How Can Engaging Communities Aid in Developing New Conservation Initiatives?

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Abstract

The field of environmental conservation is experiencing a greater awareness of the social complexities involved when implementing conservation goals. Insufficient consideration of stakeholders' interests and a limited understanding of social dynamics have been responsible for the poor adoption of conservation strategies and a subsequent failure in the realisation of conservation goals. By taking into consideration the views and perspectives of affected stakeholders and actively engaging them when planning for a project, implementation plans are likely to be readily adopted. However, the process for effectively engaging stakeholders, especially communities, remains challenging. There are insufficient practical models of how social dimensions have been incorporated into planning conservation strategies.

In this thesis, I investigated how engaging a community could aid in developing new conservation initiatives within a pest management context. Firstly, I explored the role of Sense of Place in evoking engagement or detachment of communities when planning pest management. Next, I identified conservation actors, analysed their relationships and examined the potential roles and opportunities within their social networks. Lastly, I employed the Living Lab principles of value, influence, realism, sustainability and openness to assist stakeholders in developing pest management strategies for their community. I designed the study within a pragmatism paradigm, employing a sequential mixed method approach and involving theories from different disciplines. The study proposed that conservation strategies that have minimal or no impact on a community's sense of place would likely be adopted without strong opposition; while strategies that challenge or undermine a community's sense of place would likely be rejected or strongly opposed. Also, stakeholders' position within their social networks could influence collective action that could favour conservation goals. I demonstrated that communities indeed do understand issues facing them, can define their management objectives and make decisions that would benefit and assist them in realising their goals. I used insights gained from the engagement process to develop an Open Methods Approach, which is expected to provide a practical mechanism for engaging a community in evidence-based decision making. This study has provided some relevant information and clarified assumptions

scientists, managers and planners might have about engaging communities in developing conservation strategies.

The outcome of this study is a collaborative effort among all stakeholders involved. Thus, this thesis demonstrates the potential for successful collaborations on conservation and pest management projects between diverse community groups and between community groups and external organisations. While the approach was used within a pest management context, it can be adapted for all other fields requiring a social intervention. By engaging communities in conservation planning; conservation goals developed are relevant; public opposition could be minimised; a momentum could be generated for conservation action and there is an increased likelihood that conservation goals would be achieved.

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Attestation of authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Harriet A. Omondiagbe

Date: 13/12/2016

Co-authored works

Chapters 3 and 4 of this thesis are individual studies that have been submitted to peer-reviewed journals for consideration for publication. All co-authors have approved the inclusion of the joint work in this doctoral thesis.

Study 1
Sense of place in isolated communities and implications for pest management strategies aimed at restoring native biodiversity
Chapter 3 in the thesis.

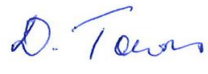
Contribution: Harriet Omondiagbe conceived the idea, developed the study, analysed the data and wrote the manuscript (80% contribution). Barbara Bollard Breen supervised the study and edited the manuscript (10%). Dave Towns and Jay Wood both reviewed and provided feedback on the manuscript (5% each).

Assoc. Prof. Barbara Bollard Breen Prof. Dave Towns Dr Jay Wood

Study 2
Stakeholders and social networks identify potential roles of communities in sustainable management of invasive species
Chapter 4 in the thesis.

Contribution: Harriet Omondiagbe conceived the idea, developed the study, analysed the data and wrote the manuscript (80% contribution). Barbara Bollard Breen supervised the study and edited the manuscript (10%). Dave Towns and Jay Wood both reviewed and provided feedback on the manuscript (5% each).

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Publications and conference presentations associated with this thesis

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Ethical approval

The research conducted in this thesis was approved by the AUT University Ethics Committee (AUTEC 14/358) on 9 December 2014 and the AUT University Faculty of Health and Environmental Sciences Māori Research Facilitation Committee on 25 November 2014.

Chapter 1

Introduction

1.1 Background

The field of environmental conservation is experiencing a shift in emphasis from an exclusive focus on ecological factors and outcomes (Peterson, Russell, West, & Brosius, 2010), to a greater awareness of the effects of social and cultural dynamics on realising conservation goals (Balmford & Cofwling, 2006; Crain, Cooper, & Dickinson, 2014; Lawton, 1997). Social and organisational constraints, a limited understanding of social issues and insufficient consideration of stakeholders' interests have often contributed to the poor adoption of conservation strategies and failed conservation projects (Mills et al., 2014; Ogden & Gilbert, 2011; Wilkinson & Priddel, 2011). Social processes are complex and dynamic and include issues such as insufficient definition of conservation problems (Game, Kareiva, & Possingham, 2013), disagreement in biological classifications of species with divergent values (Prell, Hubacek & Reed, 2009) and the probability of public opposition (Livingstone, Hancox, Nugent, Mackereth, & Hutchings, 2015) which threatens the prospect of effectively engaging the public in conservation. Yet the role of public participation in conservation practice transcends merely raising awareness and consultation, to incorporating local principles, concepts and knowledge of conservation practices (Peterson et al., 2010) and *actually* engaging people in developing and implementing goals for conservation programmes (Drew & Henne, 2006).

A desire to improve conservation outcomes and integrate social issues with ecological processes have resulted in frameworks such as systematic conservation planning (Margules & Pressey, 2000) and social-ecological system (Binder, Hinkel, Bots, & Pahl-Wostl, 2013; Folke, Hahn, Olsson, & Norberg, 2005). However, these frameworks exclude ecological assumptions (Epstein, Vogt, Mincey, & Fischer, 2013), psychological, technological and the cultural aspects of the conservation problem (Steg & Vlek, 2009). For a controversial conservation problem like pest management, different approaches are often required in different environmental, geographical or cultural settings (Ogden & Gilbert, 2009); thus, a method should be flexible and non-prescriptive (Ban et al., 2013).

In New Zealand, invasive mammals have been successfully eradicated from over 100 islands including Rangitoto-Motutapu, Rakino, Motuihe (Towns, West, & Broome, 2013),

Tiritiri Matangi and Motuora (Lee, 2005). Though, most of these eradications have been carried out on uninhabited islands or areas; while inhabited islands, such as Waiheke Island, pose as sources of re-invasion to surrounding pest-free islands (Bassett, Cook, Buchanan, & Russell, 2016).

Presently, the possibility of a predator-free New Zealand is being investigated (Russell, Innes, Brown, & Byrom, 2015). However, attempts made to remove invasive species from inhabited islands have occasionally been met with substantial resistance (e.g. Varnham, Glass, & Stringer, 2011). In addition, methods used for successful eradications on uninhabited islands are difficult to apply on inhabited islands (Ogden & Gilbert, 2009). Hence, novel concepts and methodologies and a coordinated approach aimed at consolidating the various efforts made by smaller local conservation groups across different landscapes are needed. This coordination is necessary to prevent replicating unsuccessful approaches in confronting similar problems (Chalmers, 2013). In addition, integrating knowledge and skills from a diverse range of disciplines and strengthening stakeholders engagement (Blackie et al., 2014; Pooley, Mendelsohn, & Milner-Gulland, 2014) are essential.

In this thesis, I examine the potential for a pest-free inhabited island in response to the wider predator-free concept in New Zealand, using Waiheke Island as my case study. Previous studies have failed to consider the values of island residents in developing management strategies (Towns, Bellingham, Mulder, & Lyver, 2012) and have been unable to adequately address or represent community needs. Hence, I attempt to identify the values and interests of residents in island communities. I use a Sense of Place and thematic analysis of interviews to identify what residents would really value and want from a pest management plan. I analysed relevant media content to understand the current social processes at play during the time of this study and demonstrate how these processes might influence the adoption of a pest management plan. I also employ social network analysis to understand the pattern of relationships among conservation actors and determine the individual and organisational capacity for collective action against invasive mammals. In addition, I use the principles of Living Laboratory to engage diverse stakeholders in discussing relevant questions surrounding pest management on Waiheke Island. Finally, I

employ the insights gained from interacting with stakeholders and the results of the study to develop a mechanism for implementing conservation initiatives produced by the community. This mechanism sets the direction for stakeholders, managers and planners on how to incorporate human dimensions into conservation planning, integrate diverse interests, develop partnerships with diverse stakeholders across multiple agencies and increase engagement of local communities, as we all work towards achieving a predator-free New Zealand.

1.2 Thesis aim and objectives

The aim of this thesis is to investigate how engaging a community could aid in developing new conservation initiatives. I hope to achieve this aim through four objectives.

Objective 1: Identify community values and the role of Sense of Place in facilitating or hindering the implementation of conservation goals in isolated communities

Objective 2: Understand local governance among multiple conservation actors through their social networks

Objective 3: Test the Living Laboratory approach in engaging stakeholders

Objective 4: Investigate aspects of convergent or divergent views in the wider community with respect to stakeholders' perspectives on pest management

How I achieved each of these four objectives will be presented in chapters 3 to 6 respectively.

First, I will explain the role of Sense of Place and various social processes, in evoking engagement or detachment of communities when pest management is planned (Objective 1). The result will further establish the necessity of identifying and incorporating the values and perspectives of stakeholders during the initial stages of developing a pest management plan. Next, I will identify conservation actors (also stakeholders) and analyse the

relationships among them and examine the potential roles and opportunities presented by stakeholders' social networks (Objective 2). In addition, the key conservation actors identified from the network will determine relevant challenges that have been encountered in the course of executing pest management projects on the island. Solutions will be proffered to these challenges in focus group discourses guided by the Living Laboratory principles (Objective 3). The outcome of the meetings will provide a mechanism for developing new conservation initiatives. Lastly, I will survey the wider community and test some hypotheses I constructed to determine areas of differing or similar perspectives with those of the conservation actors (Objective 4). The result of the analysis of Objective 3 will determine the contents of the survey that I will use to achieve Objective 4. In the Discussion, I will examine the prospect and readiness of the island community in working towards a pest-free environment.

1.3 Originality of thesis

This thesis describes a practical mechanism for incorporating social dimensions into planning conservation strategies. It provides a foundation for exploring the interconnections and complexities of people and pest in pest management studies. It demonstrates how communities can define their management objectives and describe other relevant information if such objectives are to be met. The work highlights the process of engaging a community in evidence-based decision making. Hence, my study sets the direction for achieving a predator-free New Zealand through extensive collaboration among diverse communities and stakeholders.

In Chapter 3, I explored a Sense of Place among the island population and reviewed responses where the locals' sense of place appeared to have been undermined using four case studies. I also reflected on the implications of my findings for planning pest management strategies. In summary, strategies that have minimal or no impact on the values that contribute to the community's sense of place would likely be adopted without strong opposition; and pest management strategies that challenge or undermine an individual's sense of place will likely be rejected or strongly opposed. I proposed that Sense of Place could be used either to evoke engagement or detachment of communities

when pest management is planned. I highlighted the importance of understanding the social climate and values of local communities, engaging the public before planning any programme, as well as incorporating their social interests and values into project objectives and conservation initiatives.

In Chapter 4, I identified those involved in or affected by the management of invasive species and analysed the pattern of relationships among them. The structure of conservation actors' network has not been previously determined. I explained how some central stakeholders could influence the behaviour of other network members for collective action. I made recommendations on employing insights from stakeholders' networks to determine potential roles and opportunities in pest management planning.

In Chapter 5, I applied Living Laboratory principles (value, influence, realism, sustainability and openness) to investigate how conservation actors make decisions on conservation issues affecting them. This is the first study that will employ these principles for conservation initiatives. Conservation actors were able to describe pest management issues to harmonise interests, identify challenges in pest management and deliberate on possible solutions to identified challenges.

In Chapter 6, I investigated the perspectives of the wider island residents by engaging the wider community in the pest management discourse. I tested hypotheses about how the perspectives of the wider community might differ or merge with those of the conservation actors in the community. I also examined the prospect for a pest-free Waiheke Island from conservation actors' interactions. This study is the first to develop a mechanism for working towards a pest-free environment by incorporating social perspectives into conservation planning. The context and logical order of the concepts investigated in this thesis have not been employed in any known conservation research. The outcome of this study is a joint effort among all stakeholders involved. Thus, this study has demonstrated the potential for successful collaborations on pest management projects among diverse community groups and between community groups and external organisations. The result was shared among interested individuals, local conservation groups and external

organisations and is available for use by the communities in further refining their conservation goals.

1.4 Rationale for research design

This thesis investigated how engaging communities could aid in developing new conservation initiatives using Waiheke Island as a case study. I chose to use Waiheke Island as a case study as inhabited islands play a major role as sources of re-invasion to surrounding pest-free islands (Bassett et al., 2016). Waiheke Island is located among several uninhabited islands that have had successful mammalian pest eradications. The Regional Pest Management Strategy (RPMS), now the Regional Pest Management Plan (RPMP), lists Waiheke, along with the other Gulf Islands such as Rakino and Great Barrier, as very vulnerable to accidental pest introduction (Auckland Council, 2007). In response to the Predator-free New Zealand programme, I hoped to investigate how to successfully engage communities living in pest-prone areas and to develop initiatives that could lead to a pest-free environment. I also chose to employ a mixed methods approach, grounded in a pragmatist worldview to design this thesis.

Conservation studies have often employed methods associated with positivist paradigms (Drew & Henne, 2006), which are restricted to quantitative data and do not adequately account for the social issues affecting conservation. Therefore, a pragmatist approach would enable me to combine concepts across disciplines and different worldviews, and explore multiple sources of data required to adequately understand and incorporate social perspectives into conservation planning. A pragmatist approach is not the ideal for an objective, science-based, single-discipline project (Larson, 2007); but in this thesis, I assume that reality is dynamic and embrace a process of collaboration where participants jointly create knowledge and solutions to problems based on shared values, meanings and understandings (Popa, Guillermin, & Dedeurwaerdere, 2015). Hence, this thesis has provided guidance on how to move from simply recognising and articulating the need for cross-disciplinary approaches to conservation, to demonstrating how to integrate and incorporate social dimensions into conservation planning.

1.5 Thesis organisation

This thesis is structured and presented in seven chapters (Table 1). In the present chapter (Chapter 1), I have introduced the thesis and described the aim and objectives. In Chapter 2, I will provide a background for this research by reviewing relevant literature and describe the research paradigms, methods and methodologies used to design this research. Chapters 3 to 6 correspond with each of my research objectives and describe how I was able to achieve them. In the Discussion, Chapter 7, I harmonised the central findings of this research and discussed how these findings realised the aim of the thesis.

Table 1. Structure of thesis outlining chapter, content and methods used

Chapter	Content	Methods
1 Introduction	• Research problem • Thesis aim and objectives • Originality of thesis • Rationale for thesis design • Structure of thesis	• Literature review
2 Literature review	• Background for research • Relevant review of literature • Theoretical assumptions underpinning thesis	• Literature review
3 Sense of Place	• Objective 1 achieved • Community values and evidence of sense of place • Role of Sense of Place and various social processes in planning conservation project	• Literature review • Interviews • Media content • Case studies • Thematic analysis
4 Social Networks	• Objective 2 achieved • Structure of conservation actors' network • Potential roles and opportunities of conservation actors' social networks • Pest management issues identified by conservation actors	• Literature review • Organisational network survey • Semi-structured interviews • Network analysis • Qualitative description
5 Living Laboratory	• Objective 3 achieved • Challenges in pest management • Possible solutions to identified challenges • New conservation initiatives developed by conservation actors through employing Living Laboratory principles	• Literature review • Focus group discussions • Thematic analysis
6 Community engagement	• Objective 4 achieved • Community perspectives on pest management • Differences and similarities in community residents and conservation actors' perspectives • Significant and non-significant interactions of variables measured in survey	• Literature review • Survey (mail, online and face-to-face) • Hypothesis testing • Statistical analysis (SPSS) • Triangulation
7 Discussion	• Relationship of main findings to thesis aim • Prospect and readiness of the island community in achieving a pest-free environment • Implications of this research for a Predator-free New Zealand • Identify limitations and knowledge gaps • Recommend future research questions	• Literature review • Triangulation • Observations • Memos

Chapter 2

Literature Review

2.1 Overview

This literature review will present relevant studies and provide a background for my research. First, I examine conservation and how other factors complicate the decision-making process. Then, I discuss the history and management of invasive species in New Zealand and give case studies of conflicts that can arise when pest management goals interfere with social values. In addition, I introduce the Predator Free concept. This concept presents a unique opportunity to investigate the likelihood of a predator-free environment in the study area. I also describe the study location and briefly highlight the complexity of managing pests on an inhabited island. I discuss in detail the theoretical paradigms employed in this thesis. Basically, the philosophical underpinning for this thesis is the pragmatism paradigm. Furthermore, I outline the phases in which the study was designed. A mixed method approach was used to design the study in five phases. I explain the theoretical sampling and methods of data collection and also outline the preliminary statistical assessments carried out. I describe the tools and methods used for data analysis and finally, summarise the main aspects of my literature review and discuss how they relate to my thesis aim and objectives.

2.2 Conservation and its complexities

Human choices affect what and how we decide to conserve the natural world. All conservation problems are directly or indirectly linked to these human choices (Balmford & Cowling, 2006; Lawton, 1997). Hence, social knowledge and the perspectives of individuals and groups affected should be considered and integrated into any remedial process (Mascia et al., 2003; Sobczak et al., 2013). However, incorporating social information with conservation goals can be very complex and include: different personal perspectives (Balmford & Cowling, 2006; Lawton, 1997); inadequate understanding of the effects of other variables, e.g., social, economic, cultural, political, historical landscapes (Peterson et al., 2010); power differences between planners and users; inadequacy of current conservation planning frameworks (Ban et al., 2013); inadequate research expertise to study social data (Drew & Henne, 2006), and a lack of realistic examples of multidisciplinary projects (Pooley et al., 2014).

Understanding the role of humans in conservation issues necessitates understanding the relationship between people and nature (Larson, 2007); conducting research beyond scientific boundaries (Peterson et al., 2010); actively involving affected individuals and groups (stakeholders) in developing conservation goals from the beginning; integrating structured organisations with informal governance systems and developing effective ways of keeping communities motivated to follow-through on implementing conservation plans (Ban et al., 2013). Also, a variety of approaches, disciplines, expertise, methodologies and perspectives are needed to address the complexities involved in conservation (Bergvall-Kåreborn, Ihlström, Stahlbröst, & Svensson, 2009). In addition, conservationists must be prepared to dismiss their personal assumptions and consider those of the locals, who might implement conservation plans more readily, if they can relate to the defined goals (Brosius & Hitchner, 2010). Considering local perspectives further means that compromises in belief and value systems have to be made (Raymond & Olive, 2008) and differences negotiated among the "four lenses (ecological, cultural, economic, political) of conservation" (Peterson et al., 2010).

2.3 Invasive species

A controversial subject in conservation is invasive species, also referred to generally as pests (Goldson et al., 2015). Invasive species are populations that have successfully established self-sustaining systems, spread and caused significant ecological or social impacts in the ecosystems that they have invaded. That is, they are widespread and locally dominant (Colautti & MacIsaac, 2004). In this thesis, pests and invasive species will be used interchangeably with a focus on mammalian species. A distinction is made between invasive species and those identified as alien, non-indigenous, non-native, exotic, introduced, established or naturalised species. The latter group need not be invasive and may even provide social benefits as crops or farm stock (Simberloff, 2010). Defining and classifying invasive species has been criticised as varied, subjective and arguable and have contributed to a conflict in their management (Nugent & Fraser, 1993). However, there is considerable evidence of the negative effects of species that are considered to be foreign to a particular environment, including damage caused by rabbits (*Oryctolagus cuniculus*) to native and pastoral grasslands; global environmental degradation, modification of

biodiversity, reduction in global species richness and species extinctions (Brown & Sax, 2004); decline in forest health (Mowbray, 2002); the spread of new diseases; for example, through rodents and cats (*Felis catus*) (Glen et al., 2013); severe alteration in nutrient cycling, forest and vegetation structure and composition of ecosystems by brushtail possums (*Trichosurus vulpecula*), red deer (*Cervus elaphus scoticus*) and goats (*Capra hircus*) (Nugent, Fraser, & Sweetapple, 2001). In New Zealand, predation by stoats (*Mustela erminea*), feral cats and ship rats (*Rattus rattus*) have led to the extinction of over 40% of bird species (Colautti & MacIsaac, 2004; Towns et al., 2012) and threaten the survival of endangered birds such as kiwi (*Apteryx spp.*) and mohua (*Mohoua ochrocephala*). Also, displacement of indigenous marine species, modification of aquatic habitats and water flow have threatened human health, livelihood and industries that depend on these habitats; for example, fishing industries. Possums and ferrets (*Mustela furo*), also carriers of bovine tuberculosis (TB), are a menace to the agricultural sector and have resulted in huge economic losses (Blackie et al., 2014).

2.3.1 A brief historical review of invasive species in New Zealand

The New Zealand fauna consists of many endemic species of reptiles, primitive frogs, large insects, flightless birds and three species of small bats which evolved in isolation and in the absence of mammalian predation or competition (King, 1990). The absence of mammalian predation made the native species very vulnerable to predators; for example, possums, rats, weasels (*Mustela nivalis*), stoats, rabbits, hedgehogs (*Erinaceus europaeus*), mice, wild pigs and feral cats (Blackie et al., 2014; Goldson et al., 2015). Less than 800 years ago, people from Polynesia settled in New Zealand and associated with this settlement, Pacific rats or kiore (*Rattus exulans*) and domestic dogs or kuri (*Canis familiaris*) were introduced (Clout & Russell, 2006), which constituted the first biological invasion. The second biological invasion came with European settlers, in the 1790s. At least 138 species of bird and 50 species of mammals were introduced (King, 1990), with 30 being established and 14 widely distributed (Clout & Russell, 2006). Most mammals were deliberately released for food (e.g., dog); hunting purposes (e.g., deer, rabbits); as companion animals (e.g., dogs, cats); for trade (e.g., possum for fur), and as biological controls (e.g., stoats, weasels, ferrets and hedgehogs) (Parkes & Murphy, 2003; Towns et al., 2011).

2.3.2 Management of invasive species

The process of coping with invasive species is complex and requires diverse management options including prevention, control and eradication (Auckland Council, 2007). Managing invasive species has been guided by the principles of prevention in the first instance, followed by a possible eradication and a long-term management plan as the last resort (Simberloff et al., 2013). Prevention includes activities such as conducting border checks; inspecting shipments and setting quarantine regulations to limit the entry of invasive species; actively searching for and placing restrictions in major conduits which may lead to harmful invasions and enlightening the general community to make informed decisions on limiting introductions and spread of invasive species. Ground control methods are similar to early methods for eradication and may include trapping and shooting, e.g., dogs and spotlight shooting (Cromarty et al., 2002). Eradication includes standard techniques of placing toxins in bait stations, shooting and trapping (Clout & Russell, 2006), particularly at the early stage of an invasion. However, when invasive populations become established, a more rigorous and targeted activity aimed at a complete removal is necessary. Monitoring of a pest control programme is essential in order to evaluate its effectiveness (Auckland Council, 2007). Ground monitoring operations include aerial surveillance (Mowbray, 2002), telemetry (Cromarty et al., 2002) and biosecurity surveillance (Goldson et al., 2015).

