A SOCIOLOGICAL AND BIOLOGICAL STUDY OF HUMAN-WILDLIFE INTERACTIONS WITHIN THE URBAN EDGE OF JOHANNESBURG

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Declaration

I declare that this Dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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Abstract

Urbanisation transforms habitat for wild animals and increases their interaction with humans as they compete for space and resources. Encounters between humans and wildlife in the City of Johannesburg Municipality (COJ) often end in conflict, more so with species that may be feared or disliked. To improve the nature of interactions between wildlife and people, it is important to understand where wildlife occurs, what kinds of conflicts it is involved in and where, and people's common motivations for how they engage with wildlife. This study aimed to provide a biological and a sociological investigation into the nature and causes of human-wildlife conflict in the City of Johannesburg. I conducted analyses of wildlife sightings reports from a number of different sources, to develop a better understanding of the distribution of wildlife in the municipality, and to determine whether locations of reports were influenced by factors such as land-cover class, proximity to green spaces, or human population density. I conducted similar analyses on reports of human-wildlife conflict incidents to determine whether reported incidents were influenced by the aforementioned factors, as well as by the number of presence records for these locations. I also intended to determine what common types of conflict occurred and where. Spatial analysis of available presence and conflict data suggested that both wildlife presence and conflict incidents were more commonly reported in regions in which certain land-cover classes, such as residential areas with dense trees, are prevalent, and within 1 km of green spaces. To investigate potential underlying socio-demographic influences of human behaviour towards urban wildlife, I conducted surveys of 416 adolescents from three schools in different areas of Johannesburg, and 779 adult urban residents. The surveys were adapted from existing scales and designed to ascertain levels of basic knowledge about wildlife, general attitudes towards wildlife, the types of behaviour respondents are likely to show when encountering wildlife, and ultimately to reveal relationships between these measures. I found that respondents' attitudes towards wildlife were significantly influenced by the extent of their knowledge, however knowledge was shown to have developed as a result of more than just formal education received. I also found that predicted behaviour towards wildlife was predominantly affected by both knowledge levels and attitudes. Demographic variables such as age and gender did influence all three measures but culture was the most significant demographic predictor of knowledge, attitude, and behaviour.

These findings provide an indication that human-wildlife interactions can be effectively improved through developing people's knowledge. However this must be addressed through both formal education and informal cultural teachings to have significant impact, particularly for interactions with animals that have deeply ingrained negative cultural associations, such as owls and bats.

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Table of contents

List of figures

List of tables

Chapter 1. Introduction and literature review

'I can vividly remember driving my Suzuki Jimny over the greens of a golf estate in hot pursuit of a Chacma Baboon that was causing alarm amongst residents of the northern suburbs of Johannesburg. Frantic calls were streaming in about a baboon that the public immediately assumed had escaped from the zoo or other captive facility. The animal had not, however, escaped from captivity, but was most likely a young male who had been kicked out of his troop and was dispersing from the Cradle of Humankind area, eastwards. With the rapid development of Johannesburg, wildlife corridors are disappearing and this poor creature could not seem to find a quieter route to his destination, and landed himself in an office park in Sandton. This is where I found him at around 4pm on a Friday afternoon. Over the next 36 hours, he led me, and a number of others, on a gut-wrenching journey across highways and golf courses, over garden walls and through construction sites and school grounds. Our plan of action was to get him to eat enough fruit laced with sedatives that he was easier to dart and we could safely transfer him to a less populated area. The smell of overripe pawpaw and watermelon still lingers in my car. We lost sight of him on the Saturday night but heard reports the following day that chronicled his progress as he slowly, and thankfully uneventfully, made his way across the south-eastern urban edge of Johannesburg, and hopefully towards a troop that he could call his own.'

Emily Taylor, 2016

Cases like this one are exceptional and most of the time the wildlife in and around Johannesburg is fairly elusive and can continue with its daily activities without incident. That being said, people encounter wildlife in the city every day, increasingly so as urban development displaces animals and forces them to travel in search of suitable habitat, often through urban and suburban areas. While the nature of these encounters varies drastically according to the kind of animal encountered, and in relation to individual people's attitudes towards wildlife in Johannesburg, they do often result in the displacement, injury or death of the animal. When a behaviour of a human or animal has a negative effect on the other,

these interactions are termed “human wildlife conflict” (Redpath *et al.*, 2013). There are few available, comprehensive, up to date datasets of wildlife presence and distribution in the City of Johannesburg (City of Johannesburg, 2009a), and I wanted to understand what wildlife is being encountered where, the nature of these encounters and what motivates people’s responses and behaviours towards wildlife that they come across in the city. Answers to these questions will contribute to the development of mitigation strategies for human-wildlife conflict within cities, as well as improved conservation planning for species that remain within the urban edge of Johannesburg, and are therefore particularly vulnerable to habitat loss and fragmentation, and to persecution, exclusion or extermination by humans.

1.1. Urbanisation and its consequences

There are two basic interpretations of the word ‘urbanisation’; one is the physical movement of people to towns or cities, and the other is the development and change of landscapes to cater to urban land-uses (Asian Disaster Preparedness Center (ADPC), 2003), that has extreme consequences for the local biophysical environment and ecosystems (Gianotti *et al.*, 2016). While urbanisation represents the most salient modification to natural habitats (McDonnell and Hahs, 2015), what is most commonly considered relevant to environmental impact is the density of human inhabitation (the number of people residing in an area and how closely they do so), which neglects to consider the manner in which these people utilise and modify the land, despite this being a significant factor in environmental impact (Kinzig *et al.*, 2005). Urbanisation has been measured quantitatively using units of measurement such as linear distance from a city, human population density, road density or percentage of surface that is impermeable; yet these measurements are not standardised and have been criticised as crude and arbitrary, of little use for comparative studies of cities and their growth patterns, and lacking in their ability to reflect the cultural aspects of urbanisation (Gianotti *et al.*, 2016).

Not only does urbanisation, referring to either interpretation, have transformative effects on the local environment and biodiversity, it also represents the development of alternative conceptions of the environment and reinforces the alienation of humans from wildlife and

the natural environment. Gianotti *et al*. (2016) emphasised the importance of adapting the definitions of 'urban' and 'urbanisation' to include social and cultural elements, such as how people perceive the environment, what they consider to be 'urban' and 'rural', and how this might motivate certain behaviours towards wildlife and green spaces in these different contexts. Without integrating these considerations, it is difficult to make meaningful comparisons between different urban environments, which would help to determine potential aspects of these environments that foster or dampen human-wildlife conflict (Elmqvist *et al.*, 2013; Gianotti *et al.*, 2016).

With the ever-increasing growth of cities and the loss of rural habitat, it has become necessary to integrate cities into conservation efforts. This is particularly so for remaining green spaces and areas inhabited by indigenous wildlife such as insects, birds, and bats that have adapted to living in and around human-made infrastructure. While such adaptations are beneficial in that the animals are able to survive and in many cases thrive in urban settings, their close proximity to people renders them vulnerable to human persecution (Hutson, Michleburgh and Racey, 2001).

The need for holistic urban conservation initiatives is not only to conserve urban wildlife and habitats. It is also to reduce threats posed to biodiversity and broader ecosystems by activities within cities, that support cities, and by the attitudes and apathy of urban residents, members of industry, policy developers and decision makers, who have lost their connection to nature, and the understanding of the vital role it plays ecologically, socially, and economically (Elmqvist *et al.*, 2013; Laidley, 2013). Elmqvist *et al.* (2013) assigned the largest negative impact of urbanisation not to the process itself, or the construction and activities associated with it, but rather to the rural-urban disconnect that ensues. They said that this disconnect has resulted in a system of food production in which the limitations of production, and strain on the environment from high human population densities, are invisible to urban residents. They stressed that disregarding social-ecological perspectives and failing to address this rural-urban disconnect has serious ramifications for policy development and sustainability on a global scale (Elmqvist *et al.*, 2013).

Consequences for biodiversity

There are a number of severe threats to wildlife populations and species diversity in urban areas such as South Africa's Gauteng Province, in which the City of Johannesburg is located. The development of a city, with its road networks, service infrastructure and tall buildings, fragments animal habitats, restricting movement of wildlife between populations and suitable habitats, thus lowering genetic diversity, as well as food availability for many species that rely on particular prey items (McDonnell, Hahs and Breuste, 2009). Alteration to, or destruction of, landscape features and aquatic habitats can have grave ramifications for wildlife refuge areas, foraging sites, as well as the flight paths and feeding patterns of bats and birds. Alterations to human-made structures disturb roosting bats, birds and underground animals, and may lead to young being abandoned and left to starve, which in turn lowers individuals' reproductive potentials (Richter and Weiland, 2012). Other activities that create disturbance include mining and quarrying, sealing of caves and mines, deforestation and groundwater extraction (Hutson, Michleburgh and Racey, 2001). McDonnell and Hahs (2015) described acute impacts of urban activities such as light and noise, birds colliding with windows, buildings and vehicles (Müller *et al.*, 2013), food availability, the direct actions of humans, chronic impacts caused by pollution, habitat loss, the urban heat island effect, and other systemic impacts that have long-term ramifications. Some species are able to overcome these and adapt to persist and even thrive in cities, others will leave the area and some species that are unable to survive the altered conditions or leave will ultimately go locally extinct (McDonnell and Hahs, 2013). The consequences of urban infrastructure and activities, however, are not always negative. Some of the aforementioned activities, such as the construction of buildings or bridges, have provided shelters in which species such as raptors and bats can nest (Müller *et al.*, 2013).

It is necessary to draw attention to the commonly perceived differences between species that occur in urban areas and those that are found only in pristine, natural landscapes. Certainly different species are perceived differently by different people, but there appears to be several species that have adapted extremely well to living in the city and are so common that they are no longer considered wildlife by many, but simply pests that should be controlled rather than conserved (DeStefano and Deblinger, 2005). Urban residents often resort to unnecessarily destructive behaviour to rid themselves of these animals, and many

species of urban wildlife are deliberately persecuted through indirect or direct poisoning, exclusion, or for use in traditional medicine and food (DeStefano and Deblinger, 2005; Morzillo and Mertig, 2011).

Consequences for humans

Humans can also find themselves in vulnerable positions when they come into contact with potentially dangerous animals, or are exposed to wildlife carriers of disease (Dickman, 2010), but there are also a multitude of less obvious consequences of the physical transformation of ecosystems for humans. The services lost through such transformation are discussed in more detail in the next section but, in short, urbanisation contributes significantly to the vulnerability of humans and wildlife to natural disasters. The modification of natural ecosystems reduces landscape resilience to extreme weather events due to the lack of vegetation and soil to absorb rainwater. The high density of people living in cities also makes more people vulnerable to localised events such as floods and droughts, that are said to be twice as severe as a result of the higher temperatures prevalent in urban areas, and the lack of vegetation and wetlands (Schaffler, 2011).

1.2. The role of biodiversity in urban areas

There are considerations other than environmental disturbance and injustice that need to be taken into account for the protection of humans and wildlife. Other, more subtle ramifications of the exploitation of natural resources and the pollution of the earth cannot be ignored. Plants and animals provide essential ecosystem services in both rural and urban environments, experienced by humans both directly and indirectly, and also play a significant role in socio-economic development (Secretariat of the Convention on Biological Diversity, 2009). While the linkages between biodiversity and human health, economic development, and poverty alleviation are often not immediately clear to the public, there is substantial evidence that they are strong and relevant (Secretariat of the Convention on Biological Diversity, 2009). In an urban setting, one insectivorous bat, for example, can consume 50–70% of its body weight in insects in one night (Hutson, Michleburgh and Racey,

2001), and this makes significant economic as well as human health contributions. Fruit bats, a multitude of bird species, and a large number of invertebrates such as bees, contribute to the pollination and seed dispersal of many plants, and therefore are integral to the plant biodiversity in any area.

Benefits of presence and diversity of wildlife to human well-being span across various use categories. Wildlife and ecosystems contribute to provisioning services in the forms of food and water, regulating services such as natural management of floods, droughts and other natural disasters, supporting services through soil formation, nutrient cycling and water filtration, as well as cultural services through providing physical space and content for recreational, spiritual and religious activities (Strategic Environmental Focus (Pty) Ltd 2002; Schaffler 2011). The list of benefits is long and growing daily as we discover more about the critical ways in which wildlife contributes to the current human way of life.

1.3. Local context: Johannesburg

The City of Johannesburg is situated in Gauteng Province, the smallest of South Africa's nine provinces. Gauteng is the country's economic capital, contributing 36% of South Africa's Gross Domestic Product (GDP) and 10% of the total GDP for the African continent, and is home to 24% of the country's population (13.2 million people). The City of Johannesburg is home to 36% of Gauteng residents (4.4 million people), more than any of the other municipalities within the province (Gauteng Provincial Government, 2016). According to the most recent census in 2011, 76.4% of Johannesburg residents were Black African, 12.3% White, 5.6% Coloured, and 4.9% Indian/Asian (StatsSA, 2011). These numbers will have changed over the past five years, however there is no updated, official, dataset available.

For the purpose of this study, the COJ refers to the City of Johannesburg Municipality, one of ten municipalities in Gauteng. The Greater Johannesburg Area includes the COJ, but also Ekurhuleni and West Rand municipalities. 'Johannesburg' officially refers to an area within the COJ that encompasses a number of suburbs in the central and eastern areas of the municipality (Figure 1.1; (City of Johannesburg, 2016).

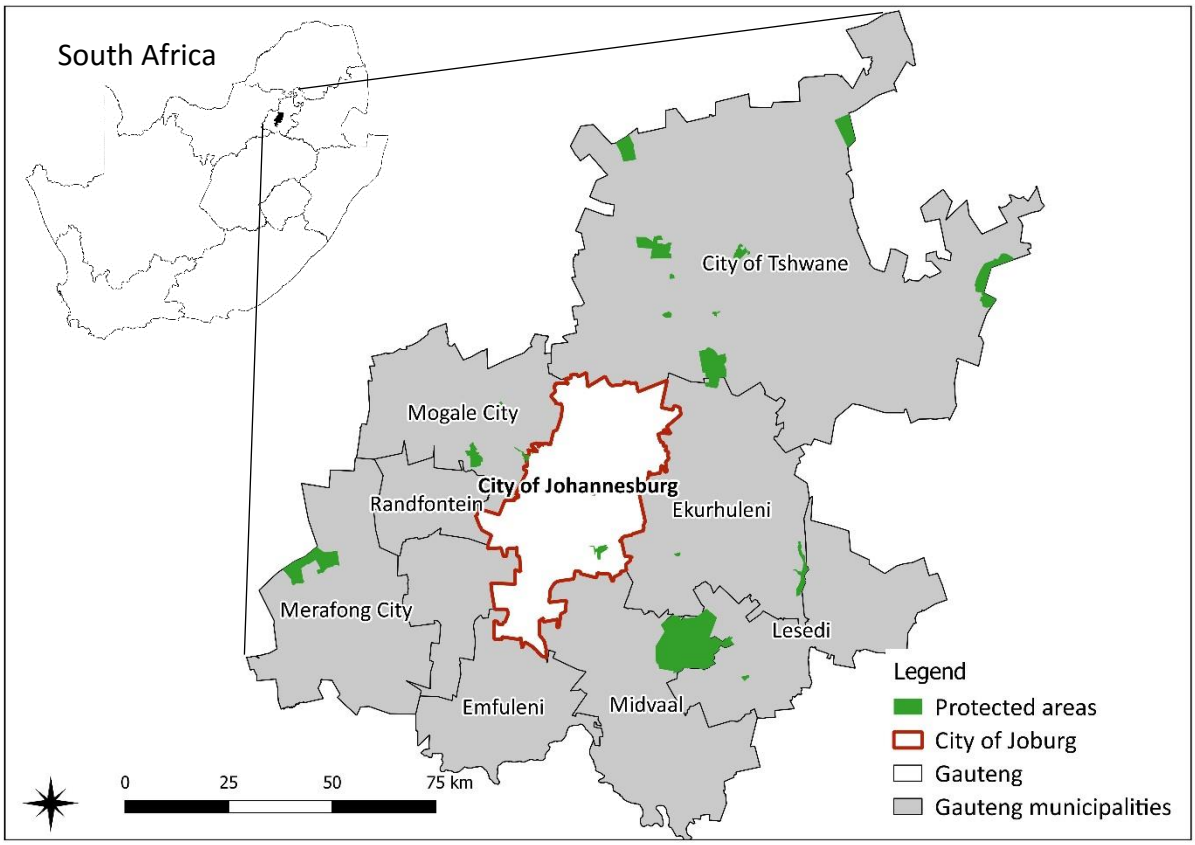


Figure 1.1: Project Study Area (Environomics, 2014)

The current spatial layout of the City of Johannesburg consists of a primary central business district (CBD), and several secondary business districts, all surrounded by medium density suburban zones and low-density residential zones, with the majority of high-density residential areas on the outskirts of these zones, not in close proximity to the business districts. The primary objective of the City of Johannesburg Spatial Development Framework (SDF) 2040 was to address the spatial inequalities that resulted from apartheid spatial policies that were in place roughly between 1948 and 1994. The current spatial pattern in the COJ is such that employment opportunities are not situated close to high-density residential areas, in which most of the population resides, and there is insufficient transport infrastructure to alleviate this spatial disconnect (City of Johannesburg, 2016). The vision of the SDF is to transform the COJ according to a Polycentric City Model, in which a strong primary metropolitan core and a number of secondary metropolitan cores are surrounded by high-density residential areas, in turn surrounded by medium-density and then low-density residential areas, all linked by an effective public transport network (City of Johannesburg, 2016).

The justifiable prioritisation of addressing the spatial inequalities in the COJ has resulted in the rapid loss of open spaces to the development of housing and infrastructure, and placed more strain on the already fragmented open space network in the municipality (Strategic Environmental Focus, 2002). However, the historic development pattern of the city has resulted in a different kind of urban green system in the form of suburban areas that have large gardens and tree-lined streets, which support a surprising amount of biodiversity (City of Johannesburg, 2009b). While much of these areas is dominated by exotic vegetation, urban biodiversity has adapted to exploit these habitats and their proximity to humans. For example, many of the large *Eucalyptus* trees that were planted throughout the city to ameliorate the effects of dust from the mines, are now commonly home to raptors such as owls that, without these trees, would not have persisted in the city and would not provide valuable services such as rodent control (Schaffler, 2011). Johannesburg is known throughout the world as one of the largest man-made forests and, while the area was originally grassland and these green spaces are not considered natural by ecologists, the trees and gardens provide a number of vital services for indigenous biodiversity and people in Johannesburg. What might be equally important is that these spaces and habitats at least provide an element of the natural, albeit an exotic natural, and suburban residents value them for the birds they bring, the cooling effect they have, the shade they provide, and the inexplicable and immeasurable feeling of calm and well-being they bring to many (Goddard, Dougill and Benton, 2010; Taylor and Hochuli, 2015). Large suburban gardens and parks also act as stepping-stones, linking larger green spaces and protected areas, allowing for better connectivity for wildlife populations (Goddard, Dougill and Benton, 2010). These spaces and their functions are explored further in Chapter 2.

As the financial capital of the country, Johannesburg is seen as the land of opportunity for better livelihoods and public services, and immigration from other areas of South Africa and Africa is constant and increasing (Turok, 2012). This increasing population density, and the plans for densification outlined in the SDF 2040, have significant implications for the remaining natural and artificial green spaces and biodiversity in the COJ, and a considered and holistic approach to spatial development is needed now more than ever. Since around 2000 there have been attempts within South African provinces to fill some of the environmental gaps in spatial planning policies, but this has been delayed owing to the lack

of up to date data on biodiversity and open spaces (City of Johannesburg, 2009a).

Two papers by Cilliers & Siebert (2012) and Holmes *et al.* (2012), published as a special edition of the 'Ecology and Society Journal' entitled 'Urban ecological and social-ecological research in the City of Cape Town', gave a brief overview of the development of urban ecology as a discipline in Cape Town, and how this process differed in other cities, including Durban, Potchefstroom, Bloemfontein and Pretoria. Cape Town differs from other major cities in South Africa because it is the only one that contains a national park (Table Mountain National Park) (Cilliers and Siebert, 2012), and is a global biodiversity hotspot (ICLEI, 2012), dependent on its natural assets and biodiversity for the income they generate through tourism (Cilliers and Siebert, 2012). For these reasons, more research and monitoring of biodiversity has been conducted in Cape Town than other large cities in South Africa (Cilliers and Siebert, 2012).

Different South African cities have also taken different approaches towards the study of biodiversity in urban areas. Cape Town authorities, driven primarily by concern with the conservation of the city's biodiversity, embarked on a systematic biodiversity assessment that led to the compilation of the BioNet Plan (2004), updated regularly, that provides established quantitative targets for biodiversity and habitat conservation (Holmes *et al*, 2012). Potchefstroom, smaller in size than many other South African cities, opted for the labour-intensive but thorough and adaptable Urban Biotype Mapping Approach, which resulted in a spatially explicit categorisation of areas, each allocated a score based on a number of criteria, representing the area's worthiness for conservation (Cilliers and Cilliers, 2013). Durban prioritised the protection of ecosystem goods and services (EGS) that open green spaces in cities provide, and focused efforts on open space planning and environmental management, taking an ecosystems-based approach, as opposed to one focussed on species conservation (Cilliers and Siebert, 2012), resulting in the Durban Metropolitan Open Space System (DMOSS). Johannesburg followed suit with the Johannesburg Metropolitan Open Space System (JMOSS) in 2002 (Strategic Environmental Focus (Pty) Ltd, 2002). The International Council for Local Environmental Initiatives (ICLEI) later selected Johannesburg as one of a number of global cities to take part in their Local Action for Biodiversity (LAB) process (City of Johannesburg, 2009a). The LAB process led to the production of a number of deliverables including a biodiversity report and the Local

Biodiversity Strategy and Action Plan (LBSAP). The COJ Draft Biodiversity Assessment and the Biodiversity Strategy and Action Plan were published in 2009 and outlined the status of biodiversity in the city, local and international obligations, guidelines for conservation actions, the action plan itself, and the means of monitoring the implementation and outcomes of the plan. The COJ LBSAP itself stated that data used in the Biodiversity Assessment were not up-to-date and one of the actions of the LBSAP was to perform studies to remedy this and allow for more informed prioritisation of conservation planning and action (City of Johannesburg, 2009a).

1.4. Conceptualising the environment

Throughout history, human beings have predominantly been conceptualised as separate from nature, as superior to and dominant over the 'natural'. Because of this perceived separation, human-populated urban areas have rarely been considered as locations relevant for conservation efforts (Barry, 2007). Social conceptualisations, along with additional factors such as personal experience and external influences, likely form our values and attitudes to the natural environment and wildlife, which in turn may influence our behaviour towards them (Stern and Dietz, 1994; Dearborn and Kark, 2009). However, what do we mean by 'attitudes' and 'values'? Fishbein and Ajzen (1975:6) defined attitudes as '…learned predispositions to respond in a consistently favourable or unfavourable manner', and values were defined by Henning (2002:55) as '…individual and collective concepts with emotional, judgemental and symbolic components that we use to determine what is important, worthwhile, and desirable'. The terms 'value' and 'attitude' are often used interchangeably and are both thought to be affected by a number of external factors such as race, age, sex, culture, religion, socio-economic status, place of residence, etc., and even by country, expressed through its constitution, legislation and enforcement of that legislation (Menon and Lavigne, 2006). Homer and Kahle (1988) hypothesised that 'value orientations', otherwise referred to as 'basic belief patterns', form as a result of the amalgamation of beliefs about a particular subject or object (such as the environment), potentially combined with personal experience or teachings that reinforce these beliefs, and what the ultimate consequences of not adhering to them are believed to be (Homer and Kahle, 1988).

According to Homer and Kahle (1988), values are essentially at the base of this hierarchy, guiding the formation of belief systems and cultural norms, albeit mediated along the way by these additional influences. Many theorists have since agreed that it is a person's values that inform his/her attitudes (Eagly and Chaiken, 1993; Stern and Dietz, 1994; Henning, 2002; Schultz *et al.*, 2004; Menon and Lavigne, 2006). Schultz *et al*. (2004:31) said that 'attitude refers to a person's evaluative judgment about a particular entity', and the construction of environmental attitudes refers to the 'collection of beliefs, affect, and behavioral [*sic*] intentions a person holds regarding environmentally related activities or issues'.

Values are thought to be a result of the socialisation process (Stern and Dietz, 1994). Socialisation refers to '...the process through which people are taught to be proficient members of a society. It describes the ways that people come to understand societal norms and expectations, to accept society's beliefs, and to be aware of societal values' (Little & McGivern, 2013:142). If our socialisation, beliefs and value orientations are significant determining factors in the formation of our attitudes, and in turn our behaviour, we must unravel the social conceptualisation of the environment and of nature by different demographics in the global population. To do this, we must examine the long-term progression of ideas regarding these concepts through periods of significant change in human economic and social orders on an international scale. The meanings behind these two ideas, nature and environment, are essentially contested in that they each hold so many connotations that are manifested in a large and varying number of human beliefs and behaviours. Words, and combinations of words, also have very different meanings amongst different groups and in different languages. For example, Thai Buddhists speaking at a conference on culture and environment explained that the Thai words for 'to conserve' (anurak) and 'nature' (thamachat) imply a much deeper meaning than what is commonly understood by the 'conservation of nature' in English (Swearer 1997; Menon & Lavigne 2006:181). The two words combined, the Buddhists said, translate to 'having at the core of one's very being, the quality of empathetic caring for all things in the world in their natural conditions; that is to say, to care for them as they really are rather than as I might benefit from them or as I might like them to be' (Swearer 1997; Menon & Lavigne 2006:181). The role that language plays in our social development will be explored further a little later in

this chapter.

The relationships people have with the environment occur on multiple planes: physical, social, political, economic, moral, philosophical, cultural and epistemological. Any study of such relationships must therefore be conducted on an inter-disciplinary, multi-faceted and multi-layered basis, and be ever conscious of the dynamic nature of these relationships. Historically, two approaches have dominated the human-environment discourse: the 'naturalist' approach and the 'social constructionist' approach (Barry, 2007). The naturalists that Barry (2007) described considered the environment to be something external to society, existing in a completely separate 'natural order', whereas the 'social constructionist' theorists postulated that environment and nature are concepts constructed by society, as illustrated in cultures and folklore, and to understand them one must analyse internal societal relations. This latter approach has been ratified by those who emphasise that by embedding the environment and nature within human culture, it is more likely to be considered and protected, whereas if these conceptualisations are externalised, they may be perceived as in opposition to human society (Barry, 2007).

A similar pair of approaches is outlined by Bell & Bell (2011) in which 'realists' are said to propose that the natural environment is threatened by the material conditions that we, as humans, create through the ways we physically live our lives. 'Constructionists', on the other hand consider environmental issues, and nature itself, to be notions unique to each individual, depending on the system of social organisation to which s/he belongs, and the ideologies that s/he subscribes to (Bell and Bell, 2012). Dunlap and van Liere (1978) interpreted traditional sociological thinking as the 'Human Exceptionalism Paradigm' (HEP), according to which humans are unique compared to other forms of life on Earth because we develop ideologies and culture and are able to solve complex social and scientific problems, and therefore the capacity for human advancement is limitless. The HEP seems to greatly exaggerate the power of human beings, and Dunlap and van Liere (1978) proposed that our extensive abilities as a species cannot completely overcome the limits of the natural environment to provide us with resources. They offered an alternative to the HEP called the 'New Environmental Paradigm' (NEP) that considers the dependency of human beings on natural resources and marries traditional sociological thinking with ecological perspectives to create a broader framework that considers both the social and the ecological, and how

they impact on one another (Dunlap, 2002). There needs to be a middle ground in which we acknowledge both our biological and social linkages to the natural, as well as the distance (both metaphorical and physical) that we have put between us and other organisms.

The dialogue between schools of thought is heavily impacted by the basic understanding of the terms used when speaking about the non-human world. The root of the word 'environment' is 'environ', which literally means surrounds (Scott and Marshall, 2009), and in urban settings, if this is taken literally, our environment must include not only the natural, untouched areas, but also the man-made structures that fill our cities. This is in contravention of many of the traditional conceptualisations of the environment, yet Dunlap (2002) acknowledged the need to consider the environment to be a unified system of both natural and human elements, as did Bell & Bell (2011:2) who described environmental sociology as 'the study of community in the largest possible sense'. The 'environment' was at one point used to denote those areas of one's country untouched by human development. The 'environment' or 'nature' was also used as the counterpart to 'civilisation', 'progress' and 'growth', and the natural was considered a threat to social order and something that needed to be tamed and controlled (Barry, 2007). Similarly, animals and humans, in many Western societies throughout history, have been considered as separate, with animals only having a place in human society if they were useful and beneficial to people (DeMello, 2012). DeMello (2012) explores the social construction of animals in different places and cultures throughout history. She describes how, in the West, Aristotle, Descartes, Kant and other early philosophers and social theorists stressed the fundamental differences between people and animals, particularly our ability for rational thought, and this was reflected in dominant cultural practices. Many non-western cultures, on the other hand, held very different views, focussed around the similarities between people and animals, and the important and often sacred roles that they play in human society, some considering humans to be just another animal in the same biological and social systems as other animals (Cock, 2007; DeMello, 2012). DeMello (2012) surmised that the turning point for most cultures, when humans placed themselves in a realm above that of animals, was when we domesticated animals and took control of them so that they existed purely to serve us in some way. It seems humans, particularly those cultures with stratified human social systems, have always used systems of classification for animals – according to their

biology, where they live, whether or not they are a part of human culture, whether they are wild or domesticated, edible or inedible, pets or not, whether they have been named and incorporated into our social world and countless other categorisations. 'The Sociozoologic Scale', conceived by Arnold Arluke and Clinton Sanders in 1996, ranks animals on the basis of the benefits they provide to human society (DeMello, 2012). The scale classifies 'good animals', which are beneficial to humans, such as pets, animals we eat or derive food from, laboratory animals, working animals and so on, versus 'bad animals', which are considered vermin and pests and of no use to society. Bad animals resist being used or controlled by humans, and are denigrated and resented for this. Animals that lack charisma, or even those that are not mammals, are easily disliked and dismissed by humans because we find it difficult to feel empathy for them – like insects. These animals are not only treated differently, they also affect humans differently (a person will mourn the loss of a pet far more easily than that of an insect) (Hill, 1993; DeMello, 2012).

Natural resources have historically been considered unlimited by the Western World, whereas those peoples who rely solely on their natural environment for their livelihoods have deeper social and cultural connections with nature, and a greater respect for its limitations. The Zulu tribes of South Africa do not consider nature as belonging to a system apart from that of people, and the Xhosa view nature as 'one community bound together through principles of respect and restraint' (Cock 2007:31). Variations in the interpretations of nature and wildlife, according to Dunlap and van Liere's NEP (1978), are a result of material and social conditions under which communities live. Culture may be a significant component of the social realities that shape our relationships with nature, an example being the Zulu and Xhosa tribes and their view of nature and humans as parts in the same system.

To begin to grapple with the effects culture may have on our relationships with the environment, we must first look at what it is exactly that we mean by 'culture'. A popular definition of the concept of culture was formulated by Edward Tylor (1871). He described 'culture' and 'civilisation' as 'that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society' (Tylor, 1871:1). Culture has also been described as the system that prescribes our societal norms, which are the accepted ways of behaving in particular situations (Haralambos, 1996), and these sometimes differ drastically from society to society. Different

societies will therefore have varying cultural identities, as well as different social relationships to, and valuations of, their natural environments. Prah (2007) described an interdependent relationship between humans and culture, in which we are constantly consciously and unconsciously creating and adapting culture, while at the same time being educated and socialised in cultures, which plays a formative role in the development of our beliefs, habits, values, attitudes, customs, and behaviours. (Prah, 2007). While some cultural groups may conceive the natural environment as part of the same system to which humans belong, people are increasingly moving to urban areas, which exposes them to new cultures and new influences. The process of urbanisation itself has further alienated humans from nature by creating a world in which the link that exists between natural resources and the urban lifestyle is no longer easily visible. Meat is no longer an animal, it is a package in the supermarket, water just comes out of the taps, clean and clear, and vegetables are genetically modified to be as aesthetically pleasing as possible (Barry, 2007).

As urbanisation is associated with positive progress for modern society, so too is science. Many cultural beliefs and assumptions have been challenged by scientific findings, and science has become another major contributor to the conceptualisation of the world around us (Menon and Lavigne, 2006). For example, the line of thinking of animals as separate and lesser to humans was disrupted by Darwin's (1859) presentation of scientific proof that humans are indeed also animals and share similar traits because of a common ancestor. He argued that there was no fundamental difference in our mental abilities, but that humans and animals possess traits on a shared continuum of mental and emotional capacities. This sparked a trend that has seen the conceptual gap between humans and animals slowly but steadily narrowing as contemporary scientists focused on finding similarities between us, rather than differences (DeMello, 2012). In South Africa however, the adoption and integration of scientific findings and concepts into beliefs, attitudes and behaviours was thought by Prah (2007) to be limited by the persistence of English (the language of a minority) as the language of literacy and education. 'Historically, the jump towards expanded knowledge production and reproduction in societies has only been possible when the languages of social majorities have been centrally placed' (Prah, 2007:4). Language shapes how we see the world and our understanding of concepts, and across all cultures, animals are used in all forms of literature and storytelling, particularly children's stories, to

represent social classifications, behaviours, desires, dreams and human characteristics (DeMello, 2012). Certain animals are cast in stories because they are associated with particular human characteristics, often used to teach moral lessons, and these stories then perpetuate these associations in generation after generation (Serpell, 2004; Jenkins, 2006; DeMello, 2012). These associations can be positive or negative, depending on the underlying culture and social context, and can change over time. Doves and pigeons, for example, were for many years used in western literature to represent Aphrodite, the Greek goddess of love, as respected and needed messengers, and as symbols of peace. Now doves and pigeons are considered pests and filthy because they live in cities and eat people's scraps (DeMello, 2012). Because they are now so closely associated with urban environments and have been known to carry disease, they are no longer appealing as beautiful, wild or free.

1.5. Values, attitudes and motivations for behaviour towards the environment: existing theories and research

Socialisation and the formation of values, aversion to perceived dangers, etc., are all said to be evolutionary adaptations to protect us from perceived, and often very real, threats (Stern, 2000). However, these threats are often taken out of context, as not all threats are equally threatening in different places, for different people. To develop a meaningful understanding of human behaviour towards the environment and other animals, we need to examine both attitudinal factors and contextual ones, as well as people's personal capabilities and available resources, and the interactions of all of these variables (Stern, 2000). Stern (2000) stressed the multitude of effects these variables have on each other and on certain behaviours for different people in different situations.

A number of measurement tools have been developed over the years, designed to unravel the motivations behind different types of attitudes, and ultimately behaviour, towards wildlife. The tools were intended to interrogate how particular attitudes towards nature and animals develop, and whether there are distinct variables such as age, gender, or levels of knowledge about animals that play a role in these developments. Studies of the motivational bases behind human attitudes towards wildlife and, more broadly, the natural

environment, have historically been explored using scales such as those listed in Table 1.1 below.

Table 1.1: Examples of scales created to study the motivational bases behind human attitudes towards wildlife and the natural environment

Scale	**Developed by**	**Year**
Ecological Attitude Scale	Maloney and Ward	1973
New Environmental Paradigm (NEP) Scale - later adapted to create the New Ecological Paradigm Scale	Dunlap and Van Liere Dunlap *et al*.	1978 2000
The Pet Attitude Scale	Templer *et al.*	1981
Hertzog's Animal Attitude Scale	Herzog, Betchart and Pittman	1991b
The Implicit Associations Test (IAT)	Greenwald, McGhee and Shwartz	1998
The Motivation Toward the Environment Scale (MTES)	Pelletier *et al.*	1998
The Inclusion of Nature in the Self (INS) Scale	Wesley Schultz	2001
The Attitudes towards the Treatment of Animals Scale (ATTAS)	Henry	2004
The Connectedness to Nature Scale (CNS)	Mayer and Frantz	2004
The Animal-Human Continuity Scale	Templer *et al.*	2006
The Composite Respect for Animals Scale	Randler, Hummel and Prokop	2012

To my knowledge, very few comprehensive studies using these or other scales have been performed on human attitudes towards wildlife, human-wildlife interactions within urban areas of South Africa, or the determinants of behaviour urban residents display towards wildlife. A few studies have touched on motivations for behaviour towards wildlife in South Africa (Minter, 2005; Winter, Esler and Kidd, 2005; Page *et al*>, 2015; Tarrant, Kruger and du

Preez, 2016), but hardly any have involved urban wildlife and, for the most part, we have to look to studies undertaken in other parts of the world to provide some insights into the effect of knowledge and attitudes on behaviour towards urban wildlife.

Kellert and Berry (1980) performed a questionnaire survey of 3,945 Americans and their attitudes towards different animals. Their results showed a strong relationship between attitudes to species and four factors: prior attitude to wildlife and nature, prior experience and knowledge of certain species, utility value or cultural significance held by a species, and the perceptions held by people about species' aesthetic appeal, intelligence and assumed threat. In 1980, Kellert and Berry developed a typology of basic attitude types (Appendix A), intended to describe the values and meanings people associate with the natural world, which provided a means of determining the presence of these specific attitude types amongst different demographic groups, under different conditions, and towards different species or aspects of the natural world (Kellert and Berry, 1980). Their attitude types (Naturalist, humanistic, aesthetic, symbolic, moralistic, scientistic, ecologistic, utilitarian, dominionistic, negativistic, and neutralistic) were based on what one's primary concern or interest was regarding nature or an animal. For example, if someone was primarily interested in the material value of an animal or natural resource, their attitude would be described as 'utilitarian', whereas if their primary concern was for an animal's role in a larger ecosystem, their attitude would be 'ecologistic' (Kellert and Berry, 1987). Subsequently, this typology has been used as a baseline for numerous researchers to follow and expand upon, and these basic attitude types can be recognised, often using different terminology, in many of these studies (Drews, 2002; Serpell, 2004; Prokop, Fancovicova and Kubiatko, 2009; Tarrant, Kruger and du Preez, 2016). The numerous studies Kellert and his colleagues performed over the past three decades have been expanded upon in chapters 3 and 4.

In 1980, van Liere and Dunlap published a review of studies of the social bases of environmental concern. The review consisted of a summation of theoretical explanations provided by these studies, presented as five hypotheses identifying these social bases. The 'age hypothesis' suggested that younger people are more concerned for the environment than older people are, while the 'social class hypothesis' proposed that those people with higher levels of education and income show more concern for the environment and more

pro-environmental behaviour. The ‘residence hypothesis’ proposed that people living in urban areas are more concerned about the environment because they are more familiar with its degradation, and the ‘political ideology hypothesis’ suggested that those with ideologies that are more liberal are more concerned for the environment. The ‘sex hypothesis’ had at that time not been comprehensively explored, and there was little consensus as to whether men or women showed more environmental concern, yet some studies included in the review had reported a distinction one way or the other (Van Liere and Dunlap, 1980).

Hill (1993) examined the historical development of attitude theory and proposed a model that places the origin of attitudes at three motivational bases: instrumental self-interest, empathy/identification and people’s beliefs and values about wildlife species. This tripartite model was interrogated and reinforced through interviews with people who had some kind of existing relationship to animals such as farmers, vets and animal rights activists. Hill (1993) then used the model as a theoretical basis for a survey study involving farmers, animal rights supporters and members of the urban public, and found that animal rights supporters scored highest on empathy and lowest on instrumentality, and farmers the converse. The urban public revealed more ambivalent attitudes, often of the belief that what they felt about animals did not really matter. Many also believed that some animals could be treated with respect, such as pets, and others utilised on a large commercial scale, not recognising the possible inconsistency in their thought processes and behaviours. This reinforces the notion that the urban public is alienated from nature, not only physically but morally and cognitively as well (Hill, 1993).

Fransson and Garling (1999) also performed a brief review of some of the existing attitude scales and theories, to determine the extent to which human behaviour is influenced by environmental concern, and whether such concern is affected by socio-demographic or psychological factors. They noted the distinction made by many attitude theorists between attitude, intention, and behaviour, and described Fishbein and Ajzen's (1975) ‘Theory of Planned Behaviour’ (previously known as the ‘Theory of Reasoned Action’) in which attitudes, formed from beliefs about the expected consequences of certain behaviours, determine intention, and the strength of this intention is the direct cause for a certain behaviour. Homer and Kahle (1988) introduced the discourse around ‘Cognitive Hierarchy

Theory' by describing the roles values and attitudes play in this model of human behaviour. According to the model, there are levels of cognition in which behaviour (at the top of the hierarchy) is determined by 'behavioural intentions', which are in turn influenced by specific attitudes and norms developed as a result of the formation of value orientations (Homer and Kahle, 1988; Sexton and Stewart, 2007). The review by Fransson and Garling (1999) examined how different kinds of value orientations described by various theorists related both to general attitudes as well as to environmental concern. These value orientations included the 'New Environmental Paradigm' (NEP) (Dunlap and Van Liere, 1978), 'anthropocentric altruism', in which one's primary concern is how environmental degradation affects humans, 'self-interest', in which the primary concern is how environmental degradation affects one's self, and the 'ecocentric' value orientation, in which one's primary concern is for the ecosystem as a whole. Fransson and Garling (1999) compared Van Liere and Dunlap's (1980) summation of previous studies of social bases with more recent findings and theory and found that, for the most part, all of the hypotheses were supported, although the relationships between socio-demographic variables such as age and gender have been found to be weaker than Van Liere and Dunlap (1980) suggested (Fransson and Garling, 1999).

Stern (2000) presented a conceptual framework for the 'theory of environmentally significant behaviour' and discussed a number of theories on behavioural change, as well as causal variables that he said were critical to understanding motivations for behaviour and developing models for promoting pro-environmental behaviour (Stern, 2000). Essentially, the paper outlined that personal norms are the primary basis for general predispositions to pro-environmental behaviour, and these norms are activated by personal beliefs about threats to what someone values, and whether a certain behaviour will reduce these threats. This type of behaviour, Stern suggests, can be influenced by providing a person with information that changes the underlying beliefs about threats and consequences. Stern (2000) emphasised that to understand motivation for behaviour, one must consider multiple variables: attitudinal factors such as values, norms and beliefs; contextual factors such as social and cultural influences; legal and regulatory restrictions; infrastructure; resources; monetary incentives and costs; political context; personal capabilities such as levels of knowledge and skill; time; level of authority; and habit or routine, which can be

difficult to break. According to Stern's (2000) theory, different types of environmentally significant behaviour are affected by different combinations of causal variables. For example, the more difficult, time-consuming or expensive a behaviour, the weaker the effect one's attitude might have on whether or not the behaviour is pursued. Context and personal capabilities such as cultural or political influences, and knowledge and resources, can either dilute the effect of attitude effect, or strengthen it.

Bjerke and Østdahl (2004) surveyed over 700 urban residents of Trondheim in Norway to reveal respondents' preferences for some animals over others, the problems they had experienced with any of these animals, the severity of these problems, and the type of animal-oriented activities they engaged in and their motives for doing so. Their results showed that most respondents preferred animals such as small birds, squirrels and hedgehogs to those such as rats, mice or mosquitoes. Their study showed significant effects of gender, age and level of education on animal preferences, and these varied across species (Bjerke and Østdahl, 2004).

Sexton and Stewart (2007) looked at the potential role of wildlife value orientations in predicting an individual's behaviour in interactions with wildlife, as well as how often humans encounter bats in their residences. They found a relationship between wildlife value orientation and support for particular management actions and mitigation measures; those residents with utilitarian leanings were found to be in favour of interventionist management practices, while those that were more protective were more likely to support less interventionist measures. The report also supported Homer and Kahle (1988) and the 'Cognitive Hierarchy Theory', as well as their conclusion that attitudes and beliefs are strongly related to levels of knowledge, and that behaviour is ultimately determined by complex interactions of factors (Sexton & Stewart, 2007).

Batt (2009) suggested a relationship between human attitudes to certain animal species and the respective species' similarity to humans in terms of physical characteristics such as size, weight, lifespan and behavioural similarities in reproductive strategies, parental investment and social organisation. Batt (2009) described her approach as a 'multivariate approach with the aim of providing an objective measure of species' biobehavioural similarity, and to test whether this measure of human-animal similarity influences our preferences for other

species' (Batt, 2009, pp.181). Her study included analyses of recorded perceptions of different species, determined by responses to images, rated on a scale ranging from 'strongly dislike' to 'strongly like'. This research followed the premises established in two ground-breaking studies performed by Kellert (1980), discussed above, and that of Czech, Krausman and Borkhataria (1998). Czech *et al.* (1998) had found similar trends and that people preferred to conserve species that were aesthetically pleasing and least threatening, such as birds. Many subsequent studies produced similar results, although Beatson and Halloran (2007) reported conflicting results in a study of humans and bonobos (*Pan paniscus*), where the similarity between the two caused uneasiness amongst the human participants; they attributed this to the idea that our similarities remind us of our own mortality.

A study by Prokop, Fancovicova, & Kubiatko (2009) sought to examine the fear and disgust elicited by bats amongst adults and children, and the possible motivations for such responses. Their findings supported the hypothesis that higher levels of knowledge contribute to more positive environmental attitudes, and that myth, study specialisation, and gender impact on people's feelings towards bats. In many of the studies encountered, there appears to be a link between feelings towards certain animals such as bats, snakes and spiders, and fear responses. Knight (2008), in agreement with many earlier studies, suggested that these responses might often result from a combination of cultural myths and beliefs, childhood experiences of these animals, as well as aesthetic characteristics. Knight (2008) found that people were more likely to support the protection of an endangered species such as a harp seal (*Pagophilus groenlandicus*) or cougar cub (*Puma concolor*), and not support that of less aesthetically pleasing endangered snakes, bats or spiders.

These studies and others demonstrate the complexity of the relationships we have with, and the feelings we have towards, different kinds of animals. Our perception of and behaviour towards animals are likely influenced by the aesthetic characteristics of an animal (how beautiful or cute, or how scary or ugly it is, as well as how similar it is to humans), how we identify with that animal (Stephen R. Kellert and Berry, 1987; Knight, 2008; Batt, 2009; Prokop, Fancovicova and Kubiatko, 2009), its cultural significance (Serpell, 2004; Menon and Lavigne, 2006; Milfont, Duckitt and Cameron, 2006; Knight, 2008; Prokop, Fancovicova and Kubiatko, 2009; Dickman, 2010; Tarrant, Kruger and du Preez, 2016); how old we are

(Wilson and Kellert, 1993; Prokop and Tunnicliffe, 2008; Barnes, 2013); our gender (Kellert and Berry, 1980; Stephen R. Kellert and Berry, 1987; Herzog, Betchart and Pittman, 1991a; Stern and Dietz, 1994; Bjerke and Østdahl, 2004; Prokop, Fancovicova and Kubiatko, 2009; Barnes, 2013; Tarrant, Kruger and du Preez, 2016), and our levels of knowledge about that animal (Kellert and Berry, 1980; Bjerke and Østdahl, 2004; Sexton and Stewart, 2007; Prokop, Fancovicova and Kubiatko, 2009; Dickman, 2010; Randler, Hummel and Prokop, 2012; Tarrant, Kruger and du Preez, 2016). Studies also suggest that we react to certain animals in a certain way based on the potential cost or benefit of doing so (Kellert and Berry, 1980; Stephen R. Kellert and Berry, 1987; Bjerke and Østdahl, 2004), out of fear, to avoid disease, or because they invoke disgust (Bjerke and Østdahl, 2004; Knight, 2008; Prokop, Fancovicova and Kubiatko, 2009; Randler, Hummel and Prokop, 2012). It follows that people are more likely to respond negatively to these less pleasing, fearsome or disgusting animals when encountering them in the city.

To improve our understanding of human-wildlife interactions in urban areas, we must look at which animals incite certain behaviours, and whether the above factors could potentially act as explanatory variables for these behaviours. We must ask what exacerbates conflict between humans and wildlife in cities. For example, are there mitigating circumstances such as animals making a mess in houses and gardens, making noise, raiding for food, or inciting fear through aggressive behaviour, or do people react in response to cultural beliefs and superstition, disgust, because they are unable to identify with an animal, or because they simply don't know enough about the animal?

1.6. Motivation for this study

A primary source of threat to urban wildlife is the lack of accurate and comprehensive information that is provided to the public, and their resulting, sometimes unfounded, beliefs about certain animals and negative attitudes towards them. Even when the correct information is communicated, it may not be heard or absorbed because our value systems (beliefs and attitudes) may automatically block out or amplify what we hear to fit in with what we expect, desire, value, or have been told to believe (Stern and Dietz, 1994). It is probable that these expectations, and resultant attitudes, shape the way people behave

towards wildlife and the way that they address human-wildlife interactions (Dickman, 2010). There are thousands of depictions of various animals in folklore and mythology throughout the world, and vestiges of rural African cultural systems are still very prominent in South Africa, all coming together in urban Johannesburg. Some well-known superstitions include the association of bats and witchcraft (Ganis, 2005), the presence of an owl as a bad omen (Garbutt, 1909) and the belief that ghosts of our ancestors revisit us in animal form (DeMello, 2012). In Western culture, bats are more than just a bad omen, they were associated with vampires and were believed to prey on humans and drink their blood (Prokop and Tunnicliffe, 2008). Bats are also known to carry diseases such as rabies, and therefore usually evoke disgust (Taylor and Signal, 2005).

Owls on the other hand, have often been depicted in Western literature as a wise animal in children's tales such as the famous Winnie-the-pooh books by Milne (1926). However, there were multiple other associations with owls, ranging from English folklore that recommended raw owl eggs as a cure for alcoholism (Lewis, 2006; Didapper, 2014), epileptic fits, and bad eyesight (Didapper, 2014); to Poland, where the hoot of an owl heard near a house meant that the residents would become ill or die (Lewis, 2012). There are similar beliefs in many African cultures, that by utilising a part of an animal in some way, the powers of that animal will be bestowed upon you (Whiting, Williams and Hibbitts, 2011). For example, it is believed in some cultures that if you eat the brains of a vulture you will be able to see far into the future (Messenger, 2009), or that wearing the scales of a pangolin will protect you as they do the animal to which they belong (Whiting, Williams and Hibbitts, 2011). While early, rural practices of such beliefs were fairly sustainable, urbanisation has brought with it a much larger consumer base and given animal parts a commercial value, and supply can simply no longer meet demand. These beliefs are so entrenched in culture and identities that they are not easily dispelled or forgotten, and trying to contradict them is likely to result in a defensive and counterproductive response (Ganis, 2005).

After perusing available literature, it became clear that a number of studies on people's knowledge of, and attitude towards, urban animals have been done in other countries, but few related to South Africa. Being one of the most culturally diverse, as well as species diverse nations (Everatt, 2013), this is clearly a gaping hole in our knowledge that we must address in order to mitigate interactions that have negative impacts on both humans and on

the animals that may have been displaced by human habitation and development. South Africa has a large socio-economic divide between different demographic groups (Turok, 2014) and a diverse array of cultures that are persistent in their characterisation of certain animals (Tarrant, Kruger and du Preez, 2016). Examining the differences in attitudes and behaviour of these diverse groups could provide a platform from which one could perhaps predict human behaviour patterns, and would be useful when looking to implement effective mitigation measures (Sexton and Stewart, 2007; Dickman, 2010).

Attempting to achieve behavioural change is most effective when addressed using a combination of approaches (moral and educational, incentive-based, and community-based), and remaining cognisant of barriers to behaviour change (Stern, 2000). Many studies have found that, while increased knowledge certainly contributes favourably to public attitudes about the environment and wildlife, everyday decisions and behaviour, and indeed important conservation and urban planning decisions, are based primarily on ethical choices, with scientific evidence playing merely an informative role (Fransson and Garling, 1999; Stern, 2000; Colby J Tanner *et al.*, 2014). Therefore, if we are to attempt to devise ways of improving behaviour towards wildlife, there is a need to understand the underlying motivations behind these behaviours (Hill, 1993; Stern and Dietz, 1994). Motivations for behaviour are dependent on a number of factors including value orientations, attitudes, social, physical, cultural, and political context, personal resources and capabilities, and social and personal norms (Dunlap and van Liere, 1978; Kellert and Berry, 1987; Homer and Kahle, 1988; Eagly and Chaiken, 1993; Stern and Dietz, 1994; Stern, 2000; Henning, 2002; Schultz *et al*, 2004; Menon and Lavigne, 2006). These underlying motivations have been investigated in detail in this study, beginning with how different cultures and physical contexts contribute to different conceptualisations of, and attitudes towards, the natural environment and wildlife.

1.7. Aim and objectives of this study

The aim of this study was to identify the common interactions that occur between humans and wildlife in Johannesburg, and the motivational bases behind human behaviour towards wildlife, to further our understanding of the causes of human-wildlife conflict in the COJ,

and inform future human-wildlife conflict mitigation strategies.

Studies and theories surrounding concepts such as ecosystem services are a major element of the emerging study of social-ecological systems worldwide (Schaffler, 2011), and determining the nature of the relationship between social and environmental discourses will enable researchers and planners to understand how social and ecological issues can be approached in tandem, as opposed to in opposition to each other.

Specific Objectives:

Objective 1: To identify wildlife species that occur in the City of Johannesburg, and where they occur.
Objective 2: To identify those wildlife species that come into frequent contact with humans.
Objective 3: To identify common types of interactions that occur between humans and wildlife, potential drivers of these interactions, and the most common behavioural responses.
Objective 4: (a) To gain an understanding about urban residents' beliefs and attitudes regarding wildlife and (b) to establish possible relationships between social attributes of a group (knowledge, cultural beliefs, socio-economic background) and their behaviour towards urban wildlife.

Research Questions

In order to assess the relationship between people's deep-seated perceptions about different wildlife species and their behaviour towards wildlife in the COJ, there are preliminary questions that must be answered in order to produce the quantitative and qualitative data necessary to begin to unravel the ideas people have about wildlife:

i. What beliefs and attitudes towards different species are most common amongst urban residents?
ii. Are there any blatant knowledge gaps evident in sample groups?
iii. What types of interactions between humans and wildlife are most prevalent in Johannesburg?

iv. To what extent do urban residents' knowledge bases and cultural beliefs influence their attitudes, and reported behaviour, towards wildlife that they may encounter?

1.8. Layout of dissertation

This dissertation is in the form of five chapters, of which chapters 2–4 are written up as research papers. Chapter 1 (this chapter) introduces the motivations for the study and the literature review. Chapter 2 addresses objectives 1, 2 and 3 by introducing the study site and providing an assessment of wildlife presence in the City of Johannesburg, as well as of human-wildlife encounters in the city. Chapters 3 and 4 address objective 4, in which Chapter 3 details a survey conducted in three schools in Johannesburg, intended to provide information about the relationships between the school learners' knowledge, attitudes, and behaviours towards wildlife in Johannesburg, while Chapter 4 presents results from a similar survey conducted among adult residents of Johannesburg. Chapter 5 provides a synthesis of the findings of the previous chapters and a discussion on the relevance of the study to conservation practice in the city going forward. Pages are numbered sequentially throughout the dissertation; however, tables and figures are in sequence within each chapter. A combined reference list and appendices for all chapters are at the end of the dissertation.

Chapter 2. Where the wild things are: using citizen science to investigate the presence of wildlife and the nature of human-wildlife interactions in the City of Johannesburg

2.1. Introduction

Historically, traditional natural scientists have been reluctant to study biodiversity or ecosystems in landscapes influenced by human activity, claiming that these landscapes were not 'natural' and thus would not contribute to the understanding of undisturbed ecosystems and wildlife populations (Miller and Hobbs, 2002; Niemela, Kotze and Yli-pelkonen, 2009). Hence, there are limited data available on biodiversity in and around urban areas all over the world (McDonnell, Hahs and Breuste, 2009; Pickett *et al*, 2012). It is only in the last 30–40 years that the quest for knowledge about urban biodiversity and ecology has gained momentum internationally, as ecologists progressively realised the importance of green spaces and wildlife in cities, and that scientific and behavioural principles applicable to biodiversity and ecosystems in untransformed landscapes do not necessarily apply in urban areas (McDonnell, Hahs and Breuste, 2009). Despite the global acknowledgement that there is a need to develop a comprehensive ecological understanding of cities, the historical lack of data on urban wildlife and ecosystems, as well as the absence of a theoretical framework to guide research into urban ecology, has presented significant obstacles to this cause in the past (Niemela, Kotze and Yli-pelkonen, 2009). Knowledge about urban ecology has increased, however an even better understanding of the status of biodiversity and the functionality of green spaces in cities will enable more comprehensive and holistic conservation planning. Holistic planning is vital to ensure the sustainability and resilience of cities in the face of industrial and residential development (McDonald, Marcotullio and Guneralp, 2013).

Urban ecology research and planning are often heavily influenced by particular characteristics of the physical landscape, such as wetlands and ridges, but also by those of the local, regional or national political and economic climates, and the priorities of city development strategies (McDonnell, Hahs and Breuste, 2009; Cilliers and Siebert, 2012). As

a result, different cities apply different approaches when integrating ecological considerations into their development and conservation plans, making comparisons difficult (Cilliers and Siebert, 2012). Because ecological principles did not feature in much of the initial planning of cities and their densification and expansion, most urban areas around the world share a number of common issues arising from the forced cohabitation of humans and wildlife. These include habitat loss for many species, the proliferation of alien and invasive species that threaten indigenous biodiversity and cause drastic changes to the environment, and explicit human-wildlife conflict, which all present numerous safety risks to both humans and wildlife (Holmes *et al.*, 2012). While these issues may be common to urban and peri-urban areas all over the world, their specific nature can differ greatly from one area to another, depending on the characteristics of the landscape, the species involved, the human communities and their particular historic, cultural and economic realities, and a number of other biological, physical and social determinants (DeStefano and Deblinger, 2005).

The 'rural-urban gradient' is a term used by urban ecologists to describe the increase in human population density and urban infrastructure, and the accompanying decrease in natural wildlife habitat, from the outer areas of cities towards their central business districts and industry hubs (Mckinney, 2002). The rural-urban gradient approach predicts that the less humans intervene in an ecosystem, the more biodiversity that system will be able to support (Niemela, Kotze and Yli-pelkonen, 2009). Most studies of rural-urban gradients appear to support this prediction, revealing significant declines in wildlife abundance towards urban centres, with abundance and diversity increasing in more suburban residential areas and those with city parks, golf courses and other open spaces, and progressively so through the peri-urban zones of smallholdings and undeveloped land (Mckinney, 2002, 2006; Widdows, Ramesh and Downs, 2015). While this model is useful in its prediction that greater intensity of human intervention creates more biotic homogenisation, cities do not always conform to concentric development patterns, but often contain multiple distinct urban cores (Mckinney, 2006). Mckinney (2002; 2006) also emphasised that there are different types of human intervention, having different effects on the landscape, and furthermore that many species have adapted to survive and even exploit certain kinds of anthropogenic land uses. Kinzig *et al.* (2005) investigated not only human

intervention, but also possible impacts the socio-economic composition of urban areas have on the presence and composition of biodiversity in Phoenix, Arizona. The premise of the study was that, when it comes to both presence of wildlife and the nature of relationships between people and wildlife in the city, the predictive and explanatory value of the conventional gradient approach could be augmented through improved understanding of the socio-economic characteristics of people in the landscape (Kinzig *et al.*, 2005). They reasoned that the diversity and nature of existing and created green environments within the cities (reserves, gardens, parks etc.) are based very much on the preferences and needs of local communities and the resources available to them. They found that there were higher numbers of species, particularly birds, in the areas with higher income households, and that economic and cultural factors did seem to play a role in patterns of urban biodiversity (Kinzig *et al.*, 2005). Such findings have implications not only for wildlife but also for these urban communities, as those with less natural spaces and species diversity will not as easily reap health and well-being benefits that accompany green spaces, but will also not develop connections with nature and wildlife in the city, thereby increasing the potential for human-wildlife conflict in these areas.

Since the advent of livestock farming in South Africa, there has been conflict between farmers and carnivores in rural areas, and this has been subject to extensive research and attempts at conflict mitigation (See Anthony, Scott and Antypas, 2010; Skead, 2011; Page *et al.*, 2015). Humans the world over have also come into conflict with a plethora of species that either cause damage to property, pose a threat (real or perceived) to humans and domestic animals, are considered valuable for food, trophy or cultural purposes, or are simply considered a nuisance (Redpath *et al.*, 2013). These conflicts are not confined to rural areas, and are actually likely to be more common in urban areas because of the higher density of people, the extension of cities into wildlife habitat, and the adaptations that animals have developed to exploit proximity to humans, such as nesting in buildings or scavenging on food waste (Mckinney, 2002; Redpath *et al.*, 2013).

As discussed in Chapter One, research on human-wildlife conflict in urban areas and mitigation measures to address it have increased internationally and a number of conservation initiatives have emerged, such as the Wildlife Society's International Urban Wildlife Working Group out of Chicago (est. 1999), the Urban Wildlife Institute in Chicago

(est. 2010), the Nature of Cities founded in New York (est. 2012), the international, collaborative Wild Cities Project (est. 2013), and the international, collaborative Urban Biodiversity Research Coordination Network (UrBioNet), established in 2014. In South Africa, the study of human-wildlife conflicts in urban areas, and the development of effective mitigation techniques for these conflicts, are comparatively novel concepts (Cilliers and Siebert, 2012). However, albeit on a smaller scale and at a slower pace, similar research and conservation action initiatives such as the Township Owl Box Project in Johannesburg in 2000, Human Wildlife Solutions in Cape Town in 2012 and the Urban Caracal Project in Cape Town in 2014, have emerged to address the increasing conflict between wildlife and humans in South African cities. One such example is the extensive academic and practical work performed on the conflict between humans and chacma baboons (*Papio ursinus*) in the Cape. Baboons at Cape Point and other tourism sites have been considered a conflict species for many years, but animosity between baboons and people escalated substantially when the urban edge encroached on baboon territory, and the baboons learned that humans provided a convenient source of food and began to forage in the more populated areas of Cape Town and surrounds (Goodness and Anderson, 2013). In 1998, the Baboon Management Team (BMT) was established to investigate the primary determinants of the conflict between humans and baboons and make recommendations to authorities of possible, practical solutions. A number of academic studies followed (Hoffman and O'Riain, 2011, 2012) and, in 2012, Human Wildlife solutions (mentioned above), was awarded the contract to study and holistically manage the baboon population in order to reduce human-baboon conflicts (City of Cape Town, 2011; Hoffman and O'Riain, 2011; Kaplan *et al.*, 2011; Human Wildlife Solutions, 2018).

In another study of urban and peri-urban wildlife, Widdows and Downs (2015) investigated potential causes behind an increase in sightings of large-spotted genets (*Genetta tigrina*) in the urban areas of eThekwini, KwaZulu-Natal. They used scat analysis to determine the dietary composition of urban genets, with the objective of identifying dietary changes in response to the availability of human food sources such as food waste and domestic pet food. The study revealed that genets were using these food sources, which are low in energy cost, full of nutrients, and readily available throughout the year, particularly in winter when natural prey such as invertebrates are scarce (Widdows and Downs, 2015). The

genets had adapted their feeding behaviour to exploit the urban environment, however, this behaviour also presented new threats to the genets. Widdows and Downs (2015) found a significant amount of indigestible materials such as rubber, plastic and aluminium in the scats, which could cause severe physical injury. Foraging in human waste and eating pet food in close proximity of human habitation also puts the genets in danger of direct conflict with humans and domestic pets, and attacks by domestic animals are one of the most common causes of genet fatalities in the eThekwini area (Widdows and Downs, 2015). There is however still very little published about the presence and behaviour of wildlife in the City of Johannesburg, and the threats it faces from, and those it poses to, humans and domestic pets.

Rarely acknowledged for its biodiversity value, the Gauteng Province, in which the City of Johannesburg (COJ) Municipality is situated, has globally unique biodiversity, second only to the Fynbos Biome in terms of plant species richness (Brownlie and Aros, 2013). A biodiversity assessment of the city conducted in 2009 by the City of Johannesburg described the diversity of wildlife habitat available as a result of plant species richness and a wide variety of geographical and topographical features throughout the municipality (City of Johannesburg, 2009a). However, only 32% of the COJ remains untransformed, providing much less habitat for wildlife than it once did (City of Johannesburg, 2016), and the connectivity between these untransformed areas is being rapidly curtailed by urban sprawl associated with socio-economic and industrial development. This fragmentation has a significant impact on the viability of wildlife populations through the restriction of dispersal potential, which reduces the genetic diversity and subsequent resilience of populations (Tann*er et al*., 2014). Nevertheless, the fragments of untransformed land in the COJ still contain high plant and animal diversity, and are host to species that have developed specific coping mechanisms in order to survive in the altered urban environment, or in fact to exploit it and thrive, and may therefore be found outside their known natural distribution ranges (Mckinney, 2006). As the city grows and densifies, and fragments of habitat are increasingly isolated, many animals adapt to and seek out alternative shelter closer to human activity (Aguayo and Pen, 2005; Ditchkoff, Saalfeld and Gibson, 2006). This ultimately results in more frequent and more variable human-wildlife interactions, both positive and negative (Hadidian, 1991).

In response to an increasing number of animals being displaced or injured as a result of urbanisation and human interaction, a group of concerned residents of Johannesburg opened the FreeMe Wildlife Rehabilitation Centre (hereafter FreeMe) in Paulshof, Johannesburg in 1997 (FreeMe Wildlife Rehabilitation Centre, 2014). FreeMe was a volunteer-based organisation launched to rehabilitate urban and suburban wildlife, as most urban veterinarians did not have the necessary facilities or capabilities to treat wildlife (FreeMe Wildlife Rehabilitation Centre, 2014). Initially the facility received approximately 500–1,000 cases per year, however this figure increased rapidly over the subsequent 19 years and, at its closure in 2016, it was treating over 10,000 cases per year from all over the country. An article published in FreeMe's magazine in 2012 provided a summarised analysis of wildlife admittance and treatment for the years between 1997 and 2011. According to the article, 337 species of indigenous wildlife were treated in FreeMe's first 14 years of operation; 223 bird species, 57 mammal species, 47 reptile species, and eight amphibian species. The reasons for admittance included falling out of nest (36%), cat catch (29%), dog catch (13%), relocation (11%), hit by vehicle (8%), storm (3%) or shot/snared/entangled (0.3%). The article noted that this list was not exhaustive, as there may have been 'hidden' causes such as poisoning or emaciation that rendered an animal susceptible to falling victim to any of the above, and some animals were confiscated as a result of the illegal pet trade. The animals admitted to the centre were rescued from the following regions in the province: Sandton (29%); Randburg (27%); Midrand (6%); Roodepoort (5%); Edenvale (4%); Inner City (3%), Pretoria (3%); Germiston (2%); Benoni (2%); Kempton Park (1%); and Mogale, Boksburg, Alberton, Rustenburg, Soweto, Randfontein, Lenasia, Hartebeespoort, Springs, Brakpan and Magaliesburg (combined <1%). Of the reptiles admitted, 85% were deemed successfully treated and released, as were 75% of mammals, 70% of waterbirds, 54% of birds of prey, and 34% of garden birds (David, 2012). Release rates were highly dependent on the reason for admittance and the severity of the injuries sustained. Another wildlife rehabilitation centre, Friends of Free Wildlife (hereafter FFW), was founded by many of the same volunteers in late 2016 when FreeMe closed down, and has as of 31 March 2017, already treated over 500 cases.

