Evaluating a citizen science research programme:

Understanding the people who make it possible

Dale Wright
WRGDAL001

MSc Thesis
February 2011

Thesis presented in partial fulfilment of the requirements of the Degree of Master of Science specialising in Conservation Biology.

Department of Zoology, University of Cape Town, South Africa.

Supervisor: Professor Les Underhill

Co-Supervisors: Dr. Andrew Knight and Mr. Matt Keene

Plagiarism declaration

1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

2. I have used the footnote convention for citation and referencing. Each contribution to, and quotation in, this assignment from the work(s) of other people has been attributed, and has been cited and referenced.

3. I acknowledge that copying someone else‟s assignment or essay, or part of it, is wrong and that this assignment is my own work.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

Signature _ _____

Date _____

Abstract

Citizen science is increasingly recognised as a useful tool for conducting scientific research and public outreach, producing multiple positive benefits for biodiversity conservation and the volunteers involved in such research. An understanding of the motivations, satisfactions and other aspects of the volunteers' psychology is essential to conservation scientists wishing to mobilize this valuable resource. By employing programme evaluation in combination with psychometric assessment one can begin to understand the complex relations which exist between citizen science programmes and their volunteers. There is an increasing call for conservation programmes to provide sound evidence of effectiveness, and employing empirical evaluations can assist in the transition to evidence-based conservation practices. The objectives of this research were to develop a logic model for the Second Southern African Bird Atlas Project (SABAP2) which would articulate the programme's theory of operation with respect to its volunteers. The second major objective was to develop psychometric instruments for assessing the motivations, satisfactions, level of burnout and ambassadorship of the programme's volunteers. Both objectives included the aim to provide robust and repeatable instruments for exploring volunteer psychology, and developing a programme's theory of operation. In this regard the processes and methodologies employed represent a major component of this research. A mixed methods approach was utilized, including stakeholder and volunteer surveys, conducted via email and the programme's website, together with two focus groups held with the programme's management. Analysis of the data thus collected included both qualitative and quantitative approaches, specifically employing coding and content analysis, together with statistical tests of internal consistency, factor analysis and doubling correspondence analysis. A new inventory, the Environmental Volunteer Functions Inventory (EVFI), was developed for assessing volunteer motivations in this and other volunteer-based research programmes. Robust indices were developed for assessing volunteer satisfaction and level of ambassadorship. These indices revealed that volunteers in SABAP2 are satisfied with the programme, and exhibit behaviours suggesting they act as advocates for the programme. Demographic data and additional information provided further insights into the programme. The development of a method for articulating the programme's theory of operation is represented, together with four logic models which graphically illustrate this theory. This process and theory allowed for recommendations to be provided for the programme's improvement. The components of an effective citizen science programme are described. A platform for adaptive management and further evaluations of this, and similar programmes, represents a major outcome of this research.

Acknowledgements

I would like to express my gratitude to my three supervisors, Prof. Les Underhill, Dr. Andrew Knight and Mr. Matt Keene, for their support and guidance throughout this research, and for the further wisdom which they imparted during our many conversations.

I would further like to thank the members of the Animal Demography Unit at U.C.T., in particular Doug Harebottle and Sue Kuyper for their involvement and support in this research, and Michael Brooks for providing information in the focus groups, and the information technology assistance required for this research.

I am in debt to all the member s of the Second Southern African Bird Atlas Project, who took the time and effort to respond to my questionnaire, thus providing the data for this thesis. I hope that the recommendations provided herein may further enhance their experience.

My thanks to the Percy FitzPatrick Institute of Ornithology's Centre of Excellence for the grant of a Centre of Excellence bursary for the Masters Prorgramme.

Finally, I express my thanks to my family and Jade MacKenzie, for providing encouragement and love, both much needed during this degree programme.

Table of Contents

Chapter 1

Literature review

The research detailed in this thesis is concerned with developing an understanding of the psychology of volunteers within a citizen science programme, together with an understanding of the ways in which the functioning of the programme influences the effectiveness of volunteers. Accordingly, the thesis has the evaluation of the programme's effectiveness as a core conceptual theme. A review of evaluation procedures and their application to conservation research have been used to provide a framework for this research, whilst literature on the discipline of citizen science provides a general background. A thorough review of the motivations of environmental volunteers provides a theoretical basis for focusing this research on the current case study.

Citizen Science

Citizen science is a relatively recent and an increasingly common approach for investigating ecological questions and conducting scientific research (Pilz et al. 2006, Bonney et al. 2009). Citizen science has been broadly defined as a method for integrating scientific data collection over varying geographic scales, with public outreach as members of the public participate in scientific research (Bhattacharjee 2005, Cooper et al. 2007, Couvet et al. 2008, DeVictor et al. 2010). This integration leads to the development of a coordinated network of citizens, who are typically volunteers, managed by professional scientists within different research programmes (Greenwood 2007, Danielsen et al. 2009). Such programmes involve up to hundreds or even thousands of volunteers, collectively resulting in what can be termed the "largest research team on earth" (Irwin 1995). An activist slogan from the 1970s, "Science for the people", reflected those times; however this would seem to be evolving into a new phenomenon in the 21st century: "Science by the people" (Silvertown 2009). There has been a perceived increase in the number of citizen science projects (Silvertown 2009, Conrad & Hilchey 2010) and certain authors maintain that this is in response to a number of factors: budget limits of government programmes, increasing needs for data on local environmental changes, recognition of including multiple stakeholders in the decision making process and

the desire of the general public to be involved in environmental management and protection (Whitelaw et al. 2003). An additional factor driving this increase is the ever pressing need to monitor and understand biodiversity changes globally, as we attempt to manage natural resources in the context of climate change (Secretariat of the Convention on Biological Diversity 2005, Schmeller et al. 2008).

A review of citizen science projects by Conrad & Hilchey (2010) suggested that volunteer-based initiatives can be divided into: 1) those concerned with data collection and monitoring and 2) those designed towards community-based management of natural resources. These different approaches are manifesting in many, diverse projects across the globe (Schmeller et al. 2008). The research conducted here is concerned with the first derivative of citizen science relating to data collection and monitoring. Community-based monitoring (CBM) is defined by Whitelaw et al. (2003) as a process in which concerned stakeholder groups including academic institutions, community groups and others, work in collaboration to monitor and respond to issues of common concern. The authors emphasize that such monitoring should be led by the community, rather than individual organizations, be designed to promote sustainability and provide data which can be used to inform decision-making (Whitelaw et al. 2003).

Community-based natural resource management (CBNRM) has arisen in a multitude of different forms and environments, with much research concerned with the effectiveness and role of CBNRM in meeting conservation and development objectives, particularly for rural communities (Western et al. 1994, Berkes 2007). In this context community involvement is explicitly concerned with the devolution of responsibility for the management of the natural resources to local-level community groups and governance structures. Multiple benefits and constraints are associated with both monitoring and management at the community level (Whitelaw et al. 2003, Conrad & Hilchey 2010). The monitoring conducted by the citizen scientists of the Second Southern African Bird Atlas Project (SABAP2) is designed to collect presence data providing information on the spatial distribution of bird species across Southern Africa. In this project the community is not concerned with managing the natural resource, but rather with tracking biodiversity changes in response to environmental change. This information then informs decision-making such as the designation of Important Bird

Areas (Fishpool & Evans 2001) or provides information for distribution maps used in field guides (for example: Hockey et al. 2005). Monitoring programs such as these have become increasingly recognized for their positive contributions to biodiversity conservation (Lepczyk 2005, Schemeller et al. 2008, Snall et al. 2011). Public participation in environmental monitoring and management has been described by the United Nations Environment Programme (UNEP) as an essential ingredient for achieving sustainability (Au et al. 2000, Sharpe & Conrad 2006).

The potential positive applications of citizen science to biodiversity conservation include: monitoring biodiversity, establishing useful indicators on the state of biodiversity and evaluating the consequences of different policies for biodiversity conservation (Couvet et al. 2008). Applications for conservation biogeography and global change biology have recently been discussed and relate to the ability of such projects to gather large–scale data, spanning entire continents in some cases (Sullivan et al. 2009, DeVictor et al. 2010). Citizen science is also represented by other forms of participatory research including participatory monitoring networks and community-based ecological monitoring (Whitelaw et al. 2003, Bell et al. 2008). Citizen science programmes, such as the type investigated here, can promote significant positive outcomes, which provide benefits to individual volunteers and society at large, as well as to the scientists and environmental educators leading such programs (Bonney et al. 2009, Raddick et al. 2010).

The benefits of such atlas projects are numerous, ranging in application from theoretical ecology or biogeographical studies and extending to land use or conservation planning and use in environmental impact assessments (Dunn & Weston 2008, Robertson et al. 2010). In ornithology research citizen science programmes have been applied to research regarding migration, distribution and habitat data, and population level studies (Greenwood 2007). Birds are useful species for monitoring approaches, as they are easily observed and identified, allowing amateurs to become involved in research programmes (Snall et al. 2011), and can act as indicator species for other components of biodiversity (Greenwood 2007). Citizen science approaches have also been applied to understanding alien invasive species and their impact on the local environment (Ingwell & Pressier 2011). Studies of birds in urban environments using citizens volunteers (McCaffrey 2005) and the role of citizens in

monitoring and active management of residential ecosystems have also been described (Cooper et al. 2007).

Other important benefits of volunteer based schemes are the multiple additional benefits, both direct and indirect, which come as a result of participation. Citizen science schemes are advocated as a means to increase understanding of the scientific process through experiential learning and involvement in research (Trumbull et al. 2000, Bonney et al. 2009). An additional benefit more difficult to measure is the ability of such projects to reconnect people with nature (Guiney & Oberhauser 2009, DeVictor et al. 2010). Further value derived from participation is the potentially enormous cost-saving to research programmes through the personal economic investment of volunteers in these programmes. This investment is essential at a time when limited economic resources are available and an increasing amount of biological research and conservation action is required (Savan et al. 2003, Measham & Barnett 2007). In the United Kingdom alone, volunteers spend an estimated $1.6 million each year, contributing to bird surveys alone (Danielsen et al. 2009). This work, which excludes the investment in other citizen science schemes, would cost an estimated $40 million if undertaken by professionals (Danielsen et al. 2009). A similar statistic calculated for the Second Southern African Bird Atlas Project estimated that for every R1 spent by the funding agencies, R25 was invested by the volunteers (L.G. Underhill pers. comm.). These benefits are resulting in increasing devolution of responsibility from central government and other institutions, to local-level stakeholders and volunteers in environmental programmes (Measham & Barnett 2007).

There are however, also constraints on projects involving volunteer citizen science researchers. These include: the inexperience of scientists in coordinating and managing very large human resource bases, lack of understanding of the marketing mechanisms essential in generating and maintaining a volunteer pool, designing research protocols suitable for the level of scientific understanding and knowledge of members of the public and ensuring that protocols suitable to the public produce rigorous data useful for scientific research (Ferraro & Pattanayak 2006). However as knowledge and experience develops, these constraints pose less of a challenge to the individuals designing and coordinating citizen science research programmes.

Citizen Science and Ornithology

Ornithology is a discipline which has relied significantly upon the contributions of volunteers for many years (Sullivan et al. 2009, Dunn & Weston 2008), dating from as far back as the Christmas bird count in 1900 (Droege 2007). Volunteer participation in ornithology has experienced significant growth in recent years, particularly in the fields of ecology and environmental science (Silvertown 2009). This linkage between amateurs and professionals within ornithology has added much value to the discipline and created what is termed an 'inclusive scientific field' whereby amateurs increasingly play a meaningful role in the discipline (Greenwood 2007). The relationship between amateurs and professionals has allowed for ornithology to contribute to the fields of ecology and conservation biology in a manner surpassing other taxon-based disciplines (Greenwood 2007). This relationship has arisen partly due to the ease of identification of many species, and the fact that people simply find birds attractive (Snall et al. 2011). Although volunteers contribute in a number of different ways, perhaps their most prominent role has been in large-scale atlasing projects (Dunn & Weston 2008, Harrison et al. 2008). These atlases are standardised surveys which document the spatial and temporal changes in bird distributions, and have also been applied to a number of other taxa (Dunn & Weston 2008). A key method for establishing distribution patterns and developing taxon atlases is the systematic recording of species' presence or absence along a pre–determined grid (Greenwood 2007). However the geographic scale of such projects often relies on large numbers of volunteers spread over large areas, a feat impossible without amateur involvement (Harrison et al. 1996). The number of employed individuals required for such projects is often constrained by limitations of both human and financial resources.

Psychology of volunteers: Motivations, Burnout & Advocacy

Biodiversity conservation initiatives owe much to the thousands of individuals who volunteer their time and effort to numerous projects (Ryan et al. 2001). However only a few research programmes have investigated the motivations and satisfactions of volunteers in environmental projects (Weston et al. 2003, Bruyere & Rappe 2007, Measham & Barnett 2007). Volunteers contribute to a wide variety of environmental programmes, and bird atlas

projects in particular would not be possible without the support of volunteers (Harrison et al. 1996, Weston et al. 2003, Greenwood 2007). Research investigating the psychology of volunteers is therefore important to conservation biologists and scientists attempting to develop and maintain volunteer programmes (Miles et al. 1998, Ryan et al. 2001, Weston et al. 2003, Measham & Barnett 2007).

Volunteering has been defined as any activity during which time is given to benefit a specific person, group or cause, without recourse to payment (Wilson 2000). It is important to note that this definition does not preclude volunteers from benefiting from their work (Wilson 2000). Volunteering is further defined as pro-social behaviour, providing an important mechanism for people to participate in civil society (Yeung 2004). When applied in an environmental context it can be taken as both pro-social and pro-environmental behaviour. Research has suggested positive links between volunteer activity, physical well-being and life functioning (Miles et al. 1998, Measham & Barnett 2007). Volunteering traditionally exists within a cluster of helping behaviours, and much research has focussed on volunteering within the humanitarian sector (Wilson 2000). Social science research has attempted to develop theories explaining volunteerism. These theories are divided between those focussed on motives or self-understanding and those emphasizing rational action of individuals (Wilson 2000). Further research has described the role of social resources in volunteerism, pertaining specifically to social ties and organizational activity, with support found for all of the abovementioned theories (Wilson 2000). Research in this study is principally concerned with investigating theories focused on personal motives, rather than the rational action of individuals. The role of social resources and the volunteer organization are also considered.

The majority of volunteer psychology research is conducted within the social sciences and concerned with the human-service sector, with few studies examining the psychology of environmental volunteers (Ryan et al. 2001, Weston et al. 2003, Bruyere & Rappe 2007, Measham & Barnett 2007). It is therefore pertinent that the proposed research draws on the literature present within both the social and natural sciences. This study sought to build on the limited existing work which has investigated the motivations of environmental volunteers. In order to do this a thorough literature review was undertaken of all studies pertaining to environmental volunteers. Volunteerism investigations in social science were also included in

the review, to expand our understanding of the theories underlying volunteerism. A review of the social science literature revealed the existence of three different models applied to understanding volunteer motivations. The Volunteer Satisfaction Index (Galindo-Kuhn & Guzley 2001) and Volunteer Process Model (Davila 2009) have not been applied in an environmental context. Furthermore both of these models are not well supported in research in the social science literature (Davila 2009). The third model, the Volunteer Functions Inventory (VFI) (Clary & Snyder 1999, Finklestein 2008) has been developed using the functional approach (Katz 1960) and investigated in environmental volunteers (Bruyere & Rappe 2007, Measham & Barnett 2007).

Psychological research on volunteers has led to the application of the functional approach to understanding volunteerism (Clary et al. 1998, Clary & Snyder 1999, Finkelstein 2008). The functional approach has been used for studying individual behaviours in both psychological and environmental disciplines (Bruyere & Rappe 2007). The functional approach can be defined as: "a motivational perspective that investigates the personal and social processes which initiate, direct and sustain action" (Katz 1960). The approach further suggests that although people may volunteer for the same service, their underlying motivations may differ vastly (Bruyere & Rappe 2007, Finkelstein 2008). Application of the functional approach to volunteerism proposes that the participation of an individual will depend on whether the motivations of the individual have been fulfilled (Clary & Snyder 1999). It is therefore imperative that attempts to recruit volunteers address specific motivational functions which underlie the behaviour and attitudes of the volunteers (Miles et al. 1999, Ryan et al. 2001, Weston et al. 2003, Finkelstein 2008). The effectiveness of a volunteer programme will therefore depend on the degree to which participants motivations for volunteering have been met (Clary & Snyder 1999).

The Volunteer Functions Inventory (VFI) has been developed through the work of Clary, Snyder and colleagues and has been applied in studies of volunteerism within the social sciences (Bruyere & Rappe 2007, Finkelstein 2008). Clary et al. (1998) identified six motives for volunteering which were subsequently described as the Volunteer Functions Inventory (VFI) (Clary & Snyder 1999). The motives identified by the inventory are presented in Table 1.1. The Volunteer Satisfaction Index (VSI) (Galindo-Kuhn & Guzley 2001) although not

widely applied, identifies four primary factors which overlap with the VFI. These factors included; organizational support, participation efficacy, empowerment and group integration (Galindo-Kuhn & Guzley 2001). Although this index measures volunteer satisfaction, rather than motivation, a strong link between these two aspects of volunteerism has been shown (Finkelstein 2008). Volunteerism research in the social sciences uses the terms motivations and satisfactions interchangeably, although they can represent different aspects of the volunteer experience. The functional approach draws a distinction between these two aspects, specifically assuming that the fulfilment of certain motivations will manifest a sense of satisfaction in volunteers (Bruyere & Rappe 2007, Finkelstein 2008). The VFI has been tested using the functional approach, and so a review was conducted of the application of the VFI and functional approach within the environmental literature, since this is the most robust research conducted on volunteer psychology. The validity of the VFI has been tested on volunteers in other fields and been found to be robust, allowing for simpler administration and better fit to the data than alternative models (Bruyere & Rappe 2007). Few examples were found which tested the validity of the VSI.

The VFI has not been widely applied to the volunteers of environmental projects. Studies which have assessed the motivations of environmental volunteers have produced lists of motives which show varying degrees of similarity with the motives described by the VFI. All studies reviewed show strong overlap of the described motives, both with respect to one another and the VFI (Table 1.1). Of the nine studies reviewed in the literature on volunteerism in the natural sciences, two of these pertained to volunteers involved in bird research. A study by Weston et al. (2003) of volunteers in Australia's Threatened Bird Network found the major motivations to include conservation in general, more specifically pertaining to 'helping birds and their habitat', whilst self-education and research were also identified as important motives. The overlaps with the VFI are evident from this list, in which conservation and helping birds could be aligned with 'Values', whilst self-education corresponds with both 'Understanding' and 'Enhancement'. A further study on volunteers involved in bird conservation was conducted by Tremblay & Hvenegaard (2008). This small scale study (only 14 volunteers were assessed) concluded that the major motivations of the volunteers were sub-divided into egoistic and altruistic motivations, an assumption supported by other research on volunteerism (Yeung 2004). The major motivations to emerge from this study included: helping birds, personal learning and achievement, conserving nature and

social interactions (Tremblay & Hvenegaard 2008). Overlaps with the factors of the VFI are again evident in these motives. Aside from these two studies involving volunteers in bird projects, the other seven studies assessed revealed similar motives (Table 1.1). The major issue across these studies is the use of different terminology specific to each study, which can make direct comparisons difficult. Resulting in subjective linking of factors based on face validity and similarity.

In addition to the motivations and satisfaction of volunteers, our study sought to investigate additional dimensions of volunteers which influence their effectiveness in contributing to SABAP2. The phenomenon of burnout in both volunteers and paid workers has been extensively researched. The term 'burnout' was first used to describe a social problem present in human service occupations (Byron et al. 2001). Burnout is thought to especially affect persons involved in health care, teaching, policing and other human service occupations due to the nature of their work (Maslach et al. 1996). Although first concerned with issues in the human service sector it has been expanded and investigated across many employment sectors. A psychologist from the U.S.A., Christine Maslach, has undertaken numerous studies into the subject and produced the definitive work. The Maslach Burnout Inventory (MBI) is to date, the most widely applied and accepted tool for measuring burnout (Maslach et al. 1996). The instrument measures an individual's level of burnout across three dimensions (or sub-scales): emotional exhaustion, cynicism and lack of professional efficacy (Maslach et al. 1996, Barnett et al. 1999). In addition to these major dimensions it is important to note that burnout is a process driven by some form of exhaustion and that the three major dimensions usually exist along a continuum distinct for every individual (Byron et al. 2001). Other instruments exist which have used similar but slightly different sets of dimensions to describe burnout (Cox et al. 2005).

Although much of the research into burnout has occurred within the social sciences, a few studies have considered burnout in environmental volunteers. The level of burnout in volunteers participating in the Landcare programme in Australia has been investigated (Byron et al. 2001, Byron & Curtis 2002). The Landcare programme has been in operation in Australia since 1986 and widely praised as a model of community action contributing to sustainable land and natural resource management (Curtis 1998). The research of burnout in

this example was taken as a model for the investigation of burnout in the SABAP2 volunteers, following the method of Byron et al. (2001), since both groups include volunteers involved in long-term environmental projects, albeit with differing activities and aims. Investigations of burnout in the Landcare programmes initially did not draw on the extensive international body of literature investigating the topic (Byron et al. 2001). However later studies applied the MBI and found it to be useful (Byron et al. 2001).

A final aspect of the volunteers' psychology which was proposed for investigation related to advocacy. A high proportion (66%) of all environmental psychological research includes environmental attitude in one way or another (Kaizer et al. 1999), thus the relationship between attitude and ecological behaviour is well explored. Psychologists are principally concerned with individual rather than societal behaviour and in this context are therefore concerned with behaviours which promote environmental concern and actions which lead to environmental preservation (Kaizer et al. 1999). The volunteers involved in SABAP2 exhibit a pro-environmental attitude simply through their role in contributing data. However we sought to further understand whether volunteers are able to place their contribution in relation to the conservation of birds, and whether they exhibit the capacity to act as "ambassadors for biodiversity conservation". A review of the literature revealed no studies investigating such a concept.

The research of Ajzen and colleagues has been the most widely applied in studies involving predicting behaviour, and particularly to studies predicting ecological behaviour. The ability of attitudes to predict behavioural intentions and overt behaviours is a major subject of research (Ajzen 2001). In this context the majority of studies investigating the attitude-behaviour link have been conducted within the framework of the theory of planned behaviour (Ajzen 2001). The theory proposed by Ajzen suggests: "people act in accordance with their intentions and perceptions of control over behaviour, while intentions in turn are influenced by attitudes towards behaviour, subjective norms and perception of behaviour control." This framework has provided the theoretical basis for our research.

Evaluation of environmental programmes

As the conservation profession continues to grow, numerous stakeholders are calling for the limited resources available to conservation projects to be more efficiently used and for the effectiveness of conservation programmes to be demonstrated (Ferraro & Pattanayak 2006, Kapos et al. 2008, Margoluis et al. 2009, M. Keene & T. Peter-Contesse unpubl. data). Evaluation and monitoring has been widespread across numerous disciplines; however conservation programmes rarely conduct comprehensive, external reviews of their outcomes (Kleiman et al. 2000). There are few examples of conservation interventions receiving empirical evaluations of their outcomes, and almost none at all which compare the effectiveness of alternative interventions (Taylor et al. 2010) As numerous anthropogenic impacts act synchronously to disturb natural systems, it is no longer acceptable for conservation managers and researchers to simply design and implement conservation programmes (Sutherland et al. 2004, Ferraro & Pattanayak 2006, M. Keene & T. Peter-Contesse unpubl. data).

Two consistent problems present in conservation are: 1) incorporating scientific knowledge into conservation practice (or applying evidence-based conservation) and 2) a lack of monitoring and evaluation of conservation programmes (Pullin & Knight 2001). The absence of evidence used for supporting conservation decision-making can be addressed by tackling the research-implementation gap (Knight et al. 2008, Sunderland et al. 2009), and adopting an evidence based approach to decision-making (Pullin et al. 2004, Sutherland et al. 2004). Useful approaches aim to integrate scientific knowledge and conservation, by using conservation threats and activities to drive scientific research (Pullin et al. 2004, Brooks et al. 2006). It is further advised that scientists seek research questions from conservation practitioners, expand the social dimension of conservation and increase societal engagement and their focus upon the implementation of conservation action (Knight et al. 2008).

Conservation academics and professionals have advocated an evidence-based revolution, as has been seen in other disciplines such as the medical sciences (Pullin et al. 2004, Sutherland et al. 2004). This call is evidence of the lack of suitable approaches evaluating the effectiveness of conservation action (Black & Groombridge 2010). Currently much of

conservation practice rests on experience-based approaches, in which the experience of the practitioner is brought to bear on the conservation problem at hand (Pullin & Knight 2001, Ferraro & Pattanayak 2006). This is often the case when critical information of the system under consideration is lacking or inadequate, or when practitioners are unaware or not concerned with locating the information necessary to design effective conservation interventions (Pullin & Knight 2001). Conservation action based purely on experience is not necessarily ineffective; however it does not provide a robust framework upon which knowledge can develop (Pullin & Knight 2001). The conservation excellence model represents one attempt to develop a framework for conservation based on fact rather than driven by personal or political agendas (Black & Groombridge 2010). Evidence-based decision making, such as that proposed by the conservation excellence model, has been effective when applied in other disciplines and will likely improve the quality of conservation and environmental resource management programmes (Pullin et al. 2004, Sutherland et al. 2004).

The principal steps in developing evidence-based conservation are: 1) making evaluation an essential component of all conservation programmes and 2) recycling the lessons learnt through social learning for adaptive management (Sutherland et al. 2004, Folke et al. 2005). Adaptive management and social learning are inherently linked and can lead to more efficient and effective conservation strategies and programmes (Folke et al. 2005). Conservation professionals should systematically test the assumptions and goals of their particular projects and programmes, and transform this research into action in order for programmes to continually evolve and improve (Salafsky et al. 2002). Systematic adaptation of programmes through evaluation and recycling of knowledge, together with knowledge sharing, can lead to social learning, both within and across conservation programmes (Folke et al. 2005). An explicit goal of this research is to overcome the research-implementation gap by contributing to an adaptive management framework for the programme under investigation.

Evaluation procedures are now seen as an essential ingredient of an effective conservation programme, in order to determine effectiveness and provide sound recommendations for programme improvement (Kleiman et al. 2000, Flowers 2010). Programme evaluation is broadly defined as: “the application of evaluation approaches, techniques and knowledge to

systematically assess and improve the planning, implementation and effectiveness of programs" (Chen 2005). The field of programme evaluation provides useful tools and techniques which can be applied across different sectors to address questions about a programmes performance (Newcomer et al. 2004). It is essentially the systematic assessment of a programme's results, and the processes which generate these results (Newcomer et al. 2004). A programme in this context is: "a set of resources and activities which are directed to one or more common goals, typically under the direction of a single manager, or management team." (Newcomer et al 2004). When deciding to undertake an evaluation three major questions should be answered: 1) can the results of the evaluation influence the program, 2) can the evaluation be performed in time to be useful and 3) is the program significant enough to warrant an evaluation. In the context of this research the answer to all of these is yes.

However, the lack of collaboration and learning both within conservation, and between conservation science and other disciplines (many of which have been using formal evaluation techniques for decades), has hampered the effectiveness of evaluation efforts in conservation (Salafsky & Margoluis 2003). Through a review of the evolution of evaluation in different fields, Salafasky & Margoluis (2003) show how these different disciplines have undergone very similar paths for incorporating evaluation, and suggested that a current downfall of evaluation approaches within the environmental sector is an attempt to re-design and develop evaluation methods, rather than drawing on existing theory.

Rather than following this path, conservation professionals should observe the lessons of others and draw directly on existing theory, instead of creating 'new' approaches, which are likely to be less effective versions of tried and tested methods of evaluation. Conservation managers should therefore recognise and utilise the long history of lessons learned in evaluation from other disciplines (M. Keene & T. Peter-Contesse unpubl. data). Evaluation in the social sciences exists as a discipline unto itself, providing an important contribution to the multiple different programmes and disciplines which have drawn on evaluation theory. Incorporating evaluation and adaptive management into programmes, whether concerned with environmental education, natural resource management, or biodiversity conservation, will involve similar knowledge, skills and processes (Keene & Blumstein 2010).