In New Zealand, the Department of Conservation (DOC) has carried out numerous eradications of invasive species including rats, stoats and mice on various islands (Towns et al., 2013), but some methods may generate conflicts among the public, or between groups and organisations with diverging values; for example, indigenous landowners and land managers, as an animal could both be a pest and a valued resource (Nugent & Fraser, 1993). Despite imminent public opposition, government agencies responsible for pest animal management often make recurring erroneous assumptions, that their views about management goals are widely shared, especially if those pests are invasive (Robinson & Whitehead, 2003). People's beliefs, attitudes and perceptions differ, influence their relationship with the environment and have implications for successful conservation. Values, such as cultural stewardship, use, personal engagement, connection, knowledge,

wisdom and ecological integrity, all play important roles in conservation plans. It is, therefore, indispensable to understand how stakeholders observe and assign values to conservation activities in order to represent a variety of perceptions and take into account these diversities when planning conservation projects (Lyver et al., 2015). However, an increasing emphasis on active intervention in conservation processes might not be commensurate with a consideration of the values of those directly affected by conservation efforts. High-level government strategies that do not generally account for variations in the values of affected communities are still being developed (Lyver et al. 2015). New Zealand's Biodiversity Strategy goals seek to "enhance community understanding, motivation, support, action, responsibility and benefits from conserving and sustainably managing biodiversity" and "to actively promote iwi and hapu interests in biodiversity and to strengthen their partnership with government agencies" (Department of Conservation, 2000); but incorporating social values into pest management is still at an early stage, without clear practical applications (Mulgan, 2006).

Below, I give some case studies representing how conflict can arise, when pest management goals interfere with social values.

2.3.3 Buffalo case study

Australia's buffalo (*Bubalus bubalis*) are valued as a potential resource for hunters and non-conservationist groups. Effective management of buffalo requires environmental managers to actively engage with local people to plan methods of control (Robinson & Whitehead, 2003). Managers were aware of the recommendation to include locals but developed a plan of action without involving the locals at the outset. The park rangers wanted to cull buffalo to facilitate floodplain restoration, while the hunters preferred to retain them for meat and income source. Attempts were made to reconcile the differences in values by offering financial incentives to hunters who strongly opposed the programme and consequently refused the offer. The park rangers and conservation managers, however, went ahead with implementing the strategy. During the implementation process, the managers realised almost too late that costs, in terms of money and time spent, far outweighed the benefits, and considered redefining buffalo management with the support of

the local people (Boulton & Freeland, 1991; Collier, Austin, Bradshaw, & McMahon, 2011; Robinson & Whitehead, 2003).

2.3.4 Deer, possums and compound 1080

There is a multidimensional conflict involving the aerial spread of toxin, disease control and pest damage in the management of deer and possums. Compound 1080 is primarily used as bait for pest control operations in New Zealand, but in particular, for the control of brushtail possums, the vector that spreads bovine tuberculosis (TB) into cattle (Towns et al., 2011). Despite arguments for the cost-effectiveness of aerial applications of 1080 over ground operations, the use of 1080 remains highly contentious and generates intense public opposition, especially when applied aerially (Parliamentary Commissioner for the Environment, PCE, 2011). The use of media by individuals and community groups (for example, Clyde & Steve, 2009), to propagate their personal preferences and perspectives on the use of 1080 has further aggravated the issue. Conservation agencies have responded with a comprehensive review of their operations and published scientific claims on the benefits of applying 1080 with the hope the public might shift their perspectives (Environmental Risk Management Authority, ERMA, 2007; PCE, 2011). But the divergent views and conflicting information have succeeded in dividing the population of New Zealanders into two groups of debaters: for or against.

Deer, for example, Red deer (*Cervus elaphus scoticus*), Wapiti (*C. elaphus nelson)* and Sika deer (*C. nippon*), complicate the debate as they severely modify the structure and composition of vegetation and can also help spread TB into cattle herd or farmed deer populations (Nugent & Fraser, 1993). During possum control operations employing compound 1080 as bait, non-target losses are likely when some deer populations come in contact with the bait. While conservationists embrace the benefits in recovering some vegetation biomass and increasing biodiversity, deer hunters are concerned about the detrimental effects on their income, sports and recreation.

Finally, possums cause severe damage to forests (Nugent & Fraser, 1993) and New Zealand's native ecosystems (PCE, 2011), with an estimated financial loss of NZ$58.32

million in 2013 dollars (Russell et al., 2015). Despite these effects, commercial fur industries advocate for the retention of possum due to its economic potential. At present, the export of possum fur ($100 million per annum) is a far cry from the dairy export value of NZ$12.2 billion in 2013, NZ$2.5 billion for beef exports and NZ$192 million for deer export industries (Russell et al., 2015). Sustainable management in this complex situation, therefore, entails fostering an active co-operation between all stakeholders and a possible compromise that provides some of the desired conservation benefits and also some reward for hunters (Nugent & Fraser, 1993).

2.3.5 Going forward

Innovative advances in technical tools for managing invasive species in New Zealand are expected in the near future (Russell et al., 2015); however, the social issues that might limit the use of such ground-breaking technologies need to be addressed. New Zealand has a concerned and motivated population who sometimes has diverging views on the values and designation of a mammalian species as a pest and approve a particular management method over another based on personal preferences (Goldson et al., 2015). For example, some people prefer the use of traps over toxins e.g. 1080, but consider the use of 1080 necessary in circumstances where there are no other substitutes. Also, biological control methods developed using genetically engineered organisms might elicit strong opposition (Parkes & Murphy, 2003). Aerial poisoning techniques have been extremely effective against rodents on islands (Clout & Russell, 2006; Towns et al., 2013) but are likely to be impeded on islands with a resident human population especially if some of them are opposed to the use of poisons (Towns et al., 2011). This opposition can fuel a need for other methods of eradicating mammalian pests in order to quell the toxin debate. Social or cultural opposition to eradications can be reduced if there is comprehensive information about the benefits of these activities.

Given the social complexities associated with pest control, those developing new technologies will need to work with researchers from non-scientific fields and backgrounds to determine what tools would be readily adopted in the first instance (Game et al., 2013), to avoid public backlash due to technical risk (Towns, et al., 2012). Preferences and choice of methods by people are mostly based on perceptions and values and values can be

changed if people are exposed to visible evidence of the impacts of invasive species (Simberloff et al., 2013; Towns et al., 2013). Also, by involving citizens and stakeholders in deciding and planning an eradication project, eradication goals and management objectives could be achieved (Glen et al., 2013). Transparent communication about management operations and improved relationships between pest control agencies and communities across agencies and regions are also necessary (PCE, 2011). In summary, undertaking conservation projects that involve controlling pests can be effective, but may also be controversial and face strong opposition.

2.4 Predator Free New Zealand

Most eradications have been executed on uninhabited islands (Towns et al., 2012). About 10% of the offshore island areas in New Zealand have had successful pest eradications. In 2012, a vision to eliminate invasive predators from the entire country was proposed, starting from the country's largest mainland reserves (that is, North and South Islands) and offshore islands (all other islands). There are already numerous pest control programmes operated by different agencies across the country, but there are no effective interactions among the projects and the project coordinators (Glen et al., 2013). A predator-free New Zealand (PFNZ) concept is being trialled by an organisation, Predator Free New Zealand (PFNZ). The organisation aims to completely eradicate selected mammalian predators such as rats, stoats, possums, weasels and ferrets by developing novel technologies that would be accepted and readily adopted by the public, and also reduce the costs of managing invasive species by 2050. In achieving this aim, PFNZ is building collaborations with different stakeholders with various interests in pest management. However, the management of dogs and feral cats remain a source of public debate and have been excluded from the PFNZ concept (Russell et al., 2015).

2.5 Location and context: Waiheke Island, Auckland, Northern New Zealand

The presence of people, pets and pests on inhabited islands make total eradication of invasive species a real challenge (Glen et al., 2013; Ogden & Gilbert, 2009). Land

ownership, absentee landowners and different management structures also limit access to some areas targeted for eradication. Inadequate local support of residents for eradication objectives and proposed methodologies could also undermine the eradication process (Glen et al., 2013; Towns et al., 2013). The present study was carried out on Waiheke Island (Fig. 1). Waiheke presents a unique opportunity to investigate the possibility of the PFNZ concept in an inhabited island. Waiheke Island (360 48'S 1750 06'E) is the second largest island (9,324 ha) in the Hauraki Gulf and is 17 kilometres from central Auckland in New Zealand (Auckland Council, 2007). The island has a diverse landscape with pasture, beaches, vineyards and regenerating native forest containing fragments of mature kauri (*Agathis australis*) old growth forest. Waiheke is surrounded by islands from which a range of invasive species have already been eradicated (Fig. 2). These islands are now focal sites for restoration of native biodiversity, often as projects led by community groups. Examples include Tiritiri Matangi, Motuora (Lee, 2005), Rangitoto-Motutapu and Rakino (Towns et al., 2013) and Motuihe. These islands collectively have been cleared of Pacific rats (*Rattus exulans*), ship rats, Norway rats (*R. norvegicus*), mice, brush-tailed possums, wallabies (*Macropus* spp), stoats, hedgehogs, rabbits and feral cats. Waiheke Island has been invaded by all of these species except possums and wallabies (Lee, 2005).

Waiheke has about 8,000 permanent residents but the population swells to between 30,000 to 40,000 people during the summer months (Waiheke Local Board, 2014). The resident population is known for its cultural diversity, alternative lifestyles and strong political activity (Lee, 2005). Several conservation groups have been formed and these groups contribute to the restoration, maintenance, protection and preservation of the natural resources in their environment. These activities directly or indirectly involve the control of invasive plant or animal species. Previous attempts at establishing bellbird (*Anthornis melanura*) populations on Waiheke Island failed due to post-release stress, dispersal from the island, or predation (Lee, 2005). Waiheke Island, like most islands in New Zealand, has a potential for eradication of pest animals as there are an increasing appreciation and desire for restoring native biodiversity among island residents (Clout & Russell, 2006).

Figure 1. Map of Waiheke Island and its location to Auckland, New Zealand

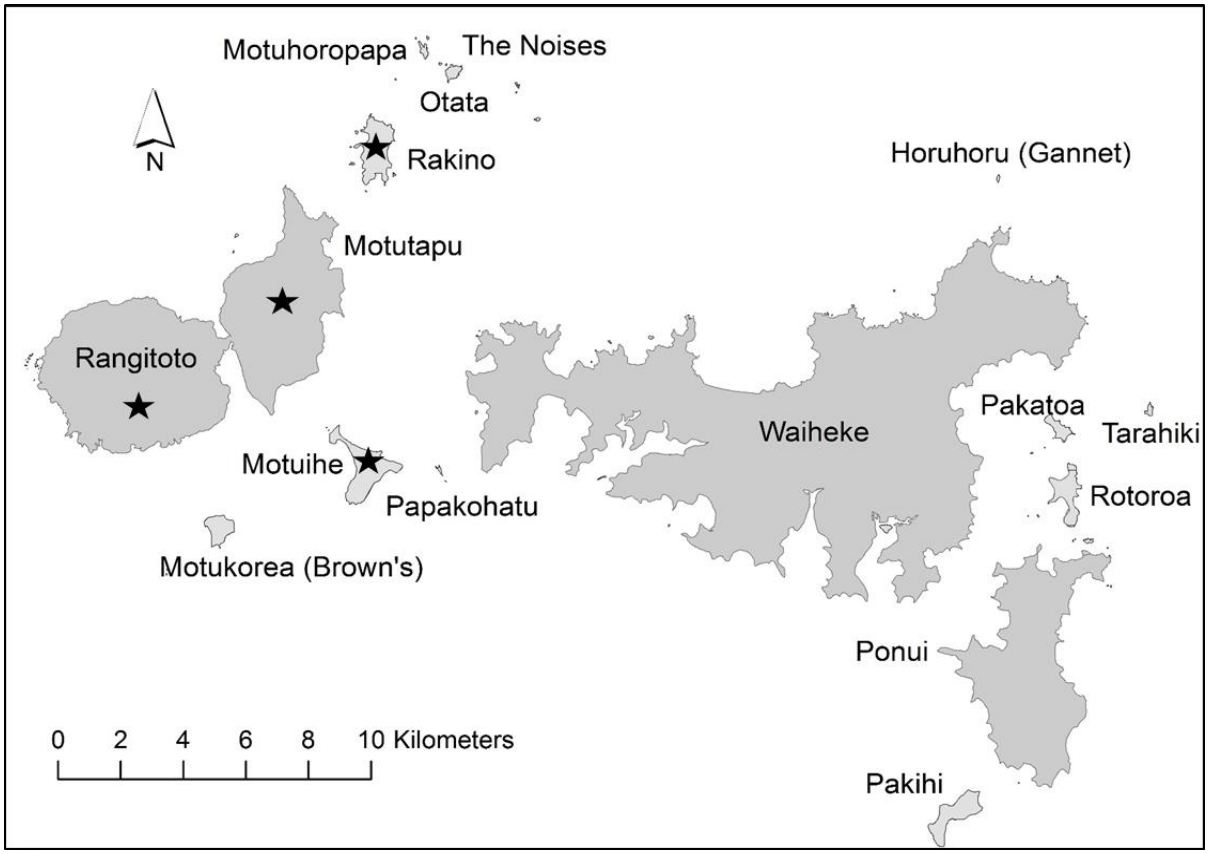


Figure 2. Map of Waiheke Island showing neighbouring islands that have had successful pest eradications

(✦ Represents islands that have had successful pest eradications)

2.6 Research paradigms, methodologies and methods

In an attempt to engage diverse stakeholders and the public and incorporate their social values and interests into pest management planning, I will employ multiple approaches involving multiple research disciplines and theories, and diverse data collection and analysis methods. Here, I provide a detailed explanation of the theoretical paradigms employed in this thesis. The paradigms provide a background for the choice of methods and tools used in investigating answers for the identified research questions (Fig. 2). A researcher's choice of research paradigm reflects their life philosophy (Mills, Bonner, & Francis, 2008). Research objectives and theoretical assumptions determine how data are analysed (Braun & Clarke, 2006). Disclosing the theoretical assumptions on which a study

is based is important to establish the validity, credibility, transferability and applicability of the findings (Clark, 1998; Creswell, 2003).

Paradigms are accepted perspectives of knowing and belief systems within disciplines and govern the development of knowledge. A research paradigm includes ontology (the nature of being and existence), epistemology (knowing or knowledge) and methodology (how knowledge is acquired) (Creswell, 2003). Methodology refers to the process of examining a specific research question. Examples of methodologies include experimental design, correlational studies, ethnography, phenomenology and case studies (O'Sullivan & Irby, 2014). Tools refer to instruments or methods used to acquire information about a study such as interviews, surveys, observation forms, cognitive tests and focus groups (O'Sullivan & Irby, 2014).

2.6.1 Philosophical paradigms

Philosophical paradigms consist of how truth is conceived and assumptions of how knowledge is acquired (Clark, 1998; Creswell, 2003). Conservation studies have often employed methods associated with positivist paradigms, which are restricted to quantitative data and do not adequately account for the social issues affecting conservation (Drew & Henne, 2006; Peterson et al., 2010). Multiple sources of data are required to incorporate social issues into conservation as the application of a single approach (i.e. quantitative or qualitative approaches only) has frequently led to unintended errors in setting conservation priorities (Game, et al., 2013). In response to the dilemma involved in choosing an appropriate method that represents and adequately incorporates social issues in conservation research, or specifically pest management research, I have attempted to employ a mixed method approach.

Pragmatism is based on the assumptions that meaning and truth can be found in situations, actions, consequences and from multiple sources (Creswell, 2003; Shaw, Connelly & Zecevic, 2010). Pragmatism embraces different ways of knowing and acquiring knowledge about a problem or situation. The focus is on the problem or resulting outcomes of actions and not particularly on the methods, hence, all approaches might be employed to

understand the problem. Researchers, therefore, are not committed to particular theoretical realities but make the choice of what procedures, methods or techniques are best suited to their research goals and objectives. Pragmatic research understands that reality is dynamic and favours a socially-driven process of solving problems through experimentation and adaptation of outcomes within a specific context. Pragmatism is embedded in the process of collaboration where participants jointly create knowledge and solutions to problems based on shared values, meanings and understandings (Popa, et al., 2015).

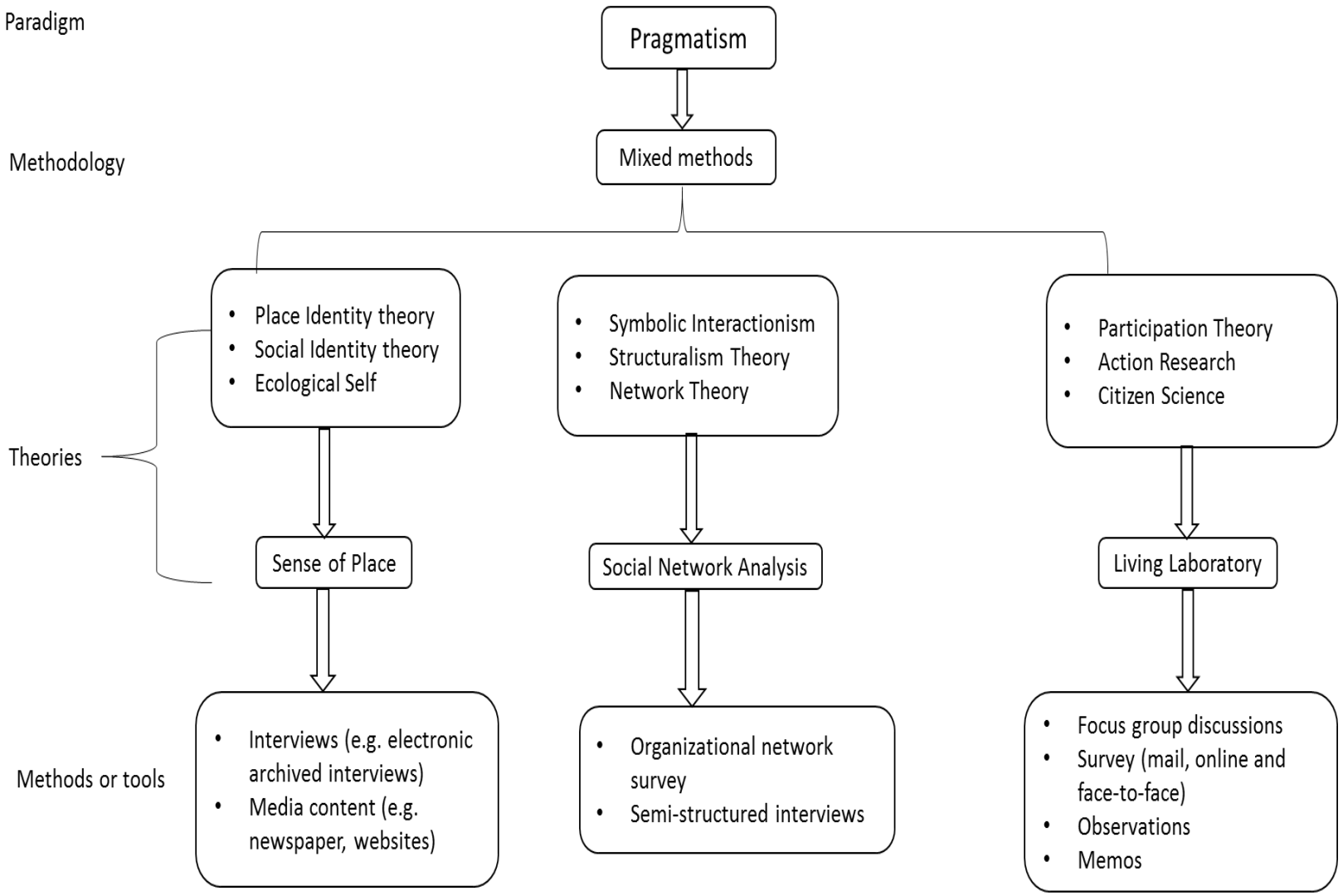


Figure 3. Theoretical framework for the study

2.6.2 Methodology

Pragmatism, a philosophical underpinning for mixed methods studies, extends beyond including only quantitative and qualitative methods in a study, to including multiple assumptions, data collection methods and analyses (Creswell, 2003). Mixed methods can be used to develop a robust information on an issue by combining multiple approaches, sources and analysis of data such as community survey, in-depth interviews, focus groups and media content analysis (Henderson, 2011; Takahashi & Selfa, 2015).

Qualitative approaches are vast and exploratory and include for example, descriptive qualitative approaches (Alavi, Irajpour, Giles, Rabiei, & Sarrafzadegan, 2013); ethnography, phenomenology, grounded theory, feminist, critical social theories (Creswell, 2003); qualitative content analysis and historical research (Hsieh & Shannon, 2005); action research, narrative analysis, thematic analysis and discourse analysis (Vaismoradi, Turunen, & Bondas, 2013). Information is collected through tools such as surveys, observations, field notes, journals, interviews, focus groups and document analysis (Bailey, 2008; O'Sullivan & Irby, 2014; Hsieh & Shannon, 2005).

Quantitative approaches in conservation research incorporating social issues generally involve collecting empirical data through surveys, questionnaires or observations. The tools are designed to test proposed hypotheses in order to obtain valid and generalisable results from the study, measure correlations between different variables, or assess the statistical significance of variables (Bettany-Saltikov & Whittaker, 2014). Mixed methods allow a study to be designed in a structured yet flexible, simultaneous or sequential manner (Creswell, 2003). Data can be triangulated to incorporate multiple data sources into a single research (Clark, 1998; Pooley et al., 2014).

2.6.3 Theories

In this study, I combined the theories of Sense of Place (see Chapter 3, 3.2), Social Network Analysis (see Chapter 4, 4.2) and Living Laboratory (see Chapter 5, 5.2), to seek answers to my research questions. However, these theories do not exist in isolation but originated from different disciplines, reflecting the multi-disciplinary nature of a mixed methods research incorporating social issues into conservation planning. In addition, these theories provide a background for understanding the social processes affecting people-conservation research. The theories of Place Identity, Social Identity and Ecological Self, make up the broader theories of Sense of Place; Symbolic Interactionism, Structuralism and Network theories inform the theory of Social Network; while Participatory Theory and its offshoots including Action Research and Citizen Science shape the Living Laboratory theory.

2.6.3.1 Place Identity theory

Place Identity theory was established by Proshansky, *et al*. (1983), who described it as a:

> "potpourri of memories, conceptions, interpretations, ideas and related feelings about specific physical settings as well as types of settings' (as cited in Dixon & Durrheim, 2002, p28).

The theory has been reconstructed from being just a mental structure limited to a head-and-mind experience, to "a collective construction, produced and modified through human dialogue that allows people to make sense of their locatedness" (Dixon & Durrheim, 2002, p40). Through conversations and interactions, people are able to establish their connections to a particular physical location, preserve their individual and collective distinctiveness and maintain a collective action (see Dixon & Durrheim, 2002).

2.6.3.2 Social Identity theory

The Social Identity theory was developed by Henri Tajfel in the 1970s and defined as:

> "Individual's knowledge that he belongs to certain social groups together with some emotional and value significance to him of this group membership" (as cited in Hogg, 2016, p6).

Social Identity theory explains how groups relate and cooperate within and between themselves; how they categorise, perceive and evaluate themselves, and how they are motivated to act as a group based on the beliefs of a shared identity that involuntarily influences how individuals behave (see Hogg, 2016).

2.6.3.3 Ecological Self

The theory of Ecological Self was proposed by Arne Naess and popularised within the field of environmental philosophy known as 'deep ecology'. Ecological Self explains that people react to defend or nurture other ecological organisms based on the experience or emotional relationship individuals have with them. The reactions are triggered by a sense of being one with nature or natural organisms; thus, people act as if they were directly affected by whatever affects the organisms (Bragg, 1996).

2.6.3.4 Symbolic Interactionism

Symbolic Interaction, a theory proposed by George Mead and named by Blumer, explains that people derive meanings from their experiences of objects or occurrences within their physical environments. It suggests that these meanings could vary from time to time as a result of personal perceptions. Since meanings could change with human perceptions, it is necessary to explore the meanings people hold for objects, or events around them in order to understand the behaviours, interactions and reactions of individuals or communities (see Aksan, Kısac, Aydın, & Demirbuken, 2009; Chamberlain-Salaun, Mills, & Usher, 2013).

