COMMUNITY PARTICIPATION IN BIODIVERSITY MONITORING

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ABSTRACT

The involvement of communities with wildlife is increasing on a global scale. Participatory approaches differ across the world, from natural resource management, environmental quality monitoring, to species and habitat data gathered through citizen science programmes. The personal and community benefits of engaging with nature are acknowledged through ongoing research, particularly in terms of health and wellbeing, yet simultaneously people are becoming increasingly distanced from nature due to factors such as urbanisation. In order to maximise the benefits associated with participatory initiatives, it is important to engage with a cross section of societal groups, providing opportunities for all, at the same time as collecting wildlife data from all habitats.

In this study, I confirm that participation in citizen science can achieve social and potentially community-level benefits on national, local and individual scales. Through semi-structured qualitative interviews, I found that conservation organisations strive to engage with a cross section of societal groups. However, postcode analysis of current wildlife recording scheme participants confirmed that socioeconomically deprived communities are under-represented in these activities. I designed a simple garden wildlife study in a socioeconomically deprived community to investigate the reasons behind this, and found that although a proportion of residents were motivated to participate, the majority had not done so in the past, which was largely attributed to a lack of awareness of opportunities. Despite this, many of these participants shared the same motivations for participation as those currently engaged. Working with a small group of community volunteers, I used semi-structured interviews to reveal that participation in an ecological study can bring about positive personal benefits with the potential to lead on to wider positive outcomes in the future. A significant factor in these transformative effects appeared to be the role of activity practitioners in supporting future participation. Alongside this investigation, a study of habitat use by hedgehogs in an urban setting, current garden management, and resources in the wider area appeared to have a positive effect upon hedgehogs.

Throughout all participants in this study, motivations for involvement were centred on contributing to a local study, an interest in the focal wildlife species/taxa, helping

conservation and learning. Gardening for wildlife was a popular activity, with many participants reporting both an active encouragement of wildlife into the garden, and a desire to learn more about this topic.

This thesis demonstrates how traditional environmental activities are not successfully engaging with people from socioeconomically deprived communities. There are likely to be many factors associated with this, but from the findings of this research, some recommendations can be made to improve future participatory approaches as well as building upon the positive effects of working with community volunteers.

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AUTHOR'S DECLARATION

I declare that the work contained in this thesis is my own and has not been submitted for any other degree or award.

Sarah Jennifer Hobbs

INTRODUCTION

Community participation in biodiversity monitoring

Community participation for conservation

Initiatives encouraging the involvement of members of the public in environmental activities, defined as community participation, are increasing on a global scale. Participatory approaches aim to fulfil a wide range of objectives in different contexts (Conrad and Hilchey, 2010), and effective engagement of communities is increasingly acknowledged as an essential component of achieving successful outcomes. There is a wealth of literature published on participatory initiatives for environmental outcomes, which is summarised (Table 1) and discussed below.

Community participation for monitoring of environmental quality is particularly common across North America (Whitelaw *et al.*, 2003, Conrad and Hilchey, 2010). Some monitoring initiatives may be driven by local governments or other external organisations in response to a change in circumstances, such as the Citizen's Environment Watch in Toronto, which has enabled formal water quality monitoring to continue despite government financial cuts in this area (Savan *et al.*, 2003). Other environmental quality monitoring programmes are initiated and driven by the communities themselves in response to an environmental issue or concern. In Louisiana, a community-driven project enabled local residents to challenge the ways in which air quality monitoring was conducted to improve conditions in their local area and on the wider scale (Ottinger, 2010).

Table 1. Summary of community engagement initiative types

Type of engagement	Partners	Drivers	Intended outcomes	Examples
Environmental quality monitoring	Government agencies, research groups, communities	Community-driven in response to environmental quality issue. Some examples driven through necessity such as funding cuts in government	Reduced government costs Empower local communities and improve local environmental conditions	Community-driven air quality monitoring in US challenged local Shell plant and resulted in challenges to regulatory standards (Ottinger, 2010). Research institutes in Canada set up participatory 'Citizens Environment Watch' in response to government funding cuts. Water and air quality monitoring (Savan *et al.*, 2003, Whitelaw *et al.*, 2003)
Natural resource management	Government agencies, conservation bodies, communities	Government and international conservation agencies shifting approach towards participatory initiatives to successfully and sustainably conserve natural resources	Protection of and species and habitats, e.g. reduced poaching, sustainable habitat management local governance, support of conservation decisions made	Community based monitoring shaped favourable attitudes in Nepal (Mehta and Heinen, 2001), reduced poaching and increased sympathetic habitat management in Pakistan (Nawaz *et al.*, 2008) and decreased poaching in Peru (Wheeler and Hoces, 1997). In Namibia, partnership approach has led to sustainable project governance by local communities (Stuart-Hill *et al.*, 2005). Also identified as an important approach for management of natural resources such as rivers in the UK (House, 1999) and watersheds in the US (Koehler and Koontz, 2008)
Gathering data through local knowledge	Government agencies, researchers, communities	Research to determine status or distribution of species or habitats, feeds into policy or legislation for conservation decision making	Distribution data gathered	Scottish Natural Heritage conducted a survey of farmers and other countryside users to gather data based on local knowledge (Reading *et al.*, 1996). Indigenous knowledge gathered from herders in Kenya provided biodiversity information and the potential for future wide scale biodiversity monitoring (Roba and Oba, 2009)
Landscape scale wildlife conservation	Multiple – government agencies, conservation organisations, other stakeholders e.g. businesses, communities	Increased understanding of conservation science and participatory approaches has led to a change in focus for wildlife conservation	Sustainable long term wildlife conservation with local support	Identified as essential for specific species conservation e.g. wood white butterfly (Jeffcoate and Joy, 2011), habitat management incentives on private land (Prager *et al.*, 2012) and for linking habitat between protected sites (Cox and Underwood, 2011).

Table 1 (cont). Summary of community engagement initiative types

Type of engagement	Partners	Drivers	Intended outcomes	Examples
Wildlife management decision making	Multiple – government, land owners and managers, academic community, other stakeholders e.g. businesses, general public	Human-wildlife conflicts, nature conservation or policy, e.g. public or wildlife health or safety. Participatory approach often driven through controversy of topic, i.e. ecologically/ public perceptions/ economic drivers	Management of wildlife, reduced opposition and increased support from local people through stakeholder engagement	Many different models of engagement used, e.g. deer management in US (Decker *et al.*, 2005) and UK (Austin *et al.*, 2010, Dandy *et al.*, 2011), fisheries management in Norway (Garcia, 2008), and US (Miller *et al.*, 2010) bears in US (Lafon *et al.*, 2004, Burkardt and Ponds, 2006), dingoes in Australia (Burns and Howard, 2003)
Wildlife population data gathering and monitoring	Government, and government agencies research institutes conservation organisations, citizen scientists	Conservation policy and legislation, conservation organisation objectives	Large amounts of data gathered to inform conservation decision making and fulfil statutory responsibilities	A number of reviews conducted, revealing a large variety of schemes and species covered, particularly in North America and Europe (Crall *et al.*, 2010, Dickinson *et al.*, 2010). Examples include long term bird monitoring studies in US (Lepczyk, 2005), and UK (BTO, 2010). Citizen science study in Australia conducted by the National Parks and Wildlife Service increased national database for koala population distribution (Lunney *et al.*, 1997)

Historically, the conservation and management of natural resources in many developing countries was approached using regulation and punitive action, and at the exclusion of local people (Ite, 1996, Colchester, 2004, Xu *et al.*, 2005). However, growing acknowledgement of the weaknesses of this technique has led to revised approaches with a strong emphasis on community engagement and collaborative working in order to maximise the ecological and social benefits of natural resources (Wheeler and Hoces, 1997, Adams and Hulme, 2001, Colchester, 2004). An essential part of making this process sustainable in the long term is the development of strong positive relationships between decision makers and local people working in partnership (Stuart-Hill *et al.*, 2005). In addition, initiatives may also address specific targets such as encouraging the development of favourable attitudes of local people towards the management of protected areas (Mehta and Heinen, 2001, Nawaz *et al.*, 2008), or discouraging actions that have a negative impact upon wildlife such as poaching (e.g. Wheeler and Hoces, 1997, Mbitikon, 2004, Nawaz *et al.*, 2008). Successful community-based initiatives can lead to far reaching benefits, for example, a participatory approach in Nepal successfully reduced poaching levels by engaging with local communities and encouraging community-led project governance to increase local support (Martin and Martin, 2011). However in other cases, the success of community engagement initiatives have been mixed (Mbaiwa *et al.*, 2011), and in situations where communities do not benefit from conservation initiatives, local people can become disengaged with conservation processes. Disengagement of communities can jeopardise the potential ecological and social benefits, and may even lead to negative outcomes such as increased poaching levels (e.g. Songorwa, 1999).

Another participatory approach is that of using local knowledge to contribute to baseline data for conservation monitoring. Although the values and understanding of local people may not necessarily align directly with those of scientists (Lepczyk, 2005), the input of community perspectives can enhance conservation projects as well as gaining valuable data (Lepczyk, 2005, Oba *et al.*, 2008, Roba and Oba, 2009, Weckel *et al.*, 2010). For example, data gathered from indigenous herders in Kenya was based upon their practical use of the areas rather than with biodiversity in mind, yet this was identified as a valuable tool in the future long term monitoring of biodiversity (Roba and Oba, 2009). Despite the associated advantages of this approach however, it is yet to have been adopted widely as a tool for gathering of biological data (Sheil and Lawrence, 2004).

Similar to the management of natural resources as described above, engagement with diverse groups is now being increasingly considered as essential for wildlife conservation on the landscape scale (Vos *et al.*, 2001) in both more and less developed countries. Rather than protecting species and habitats on a site-by-site basis, governments, researchers and conservation organisations now acknowledge the value of protecting networks of interlinked sites as habitat for wildlife (Cox and Underwood, 2011). In order to achieve this sustainably, stakeholders such as local landowners, businesses and community members must be successfully engaged and in support of the approach (Wiens, 2009), and the requirements of wildlife conservation must be balanced with the socioeconomic and other needs of the people who live and work within the landscape (Henson *et al.*, 2009). This may be approached through habitat management incentives (Sanchez-Clavijo *et al.*, 2008, Prager *et al.*, 2012), or by a focus on certain species or taxa such as butterflies (Jeffcoate and Joy, 2011) or birds (Dallimer *et al.*, 2009).

In Europe, North America and Australia, participatory approaches increasingly rely on engagement with communities and other stakeholders for wildlife management decision making (e.g. Chase *et al.*, 2004, Decker *et al.*, 2005, Cooper *et al.*, 2007, Reed, 2008). These approaches may be driven by human-wildlife conflicts such as adverse effects on ecotourism caused by bears in the US (Lafon *et al.*, 2004, Burkardt and Ponds, 2006) or by dingoes in Australia (Burns and Howard, 2003) or for conservation such as the management of deer in the UK and Australia (Decker *et al.*, 2005, Austin *et al.*, 2010). Various groups of people may be affected by management decisions and participatory decision-making aims to reduce conflict by empowering these different stakeholders. For successful outcomes, interdisciplinary approaches that promote communication and learning throughout are recommended (Chase *et al.*, 2004, White and Ward, 2010).

Participatory approaches for other types of environmental decision-making have been widely investigated, such as within the EU Water Framework Directive (Wright and Fritsch, 2011), and building multi-level resilience to enable adaptation to environmental change in Keyna (Robinson and Berkes, 2011). As a result of these studies, a large number of models and recommendations have been made for good practice (Reed, 2008). If these approaches are designed and conducted in a way that truly empowers stakeholders through the decision making process, then it is acknowledged that collaboration with stakeholders can enhance environmental outcomes and support for decisions made (e.g. Powell and Colin, 2008, Reed, 2008, Robinson and Berkes, 2011).

Another common suite of participatory initiatives recruit citizens in the collection of environmental records and monitoring data (e.g. Toms and Newson, 2006, Szabo *et al.*, 2010) through citizen science. Data are used to inform conservation management decisions and to assess that measures put in place are effective (Niemela, 2000). For example, the Aubudon Christmas Bird Count in North America, which has been running since 1900, has contributed significant amounts of data to bird monitoring across the continent (National Aubudon Society, 2011).

Citizen science

The involvement of unpaid members of the general public to assist with providing data for scientific study, or 'citizen science' (Irwin, 1995) has grown markedly in popularity over recent years (Brossard et al., 2005, McCaffrey, 2005, Silvertown, 2009). Recruiting members of the public in this way is an extremely valuable tool for conservation organisations (Devictor *et al.*, 2010), particularly in terms of collecting data on a scale and scope that would otherwise be both financially and physically impossible (Newman *et al.*, 2003, McCaffrey, 2005, Toms and Newson, 2006, Bell *et al.*, 2008). There is a vast range of citizen science projects in operation covering a wide range of species, taxa and habitats (see Dickinson *et al.*, 2010, for a review).

However, involving non-expert members of the public in gathering scientific data is not without disadvantages, and the quality of the data collected is a frequently discussed topic. Organisations must be equipped with adequate resources to manage potentially large quantities of data efficiently in order to maintain data quality (Crall *et al.*, 2010). Furthermore, the nature of citizen science schemes means that the expertise of participants and therefore the accuracy of the data are likely to be largely unknown. This has led to criticism of the scientific rigour and validity of the data collected (Irwin, 1995, Nicholson *et al.*, 2002, Conrad and Hilchey, 2010) and more in-depth data quality checks and training for participants have been recommended (Crall *et al.*, 2006, Crall *et al.*, 2010, Dickinson *et al.*, 2010). Conversely, in some schemes, the data gathered by citizens has been found to be comparable to that of professional scientists (Ryder *et al.*, 2010, Gallo and Waitt, 2011), indicating that data quality also depends upon the study species and the design and implementation of the citizen science scheme. Therefore, although data quality of schemes may be limiting for some species or scales (e.g. Lepczyk, 2005, Kremen *et al.*, 2011), the value of this approach for conservation is increasingly acknowledged, particularly by: increasing the scope or range of the

existing dataset by combining local and scientific knowledge (Lunney *et al.*, 1997, Lawrence, 2009, Goffredo *et al.*, 2010); providing large datasets that are useful for monitoring broad species trends over time (Burnett *et al.*, 1995, Toms and Newson, 2006, Cooper *et al.*, 2007, Dickinson *et al.*, 2010); or by highlighting areas that require more in-depth scientific investigation (Lepczyk, 2005). The benefits of citizen science for conservation organisations are therefore clear.

Using citizen science schemes to raise scientific understanding or for education is another potential benefit of participation (Trumbull *et al.*, 2000, Lepczyk, 2005, Conrad and Hilchey, 2010, Goffredo *et al.*, 2010, Pendl *et al.*, 2011). Increased public understanding of scientific or environmental issues may increase public support for nature conservation measures and environmental policy making (see Conrad and Hilchey, 2010). By enhancing the connections between people and nature (Devictor *et al.*, 2010), citizen science schemes may also benefit participants themselves. As well as learning and social benefits associated with activities (Lawrence, 2006), interaction with nature and natural settings is increasingly acknowledged to provide benefits to people, particularly in terms of health and wellbeing (e.g. Fjørtoft and Sageie, 2000, Taylor *et al.*, 2001, Takano *et al.*, 2002, Hartig *et al.*, 2003, Wells and Evans, 2003, Bell *et al.*, 2004, Bird, 2004, Pretty *et al.*, 2007). However increased awareness through participation should not be assumed to automatically lead to significant changes in attitudes or understanding (Brossard *et al.*, 2005) and therefore successfully striking the balance between useful data collection and awareness raising requires schemes to be carefully planned (Bonney *et al.*, 2009, Silvertown, 2009).

Successful engagement with all communities for shared beneficial outcomes requires understanding of a range of complex factors, including cultural (Lawrence *et al.*, 2006), socioeconomic (Songorwa, 1999) and personal attributes (Mehta and Heinen, 2001). In order to fully maximise the benefits of citizen science programmes, it is therefore vital to understand the links between people and nature: how people engage with nature; the personal and community benefits of this engagement; and the barriers to engagement.

Understanding engagement

There is a suite of literature exploring participatory approaches, the impacts these may have upon participants, and the potential outcomes. Much of the early work

builds upon Arnstein's (1969) ladder of participation, a typology describing the shifts in empowerment for organisers and participants through traditional 'top-down' (e.g. passive transfer of information, termed 'manipulation) to 'bottom-up' (e.g. driven by the participants, termed 'citizen control') approaches. This model suggests that only 'bottom-up' approaches constitute true participation, where empowerment fully lies with participants. However more current theories have suggested a range of frameworks for understanding participation, and have challenged the dichotomous nature of a two dimensional ladder approach, suggesting that true participation can occur at a variety of levels (Pretty, 1995, Lawrence, 2006, Reed, 2008). This is particularly relevant for initiatives that seek to encourage participation through citizen science, because where this approach would have been viewed traditionally as 'top-down' or extractive, therefore with little empowerment or benefits to participants themselves, it is now understood that engaging with nature through citizen science can bring individual and community-level benefits for participants (Pretty, 1995, Lawrence, 2005, Lawrence, 2006).

An individual's engagement with nature and the benefits gained by it are personal, and therefore difficult to broadly define. With respect to engagement with nature of people living in more developed countries, Pretty *et al.* (2005) identified three levels:

i) viewing nature – as through a window, or in a painting;
ii) being in the presence of nearby nature – which may be incidental to some other activity, such as walking or cycling to work, reading on a garden seat or talking to friends in a park; and
iii) active participation and involvement with nature – such as gardening, farming, trekking, camping, cross-country running or horse-riding

However, for initiatives seeking to engage with individuals and communities, activities such as cross country running or horse-riding, as defined in (iii) above may not be considered as active engagement with nature, rather an extension of being in the presence of nature as in i) and ii). Although the most active levels of engagement are likely to be most beneficial - and most measurable - in terms of external benefits such as data collected or physical benefits for wildlife, engaging with nature on any level may benefit participants, particularly in terms of health and wellbeing as described above (Lawrence, 2006).

The ways in which people engage with nature will also affect their motivations to participate in environmental activities. Research into practical environmental

volunteering has found several key motivating factors for participants becoming and staying involved with conservation tasks. As well as the physical and mental well-being benefits of spending time outdoors (O'Brien *et al.*, 2010), important motivators include 'giving something back': either to the environment (Weston *et al.*, 2003); to the locality (Lawrence, 2006); or to the community (Measham and Barnett, 2008). Social benefits (Hibbert *et al.*, 2003, Bruyere and Rappe, 2007, Measham and Barnett, 2008, O'Brien *et al.*, 2010), and learning (Bruyere and Rappe, 2007), and its associations with career progression (Lawrence, 2006, O'Brien *et al.*, 2008) are also known to be important factors.

Barriers to engagement with nature

Globally, urbanisation is increasing at an unprecedented rate, with approximately 74% of citizens in developed countries living in urban areas, compared with 3% in the early 1800s (Population Ref Bureau, 2010). Through the process of urbanisation, natural habitats are removed and fragmented, and pollution and disturbance caused by people, buildings and traffic can render the built environment unsuitable for many wildlife species (McKinney, 2002, Parris, 2006, Baker and Harris, 2007, Gledhill *et al*., 2008). The process of urbanisation also leads to changes in culture due to the increasing distances between people and nature (Katcher and Beck, 1987). Opportunities to encounter wildlife can be limited as many of the residential areas of large cities typically contain lower levels of biodiversity (Turner *et al*., 2004), giving urban residents fewer opportunities to encounter nature close to their homes. Cultural factors may also play a significant role. For example, children playing in natural settings is becoming increasingly rare as they spend relatively more of their time indoors (Fjørtoft and Sageie, 2000), which has been attributed to factors such as the perceived dangers of outdoor play (Burdette and Whitaker, 2005). Lower encounter rates with nature may lead to lower levels of engagement for many people and therefore as a knock-on effect, the social and ecological benefits of interactions with nature are likely to be reduced.

Participation in the UK

In the UK, the voluntary sector is considered to play a key role in the delivery of many government services (O'Brien *et al*., 2008). For example, it was estimated that in 1995, 70% of the 60,000 individuals contributing to biological record collection in

the UK did so on a voluntary basis (Burnett *et al*., 1995) and this number is thought to have grown considerably since then (Bell *et al*., 2008).

In response to the growing distance between people and nature, and in reflection of the benefits of involving volunteers in environmental activities, the UK government has directed a significant proportion of funding streams towards initiatives that encourage public participation and engagement (Silvertown, 2009). These aim to engage people on a variety of levels, as outlined in Pretty *et al.* (2005)'s definitions above. For example, the Area of Outstanding Natural Beauty (AONB) network encourages engagement with natural areas (NAAONB, 2010) through viewing nature, as in i). The health and wellbeing benefits of walking and cycling for health in natural settings are promoted through schemes such as the NHS initiative Walking for Health (Walking for Health, no date), and the National Cycle Network, which promotes scenic and traffic-free cycle routes (Sustrans, no date). The importance of high quality parks and informal green spaces is acknowledged in terms of health and wellbeing for individuals, but also for environmental, economic and community health (CABE, 2004, 2005).

It is clear that citizen science schemes should be inclusive to all societal groups in order to maximise both ecological and social benefits. However, a profile of practical environmental volunteers suggests that there is a bias in the types of participant currently involved, with white, middle class people of retirement age being most likely to participate (Trumbull *et al.*, 2000, Burningham and Thrush, 2001, Pope, 2005, O'Brien *et al.*, 2008). The profile of citizen science participants specifically is not well understood, however it is likely that a similar bias may also exist in this group (Trumbull *et al.*, 2000, Toms and Newson, 2006).

In response to this bias, there is increasing emphasis on inclusivity in environmental activities in the UK. Many participatory programmes target 'hard to reach' groups (e.g. people living in socioeconomically deprived areas and ethnic minorities) in order to strengthen participation networks (Ellis and Waterton, 2004), and include diverse volunteers to aid community development and individual well-being as well as species conservation (O'Brien *et al.,* 2008). In recent years, a number of initiatives have been launched in the UK with the aim of encouraging local communities to engage with and learn about the wildlife that surrounds them.

The Open Air Laboratories network (OPAL) is an example of one such initiative. OPAL is an England-wide partnership project which brings together scientists, natural history enthusiasts and the public through wildlife recording and other

nature-related research and activities, working to five key objectives (Davies *et al.*, 2011, OPAL, no date):

1. *A change of lifestyle - a purpose to spend time outside observing and recording the world around us*
2. *An exciting and innovative educational programme that can be accessed and enjoyed by all ages and abilities*
3. *A new generation of environmentalists*
4. *A much greater understanding of the state of the natural environment*
5. *Stronger partnerships between the community, voluntary and statutory sectors*

Aims and structure of thesis

This thesis works within the objectives of the OPAL initiative to investigate public engagement with nature on a variety of levels. Just as participatory initiatives work on the national, local and community scales, I draw upon these approaches on all of these levels in order to gain an understanding of the personal and wider effects of participation. In doing so, I am then able to better understand how to maximise the inclusivity and benefits of community engagement projects such as OPAL, both for conservation and for participants.

On the national and wider local level, Chapter 2 investigates wildlife recording schemes that are run in the UK in order to more fully understand the objectives of such recording schemes, and the benefits gained by both the conservation organisations and participants. The socioeconomic status of current participants is ascertained in to order to explore whether people living in socioeconomically deprived communities are under-represented in recording activities. The reasons behind this potential bias is then discussed through an exploration into the motivations and barriers for participation as experienced by people that currently participate in recording activities.

On the community level, Chapter 3 explores nature recording activities of residents of an urban socioeconomically deprived area. To do this, it investigates motivations for participation in nature related activities, and whether residents have participated in such activities in the past. This enables a comparison with the responses of the current participants from Chapter 2 in order to understand the reasons behind differences in participation rate between different communities.

On the individual level, Chapter 4 explores the potential transformative effects of participation in an in-depth citizen science study. Bringing together community and scientific research volunteers, this chapter investigates potential future personal and wider community changes for volunteers and makes recommendations for practitioners of environmental activities in order to maximise the benefits of similar projects.

Chapter 5 presents the scientific results of the citizen science study reported in Chapter 4. It evaluates urban habitat use by European hedgehogs *Erinaceus europaeus*, with regard to the impact of garden management upon hedgehog habitat use. Hedgehog behaviour observed through a radio tracking study is compared with householder behaviour in the same urban community, particularly regarding garden management, supplementary feeding and other factors that may affect hedgehogs.

The Discussion (Chapter 6) brings together the findings of the preceding data chapters in order to identify common themes, and make recommendations both for further research and for successful participatory approaches. The limitations and implications of the research are discussed and conclusions drawn.

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CHAPTER 2

Community participation in biodiversity recording: the social and ecological implications of an unrepresentative participant base

Preface

Engaging the public in recording activities potentially delivers benefits to conservation organisations, such as data collected, awareness of conservation messages raised and potential financial support associated with membership and donations from the public (Brossard *et al.*, 2005, Devictor *et al.*, 2010). Participants themselves may also benefit from increased scientific awareness, a stronger connection with nature and the health and wellbeing benefits associated with this. However, if recording schemes are not engaging with a cross section of socioeconomic groups, as is the case with practical environmental volunteering, the potential ecological and social benefits of these activities will not be realised. It is therefore important to ascertain the extent to which conservation organisations actively aim to recruit a cross-section of socio-economic groups among their volunteers, and the socioeconomic diversity of those currently participating in recording activities. Understanding the motivations and barriers to recording schemes as experienced by those currently participating is also necessary in order to draw future comparisons with groups living in socioeconomically deprived communities.

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Community participation in biodiversity recording: the social and ecological implications of an unrepresentative participant base

Abstract

Public citizens are involved increasingly in environmental and wildlife monitoring. Public involvement has clear environmental benefits in terms of the contribution to long-term datasets and monitoring. However, it also yields social benefits, both to the participants concerned and to the wider community. Participation in environmental activities plays an important role in increasing public awareness of scientific issues, helps to promote a reconnection between people and nature, provides individual health benefits and helps to build social capital. However, there is concern that participation is not spread evenly across different social or ethnic groups in society, and thus the potential benefits from this participation are not being realised. It is therefore important to understand better the barriers that reduce participation by these groups. Here, we seek to develop such understanding, by conducting a study of public participation in wildlife monitoring schemes in the UK. We use a combined approach, integrating the results from interviews with organisations running the schemes with the results of surveys of participants. Our results confirm that people from more 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 also that they were unable to do so due to limitations of resources and the difficulty of attracting consistent media coverage for their schemes. The major motivating factors for participants included the chance to make a positive contribution to conservation and the personal benefits they derived from their involvement, 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 (e.g. having a pond or garden) and in terms of knowledge, financial costs of participation, and access to the internet for obtaining information and contributing results. Our results show that many recording schemes in the UK providing 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.

Introduction

Globally, the involvement of local people in gathering biological data is a popular and growing phenomenon. Data may be used to inform and reinforce environmental management, particularly in developing countries, through Community Wildlife Management (CWM) and Community Based Natural Resource Management (CBNRM) (e.g. Martin and Martin, 2011, Mbaiwa *et al.*, 2011). In North America, the data collected by the public is used most frequently for environmental quality and wildlife monitoring (e.g. Savan *et al.*, 2003, Whitelaw *et al.*, 2003), whilst in the UK and Australia, public biological records are largely used in the monitoring of wildlife species distribution and populations (e.g. Toms and Newson, 2006, Szabo *et al.*, 2010). 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 and Hilchey, 2010), as well as helping to promote a reconnection between people and nature (Devictor *et al.*, 2010), and raising awareness of environmental issues (Brossard *et al.*, 2005, Devictor *et al.*, 2010). The aims of many organisations acknowledge that the conservation of wildlife involves not only practical conservation measures, but also promotion, awareness-raising and education amongst the public. Many organisations put an emphasis on awareness-raising through their objectives. For example, the mission statement of the British Trust for Ornithology (BTO) is outlined specifically *'to promote and encourage the wider understanding, appreciation and conservation of birds'* (BTO, 2010).

In addition, participation in recording activities is likely to bring benefits for participants themselves. Volunteers may benefit on a personal level by being in

contact with nature, and the activities associated with being outside and undertaking nature recording is linked to health and wellbeing benefits and stress relief (Takano *et al.*, 2002, Hartig *et al.*, 2003, Bird, 2004, CABE, 2005). In an investigation into the views of voluntary biological monitoring participants, 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 et al., 2003) and learning and career progression (Phillips, 1982, Lawrence, 2006, O'Brien *et al.*, 2008, Lawrence, 2009).

Despite the overall increase in public participation in biological monitoring, the participant base for recording activities is unlikely to be representative of a cross section of societal groups. The implications for a biased participant base could be far-reaching, both ecologically and socially. A bias in biological data may not give a true account of the status of wildlife taxa across the country as a whole, particularly as resources for wildlife may vary in habitats that are linked to different societal groups. For example, socioeconomically deprived areas may provide better habitats for some species in comparison with more affluent areas, as is the case for house sparrows *Passer domesticus* in the UK Shaw *et al.* (2008), and bird abundance in Chicago (Loss *et al.*, 2009).

It is therefore desirable from both ecological and social perspectives that recording schemes reach all groups in society. 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 socioeconomic deprivation as classified by the Department for Communities and Local Government (DCLG) (Department for Communities and Local Government, 2011). Socioeconomic deprivation as measured in the seven domains used by the DCLG cover a broad range of issues caused by a lack of resources or services, many of which are not financial. Of course an individual living in an area defined as highly socioeconomically deprived may not experience any of these issues, however this approach allows for broad classifications of different geographic areas and relative comparisons to be made (Department for Communities and Local Government, 2008). Socioeconomically deprived communities have been identified as a key under-represented group in participatory activities, although much of the current literature relates to participation and healthcare (e.g. von Wagner *et al.*, 2009, Pornet *et al.*, 2010). Therefore, if

socioeconomically deprived groups are less likely to participate in recording activities, the health and wellbeing benefits outlined above may also not be realised.

The reasons behind this bias are not fully understood. Research into barriers to involvement with some types of environmental volunteering has identified key factors including: a lack of awareness of volunteering opportunities; (O'Brien *et al.*, 2008, Martinez and McMullin, 2004); 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. Community participation is known to be lower for some ethnic minority groups (Campbell and McLean, 2002). For environmental activities, this may be due to reasons such as a lack of promotion of environmental issues in certain cultures, a lack of ethnic role models in environmental organisations, and a lack of knowledge as to where to obtain information (Bell *et al.*, 2004, CABE, 2005). 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 socioeconomic groups.

