

The Relationship Between Birders, Avitourism and Avian Conservation

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The relationship between birders, avitourism and avian conservation

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B.Sc. (Hons)



A thesis submitted in fulfilment of the requirements of the degree of

Doctor of Philosophy

Griffith School of Environment

Griffith Sciences

Griffith University, Australia



August 2015

Statement of Originality

The material in this thesis has not previously been submitted for a degree in any University, and to the best of my knowledge contains no material previously published or written by another person except where due acknowledgement is made in the thesis itself.

Rochelle Steven

August 2015

Abstract

The popularity of birding (aka birdwatching) and its tourism equivalent, avitourism, has seen an increase in global participants since the turn of the last century. The level of interest and dedication shown towards birds has been the subject of increasing research, especially the social and economic aspects of the pastime and industry. The ability for birding and avitourism to contribute to conservation has also drawn recent researcher attention, though gaps remain in the current understanding as revealed by my review of the discipline. In particular, the relationship between birders and the practical elements of avian conservation have not been comprehensively assessed. This thesis uses a multi-disciplinary methodological approach to understand the relationship between birders, avitourism and avian conservation. Data were collected using online surveys of birders, content analysis and face-to-face questionnaires and econometric methods. Several patterns emerged that defined how birders engage with birding as well as bird conservation.

Birders from key birding regions including Australia, United Kingdom (UK), United States of America (USA) and South Africa expressed preferences for different types of birds and habitats. Shorebirds and both coastal and freshwater wetlands were favoured by birders from the UK. Birder sex also influenced how and where birders watch birds, with women more likely to restrict birding activities to home, while men travelled further for birding. Male birders also participated in bird-based events such as census and atlas activities more often than females. When birders' preferences for birds characteristic of certain destinations were examined, it was found that birds that are unique or endemic to particular regions are key attractions for avitourism. In the Pacific context, it was demonstrated that avitourists that have visited New Zealand rated it as among their favourite birding destinations, while Papua New Guinea is one of the most desirable destinations to visit. Bird species driving these preferences are those that exhibit unusual characteristics (e.g. physically, behaviourally and evolutionary) including; kiwi, kaka and birds of paradise. The importance of endemism and diversity was confirmed through econometric birder preference analyses. A choice experiment categorised birders based on site attributes for hypothetical birding destinations, as defined by the bird assemblage present. Presence and abundance of endemic species, threatened species and bird diversity affected birders' selection of ideal birding sites with some birders opting for sites with more diversity and others being drawn to sites

with higher levels of endemic and/or threatened species. The willingness to pay for the right birding experience was significant, with one group of birders not affected by the prospect of payment at all. The role of avitour companies in dictating where birders see birds, and which birds they see was assessed via a desk-top content analysis study. With a focus on the BirdLife Important Bird and Biodiversity Area (IBA) network, this study determined that IBAs play a key role in the suite of destinations visited by avitour companies. Similarly, IBA trigger species (which are significant in terms of conservation) also feature highly in avitour descriptions. The IBA network however, is not emphasised in the site descriptions provided by avitour companies at all.

Birders value bird conservation as part of the larger conservation challenge in an eco-centric way, often citing the overarching importance of biodiversity. The ecological roles birds play was also highlighted, but this varied across socio-demographic groups. Despite their positive conservation attitudes, less than half of all birders surveyed were familiar with the IBA program. While birders are not opposed to making contributions to bird conservation, they feel governments should be the main funders of conservation action.

This thesis has identified multiple opportunities to improve conservation outcomes for birds. Better communication among the key birding stakeholders is central to achieving such outcomes. There is scope to enhance involvement in certain birding activities, including citizen science projects, if marketed strategically. Vulnerable species and habitats could benefit from increased awareness among birders already interested in engaging with them. Birding destinations possess attributes that appeal to birders from all over the world. Some opportunities, however, for sustainable development and conservation support are currently being missed. The combined results provide evidence that land managers could optimise diverse funding sources, especially at sites attractive for avitourism. Birders indicated a desire to learn more about bird conservation at birding sites, offering further scope for increased communication and engagement. For birders, increasing access to relevant information and presenting opportunities to contribute to conservation at birding sites could provide tangible ecological and societal benefits for protected areas, bird conservation groups, and birders.

Table of Contents

Abstract	iii
Table of Contents	v
List of Tables	vi
List of Figures	vii
Acknowledgements	viii
Statement of Published and Unpublished Papers Included in this Thesis	x
<hr/>	
Chapter 1. Introduction	1
1.1 Birdwatching, birders and tourism.....	1
1.2 Important Bird and Biodiversity Areas.....	4
1.3 Research gaps.....	8
1.4 Objectives.....	9
1.5 Content and structure of thesis.....	10
1.6 References.....	11
<hr/>	
Chapter 2. Bird watching and avitourism: A global review of research into its participant markets, distribution and impacts, highlighting future research priorities to inform sustainable avitourism management	19
<hr/>	
Chapter 3. Extending knowledge of birder preferences and practices to enhance conservation participation	20
<hr/>	
Chapter 4. Insights into the attributes of Pacific Island destinations that appeal to avitourists	55
<hr/>	
Chapter 5. Birder preferences revealed using a choice experiment can guide bird conservation funding and management	56
<hr/>	
Chapter 6. Avitourism in Australian Important Bird and Biodiversity Areas ..	85
<hr/>	
Chapter 7. Exploring attitudes and understanding of global conservation practice among birders and avitourists for enhanced conservation of birds	86
<hr/>	
Chapter 8. General discussion	116
8.1 Introduction.....	116
8.2 Contribution to knowledge.....	119
8.3 Emerging recurrent themes.....	122
8.4 Future research.....	125
8.5 Conclusion	128
8.6 References	128
<hr/>	
Chapter 9. Appendices	136
<hr/>	

List of Tables

	Page
<i>Chapter 1 – Introduction</i>	
Table 1.1 Summary of classifications of birders presented in the recreational specialisation literature.....	3
Table 1.2 Definitions of trigger species criteria used in the identification of IBAs.....	6
<i>Chapter 2 - Bird watching and avitourism: A global review of research into its participant markets, distribution and impacts, highlighting future research priorities to inform sustainable avitourism management</i>	
	See paper
<i>Chapter 3 - Extending knowledge of birder preferences and practices to enhance conservation participation</i>	
Table 1. Generalised linear model analysis of socio-demographic trends and birder preferences and practices.....	27
<i>Chapter 4 - Insights into the attributes of Pacific Island destinations that appeal to avitourists</i>	
	See paper
<i>Chapter 5 - Birder preferences revealed using a choice experiment can guide bird conservation funding and management</i>	
Table 1. Site attributes and corresponding levels on the choice cards.....	61
Table 2. Summary information for analyses determining the preferences of various latent class groups for site bird assemblages.....	64
Table 3. Coefficient estimates for bird assemblage preferences from the conditional logit model and the 4 segment latent class model with, attribute non-attendance for the cost parameter in Group 4.....	66
	See paper
<i>Chapter 6 - Avitourism in Australian Important Bird and Biodiversity Areas</i>	
<i>Chapter 7 - Exploring attitudes and understanding of global conservation practice among birders and avitourists for enhanced conservation of birds</i>	
Table 1. Specific questions asked of birders regarding bird conservation.....	91
Table 2. Values assigned to the responses for the importance of bird conservation by country, age and sex of respondent.....	95
Table 3. Level of familiarity with the IBA program among respondents.....	97
<i>Chapter 8 - Discussion</i>	
	116

List of figures

	Page
<i>Chapter 1 – Introduction</i>	
Figure 1.1 Relative position of avitourism within the larger tourism industry compared to other examples of wildlife and nature-based tourism.....	4
Figure 1.2 Conceptual model of key stakeholders and mechanisms in the relationship among birders, avitourism and avian conservation. Dashed lines for links between stakeholders and mechanisms indicate areas of uncertainly around relationships and communication among stakeholders.....	10
<i>Chapter 2 - Bird watching and avitourism: A global review of research into its participant markets, distribution and impacts, highlighting future research priorities to inform sustainable avitourism management</i>	
	See paper
<i>Chapter 3 - Extending knowledge of birder preferences and practices to enhance conservation participation</i>	
Figure 1. Geographic scale of birding activities by (a) sex; (b) age; (c) country.....	31
Figure 2. Tenure of land where birding activities take place by (a) sex; (b) age; (c) country.....	33
<i>Chapter 4 - Insights into the attributes of Pacific Island destinations that appeal to avitourists</i>	
	See paper
<i>Chapter 5 - Birder preferences revealed using a choice experiment can guide bird conservation funding and management</i>	
Figure 1 Willingness to pay values, per respondent group in the latent class model, for medium and high levels of site attributes relative to a baseline of the low level of each site attribute.....	68
<i>Chapter 6 - Avitourism in Australian Important Bird and Biodiversity Areas</i>	
	See paper
<i>Chapter 7 - Exploring attitudes and understanding of global conservation practice among birders and avitourists for enhanced conservation of birds</i>	
Figure 1. Top 50 words appearing in responses to the open ended question ‘Why do you think bird conservation is important?’ Words excluded: bird/s, conservation & important.....	93
Figure 2. Birders’ level of agreement with the two statements; ‘I believe that birders should make contributions to assist bird conservation when visiting key sites for birds’ and ‘I believe that government should be the main funders of bird conservation’. Paired responses are shown for each question respectively grouped by sex (a & b), age group (c & d), country of residence (e & f), and education (g & h)...	99
<i>Chapter 8 - Discussion</i>	
Figure 8.1 Conceptual model, re-visited, with thesis outcomes and linkages to mechanisms of bird conservation. The arrows represent linkage pathways among stakeholders in avitourism and bird conservation and opportunities to enhance conservation outcomes.....	118

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Statement of Published and Unpublished Papers Included in this Thesis

Section 9.1 of the Griffith University Code for the Responsible Conduct of Research (“Criteria for Authorship”), in accordance with Section 5 of the Australian Code for the Responsible Conduct of Research, states:

To be named as an author, a researcher must have made a substantial scholarly contribution to the creative or scholarly work that constitutes the research output, and be able to take public responsibility for at least that part of the work they contributed. Attribution of authorship depends to some extent on the discipline and publisher policies, but in all cases, authorship must be based on substantial contributions in a combination of one or more of:

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- analysis and interpretation of research data
- drafting or making significant parts of the creative or scholarly work or critically revising it so as to contribute significantly to the final output.

Section 9.3 of the Griffith University Code (“Responsibilities of Researchers”), in accordance with Section 5 of the Australian Code, states:

Researchers are expected to:

- Offer authorship to all people, including research trainees, who meet the criteria for authorship listed above, but only those people.
- accept or decline offers of authorship promptly in writing.
- Include in the list of authors only those who have accepted authorship
- Appoint one author to be the executive author to record authorship and manage correspondence about the work with the publisher and other interested parties.
- Acknowledge all those who have contributed to the research, facilities or materials but who do not qualify as authors, such as research assistants, technical staff, and advisors on cultural or community knowledge. Obtain written consent to name individuals.

Included in this thesis is a paper in **Chapter 4** for which I am the sole author.

The bibliographic details for this paper are: Steven R. 2015. Insights into the attributes of Pacific Island destinations that appeal to avitourists. *Pacific Conservation Biology* 21, 153-157.

(Where a paper(s) has been published or accepted for publication, you must also include a statement regarding the copyright status of the paper(s).

Additionally included in the thesis are papers in *Chapters 2, 3, 5, 6 and 7* which are co-authored with other researchers. My contribution to each co-authored paper is outlined at the front of the relevant chapter. The bibliographic details/status for these papers including all authors, are:

Chapter 2: Steven R, Morrison C, Castley JG. 2014. Bird watching and avitourism: A global review of research into its participant markets, distribution and impacts, highlighting future research priorities to inform sustainable avitourism management. *Journal of Sustainable Tourism* DOI.org/10.1080/09669582.2014.924955

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Chapter 3: Steven R, Morrison C, Arthur JM, Castley JG. Extending knowledge of birder preferences and practices to enhance conservation participation. *Journal of Wildlife Management*. Under Review.

Chapter 5: Steven R, Smart JCR, Morrison C, Castley JG. Birder preferences revealed using a choice experiment can guide bird conservation funding and management. *Conservation Biology*. Under Review.

Chapter 6: Steven R, Morrison C, Castley JG. Avitourism in Australian Important Bird and Biodiversity Areas. *PLoS ONE*. (10)12: e0144445. Available from: <http://dx.doi.org/10.1371/journal.pone.0144445>

Chapter 7: Steven R, Morrison C, Castley JG. Exploring attitudes and understanding of global conservation practice among birders and avitourists for enhanced conservation of birds. *Bird Conservation International*. Under Review.

Appropriate acknowledgements of those who contributed to the research but did not qualify as authors are included in each paper.

Additional relevant publications and outputs

During the course of this research project, there have been additional outputs produced that while related to the topic of this project, did not form part of the thesis itself. Additionally, the research that forms the basis of this thesis has been presented, in part, at international conferences.

Steven R, Smart JCR, Morrison C, Castley JG. 2013. Assessing avitourist preferences for bird assemblages using a choice experiment. EcoTas13; November 24-29 2013, Auckland, New Zealand.

Steven R, Castley JG, Morrison C. 2013. Patterns in research effort and knowledge about avitourism. Australasian Ornithological Conference; December 4-7 2013, Auckland, New Zealand.

Steven R, Morrison C, Smart JCR, Castley JG. 2014. Birder awareness of conservation and management of birds: comparing birders from different regions. Queensland Ornithological Conference; May 31 2014, Brisbane, Australia.

Steven R. 2014. Endemism and diversity: key avitourism attractions of island destinations and opportunities for conservation and development. Society for Conservation Biology Oceania Conference; July 7-8 2014, Suva, Fiji.

Steven R. 2015. Birder preferences for bird species and bird habitats. Student Conference for Conservation Science; January 19-22, Brisbane, Australia.

Pickering C, Grignon J, **Steven R.**, Guitart D, Byrne J. 2014. Publishing not perishing: how research students transition from novice to knowledgeable using systematic quantitative literature reviews. *Studies in Higher Education*
DOI:10.1080/03075079.2014.914907

Steven R., Castley JG. 2014. “Six extraordinary Australian birds you need to see” The Conversation, published online 4 December 2014 <http://theconversation.com/six-extraordinary-australian-birds-you-need-to-see-34481>

Steven R. 2013. “Avitourism and North Queensland IBAs” Contact Call Vol 2 No. 3 http://www.birdlife.org.au/images/uploads/branches/documents/NQ-CC_2013_11_Vol2_No4.pdf

Steven R. 2014. “Conondale Range IBA” Warbler Vol 3, No. 4 http://www.birdlife.org.au/images/uploads/branches/documents/SQ_Warbler_12.2014.pdf

Steven R. 2015. “Moreton Bay and Pumicestone Passage IBA” Warbler Vol 4, No. 1 <http://www.birdlife.org.au/images/uploads/branches/documents/SQ-Warbler-Mar2015.pdf>

Steven R. 2015. “Tamborine Mountain IBA” Warbler Vol 4, No. 2 http://www.birdlife.org.au/images/uploads/branches/documents/SQ_Warbler_06_2015.pdf

Rochelle Steven

As Principal supervisor of this research I can verify that all author contributions to this published paper were duly acknowledged and I am signing on behalf of all co-authors.

Supervisor: J. Guy Castley

Chapter 1 – Introduction

1.1 Birdwatching, birders and tourism

Birds have been the focus of pastime and recreation since the 18th century (Moss 2004). Initially, birdwatching (or birding) was often accompanied by the collection of bird and egg specimens for private and institutional collections. By the 1900s there were calls for the protection of birds, encouraging a move away from taking specimens from the wild and a growth in the observation of free living birds (Moss 2004). Establishment of non-governmental organisations such as the Royal Society for the Protection of Birds (RSPB) (United Kingdom [UK]) and the National Audubon Society (United States of America [USA]) cemented the move towards linking birding enthusiasm to avian conservation (Moss 2004; MacDonald 2002). Birding has since become a popular and expanding hobby (Wiedner & Kerlinger 1990; Cordell & Herbert 2002), particularly in developed countries (Şekercioğlu 2002). Furthermore, as people have become wealthier and technology has improved, a significant industry has developed, based on providing birders with the equipment needed for observing birds (Hvenegaard *et al.* 1989; Wiedner & Kerlinger 1990).

Birders generally share one common bond, the desire to find or look for birds in the wild. Previously characterised as a homogeneous community dominated by middle-aged, white males with tertiary qualifications and high salaries (Jones and Buckley 2004; Lee and Scott 2004); the truth is that the birding community is diverse (Connell 2009). For example, several studies surveying birders have found the majority of respondents to be female (La Rouche 2001; Scott & Thigpen 2003; Green & Jones 2010; Maple *et al.* 2010; Carver 2013). Sometimes, the male/female ratio depends on the type of birder in terms of the centrality of birding to their lifestyle (Hvenegaard 2002).

The motivations, methods, levels of commitment and dedication among birders are also highly variable (Lee & Scott 2004; Connell 2009; Kim *et al.* 2010). Birders seem to have a reputation among many in the wider community as being fanatics with a sole interest in building their ‘life list’ (i.e. the list of species they have seen since commencement of the hobby) (see director David Frankel’s motion picture “The Big Year”). However, Connell (2009) expands on the subtle specialised subsets of the birding community. Firstly, ‘birdwatcher’ is the generic term for someone that takes a

genuine interest in watching birds in the wild. The term is often used by people who are not birdwatchers, to describe birders. Most birdwatchers would describe themselves as ‘birders’ (Connell 2009), claiming to have a deeper interest in birds, including their ecology and conservation. In general, this thesis will group participants under the term ‘birders’. Finally, ‘twitchers’ are thought to engage in birding at the most dedicated and competitive level. They are avid list keepers that travel far and wide with the sole purpose of ‘collecting’ the next species for their list. For twitchers, it is not so much about the birds, but more about their skill and dedication to their chosen pastime. Twitchers have also been associated with the act of twitching, where birders or twitchers travel (often long distances) to see a bird that has appeared outside of its natural range (i.e. a vagrant or rarity) (Moss 2004). The term ‘twitch’ also appears in the names of some birding-based events (i.e. twitchathons), where birders compete to see as many species as possible during a set time frame (Dooley 2005; Koeppl 2006; Davies & Miller 2010).

Birders are often categorised by academics based on recreational specialisation, using levels of commitment, dedication, behaviour and skill to place them along a specialisation continuum (Table 1.1 and references therein). For example, more dedicated ‘birders’ and ‘twitchers’ would probably fall in the ‘advanced’ or ‘skilled’ categories (not necessarily respectively). The numbers of casual or intermediate birders outnumber those that are advanced, but advanced birders spend more time birding per capita (Scott & Thigpen 2003). Furthermore, the more advanced a birder is, the more likely they are to travel further to see more birds. Threatened birds have been increasingly sought after during avitourism activities, an aspect of the avitourism industry referred to as ‘last chance birding’ (Hvenegaard 2012). Thus, improving our understanding of birders and their practices is important from both a tourism and conservation perspective.

Table 1.1 Summary of classifications of birders presented in the recreational specialisation literature

Author/s and year of study	Classifications of birdwatchers	Focus of study
McFarlane & Boxall 1996	Casual; Novice; Intermediate; Advanced	Birdwatcher contributions to general and avian conservation
Cole & Scott 1999	Casual; Serious	Examination of participation patterns
Hvenegaard 2002	Novice; Advanced-active; Advanced-experienced	Birder specialisation and motivations
Scott & Thigpen 2003	Casual; Interested; Active; Skilled	Understanding birders as tourists
Scott <i>et al.</i> 2005	Casual; Active; Committed	Motivation and commitment of birders
Harwood 2008	Beginner; Intermediate; Advanced; Expert	Birdwatching for community-based tourism
Maple <i>et al.</i> 2010	Beginner; Intermediate; Expert	Tourism planning for birdwatchers

Birdwatching tourism (or avitourism) forms a niche segment of the nature-based tourism market (Cordell & Herbert 2002; Şekerciöğlü 2002; Newsome *et al.* 2005) (Fig. 1.1). The establishment of avitourism was a natural progression from birdwatching as affluence and global mobility increased. Research suggests that avitourists are among the wealthiest nature-based tourists (Hvenegaard *et al.* 1989; Kerlinger 1993; Cordell & Herbert 2002; Şekerciöğlü 2003). Avitourism brings significant economic benefit to local communities in both developed and developing countries, including: the UK (Dickie *et al.* 2006), the USA (Kerlinger 1993; Stoll *et al.* 2006; Measells & Grado 2007), South Korea (Lee *et al.* 2010), Canada (Hvenegaard *et al.* 1989) and South Africa (Biggs *et al.* 2011). Networks of protected public and private reserves as well as unprotected natural settings support many avitourism activities. The most popular destinations for avitourism are intuitively those that are likely to provide ideal birding experiences. For birds, a logical example is the BirdLife International Important Bird and Biodiversity Area (IBA) network (BirdLife International 2015a). A comprehensive examination of research on the avitourism industry is provided in Chapter 2.

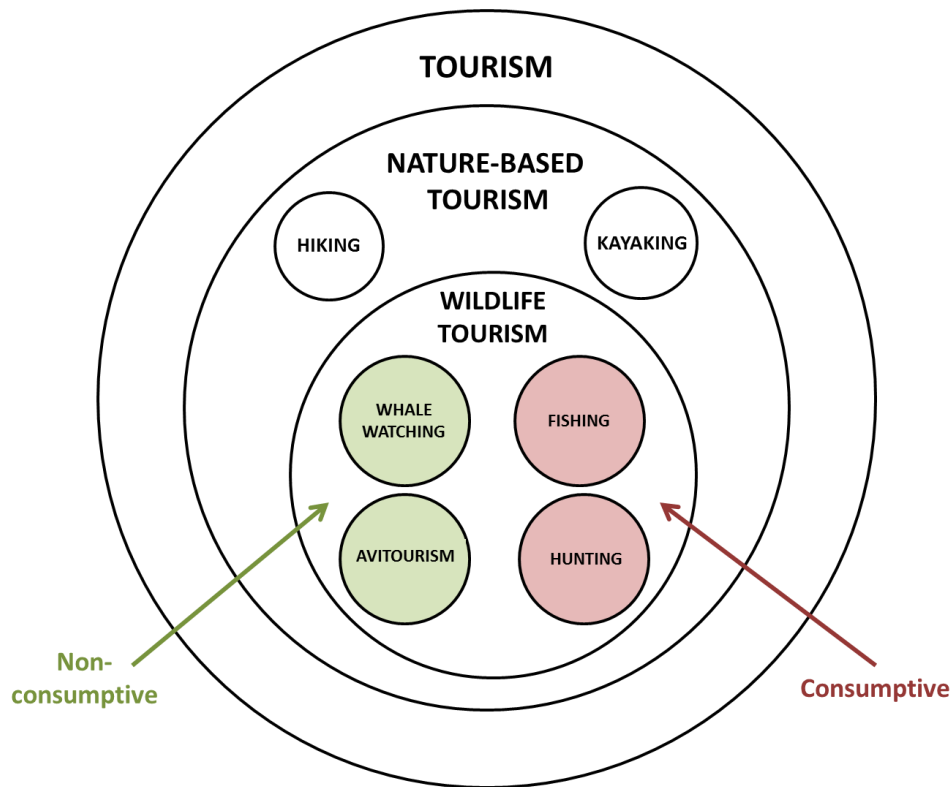


Figure 1.1 Relative position of avitourism within the larger tourism industry compared to other examples of wildlife and nature-based tourism.