Collaboration, and learning across disciplines, represents a critical step in creating robust evaluations within conservation (Salafsky & Margoluis 2003, Stem et al. 2005). Robust evaluations also demonstrate accountability, an ever increasing requirement in large, well-funded projects requiring public spending (Stem et al. 2005). In addition, programme staff are interested in their programmes performance in meeting desired goals, and improving and learning from evaluations (Newcomer et al. 2004).

Developing an evaluation is often guided by developing a programmes theory of operation through identifying key elements of the programme and how these relate to one another (Cooksy et al. 2001). Patton (1997) also refers to the programmes theory as an 'espoused theory of action' since it represents the stakeholders perceptions of how the programme operates. A critical step in developing a programmes theory of operation is often the development of a logic model. The logic model is a sensible and plausible model of how the programme works to achieve the desired outcomes within the specified environmental conditions (Bickman 1987). A further explanation of a logic model is a graphical representation of the causal relationships which link the various components, such as resources, activities, outputs and outcomes of a programme (McLaughlin & Jordan 1999, Chen 2005). Logic models are useful tools in identifying milestones which the programme seeks to achieve. Such models may further aid in identifying indicators which can be used for assessing the programmes performance (McLaughlin & Jordan 2004).

Numerous efforts have been undertaken to develop useful and practical evaluation systems for conservation programs (Stem et al. 2005). Although the search for common evaluation methods applicable to a number of different conservation interventions is underway, a brief review of evaluations illustrates the necessity for adapting any evaluation to the programme or question at hand. Conceptual models, similar in form and construction as logic models, have been suggested as a useful tool for planning and evaluating conservation interventions (Margoluis et al. 2009). Empirical evaluation tools have been applied to assess the ability of different conservation strategies to prevent the decline of threatened species (Taylor et al. 2010). Through the understanding of which interventions led to the stabilization of threatened species, Taylor et al. (2010) were able to provide further support for the use of protected areas for conserving species. Empirical evidence of effectiveness is essential in conservation

strategies with large budgets, or those applied on a large geographic scale (Stem et al. 2005). The conservation strategy of the Golden Lion Tamarin (*Leontopithecus rosalia*) has been praised as an example of an intervention which resulted in the recovery of an endangered species. This programme has relied upon specific evaluation criteria and the recycling of knowledge across multiple partners and institutional levels (Kleiman & Mallinson 1998).

Haines et al. (2008) suggest the use of human footprint data to monitor the effect of conservation interventions within a hypothesis-driven framework. If a conservation intervention has mitigated or reduced human influences on a landscape, then one might suggest the intervention is effective in that context (Haines et al. 2008). Recently, Snall et al. (2011) evaluated the use of citizen science data against a more formal scientific approach for monitoring bird species distributions. They found discrepancies between the datasets, however suggest that if used correctly citizen science data may complement other approaches, especially for species of conservation concern (Snall et al. 2011). A similar approach investigated bird distributions in the U.S.A and illustrated the need for multiple data sources and the utility of integrating citizen science with published data (Lepczyk 2005). The Cornell laboratory of Ornithology explicitly states that evaluation and monitoring of project and participant outcomes be viewed as an essential component of any citizen science research programme (Broussard et al. 2005, Bonney et al. 2009). Thus there would seem to be a steady increase in the number of conservation interventions undergoing evaluation.

These brief examples illustrate the diversity of approaches to, and applications for, monitoring and evaluation in conservation science. Increased information sharing between institutions and the public may lead to the identification of the most effective evaluation procedures. Coupled with a shift in the attitude of conservation scientists to demand evaluation of any and all interventions (Pullin et al. 2004, Sutherland et al. 2004), this can eventually lead to fully evidence-based conservation.

Methodological considerations

Questionnaires are variously referred to as surveys, questionnaires or psychometric instruments, depending on the purpose. For the purpose of this research a self-report survey was designed which included three different psychometric instruments for assessing different psychological components of the atlasers, together with standard survey questions, as outlined above. Two major objectives important in survey design are reducing non-response and the reduction of measurement error (Dillman 2007). The tailored-design method described by Dillman (2007) is the most widely applied method for designing surveys. The major aspects of this method are to design a survey which attempts to capture the best possible responses and one which insures the design intentions are carried out effectively (Dillman 2007). The work of Babbie (2004) was consulted for recommendations regarding index construction and analysis, with the recommendations of Kline (1998) also being applied for these purposes. Reducing non-response can be achieved through a respondent-friendly design (Dillman 2007), which takes into account the type of survey (posted, email or online) which most suits the target group. Major characteristics important to designing robust psychometric instruments include; 1) internal consistency (with 0.7 Cronbachs Alpha suggested as a minimum value), 2) evidence of validity, 3) strong discriminatory power and 4) low standard error of measurement (Kline 1998).

I used an online electronic version because this targeted the largest number of respondents in the shortest time period. Important attributes of online surveys which improve their efficiency include the speed of administration and data collection, convenience for respondents, low costs of construction and flexibility (Evans & Mathur 2005, Van Selm & Jankowski 2006). Using an online platform is appropriate for this citizen science project because many of the volunteers interact solely with the project through its website and other online technology. A similar approach would be useful for all citizen science projects which interact with volunteers via the internet and programme websites. The use of online surveys for a number of different purposes has increased in frequency (Kaplowtiz et al. 2004, Evans & Mathur 2005, Lumsden 2005, Van Selm & Jankowski 2006). A utility of the online platform is the ease of sending out reminders via email and advertisements on the website (Evans & Mathur 2005). Research suggests that reminders have a large impact on reducing non-response (Dillman 2007).

Table1.1. Showing studies consulted and their associated sub-motives identified for volunteers.

Study	Motivations					
Environmental						
Ryan et al. 2001	Learning	Helping the environment	Social factors	Project organization	Reflection	Fascination with nature
Miles et al. 1998	Personal growth	Meaningful action	Participation	Physical activity	Chance to be away	Fascination with nature
Measham & Barnett 2007	Improving skills	Helping a cause	Social interactions	Learning about the environment.	Desire to care for the environment	
Raddick et al. 2010	Learning	Contribute	Community	Fun	Teaching	Discovery
Bruyere & Rappe 2007	Learning	Helping the environment	Social	Project organization/career	Values & esteem	Get outside
Tremblay & Hvenegaard 2008	Learning	Conserving nature & helping birds	Social interactions	Achievement	Enjoyment	Contact with birds
Weston et al. 2003	Self-education	Conservation in general		Personal experience	Helping birds and their habitat	Research (birds/science)
Haas 2000	Learning	Protect the environment	Social	To be of service	Teaching	Nature enjoyment
Young 2008	Learning (personal growth)	Making a difference	Contributing to future generations	Professional growth	Breaking out of routine	Exploration
Social						
Clary & Snyder 1999 (VFI)	Enhancement	Values	Social	Career	Understanding	Protective
Galindo-Kuhn & Guzley 2001	Work assignment	Participation efficacy	Group integration	Communication quality	Support	

Chapter 2

Developing a logic model for the Second Southern African Bird Atlas Project.

Introduction

There has been a call in recent years for conservation science to adopt an evidence-based approach in the design and implementation of conservation programmes (Pullin et al. 2004, Sutherland et al. 2004, Keene & Pullin 2011 in press). Such an approach is integral for improving and demonstrating the effectiveness of conservation programmes, together with enhancing the cost-effective use of financial and other resources (Ferraro & Pattanayak 2006, Margoluis et al. 2009). Ensuring evaluation and monitoring are inherent components of conservation programmes is a positive step towards evidence-based decision making. Unfortunately most conservation programmes rarely receive comprehensive, external evaluations, although evaluation is now widespread across numerous other disciplines such as health services, education and international development (Kleiman et al. 2000, Keene & Pullin 2011 in press). Furthermore this lack of monitoring and evaluation manifests a disjuncture between scientific research and conservation practice, more formally known as the research-implementation gap (Pullin & Knight 2001, Knight et al. 2008, Sunderland et al. 2009).

Basing conservation programmes on defensible evidence, through both the application of scientific research and through formal evaluations, represents a fundamental step towards adopting evidence-based conservation. Conservation programmes should aim to continually improve their capacity to achieve their goals (Salafsky et al. 2002, Knight et al. 2006a). To do this, professionals must systematically test the goals and assumptions of a programme and recycle this information into the programme (Salafsky et al. 2002). Evidence-based conservation facilitates the recycling of information learnt from evaluations which is essential for social learning and adaptive management, often cited goals for conservation programmes (Salafsky et al. 2002, Folke et al. 2005, Knight et al. 2006a, Roux et al. 2006).

Although evaluation is now viewed as an essential component of effective conservation programmes and for developing knowledge of effective interventions (Kleiman et al. 2000, Kapos et al. 2008, Bruynincyk 2009, Flowers 2010), there are specific obstacles which have prevented its widespread adoption (Ferraro & Pattanayak 2006). Conservation professionals generally do not receive training on techniques for conducting evaluations, and many fail to recognise the importance of evaluation for improving conservation programmes (Ferraro & Pattanayak 2006). In combination with the limited budgets of conservation programmes, this typically results in evaluation not being included in the design of programmes, or being the first activity to be cut from programmes with limited budgets (Saterson et al. 2004, Margoluis et al. 2009). In addition, a lack of awareness regarding evaluation theory has led conservation professionals to attempt to re-design and develop evaluation methods, rather than drawing on existing theory and practices (Salafsky & Margoluis 2003). Drawing on existing information through collaboration, and social learning across disciplines is essential for creating robust evaluations in conservation science (Salafsky & Margoluis 2003, Stem et al. 2005). In this regard the field of programme evaluation can provide tools and techniques to investigate a programmes performance (Newcomer et al. 2004).

Programme evaluation is defined by Chen (2005) as: "the application of evaluation approaches, techniques and knowledge to systematically assess and improve the planning, implementation and effectiveness of programmes". This definition fits well with the intentions of the current study for investigating a citizen science research programme. Programme evaluation can assist an organization to assess its impact across all the intended activities and outcomes, including policy or social strategies, such as marketing and education (Heimlich 2010). The development of an evaluation is often guided by developing a programmes theory of operation. In this context a programme represents a set of resources, activities and outputs directed to specific goals by a manager or management team (Newcomer et al. 2004). Programme theory guides this process by identifying the key elements of the programme and how they relate to one another (Cooksy et al. 2001). A logic model is an often employed tool for developing a programs theory of operation. The logic model is a graphical representation of the causal relationships which link the various components of a programme (Chen 2005). These components are summarised in the logic model as resources, activities, outputs and short, mid and long-term outcomes.

The Animal Demography Unit (ADU) at the University of Cape Town (UCT) has conducted citizen science programmes since 1991. These programmes have engaged the citizens of South Africa and neighbouring countries in research initially concerned with birds, and later expanding to include amphibians, reptiles and butterflies and other taxa (Harrison et al. 2008). These programmes include the First and Second Southern African Bird Atlas Projects (SABAP1; 1987–1991, and SABAP2; begun 2007), The Protea Atlas Project (1991–2001), The Southern African Frog Atlas Project (SAFAP; 1995–2004), Southern African Reptile Assessment (SARCA; 2005–2009) and the Southern African Butterfly Conservation Assessment (SABCA; 2007–2010) (Harrison et al. 2008). The programme at the focus of this research, SABAP2, engages citizens in collecting scientific data on bird distributions over lengthy time periods and large geographic scales. SABAP2 was designed by building on the model developed during the first Southern African bird atlas (Harrison et al. 1996, Harrison et al. 2008). The SABAP2 programme has been running for four years, and currently about 48% of the project area (South Africa, Swaziland & Lesotho) has been atlased to some degree (http:sabap2.adu.org.za/homepage2011). Large scale atlas projects such as this would not be possible without the input of volunteers (Harrison et al 1996, Weston et al. 2003, Greenwood 2007).

An issue present in conservation programmes is that evaluation is not often incorporated in the program design (Margoluis et al. 2009). This was the case for SABAP2, resulting in a lack of baseline data, with which to compare the outcomes of the programme. It is essential for conservation programmes to establish baseline data sets for assessing their programmes outcomes; this may include biological data, such as species abundance, or social data on attitudes and perceptions.

The SABAP2 programme has three principal objectives (Harebottle et al. 2008):

1) Measuring the impact of environmental changes on birds through the collection of rigorous, scientific data tracking the spatial and temporal changes in bird distribution and abundance;

2) To increase public participation in data collection and public awareness of birds through the mobilization of citizen scientists;

3) To provide information useful in determining changes in bird distribution and abundance since the first atlas project.

The programme operates by mobilizing volunteer citizen scientists whom spend a specified period of time, no less than two hours per event, recording birds observed or heard in an area. The geographic area in which observations are recorded is known as a pentad, due to the specific size of the area, which covers five minutes of latitude and five minutes of longitude. This represents a finer scale than that used during the first atlas (Harebottle et al. 2008). An individual observer; hereafter termed an 'atlaser', submits a card with bird records and pentad coordinates to the database of SABAP2. In this way, records from across the country are collated to produce distribution maps for individual species. It is evident from this description of the programmes operations that without a motivated and active volunteer base the project would be unable to collect significant scientific data. The major emphasis of this research is to evaluate the second objective of SABAP2 which relates to the atlasers volunteering for this programme.

It is essential to consider the important role of the volunteers in citizen science, and especially to change the perception of programme management regarding its volunteer base. Citizens represent the critical cornerstone of these research programmes (Ryan et al. 2001) and must be viewed as such. Additionally since volunteers are more likely driven by internal motivating factors, programme management must take the necessary steps to understand these motivations and their role in driving participation (Weston et al. 2003, Finkelstein 2008). The interplay between motives, satisfaction and levels of participation must be explored and understood in any citizen science programme wishing to recruit and retain volunteers (Bruyere & Rappe 2007).

Principal research objectives

Although the ADU appears to have successfully managed its citizen science research to deliver the intended programme outcomes (Harrison et al. 2008), a formal review or evaluation of the effectiveness of this research has not been undertaken. As with similar citizen science initiatives, these programmes have been primarily concerned with the outcomes useful for science (Weston et al. 2003, Greenwood 2007), rather than the outcomes generated for the citizens which form the cornerstone of such research (Ryan et al. 2001, Bruyere & Rappe 2007). Developing a logic model which illustrates the programme's functioning in relation to the atlasers, along with evaluating volunteers' motivations and satisfactions, is essential in determining the effectiveness of the SABAP2 programme to

mobilize and maintain its atlaser community. It is essential to the programme's management that the psychology of the volunteers and the programme functioning in relation to the volunteers be explicitly understood.

The emphasis in this chapter is on explicitly articulating the programmes theory of operation, through the development of a logic model. An assessment of the characteristics and psychology of the atlasers is presented in Chapter three. Evaluations questions deemed important to the programmes management are described below as the major research objectives of this thesis. In addition to discerning the programmes theory of operation, an important consideration for this research is the process through which this will be achieved. A major aim is to describe a useful, repeatable method which this or other citizen science programmes may use to articulate their theory of operation, or develop a programme logic model. This method will be based on current evaluation practices, thus avoiding the pitfall of attempting to re-design new methods (Salafsky & Margoluis 2003).

There are different types of evaluation dependent on the programmes stage of development and the purposes of the evaluation (Newcomer et al. 2004, Chen 2005). Given the extent of the study area for which data has been collected, the programme can be considered to be in the mature implementation stage of development (Chen 2005). A performance assessment was selected as the appropriate type of evaluation since this fitted both the programmes level of development and the evaluation aims of the programme director (Chen 2005). The primary aim was therefore to assess the programmes performance or functioning in relation to mobilizing citizen scientists and increasing public awareness of birds, as previously stated.

Two main purposes in measuring a programs performance relate to investigating accountability or the value of the program, and for improving the program (McLaughlin & Jordan 1999). This research is concerned with the latter objective, and corresponds to an improvement-oriented evaluation (Patton 1997). Additionally the framework for performance assessment can be applied as an ongoing system of measurement and feedback about the operations and outcomes of the programme (Love 2004). Through application of the theory of evaluation the principal researcher was able to develop up a robust framework for the development of the programmes theory of operation. The overarching goal of this research is to generate recommendations for improving SABAP2, thereby contributing towards a framework for adaptive management.

Methods

Evaluation methodology

The process of evaluation within this context included six major stages which usually characterise an evaluation. An evaluation typically proceeds through a series of six stages; 1) identifying the programme and evaluation needs, 2) designing a logic model of the programme, 3) outlining evaluation questions, 4) designing appropriate instruments or measures required for generating the information needed to answer specific evaluation questions, 5) collection and analysis of the information, and 6) generating outcomes and disseminating findings (Keene pers. comm., Newcomer et al. 2004). This procedure can be applied to any programme or question, and tailored to the study at hand, thus illustrating the utility of adopting evaluation procedures. It was beyond the scope of this research to conduct a comprehensive evaluation of the programme; however the research still aimed to complete the abovementioned stages. The primary aim in this instance was to elicit the programmes theory of operation (stage two), and in so doing provide recommendations to the programmes management (stage six) and a basis for future evaluation efforts. The development of a theory of operation was explicitly concerned with understanding the programmes functioning in relation to the volunteers, and providing recommendations to improve the effectiveness of this relation. The methods described herein are those utilised in the development of the logic model and overall evaluation procedure. Analysis and the dissemination of the findings are represented by the results and discussion of this and the following chapter, together with the conclusion in Chapter 4.

Stage 1: Programme and evaluation needs

The initial evaluation plan was developed by the principal researcher and programme director, representing the first step in user-focused evaluation (Patton 1997). The primary aim of user focused evaluation, according to Patton (1997), is to "foster use by the intended users" of the evaluation. Incorporating the principal management team and other programme stakeholders in the evaluation process is pivotal to achieving this. In this instance the programme director of SABAP2 approached the principal investigator and outlined the need

for evaluation. This was achieved through numerous informal conversations about the programme and led to the development of the evaluation questions and research objectives (Stage three). The evaluation questions and methods for investigating these were developed before the conceptual model of the programme, which, although not normally the case in an evaluation, was not considered integral to our purposes (Keene pers. comm.). Thus the third stage of the evaluation has been documented in our introduction, by outlining the major research objectives of this research.

Stage 2: Logic model development

In order to develop a comprehensive and accurate model of the programme under investigation we employed a mixed methods approach, utilizing both quantitative and qualitative research instruments. A logic model was employed to describe specific elements of the programmes functioning relevant to volunteers' participation (although it could be used to describe the entire programme) (McLaughlin & Jordan 1999, Cooksy et al. 2001). In this instance the logic model was restricted to those resources, activities, outputs and outcomes which pertained specifically to the programmes atlasers, since this was the major facet of SABAP2 being evaluated. It is suggested that as many stakeholders as possible be consulted when developing the logic model (Patton 1997, McLaughlin & Jordan 2004). This allows for the programmes personnel to articulate their own understanding of the programmes operating theory (Patton 1997). This process has been termed the elicitation method, in which the researcher aims to uncover the mental models which programme staff hold about their programmes operation (McLaughlin & Jordan 2004).

SABAP2 is comprised by three major overlapping groups of stakeholders concerned with the management and implementation of the programme. Core programme management is conducted by the SABAP2 team at the ADU and consists of four principal members. Various regional area co-ordinators (RACs) are present in each of the provinces of South Africa and responsible for the management and promotion of the programme within their respective jurisdiction. In addition a steering committee oversees the overall programme and is made up of members of the core ADU team, RACs and other stakeholders, such as those representing funding bodies. Since it was impossible to conduct face-to-face interviews with all the relevant stakeholders, the development of the logic model was divided into two main phases, namely a stakeholder questionnaire and a focus group session.

The focus group sessions were held at UCT with the four core management personnel from the ADU. Focus groups were selected for this purpose as they are quick and inexpensive to administer (Wells 1974), and provide direct contact with the subject of the research (SABAP2 and its functioning regarding atlasers), thus improving understanding of the relevant issues (Kingsley & DeBald 1988). The discussions involved the principal researcher acting as facilitator and leading conversations regarding the principal components of a logic model. Two blank A3 pages were stuck to a board and headed with the different components, namely; Resources, Activities, Outputs, and short, mid and long term Outcomes, formatted as a matrix. The group proceeded across the headings and recorded any data which was pertinent, thus producing a logic table (McLaughlin & Jordan 1999, Cooksy et al. 2001). The format involved the facilitator asking questions and stimulating discussion to allow the group to provide the information relevant to each heading in the logic table. All of the information generated during the focus group was captured by the facilitator on A3 paper sheets during the discussion. This information was then input into a spreadsheet and a logic table was produced, for later combination with the results of the stakeholder questionnaire. During the first focus group session only a logic table was produced, and no linkages were hypothesized for the model. Other issues of interest with respect to the programmes relation with the atlasers were also documented.

Due to the geographic spread of the other programme stakeholders and time constraints on the research, other stakeholders were incorporated into this process through a short stakeholder questionnaire (Appendix A). The questionnaire was emailed out to all of the relevant stakeholders, members of the Steering committee and the RACs. This questionnaire included 12 items (ie. questions), which pertained to the programmes goals and eliciting information regarding the different components of the logic model. The questionnaire was attached to an email which included a short but detailed introduction to the questionnaire and a description of its purposes, explaining the theory of a logic model and its development (Appendix B). The researcher first sought to elicit the stakeholders understanding of the need for the programme and its stated goals, in order to place the forthcoming questions in context. Programme theory suggests that the needs which a particular programme is addressing will drive that programmes specific goals (Chen 2005). In this survey many of the stakeholders provided the same responses for both ‘needs’ and ‘goals’ of the programme.

Two email reminders were sent out to further prompt response from the stakeholders. Reminders are recognised as the principal means for improving response rate to questionnaires (Dillman 2007). The responses received from the stakeholders were collated in a spreadsheet. Responses were qualitatively classified, coded and used to produce a list of all items relevant to each component of the logic model. These answers were then compared and combined with the logic table produced during the initial focus group. Other items in the questionnaire, pertaining to the needs and goals of SABAP2 were also analysed through coding and content analysis.

Linkages or relationships between different elements of the logic table were then identified by the principal researcher. In this way resources were linked to activities, which are in turn linked to outputs, giving rise to desired outcomes. A final focus group comprising the core management team at the ADU then critiqued the logic model to: i) test and confirm the hypothesized linkages, ii) to discuss specific outcomes of the research, and iii) convert the logic table into a logic model outlining the programmes functioning in relation to the atlasers. Logic model construction allows for a researcher to assess all of the linkages present in the programme, and whether these are complete. Further investigation of the logic model is used for generating recommendations for the programme, and providing a model of the programmes functioning for its personnel. In this instance the researcher also aimed to generate a general model for a citizen science project, derived from the model for SABAP2.

Further evaluation stages

As previously mentioned, the third stage of the evaluation was essentially conducted before the abovementioned stages, and resulted in the research objectives previously outlined. Additionally the development of the logic model, and the methods for discerning the theory of operation, represent the fourth and fifth stages of the evaluation procedure. The stakeholder questionnaire and focus groups represent the appropriate instruments required for generating the necessary information (stage four). While the analysis of responses and combination with focus group data to produce the logic model, is the fifth stage of the methodology. Finally, the sixth stage regarding generating outcomes and disseminating findings is represented by this document and the recommendations contained herein. The major focus of this research on the process for articulating the theory of operation is evident in that our stage two also includes the fourth and fifth stages. A further consideration is that

this research should point to further evaluation questions, thus feeding into a cycle for evaluation and adaptive management.

Results

SABAP2 goals

The questionnaire was emailed out to 30 stakeholders from a list obtained from the programme director, from which a total of 11 stakeholders replied, which secured a response rate of 37%. According to survey response guidelines this is satisfactory for interpretation purposes (Fowler 1995); however, with such a small group of stakeholders a response rate of over 70% would guarantee more robust results (Babbie 2004). Respondents were acting as the Regional Area Coordinators (RACs) (n=7), members of the SABAP2 Steering Committee (n=5), or as part of the ADU management team (n=1), with two respondents acting as both RACs and on the steering committee. Seven personnel had been involved with SABAP2 since its inception in 2007, with the remaining four joining the programme in 2008. Full names and affiliations were elicited by the researcher, however to maintain stakeholder anonymity this data is not reported.

The SABAP2 goal of mobilizing citizen scientists and increasing public awareness of birds was mentioned by only two respondents (18.2%). The other major goals stated by respondents included: updated data on bird distributions to produce more accurate maps (81.82%, n=9), phenology of different events (n=1), data for conservation planning (n=2) and developing repeatable and robust methodologies for tracking species changes (n=2). All responses to items Q three, four and five in the questionnaire are shown in Table 2.1.

There was major overlap across items 3 and 4, (Q3: "What do you view as the principle 'needs' which SABAP2 is addressing?" & Q4: "What do you perceive as the primary goals of the programme?") with some respondents simply answering 'as per previous' (n=2) in response to the goals of the programme (Q4), and in reference to the needs of the programme (Q3). The principle needs which the programme is addressing were described by respondents as: data on bird distributions (n=11), abundance of species and phenology of events (n=5), data for conservation planning (n=2) and understanding possible impacts of climate or

Table 2.1. All stakeholders responses to given to the 3 first questions of the stakeholder survey.

SABAP 2 needs	**SABAP 2 goals**	**SABAP 2 effective at meeting its goals**
Update bird species distributions and changes thereof.	Continuous & repeatable method for collecting distribution data	Yes (n= 9)
Information on decline of species	Updated distribution information and maps for species	Not yet (n=1)
Changes in abundance	Increase public awareness of biodiversity data collection & of birds	Gaps in coverage preventing comparisons
Timing of migration & seasonality records	Data for conservation planning	Not enough people participating
Impacts of climate/environmental change on birds	Develop biodiversity atlas protocol	
Data for conservation planning		
Encourage birders to participate & add purpose to their birding		
Improving birding & bird identification skills		
Fostering environmental awareness		

environmental change on birds (n=1) (Table 2.1). The needs mentioned which related to citizens included: fostering environmental awareness (n=1), improving bird identification skills (n=1) and encouraging more birders to participate (n=1) (Table 2.1). In most cases respondents mentioned more than one of the needs outlined above, illustrating the diversity of needs underpinning the atlaser's involvement, and this programme.

A positive response was received to question 5 ("In your opinion has the programme been effective at reaching its goals?"), with nine respondents replying 'Yes' (81.8%, Table 2.1). A single respondent felt that it was too early for the programme to have reached its goals. Other respondents mentioned issues with gaps in the dataset preventing comparisons with the previous atlas (n=1), lack of information on phenology (n=1) and too few people participating (n=1) (Table 2.1). Only a single respondent related back to the goal of mobilizing citizen scientists, suggesting that the project has been successful at achieving this. The lack of reference to effectively achieving the second major goal of SABAP2 associates with the lack of stakeholders to mention this either as a need or goal of the programme, with important implications for the programme's functioning.

In response to the penultimate question of the survey (Q11), regarding suggestions for programme improvement, stakeholders felt that regular communication with atlasers is critical to the programmes efficiency (n=1), user-friendly software might encourage participation (n=1) and that communal challenges and small, organized trips to unatlased areas could all improve the atlasers experience (n=2). Prizes were suggested for the top atlasers (n=1), possibly generated through sponsorship by external donors. A single respondent also felt it was important to have the RACs develop the atlaser communities in their region. Five respondents (46%) did not provide any suggestions for improvement, whilst one felt that the project was running smoothly and required no improvements.

Logic model

The second half of the stakeholder questionnaire (Q6–Q10) pertained to the information required for generating a logic model, which is presented in Table 2.2. Respondents' answers were combined with those generated during the focus groups, to produce the logic model. To retain simplicity Logic model 1 has been presented in two halves (Figures 2.1 & 2.2). The first half (Figure 2.1) illustrates the resources, activities and outputs of the programme and

the linkages between these. The second half (Figure 2.2) continues with the programmes outputs and the outcomes which these generate. A simple linear path could not be used to link the various programme components, since many of these are linked to more than one other component.

It is evident that the core ADU management team is responsible for the activities relating to operational and information technology administration, workshops and training of new atlasers and formal marketing of the programme (Figure 2.1). Three of these activities, namely workshops, administration and formal marketing contribute to the output of an active or inactive programme participant or atlaser. In addition the recruitment and training of participants is dependent on informal marketing and field surveys (Figure 2.1). The complexity and numerous cross–linkages illustrate how the different components contribute to multiple other components, rather than a simple linear flow between one another. The presence of these linkages was vetted by the ADU management team, which suggests that the required linkages and flow between components is occurring in this programme.