To conserve wildlife in urban Johannesburg and secure the ecosystem services that biodiversity provides, it is necessary to try and determine possible catalysts for negative

human-wildlife interactions. By doing so, we can prioritise areas or situations requiring conflict mitigation or prevention measures. The first step was to ascertain which species occur where, then to determine where humans were coming into contact with wildlife most frequently, and whether there were any identifiable factors that may have been influencing the types of interactions taking place between humans and wildlife in Johannesburg. The highly fragmented nature of the COJ presents challenges to conservation scientists seeking to gather biodiversity data. Criminal elements often make research in open spaces perilous, and researchers experience difficulties accessing areas under private or state ownership (Cilliers and Siebert, 2012). To overcome these challenges, academic, wildlife rehabilitation and conservation organisations such as the University of the Witwatersrand (WITS), FreeMe and the Endangered Wildlife Trust, work closely with the public, encouraging urban residents who are on the ground to be citizen scientists and provide much-needed data to be used for conservation planning and action. Using citizen science as a research tool not only adds enormous value to our knowledge bases and supplements scarce resources, it also contributes to the development of more positive relationships between the citizen scientists and urban wildlife (Asah and Blahna, 2012).

In this chapter, I used data from formal research and conservation organisations, citizen scientists and volunteer groups to address three broad objectives. Firstly, I set out to identify the wildlife species that occur in the COJ, where they have been sighted, and what factors may have influenced this distribution. For the purposes of this study, 'wildlife' refers to terrestrial vertebrates. Secondly, I identified those wildlife species that came into contact with humans. Thirdly, I identified common types of interactions that occur between humans and wildlife, and examined the spatial, biological or social factors underlying these interactions.

2.2. Materials and methods

As detailed in Chapter 1, the study focused on the City of Johannesburg (COJ) Municipality, one of ten municipalities in Gauteng Province, and one of three making up the Greater Johannesburg Area. 'Johannesburg' refers to an area within the COJ that encompasses a number of suburbs in the central and eastern areas of the municipality (City of

Johannesburg, 2012) (Figure 1.1).

Species presence

To determine species presence, I conducted a desktop study of existing biological and ecological assessments of Johannesburg, and provided a summary of the biodiversity presence data to which I had access. I used Quantum GIS (QGIS Development Team, 2016) software to map spatial data records from a number of sources (Table 2.1). I focused only on sightings data from the previous sixteen years (2000–2017), as this was the period with the most accurate available data. Once I had consolidated and standardised all available presence data for the COJ, and removed records from earlier than 2000, I had a total of 918 records (Figure 2.1).

It must be noted that the collection and recording of these data was not consistent and was compiled from *ad hoc* records from a number of different sources (detailed in Table 2.1). Most of the mammal records consisted of hedgehog sightings from a Master's study by Jessica Light (Light, 2015), and I obtained most of the reptile records by monitoring reptile relocations reported in a WhatsApp group of 27 reptile removal specialists in the northern and western suburbs of Johannesburg. I grouped species presence records into their relevant classes (Amphibian/Bird/Mammal/Reptile) and further into antelope species, birds of prey, Columbids (doves and pigeons), frogs/toads, large carnivores, lizards (including geckos, chameleons, monitor lizards), terrestrial birds, water birds, primates, small birds, small mammals (bats, squirrels, rodents, rabbits, genets etc.), snakes and skinks, and testudines (tortoises, turtles and terrapins) (Table 2.2).

Table 2.1: Sources for data used in spatial analysis of species presence and human-wildlife conflict incidents in the City of Johannesburg (2000–2017)

Source of data	**Type of data record**	**Time period**	**Recs used in presence analysis**	**Recs used in conflict analysis**	**Total No. records**
Animal Demography Unit: University of Cape Town (ADU)	Presence	2000–2017	302	0	**302**
Endangered Wildlife Trust: Urban Conservation Programme (UCP)	Presence/conflict	2013–2017	54	18	**54**
Endangered Wildlife Trust: Wildlife and Roads Project (WRP)	Presence/conflict	2005–2017	117	101	**117**
Gauteng Department of Agriculture and Rural Development (GDARD)	Presence	2000–2017	48	0	**48**
Greater Kyalami Conservancy (GEKCO)	Presence	2016–2017	6	0	**6**
I Found a Hedgehog (IFAH)	Presence	2000–2014	290	0	**290**
iSpot	Presence	2013–2017	4	0	**4**
North and West Rand Snake Removal Group	Relocation	2016–2017	66	63	**66**
Private individuals	Presence/conflict	2012–2016	31	17	**31**
FFW	Admittance	2016 (Nov–Dec), 2017 (Jan–Mar)	0	506	**506**
FreeMe	Admittance	2012, 2013, 2015, 2016 (June–Dec).	0	1488	**1488**
Total number of records			918	2193	**2193**

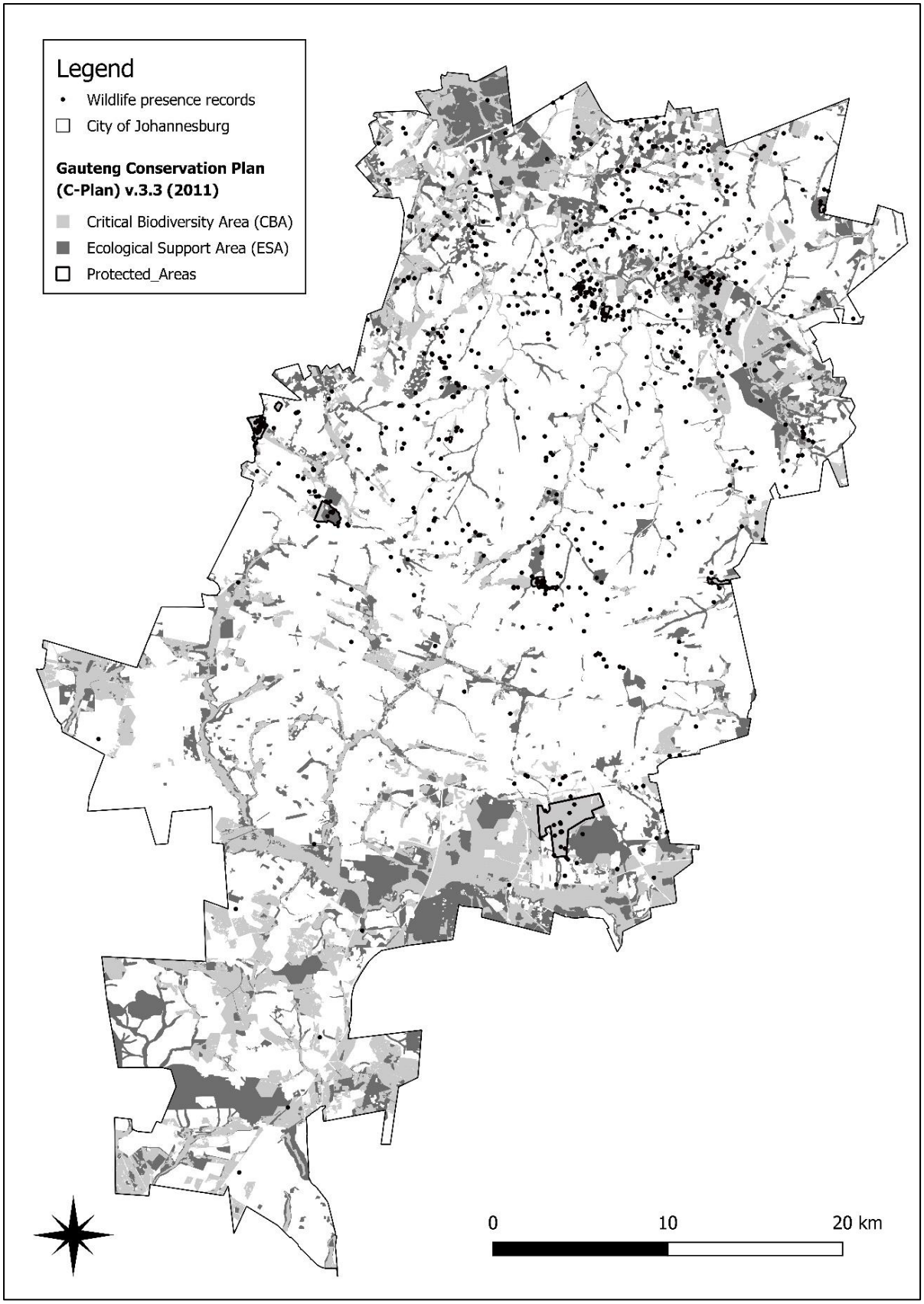


Figure 2.1: Wildlife presence records in relation to green spaces identified by the Gauteng C-Plan (v3.3, 2011) within the City of Johannesburg (2000–2017)

Table 2.2: Number of presence records for animals in Johannesburg, categorised by group.

Class	Group	No. of records	% of total
Amphibians	Frogs/toads	64	7.0%
Birds	Birds of prey	35	3.8%
	Columbids (doves/pigeons)	18	2.0%
	Small birds	21	2.3%
	Terrestrial birds	10	1.1%
	Water birds	4	0.4%
Mammals	Antelope	17	1.9%
	Large carnivores	9	1.0%
	Primates	3	0.3%
	Small mammals	403	43.9%
Reptiles	Lizards	84	9.2%
	Snakes and skinks	232	25.3%
	Testudines	17	1.9%
Unknown	Unknown	1	0.1%
	Total	918	100.0%

(Data sources include: Animal Demography Unit: University of Cape Town (ADU); Endangered Wildlife Trust: Urban Conservation Programme (UCP); Endangered Wildlife Trust: Wildlife and Roads Project (WRP); Gauteng Department of Agriculture and Rural Development (GDARD); Greater Kyalami Conservancy (GEKCO); I Found a Hedgehog (IFAH); iSpot; North and West Rand Snake Removal Group; Private individuals).

For GIS spatial analysis of the sightings data, I overlaid the presence records shapefile onto environmental base layers used to develop the Gauteng C-Plan (GDARD, 2011), which included rivers, wetlands and ridges. I used the QGIS 'extract nodes' function to convert the C-Plan polygons into nodes so that I could measure how far a species sighting occurred from the closest edge of a green space. I then used the 'distance to hub' function to measure the relevant sightings distances from the closest C-Plan Critical Biodiversity Area or Ecological Support Area (hereafter referred to as green spaces). I generated 918 random points (same as number of sightings) within Johannesburg using the 'random points in layer bound' function in QGIS, and used the 'distance to hub' function to calculate the distances of the generated random points from green spaces as well, to determine whether similar distances of sightings to green spaces could be expected from random records. I performed an

independent samples t-test to determine whether there were significant differences between the random point distances and the sightings distances. I then conducted basic statistical analysis on the sightings distance measurements by calculating the average distance of sightings to nodes, the range (minimum and maximum distances) and standard error. I also overlaid the presence shapefile onto administrative base layers such as main areas (hereafter regions) of the City of Johannesburg (Municipal Demarcation Board, 2016), as well as the 2013–14 South African National Land-Cover Dataset (GeoTerraImage 2015).

Using Statitsica 13.3 (© Statsoft, 2017) I ran a Shapiro Wilks test for normality and because the data were not normally distributed, I ran a Generalised Linear Model (GLZ) with Poisson Distribution and Log Link Function, to determine whether there were any significant ($p<0.05$) predictors for wildlife presence reporting. I used region, size of each region (km^2), human population density (people/km^2), and land-cover class as predictor (independent) variables, and reports of wildlife presence as the dependent variable. I ran Spearman's Rank Correlations between number of presence reports in each region to size of the region, and number of reports to human density of each region to determine the nature of the relationships between these variables.

I also tabulated species richness (number of distinct species found) within each land-cover class, and classified these according to the class of animal (amphibians, birds, mammals or reptiles).

Human-wildlife conflicts in the City of Johannesburg

I utilised incident reports from FreeMe and Friends of Free Wildlife (FFW), primarily in the form of wildlife admittance records, to determine common types of human-wildlife conflict and the most common species involved. I also used roadkill reports from the Endangered Wildlife Trust's (EWT) Wildlife and Roads Project (WRP), conflict reports from the EWT's Urban Conservation Programme (UCP), and relocation records from the North and West Rand Snake Removal Group. This analysis included an assessment of the common causes of human-wildlife conflict, and where these were most prevalent.

Not all of FreeMe admittance records were digitised, however I was provided with some

records from 2012, 2013 and 2015. These data included location data for where an animal was found, the date, animal group, species, approximate age, gender, reason for admittance, injury, diagnosis, outcome, release location (where applicable), or reason for death/euthanasia (where applicable). Roadkill records included incidents that occurred between 2005 and 2017, and admittance records from FFW ranged from the time of their opening in late 2016 to end March 2017. It must be noted that these data were biased towards those regions in which people were most likely to report incidents or rescue wildlife, and that conflicts were likely to occur as often, if not more often, in other regions of the city and go unreported.

I analysed the available records to identify where human-wildlife conflict occurred and was reported in Johannesburg, what kinds of conflicts took place, and what species of animals were most commonly involved. I constructed the following pivot tables in Microsoft Excel (Microsoft Corporation, 2016):

i. Count of number of records found in each region;
ii. Count of frequency of different reasons for admittance (incidents);
iii. Count of animal groups involved in incidents.

To identify the proportion of cases that were as a direct result of human action, I divided the reasons for admittance or reporting into four categories:

i. Human intent: the animal was compromised as a result of direct human intent to exploit or harm an animal (whether that animal or another). These reasons included illegal possession/use or trade, hunting or snaring, shooting, persecution and poisoning;
ii. Human induced: the animal was compromised or displaced as a result (directly or indirectly) of human activity and/or presence. Cases under this category included vehicle collision, electrocution, entanglement or contamination, attacks by domestic pets, being found injured in or around human habitation or on the road, and intentional removal or relocation;
iii. Environmental and other: the animal was not compromised by any known human action (cannot exclude the possibility that the situation may have been provoked or exacerbated by human presence). Those cases not included under

the two former categories were considered to be caused by environmental or other factors (injured in storm, attacked by another animal, etc.);

iv. Unknown (no details were provided).

Once categorised, I determined the percentage of cases that resulted from human intent or human presence and activity, as well as the regions of the COJ in which specific types of conflict were most common. I also conducted GIS spatial analysis of the conflict data (QGIS Development Team, 2016) to assess whether there were any underlying variables contributing to the likelihood of conflict, such as human population density or high levels of species presence recorded. Because I only had the general regions in which the incidents occurred and not the GPS locations, I could not conduct as detailed an analysis as for the presence data, such as distance from green spaces or specific land-cover class. However, I was able to run the same Generalised Linear Model with Poisson Distribution and Log Link Function, as with the presence reports, to determine whether there were any significant predictors ($p<0.05$) for conflict incidents. I used region, size of each region (km^2), human population density (people/km^2), land-cover class, and number of presence reports as predictor (independent) variables, and conflict incidents as the dependent variable. I then ran Spearman's Rank Correlations between number of conflict incidents in each region to size of the region, number of incidents to human density of each region, and number of presence reports to number of incidents to determine the nature of the relationships between these variables.

2.3. Results

Species presence

Spatial analysis of the species presence data revealed that the average distances of sightings from green spaces were significantly smaller (185 m vs 242 m, t-test for Independent Samples, $t_1 = 5.1$; $p<0.001$) than those of the randomly generated points (Figure 2.2). On average, animals were reported within very close proximity to green spaces, the minimum distance recorded was 2 m and the maximum distance was 1,213 m (1.2 km). The minimum

distance of random points to green spaces was 1 m and the maximum was 2.4 km.

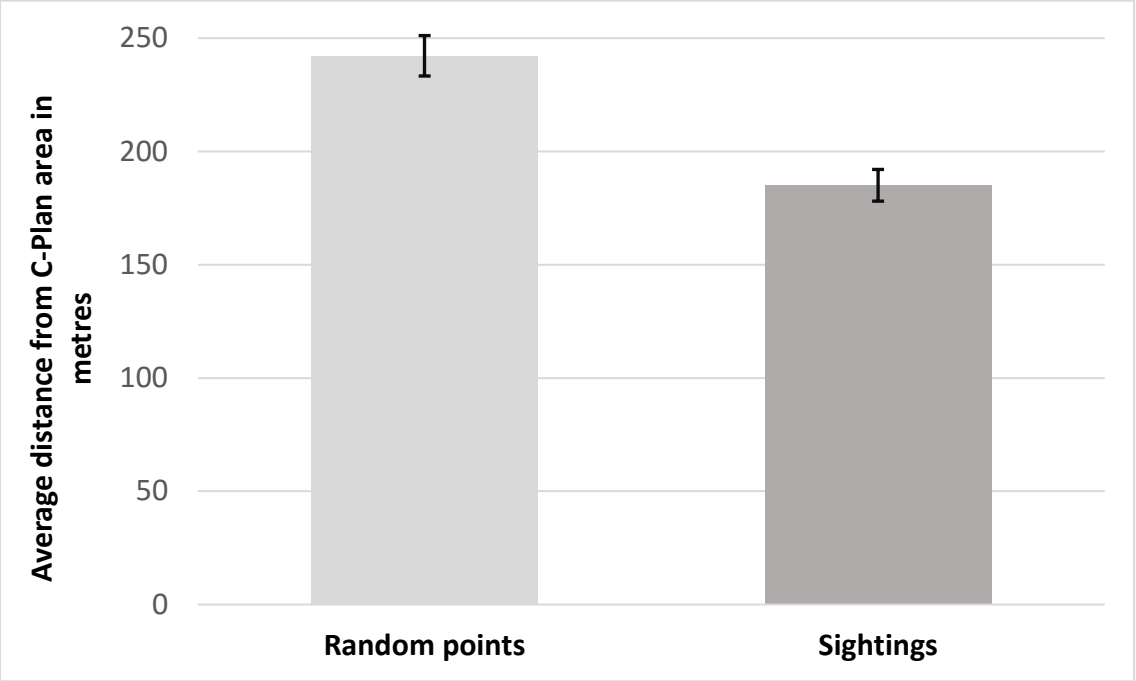


Figure 2.2: Mean distances from random points generated and presence records to green spaces (bars represent SE)

The GLZ results showed that region (*Wald* χ^2 = 499.69; p<0.001), size of region (*Wald* χ^2 = 11.96; p<0.001), and land-cover class (*Wald* χ^2 = 1256.71; p<0.001) were significant predictors of wildlife presence reports, however human population density was not a significant predictor (*Wald* χ^2 = 0.41; p>0.05).

There were significantly more reports of wildlife presence in the northern regions of the COJ (85%) and less (only 15%) in the southern half of the city. The number of presence records received from each region is presented in Figure 2.3 below.

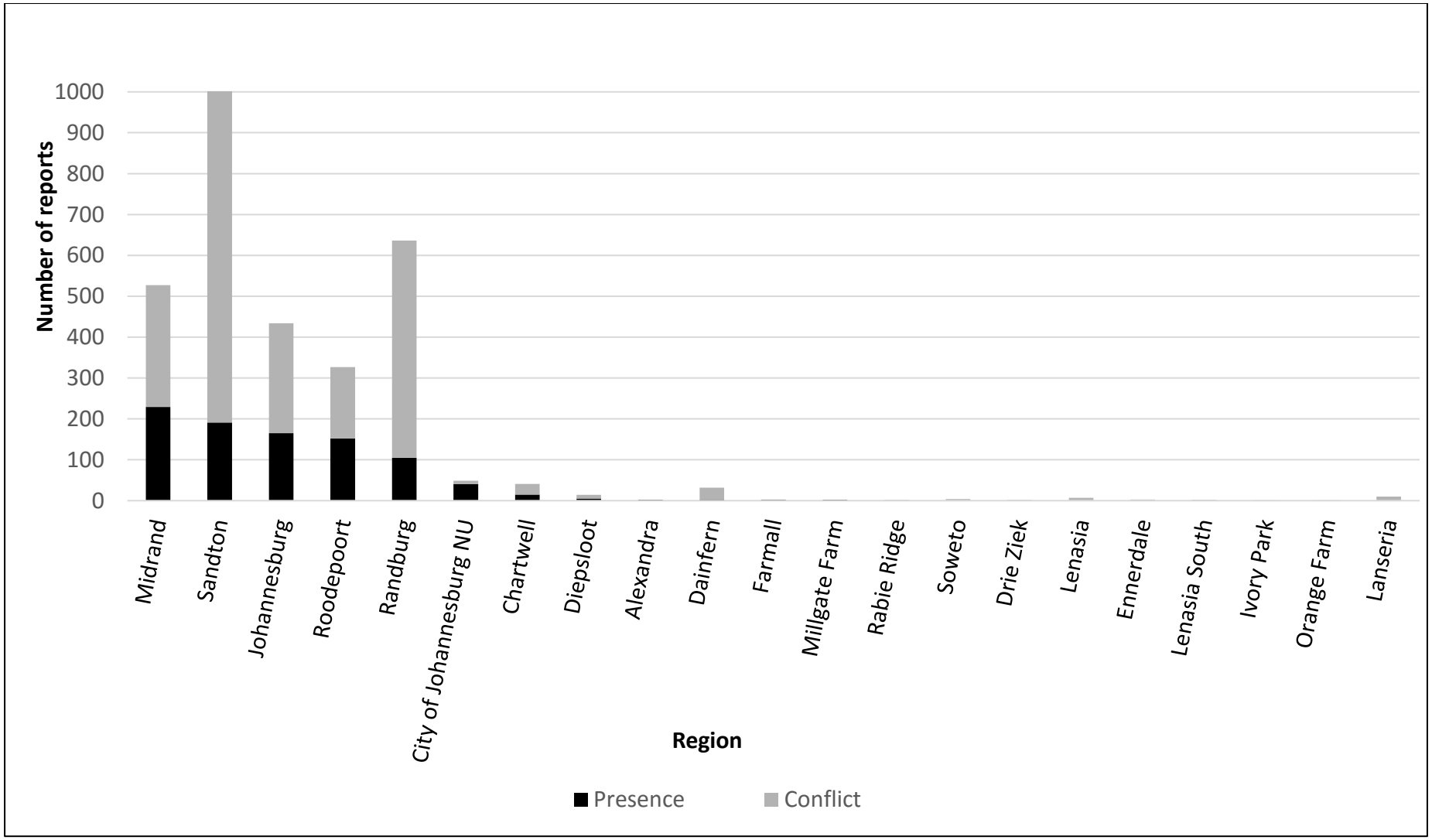


Figure 2.3: Number of presence and conflict incident reports for each region in the City of Johannesburg

Regions with a high number of presence repords included some of the larger regions of the COJ, such as Midrand (229 sightings), Sandton (191) and Roodepoort (152). The Spearman's Rank Correlation Coefficient for number of reports to size of region was 0.72 ($p<0.05$), however while the aforementioned regions are larger than most others, Midrand (153 km^2), Sandton (144 km^2), and Roodepoort (161 km^2) received unexpectedly high numbers of reports in relation to their size (solid round markers in Figure 2.4), while other larger regions such as Soweto (200 km^2) and the non-urbanised regions of the COJ (290 km^2) received only 1 and 40 sightings respectively (solid square markers in Figure 2.4).

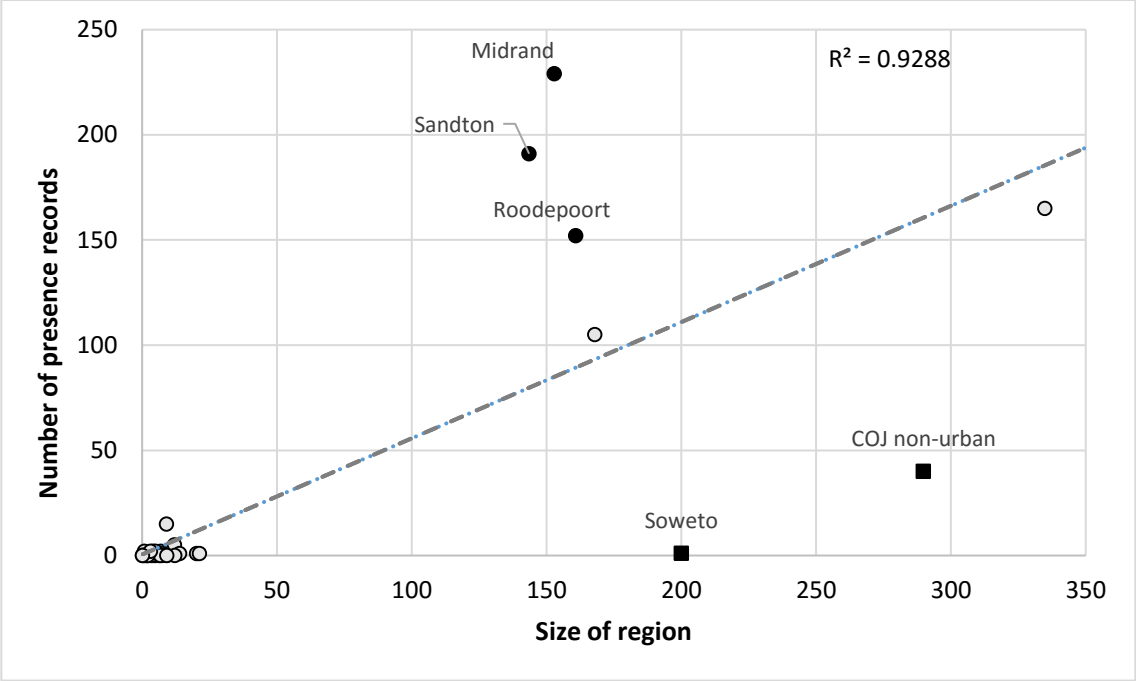


Figure 2.4: Number of presence records in a region vs the size of region in km^2. The grey line shows that the larger the region, the more presence records there are. Solid round markers represent those regions in which reporting rates were high in relation to their size, and the square markers represent regions where reporting rates were low in relation to their size

Wildlife presence was reported in 29 of the 53 land-cover classes (Figure 2.5) within the City of Johannesburg, however more than half (57%) of the presence records originated in the following three classes: urban residential (dense trees/bush) (26%), grassland (17%), and thicket/dense bush (15%) (Figure 2.5). Urban residential (dense trees/bush) makes up 18% of the total area of the COJ (29,245 km^2), grassland 24% (39,979 km^2) and thicket/dense bush 8% (13,727 km^2). These percentages are higher than for any of the other land-cover

classes in the COJ.

Species richness also tended to be higher in urban residential (dense trees/bush) with 55 species (50% of species recorded), thicket/dense bush with 46 species (42% of species recorded) and Grassland (39% of species recorded) (Figure 2.6). In comparison, species richness was lower in land-cover classes such as highly cultivated commercial fields and bare urban township, each with only 1 species (1% of species recorded), or urban smallholding (open trees/bush) and urban sports and golf (low veg/grass), each with only 2 species (2% of species recorded).

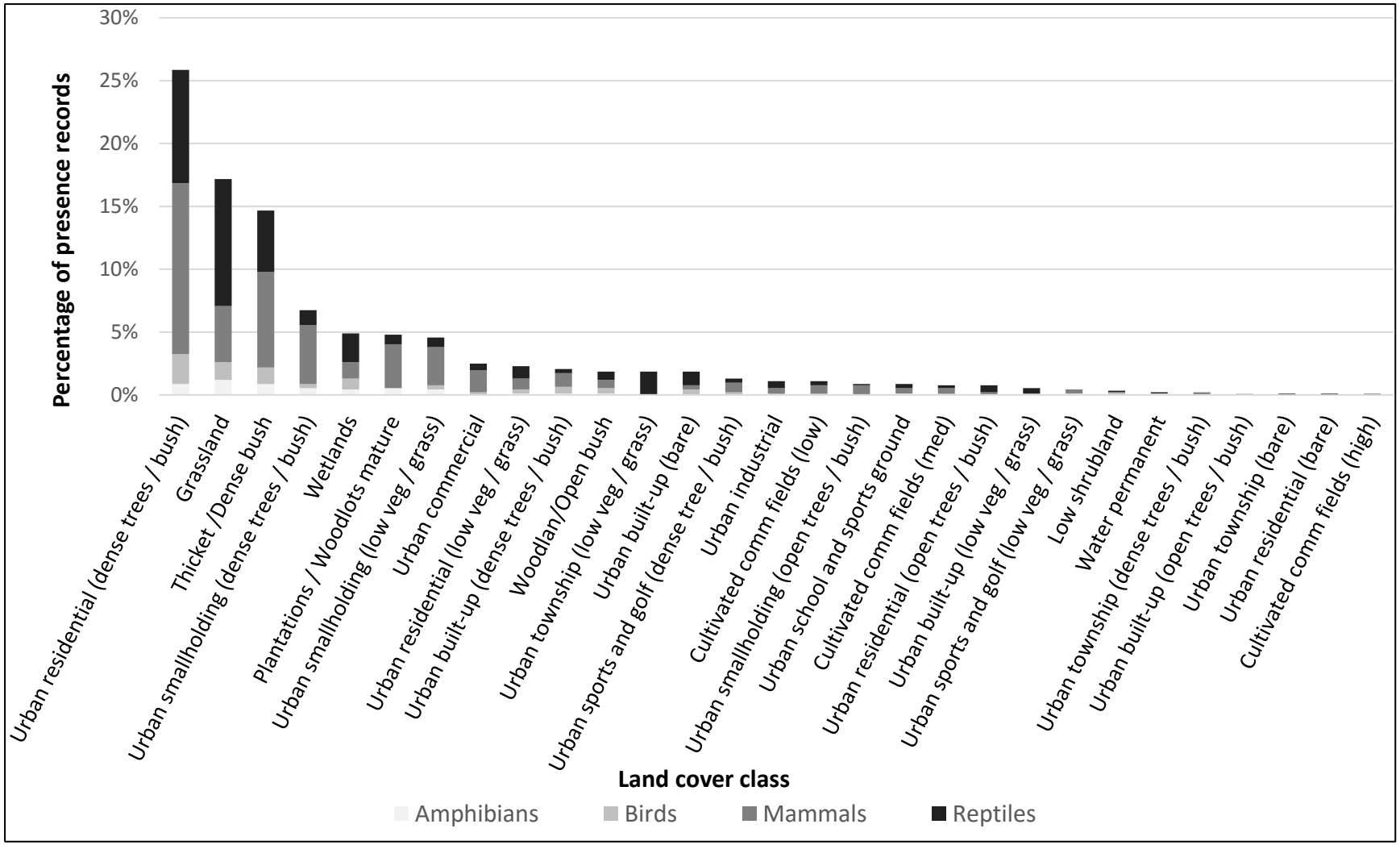


Figure 2.5: Percentage of presence records originating in each of the land-cover classes present in the City of Johannesburg (2013–14 South African National Land-Cover Dataset)

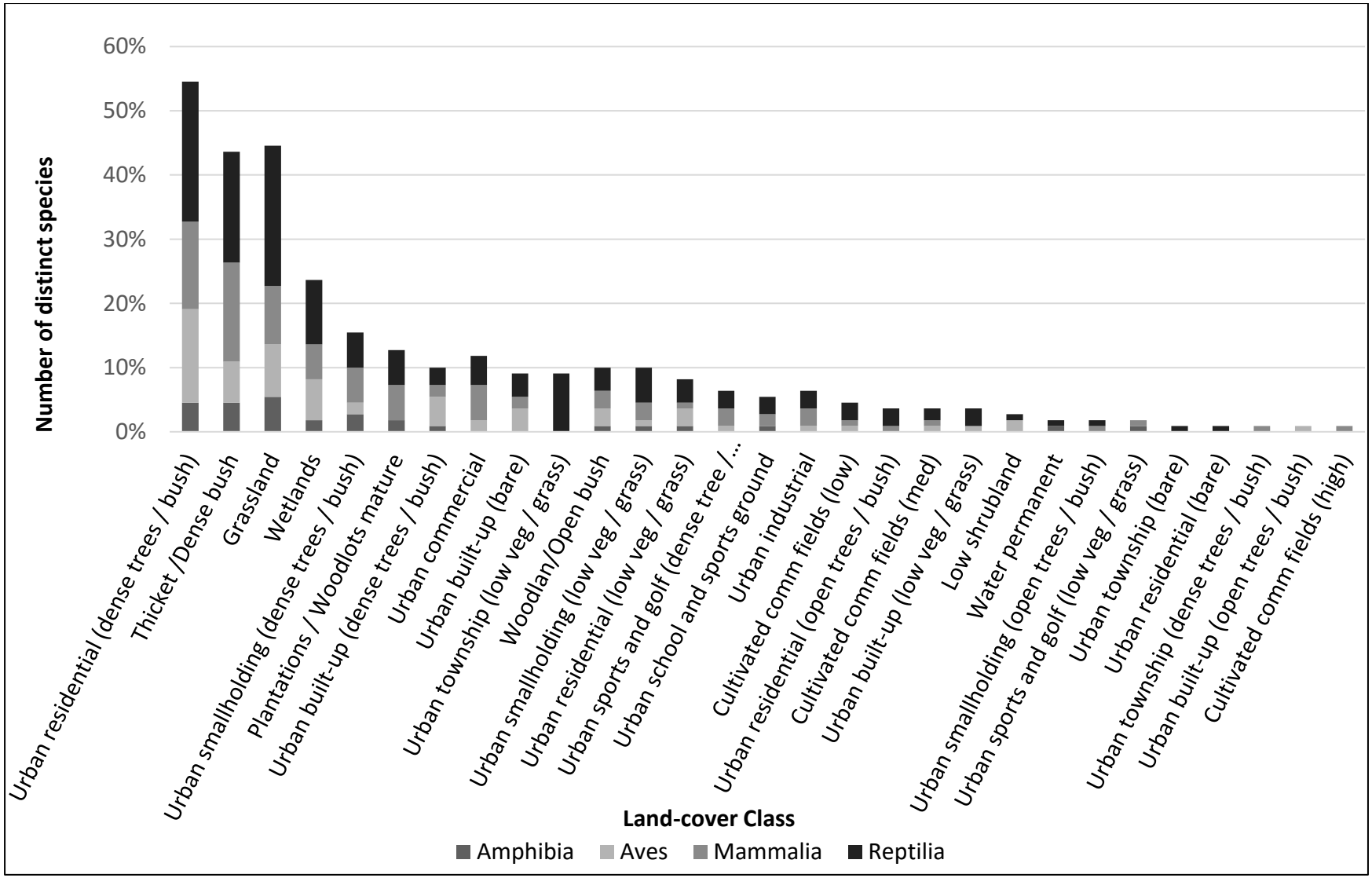


Figure 2.6: Species richness (number of distinct species) within each land-cover class

Each of the five regions from which the largest percentage of records were received (Johannesburg, Midrand, Randburg, Roodepoort, and Sandton), contain substantial percentages (> 5%) of those land-cover classes in which species were commonly recorded (Urban residential (dense trees/bush); Grassland; and Thick/Dense bush). Over 50% of the total area of Johannesburg is made up of these three land-cover classes, Midrand 40%, Randburg 69%, Roodepoort 47%, and Sandton 62% (Table 2.3).

Table 2.3: Percentage of each region made up of the land-cover classes in which presence of wildlife was most commonly recorded in the City of Johannesburg (Urban residential (dense trees/bush); Grassland; and Thick/Dense bush) (2013–14 South African National Land-Cover Dataset)

Region	**Urban residential (dense trees/bush)**	**Grassland**	**Thicket/Dense bush**	**Total**
Johannesburg	27%	13%	12%	**52%**
Midrand	12%	21%	7%	**40%**
Randburg	49%	10%	10%	**69%**
Roodepoort	23%	14%	10%	**47%**
Sandton	36%	7%	19%	**62%**

The Spearman's Rank R Correlation Coefficient for number of presence records in relation to human density was not significant at r=-0.23 ($p > 0.05$), indicating only a weak negative relationship between human population density and records received (Figure 2.7), although two regions had low records in relation to human density (solid round markers in Figure 2.7). These were Rietfontein with 0 records to only 90 people per km^2, and Farmall with 2 records to 210 people per km^2 (solid markers in Figure 2.7). Alexandra, on the other hand, received relatively high records (0.3 records per km^2) to 25 979 people per km^2 (solid square marker in Figure 2.7).

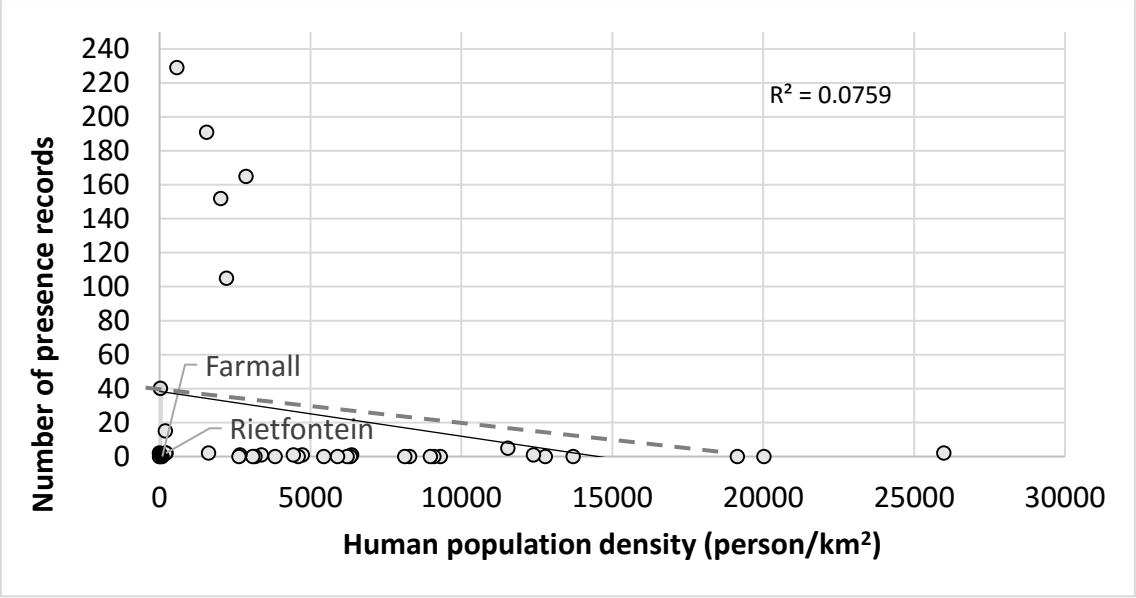


Figure 2.7: Number of presence records in relation to human population density. Line represents statistical correlation

Human-wildlife interactions in the City of Johannesburg

The combined dataset for conflict incidents in the COJ included 161 identified species (23 of them exotic to South Africa), consisting of 98 birds (12 exotic), 28 mammals (4 exotic), 32 reptiles (7 exotic) and 3 amphibian species. A total of 157 cases involved exotic species (see Appendix A for a full species list).

The most common reasons for admittance or reporting of wildlife incidents included animals being hit by a car, found out of their nest, requiring relocation, caught by a cat or dog, or confiscated from the illegal pet trade or for being held or used illegally (Figure 2.8). Animals were also often brought in because they were found injured or in poor condition in unknown locations or around human habitation and were brought in out of concern for their safety, while others were uninjured but admitted because people wanted them to be removed. Less common reasons included animals that had been burned, poisoned, entangled in snares, fishing hooks or fences, or contaminated by oil, tar or glue. Reptiles were the most commonly confiscated animal due to their popularity in the illegal pet trade, while birds were the most common animals to be victims of attacks by domestic pets (85%), with mammals making up the remainder of these cases.

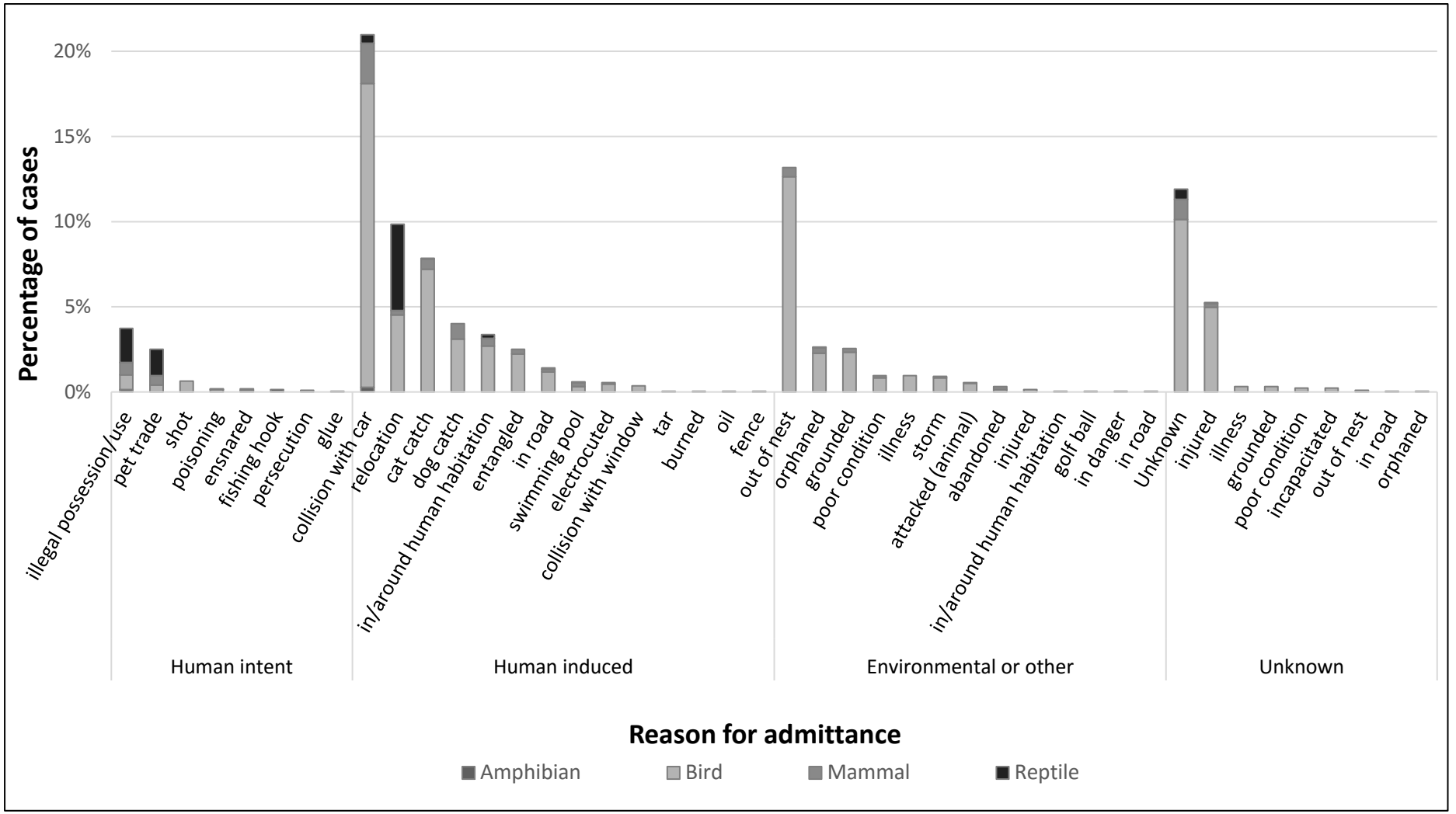


Figure 2.8: Reasons for admission or report, showing the proportion of each animal class admitted or reported for each reason between 2012 and 2017

Cases resulting from activities intended to harm made up 8% (165 cases) of the available sample. Those cases resulting from some form of human activity or presence amounted to 52% (1 133 cases). Cases where no direct human involvement was reported, yet cannot be excluded as a possibility, contributed 22% (491 cases) to the total number, with unknown causes for injury or death making up the remaining 18% (404 cases).

The GLZ results showed that region (*Wald* χ^2= 523.17; p<0.001), size of region (*Wald* χ^2 = 44.50; p<0.001), land-cover class (*Wald* χ^2 = 1091.21; p<0.001), and number of presence reports (Wald = 49.63; p<0.001) were significant predictors of incident reports, however human population was not significant as a predictor (*Wald* χ^2 = 1.87; p>0.05).

Records of human-wildlife interaction originated from 244 suburbs all over the COJ (Figure 2.3), and this is only a sample of the total number of cases, the remainder of which were unattainable. I grouped these into the major regions of the COJ and found that 37% of the cases originated in Sandton, 24% in Randburg, 12% in Johannesburg (refers to central and eastern suburbs), 14% in Midrand, 8% in Roodepoort, and the remainder distributed amongst the other regions (Figure 2.3).

As stated, Sandton, Midrand, Randburg and Roodepoort were the regions with the highest percentages of conflict incidents overall, and Table 2.4 below illustrates the regions from which certain types of human-wildlife conflict incidents or reasons for admittance of wildlife to rehabilitation centres most often originate. For most types of incidents, the four aforementioned regions were in the majority, the only notable exception was that Johannesburg was the source of 67% of wildlife persecution records, and Dainfern of the remaining 33%.

Table 2.4: Percentages of types of incident reported / reason for admittance to rehabilitation centers per major region of the City of Johannesburg

Types of incident	Chartwell	City of Johannesburg	Dainfern	Diepsloot	Ennerdale	Farmall	Ivory Park	Johannesburg	Lanseria	Lenasia	Lenasia South	Midrand	Orange Farm	Randburg	Roodepoort	Sandton	Soweto	Total
Burned	-	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-	-
Collision	1%	2%	-	1%	-	-	-	17%	-	1%	-	11%	-	22%	9%	35%	-	21%
with car	1%	2%	-	1%	-	-	-	18%	-	1%	-	11%	-	22%	9%	35%	-	21%
with window	-	-	-	-	-	-	-	-	-	-	-	25%	-	25%	-	50%	-	-
Confiscated	-	-	-	-	1%	-	1%	10%	-	1%	-	5%	-	23%	18%	41%	-	6%
illegal possession/use	-	-	-	-	-	-	1%	10%	-	2%	-	4%	-	27%	27%	29%	-	4%
pet trade	-	-	-	-	2%	-	-	11%	-	-	-	7%	-	18%	4%	58%	-	3%
Dead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	-	-
Electrocuted	-	-	-	-	-	-	-	8%	-	-	-	25%	-	8%	8%	50%	-	1%
Ensnared	-	-	-	-	-	-	-	13%	13%	-	-	13%	-	50%	-	13%	-	-
ensnared	-	-	-	-	-	-	-	25%	25%	-	-	-	-	50%	-	-	-	-
fishing hook	-	-	-	-	-	-	-	-	-	-	-	33%	-	67%	-	-	-	-
glue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	-	-
Entangled/contaminated	2%	-	-	3%	-	-	-	7%	3%	-	-	12%	-	31%	-	41%	-	3%
entangled	2%	-	-	4%	-	-	-	7%	4%	-	-	9%	-	31%	-	44%	-	3%
fence	-	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-	-
oil	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-
tar	-	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-	-
Persecution	-	-	33%	-	-	-	-	67%	-	-	-	-	-	-	-	-	-	-

Types of incident	Chartwell	City of Johannesburg	Dainfern	Diepsloot	Ennerdale	Farmall	Ivory Park	Johannesburg	Lanseria	Lenasia	Lenasia South	Midrand	Orange Farm	Randburg	Roodepoort	Sandton	Soweto	Total
Poisoning	-	-	-	-	-	-	-	-	-	-	-	50%	-	-	-	50%	-	-
Rescue/relocation	2%	-	2%	-	-	-	-	11%	-	-	-	16%	-	24%	8%	37%	-	56%
abandoned	29%	-	-	-	-	-	-	-	-	-	-	14%	-	43%	-	14%	-	-
attacked (animal)	-	-	8%	-	-	-	-	8%	-	-	-	8%	-	50%	-	25%	-	1%
cat catch	1%	-	2%	-	-	-	-	8%	-	-	-	16%	-	25%	8%	41%	-	8%
dog catch	3%	-	1%	-	-	-	-	13%	-	-	-	17%	-	24%	8%	34%	-	4%
grounded	2%	-	5%	-	-	-	-	11%	-	-	-	25%	-	17%	6%	33%	-	3%
illness	-	-	-	-	-	-	-	11%	-	-	-	4%	-	39%	7%	39%	-	1%
in danger	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	-	-
in road	-	-	6%	-	-	-	-	12%	-	-	-	15%	-	39%	9%	18%	-	2%
human habitation	1%	-	1%	-	-	1%	-	3%	-	-	-	23%	-	31%	7%	32%	1%	3%
incapacitated	-	-	-	-	-	-	-	-	-	-	-	20%	-	40%	0%	40%	-	-
injured	2%	-	-	-	-	-	-	12%	-	-	-	8%	-	29%	6%	43%	-	5%
orphaned	3%	-	5%	-	-	-	-	20%	2%	-	-	12%	-	12%	12%	34%	-	3%
out of nest	1%	-	3%	-	-	-	-	11%	1%	-	-	12%	-	25%	5%	42%	-	13%
poor condition	-	-	-	-	-	-	-	-	-	-	-	12%	-	15%	8%	65%	-	1%
relocation	2%	-	-	1%	-	-	-	13%	1%	-	-	22%	-	18%	13%	29%	-	10%
storm	-	-	6%	-	-	-	-	6%	-	-	-	6%	-	18%	6%	59%	-	1%
swimming pool	-	-	-	-	-	-	-	15%	-	-	-	23%	-	23%	-	38%	-	1%
Unknown	-	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-	-
Shot	14%	-	-	-	-	-	-	14%	-	-	-	-	-	29%	14%	29%	-	1%
Storm	-	-		-	-	-	-	-	-	-	-	-	-	33%	33%	33%	-	-
Unknown	-	-	1%	-	-	-	-	14%	-	-	-	13%	-	27%	5%	40%	-	12%
Grand Total	1%	-	1%	-	-	-	-	12%	-	-	-	14%	-	24%	8%	37%	-	100 %

The Spearman's Rank Correlation Coefficient between number of incidents and size of region was 0.54 ($p<0.05$), showing a significantly positive relationship between the two. (Figure 2.9).

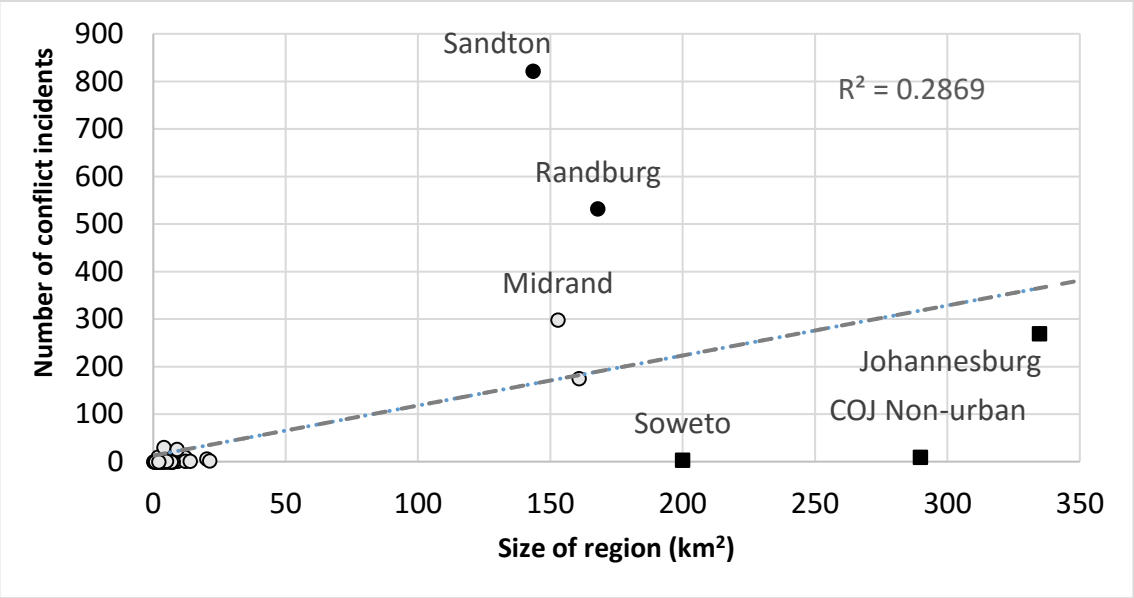


Figure 2.9: Number of incidents reported in regions in relation to size of the regions

The scatter plot of incident reports in relation to presence records (Figure 2.10) illustrates that, in general, where there are more reports of wildlife presence, there are also conflict incidents. The Spearman Rank Correlation Cooefficient was $r=0.74$ ($p < 0.05$), showing a strong positive correlation, however there were outliers in which more incidents were reported for those regions than would be expected from the number of presence records, as well as regions in which less incidents were reported than would be expected from the number of presence records. Those regions with significantly higher number of incidents included Randburg (531 presence reports and 105 incidents) and Sandton (821 presence reports and 191 incidents). Regions with fewer incident percentages included Roodepoort (175 presence reports and 152 incidents), Johannesburg (165 presence reports and 269 incidents), and Midrand (229 presence reports and 298 incidents).

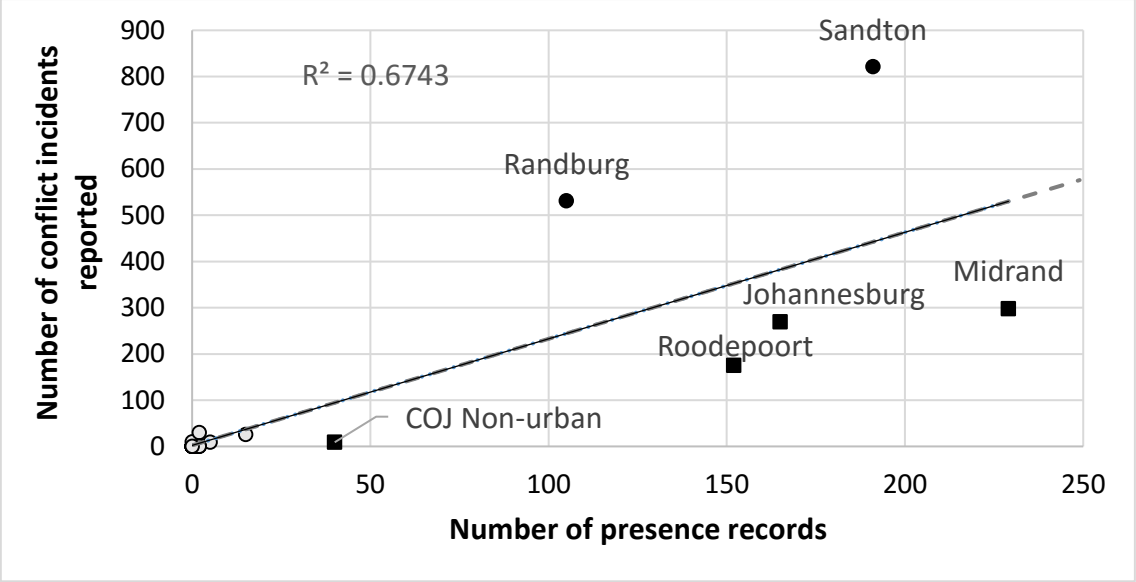


Figure 2.10: Number of incident reports in relation to number of presence records in each region. Solid round markers represent those regions with high numbers of conflict incidents in relation to number of presence reports

The Spearman rank correlation coefficient for the relationship between number of conflict incidents reported and human population density was not significant at -0.23 ($p>0.05$) (Figure 2.11).

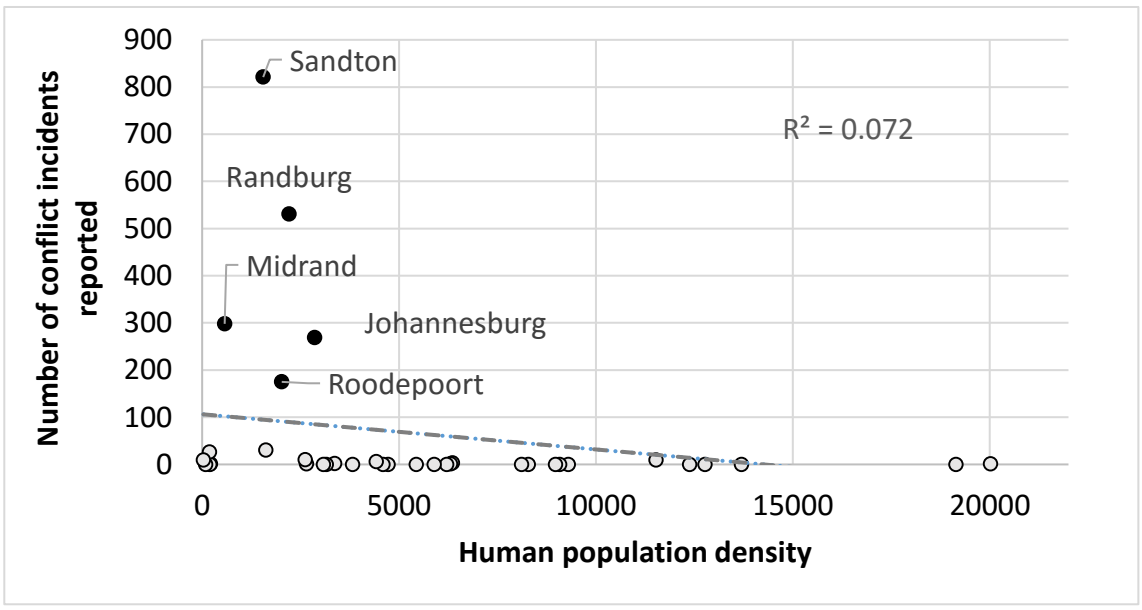


Figure 2.11: Number of incidents in relation to the human population density. Line represents statistical correlation.

2.4. Discussion

This chapter was intended to address Objective 1 (to identify wildlife species that occur in the City of Johannesburg, and where they occur), Objective 2 (to identify those wildlife species that come into frequent contact with humans), and Objective 3 (to identify common types of interactions that occur between humans and wildlife, potential drivers of these interactions, and the most common behavioural responses).

Spatial analysis of available presence and conflict data suggests that wildlife are more commonly reported in regions in which certain land-cover classes are prevalent (Figure 2.5), and are seldom found more than 1 km from green spaces, particularly those formally demarcated as either Critical Biodiversity Areas or Ecological Support Areas in the Gauteng Conservation Plan (C-Plan version 3.3, 2011). The patterns of the reporting of wildlife presence identified here appear, to a certain extent, to support the urban-rural gradient models discussed in the introduction to this chapter (Mckinney, 2006; Breuste *et al.*, 2008; Widdows, Ramesh and Downs, 2015), which predict that there will be less species abundance and diversity in highly populated and transformed city centres than in untransformed wetlands, grasslands and smallholdings.

Despite being more populated and transformed than the small holdings and peri-urban areas beyond the urban edge, the land-cover class in which most sightings were recorded here was *urban residential (dense trees/bush)*. So while the 'gradient' theory is useful to a certain extent, studies have found that, in many cities, it is these suburban areas, in which there are moderate levels of urban development, that contain the highest species richness, because of the variety of habitats created by gardens, recreational spaces, schools, parks etc. (Cilliers, Müller and Drewes, 2004; Marzluff and Rodewald, 2008; Concepción *et al.*, 2016). Another factor that encourages high levels of biodiversity in suburban areas is the availability of supplementary food resources as a result of deliberate feeding by people, or poor waste management (Cilliers, Müller and Drewes, 2004; Widdows and Downs, 2015; Concepción *et al.*, 2016). Treed suburban residential areas are also thought to allow for more species movement because gardens can form networks of stepping stones between green areas in a city (Goddard, Dougill and Benton, 2010). If managed correctly, these areas can themselves provide habitat for indigenous wildlife as well, however if not, they may

contain wildlife but be limited primarily to those species that are able to exploit human-inhabited habitats (Mckinney, 2006). Suburban gardens are also thought to contain more biodiversity because of the diversity of habitats created through gardening, as well as the variety of food sources provided by the multitude of plant species planted in suburban gardens (Marzluff and Rodewald, 2008).

The northern suburbs of the COJ, from which the largest number of presence and conflict records in this analysis originated, include regions with lower human population densities and more suburban development features (City of Johannesburg, 2012) such as the large gardens, parks, and tree-lined streets described above. This region includes Sandton, with a population density of 1,550 persons/km^2, Randburg, with 2,207 persons/km^2, and Dainfern with 1,617 persons/km^2) (StatsSA, 2011). Even further north, low density smallholdings and equestrian estates have persisted, although these are now the favoured locations for development (Schäffler *et al*, 2013). Examples of these include Midrand, with a population density of 572 persons/km^2, and Chartwell with 191 persons/km^2 (StatsSA, 2011). These regions also include a number of natural features that not only provide habitat but also corridors for movement of species, such as watercourses, nature reserves, parks, bird sanctuaries, ridges etc. Examples include the Braamfontein Spruit, which runs through the central and northern suburbs for 20.4 km, Rietfontein Nature Reserve in Sandton (25 ha), and Melville Koppies in Johannesburg (150 ha) (City of Johannesburg, 2003).

In contrast, Soweto and surrounds have higher human densities, in the range of 6,500 persons/km^2, and the more southern regions of Lenasia and Ennerdale are close behind with 4,424 persons/km^2 and 3,367 persons/km^2, respectively. The data analysed contained very few records of wildlife sightings and conflict incidents from the southern regions of the COJ but, while the lack of data could be related to the fact that there is less wildlife as a result of high human populations, because of the inconsistent collection of the data analysed, a causal relationship cannot be drawn here, particularly so in the light of a number of these regions also containing some of the largest natural features such as the Klipriviersberg Nature Reserve (615 hectares), and Spioenkop Ridge (595 ha) (City of Johannesburg, 2003). Unfortunately, the most recent official population density figures are from the 2011 population census and would likely be quite different now. It would be prudent to repeat the analysis using the new figures once they have been released.

While most sightings records originated in urban residential (dense trees/bush) (26%), grassland (17%), and thicket/dense bush (15%), land-cover class alone should not be used as a reliable predictor of the ecological condition of land in cities like Johannesburg, owing to rapid formal development, and the even more rapid sprawl of informal settlements. This is particularly so in flatter areas, such as those classified as Grassland. An example of such an region is Diepsloot, largely classified as Grassland, and containing and bordering onto Critical Biodiversity Areas (GDARD, 2011). Diepsloot has a population density of 11,532 persons/km^2 and is heavily polluted as a result of a lack of formal housing and waste management infrastructure. Areas of grassland are largely cut off from others by roads and fences and thus in reality little suitable habitat is still available for wildlife (StatsSA, 2011; City of Johannesburg, 2012). This supposition of fragmentation is reinforced by my finding that the most common form of human-wildlife conflict in Diepsloot is animals being hit by vehicles (Table 2.4). Similarly, while there is definitely less reporting of wildlife and wildlife conflict in the southern regions of the COJ, there may also well be less wildlife as a result of higher human population densities and rapid transformation and fragmentation of suitable remaining wildlife habitat. However more research on species presence and its drivers is required in these regions in order for us to draw informed conclusions.

In order to better understand, predict and mitigate human-wildlife conflict in urban areas such as the COJ, we need to better understand not only the ecological aspects but also the social, economic, cultural and spatial dynamics of high versus low conflict regions, particularly those for which high levels of conflict are experienced or predicted but have low levels of wildlife presence records. The socio-economic characteristics of regions may also have a significant effect on the presence of wildlife (Kinzig *et al.*, 2005). There are a number of possible explanations for there being either 1) no reports of wildlife presence or conflict in a region in which there are conditions considered conducive to one or both of these, or 2) reports of human-wildlife conflict in regions in which there are no, or very few, reports of wildlife presence. One such explanation could be that in regions in which there are higher percentages of conflict incidents than presence records may be that people residing in these regions have less of a connection with wildlife, either because they do not have access to natural areas (Kinzig *et al.*, 2005), or reporting wildlife presence is less of a priority because other base needs are not met (Maslow, 1954). If this is the case, then it is likely that only

when conflict occurs that presence is recorded. This theory is supported by the findings shown in Figure 2.7, which shows that less sightings are recorded in regions with high human population densities, yet Figure 2.11 shows that more conflict incidents are reported in these regions.

There are also regions in the COJ for which there are few reports of wildlife presence or conflict, that border on regions with similar environmental attributes but many reports, and no obvious explanation for this discrepancy. This requires deeper analysis of the land use and the socio-economic and cultural variables that may have an impact on the levels of reporting of wildlife presence or conflict in a region (see Chapters 3 and 4). An example of this is the suburb of Modderfontein in the Johannesburg region, which was, until recently, largely undeveloped and uninhabited because it was the site of an ammonia plant and dynamite explosives factory and testing ground, which required a 5 km buffer from residential areas (Endangered Wildlife Trust, 2017). The area of land allocated for the reserve footprint remains unfenced to the east and the adjacent land portions possess very similar ecological characteristics. According to the manager of the Modderfontein Reserve (B. Tsebe[1], pers. comm., 2016), the factory compound, and with it a significant proportion of green space and suitable wildlife habitat, remains difficult to access and has not been explored from a biodiversity perspective, and therefore contains very few records of species presence or conflict.

As discussed in Chapter 1, and explored further in Chapters 3 and 4, our priorities are dictated by a number of factors such as our values (what and who we value), our knowledge (or lack therefore) of how wildlife and natural spaces play a role in our own well-being and the sustainability of our cities and livelihoods, and our attitudes towards nature and animals (Dickman, 2010). These priorities and how we interpret knowledge and personal experience, shape the way we take interest in, and behave towards, wildlife, as well as the way in which we respond when interacting with wildlife. The hierarchy of human needs first described by Maslow in 1954, and cited in multiple attitude studies since (Fransson and Garling, 1999;

[1] Boaz Tsebe is the Manager of the Modderfontein Reserve, which borders directly onto undeveloped private land.