(Based on information presented in: Wearing & Neil 2009; Newsome *et al.* 2005)

1.2 Important Bird and Biodiversity Areas (IBAs)

1.2.1 A global program for bird conservation

Following the establishment of large avian conservation NGOs in the UK (e.g. RSPB) and USA (e.g. Audubon), the formation of an international avian conservation body was a natural progression. The International Council for Bird Preservation was established in 1922 and then reborn as BirdLife International in 1993. BirdLife International, in conjunction with in-country partners, has since been at the forefront of global avian conservation efforts, running programs and strategies to achieve conservation outcomes for birds. One of these programs is the IBA program (known as Important Bird Areas prior to 2014). The IBA program was developed to identify those areas, at a site-specific scale, critical for global avian conservation. The first inventory of IBAs was completed for the European Commission in the early 1980s and included nearly 700 sites (BirdLife International 2007). Further development in the mid-1980s saw the identification of the

first regional directory of IBAs for Europe covering nearly 2, 500 sites. Since then, the IBA network has expanded to some 12, 000 sites in over 200 countries, with the publication of at least 102 regional and national IBA directories (BirdLife International 2015a). Set criteria are used to identify IBAs based on the presence of threshold numbers of ‘trigger’ species (Table 1.2). The criteria capture two of the key aspects related to site and species conservation: vulnerability and irreplaceability (BirdLife International 2007). The vulnerability aspect is addressed via criterion A1 (species of global conservation concern), while irreplaceability is covered under the remaining three criteria: A2 (range restricted species), A3 (biome restricted species) and A4 (congregations).

Table 1.2 Definitions of trigger species criteria used in the identification of IBAs.

Criteria Code	Definition
A1	<i>Globally threatened species</i> Criterion: The site is known or thought regularly to hold significant numbers of a globally threatened species, or other species of global conservation concern. Population threshold dependent.
A2	<i>Restricted-range species</i> Criterion: The site is known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area or Secondary Area.
A3	<i>Biome-restricted species</i> Criterion: The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome.
A4i	<i>Congregations</i> Criterion: Site known or thought to hold, on a regular basis, > 1% of a biogeographic population of a congregatory waterbird species.
A4ii	<i>Congregations</i> Criterion: Site known or thought to hold, on a regular basis, > 1% of the global population of a congregatory seabird or terrestrial species.
A4iii	<i>Congregations</i> Site known or thought to hold, on a regular basis, > 20,000 waterbirds or >10,000 pairs of seabirds of one or more species.
A4iv	<i>Congregations</i> Site known or thought to exceed thresholds set for migratory species at bottleneck sites.

Source: BirdLife International 2015b

IBAs occur across both public and private land tenures. Many IBAs are public lands, with approximately 40% overlapping with the global public protected area network. As with biodiversity in general, however, BirdLife International highlights that private and community-owned reserves need to be a key part of the strategy to conserve birds of global significance (BirdLife International 2015a). This provides opportunities for enhanced conservation efforts, and gives local communities the chance to take an active role in the sustainable management and stewardship of their lands (Hughes 2005).

Monitoring and management of the global IBA network is crucial to the delivery of conservation outcomes, yet remains a challenge. Neither monitoring nor management would be possible without local partners (government agencies, non-governmental conservation organisations, tertiary institutions, land-owners, etc.) and the many volunteers devoted to IBAs and their local avifauna. This has proven to be the case for both developed and developing countries. For example, in the USA the National Audubon Society plays a key role in rallying volunteers for IBA monitoring and research activities (Burger & Liner 2005). In Africa, many IBA partners have embraced a strategy drawing on a large volunteer base for IBA management and monitoring. This approach, which uses Site Support Groups (SSGs), offers a mechanism to ensure IBAs are maintained for conservation purposes and managed sustainably, while also building skills and awareness in local communities (Bennun *et al.* 2005; BirdLife International 2012). Through monitoring, BirdLife International has set in motion an initiative called 'IBAs in Danger', where those IBAs under imminent threat are identified and flagged as needing immediate support (BirdLife International 2013). With 356 IBAs (3% of all IBAs) identified as being in danger from various threats, this highlights the need for continued research focus on IBAs. Research needs to address current activities occurring in IBAs (sustainable or not) and how IBAs can be managed to ensure effective conservation as well as economic independence and sustainability.

1.2.2 Research on The Important Bird and Biodiversity Area program

Several studies have referred to particular IBAs when describing study sites for certain papers, although these were not specifically interested in the IBA status of the site (e.g. Bamford & Moro 2011; Dutson 2012; Woinarski *et al.* 2012). Most IBA focused research originates from Africa (Bennun *et al.* 2005; Arinaitwe *et al.* 2007; Buchanan *et al.* 2009; Coetzee *et al.* 2009; Beresford *et al.* 2011) and in some cases specific African regions (e.g. Uganda, Kenya, and Tanzania) (Pain *et al.* 2005; Tushabe *et al.* 2006; Mwangi *et al.* 2010; Sritharan & Burgess 2011). The majority of these studies were conducted by researchers based in Europe and Africa, and have mostly assessed the IBA network in terms of how well it protects birds and biodiversity in general. By comparison, Iberian research has focused on the application of the IBA process in the marine context (Louzao *et al.* 2006; Amorim *et al.* 2008; Louzao *et al.* 2009; Arcos *et al.* 2012). This has presented challenges (i.e. meeting criteria for species whose

breeding and threshold numbers are uncertain), as experienced during the designation of marine protected areas previously (Gray 1997; Carr 2000; Edgar *et al.* 2008).

A small number of studies have assessed how well the IBA network has succeeded in conserving threatened birds (Arinaitwe *et al.* 2007; López-López *et al.* 2007). Gap and overlay analyses are also popular approaches for research on IBAs, with studies examining: how well the IBA network falls within the protected area network (O’Dea *et al.* 2006; López-López *et al.* 2007; Beresford *et al.* 2011; Sritharan & Burgess 2011), land-use conflicts in IBAs (Buchanan *et al.* 2009), the capacity of the IBA network to deliver conservation outcomes under a changing climate (Coetzee *et al.* 2009), and how well the IBA network captures biodiversity in general (Eken *et al.* 2004; Pain *et al.* 2005; Tushabe *et al.* 2006). Studies suggest that the effectiveness of IBAs in conserving more biodiversity than birds alone results from the systematic and quantitative nature of the IBA identification process (Pain *et al.* 2005; Tushabe *et al.* 2006). Birds have long been recommended as ideal umbrella and indicator species for ecosystem conservation (Brooker 2002; Gregory *et al.* 2003; Gregory 2006), so it is perhaps not surprising that an approach based on conserving birds also conserves many other species.

With less than half of the global IBA network under formal protection, further research is needed to identify mechanisms that will ensure ongoing conservation in currently unprotected areas encompassing various land tenures. One mechanism that provides funding to achieve species conservation goals for a variety of taxa is tourism (Buckley *et al.* 2012; Morrison *et al.* 2012; Steven *et al.* 2013). Furthermore, there is clear justification for focusing research in areas of high avian diversity or endemism, as demonstrated by the previously cited research conducted in Africa. Although the majority of this research has focused on Africa, there are many other countries and regions deserving of similar efforts including: Brazil, South-East Asia, Central America, and Australia.

1.3 Research Gaps

Against the backdrop of previous research there are a number of important avenues for further enquiry. These can be captured in two key areas:

Birders, tourism and conservation – Our current understanding of birders is skewed to certain regions. For example, there is ample knowledge about American birders (in

particular), as people, but little is known about birders' attitudes more generally in terms of conservation ethos and what types of birds and habitats they prefer. The characteristics of preferred avitourism destinations in terms of bird assemblages and habitats present have also not been investigated. There has been no comparison of specific preferences among the different socio-demographic groups and birders from different global regions. There has also been little assessment of the potential links and opportunities between birding, avitourism and bird conservation, including whether avitourism activities present specific threats to birds.

Avitourism and IBAs – To the best of my knowledge, only two previous published studies have related the IBA network to birding and avitourism opportunities, one examining Timor Leste (Trainor *et al.* 2008) and another in Peru (Puhakka *et al.* 2011). No study has directly assessed current avitourism activities in the IBA network, globally or regionally. As the IBA network covers multiple land tenure arrangements (e.g. public, private, community, etc.) it is important to investigate how these areas are recognised by birders and subsequently used (here in the tourism context). Such examination can identify opportunities for increased avitourism activities and conservation support, but also highlight areas that require management attention in terms of these areas being 'loved to death' by birders.

1.4 Objectives

The overarching aim of this research project was to assess birders and avitourism and their relationship with bird conservation (Figure 1.2), with specific inquiries of this relationship in the context of the BirdLife International IBA program. The key stakeholders that form the basis for this investigation and the mechanisms for bird conservation identified in the conceptual model are all inextricably linked. The complex and interwoven relationships between the key stakeholders provides a recurrent theme that links the components of this thesis. For example, there are direct links between bird conservation groups and action to conserve birds. There are however, indirect paths to conservation that involve the other key stakeholders. This thesis aims to examine the role avitourism can play in avian conservation and the links and opportunities for improvement in this model by addressing the following objectives:

Research Objective 1 – Identify the biological and ecological factors that influence birder preferences for birds and birding sites (Chapters 3, 4, 5).

Research Objective 2 – Quantify the importance of the IBA network in tour operators’ marketing of avitourism in Australia (Chapter 6).

Research Objective 3 – Gain an understanding of avitourists’ attitudes to avian ecology and conservation, with particular reference to the IBA program (Chapter 7).

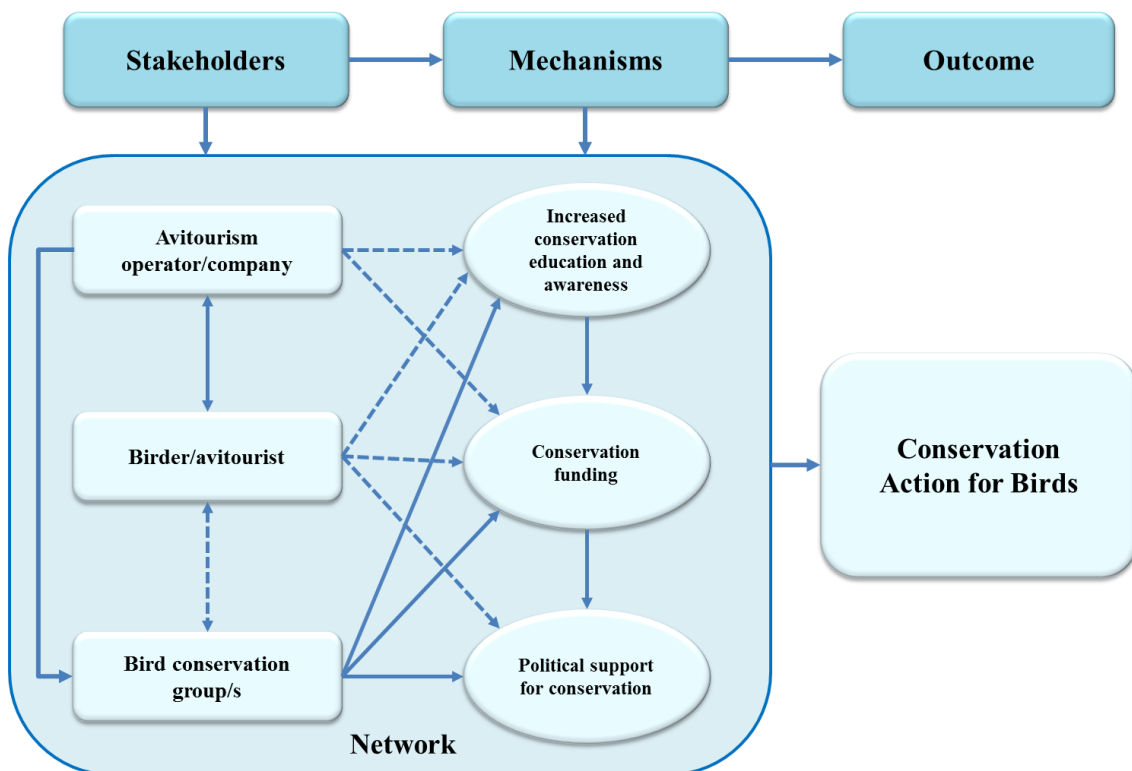


Figure 1.2 Conceptual model of key stakeholders and mechanisms in the relationship among birders, avitourism and avian conservation. Dashed lines for links between stakeholders and mechanisms indicate areas of uncertainty around relationships and communication among stakeholders.

1.5 Content and structure of thesis

The objectives of this thesis are addressed via the subsequent data chapters. The data chapters are formatted specifically for publication, in particular peer-reviewed academic journals, or included here as published papers. Chapter 2 is a published literature review which investigates and quantifies the status of the research pertaining to the broader

discipline (i.e. birding and avitourism). Chapters 3, 4, and 5 address Research Objective 1. Chapter 4 is a published paper investigating which avifaunal attributes appeal to avitourists when selecting travel destinations, using the Pacific Islands as a case study. Chapter 6 provides examination of avitourism in Australian IBAs (Research Objective 2) and Chapter 7 addresses Research Objective 3 by looking at birders and their attitudes and knowledge of avian conservation.

Due to the formatting requirements for journal publications, there are differences in the layout and referencing style among the individual chapters (see Appendix A for Griffith University's policy on presentation of theses as published and unpublished papers). Furthermore, given the need for the components of a PhD thesis to be related or have a common theme, and the presentation of this thesis as individual papers, readers will notice a modicum of repetition among the manuscripts (i.e. Introduction and Methods sections in particular). Each of the chapters, however, has its own discrete aims, results and conclusions. Ethics approval was sought and granted by the Griffith University Human Research Ethics Committee for the online and face-to-face surveys (Online: ENV_59_12_HREC, Face-to-face: ENV_01_13_HREC). The final chapter will re-visit the initial objectives of the project and summarise the key contributions to the broader fields of research contained within the thesis.

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Chapter 2

STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER

This chapter includes a co-authored paper. For copyright reasons, this chapter has been removed.

The bibliographic details of the co-authored paper, including all authors, are:

Steven R, Morrison C & Castley JG. 2014. Bird watching and avitourism: A global review of research into its participant markets, distribution and impacts, highlighting future research priorities to inform sustainable avitourism management. *Journal of Sustainable Tourism*. Available from:
<http://dx.doi.org/10.1080/09669582.2014.924955>

My contribution to the paper involved: Development of research aims, collection of data, data analysis, data interpretation, manuscript development.

Rochelle Steven

Corresponding author of paper: Rochelle Steven

Supervisor: Clare Morrison

Supervisor: J. Guy Castley

Chapter 3

STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER

This chapter includes a co-authored paper.

The bibliographic details of the co-authored paper, including all authors, are:

Steven R, Morrison C, Arthur JM & Castley JG. Extending knowledge of birder preferences and practices to enhance conservation participation. *Journal of Wildlife Management*. Under Review.

My contribution to the paper involved: Development of research aims, collection of data, data analysis, data interpretation, manuscript development.

Rochelle Steven

Corresponding author of paper: Rochelle Steven

Supervisor: Clare Morrison

Co-author: J. Michael Arthur

Supervisor: J. Guy Castley

Chapter 3 - Extending knowledge of birder preferences and practices to enhance conservation participation

Abstract

Despite having a good understanding of the social and economic drivers of birders and avitourists, little is known about their specific preferences and practices for different bird types, bird habitats and bird-based activities. Using a globally distributed online survey, birders were asked to outline their own birding preferences and practices. Subsequent analyses revealed diverse preferences for birds and habitats among birders of different sex and country of origin. Birders like to watch all birds in general, but show some preferences for songbirds and raptors. Coastal and freshwater habitats are favoured by all birders, but especially British and American birders. Australian birders participate less than other birders in bird-based events. Males participate more in bird-based events than females. Technological advances are driving increased use of electronic bird field guides and sophisticated optical equipment, though this varies among countries and between males and females. Sex, age and country of origin were all significant predictors of how frequently birders watch birds away from home. Private land and public reserves/conservation areas were consistently highest among the various tenures of land where birding takes place. The information presented has enhanced our understanding of birders and how they use birds as a natural resource. This can guide more effective communication between bird conservation groups with respect to management and conservation programmes. Birders are likely to be receptive to such communication, given their inherently engaged relationship with birds.

Introduction

Birdwatching, or birding, is a popular global pastime, where participants seek to view birds in their natural habitat (Şekercioğlu 2002; Moss 2004). Historically centred in Anglophone developed countries (Connell 2009), there is now evidence of rapid birding growth in Asian countries (Lee et al. 2010; Ma et al. 2012; Li et al. 2013). Beyond the commonly practiced backyard birding, the rise of avitourism sees birders making viewing birds the sole motivation for travel (Cordell and Herbert 2002; Dooley 2007; Steven et al. 2014). Birding and avitourism are potential mechanisms to support and fund the management and conservation of birds and an economic development opportunity (Biggs et al. 2011; Welford and Barilla 2013). However, some research points to the potential negative impacts associated with birding and avitourism where birds may either be disturbed directly (Green and Jones 2010; Biggs 2013; Harris and Haskell 2013), or their habitats degraded (Barros et al. 2013; Rankin et al. 2015). Research in natural settings, including protected areas, has found even seemingly benign activities including hiking and canoeing have impacts on threatened species, including birds (Steven et al. 2011; Ballantyne and Pickering 2013; Steven and Castley 2013).

Birding takes place across multiple spatial scales (e.g. backyard, local, international) and land tenures (i.e. public and private land). Protected areas, including: national parks, nature reserves, private reserves, are frequently used as birding hubs. However, not all areas visited by birders are necessarily protected. Programs such as the UNESCO Biosphere Reserves (UNESCO 2015) or BirdLife International's Important Bird and Biodiversity Areas (BirdLife International 2015a) cover areas that exhibit characteristics likely to attract birders (i.e. intact ecosystems supporting wild birds), but may be only partially protected. The focus on sustainable nature-based tourism in all

natural settings has seen expansion of birding and avitourism research (Conradie 2010; Biggs et al. 2011; Puhakka et al. 2011; Steven et al. 2014). As a largely non-consumptive activity, proponents of avitourism have often described it as one of the most environmentally sensitive and more sustainable forms of tourism (Şekercioğlu 2002; Morris 2008; Li et al. 2013).

Despite increased research interest, numerous aspects of the industry and its participants remain unquantified (Steven et al. 2014). In particular, general preferences and practices of birders and how they access birds and their habitats, have been under-examined. Similarly, little research has investigated differences among birding populations across multiple geographic areas. In this study we address these research deficiencies by examining some of the logistical practicalities that characterise birding in different places and by different birders. Specifically, we ask the following questions: (i) What types of birds and habitats are favoured by different birders? (ii) Where and what birding activities take place among different birders? In addition to general patterns, we also examine these preferences in terms of the socio-demographics of birders. We expand the understanding of birders by providing a broader geographical perspective to assess the ways birds are accessed. The current study can inform birding and avitourism marketing and aid strategic targeting of conservation programs towards birders.

Methods

Birders were asked questions about their birding preferences via an online survey accessible between February 2013 and December 2013. The web link for the survey was shared globally through online birding portals including: social media, birding group mailing lists, bird conservation organisation member lists (see SI 1).

The survey included questions comprising closed ended, as well as Likert type responses (see SI 2). Closed ended questions were presented to respondents with the option to choose from a set of possible answers. In each question group there were specific questions about their birding preferences and practices. Other questions were delivered as Likert type questions, with five point scales that ranged from never to frequently. The regularity with which birders engage in birding at different spatial scales was converted from a nominal to a continuous variable to allow for quantitative analysis. The responses were placed on the scale as follows: never = 1, rarely = 2, sometimes = 3, often = 4, frequently = 5. Means could then be calculated for these data with corresponding variances (i.e. suitable for ANOVA analysis) (Bireline 2005). Socio-demographic data were collected to investigate differences between males and females, age group, education level achieved and country of residence. The questions in the survey were not mandatory, thus there was a variable sample size at completion.

For some questions, respondents could provide multiple responses within a question. For example, when asked which types of birds they like to watch or habitat types they prefer, they could select multiple options. As such, these data have been analysed separately for each possible answer to satisfy assumptions related to independence for most statistical tests. Responses to questions were tested using generalised linear models (GLM). Dependent variables were binary, yes/no, responses to a suite of questions about birding preferences and practices (i.e. bird types, habitats, event participation and equipment used). These were analysed against the independent (socio-demographic) categorical variables (sex, age group, education level achieved and country of residence). For significant effects identified by the GLM, odds ratios were determined to assess the cause of the signification variation within these socio-

demographic predictors. The significance level was set at 0.05 and the data were analysed using IBM SPSS Version 22.

Results

General respondent breakdown

A total of 350 birders responded to the survey, though not all questions were answered (full completion = 74%). The average age of birders providing their age ($n = 259$) was 46 years old. The age of birders was subsequently grouped into three categories for further analysis: up to 30 ($n = 56$, 22%), 31-60 ($n = 144$, 55%) and 61 and over ($n = 59$, 23%). The majority of respondents were male (71%, $n = 185$), while 29% were female ($n = 74$). Respondents were distributed globally (i.e. 15 countries), but geographic comparisons are made between the four countries with the largest and most statistically robust sample size. These represent both Northern Hemisphere and Southern Hemisphere countries. Australian and South African respondents comprised 44% of the sample ($n = 75$, $n = 49$ respectively). British (i.e. United Kingdom [UK]) and American (i.e. United States of America [USA]) respondents represented a further 47% of the sample ($n = 80$, $n = 54$, respectively). Respondents with at least a tertiary level education represented 81% of the sample. The sample size of respondents without a tertiary education was small and therefore excluded in subsequent tests.