In addition to the full programme logic model, two further models were produced which illustrate the relation between the programme and its participants, since this is a major aspect of this research. Logic model 2 illustrates the components of the programme which lead to the output of a participant (Figure 2.3). These activities have been described; however this model was produced in order to provide a simple graphical representation of the activities necessary to generate functional participants. These components and linkages are essential in understanding how the programme generates and maintains its volunteer base.

Logic model 3 illustrates the components which they are in turn linked to, such as producing scientific data and other outcomes, or the two way flow of informal marketing which aids in sustaining the programme (Figure 2.4). The emphasis in this logic model is to represent the participants as the central component of the citizen science programme; indeed the logic model presented could include all components of the programme, and still maintain participants as the central functioning component (Figure 2.4). The double-headed feedback arrows are also important in that they illustrate how participants drive certain programme elements, which in turn contribute to both the recruitment of new participants and the satisfaction and motivation of current participants.

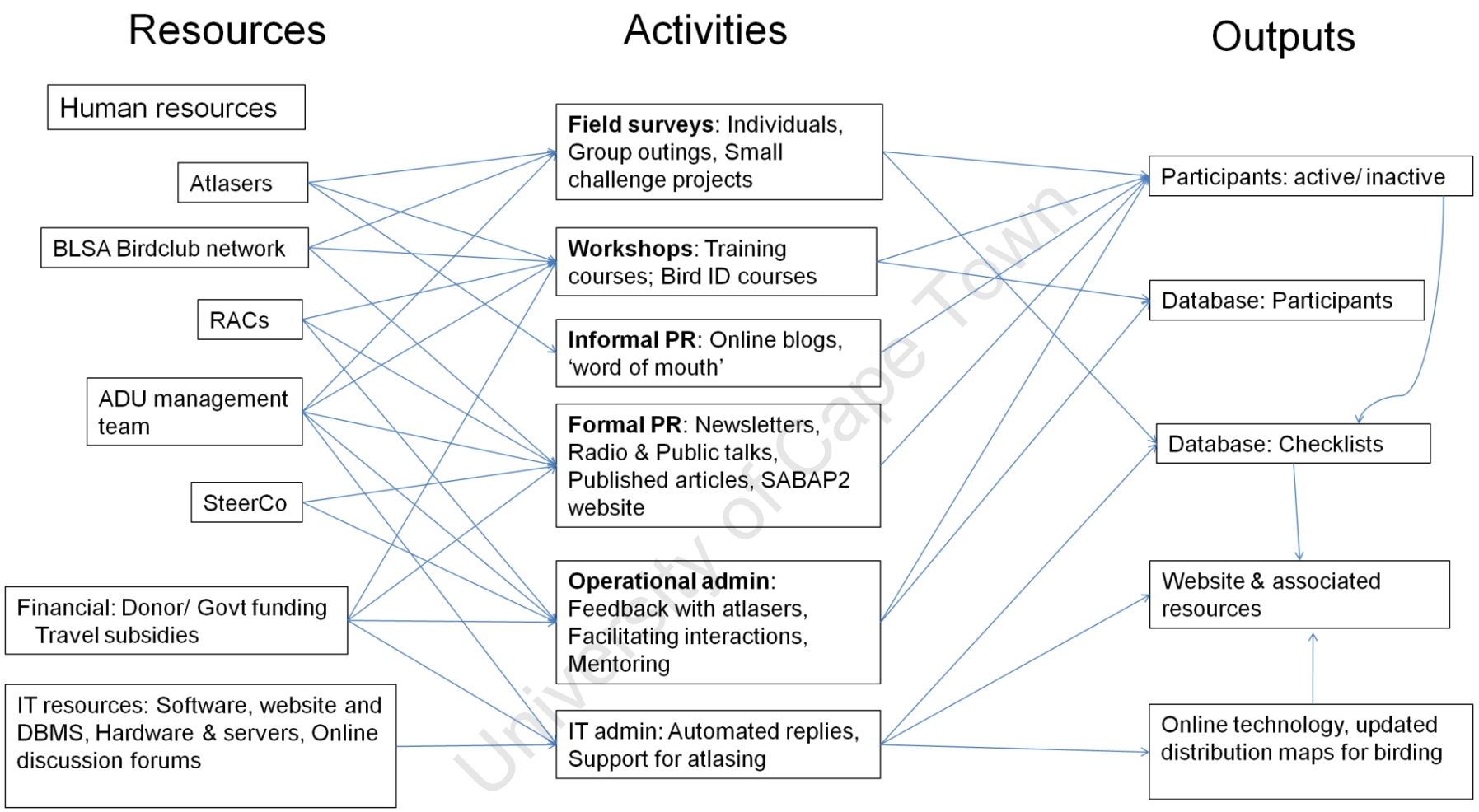

Figure 2.1. Logic model 1, first part, depicting linkages and components related to the Resources, Activities and Outputs of SABAP2.

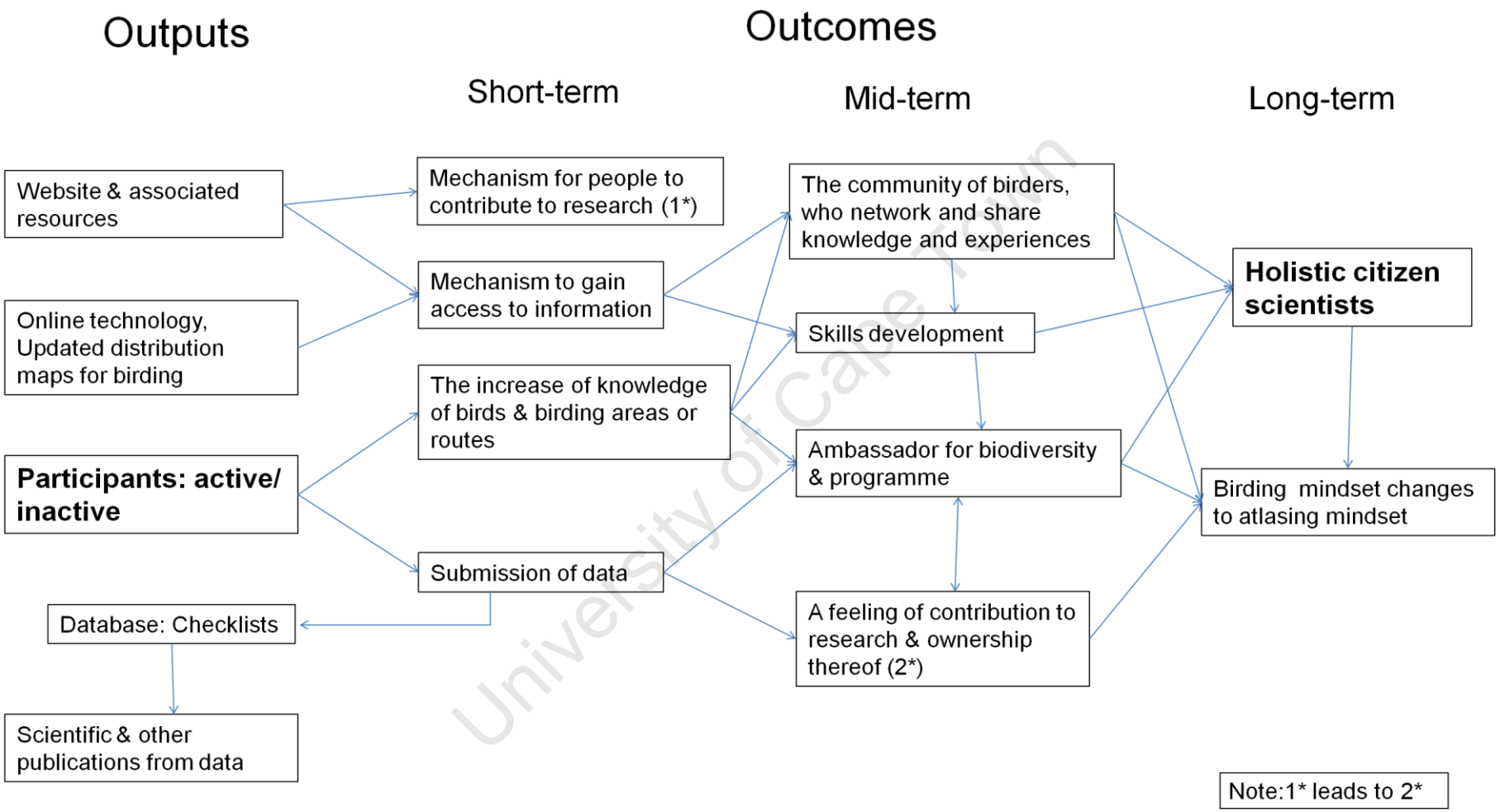

Figure 2.2. Logic model 1, second component, including Outputs and Outcomes of SABAP2 in relation to the atlasers.

Discussion

The use of a stakeholder questionnaire and focus groups to facilitate development of the logic model provides the information basis for evaluating the SABAP2 programme. This pertains both to the perceived effectiveness of SABAP2 and measures which may further improve the programme. A measure of the effectiveness of this programme is represented by the numerous complete linkages within the logic models (Figures 2.1–2.4) (Margoluis et al. 2009). Programmes which are ineffective at achieving their goals might have numerous decoupled components, including outputs and outcomes. The logic model illustrated for SABAP2 shows no disconnected components across the programmes functioning. When viewed in its entirety (Figures 2.1 and 2.2), there appears to be a smooth transition from the resources through to the final outcomes which are generated for the participants. This smooth transition leads finally to the collation of scientific data in the database, which in the long term can be used for the production of scientific and more general publications (Figure 2.2).

It is apparent from the logic models (Figures 2.2, 2.3 & 2.4) that the SABAP2 atlasers underpin the production of scientific publications. Without the intermediate step they facilitate, that of contributing data required to build a database; these publications would not be possible. The current level of coverage precludes the use of the information for scientific purposes, however SABAP1 produced a wealth of publications, and this information will no doubt allow for the same (Harrison et al. 2008). However the atlasers are not only integral to collecting the data for publications, they also play an important role in the informal marketing of the programme (Figure 2.4) through blogs, social networks and discussion forums that all expose more birders to the programme. This in turn generates participants, resulting in the feedback indicated between atlasers and the marketing of the programme (Figure 2.4). A similar relationship is required to sustain the website which is integral to the programme. The IT administration is explicitly concerned with maintaining and developing the website (Figure 2.1), but without the contributions of numerous participants and their access to the website, this aspect of the programme would hold less value (Figures 2.1 and 2.4).

Figure 2.3 illustrates the principal resources and activities hypothesized to sustain the atlaser community. It is evident that both formal and informal marketing, training workshops and

operational administration (Second focus group data) are essential activities required for producing atlasers. However a distinction must be drawn between the activities required for securing new atlasers and those required for sustaining atlasers' satisfaction with SABAP2 and hence active participation. In the proposed logic model (Figures 2.1 and 2.2) there is a distinct lack of activities aimed solely at sustaining participation, which could be considered a current limitation of the programme. Figure 2.4 shows that current atlasers may be motivated by challenges posted on the website, or through informal marketing amongst each other which may promote participation.

The numerous outcomes and motivations are hypothesized to foster atlaser satisfaction with the programme (Figures 2.2 and 2.4). Failure of SABAP2 to manifest these motivations could result in atlasers becoming disillusioned with their role in the programme, or their reasons for volunteering (Weston et al. 2003, Bruyere & Rappe 2007). It is therefore imperative that atlasers' desired outcomes from the programme be evaluated, so as to provide an evidence base from which the programme can be improved. Many of these outcomes are intangible, and can only be accounted for by examining the attitudes and perceptions of the atlasers. Chapter 3 of this thesis attempts this for specific outcomes. However, in the long term it will become necessary for citizen science programme to evaluate all of these desired outcomes. It is also essential that the programme review where and how they might actively contribute to generating these outcomes, since currently many outcomes rely purely on the atlasers themselves and changes in attitudes or behaviour which result from participation. In particular the programme might engage with the mid-term outcomes, by designing activities which, for example: maintain an atlaser community, develop skills and create ambassadors for biodiversity (Figure 2.2).

The above discussion illustrates the utility of the logic model in assessing a programs performance. Essentially we are now able to view the story of the programs operation, and the smooth transition which exists between the different components. It is beyond the scope of this data to provide a final conclusion of the programme's effectiveness, however this research has allowed for the programmes theory of operation to be articulated, and provided a repeatable and robust methodology for producing the theory of operation. It is the view of this researcher, that although certain functioning regarding the programmes relation with the atlasers may be improved, the current functions are effective in generating and maintaining a

volunteer base. This is further supported by the steady increase in the number of participants since the programme's inception (L.G. Underhill pers. comm.).

Promoting citizen science

A major issue encountered in the analysis of stakeholder responses pertains to the lack of acknowledgement of the second stated goal of SABAP2 to promote citizen science through the programme. The SABAP2 goal of mobilizing citizen scientists and increasing public awareness of birds was mentioned by only two respondents (18.2%) with important implications for the programmes implementation and expansion. This objective refers to the mobilization of citizen scientists, and increasing public awareness of birds and biodiversity data collection. Many of the stakeholders represent the RACs tasked with coordinating the programme in their respective regions. However if the focus of operations exists solely for the data and scientific needs and goals of the programme, then it is quite likely that the needs of the citizen scientists may be overlooked. It is imperative that all RACs be made explicitly aware of the goal of mobilizing citizen scientists, through developing the atlaser communities in their region, as was stated by a single respondent from the stakeholder group. This issue is larger than SABAP2 and apparent throughout the literature on citizen science. A shift in focus is required, in which mobilizing citizen scientists becomes the principal aim of any volunteer–based research project (Weston et al. 2003, Lakshminarayanan 2007, L.G. Underhill pers. comm.). As illustrated by our logic models (Figures 2.1 to 2.4), if this is achieved, then other goals are more likely to be achieved.

Recommendations

One mechanism for achieving a shift in focus required to make citizens the focal point of the programme, would be to make the RACs aware of the outcomes of research conducted herein, together with the outcomes of the research pertaining to the psychology of participants (Chapter three). In conjunction with this, the role of participants in promoting the programme must not be overlooked. By acting as facilitators for the regional communities of atlasers the RACs can essentially rely on the community itself to generate and maintain volunteer commitment. Thus rather than attempting to carry the burden themselves, RACs and other stakeholders should identify and motivate champions of the programme in their area and establish regional level social networks and online forums. This will allow for the

atlasers themselves to drive the promotion and maintenance of the programme. The role of advocacy and social networks in developing this programme is expanded upon in later chapters.

Recommendations provided by the stakeholders could also be applied to improve the programme. The regional or even local-level approach to developing atlaser communities, together with more regular communication with atlasers, could maintain the effectiveness of this programme. As seen in other programmes and research, the role of local communities in the implementation and effectiveness of conservation action must not be overlooked (Berkes 2007, Smith et al. 2009). In addition the communal challenges or small organized trips into 'unatlased' areas could also be conducted at regional scales. Atlasers could meet their local colleagues, which would facilitate regional level social networking, further reducing the burden on RACs and other stakeholders. A further recommendation in this regard is the development of the programme at a local level. Regions could be divided into manageable local areas in which atlasers can network, these in turn organised hierarchically within the regional-level network. Building of this multi-level atlaser network would reduce issues such as lack of contact between atlasers, or budget and time constraints which limit RACs from visiting all areas. Once the local-level network was established, local champions would be required to maintain these networks (Knight et al. 2006b, Smith et al. 2009). Such networks are important in enhancing the social learning and adaptation capacity of the programme. Review by the RACs of local-level discussion forums would pinpoint programme shortcomings or common issues which need addressing. In this way the atlaser community has the opportunity to contribute directly to improving the programme, whilst the programme itself can be adapted to the needs of the atlasers. Ensuring that the correct institutional systems and incentives are in place at the correct scales across the hierarchy of the programme's organization, will be fundamental to implementing effective social learning (Bruyninckx 2009, Kennedy et al. 2009).

A suggestion for offering prizes to the top atlasers was put forward from a stakeholder; however this approach might create negative as well as positive results. Rather than simply awarding prizes to the most productive atlasers across the entire programme, one could again shift this to a regional or local level. RACs could be tasked with generating sponsors from the surrounding regions, since providing prizes within the sponsors region would also act as advertising for the sponsors concerned. Prizes might include most improved atlaser or the

person who facilitated most new atlasers to join the programme, rather than simply going to the most productive atlasers. These awards and sponsors could also be aligned with the goals of the programme, for example by rewarding atlasers with accommodation in areas which are poorly known. Fuel sponsorship would provide an incentive to atlas more remote areas. There is an increasing trend for corporate involvement in, and support for biodiversity conservation (for example: The Biodiversity & Wine Initiative of WWF South Africa, Ostrich Business Chamber South Africa). The current movement towards social and environmental corporate responsibility should be investigated as a means to generating such sponsorship. Prizes such as these will serve to motivate atlasers in a number of directions, whilst also covering more ground and filling gaps in the dataset. Such an approach shifts the motivation of atlasers to the regional level, rather than an overarching approach attempting to capture all atlasers nationwide. Understanding differences in motivation and satisfaction between the different regions can be assisted by a spatial analysis of the data produced in Chapter three.

Conclusions

The stakeholder responses seemed to indicate some confusion over terms in the questionnaire. Specifically the terms needs and goals, resources and activities as well outputs and outcomes, seemed difficult to distinguish from one another. Such confusion limited the value of the information obtained from the questions investigating these concepts. Furthermore only one respondent gave detailed answers to the questionnaire, whilst many had seemed to rush through the process simply aiming to complete the document. In such an investigation it is essential that any and all information or opinions regarding the programme be elicited by the evaluator. A low response rate to the questionnaire also limited the amount of information available to produce the logic model and evaluate the programs functioning. This situation could be avoided if future evaluations adopt a face-to-face interview strategy for gathering this kind of data. Conducting face-to-face interviews with all 30 members of the stakeholder group would elicit more information. In addition confusion over certain elements or questions could be avoided as the evaluator is on hand to discuss and elaborate on any issues encountered. A further suggestion from the low response rate is that the programme does not represent a major priority for the RACs, who are themselves volunteers with numerous other commitments.

This study details a performance assessment, with particular emphasis on improving the programme. Recommendations produced regarding the different aspects of the programme may contribute to its improvement. However this will depend on the stakeholder's objectivity in providing information for the development of the logic model, the programme personnel's willingness to implement the recommendations, and the resources available for implementation. This will in turn contribute to overcoming the research-implementation gap.

It is essential that such evaluations of this programme become an annual event, and are incorporated across the citizen science research programmes of the ADU. In addition, the scientific outcomes, and other intangible volunteer outcomes, require more rigorous assessment to conclusively demonstrate the programme's effectiveness. Through such evaluations we can contribute to the practice and theory of evidence–based conservation. Evaluations could also be integrated into such programmes to form the basis of an adaptive management approach.

Finally, this process has highlighted the central role volunteers play in citizen science programmes, through their contributions to scientific data and activities required for generating and maintaining the programme. It is therefore essential that the satisfactions which atlasers hope to realize from their involvement in SABAP2 are delivered by the programme. A major shift required in the perception of the programmes staff is that the atlasers represent more than simply productive atlasing units required for the programme. This shift should be taken in other citizen science programmes, in which the traditional view of "scientists using citizens as data collectors" must be re-defined as "citizens acting as scientists" (Lakshminarayanan 2007). Additionally the perception must move away from the impersonal view of the citizens to view recognising the people behind the volunteering, and their individual wants and needs. By making all levels of programme management aware of the volunteers' pivotal role and their expectations, management may further improve on its ability to meet their desired outcomes, thereby creating a sustainable citizen science programme.

Table 2.2. Logic table comprising all stakeholder and focus group information

Resources	**Activities**	**Outputs**	**Outcomes**		
			Short-term	**Mid-term**	**Long-term**
Financial capital (Travel subsidies?)	Informal PR: Online blogs, 'Word of mouth'. Champions spreading word.	Participants: Active or Inactive.	Submission of data	Birding mindset changes to an atlasing mindset, Creating an atlasing culture.	Holistic citizen scientist, able to contribute data to other projects.
Human capital: Atlasers: Skills, equipment, finances.	Formal PR: Radio & public talks, Published articles, SABAP 2 website.	Database: Checklists, Records.	Access to information	Incorporating atlasing into their lifestyle.	Atlasing in perpetuity.
BLSA bird club network	Field surveys: Individuals, Group outings, Challenge projects.	Website & associated online resources.	Meeting fellow birders in local area.	Ambassador for biodiversity & the programme.	Increasing enjoyment & satisfaction from both activity & programme.
Steering committee & RACs	Workshops: Training, Bird ID courses	Informal blogs for social learning.	Learning amongst atlasers	'Birding with a purpose.'	
ADU management team	RAC activities: ORFs, vetting records, administration.	Milestone certificates & email notifications.	Repeated data collection in certain pentads	Awareness of changes in bird distributions.	
IT resources: Software-website & Database. Hardware- Servers Online blogs & discussion groups	Operational administration: Feedback with atlasers, Mentoring & Training, Facilitating interactions.	Online technology: Updated distribution maps and other information.	Renewed enthusiasm for birding	Awareness & feeling of ownership of the scientific & other outputs from the data.	
Media & Publications	IT administration: Automated replies, Problem solving for atlasers.				

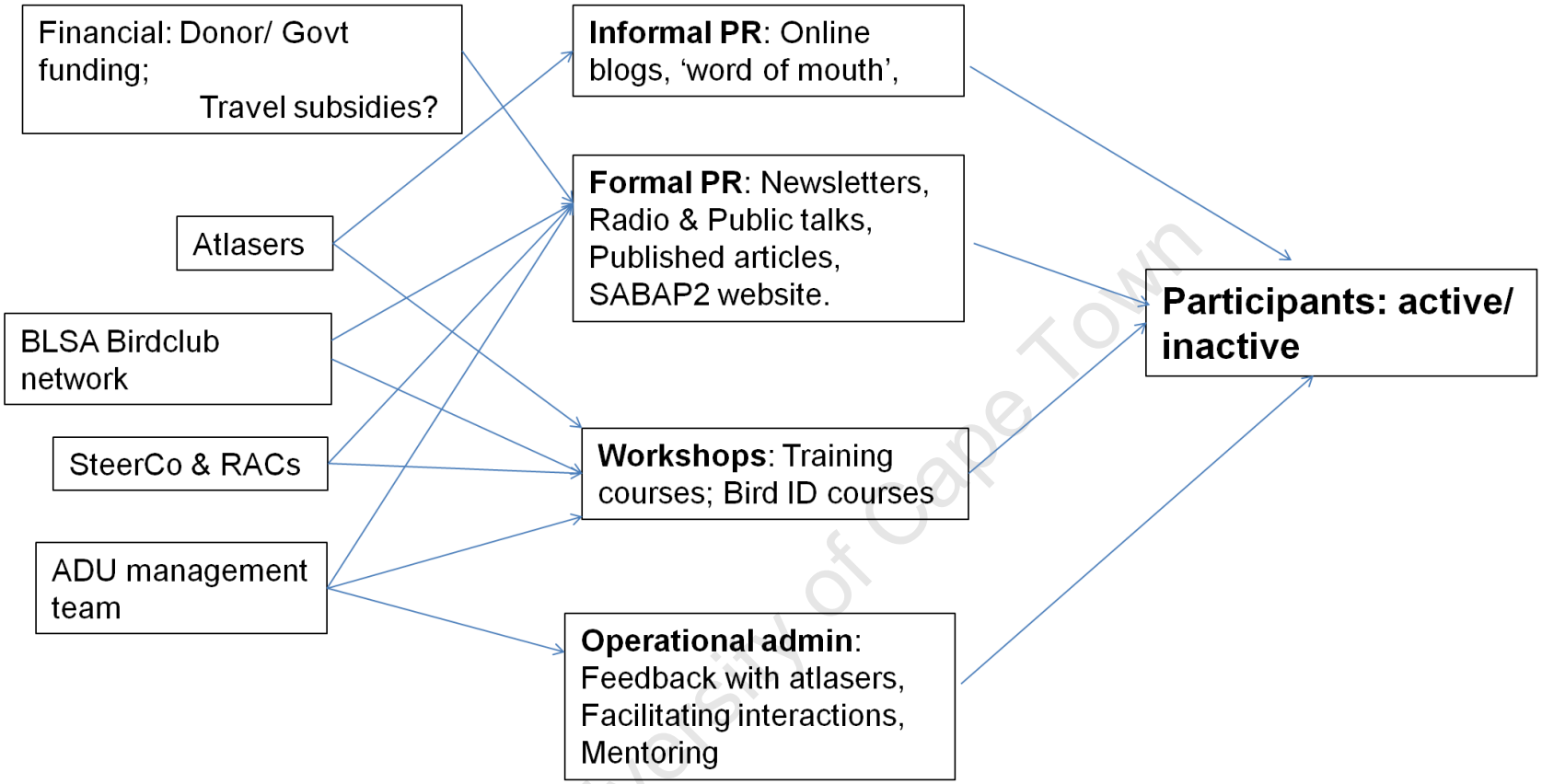

Figure 2.3. Logic model 2 illustrating the activities and components necessary to recruit and retain atlasers.

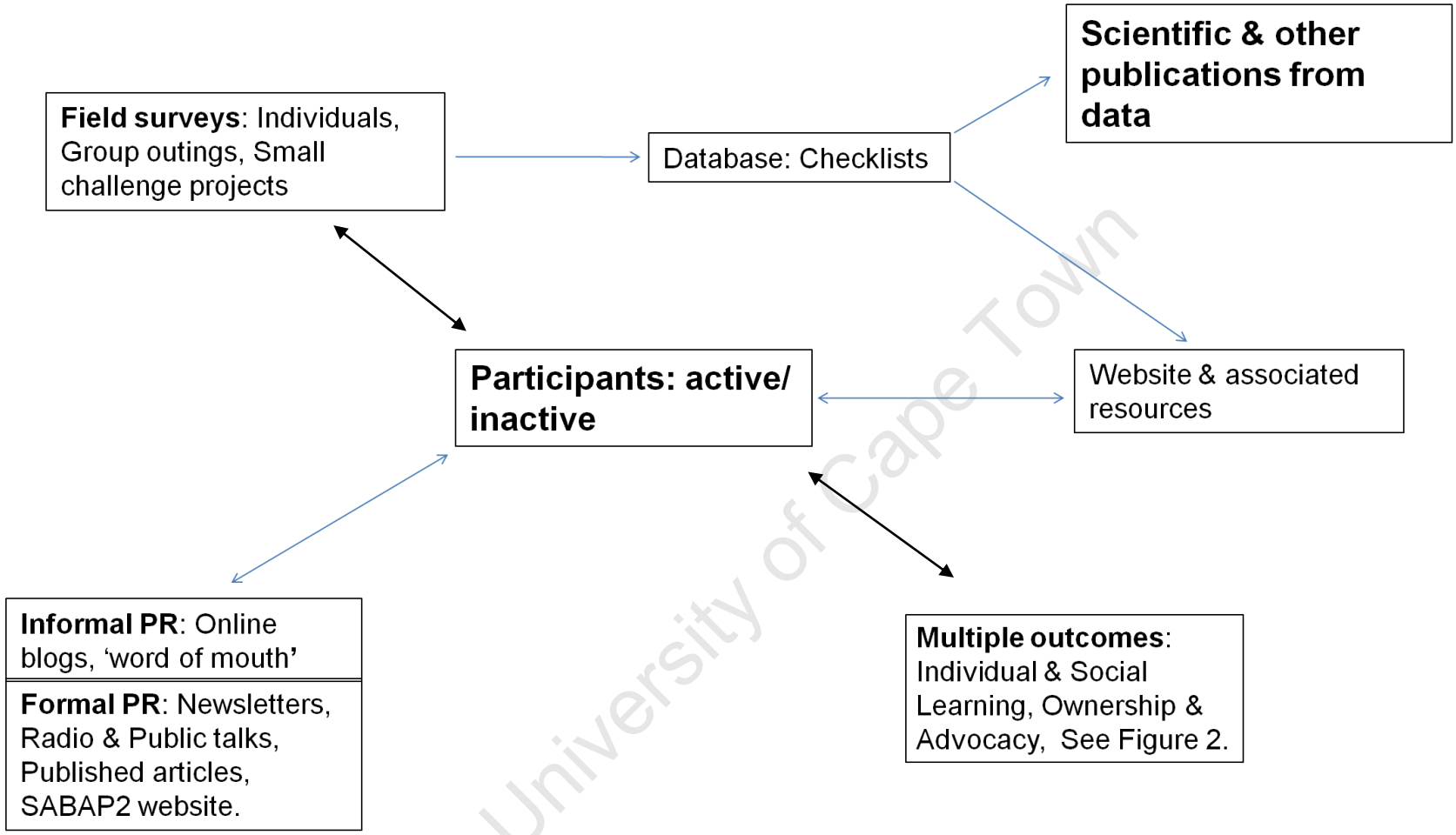

Figure 2.4. Logic Model 3 illustrating the central role of the participants, in relation to a number of different programme components.