2.6.3.5 Structuralism Theory

Structuralism Theory is rooted in several disciplines such as linguistics, philosophy, anthropology and sociology. Structuralism suggests that components of human culture are understood in terms of their relationships to a larger system or structure. Such structures provide a basis for understanding reality. Structures create a pattern for understanding relationships between individuals in a society (Harvey, 2012-16; Lounsbury & Ventresca, 2003).

2.6.3.6 Network Theory

Network Theory consists of various school of thoughts across a range of disciplines including statistical physics, economics, anthropology, computer science, mathematics, social psychology, communication and sociology. Network Theory originated with the use of graphs to represent relations between objects. The theory has evolved to include several theories including theories of self-interest, theories of social exchange or dependency, theories of mutual or collective interest, cognitive theories and theories of homophily; through which researchers investigate people's behaviour and actions by examining the pattern of relationships existing among them (Gravonetter, 1983; Katz, Lazer, Arrow, & Contractor, 2004).

2.6.3.7 Participation Theory

Participatory Theory suggests that people and local knowledge should be involved in all or different phases of research (Bonney et al., 2009). Citizen participation is the deliberate inclusion of populations that would otherwise be excluded in planning processes, giving these populations the opportunity to make decisions (Arnstein, 1969). Arnstein expounded the theory by categorising participation into different degrees on the "ladder of citizen participation" in ascending order of manipulation, therapy, informing, consultation, placation, partnership, delegated power and citizen control. The categorisation of participation has helped clarify assumptions beyond simply incorporating people's views into the planning process as a guarantee for participation. The essence of participation is in building partnerships and realising that all partners have their individual roles to play and should be responsible for working towards goals that have been jointly formulated (Buchy & Race, 2001).

2.6.3.8 Action Research

Action Research originated from the social and behavioural sciences to become an essential technique for engaging with communities to practically deal with issues they might have, by improving problematic situations and at the same time, producing knowledge. Action

Research provides an avenue to investigate the feasibility of relevant theories for solving problems. Multiple stakeholders, consultation, negotiation, collaboration and adaptation are essential elements of an action research project (Bergvall-Kåreborn & Ståhlbröst, 2009; Wilson, 2000).

2.6.3.9 Citizen Science

The theory is generally defined as "partnerships between those involved with science and the public in which authentic data are collected, shared and analysed" (Jordan, Crall, Gray, Phillips, & Mellor, 2015, p 208). Citizen Science is characterised by multiple disciplines, collaboration across different fields of expertise and engagement of the public, who are mostly non-scientists, in scientific studies to generate novel scientific information (Miller-Rushing, Primack, & Bonney, 2012).

2.7 Research design

The methodological design used in this thesis follows a sequential mixed methods research design involving five successive phases of a series of qualitative and quantitative data (Fig. 3). The sequence of the design is denoted below (see Creswell, 2003; Johnson & Onwuegbuzie, 2004).

QUAL (qualitative) → QUANT (quantitative) → qual → QUAL → QUANT

While the five phases were executed separately, I developed each successive phase based on the results of the preceding phase, after which I triangulated the findings for a deeper and richer understanding of the context of the study. In the subsequent chapters, the way various components of the design were implemented will be explained in detail.

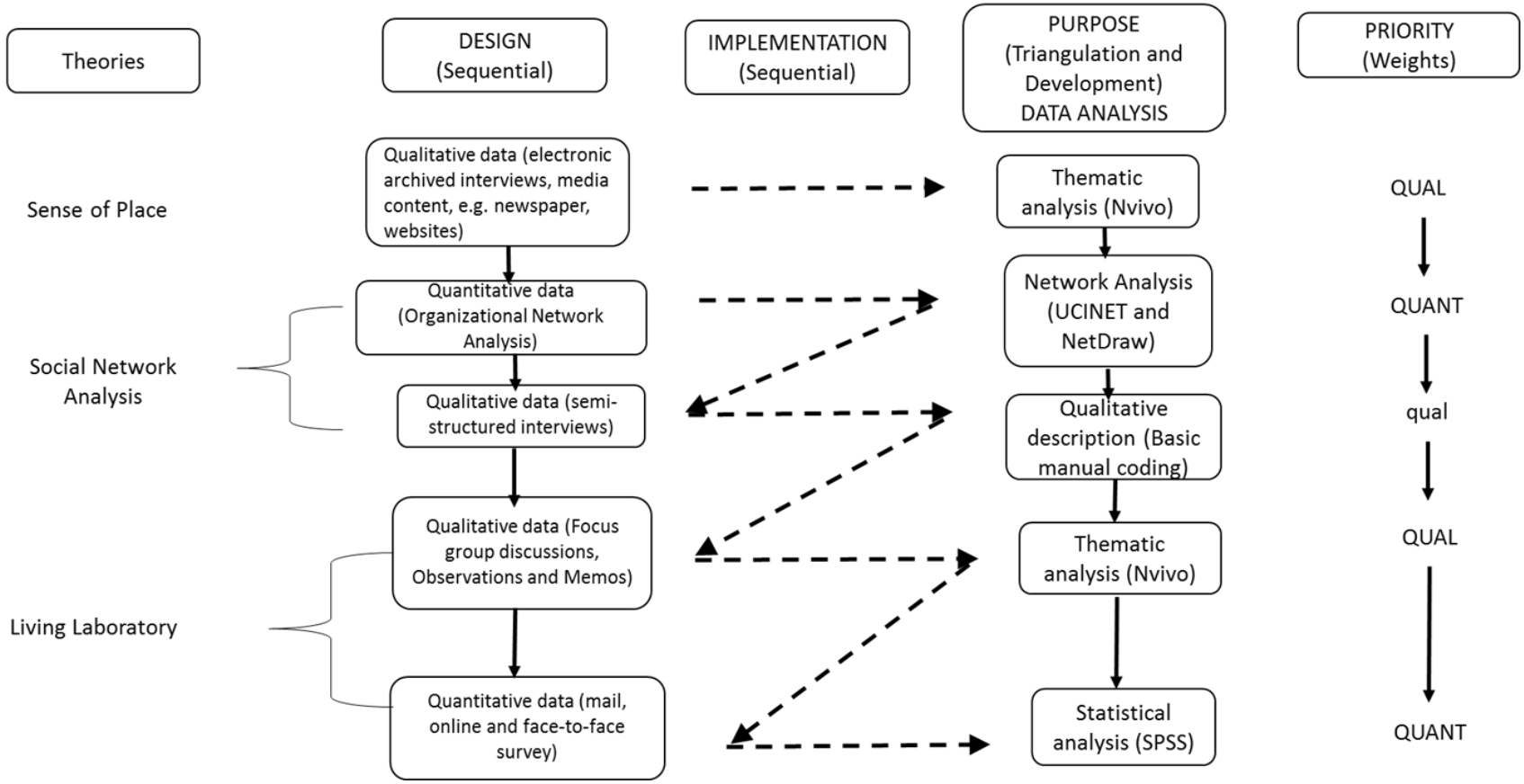


Figure 4. Sequential research design for the study

(The line ⟶ represents "sequential"; - - → represents "sequence of implementation"; QUAL denotes "qualitative"; QUANT denotes "quantitative"; Uppercase denotes "higher priority or weight"; Lowercase denotes "lower priority")

2.8 Theoretical sampling and data collection

In this research, I obtained qualitative data through focus groups, semi-structured interviews, observations, documents and newspaper reports while quantitative data were obtained through survey questions (Bringer, 2006; Hsieh & Shannon, 2005). Qualitative data aided in the development of hypotheses for quantitative measures and in determining the items in the survey instrument I designed for collecting quantitative data. A purposive sampling method was used to select participants for which the inclusion criteria involved engagement in any form of conservation activities on Waiheke Island; for example, planning, coordinating, volunteering, or managing. Since sample size was not a requirement of qualitative analysis, data collection stopped when there was no new information added (Creswell, 2003).

For quantitative sampling, I employed a stratified random sampling method (see Kandola, Banner, O'Keefe-McCarthy, & Jassal, 2014) in order to gain a representative sample from the population of eligible residents on the island. Inclusion criteria for participants involved being resident on the island, being above 18 years of age and able to respond to the survey questions. Different survey options, including online and paper formats, were made available to enable respondents to choose their preference (Graefe, Mowen, Covelli, & Trauntvein, 2011). A snowball sampling method (see Chapter 4, section 4.3) was employed for the social network survey.

2.9 Preliminary statistical assessments

Validity assessments determine whether findings are credible and represent the measures used, and reliability measures the consistency and repeatability of findings (Hesse-Biber & Dupuis, 2000). I established validity for the quantitative measures (i.e. survey) in this study by pilot testing questions with about 5% (42 independent respondents) of the expected sample size (800 respondents) before distribution to the intended respondents. However, responses from these independent respondents were not included in the final survey. Survey questions were further re-structured after relevant input from the pilot test. Reliability was

tested using Cronbach's alpha test in Statistical Package for the Social Sciences (SPSS) (Bettany-Saltikov & Whittaker, 2014). The criteria of validity and reliability do not apply to qualitative measures as the theoretical assumptions differed. However, to ensure rigour and credibility within the study, I demonstrated the principles of truth, value, consistency, neutrality and applicability (see Lincoln & Guba, 1985). For example, the philosophical positions stated earlier provided a basis for the methods and design of the study. Thus, the analyses of data were conducted with these philosophical paradigms in mind to ensure that results were reflective of assumed perspectives or worldviews; participants' perspectives were clearly represented and contrasted to reflect a pragmatist stance, and data were triangulated using different methods to produce a more comprehensive outcome (see Hsieh & Shannon, 2005; Noble & Smith, 2015).

I obtained ethics approval from the Auckland University of Technology Ethics Committee (AUTEC) as required when interacting with or engaging human participants in research (see Appendix B). I also obtained approval from the Māori Research Facilitation Committee of Auckland University of Technology (AUT) as a requirement for engaging tangata whenua with regard to mana whenua for the place (see Appendix C). Mana whenua refers to the customary authority or rights exercised by an iwi (Māori tribes) or hapu (sub-tribes or clan) in an identified area of Aotearoa New Zealand (Auckland Council, 2016). Māori is the indigenous population of New Zealand. This study was designed to also engage iwi and hapu who are indigenous residents on Waiheke Island, the study area. Therefore, in line with the procedures for conducting research with Māori, consultations with iwi representatives began at the early stage of the research (Health Research Council of New Zealand, 2010; Putaiora Writing Group, 2010). Those iwi representatives, who were not resident on the island but had mana whenua for Waiheke Island, provided support and practical guidance on engaging with iwi and hapu in the study area.

2.10 Data analysis

I employed descriptive and statistical methods to analyse quantitative data within SPSS software. A preliminary step in analysing qualitative data is a transcription of recorded data. While the procedure of transcribing seems tedious, boring and time-consuming, the

process allows researchers time to become familiar with their data (Bailey, 2008; Braun & Clarke, 2006; Brooks, 2010) and provides an opportunity to deliberately think about the data. I made use of transcription software, Express Scribe, in combination with a foot-pedal, to facilitate the process of transcribing data obtained for this study. While I had to make the decisions on what and how to code and analyse the data (for example, Braun & Clarke, 2006; Mangabeira, Lee, & Fielding, 2004), Nvivo, a Computer Assisted Qualitative Data Analysis software (CAQDAS) was employed to facilitate the cyclic and repeated process of data retrieval, coding and analysis to develop relevant themes (Bringer, 2006; Humble, 2012). In addition, I used thematic analysis to analyse data through a constructive, inductive process of refining transcribed data into meaningful categories (Hsieh & Shannon, 2005).

Thematic analysis involves the continuous reading of texts to identify meaningful patterns relating to the study objectives within the texts and group similar patterns into themes (Lawrence & Tar, 2013; Masters, Carlson, & Pfadt, 2006; Vaismoradi et al., 2013). A theme is a concise description of the essence of interactions within a text (Braun & Clarke, 2006) and reflect participants' statements (Bringer, 2006). The outcome of a thematic analysis is a compelling and comprehensive but highly-structured report which can be generalised. Interpretations also need to respond to and be relevant to research questions (Braun & Clarke 2006). Finally, I made use of a thematic map to illustrate the themes I developed and how they interacted with one another (see Chapter 3, Fig. 5).

2.11 Summary

Implementing conservation goals can be very complex and affected by human choices. Invasive species management, a controversial subject in conservation, can be further complicated by public opposition, especially on inhabited islands. By taking into consideration the views and perspectives of the public and other stakeholders and actively engaging them when planning for a project, implementation plans are likely to be readily adopted. Understanding how to effectively engage stakeholders and the public requires a multi-disciplinary approach and the combination of subjective, non-scientific approaches with objective, empirical methods. Pragmatism paradigm and mixed methods approach are

well-suited to assist in achieving the aim of integrating social variables with pest management issues.

In this thesis, I will engage diverse stakeholders in defining their pest management objectives. I will use insights gained from the engagement process to determine the readiness and possibility of residents to achieve a pest-free inhabited island. The insights gained will have relevance to the predator-free concept in New Zealand, but also a more global problem of engaging communities in conservation initiatives.

Chapter 3

Sense of place

To achieve my first research objective, I will identify community values and examine the role of Sense of Place in implementing conservation goals in this chapter.

Objective 1: Identify community values and the role of Sense of Place in facilitating or hindering the implementation of conservation goals in isolated communities

To achieve this objective, I will examine publicly available information about residents on Waiheke Island. Using one-on-one interviews and thematic analysis, I will assess and classify values of residents within the community. I will also review documents and give case studies of instances where the locals' sense of place seemed to have been undermined. The themes that were developed from the interviews revealed evidence of a sense of place within the community. The documents reviewed and case studies given highlighted the implications of an undermined sense of place. The result suggested a relationship between values and the adoption of conservation plans. Therefore, this chapter further highlights the necessity of identifying and incorporating the values and perspectives of locals and other stakeholders during the initial stages of developing a conservation plan.

3.1 Abstract

Successful pest management requires a deep understanding of the social processes at work, especially on inhabited islands. In this chapter, I review responses where the locals' sense of place appeared to have been undermined and finally reflect on the implications of the findings for planning pest management strategies. *Place identity* and *place attachment* were two overarching themes with other distinct but related sub-themes. Four case studies also revealed the community's responses to threats to their place identity, attachment, dependence and satisfaction. I propose that Sense of Place could be used to evoke engagement or detachment of communities when pest management is planned. I conclude that Sense of Place and other social processes within a community should be identified and incorporated into pest management plans.

3.2 Introduction

In order to encourage the survival of native species and restore native biodiversity, the management, early detection or prevention of invasive species is necessary (Simberloff et al., 2013). In New Zealand, invasive mammals have been successfully removed from >100 islands (Towns et al., 2013). However, most of these removals have been conducted on uninhabited islands or areas. Attempts made to eradicate invasive species from inhabited islands have sometimes been met with considerable resistance (e.g. Varnham et al., 2011), even though the proposals might improve the inhabitants' health and wellbeing. For example, on Great Barrier Island, polarised views on pest management options have resulted in the creation of factions within the community. These views might have resulted from a gradual change in the community's ethic of resource exploitation to the conservation of natural resources. Community members have been exposed to different conflicting information, which have generated different attitudes to conservation and slowed down progress in reaching an agreement about practical management options for ship rat (*Rattus rattus*) and feral cat *(Felis catus)* populations. An assessment of the community's views on conservation might have clarified and resolved public opposition to the pest management methods proposed (Ogden & Gilbert, 2011).

When considering the question of why pest management projects fail, the focus is often on failure to plan appropriately, or set relevant measurable goals. Seldom is there an attempt to understand the social climate of the location in which scientists or managers would be operating. In pest management projects, many communities may not feel engaged (Towns et al., 2011), perhaps as a result of simplistic assumptions about community attitudes by pest managers. Likely assumptions include equating communities with small spatial units, having a similar social structure, or having shared norms (Agrawal & Gibson, 1999). While assumptions about a diversity of values might not be totally true of some communities (Uzzell & Pol, 2002), there is a need to understand how to identify significant predictors of the adoption or rejection of pest management strategies on inhabited islands.

The Sense of Place is a social construct that might be useful in understanding or explaining public opposition to pest management strategies. Sense of Place generally describes a multi-dimensional construct in environmental psychology involving place identity (relationship between a place and self), place attachment (emotional connection to a place), place dependence (positive assessment of how a place meets an individual's needs) (Jorgensen & Stedman, 2001) and place satisfaction (the degree of likeness or perceived quality of a physical environment) (Stedman, 2003). This construct can also be considered to include cognitive (identity), affective (attachment) and conative (dependence) variables. These variables are determinants of desirable environmental behaviour (Jorgensen & Stedman, 2006). For example, place identity was found to be useful in shaping environmentally friendly behaviours (Carrus, Bonaiuto, & Bonnes, 2005). Hence, these variables may enable environmental planners to understand an individual’s sense of place and their implications for acceptance of strategies addressing particular environmental issues; in this case, pest management strategies. A person builds his or her sense of place from the *personal* meanings, beliefs, emotional attachments, experiences and symbols associated with various aspects of a particular location. These, along with several social factors, are intertwined to produce certain environmental attitudes and behaviour in people (Uzzell & Pol, 2002). However, the uniqueness of the environment in which these social processes take place needs to be understood in order to adequately interpret and understand them. Great Barrier Island has a social climate similar to Waiheke Island, with residents

holding different values for conservation. Having an understanding of these values might provide an avenue for productive dialogue and conflict resolution in pest management.

Within the Auckland region, pests such as invasive mammals are directly or indirectly implicated in threats to over 150 endangered species of animals and plants (Auckland Council, 2007). Impacts of invasive species can include damage to crops and native forests, predation or extinction of native species, modification of ecosystems and costs to human health (Simberloff, 2010). Waiheke, along with the other Gulf Islands such as Rakino and Great Barrier, is very vulnerable to accidental pest introduction (Auckland Council, 2007). While noting the significant measures already undertaken on Waiheke, the island is being considered for an additional, site-led, pest management programme, which will involve a further investigation into community support and consultation prior to the implementation (Auckland Council, 2007).

The Sense of Place is a promising theory when included in planning the management of natural resources and in the practice of community-based conservation (Jorgensen & Stedman, 2006; Waylen, Fischer, McGowan, & Milner-Gulland, 2013). But misconceptions about community have often been employed in these fields. Such misconceptions often lead to difficulties in engaging a community in activities such as in pest control, especially when there are many land ownership titles, several governmental organisations and heterogeneous views on conservation (Ogden & Gilbert, 2009). Project Island Song is an example of a successful community-led pest management programme. The vision to restore the native flora and fauna in Ipipiri, the Eastern Bay of Islands in New Zealand was shared by different stakeholders including government, NGOs, local organisations, landowners and Patukeha and Ngati Kuta (the resident Māori hapu or clan) in the area including the islands. There was also support from research institutions and other interest groups. A combination of aerial eradication of rodent pests and ground trapping of stoats led to a pest-free status for the island. Efforts are continuing to keep the islands free of rats and stoats swimming from the mainland (Towns et al., 2013).

In contrast, despite involving the community of Tristan da Cunha (an island of about 270 residents located between South America and Africa) at every stage of planning for rodent

eradication on the island, there was little enthusiasm for the project. While locals favoured pest control around their settlement and farmlands; perceived risks of aerial application of brodifacoum, the proposed method of eradication, was viewed as higher than any benefits from eradication could offer (Varnham et al., 2011). Similarly, conflicting and varying attitudes and beliefs about introduced buffalo were found among non-indigenous managers and indigenous Aboriginal groups in Australia (Bowman & Robinson, 2002). Divergences also arise when animals are seen as both pests and valued as a resource (Nugent & Fraser, 1993). Stakeholders perceive and value animals and their management differently as a result of their cultural preferences (Peterson et al., 2010), or when such pest animals and humans inhabit a common habitat (Lee, 2005). There is thus no simple answer to the question: what is a pest? Despite these inherent conflicts, most research on pest management focus on the technological aspects of management and not on the actual places (Bonaiuto, Carrus, Martorella, & Bonnes, 2002) or people for whom the tools and techniques are being developed. It is, therefore, necessary to explore the ways in which people experience their location as individuals, conceive places and give meaning to experiences. These meanings, when identified and valued might indicate how people behave (Shamsuddin & Ujang, 2008), and consequently, whether they will adopt pest management strategies.

In this chapter, I report on evidence of a Sense of Place within Waiheke Island and how Sense of Place could facilitate or hinder pest management in isolated communities. The outcomes provide a foundation for exploring the interconnections and complexities of people and pest in pest management research.

3.3 Methods

I used conversations and observations within the community to understand the views, values and interests of local island residents. As there appeared to be limited published literature on Waiheke Island such as academic journal articles or books; I supplemented available information with informal publications or grey literature such as local newspaper publications, working papers and documents by Waiheke Local Board, community blogs and posts and related materials. I reviewed and analysed these documents to understand

public responses to proposed developmental projects within the community at the time of this research, and uncovered reasons for opposition to such projects. The analysis and outcomes of these documents served as a basis for understanding public opposition to planning conservation and pest management strategies.

Two sets of data were collected and analysed in this chapter. The first set was interview data collected by the local newspaper, the *Waiheke Marketplace*. The *Waiheke Marketplace*, a local newspaper on Waiheke, is delivered weekly and free-of-charge to most households on the island. The newspaper has a segment titled "*Look who's talking*" which presents the experiences and views of random island residents through responses to structured interview questions including the following:

1. What do you like best about Waiheke?
2. What do you like least and how can we fix it?
3. Where's your favourite place to eat here?
4. And who does the best coffee?
5. Who is the Kiwi you admire most - and why?
6. If I was Auckland's mayor I'd...
7. When I've got a free few hours, I like to...
8. The spot on Waiheke I recommend to tourists is…
9. My two cents' worth is….

Respondents' comments and answers relating to values, views and interests were of particular interest and the focus of my analysis. The interviews are publicly available information and I accessed them from the online archive of the newspaper. Since interview data are publicly available, internal university ethical approval was not required; but, I was granted permission by the Syndicate department of the local newspaper for further use. This method of data collection has some limitations as it might not be totally representative of the resident population on the island. However, the aim of this study was to identify factors that were likely to influence the adoption of pest management strategies and did not necessarily seek to achieve that through using a statistically representative sample.

I analysed a total of 76 interviews conducted between February 2014 and August 2015. Demographic data (i.e. age and occupation) of respondents were analysed to provide context to this study and were derived from the interview transcripts, while gender was deduced from a photograph attached to each published interview. Since the sample size is not an essence of analysis in qualitative research; I stopped retrieving interview when no new information could be determined from the analysis (Alavi et al., 2013). Interview data collected were entered into Nvivo 10 (Bringer, 2006), a data management software and thematic analysis (Braun & Clarke, 2006) was done simultaneously with data collection. The texts in the interview responses were read several times to understand the content and meaning of the words used. When responses have similar contents, they were classified into a code (Creswell, 2003). For example, responses containing "beautiful landscapes, terrains, hills, beaches, vegetation" were coded as "sheer natural beauty" while responses describing the island as having an atmosphere that favoured child training was coded as "child-training support". *Place identity* and *Place attachment* were set as initial reference codes in Nvivo (and later as major themes). Subsequent codes were derived from the responses and categorised under one of the reference codes. When a set of codes were similar, they were categorised into a theme. For example, codes such as "child-training support", "community spirit", "general support" and "unity" suggest a type of 'us', 'we' or 'community' feeling and was categorised as the theme "*collective*". This process was repeatedly carried out until all the texts were coded and categorised into themes. A thematic network demonstrating the presence of a sense of place in island residents was developed as an outcome of the analysis. The thematic network or map illustrates how each code is related to a theme and how each theme is related to the reference codes *Place identity* and *Place attachment.* A total of two overarching themes, four main themes and 14 sub-themes were developed. Secondly, using the same process described above, I carried out further analysis to seek likely factors that could negatively influence a sense of place and possible consequences for such. Two overarching themes, four main themes and 17 sub-themes were developed.