Preece, 1999; Lee and Sue, 2001; Milfont, Duckitt and Cameron, 2006; Manfredo, 2008; Carlson *et al.*, 2010; Redclift and Woodgate, 2010) proposes that our basic physiological needs, such as food and shelter have to be met before we can consider any other needs, such as concern for others and the environment (Maslow, 1954). While the data available for this study were not sufficient to draw concrete conclusions, my findings would support Van Liere and Dunlap's (1980) 'social class hypothesis' mentioned in Chapter 1, which suggested that people who are more educated and have higher incomes are likely to show more concern for wildlife. In the introduction to this chapter I also described a study by Kinzig *et al.* (2005) that found more wildlife and species richness in more affluent suburbs, and stressed the value of considering socio-economic variables in the landscape to augment ecological models for predicting wildlife presence in urban areas. In areas with high levels of poverty, it may be unreasonable to expect people to take an interest in, and go to the effort of reporting wildlife sightings or conflict incidents, when they are battling to find work to feed their families or access basic services such as water and sanitation? For example, in Itsoseng in the west of the COJ, which received no sightings or conflict records, 37% of residents have no income, less than 4% have piped water in their homes, and less than 2% have access to a flush toilet (StatsSA, 2011). However, it is not only economic factors at play, as discussed in Chapter 1, there are also potentially cultural and demographic variables such as age, gender, and race that impact on willingness to report sightings and conflict incidents. As discussed, there are complex cultural and lifestyle elements that we must be cognisant of when investigating the motivational bases for people's behaviour towards wildlife, particularly in culturally and economically diverse urban regions (Hill, 1993; Kinzig *et al.*, 2005; Dearborn and Kark, 2009).

As indicated, neither the species presence data obtained for this study, nor the conflict data were collected systematically, and they were to some extent biased because both datasets were reliant on the public making the effort to report sightings, or rescuing or reporting wildlife in trouble, which makes options for analysis somewhat limited. However, the findings of this chapter do suggest that the presence of wildlife in a region, as well as the likelihood of human-wildlife conflict, is to some extent influenced by land-cover class (and availability of suitable natural habitat), proximity to areas of ecological importance, as identified in the Gauteng C-Plan version 3.3 (2011), and human population density. This

highlights the importance of strategic development which takes cognisance of environmentally sensitive areas and avoids, wherever possible, the destruction of such. I also found that there are regions within the COJ from which there have been very few wildlife presence or conflict records, but which contain characteristics ordinarily associated with higher levels of wildlife presence, such as less impermeable surfaces and more vegetation (Mckinney, 2006; Widdows, Ramesh and Downs, 2015). For example, Lanseria and Randfontein share many of the peri-urban characteristics present in regions such as Midrand, yet received no presence or conflict records. In such cases, more targeted efforts to collect data for these regions are required before any strategic or practical recommendations can be made. For example, there may be less wildlife in such regions because the vegetation present is alien or invasive (Marzluff and Rodewald, 2008; Shochat *et al.*, 2010) or homogenous, thereby reducing the value and attraction of the region to wildlife (Shochat *et al.*, 2010).

Owing to the fragmented and diverse nature of the landscapes in the COJ, it will be extremely difficult to obtain the necessary data without the assistance of members of the public. Citizen science projects such as the National Audubon Society's annual Christmas bird count (Cohn, 2008) or, closer to home, the University of Cape Town Animal Demography Unit's online Virtual Museum containing projects such as MammalMap and Southern African Bird Atlas Project 2 (SABAP2) (Animal Demography Unit, 2007) contribute substantially to our biodiversity databases. These projects have been very successful and useful in furthering our knowledge of biodiversity distribution and movement patterns, through the reporting of sightings by citizen scientists (Navarro, 2010).

Chapter 3. Are teenage boys in Johannesburg more afraid of frogs than girls? Investigating the social motivations behind human-wildlife interactions in Grade Ten learners

3.1. Introduction

Urban residents the world over have extremely varied conceptions of the natural environment and biodiversity, particularly that which occurs in urban areas. The very definition of urban biodiversity is contested for various reasons, including the habituation to humans of many species in cities, as well as the introduction of large numbers of exotic species such as, in the case of Johannesburg, Mynahs (*Acridotheres tristis*) or Rose-ringed Parakeets (*Psittacula krameri*) (Dearborn and Kark, 2009). The world is also perceived to be considerably smaller with the rapid advancement of technology and the immediacy of online communication. The adolescents of today are constantly bombarded with facts, opinions and what Prokop *et al*. (2009) describe as 'alternate conceptions', from far beyond their local community cultures and the teachings of formal education. One question that emerges when faced with performing any social research in the face of this globalisation is how pervasive local community cultures amongst adolescents in Johannesburg are, when they are exposed to so many and such diverse theories, ideas and 'facts' with a flick of their thumb on a cell phone.

Many do not consider bats, hadedas (*Bostrychia hagedash*), garden birds and such as wild animals because they are not in their 'natural habitat'. That the very concept of urban biodiversity itself is questioned makes the idea of conserving said urban biodiversity difficult to digest for many people. To formulate effective conservation strategies for urban biodiversity in Johannesburg and other cities, we must develop a better understanding of how residents perceive the animals sharing their cities, and the nature of interactions that occur between human and non-human inhabitants. Personal experiences of certain animals, and social influences such as legacies of oppression or cultural beliefs, contribute significantly to people's attitudes and behaviour towards these animals (Dickman, 2010).

Previous studies, referred to in Chapter 1, including Batt (2009), Kellert (1985), Kellert (2012), Sexton *et al.* (2007), Signal *et al.* (2005), and Prokop *et al.* (2009) provide various hypotheses as to why we behave in certain ways towards wildlife, and what our motivations behind these behaviours might be. The aforementioned studies postulate that better education about the natural world instils more positive attitudes, and in turn behaviour, towards it (Sexton and Stewart, 2007), that disgust and fear are strong motivating factors affecting our attitudes and behaviour (Serpell, 2004; Prokop, Fancovicova and Kubiatko, 2009; Tarrant, Kruger and du Preez, 2016) and that the extent and nature of the influence of these factors differs between people from different age, race, culture and gender groups (Kellert, 1985; Drews, 2002; Prokop, Fancovicova and Kubiatko, 2009). Prokop (2009) conducted a study of 236 undergraduate students in Slovakia, examining the attitudes students have towards bats, and where these attitudes may originate. The study had a particular focus on the persistence of myths, or 'alternate conceptions' surrounding bats that are extremely persistent in many cultures, despite scientific evidence refuting them.

Prokop *et al.* (2009), Batt (2009) and Tarrant *et al.* (2016) joined the likes of Kellert (1985; 1987; 2008; 2012), Hill (1993) and Serpell (2004) in the discourse around the origin of negative attitudes towards certain species of animals, and many of the resultant theories correlated with Kellert's attitude typology (Kellert and Berry, 1980) discussed in Chapter 1. Hill (1993) argued that attitudes and behaviours towards particular animals stem from three motivational bases: instrumental self-interest (utilitarian), empathy/identification (anthropomorphism), and people's beliefs and values about wildlife species (cultural influences). Serpell (2004) discussed two primary motivations for certain behaviours towards wildlife: affection for animals and economic or pragmatic considerations. Serpell (2004) also discussed people's tendencies to judge animals by physical or behavioural attributes, particularly those attributes similar to those of humans, a notion emphasised by Batt (2009) as well. Looking at all of these theories, there are certainly a number of similar ideas and themes, including the notion that fear and disgust (which may originate from a biological avoidance to injury or spread of disease) are significant motivating factors. The existence of certain motivational bases such as self-interest, manifested in utilitarian attitudes towards certain species, identification with certain species that may look or behave in similar ways to humans, pervasive cultural beliefs that are entrenched in the

fabric of all societies and perpetuated through informal teachings and media representations, and attitudes developed as a result of personal experiences or stories thereof (Davey *et al.*, 1998; Bjerke and Østdahl, 2004; Sexton and Stewart, 2007; Prokop, Fancovicova and Kubiatko, 2009; Dickman, 2010)

Prokop *et al.* (2009) sought to determine whether increased levels of knowledge about bats (and the dispelling of these alternate conceptions) resulted in better attitudes and behaviour towards them. They found that these myths were prevalent in multiple subgroups within the sample, including the myth that bats often get tangled in people's hair. The findings of the study concluded with an assertion that poor attitudes and behaviour towards bats were related to lower levels of knowledge, and that greater public awareness around the numerous benefits bats provide (including insect control and pollination), and the dispelling of myths and ideas that all bats carry disease, are likely to result in better attitudes and less avoidance of bats by humans (Prokop, Fancovicova and Kubiatko, 2009). However, our attitudes and emptions towards animals can also have an effect on our willingness to learn about them (Randler, Hummel and Prokop, 2012). A study conducted by Randler *et al.* (2005), on the ability of students who felt anxious towards amphibians to identify different species after being taught about them, found that students with more anxiety scored lower than students who were not anxious about amphibians.

In light of this discourse, my aim for this chapter was to investigate the knowledge, attitudes and behaviour of adolescents in Johannesburg towards wildlife. Some studies (Kellert and Berry, 1987; Bjerke and Østdahl, 2004; Serpell, 2004; Prokop, Fancovicova and Kubiatko, 2009) have shown that negative attitudes towards wildlife increase with age. While adolescents may have picked up on attitudes and practices of their elders, they are less likely to be significantly affected by the economic and utilitarian effects on attitudes held towards a lot of species. However, they are old enough to have experienced teachings outside of those within their own cultures, and had some experiences with urban wildlife themselves, be these positive or negative. The objectives of this study were to gain an understanding of the levels of knowledge Grade Ten learners in Johannesburg have about urban wildlife, to measure the types of attitudes and behaviour (positive or negative) that they demonstrate towards wildlife in the city, and to investigate the relationships between learners' knowledge, attitude and behaviour towards wildlife. I asked three key questions:

Do higher levels of knowledge correlate with more positive attitudes, do higher levels of knowledge correlate with more positive behaviour towards wildlife among Grade Ten learners, and do more positive attitudes correlate with more positive behaviour? I also intended to establish possible relationships between socio-demographic attributes of individuals or groups, such as gender, and their attitude and behaviour towards urban wildlife.

3.2. Materials and methods

Study area and participants

The sample group I targeted for the survey included adolescent learners from different racial backgrounds, in Grade Ten (same level of formal education and age range), from three ordinary (mainstream education), co-ed (mixed gender) schools in different regions of the City of Johannesburg, in the Gauteng Province of South Africa.

I selected Grade Ten learners as the sample group because it is the midpoint of a South African learner's high school career and, in South Africa, Grade Ten has been found to have the highest enrolment numbers of any high school grade, with these numbers decreasing exponentially in Grade 11 and Grade 12 (Department of Basic Education, 2016). This sample could then be considered the largest proportion of learners with secondary education experience. According to a report on the annual surveys of ordinary schools in South Africa for 2010 and 2011, the ideal age range for Grade Ten learners is between 14 and 17 years old, however as much as 34.4% of Grade Ten learners in South Africa were aged 18 years and older (Department of Basic Education, 2012).

I applied for, and was granted permission to, conduct research in the schools by the Gauteng Department of Education (GDE) (GDE Research Approval Letter Reference no. M2017/141AAA), and ethics clearance was granted by the University of the Witwatersrand Human (non-medical) Research Ethics Committee (ethics clearance number H17/08/34).

On receiving formal approval to conduct my study, I contacted principals of ten schools in

different regions of Johannesburg, including Diepsloot, Tembisa, Alexandra and the northern and southern suburbs via telephone and/or email. Initial correspondence with schools included a description of the aims of the study and a request for permission to distribute surveys to their Grade Ten learners. Of the ten schools that I contacted, I only received positive responses from three schools: Greenside High School (public), Bryanston High School (public), both in affluent suburbs, and St Matthew's Private Secondary School in Soweto Township (a low-income region). I selected this approach over online survey sampling because it allowed for standardised distribution and collection of questionnaires, and allowed me to more easily target a particular age range. It also ensured that learners who did not have internet access were able to respond to the questionnaire.

Questionnaire construction and distribution

I used structured questionnaire surveys for the study, as opposed to interviews, because questionnaires are a cost effective and efficient method that allows for one to target large numbers of participants, and are more easily replicated in future studies (Roberts, Sitas and Greenstein, 2003). The school questionnaires, adapted from existing scales such as Herzog's Animal Attitude Scale (Herzog, Betchart and Pittman, 1991b), and Templer's Pet Attitude Scale (Templer *et al*, 1981), consisted of 32 questions covering three categories (Appendix E). The survey was designed to ascertain levels of basic knowledge about wildlife, general attitudes towards wildlife, the types of behaviour respondents are likely to show when encountering wildlife, and ultimately to understand the relationships between these measures.

I collected completed surveys from 416 respondents: 101 learners from Bryanston High, 190 from Greenside High, and 125 from St Matthew's (Figure 3.1).

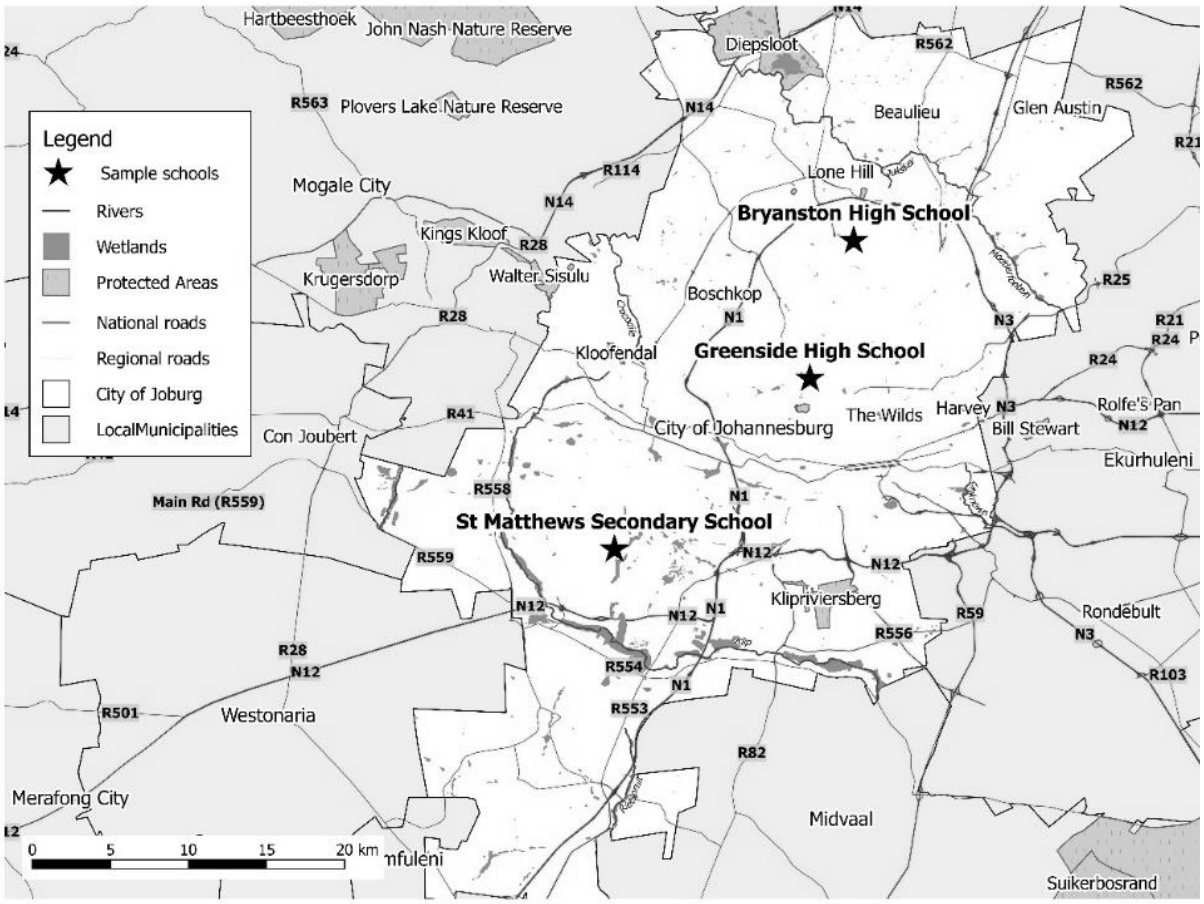


Figure 3.1: Locations of the three schools selected for the study

Determining levels of basic knowledge about wildlife

I used nine simple fact-based questions to assess basic levels of knowledge about wildlife, primarily aimed at assessing respondents' basic understanding of taxonomy, the value wildlife has for humans, the importance of certain species to the effective functioning of ecosystems and the respondents' ability to separate fact from superstition. Eight of the nine knowledge questions provided five response options on a Likert scale: 'strongly disagree'; 'disagree'; 'neutral'; 'agree' and 'strongly agree'. I allocated each of the five Likert response options a score between 0 and 4, depending on the specific phrasing of the question. For example, answering 'strongly agree' to 'Snakes are important in nature' gave a score of 4, while answering 'strongly agree' to 'Bats are not important in nature' gave a score of 0. The ninth question posed two possible responses – 'yes' or 'no' – with a possible score of either 0 or 4. Please see Appendix F for the scale of scores for selected responses. I then generated a knowledge score for each respondent by averaging their scores for that section, and rated

this score against a constructed scale ranging from 0–4; 0 indicating very poor levels of knowledge about wildlife and 4 indicating very high levels (Appendix G). For an individual respondent's knowledge score to be included in the analyses, he/she had to answer at least four of the nine knowledge questions. Five respondents answered fewer than four questions and were excluded from the analyses.

Understanding attitudes towards wildlife

Individual questions in the survey were similar to those classified according to models developed and expanded on by Kellert (1980), Hill (1993), Drews (2002) and others, that indicate likely orientations to certain types of behaviour (Moralistic, Utilitarian, Negativistic, etc.). I included questions relating to fear in this section because many studies have shown fear to be one of the key motivators of attitude and behaviour (see for example Prokop and Tunnicliffe, 2008; Batt, 2009). The attitude scale included 17 questions related to certain affective aspects of wildlife (Appendix E). Two questions were binary 'yes' or 'no' questions, while the remaining 15 provided optional responses on a Likert scale, providing respondents with five options of: 'strongly disagree'; 'disagree'; 'neutral'; 'agree' and 'strongly agree'. As with the knowledge questions, each Likert item was allocated a potential score between 0 and 4, and the two binary questions a score of either 0 or 4. Scores were once again dependent on the phrasing of each question. I generated an attitude score by averaging each respondent's scores for items on the constructed attitude scale, which provided an overall attitude score of between 0 and 4; 0 indicating very negative attitudes towards wildlife and 4 indicating very positive attitudes (Appendix G). For an individual respondent's attitude score to be included in the analyses, he/she had to answer at least ten of the 17 attitude questions. Two respondents answered fewer than ten questions and were excluded from the analyses.

Understanding types of behavioural tendencies towards wildlife

To determine the behavioural tendencies of respondents towards urban wildlife, I asked six questions (Appendix E). The first question required a 'yes' or 'no' answer, while the remaining five questions were scenario-based. In these latter questions, I presented respondents with five scenarios in which they would come across a particular animal in their

home, and requested that they select the course of action that they thought they would take in each case: 'kill it', 'take it outside', or 'leave it alone'. These scenarios included species that were included in the fear-based questions in the preceding section. The first question was allocated a score of 0 for answering 'no', and 4 for answering 'yes'. I scored this question in this manner because, while feeding wildlife is not necessarily beneficial for the animal in the long term, the desire to feed wild animals demonstrates more pro-wildlife behaviour, an instinct to protect and nurture animals (Manfredo, 2008). The scenario questions were each allocated a score of 0 for responding 'kill it', 2 for 'leave it alone', and 4 for 'take it outside'. I generated a behaviour score for each respondent by averaging their responses for all behaviour-related questions. This behaviour score ranged from 0–4, 0 indicating very negative intentions for behaviour towards wildlife and 4 indicating very positive intentions (Appendix G). The behaviour questions were designed to identify what type and characteristics of animals incite certain types of behaviour. Menon and Lavigne (2006) theorised that different species conjure different emotions and value judgements (discussed in detail in Chapter 1), and that these in turn lead to varying behaviours and therefore have bearing on developing conservation strategies aimed at these different species. Each animal presented in the scenario questions was chosen because it possesses certain characteristics – either has physical or behavioural traits similar to those of humans, is aesthetically pleasing, or is known to elicit feelings of disgust or fear such as spiders and snakes (Serpell, 2004; Batt, 2009; Prokop, Fancovicova and Kubiatko, 2009). Species such as bats and owls were also chosen for inclusion in the survey because they are known to have an association with a particular superstition, event or phenomenon (Kellert & Berry 1987; Hill 1993; Serpell 2004; Prokop & Tunnicliffe 2008; Prokop *et al.* 2009; Tarrant *et al.* 2016). For an individual respondent's behaviour score to be included in the analyses, he/she had to answer at least three of the six behaviour questions. Of all respondents, 23 answered fewer than three questions and were excluded from the analyses.

To measure the reliability of the constructed knowledge, attitude, and behaviour scales, I ran a Cronbach's alpha test on each one, a test commonly used to determine reliability of scales based on scores from multiple Likert items (Tavakol and Dennick, 2011).

Because there appears to be indication in many of the studies cited (Batt, 2009; Prokop & Tunnicliffe, 2008) that one of the key motivators of attitude and behaviour is fear, or

disgust, which is a response to fear of disease or infection, a fear scale was generated using the 'I am afraid of [bats; owls; frogs]' questions, identified in Appendix F (questions A6, A7 and A8). The fear scale was constructed from possible response scores of between 0, indicating no fear (positive), and 4 indicating high levels of fear (negative), to allow for expression of different levels of fear. To determine types of behaviour that may be related to items on the fear scale, an action scale was also created, including the 'what would you do if you saw a [spider; frog; owl; snake; bat] in your home?' (Appendix F questions B2a–B2e). The action scale was also constructed from possible response scores of between 0 and 4; 0 representing negative behavioural tendencies and 4 positive ones. I also ran a Cronbach's alpha test on the fear and action scales to determine reliability.

To reduce confusion and misunderstandings resulting from language barriers, the questionnaires were translated into isiZulu (the most common African language used within the sample groups (StatsSA, 2011)). I gave all respondents the option to complete the English or isiZulu survey. The survey was anonymous but respondents were requested to provide some demographic details, including the race group in which they classify themselves, their gender and their home language, which in South Africa is a central feature and a fairly reliable indicator of culture (Prah, 2007). These details were used as the categorical predictor variables required for the analysis of responses.

After consulting with principals from all three schools, I decided that the most effective way of ensuring that learners completed and returned the surveys was for teachers to hand them out before class tests, give the learners time to complete them, and then collect them all to be returned to me.

Analysis of responses

I used Statistica version 12 (Statsoft, 2014) to conduct both descriptive and inferential statistics. Before conducting inferential statistics, I tested the residuals of all continuous dependent (response) variables for normality. After establishing that the residuals were normally distributed, I used Pearson's correlation coefficient to identify significant correlations between knowledge, attitude and behaviour scores.

To determine whether independent variables (school, race, gender and home language) had a significant effect on average responses to individual questions, I performed a Pearson Chi-square test for each question. If the Chi-square tests identified significant differences between responses for any of these questions ($p \leq 0.05$), the average response scores per group for that question were compared to determine how scores differed between groups. When representing the response frequencies visually, I combined the 'strongly disagree' and 'disagree' options into 'disagree', and 'agree' and 'strongly disagree' into 'agree', to show clear difference between groups' levels of knowledge and whether their attitudes are negative, neutral, or positive.

Scores on the two scales based on the fear and action questions were calculated by averaging the scores for all items on each scale. The two resultant scores for these two scales were then compared by each independent variable, using a one-way ANOVA on the average score for each categorical variable (school, race, gender, home language) to find out if higher levels of fear towards certain species were related to negative behaviour towards these species.

To investigate how knowledge, attitude and behaviour scores differed (positively or negatively) between groups, the average score for each scale was calculated for each independent (categorical) variable (school, race, gender, and home language). Age was not considered to be a relevant factor because all respondents were in the same grade and age range. I performed a one-way ANOVA on the average scores for each categorical variable (school, race, gender, home language) to determine the influence of the independent variables on scale scores. Respondents who did not provide an answer to a question were not included in the average score for that measure. For the scores for racial groups, those respondents who indicated that they belonged to an 'other' race group, were also excluded from the average scores as there were only 13 of these cases and they made up a heterogeneous group, reducing their predictive potential. Similarly, for the question about home language, categories with less than ten responses were not included in the average scores for that particular scale. Before running the ANOVA, standardised residuals were assessed to ensure data within the category were normally distributed. If the residuals were normally distributed, univariate results were consulted to determine whether there was a significant difference between average scores for different groups within the category. If a

significant difference was found ($p<0.05$), Tukey's Unequal N HSD (Honest Significant Difference) test, selected because the sample sizes were not equal, was run to uncover which groups within the category were significantly different.

Because the Likert responses were converted from items into average scores on a continuous scale, I ran a General Linear Model (GLM) to determine the effect of gender and home language on knowledge scores (Norman, 2010), using females and isiZulu speakers as reference groups. I excluded race because race and home language in South Africa have a strongly collinear relationship, and home language, in this case, speaks to race and to culture, which is a more pertinent predictor variable in this study. Tukey's Unequal N HSD test was conducted to determine which groups scored differently on each scale. I ran the same model including attitude as a continuous variable for knowledge scores (along with gender and home language as independent variables) to see whether attitude scores had an effect on knowledge scores (as per Randler *et al.* 2005). The effect of knowledge, gender and home language on the attitude scores and the effect of attitude, knowledge, gender and home language on the behaviour scores were determined analogously. For all statistical analyses, the p-value was considered significant at $p<0.05$.

3.3. Results

Socio-demography

Of the 416 respondents who completed the survey, the demography was slightly biased towards females, with 50.2% (209) female and 41.1% (171) male respondents (36 chose not to disclose their gender). Black South Africans represented 52.2% (217) of the respondents, 14.2% (59) were White, 7.7% (32) Coloured, 14.2% (59) Indian, 2.4% (10) other races and 9.4% (39) chose not to disclose their race. A total of 11 home languages were identified within the group (Figure 3.2 A–C).

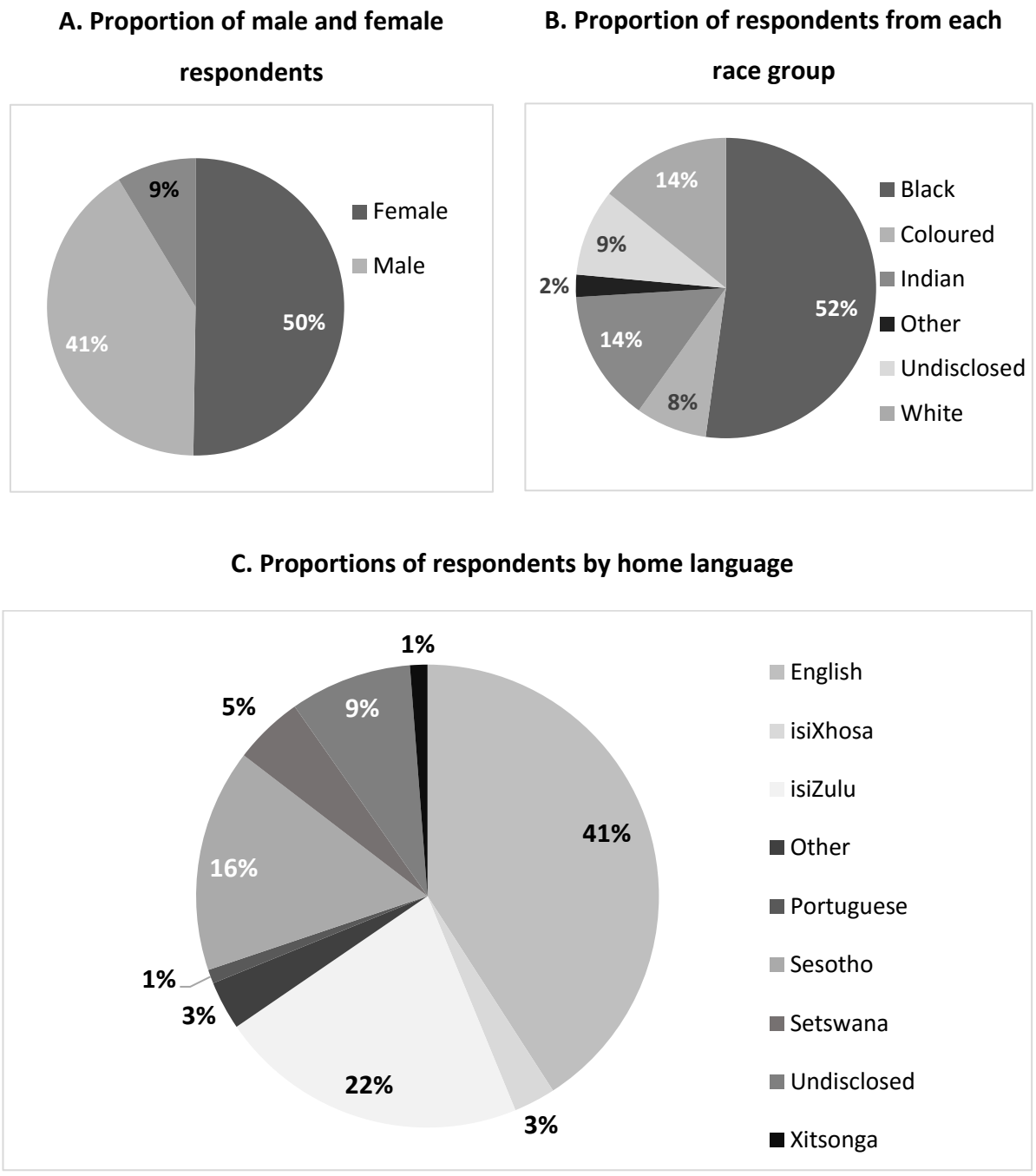


Figure 3.2: Demographic breakdown of respondents by gender (A), race (B), and home language (C)

Significant effects of one or more socio-demographic variables on responses to individual questions were found in 26 of the 32 questions (Table 3.1). Of the nine knowledge questions, four were significantly affected by school (Appendix H), six by race (Appendix I), only two by gender (Appendix A), and four by home language (Appendix A). Notably, more

male learners (35%) than female learners (19%) responded that an owl in your garden is a good thing, and 47% of males responded that bats are useful to humans, compared to 34% of females. A low 17% of Black learners agreed that an owl in your garden is a good thing, compared to 27% of Coloured leaners and Indian learners, and 59% of White learners. Similarly, only 11% of Black learners and 14% of Coloured learners agreed that bats are useful, compared to 25% and 37% of Indian and White learners respectively. Large numbers of English, isiXhosa and Setswana learners (71%, 83% and 70% respectively) disagreed with the statement that all wildlife is dangerous, whereas only 53% of isiZulu learners and 56% of SeSotho learners (56%) did so.

Of the 17 attitude questions, 12 were significantly affected by school, nine by race, eight by gender, and eight by home language. Of the six behaviour questions, all six were significantly affected by school, five by race, two by gender, and all six by home language. Most of these questions are discussed under the fear and action scales below but worth noting was that responses to questions relating to cultural beliefs or myths also emphasised the effect of race and/or home language on attitudes. In response to the statement 'It is a sign of bad luck to have an owl near your house' only 5% of English learners agreed while 17% of isiXhosa learners, 20% of Setswana learners and 33% and 39% of SeSotho and isiZulu learners agreed with the statement.

Table 3.1: Questions for which a Chi-square test showed significant effect ($p<0.05$) of demographic variables on responses. n/s denotes no significant effect

Questions		**Variance of responses between demographic groups** *(p is significant at 0.05)*			
Knowledge questions		**School**	**Race**	**Gender**	**Language**
K1	All wild animals are dangerous	**<0.001**	**<0.001**	n/s	**<0.01**
K4	Snakes are important in nature	**<0.001**	**<0.01**	n/s	**<0.001**
K5	Having an owl in your garden is a good thing	**<0.001**	**<0.001**	**<0.05**	**<0.001**
K6	Bats are useful to humans	n/s	**<0.001**	**<0.05**	**<0.05**

Questions		Variance of responses between demographic groups *(p is significant at 0.05)*			
K8	Frogs only occur in dirty water	n/s	**<0.001**	n/s	n/s
K9	Bats get tangled in people's hair	**0.001**	**<0.05**	n/s	n/s
Attitude questions		**School**	**Race**	**Gender**	**Language**
A1	I have a pet at home	**<0.01**	**<0.001**	n/s	**<0.01**
A2	Pets should be kept outside	**<0.01**	**<0.001**	n/s	**<0.05**
A3	I like it when wild animals are in cages so that the public can see them	**<0.001**	**<0.001**	**<0.05**	**<0.001**
A5	Animals deserve the same amount of respect as humans do	n/s	**<0.05**	n/s	**<0.05**
A6	I am afraid of bats	**<0.001**	**<0.001**	**<0.001**	**<0.001**
A7	I am afraid of owls	**<0.001**	**<0.001**	**<0.001**	**<0.001**
A8	I am afraid of frogs	**<0.05**	**<0.05**	**<0.001**	n/s
A9	I don't think wild animals belong in the city	**<0.05**	**n/s**	**<0.05**	n/s
A11	It is a sign of bad luck to have an owl near your house	**<0.001**	**<0.001**	n/s	**<0.001**
A12	It is okay to use animal parts in medicine	**<0.01**	n/s	**<0.001**	n/s
A13	People who poach wild animals should go to jail	**<0.01**	n/s	n/s	n/s
A14	There is nothing wrong with hunting wild animals for food	n/s	n/s	**<0.05**	n/s
A15	It is necessary to use animals in medical research	**<0.001**	**<0.01**	n/s	**<0.001**
A17	We need wildlife in the city	**<0.01**	n/s	**<0.05**	n/s
Behaviour questions		**School**	**Race**	**Gender**	**Language**

Questions		Variance of responses between demographic groups *(p is significant at 0.05)*			
B1	I like to feed wild animals and birds	**<0.05**	**<0.05**	n/s	**<0.05**
B2a	What would you do if you saw a spider in your home?	**<0.001**	**<0.01**	n/s	**<0.01**
B2b	What would you do if you saw a frog in your home?	**<0.01**	n/s	n/s	**<0.01**
B2c	What would you do if you saw an owl in your home?	**<0.001**	**<0.05**	n/s	**<0.01**
B2d	What would you do if you saw a snake in your home?	**<0.001**	**<0.001**	**<0.05**	**<0.001**
B2e	What would you do if you saw a bat in your home?	**<0.01**	**<0.01**	**<0.05**	**<0.01**

Responses to most of the questions comprising the fear scale (Table 3.1) indicated that demographic variables are significant predictors for the levels of fear towards certain animals (Figure 3.5: Response frequencies showing which language groups were fearful of frogs (A) and frequencies within each language group of predicted behaviour if a frog was in their house (B)

Table 3.2). Only A8 (I am afraid of frogs) showed no significant effect between language groups, however the effects of race ($p<0.001$) and gender ($p<0.001$) were still shown to be influencing factors in the fear of frogs, as with all other items on the fear scale. Females scored lower (1.4) than males (2.6) for all items in the fear scale, indicating that they were more fearful of those species (bats, owls and frogs), however overall there was no significant difference between males and females on the action scale.

When asked about their fear of animals that are reportedly particularly fearsome in some cultures (owls and bats) owing to the myths and superstitions discussed earlier, 34% of English respondents, 50% and 53% of isiXhosa and Setswana respondents respectively, and

a vast majority of isiZulu (70%) and SeSotho respondents (71%) reported that they were afraid of bats (Figure 3.3). However, only 12% of English respondents and 32% of isiZulu and SeSotho respondents and 33% of isiXhosa and Setswana respondents said that they would kill a bat if it was in their home (Figure 3.3). A significant number of isiZulu respondents (58%) reported that they were afraid of owls, however only 32% of them would kill an owl if it was in their house (Figure 3.4). Almost half of isiXhosa and SeSotho respondents (42% and 47% respectively) also said that they were afraid of frogs, but very few English (13%) or Setswana (30%) respondents agreed. (Figure 3.5). Unlike the fear questions, the differences in responses were only slightly significant with only 3% of English respondents admitting that they would kill an owl in their home, and 16% isiZulu, 17% of Setswana, 20% of SeSotho, and 25% of isiXhosa respondents in agreement (Figure 3.4). While there were slightly significant differences between language groups' responses regarding fear of frogs (Figure 3.5), there was none between predicted responses to a frog in their homes, the large majority of all groups reporting that they would take it outside (Figure 3.5).

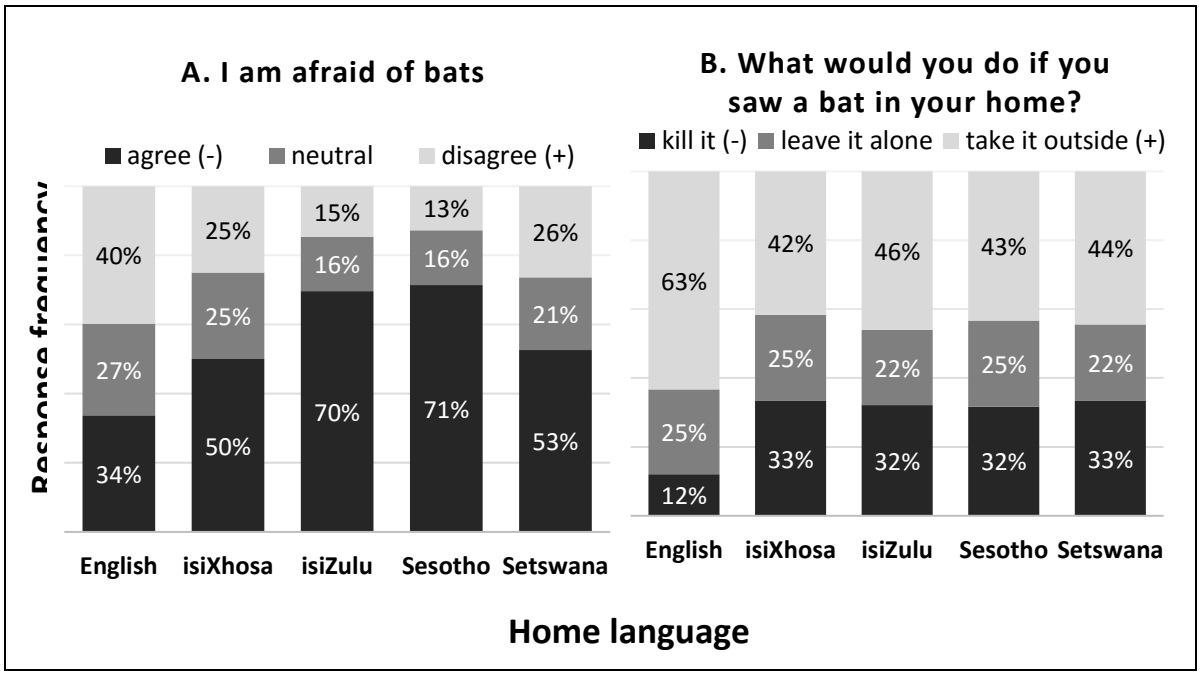


Figure 3.3: Response frequencies showing which language groups were fearful of bats (A) and frequencies within each language group of predicted behaviour if a bat was in their house (B)

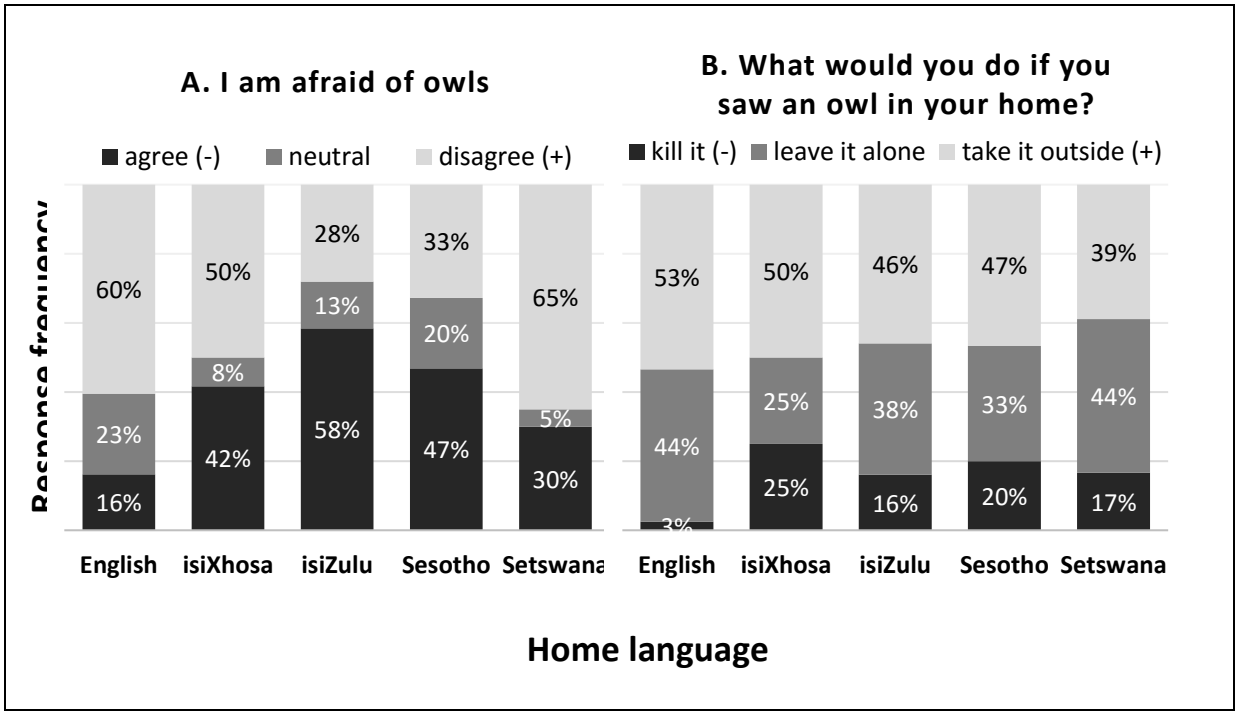


Figure 3.4: Response frequencies showing which language groups were fearful of owls (A) and frequencies within each language group of predicted behaviour if an owl was in their house (B)

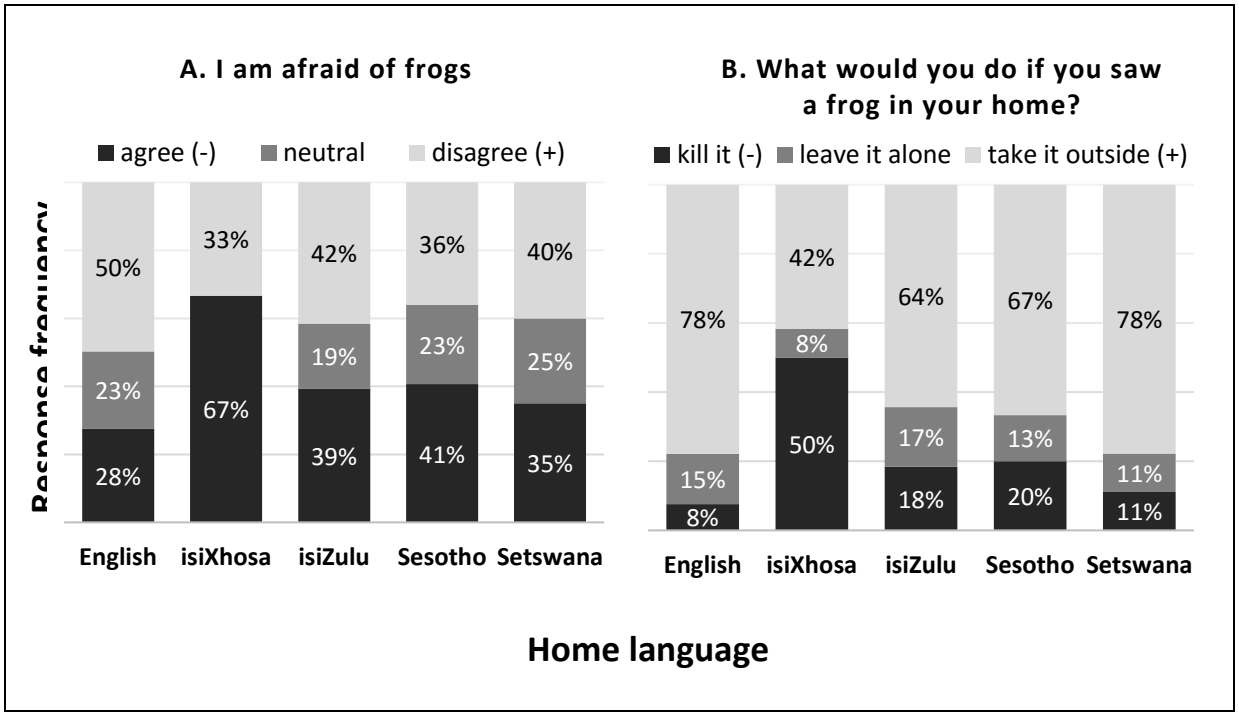


Figure 3.5: Response frequencies showing which language groups were fearful of frogs (A) and frequencies within each language group of predicted behaviour if a frog was in their house (B)

Table 3.2: Average scores for gender, race and home language groups in the fear and action scales (high values indicate less fear and more positive behaviour/action)

Demographic	Average score (fear)	Average score (action)
Gender	**p <0.001**	**p >0.05**
Male (M)	2.6 [F]	2.9
Female (F)	1.4 [M]	2.9
Race	**p <0.001**	**p <0.001**
Black (B)	2.4 [C,I,W]	2.7 [W]
Coloured (C)	1.7 [B]	3.1
Indian (I)	1.6 [B]	3.1
White (W)	1.3 [B]	3.3[B]
Home language	**p <0.001**	**p <0.001**
English (E)	1.6 [X,Z,S]	3.1 [X,Z,S]
isiXhosa (X)	2.6[E]	2.2 [E]
isiZulu (Z)	2.5[E]	2.6 [E]
Sesotho (S)	2.4[E]	2.6 [E]
Setswana (T)	1.9	2.7
Overall	2.0	2.8

Overall, there was a slightly significant negative correlation (r_{392} = - 0.15; $p < 0.01$; Figure 3.6) between the fear and the action scales (Figure 3.6). Cronbach's alpha was equal to 79% and 68% for the fear and action scales respectively.

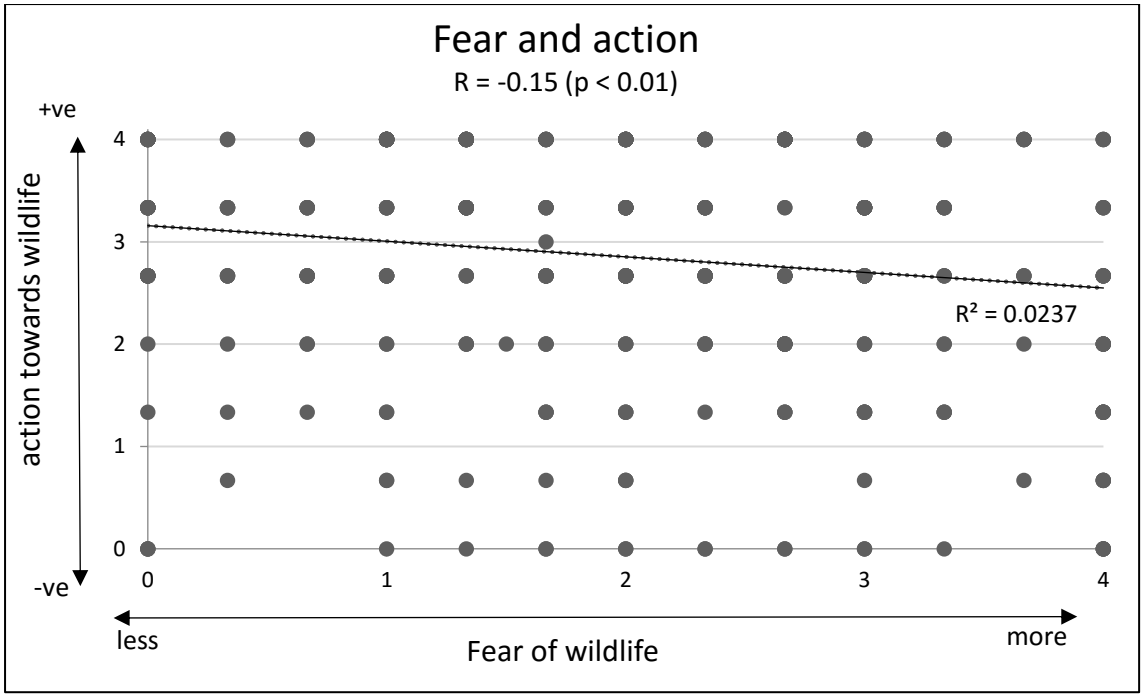


Figure 3.6: Effect of fear on respondents actions towards wildlife

Levels of knowledge and types of attitudes and behaviour

All three constructed scales showed acceptable reliability coefficients. Cronbach's alpha was equal to 72% for the knowledge scale, 70% for the attitude scale, and 67% for the behaviour scale. Across all three schools, the average scores for each scale (knowledge, attitude and behaviour) were between 2.3 and 3, showing fair to good knowledge about urban wildlife, neutral to positive attitudes towards it, and tendencies towards neutral to positive behaviour (Appendix G).

Correlations between knowledge, attitude and behaviour

Pearson Correlation tests revealed significant positive correlations between average knowledge scores and average attitude scores (r_{388}=0.5; p<0.001), average knowledge scores and average behaviour scores (r_{388}=0.4; p<0.001), and average attitude and average behaviour scores (r_{388}=0.43; p<0.001).

The influence of socio-demography on knowledge, attitude and behaviour

Results of the one-way ANOVA of scores by categorical variables showed that there were

significant differences in average knowledge scores ($F_{2,387}$=11.7, p<0.001), average attitude scores ($F_{2,387}$=28, p<0.001) and average behaviour scores ($F_{2,387}$=18.8, p<0.001) between school groups. However, Unequal N HSD post-hoc results showed that Bryanston High School and GHS did not differ in knowledge (p>0.05), attitudes (p>0.05), or behaviour (p>0.05), but both of these schools' scores differed significantly (p< 0.001) from those of St Matthew's Secondary School across all scales. Bryanston High School received the highest scores for all three scales and St Matthew's Secondary School received the lowest scores for all scales (Figure 3.7-A–C).

Significant effects were also seen between race groups in knowledge ($F_{3,343}$=18.8, p<0.001), attitude ($F_{3,343}$=32.87, p<0.01), and behaviour ($F_{3,343}$=15.37, p<0.001) scores. The Unequal N HSD test revealed that White and Indian respondents showed little difference in their knowledge scores (p>0.05), attitude scores (p>0.05), and behaviour scores (p>0.05); however, significant differences were noted between Indian and Black respondents (p<0.01) and White and Black respondents (p<0.001). Coloured, Indian and White respondents all scored higher than Black respondents across all scales. White respondents received the highest scores for all scales and Black respondents the lowest (Figure 3.8-A–C).

Males scored higher than female respondents on all three scales, however not significantly on the behaviour scale (Figure 3.9-A–C). The differences between male and female respondents were slightly significant for knowledge scores ($F_{1,359}$=5.8, p<0.05), and more so for attitude scores ($F_{1,359}$=21.94, p<0.001).

Home language (culture) had a significant effect on all three scores ((knowledge, $F_{4,343}$=10.68, p<0.001); attitude, $F_{4,343}$=17.76, p<0.001; and behaviour, $F_{4,343}$=11.20, p<0.001). However, post-hoc tests showed that effects were significant only between English and isiZulu respondents (p<0.01), and English and SeSotho respondents (p<0.001). Across all three scales, English speaking respondents scored higher than all other language groups across all scales, with SeSotho respondents scoring the lowest (Figure 3.10-A–C).

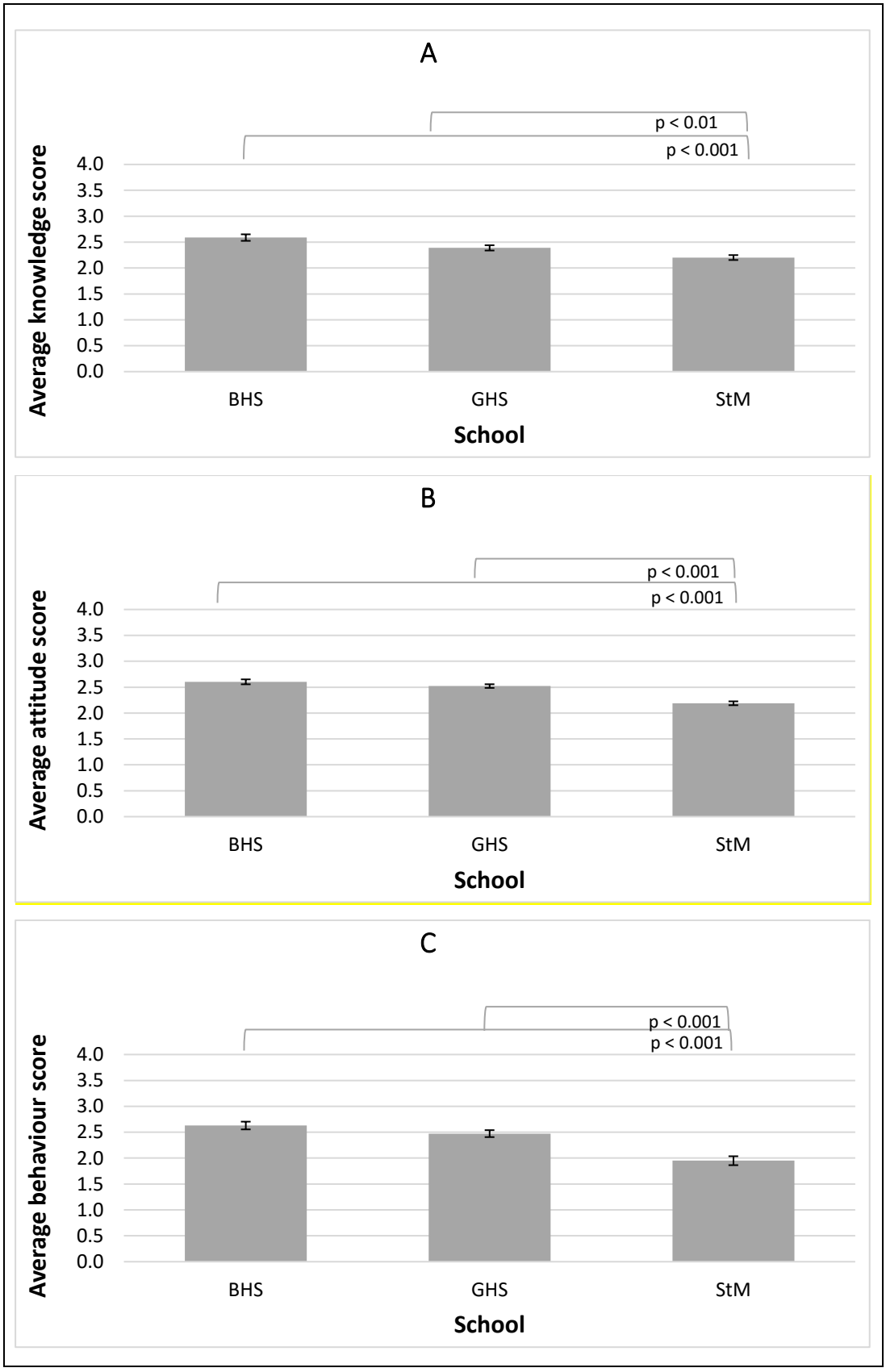


Figure 3.7: Average knowledge (A), attitude (B) and behaviour (C) scores by school. Brackets indicate which groups are significantly different to each other ($p<0.05$), and error bars show standard error

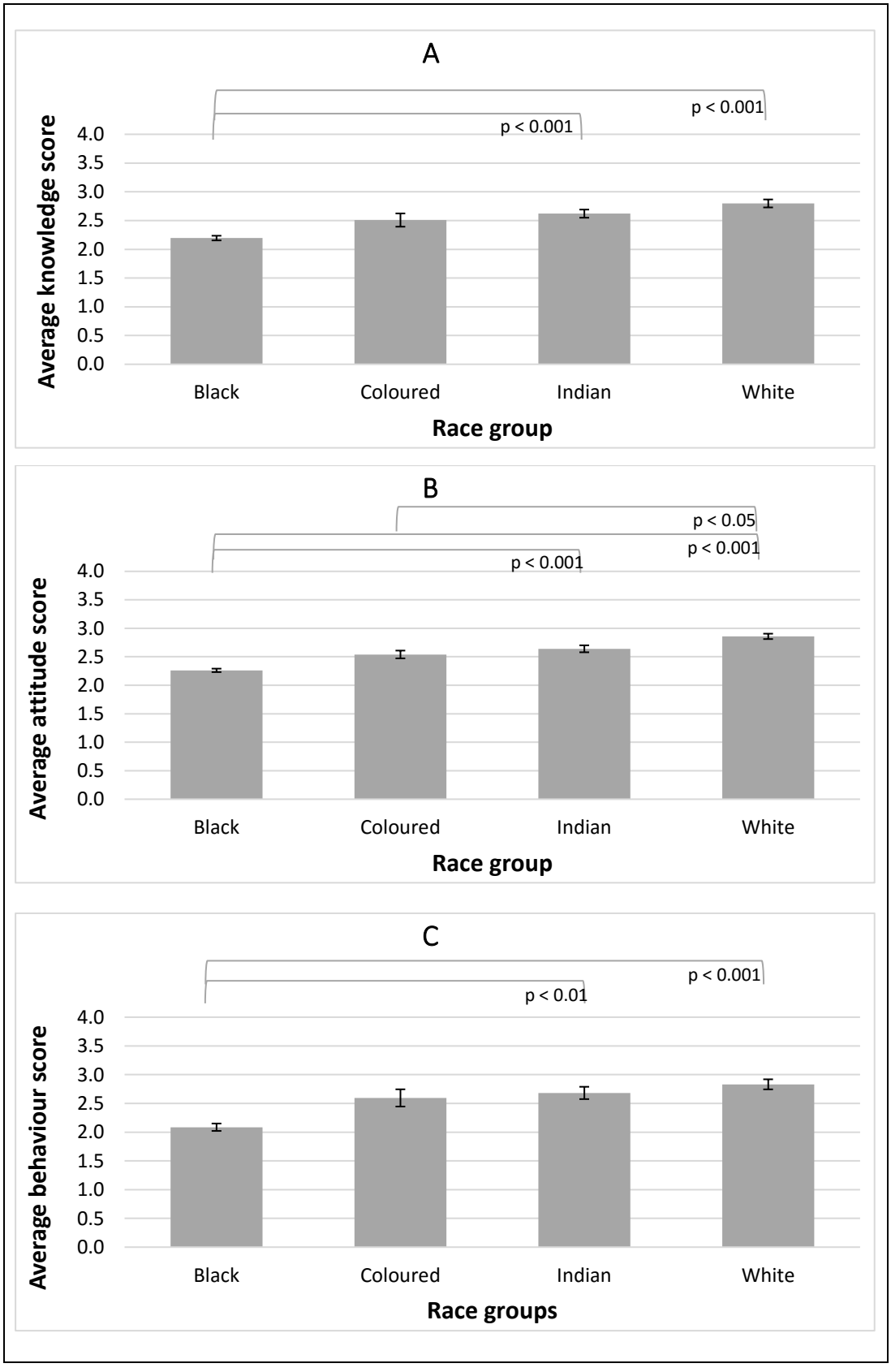


Figure 3.8: Average knowledge (A), attitude (B) and behaviour (C) scores by race. Brackets indicate which groups are significantly different to each other ($p<0.05$), and error bars show standard error

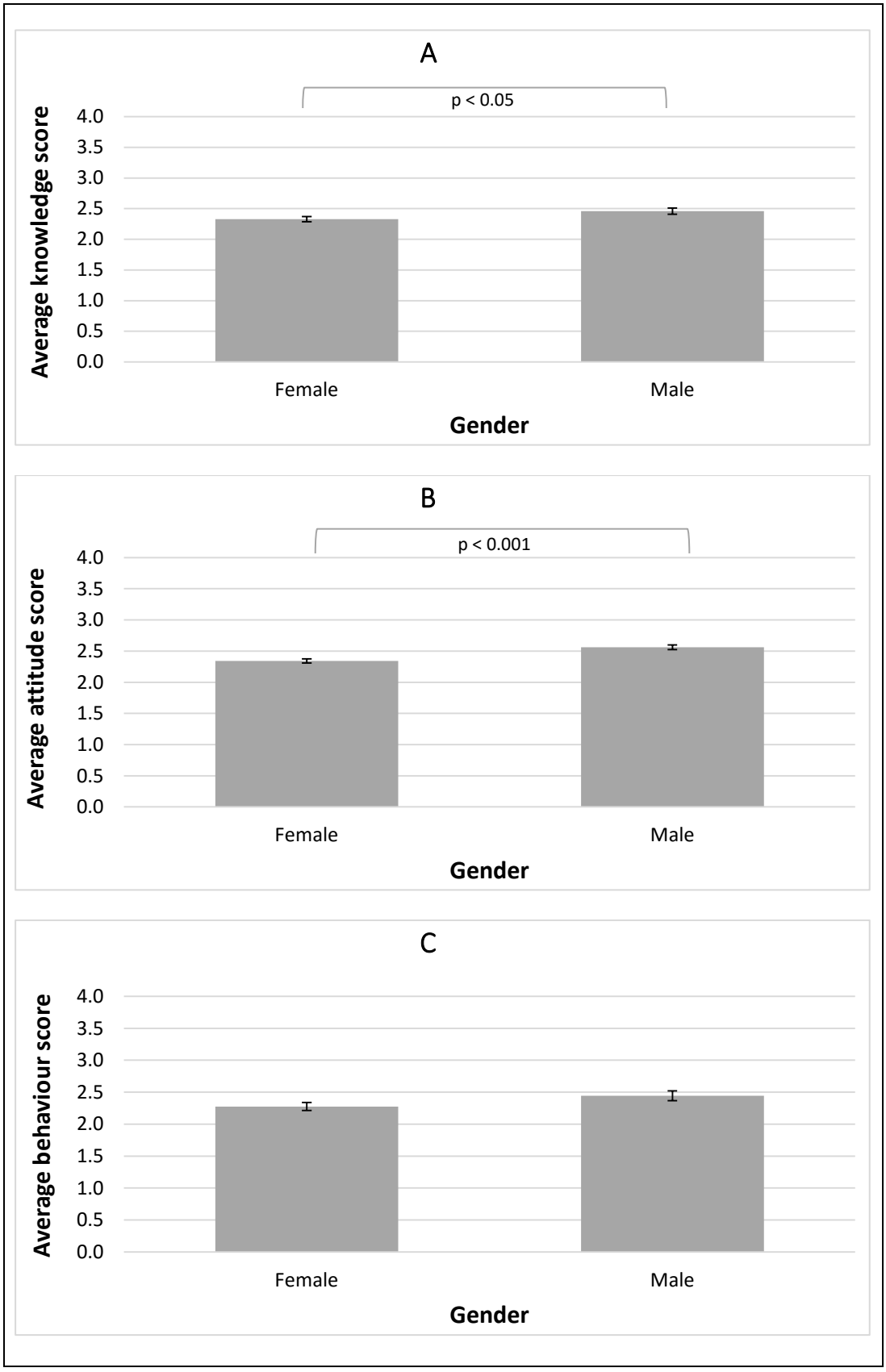


Figure 3.9: Average knowledge (A), attitude (B) and behaviour (C) scores by gender. Brackets indicate which groups are significantly different to each other ($p<0.05$), and error bars show standard error

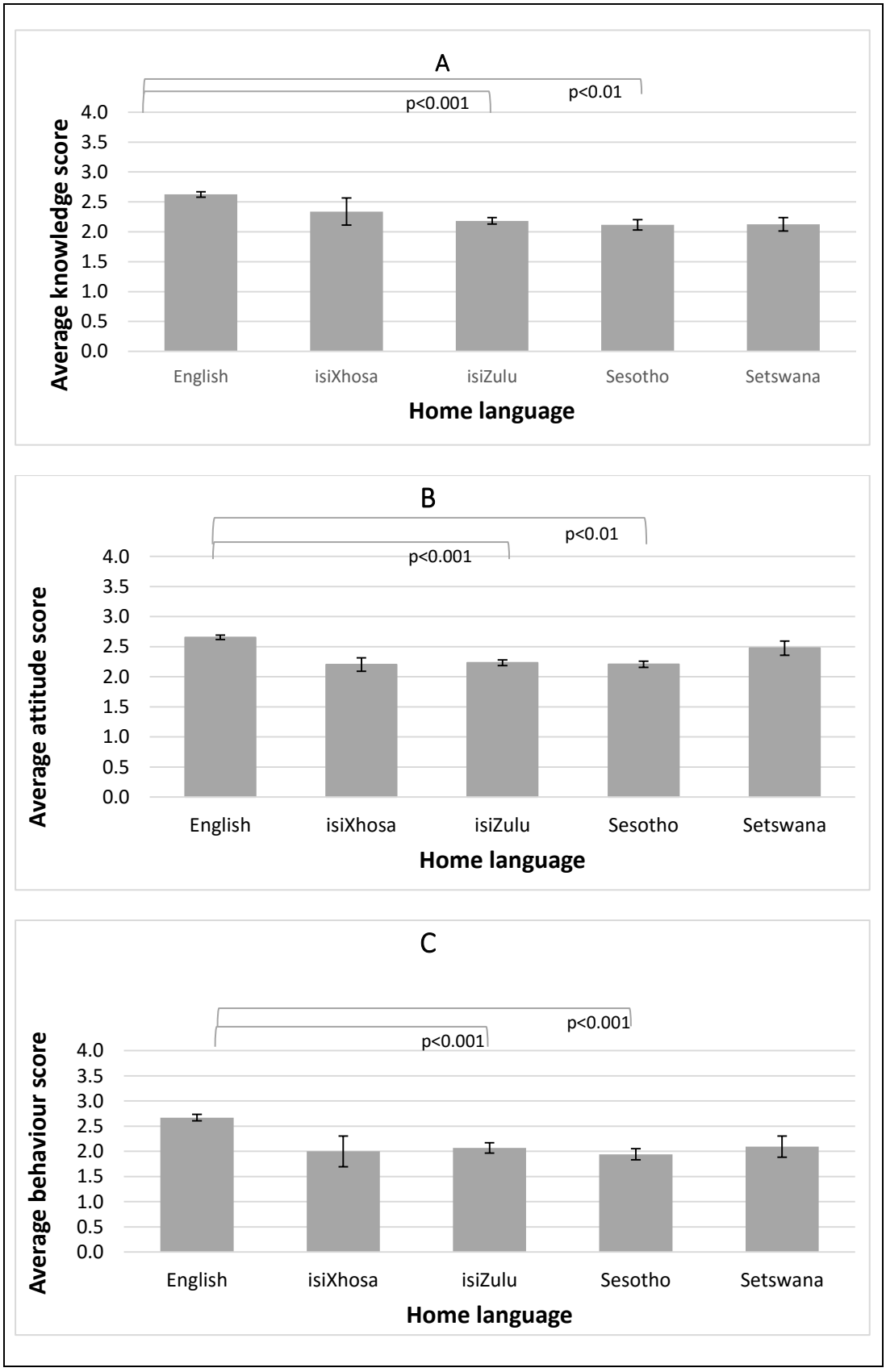


Figure 3.10: Average knowledge (A), attitude (B) and behaviour (C) scores by home language. Brackets indicate which groups are significantly different to each other ($p<0.05$), and error bars show standard error

The influence of socio-demography on knowledge, attitude, and behaviour, controlling for other variables in the model

When controlling for gender in the General Linear Mode (Table 3.3), the effect of language on knowledge scores was significant ($p<0.001$). Average knowledge scores were lower for Sesotho ($p<0.001$) and isiZulu ($p<0.001$) speakers compared to English speakers. Gender had no significant effect ($p>0.05$) when controlling for home language. The overall model was significant ($F_5=10.08$; $p<0.001$), but only explained approximately 12% of the variability (adjusted $R^2=0.12$).