For a scheme to successfully recruit participants, the chosen audience must be aware of the scheme, and both motivated and able to participate. A bias in participant base may therefore reflect the recruitment and recording methods utilised by the 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 (Gaston et al., 2005, Bell et al., 2008). 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. Of course, organisations may be specifically targeting groups that are already engaged in nature-related activities, in order, for example, to gather high quality records from more experienced participants. It is therefore important to understand what the main objectives for running recording schemes are as this is likely to have a strong impact upon who is actually recruited. To maximise the ecological representativeness and social benefits of public nature 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 under-represented 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 (Jardine et al., 1996, Bell et al., 2008). Involving volunteer recorders as citizen scientists is important for both ecological and social outcomes (Devictor *et al.*, 2010). 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 using 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 (Newman *et al.*, 2003, McCaffrey, 2005, Toms and Newson, 2006, Bell *et al.*, 2008).

However, citizen scientists and volunteer recorders in the UK may also not represent a cross section of societal groups. 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 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 and Newson, 2006), suggesting that socioeconomically deprived communities were under-represented.

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 socioeconomically deprived areas are consistently under-represented in these activities. In this study, we investigate the motivations and barriers to participate in biological recording schemes in the UK. We do this by firstly making an investigation of recording schemes in the UK at both the local and national scale through an internet-based review. The review enables the exploration of the range of recording schemes available, and the expertise and commitment levels required from participants. Second, we conduct semi-structured interviews with representatives of organisations running schemes to ascertain the ecological and social objectives for

running the schemes, including whether a cross section of societal groups is desired and achieved. Third, we undertake participant surveys of one local and one national recording scheme. This approach allows us to investigate the motivations and barriers to participation from the combined perspectives of scheme organisers and participants.

Methods

Review of UK recording schemes

We carried out an internet-based review of current nature recording schemes in the UK using Google UK. Rather than making a 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 of this sample of recording schemes that might affect the participant base.

Google has been acknowledged as an effective information-seeking tool (Brophy and Bawden, 2005, Johnson *et al.*, 2008, Jamali and Asadi, 2010), with specific advantages of having wide coverage (Brophy and Bawden, 2005) and high precision (Jamali and 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 (Google, 2009): 'take part wildlife'; 'wildlife survey'; 'garden wildlife survey'. Boolean operators were not used in order to maximise the flexibility around these terms ('AND' is a default in Google (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 2).

Table 2. 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.

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, (representing 60% of those found in the internet review). In order to gather data from a cross section of the range of local schemes, four of these which included email addresses in the website were contacted and agreed to take part (representing 5% of local schemes found through the review). These represented a small cross section of the total number of schemes available but enabled an exploration of the 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 centred on three themes: objectives for running the scheme and recruitment of participants; participant profile; and perceived motivations and barriers for participation. Interviewees were encouraged to elaborate within and beyond the themes wherever possible. The telephone interviews were conducted by the same researcher 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 transcripts coded using Atlas-Ti® (ATLAS.ti Scientific Software Development GmbH).

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 3). Open questions were used as a tool for investigating perceptions and behaviour of participants (White *et al*., 2005). Demographic information other than postcodes was not collected from participants in an attempt to maximise response rate. Of course there are limitations associated with focusing only on participants, rather than including non-participants as a control group. However, the aims of the study were to explore the views of people currently participating so this was seen as an appropriate approach in this instance.

We posted the participant questionnaires to a random sample of participants in the BTO Garden BirdWatch (a national scheme; 300 participants contacted) and all the participants in the Leeds Garden Pond Survey (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. A postage paid envelope and an online response option were provided for all participants.

Table 3. Questions included in the current scheme participant questionnaire.

Question	Response format
What was the main reason(s) for you to get involved in the scheme?	Open
What are the benefits of being involved?	Open
Are there any ways in which it could be improved for you?	Open
Do you participate in any other wildlife recording schemes?	Yes/No tick box. If yes, please give details
Have you taken part in a wildlife recording scheme and then stopped?	Yes/No tick box. If yes, please give details
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

Socioeconomic status of current participants

We collected postcodes from participants of both recording schemes and assigned each participant's postcode a score from 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 IMD 2007 score using the Geoconvert website, which uses the National Statistics Postcode Directory 2010 (http://geoconvert1.ds.man.ac.uk). 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 requesting 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) for comparison with GBW participants' scores, and scores specific to the Leeds area extracted for comparison with LGPS participants' scores. 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 29 public recording schemes were found through the internet review, representing a small cross section of the conservation organisations that currently run nature recording 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.

Table 4. 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 Own 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) Henfield Birdwatch (various bird surveys)
	Mid	High	Herefordshire Ornithological Club Garden Bird Survey (garden birds)

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. 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 RSPB Garden Birdwatch requires participants to record birds during one hour of a specific weekend, with results submitted soon after (RSPB, 2010). Requiring a higher level of expertise and commitment, participants of the National Amphibian and Reptile Recording Scheme are required 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 5) based on the criteria used for the internet-based review (table 2). Acronyms for organisations used in the following section are also provided in Table 5.

Table 5. 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 is 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	The scheme asks for records of	Low – participants are	Low, ad-hoc recording

Table 5 cont. Summary of recording schemes that interviews were based upon.

Geographic scale	Name of scheme and organisation	Description	Expertise level required	Commitment Level required
	Wildlife Survey (BWWS). British Waterways.	wildlife seen on any waterway in the UK. Photos for identification are available on the website.	required to send in ad hoc records of wildlife they have seen. ID support is provided.	
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.

Objectives of schemes

With only one exception (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, WCBI, and ARGSL). Engagement as a primary objective was stated by three organisations (LGPS, BWWS, MW) and an equal balance of both was described by three organisations (BGBW, BPD, HBW). For schemes that are

run primarily to collect data, there seems to be a range of geographic scales, expertise/commitment levels and wildlife species recorded. However, for those schemes primarily aimed at engaging with the public, it is understandable that these are simpler and easier to participate in (with lower expertise and commitment levels), thus being more likely to attract a wider range of participants.

The desired participant base

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 in their scheme. Three interviewees stated that they are trying to target some groups in particular, one of which was younger people and families (BGBW, GBW, HBW), the others were 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, BPD), stated that they require participants who have garden ponds and the ARGSL scheme stated a requirement for '*anybody who can identify an amphibian...especially people with garden ponds',* and the Garden BirdWatch, which was identified as a higher commitment scheme, described that: '*what we're looking for is commitment...what we're really interested in is consistency of effort over time.*' (GBW).

Benefits for running recording schemes

The amount of data received, the coverage for data collection and the financial benefit of involving the public was acknowledged by five of the ten 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).

Recruitment of participants

All 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). However, some interviewees described the being at the mercy of the media, and expressed unease with 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).

Perceptions of motivations for participation

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, which 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 children...that's why they do it'* (BGBW), or as an activity that 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), which 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).

Perceptions of barriers to participation

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 are much more likely to get coverage in the...broadsheet papers than we are in the tabloids,...we're much more likely to get...coverage on radio four then we are on radio one, 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 the public understanding why the scheme is important, was mentioned by two interviewees, who represent 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).

Participant base

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 participating 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 socioeconomic groups were less well represented in their scheme, six expressed a perception that groups at the lower end of the socioeconomic spectrum were less likely to be involved (BGWB, 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) '*but 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

Motivations for participating in the scheme

Coding of the questionnaire responses revealed seven main themes for motivations for participating in the scheme in the first place (Table 6). 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 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.

Table 6. Proportions of questionnaire responses for both recording schemes

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
Benefits of participation		(n=69)	(n=215)
	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
Of those that have stopped, reasons why		(n=10)	(n=98)
	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

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.

Benefits of participation

The benefits of participation described by respondents were coded into six main categories (table 6). 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%).

Health and wellbeing benefits of participation

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's an important part of my life'* (GBW participant).

Ways in which schemes could be improved for participants

For both schemes, 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%, GWB 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%).

Reasons for stopping participation in a recording scheme

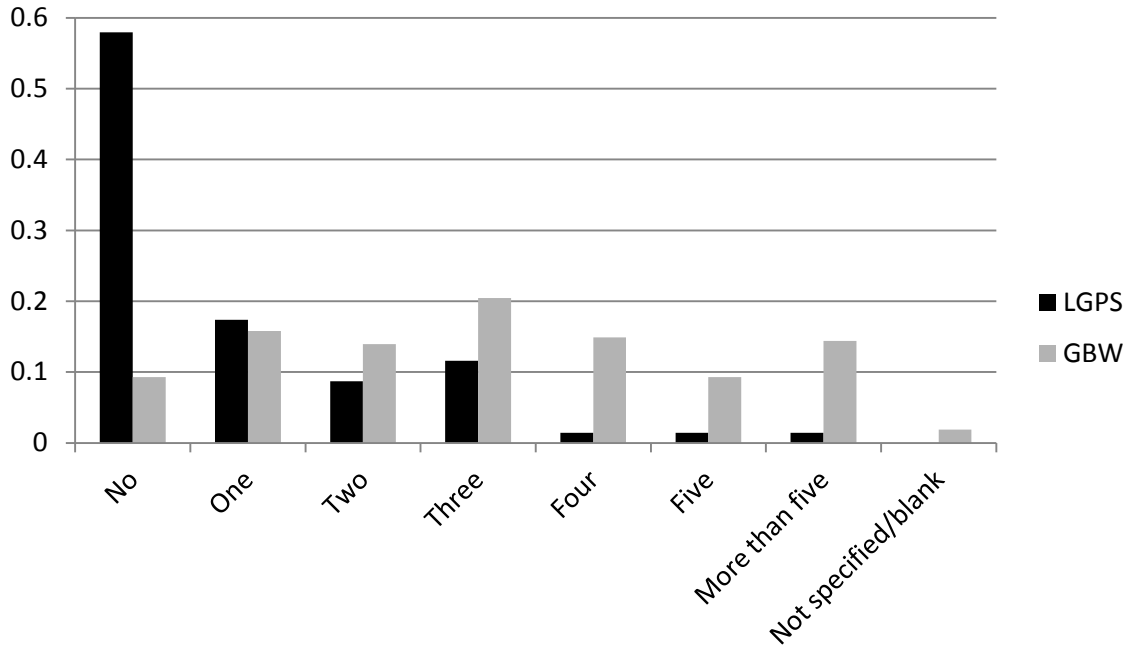
Most LGPS participants (86% of those who answered the question) had not ceased participation in a scheme once they had started. However, for GBW participants, just under half of all participants (46%) had ceased participation some time after starting. The reasons stated for ceasing participation fell into six categories (Table 6). 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 groups or societies

Membership of other environmental organisations was more frequently reported in the national scheme (GBW), than the local one (LGPS) (figure 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 active 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.

Figure 1. Proportions of membership of other environmental organisations/groups/societies for both recording schemes. Numbers of participants: LGPS, 69; GBW, 215.



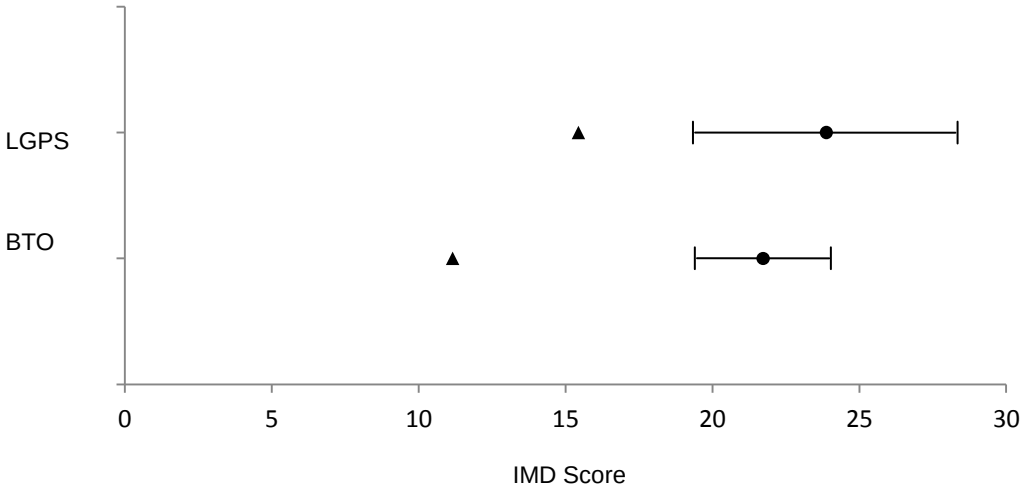
Socioeconomic status of current participants

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 7). 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 (figure 2).

Table 7. Resampled statistics for both LGPS and GBW schemes based on IMD scores obtained from participant postcodes

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

Figure 2. Mean IMD scores for LGPS and BTO recording schemes in comparison with local and national resampled data



LGPS and BTO sample means in comparison with 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.

Discussion

The role of nature recording schemes in the UK

The importance of citizen scientists for gathering important biological data is widely acknowledged, (Newman *et al.*, 2003, McCaffrey, 2005, Toms and Newson, 2006, Bell *et al.*, 2008, 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 (Phillips, 1982, Lawrence, 2006, O'Brien *et al.*, 2008, Lawrence, 2009). 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; promotion of the importance of recording activities to wildlife conservation; and personal benefits to participants themselves through learning about species and the local area.

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 socioeconomic 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 and 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 socioeconomically deprived areas, do not have access to a garden, or to certain features, such as garden pond. 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 socioeconomic 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 socioeconomically 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 socioeconomically 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 socioeconomically 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 recording schemes

It is clear from our results that many recording schemes in the UK are successfully providing benefits to nature conservation and participants alike. However, a bias in recording scheme participants appears to be present, which means that these benefits are not maximised. This bias is further acknowledged through many of the funding streams that support conservation organisations, with significant proportions

now being directed towards working with ‘hard-to-reach’ groups which includes urban and socioeconomically deprived communities, e.g. the Big Lottery Fund (Big Lottery Fund, no date). Nevertheless, it is apparent that significant barriers to participation still remain. More needs to be done to understand the reasons why people from hard-to-reach groups are less well represented in recording activities, in order to learn what can be done to reduce barriers and encourage participation, and thus capture the individual and community benefits that arise from this participation.

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CHAPTER 3

Motivations and barriers to participation in biodiversity recording within a socioeconomically deprived urban community

Preface

In other contexts, participation rates in socioeconomically deprived communities have been found to be lower than other societal groups. This has been attributed to residents being less active within their communities (Gordon, 2000) and other social and cultural factors (Brown *et al.*, 2010). Potential barriers to participation include: a lack of awareness of opportunities (O'Brien *et al.*, 2008, Martinez and McMullin, 2004) which is reliant on recording scheme promotion and advertising; a lack of accessibility of schemes, e.g. financial constraints (Brockman *et al.*, 2009); and a lack of motivation to participate.

Chapter 2 established the motivations for, and personal benefits of participating in recording schemes as experienced by people that currently participate, and confirmed that people living in socioeconomically deprived areas are under-represented in recording activities. Chapter 3 builds upon this baseline by making an investigation into the current behaviour with regard to garden wildlife and recording schemes and the motivations and barriers to recording in a socioeconomically deprived community in Hull, East Yorkshire.

Part of the outcome of this chapter has been published (Davies *et al.*, 2011), and can be seen in Appendix 1.

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Motivations and barriers to participation in biodiversity recording within a socioeconomically deprived urban community

Abstract

The involvement of communities in environmental activities continues to grow, with benefits for conservation organisations, wildlife and participants alike. However some societal groups are less likely than others to be engaged in these activities, which means that the full benefits cannot be maximised. In this paper, we use a case study in a socioeconomically deprived community of an east Yorkshire city to investigate participation in biodiversity recording activities. Through a postcard survey and self-completion questionnaire, we investigate motivations and barriers to participation. Our results show that a proportion of community members are motivated to participate in recording activities, yet the majority have not done so in the past. The motivations for participation reflected those of people currently engaged in recording activities, namely to contribute to conservation and/or a study about the local area, and in reflection of an interest in the study species or their own garden. The key barrier to participation reported was awareness of opportunities available. The majority of respondents were actively encouraging wildlife into their gardens and many requested more information on this topic, which has a positive implication for garden wildlife conservation through community engagement. The methods used in this Chapter proved to be successful in encouraging participation of a proportion of members of socioeconomically deprived communities in formal recording activities. However challenges remain for conservation organisations in encouraging future participation and it is likely that new recruitment methods are necessary in order to maximise the success of these initiatives.

Introduction

The encouragement of community participation in environmentally-related activities is a growing practice worldwide. Since the early 1970s, an increase in societal attention to environmental problems led to heightened public awareness of

environmental issues and policy making (Redclift and Woodgate, 1997). For example, a small group of environmental protestors set up environmental campaign organisation Greenpeace in 1971. In just five years, it had grown to 8,000 active supporters, which has now reached 2.8m supporters globally (Greenpeace, no date). Similarly, voluntary water quality monitoring programmes in the US tripled between 1988 and 1992 (Kerr *et al.*, 1994), and up to 500,000 new environmental quality monitoring groups were established within the 1990s (Pretty, 2003).

With nature conservation being increasingly considered on the landscape scale (Vos *et al.*, 2001), the sustainable long term success of conservation approaches is acknowledged to be reliant upon positive relationships between multiple stakeholders (Conrad and Hilchey, 2010). The drivers behind participatory approaches vary widely, for example community involvement in environmental quality monitoring in North America has enabled communities to improve local conditions (Ottinger, 2010), as well as allowing monitoring to continue despite government cuts in this area (e.g. Savan *et al.*, 2003, Whitelaw *et al.*, 2003). Community engagement approaches are also used for shared decision making, as they allow for increased understanding and empowerment of stakeholders through the participatory process. These approaches may be used for human-wildlife conflicts where social and economic factors must be balanced with conservation decisions, e.g. deer management in the US and UK (Austin *et al.*, 2010, Dandy *et al.*, 2011) or for broader environmental management decisions (see Reed, 2008). Community engagement also plays a key part in natural resource management, particularly in developing countries where successful nature conservation relies upon partnership working between communities, conservation organisations and governments (e.g. Wheeler and Hoces, 1997, Songorwa, 1999, Stuart-Hill *et al.*, 2005, Nawaz *et al.*, 2008, Mbaiwa *et al.*, 2011). In Europe and Australia, participatory approaches are central to the collection of biological data by members of the public, which are used for species distribution and population monitoring (e.g. Lunney *et al.*, 1997, Lepczyk, 2005, Toms and Newson, 2006, Szabo *et al.*, 2010, Pendl *et al.*, 2011).

The involvement of the public in biological recording schemes provides mutual benefits to wildlife, conservation organisations and participants themselves. Wildlife may benefit through the provision of monitoring data for conservation decision-making such as the UK Biodiversity Action Plan (UKBAP, 2010). Conservation organisations benefit through data gathering on a scale that would otherwise be impractical (Newman *et al.*, 2003, McCaffrey, 2005, Toms and Newson, 2006, Bell

et al., 2008), as well as awareness-raising of environmental issues (Brossard *et al.*, 2005, Devictor *et al.*, 2010), and potential membership subscription. Participants themselves may benefit on a personal and wellbeing level by: undertaking activities they enjoy whilst contributing to a cause they believe in (Lawrence, 2006, Pendl *et al.*, 2011); being in proximity to nature (e.g. Takano *et al.*, 2002, Hartig *et al.*, 2003, Bird, 2004, CABE, 2005); and learning (Trumbull *et al.*, 2000, Pendl *et al.*, 2011, Chapter 2 of this thesis).

Participation and socioeconomic status

In order to maximise these benefits, it is therefore important to provide opportunities for participation from a cross section of societal groups. Socioeconomic status has been linked to participatory and environmental outcomes, with people living in socioeconomically deprived areas being less likely to be active in their local community (Gordon, 2000, Gasparre, 2011), and being more affected by barriers to participation than other groups (Searle and Jackson, 1985, Wilkie *et al.*, 2007). Much of the literature in this field is based upon health care and treatment inequalities, which reveals a number of potential reasons for lower participation rate. For example people living in socioeconomically deprived areas may be less likely to give up smoking (Hiscock *et al.*, 2011) or survive some cancers (Stephens *et al.*, 2005, Lejeune *et al.*, 2010), which has been attributed to a lower treatment compliance (Hiscock *et al.*, 2011) or participation rate (von Wagner *et al.*, 2009) over other factors. In a mental health survey, lower response rates in deprived communities were more closely linked with non-contact rather than non-cooperation by participants (Goodman and Gatward, 2008), whereas access to information or cultural factors such as attitudes and influences were identified as potentially responsible for lower breastfeeding duration times in deprived areas (Brown *et al.*, 2010). Socio-cultural influences may also have an impact upon people accessing nature locally. For example a study in Bristol, UK, found that although socioeconomically deprived communities lived in closer proximity to greenspaces, social factors such as perceived accessibility and safety resulted in fewer visits to greenspaces by local residents (Jones *et al.*, 2009).

Participation in environmental activities

A bias in participant base has also been recognised in relation to environmental activities, although the reasons behind this are not well understood. In the UK and US, environmental volunteers are more likely to be white, middle class and of retirement age (Burningham and Thrush, 2001, Koehler and Koontz, 2008, O'Brien *et al.*, 2008), and participants of some wildlife recording schemes may be more likely to live in relatively less deprived areas (Toms and Newson, 2006, Chapter 2 of this thesis).

There are three conditions that must be met to enable participation in nature recording activities, and these in turn may be affected by socioeconomic status: Firstly, people must be aware that the opportunity to participate in recording schemes exists; secondly, the recording process must be accessible to them, both physically and in relation to their confidence, skills and knowledge; and thirdly, they must be motivated to participate.

Awareness

A lack of awareness of volunteering opportunities has been identified as a barrier to involvement with environmental activities (Martinez and McMullin, 2004, O'Brien *et al.*, 2008). Therefore the way in which wildlife recording opportunities are promoted is likely to play a key role in the participant base that is recruited. Due to financial constraints, schemes are often advertised with non-random coverage, particularly through websites and nature-based journals as well as other free or low cost media (Gaston *et al.*, 2005, Bell *et al.*, 2008). Schemes are also commonly promoted through press releases, which may only be covered by certain newspapers or radio stations (Chapter 2 of this thesis). Promotion in these ways therefore restricts potential participants to the groups who currently consume these media.

Accessibility

Limited access to IT (Gorard, 2003), or other financial costs (Brockman *et al.*, 2009) have been linked to lower participation rates of people living in socioeconomically deprived areas. Accessibility of recording activities may also be linked to individual perceptions and personal identity with some sectors (Mathers and Parry, 2009), so not only must potential participants be aware of recording opportunities, so too they must perceive the activities as relevant to themselves. Confidence to participate,

and factors relating to ill health may also be barriers to participation for people living in socioeconomically deprived areas (Pope, 2005).

Furthermore, accessibility may be linked to the prevalence of wildlife in socioeconomically deprived areas. A study by Bland *et al.,* (2004) found that the respondents of a bird nest survey were those with bird nests on their property, highlighting the link between encountering wildlife and participating in a survey. In this way, residents of socioeconomically deprived communities may be less likely to participate in biodiversity recording if they do not encounter wildlife in proximity to their homes. Research in the US and Australia has found lower abundance and species richness of vegetation in areas of lower socioeconomic status (Martin *et al.*, 2004, Mennis and Jeremy, 2006, Luck *et al.*, 2009), although other studies have found the converse to be true, e.g. increased house sparrow *Passer domesticus* prevalence in urban areas of lower socioeconomic status in the UK (Shaw *et al.*, 2008). Therefore, accessibility to nature should not necessarily be a barrier to participation in recording schemes for different socioeconomic groups, although this may vary by geographic location and study species. For example, a study of urban domestic gardens in the UK found no evidence that people living in socioeconomically deprived areas would be less likely to have wildlife-friendly features or exhibit wildlife related behaviours (such as supplementary feeding) in their gardens in comparison to other areas (Gaston *et al.*, 2007). However, it must be borne in mind that areas of socioeconomic deprivation, particularly in the urban environment, may also be linked to restricted garden space.

Motivation

Research into motivations for volunteering in environmental activities have been found to include: altruistic factors such as helping the environment or 'giving something back' (Ryan *et al.*, 2001, Bruyere and Rappe, 2007, Bramston *et al.*, 2011); contribution to improving the local area (Bruyere and Rappe, 2007); or for personal reasons such as social factors (Ryan *et al.*, 2001, Hibbert *et al.*, 2003, Bruyere and Rappe, 2007, Bell *et al.*, 2008, O'Brien *et al.*, 2008) or learning (Ryan *et al.*, 2001, Bruyere and Rappe, 2007, Bramston *et al.*, 2011).

Volunteer motivations for participating in biological monitoring or recording schemes are less well understood, although studies that have been conducted in this field have identified factors such as: enjoyment of the activities involved in the recording

process (including the sense that participation in these activities gives an 'excuse' to spend time doing an activity that people would do anyway) (Lawrence, 2005); interest in the species recorded; contribution to nature conservation and; learning, in particular about specific species or about the local area (Lawrence, 2006, chapter 2 of this thesis). Understanding motivations for participation of people living in socioeconomically deprived communities is an essential part of enabling participation in environmental activities.

Aims

In order to ensure that the social and ecological benefits of wildlife recording schemes are maximised, and to provide opportunities for participation to people living in socioeconomically deprived communities, it is vital to understand the reasons why this group is under-represented. In this paper, we use a case study in a socioeconomically deprived urban community in an east Yorkshire city to investigate the current levels of activity in wildlife recording schemes, the barriers to participation and the key motivating factors behind participation. We do this by implementing a simple garden wildlife survey using hand-delivered postcards to maximise participation rates. We then follow this up with a more detailed postal questionnaire using the same sample population to explore previous behaviour and motivations and barriers to participation in such recording schemes.

Methods

The study area

We used an area in east Hull, UK for the study. Hull had previously been chosen as a study area by the OPAL Yorkshire and the Humber team as part of the regional approach, to fulfil the OPAL objectives as outlined in Chapter 1. The area comprises ten Lower layer Super Output Areas (LSOAs) (One LSOA contains approximately 1,500 people (Department for Communities and Local Government, 2008). Each of the LSOAs in this area is classified under the Index of Multiple Deprivation (IMD) as falling within the most deprived 15% of LSOAs in England. 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). It contains seven domains of deprivation, one or more of

which may be experienced by people living in this area. These 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.

Postcard Survey

A simple garden wildlife recording scheme was designed, focusing on amphibians and hedgehogs as the study species. These species were selected for several key reasons. Amphibians and hedgehogs are urban garden-dwelling animals which are also subject to a certain level of conservation concern (Swan and Oldham, 1993, Reeve, 1994, Carrier and Beebee, 2003, Morris, 2006). They are, on the whole, relatively simple to identify and easily recognisable, and they are largely viewed as charismatic species (e.g. Baker and Harris, 2007). The postcard survey was designed to address three questions:

1. Whether people living in this community are motivated to take part in a wildlife recording scheme.
2. Whether amphibian species and hedgehogs are present in gardens in this area.
3. Whether people living in this community are interested in participating in a more in-depth wildlife recording study.

The postcards were designed in such a way as to maximise response rate and to overcome the known barriers to participation in recording activities, namely awareness, accessibility and lack of motivation. The postcard study was designed to be as inclusive as possible. Simple text was used, with illustrations to aid identification of the included animals in order to minimise misidentification. It was planned that by hand-delivering a postcard to each household in the study area, a high proportion of householders would be made aware of the scheme. Time required to participate was minimised, and accessibility maximised by condensing the survey into five simple questions with tick box responses. These were: *'1. I have: a garden/a yard/no outside space; 2. I have a pond: yes/no; 3. I have seen a frog/toad/newt in my garden (in the last 2 years); 4. I have seen a hedgehog in my garden (in the last 2 years): yes/no; 5. I am interested in taking part in a further garden survey: yes/no*. Ease of returning the survey was maximised: on the survey collection day, participants were given the option to display the response in their

window or put the postcard on their doorstep, with an online response also welcomed. A cash incentive (£50 shopping voucher) for all participants was offered through a prize draw, a factor known to successfully improve response rates (Edwards *et al.*, 2002).

Four postcard designs were tested in a pilot study in an area of similar IMD score in York in July 2009. The designs were aimed to emphasise different aspects of the scheme: conservation of wildlife; contribution to a study about the local area; cash incentive; a mixture of the preceding three. One hundred postcards of each design were hand-delivered to houses in the area, and responses collected three days later. An overall response rate of 10% (40 responses) was attained, with no marked difference in response between the four different designs (27.5%, 27.5%, 27.5% and 17.5% respectively).

The final postcard design for Hull therefore reflected a mixture of the above features and can be seen in Appendix 3. The postcard study was entitled 'Slime & Spine 2009, the Hull Garden Wildlife Study'. Postcards were hand-delivered to all accessible dwellings within the study area over three days (Monday-Wednesday) in September 2009. Blocks of flats did not receive postcards due to the lack of garden space for many residents, however all other houses were included in the delivery, regardless of whether it appeared that they had individual or shared gardens or yards. Responses were collected on the Friday of the same week to encourage participation via a short response window.

Data were also collected through a number of events in autumn 2009. Postcards were distributed and responses gathered on a large scale map at public event in a large park in the centre of Hull, at two Public Meetings, and at two local primary schools.

Questionnaires

Following the postcard survey response, those participants that had indicated they were interested in taking part in a further wildlife study were sent self-completion questionnaires through the post. The postal questionnaire explored whether participants have taken part in recording schemes before, and if not, what the reasons for this were. Participants were asked to rank their top five reasons for doing so from a list of 14 motivations (including 'other'). The motivations in the list centred on the four main themes that reflect known motivations for participation in

environmental activities (Hartig *et al.*, 2003, Lawrence, 2006, Bell *et al.*, 2008, chapter 2 of this thesis). These were: personal benefits; social reasons; enjoyment of participation in a survey; wildlife/garden related; and other (Table 8). Participants were also asked whether they are a member of any environmental group or society, and whether they would like to receive more information on several environment-related themes: taking part in more wildlife recording surveys like this; information about local groups and opportunities to help you learn more about nature in this area; getting involved in practical environmental tasks in your local area; learning more about encouraging wildlife in your garden; or anything else, (in which case, they were asked to specify). This final question allowed for further information to be sent to interested participants, but also to make a comparison between past behaviour and potential future interest in environmental activities. The questionnaire can be seen in Appendix 4.

Table 8. Themes and motivations listed in ranking exercise in the postal questionnaire.

Motivation theme	Reason listed
Personal benefits	The money prize
	Because I thought I might learn something new
Social reasons	Someone else wanted me to do it (children/friends/family/neighbours)
	I thought it would be fun to do with someone else (children/friends)
Participation in a survey	I enjoy doing surveys
	To be part of a scientific study
	To contribute to a study about my local area
Wildlife/garden-related	Because I like hedgehogs/frogs/toads/newts
	Because I am enthusiastic about my garden
	Because I see this wildlife in my garden and want to tell someone about it
	To help the conservation of wildlife
	Because I'd like to be involved in further wildlife studies
Other	It was quick and easy to do – why not?
	Other, please specify

Demographic and personal information was not requested in the questionnaires in order to maximise participation, and with the exception of the second part of the motivation ranking exercise, closed questions were used in order to encourage participation through ease of completion (Bryman, 2008), with additional comment boxes provided for every question to encourage elaboration.