Preferences for birds and habitats

Birders indicated that they liked to watch all types of birds (as a single category answer) more than twice as often as they selected any single group of birds ($n = 237$, 68%). The

single group of birds with the highest response rate was songbirds ($n = 102$, 29%), followed by raptors ($n = 74$, 21%) (SI 2).

Females preferred watching parrots more than males did ($p < 0.01$) (Table 1) but there were no other preference differences between males and females. Age did not affect bird type preference; however, country did have an effect. Australians favour parrots more when compared to birders from other countries ($p < 0.001$). Raptors were least preferred by American birders ($p < 0.05$) while British birders favoured shorebirds ($p < 0.05$).

Table 1 Generalised linear model analysis of socio-demographic trends and birder preferences and practices.

<i>Dependent Variable</i>	Significant Effect	P value	χ^2 (df)	Odds
<i>In general, what types of birds do you prefer to watch?</i>				
Songbirds (<i>n</i> = 79)	n/a	-	-	-
Parrots (<i>n</i> = 39)	Sex	0.006	7.8 (1)	F > M
	Country	<0.001	24.8 (3)	AUS > SA, USA, UK
Raptors (<i>n</i> = 58)	Country	0.047	8.0 (3)	UK, AUS, SA > USA
Doves (<i>n</i> = 7)	n/a	-	-	-
Hummingbirds (<i>n</i> = 14)	Country	0.009	11.7 (3)	USA > AUS, SA, UK
Shorebirds (<i>n</i> = 45)	Country	0.023	9.5 (3)	UK > AUS
Ducks and swans (<i>n</i> = 15)	n/a	-	-	-
All birds (<i>n</i> = 173)	n/a	-	-	-
<i>In which types of habitats do you prefer to watch birds?</i>				
Backyard only (<i>n</i> = 11)	Sex	0.029	4.8 (1)	F > M
Coastal (<i>n</i> = 167)	Country	<0.001	20.7 (3)	UK, USA > AUS, SA
Freshwater (<i>n</i> = 184)	Sex	0.019	5.5 (1)	M > F
	Country	<0.001	21.7 (3)	UK, SA, USA > AUS
Dry forest (<i>n</i> = 161)	n/a	-	-	-
Grassland (<i>n</i> = 127)	Country	0.002	15.4 (3)	SA > USA, UK, AUS
Savanna (<i>n</i> = 106)	Sex	0.045	4.0 (1)	M > F
	Country	<0.001	41.0 (3)	SA > UK, USA > AUS
Montane (<i>n</i> = 125)	Country	<0.001	36.0 (3)	USA, UK > SA, AUS
Rainforest (<i>n</i> = 143)	Country	0.023	9.5 (3)	USA, AUS > UK, SA
Desert (<i>n</i> = 113)	Country	0.004	13.4 (3)	USA, SA > AUS, UK
<i>Have you participated in any the following?</i>				
Atlas events (<i>n</i> = 141)	Sex	<0.001	25.0 (1)	M > F
	Country	<0.001	36.6 (3)	UK, SA > USA, AUST
Birdathon/twitchathon events (<i>n</i> = 92)	Sex	0.017	10.2 (3)	M > F
	Country	0.014	6.1 (1)	USA, UK > AUS; SA = AUS; SA=USA=UK
Census events (<i>n</i> = 151)	Sex	0.022	5.2 (1)	M > F
	Country	<0.001	35.6 (3)	USA, UK, SA > AUS; USA=UK; UK=SA
<i>What resources do you use to identify the birds you watch?</i>				
Bird guide (electronic form) (<i>n</i> =119)	Country	0.002	14.4 (3)	USA, SA, AUS > UK
Electronic calls/Playback (<i>n</i> =132)	Sex	0.007	7.3 (1)	M > F
Local tour guides (<i>n</i> =66)	Age	0.003	11.4 (2)	61 and over, 31-60 > up to 30
Bird guide (book form) (<i>n</i> =246)	n/a	-	-	-
<i>What equipment do you use to watch or record sightings?</i>				
Spotting scope (<i>n</i> =145)	Sex	0.003	8.8 (1)	M > F
	Country	<0.001	54.3 (3)	UK, USA > SA, AUS
Camera (<i>n</i> =183)	n/a	-	-	-
Telephoto lens (<i>n</i> =106)	Sex	0.045	4.0 (1)	M > F
Acoustic recorder (<i>n</i> =37)	Sex	0.043	4.1 (1)	M > F
Binoculars (<i>n</i> =250)	n/a	-	-	-

N.B. M=male, F=female, AUS=Australia, SA=South Africa, USA=United States of America. Sample sizes are a subset of the total number of each answer selected due to not all respondents providing socio-demographic data.

Freshwater wetlands appealed to birders most often when choosing their preferred birding habitats ($n = 242$, 69%). This was closely followed by coastal ($n = 224$, 64%) and dry forest habitats ($n = 217$, 62%) (SI 2). Of all habitat types, savanna and desert habitats were the least preferred (savanna: $n = 136$, 39% desert: $n = 139$, 40%). Eighteen of the 350 respondents (5%) indicated that they only watched birds in their backyard and did not visit other habitats. Birders that prefer backyard only birding tended to be female ($p < 0.05$) while freshwater wetlands and savanna were favoured by males ($p < 0.05$). Birders' country of residence appeared to be a strong predictor of habitat preferences in all habitats with the exception of dry forests. The only habitat that was favoured by Australians (relative to other countries) was rainforest ($p < 0.05$) (Table 1).

Practices and logistics of birding

Sixty percent of birders surveyed indicated that they had participated in bird census events ($n = 203$). Fifty-six percent ($n = 190$) have participated in bird atlas events, while 34% ($n = 114$) have taken part in twitchathon or birdathon events. This study found males tend to participate in all types of bird-based events more than females (atlas: $p < 0.001$, birdathon/twitchathon/census: $p < 0.05$). No differences in event participation were detected among the different age groups. Participation in all three types of events varied significantly among birders from different countries (atlas/census: $p < 0.001$, birdathon/twitchathon: $p < 0.05$) (Table 1). Australian birders were less likely to participate in all three types of events while British birders were more likely to participate. American birders participate more in birdathon/twitchathon and census events, and participate less in atlas events. South African birders participate most often in atlas events but less often in the other events.

The most popular types of equipment used to identify, watch and record birds are field guides in book form ($n = 323$, 92%) and binoculars ($n = 327$, 93%). The use of cameras as a tool for recording sightings is also popular ($n = 234$, 67%) (SI 2). Males tend to use electronic calls/playback ($p < 0.01$), spotting scopes ($p < 0.01$), telephoto lenses ($p < 0.05$) and acoustic recorders ($p < 0.05$) more than females (Table 1). Age was a generally a poor predictor of the equipment birders use for identification, watching and recording birds. The only exception was the use of local tour guides for aiding bird identification, with younger birders (up to 30 years old) using local guides less often than median-aged and older birders (31-60 and 61 years and over) ($p < 0.01$). Australian, American and South African birders use electronic bird field guides more than British birders ($p < 0.01$). The use of spotting scopes varies among birders from different countries, with British and American birders using scopes more than other birders ($p < 0.001$) (Table 1).

In general, the further the site from the birder's residence, the less frequently they engage in birding activities away from home. Birders regularly watch birds in their backyard ($\bar{x} = 4.53$), elsewhere in their city of residence ($\bar{x} = 4.18$) and watch birds beyond their state/province of residence less often (elsewhere in country of residence, $\bar{x} = 3.50$; outside country of residence, $\bar{x} = 2.66$). Sex and age group were both significant influences on the frequency of backyard birding, but not for birding elsewhere in their resident city. Females and older birders (31-60 and 61 and over) were both more frequent backyard participants when compared to either males or younger birders ($F = 6.973$, $df = 1$, $p < 0.01$, Fig. 1a; and $F = 3.861$, $df = 2$, $p < 0.05$, Fig. 1b respectively). Country of residence was not a good predictor of backyard birding frequency ($F = 0.198$, $df = 3$, $p = 0.898$), although this did influence patterns of birding elsewhere in a

birder's city of residence, where American birders participate more frequently than Australian birders ($F = 3.636$, $df = 3$, $p < 0.05$) (Fig. 1c).

The frequency of participation in birding activities outside the birders' city of residence, both domestically and internationally, showed more variation among sex, age and country of residence. For example, sex was a significant factor in the frequency of birding activities elsewhere in the birders state/province ($F = 5.24$, $df = 1$, $p < 0.05$) or country ($F = 7.586$, $df = 1$, $p < 0.01$) of residence, with males travelling more often than females for birding activities (Fig. 1a). Similar patterns were observed for travelling outside the birder's country of residence ($F = 4.547$, $df = 1$, $p < 0.05$). Age had no effect on the frequency of birders travelling elsewhere in their state/province of residence ($F = 0.732$, $df = 2$, $p = 0.482$), but was a significant factor for travel elsewhere in their resident country ($F = 3.747$, $df = 2$, $p < 0.05$) or outside the resident country ($F = 10.765$, $df = 2$, $p < 0.001$) (Fig. 1b). Here, younger and older birders travel further less often than median aged birders. British, American and South African birders travel more often elsewhere in their state/province (a), country (b) and outside of their resident country (c) than Australian birders (a: $F = 14.799$, $df = 3$, $p < 0.001$, b: $F = 13.385$, $df = 3$, $p < 0.001$, c: $F = 5.822$, $df = 3$, $p < 0.001$) (Fig. 1c).

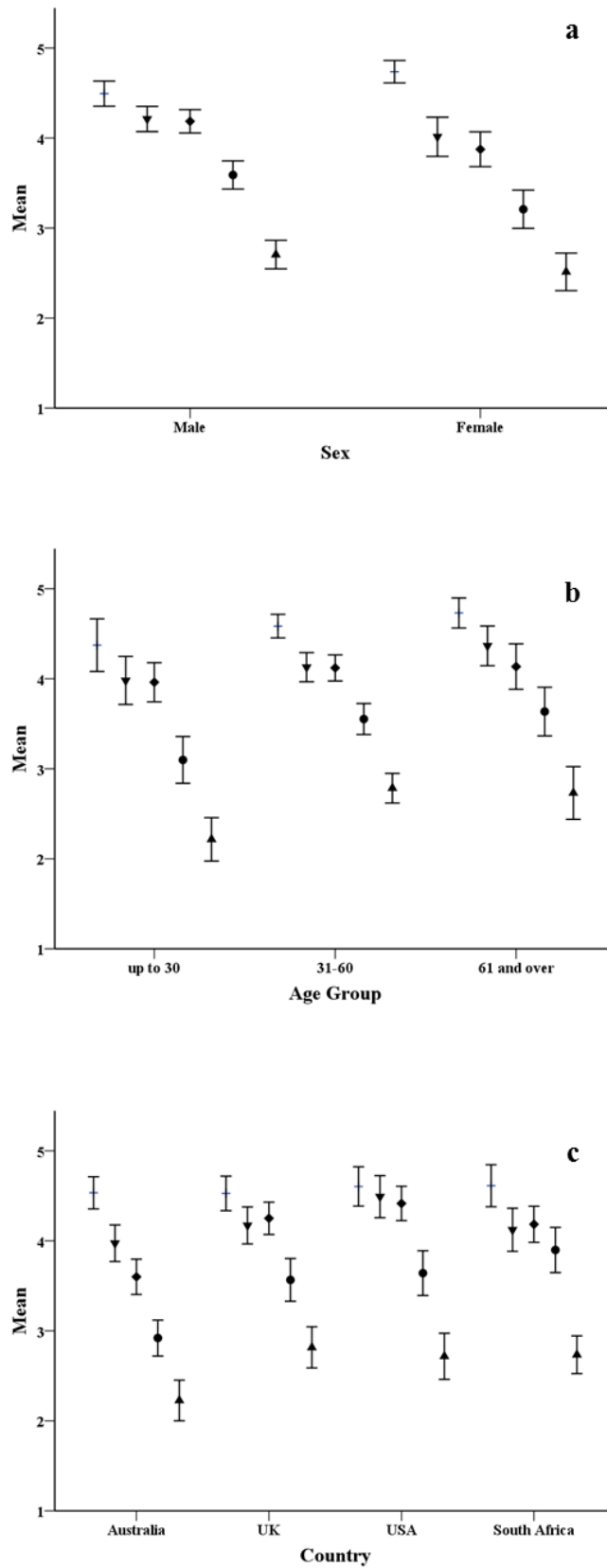


Figure 1 Geographic scale of birding activities by (a) sex; (b) age; (c) country ($N = 253-258$) Scale for mean: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = frequently. Legend: backyard (■), elsewhere within city of residence (▼), elsewhere is state/province of residence (◆), elsewhere in country of residence (●), outside country of residence (▲).

Most birding activities take place equally on land with private (including backyards) ($\bar{x} = 4.23$) and public tenures (reserves and conservation areas) ($\bar{x} = 4.23$). Local parks, national parks and IBAs are visited somewhat regularly ($\bar{x} = 3.81$, $\bar{x} = 3.69$ and $\bar{x} = 3.78$, respectively). Private reserves or conservation areas are sometimes visited ($\bar{x} = 3.09$). Sex and age has less influence over birding activities across land tenures (Fig 2a, Fig. 2b) except for birding on private property, with median aged birders (31-60 years) participating in birding on private property more than younger birders ($F = 3.525$, $df = 2$, $p < 0.05$) (Fig. 2b). Land tenures outside of private properties were influenced by a birder's country of residence. For instance, American birders watch birds in local parks more than British and Australian birders ($F = 6.244$, $df = 3$, $p < 0.001$) (Fig. 2c). Australian birders watch birds less often in public reserves or conservation areas, compared to American birders ($F = 5.209$, $df = 3$, $p < 0.01$). South African birders participate in birding in national parks more than both British and American birders ($F = 5.486$, $df = 3$, $p < 0.001$). Australians go birding in private reserves and conservation areas less than British and South African birders ($F = 8.029$, $df = 3$, $p < 0.001$), and less than British, American and South African Birders in IBAs ($F = 8.625$, $df = 3$, $p < 0.001$) (Fig. 2c).

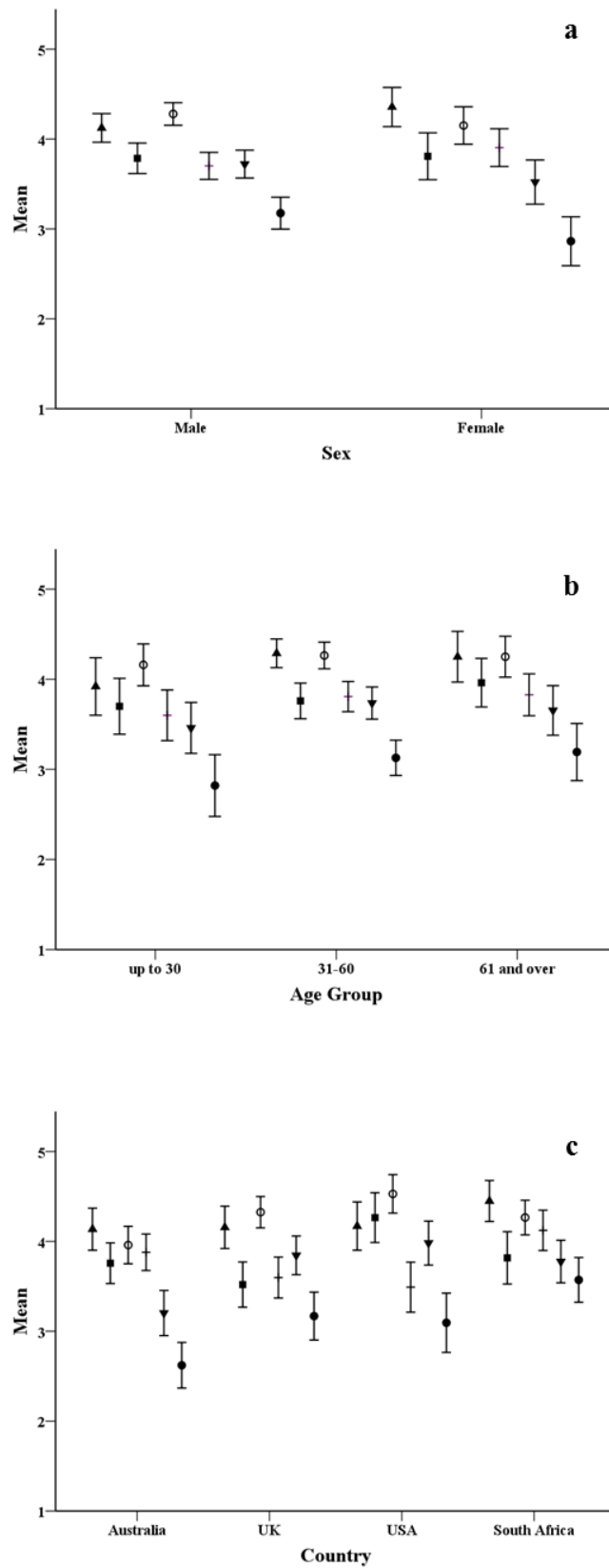


Figure 2 Tenure of land where birding activities take place by (a) sex; (b) age; (c) country ($N = 253-258$)
 Scale for mean: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = frequently. Legend: private land (▲),
 local park (■), public reserve/conservation area (○), national park (◄), IBA (▼), private reserve (●).

Discussion

This study extends the current understanding of birders and birdwatching. We achieved this by thoroughly examining the intersection between birder socio-demographics and the practical and logistical aspects of birding that relate directly to conservation management and engagement. In doing so, we have provided a robust analysis of birder preferences from a broader geographic region than previously reported. Specifically, our study makes comparisons between well-established birding regions (e.g. UK and USA), and those where this recreational activity has gained momentum more recently (e.g. Australia, South Africa).

Birds and habitats favoured by different birders

To the best of our knowledge, no previous studies have asked birders to identify their specific bird type or habitat preferences, even for American birders. While most birders stated they enjoy watching all birds, there were also general preferences for songbirds and raptors. This is not surprising as songbirds (i.e. passerines) are the most abundant order of birds and possess physical and behavioural characteristics (e.g. colourful, vocal) that appeal to people (Clucas et al. 2014). The popularity of raptors might also be expected as they are highly charismatic species that have long held cultural and historical significance globally (e.g. Ancient Egypt, falconry sports) (Schroer 2014). Counterintuitively, the habitats preferred by birders did not necessarily correspond with the bird types selected. For example, the two most preferred habitats were freshwater wetlands and coastal habitats; however, for birds often associated with these habitats, ducks did not rank highly among birders, while shorebirds were preferred only by UK birders. This contrasts with evidence suggesting that these birds are indeed targeted by birders (Burger et al. 1995; Steven et al. 2011). A possible explanation for this pattern

may be that locating and identifying birds in these habitats without the visual obstructions of trees or other vegetation is somewhat easier. However, this theory does not hold for Australians who prefer rainforest habitats, which are notoriously difficult for birding due to dense vegetation.

Australian birders' preferences for parrots is not surprising given (i) Australia's high number of endemic parrots (Low 2014; BirdLife International 2015b), (ii) the fact that some parrots are among the most urban adapted species in Australia (e.g. rainbow and musk lorikeets, sulphur-crested cockatoo and galahs) (Daniels and Kirkpatrick 2006; Parsons et al. 2006) and (iii) they are often very colourful (Castley et al. 2013). Similarly, the favour shown by American birders towards hummingbirds is intuitive given that hummingbirds do not occur outside of the Americas, and are the subject of several festival and migration events in the USA (Scott and Thigpen 2003; Measells and Grado 2007). These preferences reinforce the pattern that birders have an affinity for local species and frequently watch birds in their backyard, with songbirds, parrots and hummingbirds all common visitors to UK, Australian and USA backyards, respectively.

The preference for shorebirds and their habitats amongst British birders appears to be driven by habitat availability and sighting opportunities. The UK no longer has a large extent of forested habitats, but has relatively more coastal and freshwater wetland habitats that birders can utilise. The chance of seeing vagrants or 'rarities' (Moss 2004; Hudson et al. 2012) is also greater in coastal and wetlands areas, where wayward migratory birds sometimes turn up in the UK (BirdLife International 2015c). Australians on the other hand showed relatively less interest in shorebirds and coastal habitats, despite more than 85% of the population living within 50 kilometres of the coast (ABS 2012). This is cause for concern given the proximity of these densely populated regions to important resting grounds for migratory shorebirds. Many of these

birds have undergone significant declines in recent years (Sutherland et al. 2012), however, it appears awareness of their conservation status is not translating into popularity among Australian birders. This contrasts with the publicity surrounding migratory species declines in the UK, where opposition to hunting of migratory species in Malta is widespread among British birders (Briguglio 2014; RSPB 2015a). Australian birders showed greater preference for rainforests which are also readily accessible from east coast cities but, unlike coastal areas, have a large proportion protected in legislated national parks (managed by state governments). South African and American birders both selected grassland, savanna and desert more than British and Australian birders. For South Africa, this can be attributed to the fact that its climate lends itself to drier biomes where savannah habitats support high bird biodiversity and biomass (Kemp et al. 2003). Further, birders in the USA are probably drawn to desert habitats because the deserts in South-West USA are popular birding sites for migratory hummingbirds (Kim et al. 1998; Scott and Thigpen 2003).

Participation in birding and citizen science events

Events and activities, such as atlassing, birdathons and censuses, represent an important cultural aspect to birding, as well as a valuable source of citizen science data (Bonta 2010; Wood et al. 2011). Each has similarities and differences in their aims and appeal. Atlas events are strongly focussed on long-term monitoring of birds and their distributions. Birdathon events tend to be more competitively based (Bonta 2010), but are similar to census events by giving a snapshot of bird presence-absence and populations. It appears that British birders participate in atlas events more frequently than birdathon and census events. This is probably an artefact of atlassing commencing in 1968, and census events not following until 1979 via the RSPB's 'Big Garden Birdwatch' (RSPB 2015b).