Table 3.3: Results of a General Linear Model, testing effects of gender and home language on average knowledge scores. Bold numbers are significant ($p<0.05$)

Variable	Category	Param. Estimate	Std. err.	t	p
Intercept		**2.28**	**0.05**	**45.43**	**0.00**
Gender	Male	0.02	0.03	0.62	0.54
Home lang	English	**0.33**	**0.06**	**5.28**	**0.00**
Home lang	Sesotho	**-0.16**	**0.08**	**-2.11**	**0.04**
Home lang	Setswa	-0.15	0.12	-1.28	0.20
Home lang	IsiXhosa	0.07	0.14	0.49	0.63

The effects of home language ($p<0.01$) and attitude score ($p<0.001$) on knowledge scores were significant (Table 3.4). Setswana ($p<0.05$), Sesotho ($p<0.001$) and isiZulu ($p<0.001$) learners scored lower than English learners on knowledge scores, and average knowledge scores increased by 0.50 units for every unit increase in attitude score, controlling for the other variables in the model. The model was significant ($F_6=18.69$; $p<0.001$) and explained approximately 24% of the variability (adjusted $R^2=0.24$).

Table 3.4: Results of a General Linear Model, testing effects of gender, home language and average attitude score on average knowledge scores. Bold numbers are significant ($p<0.05$)

Variable	Category	Param. Estimate	Std. err.	t	p
Intercept		**1.09**	**0.17**	**6.58**	**0.00**
Average attitude score		**0.50**	**0.07**	**7.44**	**0.00**
Gender	Male	-0.02	0.03	-0.77	0.44
Home lang	English	**0.19**	**0.06**	**3.15**	**0.00**
Home lang	Sesotho	-0.09	0.07	-1.26	0.21
Home lang	Setswa	**-0.22**	**0.11**	**-2.05**	**0.04**

Variable	Category	Param. Estimate	Std. err.	t	p
Home lang	IsiXhosa	0.12	0.13	0.95	0.34

In determining the effects of gender, home language and knowledge score on attitude score (Table 3.5), the overall model was significant (F_6=26.82; p<0.001) and explained approximately 31% of the variability in the attitude scores (adjusted R^2=0.31). The effects of gender (p<0.001), home language (p<0.001) and knowledge score (p<0.001) were significant. Males' attitude scores were higher than those of females (p<0.001), and attitude scores for Sesotho (p<0.001) and isiZulu (p<0.001) speakers were lower than those of English speakers. Average attitude scores increased by 0.28 units for every unit increase in knowledge score, controlling for other variables in the model.

Table 3.5: Results of a General Linear Model, testing effects of gender, home language and average knowledge score on average attitude scores. Bold numbers are significant (p<0.05)

Variable	Category	Param. Estimate	Std. err.	t	p
Intercept		**1.74**	**0.09**	**18.67**	**0.00**
Gender	Male	**0.08**	**0.02**	**3.37**	**0.00**
Home lang	English	**0.18**	**0.04**	**4.02**	**0.00**
Home lang	Sesotho	**-0.11**	**0.05**	**-2.03**	**0.04**
Home lang	Setswa	**0.17**	**0.08**	**2.17**	**0.03**
Home lang	IsiXhosa	-0.14	0.10	-1.40	0.16
Average knowledge score		**0.28**	**0.04**	**7.44**	**0.00**

For effects of gender, race, knowledge score and attitude score on behaviour score, the overall model was significant (F_7=17.54; p<0.001) and explained approximately 26% of the variability in the behaviour score (adjusted R^2=0.26). The effects of home language (p<0.04), knowledge score (p<0.001), and attitude score (p<0.001) on behaviour scores were significant but gender had no effect (p>0.05). Sesotho (p<0.001) and isiZulu (p<0.001) speakers both scored lower than English speakers on the behaviour scale. Average behaviour scores increased by 0.40 units for every unit increase in knowledge score, and by 0.51 units for every unit increase in attitude score, controlling for other variables in the model.

Table 3.6: Results of a General Linear Model, testing effects of gender, home language, average knowledge score and average attitude score on average behaviour scores. Bold numbers are significant ($p<0.05$)

Variable	Category	Param. Estimate	Std. err.	t	p
Intercept		0.02	0.27	0.06	0.96
Gender	Male	-0.04	0.05	-0.83	0.40
Home lang	English	**0.27**	**0.09**	**2.89**	**0.00**
Home lang	Sesotho	-0.11	0.11	-1.03	0.30
Home lang	Setswa	-0.07	0.17	-0.43	0.67
Home lang	IsiXhosa	-0.10	0.20	-0.51	0.61
Average knowledge score		**0.40**	**0.09**	**4.55**	**0.00**
Average attitude score		**0.51**	**0.11**	**4.63**	**0.00**

3.4. Discussion

The results of the school survey indicate that there is a positive correlation between higher levels of knowledge about wildlife and more positive attitudes towards wildlife in urban COJ, as well as between higher levels of knowledge about wildlife, more positive attitudes towards it, and more positive predicted behaviour towards wildlife. I also found evidence that socio-demographic variables, and particularly home language (culture), were significant influencers of levels of knowledge about wildlife, types of attitudes towards urban wildlife, and predicted behavioural responses in potential encounters with wildlife in the COJ. Analysis of patterns in responses to individual questions also revealed that race, gender and culture (extrapolated from home language) influenced Grade Ten learners' attitudes and behaviour towards certain species such as owls, bats and snakes.

The overall average for the knowledge scale was 2.4, indicating fair levels of knowledge according to the constructed scoring scale (Appendix G). There were significant differences in scores for the knowledge scale between schools, with St Matthews Secondary School scoring lower than Greenside and Bryanston High Schools. However, as mentioned, when controlling for school there was no significant effect between black learners from all three schools. The differences between schools could be as a result of the areas in which they are situated, and the demographics of their learners. Bryanston and Greenside High are both in affluent suburbs, while St Matthews is in Soweto, which is made up of a mixture between

middle class and poverty stricken areas.

The significant differences found between knowledge scale scores for different race groups, with Black respondents scoring significantly lower than Indian and White respondents, could be explained by a number of factors. Not only are there multiple variables that influence our attitude and behaviour, there are also those that influence our knowledge, as demonstrated by results above. Knowledge is amassed throughout our lives through personal experience, level of exposure to different subject matters, formal education, and socially constructed knowledge in the form of cultural traditions and stories passed down through generations (Kellert and Berry, 1980; Serpell, 2004; DeMello, 2012). As discussed previously by Menon and Lavigne (2006) and Kellert and Berry (1987), our knowledge systems are also impacted on by the extent to which we embrace new or different knowledge that challenges our world views.

In South Africa, with its diversity of cultures, there are many factors at play, including the historical disadvantages placed on Black South Africans during Apartheid, in which Black people were subjected to low quality, if any, formal education, and were heavily disadvantaged from an economic perspective (Thompson, 2001). Black South Africans, particularly in urban areas, have also not had as many opportunities to access environmental resources through tourism and education, and the conservation of wildlife has historically been considered to be a 'White privilege', with the Kruger National Park representing the very epicentre of Afrikaner culture for many years (Beinart and Coates, 1995; Cock, 2007). However, it is not only Black South Africans who have been alienated from wildlife and the natural environment, but also many urban residents who have never left the city. One imagines that when not having direct access to wildlife and undeveloped natural spaces, a person may rely on the stories passed on by others or in books or movies, rendering nature and wildlife as fairly abstract, wild and uncivilised, far removed from urban life. Without personal experience, nature may be considered to have little benefit to the self, and therefore the concept of animals as part of a much larger ecological system essential for human survival might not be conceivable (Menon and Lavigne, 2006). All of these factors, including low levels of knowledge, contribute to the development of attitudes and behaviours (Bjerke and Østdahl, 2004; Sexton and Stewart, 2007; Batt, 2009; Dickman, 2010; Randler, Hummel and Prokop, 2012; Laidley, 2013).

The differences found between scores on the attitude scale between race, gender and cultural groups are reminiscent of those reported in many previous studies around the globe (Kellert and Berry, 1987; Stern and Dietz, 1994; Serpell, 2004; Taylor and Signal, 2005; Herzog, 2007; Prokop and Tunnicliffe, 2008; Prokop, Fancovicova and Kubiatko, 2009). If one were to categorise questions in this survey according to Kellert's (1980) scale of attitude types (Appendix A) and consider findings from studies using this scale (see Drews, 2002 and Menon and Lavigne, 2006) or adaptations of it, there are certain items in this questionnaire in which significant effects of demographic variables such as race, culture and gender would be expected. For example, high scores for question K6 (bats are useful to humans) and question A15 (it is necessary to use animals in medical research) would indicate a utilitarian attitude type, while low scores for question A11 (it is a sign of bad luck to have an owl near your house) or questions A6–A8 (I am afraid of bats/owls/frogs) would place respondents in the negativistic category. Kellert and Berry (1987) suggested that such attitude types were affected by variables such as gender, cultural beliefs or superstitions.

In my survey, Black respondents scored significantly lower on the attitude scale (a higher score reflects a more positive attitude) than White and Indian respondents, male respondents scored significantly higher than females, and English-speaking respondents scored higher than other language groups. As with the knowledge scale, there are potentially numerous factors at play here, and clarity might lie in the answers received for some of the individual questions. For example, I have read, and many Black South Africans from different cultures have told me, that according to their culture, an owl landing on your roof brings bad luck; it is an omen that there will be a death in the family (Lewis, 2006), and so members of these cultures are likely to agree with the statement 'I am afraid of owls'. In this survey, there were significant differences between the responses from different home language (cultural) groups, in which a large proportion of isiZulu, isiXhosa, SeSotho, and Setswana respondents agreed with the statement, and this pattern emerged for other items included in the fear scale (Figure 3.3;Figure 3.4; Figure 3.5). One interesting finding was that just over 30% of isiZulu, isiXhosa, SeSotho and Setswana respondents said that they would kill a bat, but only 25% of isiXhosa, 16% of isiZulu, 20% of SeSotho, and 17% of Setswana respondents said the same for an owl. This could be due to the disease avoidance and disgust reaction bats often evoke for people that owls do not (see Prokop and Tunnicliffe,

2008; Prokop, Fancovicova and Kubiatko, 2009; Randler, Hummel and Prokop, 2012), or perhaps because bats are merely considered to be pests because they are so common in urban areas. The element of fear of reprisal for killing an owl could also play a role in learners' responses.

According to Kellert's (1980) scale, these responses reveal negativistic attitudes, and are as a result of what people have been taught throughout their lives. People's attitudes are said to be a result of, among other things, what they know (or think they know) and what they are motivated by. As discussed previously, studies by others (see Hill 1993; Serpell 2004; Batt 2009; Prokop *et al.* 2009; Barnes 2013) proposed that people's beliefs and values about wildlife species are motivated by instrumental self-interest, empathy/identification, fear or disgust or by a myriad of other factors that define Kellert's attitude types, such as the dominionistic attitude type, resulting from an interest in primarily dominating or exerting full control over animals and other natural resources. Respondents agreeing with the statement 'I like it when wild animals are in cages so that the public can see them' are demonstrating a dominionistic attitude.

My results differed from many previous studies done in other countries, such as the work by Prokop, Fancovicova and Kubiatko(2009) who found significant differences between attitudes of males and females towards wildlife. Kellert (1987) discussed at length the differences between male and female attitudes to different species, arguing that males preferred species with more utility value, such as game species, and biting and stinging species such as spiders, scorpions and snakes, while females have better attitudes towards more aesthetically pleasing animals such as butterflies, or to those with anthropomorphic attributes that make an animal cute or appear vulnerable, which appeals to females' maternal instincts. While gender did not emerge as a particularly significant influencer of attitude overall, there were patterns that emerged that echoed the findings of other studies (Kellert and Berry, 1987; Bjerke and Østdahl, 2004; Batt, 2009; Prokop, Fancovicova and Kubiatko, 2009) to a degree. For example, males did reveal more utilitarian attitudes than females by scoring low on items such as 'It is okay to use animal parts in medicine' and 'It is necessary to use animals in medical research', and females more negativistic by scoring low on fear items and 'I don't think wild animals belong in the city'.

Results of this study suggest that home language (culture) of respondents was a primary determining factor in their attitudes, and that their levels of knowledge about wildlife was another. While some values and beliefs are very difficult to address, particularly those entrenched in culture, it is clear that improving knowledge about wildlife can go a long way to improving attitudes towards it (Prokop, Fancovicova and Kubiatko, 2009; Randler, Hummel and Prokop, 2012; Tarrant, Kruger and du Preez, 2016). My findings here reinforce the theory that knowledge about wildlife, and types of attitudes towards it, exert strong influences over the types of predicted behavioural responses to potential wildlife encounters (Hill, 1993; Serpell, 2004). As previous studies (Stephen R Kellert and Berry, 1987; Hill, 1993; Drews, 2002; Batt, 2009; Prokop, Fancovicova and Kubiatko, 2009) suggested, there appear to be direct motivating factors for types of behaviour, including disgust, fear, personal affinities to animals and self-interest. An illustration of this taken from the results of this survey is the positive correlation between low average scores for the fear and action scales. However, one must be careful in assuming cause and effect. While there may be a relationship between fear and behaviour, it is not necessarily causal - there may be confounding variables that affect both fear and behaviour independently, such as cultural beliefs, personal experiences and levels of knowledge. Relationships between variables also do not necessarily only run in one direction; this study, echoing the findings of Randler *et al.* (2005), also found that positive attitudes increase the likelihood that learners possess more knowledge about wildlife, presumably because they are more interested and less averse than learners who are fearful or disgusted.

The study certainly provided more insight into the levels of knowledge Grade Ten learners in the COJ have about urban wildlife, and was able to provide a measure of the attitudes and behavioural tendencies they exhibit towards animals in the city. The study also contributed to our understanding of the relationships between some learners' knowledge, attitude and behaviour towards urban wildlife in Johannesburg, demonstrating that there are significant positive correlations between higher levels of knowledge and more positive attitudes, and between higher levels of knowledge, more positive attitudes, and more positive behavioural tendencies indicated by the learners. While some patterns relating to how socio-demography affects learners' levels of knowledge and types of attitude and behaviour have also been noted, it is problematic to draw certain conclusions regarding the impact of socio-

demographic variables, because I was not able to sample schools from all regions of the city, sampling just one township school, which consisted only of black learners. This affected the validity of the sample group as a representation of the population of Johannesburg.

The results of the survey contribute substantially to the study of how knowledge, attitude, and behaviour are related, how these are affected by our socio-demographic traits. The survey also revealed where we should focus our efforts to better implement environmental education activities to improve attitudes and behaviour towards urban wildlife among the adolescents of Johannesburg. Additional studies should further investigate prevalent superstitions and how these have changed in contemporary South Africa; in particular, how our youth interpret them in light of multiple other ‘alternate conceptions’.

Chapter 4. There is a bat in my kitchen, what am I going to do? Investigating the social motivations behind human-wildlife interactions amongst adults in the general public

4.1. Introduction

Conservation action can only be effective if it takes cognisance of the motivations behind certain behaviours. What makes us behave in a particular way towards an injured baby bird, and in another to a bat trapped in our kitchen? Is it a result of an evolutionary instinct that associates bats with the spread of disease, or because we have been conditioned by books, movies and cultural storytelling to believe that bats feed on human blood or get tangled in peoples' hair? Dickman (2010) stressed that conservationists often make a fundamental mistake when attempting to mitigate conflict between humans and wildlife by not taking into account the perceived, as opposed to the actual, risks to humans in a conflict situation. Our responses are often proportionate to the risk we believe we take in an encounter with an animal, rather than the actual risk that animal likely poses to us (Dickman, 2010). To effectively reduce or mitigate human-wildlife conflict, we therefore need to examine people's motivations behind their behaviour towards wildlife. These motivations may have varying origins based on how old we are, what gender we are, what culture we have been raised in, what we have been taught (not only through formal education but also other sources such as media and storytelling) and our personal experiences with the world (Kellert and Berry, 1980; Bjerke and Østdahl, 2004; Taylor and Signal, 2005; Dickman, 2010). All of these things, as well as more unconscious factors such as an animal's physical or behavioural similarity to humans (Batt 2009), feelings that it evokes, or its aesthetic appeal (Czech B, Krausman and Borkhataria, 1998; Knight, 2008; Prokop, Fancovicova and Kubiatko, 2009) contribute to our attitudes, and in turn our behaviour towards wild animals, as discussed in chapters 1 and 3.

There are a wide variety of causes of human-wildlife conflict in rural areas, such as predation of livestock, spread of disease to domestic animals and humans, attacks on humans and destruction of crops (Dickman, 2010). Dickman (2010) also refers to losses of

livelihoods and homes experienced by rural residents when they are displaced by wild animals or conservation efforts. While this is true all over the world, the scale and extent of confiscation of land and forced removals of Black South Africans for, among other reasons, the creation of game reserves by the Apartheid regime, left a particularly heightened and long lasting legacy of anger and resentment long after apartheid was over, and in many cases that resentment was projected onto wildlife and efforts to conserve it (Cock, 2007). In addition, the rapid densification of human habitation in the form of ever-growing cities and conflict over scarce resources may well lead to a large proportion of human interactions with wildlife in urban areas being somewhat antagonistic.

In South Africa there are indeed strong associations between animals and various cultural beliefs and practices, and the COJ is home to a huge variety of cultures (Statistics South Africa, 2016). Examples of these associations were discussed in chapters 1 and 3 (Garbutt, 1909; Marcot, Johnson and Cocker, 2000; Bjerke and Østdahl, 2004; Lewis, 2012). With these kinds of associations entrenched in cultures and social realities we may consciously, or unconsciously, develop preferences for some types of animals over others.

Following theories that personal experiences and increased levels of knowledge about wildlife alter our attitudes and behaviour towards it (Kellert and Berry, 1980; Drews, 2002; Dearborn and Kark, 2009; Prokop, Fancovicova and Kubiatko, 2009; Randler, Hummel and Prokop, 2012; Barnes, 2013), it is logical to consider that, should this be the case, adults will certainly have somewhat different attitudes to children who have not had the same life experience. It may also be justified then to expect the attitudes and behaviour of adults to be quite different to those of children and adolescents because of their greater responsibilities (keeping their children safe and free of disease, valuing animals for food for their children etc.).

A study by Bjerke and Østdahl in 2004 investigated animal species preference amongst adults in Trondheim, Norway through a survey requesting respondents to indicate how much they liked a species on a five point Likert scale ranging from ‘dislike very much’ to ‘like very much’. Species included a large variety from mosquitoes and beetles to dogs, pigeons, hedgehogs, butterflies and squirrels. Bjerke and Østdahl (2004) hypothesised that adults have similar species preference to children, that adults would prefer pets to wild urban

animals, that females would demonstrate a preferance for pets over wild animals, particularly unpopular species such as bats, snakes and invertebrates, and that appreciation of urban animals increases with higher levels of education, and decreases with age. The study found that people most liked species such as hedgehogs, squirrels and small birds and disliked bees, snails, rats and mosquitoes, reinforcing the results of other studies (Czech B, Krausman and Borkhataria, 1998; Serpell, 2004; Prokop and Tunnicliffe, 2008). Bjerke and Østdahl (2004) also found that people did not prefer pets to wild animals, that females did tend to show preference to the more popular animals (e.g. squirrels, butterflies and small birds), that preference scores were positively associated with education level, but that age was not consistently related to appreciation of urban animals, rather that this varied across species.

Chapter 3 provided insight into the knowledge, attitudes and behavioural tendencies in adolescent learners (13–18 years old) residing in the City of Johannesburg, Gauteng Province, South Africa. Chapter 3 also provided some suggestions as to the extent of the role that socio-demography plays in influencing knowledge, attitude and behavioural tendencies, as well as how levels of knowledge influenced learners' attitudes and behaviour, and how their attitudes influenced their behavioural tendencies and willingness to learn about wildlife. I found there to be significant effects of socio-demographic variables such as race, gender and home language (culture) on all three dependent variables (knowledge, attitude and behaviour), as well as significant correlations between scores for the dependent variables themselves. Home language (culture) was the most significant predictor of all three variables, that attitudes towards urban wildlife increased (became more positive) with increased knowledge, and that behaviour scores increased (became more positive) with increased knowledge and attitude scores.

In this chapter, my objectives were to gain an understanding of the levels of knowledge about urban wildlife amongst the general adult public in the COJ, to assess the types of attitudes and behaviour (positive or negative) that urban residents demonstrate towards wildlife in the city, and to investigate the relationships between residents' knowledge, attitudes and behaviour towards wildlife. I also intended to establish relationships between socio-demographic attributes of individuals or groups, and their attitude and behaviour towards wildlife in the city, as well as how these variables influence each other, as in

Chapter 3. I also compared these findings to those reported in Chapter 3 regarding the knowledge, attitudes and behaviour amongst adolescents to uncover possible patterns that will guide more effective future urban conservation campaigns.

4.2. Materials and methods

Study area and participants

The City of Johannesburg is South Africa's largest city with a population of almost four million people (Anon 2012;City of Johannesburg 2012). Historically, Johannesburg was characterised by sprawling urbanisation and stark spatial inequality between the suburban residential areas and the high density townships, which had limited access to jobs (City of Johannesburg, 2016). This spatial inequality was a result of the Apartheid-enforced segregation of the population by race (Turok, 2014). Apartheid literally means 'apart'-'hood' and refers to a 'political system in South Africa in which people were divided into racial groups and kept apart by law' (HarperCollins Publishers Limited, 2018). Not only is the population of the COJ extremely diverse in terms of cultures, races and income levels, these patterns are replicated in the physical landscape of the city itself. In order to study a representative sample of adult COJ residents, it was necessary for me to distribute questionnaires in all areas of the city. I developed a more concise and slightly edited version of the questionnaire applied in Chapter 3 (shown in Appendix E) for the general public (Appendix L), with the intention that it be quick and convenient for people to complete wherever they were, enabling me to sample a larger group. The information provided to respondents when introducing the questionnaire indicated that it was intended only for residents of the City of Johannesburg, however this could not be regulated and so, where necessary, extra-limital responses were removed from the initial data sample.

Public questionnaire construction and distribution

The questionnaire was created and hosted on the Survey Monkey platform (www.surveymonkey.net), which is a web-based survey service that enables anyone to

develop and customise questionnaires and collect and analyse responses from a chosen audience. I shared a link to the questionnaire via email to personal and professional networks, by word of mouth, and through extensive exposure via social media, particularly Facebook (www.facebook.com). There is a high risk of bias when using online sampling because responses would only have been received from those who had access to the internet, which excludes approximately 35% of the population of Johannesburg (Statistics South Africa, 2015). To mitigate this, I printed over 500 hard copies of the questionnaire and distributed them in public places, left them in doctors' waiting rooms and gave them to colleagues, acquaintances, friends, peers and family to distribute to their networks. The public questionnaires were anonymous but requested similar socio-economic and cultural background details to those required by the Grade Ten group in Chapter 3 (age, race, gender, and home language), as well as their highest level of education received, their occupation (optional) and locations of places of residence. Culture was extrapolated from home language because home language among citizens of South Africa is a strong predictor of culture, and is a vehicle for the development and spread of cultural values and practices (Prah, 2007). The exception to this is that of South African English speakers who belong to any of a myriad of cultures from all over the world, however are predominantly associated with Western culture.

Similarly to the school surveys, the public survey consisted of questions adapted from Herzog's Animal Attitude Scale (Herzog, Betchart and Pittman, 1991b) and Templer's Pet Attitude Scale (Templer *et al.*, 1981), and were constructed in a similar manner to those distributed in studies by the likes of Batt (2009), Prokop *et al.* (2009) and Tarrant *et al.* (2016). The public questionnaire (Appendix L) consisted of 31 questions spread across three scales (knowledge, attitude and behaviour).

Determining levels of basic knowledge about wildlife

For the surveys directed at the general public, I used five simple fact-based questions to establish the level of general biological knowledge amongst the respondents. In the questionnaire, I asked respondents to express their level of agreement using a Likert Scale of 'strongly disagree' (SD); 'disagree' (D); 'neutral' (N); 'agree' (A) and 'strongly agree' (SA) with four statements about wild animals that occur in Johannesburg. For each question, a

score of between 0 and 4 was given; I used the answers to these questions to generate a knowledge score for each respondent by averaging the respondent's answers for that section and rated this score against a constructed scale ranging from 0–4, with 0 indicating very poor levels of knowledge about wildlife and 4 indicating very high levels (Appendix G). This is discussed further in the 'Analysis of responses' section below. Only respondents answering at least three of the five knowledge questions were included in the analysis. There were 12 respondents who answered fewer than three questions and were excluded. Please see Appendix M for the scale of scores for selected responses.

Understanding attitudes towards wildlife

I adapted an attitude scale from existing scales described in Chapters 1 and 3 (Templer, 1886; Herzog, Betchart and Pittman, 1991; Mayer and Frantz, 2004; Templer *et al*, 2006), as well as the school questionnaire itself (Appendix E) to determine how the respondents think and feel about certain species. I asked respondents to indicate their level of agreement with 11 opinion-based statements to ascertain the types of attitudes residents of Johannesburg are likely to show towards urban wildlife. Four statements required Likert-scale responses and seven were binary ('yes' or 'no') for each statement. For each question, a score of between 0 and 4 was given, and these scores were averaged to generate an overall attitude score. An average attitude score of 0 indicated a very negative attitude towards wildlife, and 4 indicated a very positive attitude (Appendix G). Only respondents answering at least six of the 11 attitude questions were included in the analysis. There were 12 respondents who answered fewer than six questions and were excluded.

Understanding types of behavioural tendencies towards wildlife

I used two direct questions and five scenario-based questions to determine behavioural tendencies respondents were likely to demonstrate towards urban wildlife. Scores assigned to response options were tabulated in Appendix M. The first question required that respondents answer 'yes' or 'no' to whether they used poison to control pests in their homes and in their gardens. Respondents were then requested to provide an estimation of how often they visit parks or green spaces by choosing one of the following answers: 'at least once a week'/'once or twice a month'/'several times a year'/'very seldom'. In addition,

I presented them with five scenarios in which they would come across a particular animal in their home or garden, and requested that they select from a list of options a course of action that they think they would take in each case - 'kill it'/'take it outside'/'call a professional'/'leave it alone'/'don't know'. I generated an overall behaviour score by averaging the respondent's answers for that section, resulting in a value of between 0 and 4, 0 indicating very negative intentions for behaviour towards wildlife, and 4 indicating very positive intentions (Appendix G). As for the school survey, the behaviour questions were designed to assess what type of animal, and what characteristics of an animal, incite certain types of behaviour. Each animal presented in the scenario questions was chosen because it possessed certain characteristics; either physical traits, behavioural traits, or an association with a particular superstition, event or phenomenon (Davey *et al.* 1998; Czech *et al.* 1998; Serpell 2004; Knight 2008; Prokop & Tunnicliffe 2008; Batt 2009). I adapted the behaviour questions slightly for the public survey in response to comments on a pilot survey sent out to around 40 COJ residents, who suggested that I also include 'call a professional' as a choice of action when encountering a wild animal in their home, as many people would not want to kill it but might be too afraid, or unsure of how, to remove it. These pilot respondents also suggested I include the likely behavioural response of residents when encountering the same animals in the context of one's garden, as this would illicit a different response to finding them in one's home. Only respondents who answered at least eight of the 15 questions were included in the analysis. There were eight respondents who answered fewer than eight questions and were excluded.

To measure the reliability of the constructed knowledge, attitude, and behaviour scales, I ran a Cronbach's alpha test on each one, a test commonly used to determine reliability of scales based on scores from multiple Likert items (Tavakol and Dennick 2011).

As in Chapter 3, a fear scale was generated using the 'I am afraid of [spiders; frogs; owls; snakes; bats; squirrels]' questions (questions A6–A11, Appendix M). To determine types of behaviour that may be related to items on the fear scale, an action scale was also created, including the 'what would you do if you saw a [spider; frog; owl; snake; bat; squirrel] in your home?' questions and the 'what would you do if you saw a [spider; frog; owl; snake; bat; squirrel] in your garden?' questions (questions B4–B15, Appendix M) I also ran a Cronbach's alpha test on the fear and action scales to determine reliability.

Analysis of responses

After receiving the responses, I removed those respondents under the age of 18, as these totalled only 12 responses and this group formed part of the schools study in Chapter 3. I also removed any responses in which respondents provided no demographic details (three responses).

I used Statistica version 12 (Statsoft, 2014) to obtain basic statistics for the dataset, including the valid number of responses, the mean, median, mode, and standard error of response scores. I used Spearman Rank Order Correlation to identify significant correlations between scores on all of the scales, including fear and action).

I performed a Pearson Chi-square test for each question to determine whether independent variables had a significant effect ($p \leq 0.05$) on responses to individual questions, and how so. If the Chi-square tests identified significant differences between responses for any of these questions, the responses were interrogated further. When representing the response frequencies visually, I combined the 'strongly disagree' and 'disagree' options into 'disagree', and 'agree' and 'strongly agree' into 'agree', to show clear difference between groups' levels of knowledge and whether their attitudes are negative, neutral, or positive.

Scores on the two scales based on the fear and action questions were then assessed using a Spearman Rank Order Correlation, to find out if higher levels of fear towards certain species were related to negative behaviour towards these species. For this analysis, I coded the responses so that 0=low fear levels and 4=high fear levels. The action scale remained as 0=negative action and 4=positive action.

I calculated the average knowledge, attitude and behaviour scores for each independent (categorical) variable - age, race, gender, home language, and highest level of formal education received (education) - to interrogate how scores differed (positively or negatively) between groups. Because the public survey response data were not normally distributed, I performed a Kruskal-Wallis ANOVA on the average scores for each categorical variable (age, race, gender, home language, and education) to determine the influence of the independent variables on scale scores. I used a multiple comparisons of mean ranks test to highlight groups within a category that vary significantly ($p \leq 0.05$) from one another.

Respondents who did not provide an answer to a question were not included in the average score for that measure. Respondents who indicated that they belonged to an 'other' race group were removed from the analysis, as there were only four of these cases and they made up a heterogeneous group, reducing their predictive potential. Similarly, with the question about home language, categories with less than ten responses were not included in the average scores for that particular scale, as these were likely to be unrepresentative. I also plotted average knowledge scores (y-axis) against highest level of education received (x-axis) for each home language (culture) to identify the extent to which informal (cultural) education may be influencing levels of knowledge about wildlife.

Because I converted the Likert responses from items into average scores on a continuous scale, I was able to run a General Linear Model (GLM) to determine the effect of gender, age, home language (culture) and highest level of education (hereafter education) on knowledge scores, with knowledge score as the dependent variable and gender, age, home language and education as the independent variables (Norman, 2010). I used respondents older than 60, females, Setswana speakers, and those with only some secondary education as reference groups for the GLM. I excluded race from the model because race and home language in South Africa are strongly collinear, and home language, in this case, speaks to race and to culture, which is a more pertinent predictor variable in this study. The effect of gender, age, home language, education and knowledge on the attitude score and the effect of gender, age, home language, education, knowledge and attitude on the behaviour score were determined analogously. I also performed an Unequal HSD post-hoc test to compare scores within the categories to confirm whether demographic groups were significantly different to each other.

A total of 779 completed questionnaires were submitted by residents of the City of Johannesburg.

4.3. Results

Socio-demography

The demography of respondents was notably biased towards females, with 65.6% female and 33.6% male respondents (six chose not to disclose their gender (Figure 4.1-A). In addition, 76.4% of respondents classified themselves as white while only 13% selected black and less than 10% selected coloured or Indian (Figure 4.1-B). A large proportion of respondents (44%) were between 31 and 45 years old while 25% were between 46 and 60 (Figure 4.1-C). The majority (79.5%) of respondents had received a tertiary level education, with only less than 4% not having matriculated (Figure 4.1-D). A total of 12 home languages were identified in the sample (Figure 4.1-E).

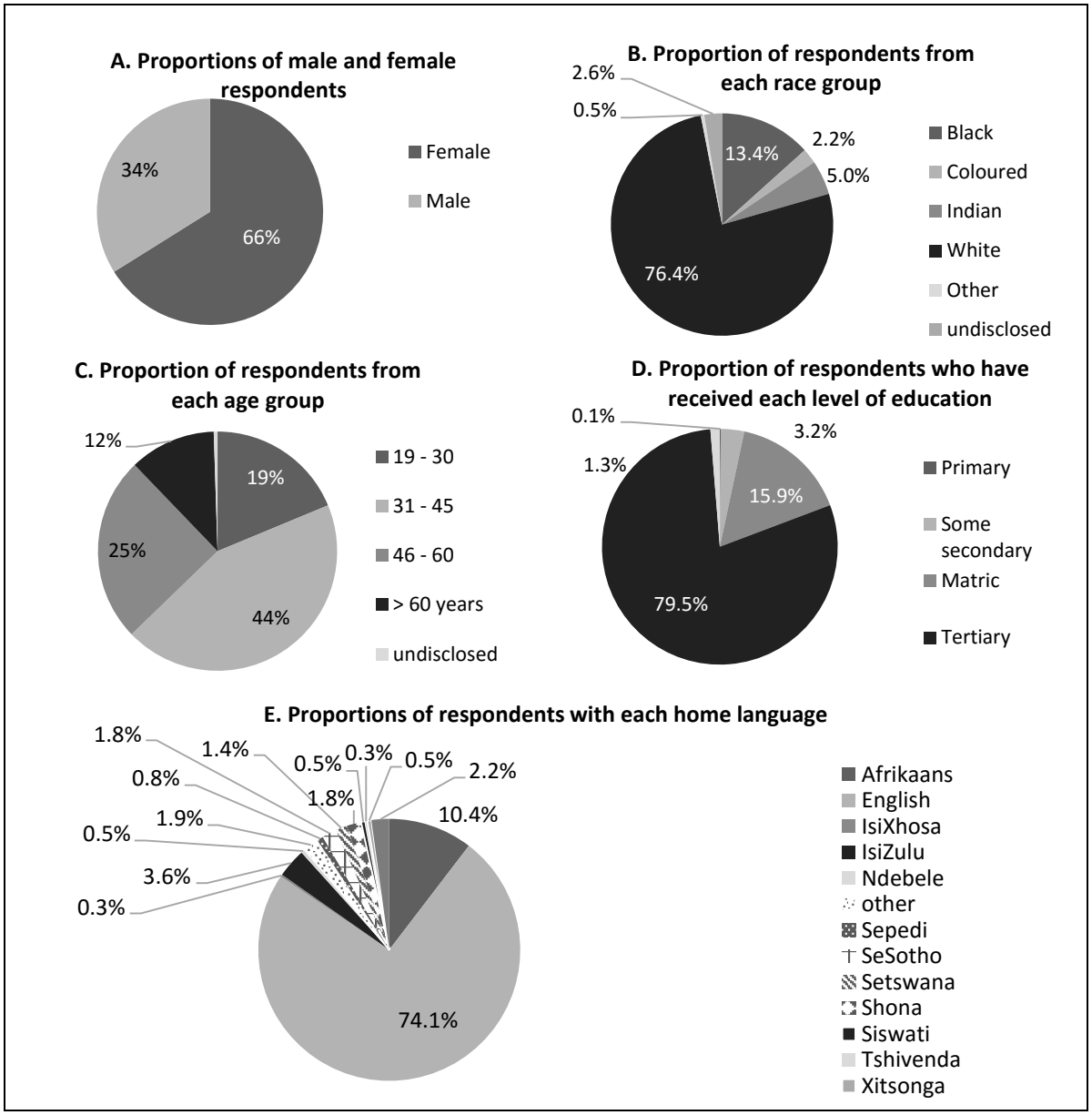


Figure 4.1: Demographic breakdown of public questionnaire respondents by gender (A), race (B), age (C), highest level of education received (D), and home language (E)

Significant effects of one or more socio-demographic variables on responses to individual questions were found in all of the 31 questions (Table 4.1). Of the five knowledge questions, three were significantly affected by age (Appendix N), four by race (Appendix N), none by gender (Appendix P), five by home language (Appendix Q), and three by level of formal education received (Appendix R). Notably, 30% of both isiZulu and Setswana, and 21% of Shona and Afrikaans respondents said that all wild animals are dangerous and 60% and 62% of Shona and Setswana respondents respectively said that bats are rodents, as did 45% of Sotho and 53% of isiZulu respondents. For all but one question (All wild animals are

dangerous), better knowledge (higher percentage of people answering correctly) increased with higher level of education received, with the highest percentage of respondents with tertiary levels of education answering questions correctly, and very few of those with only some secondary education providing the correct answers (Appendix R).

Table 4.1: Questions for which a Chi-square test showed significant effect ($p < 0.05$) of demographic variables on responses. n/s denotes no significant effect

Question		**Age**	**Race**	**Gender**	**Lang.**	**HLOE**
Knowledge questions						
K1	Snakes are important in nature	**<0.001**	**<0.001**	n/s	**<0.001**	**<0.001**
K2	Owls are useful to humans	**<0.01**	**<0.001**	n/s	**<0.001**	**<0.01**
K3	Frogs only occur in dirty water	**<0.001**	**<0.001**	n/s	**<0.001**	**<0.001**
K4	All wild animals are dangerous	n/s	n/s	n/s	**<0.05**	n/s
K5	Bats are rodents	n/s	**<0.001**	n/s	**<0.01**	n/s
Attitude questions						
A1	I think wild animals belong in Johannesburg	**<0.01**	**<0.001**	n/s	**<0.001**	**<0.01**
A2	People who poach wild animals should be punished	n/s	**0.001**	**<0.05**	**<0.001**	n/s
A3	I like to spend time outdoors	**<0.001**	**<0.001**	n/s	**<0.01**	**<0.01**
A4	I would like to see more wildlife in Johannesburg	**<0.001**	**<0.001**	n/s	**<0.001**	**<0.01**
A5	I have (or would like to have) a pet at home	n/s	**<0.001**	**<0.05**	**<0.001**	n/s
A6	I am afraid of spiders	**<0.001**	**<0.05**	**<0.001**	n/s	n/s
A7	I am afraid of frogs	n/s	**<0.001**	**<0.001**	**<0.001**	n/s
A8	I am afraid of owls	**<0.001**	**<0.001**	n/s	**<0.001**	**<0.001**
A9	I am afraid of snakes	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.05**
A10	I am afraid of bats	**<0.001**	**<0.001**	**<0.001**	**<0.001**	n/s
A11	I am afraid of squirrels	**0.001**	**<0.001**	n/s	**<0.001**	**<0.001**

Question		Age	Race	Gender	Lang.	HLOE
Behaviour questions						
B1	I use poison to control pests in my home	n/s	**<0.001**	**<0.01**	**<0.001**	**<0.05**
B2	I use poison to control pests in my garden	n/s	**<0.001**	n/s	**<0.001**	**<0.001**
B3	I visit parks / green spaces	n/s	**<0.001**	n/s	**<0.001**	**<0.05**
B4	What would you do if you saw a spider in your home?	**<0.01**	**<0.001**	n/s	**<0.001**	**<0.01**
B5	What would you do if you saw a frog in your home?	**<0.05**	**<0.001**	n/s	**<0.001**	n/s
B6	What would you do if you saw an owl in your home?	**<0.05**	**<0.001**	**<0.001**	**<0.001**	**<0.05**
B7	What would you do if you saw a snake in your home?	n/s	**<0.001**	**<0.001**	**<0.001**	**<0.001**
B8	What would you do if you saw a bat in your home?	n/s	**<0.001**	**<0.01**	**<0.001**	n/s
B9	What would you do if you saw a squirrel in your home?	n/s	**<0.001**	**<0.01**	**<0.001**	**<0.01**
B10	What would you do if you saw a spider in your garden?	n/s	**<0.001**	n/s	**<0.001**	**<0.001**
B11	What would you do if you saw a frog in your garden?	**<0.01**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
B12	What would you do if you saw an owl in your garden?	**<0.01**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
B13	What would you do if you saw a snake in your garden?	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
B14	What would you do if you saw a bat in your garden?	**<0.05**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
B15	What would you do if you saw a squirrel in your garden?	**<0.01**	**<0.001**	**<0.001**	**<0.001**	**<0.001**

Out of the 11 attitude questions, eight were significantly affected by age, all 11 by race, seven by gender, all 11 by home language, and six by level of education. Responses to the majority of the questions comprising the fear scale (A6-A11) indicated that demographic variables do have an effect on the levels of fear towards certain animals. Only A7 (I am afraid of frogs) was not greatly affected by age, only A6 (I am afraid of spiders), A7 (I am afraid of frogs), and A10 (I am afraid of bats) showed little effect between groups with differing levels of education, and A11 (I am afraid of squirrels) was not greatly affected by gender, however overall females were found to be more fearful than males. Race and home language appeared to have a strong effect on all attitude items, but particularly so for those in the fear scale.

Concerning fear of animals that evoke fear responses across all cultures, a large proportion of all respondents were afraid of spiders (Figure 4.2), and at least half of respondents from all cultural groups were afraid of snakes, with 93% of isiZulu and 90% of Setswana respondents in the majority (Figure 4.5). When asked about their fear of animals that are reportedly particularly fearsome in some cultures (owls and bats) due to the myths and superstitions discussed earlier, a large proportion of isiZulu, SeSotho, Shona and Setswana respondents said that they were afraid of bats (Figure 4.6) and owls (Figure 4.4). There appeared to be much lower levels of fear surrounding frogs and squirrels for all home language groups, however close to half of isiZulu and Setswana respondents reported that they were afraid of frogs (Figure 4.3) and squirrels (Figure 4.7).

Of the 15 behaviour questions, eight were significantly affected by age, all 15 by race, ten by gender, all 15 by home language, and 13 by level of education. Home language (culture) appeared to be the most influential predictor of knowledge, attitude and behaviour. Females scored significantly higher on the question ‘I use poison to control pests in my house’, but there was no significant difference between genders in the other two questions that fell outside of the action scale. Within the action scale, females scored lower than males in most of the questions, and females seemed significantly more likely to call a professional when encountering bats, owls, snakes or squirrels, and were more inclined to leave spiders alone, rather than take them outside or chase them away. A higher proportion of respondents with tertiary levels of education answered all of the behaviour questions positively, while the next highest was those with matric, followed by those with only some

secondary schooling.

Home language also had significant effect on all items in the action scale (Table 4.2), with similar patterns emerging to those found in the fear questions. The majority of isiZulu (64%) and Setswana (70%) respondents said that they would kill a spider in their house (Figure 4.2-B) and 31% and 33% of isiZulu and SetSwana respectively said that they would kill a bat in their house (Figure 4.6-B). About 55% of isiZulu and 50% of Shona respondents would kill a snake in their house (Figure 4.5-B), and a similar percentage would kill one in their garden (Figure 4.5-C). Very few respondents across all language groups said that they would kill a squirrel in their house (Figure 4.7-B), with 74% of them saying that they would take it outside, and similarly with a frog, 88% said that they would take it outside (Figure 4.3-B).

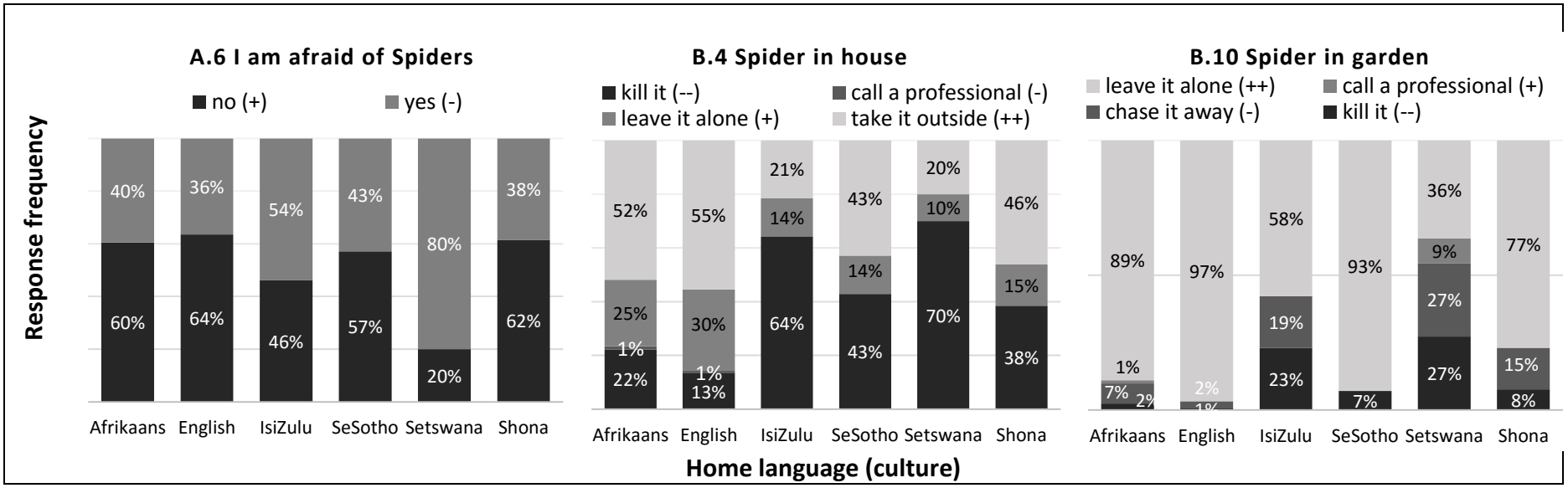


Figure 4.2: Response frequencies of respondents from different cultures to fear of, and predicted behaviour towards spiders

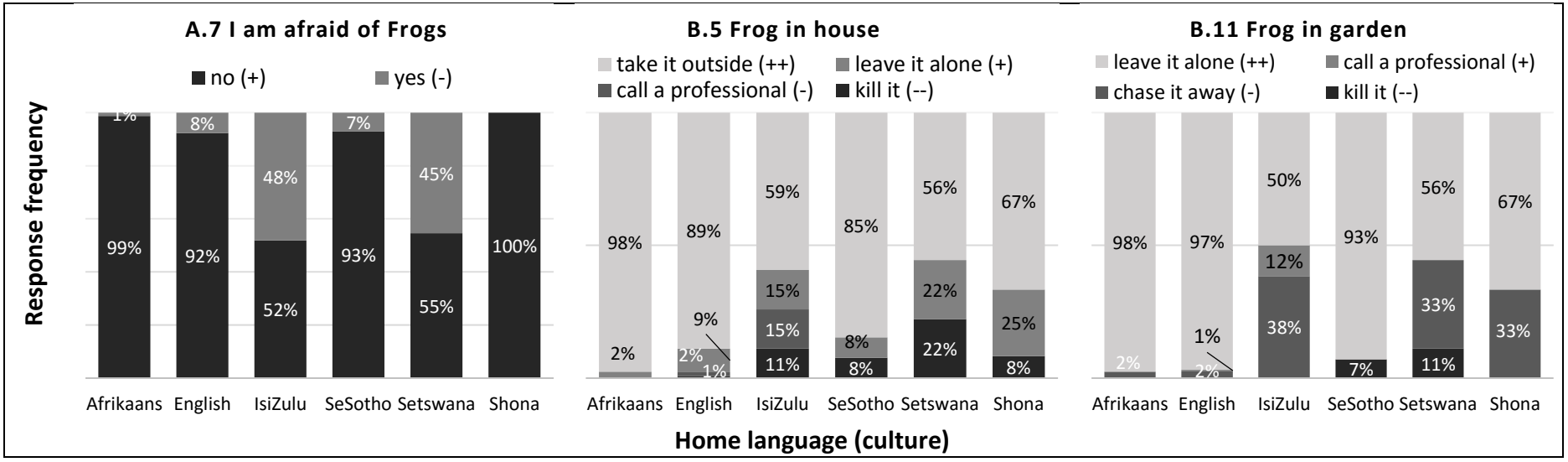


Figure 4.3: Response frequencies of respondents from different cultures to fear of, and predicted behaviour towards frogs

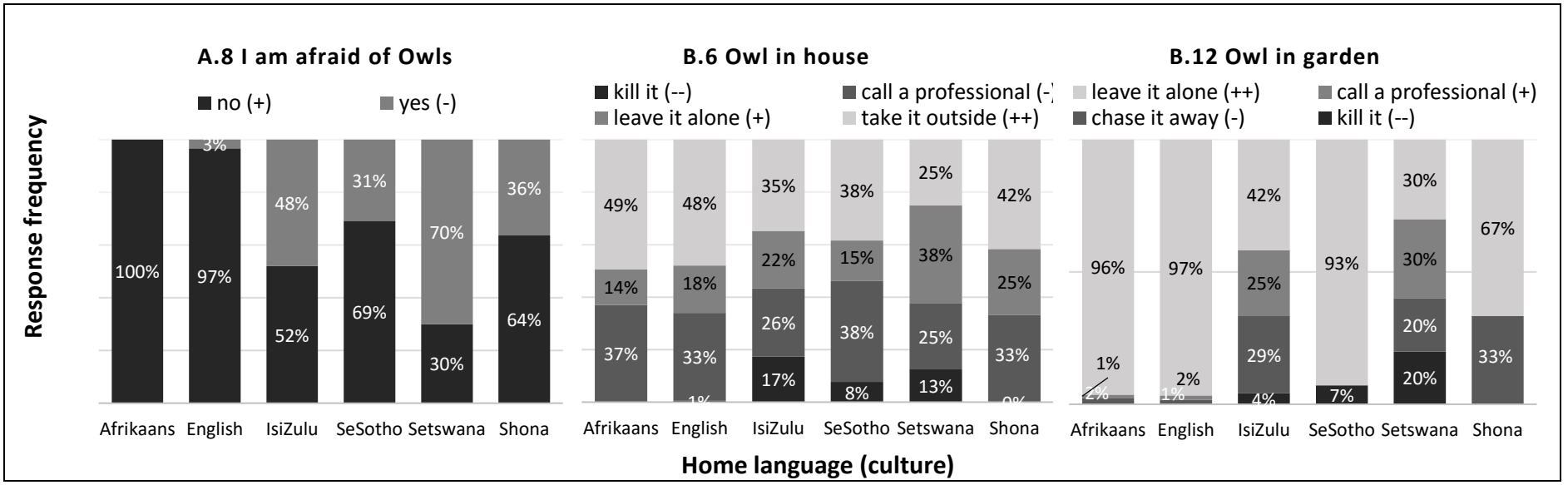


Figure 4.4: Response frequencies of respondents from different cultures to fear of, and predicted behaviour towards owls

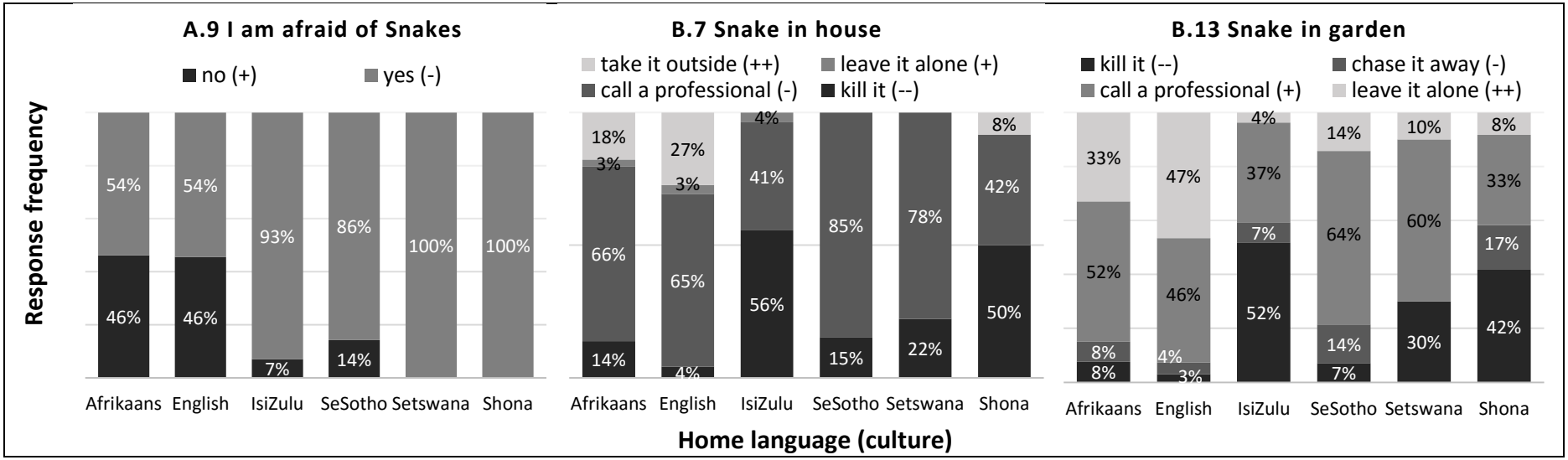


Figure 4.5: Response frequencies of respondents from different cultures to fear of, and predicted behaviour towards snakes

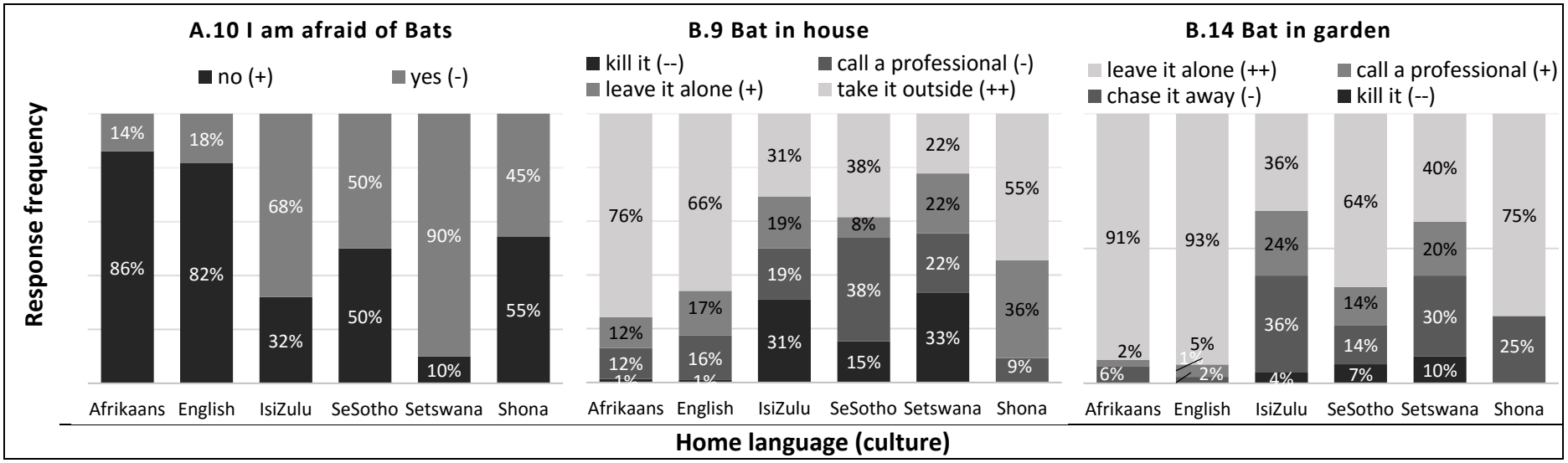


Figure 4.6: Response frequencies of respondents from different cultures to fear of, and predicted behaviour towards bats

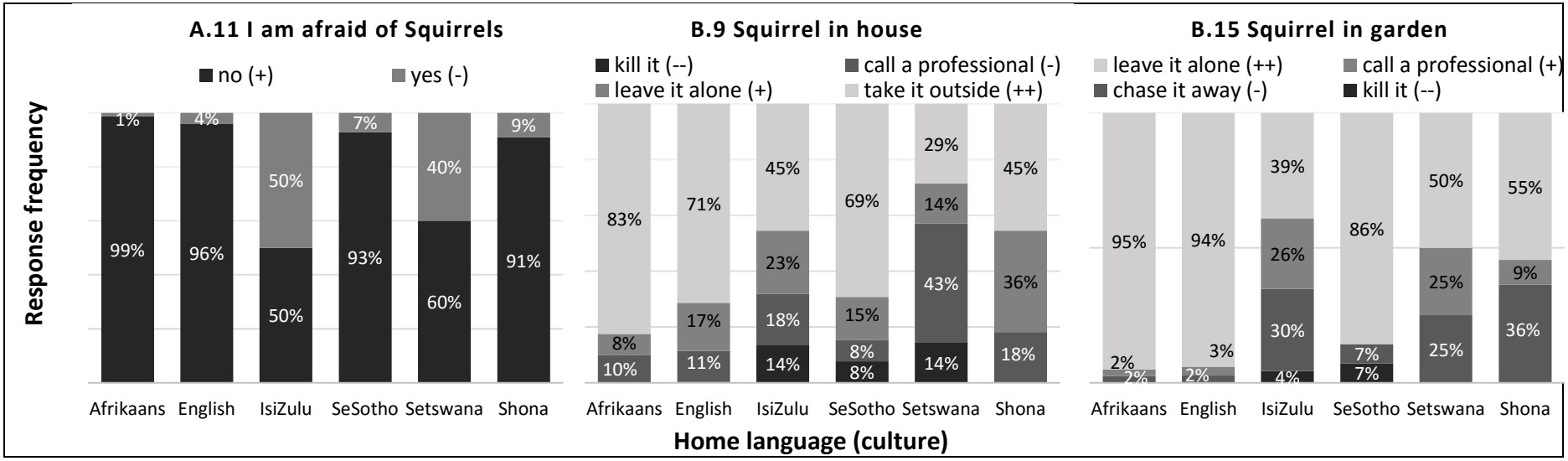


Figure 4.7: Response frequencies of respondents from different cultures to fear of, and predicted behaviour towards squirrels

Table 4.2: Average scores and p-values for age, gender, race, home language and HLOE groups on the fear and action scales

Demographic	Average fear score	Average action score
Age	**p <0.001**	**p <0.001**
19–30 (i)	1.3[ii,iv,v]	2.6[iv,v]
31–45 (ii)	1.0[i,v]	2.8[v]
46–60 (iv)	0.8[i]	2.9[i]
> 60 years (v)	0.5[i,ii]	3.0[i,ii]
Race	**p <0.001**	**p <0.001**
Black (B)	2.0[I,W]	2.0[I,W]
Coloured (C)	1.7[W]	2.3[W]
Indian (I)	1.2[B,W]	2.7[B]
White (W)	0.7[B,C,I]	2.9[B,C]
Gender	**p <0.001**	**p <0.001**
Female (F)	1.1[M]	2.7[M]
Male (M)	0.7[F]	2.9[F]
Home language	**p <0.001**	**p <0.001**
Afrikaans (A)	0.7[Z,T]	2.8[Z,T]
English (E)	0.8[Z,T]	2.9[Z,S,T,Sh]
isiZulu (Z)	2.4[A,E]	1.8[A,E]
SeSotho (S)	1.5	2.4[E]
Setswana (T)	2.8[A,E]	1.7[A,E]
Shona (Sh)	1.5	2.3[E]
Education	**p <0.05**	**p <0.001**
Primary (P)	0.7	2.3
Some secondary (S)	1.6[T]	2.4
Matric (M)	1.1	2.6
Tertiary (T)	0.9[S]	2.8
Overall	1.9	2.8

To summarise, all demographic variables were found to have significant effects on scores for the fear and action scales. Females were shown to be more fearful than males, and more negative in their predicted responses to a scenario in which they encounter an animal in their home or garden. Reported fear of wild animals decreased the older and the more educated the respondent was, and Black respondents scored lowest on both fear and action scales, followed by Indian, Coloured, then White respondents. Setswana and isiZulu participants scored significantly lower on both scales than all other language groups, followed by Shona and SeSotho, and English and Afrikaans respondents scored highest with not much difference between scores for either.

Overall, there was a highly significant negative Spearman Rank Order Correlation (r_{754}=- 0.6; $p<0.001$; Figure 4.8) between the fear and the action scales, indicating that the higher the level of fear felt towards a particular animal, the more negative the behaviour towards said animal is likely to be. Cronbach's alpha was equal to 78% and 84% for the fear and action scales respectively.

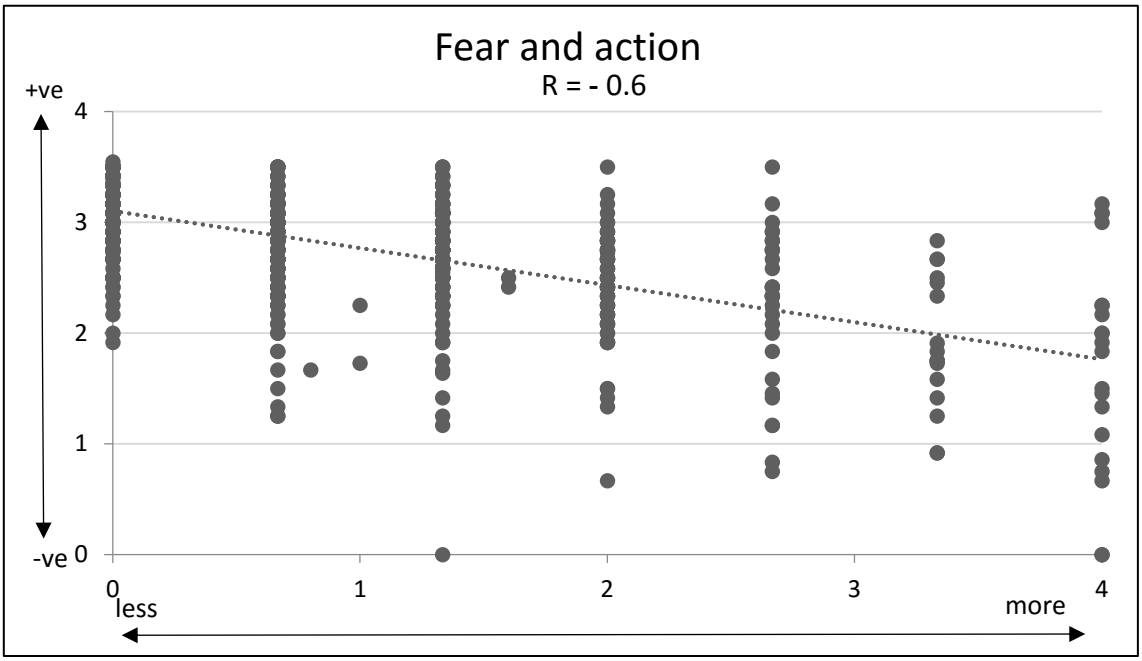


Figure 4.8: Effect of fear on actions towards wildlife. As fear levels increase, actions become less positive

Levels of knowledge and types of attitudes and behaviour

All three constructed scales showed acceptable reliability coefficients. Cronbach's alpha was

equal to 63% for the knowledge scale, 77% for the attitude scale, and 67% for the behaviour scale. The average scores for each scale (knowledge, attitude and behaviour) were between 2.8 and 3.3, showing fair to good knowledge about urban wildlife, neutral to positive attitudes towards it, and tendencies towards neutral to positive behaviour (according to the constructed scale in Appendix G).

I found significant positive correlations between average knowledge scores and average attitude scores ($r=0.56$; $p<0.001$), average knowledge scores and average behaviour scores ($r=0.47$; $p<0.001$), and average attitude and average behaviour scores ($r=0.59$; $p<0.001$).

The influence of socio-demography on knowledge, attitude and behaviour

A Kruskal-Wallis ANOVA and multiple comparisons of mean rank srevealed significant differences in knowledge scores ($H_3=21.7$; $p<0.001$), attitude scores ($H_3=50.7$; $p<0.001$) and behaviour scores ($H_3=18.1$; $p<0.001$) between age groups. For all three scales, scores increased with the age of the respondents (Figure 4.9-A–C). Scores for respondents aged 19-–30 were significantly lower than all other age groups on the knowledge and attitude scales, and significantly lower than those respondents aged 46–60 and > 60 on the behaviour scale. Scores for respondents aged 31–45 were also significantly lower than those of respondents aged > 60 on the attitude and behaviour scales, but not on the knowledge scale.

White, Indian and Coloured respondents did not differ in their knowledge scores, however Black respondents scored lower than both Indian and White respondents ($H_3=110.5$; $p<0.001$; Figure 4.10-A–C). White respondents received higher attitude scores than all other groups ($H_3=139.8$; $p<0.001$), with Black respondents scoring the lowest. Behaviour scores were also higher for White respondents than all other groups ($H_3=186.4$; $p<0.001$), with Black respondents scoring lowest.

Male respondents scored higher than females on all scales (Figure 4.11-A–C). In turn, Afrikaans and English speaking respondents scored significantly higher than Shona (Figure 4.12-A–C) and Setswana (knowledge: $\bar{x}= 2.2$; attitude: $\bar{x}= 1.8$; behaviour: $\bar{x}= 1.7$) speakers on the knowledge scale ($H_5=72.2$; $p<0.001$), attitude scale ($H_5=86.0$; $p<0.001$) and behaviour scale ($H_5=121.1$; $p<0.001$). Behaviour scores for English speakers were also significantly

higher than those of Sesotho ($\bar{x}$=2.3) respondents were.

Those respondents that had received tertiary level education scored higher than those with matric or some secondary education did on all three scales (H_3=30.2, p<0.001; attitude: $\bar{x}$=3.2 vs $\bar{x}$=3 (matric) vs $\bar{x}$=2.5 (some secondary); H_3=27.4, p<0.001; behaviour: $\bar{x}$=2.9 vs $\bar{x}$=2.6 (matric) vs 2.3 (some secondary); H_3=33.7, p<0.001) (Figure 4.13-A–C).