The questionnaires were piloted on non-expert University of York staff. Questionnaires were posted out in April 2010, and a replicate follow-up was posted to non-respondents after three weeks. Freepost response envelopes were enclosed with all questionnaires posted, and participants were also given the option of completing the questionnaire online.

Results

Postcard survey

A response rate of 10% was received from the postcard study, with 567 responses in total. A large number of wildlife sightings were reported (989 in total) and a total of 75% (423 responses) of respondents indicated that they were interested in participating in the further garden study. A copy of the postal questionnaire was sent to these participants.

Postal questionnaires

A total of 166 households participated in the questionnaire study, representing a response rate of 39.2% of postcard study respondents. A large proportion of respondents indicated that they are involved in active encouragement of wildlife into their garden, in the form of putting out supplementary food for birds and/or other species (83.1%), providing a nest box or other housing (44%), or through a log pile or provision of food plants (29.5%).

When asked about whether participants have taken part in wildlife recording schemes in the past, 12 people (7.2%) did not respond to the question. Of those that did respond, 44 (27%) confirmed they have taken part in previous schemes. However, 23 (13.9% of total) of these indicated that this previous involvement was participation in Slime & Spine 2009, the postcard study preceding the questionnaires. Without further investigation, it is not possible to ascertain whether these people have taken part in any other study. However it seems likely that by only detailing the postcard survey, this may be the only other recording scheme they have participated in. The majority of respondents (110, 66.3%) answered that they have not taken part in a recording study in the past.

Of those that indicated that they have not participated in the past, the most popular reason for this centred on not being aware of opportunities or not being asked to participate, with 87 participants (79.1%) indicating this reason. The next most popular reason stated was a lack of time (5.5%).

In response to the question on membership of environmental groups or societies, 13 (7.8%) participants stated they are a member of a group or society, with the majority of the 140 participants (84.3%) reporting they are not. Of those that are not members, reasons stated included: not having enough time (13%); not having

thought about it before or ‘no particular reason’ (9.8%); a lack of information (9.1%); financial reasons (3.9%). A large number of respondents left this section blank (64.1%).

For those 97 participants who completed the ranking of motivations, the total and median rankings were calculated, with the order of preferences listed (Table 9). The most popular motivation was ‘to help the conservation of wildlife’, which had the highest overall ranking and had a median rank of 3. The highest median rank was that assigned to participants being ‘enthusiastic about my garden’, receiving a median score of 4, although it was chosen by fewer participants overall. Two motivational factors received higher total scores but lower median ranks than this. These were that of ‘contributing to a study about my local area’ and ‘because I like the study species (hedgehogs/frogs/toads/newts)’. These received median ranks of 3.5, and total scores of 250 and 207 respectively, indicating that although they were popular factors, they were ranked as being less important overall than being enthusiastic about the garden, but more important than helping the conservation of wildlife to many of those respondents choosing these factors. The least popular responses were that of the money prize and that ‘someone else wanted me to do it’.

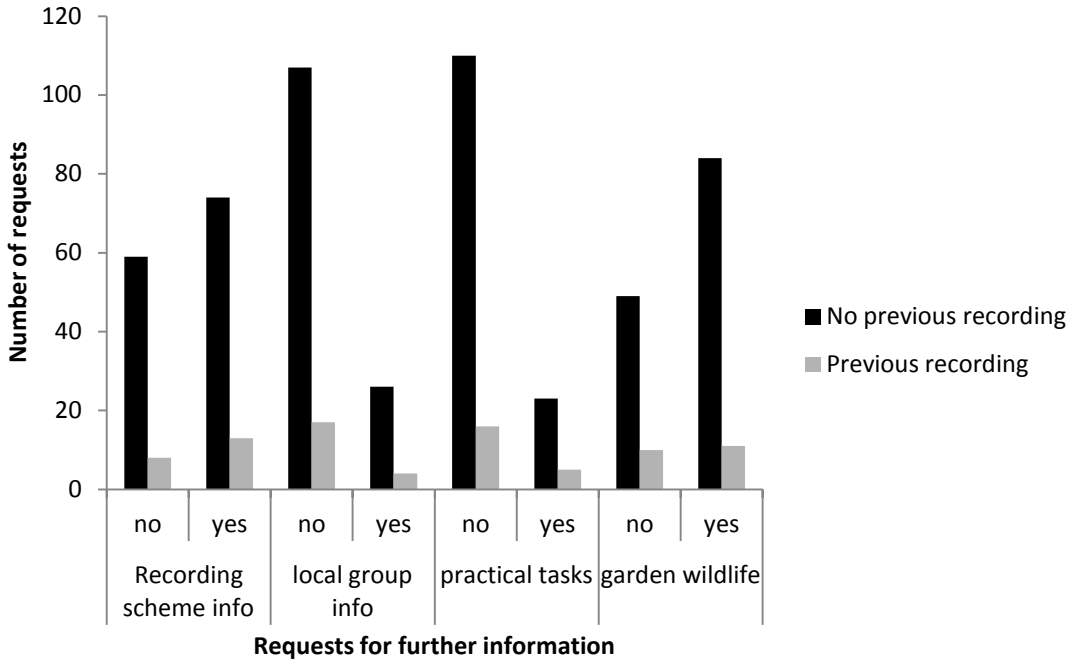
Table 9. Ranking of motivations for taking part in the study. Motivations were ranked 5 (most important) to 1 (least important), so a higher median rank represents a more important motivation.

Motivation	**Total rank score**	**Median rank**	**Number of participants assigning each score (n=97)**					
			5	**4**	**3**	**2**	**1**	**Total**
To help the conservation of wildlife	309	3	23	14	21	18	3	79
To contribute to a study about my local area	250	3.5	18	19	15	17	5	74
Because I like hedgehogs/frogs/toads/ newts	207	3.5	18	12	15	9	6	60
Because I am enthusiastic about my garden	170	4	18	12	3	6	11	50
It was easy and quick to do – why not?	114	3	7	5	10	9	11	42
Because I see this wildlife in my garden and want to tell someone about it	102	3	2	10	9	6	13	40
Because I thought I might learn something new	90	2	3	6	6	9	15	39
Because I'd like to be involved in further wildlife studies	78	3	2	7	8	6	4	27
To be part of a scientific study	73	2	3	7	3	6	9	28
I enjoy doing surveys	43	3	2	4	3	2	4	15
I thought it would be fun to do with someone else (children/ friends)	36	2	2	3	1	4	3	13
The money prize	9	1	1	0	0	0	4	5
Someone else wanted me to do it (children/friends/family/ neighbours)	5	2	0	0	0	2	1	3

When asked whether participants would like to receive further information on environmental topics, 36 (22%) participants requested no further information (either by ticking 'no thanks' or leaving the question blank). Learning about encouraging wildlife into the garden was the most popular topic with 95 participants (57.2%) requesting this information. The second most popular topic was that of learning about more recording schemes with a total of 87 (52.4%) requests. Information about 'local groups and opportunities to help you learn more about nature in this area' had 30 (18.1%) requests, 'getting involved with practical tasks in your local area' received 28 (16.9%) requests and 'other' 5 (3%) requests. In 'other', participants requested information such as *'learning more about hedgehogs', 'I am keen to attract birds', 'information about types of plants to encourage wildlife'* and *'Hull's plants'*. Respondents were posted fact sheets on the topics they had requested. These fact sheets can be seen in Appendix 5.

In an exploration of potential changes as a result of participation in the study, the requests for more information were compared with respondents who had and had not participated in recording schemes in the past (Figure 3). Of those respondents who stated that they had not participated in the past, (including those that stated only the previous postcard study, 133 participants in total), more participants (74) requested further information on similar recording activities than those that did not (59 participants). Of those that stated that they have been involved with a recording study before, 13 requested more information on other similar activities and eight did not. More markedly, there was a greater difference between those who had not participated in a recording scheme before and did not want information sent to them about local environment-related groups (107 in comparison to 26 who did request this information), and about practical environmental activities in the area (110 in comparison with 23 who did request this information). Finally, receiving information about encouraging wildlife into the garden was the most popular request, both with people who had not participated in recording schemes before (84 compared with 49 people who did not want this information), and of those who had participated in the past (11 of the 21 people).

Figure 3. Relationship between previous participation in recording activities and request for further information (n=154)



Discussion

Participation and response rates

This study investigated the motivations and barriers to participate in nature recording activities experienced by people living in a socioeconomically deprived community, through the implementation of a simple garden wildlife survey. Although relatively low response rates such as those received can be limiting (Mangione, 1995), the response rate is not atypical of studies of its kind. For example in Australia, a postal study of koala *Phascolarctos cinereus* sightings reaped a response rate of 10.3%, which contributed a valuable 70% of data to the national dataset (Lunney *et al.*, 1997). Furthermore, the response rate in its own right provides important information about participation and useful conclusions can therefore still be drawn. That both the postcard and questionnaire surveys were responded to at all indicates that a proportion of people living in this community are indeed motivated to participate in a recording study. There are therefore two sets of conclusions to be discussed, one based upon the response of the people who did participate in the study and a second based upon the proportion who did not.

Participation in the past

The questionnaire results revealed that many of the respondents living in this community have not participated in nature recording activities in the past, despite being motivated to participate in this survey. The key reason for this reported by the majority of participants was a lack of awareness of opportunities, followed by time constraints, which reflects research into barriers for other environmental volunteers (Martinez and McMullin, 2004, Pope, 2005, O'Brien *et al.*, 2008). For this proportion of community members therefore, the methods utilised in this study successfully removed these barriers.

Furthermore, the majority of questionnaire respondents were active in encouraging wildlife into their garden through supplementary feeding or other 'wildlife-friendly' practices. There is an understandable link between engaging in these activities and having the motivation to participate in a recording study centred on garden wildlife.

Motivations for participation

The main motivating factors for participants of this study closely reflected the motivations of participants of other environmental activities. These were: wanting to make a contribution to conservation; an interest or enjoyment of wildlife or particular species; and wanting to make a contribution to a study about the local area. For example, similar motivating factors have been found in participants of other recording and monitoring schemes (Lawrence, 2006, Chapter 2 of this thesis), conservation volunteers in the US (Bruyere and Rappe, 2007), and butterfly monitoring volunteers in Austria and Germany (Pendl *et al.*, 2011).

Barriers and non participants

The postcard study was designed specifically to minimise known barriers to participation. However, there may have been some people who were unable to participate, either through visual, literary or mobility problems, or if they were not at home during the survey week. Although the methods chosen to return the survey data were considered to be as inclusive as possible, a few residents expressed reluctance to display a postcard in their window. Despite this, and although there will always be a proportion of any community that will not take part in a study, it was hoped that the response rate would be higher than the achieved 10%. As a lack of awareness was successfully minimised for some participants, it is probable that

other barriers are present for those people who did not respond to the survey. Barriers experienced by volunteers in a socioeconomically deprived community in Australia centred on ill health and confidence to participate (Pope, 2005), and these may also be in place in this instance. Similarly despite the simple design of this study, having enough time to participate can be a barrier (Pope, 2005). A further proportion of postcard respondents did not successfully complete the postal questionnaire despite indicating their interest in doing so, which again suggests barriers to participation are in place, and again these may centre on having enough time, or other factors.

As well as potential barriers to participation, it may be a lack of motivation that has affected response rates for this survey. Many of the residents of this community may not be interested in recording wildlife, they may not view it as an important activity and therefore not be willing to participate. Of course this will be true of a proportion of any community, and in order to understand this more fully, it would be necessary to make comparisons between participation rates of communities of different socioeconomic status. It has been acknowledged that participation rates in socioeconomically deprived communities are often lower than that of other groups (von Wagner *et al.*, 2009) and residents are less likely to be active within their communities in general (Goodman and Gatward, 2008). It would therefore be relevant to ascertain if the same is true of biological recording activities that are promoted in a specifically inclusive way.

Future behaviour changes and implications for conservation

Questionnaire participants were given the opportunity to request further information about environment-related topics and although this cannot be used as a direct indication of future participation, it does give some information about the types of topic that these participants are interested in. The nature of this study was centred on gathering biological records from gardens, suggesting that those people who did participate have some interest in the wildlife in their garden. It is perhaps unsurprising therefore that the most popular topic for requested information was that of encouraging wildlife into the garden. This is a positive result as gardens become increasingly important habitat for many wildlife species, particularly in the urban and suburban landscape (Dickman, 1987, Owen, 1991, Swan and Oldham, 1993, Reeve, 1994, Angold *et al.*, 2006, Morris, 2006). As domestic gardens are private and therefore inaccessible in other ways, successful engagement with householders

in order to encourage or inform sympathetic management of gardens for wildlife is a key approach in urban wildlife conservation (Lepczyk, 2005, Cooper *et al.*, 2007, Davies *et al.*, 2011, Goddard *et al.*, 2011, Nilon, 2011).

Despite many of the participants stating that they had not participated in recording activities in the past, over half (56%) requested more information about other recording schemes. This suggests that there is considerable enthusiasm for future participation within these communities which is not being realised through current recruitment methods.

Implications for future recording schemes

The methods used in this study were successful in newly recruiting a small proportion of the residents of a socioeconomically deprived urban community into garden wildlife recording. As acknowledged with other environmental volunteers (Martinez and McMullin, 2004, Pope, 2005, O'Brien *et al.*, 2008), of those that were recruited in this study, awareness of other recording activities was a potentially significant barrier to participating in similar schemes in the past, which indicates that the way in which recording schemes are currently promoted is not reaching some members of this socioeconomic group. To some degree, this is not unexpected. It is acknowledged that primarily due to financial and other constraints, schemes are promoted in a non-random way, (Gaston *et al.*, 2005, Bell *et al.*, 2008) and consequently recruits are likely to be those people who consume certain types of media such as nature-related magazines or websites, and newspapers that print nature-related stories. Therefore, for recording activities to be made accessible to people not currently consuming these media, including those from socioeconomically deprived groups, and in order to reap the associated benefits for individuals and communities, the methods in which these activities are advertised and promoted must be reviewed. As participation rates in socioeconomically deprived communities are known to be lower for some activities, the solution is unlikely to be straightforward. Organisations that are already under financial constraints are unlikely to be in a position to hand-deliver surveys in target communities. Furthermore, many respondents of this study were not members of environmental groups or societies, and were also not interested in receiving more information about future membership. This indicates that potential membership benefits to organisations are likely to be more limited through activities such as this than other benefits such as data collected and increased participation rates.

In order to move forward with the successful recruitment of a cross section of societal groups, it is important to build upon the knowledge that we have gained on this subject, particularly regarding the motivations and barriers to participation. We know that many of the respondents of this sample were motivated to participate in a recording study in order to contribute to conservation, because they like the wildlife species involved and to contribute to a study about the local area. Alongside further work to understand the additional barriers to participation experienced by people living in socioeconomically deprived communities, emphasis should now be placed upon developing the promotion of recording activities using alternative methods, which is specifically recommended for those organisations running nature recording schemes.

For example, using local champions is known to enhance collective identity with activities and encourage others to participate (Campbell and McLean, 2002), as well as maintaining ongoing participation through the presence of peers (Linardi and McConnell, 2011). Charismatic celebrities as champions also have a role in promoting conservation messages (Brockington, 2008), although the choice of celebrity is important for the outcomes achieved by this approach (Brockington, 2008, Northfield and McMahon, 2010). However, if chosen celebrities are those that are identified with by socioeconomically deprived or ethnic communities, awareness and participation may be raised as a result (Bell *et al.*, 2004, CABE, 2005).

Working with school-age children alongside the wider community has been shown to increase awareness of environmental issues in some cultures through intergenerational communication (Vaughan *et al.*, 2003). Involving young people through the school system may therefore successfully promote and encourage recording activities (Pendl *et al.*, 2011) as well as raising awareness for children's families, as was found through a study on human-coyote interactions in the US (Weckel *et al.*, 2010). Conservation awareness promotion should start when children are at preschool age (Bonnett and Williams, 1998), and continue to be reinforced at regular intervals. Approaches with a strong emphasis on the local importance of conservation has been shown to promote positive participation within schools, particularly through inclusive, multidisciplinary methods (Cole, 2007). In order to link classroom activities with the wider community, education activities in schools should be contextualised with community-based initiatives such as community gardening (Krasny and Tidball, 2009) or through media such as animated films (Yong *et al.*, 2011). Social media websites have also been shown to be a successful vehicle for gathering environmental records such as bee

biodiversity data (Stafford *et al.*, 2010) although this should be considered alongside other methods due to potential restrictions to IT for people living in socioeconomically deprived communities.

Consideration of how potential recruits are approached may also affect participation. This was illustrated in Chapter 2 of this thesis, where Leeds Garden Pond Survey respondents reported an important motivating factor was being 'asked' to participate by the Local Authority. Similarly many of the participants of this study in this chapter reported that they had not participated in similar studies in the past because they had not been 'asked' to do so. Therefore, focusing promotion of recording activities as a request for people to contribute, whether it is through individual local champions, through pre existing establishments such as the school system, particularly on the local scale, is likely to be a successful approach to maximise participation and therefore more fully realise the associated ecological and social benefits.

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CHAPTER 4

Achieving positive social outcomes through participatory urban wildlife conservation projects

Preface

As well as working on the national and wider community level, as investigated in Chapters 2 and 3, many wildlife-related initiatives also seek to engage with new participants in environmental activities on the very local level, such as working with small groups of volunteers. This may be for various tasks such as habitat management through practical work, developing new skills or in gathering of ecological data for scientific research.

Again at this level, engaging with volunteers can provide immediate benefits to organisations, particularly through data collection and raising awareness of nature conservation. As with other forms of volunteering, participation may also lead to benefits to volunteers themselves on a personal level (Lawrence, 2006) and these may lead on to community level benefits, and in turn further benefits for wildlife. However in order to maximise these benefits, we must more fully understand what the potential transformative effects are of recruiting new community volunteers and engaging with participants in local level environmental activities.

This chapter brings together scientific and community volunteers in an ecological study of urban hedgehog habitat use. Following their recruitment in an ecological study, the community volunteers are interviewed to investigate potential transformative effects of involvement in conservation based ecological studies such as this, in order to learn lessons for future volunteer engagement.

The findings of this chapter were also communicated through presentations at the Mammal Society Easter Conference 2011 (SJH) and by Professor Piran White at the ICCB Society for Conservation Biology Conference in December 2011.

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Achieving positive social outcomes through participatory urban wildlife conservation projects

Abstract

As urbanisation continues to increase on a global scale, people are becoming increasingly distanced from nature. Fewer opportunities to encounter nature means the known benefits of engaging with nature will not be realised for urban residents. In response to this, there is a growing number of initiatives that aim to connect people with nature, for the benefit of individuals, communities and nature conservation. However, in order to maximise these benefits, it is important to understand the potential transformative effects for participants, both on a personal level and in terms of wider impacts. In this study, we bring together community members and scientists in a community-based exploration of urban hedgehog habitat use. Through qualitative semi–structured interviews with community volunteers, we explore transformative effects of participation in the study on the personal and community scales. Our findings support the results of research into other types of environmental volunteering in that the participants were motivated by personal wellbeing factors such as enjoying proximity to the study species, learning and social factors. Involvement in the study was a successful vehicle for increasing participants' engagement with nature both during the study and potentially into the future, particularly in terms of biological recording and gardening for wildlife. We conclude that involving volunteers on the local level has the potential to yield strong positive personal and wider outcomes, and identify the importance of the role of activity leaders, particularly in terms of signposting and supporting volunteers in future activities.

Introduction

Impacts of urbanisation on human-wildlife relationships

For the first time more than half of the world's population now lives in towns and cities (United Nations, 2008), and as urbanisation continues to increase, so will its impacts upon the environment and the people who live in these areas. One of the socio-cultural

impacts of urbanisation is an increasing distance between people and nature (Katcher and Beck, 1987). For human residents of urban areas, opportunities to encounter wildlife can be limited since many of the residential areas of large cities typically contain lower levels of biodiversity (Turner *et al*., 2004). Fewer opportunities to encounter nature will mean that the personal benefits associated with proximity to, or interaction with, wildlife and natural spaces will not be experienced by many urban inhabitants.

Simply being in the presence of nature has been linked to a sense of freedom, a sense of place (Bell *et al.*, 2004) and stress relief benefits (Bird, 2004). Nature and natural settings have been associated with health benefits such as longevity (Takano *et al*., 2002), increased recovery rates for post-operative patients (Ulrich, 1984) and decreased blood pressure (Hartig *et al*., 2003). Participation in outdoor activities such as gardening or conservation activities can be beneficial to fitness levels (Bird, 2004) and children playing in a natural setting gain improved motor fitness (Fjørtoft and Sageie, 2000), as well as improvements in the behaviour of young people suffering from Attention Deficit Disorder (Taylor *et al*., 2001). Individual benefits of interaction with nature may lead to wider, community-level benefits. For example, the presence of natural elements and green space can increase levels of neighbourhood and personal satisfaction (Kaplan, 2001), and increased use of public green spaces and the associated social benefits in an area may lead to reduced crime, improved community cohesion, and a decline in antisocial behaviour (CABE, 2005). Linking personal and community level benefits can in turn engender positive changes in social attitudes towards wildlife. Such changes can also have significant ecological implications, since the pollution and disturbance caused by people, buildings and traffic in urban areas can make them challenging habitats for many species (McKinney, 2002, Parris, 2006, Baker and Harris, 2007, Gledhill *et al*., 2008). A negatively reinforcing cycle of degrading biodiversity, decreasing individual environmental awareness and declining individual and community benefits may therefore develop. Participatory urban conservation projects have the potential to reverse this pattern, yielding both ecological and social benefits, but their potential for bringing about such transformations remains largely untested.

Maximising social benefits: increasing engagement with nature

The types of individual engagement with nature vary (Pretty *et al*. 2005a). The key aspect which determines the extent of engagement is the type of activity pursued (Table 10). Thus, low-level engagement can be achieved by viewing or being in the presence of nature, medium-level engagement requires some participation or involvement e.g.

gardening for pleasure, making a trip to the woods to see bluebells, providing resources for wildlife e.g. feeding the birds. High-level engagement constitutes more active or 'hands-on' involvement such as wildlife gardening, making records of wildlife and practical environmental tasks. Engagement with nature can also be considered in terms of its outcomes. For example, participation may illicit 'internal' outcomes for participants themselves such learning and skills acquisition; spiritual, physical and social benefits; meaning and satisfaction and mental benefits (Lawrence, 2006, O'Brien *et al*., 2008), which in turn may lead on to community level benefits. 'External' outcomes are those are likely to benefit something other than the participant, such as organisations, wildlife or the wider community. Examples of external outcomes include data gathered, practical tasks completed or financial contributions raised (Lawrence, 2006).

Table 10. Common approaches of conservation organisations and projects with the aim of increasing participants' engagement with nature. The level of engagement required for the activity is described based on the definitions stated above.

Type of engagement activity	Example	Potential outcomes		Engagement Level
		Internal	**External**	
Awareness Raising	Poster advertising the work of an organisation.	Learning and awareness: may influence behaviour through knowledge acquisition	No immediate although may lead on to higher external outcomes in future e.g. membership	Low
Fitness/ health based initiatives	E.g. Green Gym[1], Blue Gym[2], Walking for Health[3]	Personal and community health. Social benefits. Linked benefits for health organisations/initiatives.	No obvious direct external outcomes	Mid
Wildlife watching (informal)	Learning different species and actively watching wildlife for personal benefits. (records not submitted)	Health and wellbeing, learning and skills acquisition, mental and spiritual	May lead to external benefits (to wildlife if involvement formalised, e.g. records submitted)	High
Financial Contribution	Membership of an organisation. Does not require any physical engagement with nature but still has benefits for organisation and therefore wildlife.	Possibly internal benefits; e.g. meaning and satisfaction. Learning and other internal benefits if receive information as part of membership	Financial contributions from public essential for many organisations.	Low
Wildlife Gardening	Benefits for wildlife but no data input into species monitoring.	Health and wellbeing, meaning and satisfaction, mental and spiritual	Gardens increasingly important habitats for many species.	Mid
Recording schemes/practical tasks/volunteering	Submitting records to an organisation, involvement with practical conservation tasks or volunteering on ecological study	Meaning, learning and skills and spiritual benefits, health and wellbeing	Many recording schemes rely on the public to send in records in order to monitor species changes over time. Practical conservation tasks often rely on volunteers for habitat management and maintenance. Data gathered.	High

[1] BTCV (2011). accessed January 2011, www.btcv.org.uk/greengym. [2] Blue Gym (2011). accessed February 2011, www.bluegym.org.uk [3] Walking for Health (no date). accessed January 2011, www.wfh.naturalengland.org.uk

Initiatives set up to enhance engagement with nature are becoming increasingly common in many countries. Within the UK, cultural, physical and geographic barriers to access are addressed by the Defra 'Outdoors for All' action plan, which outlines steps to increase the number of people from under-represented societal groups (disabled people, black and ethnic minority groups, the young and residents of inner cities) accessing the natural environment (Defra, 2008). The Open Air Laboratories (OPAL) project is a partnership initiative which brings together scientists and communities in the study and appreciation of local wildlife (Davies *et al.*, 2011). OPAL has five key objectives: to encourage a change in lifestyle and purpose to observing and recording the world around us; to provide an education programme to be accessed by all ages and groups in society; to create a new generation of naturalists; to enable a greater understanding of the state of the natural environment; and to build stronger links between the community, voluntary and statutory sectors to work to improve local environments (Davies *et al.*, 2011, OPAL, no date). In order to maximise social benefits, it is important to understand how people engage with nature and the impacts this engagement can have upon them.

Traditionally, many environmental participatory approaches such as recording schemes or environmental volunteering would be considered extractive or 'top-down', as decisions about the activities are set by the 'central actors' or organisers (see Conrad and Hilchey, 2010, for a review) and the outcomes of the process are focused on 'external' outcomes such as data gathered (Lawrence, 2006). Whilst recent initiatives such as OPAL may still be considered as 'top-down' participatory approaches, their primary outcomes are not necessarily external, and internal or personal outcomes for individuals or communities may be given equal or greater importance. For example, OPAL strives to gather data about natural habitats, and encourage membership of conservation groups as external outcomes, yet there is a strong emphasis on internal and community outcomes, in particular encouraging engagement with, and learning about, nature, building community links and inspiring local people (OPAL, no date).

Understanding the outcomes of participatory approaches for individuals and communities is important in order to maximise the benefits achieved by them. External and internal benefits are likely to be closely linked, either at the time of participation, or in the future, in that a participant who benefits on an internal level from one activity may be motivated to participate in similar initiatives at another time, which in turn may lead to further internal and external benefits. Therefore as well as assessing the internal and external value changes for a participant, any future transformative effects as a result of participation should be considered as part of the outcome of a participatory activity. Mid- to high-level engagement levels for participants appear to be linked to activities that carry higher internal and external outcomes (Table 10). Understandably, these activities are

also centred upon a more active participation on behalf of volunteers through practical tasks, wildlife gardening and wildlife recording. Therefore, in order to maximise benefits and engagement levels, involving participants actively is likely to be a successful approach.

Aims of the study

Here, we evaluate the social outcomes of a participatory wildlife conservation project in an urban area, using hedgehogs as the focal species. The European hedgehog *Erinaceaus europeaus* is a popular and charismatic native British mammal, which is an example of a species that is declining in much of its native range (Reeve, 1994, Morris, 2006). Hedgehogs were chosen as the study species for this investigation because they are a conservation priority species in the UK (UKBAP, 2010), they are popular with the public and easy to recognise and observe. Focusing on certain charismatic species in this way is a strategy for maximising potential engagement (Mainwaring, 2001). Using such "flagship" species as a vehicle upon which to engage an audience with conservation issues can be a successful tool for generating transformative effects, to the benefit of both individual and conservation organisation (Kontoleon and Swanson, 2003). We use an area in the city of Hull in north-east England as our study area. Using an approach of community volunteers working alongside scientific researchers in an evaluation of hedgehog urban habitat use, we examine the transformative effects of this involvement at the individual and community levels via qualitative semi-structured interviews with community volunteers.

Methods

The hedgehog study

The study was conducted in Kingswood, a northern suburb of Hull, East Yorkshire. The study site was chosen as an area with a large population of hedgehogs, as revealed through the postcard study in Chapter 3. Nine hedgehogs were radio tracked between August and October 2010 by survey teams consisting of scientific researchers and community volunteers working together to maximise data validity. All volunteers were trained in telemetry techniques and were given support in following the radio tracking methodology. The ecological outcomes of the study are presented in Chapter 5 of this thesis.

Recruitment of volunteers

Community volunteers were recruited through a mail-out advertisement linked to a previous survey (Chapter 3), and through posters advertising the project which were displayed in local centres and shops. In total, fourteen (six male, eight female) 'community' (not working in science or environmental occupations or research) and ten 'scientific' volunteers (eight from the Universities of York and Hull, and two from environmental jobs outside of the two universities) worked together in the hedgehog study. Community volunteers participated in between one and six survey nights. In addition to these community volunteers, we also involved ten Youth Action Team members and four support staff for one survey night. The Youth Action Team is a community group consisting of 16-25 year old volunteers, who take part in a range of activities and promote volunteering in the region, as part of the national volunteering charity 'V' (Vinspired, 2009).

Interviews with volunteers

Following completion of the hedgehog study, community volunteers were contacted by email requesting their participation in the interviews, with follow-up emails sent twice to non-respondents. Eleven volunteers who responded positively to this email were interviewed face-to-face or over the telephone, depending upon the circumstances and preference of the individual. Three community volunteers did not respond to email interview requests.

Although we requested to conduct face-to-face interviews with each Youth Action Team member, this was not seen as appropriate by the group leader due to time constraints. A mixed method group interview was therefore conducted after a Youth Action Team meeting. Seven Youth Action Team members participated in this interview. This method involved using interview questions presented orally to the group, which were then responded to by participants in written format on individual answer sheets. It was hoped that this mixed approach would allow an exploration into individual changes rather than group observations, whilst avoiding any influencing effects of dominant participants which can be a limitation of group interviews (Flick, 2009). In addition, by using this format rather than self-completed questionnaires to be taken away by participants, some of the difficulties associated with self completion questionnaires such as comprehension issues (e.g. Bryman, 2008) could be overcome, and response rate maximised.