The second set of data was obtained through a systematic review and analysis of grey literature and online documents to identify challenges to the Waiheke's community's sense of place. The aim was to anticipate the nature of responses to new pest management initiatives through understanding public responses to proposed developmental projects in

the community. Documents used were those exploring major events during the period of this research and were associated with de-amalgamation, proposals to construct a marina and a proposed marine reserve. Keywords were pre-determined through observations and personal interactions with residents. These keywords which included “Waiheke independence”, “marina”, “marine reserve”, “de-amalgamation”, “essentially Waiheke” were entered into Google search engine, Waiheke Gulf News and Waiheke Marketplace digital search function and filtered for its relevance and content. I present four case studies to illustrate instances where the locals’ sense of place seemed to have been undermined and the consequences of such.

3.4 Results

The respondents were mostly females (58%), with predominantly people in the 45 – 54 years age group (17%) and a predominance of people who characterised themselves as community workers (32%). Other occupational categories identified were artists, entrepreneurs, civil workers and volunteers.

3.4.1 Sense of Place on Waiheke Island

Based on the interviews, I identified two overarching themes relating to a sense of place, four main themes and fourteen sub-themes, which I developed as a thematic map (Fig. 5). *Place identity* and *Place attachment* were the two overarching themes.

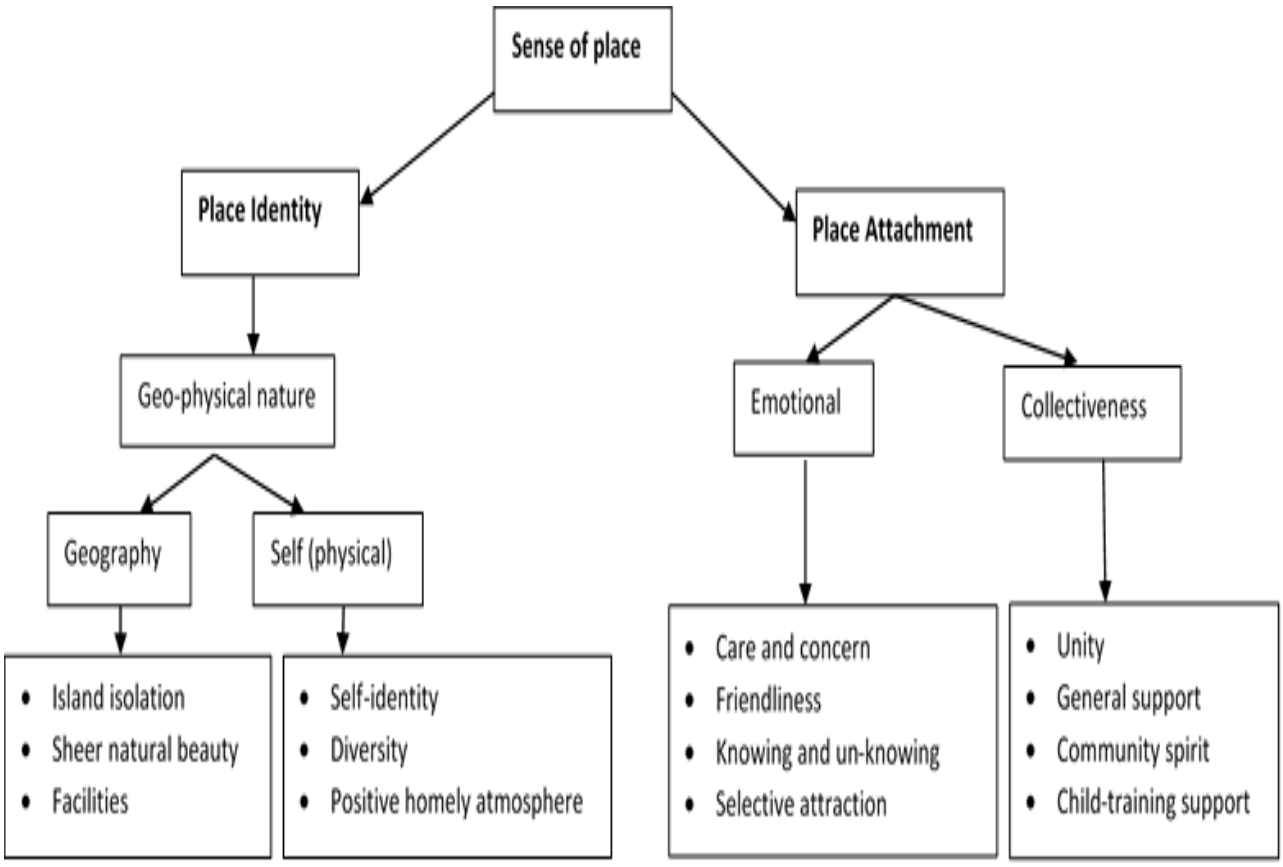


Figure 5. Thematic network for Sense of Place in Waiheke Island

(An illustration of the thematic map developed from the main themes identified from the interviews)

Place identity consisted *Geography* and *Self (Physical)* and included references to a sense of uniqueness resulting from geographical features or a strong identity of physical self in relation to the whole community. The relevant themes (written in *italics*) and corresponding examples are presented for further explanation as follows:

Island isolation - a positive characteristics of the island and what makes it unique, as in:

"I like our island isolation. We're far enough away from the hassle and bustle of Auckland but close enough to jump on the ferry and nip across to the city to visit grandchildren when we're able to" (Int214).

Sheer natural beauty - expressions that portrayed the beautiful, natural scenery, landscapes and terrains, as in:

"I like the mild climate, beautiful beaches and tranquil bush areas with its abundance of bird life….it's the green of the land and the blue of the sea" (Int814).

Self-identity - a freedom to be who you are or wanted to be, as in:

"I feel like I've found myself and I've found my identity with the support of the Waiheke community" (Int221), and

"Waiheke is a place where you can be yourself and you are accepted" (Int261).

Diversity - explored the varying mix of people, philosophies and profession, as in:

"I like that there is no particular socio-economic group on the island which makes for a diverse and tolerant community and also the amazing diversity of interesting occupations and expertise" (Int170).

Place attachment described an individual's perspectives or emotional connection to a spatial setting. It is illustrated in *Emotional* and *Collectiveness*.

Emotional illustrated a feeling, a sense, a knowing, an experience that creates an attachment to Waiheke and the people. Sub-themes are as follows:

Care and concern - represented the attention and interest people showed towards each other's welfare, as in:

"If someone's in need, the residents of the island go out of their way to provide assistance financially, physically and emotionally. It has always made me proud to be a Waihekean, to come from a background associated with such caring people" (Int253).

Friendliness - people in the community are favourable to one another, as in:

"I like the friendliness of the community. My wife and I lived next door to people [overseas] for years and didn't even know their names" (Int515)

Knowing and unknowing - expressions of knowledge (knowing) or the lack of it (unknowing) of the community as paradise, as having opportunities, or recognising the values. It is a comparative sense of being unique which could result from visiting other places, as in:

"We are so very different from Auckland. You probably only know that when you live here. We really don't know how lucky we are. This is a majestic place to live (Int278)

Selective attraction - a belief that the island is selective of those who settle there, that is, one has to be nice, friendly and warm to live there, as in:

"The people – I think Waiheke attracts a special breed of people. The ones who live here are really caring and compassionate" (Int214), and

"Definitely the community seems to attract really interesting people with kind hearts and a zest for life…there's a high concentration of creative people - artists, musicians and actors" (Int615).

Collectiveness, as opposed to individual feelings, is evident in an 'us' or 'we' or 'community' type of feeling. It consists of the following themes:

General support - here, the people in the community are supportive of each other, as in:

"The Waiheke community is simply the best. It astounds me how generous and supportive most people are. And it's not often you can put such an eclectic group of people together and have everyone get along – mostly" (Int179).

Community spirit - expressions portraying the bond that exists among island residents which make them feel relaxed and united with one another, like a family, as in:

"I love the strong sense of community and shared stories, the fact that we can pull together in so many ways and that lifts us up as a collective" (Int120).

Child-training support - described the island assuming a "village" responsibility, as the best place to raise children, as in:

"The wonderful community – it's such a great place to raise children. "It takes a village to raise a child" is truly exemplified on Waiheke" (Int307).

3.4.2 Perceived challenges to the community's sense of place

I reviewed documents from various sources to identify and explore challenges to Waiheke's sense of place. Four case studies are presented below:

Marina - halting impending distortion to an island's sense of satisfaction

In June 2013, a notification for public submissions was made by Waiheke Marinas Ltd for a 160-berth recreational boating marina and 55 car parking spaces next to the island's passenger ferry terminal. This was later modified to 112 berths, 39 car parks, along with other changes as a response to the opposition from Direction Matiatia (www.directionmatiatia.co.nz/). Direction Matiatia argued predominantly that the marina proposal encourages the conversion of public spaces to private use by wealthy individuals, which undermines the significance of the island's distinct character and natural environment. Of particular importance was the issue of biosecurity involving concern that boats might act as vectors for marine organism threats (e.g. *Ascidiacea* spp; sea squirts). Waiheke Local Board and island residents opposed to the proposal, banded together to raise more than $400,000 for legal fees and hiring experts to refute the proposal at the Environment Court, which presided over the hearings. Two-and-a-half years later, after lengthy hearings and proceedings, the Environment Court ruled against the proposed marina on the basis that the sustainable management of the island's natural and physical resources would not be promoted nor achieved. The slogan adopted by the group opposing the marina, "Love Matiatia: Let it be" reflects a sense of satisfaction with the place just as Uzzell and Pol (2002) stated that an environment that fits the aspiration of its inhabitants produces high levels of satisfaction.

De-amalgamation - driven by place attachment to make a case for independence

"Our Waiheke" is a community group on Waiheke Island that aimed for a Waiheke Council independent of Auckland Council on the basis that the services provided by Auckland Council greatly differed from Waiheke's aspiration. There was also concern that the decision-makers external to the island were trying to impose regional policies and

procedures on the island. Our Waiheke has already made their intentions official by submitting an application to the Local Government Commission. According to statistics accessed from Our Waiheke's website (www.ourwaiheke.co.nz/) on 2nd March 2016, 14 public consultation meetings have been held, 1,861 petitions have been signed and 64.8% of Waihekeans were positive about de-amalgamation. The present attempt at de-amalgamation was not the first. In 1989, Waiheke County Council was amalgamated with Auckland City Council through an amended Local Government Amendment Act. It was followed by an unsuccessful request to de-amalgamate from the Auckland City Council in 1991. Other campaigns for de-amalgamation were attempted in 2000, 2004 and then again in 2010. In 2012, amendments were made to local legislation which allowed communities with fewer than 10,000 residents to propose a change in local governance structure (as opposed to the previous 10,000 population mark). This amendment gave rise to the Our Waiheke campaign in 2014. The process is on-going and awaits a decision by the Local Government Commission.

Essentially Waiheke - re-asserting the island's unique identity

Following public consultation and community workshops over three years, a development strategy for Waiheke Island was produced in 2000. This document, *Essentially Waiheke* (Auckland Council, 2015), represents the views and voices of local residents and is built on the core values of environmental protection, economic development and employment; strong communities and protecting and enhancing Waiheke's character. Its purpose was to "establish a community-approved framework for Waiheke's development and to signpost the directions towards a sustainable future, where opportunities for development are facilitated and the island's community values and outstanding natural environment are respected and nurtured" (Auckland Council, 2015, *Essentially Waiheke* document, p 5). Although not an official document, it was adopted by Auckland City Council and recognised as a guiding document to represent Waiheke's voice and identity. An increasing population of temporary residents and visitors, along with greater diversity in skills and expectations have added pressure to develop the island beyond its village character. In response to this changes, *Essentially Waiheke* is currently being refreshed. A public review was commissioned at the end of 2015 by Waiheke Local Board for this purpose; however,

the uniqueness of Waiheke would be kept to accommodate growth without compromising or losing its special identity.

Marine Reserve - enhancing the island's unique dependence on preservation and protection

In March 2015, it was agreed by the Local Board to survey opinions of local residents on the establishment of a network of new marine protected areas linking the islands in the Waiheke area. Prior to the agreement, there have been arguments for and against the idea. Two months later, a survey response of 1,999 submissions revealed that 67% registered voters and 54% off-island ratepayers supported a marine reserve. Their support was inspired by the protection and preservation of marine life and ecosystems (which are natural and historic features), and restoration and improvement of marine life and biodiversity of the Hauraki Gulf, which is a suite of islands and marine reserves. However, opposition was also raised based on fear of losing fishing rights of local residents and recreational users and influx and attraction of more visitors to the reserve. The survey results also indicated that while there was support for the networks' establishment, the location of marine reserves was unclear. Following the result, the Local Board proposed 12 new marine reserves around Waiheke and neighbouring islands. The locations proposed have resulted in continuing tensions among marine reserve supporters and opponents (www.shapeauckland.co.nz/consultations/waiheke-marine-protection-survey/).

3.4.3 Factors likely to affect a community's sense of place

In addition to exploring for evidence of a Sense of Place in Waiheke Island, I also sought ways in which a Sense of Place could be influenced (see Fig. 6). Two overarching themes, four main themes and 17 sub-themes were developed.

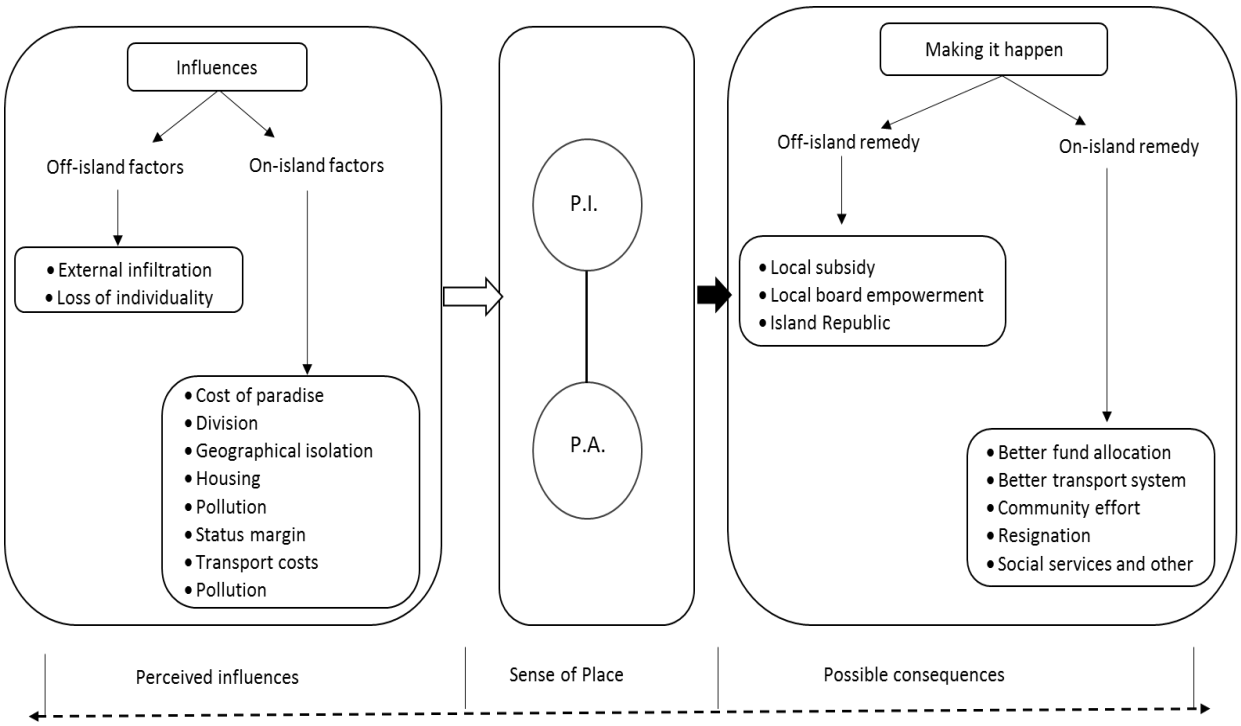


Figure 6. Factors influencing a Sense of Place and possible consequences

(P.I. – Place identity; P.A. – Place attachment. Components of P.I. and P.A. are included here as illustrated in Figure 5 above. White arrow reads "perceived influences on" while black arrow reads "lead to [these] possible consequences)

Influences

This theme generally described what island residents liked least about the island. It consisted of *off-island factors* and *on-island factors. On-island factors* included in-group and out-group influences; for example, "cost of paradise"; "division"; "geographical isolation"; "housing"; "pollution"; "status margin" and "transport costs".

On-island factors

Cost of paradise – refers to the high costs involved in living on Waiheke Island, as in:

"The extra expense of living on an island and lack of year-round jobs is a tough one for people" (Int179).

Division – despite the community feel, there were instances of division resulting from gossip, diverging views on issues, or strong personal opinions, as in:

"The way contentious issues seem to divide the island into us and them – and the inability for each side to see the validity of the others' point of view. Each of us could take a step back, listen with compassion and admit we might be wrong" (Int170).

Geographical isolation – referred to the inherent state of being an island and distant from neighbouring cities, as in:

"We are a small and isolated community" (Int121)

Housing – referred to increase in costs of housing and decrease in availability of properties, as in"

"I don't like the housing situation. Rents are pretty high and a lot of the houses on Waiheke remain empty for the majority of the year…It would be nice to see affordable rents as well as those empty houses becoming available…" (Int315).

Pollution – referred to undesirable state of the natural environment, e.g., unclean beaches, due to unwanted substances, as in:

"The polluted stream at Little Oneroa. It's kind of embarrassing to have to inform a visitor to our beautiful island, who is watching their child gleefully splashing around in it that they really shouldn't be" (Int615).

Status margin – described the difference in, for example, economic status and power, between the rich and the not-so-rich, as in:

"The amount of power all the rich people have. It seems if you have money on the island, you can do what you like" (Int214) and,

"In the background, things like the environment are controlled by money" (Int514).

Transport costs – described challenges generally related to transport; for example; parking, traffic congestion, expensive ferry fares, lack of footpaths and driving habits of people on the island, as in:

"I think we could do with a fewer cars. We could take the lead from other island communities and place a greater emphasis on walking, cycling and public transport and restrict the number of cars on the island" (Int311).

Off-island factors

External infiltration – because island residents were being treated as part of a city (Auckland); there was perceived influence and control from the people 'outside' who did not live on the island nor knew what their needs might be; as in:

"Decisions being made by people who don't live here for the people who do…domination by Auckland city" (Int914).

Loss of individuality - references to the island beginning to lose its uniqueness, control, individuality, characteristics and what makes it different from (Auckland) the city; as in:

"The island has started to lose its individuality. There's not so much that sets it apart [from Auckland] anymore. It's becoming a rich suburb of Auckland….It's being seen as part of urban Auckland Council when I don't think we are. Waiheke is Waiheke – it's different. If people don't like that, they shouldn't move here. There's no easy solution" (Int014).

Making it happen

This theme presented suggestions on how perceived challenges can be addressed on the island. These expectations from the community included a desire for independence, subsidies and discounts for island residents and better management of rate-payers money. It included *off-island remedy* and *on-island remedy*.

Off-island remedy

Local subsidy - some respondents suggested having different rates for visitors and residents on the island, discounts and subsidies for services; as in:

"I've always believed there should be a local price rate and charge tourists premium rate" (Int214).

Local board empowerment - Waiheke local board could do more if they were empowered, funded, given more freedom to make decisions that were relevant to and affected the local people. Waiheke Local Board representatives seemed to occupy a position that enabled them to better understand the needs of the locals; as in:

"Give local boards much more autonomy to make appropriate local decisions…empower local boards to be more effective in the management and development of their communities" (Int714).

Island republic – represented a desire to become independent, a republic and detached from Auckland; a desire to be treated as separate from Auckland and have a local governance; as in:

"... Auckland Council. The day we joined big brother was a massive mistake. Bring back the local council. We used to have a voice and now we just aren't heard. Give Waiheke its independence" (Int415).

On-island remedy – this theme included "better fund allocation"; "better transport system"; "community effort"; "resignation"; "social services and other".

Better fund allocation – this theme described one of the ways of improving cost challenges on the island, as in:

"One of the things I believe could be improved on the island is where the money is spent. For instance, what's the use in spending large amounts of taxpayers' money on redoing roads that have been done five times over the last two years? … I'd like to see our money being spent on more environmentally conscious projects" (Int250).

Better transport system – a theme which described possible responses to transport challenges, as in:

"Create a community focused [transport] option that is effective and inexpensive and create more bike paths" (Int220).

Community effort – described a call for more concerted effort on the part of everyone in the community to make things better, as in:

"The first thing I'd do is create a human design team to come out with solutions that are at the heart of people's needs and to think outside the square" (Int027) and,

"We could do more to support each other and work together to build an economically viable yet socially responsible place to live" (Int121).

Resignation – described expressions suggesting that nothing could be done or locals had no idea how to address certain challenges, as in:

"We can't afford wider roads so I suppose we can't do anything about it" (Int150).

"We can't fix it. It is what it [referring to transport challenges] is" (Int814)

Social services and other – this theme described, in general, ways to improve general conditions of residents on the island, as in:

"We need to take a long-term view of protecting our unique coastal and marine environments for future generations" (Int715) and;

"More job opportunities are needed to keep people on Waiheke and paying someone a living wage is really important" (Int415)

The results presented in this chapter do not seek to portray a statistically representative sample, but to present a spectrum of individual responses that could identify factors likely to influence and produce variation in the preference and uptake of pest management strategies.

3.5 Discussion

Rapid development may be disruptive especially to people who have developed a significant meaning for the places where they live (Shamsuddin & Ujang, 2008). A similar perception may apply on Waiheke Island, where previously, the island, had very few residents, minimal development and commuting to Auckland (the closest city) was time-consuming. Waiheke attracted people who wanted inexpensive land near Auckland and

who didn't mind the extra hours on the initial ferry service. Over the years, an increasing number of people bought land, not just for farming and fishing but for holiday purposes. As the island became increasingly accessible with improved and faster ferry connections, more tourists and residents were attracted. Consequently, the resident population's social, economic and environmental structures are experiencing significant changes (Waiheke Local Board, 2014), which some have viewed as incompatible with the island's character. Natural attractions such as beaches, rocky headlands, rolling landscape, bush-covered slopes and walkways and regional parks are fundamental for promoting the uniqueness of the island. But now, that clean and green image is under threat with pockets of weeds and animal pests degrading parts of the island.

3.5.1 Understanding the community's values and uniqueness

By understanding the values, views and uniqueness of a group of island residents, from their own perspectives, a window has been opened into how they view their world. *Place identity* and *Place attachment* were two main themes that stood out from the responses. Elements of *place identity* were evident in an appreciation of nature and self - either oneself or others while *place attachment* was rooted in an emotional experience of others or the collective. The diverse themes resulting from an assessment of values suggested that people living in a bounded geographical location do not necessarily have the same interests and concerns even though they might share similar experiences. While assuming that such people are not *one* social system (Agrawal & Gibson, 1999), the dissimilarities were what contributed to uniqueness and allowed for enduring connections. Where locals have felt their overall sense of place threatened, a strong reaction can be invoked. These reactions included a demand for better management of rate-payers' money; seeking subsidies and discounts for island residents and even campaigning for an independent government. These demands resulted from a desire to be heard and to govern their own affairs. In the eyes of a non-local, these reactions could be seen as regressive and negative. However, reactions to threat are coping strategies to increase the level of identity and even attachment within a community (Bonaiuto et al., 2002). As long as a place identity remains credible, locals will always seek to maintain it (Stedman, 2003). Also, when a place is able to meet the functional needs of the population better than a known

alternative, then there exists a sense of place attachment (Shamsuddin & Ujang, 2008) and a subsequent need to strengthen it. As in the case study of marine reserves, a group of local residents similarly opposed the protection of a natural park in Sardinia Island, Italy, for fear of unwanted external interference in their daily use of natural resources (Bonaiuto et al., 2002). Support for establishing a network of marine reserves ties closely with concepts of regional empowerment (Carrus et al., 2005) and also a need to enhance an environment's place dependence in relation to alternative settings (Jorgensen & Stedman, 2001).