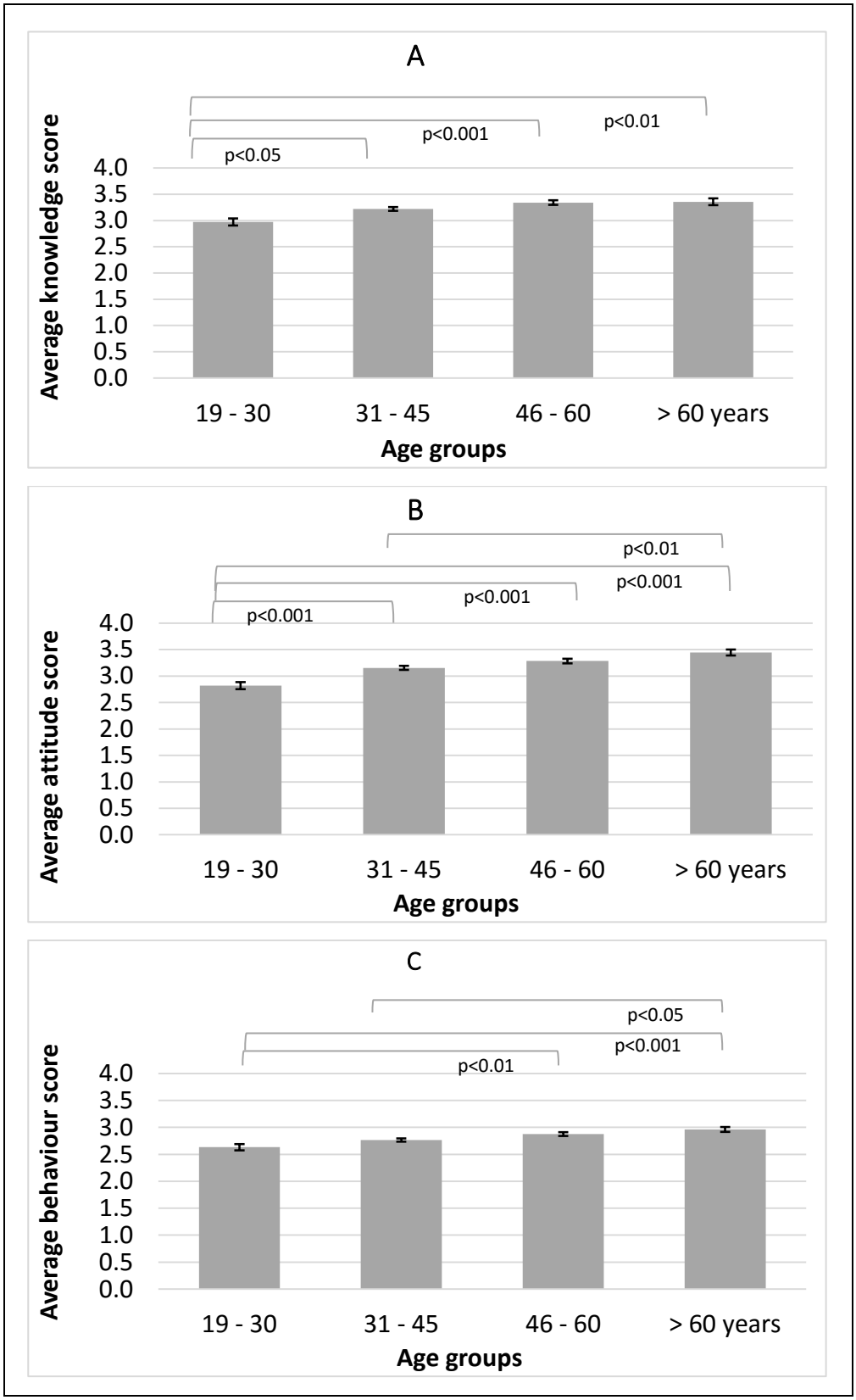


Figure 4.9: Average scores for knowledge (A), attitude (B) and behaviour (C) scales by age groups. Brackets indicate which groups are significantly different to each other ($p<0.05$), and error bars show standard error.

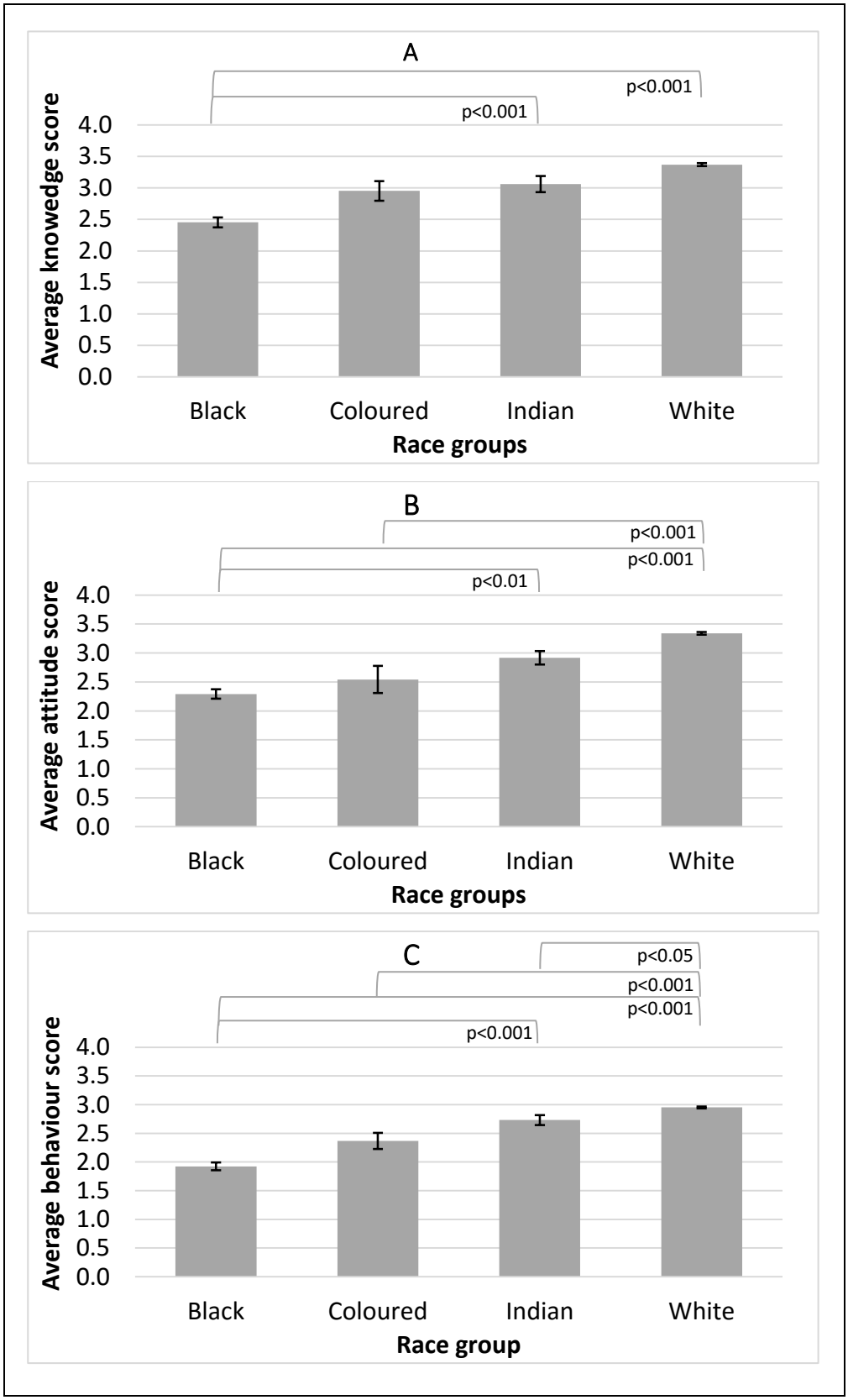


Figure 4.10: Average scores for knowledge (A), attitude (B) and behaviour (C) scales by race groups (public surveys). Brackets indicate which groups are significantly different to each other ($p<0.05$) and error bars show standard error

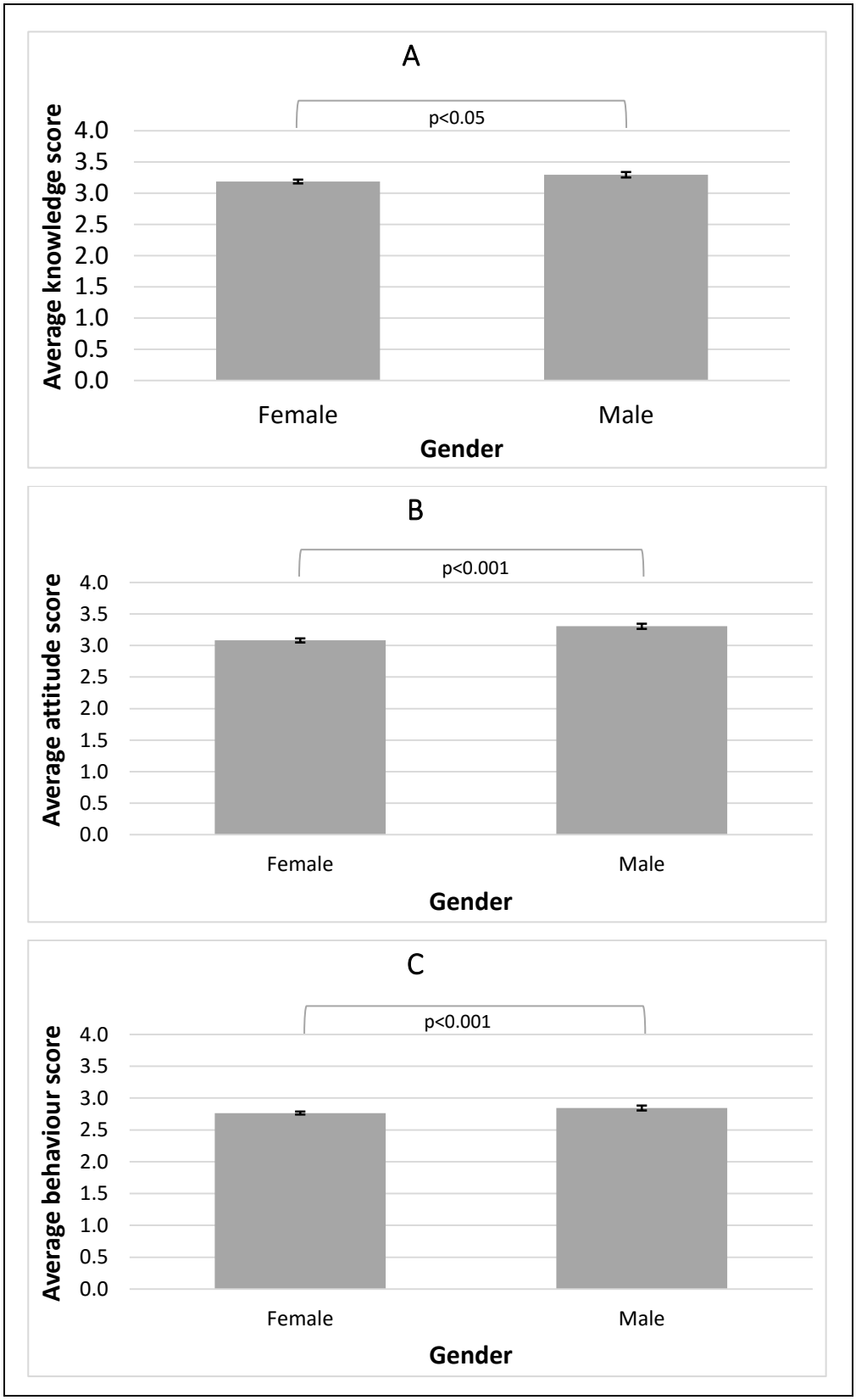


Figure 4.11: Average scores for knowledge (A), attitude (B) and behaviour (C) scales by gender groups (public surveys). Brackets indicate which groups are significantly different to each other ($p<0.05$) and error bars show standard error

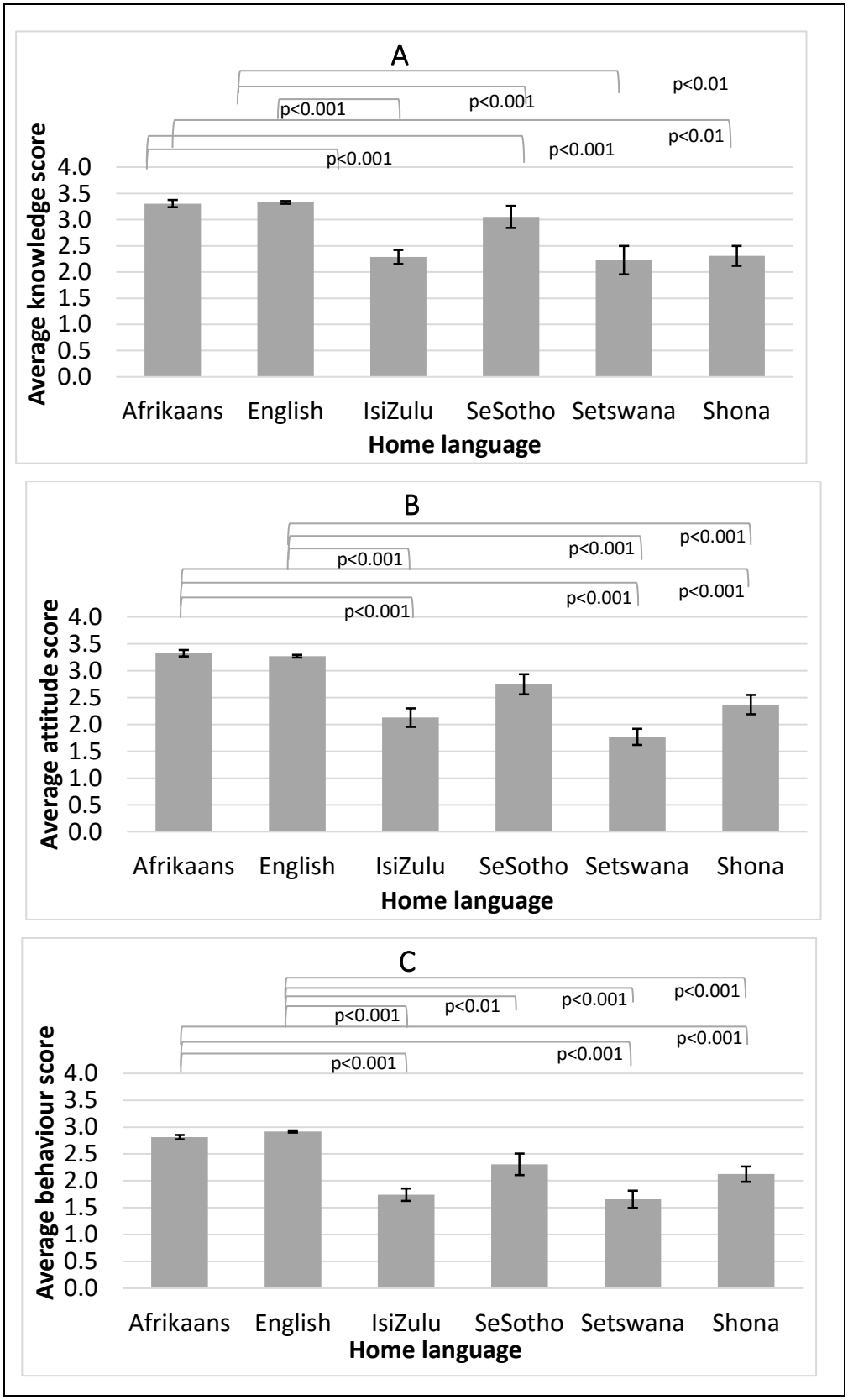


Figure 4.12: Average scores for knowledge (A), attitude (B) and behaviour (C) scales by home language groups (public surveys). Brackets indicate which groups are significantly different to each other ($p<0.05$) and error bars show standard error

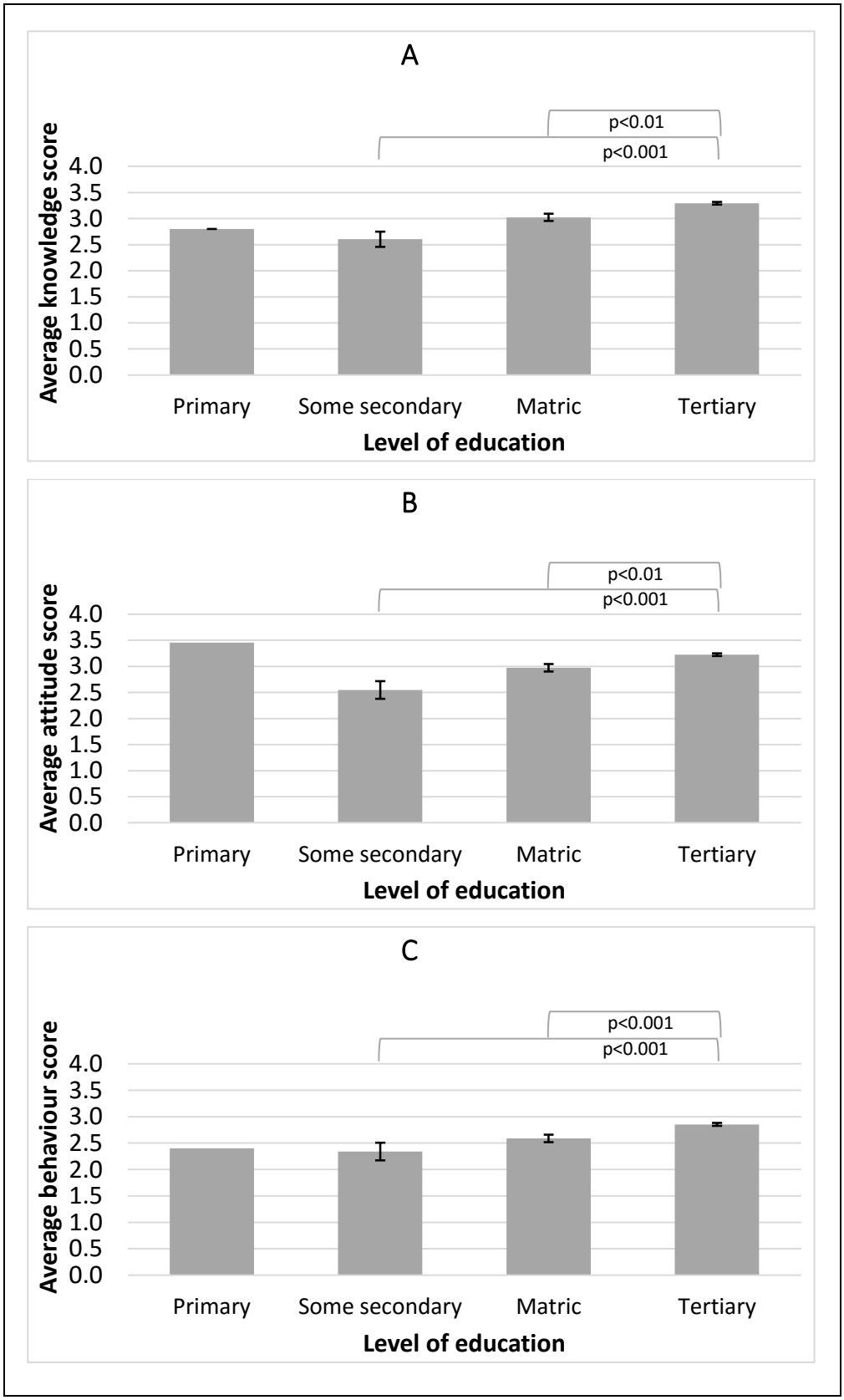


Figure 4.13: Average scores for knowledge (A), attitude (B) and behaviour (C) scales by groups with different levels of formal education. Brackets indicate which groups are significantly different to each other ($p < 0.05$), and error bars show standard error

Figure 4.14 shows that, for all language groups except for isiZulu and Setswana, levels of knowledge were positively related to levels of education received, however only Afrikaans was significantly affected.

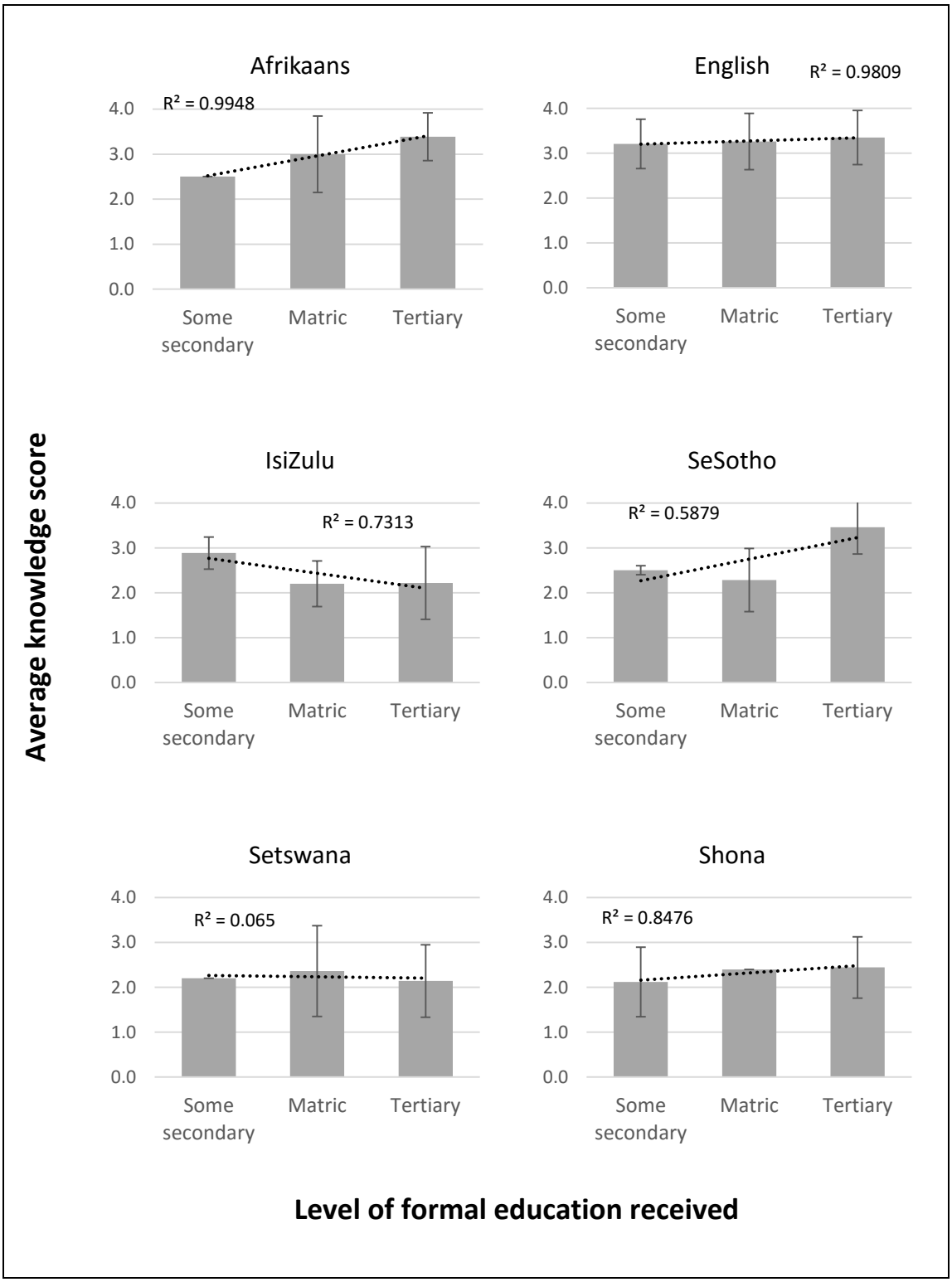


Figure 4.14: Relationship between average knowledge score and level of formal education (public surveys) by home language (culture)

The influence of socio-demography on knowledge, attitude, and behaviour, controlling for other variables in the model

The General Linear Model showed significant effects of independent variables (F_{11}=13.6; p<0.001) but only explained 17% of the variability in knowledge scores (adjusted R^2=0.17). Home language was highlighted as the most significant predictor of knowledge (p<0.001), with English, Afrikaans and Sotho speaking respondents scoring significantly higher than Shona, isiZulu and Setswana speakers. Gender (p<0.01), age (p<0.05) and highest level of education received (p<0.05) were also found to be significant predictors with females scoring lower than males, 19–30 year olds scoring lower than all other age groups, and respondents with tertiary level education scoring higher than those with some secondary and matric level.

Table 4.3: Results of a General Linear Model, testing effects of age, gender, highest level of educated completed and home language on average knowledge scores. Bold numbers are significant (p<0.05).

Variable	Category	Param. Estimate	Std. err.	t	p
Intercept		**2.75**	**0.07**	**40.77**	**0.00**
age	46 - 60	**0.09**	**0.04**	**2.11**	**0.04**
age	31 - 45	-0.01	0.04	-0.17	0.86
age	19 - 30	**-0.12**	**0.05**	**-2.67**	**0.01**
gender	Male	**0.09**	**0.03**	**3.53**	**0.00**
Highest level of education	Tertiary	0.11	0.06	1.79	0.07
Highest level of education	Matric	-0.05	0.07	-0.78	0.43
first language	English	**0.53**	**0.06**	**8.22**	**0.00**
first language	Afrikaans	**0.52**	**0.08**	**6.20**	**0.00**
first language	SeSotho	0.25	0.15	1.66	0.10
first language	Shona	**-0.40**	**0.16**	**-2.53**	**0.01**
first language	IsiZulu	**-0.42**	**0.12**	**-3.35**	**0.00**

The overall model for attitudes highlighted the significant effect of independent variables (F_{12}=41.23; p<0.001), and explained approximately 41% of the variability in attitude scores (adjusted R^2=0.41). All variables except highest level of education received were highlighted as having significant effects when controlling for other variables. Home language (culture; p<0.001) and average knowledge score (p<0.001) were the most important predictors of attitude. English and Afrikaans speaking respondents scored significantly higher than Shona, isiZulu, and Setswana speakers, and SeSotho respondents scored higher than isiZulu and

Setswana respondents, with attitude scores increasing by 0.46 units per unit increase in knowledge. Respondents aged 19–30 scored lower than all other age groups, with attitude score increasing with age, and males scored higher than females.

Table 4.4: Results of a General Linear Model, testing effects of age, gender, highest level of educated completed, home language and average knowledge score on average attitude scores. Bold numbers are significant (p<0.05)

Variable	Category	Param. Estimate	Std. err.	t	p
Intercept		**1.40**	**0.11**	**13.14**	**0.00**
Average Knowledge score	46 - 60	**0.46**	**0.03**	**13.99**	**0.00**
age	31 - 45	0.06	0.04	1.66	0.10
age	19 - 30	-0.04	0.03	-1.16	0.25
age	Male	**-0.18**	**0.04**	**-4.38**	**0.00**
gender	Tertiary	**0.08**	**0.02**	**3.79**	**0.00**
Highest level of education	Matric	0.04	0.05	0.76	0.45
Highest level of education	English	-0.04	0.06	-0.77	0.44
first language	Afrikaans	**0.36**	**0.06**	**6.19**	**0.00**
first language	SeSotho	**0.42**	**0.07**	**5.70**	**0.00**
first language	Shona	0.00	0.13	-0.01	0.99
first language	IsiZulu	-0.01	0.13	-0.04	0.97
first language		-0.20	0.11	-1.87	0.06

A large amount (approximately 50%) of the variability in behaviour scores was explained by the model (adjusted R^2=0.50), and the variability was found to be significant (F_{13}=53.8; p<0.001). Home language (p<0.001), knowledge score (p<0.001) and attitude score (p<0.001) were all significant predictors of behaviour, when controlling for other variables in the model. English and Afrikaans respondents scored significantly higher on the behaviour scale than all other languages, and SeSotho respondents higher than isiZulu and Setswana respondents did. Average behaviour scores increased by 0.15 units per unit increase in knowledge score, and by 0.33 units per unit increase in attitude score.

Table 4.5: Results of a General Linear Model, testing effects of age, gender, highest level of educated completed, home language, average knowledge score and average attitude score on average behaviour scores. Bold numbers are significant (p<0.05)

Variable	Category	Param. Estimate	Std. err.	t	p
Intercept		**1.03**	**0.09**	**12.07**	**0.00**
age	46 - 60	0.00	0.03	-0.16	0.87
age	31 - 45	-0.01	0.02	-0.38	0.71

Variable	Category	Param. Estimate	Std. err.	t	p
age	19 - 30	0.00	0.03	0.14	0.89
gender	Male	0.01	0.02	0.36	0.72
Highest level of education	Tertiary	-0.05	0.04	-1.43	0.15
Highest level of education	Matric	-0.07	0.04	-1.67	0.10
first language	English	**0.37**	**0.04**	**8.49**	**0.00**
first language	Afrikaans	**0.25**	**0.05**	**4.57**	**0.00**
first language	SeSotho	-0.07	0.09	-0.80	0.42
first language	Shona	-0.02	0.10	-0.19	0.85
first language	IsiZulu	**-0.30**	**0.08**	**-3.73**	**0.00**
Average Knowledge score		**0.15**	**0.03**	**5.69**	**0.00**
Average attitude score		**0.33**	**0.03**	**12.01**	**0.00**

4.4. Discussion

The results of the public survey echo those of the school survey (Chapter 3) to a large extent, revealing a positive correlation between higher levels of knowledge about wildlife and more positive attitudes towards wildlife in the COJ, as well as between higher levels of knowledge about wildlife, more positive attitudes towards it, and more positive predictions of behaviour towards said wildlife. Furthermore, socio-demographic variables, particularly home language (culture), were significant influencers of knowledge, attitude and behaviour scores among adult respondents in the COJ. Analysis of patterns in responses to individual questions also revealed that race, gender and culture (extrapolated from home language) influenced adult respondents' attitudes and behaviour towards certain species such as owls, bats and snakes.

An interesting result that supports the theory that culture is a strong motivator for attitude and behaviour was that, while levels of knowledge were also found to be a significant influencer on the two, knowledge levels about wildlife were not consistent with levels of formal education received for all home languages, and level of education was not found to be significant when controlling for other variables. This emphasises the large role that informal education, which is largely communicated to us through our community cultures, plays in the development of our attitudes towards the world around us. In the introduction, I mentioned a few of the beliefs within some Black South African cultures that owls and bats are considered to be omens of bad luck and associated with witchcraft and illness or death,

and that these animals also have negative associations in Western cultures. I have also discussed theories that certain attributes of an animal evoke particular responses because of associations people have with them. For example, some associate bats with the spread of disease, spiders with dirt and snails, frogs and snakes with slime (which reminds one of mucus), and these animals often evoke either fear or disgust responses from people, which affect attitudes and behaviour towards them (Knight, 2008; Prokop and Tunnicliffe, 2008; Batt, 2009; Randler, Hummel and Prokop, 2012). For all animals, but particularly with regard to spiders, snakes, bats and owls, isiZulu and Setswana respondents answered most negatively to questions about their fear towards these animals, as well as how they would react when encountering them. Not only was this pattern noted in the fear and action questions, it was also found in results for overall average knowledge, attitude and behaviour scores, with isiZulu and Setswana speakers scoring lower than all other groups. It is also interesting to note that these are the two home languages in which average knowledge scores were correlated to formal education levels received. However, it is important to remember that there are other factors at play, such as the historical educational, environmental, and economic disadvantages placed on Black South Africans during Apartheid, as discussed in Chapter 3 (Beinart and Coates, 1995; Thompson, 2001; Cock, 2007). However, as discussed in Chapter 3, alienation from nature is not isolated to Black South Africans, as many urban residents have rarely, if ever, ventured outside of the urban environment.

In the context of international studies on attitudes towards wildlife in urban areas, it is imperative that, when conducting similar studies in South Africa, one remains cognisant of a number of factors that set us apart from much of the rest of the world. While there are severe socio-economic inequalities in cities all over the world, South African cities such as the COJ represent the physical manifestation of the historical oppression of black South African communities through extreme spatial inequalities within our cities (Schäffler *et al.*, 2013; City of Johannesburg, 2016). With a large proportion of residents suffering from inadequate housing, food insecurity, limited access to water and unemployment (Statistics South Africa, 2016), the plight of urban wildlife and the conservation of open space are understandably not high on the agenda of most people in Johannesburg. In combination with the huge variety of cultural beliefs and knowledge systems around wildlife, this legacy

of spatial inequality and the idea of nature conservation as a luxury, not a necessity, makes human-wildlife conflict mitigation in the COJ particularly complex to navigate.

Nevertheless, the results of this study could play an important role in the development of targeted urban conservation campaigns. The finding that knowledge about wildlife is a strong predictor of behaviour towards it echoes those of the majority of international studies on the topic (Kellert and Berry, 1980; Drews, 2002; Bjerke and Østdahl, 2004; Dearborn and Kark, 2009; Prokop, Fancovicova and Kubiatko, 2009; Randler, Hummel and Prokop, 2012; Barnes, 2013; Tarrant, Kruger and du Preez, 2016), as well as my findings in the survey of COJ school learners in Chapter 3. As with Chapter 3, my findings here differ to those of previous studies that proposed gender as a significant predictor of attitudes and behaviour (Stephen R Kellert and Berry, 1987; Stern and Dietz, 1994; Bjerke and Østdahl, 2004; Taylor and Signal, 2005; Herzog, 2007; Prokop and Tunnicliffe, 2008; Randler, Hummel and Prokop, 2012; Tarrant, Kruger and du Preez, 2016). While females did score lower than males on all three scales, and in some of the questions in the fear and action scales, when controlling for other variables such as home language, these gender differences were no longer as pronounced.

It is outside of the scope of this study to identify the exact beliefs and personal realities that cause certain demographic groups to develop particular attitudes towards different animals. However, the findings here, and those of Chapter 3, do lend credence to theories discussed in the introduction to this chapter, and therefore provide solid motivation for more in depth investigations of the influencing factors behind the attitudes and behaviours of urban residents in the City of Johannesburg.

Chapter 5. Discussion

The origins and nature of conflict between humans and wildlife are extremely complex. Motivations behind human behaviour towards wildlife form as a result of the combination of a number of factors, including our value orientations and attitudes, the social, physical, cultural, and political contexts in which we live, our personal capabilities and the resources we have access to, social and personal norms to which we have become accustomed, and the knowledge we have gained (Dunlap and van Liere, 1978; Stephen R Kellert and Berry, 1987; Homer and Kahle, 1988; Eagly and Chaiken, 1993; Stern and Dietz, 1994; Stern, 2000; Henning, 2002; Schultz *et al*, 2004; Menon and Lavigne, 2006). These various combinations result in very specific attitudes towards certain animals, such as fear or disgust, or affection and empathy. These attitudes in turn influence a person's behaviour when encountering these animals, and in order to improve people's behaviour towards wildlife, it is imperative that we find the primary motivations for specific conflict behaviours, in specific places and under specific conditions (Hill, 1993; Stern and Dietz, 1994; Dickman, 2010). Urban environments, and the conflicts that occur within them, are very different to those occurring in rural areas, and potentially involve multiple socio-demographic groups, and multiple motivations for behaviour (DeStefano and Deblinger, 2005; Dickman, 2010).

As detailed in Chapter 1, the primary aim of this study was to identify the common interactions that occur between humans and wildlife in the COJ and the motivational bases behind human behaviour towards wildlife, to further our understanding of the causes of human-wildlife conflict in the COJ, and inform future human-wildlife conflict mitigation strategies. Specifically, I set out to determine what wildlife species were occurring in the COJ and where, as well as which animals were frequently coming into contact with humans, and what the common outcomes of these interactions were. I also aimed to better understand the relationships between people's knowledge, attitude and behaviour, and how socio-economic factors might play a role in attitudes and behaviour towards urban wildlife.

In Chapter 2, findings indicated that the highest reported presence of wildlife was in regions of the COJ that were made up of certain land-cover classes, namely urban residential areas with thick bush cover, thicket/dense bush, and grassland. Wildlife presence was also seldom reported more than 1 km from green spaces, particularly those formally demarcated as

either Critical Biodiversity Areas or Ecological Support Areas in the Gauteng Conservation Plan. Because the reporting of sightings was based on factors such as willingness to report and human access within regions, the data were not collected in a systematic manner and therefore do not necessarily indicate absence of wildlife in other regions. However, the findings do support theories discussed in the introduction of Chapter 2, which stated that in many cities, because of the variety of habitats created by gardens, recreational spaces, schools, parks etc., it is the more suburban residential areas in which there are moderate levels of urban development that support the highest species richness (Cilliers, Müller and Drewes, 2004; Marzluff and Rodewald, 2008; Concepción et al., 2016). These drawcards for wildlife are augmented by the increased availability of food in suburban areas, either through the direct feeding of wildlife by residents, poor waste management or the cultivation of a wide variety of plant species for aesthetic purposes. Regardless of whether there is presence of wildlife in other regions, these findings do tell us that these suburban environments are important for the persistence and diversity of wildlife in the COJ, either as habitats or as stepping stones between green spaces.

Unsurprisingly, human-wildlife conflict incident reports also originated in many of the same regions as the sightings reports. However there were some regions for which there were no sightings reports but there were conflict incidents. This is possibly because people residing in regions with higher percentages of conflict incidents than presence records may have less of a connection with wildlife (as suggested by Kinzig *et al*., 2005), or reporting wildlife presence is less of a priority because other base needs such as providing for their families are not met (Maslow, 1954). However for the most part, my results do suggest that, as with the presence of wildlife in a region, the likelihood of human-wildlife conflict is to some extent influenced by land-cover class (and availability of suitable natural habitat) and proximity to areas of ecological importance, as identified in the Gauteng C-Plan version 3.3 (2011).

The nature of the most common reasons for admittance or recording of wildlife conflict incidents (52% of cases) indicated that conflicts recorded were not always necessarily as a result of human intent, but of human presence or activity. These reasons included animals being hit by cars, found out of their nests, requiring relocation or being caught by a cat or dog. Incidents that were as a direct result of human intent to harm, such as animals

exploited for the pet trade, or poaching, poisoning and persecution of animals, only made up 8% of the available sample. The primary motivating factor for behaviour towards wildlife in most cases may not be malice, however our behaviour around and towards wildlife often still has a significant negative impact on it, and it is important to understand what drives this behaviour, and how we might positively influence it.

The literature review in Chapter 1 delved deep into multiple theories behind the primary motivational bases for behaviour, however there were a number of common threads that wove their way through a lot of the literature discussed. Traditional conceptualisations of the environment were based on the notion that, because of our superiority over other lifeforms, the advancement of human beings is unlimited. Dunlap and van Liere (1978) challenged this ideology, stressing the dependency of human beings on natural resources. Subsequently there have been countless studies of attitude theory that have considered the intertwined nature of the social and the ecological, and how they impact on one another (Dunlap, 2002), including the causes and effects of our attitudes and behaviour.

Stephen Kellert (1980) pioneered these studies when he developed a typology of attitudes (Appendix A) that formed a baseline used in many subsequent studies. Kellert's attitude types (naturalist, humanistic, aesthetic, symbolic, moralistic, scientistic, ecologistic, utilitarian, dominionistic, negativistic, and neutralistic) were based on a person's primary concern or interest regarding nature or an animal. Kellert and Berry (1980) attributed attitudes towards wildlife species to four factors: prior attitude to wildlife and nature, prior experience and knowledge of certain species, utility value or cultural significance held by a species, and the perceptions held by people about species' aesthetic appeal, intelligence and association with the threat of injury or disease. Subsequent studies have generally agreed that one or more of these factors influence our attitude towards wildlife in some way, and stressed that one of the primary influencers of attitude and behaviour towards wildlife is knowledge (Kellert and Berry, 1980; Bjerke and Østdahl, 2004; Sexton and Stewart, 2007; Prokop, Fancovicova and Kubiatko, 2009; Dickman, 2010; Randler, Hummel and Prokop, 2012; Tarrant, Kruger and du Preez, 2016).

Chapters 3 and 4 looked at the knowledge, attitudes and behaviours of both adolescent and adult residents of the COJ, and questioned whether higher levels of knowledge about

wildlife fosters more favourable attitudes towards it, and whether better knowledge about, and attitudes towards, wildlife influences predicted behavioural responses when encountering it. I found this to be the case in both chapters, however socio-demographic factors such as gender, race, and particularly culture also influenced knowledge, attitude and behaviour, as suggested by several attitude theorists such as Kellert and Berry (1980); Wilson and Kellert (1993); Serpell (2004); Menon and Lavigne (2006); Milfont, Duckitt and Cameron (2006); Knight (2008); Prokop, Fancovicova and Kubiatko (2009); Dickman (2010); Prokop and Tunnicliffe (2008); Barnes (2013); and Tarrant, Kruger and du Preez (2016). While I make several general comparisons between the adults and learners below, it must be noted that the sample groups, particularly the adults, were not representative of the population of the COJ, and therefore any number of variables or combinations of variables may have had an effect on responses.

Adults surveyed in Johannesburg had an overall average knowledge score of 3.2, indicating good levels of knowledge about wildlife (Appendix G), higher than that of the school learners who had a score of 2.4. Amongst the adult respondents, knowledge scores also increased with age, lending credence to theories that our personal experiences, and place in time, play an important role in the development of our knowledge of the world around us (Kellert, 1985; Drews, 2002; Randler, Hummel and Prokop, 2012). Interestingly, knowledge levels about wildlife appeared to be a product of more than just level of formal education received, which puts emphasis on the significant role that informal education through cultural learning and socialisation plays in the development of our knowledge, and in turn our attitudes.

As the previous chapters have mentioned, the human population of the COJ consists of diverse nationalities, races and cultures, and in conjunction with any formal education received, all of these things contribute to a person's knowledge and interpretation of the world around them (Kellert and Berry, 1980; Serpell, 2004; DeMello, 2012). The ecological setting in which the residents of COJ have grown up has also potentially contributed to how they may think of, feel towards, and behave towards wildlife common to the city. There have been many factors affecting residents in different ways, including the historical learning disadvantages placed on Black South Africans during Apartheid, as well as their physical isolation in areas with little natural beauty (Beinart and Coates, 1995; Cock, 2007).

Adults in the COJ today, particularly those aged 40 and over, lived in a very different city than we do now, both from a social and political aspect, as well as an ecological one. There are parts of the COJ, particularly the northern regions, in which transformation of natural land has been slower than in the business districts or mining areas, and the transformation has, for the most part, been to residential and recreational land use types with more natural features (Schäffler *et al.*, 2013). Residents of these regions, both young and old, may know more about, and have much stronger connections with, wildlife and nature because they have more contact with it on a daily basis. Routine proximity to wildlife, particularly species such as owls and bats that are known to incite fear or disgust, may result in less fear of wildlife, and in turn more positive behaviour towards it (Randler, Hummel and Prokop, 2012). However, there are areas with similar developmental trends and land uses in the south of the COJ (Schäffler *et al.*, 2013), and so there are likely additional factors such as culture or access to rehabilitation facilities or NGOs that affect reporting of wildlife sightings and conflict incidents.

While there was a positive correlation between learners' fear and action scores (more fear leads to more negative behaviour; Chapter 3), this was not the case with the adults' fear and action scores (Chapter 4). The overall fear average for the adult respondents was lower (meaning less fearful) than that of the school learners', and this could be due to adults having had more experience with the animals we hear stories about as children, and discovering them not to be as scary as they were led to believe, as well as to the assumption that adults have received higher levels of education than the adolescents (who thus far have only received some secondary education). The action average for adults however was lower than that of the learners, indicating that they exhibit poorer behaviour towards wildlife. This could be attributed to the idea that adults exhibit more defensive behaviour because they have a responsibility to protect others whom they value and conceive as vulnerable, such as children (Bjerke and Østdahl, 2004).

With regards to the effects of socio-demographic attributes on attitude and behaviour, gender did not have a highly significant effect in the adolescent survey, but adult females were shown to be more fearful of animals and have more negative attitudes towards them than adult males, and more negative behaviour towards animals. In both adolescents and adults, when controlling for other variables, home language (culture) was found to be the

most significant predictor of knowledge scores. Home language and knowledge emerged as the most significant predictors of attitude scores, and knowledge, attitude and home language were the most significant predictors of behaviour scores. The effect of both knowledge levels and socio-demographic attributes, particularly culture, was also reflected in trends identified in answers to individual questions for both surveys.

Limitations of this study

The collection of data for both wildlife presence and conflict incidents was dependant on the willingness of people to report sightings and conflicts, as well as on availability of data and access to databases. Neither presence nor conflict data were systematically collected, and there were significant geographical and temporal gaps in the data. Analysis of the data was therefore somewhat superficial, and was analysed with the inherent biases in mind. The school survey data would have been more representative if more than three schools, in all regions within the COJ, had been surveyed. Similarly, the surveys collected from adult members of the public were also not representative, as the majority of respondents were White, whereas the population of the COJ is predominantly Black. This was likely because the majority of the surveys collected had been answered online and so access to the internet, which is not as prevalent in the predominantly Black townships, could have been a factor.

Key findings and recommendations for future research

My study supports theories that suggested that it is primarily a lack of knowledge about animals that leads to negative attitudes and behaviour towards them, and that socio-demographic attributes, particularly cultural backgrounds, also play a significant role in the nature of our attitudes. This provides motivation to take an educational approach when attempting to mitigate human-wildlife conflicts in the COJ, particularly those that involve animals with cultural significance such as owls and bats. This approach must begin with the identification of the particular demographics of the target group, what cultural influences may be at play, such as myths and folklore that give certain species their negative reputations (Dickman, 2010; Randler, Hummel and Prokop, 2012), as well as the nature of

threats or problems the conflict animal poses to the group (whether imagined or real). Only then can one determine the approach that will overcome any potential cultural, physical, or economic barriers to change for the target group. Cultural beliefs are often deeply entrenched in a person's consciousness, and challenging these beliefs and achieving behaviour change is most effective and sustainable when a combination of approaches (moral and educational, incentive-based, and community-based) are used, and when one remains cognisant of these potential barriers to the desired behaviour change (Stern, 2000; Dickman, 2010). Targeted and holistic education campaigns that focus on the importance of urban biodiversity are required to equip both learners and adults with the knowledge necessary for not only responsible environmental behaviour in cities, but also an understanding of why such behaviour is needed. The result of spatial analysis in Chapter 2, which indicated that a large majority of interactions and sightings occur near to green spaces provides evidence that campaigns to teach people how to deal with wildlife along the buffers/borders of these spaces would go a long way to ensuring the integrity of wildlife populations in these spaces and reduce any source-sink effects that might be taking place as a result of human behaviours or activities. Other potential mitigation mechanisms to be used in conjunction with education include instituting measures that deter wildlife from occupying houses or certain areas, and humanely excluding wildlife from residences and other structures (Dickman, 2010; Kaplan *et al.*, 2011; Redpath *et al.*, 2013).

In order to prioritise areas, species, and types of conflict to address, and to develop and implement effective mitigation measures, future systematic biodiversity studies would do well to conduct this analysis again using more updated and representative data. However, my study certainly provides a starting point, particularly with regards to knowing what types of wildlife people are coming into contact with, and understanding urban residents' knowledge, attitude and behaviour towards wildlife. The surveys I conducted were intended to provide a general idea of the role our socio-demographic attributes play in our relationships with wildlife, as well as the effects that knowledge and attitudes have on our behaviour. The responses received supported the results of previous studies in other cities, which indicated that our social context does play a role in the development of our knowledge, attitude and behaviour, and that improving knowledge will improve reactions to wildlife encountered. Investigating these social contexts and their effects on individuals in

more detail would provide more targeted and robust theories of behaviour change and conflict mitigation strategies.

The findings of chapters 3 and 4 do support those of chapter 2 by indicating that the reporting of sightings of wildlife, and the nature of human-wildlife encounters, may very well be as a result of a larger number of people of certain cultures, ages, or with differing levels of education in an area. Similarly, answers to the behavioural questions in the survey in Chapter 4, such as opting to call a professional to remove an animal from one's house, further reinforce the relationship between the demographic and social characteristics of people in an area, and the likelihood that those people will opt for one of the following actions in response to an encounter with a wild animal: kill it, leave it alone, chase it away, or request assistance from a professional. By refining the sampling and survey method used here, and examining whether people in an area possess similar characteristics to those of future survey respondents who provide indications of these specific behavioural responses, and cross-referencing these with known sightings or conflict records, or lack thereof in the area, we may be able to contribute to a different kind of ecological niche modelling for urban areas. This modelling method could potentially include variables associated with socio-demographic variables of people, and the effect these may have on the reporting of encounters, and indeed on the likelihood of presence of wildlife in different urban areas.

References

Aguayo, M. and Pen, E. (2005). Multiple effects of urbanization on the biodiversity of developing countries: The case of a fast-growing metropolitan area (Concepcion, Chile). *Biological Conservation* **127**: 272–281.

Animal Demography Unit. (2007). *Southern African Bird Atlas Project 2 (SABAP2)*. Available at: http://sabap2.adu.org.za/index.php (Accessed: 15 July 2017).

Anthony, B. P., Scott, P. and Antypas, A. (2010). Sitting on the fence? policies and practices in managing human-wildlife conflict in Limpopo province, South Africa. *Conservation and Society* **8** (3): 225–240.

Asah, S. T. and Blahna, D. J. (2012). Motivational functionalism and urban conservation stewardship: implications for volunteer involvement. *Conservation Letters* **5**: 470–477.

Asian Disaster Preparedness Center (ADPC). (2003). Module 1: Urbanization and Vulnerability. in. *Capacity Building in Asia using Information Technology Applications (CASITA)* : 1–10.

Barnes, P. (2013). *Battitude: An assessment of human attitude and behaviour towards the critically endangered Pteropus rodricensis*. Imperial College London.

Barry, J. (2007). *Environment and Social Theory*. 2nd edn. New York: Routledge.

Batt, S. (2009). Human attitudes towards animals in relation to species similarity to humans: a multivariate approach. *Bioscience Horizons* **2** (2): 180–190.

Beatson, R. M. and Halloran, M. J. (2007). Humans rule! The effects of creatureliness reminders, mortality salience and self-esteem on attitudes towards animals. *The British journal of social psychology / the British Psychological Society* **46** (3): 619–632.

Beinart, W. and Coates, P. (1995). *Environment and History: The taming of nature in the USA and South Africa*. New York: Routledge.

Bell, M. M. and Bell, M. (2012). *An Invitation to Environmental Sociology*. 4th edn. Los Angeles: Pine Forge Press.

Bjerke, T. and Østdahl, T. (2004). Animal-related attitudes and activities in an urban population. *Anthrozoos* **17** (2): 109–129.

Breuste, J., Niemelä, J., Snep, R. P. H., Snep, Æ. R. P. H. and Niemela, Æ. J. (2008). Applying landscape ecological principles in urban environments. *Landscape Ecology* **23** (10): 1139–1142.

Brownlie, S. and Aros, M. (2013). Detailed Guideline on Biodiversity Offsets for Gauteng Province. Gauteng Department of Agriculture and Rural Development and South African National Biodiversity Institute.

Carlson, N. R., Heth, C. D., Donahoe, J. W., Martin, G. N., Schmaltz, R. M. and Macewan, G. (2010). *Psychology the Science of Behaviour*. 4th edn. Toronto: Pearson Allyn & Bacon.

Cilliers, J. and Cilliers, S. (2013). From green to gold : A South African example of valuing urban green spaces in some residential areas in Potchefstroom. (018): 1–12.

Cilliers, S. S., Müller, N. and Drewes, E. (2004). Overview on urban nature conservation: situation in the western-grassland biome of South Africa. *Urban Forestry & Urban Greening* **3** (1): 49–62.

Cilliers, S. S. and Siebert, S. J. (2012). Urban Ecology in Cape Town : South African Comparisons and Reflections. *Ecology and Society* **17(3)** (33):.

City of Cape Town. (2011). Protocol for reducing the frequency and severity of raiding behaviour by chacma baboons on the Cape Peninsula, South Africa. *2011*. Available at: http://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/Baboon-Protocol-For-Raiding-Baboons_2011.pdf.

City of Johannesburg : 2013/16 Integrated Development Plan (IDP). (2012).

City of Johannesburg. (2003). *State of the Environment Report*.

City of Johannesburg. (2009a). *City of Joburg: Biodiversity Strategy and Action Plan 2015*.

City of Johannesburg. (2009b). *City of Johannesburg Biodiversity Assessment. Draft Report*.

City of Johannesburg. (2012). *City of Johannesburg : 2012/16 Integrated Development Plan (IDP)*.

City of Johannesburg. (2016). *Spatial Development Framework Review Draft 2015/2016*.

Cock, J. (2007). *The War Against Ourselves: Nature, Power and Justice*. Johannesburg: Wits University Press.

Cohn, J. P. (2008). Citizen Science: Can Volunteers Do Real Research?. *BioScience* **58** (3): 192–197.

Concepción, E. D., Obrist, M. K., Moretti, M., Altermatt, F., Baur, B. and Nobis, M. P. (2016). Impacts of urban sprawl on species richness of plants , butterflies , gastropods and birds : not only built-up area matters. : 225–242.

Czech B, Krausman, P. and Borkhataria, R. (1998). Social construction, political power, and the allocation of benefits to endangered species. *Conservation Biology* (12): 1103–1112.

Darwin, C. (1859). *On The Origin of Species by Means of Natural Selection, or Preservation of Favoured Races in the Struggle for Life*. London: John Murray.

Davey, G. C., McDonald, A. S., Hirisave, U., Prabhu, G. G., Iwawaki, S., … Reimann, B. C. (1998). A cross-cultural study of animal fears. *Behaviour research and therapy*. Pergamon **36** (7–8): 735–50. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9682528.

David, H. (2012). *A Summary of Wildlife Admittances between 1997 and 2011: Data extracted from the FreeMe Wildlife Rehabilitation Centre Database*. Johannesburg.

Dearborn, D. C. and Kark, S. (2009). Motivations for Conserving Urban Biodiversity. *Conservation Biology* **24** (2): 432–440.

DeMello, M. (2012). *Animals and Society: An Introduction to Human-Animal Studies*. New York: Columbia University Press.

Department of Basic Education. (2012). *Annual Schools Surveys: Report for Ordinary Schools 2010 and 2011*. Pretoria. Available at: www.education.gov.za.

Department of Basic Education. (2016). *Education Statistics in South Africa 2014*. Pretoria.

DeStefano, S. and Deblinger, R. D. (2005). Wildlife as valuable natural resources vs . intolerable pests : a suburban wildlife management model. *Urban Ecosystems* **8**: 179–190.

Dickman, A. J. (2010). Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. *Animal Conservation* **13**: 458–466.

Didapper, P. (2014). *Owls in traditional medicine | Blog*. *The Pharmaceutical Journal (online blog)*. Available at: https://www.pharmaceutical-journal.com/opinion/blogs/owls-in-traditional-medicine/11137188.blog (Accessed: 22 January 2018).

Ditchkoff, S. S., Saalfeld, S. T. and Gibson, C. J. (2006). Animal behavior in urban ecosystems: Modifications due to human-induced stress. *Urban Ecosystems* **9** (1): 5–12.

Drews, C. (2002). Attitudes, knowledge and wild animals as pets in Costa Rica. *Anthrozoos* **15** (2): 119–139.

Dunlap, R. E. (2002). Chapter 10: Environmental Socoiology. in. Bechtel, R. B. and Churchman, A. (eds). *Handbook of Environmental Psychology*. New York: John Wiley & Sons, Inc.

Dunlap, R. E. and van Liere, K. D. (1978). The New Environmental Paradigm. *The Journal of Environmental Education* **40** (1): 19–29.

Eagly, A. H. and Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth: Harcourt Brace College Publishers.

Elmqvist, T., Redman, C. L., Barthel, S. and Costanza, R. (2013). Chapter 2: History of Urbanization and the Missing Ecology.pdf. in. Elmqvist, T., Fragkias, M., Goodness, J., Güneralp, B., Marcotullio, P. J., … Wilkinson, C. (eds). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment*. Springer.

Endangered Wildlife Trust. (2017). *MODDERFONTEIN RESERVE Environmental Management Plan*. Johannesburg.

Environomics. (2014). *Gauteng Environmental Management Framework*.

Everatt, D. (2013). *The Gauteng City-Region Quick introduction to the GCRO Data , indicators and benchmarks Government – academia portal Academic contribution Medium to long term research Partnership and networks On request policy work*.

Fishbein, M. and Ajzen, I. (1975). Chapter 8: Prediction of Behavior. in. *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research* : 335–383.

Fransson, N. and Garling, T. (1999). Environmental Concern: Conceptual Definitions, Measurement Methods, and Reseach Findings. *Journal of Environmental Psychology* (19): 369–382.

Ganis, M. Z. N. (2005). Political and Social Implications of Witchcraft and Legitimacy. *Africa: Rivista trimestrale di studi e documentazione dell'Istituto italiano per l'Africa e l'Orient* **60** (3/4): 361–370.

Garbutt, H. . (1909). Native Witchcraft and Superstition in South Africa. *The Journal of the Royal Anthropological Institute of Great Britain and Ireland* **39** (May): 530–558.

Gauteng Provincial Government. (2016). *Gauteng Spatial Development Framework 2030*.

GDARD. (2011). *2011 Gauteng Conservation Plan*.

Geoterraimage. (2015). *Geoterraimage*. Available at: www.geoterraimage.com (Accessed: 25 May 2017).

Gianotti, A. G. S., Getson, J. M., Hutyra, L. R. and Kittredge, D. B. (2016). Defining urban , suburban , and rural : a method to link perceptual definitions with geospatial measures of urbanization in central and eastern Massachusetts. *Urban Ecosystems* **19**: 823–833.

Goddard, M. A., Dougill, A. J. and Benton, T. G. (2010). Scaling up from gardens: biodiversity conservation in urban environments. *Trends in ecology & evolution* **25** (2): 90–8.

Goodness, J. and Anderson, P. M. L. (2013). Chapter 24: Local Assessment of Cape Town: Navigating the Management Complexities of Urbanization, Biodiversity, and Ecosystem Services in the Cape Floristic Region. in. Elmqvist, T., Fragkias, M., Goodness, J., Güneralp, B., Marcotullio, P. J., … Wilkinson, C. (eds). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment*. Springer.

Hadidian, J. (1991). Interactions between people and wildlife in urbanizing landscapes. *Fifth Eastern Wildlife Damage Control Conference* : 5–8.

Haralambos, M. (1996). *Sociology: Themes and Perspectives*. Addison Wesley Longman.

HarperCollins Publishers Limited. (2018). *Apartheid definition and meaning | Collins English Dictionary*. *Collins English Dictionary Online*. Available at: https://www.collinsdictionary.com/dictionary/english/apartheid (Accessed: 27 January 2018).

Henning, D. (2002). *Buddhism and Deep Ecology for Protection of Wild Asian Elephants in Myanmar : a Resource Guide*. Bankok.

Herzog, H. A. (2007). Gender Differences in Human – Animal Interactions : A Review. *Anthrozoos* **20** (1): 7–21.

Herzog, H., Betchart, N. S. and Pittman, R. (1991a). Animal Attitude Scale. *Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals* **4** (3): 184–191.

Herzog, H., Betchart, N. S. and Pittman, R. (1991b). Gender, sex role identity and attitudes towards animals. *Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals* **4** (3): 184–191.

Hill, A. M. (1993). The motivational bases of attitudes toward animals. *Society and Animals* **1** (2): 111–128.

Hoffman, T. S. and O'Riain, M. J. (2011). The Spatial Ecology of Chacma Baboons (Papio ursinus) in a Human-modified Environment. *International Journal of Primatology*. Springer US **32** (2): 308–328.

Hoffman, T. S. and O'Riain, M. J. (2012). Monkey Management: Using Spatial Ecology to Understand the Extent and Severity of Human–Baboon Conflict in the Cape Peninsula, South Africa. *Ecology and Society*. Resilience Alliance Inc. **17** (3):.

Holmes, P. M., Rebelo, A. G., Dorse, C. and Wood, J. (2012). Can Cape Town's unique biodiversity be saved? Balancing conservation imperatives and development needs. *Ecology and Society* **17(2)** (28): 1–17.

Homer, P. M. and Kahle, L. R. (1988). A Structural Equation Test of the Value-Attitude-Behavior Hierarchy. *Journal of Personality and Social Psychology* **54** (4): 638–646.

Human Wildlife Solutions. (2018). *Baboon Management*. Available at: http://hwsolutions.co.za/baboon-management/ (Accessed: 3 September 2017).

Hutson, A., Michleburgh, S. and Racey, P. (2001). *Microchiropteran Bats: Global Status Survey and Conservation Action Plan*. Cambridge: Information Press.

ICLEI. (2012). Cape Town , South Africa: An urban Biodiversity Network. ICLEI - Local Givernments for Sustainability : 1–6. Available at: www.inclei.org/casestudies.

Jenkins, E. R. (2006). *National Character*. *National Character in South African English Children's Literature*. Routledge.

Kaplan, B. S., O'Riain, M. J., van Eeden, R. and King, A. J. (2011). A Low-Cost Manipulation of Food Resources Reduces Spatial Overlap Between Baboons (Papio ursinus) and Humans in Conflict. *International Journal of Primatology*. Springer US **32** (6): 1397–1412.

Kellert, S. R. (1985). Attitudes toward Animals: Age-Related Development among Children. *The Journal of Environmental Education* **16** (3): 29–39.

Kellert, S. R. (2012). *Birthright : people and nature in the modern world*. New Haven & London: Yale University Press.

Kellert, S. R. and Berry, J. K. (1980). *Phase III: Knowledge, Affection and Basic Attitudes Towards Animals in American Society*.

Kellert, S. R. and Berry, J. K. (1987). Attitudes, Knowledge, and Behaviors Towards Wildlife as Affected by Gender. **15** (3): 363–371.

Kellert, S. R. and Berry, J. K. (1987). Attitudes,knowledge, and behaviors toward wildlife as affected by gender. *Wildlife Society* **15** (3): 363–371.

Kinzig, A. P., Warren, P., Martin, C., Hope, D. and Katti, M. (2005). The Effects of Human Socioeconomic Status and Cultural Characteristics on Urban Patterns of Biodiversity. *Ecology and Society* **10** (1):.

Knight, A. J. (2008). 'Bats, snakes and spiders, Oh my!' How aesthetic and negativistic attitudes, and other concepts predict support for species protection. *Journal of Environmental Psychology* **28** (1): 94–103.

Laidley, T. M. (2013). The Influence of Social Class and Cultural Variables on Environmental Behaviours: Municipal-Level Evidence From Massachusetts. *Environment and Behaviour* **45**: 170.

Lee, J. and Sue, S. (2001). *The Handbook of Culture and Psychology Chapter 15: Clinical Psychology and Culture*. Edited by D. Matsumoto. New York: Oxford University Press.

Lewis, D. (2006). *Owls in Mythology & Culture*. Available at: http://www.owlpages.com/owls/articles.php?a=62 (Accessed: 15 May 2017).

Lewis, D. (2012). *World Owl Mythology*. Available at: http://www.owlpages.com/owls/articles.php?a=63 (Accessed: 15 May 2017).

Van Liere, K. D. and Dunlap, R. E. (1980). The Social Bases of Environmental Concern: A Review of Hypotheses, Explanations and Empirical Evidence. *Public Opinion Quarterly* **44**: 181–197.

Light, J. L. (2015). *The distribution and urban occurrence of the elusive southern African hedgehog (Atelerix frontalis)*. University of the Witwatersrand.

Little, W. and McGivern, R. (2013). *Introduction to Sociology - 1st Canadian Edition*. OpenStax College.

Manfredo, M. J. (2008). *Who Cares About Wildlife?* New York: Springer.

Marcot, B. ., Johnson, D. . and Cocker, P. M. (2000). Owls in Lore and Culture (Page 1 of 3) - The Owl Pages. in. *Owls 2000: the biology, conservation and cultural significance of owls.* Canberra. Available at: http://www.owlpages.com/owls/articles.php?a=64 (Accessed: 15 May 2017).

Marzluff, J. M. and Rodewald, A. (2008). Conserving biodiversity in urbanizing areas: nontraditional views from a bird's perspective. *Cities and the Environment* **1** (2): 1–28.

Maslow, A. H. (1954). *Motivation and Personality*. New York: Harper and Row.

Mayer, F. S. and Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology* **24** (4): 503–515.

McDonald, R. I., Marcotullio, P. J. and Guneralp, B. (2013). Urbanization and Global Trends in Biodiversity and Ecosystem Services. in. Elmqvist, T., Fragkias, M., Goodness, J., Güneralp, B., Marcotullio, P. J., … Wilkinson, C. (eds). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment* : 31–52.

McDonnell, M., Hahs, A. and Breuste, J. (eds). (2009). *Ecology of Cities and Towns: A Comparative Approach*. New York: Cambridge University Press.

McDonnell, M. J. and Hahs, A. K. (2013). The future of urban biodiversity research: Moving beyond the 'low-hanging fruit'. *Urban Ecosystems* **16** (3):.

McDonnell, M. J. and Hahs, A. K. (2015). Adaptation and Adaptedness of Organisms to Urban Environments. *Annual Review of Ecology, Evolution, and Systematics* **46** (1): 261–280.

Mckinney, M. L. (2002). Urbanization, Biodiversity, and Conservation. *Bioscience* **52** (10):.

Mckinney, M. L. (2006). Urbanization as a major cause of biotic homogenization. *Biological Conservation* **127**: 247–260.

Menon, V. and Lavigne, D. (2006). Attitudes, values and objectives:the real basis of wildlife conservation. *Gaining Ground: In Pursuit of Ecological Sustainability* : 173–190.

Messenger, S. (2009). *Gamblers Smoking Vulture Brains for Good Luck : TreeHugger*. Available at: http://www.treehugger.com/natural-sciences/gamblers-smoking-vulture-brains-for-good-luck.html.

Microsoft Corporation. (2016). Microsoft Excel 2016. Microsoft Corporation.

Milfont, T. L., Duckitt, J. and Cameron, L. D. (2006). A Cross-Cultural Study of Environmental Motive Concerns and Their Implications for Proenvironmental Behavior. *Environment and Behavior* **38** (6): 745–767.

Miller, J. R. and Hobbs, R. J. (2002). Conservation Where People Live and Work. **16** (2): 330–337.

Milne, A. A. (1926). *Winnie-the-pooh*. London: Methuen & Co. Ltd.

Minter, J. E. (2005). *Teaching About Frogs in Grade 7 : a Case Study on Integrating Indigenous Knowledge into the Science Curriculum*. University of Limpopo.

Morzillo, A. T. and Mertig, A. G. (2011). Urban resident attitudes toward rodents , rodent control products , and environmental effects. *Urban Ecosystems* (14): 243–260.