Chapter 3

Psychometric assessment of the SABAP2 volunteers

Introduction

The global volunteer movement is rapidly expanding across many different sectors, environmental research and stewardship has also embraced volunteering with citizens becoming increasingly involved in these activities (Ryan et al. 2001, Greenwood 2007, Conrad & Hilchey 2010). This trend has led to the establishment of research programmes involving citizen scientists – members of the public who participate in a project by collecting scientific data (Bhattacharjee 2005, Cooper et al. 2007, DeVictor et al. 2010). Citizen science research has been applied in a variety of research contexts; however, the majority may be categorised into either those concerned with 1) with data collection and monitoring or 2) community–based natural resource management (Conrad & Hilchey 2010). These programmes can include up to hundreds or thousands of volunteers (Irwin 1995), and produce important scientific and educational outcomes for those involved (Raddick et al. 2010, Bonney et al. 2009). The United Nations Environment Programme describes public participation as a vital ingredient towards achieving global sustainability (Sharpe & Conrad 2006) and declared 2001 as the International Year of the Volunteer.

Ornithology is one scientific discipline which has maintained a long history of involvement by non-scientists, dating as far back as the United States' Audubon Christmas Bird Count of 1900 (Droege 2007, Greenwood 2007, Dunn & Weston 2008, Silvertown 2009, Sullivan et al. 2009). This long-standing relationship between scientists and members of the public has allowed volunteers to contribute to fields such as ecology and conservation biology for many years (Greenwood 2007). The most prominent contribution of volunteer ornithologists has been in large-scale atlasing projects (Dunn & Weston 2008). Atlas projects document the spatial and temporal changes in species distributions by systematically recording presence or absence on a pre-determined grid (Greenwood 2007, Dunn & Weston 2008). The geographic extent and quantity of data required for these atlas projects is often beyond the scope of

employed scientists, necessitating the use of public volunteers (Harrison et al. 1996). Atlas projects hold great value to science, investigating questions pertaining to life history ecology and evolution, biogeography and conservation planning, (Harrison et al. 2008, Robertson et al. 2010). However these projects also deliver important outcomes for the citizens who so willingly volunteer their time, effort and resources, including environmental and scientific learning (Trumbull et al. 2000, Bonney et al. 2009). The literature suggests that those co-ordinating citizen science projects have paid significantly more attention to the reliability and analysis of the data they produce than to the benefits accruing to volunteers (Weston et al. 2003).

The environmental movement owes much to the tens of thousands of individuals volunteering worldwide (Ryan et al. 2001). Although the outcomes of citizen science projects for scientists have been well documented, much uncertainty remains as to the motivations of, and satisfactions which, volunteers derive from their participation (Weston et al. 2003, Bruyere & Rappe 2007, Measham & Barnett 2007). Investigations into motives of volunteering have principally been undertaken within the human-service sector, whilst few studies have examined the psychology of environmental volunteers (Ryan et al. 2001, Weston et al. 2003, Bruyere & Rappe 2007, Measham & Barnett 2007). Understanding the psychology of volunteer participation, which is thought to be significantly different to that of employed staff is essential for conservation scientists intending to mobilize this valuable resource.

Particular dimensions of a volunteer's psychology identified as important for maintaining or increasing their involvement in a programme include the motivations (Bruyere & Rappe 2007), level of satisfaction (Finkelstein 2008) and burnout (Byron & Curtis 2002) and the ability to act as ambassadors for biodiversity (L.G. Underhill pers. comm.). The functional approach is one psychological method which has been applied to studies of volunteers, in both the social and environmental sciences (Clary et al. 1998, Clary & Snyder 1999, Bruyere & Rappe 2007, Finkelstein 2008). The functional approach investigates the personal and social processes which initiate and sustain action. Studies indicate that the participation and satisfaction of a volunteer is dependent on his or her personal motives and whether these have been fulfilled (Katz 1960, Clary & Snyder 1999). It also hypothesizes that the fulfilment of these motives correlates with the satisfaction of volunteers (Finkelstein 2008), which, in turn determines a volunteer's level of participation.

The Volunteer Functions Inventory (VFI) developed by Clary & Snyder (1999) provides a robust instrument for investigating motives within volunteers (Bruyere & Rappe 2007, Finkelstein 2008). The literature review (Chapter 1) allowed for identification of the motives predicted to correspond with SABAP2 volunteers. These include:

1) Values - to express or act on important personal values;
2) Enhancement - personal growth and development, including learning;
3) Social - to strengthen or build social relationships;
4) Recreation or Nature-based - atlasing as a recreational activity, allowing for time spent in nature;
5) Project organization and Career - to be involved in a well-run project or develop ones career through volunteering.

Another psychological dimension of an individual's psychology which is known to influence an individual's behaviour is burnout. The term "burnout" was first used in 1986 to describe a social problem identified in human service occupations (Byron et al. 2001). Burnout has been defined as a form of exhaustion driven by different processes with three distinct components, manifesting along a continuum for any individual (Maslach et al. 1986, Barnett et al. 1999). The three components (termed sub-scales) of burnout include the sense of personal efficacy or reduction thereof, emotional exhaustion and cynicism (Maslach et al. 1986). The investigation of this phenomenon has resulted in the development of the Maslach Burnout Inventory (MBI). The MBI is the most widely applied and investigated tool for assessing burnout. Modified versions of the MBI have been applied in environmental settings, notably Australia's Landcare programme, which involves long-term environmental volunteers (Byron & Curtis 2002, Byron et al. 2001). This study utilized a modified version of the MBI, taken from Byron et al. (2001) and adapted for our purposes. We suggest that levels of burnout will not correlate with the level of participation for the atlasing volunteers.

The final psychological construct relating to ambassadorship sought to elicit the level of advocacy portrayed by our volunteers. The theoretical work of Azjen (2001) provided a framework within which to assess behaviour and attitudes of the volunteers, and the relation between these concepts. I sought to understand whether volunteers are able to place their

contribution to this programme in relation to the conservation of birds, and whether they exhibit the capacity to act as "ambassadors for biodiversity conservation". An 'ambassador' is defined as: "an authorised messenger or representative", however for the purposes of this research the focus is on acting as a messenger for the programme or for biodiversity conservation.

In conjunction with the evaluation goals of this research, this chapter details an assessment of the psychology of volunteers participating in the Second Southern African Bird Atlas Project (SABAP2). It is hypothesized that developing a detailed understanding of the motivations, satisfactions, burnout status and ambassadorship for volunteers can increase the effectiveness of the project in a number of ways. These include, but are not limited to:

1) ensuring the satisfaction of volunteers with the programme so as to maintain motivation and reduce burnout, thereby increasing, or at least maintaining volunteer involvement;
2) increasing the regularity of involvement of existing volunteers, so as to increase the quantity of data gathered;
3) developing the environmental education capabilities of the programme, so as to raise awareness of conservation and sustainable development issues;
4) providing a mechanism for learning and direction for establishing adaptive capacity to refine and further improve the programme to ensure that it achieves its goals.

In this context, four hypotheses will be tested:

1. our assessment of volunteers in SABAP2 will reveal support for the identified motives;
2. levels of volunteer satisfaction will be correlated with the fulfilment of the identified motives;
3. both motives and satisfaction will be correlated with the volunteers' level of participation;
4. levels of burnout will not correlate with level of participation for the atlasing volunteers.

5. volunteers will exhibit the potential to act as ambassadors for biodiversity conservation.

The major research objectives of this chapter therefore include, but are not limited to:

1. Describing the major motivations of atlasers (Hypothesis 1).
2. Using the functional approach to test the relationship between motive fulfilment and level of satisfaction (Hypothesis 2).
3. Understanding the relationships between volunteer productivity, effort, and duration of service with the level of satisfaction and burnout (Hypotheses 3).
4. Developing a 'volunteer satisfaction index', and scoring the level of satisfaction.
5. Assessing the level of burnout using a modified Maslach Burnout Inventory, and evaluating the reliability of this version for assessing burnout in volunteers (Hypothesis 4).
6. Developing an index and investigating the potential of volunteers to 'act as ambassadors for biodiversity' (Hypothesis 5).
7. Understanding the constraints limiting atlaser effort.

Methods

Volunteer survey & psychometric instruments

Survey design and delivery

An on-line survey was developed comprising five sections, namely: introductory questions, motivations and satisfactions, ambassadorship for biodiversity conservation, burnout and demographics. The final self-report survey (Appendix C) instrument contained 75 items (ie. Questions), and included open-ended questions, close-ended questions and Likert statements (Babbie 2004). The introductory questions were open-ended and also investigated motivations of the respondents, benefits derived from volunteering and constraints on participation, among other questions deemed useful to the survey. The open-ended items were placed before the motivations and satisfactions section so as not to bias the respondents' responses (Babbie 2004, Fowler 1995). These questions were also designed for comparisons

with the dimensions investigated using the Likert statements. Close-ended questions for collecting demographic data were placed at the end of the survey, as per common survey research practice (Babbie 2004). The three psychometric sections (motivations and satisfactions, ambassador for biodiversity and burnout) were investigated using Likert scales (Likert 1932), scaled from 'Strongly Agree' to 'Strongly Disagree' with an 'unsure' category included as per social science research recommendations (Babbie 2004).

The SABAP2 project director sent out an initial survey notification, which was followed by further reminders after a two-week period, a three-week period, and two final reminders during the last few days of the survey. The researcher noted increases in the number of responses directly after the reminders were sent out. Typically response rates peaked directly after reminders and tailed off as the time after the reminder increased. This finding supports the suggestion by Dillman (2007) and other social science researchers of the importance of reminders in increasing response rates. The final survey instrument was refined iteratively through four major edits before a list of questions was available for online piloting. Further refinement of the instrument was achieved through conducting un-structured interviews with five current atlasers. Each interview lasted approximately one hour. Two of the interviews involved two atlasers simultaneously, in which case both of their answers were recorded. Interviews provided a basis for reviewing the proposed motivations and other dimensions of the survey instrument. Online piloting involved the same five atlasers who had been interviewed. Pilot respondents completed the online version and provided feedback on the time length for answering, adequacy of questions and how user-friendly the instrument and online platform were. An initial question list of 103 items was reduced to the final version of 75 items. The final survey instrument was placed on the programme's website via a link and respondents were emailed and notified of the survey and its purposes. Responses were received over a month long period, after which the survey was closed. The principal researcher, prompted by the programme director, wrote a thank-you note with brief preliminary results for posting on the programme's website. This was in accordance with the programme's attitude of acknowledging and appreciating the contributions of the volunteers.

Motivations and Satisfaction

Atlasers motivations were investigated using 27 Likert statements. Items were designed using a literature review of the existing research on environmental volunteer motivations. Major

motives common across a number of different studies involving environmental volunteers were identified (as outlined in the Introduction) and provided a basis for individual items. Motives were also aligned with the VFI (Clary & Snyder 1999) in order to create a common framework for further research on volunteer motives and allow for comparisons across the relevant literature. The motives were used as guidelines for developing the individual items or statements, whose face validity (Babbie 2004) suggested they represent volunteer motivations.

The atlasers' degree of satisfaction was investigated using 17 Likert statements. Items pertaining to satisfaction were determined using the functional approach, in which the degree to which certain motives have been met is investigated. Specific items were designed for satisfaction which correlated with motives predicted from the literature review. This format was necessary to follow the functional approach (Katz 1960). Further items which investigated levels of satisfaction with other aspects of the programme, and the programme as a whole, were also designed (e.g. "My experience with SABAP2 has been positive."). Certain items were designed to be used for the analysis of both motivations and satisfactions; the wording of these items was structured accordingly. Utilizing the same items across different analyses reduces the total number of items, and therefore the time and effort required by the respondent, which are important considerations when designing surveys (Dillman 2007).

Ambassadorship

An instrument for assessing the atlasers' ability to act as ambassadors for biodiversity conservation was developed as a literature review revealed no such instrument currently exists. The development was guided by the conceptual framework for the theory of planned behaviour (Ajzen 2001). The instrument contained nine items which were designed according to whether they assessed the ability to act as ambassadors based on the face validity of the item. Designing robust items based solely on face validity is a common practice in social science and psychometric research (Kline 1998, Babbie 2004). For example, the item "I often informally share my atlasing experiences with others" was hypothesized to determine the degree to which an atlaser acts as an ambassador for the programme. Whilst other items in this instrument were designed to explore the construct of acting as an ambassador for biodiversity conservation.

A modified version of the Maslach Burnout Inventory (Maslach et al. 1986) was used to design items assessing burnout in atlasers. The modifications made by Byron et al (2001) and Poghosyan et al. (2009) were used as guidelines for developing our instrument. Individual items were modified to place the statements in the context of the programme under investigation. Each individual statement was adjusted accordingly. Those items deemed not relevant to this research were excluded from the instrument; in addition further items were excluded due to restrictions on the length of the entire survey instrument. The survey instrument needed to capture the necessary information for analysis, however it should not become too long as this can be tiresome for respondents and increase the level of non-response.

Participation levels

Different studies have aimed to quantify participation using index development and other methods. In this instance we were able to use specific measures from the programme at hand; these are available due to the nature of the research. A card is a completed bird list submitted by an atlaser after following the research protocol in a specified pentad. The research protocol requires a minimum of two hours of birding to be conducted in the specific geographic area. The programme uses the term pentad to refer to this geographic area due to the size of area. Thus an individual may complete many cards for a single pentad; or only one card per pentad and attempt to survey as many pentads as their situation allows. Records are also kept of the intensive and total hours which an individual spends birding, as these are noted on the submitted card. The principal researcher therefore took the number of cards, pentads and intensive birding hours which an individual completes as a direct measure of their level of participation. There are some issues with this, since an atlaser may have to drive many hours, or even plan a weekend away to access a particular pentad, whereas another individual might continually survey their 'home patch'. However these measures were used since other estimates of participation were deemed to be more ambiguous and biased.

Data Analysis

Survey data were analysed using multiple techniques applied to each type of data which arose from the survey. All questions relating to demographics were analysed using Microsoft Excel

(2007). In cases with open-ended answers the researcher first read through the entire range of responses before qualitatively classifying and coding the variables which appeared related at face validity. Categories derived from the coding were then investigated using summary statistics. Advanced analyses were completed using the program Statistica version 9 (Statsoft 2009). All items from each of the four psychometric instruments which the researcher sought to develop underwent reliability analysis, factor analysis and correspondence analysis.

Reliability analysis and inter-item correlations were run on each of the psychometric datasets. Cronbachs Alpha was used as the standard measure for internal consistency of an index, and items dropped or retained accordingly. A minimum Cronbachs Alpha > 0.7 is required to suggest that a group of items shows enough internal consistency to represent an index (Kline 1998). An index in this case is a single set of items producing information regarding an individual's place within a psychological construct. Factor analysis is most often applied to survey data utilizing Likert scales, and was the most common method used in the literature consulted for this research (Miles et al. 1998, Ryan et al. 2001). Factor analyses were conducted using the principal components method, with a varimax normalized rotation. Resultant principal factors were retained at an eigenvalue larger than 1.00, except were specified (Lewis-Beck 1994).

I also conducted correspondence analysis on the data to illustrate similarities and differences with factor analysis results, and the utility of correspondence analysis for survey data (Greenacre 2007). The particular type of correspondence analysis is known as doubling correspondence analysis, in which the original matrix of values is reproduced, but each score for every item per respondent receives the negative scoring. Thus a value of five in a response will be reversed to a value of one, thus doubling the matrix of values. Grouping of items in correspondence plots is somewhat subjective, thus we retained results from the factor analyses for comparisons.

Results

Response rate

A total of 228 responses were received for the atlaser survey; at the time of data collection a total of 840 observers had submitted data to SABAP2 since it started in July 2007 (http://adu.sabap2.org.za/ home page 2010). This corresponds to a response rate of 27%. Differences in the sample size for each question exist where respondents failed to answer a certain question or stopped completing the survey at that point. It is important to note that 280 observers actively collected records during this period. Our response rate from the observers actively involved with the programme during this period is therefore 81%; but many respondents might not have atlased during the period.

Demographics

The opening paragraphs deal with the general demographics of our sample population. The respondent population was made up of 165 men and 63 women with these constituting 72.4% and 27.6% of the sample respectively (n=228). The majority of the respondent population was Caucasian (99.5%, n=224). English speakers comprised the most respondents totalling 75.8% (n=172), with Afrikaans speakers comprising 22.0% (n=50) and five people speaking other languages. An important characteristic of the atlaser sample population was the age distribution of the respondents. A total of 46.5% (n=106) of respondents were over 60 years of age, illustrating the high number of retirees volunteering for the atlas, while only three respondents were between 21–25 years old (Figure 3.1). A majority of atlasers had received tertiary education (65.35%, n=149), with 16.7% completing secondary education (n=38) (Figure 3.2). As evident from the age distribution of our respondents, the highest proportion indicated they were retired (32.0%, n=71) (Figure 3.3). Those working in the environmental sector comprised only 14% (n=31) of the respondents, with more people involved in general business (n=47) (Figure 3.3). A majority of respondents fell within our highest available income grouping relating to earnings of more than R17501 per month (61%, n=88, Figure 3.4). The proportion of respondents per income group decreased with each decreasing income group (Figure 3.4).

The life lists of bird species recorded by an individual exceeded 600 bird species for 122 respondents (42.7%), and 21 respondents (7.3%) were uncertain as to how many species they had encountered during their lifetime (Figure 3.5). The majority of respondents were also a member of another environmental organization, with 74.8% (n=193) belonging to at least one other organization; 65 respondents did not belong to any other environmental organization.

Many of the respondents were members of BirdLife South Africa and its associated regional and local level bird clubs (39%, n=101), together with other projects run by the ADU at UCT. Other organizations to which volunteers belonged included the Wildlife and Environment Society of South Africa (WESSA), Endangered Wildlife Trust (EWT) as well as the Field Guides Association of South Africa (FGASA) and honorary ranger associations. Additionally there were numerous 'friends' groups, local eco-clubs, biological or botanical societies and conservancy groups which atlasers were a part of.

Respondents had first heard about the programme through a variety of different mechanisms (Table 3.1). The most common form was via 'Word of Mouth' (22.3%, n=63, Table 3.1), with important consequences for the marketing of the programme. Internet and email (15.6%), together with bird clubs (13.8%) also represent other important forms of marketing which assist in generating interest in SABAP2.

Atlaser constraints

A total of 353 mentions were made of different factors constraining atlasers. These were mentioned in response to the question investigating what limits the atlasers from participating more often. The researcher used a coding approach to group all similar constraints and sum the number of times each of these was mentioned. In some cases respondents mentioned more than one constraint. It is evident that the major constraints include time available to atlas (26.9%, n=95), work commitments (17.8%, n=63), and other general (10.8%, n=38) and family commitments (9.1%, n=32) (Figure 3.6). Financial constraints also affect the atlasers since both money and fuel costs were mentioned multiple times (n=37, n=30, respectively). Other minor constraints not captured in Figure 3.6 include age, weather conditions and the lack of a nearby atlasing community (n=7 for all three). Burnout received only a single mention, whilst access to less popular pentads for the required amount of time also affected an atlaser. An important constraint mentioned by one respondent was a reduction in initial enthusiasm after a lack of response to corrections. There were also mentions that nothing constrained a few of the atlasers, suggesting they contribute as much to the programme as is possible (n=7).

Atlaser champions

In order to assess which atlasers were recommended as champions all names mentioned were recorded, together with the number of mentions which each name received. In this section we directly asked the respondents to name an individual they recognised as a champion of the programme as this has been shown as the most efficient method for eliciting the correct response (Knight et al. 2010). A total of 105 atlasers were named by their colleagues as champions of this programme. Although respondents were asked to rank the champions, these rankings did not contribute to the analysis. Rather each mention of an individual was taken as an equal measure. Respondents identified the ADU management team, RACs and top 10 atlasers as champions. However the definition we are applying to the concept refers to volunteers themselves, and not management, thus the members of the ADU team were excluded from the analysis. All RACs and top atlasers were included since they volunteer for the programme, and working with their fellow volunteers to promote and enhance the programme represents acting as a 'champion'. The top five atlasers regarded as champions of the programme in order are; Ernst Retief (n=43), Etienne Marais (n=38), Arnold van der Westhuizen (n=27), Trish Strachan (n=19) and Andre Marx (n=12) (Table 3.2). It is evident from these results that the top three atlasers in particular have gained the recognition and respect of their colleagues. In addition all of the atlasers named as champions are listed (Appendix D).

Text mining results

In order to analyse the open ended questions regarding motivations and benefits of participation (Q5 and Q6, Appendix C), a Statistica 9 (Statsoft 2009) text miner application was employed. The application searches the open-ended answers and produces a list of those words with the highest frequency across all answers. This approach was necessary since the responses were too varied and lengthy to allow for manual coding. The most common word resulting from the question regarding motivations was the root 'bird' (n=301), followed by 'contribute' (n=100) (Table 3.3). 'Enjoy' was the third most frequent word found (n=69, Table 3.3).The top twenty most frequently encountered words hold important insights into the motivations of atlasers (Table 3.3). It is not possible to calculate the percentage these words comprised from the entire dataset, since other words irrelevant to our analysis (for example; 'the', 'and') would confound the analysis.

The word contribute is in turn linked to various modes of contribution, ranging from 'knowledge of birds' or 'conservation of birds' to 'scientific research'. Answers extracted can be compared with those obtained from the psychometric instrument for motivations, for validation of the outcomes, and to provide further insight into the psychology of the participants.

A similar analysis performed on the question regarding the benefits of participation reveals the words most often used when describing the benefits experienced from involvement (Table 3.4). In this instance 'learning' (n=41) and 'knowledge' (n=40) were encountered most frequently (Table 3.4). There is obvious overlap across these words, and they may in turn be linked to the construct of enhancement, identified in our literature review concerning motivations (Table 1.1). There also seems to be an obvious link between the next four words; 'new' (n=36), 'see' (n=36), 'species' (n=31) and area (n=30) (Table 3.4). This result suggests that participants feel benefits when they encounter or record species new to them for the first time, or through the experience of visiting a new area. Inferences from the open-ended analysis are further expanded upon in the discussion in relation to other components of the instrument investigating similar aspects of atlaser psychology.

Atlaser improvement recommendations

An open-ended question enquired as to the atlasers' suggestions for ways to improve the programme. The responses varied widely, with many having no suggestions for improvement (20.6%, n=60), or suggesting that the programme was "Excellent as it is". A total of 291 responses were manually examined by the researcher and a full list of improvements was produced. This approach was used in order to retain all the individual level information which had been supplied. On examination of the improvements, common ideas were identified. These included extending the programme in perpetuity and creating an on-going database for observations, with periodic reviews or results synthesis. Expansion of the programme, through mobilizing more birders, and targeting alternative demographics such as the youth and university students was also suggested. The use of sponsors to aid in expansion and further mobilize the current atlas team, by for example providing fuel, was identified as a mechanism for this. Communication with atlasers from the programmes management, as well as facilitating networking between atlasers was also mentioned. A few respondents noted individual level technical and protocol issues; these should be examined by the programme

management to identify real issues. A fully standardized alphabetical bird list was identified by certain atlasers as a requirement. Although the current list is alphabetical, there are some minor faults in it. Although these were the most common improvements mentioned, their percentage against the entire dataset was still negligible since full coding was not undertaken.

Motivations analysis

The motivation index dataset included a total of 27 items, in which eight items were used for both the motivation and satisfaction indices development. The entire dataset (n=214) was first subject to reliability analysis to demonstrate the relationship between items purporting to measure motivation (Cronbachs α=0.91, Average Inter-item correlation=0.27). Results suggest that the items do measure a similar construct, however there are significant differences between individual items, due to the low inter-item correlation (<0.30). This is in accordance with our attempt to describe atlaser motivations as a single construct across a range of different motives.

An exploratory factor analysis was conducted next utilizing a principal components method with varimax normalized rotation, resulting in six factors (Table 3.5). Factor loadings for each item together with overall Cronbachs alpha and mean scores are calculated for each factor (Table 3.5). Items with a factor loading below 0.50 were dropped when investigating the reliability of each index. All factors were derived based at specified minimum eigenvalues (>1.00) (Lewis-Beck 1994). In this analysis it is imperative that one returns to the original statements in order to elicit trends in the resultant factors. It was noted that Factors 2, 4 and 6 include only items attempting to describe social (Factor 2), value (Factor 4) and enhancement (Factor 6) driven motives. These groupings correspond with those predicted by the VFI (Clary & Snyder 1999). However, factors 3, 4, 5 and 6, resulting from the exploratory analysis, did not meet the minimum threshold of internal consistency (Cronbachs α>0.70) to warrant description as complete indices. These factors did not correspond to a single motive or psychological construct, but included a range of motives. Factor 2 representing the social motive was robust; however, the relatively small mean score can be taken as indication that this motive is not as important to the respondents. Factor 1 is the most internally consistent factor, and includes a range of different motives, exhibited as items describing values, recreation and enhancement.

A confirmatory factor analysis was undertaken to investigate the extent of support for our predicted set of motives. Many of the motivation items in our dataset were produced from the VFI, and thus we sought to investigate its application to bird atlas volunteers. The items developed in relation to each of the predicted functions or motives were grouped and analysed. As previously all factor analyses used a principal components method with varimax normalized rotation and minimum eigenvalue of 1.00. Motives showed strong internal consistency and factor loadings in most cases (Table 3.6). The results suggest that the pre-determined factor groupings or motives received stronger support than those obtained through the exploratory factor analysis. High mean scores for each of the motives suggests that we have accurately determined the motives which drive our volunteers (Hypothesis 1) (Table 3.6). Only the social motive does not reach the prescribed minimum for designating an index. The mean scores are calculated across all respondents for all items in each index. On the range from 1–5 for all Likert scores, the mean score values suggest that respondents show agreement with these items as indicators of motivation (mean scores > 3.0). Motives describing value driven and recreation or nature driven motives score the highest (Table 3.6), suggesting these are the most important motivating factors for our atlasers. Enhancement driven motives score third highest, thus supporting the conclusions of the exploratory factor analysis which found these three motives to be important to the atlasers.

A doubling correspondence analysis was undertaken to determine the groupings of factors. The first two dimensions accounted for 42.3% of the inertia of the entire database (Figure 3.6). Items in the plot were grouped subjectively by linking the same item through the origin, angles between the lines linking items are then analysed to assess groupings. Items which fall on the same line or contain a very small angle between them are suggested to be highly related in the dataset. Correspondence analysis revealed that Q19 and Q42 were unrelated to the other items, whilst many of the items were strongly related (Figure 3.6). This supports the initial analysis of internal consistency, suggesting the items are in fact measuring a similar psychological construct.

The above results suggest that a multifaceted inventory representing motivations can be developed from the original items. This inventory is comprised of sub-indices each representing a different motive of the atlasers. The final major motives which are described for the atlasers, in order of importance are; recreation/nature based motives, values, enhancement and to a lesser degree; social and project organization or career motives.

Satisfaction analysis

Satisfaction with the programme was investigated using general items related to satisfaction, together with items targeting the fulfilment of certain motives, as per the functional approach. A total of 17 items were used with reliability analysis revealing that these showed strong internal consistency (Cronbachs α=0.89, Average inter-item correlation=0.34, n=217). Satisfaction items were more closely correlated than items in the motivation dataset, although with a marginally lower value of internal consistency.