Waiheke might not be viewed as a homogeneous community because individuals have differing opinions, views and interests on specific issues. These diverging views might have contributed to in-group conflicts among residents and out-group conflicts between residents and external individuals or organisations. However, it seemed that most respondents do value different aspects of their physical and emotional environment for what has been described - scenic, safe, special, shared - and it is a collection of all these values and attributes that potentially distinguish Waiheke from all other locations around it. In effect, Waihekeans preferred to be identified, understood and appreciated for these diverse and unique values, without their values being undermined.

3.5.2 Sense of Place for developing pest management strategies

In the context of pest management, does a Sense of Place have any implications for the uptake or adoption of pest management strategies? The results presented in this chapter suggest that communities can value biodiversity, a result of flourishing native species or the absence of interfering invasive species. However, pest management strategies that challenge or undermine an individual's sense of place will likely be rejected or strongly opposed. As residents and invasive species inhabit the same island, these findings reinforce the need to consult with the public before planning a programme and understand the needs of the community, as well as incorporate their social interests and values into project objectives and conservation initiatives. Strategies such as the creation of reserves, translocations, or even a ban on walking dogs at designated areas might mean a loss of freedom for some people, and the use of poisons in order to control pests such as rodents might be perceived to impact on nature which is a strong element of place identity.

Conversely, Sense of Place could be employed to generate a positive outcome for both managers and communities. For example, individuals with a strong attachment to a place will likely oppose environmental degradation (Vorkinn & Riese, 2001). In the light of this, if pest managers stopped dismissing or undermining local values and interests and take a genuine interest in understanding the underlying social processes at work in a locality, they might well be on their way to getting more community support for sustainable projects. Also, strategies that have minimal or no impact on the values that contribute to the community's sense of place would likely be adopted without strong opposition. Crafting messages and setting goals that closely align with the community's sense of place might also increase engagement and community buy-in for pest management projects, a need identified for example by Simberloff et al. (2013). In sum, because values are the foundation for what creates their community, the way these values are approached could either evoke engagement or result in detachment depending on whether these values appear threatened and whether the community members feel in control of their destiny.

3.6 Conclusions

In this chapter, I explored the concept of Sense of Place in Waiheke Island in the context of pest management aimed at developing sustainable management strategies. I also reviewed responses to having a community's sense of place undermined or challenged. I found that firstly, using interviewees' own words is crucial and necessary to project and protect their views and values. Second, any long-term strategy involving pest management should account for a Sense of Place and other social processes at play between individuals in a community, among community members as a collective and through their relationship to their environment. Lastly, Waihekeans are likely to support a pest management strategy but only if they are deeply involved in all aspects of planning and implementation. They need to believe they are responsible for making major decisions and not feel forced to comply by external governmental agencies.

Chapter 4

Social networks

To achieve my second research objective, I will map and interpret the network structure of conservation actors in diverse conservation organisations:

Objective 2: Understand local governance among multiple conservation actors through their social networks

To achieve this objective, I employ social network analysis to map the relationships between conservation actors on Waiheke Island. Conservation actors are a group or type of stakeholders. In this chapter (Chapter 4) and in subsequent chapters (Chapters 5 – 7), I refer to conservation actors as individuals who are already engaged in managing pests, while I refer to island or community residents, who are another group of stakeholders, as the general public within Waiheke Island. I aim to understand how conservation actors relate to each other by (1) identifying individuals and organizations involved in or affected by the management of invasive species on Waiheke Island (2) determining the structure or pattern of their network and (3) examining how the structure can initiate new or improve existing collaborative efforts. My study suggests that there exists a strong interest in local conservation issues, and an ability to mobilize other interested individuals for group action. Conservation groups did not form a cohesive system as the network seemed to indicate low reciprocity and weak links; and thus, not well-suited for collective action.

I conclude that in working towards achieving a predator-free New Zealand and a pest-free Waiheke, there needs to be an understanding of the network structure of stakeholders involved. Such understanding could assist in gaining valuable insight into how to initiate local support, increase the chances of collaboration and prevent public opposition during the implementation of a management plan for invasive species. In addition, there needs to be an evaluation of what might trigger potential collaborations – mandated, funded or shared interest – and whether a central administrative leadership might be best suited to coordinating the local networks on Waiheke Island.

4.1 Abstract

Identifying stakeholders and analysing the pattern of relationships among them, is an important first step towards collaborating with individuals and groups for collective action on conservation issues. The way that stakeholders communicate or work together can be understood by interpreting the structure of the network in which stakeholders operate. Within the context of invasive species management, this chapter attempted to identify stakeholders and conservation actors, determine and analyse the structure of their relationships through a Social Network Analysis and examine how network structure could aid collaborative efforts towards invasive species management. Organisational Network Analysis, a web-based program, was employed to assist with the collection of network data in this chapter. The response rate was 47% of the 103 contacts made and thirty-five conservation groups were identified. Results revealed low density, high non-reciprocity, and high centrality among a few stakeholders in the network suggesting a non-cohesive network. We identify how influential stakeholders could carefully initiate and strengthen collaborations that might lead to collective invasive species management action after a thorough examination of mandated, funded or shared interest relationships.

4.2 Introduction

The practice of conservation has gone beyond solely focusing on ecological factors and outcomes, to including the ways social issues have ecological effects (Crain et al., 2014). If social and ecological approaches are to be combined, understanding interactions among individuals living in a specific ecological setting is necessary (Cooper, Dickinson, Phillips, & Bonney, 2007). Understanding these interactions involves describing the social networks in which these individuals operate.

A social network is an individual's social interactions and personal relationships. Social network analysis (SNA) aims to measure, map and analyse social relationships and interactions among individuals, groups or organisations (Blanchet & James, 2012). Social networks provide information, support and resources for people and also determine the extent of influence and impact people can exert on an individual or collective basis. The use

of SNA has extended across diverse fields of community studies (Dawson, 2008), business, health, psychology, economics, sociology (Freeman, Borgatti, & White, 1991) and natural resource management (Bodin & Crona, 2009; Bodin, Crona, & Ernstson, 2006). Social network analysis has been employed to understand the position of actors within a fishery and forest conservation network and how they contributed to the functioning of the socio-ecological system (Bodin et al., 2006). Also, the advice network structure of farmers in Ghana was examined through SNA to determine how knowledge on sustainable agroforestry practices can best be transferred among farmers (Isaac, Erickson, Quashie-Sam, & Timmer, 2007). Crona & Bodin (2006) also mapped the distribution and exchange of ecological knowledge among fisher group networks. In pest management, SNA has been used to examine how information relating to species selection and pest control flowed within a network of farmers (Isaac et al., 2007). The ability of wildlife management organizations to influence policies relating to harvesting rights has also been attributed to the structure of their networks (Meek, 2013).

Understanding network characteristics could increase collective action and successful natural resource management, as the structure of the network could aid in uncovering subtleties in underlying social variables within a community such as pattern and flow of information (Prell et al., 2009; Waylen et al., 2013). For example, contrary to popular assumptions that farmers within a village actively dispersed information through their social relationships with other farmers within their vicinity, SNA revealed that information flowed through very few farmers with whom they occasionally communicated (Conley & Udry, 2001). On the other hand, a lack of consideration or a limited understanding of these social variables could hinder the implementation of conservation plans (Mills et al., 2014). Social processes such as collective action, consensus, or the resolution of conservation problems could be better facilitated if connections among all parties involved were effective and sustained. Assumptions made about who the leaders, actors or stakeholders are in a network are often incorrect. For example, a group of fishermen in southern USA were thought to be influential by external governmental agencies, but a closer analysis of leaders within their network revealed another group of fishermen as being most influential (Maiolo & Johnson, 1989).

Stakeholders have the capability to understand and interpret their social environment and consequently, make informed decisions for the improvement of challenges posed by intervening social processes (Aguirre-Muñoz et al., 2011). Identifying stakeholders is a necessary step in planning conservation actions (Mills et al., 2014) and when building capacity for community-based natural resource management (Mountjoy, Seekamp, Davenport, & Whiles, 2013). Stakeholders are individuals or organisations who have an interest in and may influence a project's outcomes and the system's resilience both through their interactions and through individual or collective actions. They include resource users, scientists, planners, conservation organisations, government institutions and local communities - actors who might be brought together to enhance successful participation and engagement (Selman, 2004). Beyond being able to identify stakeholders, SNA enables the identification of influential actors whose position in the network indicates their capability to make and drive favourable decisions on a long-term, sustainable basis (Sobczak et al., 2013).

Initiatives for managing invasive species are controversial because they usually involve killing animals (Simberloff, 2010). Some initiatives have failed to proceed due to social and organisational constraints and because different stakeholders were not identified and involved in all stages of the process (Blackie et al., 2014). In Lord Howe Island, Australia, for example, social challenges have been threatening rodent eradication plans despite the existence of adequate technical expertise and resources (Slezak, 2016). These challenges included confusion among locals resulting from a deliberate circulation of misinformation by a few vocal detractors about rodent eradication; fear about subsequent negative effects of aerial drops of poison cereal baits on the island; suspicion of government's motivations and distrust of mainlanders. It appeared that while the Lord Howe Island board initiated the project, residents were not all aware of and included in the process; not all locals were "inform[ed] about the need for an eradication, how it would be undertaken, when it was likely" (Wilkinson & Priddel 2011, pp 512), but were subsequently surveyed for their opinions. The late survey then made incorporating concerns difficult because "such modifications might jeopardise the success of the operation" (Wilkinson & Priddel 2011, pp 513). For a resident population of 350 people, it might be useful to understand the structure of their social network and identify individuals who might be influential in

bringing about public support for such an eradication. Similarly, in Great Barrier Island, New Zealand, factions within the community have developed from a failure to recognise power-structures and network issues and as a result, progress on rat and feral cat eradication has been slowed due to the strong public opposition (Ogden & Gilbert, 2011). Such situations may not have arisen had there been an understanding of social networks, who were influential individuals within the networks and how these individuals might provide an avenue for productive dialogue and conflict resolution. Hence, understanding how groups respond to conflict, manage resources and form collaborations could be more beneficial than simply assuming collaboration as the ultimate solution to complex management challenges (Schoon, York, Sullivan, & Baggio, 2016).

In response to the predator-free New Zealand concept (Russell et al., 2015) and as a contribution to examining the probability of a pest-free Waiheke (Waiheke Local Board, 2014), I attempt to identify the capacity for collective action against invasive mammals by individuals and organisations on Waiheke Island. My study makes a first attempt to identify and understand the utility of SNA for pest management by studying the pattern of interactions among individuals and organisations on Waiheke Island, northern New Zealand, within the context of a potential "pest-free Waiheke" program. Hence, this study adds a fresh perspective to a controversial subject in conservation.

4.3 Methods

The network structure of individual or group relationships can be analysed and described with network statistics. Dekker and Hendriks (2008), Borgatti (2005) and Prell et al. (2009) have summarised various statistics used to characterise social networks. While there are several network characteristics, a network analyst is not bound to explore all of them (Butts, 2008); hence, the choice of measurement depends on the objectives of a study. In this chapter, the relevant measures were reciprocity, density and centrality.

First, I compiled a list of conservation groups from a publicly available source (namely, Waiheke Resources Trust, n.d.). Auckland Council, a territorial local government authority, also provided me with a supplementary list of conservation groups on the island.

Second, I employed a snowball method (Valente & Pumpuang, 2006) to increase the original sample and enhance representativeness. Conservation groups identified were further contacted and asked to provide other groups or members whom they thought might be involved in conservation and activities related to invasive species on the island. The final list represented individual conservation actors and those affiliated with different governmental and non-governmental organisations (NGOs) (Table 2). Conservation actors, also referred to as nodes, are individuals, groups or organisations who act in favour of conservation or are actively involved in the management of natural resources (Bonnell & Koontz, 2007). In a social network, with a focal node or individual, other nodes that are directly connected to that focal node are referred to as "alters" (Borgatti, 2005).

4.3.1 Survey design and data collection

The survey, "Connecting Conservation Stakeholders" (CCS) (Appendix A) was designed through a web-based network data collection programme, Organisational Network Analysis (ONA). The CCS survey included three relationship questions. The first, "which of these people do you identify with in the course of your conservation activities?" was followed by a list of names. The names given here constituted the "general network". Participants were then further instructed to "select the people they have worked with in the course of their conservation activities". These names were then filtered off the original list of names and constituted an individual's "work-network". Responses to the third question "which of these people did you communicate with during the previous 12 months, about conservation-related issues?" constituted an individual's "communication-network". This process was automated in ONA based on an individual's response and minimises incomplete responses due to poor recall of alters from memory (Butts 2008). However, with a growing number of alters, the process might become tedious and complex for the participant, especially when questions on frequency of communication with each identified alter was introduced. Such complexity in participants' responses was perceived and consequently, questions asked on the frequency of communication were discarded. In addition, limiting questions to several core essentials would still provide sufficient data about network structure and function (Mountjoy et al., 2013; Kastelle & Steen, 2010).

To ensure clarity, ease of navigation in ONA and that the CCS survey met the objectives of the study, the CCS survey was tested and reviewed by a panel of experts before being sent to the participants. For confidentiality purposes, the names of the individuals and organisations have been replaced with letters and shaded boxes in the figures. I invited participants to fill out the survey based on informed consent. I sent 103 email requests for participation in the CCS survey and received 49 survey responses representing a 47% response rate. Within the ONA platform, I activated the "snowball" function which allowed participants to provide names and contact details of other individuals who were not on the original list. These names were automatically included on the original list and were visible to other participants. Twenty-six names were added and invited to fill out the survey but only a few complied. Since participants reported on individuals on the list whether those individuals responded to the survey or not, a total of 129 individuals (nodes) were included in the analysis.

4.3.2 Data analysis and visualisation

Network data collected through ONA was imported directly into UCINET 6.0 (Borgatti, Everett, & Freeman, 2002) in order to calculate the reciprocity, density and centrality measures of the network. The centrality measures included degree, betweenness, closeness and eigenvector centrality. The structure of the network was visualised in NetDraw 2.148 (Borgatti, 2002). In addition to relationships among all the members of the network based on who they identified with in the first instance, I also analysed two major relationship networks - work network and communication network - as each relationship constituted a separate network.

Demographic data of participants were analysed and compared with recent population census data for the location (Statistics New Zealand, 2013), to provide context to this study. Demographic characteristics of the participants were categorised into gender, age group, educational qualification and ethnic group. Conservation groups (actors) that participants identified with were also categorised into territorial local authority, national government, NGOs and local community categories. The local community category was further

classified into conservation trusts, neighbourhood groups, landscape-specific groups and general groups. The categories were based on the objectives of the organisations and the activities they were engaged in at the time of this research. I also wanted to determine whether the interpretations matched that of conservation actors' role predicted from the network. Thus, I interviewed each highest scoring (central) stakeholder after I explained their position within the network with the aid of network maps (the names of other network members were not mentioned).

4.4 Results

Survey participants were classified into male and female gender, four educational categories, three ethnic identities and five age groups. Most participants were female (58%), had high levels of educational qualification as postgraduates (48%), were New Zealand Europeans (85%) and were more than 50 years old (35%).

In addition, thirty-five conservation groups operating on the island were identified. These groups were categorised into four major organisations: Territorial Local Authority, National Government, NGOs and Local Community (Table 2). The roles of each organisation and an example were also given.

Table 2. Categories of conservation groups identified, their roles and an example of each group within the pest management network on Waiheke Island.

Organisation		Roles	Example
Territorial Local Authority		Local governmental organisations responsible for developing regional plans and strategies; for example, Regional Pest Management Plan (RPMP). Some participants are affiliated as contractors	Auckland Council
National Government		Government agencies operating various programmes to protect and restore the natural environment and resources and provide opportunities for people to engage with them They operate in the context of national government strategies	Department of Conservation
NGOs		Independent national or international NGOs established to protect and conserve the environment and address related issues. Participants are affiliated by providing support through funding, subscription to publications, newsletters or signing petitions	Greenpeace
Local Community		Community-led organisations established to address a specific range of issues. Volunteers are the backbone of their operations	
	Conservation Trust	A legal entity registered with Charities Services in New Zealand as a not-for-profit organisation. They are established to foster environmental sustainability through developing various community-based conservation initiatives. They are funded through grants, contracts, sponsorship, donations and sales. They mostly co-ordinate community events, administer resources, seek and manage funds and volunteers and form joint-partnerships with other local groups to provide support	Waiheke Resources Trust
	Neighbourhood groups	Operate in specific suburb within the community	Rocky Bay rat-busters
	Landscape-specific groups	Operate in specific environment e.g. a valley, a reserve	Friends of McKenzie Reserve
	General groups	Engage in various forms of activities covering different areas in the community e.g. gardening	Homegrown Waiheke

4.4.1 Network structure of conservation actors

Network densities for general, work and communication networks, which were 0.073, 0.029 and 0.041 respectively, indicated that connections within the networks were sparse. Reciprocity of the general, work and communication networks were 0.157, 0.152 and 0.157 respectively, which indicated that exchange of ties within the three networks was very low and not any different. A comparison of centrality measures revealed that there were no significant differences between the general and work network as the central or key conservation actors for both networks were very similar. Hence, to avoid redundancy, only the general and communication networks are compared and presented in this chapter.

The highest centrality measures (degree, betweenness, closeness and eigenvector) tended to be distributed among a few conservation actors for both the general and communication networks (see Figs. 7 – 9), for the order in which conservation actors were distributed by centrality measures and thus influenced the network). In the communication network, the positions of the conservation actors (A, B, C, D, E and F) with the highest centrality measures were extended from the network circle and ordered from highest to lowest (with the exception of 7d), for illustration purposes. Isolates (nodes with no connections) were deleted from the network after performing the network analysis to enhance visual representation of results. Participants A, B and C exerted a strong power and influence in the communication network due to the positions they occupied. These three participants also formed a clique (Fig. 7d) within the network as they all shared direct ties with one another.

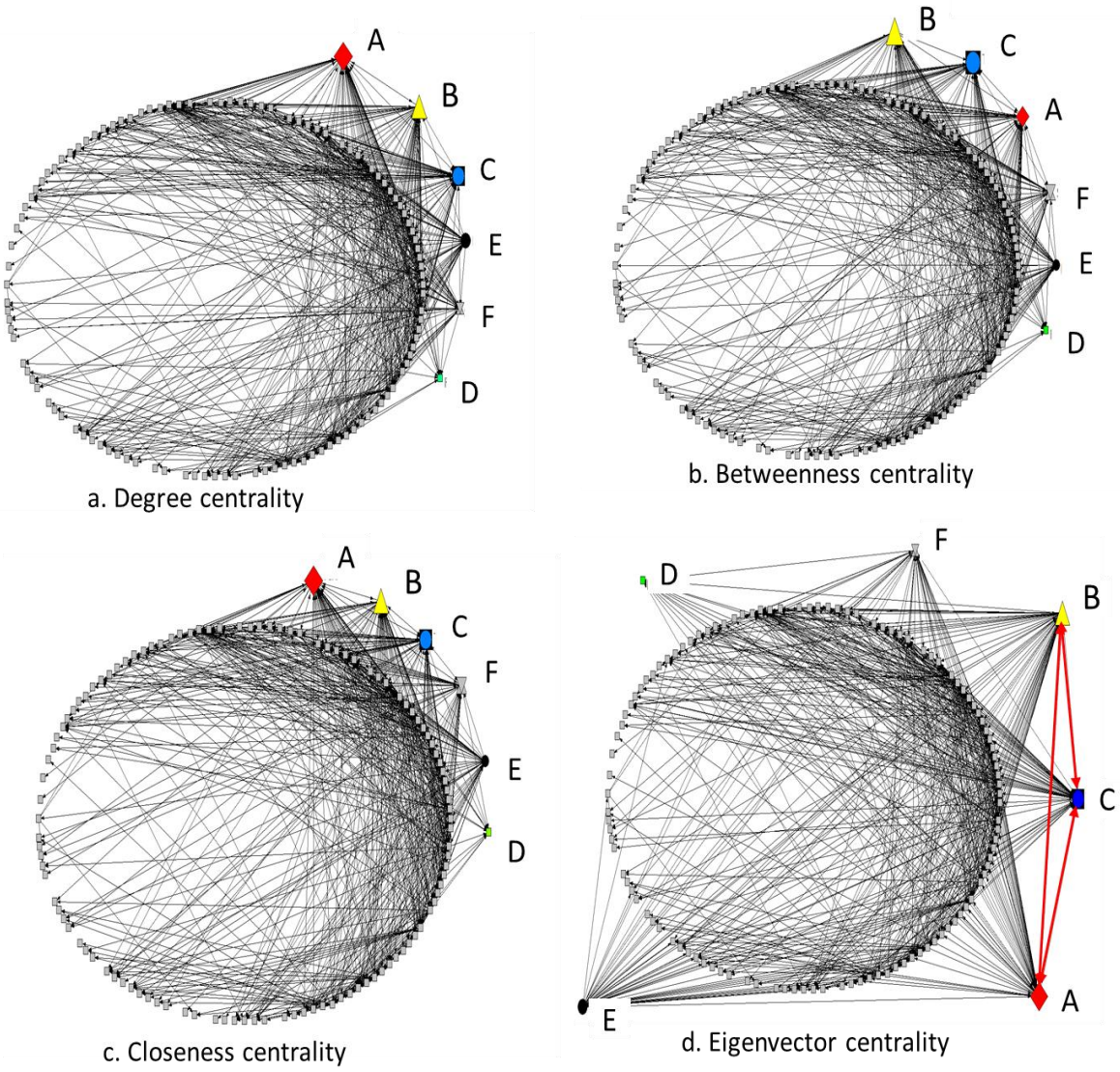
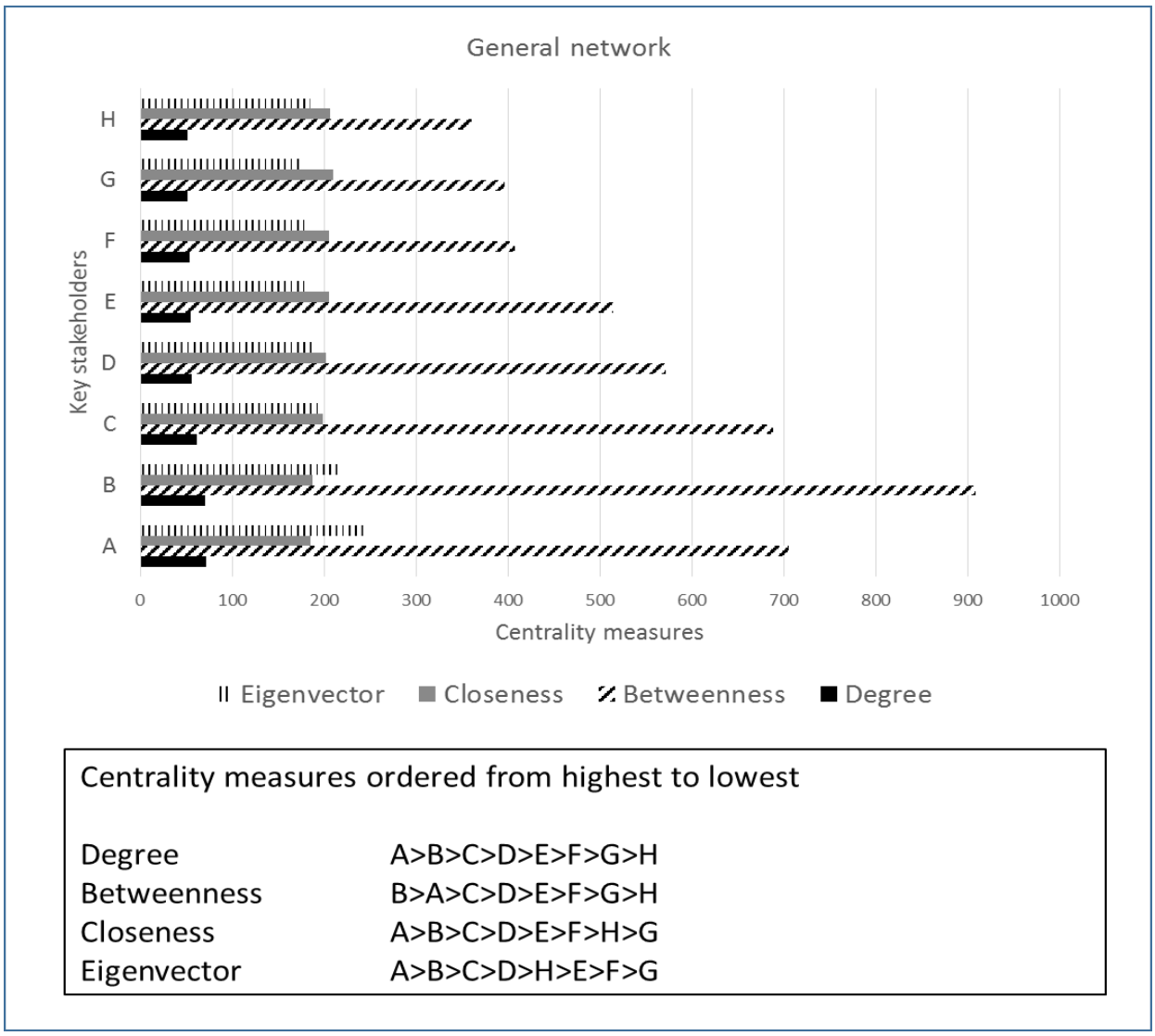


Figure 7. Centrality measures for highest scoring (central) conservation actors in communication network

(Centrality is ordered from highest to lowest stakeholder in 7a – c; "7d" illustrates with red arrows how conservation actors A, B and C formed a clique as they all shared a direct tie with one another)

General and communication networks indicated that participant A had the highest number of connections (degree) within both networks, was closest to the networks and could quickly spread information (closeness) or rally resources and support for the other members. Participant A also had the highest power and influence (eigenvector) and connected with other conservation actors who scored high on centrality measures within both networks. Participant B however and not A, was in the best position to form links with unconnected or non-communicating individuals (betweenness) within both networks. However, participant A was capable of initiating new connections with local conservation actors as well as with crucial external industry players (e.g. Auckland Council and Department of Conservation) and was also capable of resolving conflict within dissenting groups. Participant D's position in the general network was slightly higher compared to the lower position D occupied in the communication network. A reverse trend could, however, be seen for participants G and H who both occupied a lower position in the general network but a higher position in the communication network.