Müller, N., Ignatieva, M., Nilon, C. H., Werner, P. and Zipperer, W. C. (2013). Chapter 10:

Patterns and trends in urban biodiversity and landscape design. in. *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment* : 123–174.

Municipal Demarcation Board. (2016). *Shapefiles – Municipal Demarcation Board*. Available at: http://www.demarcation.org.za/site/shapefiles/ (Accessed: 17 February 2018).

Navarro, R. A. (2010). *Animal Demography Unit (ADU) Virtual Museum*. *Animal Demography Unit, University of Cape Town*. Available at: http://vmus.adu.org.za/ (Accessed: 15 June 2017).

Niemela, J., Kotze, J. and Yli-pelkonen, V. (2009). Comparative urban ecology: challenges and possibilities. in. McDonnell, M., Hahs, A., and Breuste, J. (eds). *Ecology of Cities and Towns: A Comparative Approach*. New York: Cambridge University Press : 9–24.

Norman, G. (2010). Likert scales, levels of measurement and the 'laws' of statistics. *Adv in Health Sci Educ* (15): 625–632.

Page, S. K., Parker, D. M., Peinke, D. M. and Davies-Mostert, H. T. (2015). Assessing the potential threat landscape of a proposed reintroduction site for carnivores. *PLoS ONE* **10** (3): 1–16.

Pickett, S. T. A., Cadenasso, M. L., Childers, D. L., Mcdonnell, M. J. and Zhou, W. (2012). Evolution and future of urban ecological science : ecology in, of, and for the city. *Ecosystem Health and Sustainability* **2** (7): 1–16.

Prah, K. K. (2007). *Challenges to the Promotion of Indigenous Languages in South Africa*. *Review Commissioned by the Foundation for Human Rights in South Africa*. Cape Town.

Preece, R. (1999). *Animals and Nature: Cultural Myths, Cultural Realities*. Vancouver: UBC Press.

Prokop, P., Fancovicova, J. and Kubiatko, M. (2009). Vampires Are Still Alive: Slovakian Students' Attitudes toward Bats. *Anthrozoos* **22** (1): 19–30.

Prokop, P. and Tunnicliffe, S. D. (2008). ' Disgusting ' Animals : Primary School Children ' s Attitudes and Myths of Bats and Spiders. *Eurasia Journal of Mathematics, Science & Technology* **4** (2): 87–97.

QGIS Development Team. (2016). QGIS Geographic Information System. Open Source Geospatial Foundation. Available at: http://www.qgis.org/.

Randler, C., Hummel, E. and Prokop, P. (2012). Practical Work at School Reduces Disgust and Fear of Unpopular Animals. *Society and Animals* **20**: 61–74.

Randler, C., Ilg, A. and Kern, J. (2005). Cognitive and emotional evaluation of an amphibian conservation programme for elementary school students. *Journal of Environmental Education* **37** (1): 43–52.

Redclift, M. R. and Woodgate, G. (eds). (2010). *The International Handbook of*

Environmental Sociology. 2nd edn. London: Edward Elgar.

Redpath, S. M., Young, J., Evely, A., Adams, W. M., Sutherland, W. J., … Gutie, R. J. (2013). Understanding and managing conservation conflicts. **28** (2):.

Richter, M. and Weiland, U. (2012). *Applied Urban Ecology: A Global Framework*. Edited by M. Richter and U. Weiland. Oxford: Wiley-Blackwell.

Roberts, B., Sitas, A. and Greenstein, R. (2003). *Research Methods Training Manual*. Edited by R. Greenstein.

Schaffler, A. (2011). Enhancing resilience between people and nature in urban landscapes. Stellenbosch : University of Stellenbosch. Available at: http://scholar.sun.ac.za/handle/10019.1/6473 (Accessed: 23 September 2013).

Schäffler, A., Bobbins, K., Otto, E., Nhlozi, M. W., Wit, M. De, … Phasha, P. (2013). *State of Green Infrastructure in the Gauteng City-Region*. Johannesburg: Gauteng City Region Observatory.

Schultz, P. W., Shriver, C., Tabanico, J. J. and Khazian, A. M. (2004). Implicit connections with nature. *Journal of Environmental Psychology* **24** (1): 31–42.

Scott, J. and Marshall, G. (2009). *A Dictionary of Sociology*. Oxford University Press. Available at: http://books.google.co.za/books/about/A_Dictionary_of_Sociology.html?id=pfeROnUcAPkC&pgis=1 (Accessed: 14 May 2014).

Secretariat of the Convention on Biological Diversity. (2009). *Biodiversity, Development and Poverty Alleviation: Recognizing the Role of Biodiversity for Human Well-Being*. Montreal. Available at: http://www.cbd.int/doc/bioday/2010/idb-2010-booklet-en.pdf.

Serpell, J. (2004). Factors influencing human attitudes to animals and their welfare. *Animal Welfare* **13**: 145–151.

Sexton, N. R. and Stewart, S. C. (2007). *Understanding Knowledge and Perceptions of Bats Among Residents of Fort Collins , Colorado*. *U.S. Geological Survey*.

Shochat, E., Lerman, S. B., Anderies, J. M., Warren, P. S. and Faeth, S. H. (2010). Invasion , Competition , and Biodiversity Loss in Urban Ecosystems. *Bioscience* **60** (3): 199–208.

Skead, C. (2011). Historical incidence of the larger land mammals in the broader Western and Northern Cape. in. Boshoff, A., Kerley, G., and Lloyd, P. (eds). *Historical Review: Species Occurrence and Status*. 2nd edn. Port Elizabeth: Centre for African Conservation Ecology Nelson Mandela Metropolitan University Port Elizabeth, South Africa : 212–233.

Statistics South Africa. (2015). *2015 General Household Survey, South Africa*. *Statistics South Africa*. Available at: www.statssa.gov.za.

Statistics South Africa. (2016). Community Survey 2016 Statistical Release. *Stats SA Statistics South Africa* : Community Survey 2016 Results.

Statsoft. (2014). STATISTICA (data analysis software system). Statsoft, Inc. Available at: www.statsoft.com.

StatsSA. (2011). *Local Municipality | Statistics South Africa*. Available at: http://www.statssa.gov.za/?page_id=993&id=city-of-johannesburg-municipality (Accessed: 26 February 2017).

Stern, P. C. (2000). Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues* **56** (3): 407–424.

Stern, P. and Dietz, T. (1994). The Value Basis of Environmental Concern. *Journal of Social Issues* **50** (3): 65–84.

Strategic Environmental Focus (Pty) Ltd. (2002). *Joburg Metropolitan Open Space System*. Pretoria.

Swearer, D. K. (1997). The Hermeneutics of Buddhist Ecology in Contemporary Thailand: Buddhadasa and Dhammapitaka. in. Tucker, M. E. and Williams, D. (eds). *Buddhism and Ecology*. Cambridge: Harvard University Press : 21–44.

Tanner, C. J., Adler, F. R., Grimm, N. B., Groffman, P. M., Levin, S. A., Munshi-south, J., Pataki, D. E., Pavao-zuckerman, M. and Wilson, W. G. (2014). Urban ecology: advancing science and society. *The Ecological Society of America* **12** (10): 574–581.

Tanner, C. J., Adler, F. R., Grimm, N. B., Groffman, P. M., Levin, S. A., Munshi-South, J., Pataki, D. E., Pavao-Zuckerman, M. and Wilson, W. G. (2014). Urban ecology: Advancing science and society. *Frontiers in Ecology and the Environment* **12** (10):.

Tarrant, J., Kruger, D. and du Preez, L. H. (2016). Do public attitudes affect conservation effort ? Using a questionnaire-based survey to assess perceptions , beliefs and superstitions associated with frogs in South Africa. *African Zoology*.

Tavakol, M. and Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education* **2**: 53–55.

Taylor, L. and Hochuli, D. F. (2015). Creating better cities : how biodiversity and ecosystem functioning enhance urban residents ' wellbeing. : 747–762.

Taylor, N. and Signal, T. D. D. (2005). Empathy and attitudes to animals. *Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals* **18** (1): 18–27.

Templer, D. (1886). Animal Attitude Scales.

Templer, D. I., Connelly, H. J., Bassman, L. and Hart, J. (2006). Construction and Validation of an Animal-Human Continuity Scale. *Social Behaviour and Personality* **34** (7): 769–776.

Templer, D. I., Salter, C. A., Dickey, S., Baldwin, R. and Veleber, D. M. (1981). The construction of a pet attitude scale. *Psychological Record* **31**: 343–348.

Thompson, L. (2001). *A History of South Africa*. New Haven & London: Yale University Press.

Turok, I. (2012). *Urbanisation and Development in South Africa: Economic Imperatives, Spatial Distortions and Strategic Responses*. London.

Turok, I. (2014). South Africa ' s Tortured Urbanisation and the Complications of Reconstruction. in. McGranahan and Martine, G. (eds). *Urban Growth in Emerging Economies: Lessons from the BRICS, Earthscan*. Available at: https://www.researchgate.net/publication/262802533.

Tylor, E. B. (1871). *Primitive Culture: Researches into the Development of Mythology, Philosophy, Religion, Art, and Custom*. London: John Murray.

Whiting, M. J., Williams, V. L. and Hibbitts, T. J. (2011). Animals traded for traditional medicine at the Faraday market in South Africa: species diversity and conservation implications. *Journal of Zoology* **284** (2): 84–96.

Widdows, C. D. and Downs, C. T. (2015). A genet drive-through : are large spotted genets using urban areas for 'fast food'? a dietary analysis. *Urban Ecosystems* **18**: 907–920.

Widdows, C. D., Ramesh, T. and Downs, C. T. (2015). Factors affecting the distribution of large spotted genets (Genetta tigrina) in an urban environment in South Africa. *Urban Ecosystems* **18** (4): 1401–1413.

Wilson, E. O. and Kellert, S. R. (eds). (1993). *The Biophilia Hypothesis*. Washington DC: Island Press.

Winter, S. J., Esler, K. J. and Kidd, M. (2005). An index to measure the conservation attitudes of landowners towards Overberg Coastal Renosterveld, a critically endangered vegetation type in the Cape Floral Kingdom, South Africa. *Biological Conservation* **126** (3): 383–394.

Appendix A Types of human attitudes towards animals and nature (Kellert, 1980)

Attitude Type	Definition
Naturalist	Primary interest and affection is for wildlife and the outdoors
Humanistic	Primary affection is for individual animals; emotional attachment, 'love' for nature Interest
Aesthetic	Primary interest is in the physical appeal and beauty of nature
Symbolic	Primary interest is in the use of nature for metaphorical expression, language, expressive thought
Moralistic	Primary concern is about the treatment of animals, with strong opposition to exploitation or cruelty toward animals; strong affinity, spiritual reverence, ethical concern for nature
Scientistic	Primary interest is in the physical attributes and biological functioning of animals
Ecologistic	Primary concern is for the environment as a system, for interrelationships between wildlife species and natural habitats
Utilitarian	Primary interest is in the practical and material exploitation of natural resources including animals or their habitats
Dominionistic	Primary objective is the mastery and control of animals and their habitats
Negativistic	Primary motivation for avoidance is fear, aversion, and alienation from nature
Neutralistic	Primary motivation for passive avoidance of animals is indifference or lack of interest

Appendix B

Species recorded in the City of Johannesburg between 2000 and 2017, and number of records. (Animal Demography Unit: University of Cape Town (ADU); Endangered Wildlife Trust: Urban Conservation Programme (UCP); Endangered Wildlife Trust: Wildlife and Roads Project (WRP); Gauteng Department of Agriculture and Rural Development (GDARD); Greater Kyalami Conservancy (GEKCO); I Found a Hedgehog (IFAH); iSpot; North and West Rand Snake Removal Group; Private individuals).

Class	Common name	Scientific name	Records
Amphibians (14 species)	Cape River Frog	*Amietia fuscigula*	1
	Common Caco	*Cacosternum boettgeri*	3
	Common/ Angola River Frog	*Amietia angolensis*	3
	Common Platanna	*Xenopus laevis*	4
	Giant Bullfrog	*Pyxicephalus adspersus*	23
	Guttural Toad	*Bufo gutturalis*	7
	Natal Sand Frog	*Tomopterna natalensis*	3
	Plain Grass Frog	*Ptychadena anchietae*	1
	Poynton's River Frog	*Amietia poyntoni*	2
	Queckett's River Frog	*Amietia quecketti*	7
	Raucous Toad	*Sclerophrys capensis*	1
	Red Toad	*Schismaderma carens*	6
	Tremelo Sand Frog	*Tomopterna cryptotis*	2
	Unknown		1
	Total		**64**
Birds (32 species)	African Grass Owl	*Tyto capensis*	11
	African Harrier-hawk	*Polyboroides typus*	3
	African Hoopoe	*Upupa africana*	2
	Barn Swallow	*Hirundo rustica*	2
	Black-shouldered Kite	*Elanus caeruleus*	2
	Blacksmith Lapwing	*Vanellus armatus*	2
	Blue Crane	*Anthropoides paradiseus*	2
	Cape Glossy Starling	*Lamprotornis nitens*	1
	Cape Vulture	*Gyps coprotheres*	1
	Crowned Lapwing	*Vanellus coronatus*	1
	Egyptian Goose	*Alopochen aegyptiaca*	1
	Fiscal Flycatcher	*Sigelus silens/Lanius collaris*	1
	Greater Flamingo	*Phoenicopterus roseus*	1
	Hadeda Ibis	*Bostrychia hagedash*	4
	Half-collared Kingfisher	*Alcedo semitorquata*	2
	Indian Myna	*Acridotheres tristis*	4
	Karoo Thrush	*Turdus smithi*	1
	Lanner Falcon	*Falco biarmicus*	1

Class	Common name	Scientific name	Records
	Laughing Dove	*Streptopelia senegalensis*	8
	Lesser Striped Swallow	*Cecropis abyssinica*	1
	Long-crested Eagle	*Lophaetus occipitalis*	1
	Marsh Owl	*Asio capensis*	3
	Melodious Lark	*Mirafra cheniana*	2
	Peregrine Falcon	*Falco peregrinus*	1
	Red-eyed Dove	*Streptopelia semitorquata*	2
	Ring-necked Dove	*Streptopelia capicola*	2
	Rock Dove	*Columba livia*	1
	Southern Red Bishop	*Euplectes orix*	1
	Speckled Pigeon	*Columba guinea*	2
	Spotted Eagle Owl	*Bubo africanus*	6
	Spotted Thick-knee	*Burhinus capensis*	2
	White-bellied Korhaan	*Eupodotis senegalensis*	1
	Unknown		13
	Total		88
Mammals	African Civet	*Civettictis civetta*	2
(37 species)	Angolan Free-tailed Bat	*Mops condyluru/Mops midas*	1
	Angoni Vlei Rat	*Otomys angoniensis*	1
	Black-backed Jackal	*Canis mesomelas*	5
	Blesbok	*Damaliscus pygargus phillipsi*	4
	Brown Hyaena	*Hyaena brunnea*	5
	Cape Clawless Otter	*Aonyx capensis*	3
	Cape Porcupine	*Hystrix africaeaustralis*	2
	Cape Serotine Bat	*Neoromicia capensis*	4
	Common Duiker	*Sylvicapra grimmia*	9
	Egyptian Free-tailed Bat	*Tadarida aegyptiaca*	8
	Egyptian Slit-faced Bat	*Nycteris thebaica*	2
	Geoffroy's Horseshoe Bat	*Rhinolophus clivosus*	4
	Greater Cane Rat	*Thryonomys swinderianus*	2
	Klipspringer	*Oreotragus oreotragus*	2
	Large-spotted Genet	*Genetta tigrina*	6
	Leopard	*Panthera pardus*	1
	Red Hartebeest	*Alcelaphus buselaphus caama*	1
	Rock Elephant-shrew	*Elephantulus myurus*	1
	Rock Hyrax	*Procavia capensis*	5
	Rusty Bat	*Pipistrellus rusticus*	6
	Rusty-spotted Genet	*Genetta maculata*	1
	Scrub Hare	*Lepus saxatilis*	7
	Serval	*Leptailurus serval*	2
	Slender Mongoose	*Galerella sanguinea*	3
	Small-spotted Genet	*Genetta genetta*	14
	Southern African Hedgehog	*Atelerix frontalis*	295
	Spotted Hyaena	*Crocuta crocuta*	1
	Steenbok	*Raphicerus campestris*	1

Class	Common name	Scientific name	Records
	Striped Mouse	*Rhabdomys pumilio*	3
	Striped Polecat	*Ictonyx striatus*	1
	Vervet Monkey	*Cercopithecus aethiops pygerythrus*	2
	Vlei Rat	*Otomys irroratus*	1
	Wahlberg's Epauletted Fruit Bat	*Epomophorus wahlbergi*	6
	Water Mongoose	*Atilax paludinosus*	4
	Yellow House Bat	*Scotophilus dinganii*	2
	Yellow Mongoose	*Cynictis penicillata*	1
	Unknown		14
	Total		**432**
Reptiles (44 species)	Aurora House Snake	*Lamprophis aurora*	8
	Bibron's Blind Snake	*Afrotyphlops bibronii*	8
	Bibron's Stiletto Snake	*Atractaspis bibronii*	5
	Black Mamba	*Dendroaspis polylepis*	1
	Black-headed Centipede-eater	*Aparallactus capensis*	19
	Boomslang	*Dispholidus typus*	5
	Brown House Snake	*Boaedon capensis*	36
	Brown Water Snake	*Nerodia taxispilota*	1
	Cape Gecko	*Pachydactylus capensis*	18
	Cape Skink	*Trachylepis capensis*	8
	Central Marsh Terrapin	*Pelomedusa subrufa*	1
	Common Dwarf Gecko	*Lygodactylus capensis capensis*	22
	Common Flap-neck Chameleon	*Chamaeleo dilepis dilepis*	3
	Common Girdled Lizard	*Cordylus vittifer*	3
	Common Tropical House Gecko	*Hemidactylus mabouia*	1
	Copperhead	*Agkistrodon contortrix*	1
	Corn Snake	*Pantherophis guttatus*	1
	Distant's Ground Agama	*Agama aculeata distanti*	2
	Eastern Cape Dwarf Chameleon	*Bradypodion ventrale*	1
	Helmeted Turtle	*Pelomedusa galeata*	1
	Leopard Tortoise	*Stigmochelys pardalis*	13
	Mole Snake	*Pseudaspis cana*	1
	Natal Green Snake	*Philothamnus natalensis*	1
	Night adder	*Causus rhombeatus*	1
	Nile Monitor	*Varanus niloticus*	6
	Olive House Snake	*Lycodonomorphus inornatus*	3
	Peter's Thread Snake	*Leptotyphlops scutifrons*	3
	Puff Adder	*Bitis arietans arietans*	5
	Red-lipped Herald Snake	*Crotaphopeltis hotamboeia*	19
	Rhombic Egg-eater	*Dasypeltis scabra*	5

Class	Common name	Scientific name	Records
	Rhombic Night Adder	*Causus rhombeatus*	1
	Rinkhals	*Hemachatus haemachatus*	40
	Rock Monitor	*Varanus albigularis*	2
	Short-snouted Grass Snake	*Psammophis brevirostris*	2
	Short-snouted Sand Snake	*Psammophis brevirostris*	1
	Snow Cornsnake	*Pantherophis guttatus*	1
	South African Marsh Terrapin	*Pelomedusa galeata*	2
	Southern Rock Agama	*Agama atra*	7
	Speckled Rock Skink	*Trachylepis punctatissima*	21
	Spotted Bush Snake	*Philothamnus semivariegatus*	3
	Spotted Grass Snake	*Psammophylax rhombeatus rhombeatus*	2
	Striped Skaapsteker	*Psammophylax tritaeniatus*	3
	Striped Skink	*Trachylepsis striata*	1
	Transvaal Gecko	*Pachydactylus affinis*	11
	Variable Skink	*Trachylepis varia*	6
	Wahlberg's Snake-eyed Skink	*Panaspis wahlbergii*	5
	Water Monitor	*Varanus salvator*	1
	Yellow-throated Plated Lizard	*Gerrhosaurus flavigularis*	6
	Unknown		17
	Total		**334**
Total			**918**

Appendix C Regions in the City of Johannesburg, the percentage of the total area of the COJ each region occupies, the human population density of each region (persons/km^2) (StatsSA, 2011), and how many wildlife presence records were received from each region (per km^2).

Region	Size (km^2)	% of COJ	Persons /km^2	Presence records	Records /km^2	% of records
Alexandra	6.91	0%	25,979	2	0.3	0%
Chartwell	9.07	1%	191	15	1.7	2%
City of Johannesburg NU	289.84	18%	34	40	0.1	4%
Dainfern	4.08	0%	1,617	2	0.5	0%
Diepsloot	11.99	1%	11,532	5	0.4	1%
Drie Ziek	7.53	0%	4,728	1	0.1	0%
Ebony Park	1.63	0%	13,696	0	0.0	0%
Ennerdale	21.33	1%	3,367	1	0.0	0%
Farmall	5.01	0%	210	2	0.4	0%
Itsoseng	0.58	0%	8,973	0	0.0	0%
Ivory Park	9.21	1%	20,020	0	0.0	0%
Johannesburg	334.81	20%	2,860	165	0.5	18%
Kaalfontein	4.96	0%	9,302	0	0.0	0%
Kagiso	0.57	0%	9,083	0	0.0	0%
Kanana Park	6.82	0%	3,079	0	0.0	0%
Lakeside	3.78	0%	6,214	0	0.0	0%
Lanseria	1.83	0%	2,623	0	0.0	0%
Lawley	6.09	0%	5,439	0	0.0	0%
Lehae	3.50	0%	3,819	0	0.0	0%
Lenasia	20.28	1%	4,424	1	0.0	0%
Lenasia South	13.98	1%	2,655	1	0.1	0%
Lucky 7	0.11	0%	-	0	0.0	0%
Malatjie	0.18	0%	12,771	0	0.0	0%
Mayibuye	1.16	0%	19,143	0	0.0	0%
Midrand	152.87	9%	572	229	1.5	25%
Millgate Farm	0.88	0%	195	2	2.3	0%
Orange Farm	12.16	1%	6,312	0	0.0	0%
Poortjie	2.43	0%	4,591	0	0.0	0%
Rabie Ridge	3.33	0%	12,386	1	0.3	0%
Randburg	167.98	10%	2,207	105	0.6	11%
Randfontein	9.19	1%	-	0	0.0	0%
Rietfontein	2.17	0%	90	0	0.0	0%
Roodepoort	160.83	10%	2,021	152	0.9	17%
Sandton	143.54	9%	1,550	191	1.3	21%
Soweto	200.03	12%	6,357	1	0.0	0%
Stretford	7.38	0%	8,282	0	0.0	0%
Tshepisong	6.56	0%	8,117	0	0.0	0%
Vlakfontein	4.63	0%	5,894	0	0.0	0%

Region	Size (km^2)	% of COJ	Persons /km^2	Presence records	Records /km^2	% of records
Zakariyya Park	1.96	0%	3,160	0	0.0	0%
Zevenfontein	3.11	0%	-	2	0.6	0%
Mean	41.11	0.03%	5837.33	22.95	0.29	0.03

Appendix D Land-cover Classes of the City of Johannesburg (GeoTerraImage 2015), area of each class in hectares and km^2, and the percentage of the total area of the city occupied by each class

Land-cover Class	Area (ha)	Area (km^2)	Percentage of COJ area
Bare none vegetated	163.6	1.6	0.10%
Cultivated comm fields (high)	1,302.0	13.0	0.79%
Cultivated comm fields (low)	1,928.7	19.3	1.17%
Cultivated comm fields (med)	2,706.0	27.1	1.64%
Cultivated comm pivots (high)	513.2	5.1	0.31%
Cultivated comm pivots (low)	6.3	0.1	0.00%
Cultivated comm pivots (med)	278.9	2.8	0.17%
Cultivated orchards (high)	2.4	0.0	0.00%
Cultivated orchards (low)	1.1	0.0	0.00%
Cultivated orchards (med)	3.0	0.0	0.00%
Cultivated subsistence (high)	52.8	0.5	0.03%
Cultivated subsistence (low)	6.9	0.1	0.00%
Cultivated subsistence (med)	18.5	0.2	0.01%
Grassland	39,978.6	399.8	24.30%
Low shrubland	841.6	8.4	0.51%
Mines 1 bare	2,023.4	20.2	1.23%
Mines 2 semi-bare	623.0	6.2	0.38%
Mines water permanent	35.7	0.4	0.02%
Mines water seasonal	18.1	0.2	0.01%
Plantation / Woodlots young	316.9	3.2	0.19%
Plantations / Woodlots mature	5,589.8	55.9	3.40%
Thicket /Dense bush	13,726.6	137.3	8.34%
Urban built-up (bare)	3,193.4	31.9	1.94%
Urban built-up (dense trees / bush)	1,910.6	19.1	1.16%
Urban built-up (low veg / grass)	1,438.4	14.4	0.87%
Urban built-up (open trees / bush)	302.3	3.0	0.18%
Urban commercial	5,826.2	58.3	3.54%
Urban industrial	4,094.9	40.9	2.49%
Urban informal (bare)	692.2	6.9	0.42%
Urban informal (dense trees / bush)	129.0	1.3	0.08%
Urban informal (low veg / grass)	1,502.0	15.0	0.91%
Urban informal (open trees / bush)	122.0	1.2	0.07%
Urban residential (bare)	1,559.3	15.6	0.95%
Urban residential (dense trees / bush)	29,245.4	292.5	17.78%
Urban residential (low veg / grass)	4,395.0	44.0	2.67%
Urban residential (open trees / bush)	1,099.9	11.0	0.67%
Urban school and sports ground	3,213.5	32.1	1.95%
Urban smallholding (bare)	107.7	1.1	0.07%
Urban smallholding (dense trees / bush)	4,752.0	47.5	2.89%

Land-cover Class	Area (ha)	Area (km^2)	Percentage of COJ area
Urban smallholding (low veg / grass)	5,306.9	53.1	3.23%
Urban smallholding (open trees / bush)	577.0	5.8	0.35%
Urban sports and golf (bare)	43.4	0.4	0.03%
Urban sports and golf (dense tree / bush)	2,289.4	22.9	1.39%
Urban sports and golf (low veg / grass)	705.9	7.1	0.43%
Urban sports and golf (open tree / bush)	92.3	0.9	0.06%
Urban township (bare)	5,391.5	53.9	3.28%
Urban township (dense trees / bush)	451.2	4.5	0.27%
Urban township (low veg / grass)	4,898.5	49.0	2.98%
Urban township (open trees / bush)	490.8	4.9	0.30%
Water permanent	415.5	4.2	0.25%
Water seasonal	23.9	0.2	0.01%
Wetlands	6,767.2	67.7	4.11%
Woodland/Open bush	3,323.9	33.2	2.02%
Total	**164,498.3**	**1,645.0**	**100.00%**

Appendix E School survey distributed in three schools in the COJ

Age _____

Race _____

Gender _____

Home language _____

Place of birth and rural/urban _____

Place of residence and rural/urban (Street name & suburb sufficient)

_____

Attitudes

1. I have a pet at home

   YES ◯ NO ◯

2. Pets should be kept outside

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

3. I like it when wild animals are in cages so that the public can see them

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

4. I have visited the zoo

   YES ◯ NO ◯

5. Animals deserve the same amount of respect as humans do

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

6. I am afraid of bats

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

7. I am afraid of owls

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

8. I am afraid of frogs

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

9. I don't think wild animals belong in the city

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

10. I like to walk in the park

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

11. It is a sign of bad luck to have an owl near your house

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

12. It is okay to use animal parts in medicine

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

13. People who poach wild animals should go to jail

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

14. There is nothing wrong with hunting wild animals for food

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

15. It is necessary to use animals in medical research

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

16. I would rather avoid wildlife in the city

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

17. We need wildlife in the city

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

<u>Knowledge</u>

1. All wild animals are dangerous

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

2. Bats are rodents

YES ◯ NO ◯

3. Bats are not important in nature

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

4. Snakes are important in nature

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

5. Having an owl in your garden is a good thing

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

6. Bats are useful to humans

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

7. South African bats drink blood

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

8. Frogs only occur in dirty water

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

9. Bats get tangled in people's hair

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

Behaviour

1. I like to feed wild animals and birds

strongly disagree ◯ don't agree ◯ neutral ◯ agree ◯ strongly agree ◯

2. What would you do if you saw the following animals in your home?

Spider	**Frog**	**Owl**	**Snake**	**Bat**
Kill it ◯	**Kill it** ◯	**Kill it** ◯	**Kill it** ◯	**Kill it** ◯
Take it outside ◯	**Take it outside** ◯	**Take it outside** ◯	**Take it outside** ◯	**Take it outside** ◯
Leave it alone ◯	**Leave it alone** ◯	**Leave it alone** ◯	**Leave it alone** ◯	**Leave it alone** ◯

Thank you for your cooperation!

Appendix F School survey questions, response options and scores (high scores always positive)

Questions		Response options[1]				
Knowledge questions		**SD**	**D**	**N**	**A**	**SA**
K1	All wild animals are dangerous	4	3	2	1	0
K2	Bats are rodents	Y = 0				N = 4
K3	Bats are not important in nature	4	3	2	1	0
K4	Snakes are important in nature	0	1	2	3	4
K5	Having an owl in your garden is a good thing	0	1	2	3	4
K6	Bats are useful to humans	0	1	2	3	4
K7	South African bats drink blood	4	3	2	1	0
K8	Frogs only occur in dirty water	4	3	2	1	0
K9	Bats get tangled in people's hair	4	3	2	1	0
Attitude questions		**SD**	**D**	**N**	**A**	**SA**
A1	I have a pet at home	Y = 0				N = 4
A2	Pets should be kept outside	4	3	2	1	0
A3	I like it when wild animals are in cages so that the public can see them	4	3	2	1	0
A4	I have visited the zoo	Y = 4				N = 0
A5	Animals deserve the same amount of respect as humans do	0	1	2	3	4
A6	I am afraid of bats*	4	3	2	1	0
A7	I am afraid of owls*	4	3	2	1	0
A8	I am afraid of frogs*	4	3	2	1	0
A9	I don't think wild animals belong in the city	4	3	2	1	0
A10	I like to walk in the park	0	1	2	3	4
A11	It is a sign of bad luck to have an owl near your house	4	3	2	1	0
A12	It is okay to use animal parts in medicine	4	3	2	1	0
A13	People who poach wild animals should go to jail	0	1	2	3	4
A14	There is nothing wrong with hunting wild animals for food	4	3	2	1	0
A15	It is necessary to use animals in medical research	4	3	2	1	0
A16	I would rather avoid wildlife in the city	4	3	2	1	0
A17	We need wildlife in the city	0	1	2	3	4
Behaviour questions		**SD**	**D**	**N**	**A**	**SA**
B1	I like to feed wild animals and birds	0	1	2	3	4
			K	**T**	**L**	
B2a	What would you do if you saw a spider in your home?		0	4	2	
B2b	What would you do if you saw a frog in your home?[+]		0	4	2	
B2c	What would you do if you saw an owl in your home?[+]		0	4	2	
B2d	What would you do if you saw a snake in your home?		0	4	2	
B2e	What would you do if you saw a bat in your home?[+]		0	4	2	

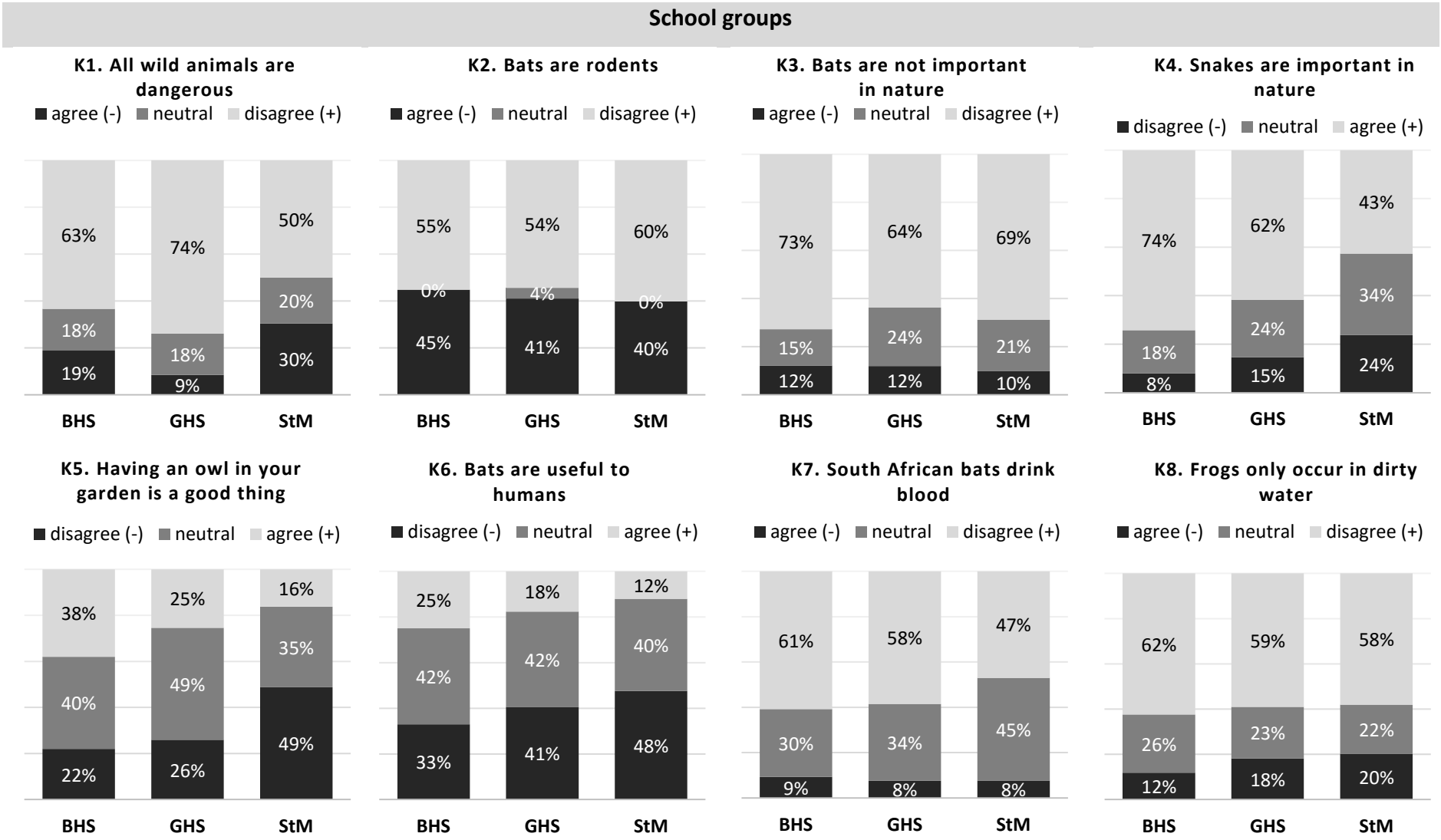
*Fear questions; [+]Action questions

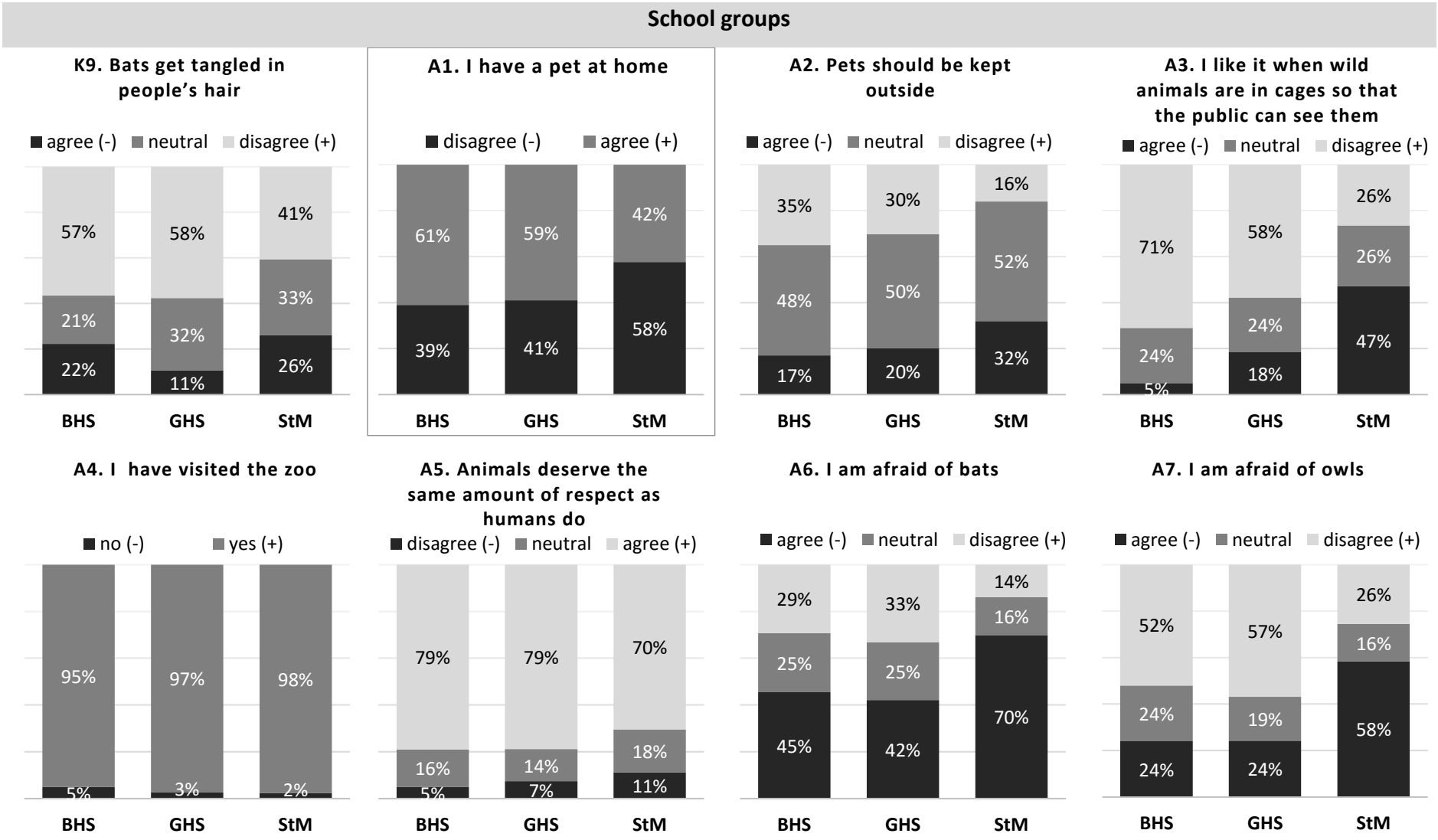
[1]SD = strongly disagree; D = disagree; N = neutral; A = agree; SA = strongly agree; Y = yes; N = no; K = kill it; T = take it outside; L = leave it alone

Appendix G Descriptive ratings for scores on each scale (knowledge, attitude and behaviour)

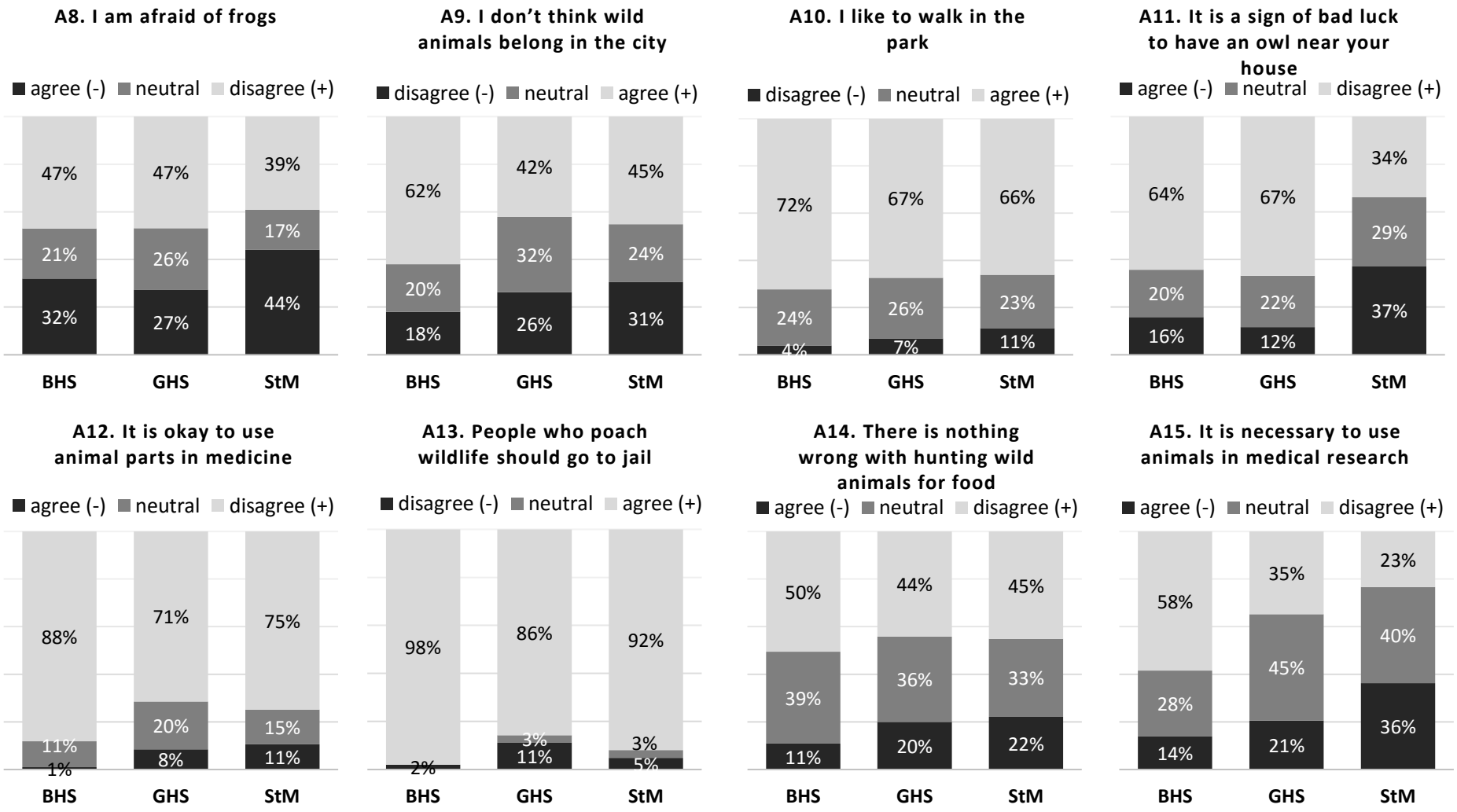
Score $\bar{x}$	**Knowledge**	**Attitude**	**Behaviour**
0.00–0.99	Very poor	Very negative	Very negative
1.00–1.99	Poor	Negative	Negative
2.00–2.99	Fair	Neutral	Neutral
3.00–3.99	Good	Positive	Positive
4.00	Very good	Very positive	Very positive

Appendix H Frequency of different responses to questions in the school survey (Chapter 3) by school group



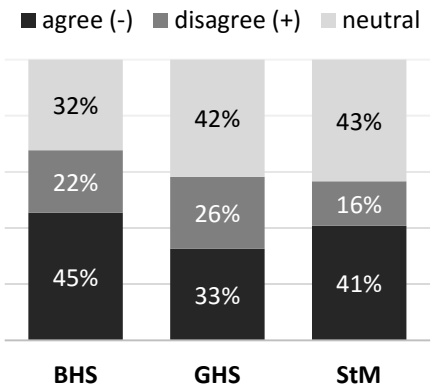

School groups
K9. Bats get tangled in people's hair
agree (-) neutral disagree (+)
57% 21% 22%
58% 32% 11%
41% 33% 26%
BHS GHS StM
A1. I have a pet at home
disagree (-) agree (+)
61% 39%
59% 41%
42% 58%
BHS GHS StM
A2. Pets should be kept outside
agree (-) neutral disagree (+)
35% 48% 17%
30% 50% 20%
16% 52% 32%
BHS GHS StM
A3. I like it when wild animals are in cages so that the public can see them
agree (-) neutral disagree (+)
71% 24% 5%
58% 24% 18%
26% 26% 47%
BHS GHS StM
A4. I have visited the zoo
no (-) yes (+)
95% 5%
97% 3%
98% 2%
BHS GHS StM
A5. Animals deserve the same amount of respect as humans do
disagree (-) neutral agree (+)
79% 16% 5%
79% 14% 7%
70% 18% 11%
BHS GHS StM
A6. I am afraid of bats
agree (-) neutral disagree (+)
29% 25% 45%
33% 25% 42%
14% 16% 70%
BHS GHS StM
A7. I am afraid of owls
agree (-) neutral disagree (+)
52% 24% 24%
57% 19% 24%
26% 16% 58%
BHS GHS StM

School groups

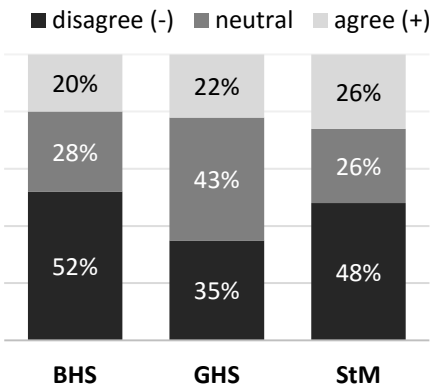


School groups

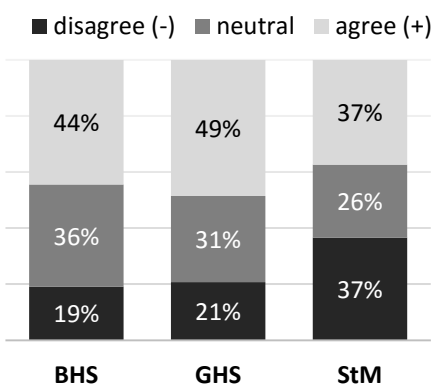
A16. I would rather avoid wildlife in the city



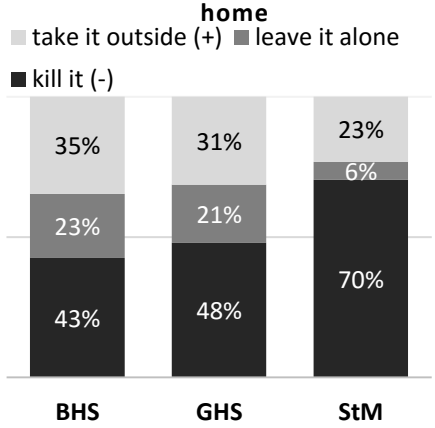
A17. We need wildlife in the city



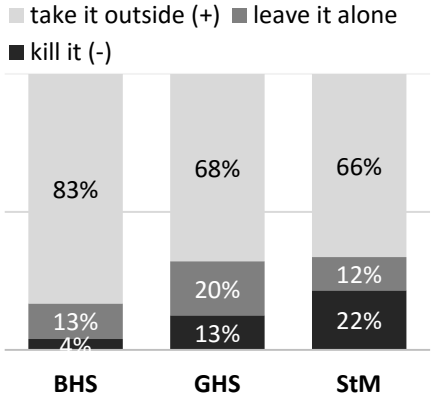
B1. I like to feed wild animals and birds



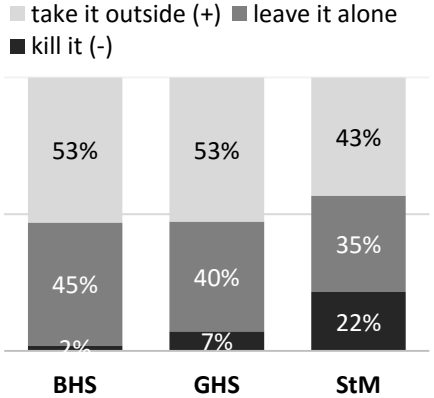
B2a. What would you do if you saw a spider in your home



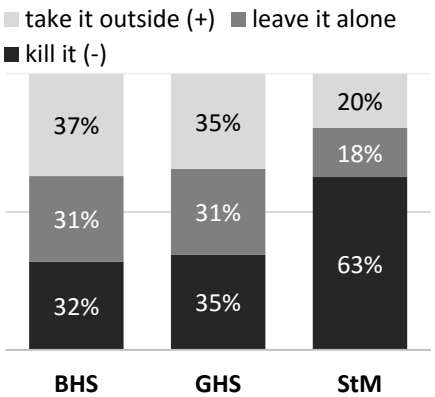
B2b. What would you do if you saw a frog in your home?



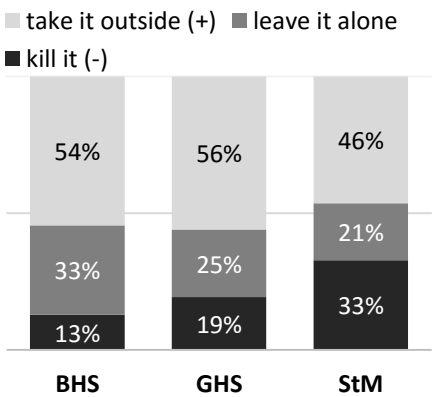
B2c. What would you do if you saw an owl in your home?



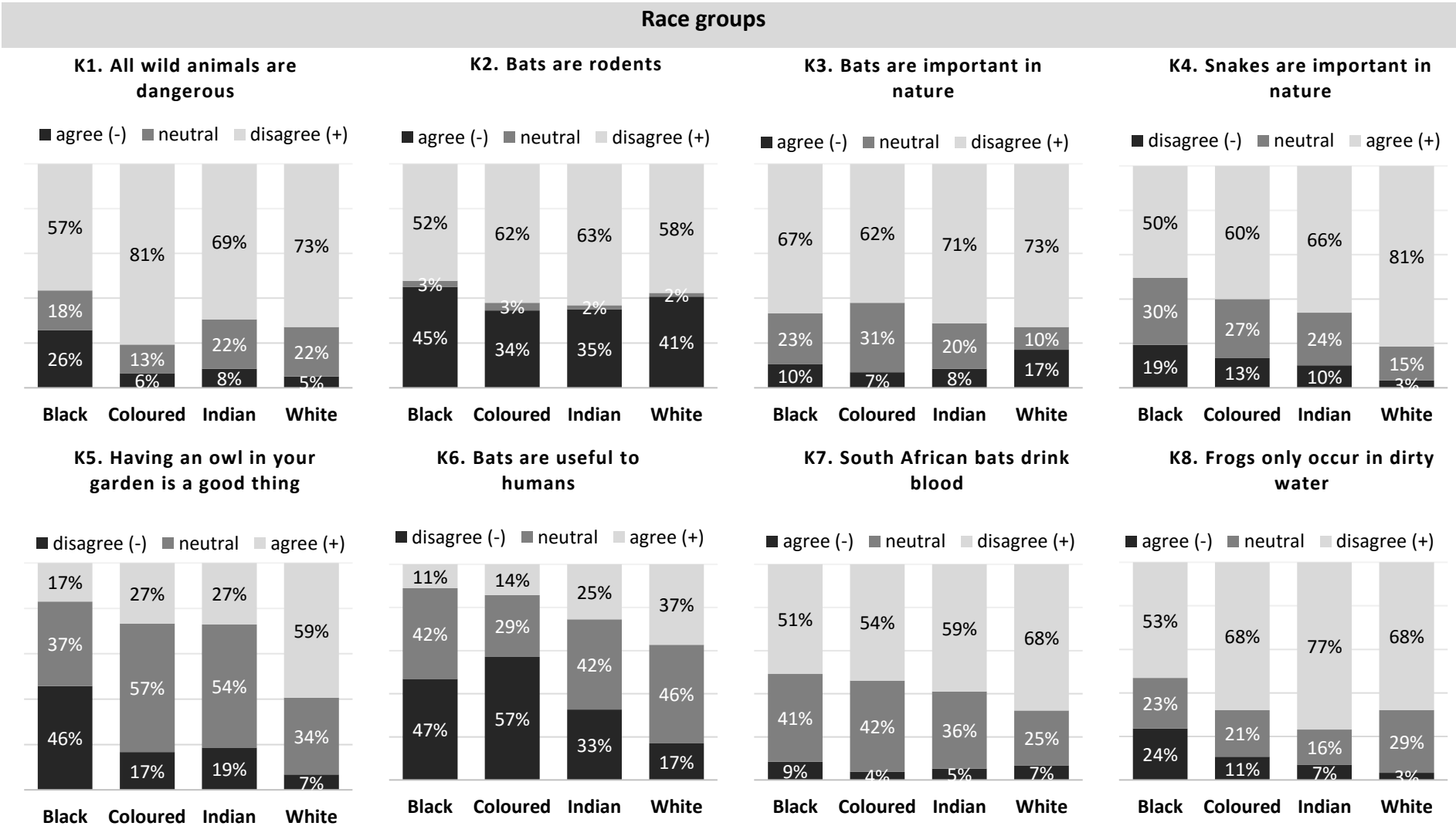
B2d. What would you do if you saw a snake in your home?



B2e. What would you do if you saw a bat in your home?

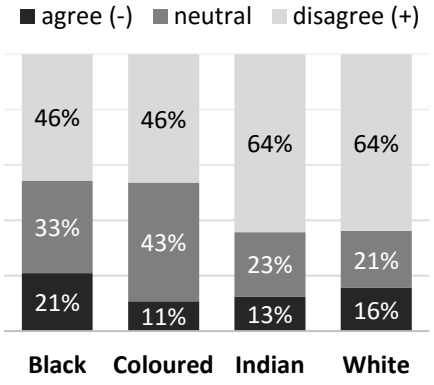


Appendix I Frequency of different responses to questions in the school survey (Chapter 3), by race group

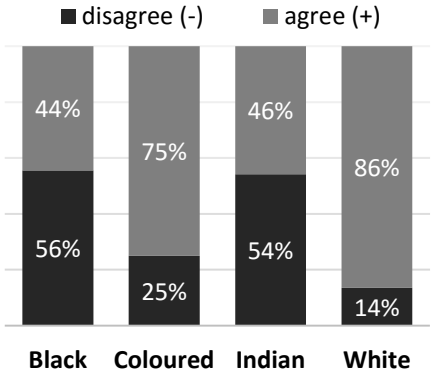


Race groups

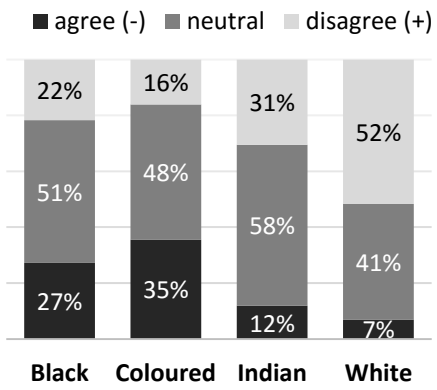
K9. Bats get tangled in people's hair



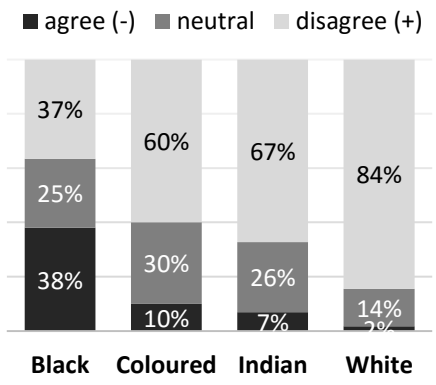
A.1. I have a pet at home



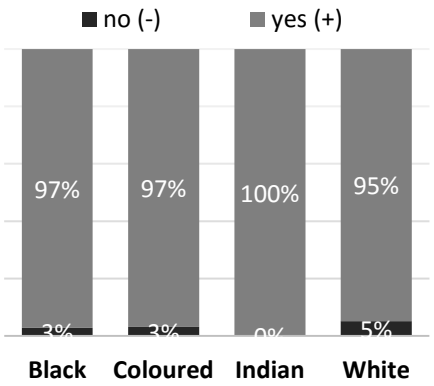
A2. Pets should be kept outside



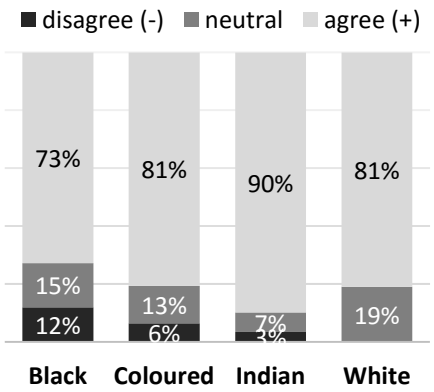
A3. I like it when wild animals are in cages so that the public can see them



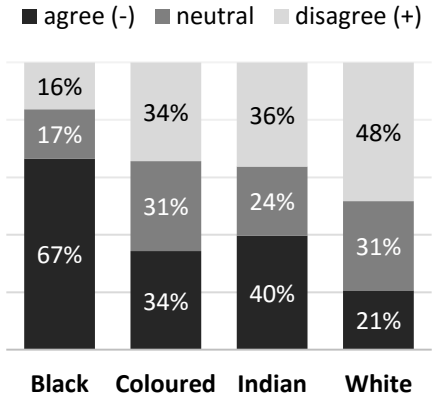
A4. I have visited the zoo



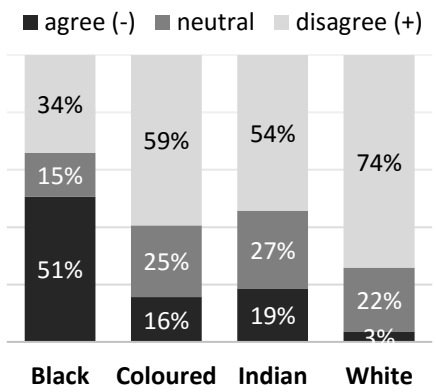
A5. Animals deserve the same amount of respect as humans do



A6. I am afraid of bats

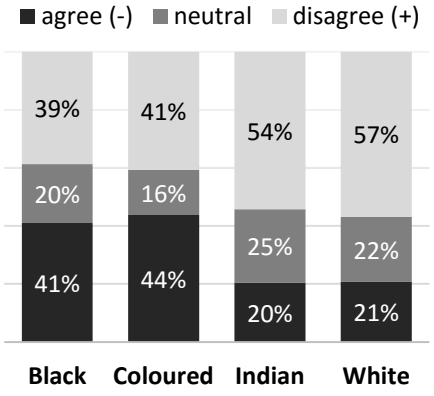


A7. I am afraid of owls

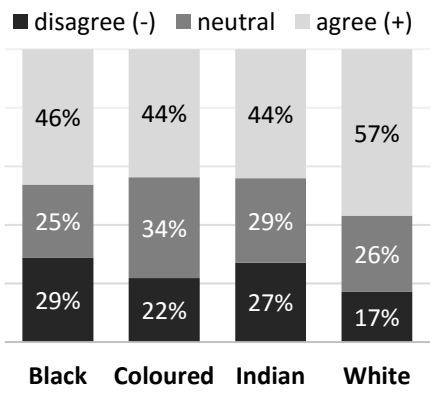


Race groups

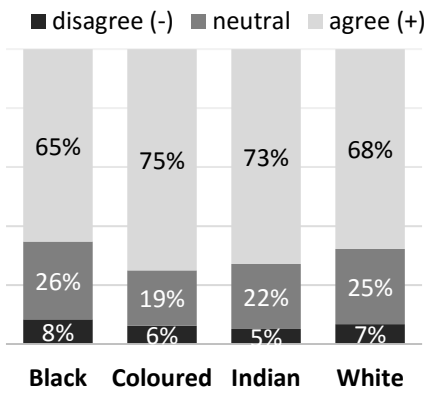
A8. I am afraid of frogs



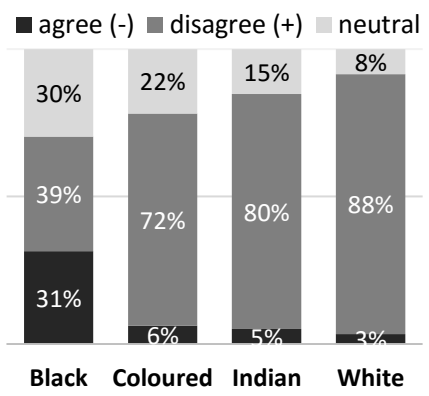
A9. I don't think wild animals belong in the city



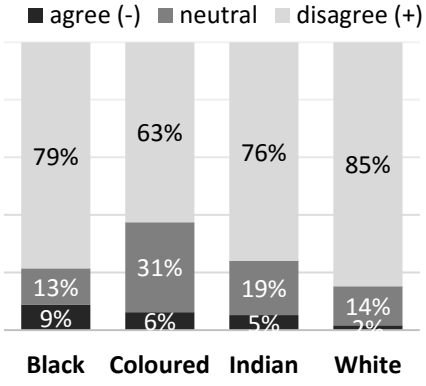
A10. I like to walk in the park



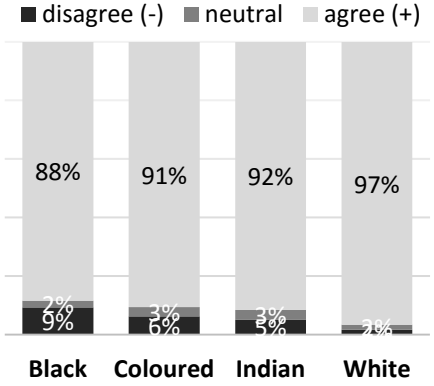
A11. It is a sign of bad luck to have an owl near your house



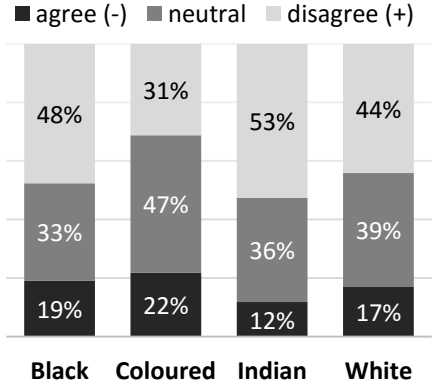
A12. It is ok to use animal parts in medicine



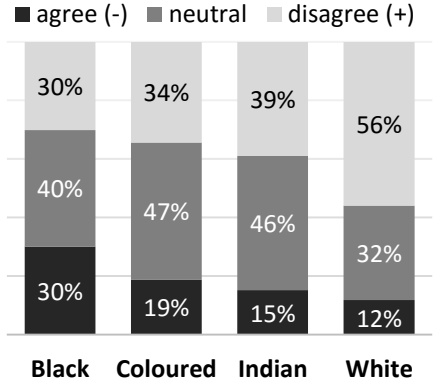
A13. People who poach wild animals should go to jail



A14. there is nothing wrong with hunting wild animals for food

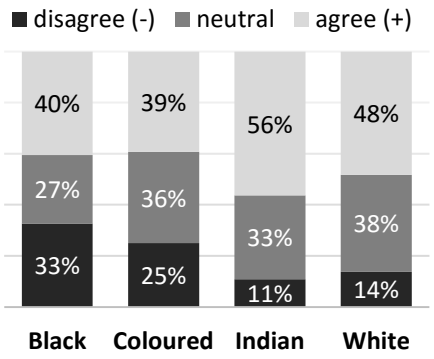


A15. It is necessary to use animals in medical research

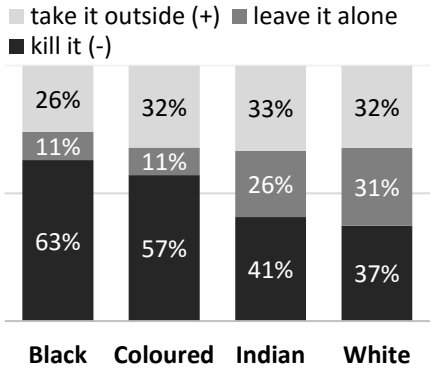


Race groups

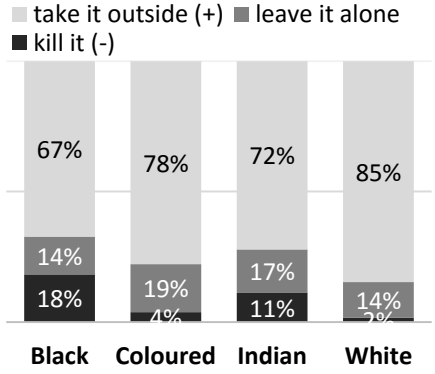
B1. I like to feed wild animals and birds



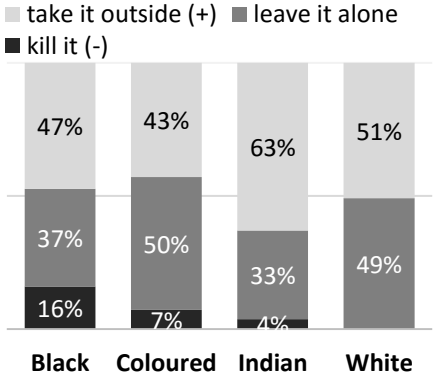
B2a. What would you do if you saw a spider in your home?



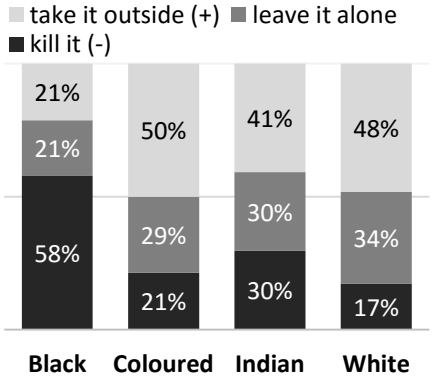
B2b. What would you do if you saw a frog in your home?



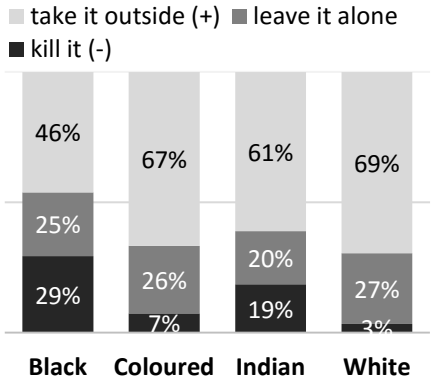
B2c. What would you do if you saw an owl in your home?