An exploratory factor analysis as per previous methodology resulted in 4 factors (Table 3.8). Factors produced by this analysis did not seem related at face validity when one considered the statements which they represent. However they might be grouped as the first, through fourth most important satisfactions which atlasers derive from the programme. As the two first factors contained most of the variance of the entire factor analysis, the researcher sought to conduct a second analysis restricting the outcome to two factors. The resulting factors seemed to group into those related to general satisfaction with the programme, and those items more concerned with fulfilment of certain motives (Table 3.9). Three items (Q36, Q45 Q46) were dropped from these factors due to factor loading < 0.50. These two final factors are taken as indices for volunteer satisfaction in the programme; both exhibit internal consistency and robust inter-item correlations (Table 3.9). Mean scores for these indices are greater than 3.0, suggesting agreement with the statements relating to satisfaction with the programme and motive fulfilment. Mean scores across the individual statements support this level of satisfaction (Table 3.7).

The doubling correspondence analysis was used to produce a two dimensional plot of the positive and negative variables (Figure 3.7). Two dimensions accounted for 50.7% of the inertia in the dataset, with eigenvalues of 0.0324 (dimension 1) and 0.0066 (dimension 2). Item Q42 was unrelated to any of the other items in the satisfaction dataset. All other items in the dataset clustered fairly closely along the axes linking items, suggesting an overall relationship between items (Figure 3.7). On closer inspection there is grouping of different items within the two-dimensional plot (Figure 3.7). The items showing strong correspondence with one another, and thus suggesting a relationship in the dataset, include; Group 1 (Q30, Q33, Q36, Q46), Group 2 (Q34, Q37, Q41), Group 3 (Q35, Q38, Q43, Q44,

Q45) and finally Group 4 (Q23, Q32, Q40) with Q39 loosely associated with this group. There appears to be some overlap between factor 1 (Table 3.9) and the groups 1 and 2, with some items missing. Whilst the second factor (Table 3.9) contains a few of the items of groups 3 and 4 (Figure 3.7). There is therefore a degree of overlap between the results of the correspondence analysis and the factor analysis, however in order to understand the meaning behind the proposed groups one must consider the content of the different items.

A test of the correlation between the average score of individuals across the motivations and satisfaction datasets revealed a linear relationship (R^2=0.73, Figure 3.11). In the analysis, items pertaining to both were restricted to the satisfaction component. This relationship is in accordance with the functional approach, in that the score for motivations of an individual predicts their level of satisfaction.

Ambassador analysis

Important issues to evaluate given by the programme director included the concept investigating whether the atlasers were able to act as ambassadors for biodiversity. These items were thus designed in an attempt to develop an index measuring the potential for this ability. Summary statistics for the 9 items used were calculated (Table 3.10). An initial investigation revealed a reliable level of internal consistency across all 9 items (Cronbachs α=0.76, Average inter-item correlation=0.27, number of valid cases=217; Table 3.11). Item Q55 alone increased the internal consistency when dropped from the analysis.

Factor analysis on this dataset revealed two major groupings with eigenvalues of 3.27 and 1.40 respectively (Table 3.12). These two factors were further supported by a reliability analysis which confirmed the groups.

Correspondence analysis revealed two similar groupings, however with one item, Q55, again unrelated to any others. The two-dimensional plot of the row and column profiles represented in Figure 3.8 illustrates that a total of 53.3% of the variance of the dataset was captured in two dimensions. Items falling together in the factor analysis cluster similarly in the doubling correspondence analysis. In addition item Q53 and Q47 are highly related, as are items Q49 and Q51, as well as Q50 and Q54. This suggests that certain of these items could be dropped since their information is captured by other items. Factor analysis, and inter-item correlation

values did not reveal such strong relationships between these items, illustrating the need for investigating different avenues when analyzing the data.

On inspection it was noted that the items in the statistical groups hold some relevance to the item phrasing. The first index containing six items related to the atlasers spreading a message regarding the programme, whilst the other index represented items related to spreading a message about conservation, or exhibiting environmentally aware activities. Thus the two indices created are taken to represent 1) Acting as an ambassador for SABAP2, and 2) Acting as an ambassador for the environment. High mean scores (Table 3.10) across all participants suggests that they are in agreement with these indices, and thus are exhibiting strong potential to undertake these behaviours.

Burnout analysis

Following the analysis protocol for other psychometric components of this research, a test of internal consistency was run first. The 13 items representing burnout showed significant internal consistency to be describing a single construct (Cronbachs α=0.71, n=197), however the items themselves were not strongly correlated (Average inter-item correlation=0.14). It is important to note that scores for items in this instrument are viewed in reverse, such that a lower score indicates a lower propensity to experience burnout (Table 3.13). The items measuring personal accomplishment are scored in the reverse to all others, thus a lower score indicates a high feeling of personal accomplishment corresponding to a low level of burnout. Analysis revealed that excluding three items would increase the reliability of the instrument, thus items Q59, Q65 and Q67 were removed from subsequent analyses. Internal consistency and item correlation increased after removing these items (Cronbachs α=0.76, Average inter-item correlation=0.22, n=204).

Factor analysis revealed a three–factor structure as proposed by Maslach (1986) in the development of the inventory; however the factors did not correlate with those predicted by the design of the items (Table 3.14). All items in the first factor correspond to those investigating personal accomplishment, whilst the second contains a mix of items related to emotional exhaustion and depersonalization. Items in the third factor related only to emotional exhaustion. The reduced number and re-phrasing of all items from the original MBI is quite likely a cause for departure from the predicted results.

Doubling correspondence analysis revealed similar trends to that of the factor analysis. Items Q59 and Q65 grouped together, but apart from all other items. This lack of correlation with other items was evident in the reliability and factor analyses. All of the items relating to personal accomplishment grouped together and well apart from other items in the instrument (Figure 3.9). The two-dimensional plot of the variables captured 52.2% of the inertia in the dataset (Figure 3.9). Items Q61 and Q63 were highly correlated, as were Q58 and Q62, suggesting a strong overlap of content between these items. These four grouped together with items Q67 and Q56, thus resulting in two major groups. In comparison with the factor analysis it is evident that these groups correspond to those of personal accomplishment and emotional exhaustion. The items predicted to relate to a sense of depersonalization did not fall separately in either analysis.

Participation levels

An analysis of the levels of participation of the respondent group illustrate that we received a wide diversity of experience in our respondent pool, from those just starting out, to those having completed over 700 cards (Figure 3.10). The same spread was evident across the number of pentads and intensive birding hours conducted by each respondent. Such a spread of participation is important in illustrating the applicability of the results to all atlasers. Information on participation was elicited by recording observer number in the original survey. Subsequently this number was used to extract an individual atlasers' participation record, however no names or other details were extracted from the database, nor are the observer numbers reported here. Ensuring and maintaining anonymity of respondents is an essential component of survey research.

Participation levels were tested against the major psychometric instruments produced. This is in accordance with aspects of the functional approach, and for our own purposes in determining relationships between participation and outcomes for the atlasers. No correlations were present across all four psychometric instruments. The analyses of level of satisfaction plotted against the individual's participation level, taken by the number of cards submitted, revealed no significant correlation ($R^2 = 0.078$). A similar result was found for the relationship between the scores for the ambassador of biodiversity index and the individuals' level of participation ($R^2 = 0.0191$). This suggests that levels of motivation, satisfaction,

burnout and ambassador ability do not result from how active an individual is in the programme. Nor do these psychological attributes determine how much of their time an atlaser is willing to give to the programme. These results indicate the importance of understanding other factors which contribute to the motivation and satisfaction of atlasers, as well as the level of participation. In further tests with participation, both income group and employment type were found to be unrelated to levels of participation.

Discussion

Instrument design and application

The response rate which we received was adequate to allow for the analysis of results and for the production of psychometric indices. A minimum number for responses suggested for psychometric index development is approximately two responses per item in any index (Kline 1998). Thus we received an adequate number of responses in order to analyse the various datasets, since none were larger than 27 items (motivation dataset). Certain studies have used smaller sample sizes for analyses, such as Weston et al. (2003, n=57) or Ryan et al. (2001, n=148), thus confirming we received adequate responses to infer conclusions. Although our response rate (RR) is less than in comparable studies (Bruyere & Rappe 2007, RR=33% and Ryan et al. 2001, RR=48%) it is within social science research recommended levels (Babbie 2004). Additionally certain authors have noted a trend for web-based surveys to receive lower response rates than traditional or mail-out survey methods (Shih & Fan 2008).

We therefore suggest that future evaluations more fully explore the mixed mode design (Dillman 2007) by combining online survey instruments with more traditional approaches. Although requiring a longer time span for data collection, the mail-out format might appeal to a different sector of the atlasing community, who are not as comfortable with an online platform. An increase in response rate will increase the applicability of results to more of the atlasing community. In questions such as those regarding suggestions for improvement, or in psychometric index design, increasing response rate will enhance the information generated by the survey instrument. Furthermore the results obtained from this survey might have been biased by the low response rate. In particular one might suggest that those atlasers who are

more active and more satisfied with the programme would be more likely to respond. This is one explanation for the high level of satisfaction of the respondents. The motivations of this sub-group of atlasers whom responded might not correspond with the motivations of the entire atlaser group, leading to incorrect inferences of motivation. In order to overcome this obstacle future research might attempt to target the inactive participants and conduct face-to-face interviews in order to obtain a fuller understanding of the satisfactions and motivations of the entire atlaser group.

Demographics

An overall description of the demographics of our respondent population is essential in understanding the different psychological constructs under investigation. The response rate received, when taken in combination with the spread of atlaser participation (Figure 3.10), suggests that results may be inferred for other atlasers. In this document the sample is referred to as the respondents, however for purposes of the discussion, these results may be applied to the entire atlasing community.

The demographics of the respondents, relating to age, gender, language and culture, inevitably result from the type of individual who practices bird watching as a hobby. It is evident from the demographics that a current shortfall of the programme is concerned with mobilizing the lower income groups and individuals from a greater variety of South Africa's demographic groups. Although these groups may not traditionally practice bird watching, the programme should develop strategies to expand the atlaser population to become more representative of the diversity of South Africa. However there are certain restrictions on participation, such as adequate knowledge of birds, financial resources necessary to conduct atlasing activities and the education level required to understand scientific protocol.

Despite these barriers to entry the programme may still attempt to engage more of the citizens of Southern Africa. This may be achieved through targeting young learners at schools, technical colleges or universities. In the effort to expand public awareness of birds and further mobilize citizen scientists, the programme must become explicitly concerned with involving a greater diversity of people. Young learners in particular should be targeted, as involvement in this kind of programme has been shown to produce outcomes related to both environmental and scientific learning (Broussard et al. 2005, Bonney et al. 2009). University

courses might be encouraged to take on atlasing as an activity, either as part of biology course, or through more informal arrangements, thus expanding the age distribution of volunteers. Such a project can introduce students to the scientific method, and data collection, whilst providing environmental education and awareness.

Although the respondent population is dominated by individuals who have already completed tertiary education, it is nonetheless possible to involve other segments of society in such research. In such a case schools might adopt areas within their local pentad, and use this as a base. Learners completing surveys would then experience firsthand exposure to the scientific process or method through accurately recording observations. Assisting in uploading these observations to the website will further engage them with the information technology behind such projects. Generating awareness of bird species in the local school patch would possibly transfer as learners look for birds at home or in other environments. Amateur birders could undertake a similar process at home and thus develop the skills necessary to atlas. This will in turn act to foster environmental awareness through real engagement with the environment, in a safe and inexpensive manner. A similar result is applicable when viewed from the point of the number of species seen. Although it is a requirement that the atlasers be experienced birders with adequate identification skills, this does not preclude the programme from using involvement as a strategy for developing such skills. Introductions to atlasing at schools or universities by a member of the management team (RAC or ADU), followed by the appointment of an individual for vetting records could aid in establishing smaller atlasing communities. A pilot programme along the lines of the above recommendations has been described to the principal researcher (L.G. Underhill pers. comm.).

Viewed from the demographic of our respondents it would seem that involvement in citizen science research is currently limited by multiple factors, including education level and income. We therefore re-iterate the need for expanding this demographic. Using SABAP2 as a model programme for increasing the diversity of people involved will ultimately allow for the expansion of citizen science in South Africa. The outcomes of environmental education and stewardship may then be achieved for a greater proportion of the population, with knock-on effects for conservation and management of natural resources.

Atlaser motivations

Our analysis of the motivations of atlasers partially supported the use of the VFI for environmental volunteers (Clary & Snyder 1999). Motivations were also strongly related to similar motives described for environmental volunteers, identified through our literature review (Table 1.1). The first hypothesis of this study related to predicting the motivations of the atlasers, strong support for the indices created from our motivation item dataset, together with high mean scores, show that the predicted motives held true.

Recreation/ Nature based motives: Motives similar to these have been confirmed in other studies but termed differently. Raddick et al. (2010) identified 'fun' as major motive, whilst Miles et al. (1998) and Ryan et al. (2001) both suggest 'fascination with nature' as an underlying motive. Tremblay & Hvengaard (2008) identify 'enjoyment', and Bruyere & Rappe (2007) name a motive 'get outside', and suggest further research into the significance of recreation as a motive (Table 1.1, Chapter 1). All of these studies together with our results, point to a strong connection between environmental volunteers and the natural world which they value (Guiney & Oberhauser 2009). In many instances, the ability for exploring new places (Item Q20) or indulging ones passion (Q17) might be motivation enough for individuals to volunteer their free time to such a cause. Atlasing is therefore capable of combining the benefits derived from being in nature, with those derived from volunteering, conservation or leisure activities, as has been suggested for restoration ecology volunteers (Miles et al. 1998).

It is recommended that this programme attempt to tap this motive in individuals by emphasizing the time spent outdoors, exploring new environments and having fun. Using nature and outdoor experiences as the primary focal point of the activity has been suggested in other studies of volunteer motivations (Bruyere & Rappe 2007). Rather than placing initial emphasis on strict scientific protocol to be adhered to, a sense of enjoyment and relaxation, whilst connecting with nature, should form the primary marketing strategy. Emphasis in marketing can be placed on other benefits which volunteers experience such as stress reduction, relaxation and exercise (Guiney & Oberhauser 2009). Certain hobbies which exist in the natural sciences would therefore make good candidates for citizen-based research projects, since individuals are already likely to spend the time practicing such activities. Examples include fishermen or recreational divers contributing records of species caught and

released or observed, and in so doing, contributing to databases which assist in understanding and conserving the environments and species which they value. Scientists should act on this important motive, both for mobilizing people to conduct research, and also for generating environmental awareness and stewardship in volunteers.

Value-driven motives: The above connection with nature would seem to be derived from a sense of the intrinsic value of nature itself, and being in nature. It is not surprising therefore that many studies of environmental volunteers find a strong sense of values driving their volunteers (Miles et al. 1998, Haas 2000, Ryan et al. 2001, Bruyere & Rappe 2007, Measham & Barnett 2007, Young 2008, Raddick et al. 2010, Table 1.1). These studies refer to motives such as 'meaningful action', 'helping a cause', 'contribute', or 'helping the environment' (Table 1.1). All of these statements essentially correspond to an individual's propensity for 'doing good' which in turn is a manifestation of their values or value system. We therefore suggest that future research labels these motives as values, as is the case in the VFI (Clary & Snyder 1999), to allow for more direct comparisons between studies. This motive was strongly supported by the open ended question regarding motivations, which produced 'contribute' as the most frequent word. A result which confirms the sense of values in the respondents which in turn prompts them to contribute to bird and biodiversity conservation (Items Q11, Q14 & Q18, Table 3.4 & Table 1.1). Although the index designed to measure values did not receive significant support, the high mean score across the index suggests that participants view this as an important motive. A re-design of certain items, or a more explicit connection with values, might increase the strength of this index. In this context the programme should make the significance of an individual's contribution explicit to them, in order to satisfy and further enhance the values motive (Bruyere & Rappe 2007).

Personal development motives: Personal development in this research corresponded with a motivation for learning and enhancing oneself, such that the individual is developing their skills or other personal attributes. The VFI (Clary & Snyder 1999) utilizes the term enhancement, however the literature concerned with environmental volunteers more commonly focuses on learning or personal development and thus this term was chosen to designate this index (Table 1.1). Through learning about a species, ecosystem, or a new skill such as utilizing mapping software, an individual will be developing themselves. Learning or an associated term is identified by all our comparative studies as an important motive for volunteers (Table 1.1) (Miles et al. 1998, Hass 2000, Ryan et al.. 2001, Weston et al. 2003,

Bruyere & Rappe 2007, Measham & Barnett 2007, Tremblay & Hvenegaard 2008, Young 2008, Raddick et al. 2010). It is suggested that future studies term learning related motives as personal development, since this can encompass both learning and skills development.

Again it is recommended that a sense of enhancement be used explicitly as a motivation, both for generating and sustaining volunteers. A sense of personal development is an often used marketing ploy for many products and services. In this context, the programme can advocate enhancing both oneself, through learning, and the environment, through contributing to scientific research. Such an approach will tap both the personal development and value driven motives.

In addition the programme should organise different courses or workshops, such as mapping or bird identification courses targeted at different levels of expertise. This will ensure that this motive is fulfilled, whilst additionally allowing for the atlasers development to continue throughout the course of their involvement. The acquisition of such skills will contribute to the generation of holistic citizen scientists capable of contributing to other projects (Figure 2.2, Chapter 2). Building social capital is an important outcome which this programme should aim to achieve. Personal development could similarly be utilized as a motivation for integrating this programme into schools or universities.

Social motives: Our exploratory and confirmatory analyses revealed robust indices describing social motivations. As with the personal development motive, all studies assessed suggested social interactions as a motive of volunteers, both for human-service and environmental volunteers (Table 1.1). (Clary & Snyder 1999, Ryan et al. 2001) Atlasers' improvement suggestions also included a need for further developing their local atlasing community. Although certain atlasers will prefer birding alone, they do still feel the need to form part of a broader atlasing community with which they might share their experiences and knowledge. Thus the programme should provide the platform for atlasers to become involved in social networks should they feel the need. The importance and outcomes of such social networks is discussed in Chapter 2. It is apparent that although social interactions might not drive motives for participating in this programme, they can become an important factor contributing to the atlasers' overall experience and their satisfaction with the programme. In addition, atlasers may realize that social networking can drive the expansion of the programme, and thus may identify with this motive as a means to increase participation. Increased participation and a

programme running in perpetuity were both suggested in response to improvements to this programme. Although not directly related to improving the programme, these statements illustrate the sense of ownership present in the current volunteers, and their desire to see the programme expand.

Project organization motives: The index developed for this motive did receive significant support in the confirmatory factor analysis; however the items did not cluster in the exploratory factor analysis. Only two of the comparative studies identified this as an important motive for their volunteers (Ryan et al. 2001, Bruyere & Rappe 2007). It was predicted as a motive in this study as the ADU has established a good reputation for co-ordinating citizen science programmes in conjunction with its partners. Thus we suggest that participants might gravitate towards such a project exhibiting effective organization, since they feel that their time is being used wisely (Bruyere & Rappe 2007). However in this case project organization would function in a similar way to the social motive in that it may not drive people to join the programme, but will no doubt play a role in ensuring a satisfactory experience.

Analysis of the open-ended questions (Q5 & Q6) regarding atlasers' motivations and benefits derived from the programme provides further insight and support for the above conclusions. The high frequency of the word 'contribute' (n=100) is strong evidence that atlasers are motivated by the need to contribute to a worthwhile research programme, or to the conservation of birds, as indicated by the frequency with which 'conserve' is encountered (Table 3.3). A sense of the need to contribute is associated with ones value system, thus providing support for the values motive previously discussed. It is a person's value system which will determine the activities or organizations which they might become involved with, and in turn drive them to 'contribute' to those actions which hold meaning for them. Further support for the values motive is evident in the frequency of the words 'give' (n=43) and purpose (n=38). These suggest a motivation to give ones time or effort towards a cause which one values, whilst being motivated by a purpose also extends from a person's value system. The inclusion of the word purpose might also result from the SABAP2 marketing phrase of 'birding with a purpose', which attempts to tap peoples enjoyment of the hobby and extend that towards a more purposeful behaviour.

Support for the motive of recreation is also found through the high frequency of 'enjoy' recorded in the open-ended analysis (Table 3.3). Participants who are motivated by a sense of enjoyment from the programme or who enjoy contributing data, essentially view their involvement in a recreational light. Inclusion of the word 'love' (n=34, Table 3.3) corresponds to both a value system and a recreational behaviour, in that participants may love birds or their environment and thus be inspired to contribute towards conserving it. Alternatively they might love the act of birding, or atlasing in this instance, thus considering the behaviour part of their recreational activities. The presence of the words 'interest' (n=43, Table 3.3) and 'knowledge' (n=29, Table 3.3) are potentially associated with the motive of enhancement. Atlasers might find the programme and its method interesting, and volunteer their time to satisfy this interest. Mentioning 'knowledge' in connection with motivations can correspond with the need for more knowledge on the subject, or contributing knowledge to further understanding of birds. This may therefore be linked to both the values and enhancement motives.

Comparisons of the word frequencies generated from the motivations and benefits questions reveal many similar words used in reference to each concept. This is mirrors the literature on this subject, which refers to motivations, benefits and satisfactions interchangeably. In this research I have attempted to isolate motives and benefits or satisfactions in order to further understand the different concepts. The benefits which most atlasers derive pertain to 'learn' (n=41) and 'knowledge' (n=40) reflected by their high frequency in the text miner extraction (Table 3.4). We therefore suggest that a sense of personal development, exhibited through learning, or a sense of contributing towards the knowledge of birds, is a source of satisfaction for the atlasers. This may in turn be associated with their value system. The frequencies of the words 'improve' (n=27) and 'skills' (n=26) may similarly be associated with the enhancement motive and the benefits it holds for atlasers.

Further associations between motives and satisfactions are evident in the frequency of the words 'contribute' and 'enjoy' present in the benefits listed by atlasers. In connection with the recreational aspect one might suggest that 'seeing new species' is an important benefit driving the atlasers, as all three words are present with similar frequencies in the atlasers answers (Table 3.4). Thus the open ended items provide further support for the functional approach which suggests direct links between the atlasers' motivations and the satisfaction which they derive from participation. These items also provide support for the motives which

were identified by the psychometric instrument. Validation of the instrument through this method is important, since one might bias the outcome when using pre-determined likert statements (Babbie 2004).

These described motives have now been shown in an increasing number of studies investigating environmental volunteers (Miles et al. 1998, Ryan et al. 2001, Bruyere & Rappe 2007, Measham & Barnett 2007). In order for this research to progress and to expedite the sharing of knowledge generated by such research we suggest a new tool, the Environmental Volunteer Functions Inventory (EVFI). The EVFI includes the majority of current work conducted on environmental volunteers and builds on the robust approaches used in the social sciences to develop its predecessor, the VFI (Clary & Snyder 1999). Such a tool may be used as a guide for developing instruments required for understanding environmental volunteers' motives, as the motives guide the production of individual items specific to the scenario at hand. Future research should therefore test and further validate the application of the newly described EVFI. The five major motives described by the EVFI, and detailed in preceding paragraphs of this discussion include: recreation/nature-based, values, personal development, social and project organization.

Atlasers' sense of satisfaction

The high mean scores achieved for both indices derived from the satisfaction dataset suggests that overall the atlasers in the programme are satisfied with their experience (Hypothesis 2). The items designed for this index may easily be adapted for other programmes, and either expanded or used in isolation if a quick test of satisfaction is required. Developing a repeatable instrument for assessing volunteer satisfaction was an important objective of this research.

The linear correlation between the motivations and satisfactions mean scores for all individuals suggests that the motives of the atlasers are being fulfilled by the programme, resulting in their satisfaction, thus confirming the hypothesis of the functional approach, and the application of this approach in an environmental context (Clary & Snyder 1999, Bruyere & Rappe 2007, Finkelstein 2008). We also find support that motive fulfilment plays a large role in the satisfaction of environmental volunteers, and that programme management must understand these motives if they are to successfully manage a volunteer community (Ryan et

al. 2001, Bruyere & Rappe 2007). Using SABAP2 as an example of a successful citizen science programme is therefore justified by these results. This allows for use of the model of SABAP2 in describing the components, in relation to the volunteers, of an effective citizen science research programme.

The importance of understanding the motivations of environmental volunteers has been discussed in this thesis. As unpaid labour, volunteers will likely be more responsive to internal motivating factors than individuals in paid labour (Weston et al. 2003) and programme managers must take this into account. Setting targets and enforcing participation might easily lead to a feeling of 'abuse' in the programmes participants. In citizen science schemes a fine line exists between abusing and supporting the volunteers so integral to the programmes outcomes (Measham & Barnett 2007). Through improved understanding of the participants' psychology this fine line may be managed to produce the intended outcomes, thereby balancing the requirements of the scientific research with those of the volunteers (Weston et al. 2003). Professional marketing strategists should be used to fully transform the knowledge on motivations into appropriate marketing strategies for the programme. The high level of atlaser's satisfaction suggests that the managers of SABAP2 seem aware of this balance in maintaining participation without abusing the workforce. However the marketing strategy of SABAP2 requires much review and input if the goal of mobilizing citizen scientists is to continue to be achieved.

Ambassadors for SABAP2

The analysis of the ambassador items allowed for the development of an index regarding the volunteers' level of advocacy of the programme. This index can be adapted and applied to any citizen science programme in order to understand the degree to which the volunteers act as advocates of the programme.

It is important to return to the original framework within which this psychometric instrument was placed. According to the theory of planned behaviour (Ajzen 2001), behaviour intentions represent the antecedent to actual overt behaviours. Atlasers responses to our statements suggest that they intend to behave in a certain way, in this context they intend to spread a positive message about the programme. The mean scores above the neutral value for most items suggest that atlasers are in agreement with the statements, which therefore predict their

actions, to a degree. The highest mean score for an item in this index does however relate to discussing general conservation and environmental issues (Q50, Table 8), rather than this programme specifically. Since the rest of the items relate to communicating the programme to others we therefore suggest this to be the index's goal. An important addition which is required when testing for advocacy is the level of awareness and understanding of the programmes major outcomes. These might relate to scientific publications, conservation planning reports, or simply the bird atlas itself. It is important for volunteers to not only act as advocates for the programme, but also to spread a message which is both accurate and positive. Accuracy can be maintained by assessing awareness of scientific and other outcomes, whilst positivity towards the programme will be maintained through understanding and regularly assessing the atlasers' satisfaction.

A further recommendation for this programme is to make the advocate role explicit to new volunteers. In this way the programme can engender advocacy right from the start of involvement, rather than having an atlaser develop the propensity to advocate the programme once they are well acquainted with it.

In conjunction with this, our results regarding methods through which the atlasers heard of the programme (Table 3.1) further confirm the role of atlasers as advocates. The response 'word of mouth' was suggested by the largest proportion of atlasers as the method by which they were notified of the programme. Participating atlasers are undoubtedly the people involved in spreading the programme through this medium, confirming the suggestion that atlasers act as advocates for the programme. The role of the described champions in further expanding the programme must also be acknowledged by the programmes management. Knowledge of the individuals who are championing this programme is essential to maintain their motivation and to understand how such individuals can further enhance the programme.

A pre-test is proposed to further investigate how attitudes towards conservation and environmental awareness may be developed through the programme. It is not possible with a simple snap-shot investigation to disentangle other factors contributing to environmental awareness. Pre-testing could also incorporate the use of an already designed instrument such as the New Ecological Paradigm (NEP) (Dunlap et al. 2000). The NEP test could be used to assess the level of environmental awareness of an atlaser before beginning the programme. A standardized test such as this would explicitly show increases in environmental awareness

over time, and with modifications, could determine the changes which are attributed directly to the programme.

Burnout

Testing the well developed MBI and level of burnout for our environmental volunteers was the major aim of this section. However due to restrictions on the overall number of items, we reduced the original MBI, from 22 items to 13. Additionally these items were adapted to make them more relevant to the programme at hand. However this resulted in a weaker instrument as many of the respondents were confused by the statements given describing burnout. In a similar way, the response categories used were not applicable to atlasing activities. The MBI has been designed for persons employed in the human service sector, such as nurses or policeman. The response categories pertaining to 'Everyday', 'once per week' etcetera (Appendix C) were not valid to the atlasers as many of them partake in the activity on a more sporadic basis.