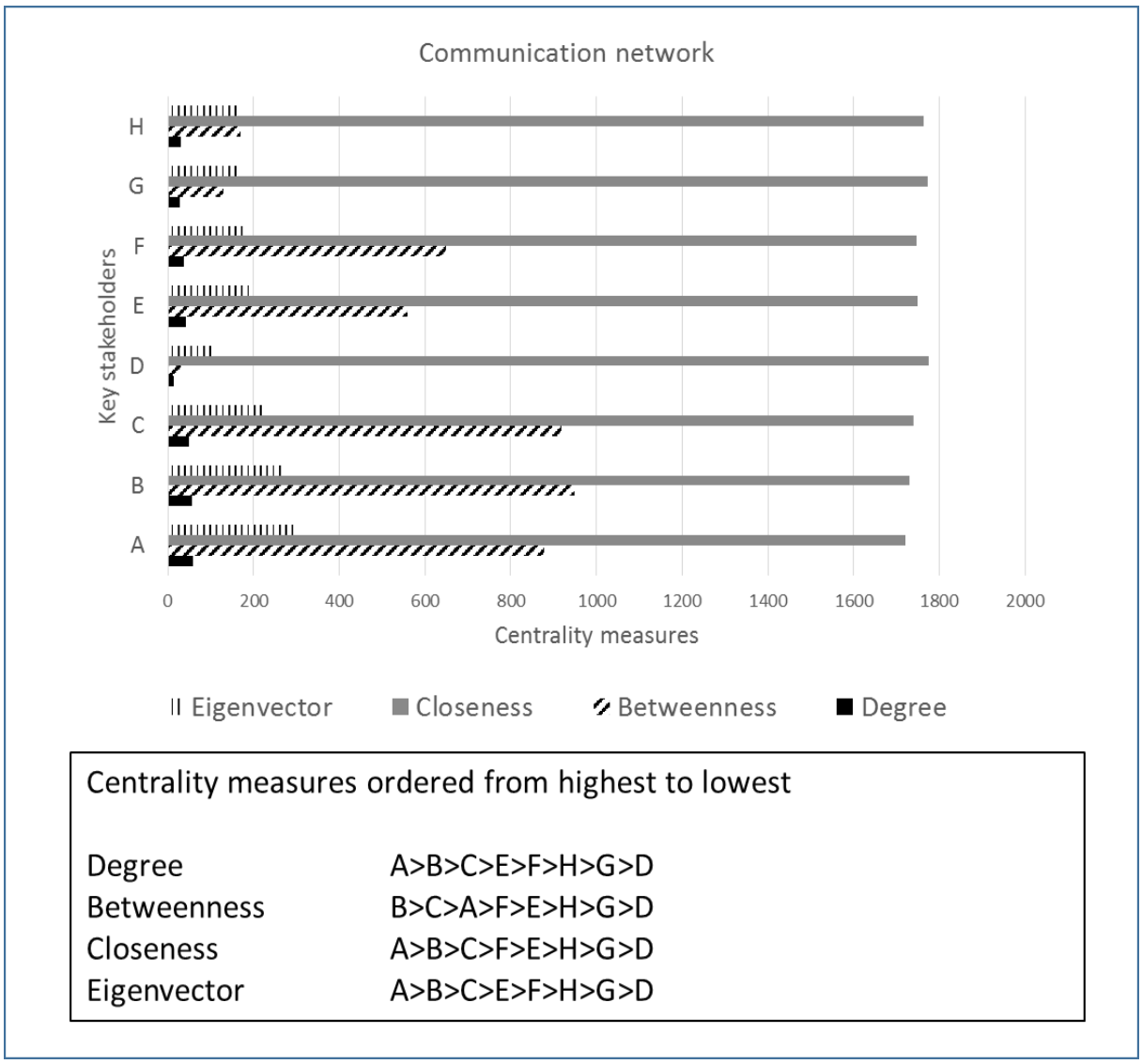
When stakeholder and conservation group networks were examined, an overlap in conservation actors' membership was revealed. Some conservation actors identified with more than one conservation group category. The key conservation actors (A, B, C, D, E and F) all belonged to a conservation Trust (see Table 2). The conservation Trust seemed to be very influential and played a major role within the community, but additionally had the capacity to interact and relate with the other groups. Interaction among groups might be determined by the scope of activities that were jointly carried out or by the roles played by each stakeholder.



Centrality measures ordered from highest to lowest	
Degree	A>B>C>D>E>F>G>H
Betweenness	B>A>C>D>E>F>G>H
Closeness	A>B>C>D>E>F>H>G
Eigenvector	A>B>C>D>H>E>F>G

Figure 8. Centrality measures for central conservation actors in the general network

(Eigenvector values have been multiplied by 1000 to enhance the visibility of the chart. The symbol '>' within the boxes indicates that the preceding stakeholder had a higher centrality than the following stakeholder within each respective network)



Centrality measures ordered from highest to lowest	
Degree	A>B>C>E>F>H>G>D
Betweenness	B>C>A>F>E>H>G>D
Closeness	A>B>C>F>E>H>G>D
Eigenvector	A>B>C>E>F>H>G>D

Figure 9. Centrality measures for central conservation actors in the communication network

(Eigenvector values have been multiplied by 1000 to enhance the visibility of the chart. The symbol '>' within the boxes indicates that the preceding stakeholder had a higher centrality than the following stakeholder within each respective network)

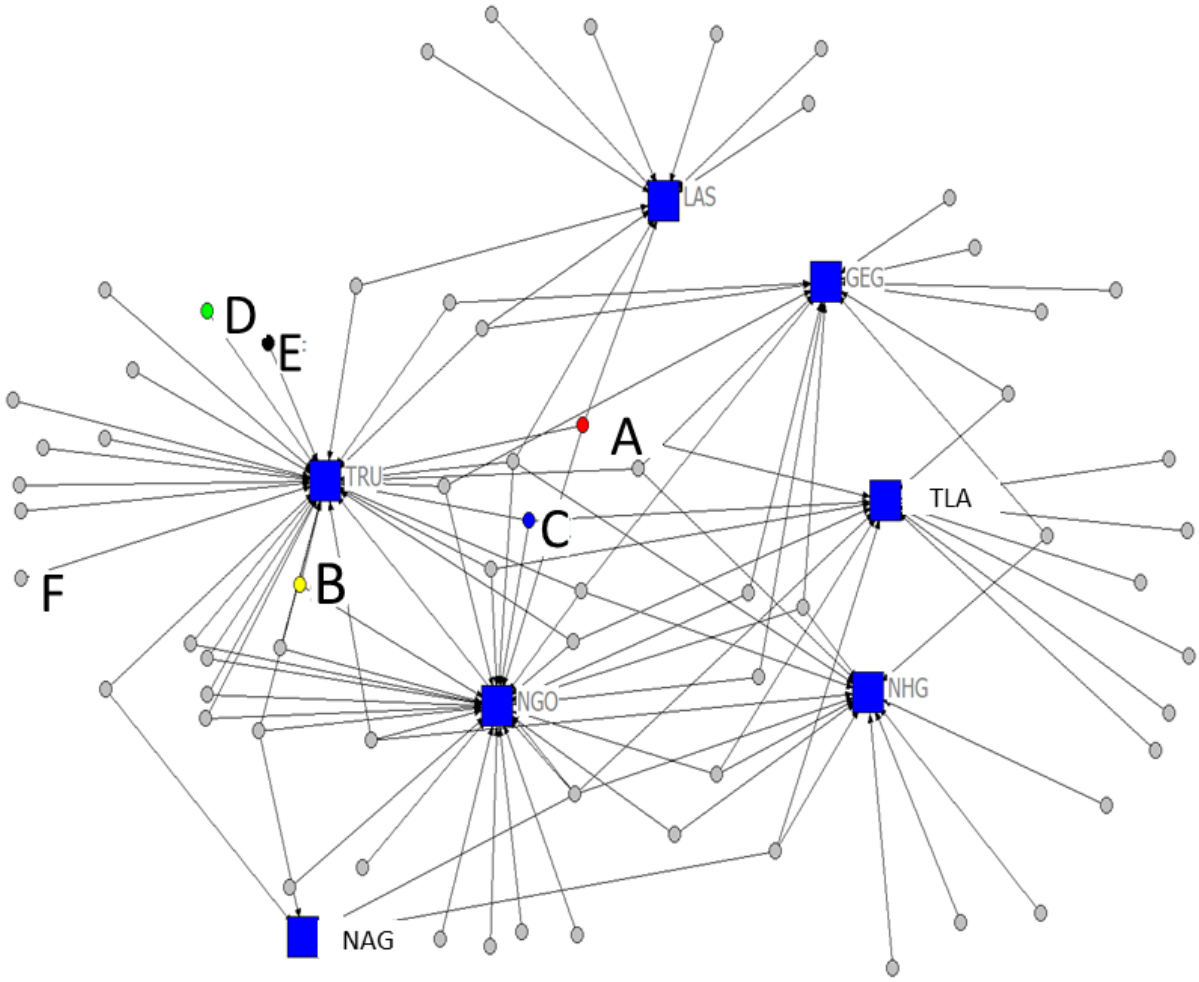


Figure 10. Conservation actors and categories of conservation groups with which they identified

(Conservation groups are categorised and represented by blue squares. TRU – Conservation Trust; NGO – Non-governmental organisations; TLA – Territorial Local Authority; NAG – National Government; LAS – Landscape-specific groups; NHG – Neighbourhood groups and GEG – General groups. Conservation actors are represented by grey circles. The central conservation actors are colour-coded and illustrated as A, B, C, D and E).

4.4.2 Challenges in identifying conservation actors' network

Identifying conservation actors in the community was a challenging exercise especially as there was no central source of information on the conservation actors. While determining network boundaries is a common problem in SNA (Prell et al., 2009), the boundary for this research was defined by interest groups within a geographical location. Even though respondents were presented with names of alters and a "filter" function was activated

through a computer-assisted platform, some instances of non-completion of the survey were experienced. Also, while the snowball function allowed additional names to be added to an existing network, the names were only visible to respondents who logged in after a name has been added, thereby excluding respondents who have completed the survey from stating their relationship with the additional names. One participant attempted to preclude other network members from participating in the survey because of discomfort with the network questions. The participant informed me of this intention to stop other members from participating and I responded by giving further explanations as necessary. I cannot say whether the intention was followed through; if this situation impacted on survey responses or to what extent (if any) there was an impact. However, if the survey results were to be shared openly with network members, the results would be presented on a positive note, with emphasis on network strengths and weaknesses interpreted as opportunities for collaborations. Finally, because the network structure was affected by the unwillingness of some conservation actors to be involved in the survey, the networks provided cannot fully represent all conservation actors within the community. However, I am confident about the roles and influence of the central conservation actors that were identified.

4.5 Discussion

Despite the high social components involved such as making decisions on what qualifies as invasive species for eradication in a management plan (Lawton, 1997), or the daunting challenges of changing human behaviour as a precursor to promoting sustainable conservation practices (Schultz, 2011), SNA offers a valuable prospect in combating conservation problems. To my knowledge, this study is the first to apply social network analysis in establishing a management program for invasive species.

4.5.1 Individuals affected by invasive species management

The analyses of participants' educational status suggested a likely comprehension of local and national conservation and invasive species management. Some conservation actors probably had a wider access to information or other resources and a wide range of social connections which spanned beyond their immediate networks. The relatively high number

of conservation groups identified suggested a strong interest in local conservation issues and an ability to mobilise other interested individuals for group action. This finding supports the analysis of the islanders' sense of place (see Chapter 3, 3.5). However, the identified network on Waiheke Island suggests that there are few distinctive pest management groups; most individuals generally belonged to a broader conservation group whose functions also included pest management. For example, a mountain biking or cycling group might also cut bush tracks, creating access for setting and monitoring traps. In some cases, they also volunteered to set and monitor the traps. Some individuals did not belong to a group that directly carried out pest management, but personally managed pests on their property, sometimes influenced by neighbourhood groups that focused on pest management within their streets or suburbs. Hence, I could not clearly state the number of pest management groups on the island as the conservation groups I identified played several roles in managing invasive species. A blurred differentiation between conservation and exclusive pest management groups might pose a challenge to collaboration efforts for managing pests within the community (Lubell, Jasny, & Hastings, 2017), but is understandable if managing pests is a means to achieving other conservation goals such as increased numbers of native birds. Most (91%) of the identified groups operated on the island with the exception of a few international organisations where members were affiliated by providing support through funding, subscription to publications, newsletters or by signing petitions. Conservation groups operated on different scales within a local context. For example, neighbourhood groups concentrated their activities within a specific suburb in the community while landscape-specific groups were particular about specific geographical features. However, some neighbourhood groups were also involved in the conservation of either plant or animal species. Members who identified with governmental organisations were either paid staff who lived locally or were affiliated as event coordinators or contractors to the organisations. Most members belonged to more than one conservation group and played different roles in those groups.

Conservation actors' positions varied within the general and communication network and suggested that specific roles can best be played by certain conservation actors. However, in identifying interested or affected individuals, it is important not to overlook those on the edges of the network (outliers). The outliers identified in the presented network were

mostly individuals who did not have any link or association with other individuals or groups but were affected by invasive species management. These outliers were identified by some members of the network. The involvement of individual outlier likely varies between individuals, as some were more actively involved than the others. While outliers did not show evidence of communication within a conservation network, it might be beneficial not to overlook them but to identify and include them in a new conservation initiative.

4.5.2 Nature of relationships

The analyses of participant membership indicated that groups had the capacity to mobilise individuals for conservation actions, but the low densities and reciprocity of their network suggested that they did not form a cohesive system. Density, however, has varying effects on different types of network as low density might increase diversity but limit the spread of information and inhibit the likelihood of joint action. Likewise, high density might increase trust, boost exchange of information and enhance the flow of novel ideas but reduce the development of innovations as individuals within the network might become homogenized (Bodin et al., 2006; Bodin & Crona, 2009; Janssen et al., 2006).

Low density and reciprocity could also be indicative of the nature of communication among members of the network. By nature, some communications were one-off and unidirectional from person A to B, not requiring a response. Participants revealed that one-way communications included requesting information for funds, contact details, advice and co-ordinating, organising, or speaking at an event. These one-way communications, while non-reciprocal, were suspected to have contributed to weak links or relationships among conservation actors, as there were few on-going, consistent opportunities for them to communicate and work together. If cohesion and reciprocity could predict a network's adaptive capacity and ability to act collectively (Armitage, 2005), the present network among conservation actors on Waiheke can then be assumed as not well-suited for collective action. Nonetheless, the network provided an opportunity for potential communication and collaboration among conservation actors.

A relationship existed between the position of conservation actors and their ability to influence the network. Volunteers dominated invasive species management activities on Waiheke (D. Jeffery, personal communication, April 10, 2015). Conservation actors with a high number of connections and closeness could more easily and quickly bring volunteers together at short notice than those with lesser connections. Conservation actors with high central position (eigenvector) could also be trusted to make decisions that would benefit the whole network based on their influence within the network.

Conservation actors with high betweenness centrality occupied a very important position and were capable of providing access to various kinds of resources and exposing the network to innovative ideas beyond their immediate local network. These types of actors can use their knowledge of members of the network and the different powers or connections at their disposal to meet the needs of members as and when required (Hoppe & Reinelt, 2010). Within an invasive species management context, conservation actors with high betweenness can provide information on relevant workshops and seminars, funds from a relevant organisation and facilitate collaboration between a group and other groups with similar interests. These actors could also act as bridges, initiate new relationships and collaborations with the outliers that were identified as not actively involved with the network.

4.5.3 Opportunities within identified social network

Stakeholders or communities involved in the management of natural resources have often been encouraged to form collaborations across different relevant organizations to increase their effectiveness in achieving their goals and objectives (Selman, 2004). Collaboration among diverse organizations have been enhanced through the positions occupied by stakeholders within the structural network (Lubell, Robins, & Wang, 2014). The successful eradication of an invasive plant in San Francisco Bay has also been attributed to an effective collaboration of the stakeholders involved (Lubell et al., 2017). However, different structural patterns of networks and the complexity of collaboration due to underlying power relations within and across stakeholder types might inhibit effective stakeholder interaction; instead, necessitating an advocacy approach (McAllister, McCrea,

& Lubell, 2014). Also, ineffective management of collaboration efforts could lead to conflict and a change in the overall network structure as new networks could emerge as a response to the conflict (Schoon et al., 2016).

While a case is being made for influential stakeholders to initiate collaborations and foster collective action for managing pests on Waiheke, reasons for collaborations, for example, "mandated (through institutional arrangements), funded and shared interest (through personal choice)" (Sayles & Baggio, 2017) need to be taken into account to design appropriate interventions for such collaborations. For example, a mandated or funded collaboration might be necessary for a pest management group to combat risks of re-introductions of invasive species through enforcing legislations restricting the movement of invasive species through the ferry terminals connecting Waiheke Island to Auckland City. Whereas, a shared interest collaboration might lead to interventions such as sharing individual or group success stories on pest management on community newspapers, increasing visibility of pest management by profiling volunteers and their achievements, or even establishing landlord associations that could encourage other landowners to get involved in managing invasive species on their private properties. A shared interest collaboration could be more productive and sustainable than a mandated collaboration (Sayles & Baggio, 2017) due to its less formal nature and the willingness of individuals who are brought together through informal relationships.

Gaps identified within networks create potential opportunities for designing strategic links to encourage collaboration among local groups and external organisations (Valente & Pumpuang, 2006). For example, the Māori ethnic group represented a potential source of collaboration. Māori, an indigenous group in New Zealand, could "provide a [unique] cultural response" to invasive species management issues (Roberts, Norman, Minhinnick, Wihongi, & Kirkwood, 1995, pp 1). Māori has mana (authority) to act as kaitiaki (guardians) of the environment which presents a different worldview from the scientific norm of conservation (Roberts et al., 1995, pp 11-12). Individuals who were below 40 years of age also presented another potential source of collaboration. Survey participants identified age as one of the challenges facing governance in conservation groups within the community. While certain participants (for e.g. A and B) emerged as having the highest degree and betweenness centrality respectively, others (such as C, D and E) could

invariably assume responsibility in the absence of A or B. Ideally, these individuals (for e.g. A and B) should be able to effectively delegate duties to conservation actors who have the capacity to act, rather than to some random individual within the network. Strength, high reciprocity, high density and cohesiveness, which were positive indicators of a stable network on Waiheke should engender collaboration among members. Otherwise, if links could be increased and connections strengthened, members might be able to act in a more collaborative capacity.

In the present network, there seemed to be an over-reliance on a few key individuals, which also suggested an unhealthy and over-burdened network. Efforts could be made to duplicate roles within the network by empowering other members and increasing their individual capacity to carry out important management functions for invasive species.
The results in this chapter provided insight into the nature and pattern of relationships among conservation actors whose networks could affect how local conservation decisions are being made. Local conservation decisions could collectively have a global impact (Rudel, 2011). Local conservation actors who are capable of networking with external organisations provided a valuable avenue for the local network to access global resources and be exposed to national and international organisations, whose goals, interests, objectives and values might be closely related. In addition, information on conservation actors' ability and influence through analysing and understanding their network structure is crucial for conservation and invasive species management. If some central conservation actors could influence the behaviour of other network members (Prell et al., 2009), then buy-in for invasive species management strategies and collective action within a community might be enhanced. Hoppe and Reinelt (2010) cautioned against over-reliance on network structures for interpreting relationships among network members.

While I aimed to identify conservation actors in invasive species management within the community, the interpretations suggested central conservation actors' influence and probable roles. Not surprisingly, the role of the central actors corroborated these interpretations. For example, one of the key conservation actors with high betweenness centrality illustrated their role in conflict resolution between two opposing groups, playing a broker's role (Prell et al., 2009) and even mentioned the names and roles of the other

central conservation actors within the network when explaining collaborations with other individuals within the community.

4.5.4 Gaining local support for an invasive species management initiative

As management goals and methods for invasive species are sometimes diverse and factors affecting collaboration are not immediately obvious; understanding the nature of relationships among those affected by invasive species management might be beneficial for any management project. When relationships are understood, collaboration could better be facilitated among the individuals or organisations. Identifying and understanding the pattern of conservation actors' relationship within a network for invasive species management, also involves appreciating conservation actors' values and interests (Peterson et al., 2010). In working towards achieving a pest-free Waiheke, planners, managers and governmental organisations, there needs to be an understanding of the network structure of stakeholders involved. Such understanding could assist in gaining valuable insight into how to initiate local support, increase the chances of collaboration and prevent public opposition during the implementation of a management plan for invasive species.