Census events have a very long history in the USA with the first Audubon Christmas Count held in 1900 (Audubon 2015). This explains why American birders indicated strong participation in census events in the current study, supporting previous research (Bonta 2010). However, the USA began atlassing in 1966, and birders indicated less involvement here. Australian birders participate in all events less than their international counterparts. For national census events this is understandable, with BirdLife Australia's 'Aussie Backyard Birdcount' starting as recently as 2014 (BirdLife Australia 2015). BirdLife South Africa celebrated its 30th annual 'Big Birding Day' in 2014 (BirdLife South Africa 2015). South Africa has also held atlas and census events for approximately 30 years, and participation in these appears to be fairly popular (BirdLife South Africa 2015; SABAP2 2015). Events that allow birders to collect data on birds visiting their backyards are one of the best ways to get them involved in conservation via citizen science opportunities (Wood et al. 2011). BirdLife Australia, for example, has a specific online portal and education program aimed at engaging community members in backyard bird monitoring efforts (see <http://www.birdsinbackyards.net>).

Birding equipment in the modern age

Much of the research examining the equipment used for watching and identifying birds is limited to the USA (Wiedner and Kerlinger 1990; Kerlinger and Brett 1995; Kim et al. 1997; Eubanks and Stoll 1999; La Rouche 2001; Bireline 2005; Carver 2013) and South Africa (Conradie 2010; DTI 2010; Simango 2011; Rogerson et al. 2013). Birders are typically asked about equipment to gain an understanding of their expenditures, or as indicators of committed-ness to birding. In the current study, our motivation was to assess the relative prevalence of the different types of equipment used among birders (i.e. how many birders use spotting scopes, relative to birders not using spotting scopes

etc.). This is necessary given more recent technological developments (e.g. more affordable digital SLR cameras, electronic field guides for smart devices, accessibility to recorded bird calls etc.), resulting in myriad ways that birders can equip themselves with gear for birding. Binoculars and field guides in book form remain the most popular tools for watching and identifying birds but the use of cameras and photography accessories is increasing among all types of birders (Bireline 2005; Green and Jones 2010). The role of photography in keeping people engaged with nature cannot be understated (Tsang et al. 2009), with the popularity of bird photography having global appeal among all birders (male, female, all ages, all countries). Visual imagery is also heavily used by avitourism companies in their online promotion materials (Castley et al. 2013), and this provides a means for birders to connect with their birding destinations.

Electronic field guides and electronic bird calls have clearly gained popularity in a short time (~5 years). This is especially the case for males, who have taken up using electronic calls/playback more than females. While the disconnect between nature and the human population can be attributed to increased preoccupation with technology, as seen here it can also be the catalyst for increased engagement. In addition to the electronic birding field guides, there is also an increasing number of birding applications for mobile devices that enable birder to submit sighting records (e.g. eBird, Birdlasser, Birdlog ANZ etc.). However, the uptake of these birding and citizen science applications within the birding community has not yet been quantified.

Spatial scale and tenure of birding activities

Travel for birding (avitourism) is increasing in popularity but these patterns are not uniform among birders, where males travel more frequently than females. This is consistent with research suggesting males tend to be more competitive, committed and

intense about their birding, hence the desire to travel to see more birds (McFarlane and Boxall 1996; Cole and Scott 1999; Moore et al. 2008). Correspondingly, the tendency for women to prefer to watch birds in their backyard could be related to the perceived role of women in the household and barriers to them participating in activities outside of the home (Bellows-Riecken and Rhodes 2008; Sali et al. 2008). As such, when engaging residents to participate in citizen science projects such as backyard census events, women may represent the most effective point of contact within households.

Our data suggest birders from the UK, USA and South Africa travel more often both domestically and internationally, than Australian birders. For birders in the USA this is expected given the accessibility to diverse habitats present within the country as well as their proximity to destinations that are international but relatively close (e.g. Central America). The UK had the highest participation in birding internationally, which could be another example of proximity to affordable international destinations. Spain and other Mediterranean destinations, the Middle East and Africa have all gained popularity for birding, as well as being relatively accessible from the UK (Connell 2009; Collins-Kreiner et al. 2013; Conradie et al. 2013). Conversely, Australia is a destination that could be said to suffer from the tyranny of distance (Cooper and Ruhanen 2004). The travel time to Australia (from other continents in particular) is very long, as is much of the domestic travel time once inside Australia (Cooper and Ruhanen 2004). International destinations that would make attractive birding destinations (e.g. Papua New Guinea, Indonesia and other South-east Asian countries) are relatively close, but appear to be receiving little attention from Australian birders. Sceptics question the sustainability of ecotourism for conservation and economies in developing countries (Coria and Calfucura 2012; Das and Chatterjee 2015), and the non-attendance of relatively wealthy Australian birders to these areas can exacerbate this dilemma.

In general, the birding patterns we found across land tenures are a reflection of the common types of areas available to birders in their country of residence. Private reserves are visited least often, with South African birders visiting these areas more than other birders. South Africa has arguably been a leader in the establishment of privately owned conservation reserves, recognising that public protected areas are not sufficient for adequate conservation (Bond et al. 2004; Gallo et al. 2009). The UK followed, and again this is probably attributable to the extensive reserve network in the UK owned by the RSPB which, if members, birders can access freely (RSPB 2015c). The popularity of public reserves/conservation areas and national parks was fairly consistent across all countries, with all countries assessed here having a reasonably comprehensive network of public protected areas. The only exception here was that national parks appear somewhat less popular among USA birders. This could be explained by the many national parks in the USA that experience extremely high visitation numbers, and birders preference for watching birds in settings without disruption from other users (Che 2003; Green and Jones 2010; Remacha et al. 2011). The USA also has an extensive network of state owned parks and reserves as well as the National Wildlife Refuge network (managed by the Fish and Wildlife Service), both of which would be classified as public reserve/conservation areas, as chosen frequently by USA birders.

The IBA network comprises areas that are both public and privately owned and of varying levels of accessibility. These areas are chosen by partners of BirdLife International based on the presence of conservation significant species at threshold numbers (BirdLife International 2015a). As such, they make ideal birding areas. The frequency of visitation to IBAs is probably a function of how long the network has been in place in the respective country and the concomitant familiarity among birders. The UK IBA network was established in the early 1990s and the USA and South African

networks in the mid to late 1990s. Australia's IBAs on the other hand were not formally identified until 2009. This could explain why Australian birders think they visit these areas less frequently than other areas. What they are probably not aware of, is that many national parks that are popular for birding in Australia are also IBAs. In general, if birders are given adequate information about where they are going birding this could lead to significant increased support (both political and financial) for all types of protected and conservation areas.

Conclusion

This study provides an improved geographic assessment of the current practices and preferences of birders from different backgrounds. Our findings highlight areas worthy of attention by bird conservation groups, particularly in terms of support for bird citizen science and general conservation support. Birders from all backgrounds have a general appreciation for all birds, but it appears their preferences for habitats are somewhat driven by residential familiarity. Conservation programs may best be targeted to the population of birders living close to habitats in need of support. Multiple opportunities exist to increase involvement for women in birding based events, and targeting backyard birding events may be an effective starting point. Furthermore, Australian birders (to date, an under-researched population) appear less engaged in many aspects of birding when compared to birders from other countries. This is in part a symptom of historical birding, but as technology evolves and communications between key stakeholders increase it is hoped the level of engagement will also increase. Mobilising community support is a key strategy of conservation groups, and for birds, who better to target than those already showing an interest in them.

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Supplementary Information 1 – Online distribution channels for survey

Type of channel	Specific companies/organisations
Birdwatching forums	Birdforum.net, Feathers and Photos, Surfbirds, BirdingNZ, Birding UK and Ireland
Social media birdwatching pages (Facebook Pages)	US Bird Watching, Bird Watching Rocks!, Bird Watching in Sri Lanka, Bird Lovers, British Bird Lovers, British Birdwatching Fair, Birding Abroad, Birding, Southern Birding Services, American Birdwatching Association, Birdwatching Ecotours, Amazon Birdwatching, BirdLife South Africa
Birdwatching mailing lists Magazine subscription lists	Various Yahoo mailing lists American Birding Association, BirdLife South Africa, Birdwatching Daily Mag
Bird tour companies	Wingspan Bird Tours, Wings Tours, Limosa Holidays, Sunbird Tours, Rockjumper Tours, Birdquest Tours, Birdwatching Dot Com

Supplementary Information 2 Questions asked in questionnaire about birding preferences and practices.

<i>Question</i>	<i>Possible responses</i>	<i>Total number of times selected</i>
<i>General birdwatching question group</i>		
<i>In general, what types of birds do you prefer to watch?</i>		
	Songbirds (Passeriformes)	102
	Parrots (Psittaciformes)	46
	Raptors (Falconiformes)	74
	Doves (Columbiformes)	8
	Hummingbirds (Apodiformes)	21
	Shorebirds (Charadriiformes)	59
	Ducks and Swans (Anatidae)	24
	All birds	237
<i>In which type of habitats do you prefer to watch birds?</i>		
	I only watch birds in my backyard	18
	Coastal/estuarine	224
	Freshwater wetlands	242
	Dry forests/scrub	217
	Grassland	174
	Savanna	136
	Montane	163
	Rainforests	186
	Desert/arid lands	139
<i>How frequently do you participate in birdwatching activities in the following areas?</i>		
<i>[My backyard; Elsewhere in my city of residence; Elsewhere in my state/province of residence; Elsewhere in my country of residence; Outside my country of residence]</i>		
	Never; Rarely; Sometimes; Often; Frequently	

How frequently do your birdwatching activities take place in the following areas?

[Private land (including my property); Local parks (i.e. urban and peri-urban parks); Public reserves and conservation areas; National Parks; Important Bird Areas; Private reserves and conservation areas]

Never; Rarely; Sometimes; Often; Frequently

Have you participated in any of the following?

[Bird atlas activities; Birdathons/Twitchathons; Bird census days]

Yes; Uncertain; No

What resources do you use to identify the birds you watch?

Bird guide (electronic form)	155
Electronic calls/Playback	170
Local tour guides	88
None	16
Bird guide (book form)	323

What equipment do you use for watching birds and/or recording sightings?

Spotting scopes	187
Camera	234
Telephoto lenses	130
Acoustic recorder	44
None	6
Binoculars	327

Socio-demographics

What is your current age in years?

Numerical answer

Are you?

male, female

What is your town/city of residence?

open-ended

Please indicate your highest level of education?

Primary/some secondary

Completed secondary

Vocational/technical qualification

Tertiary/university qualification

Chapter 4

STATEMENT OF PUBLISHED PAPER

This chapter includes a published paper. For copyright reasons, this chapter has been removed.

The bibliographic details of the paper are:

Steven R. 2015. Insights into the attributes of Pacific Island destinations that appeal to avitourists. *Pacific Conservation Biology* **21**, 153-157.

Rochelle Steven

Chapter 5

STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER

This chapter includes a co-authored paper.

The bibliographic details of the co-authored paper (at the time of submission), including all authors, are:

Steven R, Smart JCR, Morrison C & Castley JG. Birder preferences revealed using a choice experiment can guide bird conservation funding and management. *Conservation Biology*. Under Review

My contribution to the paper involved: Development of research aims, collection of data, data analysis, data interpretation, manuscript development.

Rochelle Steven

Corresponding author of paper: Rochelle Steven

Supervisor: Jim CR Smart

Supervisor: Clare Morrison

Supervisor: J. Guy Castley

Chapter 5 - Birder preferences revealed using a choice experiment can guide bird conservation funding and management

Abstract

Natural area resource management relies on an understanding of tourist preferences. Stated preference methods (e.g. choice experiments - CE) are increasingly used to provide these data for natural ecosystem values. Here we use a CE to calculate birders' willingness to pay for different levels of bio-ecological attributes (threatened species, endemic species and diversity) of birding sites, with hypothetical entry fees. The CE was delivered at popular birding and avitourism sites in Important Bird and Biodiversity Areas in Australia and the United Kingdom. Latent class modelling results revealed heterogeneous preferences among birders, with correspondingly variable willingness to pay. We were able to distinguish four clear groups from the sample: 'quantity driven birders', 'special bird seekers', 'confused respondents' and 'price is no object birders'. Quantity driven birders are attracted to sites that deliver high levels of diversity and endemic species. Special bird seekers value threatened species and high levels of endemics most. Confused respondents' preferences were difficult to determine, but showed most objection to the hypothetical cost parameters, unlike the price is no object birders who were not at all sensitive to cost. Our findings demonstrate that birders are amenable to paying for their preferred birding experience. These payments could provide an alternative source of funding in some avitourism sites, on both public and private land. These alternative revenue streams should be explored and given full consideration in increasingly competitive conservation financing environments.

Keywords: birding, avitourism, birdwatching, protected areas, Important Bird and Biodiversity Areas

1. Introduction

Birding, or more specifically avitourism, is supposedly one of the most sustainable and responsible sub-sectors of the nature-based tourism industry (Li et al., 2013). Reasons for this include the relatively low impact of avitourism activities on the natural environment (Şekercioğlu, 2002) and the perceived ability of birders to make contributions to conservation (Hvenegaard, 2002; Şekercioğlu, 2002; Biggs et al., 2011; Welford and Barilla, 2013). Avitourism, among other nature-based tourism activities, also provides an opportunity to diversify the funding stream to protected areas, beyond the conventional government and large donor sources (Şekercioğlu, 2002; Biggs et al., 2011; Steven et al., 2013).

Trip expenditures arising from avitourism can provide economic benefits to local communities in various locations (Hvenegaard et al., 1989; Dickie et al., 2006; Biggs et al., 2011; Czajkowski et al., 2014). This encourages communities to conserve and protect bird habitats, as opposed to more destructive economic stimuli such as logging, mining or clear felling (Kuenzi and McNeely, 2008; Stronza and Durham, 2008). Research also highlights that birders are a heterogeneous group of individuals driven by various motivations with different levels of dedication and commitment to the hobby of birding (Hvenegaard, 2002; Scott and Thigpen, 2003; Burr and Scott, 2004; Conradie et al., 2013). Relatively few studies, however, have examined the characteristics of bird communities that appeal to birders (Stoll et al., 2006; Çakici and Harman, 2007; Green and Jones, 2010).

Using diverse and multi-disciplinary research methods is central to our understanding of the ecological attributes of nature valued most by the general public and nature-based tourists, including birders. Non-market valuation methods are now widely used among economists and ecologists alike to value natural assets and resources (Naidoo and Adamowicz, 2005; Christie et al., 2006; Veríssimo et al., 2009; Di Minin et al., 2013). Commonly used non-market valuation methods include contingent valuation and choice experiments (CEs), which as ‘stated preference’ approaches can capture both use and non-use values. The travel cost method, which is also widely used, is a ‘revealed preference’ method which captures direct use values. Previous stated preference studies have quantified public willingness to pay for improvements in the condition of natural assets such as river catchments and wetland ecosystems (Birol et al., 2006; Zander et

al., 2010; Kaffashi et al., 2012), forests and woodland (Macmillan and Duff, 1998; Willis et al., 2003) and marine environments (Ahtiainen et al., 2014). Tourism and recreation studies have also used environmental valuation, particularly CEs, to determine which attributes (e.g. animals present, protected area location, travel time, entrance fees, landscape features, chance of seeing large wildlife, species appearance, species visibility, etc.) are most valued by nature-based tourists (Naidoo and Adamowicz, 2005; Veríssimo et al., 2009; Di Minin et al., 2013; Fischer et al., 2015). Knowing which attributes are most valued helps target investments to increase tourism revenue and/or market share (e.g. investments in conservation of particular species or development of particular infrastructure). Environmental valuation methods can help to achieve these objectives, while also enhancing our understanding of nature-based tourists' attitudes towards resource management and conservation.

This study uses a CE approach to identify which bio-ecological attributes of birding sites appeal to birders when selecting an avitourism destination. Bio-ecological attributes are characteristics of a species assemblage or site that are a result of biological and/or ecological processes. These attributes may include: species specific body size, colouration, geographic distribution (i.e. scale of endemism) and risk of extinction, a site's diversity, the type of biome or ecosystem within which the site is located, etc. The attributes used in this study can be clearly defined when asking birders what attracts them to a birding destination. This study answers calls for research quantifying wildlife viewing preferences in more detail (Di Minin et al., 2013), especially bird viewing preferences outside the Northern Hemisphere (Steven et al., 2014). We provide new insights by classifying birders, from both northern and southern hemisphere locations, in terms of their bio-ecological preferences for birds and birding sites. Additionally, we determine how much birders are willing to pay to visit birding destinations which offer different combinations of bird species attributes. Understanding which attributes are sought after by the birding community may help guide strategies for funding conservation practice. These findings can also provide managers of protected and non-protected habitats with information on how they might tailor avitourism products to generate additional funding for enhanced conservation activities.

2. Methods

Birders may be attracted to particular sites for a diverse range of reasons. These may not be solely limited to characteristics of the bird assemblage, as the provision of tourist infrastructure, services and a safe travel environment are also important (Trainor et al., 2008; Kim et al., 2010; Puhakka et al., 2011). However, in this study, we were specifically interested in ascertaining birders' relative preferences for characteristics of the bird assemblage at a site, in isolation from other factors. We therefore quantified relative preferences for birding site attributes, some of which have been previously highlighted as important to birders in previous research (Stoll et al., 2006; Green and Jones, 2010; Puhakka et al., 2011). The attributes chosen were: number of threatened species present at a site (i.e. critically endangered or endangered), the diversity of a site (using species richness as the metric of measure), and the number of regionally endemic species present at the site. A payment attribute, in the form of a site entrance fee was also included so that relative preferences for delivery of different levels of the three birding site attributes could be converted into monetary (\$) values.

2.1 *Developing the choice experiment*

A CE presents respondents with a number of alternative options on choice cards. Each alternative comprises a set of attributes, present at particular discrete levels. In this study, each choice card presents the respondent with three site alternatives, and a 'stay at home' opt-out alternative, from which they must choose their single preferred option. The alternatives differ in the levels (low, medium and high) of the three site attributes present (number of threatened species, species diversity and endemism) and the entry fee for the site, expressed as either Australian Dollars (AUD) or British Pound (GBP) depending on the location of the survey (GBP converted back to AUD for further analysis) (Table 1, Supplementary Figure 1). These site attribute levels were specified in terms which were meaningful to birders. To confirm the selection of attributes and their levels in this study, several focus groups were held with colleagues and birdwatchers within the institution of the authors. After the focus groups were completed, the attributes, levels and choice card presentation were finalized for data collection.

Table 1. Site attributes and corresponding levels on the choice cards.

Attribute	Definition	Levels
Number of threatened species present	Species that are listed as either critically endangered or endangered on the IUCN Red List	High – More than three CR/EN species Medium – One to three CR/EN species Low – Zero CR/EN species present
Number of endemic species present	Species that are limited in their distribution to a small geographic area	High – More than six endemics present Medium – One to six endemics present Low – Zero endemics present
Bird species diversity	The total number of bird species one can see on a visit to a given site	High Diversity – More than 60 species Medium Diversity – Between 20 and 60 species Low Diversity – 20 or less species
Entry fee	The fee paid to enter the particular site	Fee levels: \$2; \$10; \$15; \$30; \$60; \$100

N.B. CR = critically endangered, EN = endangered; the currency presented on the CE was altered for the BirdFair so as to make interpretation clearer for the respondents and to avoid any unnecessary confusion [£1; £4.50; £6.50; £12.50; £25; £45]. Currency conversions were calculated based on published OECD data on purchasing power parity for individual consumption (OECD, 2013)

2.2 Validation and final experimental design

A pilot study using an optimal orthogonal in the differences (OOD) experimental design was undertaken with 30 respondents. This confirmed the appropriateness of the attributes, especially the entry fee levels and derived some initial estimates for relative preferences. The pilot study also checked the user friendliness of the cards themselves and the supporting questionnaire. The entry fee levels needed to be high enough to induce a response (i.e. to ensure that respondents attended to the cost attribute when choosing their preferred option), but not so high that respondents consistently chose the ‘opt out’ option on each choice card. The pilot study yielded statistically significant

preference results for most attributes in a basic conditional logit analysis. These results were then used as Bayesian priors to generate a more efficient experimental design that could detect main effects (i.e. the effect of each level of each attribute acting independently) and also first order interaction effects between the attributes (Choice Metrics, 2014)

2.3 Data collection

The CE was delivered at multiple BirdLife Important Bird and Biodiversity Areas (IBAs) in: Queensland, Australia (Atherton Tablelands, Daintree, Coastal Wet Tropics, Wooroonooran, Scenic Rim IBAs), Northern Territory, Australia (Adelaide and Mary River Floodplains, Kakadu Savanna IBAs) as well as the British BirdFair in the United Kingdom (Rutland Water IBA). These survey sites were selected as they are known to have high rates of participation in birding. The IBA network was also selected for data collection as these sites are designated based on the presence of threshold populations of certain species (i.e. trigger species – threatened, range-restricted, biome-restricted, migratory and congregatory species) (BirdLife International, 2015). These trigger species have some overlap with the species attributes used in this survey, thus giving this study additional management relevance. All data presented here were collected between May 2013 and November 2014. Completing data collection at both Australian and UK IBAs expanded the scope of the study and enabled a broader hemispherical comparison of birding preferences.

Respondents intercepted at Australian sites were selected using cues to determine whether or not they were participating in birding (Hvenegaard, 2002). These cues included being in possession of either a pair of binoculars or a camera appropriate for bird photography (i.e. SLR with zoom lens) and indicating that they were interested in birding when engaged in a casual greeting. Respondents were then asked if they would be interested in participating in a research project about birding and tourism. For respondents at the BirdFair, the request to participate was prompted during discussions about birding given BirdFair visitors are generally participants in the activity of birding. Respondents were given a standard explanation of what was required to complete the CE and were also given an accompanying questionnaire. The questionnaire asked questions about birding and conservation and also obtained basic socio-demographic information (i.e. respondents' age, gender, income and education).

Respondents were presented with six choice cards and asked to choose their preferred option on each card. The six cards formed part of an experimental design, which comprised 18 cards, blocked into three sets of six. Their preferred options from the combination of attribute levels on the cards enables their preferences for the different levels of the different attributes to be quantified. Preferences were determined via discrete choice analysis.