Scores and analysis were nonetheless conducted on this dataset to provide some insights into burnout. Low levels of burnout are evident in the low scores across all items in this instrument (Table 3.12). We therefore suggest that volunteers are exhibiting low levels of emotional exhaustion and depersonalization, whilst retaining high feelings of personal accomplishment. This is accordance with their involvement as voluntary. Many of the atlasers felt they would contribute more to the programme if time allowed, and combined with the burnout scores this suggests that burnout is not an issue of immediate concern to the programmes management. However it is essential that further investigation be conducted into this psychological construct, particularly for environmental volunteers, since current understanding of the topic is lacking. Response categories must be altered and made more applicable to the volunteer programme under consideration, and the MBI items should remain as intact as possible.

Participation

Analysis of the levels of participation exhibited by our respondents revealed a wide range of participation levels, with numbers of respondents tapering off as the number of cards

increases (Figure 3.10). This is a natural component of the programme, and in this context our respondent sample likely shows similar trends to the rest of the atlasers' participation levels. It is not likely that all participants in a programme can contribute equal amounts, and only a few volunteers will have the time, resources or commitment to participate very regularly, and thus submit large numbers of cards. The lack of correlation between participation and the psychological constructs is possibly in relation to the flexibility of the volunteers' involvement. This flexibility in turn reduces burnout and maintains the high levels of satisfaction, as atlasers may be involved at their own discretion.

Participation was further tested with income and employment groupings to assess relationships, and once again showed no correlations. It is therefore suggested that many of the participants contribute as much to the programme as their situation allows for. The hypothesis of the functional approach suggests that participation levels should be correlated with general satisfaction (Finkelstein 2008). However if participants are highly satisfied, as is suggested for the atlasers of SABAP2, then one might predict elevated levels of participation. The lack of relationship between these two aspects of volunteerism suggests that participation is rather constrained by factors external to the programme. Thus although the programme might improve its efficiency at motivating and satisfying participants, this is unlikely to enhance levels of participation. It then becomes imperative that constraints on participation are understood and tackled by the programme, if possible. Additionally the focus should move towards increasing the atlasing community, rather than placing too much pressure on the current community. The level of informal marketing in the programme is one aspect which the programme's management must seek to engage when attempting to expand the programme.

Major constraints mentioned by respondents ranged from time, work, and family commitments, through to financial limitations (Figure 3.5). Additionally minor constraints such as age, weather or lack of an atlasing community where also mentioned (Figure 3.5). Certain of these constraints, such as time and work or family commitments are indeed out of the hands of the programme organizers. In this instance the volunteers need to make time and effort available to attend to other matters in their life, in order to maintain a functional life balance. Links between life functioning and volunteering have been shown (Miles et al. 1998), and this is further supported by our atlasers needs to spend time with family or for other commitments. Work is an obvious constraint for any volunteer programme, since the

volunteers inevitably have employment commitments which precede their recreational activities. The emphasis on the time constraint also suggests that atlasers have the financial resources available to participate, an important pre-requisite in a project of this nature.

Since atlasing is a volunteer-based activity they cannot receive any remuneration from the programme, and thus in order to volunteer they need to be employed or financially secure. The one constraint which the programme might act on is that of funding for fuel or accommodation for travel to far flung pentads. Many volunteers may be willing, and often do, travel large distances to conduct their activities, yet few projects provide any kind of financial support (Weston et al. 2003). By generating sponsorship, either for fuel or accommodation, and providing remuneration of these expenses to atlasers who access pentads far off the beaten track, the programme may both motivate atlasers to explore these areas, whilst also reducing this as a constraint on atlasing. The dual benefits of this strategy have been discussed in Chapter two.

Chapter 3

Figures and Tables

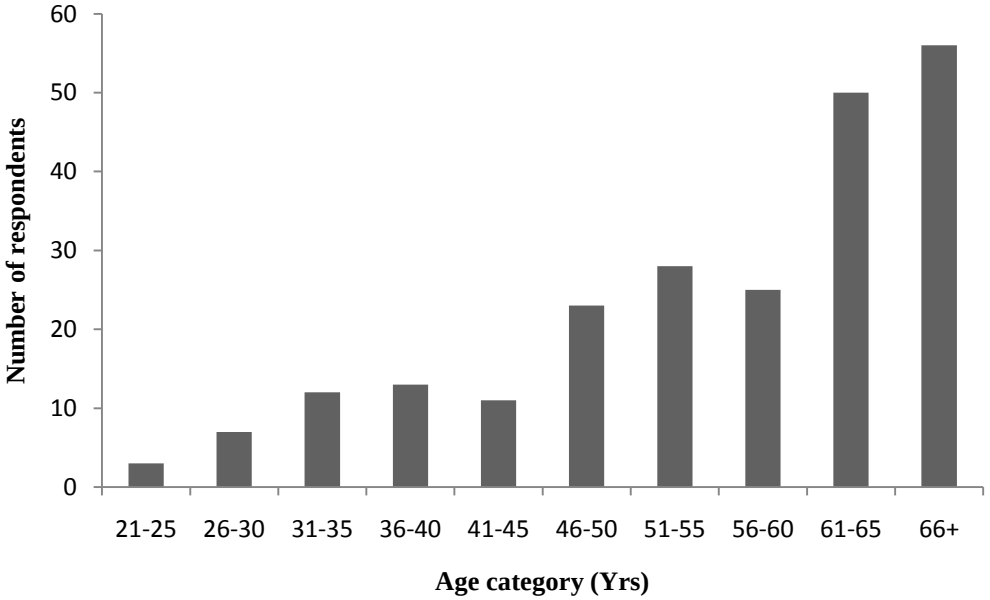

Figure 3.1. Age distribution of the respondents across specified age classes.

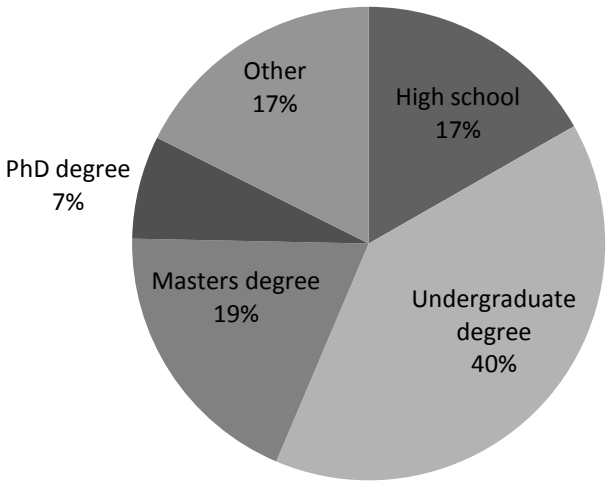

Figure 3.2. Distribution of respondents across different education groups.

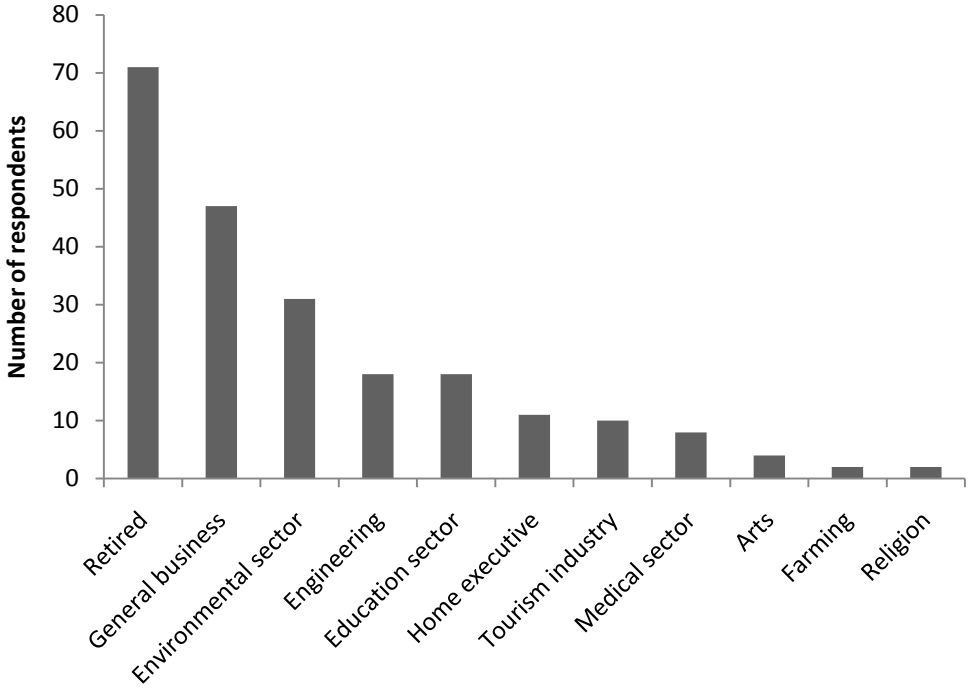

Figure 3.3. Number of respondents per employment category.

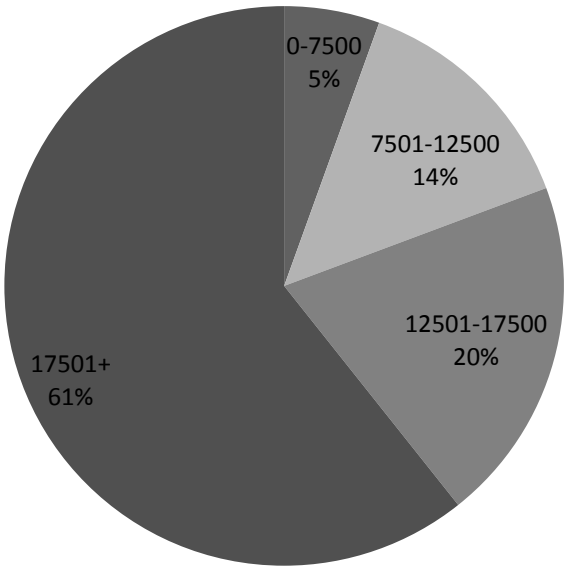

Figure 3.4: Proportion of respondents per income category. (Categories indicate earnings range per month.)

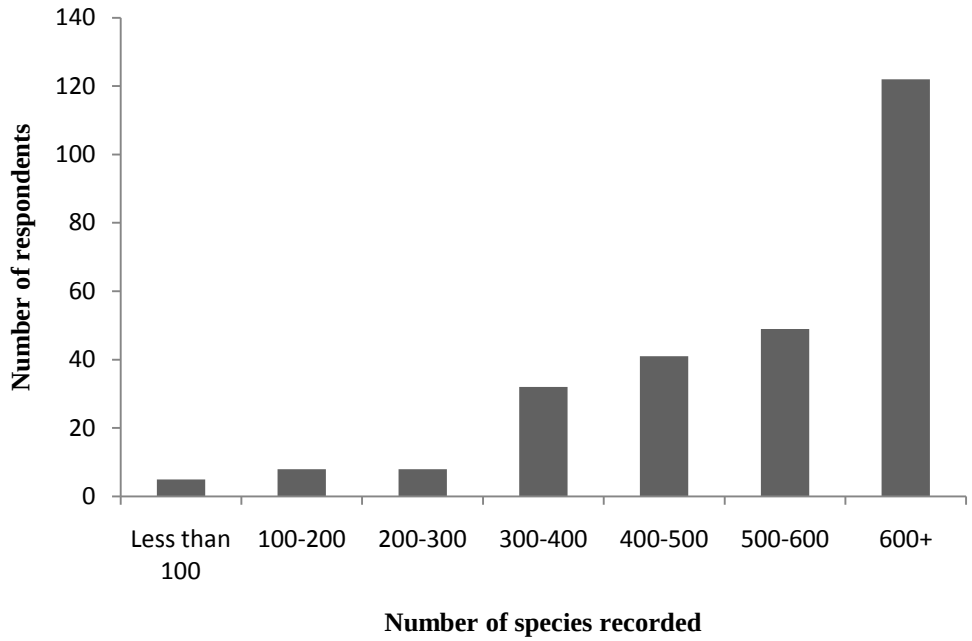

Figure 3.5. Number of respondents per category for number of species recorded.

Table 3.1. Type of notification through which respondents learnt about the programme, and number of respondents per notification type.

Notification type	Number of respondents	Percentage of total (n=283)
Word of mouth	63	22.26%
Birdlife SA	46	16.25%
Internet & email	44	15.55%
Local bird clubs	39	13.78%
Via SABAP 1	29	10.25%
ADU	28	9.89%
Birds & Birding magazine	14	4.95%
Other media	11	3.89%
Unsure	9	3.18%

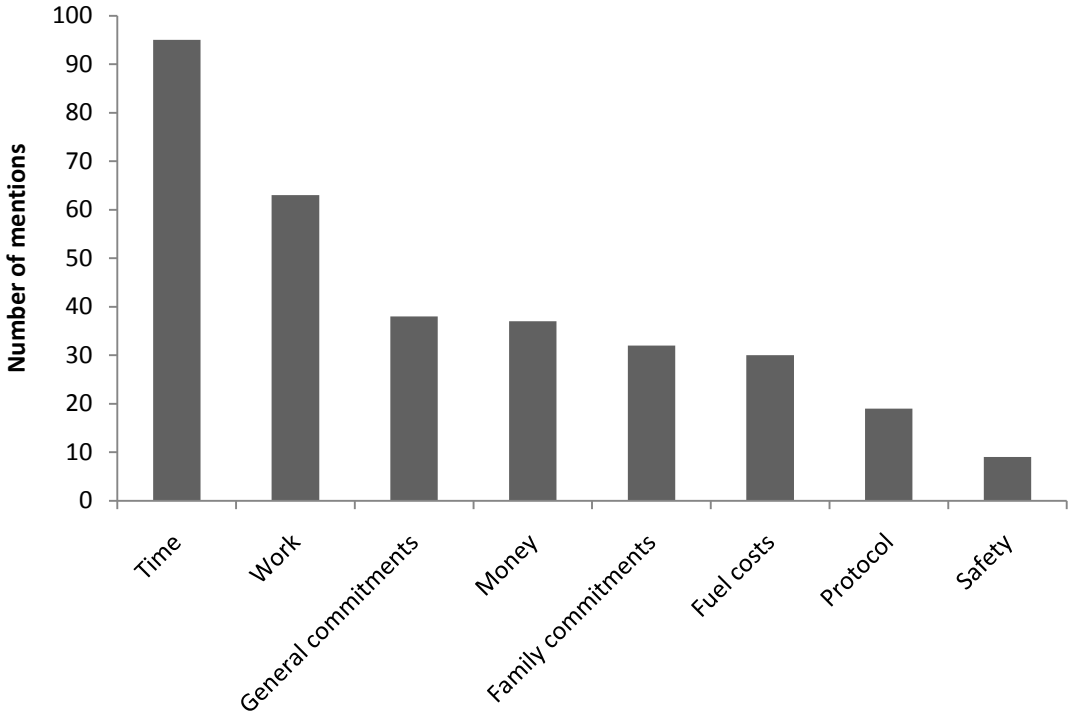

Figure 3.6. Graph showing the number of mentions made by respondents for each type of constraint.

Table 3.2. Illustrating the top 15 atlasers and the number of times each was named by a fellow atlaser.

Atlaser	Number of mentions
Ernst Retief	43
Etienne Marais	38
Arnold vd Westhuizen	27
Trish Strachan	19
Andre Marx	12
Peter Lawson	11
Geoff Lockwood	11
Jeff Curnick	8
Felicity Elmore	8
Phil Whittington	7
Colin Summersgill	6
Gerald Windgate	6
Andy Featherstone	6
Rick Nuttall	5
Tim Wood	5

Table 3.3: Frequencies of words extracted from open-ended question regarding atlaser motivations.

Word	Frequency
bird	301
contribute	100
enjoy	69
make	48
conserve	43
give	43
interest	43
purpose	38
area	37
project	35
love	34
data	29
knowledge	29
new	28
help	27
like	27
involve	25
time	25
list	24
distribution	22

Table 3.4: Frequencies of words extracted from the open-ended question regarding benefits derived from participation.

Word	Frequency
learn	41
knowledge	40
new	36
see	36
species	31
area	30
give	28
improve	27
skill	26
contribute	23
people	22
enjoy	21
satisfaction	21
know	19
feel	18
time	18
make	16
interest	15
places	15
benefit	14

Table 3.5. Exploratory factor analysis of the motivation items dataset. (Including items taken to represent both motivations and satisfactions.)

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Cronbachs Alpha**	Mean score
Q15	0.486*						*0.82*	*4.22*
Q16	0.693							
Q17	0.594							
Q20	0.609							
Q31	0.633							
Q36	0.600							
Q38	0.616							
Q40	0.535							
Q44	0.438*							
Q19		0.648					*0.78*	*3.52*
Q21		0.501						
Q26		0.719						
Q27		0.474*						
Q32		0.629^						
Q42		0.752						
Q12			0.826				*0.62*	*4.77*
Q13			0.757					
Q11				0.609			*0.66*	*4.58*
Q14				0.718				
Q18				0.577				
Q30				0.575				
Q28					0.657		*0.43*	*4.69*
Q29					0.671			
Q23						0.551	*0.61*	*4.11*
Q24						0.747		
Q25						0.541		

*Items with a factor loading <0.50 were dropped from the subsequent analyses due to low levels of support.

**Calculated for each factor, with items loading below 0.50 dropped from the overall index.

^Item described career driven motives, but could also associate with social aspects.

Note: Factors are not named since they did not correspond to any definite motivation.

Table 3.6. Results of the confirmatory factor analysis investigating items grouped according to the Volunteer Functions Inventory.

Motive & Items	Factor 1 scores	Factor 2 scores	Cronbachs Alpha	Mean score
Personal development			*0.74*	*4.02*
Q13	0.511			
Q23		0.795		
Q24		0.861		
Q25		0.504		
Q31	0.776			
Q41	0.641			
Q43	0.813			
Values			*0.66*	*4.47*
Q11		0.730		
Q14		0.760		
Q16	0.691			
Q18		0.750		
Q36	0.813			
Q40	0.725			
Social			*0.75*	*3.64*
Q19	-0.512*			
Q21	-0.723			
Q22	-0.727			
Q26	-0.809			
Q42	-0.782			
Recreation/Nature			*0.76*	*4.46*
Q12	0.436**			
Q15	0.682			
Q17	0.770			
Q20	0.772			
Q28		0.632		
Q29		0.600		
Q38	0.687			
Q45	0.650			
*Project organization/ Career****			*0.71*	*3.78*
Q27	-0.662			
Q30	-0.702			
Q32	-0.755			
Q44	-0.751			
Q46	-0.572			

*Item reduced strength of index under test of internal consistency (Cronbachs).

**Item was dropped from subsequent analyses due to factor loading below 0.50.

***The items remaining pertained mostly to project organization, apart from Q27 which related to Career enhancement.

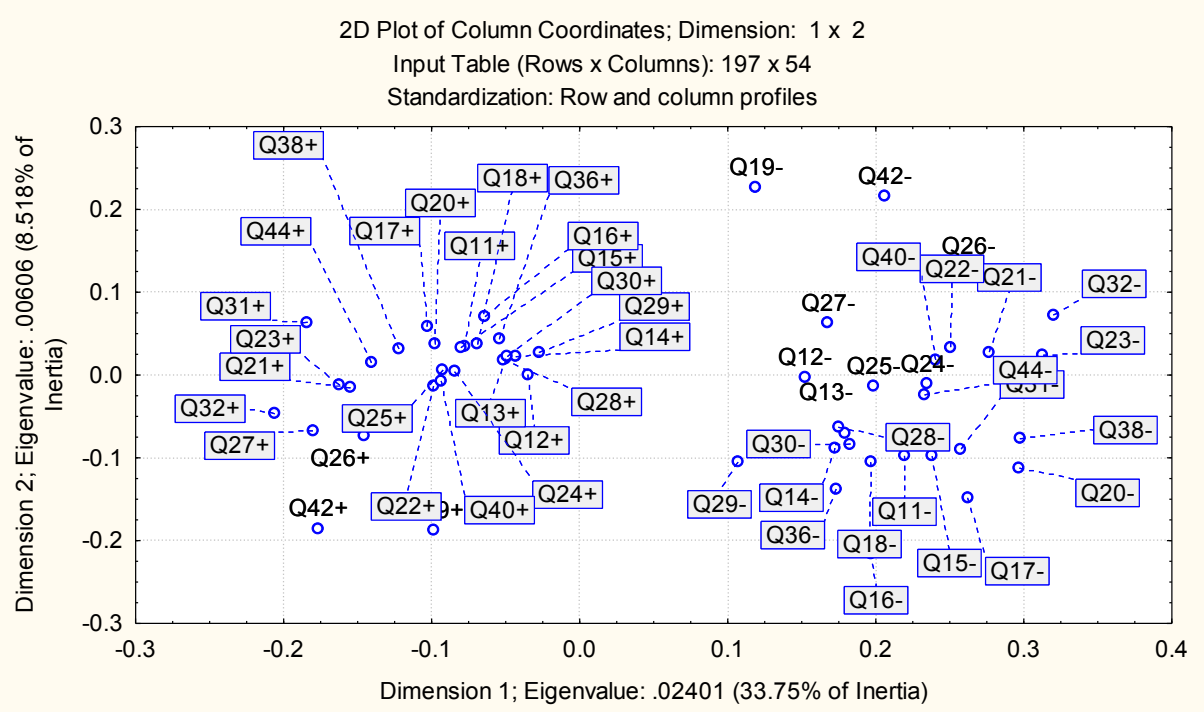

Figure 3.6. Two-dimensional plot resulting from doubling correspondence analysis of the motivations dataset.

Table 3.7. Mean, Standard deviations and coefficient of variation for all satisfaction items.

Item	Valid n	Mean	Std. Dev.	CV
Q23	232	3.88	0.96	0.25
Q30	230	4.69	0.52	0.11
Q32	228	3.59	1.00	0.28
Q33	228	4.57	0.71	0.16
Q34	228	3.88	1.00	0.26
Q35	226	3.88	1.11	0.29
Q36	226	4.51	0.61	0.14
Q37	226	4.42	0.82	0.19
Q38	222	4.14	0.96	0.23
Q39	227	3.30	1.15	0.35
Q40	227	4.21	0.90	0.21
Q41	227	4.22	0.88	0.21
Q42	226	3.20	1.02	0.32
Q43	227	3.50	1.13	0.32
Q44	227	3.63	0.93	0.26
Q45	227	4.11	0.81	0.20
Q46	224	4.22	0.80	0.19

Table 3.8. Exploratory factor analysis of items representing satisfaction.

Item	Factor 1	Factor 2	Factor 3	Factor 4
Q33	0.651			
Q34	0.766			
Q37	0.685			
Q41	0.561			
Q44	0.691			
Q32		0.729		
Q35		0.450*		
Q39		0.728		
Q42		0.654		
Q43		0.469*		
Q23			0.515	
Q36			0.713	
Q38			0.656	
Q40			0.503	
Q45			0.581	
Q30				0.644
Q46				0.685
Explained variance.	3.191	2.657	2.524	1.766
Proportion of total variance.	0.188	0.156	0.148	0.104

*Items loading below 0.5 are dropped due to weak factor loading.

Table 3.9. Second factor analysis on two main factors resulting from initial exploratory analysis.

Items	**Factor 1**	**Factor 2**	**Cronbachs Alpha**	**Avg. Inter-item correlation**	**Mean scores**
Q30	-0.593		*0.84*	*0.45*	*4.14*
Q33	-0.792				
Q34	-0.701				
Q37	-0.800				
Q41	-0.717				
Q43	-0.662				
Q44	-0.790				
Q23		-0.603	*0.82*	*0.40*	*3.74*
Q32		-0.803			
Q35		-0.722			
Q38		-0.688			
Q39		-0.671			
Q40		-0.693			
Q42		-0.667			
Explained variance.	3.687	3.378			
Proportion of total variance.	0.527	0.483			

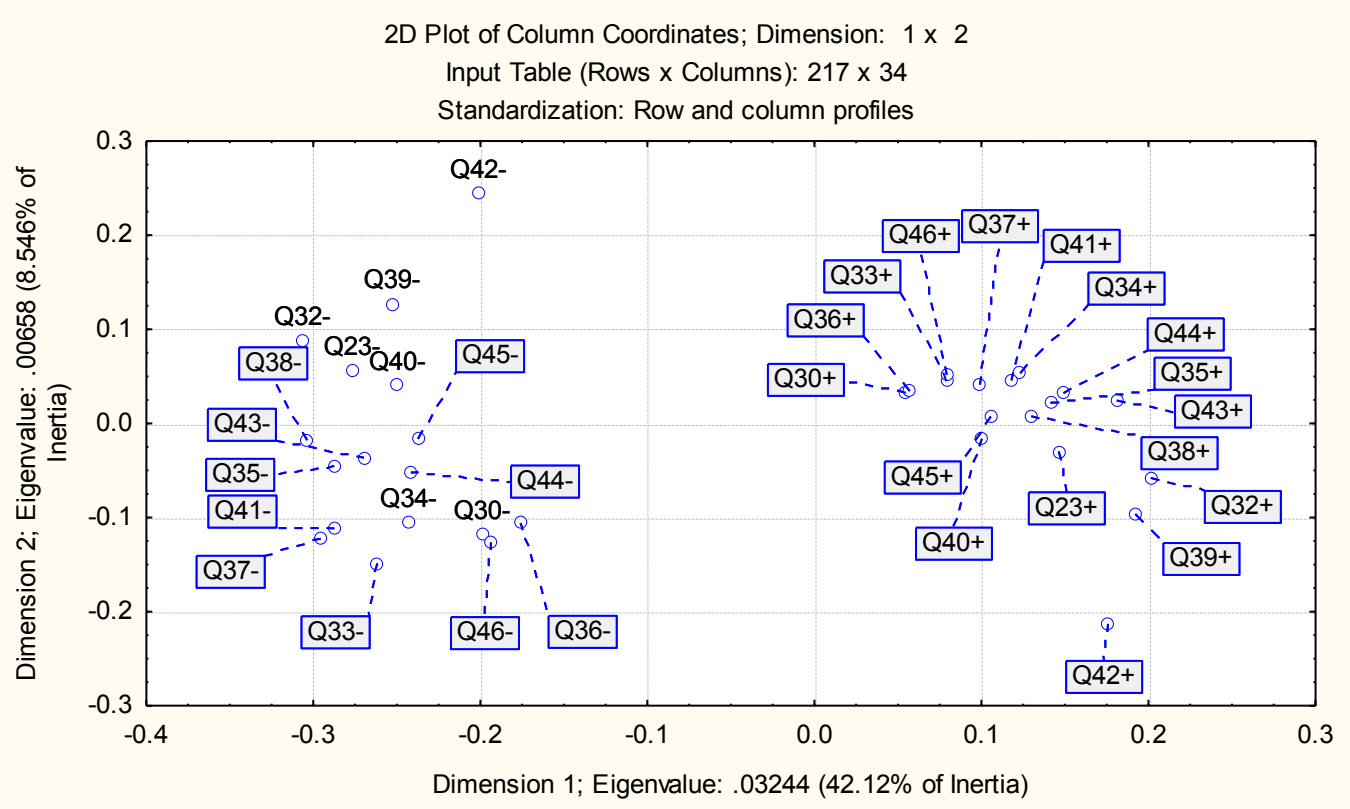

Figure 3.7: Two-dimensional plot illustrating results of the correspondence analysis for the satisfaction items dataset.

Table 3.10. Showing mean, standard deviation and coefficient of variation for each item related to ambassador potential.

Item	Mean	Std dev	CV
Q47	3.79	0.98	0.26
Q48	2.91	1.20	0.41
Q49	3.81	0.91	0.24
Q50	4.18	0.63	0.15
Q51	3.58	0.96	0.27
Q52	3.92	0.90	0.23
Q53	3.27	1.05	0.32
Q54	3.06	1.01	0.33
Q55	4.13	0.95	0.23
Mean	**3.63**	**0.96**	**0.26**

Table 3.11: Internal consistency values for the ambassador index.

Items (n)	Valid cases	Items removed	Cronbachs Alpha	Avg. Inter-item correlation
9	217	None	0.758	0.27
6	218	Q47, Q53, Q55	0.788	0.40

Table 3.12: Factors and factor loading for each item in the ambassador dataset.

