (Bell et al., 2008; McCaffrey,

Table 6

Mean and median scores from the LGPS and GBW participant sample compared with 95% confidence intervals based on 1000 equivalent sized samples, sampled with replacement, from the national and relevant local areas.

Scheme	LGPS (n = 59)	GBW (n = 179)
Scheme sample mean IMD score	15.44	11.16
95% confidence interval for resampled data	19.51–28.46	19.60–24.16
Scheme sample median IMD score	11.24	10.51
95% confidence interval for resampled data median	13.42–25.02	14.44–20.10

2005; Newman et al., 2003; Toms & Newson, 2006; UKBAP, 2010). This was confirmed through this study by the conservation organisation representatives running the schemes, and also understood by many of the current scheme participants. The fact that many current participants reported that a benefit of their participation was the notion of helping wildlife and/or contributing to conservation implies that the importance of their participation has been successfully communicated to them through the scheme organisers.

The role of recording schemes to raise awareness or engage with the public (Brossard et al., 2005; Devictor et al., 2010) to some extent was also reported by all recording scheme representatives interviewed. Indeed many of those interviewed stated that this was the principal reason for running their scheme, which reflects the need for financial support from new members and the objectives of conservation organisations. Furthermore, awareness through learning, whether about the wildlife in their own garden, or about the local area was the most important motivational factor for participants of both local and national recording schemes, reflecting the motivations for other environmental volunteering (Lawrence, 2006, 2009; O'Brien et al., 2008; Phillips, 1982). Therefore, by engaging members of the public in recording activities, conservation organisations may successfully be able to achieve the following: promotion of their organisation; potential recruitment of new members and hence increased financial support; promotion of the importance of recording activities to wildlife conservation; and, personal benefits to participants themselves through learning about species and the local area. Although it may be considered logical that more socio-economically deprived communities might be less likely to be able to support conservation organisations financially, none of the organisations interviewed reported that these groups were less likely to be targeted for these reasons. In fact the scheme organisers largely expressed a desire to be as inclusive as possible to all societal groups.

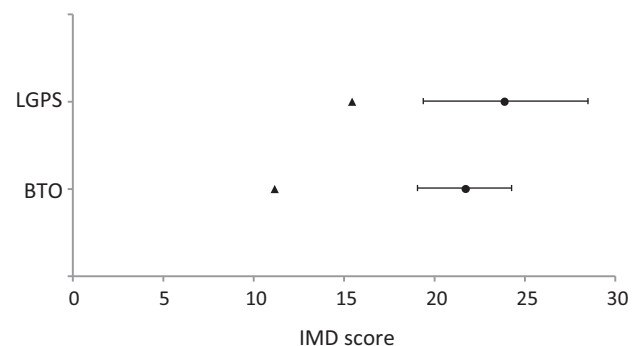


Fig. 2. Mean IMD scores for LGPS and BTO participants in comparison with local and national resampled data. LGPS and BTO sample means in comparison with 95% resampled datasets. Closed triangles represent scheme sample means. Closed circles represent local (for LGPS) and national (BTO) resampled mean scores, with error bars representing 95% confidence intervals for resampled data.

A significant personal benefit for current participants was the enjoyment of participation in recording activities, that of enjoying the process of seeing and recording wildlife as an activity. This was emphasised less in the interviews with conservation organisations running schemes, which perhaps suggests that there is a perception that other motivational factors are more significant. The fact that these activities can also give purpose to an activity already being conducted, particularly in the case of the bird recording scheme (GBW), reflects the findings of [Lawrence \(2006\)](#) with other voluntary biological monitoring participants, although this is clearly going to be more the case with some recording schemes than others.

The motivational factor linked to contributing to conservation through participation has been identified for other environmental volunteers ([Hibbert et al., 2003](#)), and was reflected in this study with recording scheme participants, both through the perception of many of the conservation organisations, and as stated by many of the participants themselves. Many conservation organisations therefore appear to have an understanding of one of the key motivational factors for many participants, and this may be linked to how recording schemes are advertised and marketed.

Potential barriers to attaining the cross section of societal groups

Although a large number of conservation organisations run nature recording schemes in the UK, the internet review revealed a sample of these through the search terms that were used. For people who have not participated in recording schemes before, there may therefore be an initial barrier of finding suitable opportunities if using internet searches as a tool. This study reveals that despite this wide range of recording schemes available for public participation in the UK, it is likely that a cross section of socio-economic groups are not equally represented in these activities, on either the local or national level, as indicated by both the perception of the recording scheme organisations and through the postcode analysis. By investigating more closely the different factors of recording schemes, as reported by some of the organisations running them, as well as the motivations and benefits stated by current scheme participants, it is possible to explore potential reasons for this bias.