Networks for invasive species management seemed to act as a vehicle for flow (exchange or dispersal) of information, resource, funds, innovations, tools and methods among members. These networks also indicated how coordinated individuals or groups were. Without proper coordination, effective collaboration might remain a mirage and proper coordination could be an indication of an effective communication. Analyses of networks for invasive species management could allow for individuals and their corresponding roles to be evaluated for appropriateness, especially before a management project is being embarked on. Such evaluation might save time and other resources and might also ensure that management goals are being implemented by the right individuals or organisations.

4.6 Conclusion

I attempted to identify those individuals and organisations who played a major role in managing invasive species on Waiheke Island and to understand how they related with one

another by analysing their relationships through network analysis. Agencies such as Department of Conservation could benefit from such analyses by utilising the relative position of individuals and their capacity to achieve conservation goals within a network to identify key individuals when planning conservation projects.

In sum, a coordinated program for pest management on Waiheke Island has likely failed to materialize because the large number of conservation groups and their activities had not been previously identified. The highest centrality measures for Waiheke Island were distributed among a few central conservation actors in the network. The strength of this distribution was the creation of a core or centre of influence within the network while its limitation was the potential for disintegration if one or two focal actors were removed.

Interventions aimed at increasing collaboration between groups engaged in pest management on Waiheke would most likely benefit from building on existing relationships rather than creating a new network. However, there needs to be an evaluation of what might trigger such collaborations – mandated, funded or shared interest – and whether a central administrative leadership might be best suited to coordinating the local networks on Waiheke. Also, would central management be necessary to harmonize goals and objectives of various pest management groups, thereby reducing the duplication of similar efforts across the island; or would a more effective approach enhance coordination of the network and enable actors to have an influence on policies affecting pest management on Waiheke? The answers to these questions would ideally come from the islanders themselves.

I recommend that in order to initiate and sustain productive dialogue and collaboration among conservation actors and other stakeholders, the pattern of relationships among them needs to be identified, analysed, understood and utilised in developing conservation or pest management strategies.

Chapter 5

Living Laboratory

In this chapter, I will describe how Living Laboratory principles can be employed to achieve my third research objective:

Objective 3: Test the Living Laboratory approach in engaging stakeholders

To achieve this objective, I conducted semi-structured face-to-face interviews with identified central conservation actors in order to determine relevant issues in pest management planning. I provided a platform for conservation actors to deliberate on identified issues, set goals and objectives, prioritise goals, discuss challenges and propose solutions for developing pest management strategies. I applied Living Lab principles – value, influence, realism, sustainability and openness – in the process of engaging with conservation actors. The application of these principles in the research process enabled conservation actors to influence the research process and develop a practical mechanism for developing pest management plans. My study demonstrated the extent to which communities understand issues facing them and how they can, with appropriate information, make decisions that would benefit and assist them in realising their goals. In addition, empowering stakeholders (conservation actors and locals) to influence project plans at the inception phase is achievable when applying the right principles. I recommend that in working towards a predator-free New Zealand and a pest-free Waiheke, the Living Lab principles employed in this study should be used to enable a productive collaboration between all stakeholders and increase the relevance and adoption of pest management goals and objectives.

5.1 Abstract

Stakeholders' interests have often been undermined and excluded from conservation planning. When such interests are considered, they are probably as an afterthought, during later stages of a planning process when the opposition is imminent and the likelihood of engagement is minimal. Pest management projects have often been met with suspicion, distrust and resistance, especially on inhabited islands. The presence of invasive animals and humans residing within the same space creates a unique challenge. In this chapter, I adopt the principles of value, influence, realism, sustainability and openness in a research Living Laboratory to engage stakeholders in developing strategies for addressing pest management problems within an inhabited island. I combine qualitative (in this chapter) and quantitative data (see chapter 6) in a mixed method approach to engaging 17 conservation actors and 380 island residents in focus group sessions, survey and observations. In this chapter, I report on the outcomes of the focus group sessions and observations. Thematic analysis of qualitative data was carried out with the aid of Nvivo, a computer-assisted qualitative data analysis software. The major themes identified by conservation actors were values, aspiration, setbacks and challenges and resolution. Conservation actors are now better positioned to make decisions, engage and collaborate with external organisations and increase community engagement in the quest for a pest-free environment, as a result of the mechanisms or products of engagement developed and owned by conservation actors in this study.

5.2 Introduction

A key component in improving conservation outcomes is a collaboration by multiple and different stakeholders (Brody, 2003); however, insufficient consideration of stakeholders' interests has often contributed to failed conservation projects. When stakeholders, their views, values and interests are adequately represented and involved, conservation strategies developed should be readily adopted. Stakeholders in pest management including researchers, companies, governmental organisations and members in an affected community, all play unique roles in working towards achieving pest management objectives. However, community members sometimes feel victimised when decisions are

imposed on them by agencies or other groups of stakeholders and especially when members are not aware of the decision-making process; or even when aware, are excluded from the process (Buchy & Race, 2001). For example, private property right is a conservation value unique to landowners or cultural groups. Excluding landowners or cultural groups from engaging in conservation decisions might thwart the efforts of governmental organisations in reaching their conservation goals (Raymond & Olive, 2008). Giving community members an opportunity to comment on or react to conservation policies should not be misconstrued as the same as actively engaging them in the design and plan of such policies (Tippett, 2005).

Different stakeholders can often hold different views about the same issues, which are not clearly communicated or understood in a given context (Ståhlbröst & Bergvall-Kåreborn, 2007). For example, in the basic definition and application of conservation, stakeholders are divided along the preservation - sustainable use line, a position that has hampered the development of common conservation objectives (Berkes, 2004). Notwithstanding, when actors with different views interact with one another, innovative opportunities are opened for conservation which increases the potential for better results, while also acknowledging the likelihood of conflicts and other associated complexities (Armitage, 2005). Such complexities could be encountered in the definition of a conservation problem, which could either be unclear or generally unacceptable by the community of interest (Game et al., 2013). Conflicts could also arise when conservation decisions are made under doubtful circumstances (Minteer & Collins, 2005). Conservation decisions made by stakeholders could result from the different views they hold on certain issues. These views might be influenced by various value systems, subject to change under varying circumstances; or even the disciplinary background of the stakeholder concerned (Brook, et al., 2003; Simberloff et al., 2013). Strong stakeholder engagement and integrating knowledge and skills from a diverse range of disciplines could provide innovative solutions needed to solve the challenges facing conservation in general and pest control in particular (Blackie et al., 2014). Glen et al. (2013) shared similar views as he described an adaptive and iterative approach to pest eradication, a process he referred to as "experimental eradication". There is, therefore, a need for a process that changes with the changing problems, rather than relying on a rigid format for dealing with the problems. A shift from the traditional way of

research, integration and engagement, which might be solely scientific-based, to a more dynamic approach involving multiple disciplines and people who are directly affected by the issue, could be a path in the right direction. Traditional authoritarian methods are closed, used in settings where there is little or no human interaction; hence, there is no real understanding of people's needs or values.

Cases of pest management projects that failed sometimes reflect a lack of understanding and articulation of the problems, making residents incapable of collaborating with one another or external organisations to address identified issues. For example, on islands inhabiting humans and pest animals such as in Great Barrier Island, most people neither had a clear understanding of the need to eradicate pests nor approved of any aerial eradication methods (Ogden & Gilbert, 2009). Often, the magnitude of the problem of a pest is not realised or clearly articulated. Also, a lack of trust and confidence in existing pest eradication methods have led locals to question the use of such methods (Game et al., 2013; Goldson et al., 2015).

Waiheke Island, like most islands in New Zealand, has a potential for eradication of pest animals as there are an increasing appreciation and desire for restoring native biodiversity among island residents (Clout & Russell, 2006). Diverse mammalian pests are found on Waiheke Island even though classifying such animals as pests has sometimes been considered controversial (Goldson et al., 2015). However, drawing on the knowledge of local people through the processes of interaction and engagement might clarify impending controversies (Larson, 2007). Early engagement might also enhance the prospect of working together with locals to achieve pest management goals. Such engagement needs a coordinated approach aimed at consolidating, or at least strengthening, the various efforts made by smaller local conservation groups operating separately from one another. This coordination is necessary to avoid "duplicating failed approaches" in tackling similar problems (Chalmers, 2013). There is also a need to clearly consider what views are held about pests on Waiheke Island before embarking on "ambitious projects" (Towns, et al., 2013). Some of these considerations range from basic questions such as: "what is a pest?" and "what are some examples of pests that are found in my area?"; to complex questions such as: "which pests would I prefer to eradicate or control?", or "what methods are

appropriate to eradicate or control pests?" and "who should be involved in managing pests in my area?" Finding common answers to these questions has not been straightforward or easy.

I attempted to bring together a range of stakeholders with diverse interests in managing pests on Waiheke Island with a purpose to understand their views, values, interests and preferences for managing pests. This process of involving different stakeholders is often referred to as an open process, which allows many perspectives and inputs into a project and increases the capacity for quality and valuable output (Ståhlbröst & Bergvall-Kåreborn, 2011). I proposed that when these views are properly integrated, stakeholders can effectively work with one another to set relevant goals and objectives and follow through to reach a desirable outcome. I employed a process that is open and transparent, inclusive and flexible, which are key components of a Living Laboratory approach.

5.2.1 The Living Laboratory theory

A long history of involving citizens based on user-driven approaches has resulted in theories such as participatory design, socio-technical design, public-private partnerships, user experience, contextual design, action research, cooperative design and crowd-sourcing (Bergvall-Kåreborn & Ståhlbröst, 2009; Mulvenna, Bergvall-Kåreborn, Wallace, Galbraith, & Martin, 2010). Based on the assumption that involving users in real-life situations in innovation processes could result in better outcomes, the idea of involving citizens and real users in project design was further developed to create the Living Laboratory (or Living Lab) theory (Edwards-Schachter, Matti, & Alcántara, 2012). The theory was first used in 2000 to actively involve city dwellers in the design of smart homes through observing how they interacted with technology while they lived in the smart home trial (Bergvall-Kåreborn & Ståhlbröst, 2009). In 2006, several Living Labs across Europe came together to form the European Network of Living Labs (ENoLL) which to date has 395 Living Labs across Europe and beyond (European Network of Living Labs, n.d.). While Living Lab is a new and growing theory, its applications have been in specific areas of research including ICT-development, health services and rural development. Also, while Living Labs share similar

attributes with other user-driven approaches (Bergvall-Kåreborn & Ståhlbröst, 2009), it is situated in a natural and real-world environment.

Living Lab theory is useful when dealing with issues of social and locational relevance (Mulder et al., 2007). For example, in conservation planning, understanding social, cultural and locational characteristics are important to enable stakeholders from various backgrounds to communicate freely and jointly make decisions that might benefit all parties (Ban et al., 2013; Mulder, Velthausz, & Kriens, 2008). As a result, new ideas could be produced from multiple perspectives and the integration of both external and internal ideas and knowledge could be encouraged within a sustainable process (Bergvall-Kåreborn, Holst & Ståhlbröst, 2009). However, the skills and competencies needed for Living Lab activities which include the ability to think critically, the willingness to search for and be open to new sources of knowledge and expect and tolerate levels of uncertainties, are not traditionally acquired. These skills might have to be learned in some cases (Juujärvi & Pesso, 2013).

Living Labs have been defined as a research methodology focused on users being actively engaged in the research process (Bieling, Joost, & Müller, 2010; Eriksson, Niitamo, & Kulkki, 2005), thus highlighting user engagement. It is also a system where all stakeholders participate in an innovative development, with a focus on multiple disciplines and collaboration. Another definition of Living Lab is "a system enabling people, users/consumers of services and product, to take active roles as contributors and co-creators in the research, development and innovation process" (CoreLabs, 2007). The theory has also been defined by the European Network of Living Labs (ENoLL) as "open innovation environments, operating in real-life settings, where the active engagement of end-users allows the creation of paths of co-creation of new services, products and social infrastructures" (Corallo, Latino, & Neglia, 2013). A more comprehensive definition is given by Cunningham, Herselman, & Cunningham (2012) as "an environment, a methodology, or an approach that facilitates user-driven open innovation within real-life rural and urban settings/communities in which users collaborate with multiple committed stakeholders (non-governmental organisations [NGOs], small and medium-sized firms, industry, academic/research institutes, government, or donors) in one or more locations to

become co-creators or co-designers of innovative ideas, processes, or products within multidisciplinary environments". From a methodology perspective, the focus is on the process of engaging users or communities. Living Labs could engage and empower communities to investigate and discover innovative methods of solving problems in their living environment (van der Walt, Buitendag, Zaaiman, & van Vuuren, 2009). My research used the methodology perspective of Living Labs.

5.2.2 Essentials in a Living Lab

While a common definition for Living Lab is evolving and may slightly vary, the essentials are basically similar for applying the theory in most environments. Mulder et al. (2007) summarised the essentials as user involvement, service creation, infrastructure, governance, innovation outcomes and methods and tools. These involve the following:

User involvement - users have to be involved and actively engaged in the processes within the Living Lab. While users might not have the technical expertise to engage in certain aspects of the Living Lab, other aspects such as project design, data collection and interpretation might be considered. What is important is that they do not become mere research subjects (Bieling et al., 2010).

Service creation - Living Labs should be innovative enough to add distinct values to the environment for which it is being used. When new ideas are tested in a real-life situation, data generated, relationships developed or lessons learned, all contribute new values to the environment involved.

Infrastructure - refers to services, technologies or facilities that are required to make the Living Lab functional. This might also include a framework for operation.

Governance - refers to the management and organisation of the operations within the Living Lab. This includes aspects such as finance and level and type of stakeholders' engagement.

Innovation outcomes – refers to the solutions proffered by a Living Lab in the forms of new knowledge, products or services, clarity of defined goals or objectives and adaptive capacity of a system to respond to changing needs.

Methods and tools - include instruments used to engage with users, analyse data collected and disperse outcomes in a timely and efficient manner to a large audience (Mulvenna et al., 2010).

5.2.3 Principles of a Living Lab

Designing an appropriate process for including users and stakeholders in the planning process is important in facilitating ownership and buy-in of the resulting plan. Such process could in turn aid proper implementation and in the case of conservation, forestall public opposition to the implementation of conservation objectives. The principles for how a Living Lab should function have been established as value, influence, realism, sustainability and openness (Bergvall-Kåreborn & Ståhlbröst, 2009; Bergvall-Kåreborn, et al., 2010; Ståhlbröst, 2012; Ståhlbröst & Holst, 2012; Ståhlbröst, 2013). These principles are briefly explained below;

Value – the quality of an innovation could be assessed by how well users' needs are met. In order to meet users' needs adequately, their needs and desires have to be properly understood so as to avoid developing solutions that users do not need and would not use. The Living Lab approach provides insights on the users' value of a service or product and the level of acceptance or rejection of that service or product in a real-world environment and allows organisations to channel their resources and energy into developing valuable innovations. Also, when users are asked to give their input into an innovation process, it is necessary to keep them informed of what aspect of their input was adopted or aspects that could not be implemented with reasons. This way, they know that they are valued and will naturally maintain their engagement in the process (Ståhlbröst & Holst, 2012).

Influence – participation, involvement and engagement of users offer limited opportunities for users to influence an innovation process; however, a Living Lab process allows for

users to influence the decisions that are made through the process. Since users assume an active role within the Living Lab and innovations are being designed to meet their needs, users could ensure that the right product, service or response matches up with the identified need; hence, preventing innovations that do not serve any purpose to the intended users.

Realism – this principle differentiates Living Labs from all other user-driven approaches as the focus is on innovation activities being carried out by real users within an actual environment. In addition, project recommendations need to be relevant to users and grounded in their natural environment for a viable outcome, as different users or set of users face different realities. For real and relevant outcomes to be generated by stakeholders, a level of agreement needs to be reached among all parties involved (Mulvenna et al., 2010).

Sustainability – the diverse nature of the stakeholders involved in the Living Lab process means that diverse knowledge, skills, expertise, beliefs and perspectives would also be involved. For these diversities to be properly integrated for a desirable outcome, there need to be multiple iterative interactions between innovation phases and people. Such iterative interactions are essential as knowledge increases and beliefs are prone to change; people acquire new knowledge and gain new and often better insights on possible solutions to a problem. It is, therefore, necessary to provide a platform and a sustainable environment to continually re-examine user needs and their associated solutions.

Openness – as stakeholders with different backgrounds, knowledge and experiences would be working together, sharing of information and knowledge transfer between and among individuals and groups and across levels of organisations are inevitable. For information to be safely and effectively shared, stakeholders need to have a receptive and open mindset and keep the communication lines open to both internal and external ideas. Organisations need to be willing to consider new and different ideas and information that are unfamiliar and external to its operations, with the aim of determining which ideas offer potential solutions to the issue being addressed. Ideas developed are continually run and iterated by developers who manage the technical aspects of the process until the desired goal is

reached. The more ideas generated through an open process, the easier it might be to adopt solutions that were jointly co-created.

5.2.4 Examples and applications of Living Lab

A consideration of the existing Living Labs revealed that many operated within a specific niche, which could be particular to a region, service, product or societal need (Mulvenna et al., 2010). The Living Lab theory has been applied in different sectors including health, transportation, energy, environment, sustainable home designs and smart city design among others (Pallot, et al., 2010). Some Living Labs also focused on different environments including research (research Living Labs); physical spaces (corporate Living Labs); target members of an organisation (organisational Living Lab); partners from different organisations (intermediary Living Labs) and short-term support for an innovation process (time-limited Living Labs) (Ståhlbröst & Holst, 2012). For example, the Georgia Tech Aware Home is a physical home setting built with hidden sensors, cameras and microphones. These devices are meant to record the interactions of resident project participants in order to give researchers insights on improving the features within the home and enable a sustainable home design (Følstad, 2008). In Germany, StreetLab explored the perspectives of children and teenagers on improving designs on ICT-related projects (Bieling et al., 2010). Suurpelto "Lab" was designed to integrate different aspects of human well-being and increase accessibility to a range of activities that would boost participants' well-being (Juujärvi & Pesso, 2013). Lastly, SABER was designed to increase energy savings by helping users discover various ways to reduce energy consumption (Ståhlbröst & Bergvall-Kåreborn, 2011).

In this study, I investigated whether a Research Living Lab would assist with developing a community-based initiative for sustainable pest management. In order to develop the Living Lab, I used a platform based on stakeholders identified through a social network, then invited them to discuss and resolve relevant questions and issues surrounding pest management on Waiheke Island. In addition, I examined how new initiatives would best be implemented. To my knowledge, Living Labs have not previously been used for this form of environmental management.

5.3 Methods

While the theory of Living Labs might be considered relatively new and increasingly used, the methods and tools employed are familiar. Living Labs are by definition multidisciplinary, so the challenge within individual projects is access to various ideas and information needed within the lab (Eriksson et al., 2005). Pragmatism, a methodological paradigm where liberal assumptions could be drawn from both qualitative and quantitative knowledge sources (Creswell, 2003), seems to fit very well with the operations of a Living Lab. Researchers combine different tools and methods in a pragmatist worldview or change to a different tool if the need arises in order to explore whatever is available to obtain information; there is no confinement to a pre-set way of knowing (Creswell, 2003). While a range of methodologies have been employed in different Living Labs, these methods have somewhat focused on qualitative designs (for example, Almirall, Lee, & Wareham, 2012) with very few quantitative studies (for example, Mulrennan, Mark, & Scott, 2012). A combination of one or more of the following methods have been employed in several projects: case study approach; phone and face-to-face interviews (Bergvall-Kåreborn, Ihlström, Stahlbröst, & Svensson, 2009); photovoice (community engagement using photography), focus groups, questionnaire, diary-keeping; survey and ICT programs; online discussion forums and online interviews, story-telling (Ståhlbröst, 2012); creativity groups, social network logging, field trials and participatory design; participant observation (Følstad, 2008); GIS-assisted modelling and remote sensing imagery, workshops, conferences, and face-to-face meetings, website and blogs (Corallo et al., 2013; Mulrennan et al., 2012). Combining one or more of these methods allows for triangulation of data to get even richer information (Hsieh & Shannon, 2005).

5.3.1 Study design, data collection and analysis

The challenge for this project was to determine how different knowledge sources would be integrated, and how participants would prefer to be engaged so as to maximise engagement. In order to ensure adequate engagement and representation by interested stakeholders, data were obtained in two stages using qualitative and quantitative methods (see Creswell, 2003; Onwuegbuzie, Johnson, & Collins, 2009). The aim was to triangulate data

methodologically to provide a more robust information and deeper understanding of pest management issues in the community. The first stage included conservation actors who were actively involved in managing pests on the island, while the second stage involved the wider island residents (see Chapter 6).

Prior to designing the tool used for the Living Lab, a social network analysis was conducted to determine key conservation actors in the community and the roles they played in the various pest management groups that were identified. Conservation actors are a group of stakeholders who have an interest in managing pests and whose activities may influence or determine the direction and future of pest management on the island. Face-to-face semi-structured interviews were then conducted with the individual conservation actors to determine relevant questions that could be discussed during the broader focus group sessions within the community (see Appendix D). This initial interview proved to be essential as I was able to elicit important themes for discussions that were not just relevant but also unique to the social and cultural environment under consideration. The questions were summarised into the following domains;

- Definition, examples and classification of pest species
- Objectives, goals and effective plans for a pest-free Waiheke island
- Lessons from failed projects on Waiheke island
- Acceptable pest management methods
- Setbacks and challenges in pest management planning
- Practical solutions and steps to achieving a pest-free Waiheke
- Empowering Waihekeans to take action and increase engagement in pest management activities
- Governance and organisation for effective collaboration in pest management.

These questions formed the basis of the focus group discussions and guided dialogue among conservation actors as they attempted to make sense of the issues surrounding pest management in their community. The study design and data collection procedures were approved by the ethics committee as required when engaging human participants, but

Living Lab principles were employed and thus introduced some degrees of flexibility in my operations.

5.3.2 Data collection

Conservation actors provided me with information on pest management within the community through their engagement in focus group discussions and my observation of how they interacted during the discussions. Participants who attended a focus group session were given background information about the purpose of the study and signed a consent form. In response to interactions among conservation actors on the choice of a facilitator, a trusted member of the group was invited by participants to facilitate the focus group discussions. Lack of trust could discourage engagement of stakeholders and increase chances that participants might be absent (Mountjoy, et al., 2014). Facilitator choice might also encourage an open and honest communication among the stakeholders. The process of planning and organising the focus groups was time-consuming but worthwhile, as Shaha, Wenzel, & Hill, 2011 also reported in their study. Data were captured using digital recorders. The interactions among focus group members were observed and handwritten on notes by focus group assistants during the meeting. Conservation actors provided additional sources of information through written responses on flip charts and Post-it notes during the meetings. A total of 17 conservation actors met on two different occasions to discuss the themes that have been previously identified by four key conservation actors. Each discussion lasted for about 1 hour 45 minutes.

5.3.3 Data analysis

Recorded data and handwritten notes from the focus groups were transcribed, imported into Nvivo, a Computer Assisted Qualitative Data Analysis software (see Bringer, 2006) and organised in preparation for thematic analysis (see Chapter 3, 3.3) (Braun & Clarke, 2006). The transcribed data were carefully scrutinised for ideas or words that predominated within the texts. These ideas were then grouped into similar codes or basic themes. The basic themes were further reviewed and refined and grouped into similar sub-themes; the latter were further grouped into similar major themes. Overall, the themes were further re-

grouped into similar dimensions, which were a classification of themes based on a common direction or attribute; while the themes summarised the main context of conservation actors' discourse (see Appendix E). The relationship among the major themes was illustrated through a thematic network or map and further checked against responses provided on flip charts and Post-it notes. Another meeting outside the scope of the present analysis is being planned to discuss and share the results of the analysis with the conservation actors.