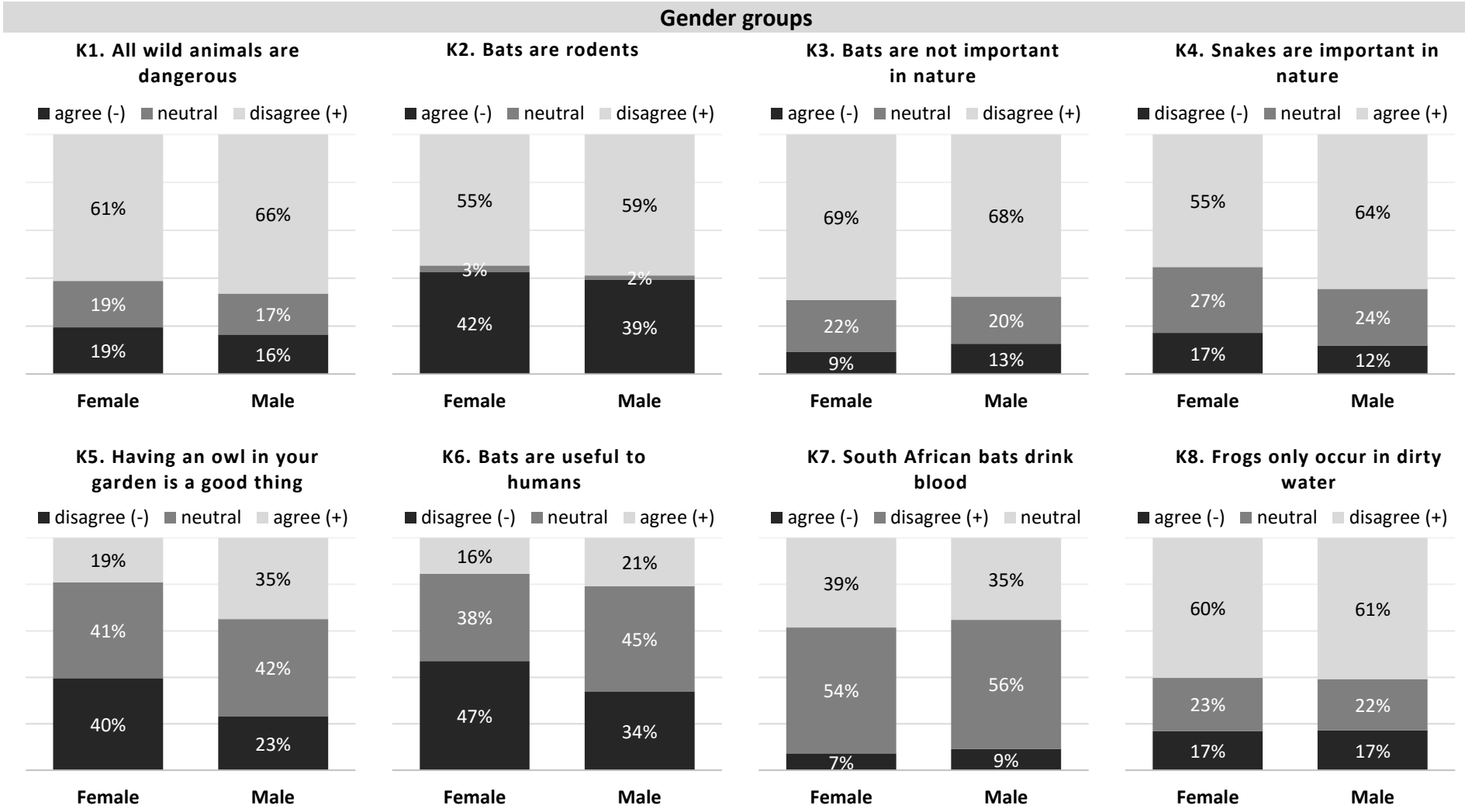
B2d. What would you do if you saw a snake in your home?



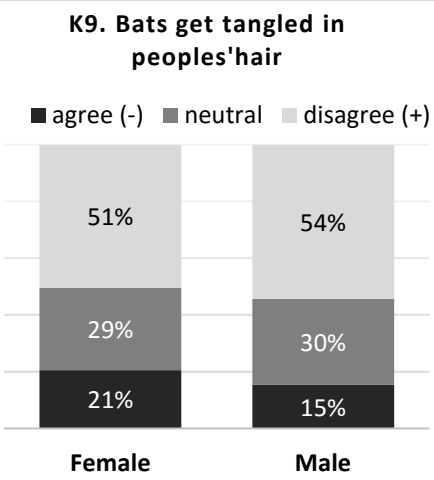
B2e. What would you do if you saw a bat in your home?

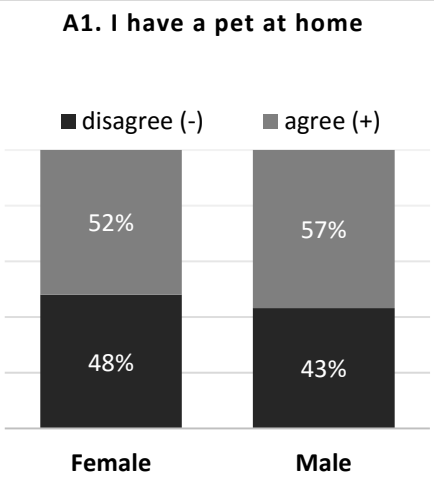


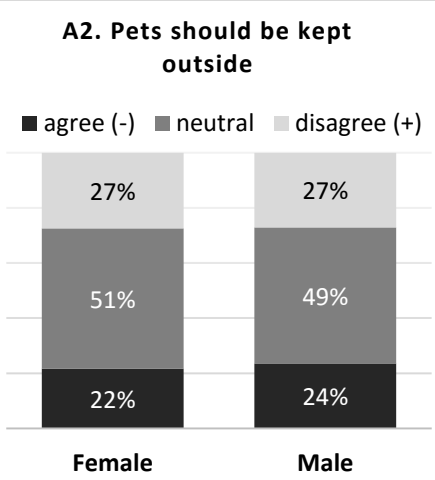
Appendix J Frequency of different responses to questions in the school survey (Chapter 3), by gender group

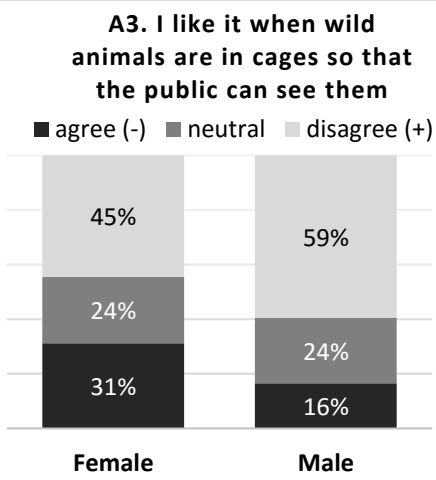


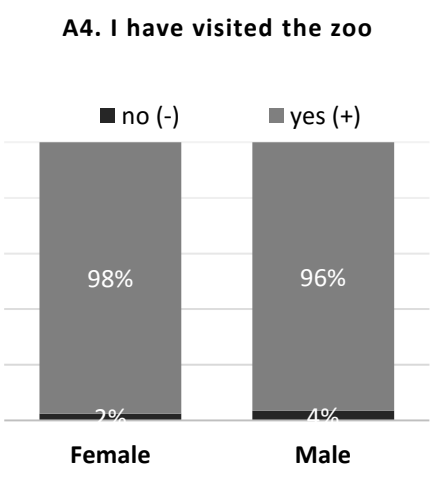
Gender groups

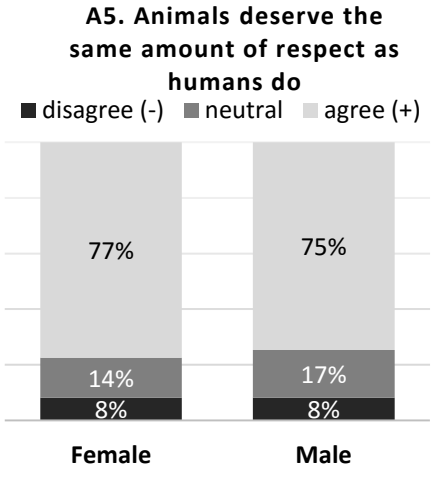


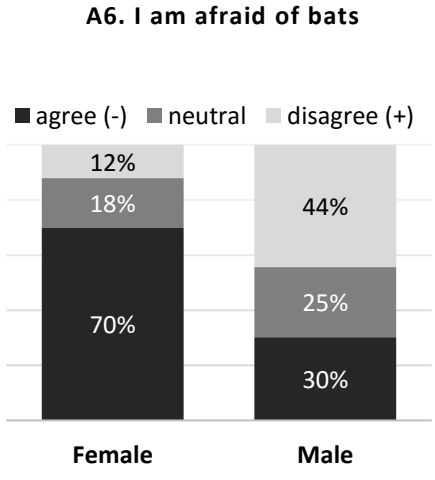


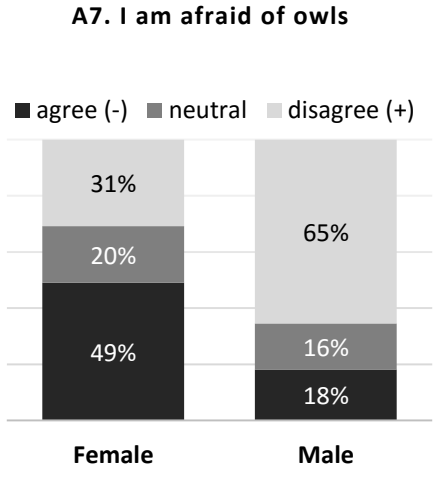




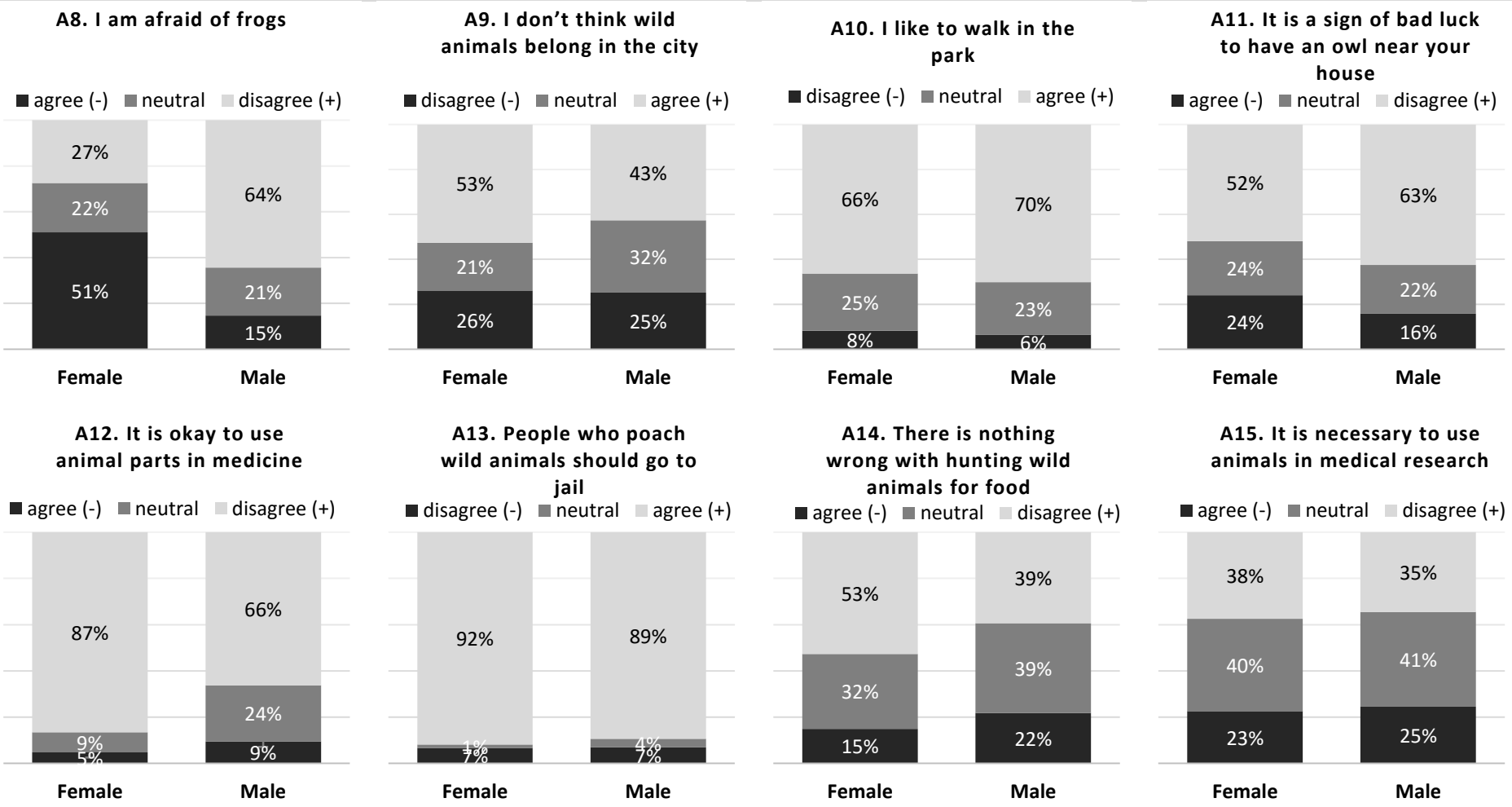






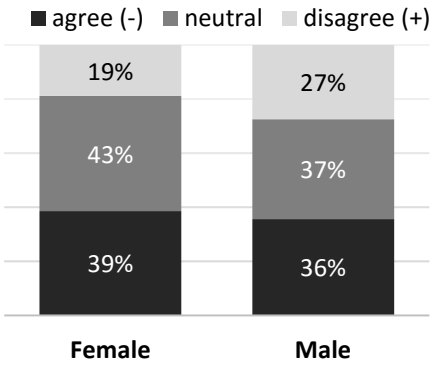


Gender groups

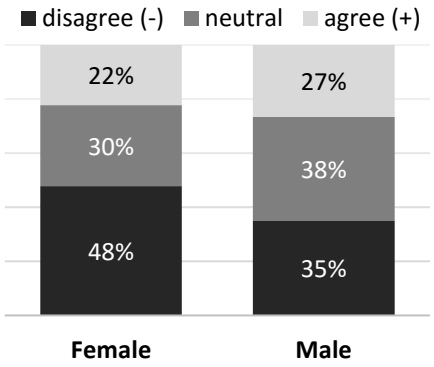


Gender groups

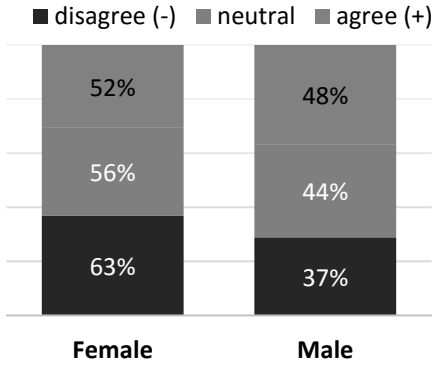
A16. I would rather avoid wildlife in the city



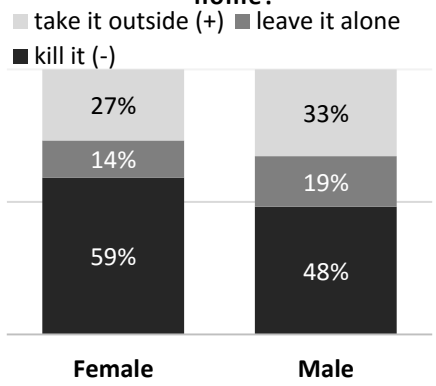
A17. We need wildlife in the city



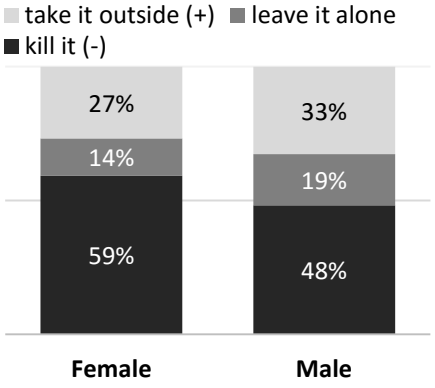
B1. I like to feed wild animals and birds



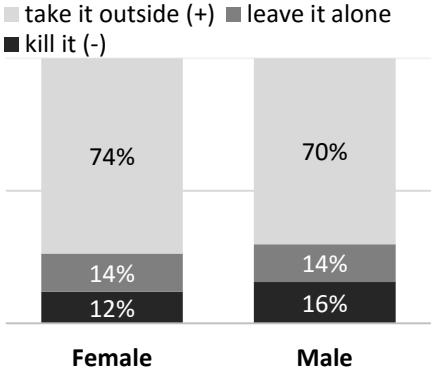
B2a. What would you do if you saw a spider in your home?



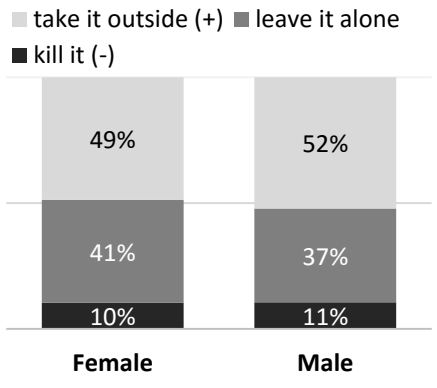
B2a. What would you do if you saw a spider in your home?



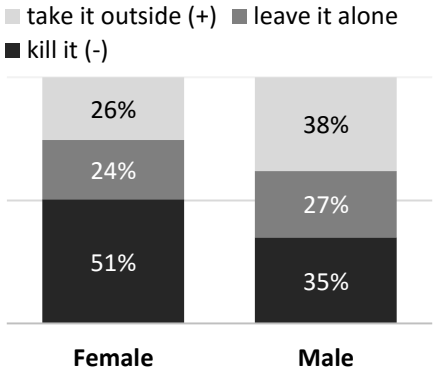
B2b. What would you do if you saw a frog in your home?



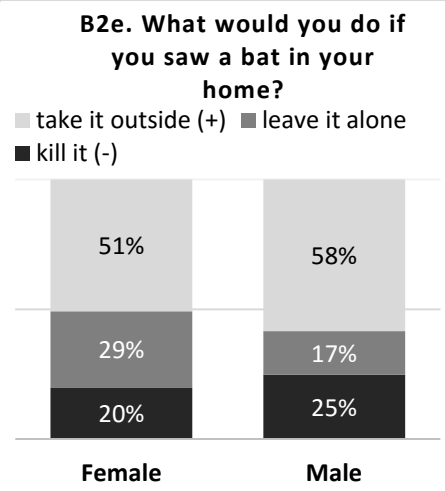
B2c. What would you do if you saw an owl in your home?



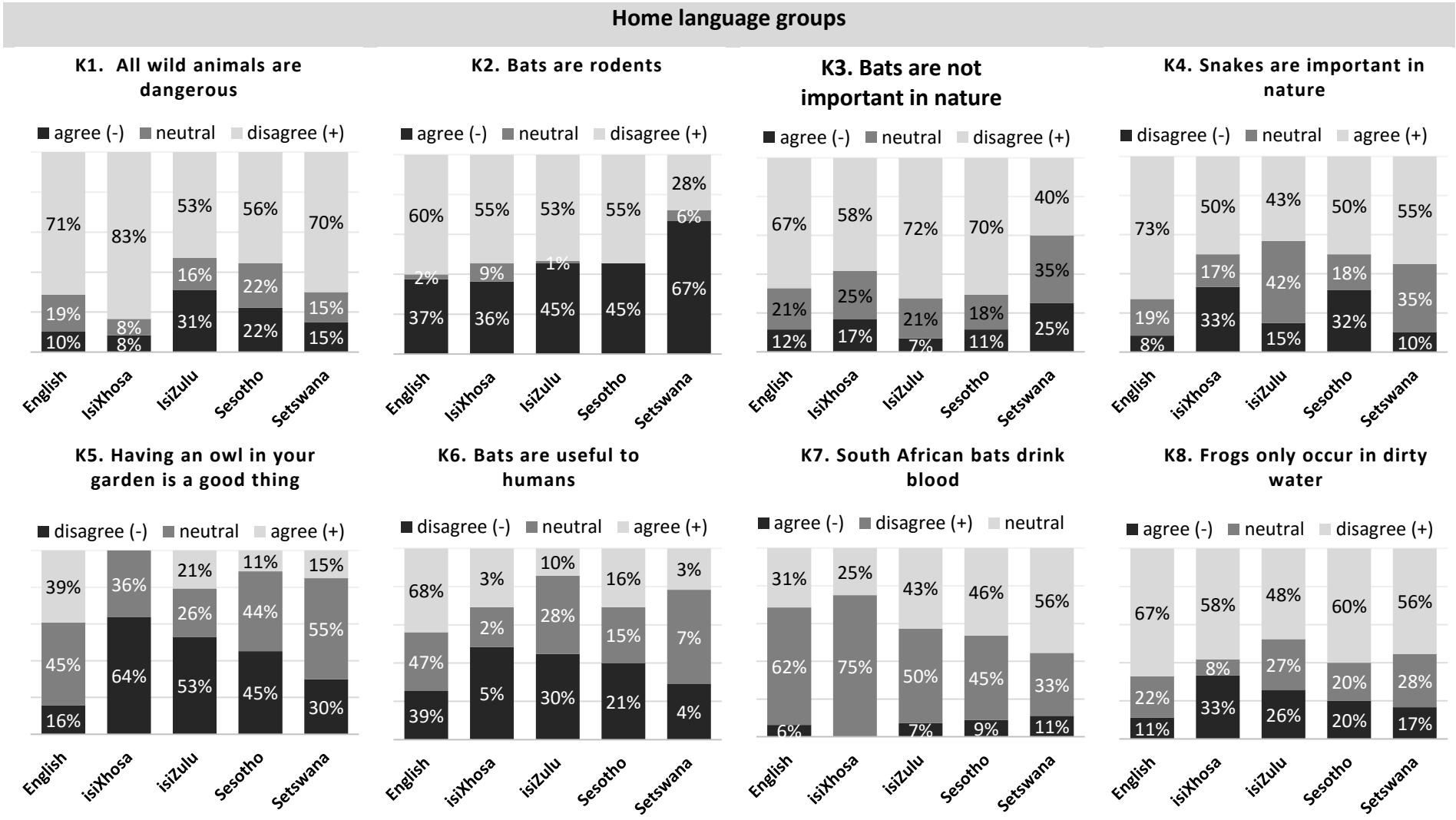
B2d. What would you do if you saw a snake in your home?



Gender groups

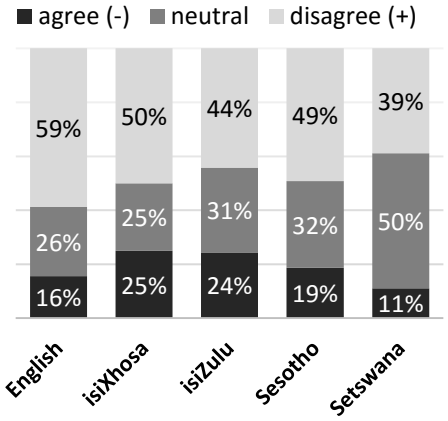


Appendix K Frequency of different responses to remaining questions in the school survey (Chapter 3), by home language group

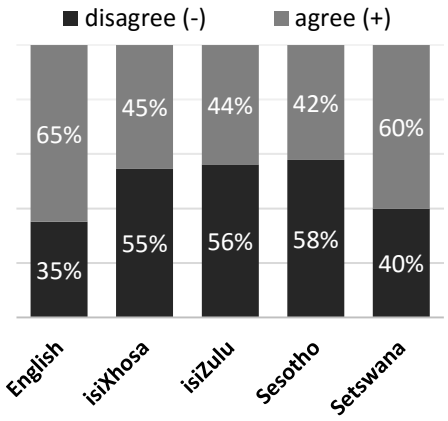


Home language groups

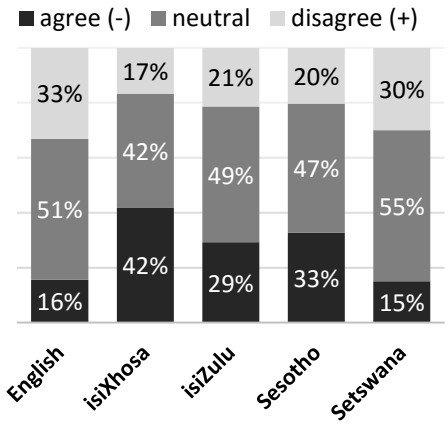
K9. Bats get tangled in people's hair



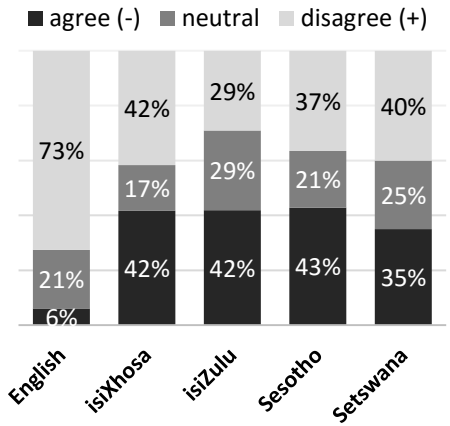
A1. I have a pet at home



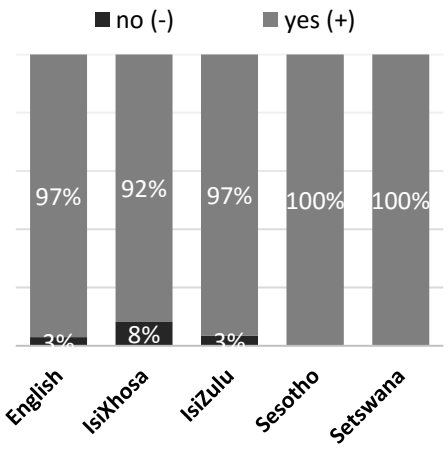
A2. Pets should be kept outside



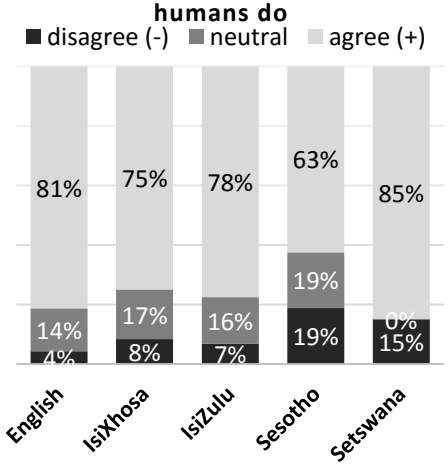
A3. I like it when wild animals are in cages so that the public can see them



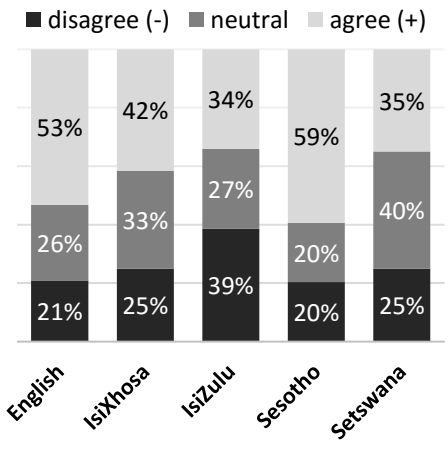
A4. I have visited the zoo



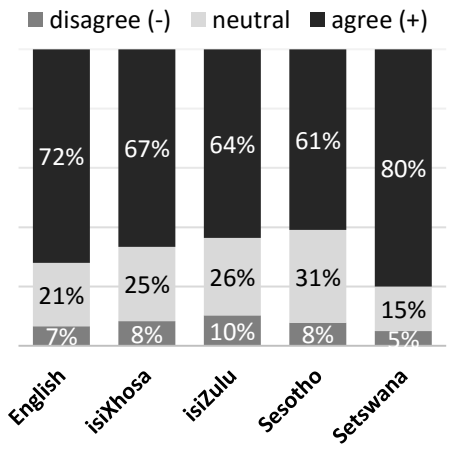
A5. Animals deserve the same amount of respect as humans do



A9. I don't think wild animals belong in the city

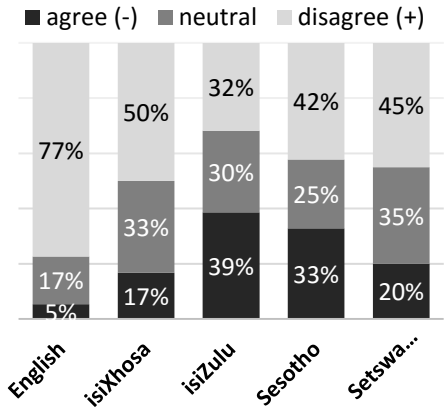


A10. I like to walk in the park

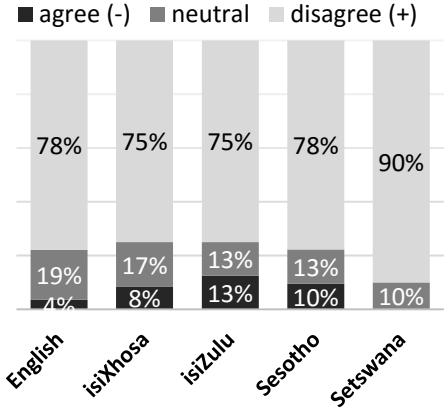


Home language groups

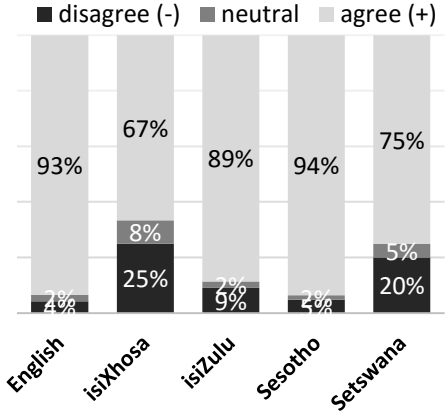
A11. It is a sign of bad luck to have an owl near your house



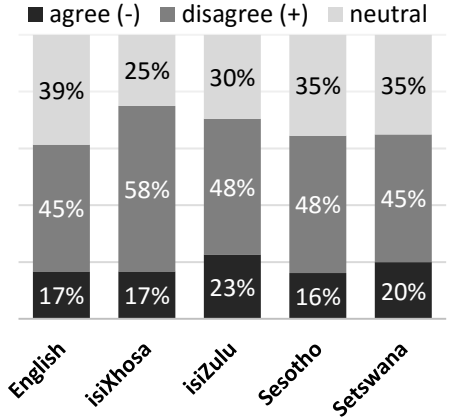
A12. It is okay to use animal parts in medicine



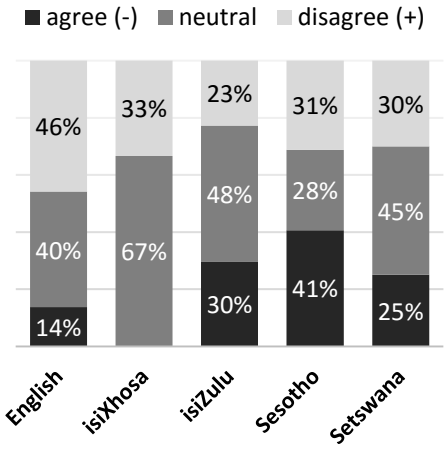
A13. People who poach wild animals should go to jail



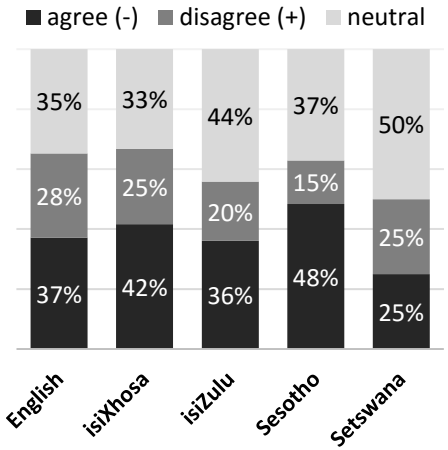
A14. There is nothing wrong with hunting wild animals for food



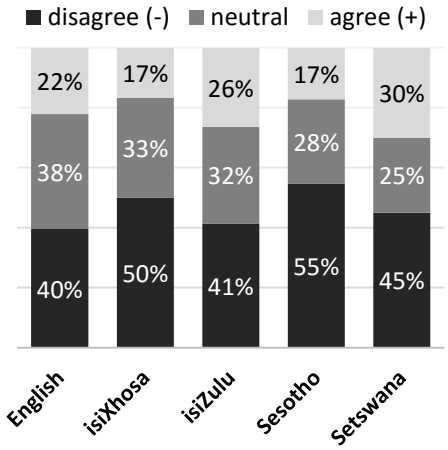
A15. It is necessary to use animals in medical research



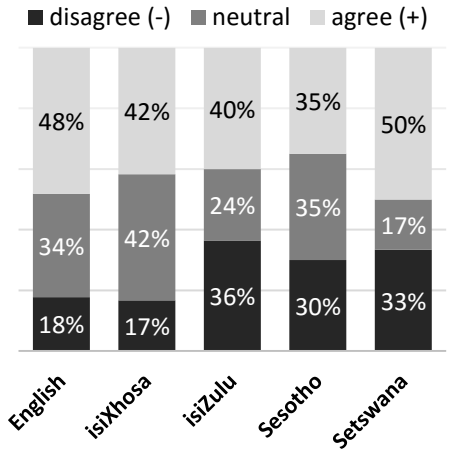
A16. I would rather avoid wildlife in the city



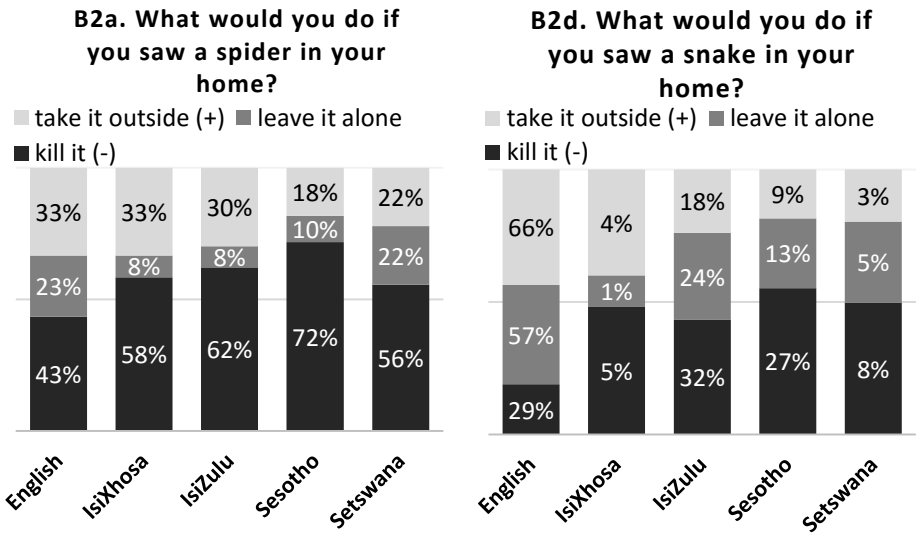
A17. We need wildlife in the city



B1. I like to feed wild animals and birds



Home language groups



Appendix L Public survey distributed to adult members of the public in the COJ

Residents of Johannesburg

Good day. My name is Emily Taylor and I am a Masters of Science student at the University of the Witwatersrand. As part of my degree, I am handing out surveys to find out how you feel about wildlife living in Johannesburg. I invite you to participate in this survey if you don't mind and have **five minutes** to spare, but if you don't want to, you don't have to, and there will be no negative consequences if you don't.

If you do decide to participate, please be assured that:

- There are no right or wrong answers.
- You don't need to put your name on the survey – it is completely **anonymous**!
- You don't have to answer any questions you don't feel comfortable answering.
- Your response will also be kept **confidential** – no one other than myself and my supervisors will have access to the answers.

If you have any questions, please contact me at 011 372 3600, via email emily.taylor@students.wits.ac.za or my supervisor, Dr. Ute Schwaibold at Ute.Schwaibold@wits.ac.za and I will answer them to the best of my ability. Should you wish to receive a summary of the results of this research, an abstract will be made available on request. There will be no rewards for participating in this research.

Thank you in advance for helping me out.

I hereby consent to be interviewed on part of the research dissertation. The purpose and procedures of the study have been explained to me. I understand that my participation is voluntary and that I may refuse to answer any particular items or withdraw from the study at any time without any negative consequences. I understand that my responses will be kept confidential.

YES ☐ NO ☐

Please place an X on the answer you agree with most:

	strongly disagree	**don't agree**	**neutral**	**agree**	**strongly agree**
I think wild animals belong in Johannesburg	☐	☐	☐	☐	☐
All wild animals are dangerous	☐	☐	☐	☐	☐
People who poach wild animals should be punished	☐	☐	☐	☐	☐
I like to spend time outdoors	☐	☐	☐	☐	☐
Snakes are important in nature	☐	☐	☐	☐	☐
Owls are useful to humans	☐	☐	☐	☐	☐
Frogs only occur in dirty water	☐	☐	☐	☐	☐
I would like to see more wildlife in Johannesburg	☐	☐	☐	☐	☐

	Yes	**No**
Bats are rodents	☐	☐
I have (or would like to have) a pet at home	☐	☐
I use poison to control pests in my home	☐	☐
I use poison to control pests in my garden	☐	☐

I visit parks / green spaces:

at least once a week ☐ once or twice a month ☐ several times a year ☐ very seldom ☐

Please place an X on the answer you agree with most:

I am afraid of:

	Yes	No
Spiders	☐	☐
Frogs	☐	☐
Owls	☐	☐
Snakes	☐	☐
Bats	☐	☐
Squirrels	☐	☐

What would you do if you saw the following animals in your <u>house</u>?

	Kill it	Take it outside	Call a professional	Leave it alone	Don't know
Spider	☐	☐	☐	☐	☐
Frog	☐	☐	☐	☐	☐
Owl	☐	☐	☐	☐	☐
Snake	☐	☐	☐	☐	☐
Bat	☐	☐	☐	☐	☐
Squirrel	☐	☐	☐	☐	☐

What would you do if you saw the following animals in your <u>garden</u>?

	Kill it	Chase it away	Call a professional	Leave it alone	Don't know
Spider	☐	☐	☐	☐	☐
Frog	☐	☐	☐	☐	☐
Owl	☐	☐	☐	☐	☐
Snake	☐	☐	☐	☐	☐
Bat	☐	☐	☐	☐	☐
Squirrel	☐	☐	☐	☐	☐

Please give us some basic information about you:

Age: < 12 years ☐ 12–18 ☐ 19– 30 ☐ 31 – 45 ☐ 46 – 60 ☐ > 60 years ☐

Race Black ☐ White ☐ Coloured ☐ Indian ☐ Other ☐

Gender Male ☐ Female ☐

First language (Mother tongue): _____

Were you born: In a rural area ☐ In an urban area ☐

Current Suburb: _____

Level of education: Primary ☐ Some secondary ☒ Matric ☐ Tertiary ☐

Occupation (optional): _____

Any comments? _____

If you would like to know more about urban wildlife in Johannesburg, please provide an email address to be added to our mailing list:

Email: _____

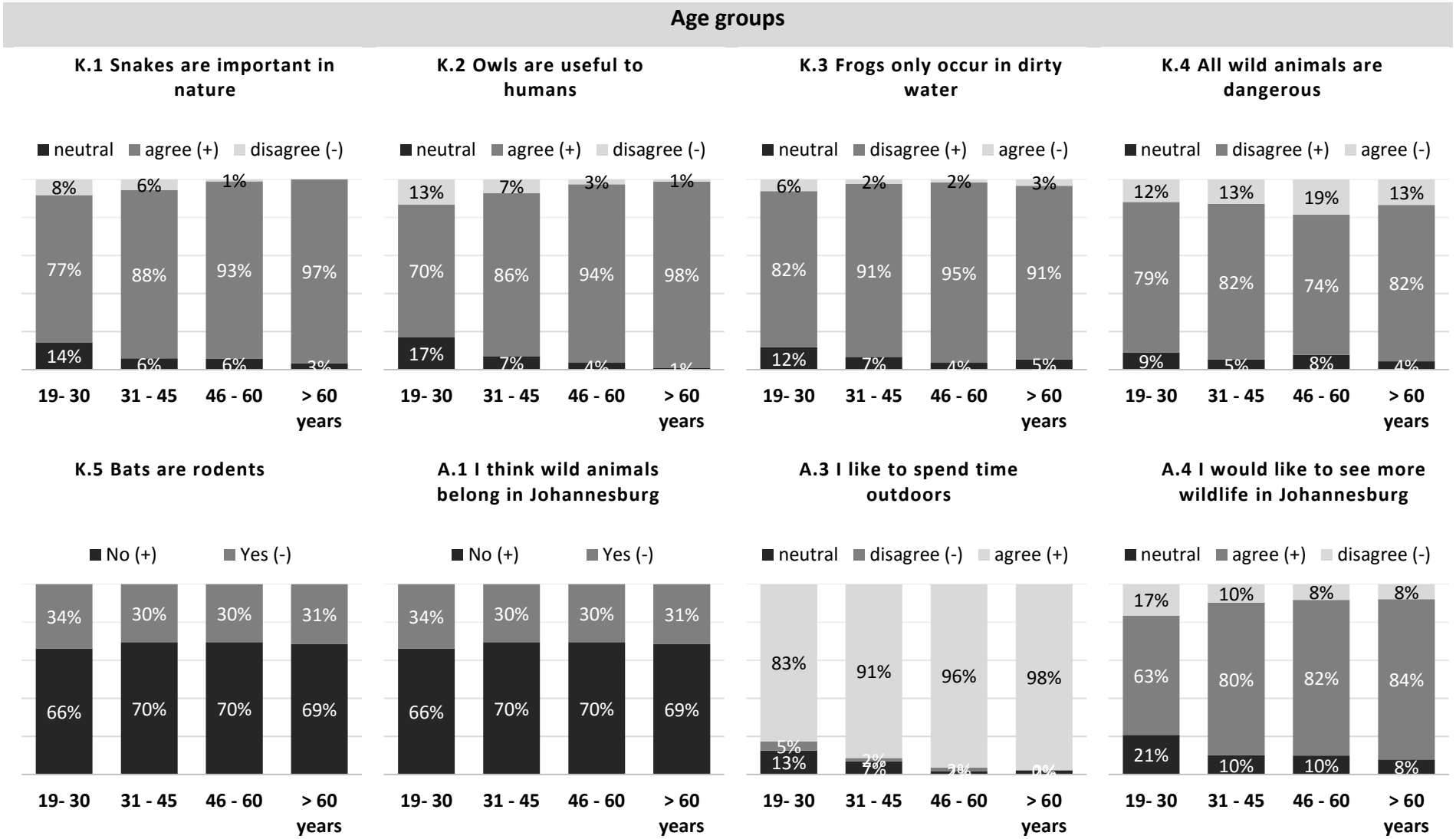
Thank you

Appendix M Public survey questions, response options and scores (high scores always positive)

Questions		Response options				
Knowledge questions		**SD**	**D**	**N**	**A**	**SA**
K1	Snakes are important in nature	0	1	2	3	4
K2	Owls are useful to humans	0	1	2	3	4
K3	Frogs only occur in dirty water	4	3	2	1	0
K4	All wild animals are dangerous	4	3	2	1	0
K5	Bats are rodents		Y = 0		N = 4	
Attitude questions		**SD**	**D**	**N**	**A**	**SA**
A1	I think wild animals belong in Johannesburg	0	1	2	3	4
A2	People who poach wild animals should be punished	0	1	2	3	4
A3	I like to spend time outdoors	0	1	2	3	4
A4	I would like to see more wildlife in Johannesburg	0	1	2	3	4
A5	I have (or would like to have) a pet at home		Y = 0		N = 4	
A6	I am afraid of spiders		Y = 0		N = 4	
A7	I am afraid of frogs		Y = 0		N = 4	
A8	I am afraid of owls		Y = 0		N = 4	
A9	I am afraid of snakes		Y = 0		N = 4	
A10	I am afraid of bat		Y = 0		N = 4	
A11	I am afraid of squirrels		Y = 0		N = 4	
Behaviour questions						
B1	I use poison to control pests in my home		Y = 0		N = 4	
B2	I use poison to control pests in my garden		Y = 0		N = 4	
B3	I visit parks / green spaces	OW=4	OM=3		ST=1	VS=0
		K	**T**	**P**	**L**	**D**
B4	What would you do if you saw a spider in your home?	0	4	1	3	2
B5	What would you do if you saw a frog in your house?	0	4	1	3	2
B6	What would you do if you saw an owl in your house?	0	4	1	3	2
B7	What would you do if you saw a snake in your house?	0	4	1	3	2
B8	What would you do if you saw a bat in your house?	0	4	1	3	2
B9	What would you do if you saw a squirrel in your house	0	4	1	3	2
		K	**C**	**P**	**L**	**D**
B10	What would you do if you saw a spider in your garden?	0	1	3	4	2
B11	What would you do if you saw a frog in your garden?	0	1	3	4	2
B12	What would you do if you saw an owl in your garden?	0	1	3	4	2
B13	What would you do if you saw a snake in your garden?	0	1	3	4	2
B14	What would you do if you saw a bat in your garden?	0	1	3	4	2
B15	What would you do if you saw a squirrel in your garden?	0	1	3	4	2

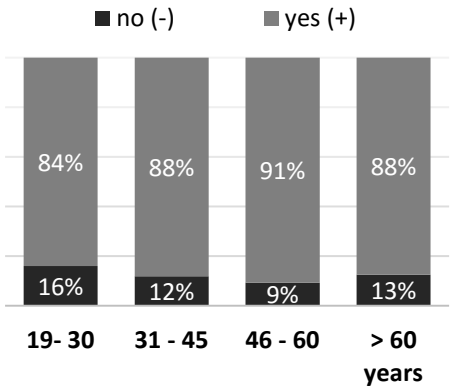
[1] OW = once a week; OM = once a month; ST = several times a year; VS = very seldom; SD= strongly disagree; D = disagree; N = neutral; A = agree; SA = strongly agree; Y = yes; N = no; K = kill it; T = take it outside; P = call a professional; L = leave it alone

Appendix N Frequency of different responses to remaining questions in the public survey (Chapter 4), by age group

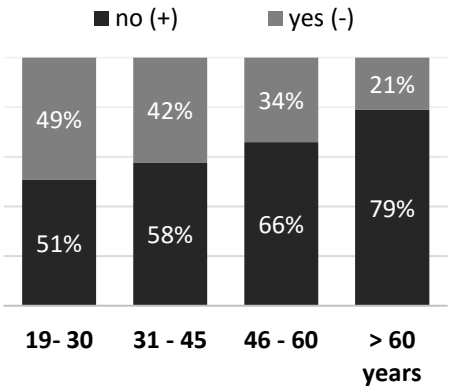


Age groups

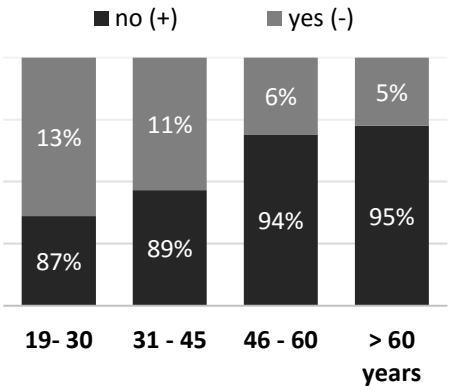
A5. I have (or would like to have) a pet at home



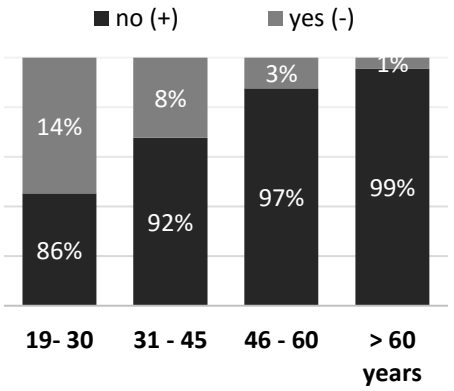
A.6 I am afraid of Spiders



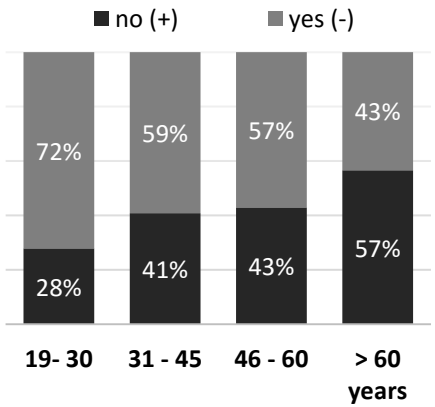
A.7 I am afraid of Frogs



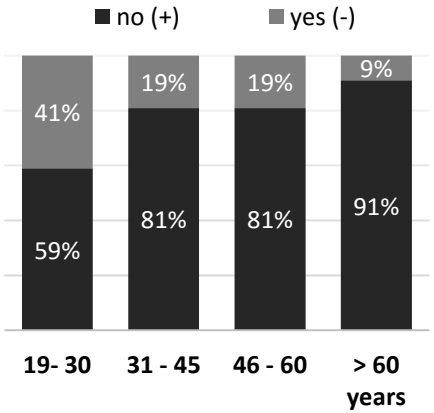
A.8 I am afraid of Owls



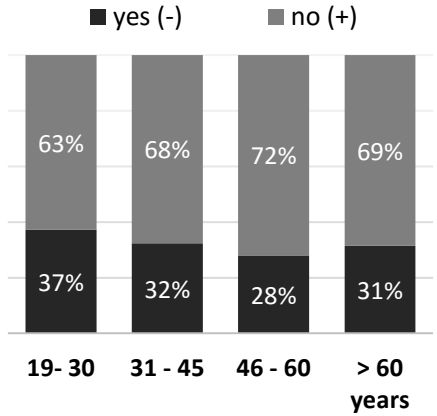
A.9 I am afraid of Snakes



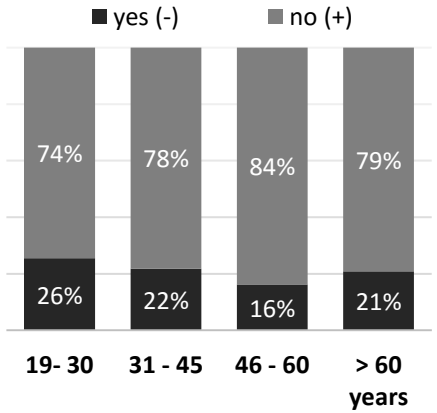
A.10 I am afraid of Bats



B1. I use poison to control pests in my home

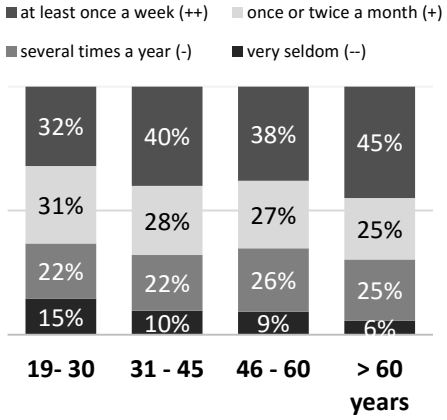


B2. I use poison to control pests in my garden

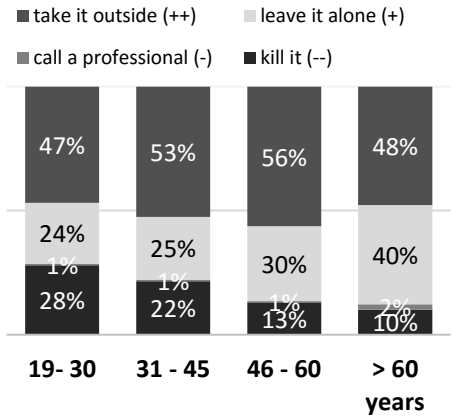


Age groups

B3. I visit parks and green spaces

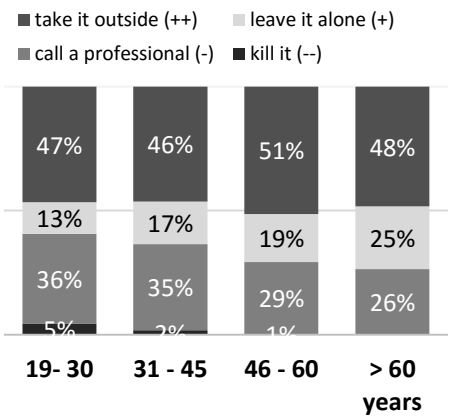


B.4 Spider in house

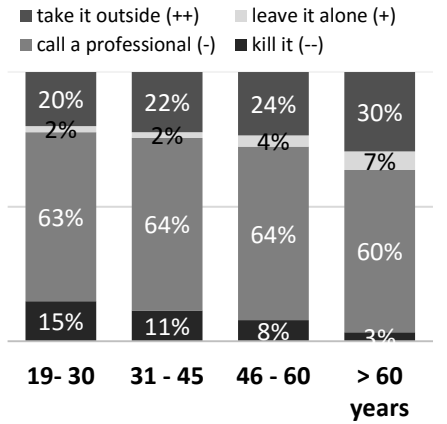


B.5 Frog in house

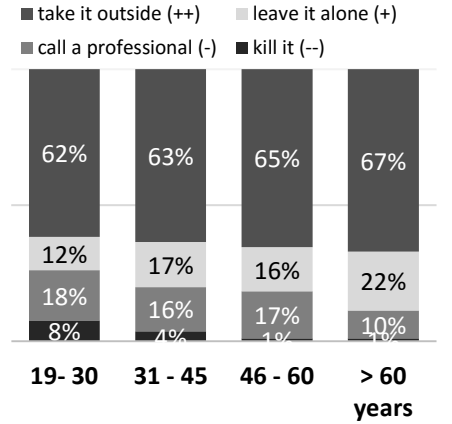
B.6 Owl in house



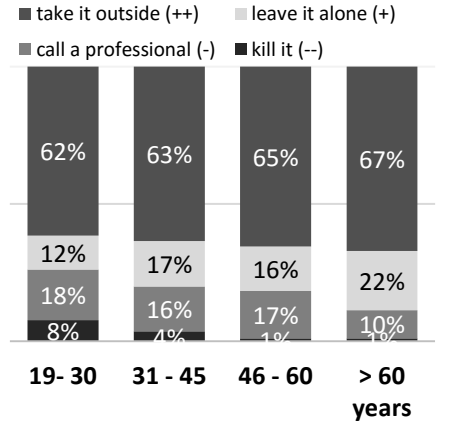
B.7 Snake in house



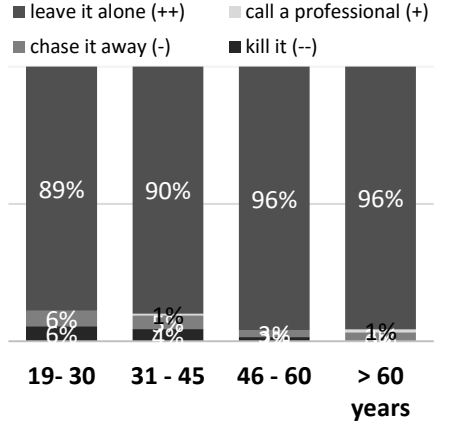
B.8 Bat in house



B.9 Squirrel in house

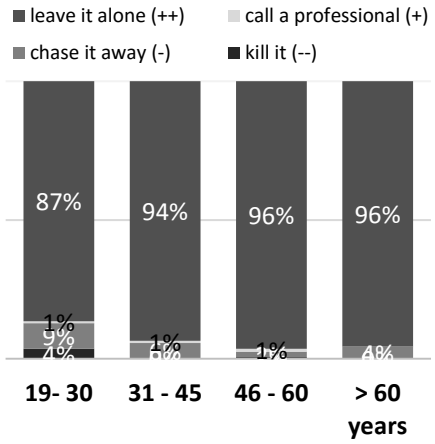


B.10 Spider in garden

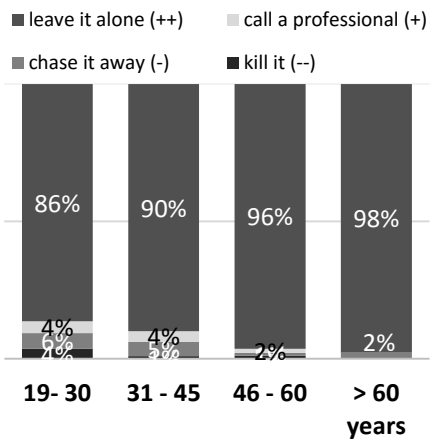


Age groups

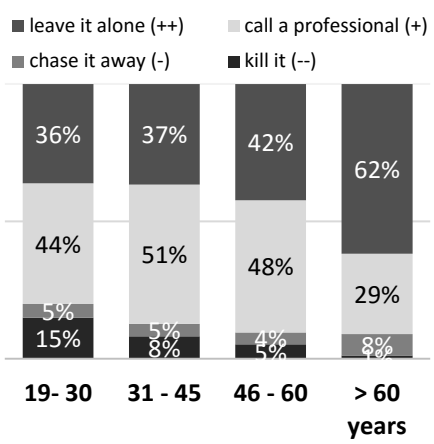
B.11 Frog in garden



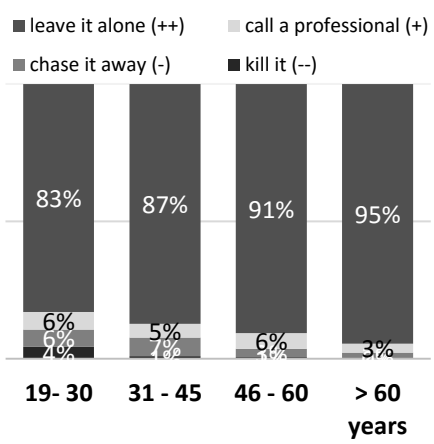
B.12 Owl in garden



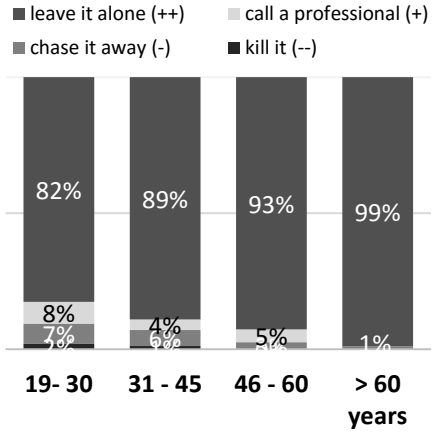
B.13 Snake in garden



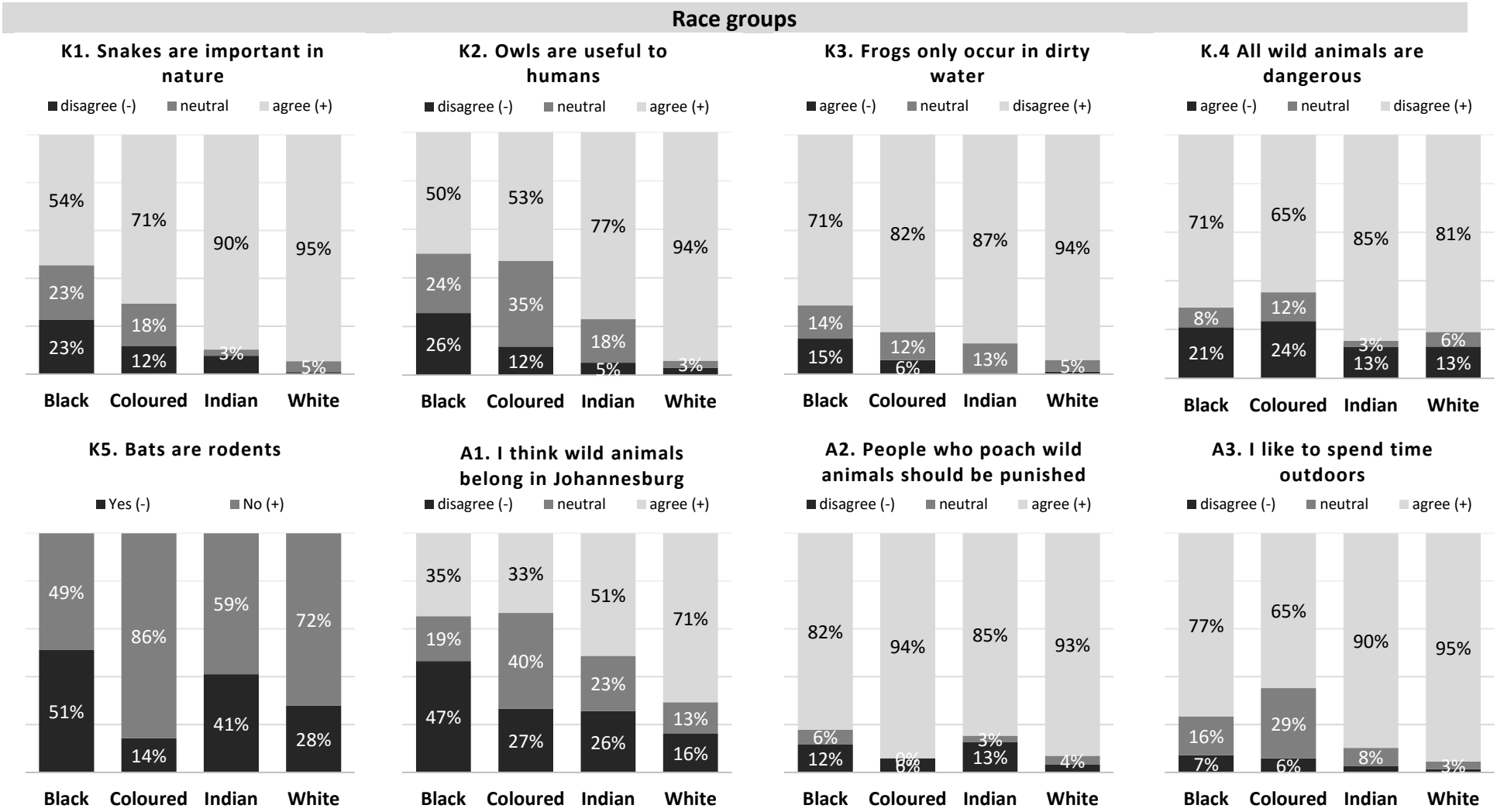
B.14 Bat in garden



B.15 Squirrel in garden

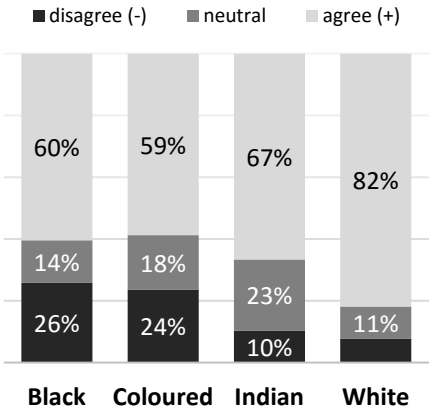


Appendix O Frequency of different responses to questions in the public survey (Chapter 4), by race group

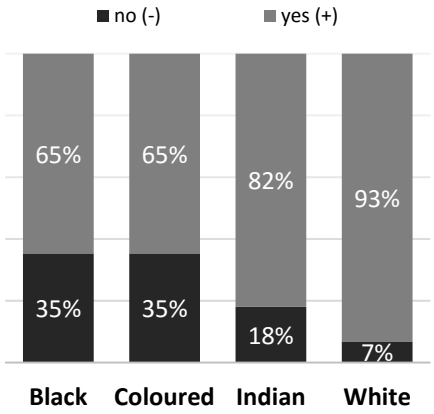


Race groups

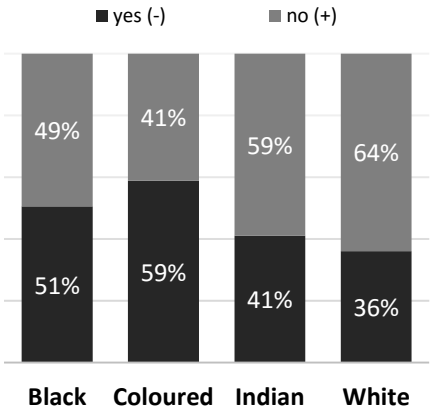
A4. I would like to see more wildlife in Johannesburg



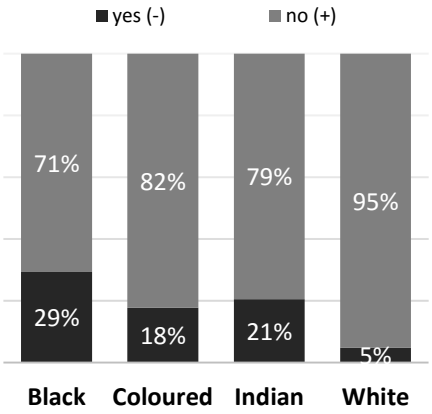
A5. I have (or would like to have) a pet at home