Firstly, a key barrier to participation in environmental activities has been linked to a lack of awareness of opportunities ([Martinez & McMullin, 2004](#); [O'Brien et al., 2008](#)), which may also be applicable with participation in recording schemes. Many of the organisations interviewed indicated that the media plays a key role in promoting their scheme, although some expressed frustration at their lack of control over which types of media report the scheme and how it is presented. Where certain types of media are more likely to include information about recording schemes, this can result in the exclusion of those people in society who do not consume these media. Other promotional activities carried out by organisations are likely to be reflective of their financial and time constraints, for example through their own and other related websites. Recording activities will then be advertised to people who have the internet and are already visiting these websites or actively searching for specific opportunities. Therefore, this approach is unlikely to be successful in encouraging new people to participate in the scheme.

Secondly, participants must be motivated to participate. Key motivations for participation identified by both organisations and participants themselves centred on learning about their local area or species using their garden, enjoyment of the activities and making a contribution to conservation. Of course many people in the UK, in particular people living in socio-economically deprived urban areas, which comprise 98% of the most deprived communities in the UK ([Department for Communities and Local Government, 2008](#)), do not have access to a garden, or to certain features, such as garden pond, which may be particularly relevant. Although the review of

schemes in this study identified recording opportunities that are applicable in a range of habitats, the likelihood that these groups may be aware of, and motivated to participate in these activities may be reduced by this factor.

Thirdly, recording schemes must be accessible for participants. Being confident to participate has been identified as a potentially important restrictive factor for people living in low socio-economic communities ([Pope, 2005](#)). Although the review of schemes found that the majority require only a low level of expertise in order to participate, this may remain a significant barrier for some groups.

Financial barriers were also identified for other volunteers, although many recording activities are free of charge to participate in and can be done in proximity to the home. The availability of other resources may be a significant barrier for socio-economically deprived groups, however. As well as a limit to recording opportunities for people who do not have gardens as mentioned above, access to the internet has been identified as a barrier to participation for people living in socio-economically deprived areas ([Gorard, 2003](#)). Access to the internet was discussed by some of the recording scheme organisations, and it constitutes a barrier which may be applicable both for participation and for being aware of recording schemes in the first instance. Although schemes may not be limited to online participation, this may remain a barrier for some groups.

Finally, ill health has been identified as a barrier to participation in environmental activities ([Pope, 2005](#)), and health deprivation and disability are factors that may be more likely to affect people living in socio-economically deprived communities. Although some of the current participants reported the health and wellbeing benefits of participating in the recording scheme, this may remain a significant barrier for other people or groups.

The future of participation in wildlife recording

Our study has provided the first quantified evidence concerning the under-representation of people from socio-economically deprived communities in biodiversity recording schemes in the UK. This is significant, since it is a hitherto untested assumption which underpins the orientation of many of the funding streams that support conservation organisations towards working with 'hard-to-reach' groups, including urban and socially deprived communities, e.g. the Big Lottery Fund ([Big Lottery Fund, no date](#)). Our work has shown that whilst the importance of broader outreach is acknowledged by organisations running biodiversity recording schemes and many conservation organisations have made significant efforts to broaden their support base, significant barriers to participation still remain for many people in socio-economically deprived communities. More needs to be done to understand the reasons why people from hard-to-reach groups are less well represented in wildlife recording activities, including focused studies within these communities, in order to learn what can be done to reduce barriers and encourage participation, and thus maximise the individual and community benefits that arise from this participation.

Acknowledgements

This research was conducted as part of the Open Air Laboratories (OPAL) project, which is supported by the Big Lottery Fund. OPAL is a consortium programme led by Imperial College London involving nine regional partners: University of Central Lancashire, Dr M. Too-good (North West); University of Newcastle, Dr A.M. Borland (North East); University of York, Professor M.R. Ashmore (Yorkshire and Humber); University of Nottingham, Dr P.D. Crittenden (East Midlands); University of Birmingham, Dr J.P. Sadler (West Midlands); University of Hertfordshire, Dr M.A. Burton (East of England);

Imperial College London, Professor R. Toumi (London); Imperial College London, Dr S.A. Power (South East). There are five centres: Imperial College London, Dr N. Voulvoulis (Soil); Imperial College London, Dr S.A. Power (Air); University College London, Dr N. Rose (Water); Open University, Professor J. Silvertown & Natural History Museum, Dr G. Stevens (Biodiversity) and Meteorological Office, Dr G. Jenkins (Climate). Essential support services are provided by: Natural History Museum, Dr G. Stevens; National Biodiversity Network, Dr J. Munford; Royal Parks, Dr N. Reeve; Field Studies Council, Dr R. Farley.