All interviews were conducted by the same researcher to minimise error due to interviewer variability (Bryman, 2008). Interviews were conducted in a semi-structured manner in order to maintain the informal relationship between interviewer and

interviewee, and to encourage elaboration. Community volunteer interviews were recorded using a digital voice recorder, and transcripts coded using Atlas-Ti® (ATLAS.ti Scientific Software Development GmbH). Advertisement response data obtained from the interviews were analysed using SPSS v. 17.0 (SPSS, 2008). Atlas Ti was chosen for exploring interview data because of its suitability for working with small sample sizes (Barry, 1998). Computer aided qualitative data software such as Atlas Ti is also a useful analysis tool because of the flexibility to visually map out categories in the data, reflect on emerging themes and code key concepts, generating theory that is grounded within the data (Barry, 1998, Basit, 2003, Carcary, 2010). Interviews were coded by working through transcripts within the context of each interview and identifying main points made, which were then grouped into key themes.

Interview guide

Semi-structured interview questions were centred on two main themes: (1) internal outcomes via motivations, benefits and negative aspects of involvement in the study; changes in engagement with nature over time; and (2) external outcomes via perceived community or other benefits, future changes in behaviour as a result of participation. Motivations and benefits of participation were investigated through informal conversational interview, with participants encouraged to elaborate within and beyond the themes wherever possible.

Changes in engagement with nature were explored using an arbitrary 'engagement scale', whereby participants were asked to position three stickers indicating their reflection of their past, present and future positions on a scale of 1-10 to represent any changes in engagement with nature over time. The concept of engaging with nature was explained at the beginning of the question, and confirmation of participant comprehension was sought before proceeding. In terms of time values, participants could assign their own timescale for past and future, but the concept of 'present' was set as the time when the volunteer was actively participating in the hedgehog study. For all participants, elaboration on their choices was encouraged. This visual participatory method was chosen as a clear way of communicating a relative change over time in context with the interview question (e.g. Bryman, 2008), and can be seen at Appendix 6.

In order to explore potential future changes in behaviour, five printed advertisements were presented in the interviews. The advertisements were used as a visual tool to focus discussions and to give real examples of environmental activity recruitment. Prior to asking for a response for each advertisement, the nature of the advertisement and the organisation running the scheme was explained to the participants.

The advertisements were chosen to represent the bottom three activities identified in Table 10 in order to explore potential changes in behaviour with respect to environmental activities that are likely to lead to external outcomes. Due to the high variability and number of wildlife recording schemes, these were split up into one at the higher involvement level (British Trust for Ornithology), and a lower level with less commitment (British Waterways). The advertisements are summarised below and a copy of each can be seen in Appendix 7.

1. British Trust for Ornithology (BTO) advertisement recruiting the public to participate in the Garden BirdWatch, a garden wildlife recording scheme. Participants for this scheme pay an annual fee to participate, and submit records on a regular basis throughout the spring and summer. It was explained to participants that other recording schemes exist that require differing levels of time and financial commitment.

2. British Waterways (BW) press article taken from a local newspaper (The Yorkshire Post). The article explains that a decline in numbers of kingfishers had been noticed as a result of the public providing records of wildlife upon their local waterways. It encourages people to join the free, *ad hoc* recording scheme.

3. Mammal Society (MS) membership advertisement. The nature of the society, its activities and the associated membership fees and benefits were explained to participants.

4. British Trust for Conservation Volunteers (BTCV) volunteer calendar for York region. This represented participation in practical environmental tasks such as scrub clearance and habitat management.

5. Wildlife Trusts (WT) 'Gardening for Wildlife' leaflet. This leaflet endorsed and gave advice on management practices that encourage wildlife into gardens.

Prior to the commencement of interviews, Social Research Association ethical guidance was consulted (Social Research Association, 2003), and methodologies were approved by University of York ethical procedures. Informed consent was obtained from all participants and personal information and responses were handled in accordance with the Data Protection Act 1998 (The Data Protection Act, 1998).

Results

Motivations for involvement

Community volunteers

None of the fourteen community volunteers had been involved in a wildlife radio tracking study before. Two of the eleven interviewed were currently engaged in environmental volunteering in some respect, and another had been involved in environmental projects in the past.

Reasons for getting involved in the study were centred around learning about hedgehogs, either in terms of managing their own gardens appropriately (two participants) '*we were feeding a group of hedgehogs in the garden, so if I get to know a bit more about them, it might help me to improve their chances'* (male volunteer), or to learn more about wildlife or hedgehogs in general (five participants). Two participants also stated that the social aspect of a community project was a motivating factor in their involvement and learning about radio tracking was a motivation for involvement for one participant.

All of the volunteers expressed that the process of being involved in the study was positive, with ten of the eleven interviewees saying that it was an enjoyable thing for them to do. Many participants used strongly positive language when describing their experiences, such as: *'sheer pleasure'* (male volunteer); *'it was great fun'* (female volunteer)*; 'it was a very enjoyable experience'* (male volunteer). Seven participants also explained that they would like to have been more involved during the study period, or would like to be more involved in the future; *'if you do a similar thing next year, we'll volunteer again, definitely'* (male volunteer).

Youth Action Team members

All of the participating Youth Action Team stated that they became involved in the hedgehog study because it sounded interesting or exciting to do so. Four of these elaborated further, identifying an interest in hedgehogs and/or wildlife as a motivating factor.

Internal outcomes: personal benefits

Community volunteers

Only one participant did not mention hedgehogs in relation to their own enjoyment or benefit as a result of the study, and some participants elaborated upon this by expressing positive emotions associated with being in close proximity to hedgehogs. For example, one volunteer expressed that she *'loved seeing the hedgehogs, they were amazing, and that was a real highlight'* (female volunteer), and another stated: *'I wasn't expecting to handle a hog, so I was delighted when I did*' (male volunteer).

The process of radio tracking as an exciting and positive activity was described by three participants. For example, one participant described an enjoyable aspect of his involvement in the study as *'the chase, the crazy chase'* (male volunteer).

There were several different learning experiences described by the participants. Learning about hedgehog behaviour and ecology was mentioned in some way by ten out of the eleven participants, the other being the volunteer who had been marking hedgehogs in their garden in this area over previous years. Some participants expressed surprise at aspects of hedgehog behaviour that they had learnt, as described by this volunteer: *'I think we learned...a lot about hedgehogs that we didn't know. We didn't think...for one they'd move as bloody fast as they did, and some of their little characters'* (female volunteer).

Despite the fact that all of the volunteers learned how to use the radio tracking equipment and techniques for the first time, only five participants mentioned this when asked about what they had learnt. When prompted, the other participants agreed that they had learnt about these aspects, but did not elaborate further, giving the impression that this was not largely acknowledged as a significant learning experience. Two of the five participants also made a comparison with other radio tracking work they have seen on the television. Both stated that they had gained a greater understanding of what was involved in this type of scientific research as a result of their participation in the hedgehog study.

The social aspect of the project was described as a positive factor by eight of the volunteers, in particular the idea of meeting 'like-minded' people through their involvement. One participant identified that a positive aspect of their participation was learning from other volunteers; *'I had interesting conversations...and, it was nice...just having a group of people that were generally aware of wildlife, and had knowledge and interesting facts to impart' (*female volunteer). Another participant described how talking to other volunteers about her own experiences of hedgehogs helped her learn something

about herself; *'I was surprised at how much I know...chatting to people...I sound as though I know a lot'* (female volunteer). Health benefits were touched upon by one participant who expressed that they thought they got physically fitter as a result of participation.

When asked about any less enjoyable aspects associated with their participation, three community volunteers identified the cold temperatures, three mentioned the late nights, and four identified sitting and waiting. Two volunteers reported that there were no negative aspects, and four of the volunteers who had identified less enjoyable aspects also qualified their explanation with a contrasting statement explaining their acceptance of the conditions as an integral part of the study. For example; '*I could accept the sitting around, because that must go with the territory'* (male volunteer).

Youth Action Team

When asked about the enjoyable aspects of the study, four Youth Action Team participants indicated that the physical process of tracking the hedgehog was a positive part of their involvement. Two participants described enjoying using the tracking equipment. Three participants described some sort of social factor as enjoyable, whether it was meeting new people; '*some lovely people were met'*, or working within the existing group. One participant did not respond to this question.

In terms of personal learning, four respondents mentioned that they had learnt about some aspect of how scientific studies are conducted, two of them elaborating that there was more involved than they expected.

Personal benefits were described by two people in more detail, one identifying *'needing patience'*, and the other stating *'I got more fresh air'.* Two other respondents indicated that they benefited by being interested in some aspect of the study.

For every participant responding about less enjoyable aspects of this study (one participant did not respond), all described the associated physical discomfort, specifically the cold weather. Referring to a confrontation with local residents on the evening that the Youth Action Team was involved with the study, two participants also mentioned the *'awkward people'* as a less enjoyable aspect.

Internal outcomes: changes in engagement with nature

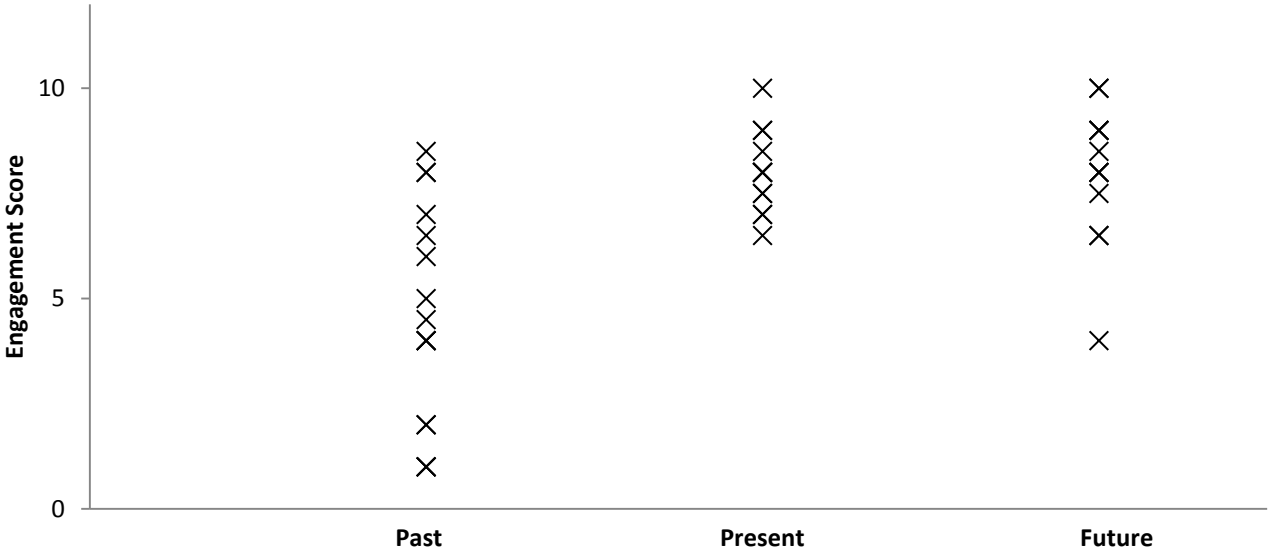
The two community volunteers who are currently involved with environmental recording activities put all three of their engagement markers in the same score, indicating that they consider their engagement is at a relatively high (score 8 for one and score 8/9 for the other), stable level which they will maintain into the future.

The response of all of the other participants indicated that their involvement in the hedgehog study (represented by the present) led them to be more engaged with nature than in the past (Figure 4). All participants reported a relatively high level of engagement during this time.

Predicted changes of engagement in the future were more varied, although every participant indicated a level of engagement in the future higher than that of the past. In relation to scores for the 'present', five participants gave lower future scores, three at the same level, and the remaining eight expressed a higher score in the future

Participants were not specific about the types of activities they envisage they will be involved with in the future, but there was a common desire to stay engaged with nature, or to become more so. For example, one participant explained: *'I'd like to have it more built into my life that there was a kind of routine...whether it's sort of a hobby or...definite volunteer work with wildlife'* (female volunteer).

Figure 4. Changes in responses of participants illustrating changes in their engagement with nature over time (n=15). Participants were asked to define their own concept of past and future, with the present being defined as the time at which they were actively involved in the hedgehog study



During one community volunteer interview, it became apparent that the participant was not confident in providing her own engagement scores, despite sensitive prompting from the interviewer. However, throughout the course of the conversation, it was clear that she felt that her engagement during the study was higher than in the past, and she would like to be even more involved with environmental activities in the future. Similarly, two of the Youth Action Team respondents did not write numeric scores onto their engagement scale responses. However, their response sheets indicated their relative positions over time. Therefore for these three participants, movement on the scale is still included in this description, but no scores are depicted in Figure 4.

External outcomes: community-level or wider benefits

Community volunteers

The two participants living within the hedgehog study area communicated that there were benefits of the study on a community level. Both of these were centred on the discovery that other people in the local community are also engaged by the local hedgehogs in some way as themselves: '*we talked to people locally...and we were actually finding that yes, people were actually finding hedgehogs, people were putting food out for them'*

(female volunteer) and *'I got to see that local...sympathy for the hedgehogs was brilliant, the number of people that were...interested in actively feeding them and helping them, I thought was great, it was really...encouraging' (male volunteer).* Another participant who volunteers as a Girl Guide leader said that she would pass on her new knowledge and experience to other groups in her local community, specifically the Guides that she works with. In this way, she reported that her own learning as a result of her participation was also a community benefit. Only two participants described that their involvement in the study might benefit something other than themselves, for example *'feeling like I was helping local wildlife in some way'* (female volunteer).

Youth Action Team

External values were not elaborated upon in depth by many of the Youth Action Team respondents. However one respondent implied that there may be future external benefits by writing that involvement in the study had raised awareness of hedgehogs. Although there was no further elaboration, this comment suggests that the raised awareness is likely to be for the individual participant or the youth group. Another participant stated that their involvement in the study meant they *'did something useful with my time instead of spending it in the pub or at home watching TV'.* The word 'useful' implies that their involvement benefitted something beyond their own self.

External outcomes: Future behaviour changes

Responses to the advertisements showed that British Waterways and the Wildlife Trusts were the organisations that the largest number of participants were aware of, followed by the BTCV. The more specialist conservation organisations (the BTO and Mammal Society) were not known to the majority of respondents (Table 11).

In terms of perceived changes in personal behaviour, there was an overall positive change from past into future for all activities (Table 11). Of all interviewees, only one participant indicated that there would be a negative change, i.e. having done an activity in the past and not being interested in doing it in the future. This was a Youth Action Team member, who indicated on their answer form that they had participated in a study like the British Waterways informal recording scheme in the past, but would not want to do it in the future. This answer was accompanied by their comment '*just not interested'.*

Response to the formal wildlife recording scheme, (e.g. BTO), was mixed. Although most (88.9%) participants had not undertaken this activity before, six (37.5%) would not be

interested in doing it in the future, and ten (62.5%) would be, although four of these said that the fees associated with the BTO scheme would be a barrier to their involvement, preferring a scheme that is free of charge. One of these participants stated that they would not be confident enough in identifying birds to participate in this scheme, but they would be interested in similar schemes for other wildlife taxa.

Table 11. Summary of volunteer responses to advertisements. The table summarises whether participants reported that they had heard of the stated organisations before, whether they have participated in the advertised activity in the past, and whether they would be interested in doing so in the future. BTO, British Trust for Ornithology; BW, British Waterways; MS, Mammal Society; BTCV, British Trust for Conservation Volunteers; WT, Wildlife Trusts.

Activity name	**Heard of organisation? (n=17)**			**Done activity before (n=18)**		**Interested in the future (n=18)**		**Future interested from those who have done activity before**		**Future interest from those who have not done activity before**	
	Yes	No	Not Sure	Yes	No	Yes	No	Yes	No	Yes	No
Formal recording scheme (e.g. BTO)	6 (35.3%)	11 (64.7%)	0	2 (11.1%)	16 (88.9%)	12 (66.7%)	6 (33.3%)	2 (11.1%)	0	10 (62.5%)	6 (37.5%)
Informal recording scheme (e.g. BW)	11 (64.7%)	4 (23.5%)	1 (5.9%)	1 (5.6%)	17 (94.4%)	16 (88%)	2 (11.1%)	0	1 (100%)	16 (94.1%)	1 (5.9%)
Society membership (e.g. MS)	2 (11.8%)	15 (88.2)	0	1 (5.6%)	17 (94.4%)	7 (38.9%)	11 (61.1%)	1 (100%)	0	6 (35.5%)	11 (64.7%)
Practical tasks (e.g. BTCV)	10 (58.8%)	4 (23.5%)	2 (11.8%)	8 (44.4%)	10 (55.6%)	15 (83.3%)	3 (16.7%)	8 (100%)	0	7 (70%)	3 (30%)
Gardening for wildlife (e.g. WT)	14 (82.4%)	3 (17.6%)	0	10 (55.6%)	8 (44.4%)	17 (94.4%)	1 (5.6%)	10 (100%)	0	7 (87.5%)	1 (12.5%)

Only two of the 18 respondents stated that they would not be interested in participating in the informal wildlife recording scheme. One of these is discussed above and the other was a Youth Action Team member who was not interested in participating in any of the environmental activities they were questioned about. Despite this high interest rate, 94.4% (17 participants) had not taken part in this activity before, even though more than half (64.7%) of all participants had heard of British Waterways before. This suggests that despite being aware of the organisation, participants were not aware of the wildlife recording scheme run by British Waterways, or of other similar recording schemes.

The activity with the highest proportion of people who have never undertaken it and would not be interested in doing so in the future was that of society membership (e.g. Mammal Society). Only one participant had been a member of a conservation society in the past, and this person was interested in continuing with this into the future. Of the 17 respondents who have not done this in the past, only six would consider doing it in the future. The reasons behind this were varied: three participants explained that they would be interested in taking part in surveys for this sort of organisation, but were not interested in joining; one participant stated that they '*like something more physical to do'* and another two explained that they would be put off by the money required to join, or stated that if they were going to donate money, a conservation organisation would not be their recipient of choice. Even amongst those who said they would be interested in becoming a member in the future, five of the seven participants commented that they would want to investigate in more detail where their money goes before committing to join.

A high proportion (44.4%) of respondents had been involved with practical environmental tasks in the past (e.g. BTCV activity), and of those who had not, only one would not be interested in being involved in the future. This was the same Youth Action Team respondent who indicated that they would not be interested in doing any of the environmental activities in the future.

Gardening for wildlife was the activity that most participants (55.6%) had done before in the past. Only one participant stated that they would not be interested in doing wildlife gardening in the future, and wrote *'don't have time or garden'* on their response sheet (Youth Action Team respondent).

Perceived changes in reaction as a result of participation

Community volunteers

Through the environmental advertisements activity, all of the participants expressed an interest in one or more of the activity types that they had not undertaken in the past.

When asked whether they thought their reaction had changed as a result of their participation in the hedgehog study, seven participants agreed that they might be more likely to respond positively to some or all of the activities, four of whom specified that this was due to increased or heightened awareness of opportunities rather than increasing their level of interest in activities like this.

Youth Action Team

Out of the seven Youth Action Team participants interviewed, one did not respond to the question asking if their reaction has changed as a result of involvement in the study. This respondent also indicated that they were not interested in any of the activities described. Of the others, four answered that their response may be, or was, different for at least one of the activities, and two wrote that there had been no effect.

Discussion

This study brought together community volunteers and scientists in an exploration of the social benefits of engagement in an urban wildlife conservation project. Where many other investigations of this type explore existing initiatives (e.g. Lawrence, 2006, Bruyere and Rappe, 2007), this study was designed and implemented specifically to address these questions. Using this approach enables a high level of control over survey design, allowing for reliable conclusions to be drawn.

Internal outcomes

The interviews revealed that there have been internal transformative outcomes for community participants. Internal benefits centred on personal wellbeing and satisfaction, particularly in terms of learning, social benefits and personal enjoyment. The majority of participants emphasised the benefits of learning about, and being in proximity to, wildlife in a way that was new to them. These internal values correspond to those reported from research with other environmental volunteers (Lawrence, 2006, O'Brien *et al.*, 2008). However in other studies, an altruistic factor of 'giving something back' was noted as a key motivational factor for participation (Phillips, 1982, Hibbert *et al.*, 2003, Martinez and McMullin, 2004), which was only acknowledged by three of our volunteers, and not stated in the initial response to benefits of being involved in the study. This is perhaps

indicative that participants did not link the objectives of the study with being beneficial to wildlife, or that they did not recognise their role as beneficial in some other sense.

Other than those participants already engaged in environmental activities, all interviewees expressed that involvement in the hedgehog study corresponded with an increase in their own engagement with nature from past to future. Although the motivation for a higher engagement with nature in the future may already be present in many volunteers, this suggests strongly that environmental activities such as the hedgehog study do encourage and enable participants to increase their engagement with nature. The majority of volunteers interviewed in this study also expressed a key benefit as being in proximity to, or learning about hedgehogs themselves indicating that, as in other cases (Mainwaring, 2001, Kontoleon and Swanson, 2003, Home *et al.*, 2009), use of this charismatic flagship species was also a successful engagement tool in this study.

External outcomes

One of the external outcomes of this study, and others like it, is that of the successful collection of scientific data (Lawrence, 2006, Chapter 5 of this thesis). However it is important to consider potential further external outcomes. Although expressing an interest in an environmental activity through an interview does not automatically mean a participant will go on to actually participate, by learning about new opportunities participants will have experienced a change in awareness. This awareness change constitutes an internal outcome, which may lead to future external changes or future commitment to the environment in one form or another (Lawrence, 2006), even though changes in awareness, knowledge or education are not necessarily linked to changes in behaviour (Kollmuss and Agyeman, 2002, Lawrence, 2005). An assessment of whether real changes in engagement and behaviour have occurred would require a series of follow-up interviews several years after the activity was undertaken.

As well as the potential indirect internal community benefits, external community-level benefits were described by the two participants currently living in the study area, specifically in an increased understanding of the motivations and behaviour of other community members. It may be concluded therefore that if more local community volunteers had been recruited from the study area, further community-level benefits, such as increased community cohesion (CABE, 2005), may have been realised.

The majority of participants reported that their reaction to the environmental activity advertisements had changed as a result of involvement in the wildlife study. As expected by the limited scope of the study, participants did not express a particularly strong reaction change, specifying that their participation in the study served to increase their

awareness of activities, rather than making them more interested in participation in the first instance. By participating in the study, the volunteers had already demonstrated their motivation for participation in a wildlife–related activity. Nonetheless, the majority of participants had not taken part in this sort of study before, so any potential increase in future participation as a result of their involvement could be viewed as a positive change.

The most popular environmental activities for the future were that of informal recording schemes and wildlife gardening, both representing a mid to high engagement level based on our classification. The least popular activity was that of society membership, classified as low-level engagement. This is a positive outcome as the higher-level engagement activities are also linked more closely to external outcomes in terms of benefits for conservation.

More notable was the overall positive response towards the environmental activity advertisements. Although many of the activities had not been known to the participants, many expressed an interest in participating in the future. The very fact that participants were not aware previously of these opportunities highlights another transformative outcome of the hedgehog study. The researcher's role in signposting other environmental opportunities to volunteers appears to have brought about a more significant potential behaviour change than that of running the study itself. A key barrier to participation in environmental activities is that of a lack of awareness of opportunities (Hibbert *et al.*, 2003, Martinez and McMullin, 2004, Chapter 3 of this thesis) and it is clear from our data that linking volunteers with other activities could play an important role in overcoming this.

This signposting role has the potential to be even more important, as illustrated in this instance with the Youth Action Team. From the responses of interviewees, it was apparent that the environmental conditions associated with the study were a significant negative aspect for many of the participants. However, despite this, the group members' overall response towards the environmental activity advertisements reflected that of the other community volunteers, in that many expressed an interest for participating in activities in the future, having not participated in the past. This implies that there may be transformative effects for participants in other activities through increased awareness of opportunities regardless of whether the initial activity was an enjoyable experience for volunteers.

The hedgehog study was clearly a very intensive way of engaging volunteers to investigate potential transformative influences of participation. Of course working in such an intimate way with volunteers is not likely to be practical for many organisations, due to constraints such as staff time and financial implications. Despite this, the lessons learnt

can be applied more generally to lower-intensity engagement exercises. For example if conservation organisations can enable volunteers to increase engagement with nature, particularly via charismatic species, and they can emphasise these factors in their volunteer recruitment mechanisms, this may be an effective way of engaging with potential participants. Using charismatic or flagship species is known to be a successful mechanism to maximise engagement (Kontoleon and Swanson, 2003), and it is clear from the positive responses of volunteers in this study that the hedgehogs themselves were a key component in engaging these new participants in environmental activities. Of course not all wildlife monitoring studies can have a focus on flagship species (Bowen-Jones and Entwistle, 2002, Verissimo *et al.*, 2009) yet even species considered to be traditionally uncharismatic can gain public support when they are understood to be important in the local context (Bowen-Jones and Entwistle, 2002, Home *et al.*, 2009) or are of particular conservation concern (Verissimo *et al.*, 2009). However in studies such as this which aim to recruit new participants into intensive ecological study, using a charismatic focal species is likely to maximise their success (Leader-Williams and Dublin, 2000).

Local level studies that target participant recruits from the local community are also likely to lead to benefits on the community level as well as personally for individuals through social factors. Finally, by setting up mechanisms to communicate further participatory opportunities to volunteers as an intrinsic part of running environmental activities, organisations will maximise potential future involvement by volunteers.

Future recommendations

Participation in a wildlife study is a positive experience for many volunteers, leading to potential changes in both internal and external values as a result. The wider role of initiatives such as OPAL is likely to be especially significant in the context of signposting and supporting volunteers to follow future environmental aspirations in order to fully maximise the benefits associated with participation. A more joined-up approach could be maximised by linking volunteering opportunities in with pre-existing community-based networks. For example the church, schools and health service are likely to be community networks that are accessed regularly by a proportion of any community. In addition, key individuals that are linked with these existing networks may be known and trusted by the local community. Therefore, accessing these key people to act as advocates for the conservation message as well as information points for volunteering opportunities may be a successful approach in raising awareness and engaging with local people.

As urban wildlife conservation continues to grow in importance for wildlife, individuals and communities, participatory initiatives have the potential to make a significant impact upon its success. Therefore, it is essential to understand how to increase participation and accessibility in these initiatives in order to fully maximise the benefits associated with them. As discussed above, lessons learnt from this study should be applied in a practical way by conservation organisations that aim to maximise the potential benefits of engaging with volunteers in environmental activities.

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CHAPTER 5

The effects of householder behaviour on urban hedgehog habitat use

Preface

Chapter 5 reports on the data gathered in the ecological study introduced in Chapter 4. Urban wildlife is increasingly under threat due to factors relating to urbanisation such as habitat fragmentation, the effect of roads, pollution, disturbance and habitat loss. For some wildlife species such as common frog and the European hedgehog, some habitats associated with the urban and suburban landscape are considered to be increasingly important for their future conservation (Reeve, 1994, Carrier and Beebee, 2003, Morris, 2006). In particular, interconnected domestic gardens can form a substantial tract of habitat (Smith *et al.*, 2005) for these species.

Despite being well adapted to the urban environment, the long term survival of European hedgehogs is threatened as domestic gardens become increasingly smaller and less connected. The heavy reliance of hedgehogs on domestic gardens also makes them susceptible to the actions of individual householders, in terms of garden management and 'wildlife friendly' practices. Therefore, in order to secure the future of hedgehog populations within the urban environment, it is vital to work with communities in landscape scale conservation through sympathetic management of gardens. In order to do this, however, it is also important to learn which factors in gardens are important to hedgehog populations. This chapter investigates urban habitat use by hedgehogs by combining radio tracking data of hedgehog movements with householder questionnaires exploring garden features and supplementary feeding.

The findings reported in this chapter were communicated through a presentation (SJH) at the Mammal Society Easter Conference, 2011.

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The effects of householder behaviour on urban hedgehog habitat use

Abstract

Urbanisation is increasing on a global scale, causing detrimental effects upon wildlife populations through factors such as habitat loss and fragmentation, pollution and disturbance. However, for some species, the green spaces associated with the built environment provide suitable habitat which is becoming increasingly important for their long term survival as pressures increase in the wider countryside. One important component of urban green space is that of domestic gardens, which can form significant tracts of suitable habitat for some species, including the European hedgehog. Understanding the effects of householder garden management on urban-dwelling hedgehogs is therefore important in considering their future conservation. Previous studies have either used radio telemetry to investigate urban habitat use or drawn correlations between hedgehog sightings and garden features using national questionnaire surveys. In this study, we use a mixed methods approach to conduct a community-based study on the local scale. By combining radio tracking data with door-to-door questionnaires, we explore how the behaviour and management of gardens by local householders affects habitat use by hedgehogs. Our results show that hedgehog sightings by householders are correlated with supplementary feeding behaviour, although we found no significant relationship between hedgehog sightings and other garden features. However the radio telemetry study reveals that garden features such as supplementary food sources or the presence of dogs did not appear to influence where hedgehogs spent their time, suggesting that correlations drawn based upon sightings alone should be treated with caution. Furthermore, the findings imply that in areas such as this, resources may be super-abundant for hedgehogs, which means that the relationship between individual householder behaviour and hedgehog habitat use may be weak. In order to more fully understand the dynamics of urban habitat use by hedgehogs, more in-depth studies of this nature are recommended, however the current behaviour of many urban householders is encouraging, and should be further built upon in the future to ensure the long term conservation of garden dwelling species.

Introduction

Wildlife and urban communities

Globally, the conservation status of many wildlife taxa is under threat due to habitat change and loss through modern agricultural practices, development and natural resource depletion (McKinney, 2002, Hoekstra *et al.*, 2005, Millennium Ecosystem Assessment, 2005, Natural England, 2008). For the first time, more than half of the world's population now lives in towns and cities (United Nations, 2008), and as urbanisation continues to spread, so do the impacts upon wildlife. Through the process of urbanisation, natural habitats are removed and fragmented, and pollution and disturbance caused by people, buildings and traffic can render the built environment unsuitable for many species (McKinney, 2002, Parris, 2006, Baker and Harris, 2007, Gledhill *et al*., 2008).

However, towns and cities may also offer opportunities for wildlife (Adams, 1994). Green spaces such as gardens, embankments, parks and allotments can provide valuable habitat, food resources (Dickman, 1987) and important dispersal corridors (Angold *et al*., 2006). Many species have adapted to living within the urban landscape to some degree (Davis, 1976, Owen, 1991, Swan and Oldham, 1993), notably the red fox *Vulpes vulpes*, which has been particularly successful in towns and cities across Europe (Harris *et al.*, 1986, Gloor *et al.*, 2001). For some species, the habitats associated with the built environment are increasingly important as suitable habitat declines in the wider countryside (e.g. Chamberlain *et al*., 2004). For example, suburban and urban habitats are now thought to be important for the survival of reintroduced peregrine falcon *Falco peregrinus* fledglings (Kauffman *et al*., 2003), thrushes *Turdus* spp. (Mason, 2000), common frogs *Rana temporaria* (Carrier and Beebee, 2003) and European hedgehogs *Erinaceus europeaus* (Reeve, 1994, Morris, 2006).