Item	Factor 1	Factor 2
Q47	0.18	**0.65**
Q48	**0.64**	0.06
Q49	**0.77**	0.11
Q50	**0.57**	0.17
Q51	**0.68**	0.10
Q52	**0.80**	-0.03
Q53	0.20	**0.67**
Q54	**0.67**	0.32
Q55	-0.06	**0.82**
Explained Variance	2.98	1.69
Proportion of Total	0.33	0.19

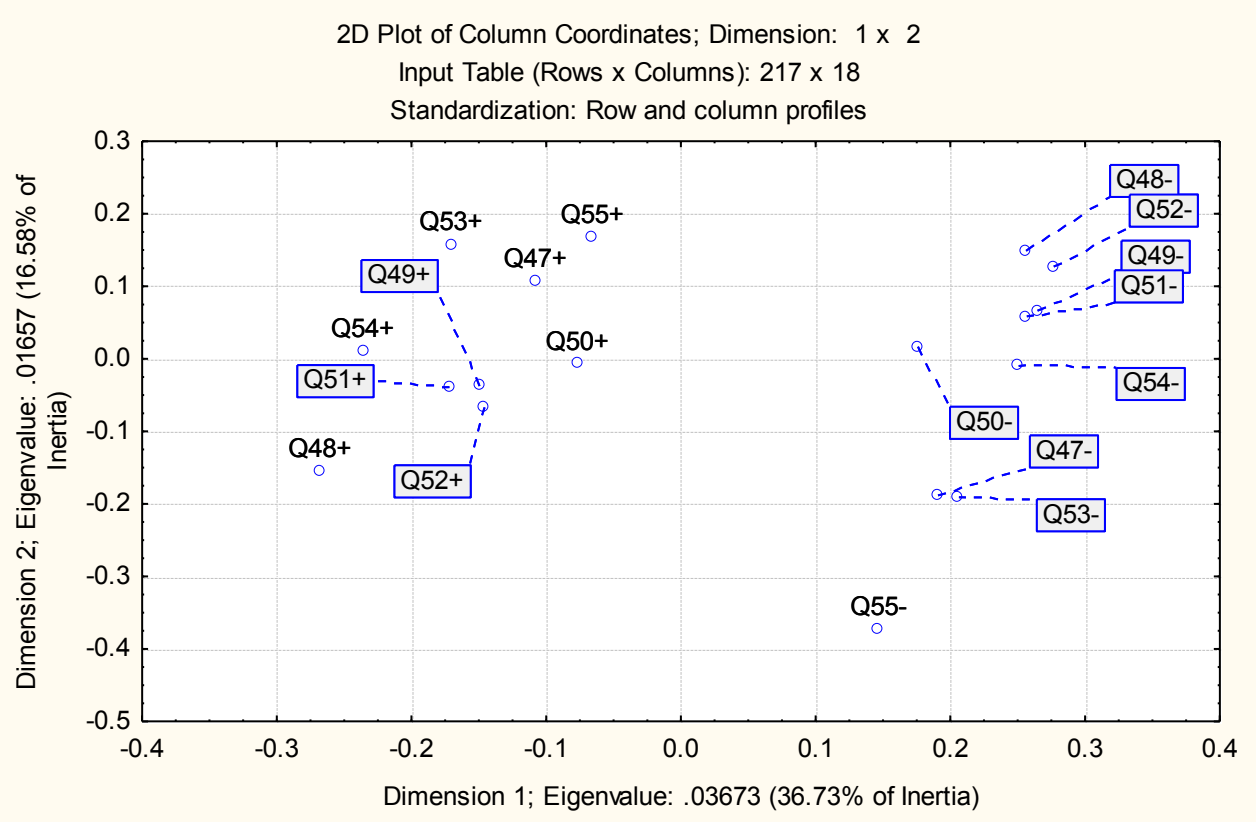

Figure 3.8: Two dimensional plot of items coordinates resulting from doubling correspondence analysis of the ambassador potential dataset.

Table 3.13: Showing the mean scores, standard deviations and coefficient of variation for each of the items in the burnout dataset.

Item	Mean	Std. Dev.	CV
Q56	1.381	0.803	0.582
Q57	5.310	1.348	0.254
Q58	1.269	0.680	0.536
Q59	1.269	1.056	0.832
Q60	3.401	1.947	0.573
Q61	1.391	0.745	0.536
Q62	1.284	0.909	0.708
Q63	1.437	1.103	0.768
Q64	2.863	2.064	0.721
Q65	1.371	0.931	0.679
Q66	3.168	2.047	0.646
Q67	1.706	1.434	0.841
Q68	2.660	1.967	0.739

Table 3.14: Resultant factors showing the factor loading of each item in the reduced dataset.

Item	Factor 1	Factor 2	Factor 3
Q57	0.519		
Q60	0.843		
Q64	0.739		
Q66	0.896		
Q68	0.850		
Q61		0.670	
Q62		0.698	
Q63		0.796	
Q56			0.772
Q58			0.738
Explained variance	3.090	1.943	1.486
Proportion of the total	0.281	0.177	0.135

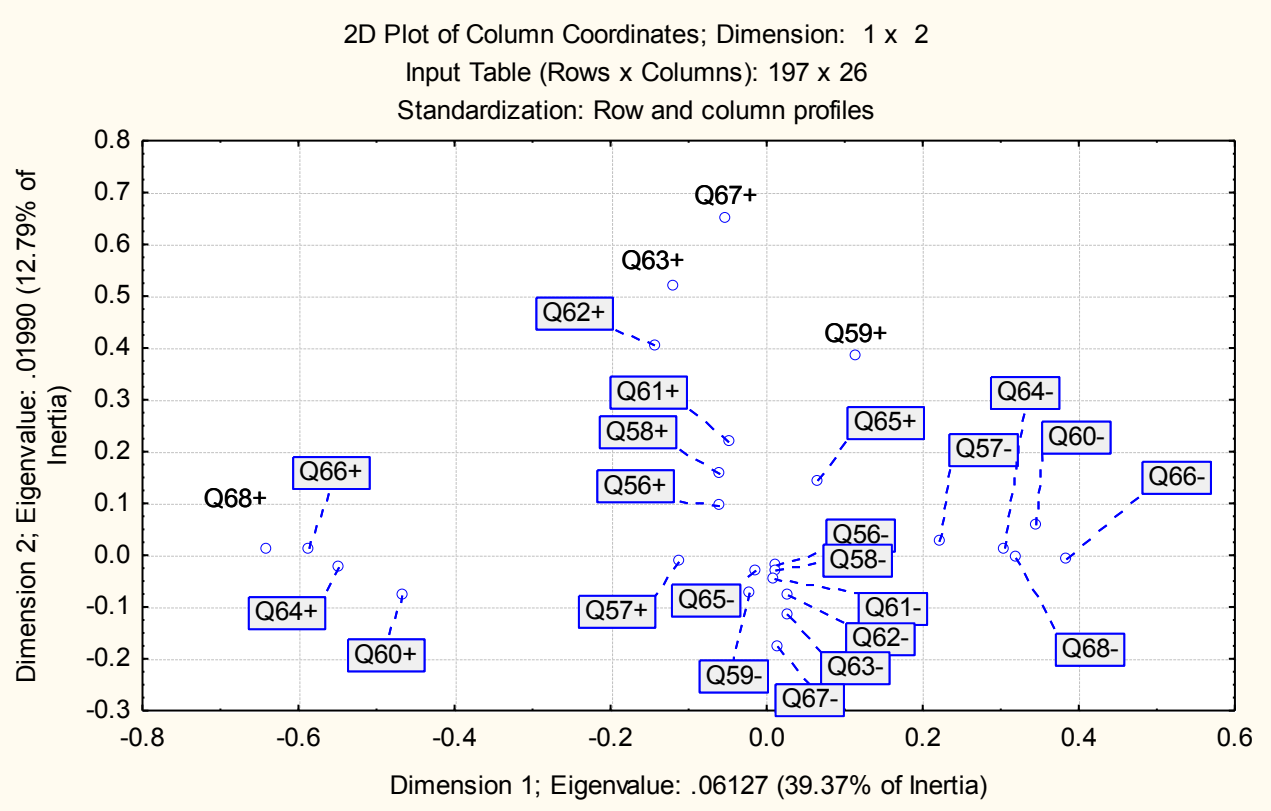

Figure 3.9: Two-dimensional plot produced from doubling correspondence analysis of the burnout dataset.

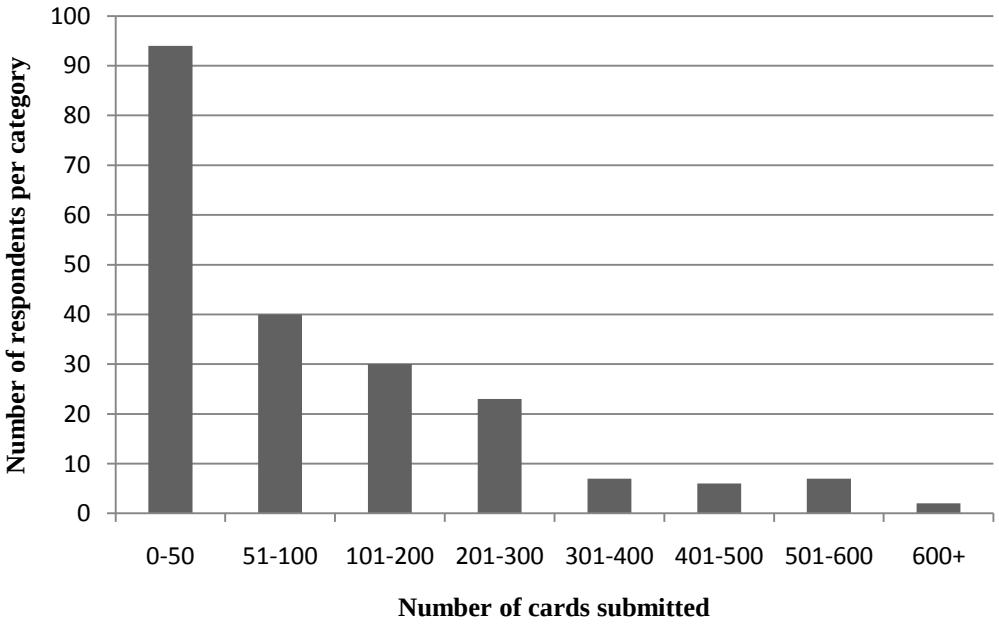

Figure 3.10: Graph showing the number of respondents in each participation category. (Participation categories represent the number of cards submitted by an individual.)

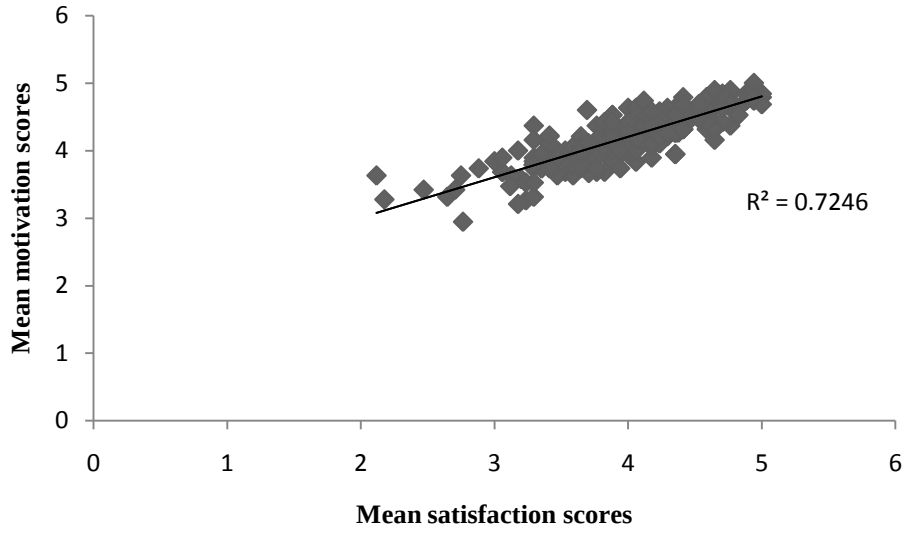

Figure 3.11: Showing strong liner correlation between mean scores for motivation and satisfaction for all individuals.

Chapter 4

Synthesis and Recommendations

This chapter summarises the major findings of this thesis and describes recommendations for management of the SABAP2 programme and for future research.

Major conclusions

A new tool, the Environmental Volunteer Functions Inventory (EVFI) was evaluated as a useful inventory for investigating motivations of volunteers in the environmental sector. This tool incorporated the research presented here in combination with the most relevant literature (Ryan et al. 2001, Weston et al. 2003, Bruyere & Rappe 2007, Measham & Barnett 2007). It is suggested that future research into environmental volunteers further tests and validates the major motives described in the EVFI. The motives described in the EVFI should be used as a basis for developing items specific to each motive. Item design must in-turn take into account the specific programme and context within which the inventory is being tested. Understanding motivations is essential to all programme managers wishing to recruit and retain their volunteers, and such information can provide a useful starting point for designing citizen science projects (Miles et al. 1999, Ryan et al. 2001, Weston et al. 2003, Bruyere & Rappe 2007).

An index for determining the satisfaction of the atlasers in SABAP2 was developed and illustrated high levels of satisfaction for the programme's volunteers. This index may be adapted for other similar programmes, and used in isolation for providing a rapid assessment of volunteers' satisfaction. The relationship between motive fulfilment and satisfaction was tested and conformed to the suggestions of the functional approach (Clary & Snyder 1999, Finkelstein 2008). Research conducted on burnout showed a low degree of support with the Maslach Burnout Inventory (Maslach et al. 1996), but possibly due to reduction and alteration of items. The index developed revealed low levels of burnout in the SABAP2 atlasers. An additional psychometric instrument allowed for the development of an index relating to the participants' level of advocacy. Atlasers' responses revealed strong support for

the index, suggesting they act as ambassadors for the SABAP2 programme, and to a lesser degree as ambassadors for biodiversity conservation. Again, this instrument can be easily modified and applied to any citizen science programme attempting to gauge the level of advocacy portrayed by its volunteers. Thus the research has produced repeatable instruments which can be applied in other citizen science programmes, or iteratively applied in SABAP2, to further understand volunteers' psychology, and use this understanding as a basis for providing recommendations to improve the programme.

The development of a logic model explicitly depicting the programmes functioning in relation to the atlasers provided useful insights into the management of the volunteer pool (Figures 2.1 and 2.2) (McLaughlin & Jordan 1999). In addition the research articulated the programmes theory of operation with respect to the volunteers. The process used to develop the programme's theory of operation is clearly outlined, and may be repeated by this or other programmes, in order to provide a baseline for evaluating such programmes. Knowledge of the programmes theory is a useful platform upon which future citizen science projects can be based. The success of SABAP2 and the satisfaction of the volunteer group provided evidence that the described model represented that of a successful citizen science project. In addition the logic models together with other evaluation components and a review of the relevant literature allowed for the identification of the components of a successful citizen science programme.

In particular the recommendations provided by the Cornell Laboratory of Ornithology provided a useful baseline to compare our model and recommendations (Brossard et al. 2005, Bonney et al. 2009, Sullivan et al. 2009). Although each individual project will vary, we present this model, with the attributes listed below as a baseline for future citizen science projects. Other models for developing citizen science projects have been described (for example. Bonney et al. 2009). However the model presented here relates explicitly to the volunteer pool and the programmes functioning in order to increase effectiveness of the volunteers.

Components of a successful citizen science programme

- An interactive and user-friendly website in which information is readily available to all participants (Sullivan et al. 2009).
- An automated reply system thanking the participants for their data contribution when data are uploaded to the site.
- A visual or other representation of the participants' data contribution as data are uploaded. This, together with the reply system, is important in a society driven by 'instant gratification' (Bonney et al. 2009, Sullivan et al. 2009).
- Provision of information to project participants which allows them to understand their contribution from a broader perspective and the outcomes of data collection, thus allowing them to fully appreciate the value of their individual contributions (Bonney et al. 2009).
- Similarly providing information and support to participants when conducting programme activities; in this programme examples include bird lists for a specific area or map files which can be downloaded.
- Providing intellectual stimulation and continued motivation to the participants. This could be in the form of small challenges regarding data collection set up around significant dates or seasons. Information on the publications or other outcomes which result from research conducted using the data collected will also be motivational.
- Ensure that effective training and registration of new participants is matched with efficient operational and information technology administration. Sound project organization at all levels, from the field, through to regional and central management is essential for ensuring volunteer satisfaction (Bonney et al. 2009, Weston et al. 2003).
- Decentralising management, especially when the project covers a large geographic area. This allows for regional centres to have a greater level of involvement with the individual volunteers, thus ensuring their satisfaction.
- Allowing participants to network with one another, thereby creating social networks in which they can share knowledge and experiences or plan joint data collection trips with nearby colleagues. Participant based social networks are an invaluable source of informal marketing for these programmes.

- Understanding and utilising the motivations of volunteers in marketing a programme and to recruit new volunteers and maintain commitment in current volunteers (Ryan et al. 2001, Weston et al. 2003, Bruyere & Rappe 2007).
- Enhancing the participants through skills development in association with the programme. This serves to maintain motivation and generate citizen scientists willing to participate in similar projects.
- The logic model presented in two parts in chapter two of this thesis provides a graphic description of the components of a successful citizen science programme (Figures 2.1 and 2.2).

Management recommendations

- Utilise the information generated by this research on the motivations of atlasers to drive the marketing of the programme. Utilise this same information for recruiting and retaining volunteers in the programme. The uptake and use of this research by the programme at hand, was a major aim of this project, in order to overcome the research-implementation gap (Knight et al. 2008, Sunderland et al. 2009). The onus now lies on the programme to incorporate the outcomes of this research if and where possible.

- The index of satisfaction could be applied annually to the volunteer pool to assess how satisfaction changes over time or with different management strategies, and contribute to adaptive management of the programme. This will provide an explicit platform for adaptive management. Currently the programme is adapted via the intuitions and ideas of the programme's management. As previously stated this is not a robust mechanism for allowing knowledge to develop, and it therefore strongly suggested that the programme adopt more empirical and evidence-based adaptive management (Pullin et al. 2004, Sutherland et al. 2004, Folke et al. 2005). Thus contributing to the development of evidence-based conservation.

- Undertake regular evaluations (dependent on available resources) to ensure the generation of outcomes and to assess the volunteers' satisfaction, again in line with developing cyclical adaptive management approaches. This research has provided an

initial platform for developing further evaluations. It is strongly recommended that the programme undertake regular, comprehensive and empirical evaluations to provide further evidence of outcomes, and to assess the effectiveness of the programme. An initial step towards this goal will be to make all levels of the programme's management aware of the outcomes of this research.

- Initiate local level social networks allowing the participants to share knowledge and experiences thus increasing the level of interaction among participants. Engaging local-level participation and developing robust social networks is deemed an important component of an effective conservation programme (Smith et al. 2009). Currently much of the social networking is driven by the volunteers themselves, and the programme is therefore called upon to increase its contribution to these social networks. In particular the RACs must be made accountable for developing and monitoring social networks within their regions, and developing hierarchical networks as outlined in Chapter 2.

- Establish an online platform for discussion between atlasers, who might then assist one another in overcoming technological, protocol or identification issues. Programme management should monitor such a platform to understand common issues and areas for programme improvement thus further enhancing the adaptive management of the programme. These platforms should also be nested within the social-network hierarchy, such that different levels of integration utilise different online platforms. RACs could call on the volunteers themselves, especially identified champions, to assist in developing these online tools.

- Ensure that the programmes goals are explicitly stated to all involved. Of particular concern is emphasizing the goal of mobilizing citizen scientists to the regional level management. Emphasizing the participants' role as an ambassador for biodiversity and the programme is essential to enhance their capacity to fulfil this role. Currently the objectives of mobilizing citizen scientists and the director's vision of creating ambassadors for biodiversity conservation are not being fully realized. Both of these objectives must be re-iterated to management, and specific mechanisms identified to further enhance their achievement. In this regard, the perception that volunteers are no

more than simple ‘atlasing units’ once trained and recruited, must be overcome. Management, at all levels, must recognise and understand the wants and needs of the people behind this programme.

- Expand the environmental education and awareness aspect of involvement through dissemination of information to current participants, and by increasing the demographic involved in this research. This programme may explore avenues for increasing involvement, and thereby establish useful tools which will aid in the expansion of citizen science in Southern Africa.

Recommendations for future research

A GIS-based spatial analysis of the motivations and levels of satisfaction across the entire geographic extent of the programme is advised. Such an analysis could be combined with understanding of the champions of the programme. Information relevant to each geographic region of the programme could be made available to the RACs, thus allowing for adaptation of management and motivational approaches to suit each region.

In a similar manner the psychological constructs should be assessed against the time since involvement in order to understand how the duration of service will affect the volunteers’ psychology, and other outcomes such as the participants’ level of advocacy.

The psychometric instruments described in this research should be further tested and validated on volunteers in the environmental sector. Research methodologies could be enhanced in future research, including the use of mixed mode survey methods, utilizing traditional paper-based and online platforms. Interviews or focus groups should also be conducted with members of the volunteer pool. In addition, face-to-face interviews with stakeholders are advised to increase involvement in the evaluation and generate information about the programmes functioning. A particular point of interest is to assess the members of SABAP 1 who have not participated in SABAP 2 in order to understand the changes in project design which turned them away from SABAP 2. Such a process could also highlight certain inadequacies of the current project. In addition one might contact and interview those

inactive members of SABAP 2 in order to understand their limitations to participation or their dissatisfaction with the programme.

In closing

This research has undertaken to develop instruments which can be applied by the programme at hand for future evaluations. The methods detailed herein provide sound guidelines for this purpose. In addition the research employed a multi-disciplinary approach by incorporating aspects of conservation science, psychology and programme evaluation. This approach was necessary to evaluate what could be termed a trans-disciplinary research programme. By incorporating biological data collection, information technology, statistics, and concepts of environmental education, citizen science is a new discipline emerging out of the base provided by these individual disciplines. It has been suggested that the full potential of citizen science is just beginning to be understood (Bonney et al. 2009). We therefore strongly suggest that conservation scientists and practitioners continue to increase their awareness of the utility of participatory research approaches, and also of the utility of evaluation in assessing the effectiveness of conservation programmes.

Literature Cited

Ajzen, I. 2001. Nature and operation of attitudes. Annual Review of Psychology 52: 27–58.

Au, J., Bagchi, P., Chen, B., Martinez, R., Dudley, S. A. & Sorger, G. J. 2000. Methodology for public monitoring of total coliforms, *Escherichia coli*, and toxicity in waterways by Canadian high school students. Journal of Environmental Management 58: 213–230.

Babbie, E. 2004. The Practice of Social Research 10th Edition. Wadsworth/Thomson Learning, Belmont, California, U.S.A.

Barnett, R.C., Brennan, R.T. & Garies, K.C. 1999. A closer look at the measurement of Burnout. Journal of Applied Biobehavioural Research 4: 65–78.

Bell, S., Marzano, M., Cent, J., Kobierska, H., Podjed, D., Vandzinskaite, D., Reinert, H., Armaitiene, A., Grodzin'ska-Jurczak, M. & Murs, R. 2008. What counts? Volunteers and their organisations in the recording and monitoring of biodiversity. Biodiversity and Conservation 17: 3443–3454

Berkes, F. 2007. Community-based conservation in a globalized world. Proceedings of the National academy of sciences 104: 15188–15193.

Bhattacharjee, Y. 2005. Citizen scientists supplement work of Cornell researchers. Science 308: 1402–1403.

Bickman, L. 1987. The functions of program theory. In Bickman, L. Ed. Using program theory in evaluation. New directions for program evaluation. Jossey-Bass, San Francisco, U.S.A

Black, S. & Groombridge, J. 2010. Use of a business excellence model to improve conservation programs. Conservation Biology 24: 1448–1458.

Bonney, R., Cooper, C.B., Dickinson, J., Kelling, S., Phillips, T., Van Rosenberg, K. & Shirk, J. 2009. Citizen Science: A developing tool for expanding science knowledge and scientific literacy. BioScience 59: 977–984.

Brooks, J., Franzen, M.A., Holmes, C.M., Grote, M.N. & Borgerhoff Mulder, M. 2006. Testing hypotheses for the success of different conservation strategies. Conservation Biology 20: 1528–1538.

Brossard, D., Lewenstein B. & Bonney, R. 2005. Scientific knowledge and attitude change: The impact of a citizen science project. International Journal of Science Education 27: 1099–1121.

Bruyere, B. & Rappe, S. 2007. Identifying the motivations of environmental volunteers. Journal of Environmental Planning and Management 50: 503–516

Bruyninckx, H. 2009. Environmental evaluation practices and the issue of scale. In Birnbaum, M. & Mickwitz, P. (Eds.) Environmental program and policy evaluation: Addressing methodological challenges. New Directions for Evaluation 122: 31–39.

Byron, I., Curtis, A. & Lockwood, M. 2001. Exploring burnout in Australia's Landcare program: A case study in the Shepparton region. Society and Natural Resources 14: 901–910.

Byron, I & Curtis, A. 2002. Maintaining volunteer commitment to local watershed initiatives. Environmental Management 30: 59–67.

Chen, H. 2005. Practical Program Evaluation. Sage Publications, Thousand Oaks, California, U.S.A.

Clary, G., Synder, M., Ridge, R.D., Copeland, J., Stukas, A.A., Haugen, J. & Meine, P. 1998. Understanding and assessing the motivations of volunteers: A functional approach. Journal of Personality and Social Psychology 74: 1516–1530.

Clary, G. & Snyder, M. 1999. The motivations to volunteer: Theoretical and practical considerations. Current directions in psychological science 8: 156–159.

Conrad, C.C. & Hilchey, K.G. 2010. A review of citizen science and community-based environmental monitoring: Issues and opportunities. Environmental Monitoring and Assessment: DOI 10.1007/s10661-010-1582-5.

Cooksy, L.J., P. Gill & Kelly, P.A. 2001. The program logic model as an integrative framework for a multi–method evaluation. Evaluation and Program Planning 24: 119–128.

Cooper, C. B., J. Dickinson, T. Phillips, & Bonney, R. 2007. Citizen science as a tool for conservation in residential ecosystems. Ecology and Society 12: 11. URL: http://www.ecologyandsociety.org/vol12/iss2/art11/.

Couvet, D., Jiguet, F., Julliard, R., Levrel, H. & Teyssdre, A. 2008. Enhancing citizen contributions to biodiversity science and public policy. Interdisciplinary science reviews 33: 95–103.

Cox,T., Tisserand, M. & Taris, T. 2005. The conceptualization and measurement of burnout: Questions and directions. Work & Stress 19: 187–191.

Curtis, A. 1998. The agency/community partnership in Landcare: Lessons for state sponsored citizen resource management. Environmental Management 22: 563–574.

Danielsen, F. Burgess, N.D., Balmford, A., Donald, P.F., Funder, M., Jones, J.P.G., Alviola, P., Balete. D.S., Blomley, T., Brashares. J., Child, B., Enghoff, M., Fjeldsa, J., Holt, S., Hubertz, H., Jensen, A.E., Massao, J., Mendoza, M.M., Ngaga, Y., Poulsen, M.K., Rueda, R., Sam, M., Skielboe, T., Stuart-Hill, G., Topp-Jorgensen, E. & Yonten, D. 2009. Local Participation in Natural Resource Monitoring: A Characterization of Approaches. Conservation Biology 23: 31–42.

Davila, M. 2009. Assessment of the Volunteer Process Model in environmental volunteers. Interamerican Journal of Psychology 43: 181–186.

DeVictor, V., Whittaker, R.J. & Beltramel, C. 2010. Beyond scarcity: citizen science programmes as useful tools for conservation biogeography. Diversity and Distributions 16: 354–362.

Dillman, D.A. 2007. Mail and Internet Surveys. The Tailored Design Method, 2nd Edition. John Wiley and Sons, Hoboken, New Jersey, U.S.A.

Droege S. 2007. Just because you paid them doesn't mean their data are better. In McEver G, Bonney R, Dickinson J, Kelling, S., Rosenberg, K. & Shirk, J. eds. Citizen Science Toolkit Conference. Cornell Laboratory of Ornithology.

Dunlap, R.E., Van Liere, K.D., Mertig, A.G. & Emmet Jones, R. 2000. Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. Journal of social issues 56: 425–442.

Dunn, A.M. & Weston, M. 2008. A review of terrestrial bird atlases of the world and their application. Emu 108: 42–67.

Evans, J.R. & Mathur, A. 2005. The value of online surveys. Internet Research 15: 195–219.

Ferraro, P.J. & Pattanayak, S.K. 2006. Money for nothing? A call for empirical evaluation of biodiversity conservation investments. PLoS Biol 4: e105.