References

- Barry, C. A. (1989). Choosing qualitative data analysis software: Atlas/ti and Nudist compared. *Sociological Research Online*, 3, <http://www.socresonline.org.uk/3/3/4.html>
- Basit, T. (2003). Manual or electronic? The role of coding in qualitative data analysis. *Educational Research*, 45, 143–154.
- Bell, S., Marzano, M., Cent, J., Kobierska, H., Podjed, D., Vandzinskaite, D., et al. (2008). What counts? Volunteers and their organisations in the recording and monitoring of biodiversity. *Biodiversity and Conservation*, 17, 3443–3454.
- Big Lottery Fund (no date). www.biglotteryfund.org.uk Accessed 14.06.11.
- Bird, W. (2004). *Natural Fit. Can greenspace and biodiversity increase levels of physical activity?* (Report to RSPB).
- Brodie, E., Cowling, E., & Nissen, N. (2009). *Understanding participation: A literature review* (Report to Institute for Volunteering Research). www.ivr.org.uk Accessed 03.07.2012.
- Brophy, J., & Bawden, D. (2005). Is Google enough? Comparison of an internet search engine with academic library resources. *Aslib Proceedings*, 57, 498–512.
- Brossard, D., Lewenstein, B., & Bonney, R. (2005). Scientific knowledge and attitude change: The impact of a citizen science project. *International Journal of Science Education*, 27, 1099–1121.
- Bryman, A. (2008). *Social research methods*. Oxford: Oxford University Press.
- CABE. (2005). *Decent Parks? Decent behaviour? The link between the quality of parks and user behaviour*. London: Commission for Architecture and the Built Environment.
- Conrad, C. C., & Hilchey, K. G. (2010). A review of citizen science and community-based environmental monitoring: Issues and opportunities. *Environmental Monitoring and Assessment*, 176, 273–291.
- Data for Neighbourhoods and Regeneration. (2008). <http://www.data4nr.net/introduction/> Accessed 31.05.11.
- Department for Communities and Local Government. (2008). *The English Indices of Deprivation 2007*. London: Communities and Local Government.
- Department for Government and Local Communities. (2011). *The English indices of deprivation 2010*. <http://www.communities.gov.uk/publications/corporate/statistics/indices2010>. Accessed 10.09.12.
- Devictor, V., Whittaker, R. J., & Beltrame, C. (2010). Beyond scarcity: Citizen science programmes as useful tools for conservation biogeography. *Diversity and Distribution*, 16, 354–362.
- eBizMBA Inc (2012). Top 15 most popular search engines. <http://www.ebizmba.com/articles/search-engines>. Accessed 10.09.12.
- Gaston, K. J., Warren, P. H., Thompson, K., & Smith, R. M. (2005). Urban domestic gardens (IV): The extent of the resource and its associated features. *Biodiversity and Conservation*, 14, 3327–3349.
- Geoconvert (no date). <http://geoconvert.mimas.ac.uk/index.htm>. Accessed 10.09.12.
- Google. (2009). www.google.co.uk Accessed 10.09.
- Google (2012). Google Guide: making searching even easier. <http://www.googleguide.com/>. Accessed 10.09.2012.
- Gorard, S. (2003). Adult learners in Wales: Trajectories and technologies. *Innovations in Education and Teaching International*, 40, 395–403.
- Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology*, 23, 109–123.
- Hitwise Pty. Ltd. (2012). Data Center – Top sites and engines. <http://www.hitwise.com/uk/datacentre/main/dashboard-7323.html>. Accessed 10.09.12.
- Hibbert, S., Piacentini, M., & Dajani, H. (2003). Understanding volunteer motivation for participation in a community-based food cooperative. *International Journal of Nonprofit and Voluntary Sector Marketing*, 8, 30–42.
- Hyndman, J. C. G., Holman, C. D. J., Hockey, R. L., Donovan, R. J., Corti, B., & Rivera, J. (1995). Misclassification of social disadvantage based on geographical areas—Comparison of postcode and collectors district analyses. *International Journal of Epidemiology*, 24, 165–176.
- Jardine, N., Secord, J. A., & Spary, E. C. (Eds.). (1996). *Cultures of natural history*. Cambridge: Cambridge University Press.
- Jamali, H. R., & Asadi, S. (2010). Google and the scholar: the role of Google in scientists' information-seeking behaviour. *Online Information Review*, 34, 282–294.