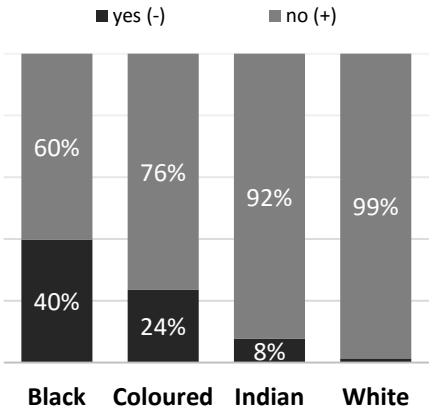
A6. I am afraid of Spiders



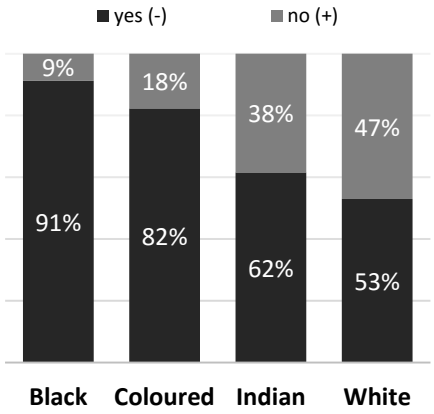
A7. I am afraid of Frogs



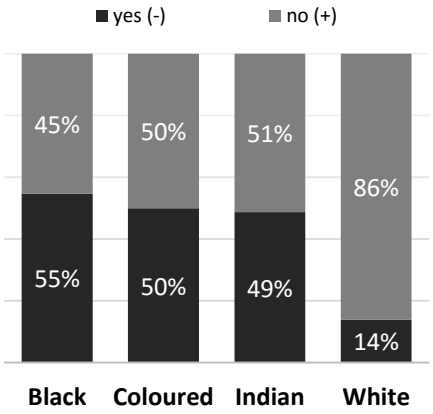
A8. I am afraid of Owls



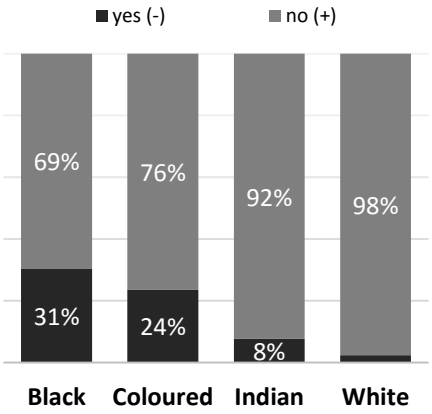
A9. I am afraid of Snakes

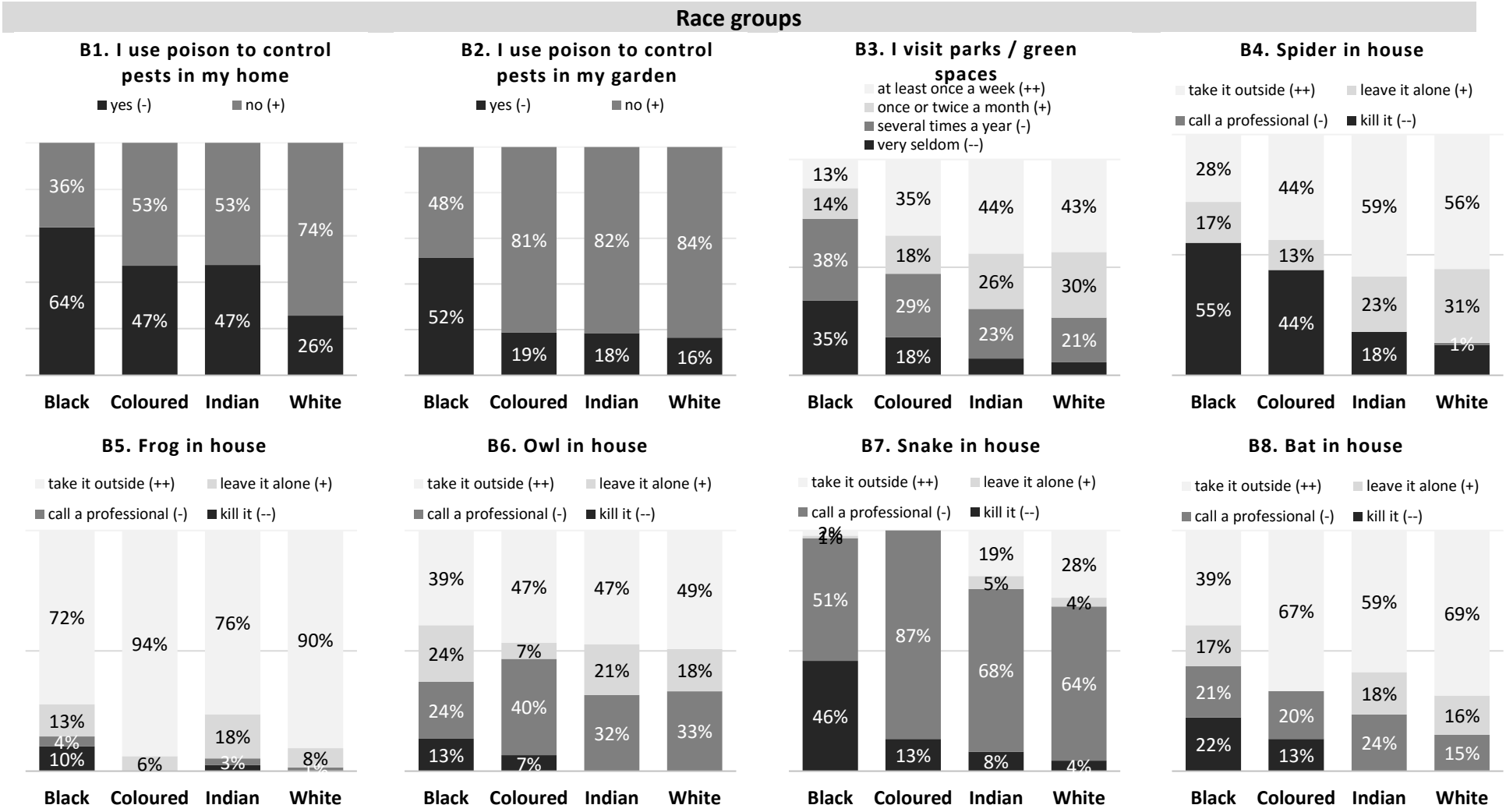


A10. I am afraid of Bats



A11. I am afraid of Squirrels

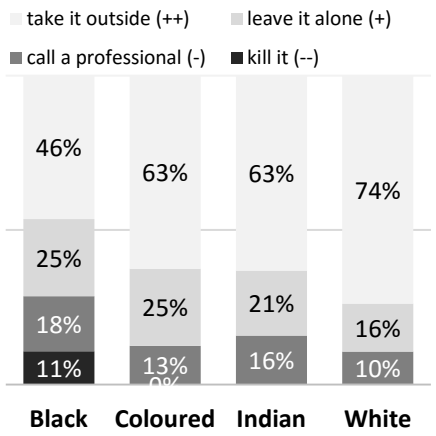



Race groups
B1. I use poison to control pests in my home
yes (-)
no (+)
64%
47%
47%
26%
36%
53%
53%
74%
Black
Coloured
Indian
White
B2. I use poison to control pests in my garden
yes (-)
no (+)
52%
19%
18%
16%
48%
81%
82%
84%
Black
Coloured
Indian
White
B3. I visit parks / green spaces
at least once a week (++)
once or twice a month (+)
several times a year (-)
very seldom (--)
35%
18%
23%
21%
38%
29%
26%
30%
14%
35%
44%
43%
13%
Black
Coloured
Indian
White
B4. Spider in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
55%
44%
18%
1%
17%
13%
23%
31%
28%
44%
59%
56%
Black
Coloured
Indian
White
B5. Frog in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
10%
6%
3%
4%
13%
18%
8%
72%
94%
76%
90%
Black
Coloured
Indian
White
B6. Owl in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
13%
7%
24%
40%
24%
7%
32%
21%
33%
18%
39%
47%
47%
49%
Black
Coloured
Indian
White
B7. Snake in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
46%
13%
8%
4%
51%
87%
68%
64%
4%
5%
2%
1%
19%
28%
Black
Coloured
Indian
White
B8. Bat in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
22%
13%
24%
15%
21%
20%
18%
16%
17%
67%
59%
69%
39%
Black
Coloured
Indian
White

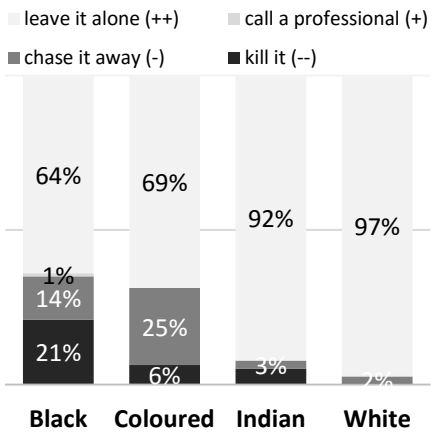
Appendix O

Race groups

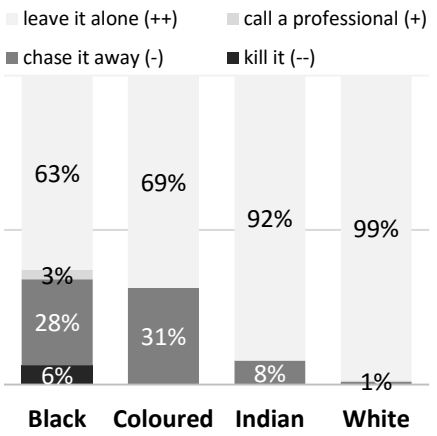
B9. Squirrel in house



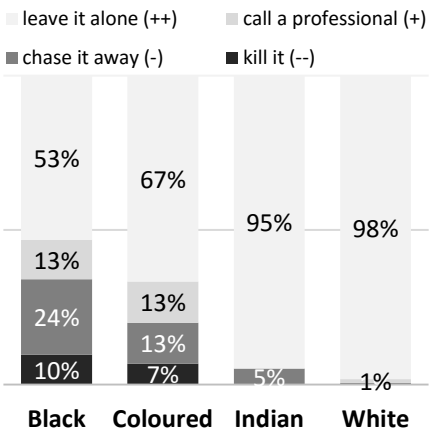
B10. Spider in garden



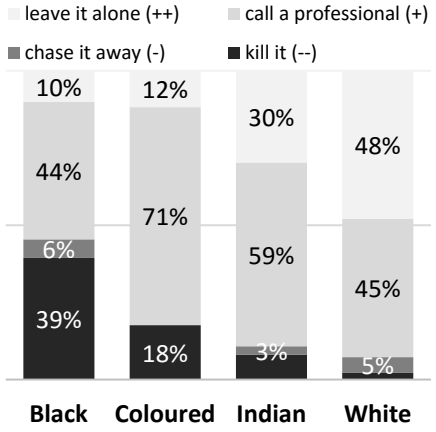
B11. Frog in garden



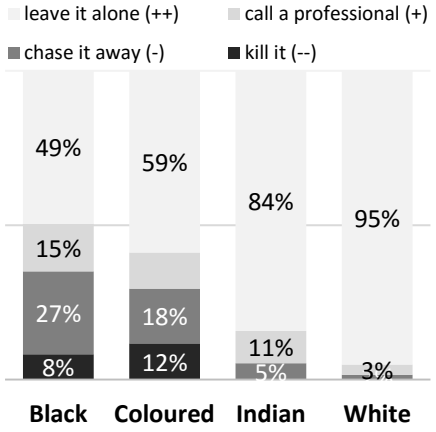
B12. Owl in garden



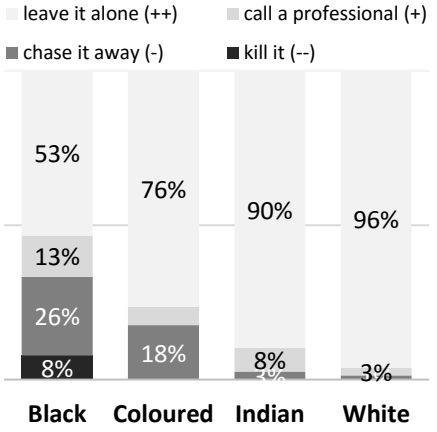
B13. Snake in garden



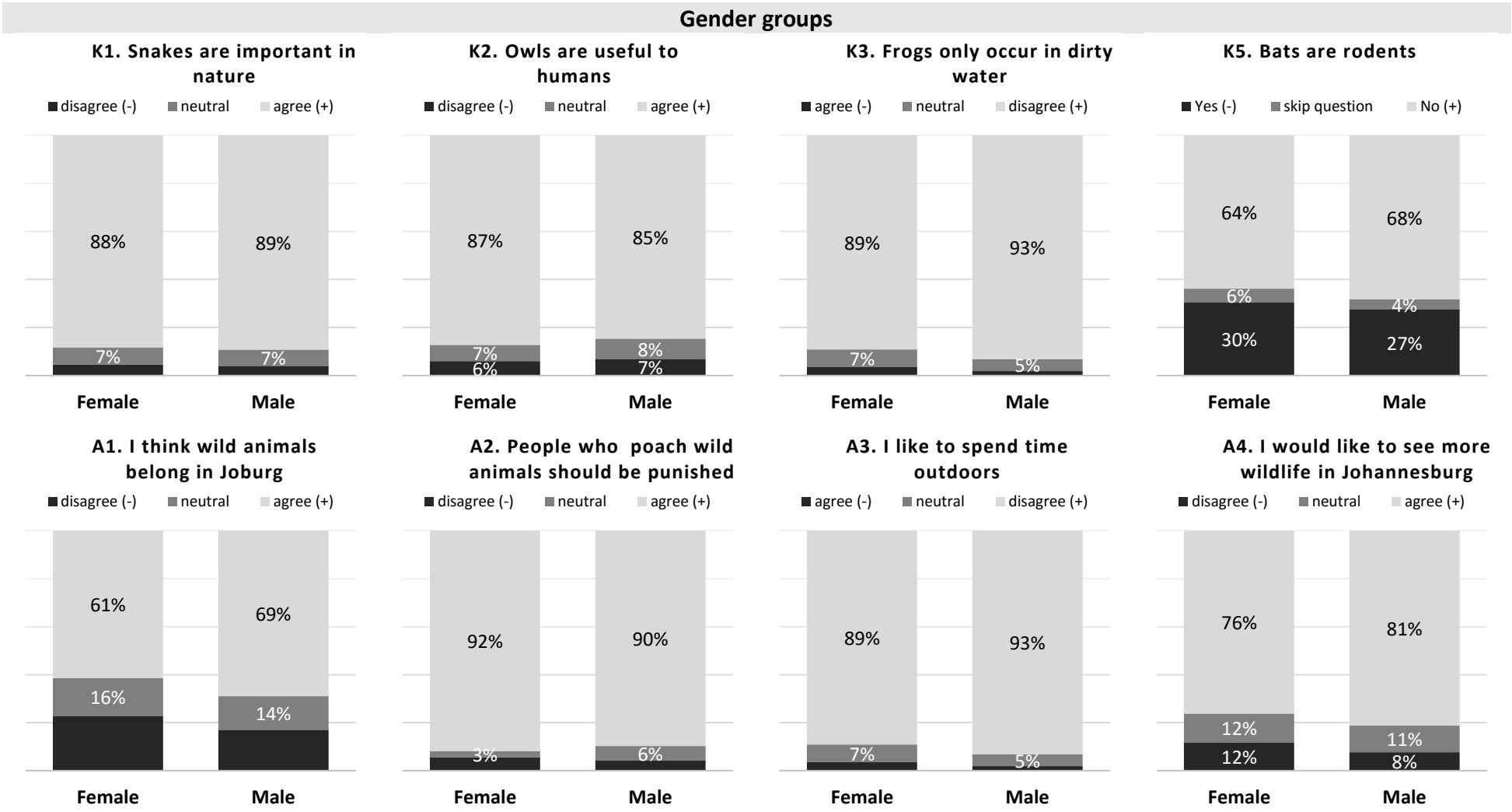
B14. Bat in garden



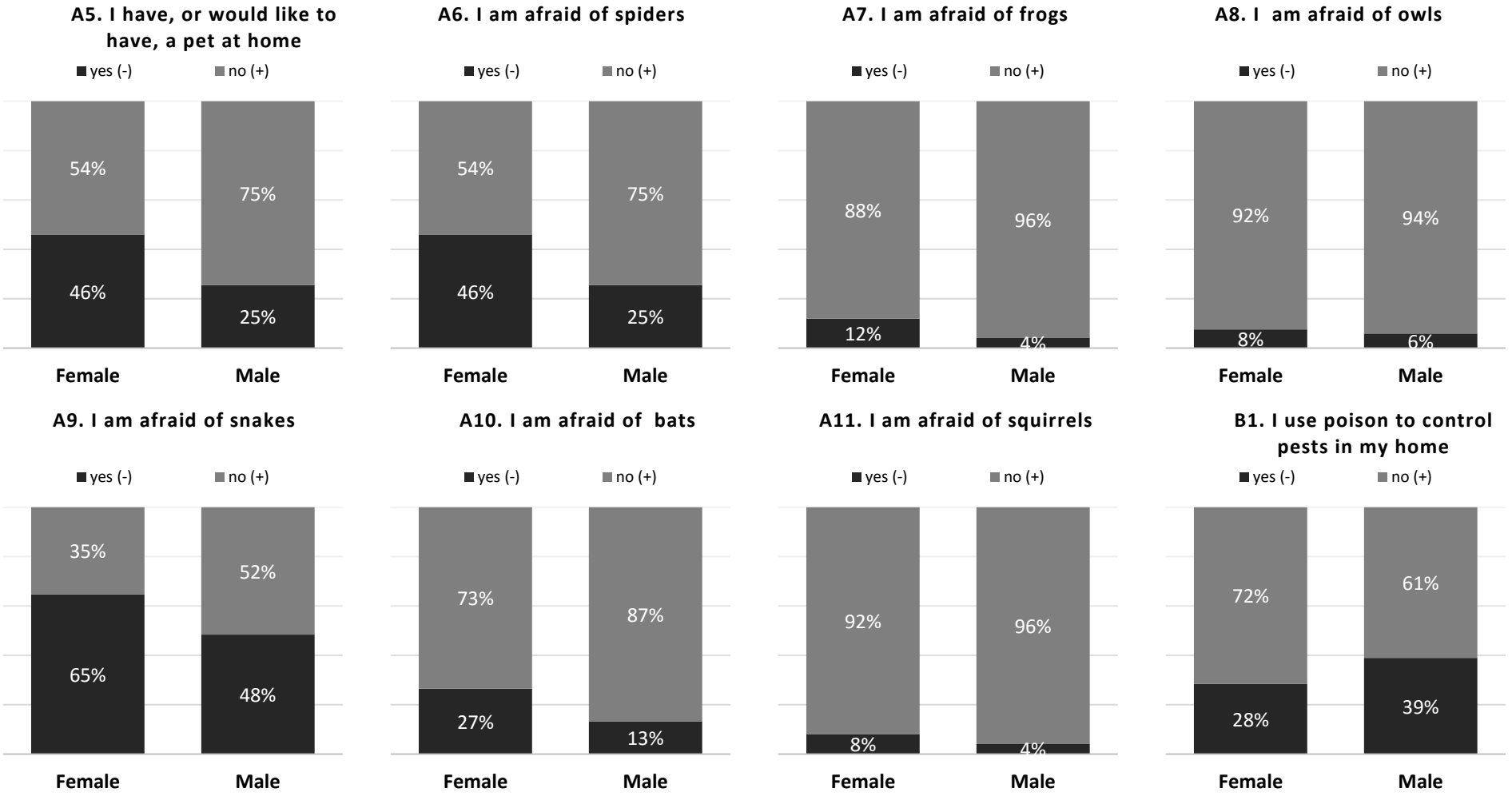
B15. Squirrel in garden



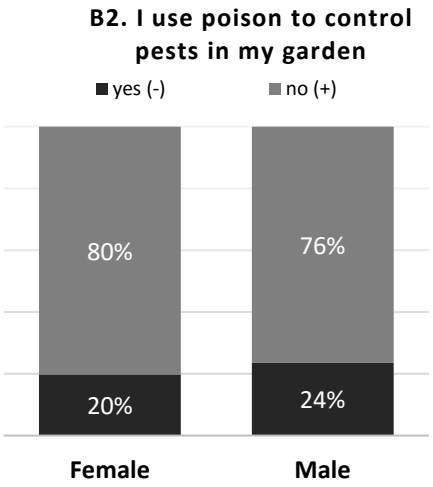
Appendix P Frequency of different responses to questions in in the public survey (Chapter 4), by gender group

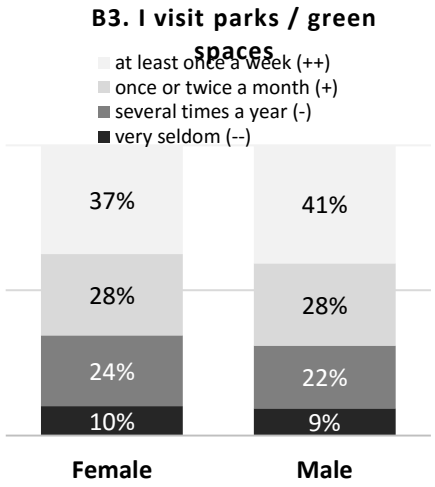


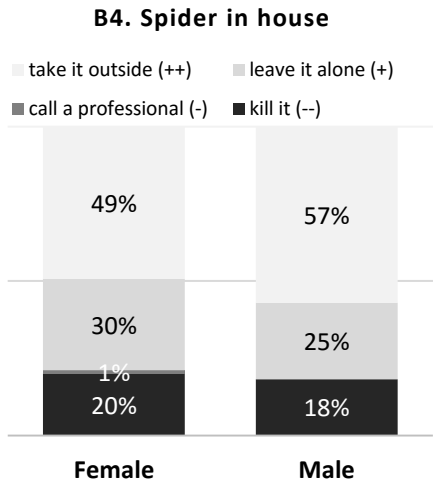
Gender groups

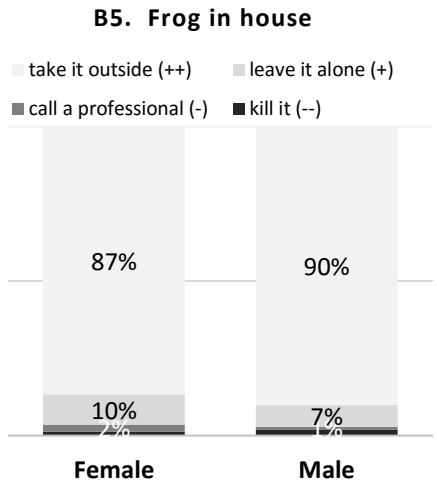


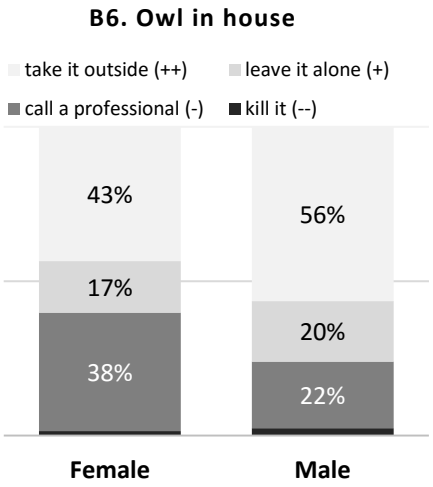
Gender groups

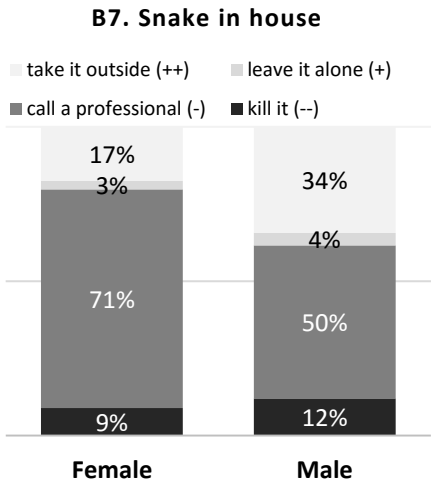


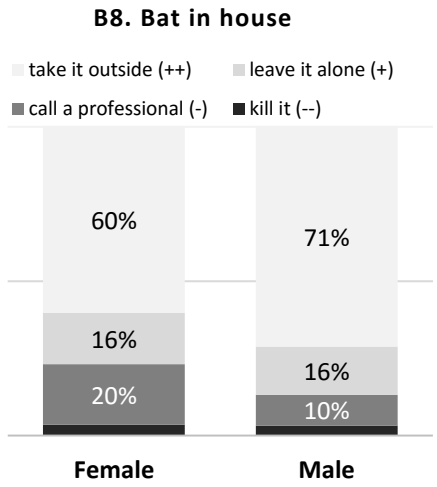


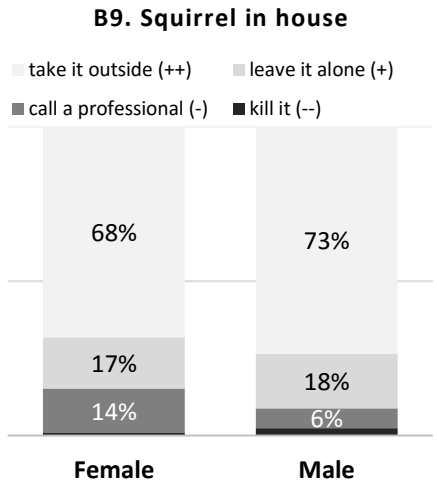




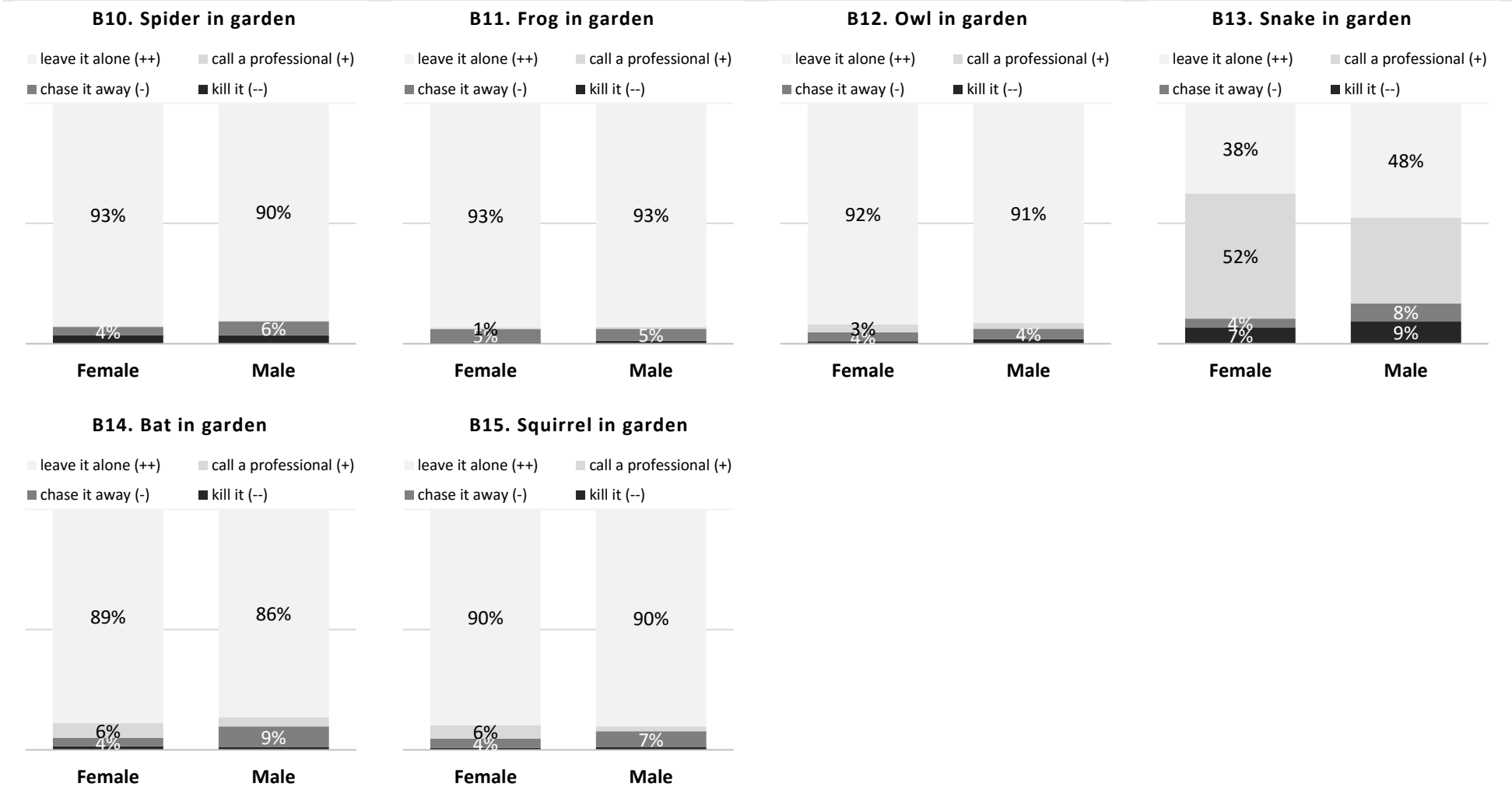






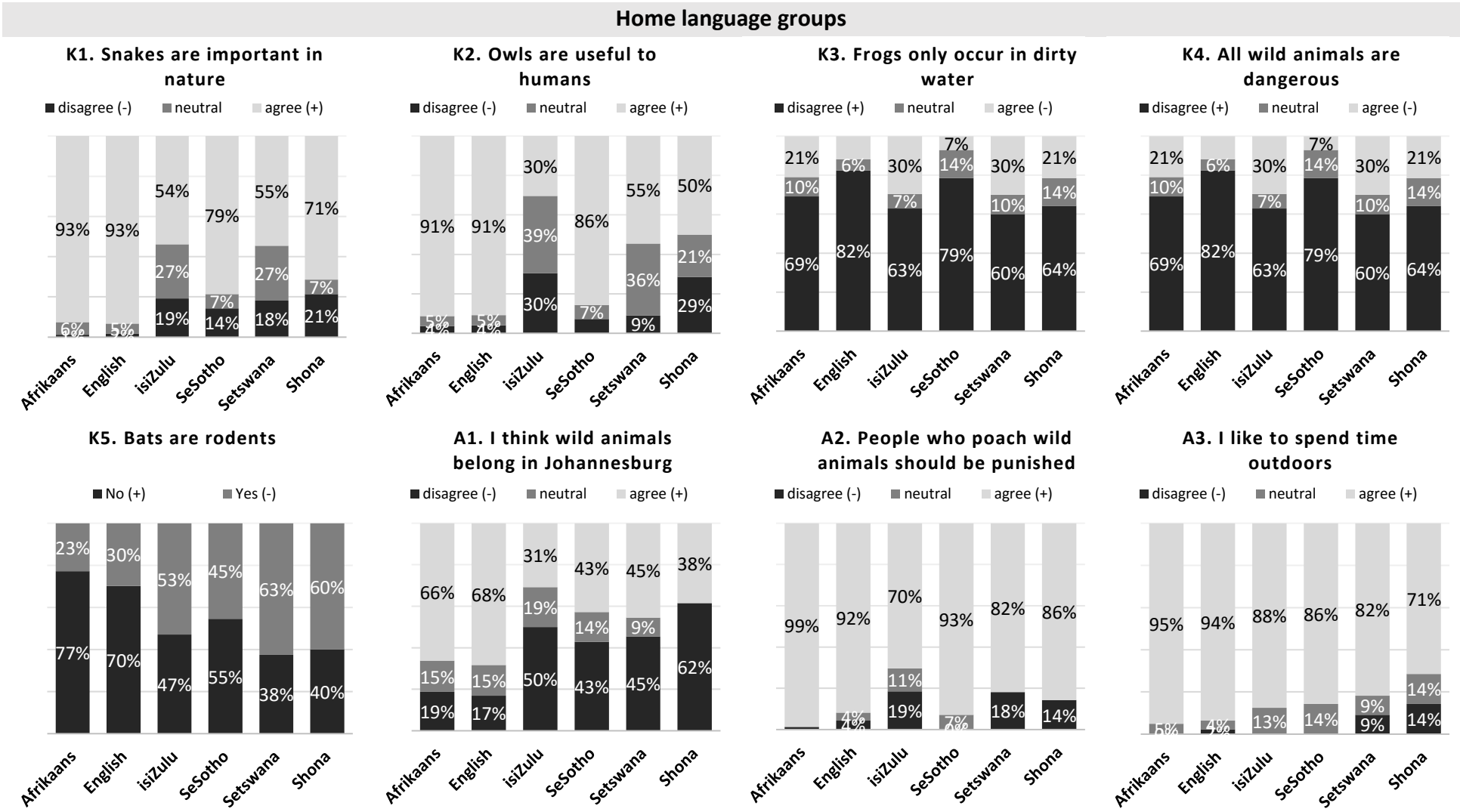


Gender groups

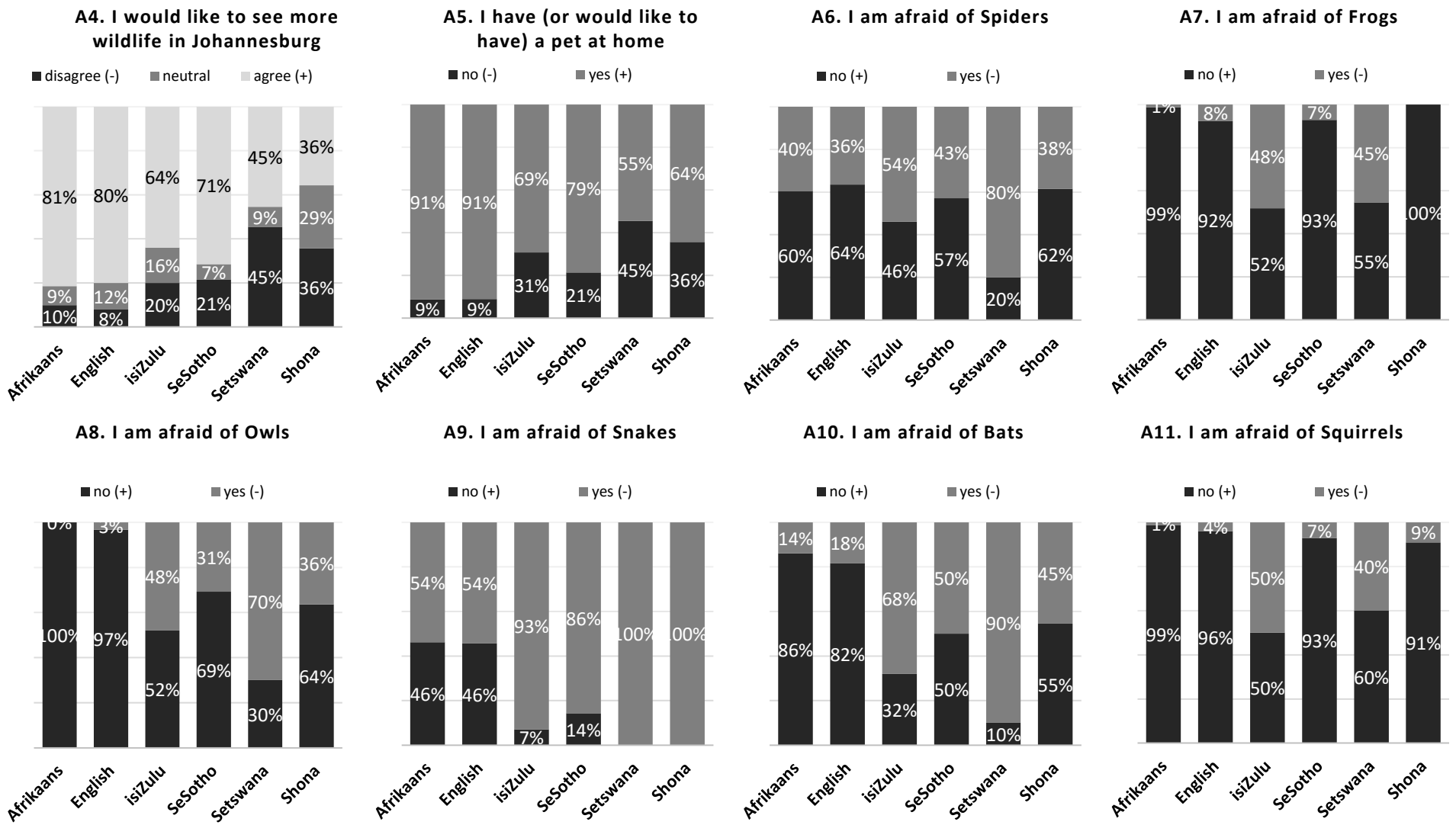


Appendix P

Appendix Q Frequency of different responses to questions in in the public survey (Chapter 4), by home language group

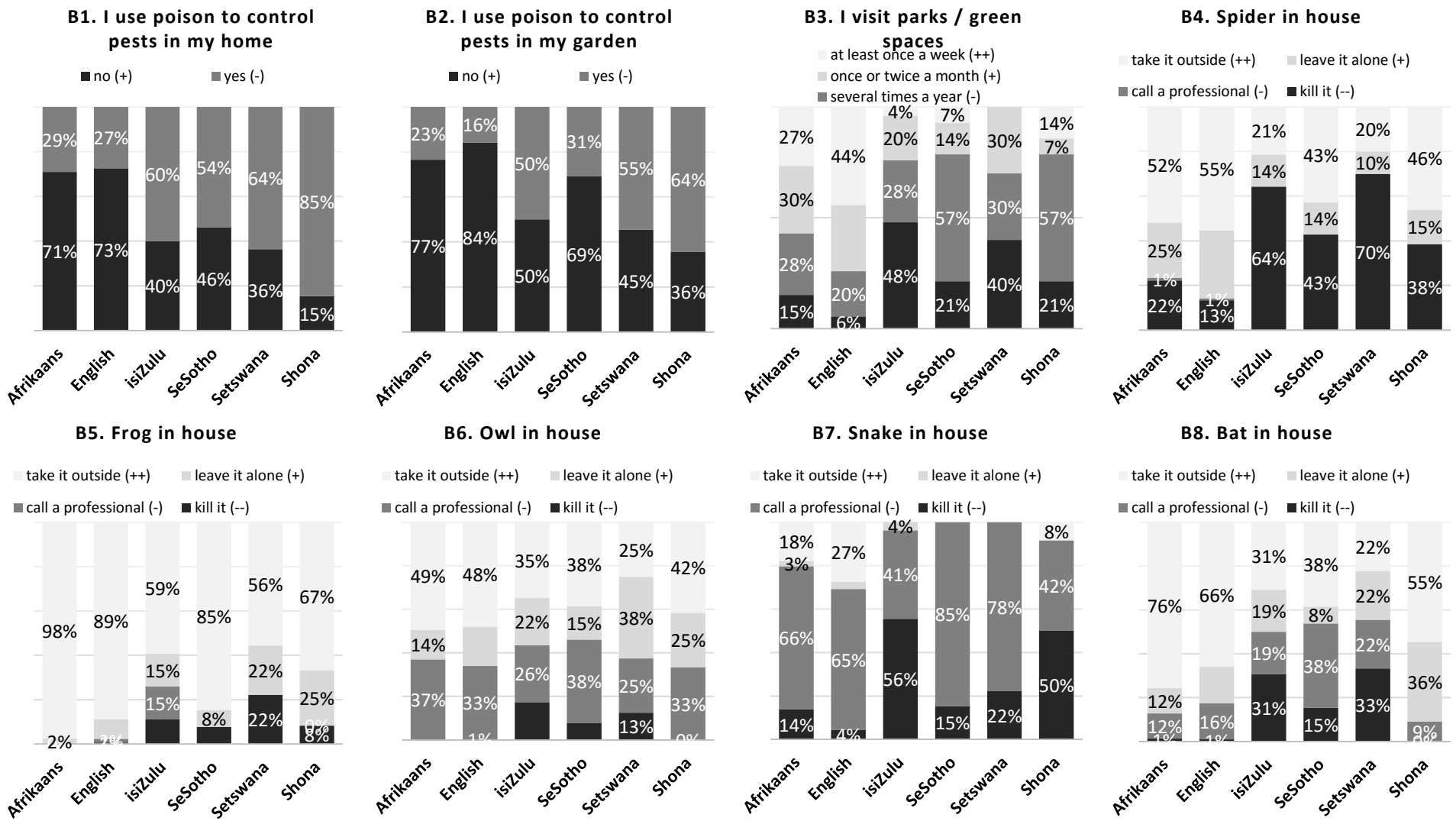


Home language groups



Appendix Q

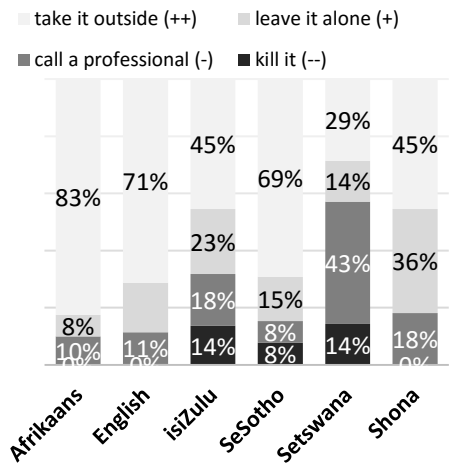
Home language groups



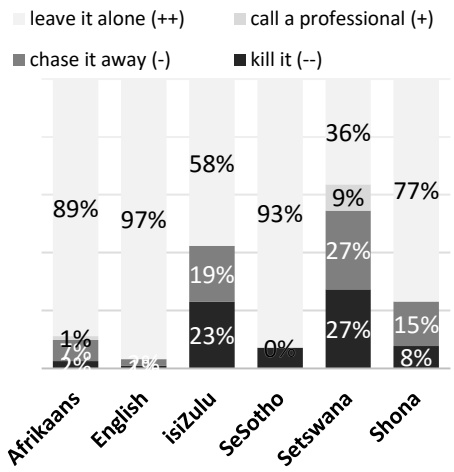
Appendix Q

Home language groups

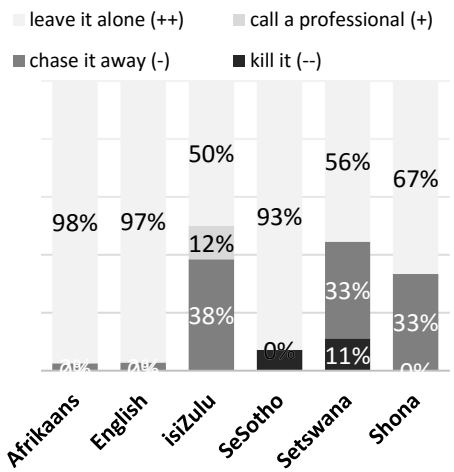
B9. Squirrel in house



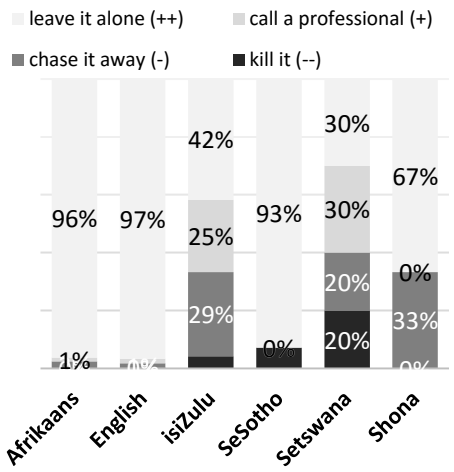
B10. Spider in garden



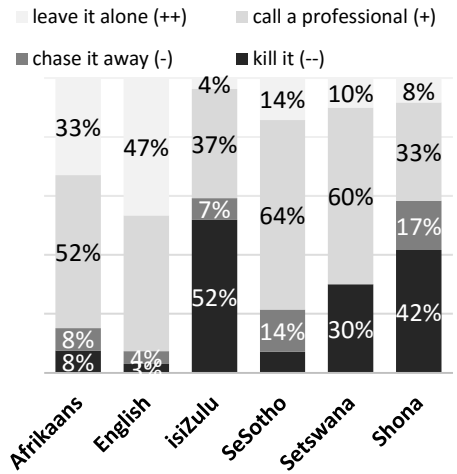
B11. Frog in garden



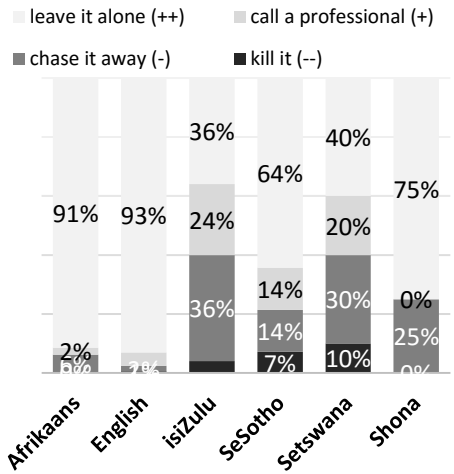
B12. Owl in garden



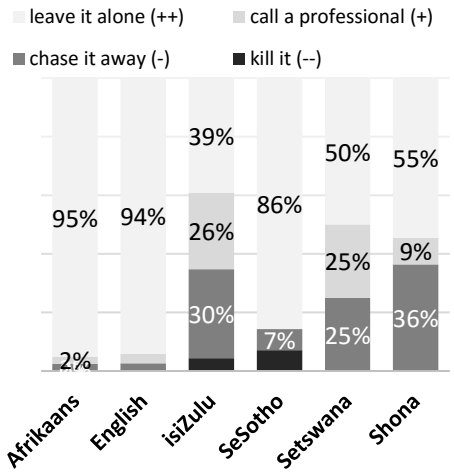
B13. Snake in garden



B14. Bat in garden

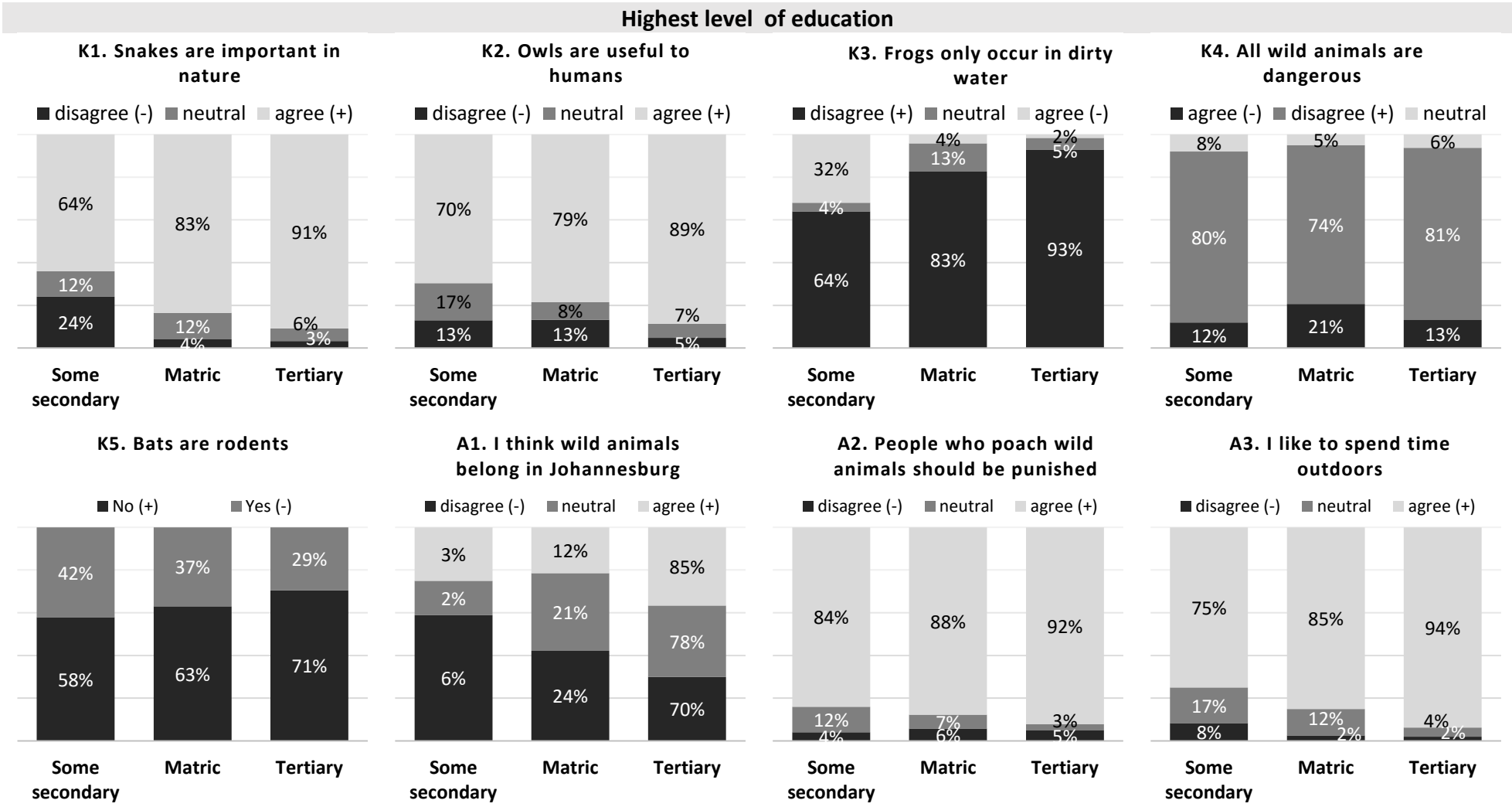


B15. Squirrel in garden

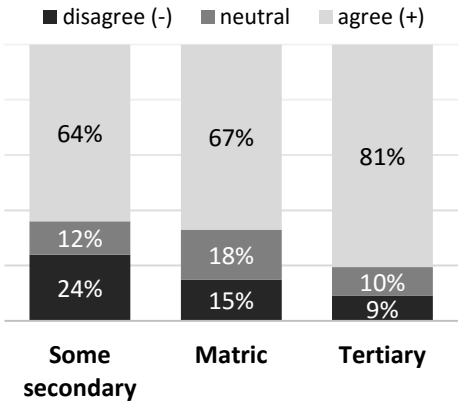


Appendix Q

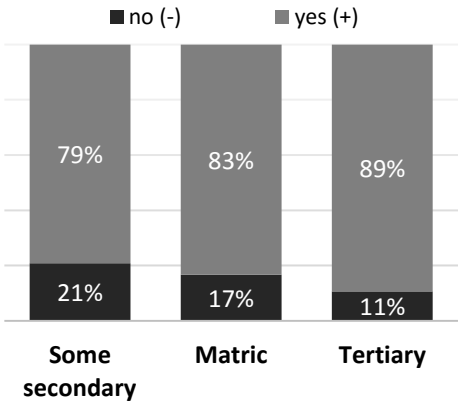
Appendix R Frequency of different responses to questions in in the public survey (Chapter 4), by level of education groups



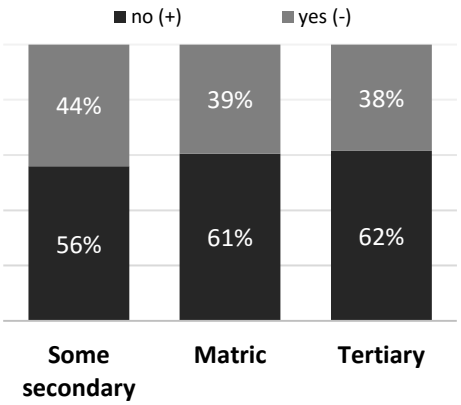
A4. I would like to see more wildlife in Johannesburg



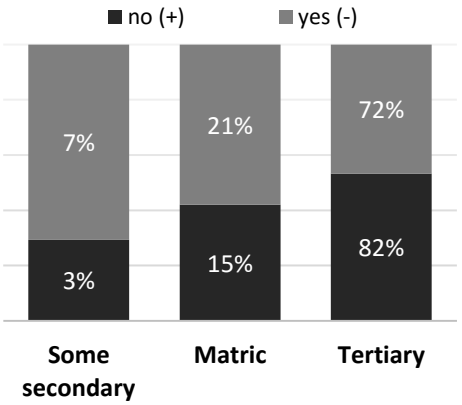
A5. I have, or would like to have a pet at home



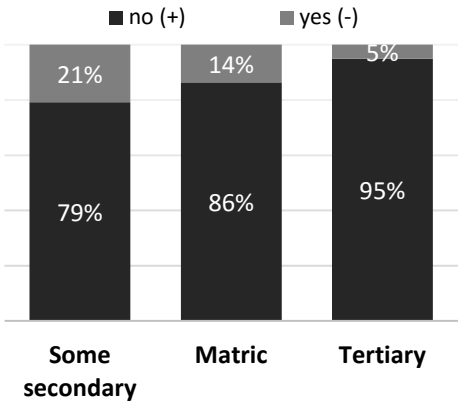
A6. I am afraid of spiders



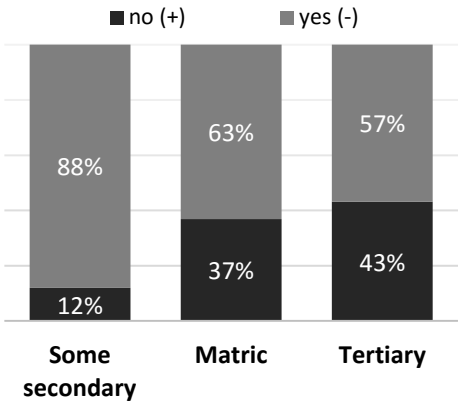
A7. I am afraid of frogs



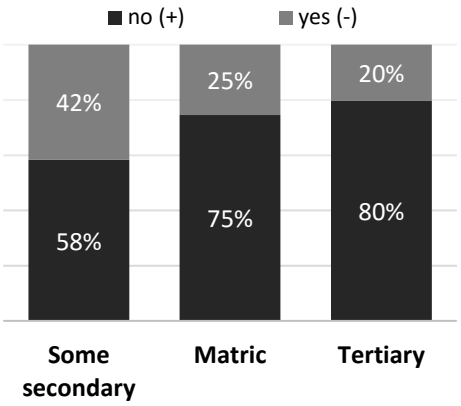
A8. I am afraid of Owls



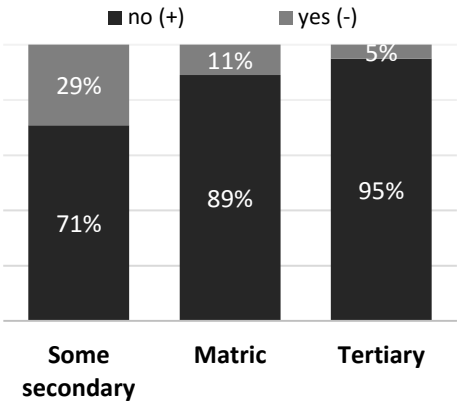
A9. I am afraid of Snakes

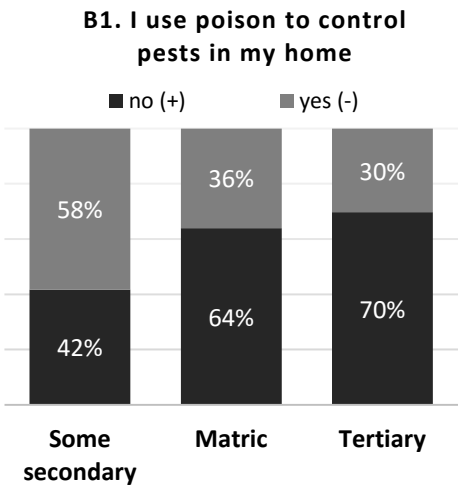


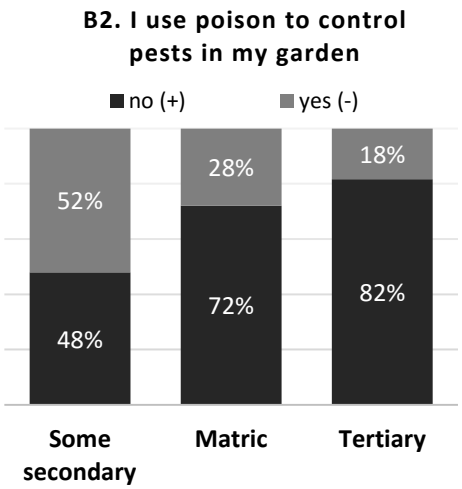
A10. I am afraid of bats

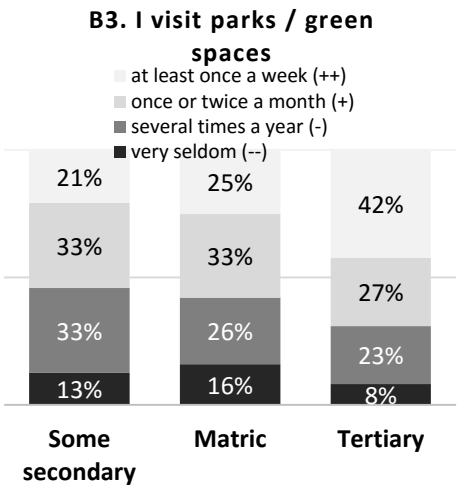


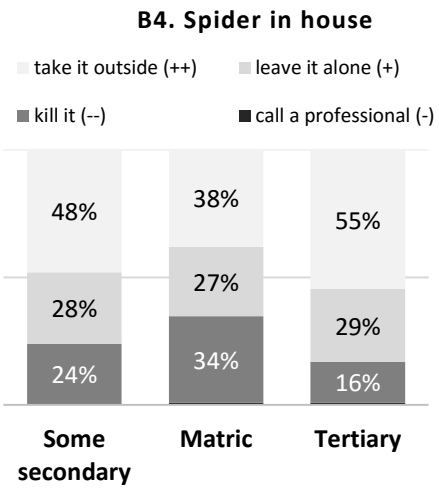
A11. I am afraid of Squirrels

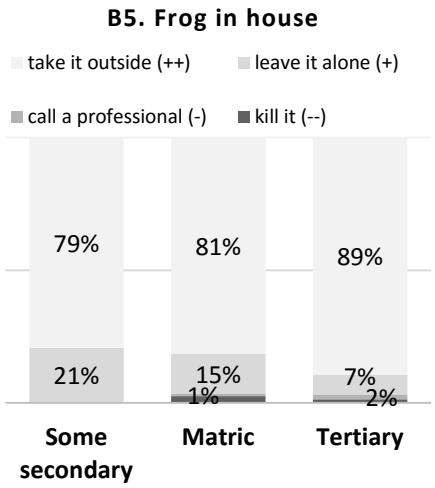


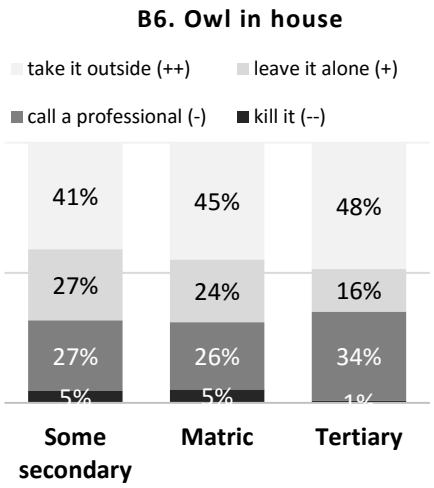

B1. I use poison to control pests in my home
no (+)
yes (-)
58%
36%
30%
42%
64%
70%
Some secondary
Matric
Tertiary

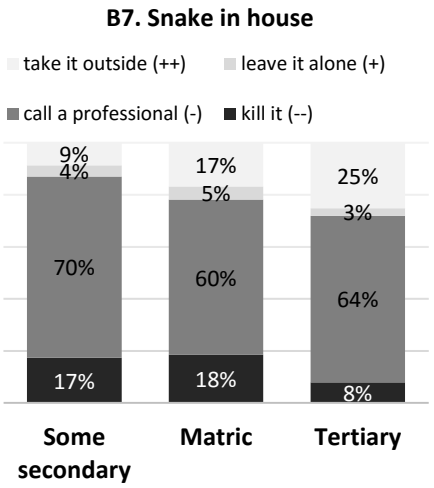

B2. I use poison to control pests in my garden
no (+)
yes (-)
52%
28%
18%
48%
72%
82%
Some secondary
Matric
Tertiary

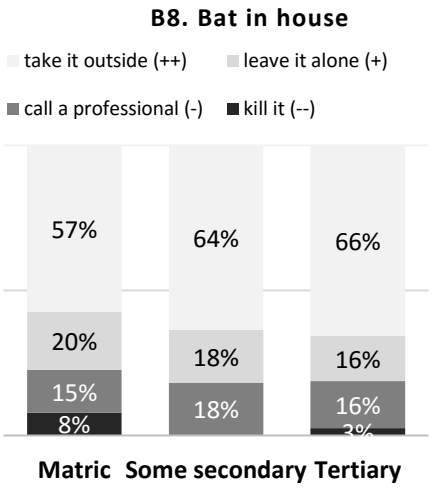

B3. I visit parks / green spaces
at least once a week (++)
once or twice a month (+)
several times a year (-)
very seldom (--)
21%
33%
33%
13%
25%
33%
26%
16%
42%
27%
23%
8%
Some secondary
Matric
Tertiary

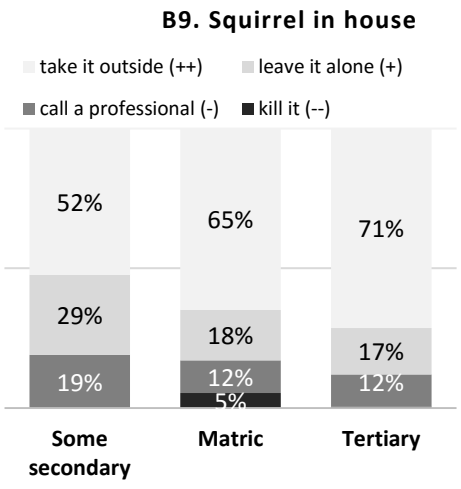

B4. Spider in house
take it outside (++)
leave it alone (+)
kill it (--)
call a professional (-)
48%
28%
24%
38%
27%
34%
55%
29%
16%
Some secondary
Matric
Tertiary

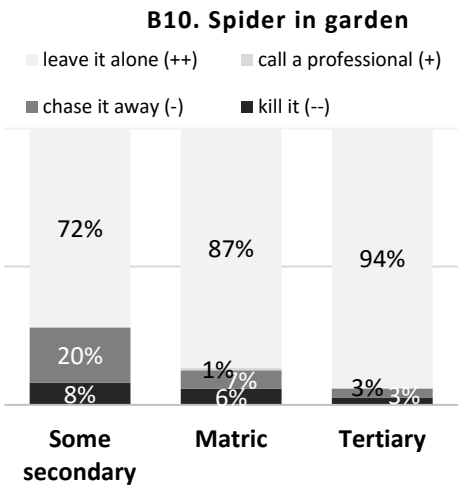

B5. Frog in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
79%
81%
89%
21%
15%
7%
1%
2%
Some secondary
Matric
Tertiary

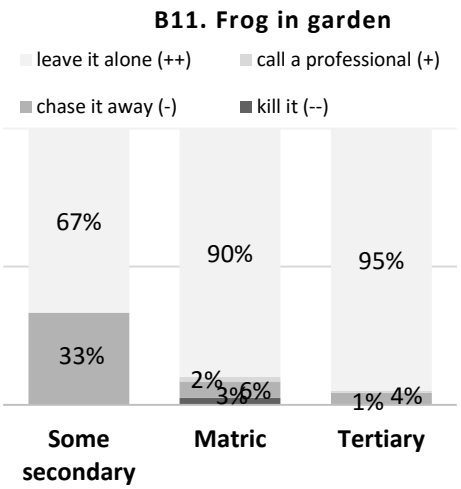

B6. Owl in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
41%
45%
48%
27%
24%
16%
27%
26%
34%
5%
5%
Some secondary
Matric
Tertiary

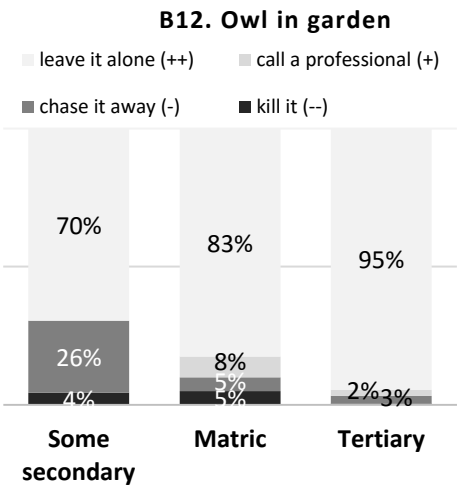

B7. Snake in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
9%
4%
70%
17%
17%
5%
60%
18%
25%
3%
64%
8%
Some secondary
Matric
Tertiary

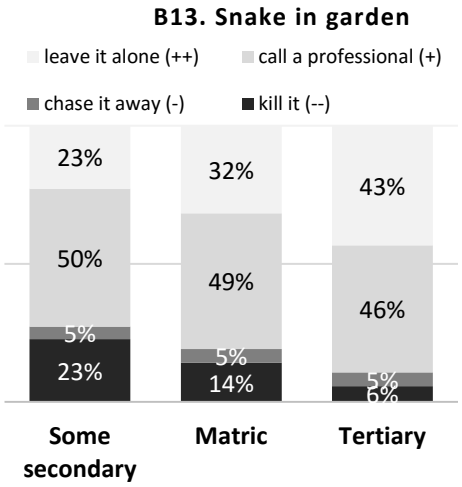

B8. Bat in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
57%
64%
66%
20%
18%
16%
15%
18%
16%
8%
3%
Matric
Some secondary
Tertiary

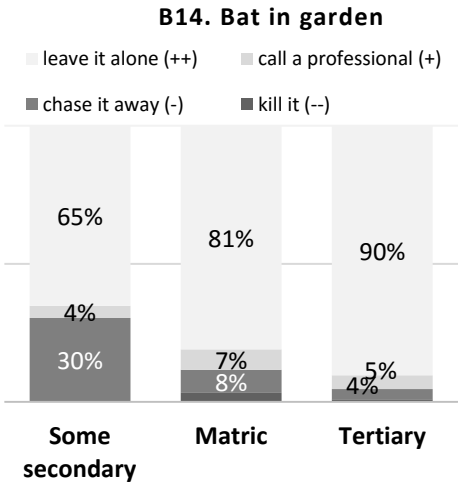

B9. Squirrel in house
take it outside (++)
leave it alone (+)
call a professional (-)
kill it (--)
52%
65%
71%
29%
18%
17%
19%
12%
12%
5%
Some secondary
Matric
Tertiary

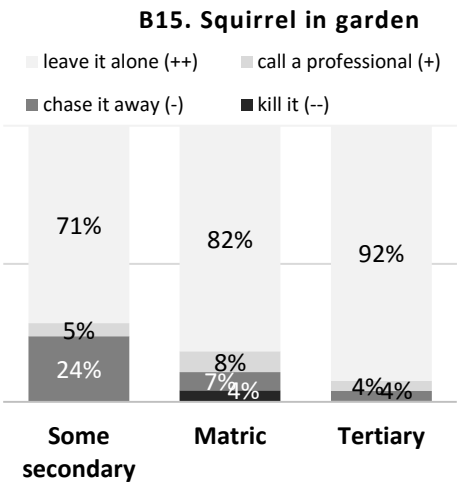

B10. Spider in garden
leave it alone (++)
call a professional (+)
chase it away (-)
kill it (--)
72%
87%
94%
20%
1%
8%
6%
3%
Some secondary
Matric
Tertiary


B11. Frog in garden
leave it alone (++)
call a professional (+)
chase it away (-)
kill it (--)
67%
90%
95%
33%
2%
3%
1%
Some secondary
Matric
Tertiary


B12. Owl in garden
leave it alone (++)
call a professional (+)
chase it away (-)
kill it (--)
70%
83%
95%
26%
8%
2%
4%
5%
Some secondary
Matric
Tertiary


B13. Snake in garden
leave it alone (++)
call a professional (+)
chase it away (-)
kill it (--)
23%
32%
43%
50%
49%
46%
5%
5%
23%
14%
5%
Some secondary
Matric
Tertiary


B14. Bat in garden
leave it alone (++)
call a professional (+)
chase it away (-)
kill it (--)
65%
81%
90%
4%
30%
7%
8%
5%
4%
Some secondary
Matric
Tertiary


B15. Squirrel in garden
leave it alone (++)
call a professional (+)
chase it away (-)
kill it (--)
71%
82%
92%
5%
24%
8%
7%
4%
4%
4%
Some secondary
Matric
Tertiary

Appendix R