Maximising ecological benefits: managing urban gardens for wildlife

In the UK, domestic gardens form a significant proportion of urban green spaces, estimated at 22-27% from a study of six large conurbations (Gaston *et al.*, 2005a, Loram *et al.*, 2007). The importance of gardens as wildlife habitat is reflected in their inclusion into some local Biodiversity Action Plans (UKBAP, 2010). The ecological benefits of gardens and other green spaces can be maximised through sympathetic

management and the provision of supplementary habitat, food or shelter, such as ponds, bird feeders and nest boxes (e.g. Ryall and Hatherell, 2003, Gaston *et al.*, 2005b, Smith *et al.*, 2005, Hof and Bright, 2009). Some garden management practices, in particular the use of chemical pesticides, may have adverse effects on wildlife. Although the extent of these impacts is not yet clear (Ansell *et al*., 2001, Morris, 2006), much advice on gardening in a more wildlife-friendly manner includes avoiding chemical use wherever possible (Good, 2000, Peace, 2005, Natural England, 2011).

It is increasingly well understood that in order to maximise ecological benefits in urban areas, particularly through such measures as encouraging wildlife-friendly gardening on the landscape scale, social communities must be considered and included (e.g. Gaston *et al.*, 2007, Davies *et al.*, 2009, Goddard *et al.*, 2011, Nilon, 2011). In order to do this, we must understand the ecological requirements of the species and how human behaviour can influence these, e.g. by feeding and garden management.

Urban hedgehogs

The European hedgehog is a charismatic British mammal, which is an example of a species that is declining in much of its native range (due to factors such as hedgerow and permanent short pasture loss in the wider countryside), but for which urban environments can offer favourable conditions (Reeve, 1994, Morris, 2006). Its decline has led to its inclusion in the UK Biodiversity Action Plan, through which it is now considered a priority species for conservation (UKBAP, 2010).

The hedgehog is closely associated with the built environment, particularly in suburban settings where domestic gardens and amenity grassland provide habitat and food resources (Rondinini and Doncaster, 2002, Harris *et al*., 2008, Dowding *et al*., 2010). Although individual gardens in isolation are unlikely to be large enough to support hedgehogs, networks of interlinked gardens can provide a substantial habitat resource (Smith *et al*., 2005). Gardens may also provide a spatial refuge from badgers *Meles meles*, which compete for the same food sources as well as directly preying on hedgehogs (Doncaster, 1994, Micol *et al.*, 1994, Young *et al.*, 2006). A national study, *Living with Mammals*, revealed a positive correlation between hedgehog sightings and the provision of supplementary food supplies and features such as dead wood piles, sheds, large proportions of lawn and large

numbers of shrubs (Hof and Bright, 2009). Of course a study such as this uses sightings as reported by a self-selecting group of members of the public, who are, by nature of their participation, engaged in garden wildlife. Therefore, although the correlations observed are a useful tool in assessing hedgehog habitat use, the results cannot give information about habitat use within the local area, i.e. whether hedgehogs are preferentially using gardens containing these features, or avoiding gardens that lack them. Further investigation is therefore necessary in order to more fully understand the relationship between householder behaviour in terms of garden resources and hedgehog habitat use.

Despite being well adapted to living within the built environment, threats still exist for the survival of hedgehog populations. Increases in high-density housing developments (Department for Communities and Local Government, 2010) and road traffic mean the urban landscape is likely to become increasingly unsuitable for long-term population survival (Morris, 2006). Roads pose considerable threats to hedgehogs though traffic collision, isolation, disturbance and pollution effects (Huijser and Bergers, 2000). Despite actively avoiding crossing large roads (Huijser and Bergers, 2000, Rondinini and Doncaster, 2002, Dowding *et al*., 2010), the mortality risk of traffic collisions for hedgehogs is significant, reducing population density by an estimated 30% in the Netherlands (Huijser and Bergers, 2000). Mortality and disturbance from people and dogs (Hof and Bright, 2009) and horticultural chemical use in gardens may also threaten hedgehogs (Ansell *et al*., 2001), although the impact of these factors is less well understood.

The management of urban green spaces and householder behaviour is therefore particularly likely to play an important role in the success of urban hedgehog populations. If raising public awareness can encourage increased 'wildlife friendly' management practices in gardens, urban hedgehogs and other wildlife will benefit (Kendle and Forbes, 1997, Ansell *et al*., 2001, Hof and Bright, 2009). As urban green spaces become increasingly smaller and more fragmented, linking important habitat features and working with communities towards conservation benefits is likely to be increasingly important in the continued conservation of wildlife taxa associated with gardens.

Many previous studies on species-habitat relationships have focused either on habitat use through radio tracking (e.g. Dowding *et al.*, 2010) or on correlations drawn between sightings and garden features as reported by members of the public e.g. *Living with Mammals* (Hof and Bright, 2009). Using these methods in isolation

provides valuable information about the importance of urban habitats for wildlife, however by combining the two factors, a more in-depth exploration can be made, as was successfully conducted by Baker *et al.* (2000) in a study of urban foxes. In this study, we use a combined approach through a radio telemetry study alongside door-to-door householder questionnaires. This enables us to build upon existing knowledge gained from single methodologies, and more fully investigate the effect that householder behaviour has upon hedgehog habitat use. This approach also enables us to better understand the potential biases in results associated with single approaches, particularly those that rely on correlations drawn from sightings of hedgehogs.

Methods

Hedgehog habitat use

The study area was located in Kingswood, a northern suburb of Kingston-upon-Hull, East Yorkshire. The area comprises medium-density mixed housing built within the last twenty years, with some parts of the study area still under construction. Since the presence of badgers can affect hedgehog behaviour (Doncaster, 1994, Ward *et al*., 1997), a search for badger records in a 5km radius of the centre of the study area was commissioned through the North and East Yorkshire Ecological Data centre.

Hedgehogs were captured under licence from Natural England, and transmitters affixed to adults over 750g (Biotrack, Dorset: 7g on acrylic mount). Hedgehogs were radio tracked between August and October 2010, when activity levels started to drop, indicating the onset of hibernation. In total, nine hedgehogs were successfully tracked over 29 ‘hedgehog nights’. Survey teams consisting of scientific and community volunteers were trained in telemetry techniques and were given support in following the radio tracking methodology.

Hedgehogs were tracked continuously over a 6-hour period using Mariner 57 receivers and hand-held Yagi antennae. Surveys commenced 30mins after mean monthly sunset time (taken from www.ukweather.com), to reflect the relative change in hedgehog activity levels in relation to the onset of dusk. Hedgehog tracking methodology followed that of Dowding *et al.* (2010), with habitat categories modified to reflect the main features of the study area: rear garden,

front garden, park, road and other (which included road verges and other green spaces).

Hedgehog ranging behaviour and distances travelled were calculated using the Home Range Extension (Beta test version 0.9, July 1998) for ArcGIS. Mean nightly distance travelled data for male and female hedgehogs were tested for normality using Shapiro-Wilk, and between-sex variation explored using Analysis of Variance in statistics package SPSS (SPSS v. 17.0, 2008). Variations in home range sizes were compared using Chi-squared analyses in statistics package SPSS.

Patterns of habitat utilisation were assessed using compositional analysis, which allows habitats to be ranked in order of use in proportion to their relative availability (Aebischer *et al*., 1993). Available habitat was identified using 100% minimum convex polygons for each hedgehog. Habitats were digitised using GIS software (ArcMap v 9.3.1, ESRI) using base maps (Ordnance Survey Mastermap) and aerial photos (Google Earth). Following Aebischer *et al.,* (1993), habitat preferences of individual hedgehogs were compared using ANOVA, based on mean log ratios of time:availability for each habitat type.

Householder questionnaires

To provide more detailed information on resource availability, door-to-door householder questionnaires were conducted with householders living within the study area. The questionnaires investigated the following: sightings of hedgehogs in the garden; accessibility of garden to hedgehogs; presence of potential hedgehog nesting habitat; presence of pets; supplementary feeding of wildlife or pets; and use of chemicals in the garden. Rear gardens and the corresponding questionnaire data were digitised and presence of known features as a result of questionnaires was assigned to the grid square to which they corresponded. Data were tested for normality, and the potential effect of specific garden features (identified from the householder questionnaires) on hedgehog ranging behaviour was investigated using Kruskal-Wallis test for non parametric data, based on the data from those grid squares containing householder questionnaire responses.

Results

Hedgehog habitat use

No badger records were returned from the record centre within 5km of the centre of the study area. Nightly distances travelled by the hedgehogs were 25-1486m for females, and 0–1633m for males. Mean nightly distances were 594.5m (±108.5) for females and 579.3m (±118.6) for males (Table 12). Chi-squared analyses revealed was no significant difference between males and females in the nightly distance travelled (Z=0.49, p>0.05).

Table 12. Hedgehog ranging distances and home range sizes (in hectares) for individuals grouped by sex using 95% and 100% fixed mean minimum convex polygons (MCP).

Hedgehog	Sex	95% MCP (ha)	100% MCP (ha)	Mean distance travelled per night (m)
1	M	4.13	5.72	478.67
2	M	3.60	4.00	1306.00
3	F	3.44	3.82	493.60
4	F	5.25	8.95	912.75
5	F	1.09	1.19	497.25
6	F	0.91	0.91	404.50
7	M	1.56	1.66	280.25
8	M	1.19	1.25	673.75
9	M	0.25	0.25	246.00
mean	F	2.67 ±1.03	3.71 ±1.86	594.47 ± 108.5
	M	2.15 ±0.74	2.58 ±1.0	579.29m ± 118.6
	F+M	2.38 ±0.6	3.08 ±0.95	

There were significant differences in hedgehog activity between habitats, i.e. duration of activity based on numbers of active fixes pooled across individuals (F=36.067, d.f.=4, 30, P<0.001), so compositional analysis was used to determine ranked habitat selection (Table 13). The preference ranking of habitats was: rear garden > park > front garden > other >> road, (with >> symbolising a significant difference at P=0.001 between habitat types), indicating a significant avoidance of roads. There were no significant differences in habitat selection between individual hedgehogs.

Table 13. Summary of compositional analysis result for active data fixes. Positive values indicate preferences for habitat in the row over habitat in the column, and negative values indicate avoidance. Values are replaced by corresponding positive or negative symbols for clarity (n.s represents a non significant interaction) Interactions are ranked in order of preference with higher ranks indicating more preferred habitat.

	Front garden	**Rear garden**	**Park**	**Other**	**Road**	**Ranking**
Front garden	-	n.s (-)	n.s (-)	n.s. (+)	*** (+)	2
Rear garden	n.s (+)	-	n.s. (+)	n.s. (+)	*** (+)	4
Park	n.s (+)	n.s (-)	-	n.s. (+)	*** (+)	3
Other	n.s (-)	n.s (-)	n.s (-)	-	*** (+)	1
Road	*** (-)	*** (-)	*** (-)	*** (-)	-	0

Householder questionnaires

In total, 315 houses were approached with questionnaires. There was no response from 102 households, and six householders that did answer the door declined to participate, giving an overall response of 206 households (66.5% of the total households approached, 97.2% of the households that answered the door). Half of all respondents had seen hedgehogs in their back garden, and over 80% considered that their garden was accessible to hedgehogs (Table 14). Just under half of all respondents provided some form of food in their garden, whether for pets or wildlife, and just under half used horticultural chemicals.

Table 14. Summary of door-to-door questionnaire results (n=206).

Question	Proportion of positive responses (%)
Seen hedgehogs in the back garden	50.5
Garden accessible to hedgehogs	86.1
Nesting habitat present in garden (shrubs, shed, decking, other)	25.7
Do not provide food for wildlife or pets in garden	52.4
Feed hedgehogs in garden	7.6
Feed birds in garden	36.4
Feed pets in garden	8.3
Dog present	24.8
More than one dog present	6.3
Use horticultural chemicals in garden (total)	45.1
Use weedkiller	17
Use slug pellets	8.3
Use lawn treatment/feed	21.4
Use ant powder	1.9

Kruskall-Wallis tests revealed no significant association between using chemicals in the garden and either feeding wildlife or pets in the garden (χ^2 = 0.395, d.f.=1, *P*=0.530), or having seen hedgehogs (χ^2 = 2.087, d.f.=2, *P*=0.352). Similarly, hedgehog sightings were not significantly associated with the presence of one or more than one dog in the household (χ^2 = 1.885, d.f.=1, *P*=0.170 and χ^2= 0.63, d.f.=1, *P*=0.802 respectively).

Hedgehog sightings by householders were, however, significantly associated with some feeding activities in the garden, in particular for households that feed hedgehogs (χ^2 = 9.508, d.f.=1, *P*=0.002), feed pets in the garden (χ^2 = 10.563, d.f=1, *P*=0.001), and for feeding wildlife/pets in general (χ^2 = 10.341, d.f.=1, *P*=0.001). Of all feeding activities, only bird feeding had no significant associations with hedgehog sightings (χ^2 =0.383, d.f. =1, *P*=0.536).

Hedgehogs spent between 12-92% of their total time within grid squares containing information obtained through the householder questionnaires. Kruskall-Wallis was used to investigate relationships between the proportion of time hedgehogs spent in one of these grid squares and the known contents of the squares both combined and in isolation, categorised as: supplementary food supplied; known nesting habitat; presence of dogs; and chemicals used. The results of the statistical tests revealed no significant relationships between proportion of time spent in the grid squares covered by the questionnaires and any of these garden features known to be present within them. This therefore indicates that none of the hedgehogs spent

significantly more or less time in grid squares containing any of these features or combination of features.

Discussion

This study used a mixed-methods approach to investigate features affecting hedgehog habitat use in an urban setting. By comparing door-to-door questionnaire results with radio telemetry data, it was possible to explore how hedgehogs spent their time in relation to specific garden features, namely supplementary food, nesting habitat, the presence of dogs and horticultural chemicals. As hedgehogs become increasingly reliant on urban and suburban garden habitats for survival, understanding the effects of householder behaviour in managing their gardens is vital in considering hedgehog conservation.

Hedgehog ranging behaviour and habitat use in relation to householder behaviour

Radio telemetry revealed that a number of hedgehogs were using the study area as core habitat throughout the duration of the study, suggesting that the area is likely to support a healthy population. However, use should not be regarded as an indicator of habitat quality (Horne, 1983), particularly as the demography of the population is not known. Longer-term monitoring studies and/or genetic analyses would therefore be useful in determining the future success of this hedgehog population.

Compositional analysis revealed that the hedgehogs were spending a high proportion of time in rear gardens and parkland, although the relative time spent in these habitats was not significantly greater than in any other habitats. This lack of significance may be because of the small scale or short duration of the study, however the significant avoidance of roads by hedgehogs in our study area supports the results of other studies (Huijser and Bergers, 2000, Rondinini and Doncaster, 2002, Dowding *et al*., 2010).

The hedgehogs in this study did not spend proportionally more or less time in gardens with chemicals present. However, this is perhaps not surprising, because as has been found with the bioaccumulation of other toxins, (e.g. Dowding *et al.,* Vermeulen *et al.*, 2010) hedgehogs may not be aware of the presence of horticultural chemicals.

The significant relationship between householders seeing hedgehogs and providing hedgehog food reflects the outcome of the *Living with Mammals* study (Hof and Bright, 2009). Householders are unlikely to continue to provide food for hedgehogs in the longer term without the having seen them in the garden. In fact the presence of hedgehogs in an area may be a trigger for householders to begin feeding in the first instance. The relationship between feeding pets and seeing hedgehogs is perhaps more complex. It may be that pet food (in particular cat or dog food, which is known to be eaten by hedgehogs (Reeve, 1994)), attracts hedgehogs to feed at pet feeding stations, which may in turn be more visible from within the house. Secondly, the presence of pets using the garden may make householders more aware of this space and therefore more likely to see hedgehogs should they visit.

Conversely however, the radio telemetry study found that hedgehogs did not spend relatively more of their time in gardens where supplementary food was provided. There is an implication therefore, certainly within the scope of this study, that sightings of hedgehogs in gardens do not necessarily indicate increased hedgehog use of these areas, as discussed above. There are several potential explanations for this result. Firstly, a study of this scale will not pick up on seasonal patterns, so the outcome may be different if the radio tracking was conducted over a longer time period. Secondly, the hedgehogs in this study displayed ranging behaviour that was relatively restricted compared with other urban studies e.g. hedgehogs in Bristol travelled between 427-1759m (males) and 210-1029m (females) during a tracking study (Dowding *et al*., 2010) compared with 0-1633m (males) and 25-1486 (females) in this study. Although the scope of this study may limit the representativeness of this result as differences in seasonality may contribute to this outcome, smaller distances travelled may be a consequence of the level or quality of resources in the area available to them. Indeed, the questionnaire results show that more than half of respondents provide some sort of supplementary feeding in their gardens, even if some of it is not accessible or eaten by hedgehogs (e.g. some forms of bird food). It is therefore likely that food resources for hedgehogs in the study area are super-abundant, comprising those provided by local people, natural prey items in gardens and green spaces, and potentially scavenged food from litter waste and domestic refuse. If this is the case, then the links between hedgehog ranging behaviour and food resources may be relatively weak in this area.

Although conducted at different scales, it is possible to make some comparisons between this study with national questionnaire surveys on wildlife sightings and garden features. Participants of national studies such as Living with Mammals are,

by nature of their participation, already engaging and interested in wildlife to some degree, and therefore may not be representative of other garden types and householder behaviours in the garden (Toms and Newson, 2006). Local-level studies are therefore important as they may reveal processes or pressures acting on populations that do not emerge from large-scale national studies. In particular, a door-to-door questionnaire such as the one used in this investigation allows data to be gathered from a range of people living in one geographical area, who may not otherwise respond to a nature-related garden recording survey (Lepczyk, 2005). In this study, some of the results reflect the findings of national questionnaires, in particular the correlation between hedgehog sightings and wildlife-friendly garden practices. However, combining these data with radio telemetry results highlights that using correlations drawn from householder sightings is not necessarily a reliable way of inferring habitat use. Therefore, data drawn from studies using sightings should clearly be interpreted carefully and with appropriate caveats. Furthermore, it might be expected that participants of national nature-related questionnaire studies are more likely to exhibit these behaviours (Toms and Newson, 2006). However this study revealed that a large proportion of the residents of the study area were actively encouraging wildlife into the garden through practices such as supplementary feeding.

Conclusions and future applications

Although this short term study did not find significant patterns between the features contained within gardens and the proportion of time hedgehogs spent in these areas, some meaningful conclusions can still be drawn. The findings of this study reflects other research (Gaston *et al.*, 2005b, Hof and Bright, 2009, Chapter 3 of this thesis) in that a large number of householders are actively encouraging wildlife into their gardens, particularly by providing supplementary food. Similarly, a large proportion of the gardens appeared to be accessible to hedgehogs, and to provide nesting habitat. The abundance of these resources in this area, constituted by foods provided by householders as well as other resources, appears to suggest that hedgehogs do not need to travel particularly long distances or to spend greater proportions of their time in specific places. Within the scope of the study, the garden management practices and behaviours of the local community as a whole therefore appear to be having a potentially positive impact for the hedgehogs living there. However, the resources available to wildlife on either the local or the national scale

are difficult to quantify (Davies *et al*., 2009), and their variability means that they cannot be explained using a single approach. This is particularly relevant for domestic garden-based studies, since individual gardens should clearly not be considered in isolation, but rather as a network of resources available to wildlife (Goddard *et al.*, 2011). Domestic gardens potentially provide a significant area of habitat for some species of wildlife (Smith *et al.*, 2005), which means that sympathetic garden management by householders is an important part of urban nature conservation (Ryall and Hatherell, 2003). Therefore, in order to fully understand the value of urban green spaces and gardens, and the impact of householder behaviour upon them, a longer term landscape-scale approach should be adopted, using different urban areas for comparison.

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DISCUSSION

Summary of thesis aims and results

Volunteer participation in environmental activities is becoming an increasingly important component of wildlife conservation on an international scale. Recruiting the public in citizen science initiatives provides social and ecological benefits. These initiatives enable data to be collected on a scale and scope that would otherwise be practically and financially impossible (e.g. Newman *et al.*, 2003, McCaffrey, 2005, Toms and Newson, 2006, Bell *et al.*, 2008). Schemes can also raise public awareness (Trumbull *et al.*, 2000, Lepczyk, 2005, Conrad and Hilchey, 2010, Goffredo *et al.*, 2010, Pendl *et al.*, 2011), increase scientific literacy (Conrad and Hilchey, 2010) and encourage people to engage with nature, which has associated personal (e.g. Fjørtoft and Sageie, 2000, Taylor *et al.*, 2001, Takano *et al.*, 2002, Hartig *et al.*, 2003, Bell *et al.*, 2004, Bird, 2004, Pretty *et al.*, 2007) and in turn community benefits (CABE, 2004, 2005). However, urbanisation and cultural changes are increasing the distance between people and nature (Katcher and Beck, 1987), and some societal groups are engaging less than others in participatory activities (Trumbull *et al.*, 2000, Pope, 2005, Toms and Newson, 2006). As a result of this, neither social nor ecological benefits of participatory initiatives are likely to be fully realised.

In order to best recruit and engage with new participants and hard-to-reach groups, it is therefore essential to understand how to maximise the benefits associated with environmental activities, on the national, local and community levels. Through project-based research as part of the OPAL initiative, the aim of this thesis was to explore public participation in nature-related activities on these different levels. By investigating how and why people engage with nature through recording schemes and volunteering, as well as the barriers to participation, we aimed to more fully understand whether socioeconomically deprived communities are under-represented in these activities and the reasons behind this, and whether involvement in environmental activities can lead to positive transformative effects.

Chapter 2 summary

In Chapter 2, we investigated participation in biological recording schemes in the UK in order to ascertain the desired and actual participant base, the motivations for participation for current participants and the perspectives of organisations that run recording schemes. To do this, we reviewed wildlife recording schemes at the national and city-wide levels. We conducted semi-structured interviews with organisations running recording schemes, and questionnaires with people that currently participate. Although the organisations stated that they would like to engage a full cross section of societal groups in their recording schemes, postcode data analysis of current participants revealed that people living in more socioeconomically deprived areas are under-represented in these activities, on both the national and local levels. Scheme organisers were largely aware of this bias and expressed both a desire to address it and a frustration that they were unable to do so due to limitations of resources and the difficulty of attracting consistent media coverage for their schemes. The motivations for participation as perceived by scheme organisers broadly aligned with those reported by participants, namely learning, helping conservation and, for the local scheme, contributing to a study about the local area. However the most important motivating factor for participants, that of their own specific interest in the wildlife species/taxa involved, was not acknowledged by scheme organisers. We conclude from these findings that wildlife recording schemes on both national and local levels are successfully providing benefits to wildlife and to participants alike. However there is not a cross section of societal groups participating in these activities, and therefore more research is essential to more fully understand the barriers in place, with a specific focus on under-represented societal groups.

Chapter 3 summary

In Chapter 3 we build upon the findings of Chapter 2 by investigating wildlife recording behaviour and motivations of a socioeconomically deprived community of an East Yorkshire City. We received a 10% response rate for a simple garden wildlife recording postcard study, indicating that a proportion of this community were motivated to participate. In the follow-up questionnaire, the majority of participants (66.3%-80.1%) reported that they had not participated in a recording study in the past. This was primarily attributed to not being aware of opportunities or not 'being asked' to do so, although time constraints were another reason given. The

motivations for participating in this study reflected those of other recording scheme participants, which related to contributing to conservation in general or a study about the local area specifically, and enthusiasm about participants' gardens or about the study species. Many participants reported that they actively encouraged wildlife into their gardens, e.g. by providing food for wildlife (83.1%), or providing a nest box or other housing (44%). The majority (84.3%) of participants were not members of environmental groups and societies. When given the opportunity to request further information, the most popular topics were that of encouraging wildlife into their garden and other wildlife recording opportunities. This study successfully raised awareness of this wildlife recording scheme by using hand-delivered postcards and enabled recommendations to be made for conservation organisations to increase participation rates in socioeconomically deprived communities. As awareness of opportunities constitutes a major barrier to participation, the ways in which recording activities are advertised and promoted should be reviewed. In addition, recommendations are made to organisations running recording schemes. These are based upon using more innovative methods, such as the use of local champions or appropriate celebrities, recruiting through schools systems, linking environmental education with community-based and family activities and promoting recruitment as a 'request' for knowledge on the local scale.

Chapter 4 summary

In Chapter 4, we worked on the community level with a small group of local volunteers in an in-depth exploration into the impact that involvement in an ecological study can have upon volunteers. Through qualitative semi–structured interviews with community volunteers, we explored transformative effects of participation in the study on the personal and wider scales. Our findings support research into other types of environmental volunteering in that the participants of this study were motivated by personal wellbeing factors such as enjoying proximity to the study species, learning and social factors. Involvement in the study was a successful vehicle for increasing participants' engagement with nature both during the study and potentially into the future, particularly in terms of biological recording and gardening for wildlife. One particularly significant aspect relating to potential future engagement with environmental activities was that of the signposting role that activity leaders can play. By using real advertisements for environmental activities as a visual tool to explore potential future behaviour changes, participants'

awareness of opportunities was raised, and many participants reported potential positive transformative outcomes for the future as a result. We conclude that involving volunteers on the local level has the potential to yield strong positive personal and wider outcomes. Organisations that seek to do this could maximise the potential benefits by promoting their activities to appeal to these known motivations of potential volunteers, working with local residents as well as other volunteers, signposting volunteers to other environmental opportunities, and linking in with pre-existing community networks and key individuals within these networks.

Chapter 5 summary

In Chapter 5, we used the data gathered in Chapter 4 to make an assessment of urban hedgehog habitat use. The ways in which householders manage their gardens may significantly impact upon future hedgehog conservation, and it is therefore important to understand how hedgehogs use urban green spaces and which features are important for their survival. In this study, we combined radio-tracking data of hedgehog habitat use with data gathered through door-to-door questionnaires of households living in the study area. By combining these two datasets, we investigated whether particular garden features were likely to affect how hedgehogs use the local urban environment. Our results showed that hedgehogs did not appear to spend relatively more of their time in gardens where supplementary food or nesting habitat was potentially available, neither did they spend relatively less time in gardens where horticultural chemicals were used or dogs were present. A potential explanation for this result is centred on the number of respondents of the door-to-door questionnaires actively providing supplementary food for wildlife. If other resources are also readily available in the area, this may mean that hedgehog time budgeting is not limited by resource distribution. By using this combined approach, we were also able to better understand potential biases in results associated with sightings-based studies, as the correlations drawn from householder sightings did not reflect actual hedgehog habitat use in the area.

Participation in environmental activities

By bringing together the data gathered from the three different groups of participants in this thesis - people currently participating in the local and national recording schemes (Chapter 2), residents of the socioeconomically deprived

community in Hull (Chapter 3), and community volunteers from the hedgehog study (Chapter 4) - it is possible to identify common themes for participation in environmental activities.

Other than the current participants of the recording schemes, many of the participants involved in this research were not active in other environmental activities. Regardless of this, motivations to participate were similar throughout all of these diverse groups. Participants were motivated by three main factors: to contribute to wildlife conservation; because of reasons relating to the particular species/taxa and the learning associated with this; and contributing to a local study. Community volunteers (Chapter 4) were also motivated by social aspects. These common motivations mirror findings from other environmental volunteers in the US (Ryan *et al.*, 2001, Martinez and McMullin, 2004, Bruyere and Rappe, 2007), Europe (Bell *et al.*, 2008, O'Brien *et al.*, 2008, Pendl *et al.*, 2011) and Australia (Weston *et al.*, 2003, Esmond, 2004, Measham and Barnett, 2008, Bramston *et al.*, 2011).

Understanding that motivations are similar across different societal groups and for people who are otherwise not engaged in environmental activities is useful for conservation organisations in consideration of recruiting and engaging with the public. As outlined in Chapters 3 and 4 as well as for other environmental volunteers, awareness of opportunities appears to be a significant limiting factor to involvement for many otherwise motivated people (e.g. Martinez and McMullin, 2004, O'Brien *et al.*, 2008). Awareness of opportunities is related to how activities are advertised and promoted, although socio-cultural factors are also likely to affect whether people identify with, and react to, opportunities. Therefore in addition to overcoming biases in press coverage and other advertising (Gaston *et al.*, 2005b, Bell *et al.*, 2008), the way in which opportunities are advertised and promoted is also likely to be important for recruitment of participants. Socio-cultural factors are known to affect participation in different societal groups (e.g. Jones *et al.*, 2009, Brown *et al.*, 2010). It is possible therefore that the current stereotype of environmental volunteers (white, middle-class, of retirement age) (Trumbull *et al.*, 2000, Burningham and Thrush, 2001, Anthony *et al.*, 2004, Pope, 2005, O'Brien *et al.*, 2008), creates an exclusive culture to these activities which may present a barrier to other people getting involved. For example, it has been suggested that ethnic groups may experience barriers to participation due to reasons relating to lower levels of promotion of environmental issues in some cultures and a lack of ethnic role models in environmental organisations (Bell et al., 2004, CABE, 2005). In

order to address this, organisations running participatory initiatives must first consider proactively targeting different groups. The findings of Chapters 2 and 3 support this recommendation: participation in the Leeds Garden Pond Survey was often attributed to participants having been 'asked' to do so, whereas in Hull, a lack of previous participation was explained by many respondents as not having been 'asked' to be involved.

Secondly, the 'culture' of environmental activities must be reviewed. Contributing to a local study played an important role in many participants' motivations for participation, and although this factor requires further investigation in order to more fully understand it, this suggests that many potential participants, regardless of societal group, are particularly motivated to contribute to improving and learning about their local area, a factor that should be built upon by conservation organisations in engagement with volunteers. The role of environmental education in promoting the importance of environmental participation may also be a successful approach in increasing motivations to participate. In Chapter 3 we discuss the value of local champions (Campbell and McLean, 2002), as the presence of peers is known to be an effective approach to promoting volunteering (Linardi and McConnell, 2011), particularly because habits are a strong factor in pro-environmental behaviour (Kollmuss and Agyeman, 2002). In a study of environmental volunteers in the US, Martinez and McMullin (2004) highlighted the importance of recruiting on the local as well as the national scale. Although investing time and money into local champions and other local-scale aspects may be expensive for conservation organisations, it may be only through means such as this that the cultural perceptions of environmental activities in some societal groups may start to shift.

Gardening for wildlife

The results of this thesis share a common link of positive householder behaviour and attitudes towards wildlife in domestic gardens. Whilst this is perhaps not surprising from participants of garden wildlife recording schemes (Chapter 2), Chapters 3, 4 and 5 gathered information from householders who are not necessarily currently engaged in garden or other wildlife-related activities. Although self-selecting to some degree, the proportion of householders from Chapter 3 reporting some active encouragement of wildlife into the garden was high, as well as the number of requests for more information on this topic. In Chapter 4, the

environmental activity that most participants were already engaged in was gardening for wildlife, and again participants were keen to learn more about this. In Chapter 5, the door-to-door questionnaires did not allow for self-selection yet almost half of these householders reported active encouragement of wildlife, as well as the presence of other suitable wildlife habitat, within their gardens. In this chapter, this garden management by householders alongside resources available on the wider landscape scale appeared to be positively supporting urban hedgehogs, to the extent that their nesting and feeding behaviour was not restricted to certain gardens or areas.