2.4 Analytical models

The choice data were analysed using of discrete choice modelling. A conditional logit (CL) model [Eq 1, Eq 2; Supplementary Information] (Hensher et al., 2005) was used initially to identify relative preferences for the various levels of the different attributes. A latent class model [Eq 3; Supplementary Information] was estimated to allow for preference heterogeneity among respondents (Boxall and Adamowicz, 2002). Effects coding was used to capture non-linear preference variation across attribute levels. The latent class model (LCM) can identify discrete groups whose preferences or ‘mindsets’ are relatively homogeneous within the overall respondent sample. LCMs were constructed with 2, 3 and 4 separate segments, representing 2, 3 or 4 separate mindsets amongst respondents. The three and four segment LCMs provided a significantly better representation of respondent preferences than the simpler CL and two-segment LCM models. It appeared that some of birders were not responding to the cost parameter in the CE. Thus a four segment LCM was constructed which modelled attribute non-attendance (ANA) to the cost parameter in one of its segments (Hensher and Greene, 2010). This four segment LCM with ANA provided the best portrayal of respondents’ preferences (Table 2).

Table 2. Summary information for analyses determining the preferences of various latent class groups for site bird assemblages

Model	Log-likelihood Function	Pseudo R ²	AIC	Adj BIC
Conditional Logit Model – 1 segment	-1856.09	0.097	3728.17	3746.26
2 segment latent class model	-1724.47	0.161	3482.95	3521.37
3 segment latent class model	-1686.98	0.179	3425.96	3484.73
4 segment latent class model	-1668.10	0.188	3406.20	3485.31
4 segment latent class model with attribute non-attendance for cost	-1668.17	0.188	3404.35	3481.20

N.B. AIC = Akaike's Information Criterion, Adj BIC = Adjusted Bayesian Information Criterion

Willingness to pay (WTP) values were obtained for increased delivery of each of the site attributes, relative to a baseline site which offered ‘low’ levels of all three attributes (low numbers of threatened species, low species diversity and low endemism). WTP values were obtained by dividing the relevant preference parameters by the cost parameter [Eq 4, Eq 5; Supplementary Information] (Hensher et al., 2005).

3. Results

3.1 Respondent summary

The average age across all respondents ($N=283$) was 56 (range 18-81). The sampled population comprised 60% males ($n = 169$) and 39% females ($n = 110$) (1% provided no answer to the question of sex) (Supplementary Table 1). Most respondents had completed a tertiary or university qualification ($n = 204$, 72%). There were a similar number of retired ($n = 139$, 49%) and non-retired ($n = 136$, 48%) respondents. Of those that divulged information about their income ($n = 248$, 88%), 32% revealed that their income was more than AUD\$80,000 per year.

3.2 Conditional logit results

A basic conditional logit (CL) model indicated that birders’ showed positive preferences for increasing levels of all site attributes and – as expected – an aversion to increasing site entry fees (Table 3). The CL model assumes that errors around the predicted choice

options are independent and identically distributed (IID), and therefore preferences are homogeneous across respondents. The Hausmann's test indicated that this IID assumption did not hold, and therefore that preferences were heterogeneous across respondents (Hausman test statistic = 26.4 with prob <0.001 cf. χ^2 8- d.f. critical value at 0.05). This suggested that a more flexible model was required, such as a latent class model, to accommodate heterogeneous preferences.

3.3 Latent class results

The four groups identified in the four segment LCM with ANA are termed as follows: (i) quantity driven birders, (ii) special bird seekers, (iii) confused respondents, and (iv) price is no object birders. Site preferences are expressed relative to a baseline of a site with a low level of diversity and low numbers of endemic and threatened species.

Quantity driven birders (24% of the sample) expressed a very strong (Table 3) preference for sites with high bird diversity as well as a strong preference for sites with medium diversity, and high levels of endemic birds. Quantity driven birders do not appear to favour sites that contain threatened species and were sensitive to the cost parameter. Quantity driven birders, however, were not as sensitive to cost as special bird seekers or confused respondents.

Table 3. Coefficient estimates for bird assemblage preferences from the conditional logit model and the 4 segment latent class model with, attribute non-attendance for the cost parameter in Group 4 ($N=283$)

Attribute Level	Conditional Logit Model	Latent Class Model			
		Group 1 Quantity Driven Birders Utility Parameters (SE)	Group 2 Special Bird Seekers Utility Parameters (SE)	Group 3 Confused Respondents Utility Parameters (SE)	Group 4 Price is No Object Birders Utility Parameters (SE)
Medium threatened spp	0.060 (0.043)	-0.257 (0.129)**	0.280 (0.124)**	0.258 (0.284)	0.130 (0.083)
High threatened spp	0.455 (0.043)***	-0.005 (0.141)	0.960 (0.157)***	-0.043 (0.307)	0.548 (0.098)***
Medium endemic spp	0.309 (0.044)***	0.005 (0.152)	0.270 (0.128)**	0.850 (0.306)***	0.370 (0.093)***
High endemic spp	0.709 (0.047)***	0.794 (0.126)***	1.009 (0.159)***	0.588 (0.278)**	0.908 (0.104)***
Medium bird diversity	0.246 (0.039)***	0.609 (0.133)***	-0.018 (0.125)	0.645 (0.251)**	0.281 (0.102)***
High bird diversity	0.604 (0.051)***	1.337 (0.184)***	0.900 (0.159)***	0.431 (0.293)	0.257 (0.096)***
Cost attribute	-0.021 (0.002)***	-0.024 (0.005)***	-0.049 (0.006)***	-0.110 (0.027)***	Fixed 0.00
Opt out constant	-3.100 (0.154)***	-3.613 (0.541)***	-3.958 (0.396)***	-3.638 (0.500)***	-3.670 (0.650)***
Probabilities of latent class membership		0.244	0.282	0.117	0.357

N.B. Effects coding used for calculation of coefficients for medium and high attribute levels relative to baseline level; spp abbreviates 'species'; Significance levels indicated by, ** (5%), *** (1%);

Special bird seekers (28% of the sample) prefer high levels of both endemic and threatened species, as well as high levels of diversity (Table 3). The special bird seekers want the best of everything, but especially birds that are theoretically rarer. They were also more sensitive to the cost parameter than the quantity driven birders.

The group with the smallest probability of membership (12% of the sample) was the confused respondent group. These birders showed the highest aversion to the cost parameter, but it is unclear which of the bird attributes were driving their selections in the CE (Table 3). This group appeared to prefer medium – rather than high – levels of the site attributes. This is not an intuitive result, and could be due to the birders finding the presentation of the attribute levels in the CE confusing, whilst still responding consistently to the site entry price.

The final group (price is no object birders) in the LCM (36% of the sample) is comprised of birders that paid no attention to the cost parameter (Table 3). These birders express their strongest preference for sites featuring high levels of endemic species, and lower, but still significant, preferences for high levels of threatened species. This differs with the preferences of the special bird seekers, who preferred high levels of threatened species almost as much as high levels of endemism.

Segmentation revealed that, in general, socio-demographic factors were not good predictors of group membership in the LCM. Similarly, our analysis did not identify any significant interaction effects between site attributes, so they will not be discussed further here. All groups of respondents showed a strong aversion to the ‘stay at home’ option, even compared with visiting a birding site which delivered the lowest levels of all three attributes.

3.4 Willingness to pay

The willingness to pay (WTP) values for the different levels of each attribute varied across the groups identified in the LCM (Fig. 1). WTP could not be calculated for the price is no object birders because cost did not play any role in their site selection.

Of the three groups for which WTP values could be calculated, quantity driven birders expressed the highest WTP values, particularly for sites with medium and high diversity (AUD\$105 and AUD\$135, respectively). Similarly, they were also prepared to pay the

most for sites with medium and high levels of endemic species (AUD\$33 and AUD\$66, respectively).

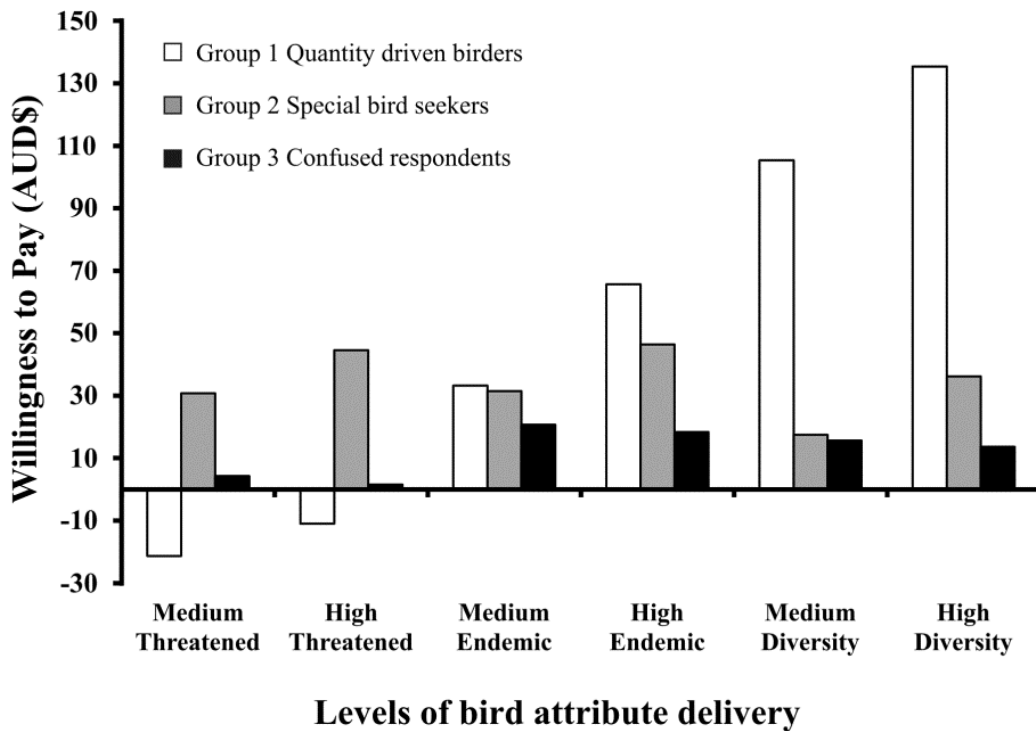


Figure 1. Willingness to pay values, per respondent group in the latent class model, for medium and high levels of site attributes relative to a baseline of the low level of each site attribute.

Special bird seekers expressed a lower WTP for diversity (AUD\$18 and AUD\$36 for medium and high levels, respectively) and endemic species (AUD\$32 and AUD\$46 for medium and high levels, respectively), compared to quantity driven birders. Special bird seekers had the highest WTP for threatened species (AUD\$31 and AUD\$45 for medium and high levels, respectively). Their WTP for high levels of endemic and threatened species were almost identical.

The WTP values for the confused respondents were lower overall, reflecting their strong and consistent aversion to entry costs. The bird attribute for which they expressed the highest WTP was medium levels of endemic species (AUD\$21) (i.e. higher than that for high levels of endemic species [AUD\$18]). As stated previously, these findings are not intuitive – hence the ‘confused’ label.

Price is no object birders' WTP for attribute delivery could not be estimated because this group ignored the cost attribute, at least within the range of entry fees included on the choice cards (up to AUD\$100). This suggests that entry prices well in excess of AUD\$100 would be required before price is no object birders' site visit intentions would be affected, even if the site only offered medium levels of diversity, and threatened and endemic species. This group's preferences for sites offering high numbers of threatened and endemic species are at least twice as strong as those for sites offering medium levels of these attributes. This response and comparisons with the WTP values estimated for the other birder groups, suggests that price is no object birders' WTP values might conservatively be placed in the AUD\$100 - 200 range.

4. Discussion

Birders are a diverse group of nature enthusiasts and this study has used a CE to quantify this heterogeneity in a novel way. The LCM was able to group birders specifically by their birding site preferences, finding that bird assemblages of various compositions will appeal to different groups of birders. Previous research has examined the variation among birders, using different metrics to those employed here (Scott and Thigpen, 2003; Burr and Scott, 2004; Kim et al., 2010). Similarly, CE has been used in tourism and recreation (including birders) previously, but with objectives related to other aspects of the industry (e.g. accommodation preferences, site management actions, availability of other activities, preferences for big game species in Africa, etc.) (Naidoo and Adamowicz, 2005; Di Minin et al., 2013; Guimarães et al., 2015). The findings presented here will further enhance our understanding of the avitourism industry, and more specifically, of birders themselves.

4.1 A new way to categorize birders

This study provided us with the opportunity to build a novel set of profiles for birders. The results presented here contrast with and extend on previous research where respondents were asked about other bird attributes, including: colourful plumage, visibility, attractiveness, bird calls and interesting bird behaviour (Çakici and Harman, 2007; Green and Jones, 2010; Veríssimo et al., 2013). The attractiveness of diversity (especially for the quantity driven birders) agrees with findings from previous studies

(using various methods) that bird diversity is a positive element of an overall nature-based tourism experience (Hvenegaard, 2002; Lindsey et al., 2007; Kim et al., 2010). In previous studies, bird diversity was presented in combination with other destination attributes (e.g. mammal species, floral diversity, attractive scenery, etc.), thus the importance of diversity had not previously been determined in relation to other bird specific attributes.

Two groups of birders are particularly attracted to sites with higher endemic species numbers. One of these groups, the price is no object birders, express their strongest preference for endemic species. This group probably conforms to the wider public's generalization of birders as 'listers', 'tickers' or 'twitchers' (Oddie, 1980; Wright, 1995; Moss, 2004; Dooley, 2007; Hvenegaard, 2012). These birders are driven to see species they have not seen before, and are willing to pay substantially to do that. Special bird seekers also valued endemics highly, but expressed a similar preference for threatened species and were more sensitive to cost. These findings confirm previous surveys which have identified that endemic species appeal to birders (Green and Jones, 2010; Kim et al., 2010 Puhakka, et al., 2011). Endemic and threatened species may be appealing to these birders because they are often perceived as being rarer species. It is important to note that there are several ways to define rarity in birding, including: a species that is behaviourally cryptic and therefore rarely seen, a species that has a small range or population size and a vagrant that is rarely seen outside its home range (Nightingale and Elkins, 2001; Lindenmayer and Burgman, 2005; Dooley, 2007; Booth et al., 2011). No matter the definition, the rarer a species is, the greater the challenge to see it and the more sought after by certain birders (Moss, 2004; Dooley, 2007).

Two explanations can be provided for the small group identified as confused respondents. Firstly, it is possible they had trouble weighing up the different bird attributes and found it difficult to make a choice about the hypothetical destinations offered. This is a hazard of the hypothetical nature of CE and has been acknowledged in previous research (Naidoo and Adamowicz, 2005; Bech et al., 2011; Di Minin et al., 2013). Secondly, as this group showed the highest sensitivity to cost, it is also possible that this was the only attribute that mattered to them and they were casting protest votes against the concept of paying an entry fee (Buckley, 2003; Chung et al., 2011). Despite this, it is important to note that this study found the vast majority of birders indicated a WTP of some level for their preferred birding experience.

4.2 Conservation and Management Implications

The data presented here could be used to inform conservation and management of birds in three ways: habitat conservation, individual species management and sustainable conservation financing.

4.2.1 Habitat conservation

The species attributes included in the CE can be related to the habitat requirements of different types of birds. Diversity, for example, and the need for increased availability of habitat to support more species has been discussed at length in the research community (e.g. Connor and McCoy, 1979). While there are exceptions and scale dependencies (Scheiner et al., 2000), in general the greater the extent and types of habitats available, the greater the area of occupancy will be for more species (Kallimanis et al., 2008). Thus, there is an argument for conserving larger areas of habitat to sustain higher bird diversity (and general biodiversity), which, as we have found, appeals to a large proportion of high WTP birders. Endemic and threatened species, which are usually vulnerable to more localized threats (Jankowski and Rabenold, 2007), are strongly favoured by many birders. Therefore, the conservation requirements of these species will need to be correspondingly localized. This site targeted approach to species conservation has been the goal of the IBA program and the findings presented here provide support for this approach. It highlights that securing populations of species that are restricted to certain biomes and regions (in light of their economic importance) may foster support for conservation in the political arena (Dickie et al., 2006; Stoll et al., 2006; Welford and Barilla, 2013).

4.2.2 Individual species management

This study has not estimated valuations for a whole species or individuals within a species. Instead, we have attempted to value changes in the composition and diversity of species assemblages. Despite this, where particularly rare or endemic species are present in a given area, the results and valuations obtained here could be used to guide management. For example, land managers that are aware of avitourism activities in their jurisdiction may need justification for restricting or enhancing those activities at certain times (e.g. breeding vs. non-breeding). The results presented here suggest that endemic and threatened birds in particular may be targeted vigorously by certain types of birders.

Some birding activities such as: using call playback, ‘pishing’, using flash photography and deliberately flushing birds from roosting spots or nests can harass birds, with subsequent impacts on breeding and foraging activities (Şekerciöđlu, 2002; Langham et al., 2006; Green and Jones, 2010; Harris and Haskell, 2013). Threatened species are especially vulnerable to these types of disturbance, which may have impacts on breeding success and thus population size.

For endemic species with small range sizes, these disturbances represent a threat, potentially causing the species to vacate a site after consistent disturbance and relocate to areas that are less suitable for them to persist (Steven et al., 2011). Conversely, areas with good representation of endemic or threatened species may provide opportunities to increase avitourism activity, under appropriate management that ensures ethical birding practices. It is a balancing act, where there is a need to find the middle ground between ‘out of sight out of mind’ (which can result in lack of conservation support) and ‘loving a species to death’ (Newsome et al., 2013). If land managers can identify the species in their care that are of interest to birders, they can manage for any potential impacts through time. This may include limiting access to certain species during breeding season or installing infrastructure to minimize disturbance (e.g. bird hides) (Ikuta and Blumstein, 2003).

4.2.3 Sustainable conservation financing

We have demonstrated that birders have significant willingness to pay for access to areas that deliver appropriate birding opportunities. There is a global trend towards governments reducing funding for natural area management, forcing conservation managers to find new ways to fund their maintenance and conservation activities (Buckley, 2003; Eagles, 2014). Tourism, especially eco-tourism, has been suggested as a means to alleviate the financial burden on protected area managers (Eagles, 2002; Emerton et al., 2006). Often this is not as simple as it seems, as in certain countries and regions legislation requires that access to national parks and other public protected areas is free of charge. However, there are examples where a user pays principle has been successfully implemented (Benitez, 2001; Eagles, 2002). Furthermore, fees are often charged for access to private protected areas. Our findings extend on previous research valuing tourism and nature experiences (Naidoo and Adamowicz, 2005; Di Minin et al., 2013), showing that a significant proportion of birders hold substantial WTP for access

to sites which can offer their desired birding experience. Critics of WTP studies are concerned about inflated WTP estimations, typically due to hypothetical bias (Carlsson and Martinsson, 2001; Murphy et al., 2005). The results of this study, however, suggest that even a modest proportion of the total WTP values estimated here would provide a significant income injection for premium avitourism sites.

In conclusion, avitourism has been suggested as a means to increase economic and conservation benefits for birds. Using a CE we have identified those bird assemblages that appeal most to birders, as well as highlighting heterogeneity amongst avitourists. We have demonstrated that birders are willing to pay (sometimes substantial amounts) for their birding experience. This implies that there are potentially missed opportunities for conservation funding at some birding sites, especially those with the most sought after species assemblages. Multi-disciplinary approaches, as employed here, may help inform the development of tangible and practical suggestions for enhancing bird conservation on both public and private lands.

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Supplementary Figure 1 – Example of choice card issued to birding respondents

	Birding site 1	Birding site 2	Birding site 3	I would not visit any of these sites on my next trip
Number of threatened species	Nil CR/EN species	1-3 CR/EN species	>3 CR/EN species	
Bird species diversity	<20 species	20-60 species	<20 species	
Number of endemic species	>6 endemics	1-6 endemics	Nil endemics	
Entry Fee	\$15	\$100	\$2	
Tick →				

Supplementary Information Eq 1- Eq 5 - Equations used for choice modelling

Discrete choice models

Conditional logit model (CL)

The CL model postulates an indirect utility function (U_{nj}), which represents the satisfaction that a respondent (n) associates with one of the site visit options (j) offered on a choice card, as the summation of separate components of utility delivered by each of K attributes x_{kj} of the site, together with a stochastic error term ε_{nj} , which captures unobserved random influences affecting individual n 's choice:

$$U_{nj} = ASC_{OptOut} \cdot OptOut + \beta_1 x_{1j} + \beta_2 x_{2j} \cdots + \beta_K x_{Kj} + \varepsilon_{nj} \quad (\text{Eq 1})$$

A constant term (ASC_{OptOut}) is included to capture the effect that unobserved influences exert over the selection of the 'stay at home' option. $OptOut$ here is a dummy variable that takes a value of 0 if one of the site visit options is selected by a respondent on a particular choice card, or 1 if the 'stay at home' option is selected.

In (1.1) categorical levels of the 3-level programme, attributes are encoded using two effects-coded variables per attribute (Table 1). Actual monetary values of the entry fee (AUS \$) are entered for the cost attribute. The β coefficients quantify the influence which the various levels of the different attributes exert over the utility that respondents associate with the j different site visit options available, relative to the utility of the 'stay at home' option that appears on every choice card.

Under the CL model, assuming that respondent n selects the alternative on each choice card that delivers them the highest level of utility, and assuming that the error terms ε_{nj} are independently and identically distributed and follow a Gumbel distribution, the probability that respondent n chooses alternative i (P_{ni}) in preference to all other alternatives j can be expressed as:

$$P_{ni} = \frac{\exp(\beta'x_i)}{\sum_j \exp(\beta'x_j)} \quad (\text{Eq 2})$$

Vector β' contains the β_k parameters from Equation 1.1 and vector x_i holds the attribute content of alternative i , expressed in effects-coded variables. The model is estimated using maximum likelihood procedures.

Latent class model (LCM)

Following Swait (1994), the LCM is specified as a random utility model in which respondent n belongs to latent class $s = (1,2,\dots,S)$ with a particular probability $M_{n,s}$. Attribute preferences are assumed homogeneous within each latent class, but heterogeneous between latent classes. A segment membership likelihood function $M_{n,s}$ specifies the probability of a particular respondent n belonging to each one of the S segments. In the LCM, the probability that respondent n chooses alternative i (P_{ni}) in preference to all other alternatives j can be expressed as:

$$P_{ni} = \sum_{s=1}^S \left(M_{n,s} \cdot \frac{\exp(\beta'_s x_i)}{\sum_j \exp(\beta'_s x_j)} \right) \quad (\text{Eq 3})$$

Parameter estimates for attribute preferences within each latent segment (β'_s), and the individual-specific probabilities of segment membership ($M_{n,s}$), are adjusted iteratively by maximum likelihood methods to maximize the explanatory power of the LCM for a given number of discrete segments S .