Finkelstein, M. 2008. Volunteer satisfaction and volunteer action: A functional approach. Social behaviour and personality 36: 9–18.

Fishpool, L.D.C. & Evans, M.I. eds. 2001. Important Bird Areas of Africa and associated islands: Priority sites for conservation. Pisces Publications and BirdLife International. Newbury and Cambridge, UK.

Flowers, A. B. 2010. Blazing an evaluation pathway: Lessons learned from applying utilization-focused evaluation to a conservation education program. Evaluation and Program Planning 33: 165–171.

Fowler, F.J. Jnr. 1995. Improving survey questions. Design and evaluation. Sage Publications, Thousand Oaks, California, U.S.A.

Folke, C., Hahn, T, Olsson, P. & Norberg, J. 2005. Adaptive governance of socio-ecological systems. Annual review of Environmental Resources 30: 441–473.

Galindo-Kuhn, R. & Guzley, R.M. 2001. The volunteer satisfaction index: Construct definition, measurement, development and validation. Journal of Social Service Research 28: 45–68.

Greenacre, M. 2007. Correspondence analysis in practice, 2nd Edition. Taylor & Francis Group, LLC, Chapman & Hall/CRC. London, England.

Greenwood, J.J.D. 2007. Citizens, science and bird conservation. Journal of Ornithology 148: (Supplement 1): S77–S124.

Guiney, M.S. & Oberhauser, K.S. 2009. Conservation volunteers' connection to nature. Ecopsychology 1: 187–197.

Haas, S.C. 2000. Virginia Save Our Streams (SOS): Volunteers' motivations for participation and suggestions for program improvement. MSc thesis, Faculty of the Virginia Polytechnic Institute and State University.

Haines, A.M., Leu, M., Svancara, L.K., Michael Scott, J. & Reese, K.P. 2008. A theoretical approach to using human footprint data to assess landscape level conservation efforts. Conservation Letters 1: 165–172.

Harebottle, D.M., Smith, N., Underhill, L.G. & Brooks, M. 2008. Southern African Bird Atlas Project 2, Instruction Manual, Updated first edition.

Harrison, J.A., Allan, D.G., Underhill, L.G. & Oatley, T.B. 1996. The Avian Demography Unit: tracking bird populations in a changing South Africa. South African Journal of Science 92: 14–16.

Harrison J.A., Underhill, L.G & Barnard, P. 2008. The seminal legacy of the Southern African Bird Atlas Project. South African Journal of Science 104: 82–84.

Heimlich, J.E. 2010. Environmental education evaluation: Reinterpreting education as a strategy for meeting mission. Evaluation and Program planning 33: 180–185.

Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. 2005. Roberts – Birds of Southern Africa, 7th edition. The Trustees of the John Voelcker bird book fund, Cape Town, South Africa.

Ingwell, L.L. & Pressier, E.L. 2011. Using citizen science programs to identify host resistance in pest-invaded forests. Conservation Biology 25: 182–188.

Irwin, A. 1995. Citizen science: a study of people, expertise and sustainable development. Routledge, London, England.

Kaizer, F.G., Wolfing, S. & Fuhrer, U. 1999. Environmental attitude and ecological behaviour. Journal of Environmental Psychology 19: 1–19.

Kaplowitz, M.D., Hadlock, T.D. & Levine, R. 2004. A comparison of web and mail survey response rates. Public Opinion Quarterly 68: 94–101.

Kapos, V., Balmford, A., Aveling, R., Bubb, P., Carey, P., Entwistle, A., Hopkins, J., Mullikenz, T., Safford, R., Stattersfield, A., Walpole, M. & Manica, A. 2008. Calibrating conservation: new tools for measuring success. Conservation Letters 1: 155-164.

Katz, D. 1960. The functional approach to the study of attitudes. Public Opinion Quarterly 24: 163–204.

Keene, M. & Blumstein, D.T. 2010. Environmental education: A time of change, A time for change. Evaluation and Program planning 33:201–204.

Keene, M. & Pullin, A. in press. Realizing an effectiveness revolution in environmental management.

Kennedy, E. T., Balasubramanian, H., & Crosse, W.E.M. 2009. Issues of scale and monitoring status and trends in biodiversity. In Birnbaum, M. & Mickwitz, P. (Eds.), Environmental program and policy evaluation: Addressing methodological challenges. New Directions for Evaluation: 122 41–51.

Kingsley, N. P., Brock, S. M., & DeBald, P. S. 1988. Focus group interviewing applied to retired West Virginia nonindustrial private forest landowners. Northern Journal of Applied Forestry 88: 198–200.

Kleiman, D.G. & Mallinson, J.J.C. 1998. Recovery and Management committees for Lion tamarins: Partnerships in conservation planning and implementation. Conservation Biology 12: 27–38.

Kleiman, D., Reading, R.P., Miller, B.J., Clark, T.W., Michael Scott, J., Robinson, J., Wallace, R.J., Cabin, R.J., Felleman, F. 2000. Improving the evaluation of conservation programs. Conservation Biology 14: 356–365.

Kline, P. 1998. The New Psychometrics. Science, Psychology and Measurement. Routledge, London, England.

Knight, A.T.K., Driver, A., Cowling, R.M., Maze, K., Desmet, P.G., Lombard, A.T., Rouget, M., Botha, M.A., Boshoff, A.F., Castley, J.G., Goodman, P.S., Mackinnon, K., Pierce, S.M., Sims-Castley, R., Stewart, W.I. & Von Hase, A. 2006a. Designing systematic conservation assessments that promote effective implementation: Best practice from South Africa. Conservation Biology 20:739–750.

Knight, A.T., Cowling, R.M., Rouget, M., Balmford, A., Lmobard, A.T. & Campbell, B.M. 2008. Selecting priority conservation areas and the research-implementation gap. Conservation Biology 22: 610–617.

Knight, A.T., Cowling, R.M., Difford, M. & Campbell, B.M. 2010. Mapping human and social dimensions of conservation opportunity for the scheduling of conservation on private land. Conservation Biology 24:1348–1358.

Lakshminarayanan, S. 2007. Using citizens to do science versus citizens as scientists. Ecology and Society 12(2):2. [online] URL: http://www.ecologyandsociety.org/vol12/iss2/resp2/.

Lepczyk, C.A. 2005. Integrating published data and citizen science to describe bird diversity across a landscape. Journal of Applied Ecology 42: 672–677.

Lewis-Beck, M.S. 1994. Factor analysis and related techniques. Sage publications, London, England.

Likert, R. 1932. A technique for the measurement of attitudes. Archives of Psychology 22:1–55.

Love, A. 2004. Implementation evaluation In Wholey, J.S., Hatry, H.P. & Newcomer, K.E. 2004 (Eds.), Handbook of Practical Program Evaluation (2nd Edition). Chapter 1; Pages 7-32. John Wiley & Sons, Inc. San Francisco, California, U.S.A.

Lumsden, J. 2005. Guidelines for the Design of Online Questionnaires. National Research Council Canada.
http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/ctrl?action=rtdoc&an=5765110&lang=en

Margoluis, R., Stem, C., Salafsky, N., & Brown, M. 2009. Design alternatives for evaluating the impact of conservation projects. In M. Birnbaum & P. Mickwitz (Eds.), Environmental program and policy evaluation: Addressing methodological challenges. New Directions for Evaluation 122: 85–96.

Maslach, C., Jackson, S. & Leiter, M.P. 1996. Maslach Burnout Inventory, 3rd Edition. Consulting Psychologists Press, Palo Alto, U.S.A.

McCaffrey, R.E. 2005. Using citizen science in urban bird studies. Urban habitats 3: 70–86.

McLaughlin, J.A. & Jordan, G.B. 1999. Logic models: a tool for telling your program's performance story. Evaluation and Program Planning 22: 65–72.

McLaughlin, J.A. & Jordan, G.B. 2004. Using logic models. In Wholey, J.S., Hatry, H.P. & Newcomer, K.E. 2004 (Eds.), Handbook of Practical Program Evaluation (2nd Edition). Chapter 1; Pages 7-32. John Wiley & Sons, Inc. San Francisco, California, U.S.A.

Measham, T.G. & Barnett.G.B. 2007. Environmental volunteering: Motivations, modes and outcomes. Socio-Economics and Environment in discussion. CSIRO Working paper series 2007-03. CSIRO Sustainable Ecosystems. Canberra, Australia.

Miles, I., Sullivan W.C. & Kuo, F.E. 1998. Ecological restoration volunteers: the benefits of participation. Urban Ecosystems 2: 27–41.

Newcomer, K.E., Hatry, H.P. & Wholey, J.S. 2004. Meeting the need for practical evaluation approaches: An introduction. In Wholey, J.S., Hatry, H.P. & Newcomer, K.E. 2004 (Eds), Handbook of Practical Program Evaluation. 2nd Edition. Pages: xxxiii. John Wiley & Sons, Inc. San Francisco, California, U.S.A.

Patton, M.Q. 1997. Utilization-Focused Evaluation, 3rd Edition. Sage Publications, Thousand Oaks, California, U.S.A.

Pilz, D., Ballard, H.L. & Jones, E.T. 2006. Broadening participation in biological monitoring: Handbook for scientists and managers. General Technical Report. PNW-GTR-680. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Poghoysan, L., Aiken, L.H. & Sloane, D.M. 2009. Factor structure of the Maslach burnout inventory: An analysis of data from large scale cross-sectional surveys of nurses from eight countries. International Journal of Nursing studies 46: 894–902.

Pullin, A.S. & Knight, T.M. 2001. Effectiveness in conservation practice: Pointers from medicine and public health. Conservation Biology 15: 50–54.

Pullin, A.S., Knight, T.M., Stone, D.A. & Charman, K. 2004. Do conservation managers use scientific evidence to support their decision making? Biological Conservation 119: 245–252.

Raddick, M.J., Szalay, A.S., Vandenburg, J., Bracey, G., Gay, P.L., Lintott, C.J., Murray, P. & Scwaniski, K. 2010. Galaxy Zoo: Exploring the motivations of citizen science volunteers. Astronomy Education Review 9 DOI: 10.3847/AER2009036

Robertson M.P., Cumming G.S. & Erasmus, B.F.N. 2010. Getting the most out of atlas data. Diversity and Distributions 16: 363–375.

Roux, D. J., Rogers, K.H., Biggs, H.C., Ashton, P.J. & Sergeant, A. 2006. Bridging the science-management divide: moving from unidirectional knowledge transfer to knowledge interfacing and sharing. Ecology and Society 11: 4.
URL: http://www.ecologyandsociety.org/vol11/iss1/art4/

Ryan, R.L., Kaplan, R. & Grese, R.E. 2001. Predicting volunteer commitment in environmental stewardship programmes. Journal of Environmental Planning and Management 44: 629–648.

Savan, B., Morgan, A.J. & Gore, C. 2003. Volunteer environmental monitoring and the role of the universities: The case of citizens environment watch. Environmental management 31: 561–568.

Salafsky, N., Margoluis, R., Redford, K.H. & Robinson, J.G. 2002. Improving the practice of conservation: A conceptual framework and research agenda for conservation science. Conservation Biology 16: 1469–1479.

Salafsky, N & Margoluis, R. 2003. What conservation can learn from other fields about monitoring and evaluation. Bioscience 53: 120–121.

Schmeller, D.S., Pierre-Yves, H., Julliard, R., Gruber, B., Clobert, J., Dziock, F., Lengyel, S., Nowicki, P., D'Eri, E., Budrys, E., Kull, T., Tali, K., Buach, B., Settele, J., Van Swaay, C., Kobler, A., Babij, V., Papastergiaodou, E. & Henle, K. 2008. Advantages of volunteer-based biodiversity monitoring in Europe. Conservation Biology 23:307–316.

Secretariat of the Convention on Biological Diversity. 2005. Handbook of the Convention on Biological Diversity Including its Cartagena Protocol on Biosafety, 3rd edition. Montreal, Canada.

Sharpe, A. & Conrad, C. 2006. Community based ecological monitoring in Nova Scotia: Challenges and opportunities. Environmental Monitoring and Assessment 113: 395–409.

Shih, T. & Fan, X. 2008. Comparing response rates from web and mail surveys: A Meta-Analysis. Field Methods 20: 249–271.

Silvertown, J. 2009. A new dawn for citizen science. Trends in ecology and evolution 24: 467–471.

Smith, R.J., Verissimo, D., Leader-Williams, N., Cowling, R.M. & Knight, A.T. 2009. Let the locals lead. Nature 462: 280–281.

Snall, T., Kindvall, O., Nilsson, J. & Part, T. 2011. Evaluating citizen-based presence data for bird monitoring. Biological conservation 144: 804-810.

Stem, C, Margoluis, R, Salafsky, N & Brown, M. 2005. Monitoring and evaluation in conservation: A review of trends and approaches. Conservation Biology 19: 295–309.

Sullivan, B.L., Wood, C.L., Iliff, M.J., Bonney, R.E., Fink, D. & Kelling, S. 2009. eBird: A citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2282–2292.

Sunderland, T., Sunderland-Groves, J., Shanley, P. & Campbell, B. 2009. Bridging the gap: How can information access and exchange between conservation biologists and field practitioners be improved for better conservation outcomes? Biotropica 41:549–554.

Sutherland, W.J., Pullin, A.S., Dolman, P.M. & Knight, T.M. 2004. The need for evidence-based conservation. Trends in Ecology and Evolution 19: 305–308.

Taylor, M.F.J., Sattler, P.S., Evans, M., Fuller, R.A., Watson, J.E.M. & Possingham, H. 2010. What works for threatened species recovery? An empirical evaluation for Australia. Biodiversity Conservation: DOI 10.1007/s10531-010-9977-8.

Tremblay, C.A & Hvenegaard, G.T. 2008. For me or the martins? Motivations for being a Purple Martin landlord. Purple Martin Update 17:10–13.

Trumbull, D.J., Bonney, R., Bascom, D. & Cabral, A. 2000. Thinking scientifically during participation in a citizen–science project. Science Education 84: 265–275.

Van Selm, M. & Jankowski, N.W. 2006. Conducting online surveys. Quality and Quantity 40: 435–456.

Wells, W. D. 1974. Group interviewing Part 2, in Handbook of Marketing Research. McGraw-Hill Book Co., New York.

Western, D., Wright, R.M. and Strum, S. (eds.). 1994. Natural Connections: Perspectives in Community-based Conservation. Island Press, Washington D.C., U.S.A.

Weston. M., Fendley M., Jewell, R., Satchell, M. & Tzaros, C. 2003. Volunteers in bird conservation: Insights from the Australian Threatened Bird Network. Ecological management and restoration 4: 205–211.

Whitelaw, G., Vaughan, H., Craig, B. & Atkinson, D. 2003. Establishing the Canadian community monitoring network. Environmental Monitoring and Assessment 88: 409–418.

Wilson, J. 2000. Volunteering. Annual Review of Sociology 26:215–40

Yeung, A.B. 2004. The Octagon Model of volunteer motivation: Results of a phenomenonological analsysis. Voluntas: International Journal of Voluntary and Nonprofit Organizations 15: 21–46.

Young, J.K. 2008. An exploration of volunteers' motivations for and benefits of participating in a Galapagos islands earthwatch expedition. MSc thesis. University of Michigan, U.S.A.

Appendix A: SABAP 2 Stakeholder questionnaire

1. What is your involvement or position with SABAP 2?

2. How long have you been involved?

3. What do you view as the principle 'needs' which SABAP 2 is addressing?

4. What do you perceive as the primary goals of the programme?

5. In your opinion has the programme been effective at reaching these goals?

As outlined in the email introduction to this survey, please focus on the programme in **relation to the atlasers** when answering the following questions. Please be as specific as you can, and if need be refer back to the logic model to check which component the answers to each question fit into.

6. What resources does the programme utilise to mobilize its atlasers?

7. Please list all the activities you are aware of which are undertaken to mobilize the citizen scientists, and increase both levels of participation and public awareness of birds?

8. What are the observable products, goods and services which this programme generates with regard to the atlasers?

9. Please describe what you perceive as the major outcomes of this programme with respect to the atlasers.

10. Could you distinguish amongst these outcomes as short, mid or long term outcomes?
(You can simply add the label of short, mid-term, or long-term behind each of the outcomes you have written above in Q9.)

11. Do you have any suggestions for how the programme might improve the experience of the atlasers?

12. Finally please provide any additional comments which you might have, with regard to the atlasers or this evaluation.

Thank-you for your time.

Appendix B: Stakeholder briefing.

Hello all,

I am an MSc conservation biology student at UCT working with Les Underhill on a research project to evaluate certain dimensions of the SABAP 2 programme. This evaluation is focusing on outcomes which the programme has been aiming to generate with regard to the atlasers. As you are well aware SABAP 2 has two major goals; the first attempts to measure the impact of environmental change on birds, the second is: "To provide a basis for increasing public participation in biodiversity data collection, and public awareness of birds, through large-scale mobilization of citizen scientists."(SABAP 2 instruction manual v6).

In order to 'mobilize' citizen scientists the programme requires that the volunteers/atlasers be highly motivated to participate & highly satisfied with the programme. We are conducting an evaluation of SABAP 2 to determine whether it has achieved these outcomes. This evaluation consists of 2 main components. The first is a questionnaire the atlasers will complete online, which investigates research questions pertaining to their motivations, satisfactions, burnout and their ability to act as ambassadors for biodiversity, amongst others. You might have seen the latest news item and the 'take a survey' tab posted on the site yesterday. The second major component is designing a logic model for SABAP 2 in relation to its participants. The logic model is a plausible and sensible model of how the programme works under certain conditions to solve the identified problems. An example of a logic model is attached to this email.

A logic model can be thought of as a series of if-then statements. As can be seen from the attached diagram, if the programme has certain resources such as financial or human capital then certain activities become possible. If these activities take place, such as workshops for new atlasers, then this will lead to certain outputs, such as a trained atlaser. The outputs are the various products, good or services which the programme generates. A trained atlaser (output) can then lead to various future outcomes. Outcomes may exist at different stages and be categorised as short, mid or long term outcomes. Examples of outcomes from SABAP 2 might include data collection, change in environmental awareness or behaviour, or achieving certain target conditions. This is a very simplified model, and we will probably find that the model for SABAP 2 is much more complex than the simple linear diagram, with multiple resources, activities etc all interacting together. When answering the attached questionnaire please focus on activities, resources etc which pertain specifically to your interactions with atlasers.

This is the point at which your input becomes critical. In order to design an inclusive and robust logic model for SABAP 2 we require all the relevant stakeholders to provide their input, or give their version of how the programme operates. I might guess that many of the

activities, outputs etc will be similar for many of the steering committee members, however it is still essential that we consult all the relevant players. The questionnaire attached to this email is your platform for contributing to the logic model of SABAP 2 in relation to its participants. Please include anything in your answers which you feel is relevant. In addition I will be conducting a focus group with the relevant staff at the ADU. The outcomes of the focus group discussion will then be combined with your feedback from these questionnaires, to design the programme logic model. The logic model will be used, in conjunction with the results of our atlaser questionnaire, to target or design activities or processes which will further improve the atlaser's experience, and hopefully contribute to the long term success of SABAP 2.

Please download the attached questionnaire and type your answers in the space below each question. I have not drawn in lines or specified the length of answers as different individuals might want to contribute different amounts. If possible please type in a different font to that used for the questions (not essential). Once you have completed the questionnaire simply save the new version, with your name in the document title, and return to me at this email address. If possible, I would like to have received your questionnaire by the 16thNovember. The questionnaire includes 12 questions and will not take much time. Please do not hesitate to email me if you have any queries regarding the questionnaire.

Thank you in advance for your time and effort in providing this information.

Regards,

Dale.

Appendix C: Online atlaser questionnaire.

Introductory questions

Q1_How, or from where, did you first hear about the programme?

Q2_Please name, and rank from 1 to 3, the three best sightings you've had throughout your life, including the species and location for each.

Q3_How many species in total have you recorded during your life? Tick one.

(0-100; 100-200; 200-300; 300-400; 400-500; 500-600; 600+).

Q4_Are you a member of any environmental or conservation organizations?

If yes, please name these and your level of involvement.

Q5_Please list your reasons for volunteering with this programme? Can you please rank these reasons?

Q6_How do you benefit from being involved in the programme?

Q7_What prevents you from atlasing more often?

Q8_How do you feel this programme might be improved?

Q9_Please name, and rank in order, any fellow atlaser/s you view as leaders or champions of this programme.

Q10_Please enter your observer number. This will allow us to retrieve important information from our database however your number will not be recorded, therefore retaining your anonymity.

Please indicate your level of agreement with the following items, or how accurately each item represents you. (5 point Likert scale).

(Strongly agree; Agree; Neutral; Disagree; Strongly disagree; Unsure)

Q11_I feel it is important for people to volunteer their time to a worthy cause.

Q12_I enjoy being in the outdoors.

Q13_ want to learn more about birds.

Q14_I am concerned about the impacts of environmental change or degradation on birds.

Q15_I atlas because it is a lot of fun.

Q16_I am excited about collecting data for an 'unatlased' pentad.

Q17_Atlasing allows me to indulge my true passion.

Q18_I want to actively contribute towards improving our society.

Q19_I prefer birding with others, rather than birding alone.

Q20_Atlasing provides an opportunity for exploring new places.

Q21_Atlasing allows me to introduce others to birding.
Q22_I enjoy sharing new knowledge with others in the birding community.
Q23_I participate in atlasing as it allows for personal development.
Q24_I enjoy the challenge or stimulation of learning new skills.
Q25_I am interested in the techniques used to analyse the data I collect.
Q26_Atlasing provides me with an opportunity for meeting people with similar interests.
Q27_I regularly consult the SABAP 2 organisers to see how and where the analysed data is being applied.
Q28_Birds are a never-ending source of fascination for me.
Q29_I feel a strong connection with nature.
Q30_SABAP 2 is a well-run, organized programme.
Q31_I strive to meet the challenges, such as coverage targets, set by the SABAP 2 organizers.
Q32_I enjoy atlasing for the ADU because it provides me the opportunity to network with birding professionals.
Q33_My experience with SABAP 2 has been positive.
Q34_I receive adequate recognition for my work as an atlaser.
Q35_My role and responsibilities for SABAP 2 meet my motives for volunteering.
Q36_This programme allows me to actively contribute information to the broader body of scientific knowledge.
Q37_The overall experience as an atlaser has been personally fulfilling.
Q38_Atlasing allows me to break away from my normal routine.
Q39_My network of fellow birders has grown as a result of participating in atlasing.
Q40_Through my involvement I am able to actively contribute to the conservation of birds.
Q41_My birding skills have improved since becoming involved in this programme.
Q42_I enjoy atlasing because of the social time it provides.
Q43_The programme has improved my map reading and GIS skills.
Q44_I enjoy working under the supervision provided by the SABAP 2 team.
Q45_Atlasing provides a great opportunity for recreation.
Q46_The SABAP 2 website is user friendly.

Please indicate your level of agreement with the following items, or how accurately each item represents you. (5 point Likert scale)

(Strongly agree; Agree; Neutral; Disagree; Strongly disagree; Unsure)

Q47_I have taken practical measures to reduce my impact on the environment. Eg. Fitting a low flow shower head, reducing my carbon emissions.

Q48_I have formally shared my atlasing experiences with others through public speeches, presentations or via the media.

Q49_I encourage friends and family to join the programme.

Q50_I discuss conservation and environmental issues with non-atlasing friends and acquaintances.

Q51_I think it is important to take non-atlasers along on data collection trips.

Q52_I often informally share my atlasing experiences with others.(eg. During office tea or at a braai or dinner party.)

Q53_I make annual donations to other conservation organisations.

Q54_I try to encourage people to join the programme by facilitating logistics, such as providing transport.

Q55_I make a point of recycling different waste products, such as paper or glass.

Please read the following statements below, and check the response which MOST ACCURATELY DESCRIBES HOW OFTEN THE STATEMENT MATCHES HOW YOU FEEL. (7 point Likert scale).

(Never; A few times a year or less; Once a month or less; A few times a month; Once a week; A few times a week; Everyday.)

Q56_I feel fatigued when I get up to go atlasing.

Q57_I strive to deal effectively with the challenges atlasing presents, such as accessing 'out of the way' pentads.

Q58_I feel burned out from atlasing.

Q59_I have become more insensitive towards my fellow atlasers.

Q60_I feel very energised during atlasing.

Q61_I feel frustrated by the SABAP 2 programme.

Q62_I am cynical about the usefulness of my contribution.

Q63_I feel decreasingly interested in atlasing activities.

Q64_I feel confident that my atlasing is effective.

Q65_I feel I work too hard on atlas activities.

Q66_I feel exhilarated after time spent atlasing.

Q67_I feel less enthusiastic about atlasing.

Q68_I feel a sense of accomplishment when collecting scientific data.

Demographics

Q69_Age: Please tick one.

(15-20; 21-25; 26-30; 31-35; 36-40; 41-45; 46-50; 51-55; 56-60; 61-65; 66+)

Q70_Gender: Please tick one.

(Male; Female)

Q71_Cultural group: Please tick one.

(White; Black; Coloured; Asian)

Q72_Home Language: Pleas tick one

(English; Afrikaans; Xhosa; Zulu; Other)

Q73_What is your current occupation?

Q74_What is your highest level of education? Please tick one.

(High School; Undergraduate university degree; Masters level degree; PhD level degree; Other).

Q75_What is your average household income per month? Please tick one.

(0-7500; 7501-12500; 12501-17500; 17501+)

Q76_Finally, please provide any additional comments about the programme and this survey.

Thank you for your time!

Appendix D: Atlaser champions named and number of mention for each.

Ernst Retief 43
Etienne Marais 38
Arnold v d Westhuizen 27
Trish Strachan 19
Andre Marx 12
Peter Lawson 11
Geoff Lockwood 11
Jeff Curnick 8
Felicity Elmore 8
Phil Whittington 7
Colin Summersgill 6
Gerald Windgate 6
Andy Featherstone 6
Rick Nuttall 5
Tim Wood 5
Japie Claasen 4
Alan Manson 4
Stephan Terblanche 4
John Carter 4
Dawie Kleynhans 4
Andrew Stainthorpe 4
Steve Davies 4
Dawie De Swaardt 4
Yvonne Bosman 4
Duncan Mckenzie 4
Koos du Plessis 4
Peter Nupen 4
Derek Engelbrecht 3
Bruce Lawson 3
Lisl van Deventer 3
Brian vanderWaalt 3
Lia Steen 3
Roy Cowgill 3
Lance Robinson 3
Stuart Groom 3
Pat Nurse 3
Simon Fogarty 3
Stefan Theron 3

Jaco van Vuuren 2
Ian Field 2
Tony Archer 2
Bryan Groom 2
Reiner Balt 2
Peter Ginn 2
Willem Boshoff 2
Gerry Horn 2
Richard Johnstone 2
Henk Alting 2
Errol de Beer 2
Sarah Kidson 2

Davin Alla 1
Ferdi Myburgh 1
Ross Zietsman 1
Peter Hall 1
Dave Brown 1
Paddy Campbell 1
Roddy Furlong 1
Lynne Craig 1
Stuart McLean 1
Bill Small 1
Mike Sims 1
Lance Robinson 1
Philip Tarboton 1
Chris McDonald 1
Bing Comry 1
Magriet Le Roux 1
Annatjie Becker 1
Brian Colahan 1
Brigid de Kock 1
Normal Elwell 1
Colin Gerrans 1
John Magner 1
Mike Buckham 1
Trevor Hardaker 1
Niall Perrins 1
Ben Baxter 1
Patrick Rollinson 1
Yvonne Craig 1
Maggie Langlands 1
Robert Smith 1
Andy Nixon 1
Joe Grosel 1
Mel Tripp 1
Ken Hattingh 1

Faansie Peacock 1
Gertie Griffeth 1
Riaan Geyser 1
Eric Hermann 1
Rina Pretorius 1
Graham Pringle 1
Jessie Blackshaw 1
Sally Harris 1
Roger Feldwick 1
Justin Niclolau 1
Mike Bridges 1
Jo Johnson 1
Colin Gerrans 1
Pam Nicol 1
Karin Nelson 1
Res Altwegg 1
Chris van Gaas 1
Kate Henderson 1
Michael Cunningham 1
Martin & Melanie Potgieter 1
Adam Welz 1