The importance of domestic gardens for wildlife is increasing (e.g. Mason, 2000, Ansell *et al.*, 2001, Baker and Harris, 2007, Gaston *et al.*, 2007, Davies *et al.*, 2009, Hof and Bright, 2009), and there is a large amount of current research investigating the value of the resources for wildlife provided by networks of domestic gardens (Smith *et al.*, 2005, Goddard *et al.*, 2011). The importance and popularity of wildlife gardening is reflected in the literature available to support gardeners in 'wildlife friendly' garden practices. For example, international promotion of wildlife gardening is widely achieved via various mechanisms including: Non-Governmental Organisations such as the Wildlife Trusts in the UK (Ryall and Hatherell, 2003) and Sustainable Gardening Australia, (Sustainable Gardening Australia, 2011); websites (e.g. Peace, 2005) and blogs (e.g. Montana Wildlife Gardener, 2011), books (Kress, 2000, Thomas, 2010, Titchmarsh, 2011); and television programmes such as Gardeners' World (see www.Gardenersworld.com).

Other studies have also reported positive responses regarding householders and wildlife in the garden. For example a study in the UK found 78% of households claiming to actively encourage wildlife into their gardens (DEFRA, 2002) which is commonly achieved by providing resources such as bird feeders and nesting boxes (Gaston *et al.*, 2005b). Many environmental activities focus on garden wildlife species which is a popular approach because in addition to the potential benefits to wildlife conservation, they are relatively easy for participants to get involved with due to proximity to the home. In addition, gardens constitute private land, which is therefore out of the control of conservation organisations or Local Authorities (Gaston *et al.*, 2005a, Goddard *et al.*, 2011), and therefore these activities provide data from land that would otherwise be inaccessible to scientists (Lepczyk, 2005, McCaffrey, 2005, Toms and Newson, 2006). Therefore successfully engaging with communities is vital in order to achieve sympathetic garden management on the landscape scale (Lepczyk, 2005). Alongside other research, the findings from this

thesis suggest that gardening for wildlife constitutes an activity that many people are both engaged with, and motivated to learn more about. Therefore maintaining and enhancing the focus of wildlife in the garden is likely to be a successful approach when recruiting and engaging new people, and different societal groups, with wildlife-related activities.

Flagship species

A key motivator for participation in the environmental activities explored in this thesis was linked to participants' own enjoyment of, or affinity with, the focal species or taxa of the activities. From a conservation perspective, concentrating on certain species as 'flagships' is a widely contested topic (Leader-Williams and Dublin, 2000) as this may not necessarily bring direct benefits to wildlife on the wider scale (e.g. Caro *et al.*, 2004). However, as a strategy to maximise engagement, and for supporting positive transformative effects (Kontoleon and Swanson, 2003), using charismatic focal species is a common and successful approach for environmental organisations (Mainwaring, 2001). Definitions of charismatic species vary, but these tend to be easily recognisable by name and sight (Kontoleon and Swanson, 2003), often vertebrates (Home *et al.*, 2009), and usually mammals (Leader-Williams and Dublin, 2000). However, additional factors may help to make flagship species charismatic, for example a study in Switzerland found that even species deemed as 'uncharismatic' (the clover stem weevil) were still successful in gaining public support, specifically because of the local context (Home *et al.*, 2009).

For participatory initiatives such as OPAL, understanding the importance of focal species is important in approaching new audiences to encourage engagement and appreciation of nature. Emphasising the importance of focal species is therefore recommended in order to maximise the benefits associated with participatory initiatives. Species clearly do not need to be traditionally 'charismatic', but must be appropriate to the local context (Bowen-Jones and Entwistle, 2002) in order to successfully engage the prospective audience. Further research into the effects of different types of flagship species in engaging with diverse communities is therefore needed in order to more fully understand how to maximise the potential benefits of this approach.

Transformative effects and maintaining participation

There is a clear distinction between engaging participants in one environmental activity and encouraging ongoing engagement and participation into the future for continued benefits for conservation organisations, participants and wildlife. Although encouraging participation may not directly achieve outcomes desired by some organisations, such as attitude changes or increases in understanding of scientific processes (Brossard *et al.*, 2005), personal change on some level is likely to occur for participants regardless (Lawrence, 2006). Although these changes are difficult to quantify, increased internal benefits (such as learning and personal enjoyment) should not be ignored as positive outcomes of participation activities (Lawrence, 2006), even if participation occurs only once. However, maintaining a level of ongoing participation is important in order to maximise future benefits for both conservation organisations and participants themselves.

Maintaining participation is not a straightforward process. For example, the majority of participants of the garden wildlife survey in Chapter 3 stated that they had not participated in recording activities in the past due to a lack of awareness of these opportunities. Although the most of these (55%) requested more information on other recording opportunities, for the proportion that did not request more information, the findings suggest that there are still barriers in place to continued participation in this way. The response from community volunteers (Chapter 4) was also positive, but as discussed in both of these chapters, the link between requesting more information and actual behavioural change cannot be assumed. Therefore further research over longer timescales is necessary to more fully understand these transformative effects.

One way that many conservation organisations communicate and engage with the public is through membership and its associated media, which also provides financial benefits. However, membership of groups and societies was another topic that was largely unpopular in local participants in this study. It was only in the national recording scheme (Garden BirdWatch) that many participants were members of other groups and societies, with less than 1% not being a member of at least one group. In contrast, less than half of the local recording scheme participants (Leeds Garden Pond Survey, Chapter 3), 84.3% of Hull residents (Chapter 3) and most of the community volunteers (Chapter 4) were not members of groups or societies and there was an overall reluctance to joining these groups by the majority of respondents.

Despite this, membership of environmental organisations is high on international, national and local scales. For example: international conservation organisation The Nature Conservancy has over 1 million members worldwide (The Nature Conservancy, 2011); on the national level the Royal Society for the Protection of Birds has over a million members (RSPB, 2010); and locally Somerset Wildlife Trust has more than 21,000 members (Somerset Wildlife Trust, 2011), constituting 4% of the total population of this county (Somerset County Council, 2011). Clearly, people become members of groups and societies for different reasons (Dennis and Zube, 1988), which may be linked to factors such as affluence or because of nearby threatened natural resources (Wikle, 1995). Although this thesis does not investigate factors relating to society membership, the findings suggest that despite being motivated to participate in environmental activities, promotion of society or group membership is unlikely to be a successful ongoing engagement mechanism for new recruitment for many people who are motivated to get involved in recording or volunteering projects.

UK participatory policy and community engagement

Since the late 19th Century, collection of ecological records for biodiversity monitoring has increasingly been driven by policy and legislation (Burnett et al., 1995), and the contribution of volunteers in data collection has been acknowledged as an essential component of conservation (Martinez and McMullin, 2004). In recent years however there has been a shift in the emphasis of nature conservation programmes. Although voluntary data collection for conservation monitoring is still considered important (e.g. UKBAP, 2010), there is now an increasing focus upon participatory initiatives in recognition of the important social and ecological links between people, communities and wildlife for mutual benefits to all. As a result of this, building upon existing knowledge and recommendations in order to maximise these opportunities and the benefits that result from them is increasingly important.

In 2011 the UK Government published two White Papers setting out their approach for promoting social action. The Giving White Paper was published in May 2011 in recognition of the individual and community benefits of volunteering. More than £40m has been pledged to increase volunteering and social action over two years, with an emphasis on working with deprived communities, and encouraging volunteering to become part of the culture in schools through National Citizen Science (Minister of State for the Cabinet Office, 2011). The Natural Environment

White Paper, published in June 2011, recognises the economic and social value of a healthy natural environment. Through this paper, the Government acknowledges the positive impact that nature has on mental and physical health and the importance of voluntary action for nature benefits, and pledges to facilitate local action and strengthen the connections between people and nature (Secretary of State for Environment Food and Rural Affairs, 2011).

Alongside Government support of participatory approaches, and in reflection of changing funding emphases (Silvertown, 2009), conservation organisations are also developing wildlife conservation projects with a stronger focus on engaging the public. This highlights a shift in approach from site-based nature conservation through protected areas such as nature reserves to working with local people in order to benefit wildlife, communities and local economies (Lawton *et al.*, 2010, England Biodiversity Group, 2011).

These White Papers and conservation approaches demonstrate the UK Government's acknowledgement of the importance of engaging with diverse communities for a healthy ecological, economic and social environment. However, the ways in which the resulting initiatives are conducted must be carefully considered in order to ensure that the full benefits are realised. The findings of this thesis highlight some key issues and motivational factors when working with volunteers on different levels, and the recommendations resulting from these should be adopted and built upon by future engagement initiatives.

Limitations of the study

The research conducted in this thesis was in no way exhaustive. As a result, more in-depth conclusions could be drawn if the research could have been conducted over a longer timescale and with more comparisons drawn. For example, the work conducted in socioeconomically deprived communities could be improved if it had been possible to sample from different areas, both geographically and in deprivation level, in order to clarify the role of deprivation and the other factors involved as participation barriers. If time were not limiting, it would have benefitted the research to focus more on non-respondents in order to more fully understand how environmental activities could more successfully be promoted to socioeconomically deprived communities. However, because these communities do not engage as

readily as other groups, this work can be extremely time-consuming and challenging regardless of the resources available.

The tools used to assess transformative effects and potential behaviour changes were simple and based upon the ways in which real conservation organisations recruit participants. There are, however, more structured ways of gathering data to measure the internal affects of participation. For example the Volunteer Motivation Inventory was used in Australia to gain an understanding of volunteer motivations (Esmond, 2004) and attitude change of participants has measured in the US through a modified form of the 'attitude towards organized science scale' (Brossard *et al.*, 2005). However, although using tools such as these may benefit the wider interpretation of results, particularly in respect of the quantity of data gathered, qualitative approaches have strong positive aspects. For example, using semi-structured methods throughout this research enabled a flexible approach which was potentially able to identify new and unexpected themes. These methods were appropriate to this context as they reflected the informal relationship between researcher and volunteers in an attempt to build confidence and encourage elaboration. This is particularly important when working with hard-to-reach groups as a lack of confidence is a known barrier to participation. The qualitative approach enabled the interpretation of more reliable and open results without alienating participants through overly qualitative methods.

Conclusions

The future of wildlife conservation is becoming increasingly interlinked with working with people from all societal groups for social, community and ecological benefits. However, in order to maximise these benefits, we must build upon existing knowledge to successfully engage with diverse groups. In the UK, socioeconomically deprived communities remain under-represented in environmental activities, despite many community members sharing the same motivations for participation as other societal groups.

The findings from this research allow for recommendations to be made for engaging with 'hard to reach' groups in order to achieve positive transformative effects for people and for wildlife. Firstly, an innovative and proactive approach is necessary in order to break the current stereotypes and engage with new groups. This approach should reflect known motivations of local people, but longer term consideration must

be made to changing the 'culture' of environmental activities in diverse communities. Secondly, a clear emphasis on local features or concerns is likely to be a successful mechanism for recruiting and engaging with many new participants, which aligns well with current conservation policy approaches. Conservation organisations must strive to engage with diverse communities by targeting and working with individuals or small groups, (such as local champions) in the first instance. This will enable trust to develop and will initiate changes to the culture of different societal groups. Thirdly, strong links with 'flagship' species that have meaning in the local context, e.g. through an emphasis on garden wildlife, may be a popular starting point for new projects. One species that may benefit from this specifically is the hedgehog, should local gardens form interlinked habitat, and food and nesting resources in the wider area be provided. Conversely, emphases on environmental group or society membership is likely to be less successful in engaging people on a large scale, particularly those who are motivated to participate in local activities, although this type of participation may appeal to some community members. Finally, although any participation is likely to provide positive internal transformative effects for individuals, maintaining future participation should be encouraged in order to maximise outcomes for participants, communities and conservation organisations as well as for nature conservation. Supporting ongoing participation is likely to require a partnership approach working with other organisations and pre-existing community networks in the signposting and promotion of other activities and opportunities.

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APPENDICES

APPENDIX 1

Current recording scheme participant questionnaire

Sal Hobbs
OPAL
Environment Department
University of York
Heslington
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YO10 4DD

sjh519@york.ac.uk
07581 832982

Dear Participant,

Take part and you could win £25 worth of garden vouchers!

Thank you very much for taking part in this short survey. Information about your views on wildlife recording schemes is extremely valuable for our project.

This survey forms part of a PhD, which links in to the Open Air Laboratories (OPAL) project; a national, Big Lottery funded project concerned with inspiring and engaging people with nature. As a participant of a wildlife recording scheme, your personal motivations for taking part are important as part of a wider project on why people do and don't get involved with wildlife recording and conservation.

Please answer the questions as fully and honestly as possible. All views will be kept anonymous, although quotations may be used to demonstrate particular views. If you would prefer your words not to be used, please tick this box ☐

Please also give your postcode – this will only be used to identify geographical areas of participants.

We would be really grateful if you can return your completed questionnaire by using the self addressed envelope. Alternatively, you can fill your answers online at **www.sei.se/opal.** All returned questionnaires will be entered into a prize draw to win £25 garden vouchers.

If you would like more information about the OPAL project or this research, please don't hesitate to contact me.

Thank you again for taking part, your time is very much appreciated.

Kind Regards

Sal Hobbs

Sal Hobbs
PhD Student, OPAL Project
www.OPALExplorenature.org

About the Garden BirdWatch

1. When did you first get involved with the Garden BirdWatch?

   Approximate year

2. What was the main reason(s) for you to get involved in the first instance?

3. Since starting the scheme, have your motivations for participating changed at all?

4. What are the benefits of being involved?

5. Are there any ways in which it could be improved for you?

About other wildlife recording schemes

6. Do you participate in any other wildlife recording schemes?

☐ **Yes** (please give details) →

☐ **No**

7. Have you taken part in a wildlife recording scheme and then stopped?

☐ **Yes** (please give details)

☐ **No**

8. Are you a member of any wildlife/environmental/nature related societies or groups e.g. wildlife trust, bird group?

☐ **Yes** (please specify) →

☐ **No**

That is the end of the questionnaire. Thank you again for your contribution.

If you would like to be informed about the outcome of this research, please supply a postal or email contact address.

APPENDIX 2

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Review

Open Air Laboratories (OPAL): A community-driven research programme

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ABSTRACT

OPAL is an English national programme that takes scientists into the community to investigate environmental issues. Biological monitoring plays a pivotal role covering topics of: i) soil and earthworms; ii) air, lichens and tar spot on sycamore; iii) water and aquatic invertebrates; iv) biodiversity and hedgerows; v) climate, clouds and thermal comfort. Each survey has been developed by an inter-disciplinary team and tested by voluntary, statutory and community sectors. Data are submitted via the web and instantly mapped. Preliminary results are presented, together with a discussion on data quality and uncertainty. Communities also investigate local pollution issues, ranging from nitrogen deposition on heathlands to traffic emissions on roadside vegetation. Over 200,000 people have participated so far, including over 1000 schools and 1000 voluntary groups. Benefits include a substantial, growing database on biodiversity and habitat condition, much from previously unsampled sites particularly in urban areas, and a more engaged public.

1. Introduction

Open Air Laboratories (OPAL) brings scientists and communities together to deliver a research programme focused on three environmental themes: loss of biodiversity, environmental degradation and climate change. Through regional and national projects, people of all ages, abilities and backgrounds can contribute to OPAL by observing and recording the world around them and sending their data to local and national databases for analysis and interpretation. A suite of supporting educational tools and materials is being delivered through an informal educational pathway to help develop the skills and confidence necessary to monitor flora, fauna and fungi and to investigate the conditions under which they thrive or suffer (pollution and climate). The focus is urban with emphasis on areas of deprivation.

OPAL was awarded £13 m by the UK Big Lottery Fund (BLF, 2010a) to deliver the programme. Half of the funding goes towards the research programme and half for support services. In this paper we explain how the 31 projects that form the OPAL portfolio are integrated to form a cohesive programme. We provide early insights into the pivotal role of biological monitoring in mobilising the national interests. Two regional projects are also introduced.

2. Background

The concept of sustainable development is now firmly embedded in international policy but the delivery of the objectives defined under the Convention for Biodiversity, Convention for Climate Change and Agenda 21 remain a challenge for society (UNEP, 1992). When the UK Government launched its report and action plan on sustainability (ODPM 2005), it acknowledged that governments alone cannot secure a more sustainable future. Everyone has a part to play. Community groups, the voluntary sector and the local authorities were all identified by the Government as having a critical role. The Open Air Laboratories Project (BLF, 2010b) seeks to encourage greater collaboration between these groups by supporting environmental scientists from academia and other leading institutions to direct and help deliver a research programme powered by the community.

We know that healthy ecosystems are essential for human well-being (WRI, 2005). OPAL national surveys combine observations of

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wildlife with data on air, soil and water condition; a strong emphasis is on pollution. The national approach is largely based on biological monitoring which can be described as the investigation of living organisms to give qualitative or quantitative information on the state of the environment. It is not a new concept (De Temmerman et al., 2004). In recent decades we have come to rely increasingly on instrumented measurements, modelling and a limited range of observations to monitor the state of the environment (WHO, 2006; Defra, 2010a). Collecting and analysing these data is largely the responsibility of a small number of highly trained experts and the results are generally disseminated in numerical format. Biological monitoring does not attempt to replicate measurements or modelling but can be used to supplement these data with evidence of the effects of pollutants on plants, animals and fungi. The first European Biomonitoring Standards are under development (CEN, 2010).

Through OPAL, scientists from different disciplines have worked together to develop a suite of biological monitoring surveys covering soil, air, water, biodiversity and climate. Experts train and equip regional community-based science teams who work directly with local people to deliver them. Two major national surveys of this type took place in the UK in the 1970s on the topics of water and air pollution. Environmental Pollution published the results and reported that circa 9000 people participated (Mellanby, 1974b; Gilbert, 1974). Kenneth Mellanby, in his role of editor of Environmental Pollution (1974a) said, 'We realise that such projections of these surveys will themselves need careful surveillance but their potentiality in preserving and improving the environment is one that should receive more attention.'

3. Approach

More than 60 million people live in the UK (ONS, 2009) and 90% of them are urbanised (ONS, 1998) living in an area covering less than 7% of the UK landscape (CEH, 2002). Urban accessible *per capita* greenspace is highly variable and poorly quantified, but was recently estimated at 2 ha 1000^{-1} (CABE, 2010). Ecological literacy is variously described, but can be considered in its simplest form as the naming of flora, fauna and fungi and the understanding of their relationship with each other and with the physical world, including our dependence on it (Berkes, 1999). Many of the ways in which such knowledge has traditionally been exchanged have changed and urbanisation and market-based lifestyles, combined with disconnection from land, are reducing levels of ecological knowledge (Pilgrim et al., 2007, 2008). Contact with nature is also important for good physical and mental health and childhood development (Barton and Pretty, 2010; Maas et al., 2008, 2006; Mitchell and Popham, 2008) yet urbanisation is increasingly distancing society from the natural world (Bird, 2007) and its responsibility to maintain the natural capital that provides the ecosystem services and goods essential for human well-being (Costanza et al., 1997).

Pretty et al. (2005) describes three levels of engagement with nature: i) viewing nature as through a window or in a painting; ii) being in the presence of nature; iii) active participation and involvement with nature. OPAL promotes active participation and involvement with nature and the pressures upon it from pollution and a changing climate but OPAL also encourages participants to take the next step and record their observations, develop ecological knowledge and apply it. OPAL seeks to broaden participation in environmental monitoring and management, largely the province of the expert recorder or environmental scientist, by making experts more accessible, adapting and designing tools and materials for a wider audience, and storing, analysing, interpreting and publishing the data. The main aim of OPAL is to carry out high quality research with maximum public engagement. The key objectives are to:

- encourage more people to spend time outside exploring and recording the world around them;
- develop an innovative environmental education programme to support them;
- stimulate a new generation of environmentalists;
- strengthen collaboration between the statutory, voluntary and community sectors;
- gain a greater understanding of the state of the natural environment.

4. A portfolio of projects

OPAL is delivered through nine Regional Programmes, each led by a university, five thematic Centres and an essential Support System (Fig. 1). Regional projects focus on local issues and local communities whilst national Centres address national research issues and lead on the development of the national surveys. Essential supporting services include the OPAL portal, national database, communications office, celebrations and exhibitions facilities. Projects to develop and deliver innovative educational resources and recording and mapping tools complete the OPAL programme. All staff participate in the production, delivery and promotion of the national surveys which are launched every six months, bind the OPAL team together and attract the general public.

A university-led team in each of the nine regions of England investigates issues in its locality, giving priority to areas of deprivation and to engaging with people from disadvantaged and minority groups. The topics are planned and conducted through communal activities in four ways:

- regional meetings and workshops, open days and community visits build collaboration and knowledge of local environmental issues and involve local government, government agencies, local communities and voluntary sector organisations;
- community scientists work directly with local people;
- provision of training and materials to help and support communities to participate in the five national surveys;
- research into problems of regional and local concern to engage local people and contribute knowledge to a Community Environment Report and identify best practice in community-based collaboration.

Each regional community-based science team includes a PhD student, studying a topic of regional relevance, students and volunteers. Projects are highly variable investigating loss of orchards, nitrogen deposition to heathlands, traffic emissions on roadside vegetation, urban ecology and the urban heat island effect. The programme provides opportunities for the local community to participate in the collection of data for their own use and for research purposes and to explore and understand some of the uncertainties inherent in such activities, demonstrating why scientists carry out such work and how these data can be used (i.e. address statutory obligations and policy support).

The OPAL portfolio draws on expertise across a broad range of environmental disciplines that in combination provide a strong ecosystem-based knowledge bank to support the successful delivery of the portfolio. The OPAL Air Centre includes sixteen Open Top Chambers where fumigation studies on individual plants and plant communities are being used to investigate effects on

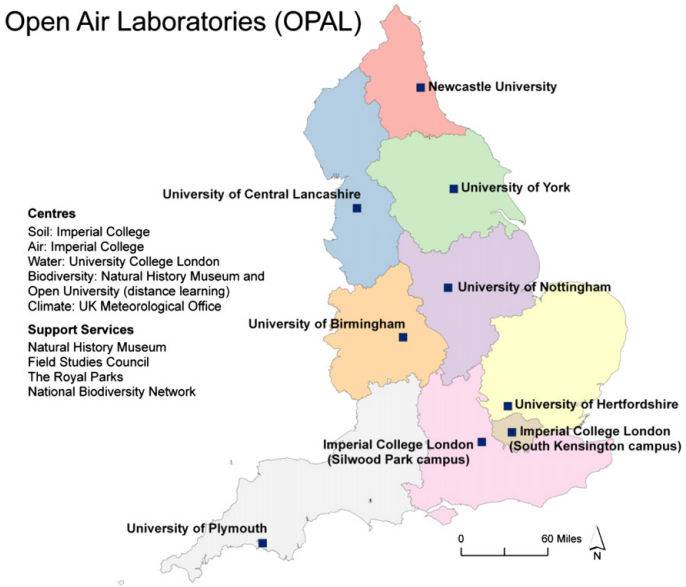

Fig. 1. Location and name of each regional university, centre and support organisation.

ecological functions, with the current focus being on ozone and grassland plants. The OPAL Water Centre investigates the condition of lakes and ponds in England with respect to pollution impacts. The research aims to identify the scale of contamination from trace metals (mercury, lead, cadmium, copper, nickel and zinc) and certain persistent organic pollutants in the water, aquatic organisms and sediment of selected ponds and lakes, with the objective of assessing the effects of these pollutants on the freshwater ecosystem. The OPAL Soil Centre investigates sites across England, sampling soils and recording earthworms. The objective is to learn more about soil pollution, its sources, how it moves through the soil and how it affects soil condition. A key component of the research is the relationship between soil condition and earthworm distribution. The focus is on inner-city areas, where soil condition is poorly quantified and pollution loads often elevated. This research will help with the future management of soil condition, particularly in urban areas.

The UK Meteorological Office is leading the climate education programme and, along with the Royal Parks, is installing meteorological monitoring stations to support the OPAL urban heat island research programme. The remaining projects focus on the very important topic of biodiversity and are geared more towards education, provision of supporting services and importantly, the promotion and understanding of taxonomy, the role and rejuvenation of natural history societies and services associated with online biological recording. All data gathered through OPAL will be used towards the production of the Community State of the Environment Report to be published in 2012.

5. National surveys

OPAL's success depends on close collaboration within the partnership as well as externally, working closely with government departments and the Environment Agency of England and Wales, in all aspects of project development. Whilst partners are responsible for organising their own research, everyone has a part to play in the development and delivery of the national surveys. Each survey explores the relationship between a group of organisms (biotic) and habitat quality (abiotic) and promotes current policies that address pollution and environmental protection. All monitoring packs include an explanation of the topic, references to policy (e.g. air quality guidelines) and instructions on how to complete the survey. Three surveys have been launched to date and three more are scheduled. 40,000 packs are produced for each survey with half going directly into schools and the remainder to local communities. Packs can be downloaded from the website where results should be submitted once the surveys have been completed (OPAL, 2010). Repeat sampling is encouraged.

6. Soil

The soil pack contains a laminated field guide and earthworm key, a workbook, pH strips, a ×4 magnifier, vinegar (for a soil fizz test) and mustard sachets (a slight irritant that, when diluted, mobilises earthworms to the surface). The first task is to select a site and record local features and location details. The main activity is to dig a soil pit (20 cm × 20 cm square × 10 cm deep), record the number of earthworms found and identify them to species level (identification key provided to 12 common species) and assess the soil condition. The following soil parameters should be recorded: presence of roots, presence of other objects (bricks, glass etc.), soil compactness (pencil test), and the presence of carbonates (fizz test), moisture content, soil pH, soil texture (key provided), soil smell, soil colour.

7. Air

The air pack contains a laminated field guide and lichen identification chart, workbook, a ×4 magnifier and a tree identification guide. The first task is to select a site and record the location and

local features. Online mapping tools are available to help with the grid reference. The main task is to select up to four trees, identify them, measure their girth, record the presence and abundance of nine lichen (key provided to genus level) that are considered to be adversely affected by, or stimulated by, reduced or oxidised nitrogen or else neutral with respect to either of these. Also, the number of other lichens present and any insects, identified to broad groups, should be recorded. A second activity requires participants to survey sycamore (*Acer pseudoplatanus*) trees to record the presence and abundance of *Rhytisma acerinum*, a pathogenic fungus that manifests as tar spots on the leaves. Research suggests that this fungus is sensitive to oxides of nitrogen (Bell et al., 2004; Jarraud, 2000).

8. Water

The water pack contains a laminated field guide and identification chart to aquatic invertebrates, a workbook, an 'Opalometer' disc to measure water clarity (Fig. 2), a ×4 magnifier, pH strips, a ponds and lakes wall chart (compiled by the organisation Buglife), a guide to duckweeds (Botanical Society of the British Isles), a guide to amphibians (Amphibian and Reptile Groups of the UK) and a guide to dragonflies and damselflies (British Dragonfly Society).

Tasks include selecting a lake or pond and recording local site features; taking a water sample for the clarity test using the 'Opalometer' and measuring water pH; invertebrate sampling using a standard net-sweep approach and identification of selected invertebrates to group level (where these have been assigned a 'pond health' rating). This enables a 'health' score to be calculated for the lake or pond.

All survey data can be entered on the OPAL database (OPAL, 2010) or submitted by post. Results are immediately visible (Fig. 3).

9. Early results

9.1. OPAL participants

To date over 7000 sites have been surveyed and results submitted to the website (Table 1). More than half of the results are from school children. We know that thousands more participants have carried out surveys although they have not all submitted their data. The low number of records submitted to the online database has been of particular concern. The main reasons given for this are: i) enjoyed the activity but did not want to enter data on the computer, ii) did not have access to a computer, iii) lacked confidence in their data. OPAL targets minority groups, disadvantaged sectors of society and areas of deprivation (DCLG, 2007). Of the data analysed so far, 46% of survey packs went to schools in deprived areas and 14.4% of soil surveys were completed in the top 20% of deprived areas. It is recognised now that computer access is a major issue in deprived areas so a postal service has been introduced.

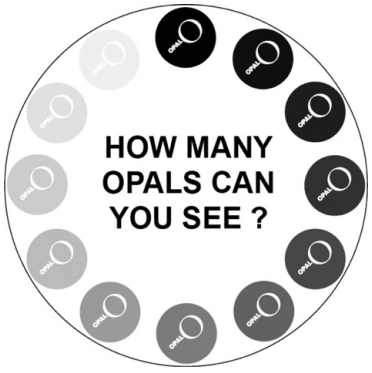

Fig. 2. Opalometer developed by University College London for the water clarity test.

9.2. National survey data

Data from over 3000 soil surveys have been entered online to date. Nearly 70% of these records are from urban or suburban locations and 74% are within 100 m of a road. Half of all surveys were either carried out in gardens (24%) or playing fields (26%). The majority of sites showed no obvious signs of pollution with just 5% reporting sour, putrid or chemical smells, suggesting contamination. Soil pH was in the range of 5.5–6.0 at 45% of the sites described as urban garden, whereas woodland and heathland results had a lower pH range of 4.0–5.0. Nearly a quarter of surveyors did not record any earthworms during their survey. Of those pits with earthworms, the mode was two earthworms. The mean number of earthworms found by site classification was: gardens, 7.4; playing fields, 6.1; woodlands, 4.0; heathland, 2.3. The most frequently recorded species was *Lumbricus rubellus* (11% of adult species), followed by *Aporrectodea longa* (10%) and *Aporrectodea caliginosa* (9%). *Eisenia fetida* (also 9%), associated with compost heaps, was found in 16% of the gardens.

Participants in the air survey have submitted almost 3000 survey records to date and these are currently being analysed. They include data from 6130 trees (mainly oak, ash and sycamore), 30% of which are located close to roads. The most widely recorded lichen genera are *Xanthoria* and *Physcia*, both associated with eutrophicated conditions and indicative of high nitrogen deposition (Barkman, 1958; van Herk, 2002; Davies et al., 2007). An instant condition score is calculated when data are submitted. It currently shows that the majority of records are of nitrophytic species. Over 2000 water surveys have been submitted in the first three months of the survey. These first data have not yet been analysed but the pond health score shows that the majority of waterbodies are rated in the intermediate water quality range.

9.3. Regional Projects

Projects differ from region to region and within region. Here we give just two examples taken from two different regions.