Willingness to pay (WTP)

WTP values for changes in the attribute levels relative to a defined baseline can be calculated from the estimated CL and LCM parameters. The estimated coefficient on the cost attribute (β_{cost}) represents the marginal utility of income. Dividing any other attribute parameter estimate by the magnitude of β_{cost} therefore produces the WTP for the relevant change in delivery of the associated attribute. WTP for a particular step change k in a particular site attribute l is calculated as the negative of the ratio of the $\beta_{k,l}$ coefficient divided by β_{cost} :

$$WTP_{k,l} = - \left(\frac{\beta_{k,l}}{\beta_{cost}} \right) \quad (\text{Eq 4})$$

Confidence intervals around mean WTP values can be estimated using the Krinsky & Robb method (Krinsky & Robb 1986).

For the LCM model, individual n -specific conditional estimates of the marginal WTP for a particular change in level l of attribute k can also be obtained (Haab & McConnell 2002), expressed as:

$$WTP_{n,k,l} = \sum_{s=1}^S \hat{M}_{n,s} \left(\frac{-\beta_{k,l,s}}{\beta_{\text{cost}}} \right) \quad (\text{Eq 5})$$

Where $\hat{M}_{n,s}$ is the estimated matrix of individual-specific posterior probabilities of segment membership and the $\left(\frac{-\beta_{k,l,s}}{\beta_{\text{cost}}} \right)$ ratio is the implicit price for the attribute change being valued, relevant to each of the latent class segments.

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**Supplementary Table 1 Pooled respondent characteristics across all survey sites
(N=283)**

Respondent demographic	<i>n</i>	%
<i>Age</i>		
<31	23	8%
31-40	21	7%
41-50	39	14%
51-60	66	23%
>60	126	45%
No answer provided	8	3%
<i>Sex</i>		
Male	169	60%
Female	110	39%
No answer provided	4	1%
<i>Education</i>		
Primary/some secondary completed	9	3%
Secondary completed	40	14%
Vocational/technical training	25	9%
Tertiary/university completed	204	72%
No answer provided	5	2%
<i>Retirement status</i>		
Retired	139	49%
Not retired	136	48%
No answer provided	8	3%
<i>Income</i>		
<AUD\$40,000	74	26%
AUD\$40,000-AUD\$59,999	47	17%
AUD\$60,000-AUD\$79,999	38	13%
>AUD\$80,000	89	32%
No answer provided	35	12%

Chapter 6

STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER

This chapter includes a co-authored paper. For copyright reasons, this chapter has been removed.

The bibliographic details of the co-authored paper, including all authors, are:

Steven R, Morrison C & Castley JG. Avitourism in Australian Important Bird and Biodiversity Areas. *PLoS ONE* (10)12: e0144445. Available from:
<http://dx.doi.org/10.1371/journal.pone.0144445>

My contribution to the paper involved: Development of research aims, collection of data, data analysis, data interpretation, manuscript development.

Corresponding author of paper: Rochelle Steven

Supervisor: Clare Morrison

Supervisor: J. Guy Castley

Chapter 7

STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER

This chapter includes a co-authored paper.

The bibliographic details of the co-authored paper, including all authors, are:

Steven R, Morrison C & Castley JG. Exploring attitudes and understanding of global conservation practice among birders and avitourists for enhanced conservation of birds. *Bird Conservation International*. Under Review.

My contribution to the paper involved: Development of research aims, collection of data, data analysis, data interpretation, manuscript development.

Rochelle Steven

Corresponding author of paper: Rochelle Steven

Supervisor: J. Guy Castley

Supervisor: Clare Morrison

Chapter 7 - Exploring attitudes and understanding of global conservation practice among birders and avitourists for enhanced conservation of birds

Summary

Support for conservation efforts may be influenced by knowledge and understanding of conservation issues. Birders are a group that are already nature-oriented; however their understanding of key bird conservation issues remains under-examined. We surveyed birders asking questions related to their views on conservation, conservation funding and their understanding of a global bird conservation program (BirdLife International's Important Bird and Biodiversity Areas [IBAs]). Birders generally value bird conservation as part of the larger conservation dilemma in an eco-centric way, often citing the overarching importance of biodiversity. The ecological roles birds play was also highlighted, but this varied across socio-demographic groups. Despite their positive conservation attitudes, less than half of all birders are familiar with the IBA program. Familiarity with IBAs was driven by socio-demographic factors, with males more familiar than females and South African birders more familiar than birders from Australia and the United Kingdom. Most birders are willing to make contributions to bird conservation when visiting key sites for birding, however birders generally feel governments should remain the main funders of conservation. Opportunities to enhance engagement between birders and bird conservation groups exist with most birders indicating a desire to learn more about bird conservation at birding sites. For birders, increasing access to relevant information and presenting opportunities to contribute to conservation at birding sites could provide tangible ecological and societal benefits for protected areas, bird conservation groups, and birders.

Keywords: avitourism, ecotourism, important bird and biodiversity areas, protected areas, funding

Introduction

Global biodiversity continues to decline, across all taxonomic groups (Brooks et al. 2014, Visconti et al. 2015). Against this backdrop, conservation practitioners, researchers and governments are challenged to find mechanisms to achieve outcomes that meet global and national conservation targets (CBD 2010, McCarthy et al. 2012). Political positions on conservation will be driven by public support for conservation policy. Therefore, it is key to engage the general public in nature conservation (McKay 2007, Novacek 2008, Papworth et al. 2015). Support may be expressed as recreational use and visitation of public protected areas providing revenue for conservation (Buckley et al. 2012, Morrison et al. 2012, Steven et al. 2013, Balmford et al. 2015), but also through independent conservation action (e.g. private reserves) (Lamers et al. 2014, Pegas and Castley 2014). Among many nature-based activities, one of the most popular is birdwatching, or birding.

Birding is one of the most popular nature-based recreational activities in the Western world, especially in the United Kingdom (UK) and the United States of America (USA) (Moss 2004, Connell 2009, Steven et al. 2014). There is also growing interest from China and South Korea (Lee et al. 2010, Li et al. 2013, Chen and Chen 2015), Africa (Biggs et al. 2011, Simango 2011) and India (Urfi 2012, Seshadri et al. 2013). There are few, if any, taxonomic groups in which people invest as much recreational time and energy in, as birds. Conceptually, birders should make ideal proponents of a general conservation ethos and the environmental movement, but there is limited evidence supporting this. McFarlane and Boxall (1996) and Glowinski and Moore (2014) found that, among North American birders, the level of environmental concern and tangible conservation benefit is as variable as the population of birders themselves. There are also some activities specific to birding and avitourism that can actually represent a threat to birds (e.g. using call playback, making verbal noises to attract birds, using flash photography to photograph birds etc.) (Şekercioğlu 2002, Green and Jones 2010, Biggs 2013). However, the relative threat that these activities pose are probably minimal compared to other human induced impacts such as habitat loss and introduced species (Steven and Castley 2013, Butchart et al. 2006).

Research is beginning to explore the links between birding (general hobby of birding) and avitourism (significantly incorporating birding into travel plans) and conservation

(Steven et al. 2014). For example, studies have discussed birders' and avitourists' donations to and membership of conservation organisations (Hvenegaard and Dearden 1998a, 1998b, Hvenegaard 2002, Isaacs and Chi 2005, Green and Jones 2010, Cooper et al. 2015). However, results are not consistent or conclusive; with birders surveyed in Thailand having high levels of membership in conservation organisations (72.7% respondents) (Hvenegaard 2002) and birders surveyed in USA having lower rates of donations and membership (62% and 36% of respondents, respectively) (Isaacs and Chi 2005, Cooper et al. 2015). A wider and updated examination of the relationship between birding and conservation among globally distributed birders is needed.

Before we can reliably generalise about whether birders make effective conservationists we need to assess: their position on bird conservation, their willingness to learn about bird conservation, their feelings about conservation funding and their knowledge of conservation policies and management. Birder awareness of conservation initiatives is examined by asking about their familiarity with a global program implemented specifically to conserve birds, the BirdLife International Important Bird Area network (IBA) (now known as Important Bird and Biodiversity Areas). The IBA network was first implemented in Europe in the early 1980s (Osieck and Mörzer Bruyns 1981). Since then, it has grown to comprise 12,000 sites across 200 countries and territories (BirdLife International 2015) and contributes to advancing global conservation goals (Butchart et al. 2012). Our research will inform bird conservation groups and practitioners about potential gaps in birders' understanding of conservation issues and how addressing these gaps can enhance conservation outcomes for birds.

Methods

To maximise representativeness of the sample, data were collected via survey instruments (i.e. questionnaires) presented to birders both in person and online (Miller et al. 2014, Guimarães et al. 2015). Questionnaire design and interpretability was tested by distributing the survey to reviewers of different disciplines prior to general dissemination. All necessary research ethics approvals were obtained prior to any survey instruments being used (Griffith University, Human Research Ethics Committee: ENV_01_13_HREC; ENV_59_12_HREC).

The face-to-face questionnaire was delivered during 2013-2014 at various birding locations across Australia: Lamington National Park (Scenic Rim IBA) (May 2013-November 2013), Wet Tropics World Heritage Area (Daintree, Atherton Tablelands, Wooroonooran and Coastal Wet Tropics IBAs) (October 2013), Fogg Dam Conservation Reserve (Adelaide and Mary River Floodplains IBA) Kakadu National Park (Kakadu Savanna IBA) (September 2014). Data were also collected at the British BirdFair at Rutland Water Reserve (Rutland Water IBA) in the United Kingdom (UK) (August 2013). These sites were selected as they are known to have high levels of birding activity.

Respondents intercepted at field sites in Australia were selected using cues to determine whether or not they were participating in birding (Hvenegaard 2002). These cues included being in possession of either a pair of binoculars or a camera appropriate for bird photography (i.e. SLR with zoom lens) and indicating they were interested in birding when engaged in a casual greeting. Respondents were then asked to participate in a research project about birding and tourism. For respondents at the BirdFair, the request to participate was prompted during discussions about birding, where most people attending the BirdFair were regular birders.

Data were also collected via an online survey which was available from February 2013 to December 2013. The questionnaire was distributed through approximately 30 web-based portals including: birding forums, birding mailing lists, social media pages for birding, direct emails to people in the birding or ornithological field and requests to magazine and newsletter editors for their assistance in sharing the web link to the survey and distributing the link to their mailing lists (SI1). Completion of the online questionnaire was completely voluntary and participants could quit the questionnaire at any time. The estimated time taken to complete the questionnaire was kept below 12 minutes in an effort to maximise complete responses. In addition to collecting primary demographic information of each respondent, questions were asked regarding specific aspects of bird conservation (Table 1).

Table 1 Specific questions asked of birders regarding bird conservation.

Question asked	Type/format of response
Why do you think bird conservation is important?	This was an open-ended question where birders could respond by providing details about any area of bird conservation important to them.
How familiar are you with the BirdLife International Important Bird Area Program?	For this question birders were asked choose from the options – familiar, not familiar or uncertain
Please indicate your level of agreement with the statements: ‘I believe that birders should make contributions to assist bird conservation when visiting key sites for birds’ and ‘I believe that governments should be the main funders of bird conservation’	Birders were asked to respond using a five point Likert type scale from strongly disagree to strongly agree
Please indicate your level of agreement with the statement ‘I am interested in learning more about the conservation of birds at this site’	Birders were given the options; yes, no or uncertain to respond to this question

Responses for the open-ended question regarding the importance of bird conservation were first explored using an online word cloud tool (www.wordle.net) and the top 50 words used were represented visually. Common words (and, the, it, etc.) were removed as well as the key words from the question itself (bird, conservation and important). Full responses were subsequently coded for quantitative analysis. The nine categories used to code all responses were adapted from common definitions for natural resource valuation among the Western world, in the social and conservation literature (Table 2) (Byrne 1998, Wolch and Zhang 2004, Lindenmayer and Burgman 2005). Birders often gave responses that could not be assigned to only one value definition, and were thus given multiple counts to fully encompass the myriad ways in which they value bird conservation.

The influence of sex, country of residence, age and education on awareness of the different conservation aspects were examined. Statistical analyses (contingency analyses and one-way analysis of variance [ANOVA]) were conducted using IBM SPSS Statistics Version 22.

Results

General respondent summary

A total of 350 birders responded to the online questionnaire. However, not all questions were answered due to the voluntary nature of the survey. Consequently, the response rate to the questions presented here varied. The face-to-face questionnaire yielded 283 responses. These respondents were also able to withdraw at any time, as the survey was completely voluntary. However, as the researcher was present to answer queries etc. this survey had a greater completion rate (95%). For both face-to-face and online delivery methods, most respondents were male, with 60% and 71% of the sample, respectively (65% combined). The average age of respondents was 56 for the face-to-face survey and 46 for the online survey. For both delivery methods, more than 70% of respondents had completed a tertiary degree.

responses included the following; *'It cannot be in isolation. Biodiversity needs to be protected'*, *'Conserving birds means conserving habitat which directly helps with other species'* and *'Because birds are an essential part of food webs and ecosystem - but it is about preserving habitats (on a landscape scale) and all of the wildlife within them rather than simply focusing on birds'*.

Table 2 Values assigned to the responses for the importance of bird conservation by country, age and sex of respondent ($N = 210$).

Value	Value definition	(<i>n</i>)	Pearson's Chi Square Results - Country	Pearson's Chi Square Results – Age Group (up to 30, 31-60, 61 and over)	Fisher's Exact Test Results - Education	Fisher's Exact Test Results - Sex
General biodiversity conservation	Bird conservation is/should be about biodiversity conservation in general	115	$\chi^2 = 5.120$, $df = 5$, $p = 0.401$	$\chi^2 = 3.017$, $df = 2$, $p = 0.221$	$p = 0.304$	$p = 0.468$
Ecological role	The role of birds in the ecosystem is recognised – birds are pollinators/dispersers, birds (e.g. raptors) aid in nutrient cycling etc	84	$\chi^2 = 12.310$, $df = 5$, $p = 0.031$	$\chi^2 = 7.574$, $df = 2$, $p = 0.023$	$p = 0.717$	$p = 0.012$
Indicator	Birds can be good indicators of change in the ecosystem as a whole	69	$\chi^2 = 5.391$, $df = 5$, $p = 0.370$	$\chi^2 = 8.951$, $df = 2$, $p = 0.011$	$p = 0.039$	$p = 0.484$
Aesthetic/personal wellbeing	Watching or hearing birds gives pleasure, birds are stunning/beautiful	51	$\chi^2 = 4.891$, $df = 5$, $p = 0.429$	$\chi^2 = 0.644$, $df = 2$, $p = 0.725$	$p = 0.270$	$p = 0.126$
Bequest	Birds should be conserved so future generations can enjoy them	32	$\chi^2 = 2.662$, $df = 5$, $p = 0.752$	$\chi^2 = 8.995$, $df = 2$, $p = 0.011$	$p = 0.776$	$p = 1.000$
Intrinsic	Birds have a right to exist independent of humans	29	$\chi^2 = 4.071$, $df = 5$, $p = 0.539$	$\chi^2 = 4.116$, $df = 2$, $p = 0.128$	$p = 1.000$	$p = 0.648$
Stewardship	We have a responsibility to not damage the environment but protect it	20	$\chi^2 = 5.275$, $df = 5$, $p = 0.383$	$\chi^2 = 0.032$, $df = 2$, $p = 0.984$	$p = 0.212$	$p = 0.109$
Flagship	Birds can be figure-heads or icons of wider conservation issues	24	$\chi^2 = 3.632$, $df = 5$, $p = 0.604$	$\chi^2 = 2.350$, $df = 2$, $p = 0.309$	$p = 0.750$	$p = 0.786$
Economic	Birds can provide economic benefits via tourism and recreation	10	$\chi^2 = 2.948$, $df = 5$, $p = 0.708$	$\chi^2 = 1.892$, $df = 2$, $p = 0.388$	$p = 0.357$	$p = 0.691$

Some respondents identified the role humans have had in degrading the environment, and that society has a responsibility to minimise the interference of nature. In general, respondents did not recognise the potential for birds to be flagship species and economic assets as much as they recognised other qualities. With respect to the ecological role that birds play, respondents often spoke of them in terms of pollinators and dispersers of plant species.

For most responses, males and females were largely consistent in their reasons for why bird conservation is important (SI2, SI3). However, females recognised the ecological role birds play more than males (Fisher's exact test, $p = 0.012$) (Table 2). Age had an effect on the reasons given for the importance of bird conservation. The ecological roles played by birds was recognised by younger birders (≤ 30 years old) more than expected and less than expected by mature birders (aged 61 and over) ($\chi^2 = 7.574$, $df = 2$, $p = 0.023$) (Table 2). Conversely, the role birds play as indicator species was identified more than expected by mature birders (aged 61 and over) and less than expected among younger birders (≤ 30) ($\chi^2 = 8.951$, $df = 2$, $p = 0.011$). Younger birders identified bird conservation as important for future generations (i.e. bequest value) more than was expected ($\chi^2 = 8.995$, $df = 2$, $p = 0.011$).

Generally, education and country of residence (as far as those surveyed here) had no significant effect on the ways birders value bird conservation (Table 2). Exceptions include: the ecological role played by birds where Australian respondents appear to place more value on this role than respondents from other countries ($\chi^2 = 12.310$, $df = 5$, $p = 0.031$) and the importance of birds as indicators, where tertiary educated birders had higher than expected responses (Fisher's exact test, $p = 0.039$).

Awareness of the BirdLife International's IBA Program

Almost 43% of the 534 birders responding to this question stated that they were familiar with the BirdLife International IBA program. A further 21% were uncertain if they were familiar with the program and 36% were unfamiliar with the IBA program (Table 3).

More males were familiar with the IBA program than females ($\chi^2 = 20.276$, $df = 2$, $p < 0.01$), with similar proportions expressing uncertainty about their IBA awareness.

Table 3 Level of familiarity with the IBA* program among respondents.

IBA Familiarity	Yes <i>n</i> (%)	No <i>n</i> (%)	Uncertain <i>n</i> (%)	Pearson's Chi Square Results
All (<i>n</i> = 534)	229 (42.9%)	193 (36.1%)	112 (21%)	
Sex	obs/exp	obs/exp	obs/exp	$\chi^2 = 20.276$, $df = 2$, $p < 0.01$
Male (<i>n</i> = 351)	174/151	107/127	70/74	
Female (<i>n</i> = 183)	55/79	86/66	42/38	
Age group	obs/exp	obs/exp	obs/exp	$\chi^2 = 26.246$, $df = 4$, $p < 0.01$
up to 30 (<i>n</i> = 79)	34/34	19/29	26/17	
31-60 (<i>n</i> = 270)	129/116	83/98	58/57	
61 and over (<i>n</i> = 185)	66/79	91/67	28/39	
Country of residence	obs/exp	obs/exp	obs/exp	$\chi^2 = 70.257$ $df = 8$, $p < 0.01$
Australia (<i>n</i> = 204)	58/88	109/74	37/43	
United Kingdom (<i>n</i> = 143)	58/61	45/52	40/30	
United States (<i>n</i> = 86)	41/37	25/31	30/18	
South Africa (<i>n</i> = 49)	38/21	4/18	7/10	
Other (<i>n</i> = 52)	34/22	10/19	8/11	
Highest level of education completed	obs/exp	obs/exp	obs/exp	$\chi^2 = 12.686$, $df = 6$, $p = 0.048$
Primary (<i>n</i> = 18)	3/8	11/7	4/4	
Secondary (<i>n</i> = 60)	22/26	29/22	9/13	
Technical/Vocational (<i>n</i> = 36)	19/20	14/17	13/10	
Tertiary (<i>n</i> = 410)	185/176	139/148	86/86	

* IBA = Important Bird and Biodiversity Area

Birders in the age groups ≤ 30 and 31-60 had the highest rates of familiarity with the IBA program ($\chi^2 = 26.246$, $df = 4$, $p < 0.01$) (Table 3). Despite having higher rates of familiarity respondents in the ≤ 30 group also had high rates of uncertainty about their awareness of the IBA program. More respondents in 61 and over age group stated that they were unfamiliar with the IBA program than those that were familiar.

Australian respondents had the least familiarity with the IBA program (as a proportion of the number of respondents for each country) ($\chi^2 = 70.257$, $df = 8$, $p < 0.01$) (Table 3)

and most South African residents indicated they were familiar with the IBA program (familiar $n = 38$, expected $n = 21$). Respondents from the UK and USA had similar results, with respondents having slightly more familiarity with the IBA program than those unfamiliar or uncertain.

Education appears to have a positive effect on the level of familiarity with the IBA program ($\chi^2 = 12.686$, $df = 6$, $p = 0.048$). Respondents with higher levels of education (both vocational and tertiary) tended to be more familiar with the IBA program (Table 3). Conversely, respondents with primary and secondary school level educations responded more often that they were unfamiliar with the IBA program or were uncertain about their familiarity.

Who should pay for bird conservation?

Generally, birders agree with the statement ‘I believe that birders should make contributions to assist bird conservation when visiting key sites for birds’, with a mean score of 3.98 on a scale of one to five, where five is the strongest level of agreement with the statement (SI4). They also showed agreement with the statement ‘I believe that government should be the main funders of bird conservation’, with a mean score of 3.84.

There was no significant difference between males and females with respect to either statement. Similarly, age had no effect on the level of agreement with government being the main funders of bird conservation. However, younger respondents (≤ 30 years old) were more inclined to agree that birders should make contributions to bird conservation than mature birders (aged 61 and over) ($F = 5.692$, $df = 2$, $p = 0.004$) (Figure 2c, Figure 2d).