- Johnson, P. T., Chen, J. K., Eng, J., Makary, M. A., & Fishman, E. K. (2008). A comparison of World Wide Web resources for identifying medical information. *Academic Radiology*, 15, 1165–1172.
- Lawrence, A. (2006). No personal motive? Volunteers, biodiversity, and the false dichotomies of participation. *Ethics Place and Environment*, 9, 279–298.
- Lawrence, A. (2009). The first cuckoo in winter: Phenology, recording, credibility and meaning in Britain. *Global Environmental Change*, 19, 173–179.
- Lee-Smeltzer, K.-H. (2000). Finding the needle: controlled vocabularies, resource discovery, and Dublin Core. *Library Collections, Acquisitions, and Technical Services*, 24, 205–215.
- Martin, E., & Martin, C. (2011). Enhanced community support reduces rhino poaching in Nepal. *Pachyderm*, 48, 48–56.
- Martinez, T. A., & McMullin, S. L. (2004). Factors affecting decisions to volunteer in nongovernmental organizations. *Environment and Behavior*, 36, 112–126.
- Maslow, A. (1943). A theory of human motivation. *Psychological Review*, 50, 370–396.
- Max-Neef, M. (1991). *Human Scale Development: Conception, Application and Further Reflections*. New York: Apex Press.
- Mbaiwa, J. E., Stronza, A., & Kreuter, U. (2011). From collaboration to conservation: Insights from the Okavango Delta, Botswana. *Society and Natural Resources*, 24, 400–411.
- McCaffrey, R. (2005). Using citizen science in urban bird studies. *Urban Habitats*, 3, 70–86.
- Mook, D. G. (1987). *Motivation: The Organization of Action*. New York: W. W. Norton.
- NARRS. (no date). www.narrs.org.uk Accessed 04.08.10.
- Newman, C., Buesching, C. D., & Macdonald, D. W. (2003). Validating mammal monitoring methods and assessing the performance of volunteers in wildlife conservation—“Sed quis custodiet ipsos custodies?” *Biological Conservation*, 113, 189–197.
- O'Brien, L., Townsend, M., & Ebdon, M. (2008). *Environmental volunteering: Motivations, barriers and benefits* (Report to the Scottish Forestry Trust and Forestry Commission).
- Phillips, M. (1982). Motivation and expectation in successful volunteerism. *Nonprofit and Voluntary Sector Quarterly*, 11, 118–125.
- Pope, J. (2005). Volunteering in Victoria over 2004. *Australian Journal on Volunteering*, 10, 29–34.
- Porner, C., De Jardin, O., Morlais, F., Bouvier, V., & Launoy, G. (2010). Socioeconomic determinants for compliance to colorectal cancer screening. A multilevel analysis. *Journal of Epidemiology and Community Health*, 64, 318–324.
- RSPB. (2010). www.rspb.org Accessed 04.08.2010.
- Savan, B., Morgan, A. J., & Gore, C. (2003). Volunteer environmental monitoring and the role of the universities: The case of Citizens' Environment Watch. *Environmental Management*, 31, 561–568.
- Scottish Government. (2011). <http://www.scotland.gov.uk> Accessed 05.11.
- Szabo, J. K., Vesik, P. A., Baxter, P. W. J., & Possingham, H. P. (2010). Regional avian species declines estimated from volunteer-collected long-term data using List Length Analysis. *Ecological Applications*, 20, 2157–2169.
- Takano, T., Nakamura, K., & Watanabe, M. (2002). Urban residential environments and senior citizens' longevity in megacity areas: The importance of walkable green spaces. *Journal of Epidemiology and Community Health*, 56, 913–918.
- Toms, M. P., & Newson, S. E. (2006). Volunteer surveys as a means of inferring trends in garden mammal populations. *Mammal Review*, 36, 309–317.
- UKBAP. (2010). www.ukbap.org.uk Accessed 04.08.10.
- von Wagner, C., Good, A., Wright, D., Rachet, B., Obichere, A., Bloom, S., et al. (2009). Inequalities in colorectal cancer screening participation in the first round of the national screening programme in England. *British Journal of Cancer*, 101, S60–S63.
- Waterscape. (2011). *British waterways wildlife survey*. Accessed 12.05.11. www.waterscape.com/wildlifesurvey
- White, P. C. L., Jennings, N. V., Renwick, A. R., & Barker, N. H. L. (2005). Questionnaires in ecology: A review of past use and recommendations for best practice. *Journal of Applied Ecology*, 42, 421–430.
- Whitelaw, G., Vaughan, H., Craig, B., & Atkinson, D. (2003). Establishing the Canadian Community Monitoring Network. *Environmental Monitoring and Assessment*, 88, 409–418.