The London regional team receives meteorological data from 36 weather stations located in schools across London. This dense network of monitoring stations was initiated through the London Grid for Learning (LGFL, 2010), a facility developed by local government to encourage collaboration between schools, using broadband. OPAL updated the network of weather stations and developed an associated research and education programme. The meteorological stations (Davis vantage Pro2 Plus automatic weather stations) measure temperature, precipitation, pressure, solar radiation, relative humidity, wind speed and direction and UV radiation. These data are being used by scientists, primarily for model validation and for projects in schools. Solar radiation data were recently used in a campaign to map particulate transport into and out of London. A comparative study of a range of models and measurements was undertaken including data from a mobile lidar and airborne instruments, aerosol optical depth profiles from satellites, ground-based measurements of PM_{10} and $PM_{2.5}$ from the Automated Urban Network (Defra, 2010b) and data from various air quality forecasting models. OPAL schools participated and the OPAL

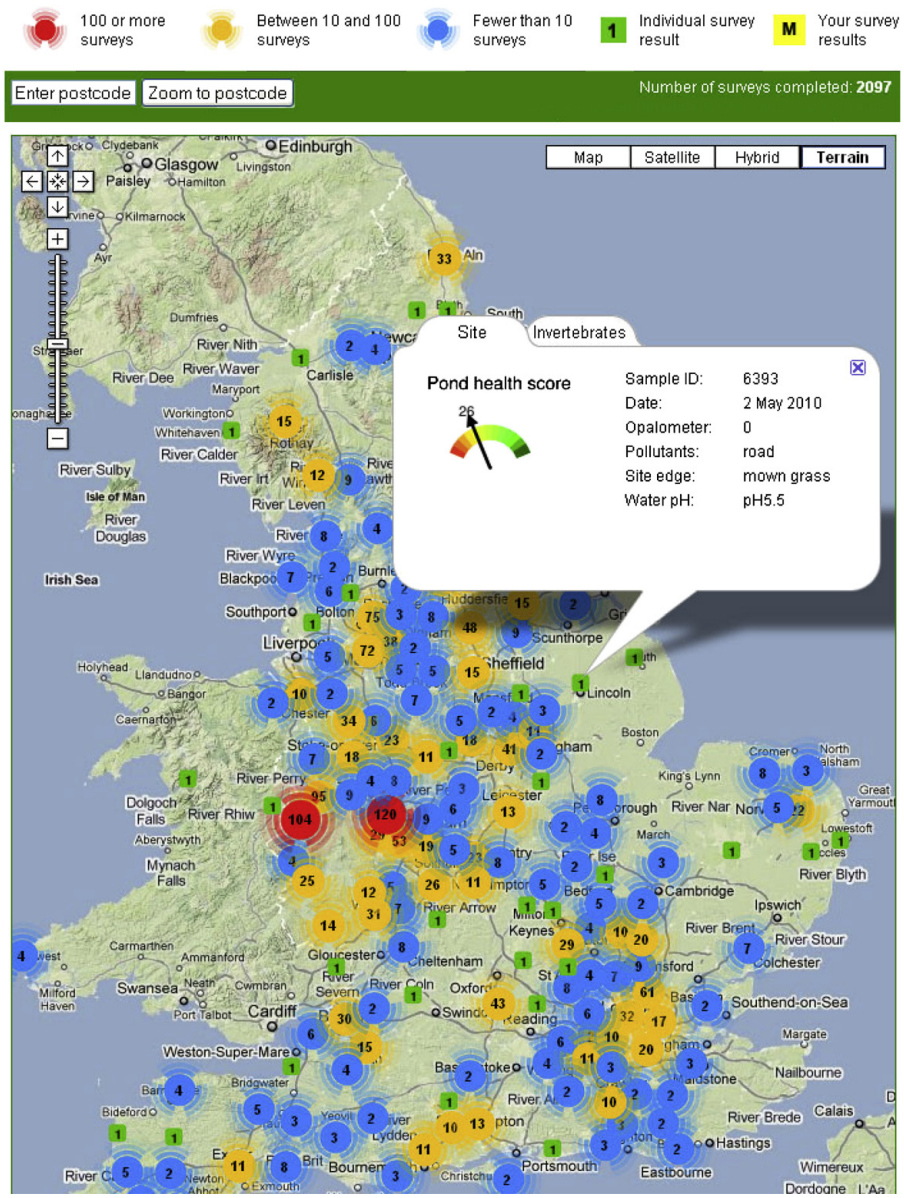

Fig. 3. OPAL results map and instant water quality assessment score.

network detected the correct pattern of aerosol transport on the date of the measurement campaign.

In contrast, the University of York is working with local communities on urban ecology. The research programme is extensive and illustrated here with just one project on small mammals. York is investigating the way that hedgehogs use urban resources and the value of different urban habitats by working in one of the most deprived parts of Hull. Hull is a long established foreign-trading port, but is also one of the cities in the UK which has been most adversely affected by job losses in recent years. The research examines the motivations and barriers to participation in wildlife recording and monitoring. In particular, it focuses on the transformative effects of involvement in such projects, for example changes in participants' perceptions of environmental issues. The first phase of the study involved hand-delivery of postcards to households in the area to elicit interest in participation (a small

Table 1
Groups submitting survey data (June, 2010).

	Soil	Air	Water
Schools	1906	1333	1203
Individuals	740	384	+
Voluntary groups	461	270	279
Family	*	326	343
Other	27	33	–
Total	3134	2346	1825

*Data not requested for soil surveys.
+ Recommendation not to complete the survey alone due to health and safety issues.

cash incentive was offered) and to ask five simple questions exploring wildlife sightings and garden features. Over 10% of households responded to the survey and, of these, just over half had seen a hedgehog and 74% said they were willing to participate in a further study. Questionnaires were developed and despatched to investigate the ecological resource of gardens in the area, record hedgehog sightings and explore motivations and barriers to participation.

The top three motivations for taking part were: i) to help conservation of wildlife; ii) to contribute to a study about the local area; and iii) because participants liked hedgehogs and other wildlife. Just 7% of respondents had taken part in wildlife recording in the past and 83% gave lack of awareness of recording opportunities as the reason for this. Nearly half of respondents said involvement in the study had led them to think differently about wildlife in their area.

10. Discussion

Evidence of the increasing devolvement of the public from nature (Bird, 2007), the inverse correlation between ecological knowledge and economic development (Pilgrim et al., 2008) and the issues associated with engaging communities in sustainable development (ODPM, 2005), suggests that the general public is not sufficiently interested in the natural environment to respond to the environmental challenges (UNEP, 1992). Experience with OPAL provides evidence that this is not the case. It is perhaps the opportunity to participate and the knowledge and skills to do so that are not now as readily available as in the past.

OPAL has been fully operational for just over a year so it is too early to provide statistically significant data on public engagement. Over 200,000 people have participated to date against a target of 500,000 by 2012. In addition over 1000 schools and 1000 organisations have started working with us. Of those questioned, the majority report a very positive experience. The vast majority state that it is the first time they have participated in a monitoring activity, that they want to continue to develop and apply their new skills and that they now think differently about their local environment. Media interest and public participation is rising. This trend is reflected in the requests for survey packs, an accelerating rate of national survey data submissions, requests for repeat visits to schools and community groups, increases in web hits and positive statements in evaluation forms and through emails. An ethnographic study, online and field-based questionnaires and other evaluation techniques are in place and the results will be published in due course.

It is interesting to review the differences between the surveys carried out in 1971 (water) and 1972 (air) and the OPAL surveys. These earlier projects were developed in collaboration with the education authorities and were advertised through a national newspaper campaign. A fee was charged so only those keen to participate and willing to pay received survey packs. Conversely, OPAL is free, targets audiences largely not actively engaged in ecological issues and focuses on areas of deprivation. The general public can order a survey but the majority of OPAL packs are allocated to schools and community scientists before the survey launch although thereafter pack materials can be obtained by downloading them from the OPAL website.

There is also a substantial difference between the number of people receiving survey packs and the number of results submitted. During the 1972 campaign 15,000 lichen survey packs were ordered, mainly by children, but less than 1000 results were received for analysis (Gilbert, 1974) compared with 40,000 OPAL packs with nearly 3000 surveys completed to date. This suggests that difficulties occurred in the practical application of the 1972 survey. The acidic conditions that prevailed in the 1970s have since been controlled; lichen diversity in polluted areas then was very low and surveyors had to search for lichens on a range of substrata, not just for epiphytes as in the OPAL survey. Air quality has changed and this is reflected in a more diverse flora across England, particularly in cities and areas of intensive agriculture where eutrophication is now stimulating lichen growth and nitrophytic species dominate. The river water survey was exceedingly popular in the 1970s and of 10,000 packs ordered 8000 participants (peak age range 10–13) completed the surveys, largely unsupervised. By contrast the OPAL water survey focuses on lentic waterbodies and a major emphasis during its development was on 'health and safety', including the requirement for children to be supervised at all times when close to water. Although it has proved to be the most popular of the OPAL surveys so far there is a long way to go before OPAL data reaches the 8000 water survey records submitted in 1971 (Mellanby, 1974b). Results from both periods will be analysed and discussed in the OPAL Community Report in 2012.

Data quality is important and considered carefully in the planning of the national surveys.

One of the most frequently quoted reasons for non-submission of national survey data is lack of confidence in the data collected, so we know that participants are aware of the importance of data quality. Community-based studies led by OPAL staff often lead to discussions on uncertainty as participants compare their results and recognise the degrees of variance. There are many reasons for these differences but through working together these issues can be explored to the benefit of both science and society. The national survey data are largely collected by people new to recording, so errors do occur; nevertheless, correlations are being identified, trends are being explored and new research is being developed and targeted accordingly.

Efforts have been made to minimise and quantify uncertainty. For example, the total number of earthworms found is a more reliable measure than the identification of earthworms to species level. Nevertheless, interest is in species level data so various parameters are introduced to reduce error, such as recording the length of earthworm specimens to help validate species identification. To further investigate confidence levels, 579 earthworms identified by the public were examined by an earthworm specialist to quantify the proportion of misidentifications. Overall, adults identified two-thirds of specimens correctly, whereas children correctly identified just over half of their specimens (Jones, in preparation). However, certain species were consistently easier to identify than others, thereby providing more reliable results for those species. For example, adults identified more than 95% of all *Aporrectodea longa* specimens correctly but misidentified about two-thirds of *Octolasion cyaneum* specimens. The most frequently recorded species showed similar distribution patterns as the Natural History Museum's Soil Biodiversity Group's extensive earthworm database. Similar validation exercises have been carried out for soil properties (OPAL Soil and Earthworm Report, 2009).

Although results indicate spatial variability in soil properties, national surveys lack a methodological sampling strategy. To address this issue, sampling campaigns can be developed to improve spatial coverage and increase sampling density. One of the objectives of the soil research is to investigate the value of combining multiple soil properties to evaluate soil status (Bone et al., 2010).

The air survey validation exercise includes similar comparative studies. Simple characters were used when selecting lichens for the survey such as thallus colour and presence of cilia, but errors are occurring between taxa within the same sensitivity group. Preliminary results suggest that the three most sensitive, fruticose lichens, the nitrophobes, are regularly misidentified but this does not affect the overall OPAL pollution scoring system. The water survey team has developed an online photographic tool that tests participants' knowledge of six common species after they have entered their results online. Their score is then used as an indication of the reliability of their results. These examples illustrate just a few of the approaches applied in the development of the national surveys to improve data quality and reduce uncertainty.

Trends identified in data received to date across all three surveys are broadly consistent with existing data although it should be noted that urban data are not widely collected. The most frequently asked questions from participants are about the meaning of the results; what has been learnt, how will the data be used and by whom? It is clear that people want to know about their environment and want to contribute to protecting it.

11. Conclusions

Monitoring the state of the environment using plants, animals and fungi has proved to be very popular with the public. Awareness of the relationship between anthropogenic pollution and harm to the natural environment has been heightened through these activities. These simple tasks have provided an opportunity for communities to learn more about their local environment and to contribute to the steps needed to protect it. Participants from all ages, backgrounds and abilities are actively involved. They are discovering the wildlife where they live and work and understanding more about pollution in their local area. Expertise has been harnessed to build and deliver this programme. Scientists have made significant changes to their approach to research to support and deliver these activities and communities have embraced them allowing knowledge from a few experts to permeate into the heart of a community. We are only just beginning to analyse data about the state of the environment, explore public motivation and quantify transformative effects, but there is little doubt that the public want to be engaged in observing and recording the world around them; they just need the means to do it and for the value of their contribution to be recognised. OPAL provides evidence to support Mellanby's (1974a) suggestion that the potential of public observations in preserving and improving the environment should receive more attention. Further benefits are accrued through improved well-being (Bird, 2007; Barton and Pretty, 2010; WRI, 2005) and a positive contribution to sustainable development (ODPM, 2005).

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Five Centres: Soil, Imperial College London (Dr N. Voulvoulis); Air, Imperial College London, (Dr S.A. Power); Water, University College London (Dr N. Rose); Biodiversity, Open University (Professor J. Silvertown)& Natural History Museum and Climate, Meteorological Office (Dr G. Jenkins).

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APPENDIX 3

Garden wildlife recording scheme postcard design

Slime & Spine 2009

The Hull Wildlife Survey

Take part and WIN!!

Slime & Spine 2009 - The Hull Wildlife Survey

WIN £50 ARGOS VOUCHERS

Everyone who takes part in this study will enter a prize draw to win a £50 Argos voucher.

WE NEED YOUR HELP

In Britain, much of our wildlife is under threat. As our towns grow, green spaces such as parks and gardens are becoming vital for wildlife.

Amphibians (frogs, toads and newts) and hedgehogs are animals that can live in gardens and green spaces, however very little is known about where they live in Hull.

Please help us by answering the five questions on this postcard. All answers are important to us, even if you don't have a garden, or have never seen an amphibian or hedgehog in it.

IT'S EASY TO TAKE PART!

What to do:

Tick the boxes on the right and put this postcard in your window (so we can read your answers) or on your doorstep on **Friday 18th September.**
Alternatively you can enter your answers online at:
www.sei.se/opal

We will not knock on your door

To take part in the survey, please tick the boxes as appropriate

1. I have: **A garden** ☐ **A yard** ☐

No outside space ☐

2. I have a pond: **Yes** ☐ **No** ☐

3. I have seen a frog/toad/newt in my garden (in the last 2 years)

Frog are green/ brown, wet skin, with a dark patch behind eye

Frog ☐ **Toad** ☐

Toads are flatter, brown, dry and with bumpy skin.

Newts are brownish/ green, four legs of same length and have a tail.

Newt ☐

4. I have seen a hedgehog in my garden (in the last 2 years)

Yes ☐ **No** ☐

5. I am interested in taking part in a further garden survey

Yes ☐ **No** ☐

For details about this study, email Sal Hobbs on sjh519@york.ac.uk or ring on 01904 434074

Supported by The National Lottery® through the Big Lottery Fund

BIG LOTTERY FUND

THE UNIVERSITY of York

DISCOVER OPAL

APPENDIX 4

Hull residents follow-up questionnaire

DISCOVER OPAL

THE UNIVERSITY of York

LOTTERY FUNDED

February 2010

Dear Participant,

Thank you very much for taking part in Slime & Spine 2009. We are delighted with the results of the postcard survey. More than 550 people took part, revealing that there has been a large number of amphibians and hedgehog sightings in Hull gardens in recent years.

As you indicated that you are interested in taking part in a further garden survey, you have been sent this short questionnaire. It investigates further into how these animals are using urban green spaces, and how important Hull gardens are to wildlife within the city.

A summary of the results of the postcard survey are enclosed in this pack, along with information about how you can get involved with hedgehog surveys in Spring 2010. If you have any questions or comments, please do not hesitate to contact me on sjh519@york.ac.uk, or ring the Hedgehog Phone: 07581 832982.

We would be really grateful if you can return your completed questionnaire by using the self addressed envelope. Alternatively, you can fill your answers online at **www.sei.se/opal.**

Your answers are really important to us,

Thank you,

Sal Hobbs
and The OPAL team

Poster Competition

Are there children in your household that would like to take part in our poster competition? We are asking for children up to the age of 18 to design a poster entitled **'a hedgehog in my garden'.** Posters can be sent back with the completed questionnaire in the envelope provided. Please write the name and age of the entrant on the back of the poster.

All posters submitted will be put up on our website and we will be awarding prizes to the most eye-catching art work!

The Questionnaire

Unless specified, please TICK all boxes that apply. Please do NOT use crosses to indicate positive answers.

Let's put Hull's wildlife on the map!

So that we can put all our survey results onto the map, please provide your address and postcode. As before these details will not be shared with anyone else and we will not send you anything else unless you request it below.

House number…….. **Street Name……..**

Postcode……... **Email address……..**
(if preferred contact method)

About your garden

1. How large is your garden? Please give an estimate in metres or feet

_____metres long x _____metres wide

OR

_____feet long x _____feet wide

2. Do you have cats or dogs? (if more than one, please indicate how many)

☐ **Cat(s)** ☐ **Dog(s)**

3. Does the boundary of your back garden (e.g. fence or wall) have gaps under or around it so that wildlife such as hedgehogs might get into and leave your garden easily?

☐ **YES** ☐ **NO**

4. During the summer months would you describe your back garden lawn as: (please tick one)

☐ **Very short – I mow it regularly**
☐ **Medium length – I mow it every few weeks**
☐ **Long – I do not mow often**
☐ **I do not have a lawn**

5. Do you provide any of the following features for wildlife in your garden?

☐ **Bird nest box**
☐ **Bird feeder/table**
☐ **Food for other wildlife (please explain)** →
☐ **Log pile**
☐ **Other (please explain)** →

The Questionnaire

Unless specified, please TICK all boxes that apply. Please do NOT use crosses to indicate positive answers.

About your pond

If you do not have a pond, please go straight to question 9

6. How big is your pond?

- ☐ **Small** (less than 1 metre x 1 metre or 3 feet x 3 feet)
- ☐ **Medium** (up to 5 metres x 5 metres or 15 feet x 15 feet)
- ☐ **Large** (bigger than 5 metres x 5 metres or 15 feet x 15 feet)

7. Do you have any plants in your pond? Please tick all that apply.

- ☐ **Plants around the edge (includes grass)**
- ☐ **Plants with leaves that float on the water**
- ☐ **Plants that grow completely underwater**

8. Animals in your pond. In 2009, have you seen any of the following animals **in your pond?**

- ☐ **Fish**
- ☐ **Adult frog(s)**
- ☐ **Adult toads**
- ☐ **Adult newts**
- ☐ **Frog/toad – not sure which**
- ☐ **Frog spawn (eggs in clumps)**
- ☐ **Toad spawn (eggs in strings)**
- ☐ **Tadpoles**
- ☐ **Baby newts/ 'newtpoles'**

Animals in your Garden

9. In **2009**, did you see any of the following animals **in your garden?**

- ☐ **Frogs**
- ☐ **Toads**
- ☐ **Adult hedgehogs**
- ☐ **Young hedgehogs**
- ☐ **A hedgehog nest**
- ☐ **Frog/toad – not sure which**
- ☐ **Newts**

Any other wildlife you'd like to report

If you saw **hedgehog(s),** how often did you see it/them?

- ☐ **A few times a week**
- ☐ **About once a week**
- ☐ **A few times a month**
- ☐ **About once a month**
- ☐ **Only a few occasions**
- ☐ **Only saw it/them once**

The Questionnaire

Unless specified, please TICK all boxes that apply. Please do NOT use crosses to indicate positive answers.

A Bit about You…..

10. Are you a member of any wildlife/environmental/nature related society or group e.g. wildlife trust, bird group?

- ☐ **Yes (please specify)** →

- ☐ **No (any particular reason why not?)** →

11. Why did you decide to take part in this study?

Please give your top five reasons, with the most important as number 1 and the least important as number 5.

- ☐ **The money prize**
- ☐ **It was easy and quick to do – why not?**
- ☐ **I enjoy doing surveys**
- ☐ **Someone else wanted me to do it (children/friends/family/neighbours)**
- ☐ **I thought it would be fun to do with someone else (children/ friends)**
- ☐ **Because I like hedgehogs/frogs/toads/newts**
- ☐ **Because I am enthusiastic about my garden**
- ☐ **To be part of a scientific study**
- ☐ **To contribute to a study about my local area**
- ☐ **Because I see this wildlife in my garden and want to tell someone about it**
- ☐ **To help the conservation of wildlife**
- ☐ **Because I'd like to be involved in further wildlife studies**
- ☐ **Because I thought I might learn something new**
- ☐ **Other, please specify** →

The Questionnaire

Unless specified, please tick all boxes that apply. Please do NOT use crosses to indicate positive answers.

12. Have you taken part in a study like this before? (where you're asked to record wildlife that you've seen and send it to someone)?

☐ **Yes** → If so, which one and how did you find out about it?

☐ **No**

If not, please state any particular reason, e.g. weren't aware of it happening, not enough time, not interested in the wildlife involved….

13. As well as finding out where wildlife is found in Hull, one of the objectives of the OPAL project is to raise awareness of British wildlife. Has your involvement in this study led you to think any differently about wildlife in your area?

☐ **Yes** → Please explain

☐ **No**

14. Would you be happy for a scientist from the University of York to contact you about visiting your garden to asses its features as part of this study?

☐ **Yes**

☐ **No**

If you would like to learn more about the things covered in this study, we are happy to send you further information. If you are interested, please indicate this below;

☐ **More wildlife recording surveys like this**

☐ **Information about local groups and opportunities to help you learn more about nature in this area**

☐ **Getting involved in practical environmental tasks in your local area.**

☐ **Learning more about encouraging wildlife in your garden.**

☐ **No thanks**

☐ **Anything else (please specify)** →

APPENDIX 5

Fact sheets posted to questionnaire respondents

Wildlife Recording Surveys

This sheet gives details of some of the wildlife recording schemes that you can take part in, either in your garden, or in a local park or green space.

OPAL Surveys

OPAL (Open Air Laboratories) is funded by the Big Lottery Fund and has produced a range of surveys that anyone can get involved with. The themes of these surveys are Soil and earthworms, Air quality and lichens, Water, Biodiversity, and Climate Change. To request a free survey pack, contact Sarah West via opalproject@york.ac.uk, 01904 434577, or for more information go to www.OPALexplorenature.org

RSPB Big Garden Birdwatch

Every year in January, the RSPB asks people to count the number of birds they see in their garden in an hour. To take part, visit www.rspb.org.uk/birdwatch/ or contact the RSPB on 01767 693690

BTO

The British Trust for Ornithology runs a garden bird survey throughout the year. Participants send in weekly records of the birds they see in their garden. This charity charges participants to take part, but in return you get a magazine and a free book.To take part, call 01842 750050 or go to www.bto.org/gbw

Harlequin Ladybird Survey

The harlequin ladybird is a recent arrival to Britain, and the Harlequin Ladybird Survey aims to monitor the spread of this species across the country. Simply contact www.harlequin-survey.org if you see one of these ladybirds, or write to Helen Roy, Centre for Ecology & Hydrology, Maclean Building, Benson Lane, Crowmarsh Gifford, Wallingford, Oxon OX10 8BB for more information.

Butterfly conservation

Butterfly Conservation is a charity dedicated to saving butterflies, moths and the places they live. They run a range of different surveys, including “Butterflies for the New Millennium” which you can take part in from your back garden or local part. Contact Butterfly Conservation on 01929 400209 or visit www.butterfly-conservation.org

Pond conservation – Big Pond Dip

Pond Conservation organise a Big Pond Dip once a year, and they want people who have ponds in their gardens to take part. For more information contact them on 01865 483249 or visit www.pondconservation.org/uk/bigponddip

British Waterways wildlife survey

British Waterways manage many rivers and canals, and they are keen to get people involved in recording the wildlife they see when they visit these sites. Contact British Waterways on 01923 201120 for information about their Wildlife Survey, or visit www.waterscape.com/wildlifesurvey

Environmental groups

There are a range of nature-related groups in Hull that are always looking for new members, this sheet gives details of some of these.

East Yorkshire Bat Group

The East Yorkshire Bat Group helps to conserve bats by carrying out surveys, caring for injured bats, putting up bat boxes and giving talks and advice to people about bats. They run events throughout the year. Contact Tony Lane on 01482 844800 or by email tlane05@tlane05.karoo.co.uk.

Hull Valley Wildlife Group

Hull Valley Wildlife Group has a members hut at Tophill Low, near Huttons Cranswick, and aims to improve and preserve the natural history of the area. Contact Andrew Tongue on 01482 803905

Hull Natural History Society

Hull Natural History Society run events throughout the year and new members are always welcome. The group was founded in 1880 and their aim is to record, study and conserve wildlife in Hull. Their website has an events listing on it, which includes indoor meetings and monthly trips to nature reserves www.hullnats.org.uk.

Yorkshire Wildlife Trust

YWT manages around 80 reserves in Yorkshire, the nearest to Hull are Pulfin Bog and Keldmarsh near Beverley. They also run a project called “Making Space for Wildlife” in Hull, details can be found at http://www.ywt.org.uk/making_space_for_wildlife.php or telephone their office on 01904 659570

Hull Friends of the Earth Group

Hull FoE Group meet on the first Tuesday of every month at 7.30pm. They publish a newsletter 4 times a year giving information about environmental issues in Hull. They run events throughout the year, including a Green Fair and tree planting. They also have an allotment. Contact Sue Jolliffe on 01482 845 958 for details, or see www.hfoe.org.uk

Practical Environmental Tasks

Volunteering with a conservation group is a great way of getting a bit of fresh air and exercise, meeting new people and making a difference for communities and wildlife in your local area. There are a number of conservation groups active in Hull.

Bransholme Enterprises

For those out of work, Bransholme Enterprises run free, accredited training courses in horticulture and gardening. Every Thursday they hold volunteer work days, where you can learn about gardening and meet new people. On Wednesdays people can volunteer to work in the woodland. They also run occasional events such as tree planting days and open days. Contact 01482 821467 or email info@bransholme.enterprises.co.uk, or go to www.bransholmeenterprises.co.uk .

BTCV

BTCV is a practical environmental education charity. The organisation has an office in Adelaide Street, and they run practical tasks every weekday that anyone can get involved with. You can volunteer regularly and receive training which could help you get a job in conservation, or you can volunteer as little as you like. Contact the office on 01482 620 309 for details of upcoming tasks.

Yorkshire Wildlife Trust

YWT manages around 80 reserves in Yorkshire, the nearest to Hull are Pulfin Bog and Keldmarsh near Beverley. You can help manage their reserves by taking part in their work days. They also run a project called “Making Space for Wildlife” in Hull, details can be found at http://www.ywt.org.uk/making_space_for_wildlife.php or telephone their office on 01904 659570

Wildlife in your Garden

Gardens can be fantastic places for all sorts of wildlife to live. The organisations listed below can help you make your garden more friendly for wildlife.

RSPB

The RSPB have masses of information on their website about wildlife gardening. See http://www.rspb.org.uk/wildlife/wildlifegarden/ for details of their project called “Homes for Wildlife”. You can get information about the wildlife you might see in your garden and fact sheets about how to encourage wildlife into your garden. If you’re not on the internet, try calling the RSPB on 01767 693690 and asking about their “Homes for Wildlife” project.

Wild About Gardens

This is a joint project between the Wildlife Trusts and the Royal Horticultural Society. Their website http://www.wildaboutgardens.com/ aims to give people advice, inspiration and the knowledge to help make their garden a better place for wildlife, whatever the size of their garden! The site includes helpful sheets on “what to do this month” and what wildlife you should be looking out for each month.

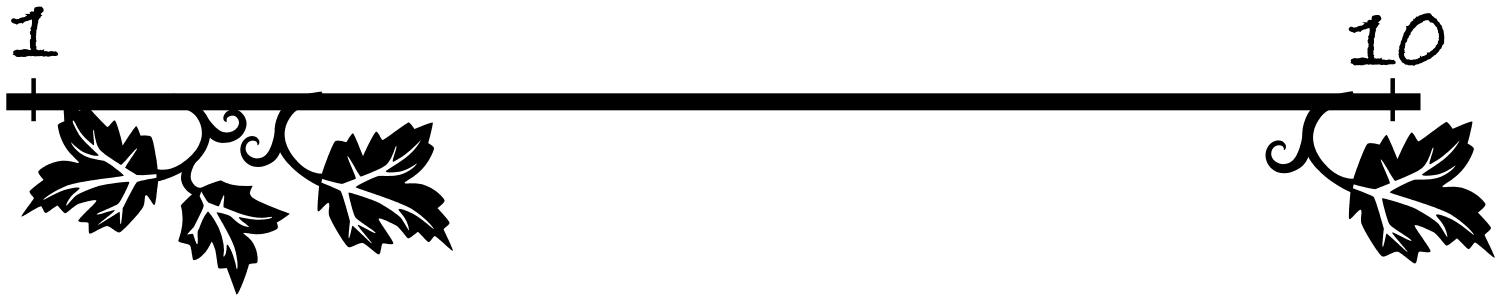
Pond Conservation

Pond Conservation is a national charity dedicated to protecting wildlife of freshwaters, including ponds. They provide information on creating and enhancing ponds for wildlife www.pondconservation.org.uk 01865 483249.

APPENDIX 6

The Engagement Scale

The Engagement Scale



APPENDIX 7

Environmental activities advertisements

Source: Yorkshire Post {Main}
Edition:
Country: UK
Date: Friday 19, March 2010
Page: 7
Area: 187 sq. cm
Circulation: ABC 47760 Daily
BRAD info: page rate £9,856.00, scc rate £16.00
Phone: 0113 243 2701
Keyword: British Waterways

Survey appeal as kingfishers hard hit by harsh winter

THE harsh winter may have significantly reduced numbers of kingfishers on the UK's rivers and canals British Waterways said today, as it began its annual wildlife survey.

The organisation, which looks after 2,200 miles of the nation's waterways, is calling on people to head to their local canals, rivers, reservoirs or docks to spot birds, animals and insects.

This year' British Waterways is focusing its survey on kingfishers, amid fears the frozen waters and icy temperatures experienced for weeks on end this winter could have hit the bird hard.

WORRIES: Kingfishers may have suffered greatly in the big freeze.

Mark Robinson, British Waterways' national ecology manager, said that although nature was "pretty resilient" to events such as the hard winter, many species would have suffered.

"The good news is that our waterways act as green corridors connecting towns, cities and farmland and providing vital shelter and a winter larder for wildlife struggling to survive."

But he said some species would have been particularly hard hit.

According to British Waterways, the harsh winter of 1962/1963 killed off between 80 and 90 per cent of kingfishers.

"Frozen water and plummeting temperatures may have significantly reduced kingfisher populations, with the possibility that many lost the battle against the cold.

"It is therefore particularly important for us to monitor what species will need our support over the coming year and we're asking the public to help us do that," Dr Robinson said.

He added: "Now that the weather has warmed up, kingfishers are starting to nest and so now is a great time to see them."