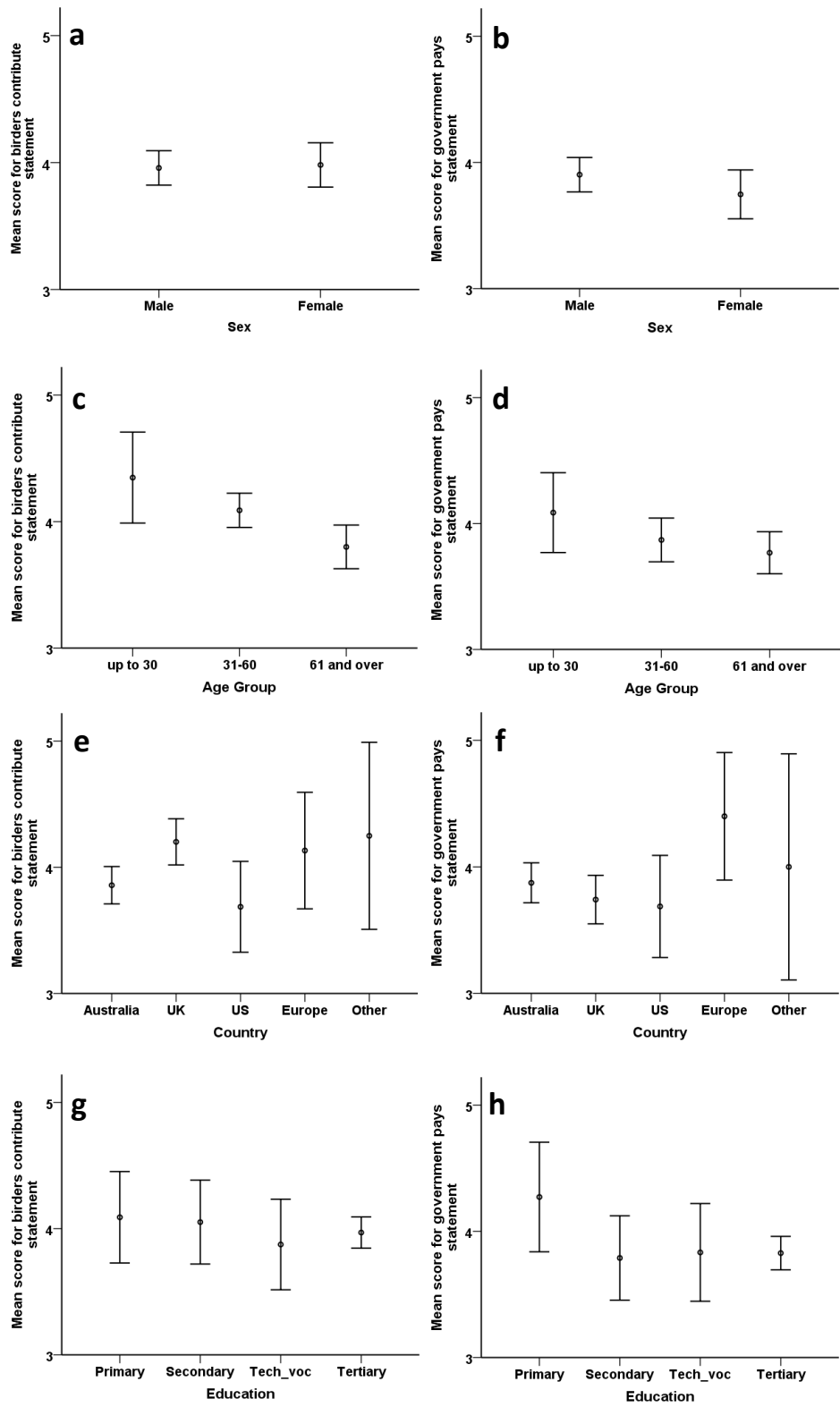


Figure 2 Birders' level of agreement with the two statements; 'I believe that birders should make contributions to assist bird conservation when visiting key sites for birds' and 'I believe that government should be the main funders of bird conservation'. Paired responses are shown for each question respectively grouped by sex (a & b), age group (c & d), country of residence (e & f), and education (g & h).

There was a significant difference between their level of agreement regarding birders contributing to conservation, with the UK showing a higher level of agreement than both Australian and USA birders ($F = 3.271$, $df = 4$, $p = 0.012$) (Figure 2e). There was no geographical variation among birders in their attitudes to governments being the primary funders of bird conservation (Figure 2f). Education level had no significant effect on agreement with either statement (Figure 2g, Figure 2h).

Interest in learning about bird conservation at birding sites

In general, most birders would like to learn more about the conservation of birds at birding sites across Australia (yes; $n = 125$, no; $n = 30$, uncertain; $n = 41$). Australian birders stated they would like to learn about bird conservation more than was expected, while birders from the USA less than expected ($\chi^2 = 19.526$, $df = 8$, $p = 0.012$). There was no significant difference between birders with respect to age ($\chi^2 = 4.585$, $df = 4$, $p = 0.333$), sex ($\chi^2 = 3.658$, $df = 2$, $p = 0.161$) or education (Fisher's exact test $p = 0.504$).

Discussion

Values of bird conservation

Previous assessments of how people value birds have been driven by: species-specific assessments (Brock et al. 2014), threatened bird species valuation among the general public (Zander et al. 2014), or the recreational value of birds (Kaval and Roskrug 2009, Myers et al. 2010, Booth et al. 2011). This paper has extended the current knowledge base by examining the relationship between birders from different socio-demographic groups and their attitudes and knowledge of bird conservation and management issues. We found that, just as birders can be diverse in their experience level and motivations (Hvenegaard 2002, Connell 2009, Glowinski and Moore 2014), there is some significant variation among their attitudes and knowledge of the conservation issues examined here. If birders are to be effective advocates of bird conservation, our findings suggest there is scope for improvement in engagement between them and bird conservation practitioners.

In general, birders express a genuine concern for birds, as demonstrated by their largely eco-centric responses to why bird conservation is important. Understanding birder attitudes to conservation has previously been examined by presenting respondents with statements about conservation and then their assessed levels of agreement with those statements (Green and Jones 2010, Glowinski and Moore 2014). By asking birders about their attitude towards conservation in an open-ended manner we gained a wider assessment of the ways in which people value birds and removed potential bias associated with the provision of set response options. More importantly our approach was able to detect that birders value conservation at a scale beyond birds in isolation. For example, more than half of the birders, across all socio-demographic groups, framed their response to the open-ended question in the broader terms of general biodiversity conservation. The general biodiversity appreciation among birders supports the recent move by BirdLife International to now refer to IBAs as Important Bird and Biodiversity Areas. The role birds can play as flagships for conservation (Veríssimo et al. 2013) and their use as biological indicators of ecosystem health and function (Gregory et al. 2003) provides justification for this shift.

Many birders also recognised bird's roles in ecosystems, demonstrating an appreciation of the complexity of the natural world and the need to conserve species critical to ecosystem function. However, this varied among birders from different countries, age groups and sexes. Australian birders in particular recognised the ecological role that birds play. This could be attributed to the fact that birds are responsible for plant pollination and seed dispersal in Australia, more than any other continent (Ford et al. 1979, Low 2014). Younger birders and female birders were also more likely to recognise the ecological importance of birds in their responses, which is more challenging to explain. We could speculate that a deeper understanding of ecological processes is associated with advancements in education among these groups in recent times.

The more anthropocentric values (e.g. economic, aesthetic and bequest values) were less frequently detected in birders' responses. In fact, economic reasons for bird conservation were the least commonly stated factor. This is important given that the economic argument is often used to promote the benefits of supporting the birding industry (Dickie et al. 2006, Lee et al. 2010, Simango 2011, Li et al. 2013). While the economic potential of the industry has been explored and well documented (Steven et

al. 2014), it is clear that this is not a major factor in how birders themselves value birds. It appears they do not value bird conservation because birds are the basis of a lucrative economic industry. Therefore, arguing for conservation based on economic grounds is unlikely to win more support (financial or political) from the birding population.

Awareness of bird conservation practice: the global IBA network

The temporal implementation of the IBA program in different regions may explain the variation in familiarity among birders. South Africa and the USA had the highest levels of familiarity and these countries began establishing their IBAs in the mid to late 1990s (Barnes 1998, CEC 1999). Australia did not formally establish an IBA network until 2009 (Dutson et al. 2009), thus the lowest levels of familiarity among Australian birders could be explained by this time lag. Despite this lower familiarity, the recent advent of social media and information sharing through digital means has provided opportunities for environmental organisations to inform the public faster than ever before of conservation issues and strategies. Many organisations use such portals for updating members and supporters on topical issues and rallying support for those issues.

Our data clearly demonstrate that birders, by and large, want to learn more about the birds they watch at key sites. Previous research of birders has also found a willingness to pay for educational and interpretive services at birding sites (Green and Jones 2010, Kim et al. 2010, Lee et al. 2010). This is especially the case for Australian birders. So despite having the lowest levels of familiarity with the IBA program, this is exactly the type of issue that Australian birders want to know more about. Signage at birding sites, provision of information on tourist information websites and topical social media campaigns by bird conservation groups are just two ways that this improved education could be initiated (McKay 2007). There is also scope to raise the awareness and promotion of IBAs within the Australian avitourism industry more generally (see Chapter 6).

Birders from the USA were less enthusiastic in their desire to learn more about bird conservation. It is difficult to explain why more than half of the USA birders surveyed in this current study expressed a negative response or uncertainty towards learning more about bird conservation at the site of visitation. One might speculate there is already

adequate availability of such information among American birders (e.g. community groups, magazines, newsletters etc.) and perhaps that birders are becoming fatigued through information overload (Zavaleta et al. 2008). Given the size of the birding population in the USA (i.e. 47 million birders) (Carver 2011), a much deeper examination of this issue is warranted.

Funding and political support of bird conservation

Funding conservation action continues to challenge natural area managers, in both protected and unprotected landscapes (McCarthy et al. 2012, Balmford et al. 2015). Diversified funding sources may provide resilience against economic perturbations for conservation practitioners and alleviate some (but not all) pressures placed on governments (Emerton et al. 2006, Dudley et al. 2014, Eagles 2014). Our findings suggest that birders are in favour of multiple funding sources for bird conservation, including making contributions themselves (see Chapter 5). Birders from the UK and ‘other’ countries showed most agreement with birders contributing to conservation, with American and Australian birders having slightly lower levels of agreement. The debate around entrance fees to protected areas has been active for some time (Buckley 2003, Chung et al. 2011), however it has been demonstrated that tourism revenue does contribute to bird conservation (Steven et al. 2013), as well as for mammals and frogs in protected areas (Buckley et al. 2012, Morrison et al. 2012). Birders should be given the opportunity to contribute to conservation, or perhaps join bird conservation organisations when they visit birding sites. The logistics of this would need to be a collaborative effort between public and private protected area managers and the key bird conservation organisations (e.g. BirdLife branches, RSPB [Royal Society for Protection of Birds, other bird focused NGOs [non-government organisations]). Where bird conservation groups are the land-owners, (e.g. reserves in the UK owned by the RSPB), there are already entry or membership fees imposed to fund conservation works and further land acquisition. These reserves serve as a positive example of what is possible for other land-owners and conservation practitioners.

Despite a generally positive attitude towards their own ability to contribute, birders also felt that government should remain the main funders of conservation. This was, however, not as evident as the willingness for birders to contribute. This could be an

artefact of respondents having less faith in governments to fund the conservation requirements, or it could represent an underestimation by birders of the funding needed to sufficiently conserve birds (McCarthy et al. 2012, Butchart et al. 2015). In the USA, it has been found that birders tend to sit on the right-wing side of politics (Cooper et al. 2015); however, conservative governments have historically placed little priority on funding environmental programs (Neumayer 2004, Jacques et al. 2008). Those birders that feel government should fund conservation may find their views on this topic are contrary to those of the political parties they support. This is especially the case for the countries examined here, most of which are signatories or parties to various international agreements regarding conservation of birds and biodiversity in general (e.g. Ramsar, Aichi Convention on Biological Diversity etc.).

We have found that birders appear to value birds for more eco-centric reasons than anthropocentric reasons. Despite this, it appears that there are opportunities to extend their concern for birds by increasing their knowledge and understanding of practical conservation measures. Our study found that birders are, for the most part, keen to learn more about birds, and are willing to contribute to their conservation. While some birders do, or are inclined to, make contributions to bird or general conservation, we speculate that they may not fully appreciate what their contributions are used for or where more investment is required. Birders may also be unaware how their support of certain political groups may not be consistent with the role they think governments should be playing in the conservation context. We suggest an increased dialogue between birders and the bodies promoting bird conservation. Focusing transparent and effective communication efforts on an already nature-oriented group may yield greater benefits for all parties involved.

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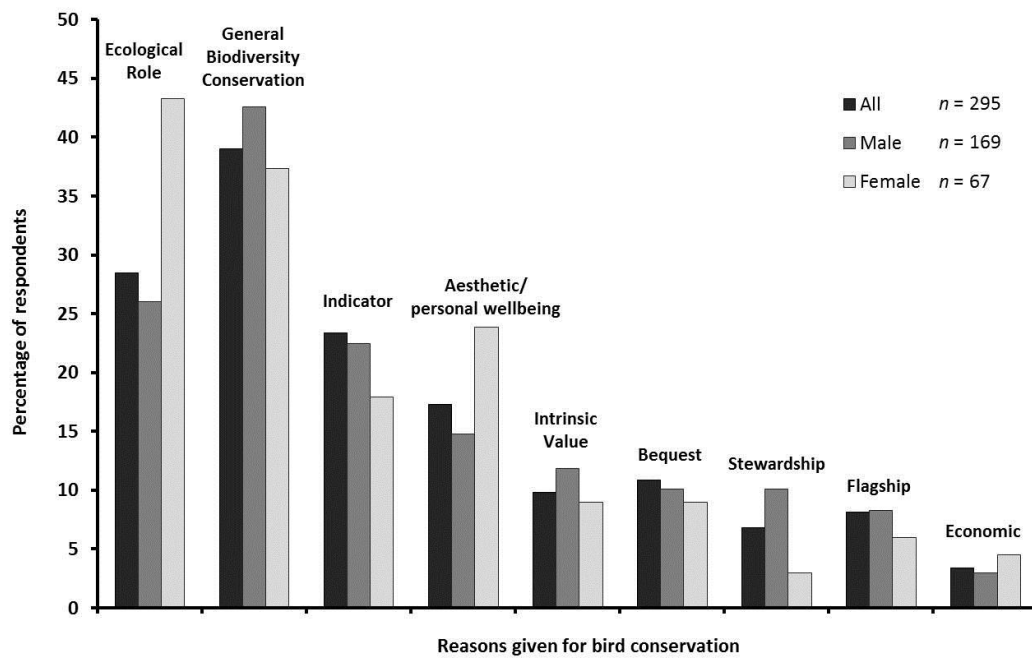
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Appendix S1 – Online distribution channels for survey

Type of channel	Specific companies/organisations
Birdwatching forums	Birdforum.net, Feathers and Photos, Surfbirds, BirdingNZ, Birding UK and Ireland
Social media birdwatching pages (Facebook Pages)	US Bird Watching, Bird Watching Rocks!, Bird Watching in Sri Lanka, Bird Lovers, British Bird Lovers, British Birdwatching Fair, Birding Abroad, Birding, Southern Birding Services, American Birdwatching Association, Birdwatching Ecotours, Amazon Birdwatching, BirdLife South Africa
Birdwatching mailing lists Magazine subscription lists	Various Yahoo mailing lists American Birding Association, BirdLife South Africa, Birdwatching Daily Mag
Bird tour companies	Wingspan Bird Tours, Wings Tours, Limosa Holidays, Sunbird Tours, Rockjumper Tours, Birdquest Tours, Birdwatching Dot Com

Appendix S2 Why bird conservation is important among all respondents ($n = 295$) and provided their sex ($n = 236$)



Appendix S3 – Geographic comparison of bird conservation values, by respondent sex
(*N* = 210)

	All (<i>N</i> = 210)	Australia (<i>n</i> = 68)		UK (<i>n</i> = 48)		USA (<i>n</i> = 47)		South Africa (<i>n</i> = 47)	
		Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
General Biodiversity Conservation	115	38.2	32.4	45.2	50	35.3	61.5	44.1	23.1
Ecological Role	84	32.4	52.9	23.8	50	23.5	46.2	29.4	30.8
Indicator	69	17.6	11.8	23.8	16.7	20.6	23.1	20.6	30.8
Aesthetic/ personal wellbeing	51	14.7	29.4	26.2	16.7	11.8	15.4	8.8	23.1
Bequest	32	17.6	5.9	9.5	0	8.8	7.7	8.8	23.1
Intrinsic	29	5.9	8.8	16.7	0	17.6	15.4	8.8	7.7
Stewardship	20	5.9	0	11.9	16.7	17.6	0	5.9	7.7
Flagship	24	8.8	8.8	9.5	0	11.8	7.7	5.9	7.7
Economic	10	5.9	5.9	0	0	2.9	0	2.9	7.7

Appendix S4 - Birders' level of agreement with the two statements; 'I believe that birders should make contributions to assist bird conservation when visiting key sites for birds' and 'I believe that government should be the main funders of bird conservation'.

BP = Birders pay; GP = Governments pay. Mean calculated by assigning values: 1 to Strongly Disagree, 2 to Disagree, 3 to Not Sure, 4 Agree and 5 to Strongly Agree. The closer the mean is to five the higher the level of birder agreement with the statement.

Region	N	Mean Score		Strongly Disagree		Disagree		Not Sure		Agree		Strongly Agree	
		BP	GP	BP (%)	GP (%)	BP (%)	GP (%)	BP (%)	GP (%)	BP (%)	GP (%)	BP (%)	GP (%)
Australia	127	3.86	3.87	1.6	2.4	6.3	7.1	15.0	11.8	59.1	58.3	18.1	20.5
UK	88	4.19	3.75	2.3	0.0	3.4	12.5	5.7	19.3	50.0	48.9	38.6	19.3
USA	32	3.69	3.69	6.3	3.1	3.1	15.6	21.9	15.6	53.1	40.6	15.6	25.0
Other	24	4.21	4.21	0.0	0.0	0.0	8.3	25.0	12.5	29.2	29.2	45.8	50.0
All respondents	271	3.98	3.84	2.2%	1.5%	4.4%	10%	13.7%	14.8%	52.8%	50.6%	26.9%	23.2%

Chapter 8 – General Discussion

8.1 Introduction

Birding and avitourism have been the focus of many studies globally (Chapter 2 [Steven et al. 2014]). These studies have drawn attention to the nature of birding as a recreational pursuit (Kerlinger 1993; Cordell & Herbert 2002), birder typology (Hvenegaard 2002), and the economic and conservation potential of avitourism development (Biggs et al. 2011; Puhakka et al. 2011; Welford & Barilla 2013). Notwithstanding this research and the self-evident close links between birders and birds, there has been little examination of this relationship in the context of birding practices and conservation specifically.

Using a multi-disciplinary and mixed-methods approach, I have provided insights into this relationship and highlighted opportunities for increasing the involvement of birders in avian conservation. By completing a comprehensive systematic quantitative literature review (Chapter 2 [Steven et al. 2014]) I initially assessed the current depth and breadth of literature relating to the broader field of birdwatching research. Following the literature review, I identified the birding practices, bird types and habitats that appeal to birders of different geographic origins, using an online survey. I then related those findings to opportunities for enhanced conservation outcomes for birds (Chapter 3). I examined bird preferences in the context of a specific geographic region of birding destinations (i.e. the Pacific Islands) (Chapter 4 [Steven 2015]). Bird preferences, in terms of site selection, were also investigated hypothetically using a choice experiment administered via face-to-face surveys (Chapter 5). The choice experiment modelled willingness-to-pay values for sites exhibiting ideal bird assemblages, which can in turn inform conservation managers of prospects for avitourism to fund conservation of key birding sites.

I subsequently assessed the relationship between avitourism tour companies and key bird conservation sites (BirdLife Australia Important Bird and Biodiversity Areas) via a desk-top study that identified scope for increased communication between the stakeholders concerned (Chapter 6). Finally, I investigated birders' attitudes and awareness of issues and programs related specifically to bird conservation (i.e. IBAs) using online and face-to-face surveys (Chapter 7).

The findings from this research provide tangible and practical guidance for growth and management of birding and avitourism as well as opportunities for enhance conservation, globally and in Australia. While not exhaustive, the implications of this research can be illustrated by re-visiting the conceptual model outlined in Chapter 1 (Fig. 8.1). The arrows linking the chapters to model elements highlight potential pathways identified within this study between the relevant stakeholders and mechanisms for conservation.

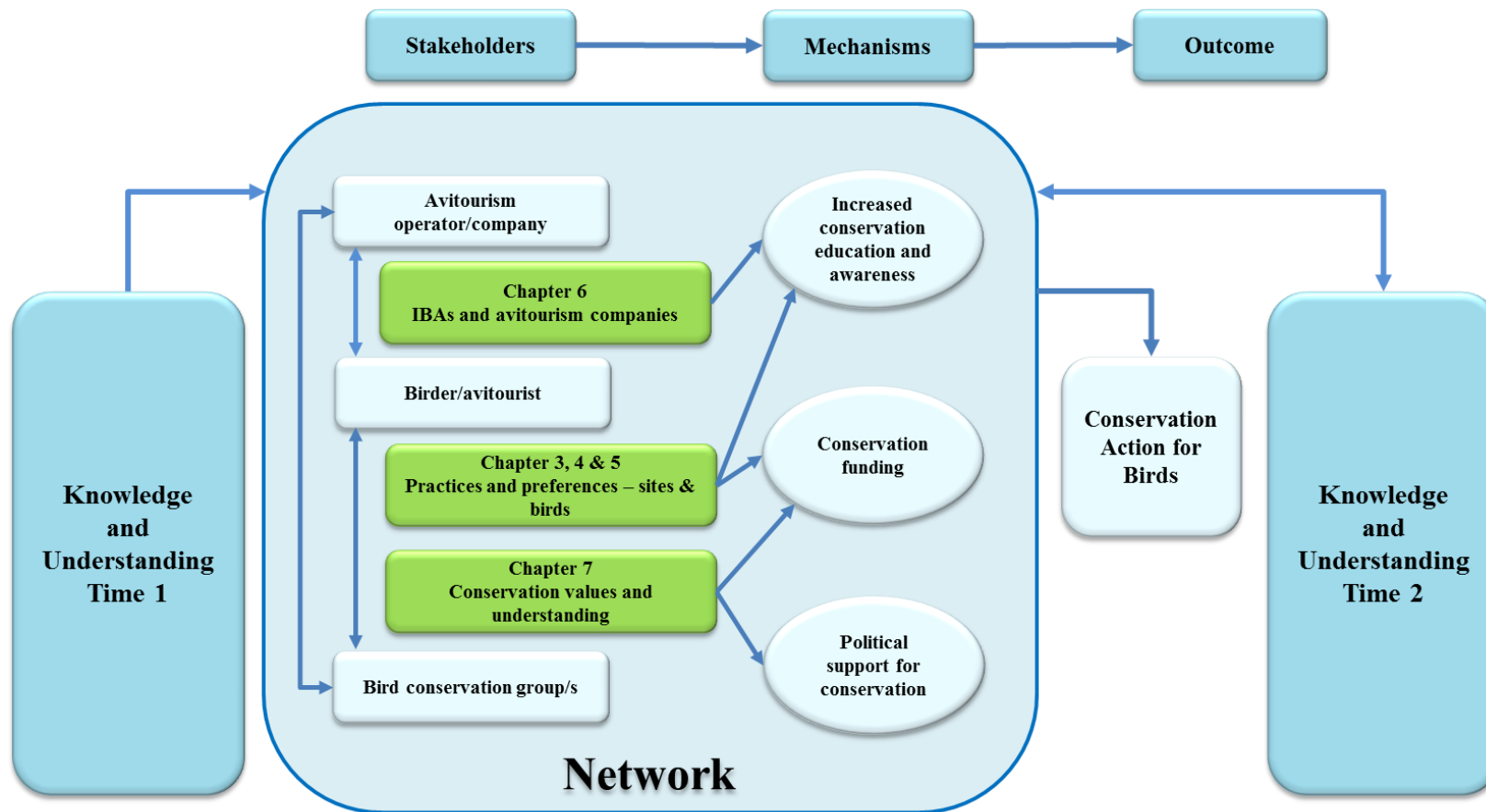


Figure 8.1 Conceptual model, re-visited, with thesis outcomes and linkages to mechanisms of bird conservation. The arrows represent linkage pathways among stakeholders in avitourism and bird conservation and opportunities to enhance conservation outcomes.