British Waterways is raising money to improve habitats for birds found on the waterways, including providing nesting tunnels for kingfishers and preserving their perches.

The measures also include providing reedbed habitat alongside canals and in reservoirs for rare bitterns and reed buntings and putting up nest boxes for grey wagtails nesting near lock gates and for barn owls.

Last year, the survey recorded more than 42,500 sightings including almost 300 different species of birds, amphibians, reptiles, insects and mammals.

Reporting findings is easy using a simple form on the www.waterscape.com/wildlifesurvey website. It also includes a map showing which species have already been spotted and where.


THE
Mammal
SOCIETY
Join Us and help conserve Britain's mammals.
The Mammal Society is the only organisation dedicated to the study and conservation of all mammals of the British Isles.
The Mammal Society:
• Surveys mammals and their habitats to identify the threats they face, monitor population changes and halt declines before it's too late
• Advocates conservation plans based on sound science
• Educates people of all ages about British mammals, their ecology and conservation through our training workshops and at our annual events
• Provides current reliable information on mammals through our publications, available on our website
• Supports an extensive local group network so you can get involved in mammal conservation on your doorstep
To become a member and get involved in mammal conservation today, visit
www.mammal.org.uk
or fill out the form overleaf.

If this membership is for you:

Your Name: _____

Address: _____

_____

_____

Postcode: _____

Telephone: _____

To reduce the amount of paper we use, please provide a current email address below.

Email: _____

If this membership is a gift for someone else:

Their Name: _____

Address: _____

_____

_____

Postcode: _____

Telephone: _____

To reduce the amount of paper we use, please provide a current email address below.

Email: _____

I would like to contribute to the conservation of British mammals with a monthly/annual membership of:

ADULT (UK/RoI only)	£25* Yearly ☐	£2.10 Monthly ☐	STUDENT (UK/RoI only)	£12.50* Yearly ☐	£1 Monthly ☐	CONCESSION (UK/RoI only)	£12.50* Yearly ☐	£1 Monthly ☐
JOINT (UK/RoI only)	£30* Yearly ☐	£2.50 Monthly ☐	OVERSEAS	£30* Yearly ☐	£2.50 Monthly ☐	AFFILIATED GROUP	£30* Yearly ☐	£2.50 Monthly ☐

*Suggested minimum. If you would like to support our work further by paying a higher subscription, we would be very grateful.

☐ **Please add Mammal Review** (our quarterly scientific journal) to my membership:
Electronic (*including all back issues*) at £22+VAT ☐ Paper at £22 ☐ Student £12.50 ☐

☐ I would like to make an **additional one-off donation of £**_____ to further help The Mammal Society.

☐ **Please Gift Aid my membership –** increase the value of your subscription 28% **at no extra cost to you.**
The Mammal Society can claim 28p for every pound you give, providing us with much needed funding.
(The Income/Capital Gains tax you pay must at least equal to the amount we will reclaim on your donations in a year).

I would like to pay by: ☐**Standing Order** ☐**Debit/ Credit Card**
☐**Cheque** (please make cheques payable to The Mammal Society)

Instructions to your bank or building society to pay by STANDING ORDER

Bank/ building society name: _____

Address: _____

_____

Postcode: _____

Account no: _____

Sort code: _____

Name of account holder: _____

_____

Please pay the Standing Order to: The Mammal Society (Co-operative Bank; account: 65834075; sort code: 08-92-99).

Please pay £_____ immediately, and thereafter annually / monthly until further notice (delete as appropriate).

Debit/Credit Card Details Amount: £ _____

Card Type: Visa / Mastercard / Switch / Maestro Card Number: _____

Expiry Date: _____/_____/_____ Start Date: _____/_____/_____ Issue no: _____

Security code (last 3 digits on signature strip): _____

Name on card: _____

Address card is registered to: _____

_____ Postcode: _____

Signature: _____ **Print Name:** _____ **Date:** ___/___/___

Please send to: **Membership, The Mammal Society, 3 The Carronades, New Road, Southampton SO14 0AA**

We will not pass your details on to other organisations, but we would like to send you information about our activities.
If you do not wish to receive this, please tick here. ☐

activity programme

inspiring people, improving places

BTCV Vale of York Group

October and November 2010

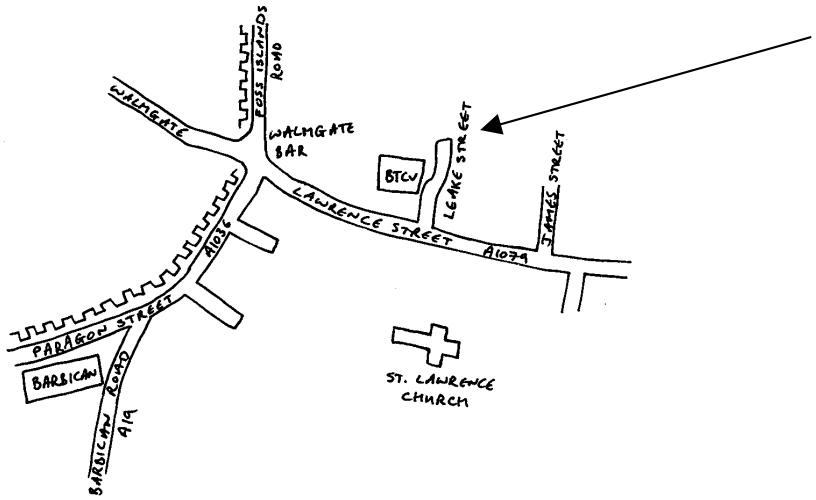
Volunteer Calendar October 2010

Tuesday	Wednesday	Thursday
5th Ray Wood	**6th Ray Wood**	**7th Ray Wood**
This 40-acre area of woodland was clear-felled in the 1940s but was first surveyed in the 16th century and much of the present ground flora is characteristic of secondary ancient woodland. Today the wood has a collection of 500 species of rhododendron and many other rare shrubs and trees set around a network of paths from an earlier woodland garden. Ray Wood is managed by Castle Howard Arboretum Trust, a joint charitable trust formed between Castle Howard and the Royal Botanic Gardens, Kew. Over the first two weeks of October we will be working to replace the fencing and repair gates around this important collection.		
12th Ray Wood	**13th Ray Wood**	**14th Ray Wood**
Fencing is valuable in conservation work, helping to protect sensitive habitats from interference. This week Paul Appleton will be on site to provide training in fence building. There will be an opportunity to learn about different types of fencing, how to select the most appropriate type of barrier and choose the correct materials. We will be constructing a particular type of post and wire fence aimed at keeping rabbits out of the wood. Find out how to install strainer posts, struts and intermediates as well as learning how to tension wire using Monkey Strainers. **Booking is essential if you would like to take part in the training – please contact the office on 01904 644300 to reserve a place.**		
19th York Citizens Advice Bureau	**20th York Citizens Advice Bureau**	**21st York Citizens Advice Bureau**
The Citizens Advice Bureau in York occupies the site of a former school in the shadow of the city walls. There is a secluded, walled garden behind the office that used to be the school playground. Over the years this area has fallen into disuse and become overgrown with brambles, nettles and self-seeded sycamore. The project this week is to begin the clearance work that marks the first stage in the regeneration of the playground into a garden for users of the CAB and local wildlife.		
26th St Nicholas Fields LNR	**27th St Nicholas Fields LNR**	**28th Hackfall Wood**
This year's annual V Community Challenge will take place at St Nicholas Fields Local Nature Reserve. Teams of young volunteers and members of the business community will be working on a number of projects to landscape the play area and improve the Melrosegate entrance. As part of the event we will be building some new steps and extending the woodchip footpaths. We are also helping to install some new benches made from timber felled on the reserve.		A Grade 1 listed landscape and Site of Special Scientific Interest, Hackfall has been described as one of the most beautiful woodlands in England. We will be repairing steps and improving paths using materials from the wood.

Congratulations to Anne Heathcote and Leroy Horrobin who successfully passed their NPTC Chainsaw assessment following four days of intensive training under the expert eye of Peter Robinson of Travelogger. Anne and Leroy battled rain and high winds to complete the training which was part of the Vale of York Environment Group's **Environmental Training Programme – The Forgotten Year**s project, funded by Awards for All. The aim of the project is to provide opportunities for those over the age of 25 to undertake training in a variety of practical conservation skills. For further details of the project and to register an interest in future training opportunities - including ID skills, first aid, MiDAS, risk assessment and practical conservation - please contact the BTCV office.

Volunteer Calendar November 2010

Tuesday	Wednesday	Thursday
2nd Rawcliffe Meadows	**3rd Burneston School**	**4th Burneston School**
The pond at Rawcliffe Meadows is an important stronghold for York's tansy beetles. We will be clearing vegetation at the pond to help ensure a good supply of tansy for next year's beetles.	Come along and help to create a new wildlife area for this lovely school in the Yorkshire Dales. On Wednesday we will be erecting a post and wire fence around the perimeter to ensure it is safe after the digger has been in to excavate the new pond. Thursday's task will be to finish any fencing and build the dipping platform for the pond.	
9th Burneston School	**10th Hackfall Wood**	**11th Burneston School**
Now that we have the area secure, it's time to install the footpath around the wildlife area. It will be a stone footpath to allow for wheelchair use. Come along and find out what a stob twister is used for!	Turner came to Hackfall to paint and Wordsworth is reputed to have loved the wood. Today we will be cutting back vegetation to help restore the views that might have inspired them.	It's a long winding footpath so we will still be installing it today but with the help of a wacker plate, essential for a nice smooth surface.
16th Burneston School	**17th Burneston School**	**18th Burneston School**
The school is eagerly awaiting its wildlife area and at this point the area should really be taking shape. Over the next three days we will be doing a variety of tasks which include; post and rail fencing around the pond area, gate hanging, raised bed building, sleeper bench construction and building bird tables. There will be lots of fun things to try your hand at and have an opportunity to practice your small carpentry skills.		
23rd Hambleton Hough	**24th Hambleton Hough**	**25th Hambleton Hough**
Hambleton Hough, formed from debris left behind when the glaciers retreated after the Ice Age, is one of the few hills in an otherwise flat landscape. Some of you will remember the beautiful woodland at this site from our visits in the Spring and it will be interesting to compare the flora and fauna this Autumn with that which we found earlier in the year. The work this week will be to continue management of the vegetation in the wood and, in particular, to clear new growth arising since our last visit.		
30th Barlby Woodland Walk	**The Green Pennant Award**	
We will be working with Barlby and Osgodby Parish Council to carry out some improvements to the Woodland Walk. We will be clearing fallen timber and tidying paths through the woods. The Parish Council is hoping that the Woodland Walk will follow in the footsteps of another of its sites – the Old Railway Walk – and achieve the Green Pennant Award.	The Green Pennant Award is a national award scheme that recognises high quality green spaces in England and Wales that are managed by voluntary and community groups. The Award has an impressive and established background – it is part of the Green Flag Award scheme, the national standard for quality parks and green spaces. Winning a Green Pennant Award brings excellent publicity. Both the media and the public are becoming increasingly aware that a site holding a Pennant is a valued and high quality green space. If you are part of a community group that manages a local green space and would like to find out more about the award, please contact the BTCV office on 01904 644300.	



We meet in the mornings at:
3, 5 & 7 Leake Street YO10 3BR (see map)
at 9:00-9:15
Phone: 01904 644300 email: York@btcv.org.uk
http://www2.btcv.org.uk/display/btcv_york
There is no car parking at the office but there are streets nearby with some parking and secure storage for bikes.
Note: Tasks may be subject to change – if you're making your own way to site, please call to confirm a meeting point.

Structure of the Day

- Meet at the office to load the minbus at 9.00am)
- Minibus leaves the BTCV office at 9.15am
- Details about the task are given on arrival
- A safety talk is conducted, showing you how to use the tools and any site hazards
- Lunch is around mid-day
- Continue with the task in the afternoon
- Tidy the site and load the tools into the minibus
- Leave the site and aim to be back in York between 4.30 and 4.45pm
- On arrival at the office, tools are unloaded, cleaned and put away

BTCV INFORMATION

Who are BTCV?
We are a national conservation charity enabling individuals to become involved in improving their local environment on a practical level. The Vale of York Group offers one of the ways of experiencing practical conservation work. People of all ages and backgrounds volunteer. Whether you can spare three days a week or one day a year, please support BTCV in York.

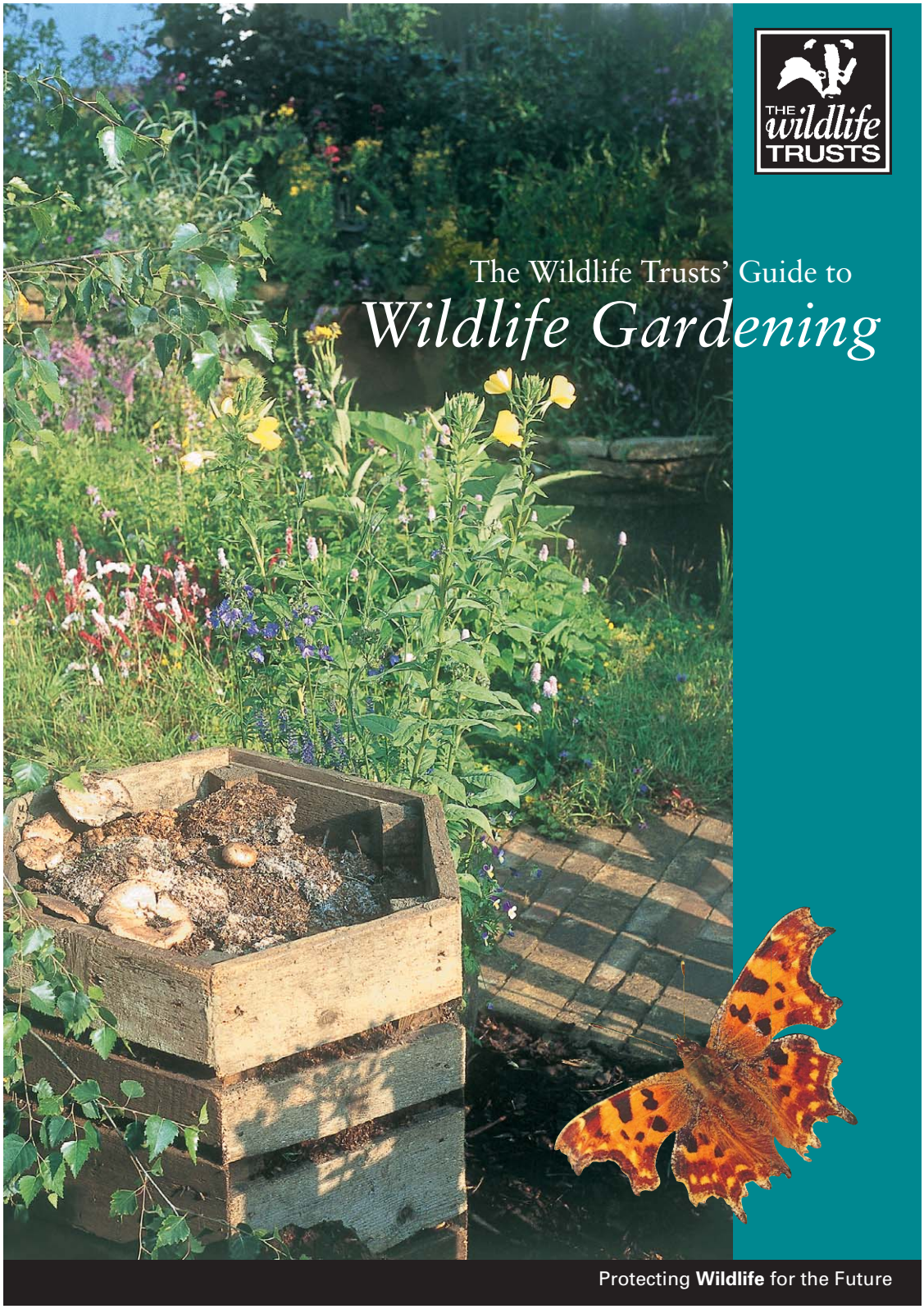
Do I need experience?
No. Full instruction is given on every project by trained leaders. BTCV has 50 years of conservation experience behind it.

What do I need?
You will need a packed lunch, old work clothes, waterproofs and strong boots or wellies. Work or gardening gloves are recommended though some gloves, wellies and waterproofs are available at the office.

What training can I get?
A range of practical training such as weekend practical courses in hedgelaying to informal wildlife identification skills. We also run courses in first aid and machinery use – please call for details

What do I do next?
We operate a booking system whereby volunteers wishing to ensure a place on the minibus to a particular task can put their name down for that day.

Registered Office: BTCV, Sedum House, Mallard Way, Potteric Carr, DONCASTER, DN4 8DB
Web Address: www.btcv.org.uk Registered Company: 976410
BTCV is a charity registered in England (261009) and in Scotland (SC039302)
Connecting People with Place...Building Healthy and Sustainable Communities...Increasing Peoples Life Skills


THE wildlife TRUSTS
The Wildlife Trusts' Guide to
Wildlife Gardening
Protecting **Wildlife** for the Future

Making room for wildlife

Across the UK, we look after more than two million acres of garden – an area five times the size of Greater London. With our countryside increasingly under threat, every garden, however big or small, is a potential nature reserve.

In the past 50 years, the countryside has changed dramatically with the destruction of much of our ancient woodlands, meadows and wetlands.

We can't replace these losses but we can help wildlife in our gardens and enjoy watching it at the same time.

Individual gardens may be small but together they form a patchwork, linking urban green spaces with nature reserves and the wider countryside.

Making our 15 million gardens wildlife-friendly will help the plants and animals that make the UK special, and ensure that they are there for future generations to enjoy.

Wildlife gardening is about creating places for animals and plants to thrive alongside people. You can practise it on a large or small scale, with formal designs and tidy edges, or more informally.

Wildlife gardening brings life to your garden. Small ponds and meadows are easy to create and quickly become focal points. Being wildlife-friendly also means using fewer chemicals, saving you money and helping the environment.

Top tips for greening your garden

- Choose local seeds and plants that are suitable for your soil. Your local Wildlife Trust can advise you.
- Wild flowers belong in the wild – before buying, check plants, seeds and bulbs are labelled as being from cultivated stock.
- Ask your garden centre for peat-free products and use reclaimed stone or stone substitutes. Don't buy water-worn limestone as it may have come from limestone pavement, a threatened natural habitat.
- Save water. Install water butts under downpipes outside your house.

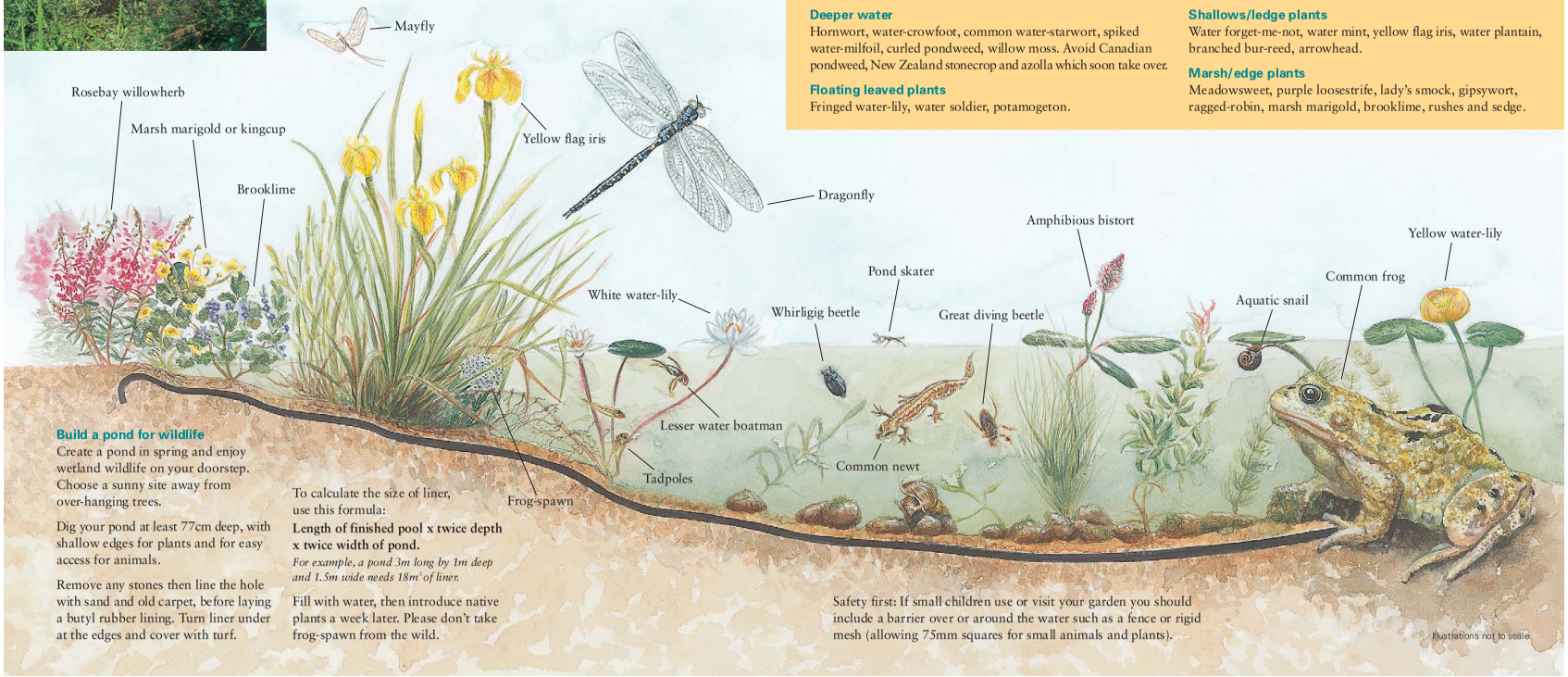
Common water plants suitable for small garden ponds

Deeper water
Hornwort, water-crowfoot, common water-starwort, spiked water-milfoil, curled pondweed, willow moss. Avoid Canadian pondweed, New Zealand stonecrop and azolla which soon take over.

Floating leaved plants
Fringed water-lily, water soldier, potamogeton.

Shallows/ledge plants
Water forget-me-not, water mint, yellow flag iris, water plantain, branched bur-reed, arrowhead.

Marsh/edge plants
Meadowsweet, purple loosestrife, lady's smock, gipsywort, ragged-robin, marsh marigold, brooklime, rushes and sedge.



Build a pond for wildlife
Create a pond in spring and enjoy wetland wildlife on your doorstep. Choose a sunny site away from over-hanging trees.

Dig your pond at least 77cm deep, with shallow edges for plants and for easy access for animals.

Remove any stones then line the hole with sand and old carpet, before laying a butyl rubber lining. Turn liner under at the edges and cover with turf.

To calculate the size of liner, use this formula:
Length of finished pool x twice depth x twice width of pond.
For example, a pond 3m long by 1m deep and 1.5m wide needs 18m² of liner.

Fill with water, then introduce native plants a week later. Please don't take frog-spawn from the wild.

Safety first: If small children use or visit your garden you should include a barrier over or around the water such as a fence or rigid mesh (allowing 75mm squares for small animals and plants).

Illustrations not to scale

Gardening for wildlife
getting you started

Wildlife needs four things: food, water, shelter and places to breed.

You can provide some if not all of these things and bring your garden to life. Here are some ideas to get you started and help you to make a difference for wildlife, whatever the size of your garden.

Climbing plants
Climbing plants on fences and walls make nesting and roosting sites for birds, and a haven for insects and small animals. Choose plants like quince and honeysuckle which have nectar-rich flowers followed by fruit. Make sure you have some evergreens too, ivy is especially valuable.

Go organic
You can have an attractive and productive garden without using chemical fertilisers and pesticides.

You can make and use your own compost, encourage insect and slug-eating creatures and adapt natural processes to maintain your soil.

Gardeners' friends include frogs and toads, birds, and small mammals like bats and hedgehogs – all of which eat insects or slugs. Ladybirds, lacewings and hoverflies feast on aphids.

Butterfly gardens
Butterflies bring beauty to any garden. Attract them to yours with nectar-rich flowers like buddleia, scabious and ice-plant. Plant in a sheltered sunny spot and don't forget to provide food plants for caterpillars too. *(See the box below)*

Native trees
Favour native trees, but remember other species are good for wildlife too.

Trees: alder, ash, aspen, beech, birch, bird cherry and wild cherry, crab apple, field maple, hazel, holly, juniper, oak, Scot's pine, rowan, yew, whitebeam, willow, wych elm.

Shrubs: alder buckthorn, blackthorn, buckthorn, broom, dog-rose, dogwood, elder, guelder-rose, hawthorn, spindle.

Bird boxes
Tits and nuthatches need boxes with a 28mm entrance hole, house sparrows around 32mm. Open-fronted boxes attract robins and flycatchers. Large open-fronted boxes high in trees may attract owls or kestrels.

Do not put boxes in full sun and site them away from places that predators might attack from, such as overhanging branches.

Feeding birds
Different birds eat different things, in different ways and places. Provide nuts, seeds, fat and kitchen scraps in feeders, trays and on the ground. Move feeding places from time to time to guard against predators, disease and unwelcome visitors such as rats.

Hedges
Hedges provide living space and food for all sorts of wildlife, as well as privacy and security for you. Good native choices include hawthorn, blackthorn, wild rose, holly, hazel and elder. In addition, berberis, cotoneaster and pyracantha produce lots of berries for the birds.

Peat-free gardening
Peat bogs are very special places for wildlife but, partly due to gardeners' demand for peat, nearly all have been destroyed in the UK. Help save our remaining bogs by using peat-free composts and mulches, such as chipped bark, leaf mould or coir. Contact The Wildlife Trusts for details of where to buy peat-free products.

Cracks and crevices
Many plants grow on walls, including ivy-leaved toadflax, various ferns, red valerian and, of course, wallflower. Spiders and solitary bees like nooks and crannies, and rockeries will shelter many small creatures. Hollow stems left over the winter provide homes for insect larvae and pupae.

Meadow magic
To bring vibrant colour into your garden, meadow flowers can be sown or planted to produce spring or summer displays. A meadow makes a wonderful alternative to plain grass on your lawn. Your soil type and how and when you mow will dictate which species you should plant, but generally cowslip, ox-eye daisy, meadow cranesbill, yellow rattle, self-heal and meadow buttercup will do well.

Compost bins
Make your own natural fertiliser. Compost garden waste and vegetable kitchen scraps in a home-made box or bought compost bin. If you have limited space, you can still make compost in a small 'worm bin' in your house or back yard.

Food plants for caterpillars

Butterfly	Plant
Meadow brown, hedge brown wall brown, marbled white and large skipper	Grasses including meadow grass, false brome, cocksfoot and Yorkshire fog
Large and small white	Wild/cultivated cabbages
Green-veined white Orange tip	Lady's smock, hedge garlic and hedge mustard
Brimstone	Alder buckthorn and purging buckthorn
Common blue	Bird's foot trefoil
Painted lady	Thistles

Nectar-giving plants

Nectar plants
Primrose, aubretia, sweet rocket (spring)

Lavender, cat mint, thyme, heliotrope, red valerian, hebe, buddleia, knapweed (summer)

Michaelmas daisy, sweet scabious, hyssop, ice plant (autumn)

Moths like night-scented stocks, honeysuckle, evening primrose and tobacco plants

Pile of logs
A pile of logs in a shady corner will feed beetle larvae and shelter many other animals, including frogs, toads and slow worms. The rare stag beetle needs dead wood to breed in. Hedgehogs often hibernate in wood piles, so if you're having a bonfire, check for sleeping hedgehogs first.

Nettle feeders
Nettles are the food plant of the caterpillars of some beautiful butterflies: red admiral, peacock, small tortoiseshell and comma. Butterflies prefer not to lay their eggs in the shade, so choose a sunny spot to grow your nettles.

Handy hints for the wildlife gardener

- **Avoid using slug pellets. They don't just poison slugs, they also affect the birds, frogs and hedgehogs that eat the slugs. Control slugs with a barrier of grit or sand around plants, or use pitfall traps – a cup or jar with a little beer in the bottom, sunk into the ground, is ideal.**
- **Newly planted trees can be watered more easily via a drainpipe sunk into the ground alongside their roots.**
- **Epsom salts sprinkled around plants will prevent rabbit damage.**
- **Dilute household detergent is effective against greenfly and blackfly, and is thought not to harm other insects.**
- **You can treat seed-eating birds to a free meal by planting globe thistles and teasels.**
- **Enjoy your garden – wildlife-friendly gardening is about making your back yard into a haven for people and wildlife.**

Help and advice

This leaflet is intended as a simple guide to get you started on wildlife gardening. Once you have begun, you might get hooked, so below are some suggested sources of additional information, supplies and further reading.

Wild About Gardens is a joint project between The Wildlife Trusts and the Royal Horticultural Society.

To find out more and share your wildlife gardening tips, visit **www.wildaboutgardens.org**

Organic gardening: advice, gardens to visit, fact sheets, seeds and product catalogues available from:

Henry Doubleday Research Association (HDRA)
Ryton Organic Gardens
Coventry
CV8 3LG

Tel: 02476 303517

Where to buy peat-free products leaflet and advice on peat alternatives – download from www.wildlifetrusts.org or free with an A5 SAE:

The Wildlife Trusts
The Kiln, Waterside
Mather Road
Newark
NG24 1WT

Further reading

Wildlife Gardening by Fran Hill, from Derbyshire Wildlife Trust Tel: 01773 881188 – £7.95 inc p+p £4.50 if ordering 10 or more copies *(cheques made payable to Derbyshire Wildlife Resources)*.

Attracting Wildlife to Your Garden by John Burton/David Tipling, New Holland, price £16.99

Designed by FDA, Huddersfield
Illustrations by Anna Sutton Text by Isobel Bretherton
Photographs by The Garden Picture Library, Laurie Campbell and Woodfall Wild Images

Join The Wildlife Trusts

The Wildlife Trusts is the UK's leading organisation working on all aspects of nature conservation. Managing more than 2,500 nature reserves, we campaign tirelessly on behalf of wildlife and run thousands of projects and events, nationally and locally. The Trusts' work is dependent on support from people like you.

Membership of The Wildlife Trusts gives you:

- **A full colour magazine, Natural World, three times a year.**
- **A newsletter from your local Wildlife Trust, keeping you up to date with local wildlife news and events.**
- **The opportunity to get involved in many activities and events, and access to spectacular nature reserves around the UK.**
- **The knowledge that your support is crucial in helping to keep the UK's wildlife safe for the future.**

To find out more about joining The Wildlife Trusts, or if you'd like to make a donation to support our vital work, please visit our website *www.wildlifetrusts.org* or write to:

The Wildlife Trusts
DEPT.MSFR (GL)
FREEPOST MID20441
Newark
NG24 4BR

Telephone: 0870 036 7711

Protecting **Wildlife** for the Future