8.2 Contribution to knowledge

In this study I have addressed the three research objectives outlined in Chapter 1, using a multi-disciplinary and mixed methods approach. There is a need for integrated research to identify effective and realistic mechanisms and solutions to conservation challenges on a global scale (Ban et al. 2013; Palomo et al. 2014; Armitage et al. 2008). To date the research on birding has been dominated by the social and economic disciplines (Chapter 2 [Steven et al. 2014]). This foundation underpins our understanding of birding in terms of its importance to people, with respect to social interaction and well-being, as well as the benefits birding and avitourism can provide to local economies.

The methods employed here are not dissimilar to those used by social scientists and economists (e.g. surveys [online and face to face] and econometric studies). The findings, however, have been interpreted to broaden our understanding of birding and avitourism with a deeper focus on birds and bird habitats as well as conservation management of birds. In addition to the new information this study has yielded, certain findings reinforce some key patterns previously demonstrated within the literature. For the online and face-to-face survey elements of this research, birders tend to fall into age categories over 45 years old and are highly educated (Sali et al. 2008; Carver 2013; Miller et al. 2014; Chen and Chen 2015). Further, just as Scott and Thigpen (2003) and Eubanks et al. (2004) revealed the diversity of birders in terms of their motivations and commitment to birding, this study finds birders are equally heterogeneous in their preferences for birds, habitats and birding destinations.

To demonstrate how my research has advanced our knowledge and understanding of birders, avitourism and bird conservation, I first review each of my primary research objectives. I then expand on a number of recurring themes that emerged from the study.

8.2.1 Research Objective 1

- Identify the biological and ecological factors that influence birder preferences for birds and birding sites

Birders have previously been classified using sociological typologies demonstrating their heterogeneity in terms of preferences related to recreational specialisation and personal attributes (McFarlane 1994; Lee and Scott 2004; Hvenegaard 2002; Scott et al. 2005; Cole and Scott 1999). The research presented in this thesis highlights the diversity of birders preferences using characteristics more specific to birds and the natural environment. This is the first dedicated appraisal of the biological and ecological attributes of birders' preferences.

Some anticipated results were found in birder preference patterns among certain bird guilds (e.g. raptors, songbirds, endemic species), habitats (e.g. wetlands, coastal regions) and destinations (e.g. islands) (Chapter 3, 4, 5). The patterns observed provide an ideal opportunity for effective engagement and more targeted conservation efforts. For example, as coastal development presents an ongoing threat for many migratory shorebirds (Murray et al. 2014; Amano et al. 2010), raising awareness and support for these birds among birders favouring these habitats can lead to improved conservation outcomes.

Anecdotal and generalist assertions about birders being solely interested in endemic or threatened species, or bird diversity generally are not uncommon. In reality, all of these are true, but not for all birders. Birder typologies may drive bird species preferences but also destination choices (Chapter 4, 5) and can therefore have important implications for rallying support for site-specific conservation (e.g. IBAs, islands, other informal birding sites). Identifying the preferences of birders as stakeholders is the first step towards linking these preferences to conservation actions. Here, acknowledging the interactions and relationships between birds and birders as well as avitourism destinations are important.

8.2.2 Research Objective 2

- Quantify the importance of the Important Bird and Biodiversity Area network in tour companies marketing of avitourism in Australia

Important Bird and Biodiversity Areas (IBAs) are recognised as sites of significant conservation value (Pain et al. 2005; Tushabe et al. 2006). However, it

is unclear whether this recognition (i.e. by conservation NGOs etc.) is mirrored within other sectors of society. This is important as the recognition of such sites is necessary to build support for their ongoing protection.

Despite finding high usage patterns of IBAs (73% of all Australian avitours) by avitourism companies, none mention IBAs in their marketing efforts to birders. This highlights a number of central concerns: (1) that IBAs are not acknowledged or identified as destinations, and (2) that IBAs are under-recognised and potentially undervalued. Conversely, the lack of awareness may actually serve to reduce tourism impacts on birds and their habitats in these sites. This two-sided relationship will need to be mindfully balanced for future conservation benefits to be realised.

Key issues emerging from these results include improving communication among all birding stakeholders to raise awareness about conservation efforts (e.g. IBAs). Chapter 7 demonstrates there is a strong level of intrinsic value for birds, among birders. Furthermore, as seen in Chapter 5, birders place a high economic value on birds. These results therefore suggest that there are opportunities to attract financial support for conservation from avitourism activities, but that these are not currently being explored to their fullest potential.

8.2.3 Research Objective 3

- Gain an understanding of avitourists' attitudes to avian ecology and conservation, with particular reference to the Important Bird and Biodiversity Area program

Birders are one of the important links in the avitourism / bird conservation network (Chapter 3, 4, 5). Their experience could be improved through enhanced communication among all stakeholders. The potential to link avitourism and conservation may depend on avitourist attitudes to conservation generally. Birder familiarity with specific conservation interventions will also affect their willingness to support them.

Birders surveyed in this study value bird conservation in a holistic way, valuing biodiversity conservation highly and recognising the ecological roles that birds play within the environment (i.e. ecocentric over anthropocentric). Despite acknowledging the conservation value of birds, which has also been reported previously (Clucas et al. 2014; Zander et al. 2014); fewer birders were familiar with actual conservation practice, specifically the IBA program. There were also differences in conservation attitudes among birder groups (e.g. males and females) and this could have important implications for how future promotions aimed at generating conservation revenues are administered.

Once again, inefficiencies in communication pathways suggests: (1) that birders are not always receiving the information about bird conservation that resonate with them, (2) that birders would typically appreciate more information about site-specific bird conservation efforts, (3) that contributing to conservation efforts would potentially be greater *in situ* but that these opportunities are generally lacking and (4) that while birders are comfortable in making financial contributions to bird conservation (see Chapter 5), they do feel that governments are should be the main funders of avian conservation efforts.

8.3 Emerging recurrent themes

While completing this research three themes were repeatedly identified as key elements within the birder / avitourism / bird conservation relationship. These relate to the stakeholders involved, communication pathways and placing values on birds and conservation. I expand on these elements by offering practical suggestions for industry and conservation management as well as making recommendations for future research.

8.3.1 Key stakeholders and their interrelations

Stakeholders and their relationship with bird conservation can be considered a network interacting within a social-ecological system, as opposed to independent entities (Palomo et al. 2014; Ban et al. 2013). This concept frames conservation action within social-ecological systems recognising the necessity of incorporating multi-disciplinary approaches into conservation and resource management at

various spatiotemporal scales. This often occurs through analysis of existing relationships between people and the natural environment concerned. Once those relationships are identified and their relative strengths assessed, opportunities to enhance conservation can be identified. The stakeholders that form the central hub for the topics explored in this thesis are the birders, the avitourism companies and the bird conservation groups. These are not necessarily all of the stakeholders involved, with numerous others on the periphery (e.g. governments, traditional owners, other land use practitioners, NRM managers, general tourists etc.). They do however provide a logical starting point for suggesting initial actions to improve conservation outcomes from birding and avitourism.

If bird conservation is to be achieved through birding and avitourism relationships between the relevant stakeholders will require strengthening. For example, many birders interact with avitourism companies (as avitourists), but not all avitourism occurs with facilitation from an avitourism company (i.e. independent avitourists) (DTI 2010). Some birders are members of birding groups and/or bird conservation groups (Green and Jones 2010; Luke 2009; Hvenegaard 2002), yet many are unaware of global conservation programs, such as IBAs. Avitourism companies advertise their services in magazines issued by bird conservation groups or on bird conservation group websites, but these companies do not make mention of these organisations on their own websites.

8.3.2 Communication pathways

Effective communication in the context of environmental education and ecotourism will dictate the success of catalysing pro-conservation behaviours among the general public and tourists alike (Powell and Ham 2008). This is likely to hold true for the network of stakeholders identified in the previous section, which could clearly benefit from more effective communication. The need for accessible, positive and empowering communication is a consistent theme within the literature on effective environmental education (Papworth et al. 2015; McKay 2007; Hunter and Rinner 2004). Fortunately, the areas for improvement identified throughout this research can be framed in a positive light, which would likely result in greater receptiveness among the stakeholders concerned.

Bird conservation groups use marketing, as a key part of their communication strategy, to appeal to their existing and potential supporters (financial and otherwise) (McKay 2007). Catch-phrases can be effective for gaining exposure and increasing familiarity of an organisation among the general public. The RSPB has used catch-phrases to guide their transformation from a specialist to a generalist conservation body. In 2005, they used ‘for birds, for people, for ever’, then in 2009 ‘a million voices for nature’. Now (2015), the RSPB’s ‘giving nature a home’ campaign has assertively encouraged British citizens to tailor their gardens for occupancy by wildlife (including birds). As an organisation initially started for bird conservation, they are now positioning themselves as a general wildlife body, through marketing (RSPB 2005; RSPB 2009). This is a strategic move to build a positive reputation and capture the support of more than just bird lovers. The success of RSPB has been possible through effective and targeted communication selling positive messages to people about the benefits of actively engaging in nature and conservation (RSPB 2005). There is potential for a similar approach by BirdLife (especially Australia), since the evolution of the IBAs from *Important Bird Areas* to *Important Bird and Biodiversity Areas*.

There are benefits for all in the network (birders/avitourists, avitourism companies and bird conservation groups) if communication gaps are addressed. If avitour companies make reference to the IBA network in their marketing, it will add value to those sites in the eyes of a paying avitourist. Simple measures such as avitourism companies sharing information about IBAs is one way to improve information flow and has already received positive support from within the industry (B. Davies, Gondwana Guides, pers. comm, 2015).

It may also be the catalyst for birders to ask themselves ‘What is an IBA?’ and perhaps do some research to learn more about them. At the least this will enhance the awareness of the program among birders; at best it will catalyse increased membership numbers for BirdLife and their respective partners. This then translates into more funding for conservation of birds both in the IBA network and on other lands. Politically, increased awareness among birders and avitourism companies will encourage engagement with the politics around protected and unprotected natural area management (e.g. proposed small and large scale developments, permitted activities in protected areas or degazettement etc.).

Avitourism companies inevitably consider the viability of their business first and foremost. Their advertising and marketing provides them the mechanism to sell the birding experiences they offer. Avitour companies currently do this by focusing on the species and habitats their prospective customers will see (Chapter 6, Castley et al. 2013). Given their reliance on ecosystems that support the birds they need for their business to prosper, there is a benefit to them to facilitate conservation awareness among their customers. One practical way this could be enacted during the birding experience is to keep accurate records of the bird species (and abundances) seen in a given area and sharing these data on an interactive citizen science database (Sullivan et al. 2014; Sullivan et al. 2009). Such databases (e.g. Cornell Institute's 'ebird' and British Trust for Ornithology's 'birdtrack') are often managed and used by bird conservation and research groups. In this situation, all three stakeholders in the network have much closer interaction, fostering a cohesive approach to bird conservation and the avitourism industry. Citizen science is increasingly viewed as a cost effective way to acquire more data about bird distributions. It offers participants the ability to contribute to conservation in a tangible manner, requiring little economic investment on their part. Most importantly, contributing to citizen science is a measurable pro-conservation behaviour and may catalyse increased membership in bird conservation organisations.

8.4 Future research

8.4.1 Threats from birding and avitourism activities

Distinguishing the threats that birding and avitourism activities directly pose to birds from those related to nature-based recreation and tourism is necessary to guide further research. The evidence for general recreation and tourism activities impacts on birds is comprehensive (Steven and Castley 2013; Steven et al. 2011; Buckley 2004). Evidence points to an overall negative effect of recreation and tourism on birds, though this is small relative to other threats such as large-scale land use change (i.e. habitat loss) and introduced species (Steven and Castley 2013). These broad-scale activities tend to have negative impacts on other elements of biodiversity as well (Rankin et al. 2015; Barros et al. 2013; Newsome

et al. 2013), and there are certain birds and habitats across different geographic scales that merit further examination. Some activities, however, are specific to birders and the types of impacts they have on birds.

Firstly, the use of recordings of bird calls to entice birds closer to the observer (sometimes to provide better photographic opportunities), is an activity with poorly quantified impacts. There is some evidence to suggest that this is distressing to birds (Biggs 2013; Harris and Haskell 2013; Green and Jones 2010), though much caution about its use is based on anecdotal information. Without further experimentally derived data to support the hypothesis that it is harmful, its restriction is unlikely to be actively enforced by conservation managers. Multiple species need to be assessed at the localised population level, to determine the severity of this activity and its net effect. Secondly, the use of flash photography is also attracting negative appraisal from some birding groups and researchers (Green and Jones 2010; Birdlife Australia 2012; Ebersole 2015), as this can not only stun birds (especially nocturnal species), but attract attention of predators leaving the photographic subject vulnerable to predation. Finally, intentionally flushing birds from roosting perches or nests to secure good views for identification purposes (Green and Jones 2010) are a specific threat that may only be replicated by other nature-based recreationists by accident and therefore less often.

8.4.2 Social drivers of birding outside USA and the UK

The majority of research examining the social aspects of birding as a pastime has focused on birders in the USA (Chapter 2 [Steven et al. 2014]). There are also birding monographs in the British literature (Oddie 2000; Moss 2004; Oddie 2011), giving an insight into the history and social elements of the hobby in the UK. This deeper approach to understanding the human constructs of birding should also be applied outside of these regions, given the emergence and increasing popularity of birding in other countries and regions (Chen and Chen 2015; Li et al. 2013; Ma et al. 2012; Urfi 2012; Lee et al. 2010; Çakici and Harman 2007). This thesis is one of a few studies examining birding with some focus on the Australian context. Given the focus on assessing the conservation elements of avitourism however, it has not delved as deeply into the social

aspects as previous research from the USA. The same could be said for South Africa, with several studies (Biggs et al. 2011; Simango 2011; Conradie and van Zyl 2013) examining the birding and avitourism industry there, but not in the context of social drivers. Given the divergent cultural and historical contexts among nations, it would be erroneous to assume that the same social drivers of birders in the UK and USA apply to all birders globally. This is especially relevant in the light of increased international travel for birding in recent years. A deeper understanding of the social drivers, in conjunction with the type of information collected by this thesis, will comprehensively guide targeted and effective communication of bird conservation issues across different geographic regions.

8.4.3 Understanding and tracking growth in the avitourism industry

The avitourism industry is growing rapidly, and research to track this growth is not keeping pace with the changes. The Asian market (including China and India), is being aggressively targeted as a source of tourists by western nations (Office of Travel and Tourism Industries [USA] 2012; Government of Canada 2011; Tourism Australia 2011, 2012). Within the larger mass tourism market, a proportion of Asian tourists are engaging in birding (Chen and Chen 2015; Ma et al. 2012; Urfi 2012; Li et al. 2013), or more commonly, bird photography. This presents a substantial economic opportunity for the industry. However, as previously noted, tourism is not without its challenges in terms of managing environmental impacts including the specific activities related to avitourism. Asian countries are diverse in their cultural profiles, with diverse motivations and value systems within and between countries, especially where environmental conservation is concerned (Gratwicke et al. 2008; Karanth et al. 2008). This variation in value systems among avitourists from different countries should be explored more deeply and considered when promoting growth in the avitourism industry. Beyond the traditional Anglophone source countries for avitourists, little is known about emerging source markets, or the nature of the avitourism product demand.

Avitourists travel independently as well as part of organised tours (DTI 2010). The diverse way that avitourists plan and execute their travel activities makes

tracking their numbers and demographics challenging at any given destination. Governments and their corresponding tourism agencies often survey departing international tourists to gather data about their tourism activities. For example, specific activities explored in Australian exit surveys include (but are not limited to): visiting zoos, whale-watching, visiting national parks and theme parks. Birding cannot be estimated from entry numbers to parks and boat trips, thus it is necessary to ask tourists directly to gauge numbers. Adding birdwatching (or birding) as a specific activity to exit surveys in departure lounges is recommended.

8.5 Conclusion

This thesis has contributed to the growing body of research on birding and its related activities addressing several gaps identified in the literature. Research here has demonstrated the usefulness and advantages of using multi-disciplinary methods to address questions related to human-wildlife interactions and conservation. Key findings include: assessing the types of birds and habitats that appeal to birders, the bird attributes that make potential birding sites attractive, the relationship between avitourism activities and IBAs and the value birders place on different types of birds and their understanding of bird conservation.

Multiple opportunities to increase the communication between the key stakeholders exist, which will yield greater benefits for bird conservation. First steps include addressing the communication weaknesses in the network of stakeholders identified here. The largely positive nature of the potential relationship between birding and conservation ensures prospects for success are promising.

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9.0 Appendices

Appendix 1: Griffith University policy for the submission of PhD theses as a series of published and unpublished papers. Available online: <http://www.griffith.edu.au/higher-degrees-research/current-research-students/thesis/preparation/thesis-as-a-series-of-published-unpublished-papers>, accessed 17th June 2015.








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This information is not relevant to those students enrolled in the PhD by Publication program, 6002. PhD by Publication students should refer to the program specific thesis formatting information.

HDR Candidates may organise their thesis as a series of papers. This thesis format may include one or more papers that have been prepared, submitted, or accepted for publication. A Doctoral or MPhil thesis prepared in this way is not a different degree. There are several advantages to organising a thesis in this way:

- » Preparing papers for publication saves time when preparing the thesis for examination as papers may make up one, or several, chapters within the thesis.
- » It is to your advantage to publish work from your thesis as a means of disseminating your research, and developing your writing skills.
- » It may improve the quality of your thesis as part of your thesis has already been subjected to peer review.
- » Examiners may have more confidence in your thesis if they can see that you have already published your research. In addition, you will have already met one of the criteria of examination, with the thesis suitable for publication.

In addition, as a candidature requirement all doctoral candidates are expected to have at least one peer reviewed output accepted for **publication during candidature**. Whilst not compulsory, students are encouraged to include this publication in the body of the thesis due to the advantages as outlined above.

Conditions

Requirements for inclusion of papers

A thesis may include published or unpublished papers where such papers have been produced under supervision and during the period of candidature; and where the quality of such papers is appropriate to Doctoral, or MPhil, level research. For the purpose of this requirement, papers are defined as a journal article, conference publication, book or book chapter. Papers which have been rejected by a publisher must not be included unless they have been substantially rewritten to address the reviewers' comments, or have since been accepted for publication.

Overall, the material presented for examination needs to equate to that which would otherwise be presented in the traditional thesis format. This remains a matter of professional judgment for the supervisor and the student.

Extent of student's contribution

The student should normally be principal author (that is, responsible for the intellectual content and the majority of writing of the text) of any work included in the body of the thesis. Where any work has been jointly authored, a signature from the corresponding author is required in order to include the material in the body of the thesis. Co-authored work in which the student was a minor author can only be used and referenced in the way common to any other research publication cited in the thesis.

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If copyright on a publication has been, or will be, assigned to a publisher, permission must be sought to reproduce the work in the thesis and allow for a digital copy to be made available on the institutional repository. This can be requested via the publication agreement with the publisher. Information on how to seek permission is available at:

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136

Publishers

Students should endeavor to publish their research in high quality publications. Students should consult their supervisor for advice on suitable publications specific to their research discipline. In addition, the library provides support and advice to students on choosing a journal. Students are advised to note in particular advice regarding open access journals in order to avoid 'predatory' open access publishers.

- » [Research Guide: Higher degree students - Get Published](#)
- » [Publishing in Open Access journals](#)

Format

General

Consult the [thesis preparation and formatting guidelines](#) for general information about the requirements for formatting the thesis.

Format of papers

A thesis may entirely or partly be composed of papers. Where a thesis is entirely composed of papers, there is no minimum requirement for the number of papers that must be included and is a matter of professional judgment for the supervisor and the student. The papers may be rewritten for the thesis (post-print or pre-print versions); or they can be inserted in their published format, subject to copyright approval as detailed above. A paper may form a single chapter, or several papers may form successive chapters. Passages from papers may be transferred directly or in modified form into one or more of the chapters of the thesis. Students may repaginate the papers to be consistent with the thesis. However, this is at the discretion of the student.

Linking chapters

The thesis must be more than a collection of papers in the following ways. The chapters must be in logical order and strongly linked together. Students who submit a thesis in this format may introduce each new chapter with a foreword which introduces the research and establishes its links to previous chapters. In general, the thesis should include a general introduction which sets out the context of the thesis. The thesis should also include a conclusion which draws together the main findings of the thesis and establishes the significance of the work.

Declarations

All theses that include papers must include [declarations](#) which specify the publication status of the paper(s), your contribution to the paper(s), and the copyright status of the paper(s). The declarations must be signed by the corresponding author (where applicable). If you are the sole author, this still needs to be specified. The declaration will need to be inserted at the beginning of the thesis, and for any co-authored papers, additional declarations will need to be inserted at the beginning of each relevant chapter. You may wish to consult the [declaration requirements for inclusion of papers diagram](#) to ensure that you insert the correct declaration(s) within the thesis. Please note that completion of the declaration(s) does not negate the need to comply with any other University requirement relating to co-authored works as outlined in the [Griffith University Code for the Responsible Conduct of Research](#).

Element requirements

Requirements for submitting a thesis as a series of published or unpublished papers may vary in some Elements. Consult your HDR Convenor for further information.