5.4 Results

Conservation actors who participated in the focus group sessions were slightly mostly males (53%), the average age was 54 years old, 93% identified as New Zealand Europeans, 53% had postgraduate qualifications and 87% owned a parcel of land. In addition, conservation actors resided in one of the following geographical locations on the island: Oneroa, Awaawaroa, Surfdale, Ostend, Orapiu/Rocky Bay, Palm Beach, Blackpool, Te Whau and Onetangi.

5.4.1 Thematic issues affecting pest management

Participants were able to explore, discuss and respond to several issues facing pest management on Waiheke Island during the focus groups, with the help of questions designed by some key conservation actors. A total of forty-two basic themes, five sub-themes, four major themes and four dimensions were derived from a thematic analysis of the discourse (Table 3; also see Appendix E for the codebook containing the full list of themes). The major themes were community values; setbacks and challenges; aspiration and resolution. The basic themes are italicised and enclosed in inverted commas; the dimensions are simply italicised; while examples are given in separate paragraphs as quotations.

Table 3. Classification of conservation actors' discourse into major themes and their dimensions

Major themes / Dimensions	Community Values	Setbacks and challenges	Aspiration	Resolution
People	Diversity; Passionate people	Absentee landowners; The strength of minority opposition; Volunteer-champion burn-out; Social dynamics; Behavioural inhibition	Personal drive; Neighbourly responsibility	External conformity; Local resources; Policy change; Awakening consciousness; Tapping into motivations
Environment	Small and remote; Environment	Unconnectedness to nature; Changing sense of place	Release of kiwi; Sustainable biodiversity	Biodiversity monitoring; Experiencing nature;
Cost / Benefit		Finance ; Deficient resource	Potential for tourism; Potential for pest-free status	Practical education; Paid drivers; Paid absenteeism
Methods		Acceptable level of exotic species; Defining pests; Conservation is killing; Unrealistic conservation goals; Necessary evil; Prioritising eradication		Early consultation; Research; Goal-setting; Locally-driven projects; Story-telling; Next-door advocacy

5.4.1.1 Community values

Conservation actors identified what they valued about the island as "*diversity*" of population and ideas; "*environment*" including beaches and bushes, and "*small and remote*" as the size of the island and distance from the closest city. These values were classified as dimensions of *people* (e.g. *"diversity"*) and *environment* (e.g. *"small and remote"*). Examples were given as:

"[Waiheke island is] best of both worlds. We are able to be remote if we want to be, but it's close to the city when we choose to go [there]"

"I like that ... most places are so quiet and you can easily find a place that there is nobody else around; the beaches are so beautiful, bush areas are lovely; it's tranquil, it's peaceful"

5.4.1.2 Setbacks and challenges

In relation to carrying out individual or group pest management activities, or implementing local pest management plans, conservation actors experienced the following challenges: confrontations from a few people who had a different opinion about pests as *"the strength of minority opposition"*; volunteers' loss of enthusiasm as project progressed, as *"volunteer-champion burn out"*; the difficulty of getting people to agree on a particular method or sticking to a plan, as *"social dynamics"*; the risk of pest re-invasion from neighbouring areas where landowners were not making eradication or control efforts, as *"absentee landowners"*, and the lack of consciousness or appreciation of the need for eradication as *"behavioural inhibition"*. These themes were classified as the *people* dimension.

Other challenges were the perceived shift of values held by new residents in the community, as *"changing* [the] *sense of place"*, and little or non-existing connection with nature resulting in individuals' inability to care for the environment, as *"unconnectedness to nature"* (classified as *environment* dimension). Also included were the cost of managing pests on the island, as *"finance"*, and unofficial assumption of responsibility by residents who managed pests on government property, because there was insufficient resource input

from the government, as *"deficient resource"* (classified as *cost* dimension). Additional challenges classified as *methods* dimension were: setting *"unrealistic conservation goals"*; a denial or refusal of an *"acceptable level of exotic species"*; the ambiguity in *"defining pests"*; *"the necessary evil"* of choosing poison baits against personal preference to control pests, and the difficulty in setting goals and *"prioritising eradication"* in order of species invasiveness.

Examples of some of the statements illustrating setbacks and challenges were:

"We have a problem on Waiheke of absentee landowners who have a number of invasives ... if there were some requirements for property owners to deal with the invasives"

"… Even if there are 7,000 people on this island who long to have the rat eradication and there were 20 objections … it's astonishing to me; the way the opposition always get much more..."

"So, there'd be a few people in the community that are really enthusiastic and love the project and love the idea and get really involved … and by 12 months' time, they've lost that enthusiasm"

"We have to have a model that is built to an idea of people living within an improved environment and a model that has to accept a level of exotic species and … introduced animals"

"We've talked about these so many times that … I want to see that happen 20-30 years ago, right? And this is why people get frustrated with the whole system because you're talking about the same things all the time…It's going to be a continuing battle because we are never going to get rid of these pests completely"

5.4.1.3 Aspiration

Conservation actors sustained their engagement in pest management activities, despite the challenges involved in managing pests as a result of *"personal drive"* and individual motivation to care for the environment; and a compelling duty of care to surrounding pest-free islands necessitating a *"neighbourly responsibility"* in ensuring Waiheke does not become a source of re-invasion. Both themes were classified as *people* dimension. Other

driving forces were the *"potential for pest-free status"* and *"potential for tourism"* classified as *cost* dimension. Conservation actors were also motivated by a drive towards a *"sustainable biodiversity"* and to "*release kiwi*" birds; classified as *environment* dimension.

Examples of conservation actors' statements illustrating aspiration were:

"The potential for tourism based on pest-free status and thriving biodiversity is huge value"

"Love of nature; it's compelling, it just draws you to do it and that you can, if you have, or even if you don't have your own plot; there's a lot of opportunities to go and commune with nature that way"

"We are near so many islands that had money spent on eradicating pests, we don't really want to infect these islands with our pests, therefore we have a neighbourly responsibility"

5.4.1.4 Resolution

While there were numerous suggestions for addressing the setbacks and challenges faced in managing pests, conservation actors described a general process for the community referred to as the Waiheke way. This process involved *"external conformity"* where tourists and visitors adhered to the island way of life; *"awakening consciousness"* by gradually making the community aware of their environment and enabling members to personally connect with nature; *"tapping into motivations"* people already have for managing pests; strengthening and increasing *"local resources"* to support the efforts already being made; and *"policy change"* to enable, for example, an honest recognition of some pets as pests on the island. These themes were classified as *people* dimension.

Additional suggestions were for island residents to directly relate to the benefits of managing pests through a "*practical education*"; for *"paid drivers"* to implement long-term pest management projects for two groups: volunteers who might become disinterested; and landowners who are absent or do not have the time, nonetheless become responsible and involved in managing pests on their land by paying others, that is, *"paid absenteeism"*. These themes were also classified as *cost* dimension. Involving community members in

"biodiversity monitoring" and *"experiencing nature"* might encourage large-scale engagement, increase individual's appreciation for the environment and develop motivation for pest management. These themes were classified as *environment* dimension. Other ways of addressing challenges included *"early consultation"* with community members on pest management projects to avoid opposition at a later stage of the project; thorough *"research"* into proven eradication and control methods and deciding what's applicable to the community; realistic *"goal-setting"*; designing *"locally-driven projects"* that would have inputs from external organisations; sharing and showcasing successful outcomes of pest management through *"storytelling"*; and seeking local support through low-key campaigns and *"next-door advocacy"*. These themes were classified as *methods* dimension. The basic themes in resolution were further classified into the following sub-themes: communication, engagement, methodology, education and local expertise.

Some examples of conservation actors' suggestions for addressing setbacks and challenges in pest management were:

"Yeah, you can expand it from existing conservative areas, we do have a dog-free colony on the island; so, you could start from say A's land and you could go to those non-dog-free areas with that idea"

"And there's a lot of people I know who have big chunks of land who just can't take the time ... so, they are more than happy to have someone come around, set and check their traps and they pay for it"

"You know people who have different motivations and if you can tap into the different motivation, just so to achieve the same end goal, people who you know hunt pigs for the pleasure of pig-hunting, bring them in because a greater goal is we are eradicating pigs for example"

"Consultation at the start with as many people as possible. For some of these, objections might have been apparent very early as opposed to apparent half-way through the process"

"I think it's important that it's not a Council (project) ... so the general public doesn't feel it's been forced upon them by the local or national government. It's got to be something locally and that's got to be locally-driven.

5.4.2 Interactions among the major themes for developing a pest management plan

Community values, aspiration, setbacks and challenges and resolution were identified as major themes for pest management on Waiheke Island. Basic themes in community values such as care for the *"environment"* could be seen as closely associated with, or acted as an indicator for themes in aspiration such as *"personal drive"*, *"neighbourly responsibility"* or a drive towards *"sustainable biodiversity"*. Likewise, the setbacks and challenges faced by conservation actors were an indication of obstacles, which if addressed could lead to the realisation of their aspiration. Their suggestions for resolution were closely associated with the types or themes of setbacks and challenges already identified (Fig. 11).

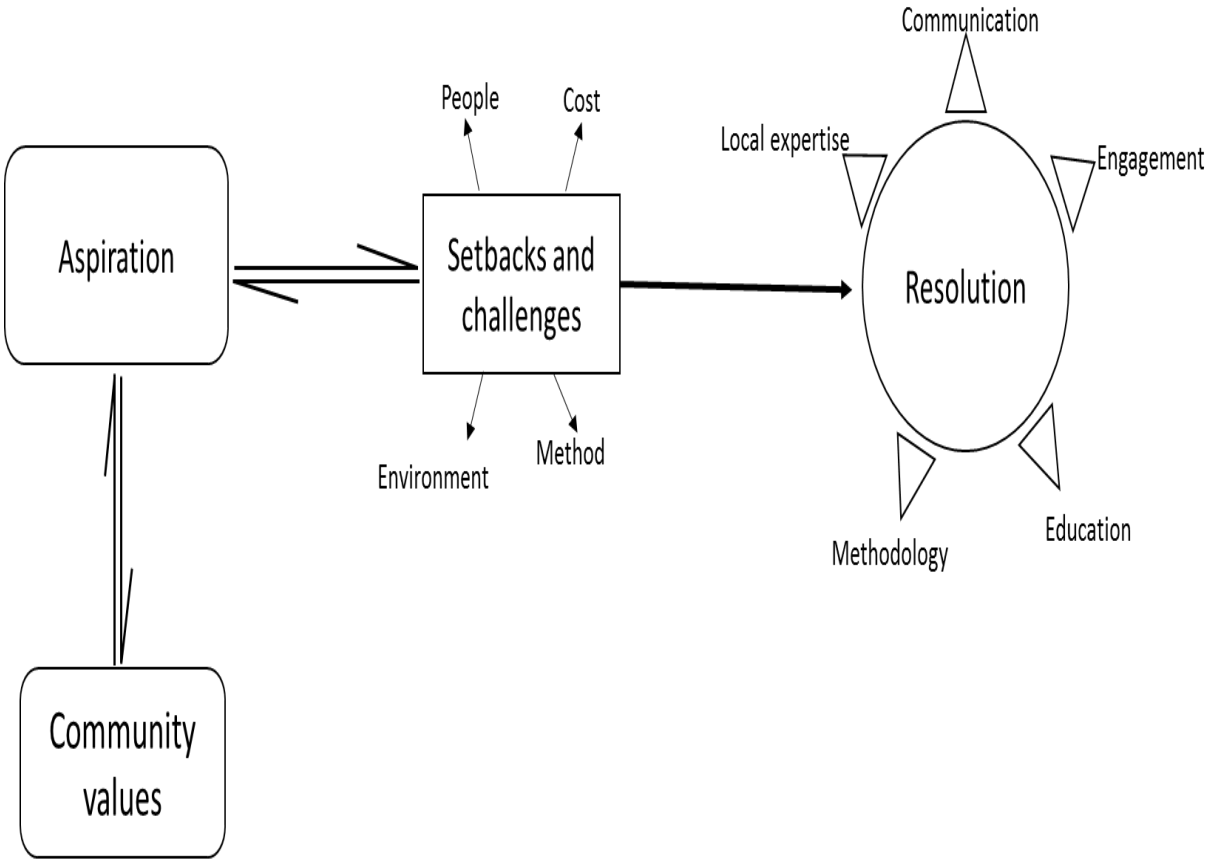


Figure 11. A model illustrating the relationship among the major themes of community values, aspiration, setbacks and challenges and resolution for developing a pest management initiative

5.4.3 Setting priorities for pest management

Conservation actors collectively listed mammalian pest species that were present on the island, attempted to prioritise a method for managing pests as either eradication or control; as well as categorise identified pest species into one of the two categories (see Table 4). However, responses written on flip charts and post-it notes within activity breaks during the focus groups, observation of how focus group members interacted with one another and notes taken by focus group assistants revealed that conservation actors were not in full agreement on what pest species to prioritise for eradication or control. A majority did agree, for example, that stoats, rats, pigs and feral cats should be highly prioritised for eradication; while dogs and domestic cats should be prioritised for control. An ambiguous definition for pest species also contributed to a lack of agreement on determining the status of cats as domestic, feral or stray.

Table 4. Setting priorities for pest management: eradication versus control of pest species in decreasing priority order

Pest species for eradication	**Pest species for control**
Stoats	Humans
Rats and pigs	Dogs
Feral cats and wasps	Cats
Stray (domestic) cats and argentine ants	Starling and sparrows
Hedgehogs, plague skinks and mynas	Rosellas
Mice	Pheasants
	Barbary dove
	Magpies
	Mosquitoes
	White tail spiders
	Cockroaches

5.4.4 Elements of a successful pest management plan

In response to what might constitute a successful pest management plan on Waiheke Island, conservation actors suggested various elements that had to be present in a plan (Table 5). The major elements included community engagement, communication, research, goal-setting, expertise, leadership and governance, and methods. While the elements listed appeared to be closely related to the themes that have been previously mentioned, the elements differed in being more specific, clearly stated and somewhat comprehensive. The sub-components provided further explanations or evaluations of the individual elements that have been suggested.

Table 5. Elements of a successful pest management plan on Waiheke Island

Elements	Sub-components
Community engagement	Public consultation Target and include private and/or absentee landowners Differentiate between personal acceptance of the management plan and personal responsibility Identify people that might be upset with the plan and address grievances Decide who is responsible for individual's dissatisfaction
Communication	Maintain clear and multiple lines of communication throughout the process Clearly state impacts of plan on individuals and the community in general Involve the media in a reasonable manner Communicate through campaigns Good science which involves communicating scientific terms to the community in a clear manner
Research	Are methods effective? Have the methods been attempted before? What was the outcome? How much will it cost? Who will pay for it? A reasonable short timeframe (and reasons for longer timeframes)
Goal-setting	Name of plan for general reference Clear vision, aims, goals and objectives (what do we want to achieve and why?) A clear reason for eradication or control What should be the priority and why? A mutual agreement arrived at, for the greater good
Expertise	Availability of necessary resources and knowledge Expert advice
Leadership and governance	Recognise and involve the community champions Management, recognition and/or reward for volunteers; incentives Paid roles for strategic positions Clear expectations for community input Clarity of motivation Acknowledge and celebrate post success or failure A team of clever people
Methods	Address impacts of methods on non-target species Employ humane interventions How does a plan relate to best practice and why follow or not follow best practice?

5.4.5 Likely reasons for public opposition to pest management plans

In recognition of possible detractors, conservation actors explored likely reasons for opposition to a pest management plan within the community. Some of the reasons included the following (Fig. 12);

- Unintended consequences of methods used; for example, soil and freshwater contamination, human health impact of spray poisons, secondary poisoning of pets and non-target species (e.g. birds, insects) and aerial toxin effects on olives, grapes, livestock, water tanks;
- Cultural/historical beliefs and/or religious views; for example cruelty to animals and intrinsic right to life for species;
- Futility of past projects as a deterrent for willingness to approve the cost for future projects;
- Methodologies employed; for example, lackadaisical spraying attitude; and policy, for example, the Society for the Prevention of Cruelty to Animals' (SPCA) Trap-Neuter-Release (TNR) policy for stray cats;
- Attitudinal issues; for example, pest management not being a priority, fear of handling a dead rat, time constraints, family or other responsibilities.

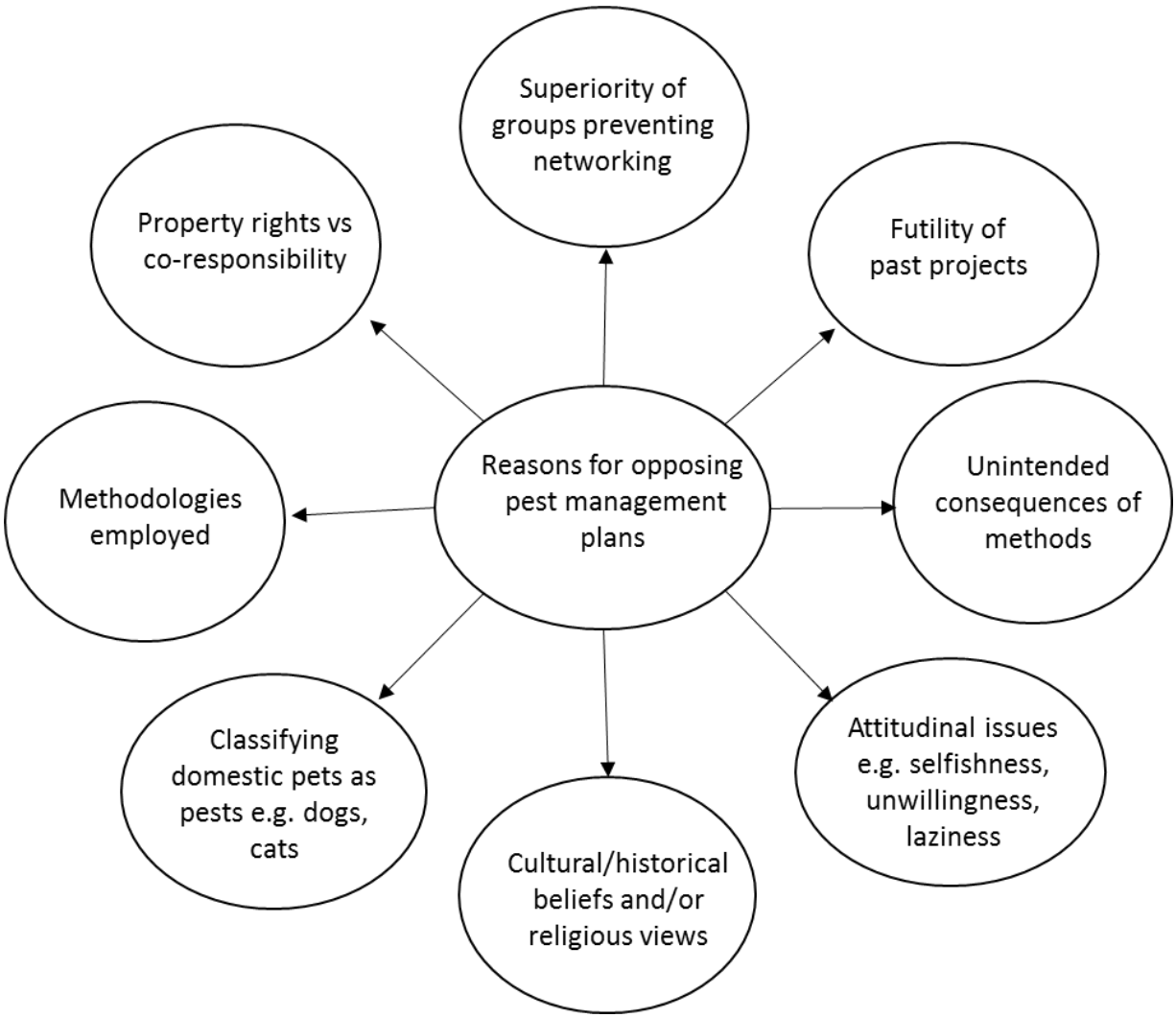


Figure 12. The most likely reasons for opposing pest management plans on Waiheke Island identified in responses from the focus group discussions

5.4.6 Implementing the Living Laboratory principles through engaging conservation actors

While complying with ethical and experimental procedures during the conduct of this study, the principles of Living Laboratory were also adopted and applied in the process of engaging with conservation actors and island residents. In Table 6 below, I present the procedures for practice in a real-life situation.

Table 6. Principles of a Living Laboratory and their applications to pest management

Living Lab Principles	**Applications to engaging stakeholders and communities in pest management**
Value	- Identified values, aspiration and motivations for pest management to enable technical developers design relevant product or service[1] - Development of solutions to match up with pest management needs[1] - Paid drivers and strengthening local resources and capacities[2]
Influence	- Collaboration between researcher and key conservation actors who acted on behalf of other members and leaders within their network[1] - Clarification with conservation actors on interpretation of social network data[1] - Focus group questions were determined by conservation actors [1] - Facilitation was done by a local key stakeholder[1] - The channel of engaging community residents was decided by conservation actors [1] - Involve residents in monitoring of biodiversity, trapping and related activities[2] - Locally-driven projects with external collaboration[2] - Early consultation with residents and locally-driven projects[2] - Recognise and involve community champions[2]
Realism	- Development of major themes in pest management that were unique to the island[1] - Adoption and implementation of plans relevant to and agreed by the community and not necessarily best practice in another location[2]
Sustainability	- Integration of diverse knowledge and perspectives through triangulation of qualitative and quantitative data sources[1] - Maintain[ed] clear and multiple lines of communication throughout the process to encourage iterative interactions and constantly re-examine the needs of the community and solutions proffered[1,2]
Openness	- Creation of a platform for new relationships to be developed as stakeholders discussed their activities and sought prospective partnerships among themselves[1] - Encouraged inputs and suggestions from all stakeholders[1] - Inclusion of cultural stakeholders who were obviously not represented[3] - Target and include private and/or absentee landowners[2] - Identify individuals who are likely to oppose a plan and address grievances[3]

Living Lab principles and applications were adapted from Bergvall-Kåreborn & Ståhlbröst (2009); Bergvall-Kåreborn, et al. (2010); Ståhlbröst (2012); Ståhlbröst & Holst (2012); and Ståhlbröst (2013). Their applications are specifically developed for this study but could be adapted for any conservation project.

1 – Approaches implemented
2 – Suggested approaches from conservation actors
3 – Unsuccessful attempts constrained by time

5.5 Discussion

Scientists and managers cannot develop effective management plans based on assumptions (Larson, 2007), hence the need to identify and understand local discourse around pest management on Waiheke Island. The focus group discussions provided an avenue for conservation actors who were already managing pest animal species to clarify goals and objectives for pest management, identify challenges and suggest solutions for addressing challenges identified. The major themes identified from stakeholders' discourse were *community values*; *setbacks and challenges*; *aspiration* and *resolution*. These themes were further classified into *people*, *environment*, *cost* and *methods* dimensions. While the issues identified were not entirely new, they were unique to the environment being studied. By identifying and articulating issues, rather than assuming them, planners can then set relevant goals and scientists or companies can develop relevant and useful tools.

Conservation actors valued different aspects of their environment and their motivations for engaging in conservation actions can be suggested as closely related to these environmental values. Conservation actors were motivated to act in a reflection of their environmental values, despite challenges encountered. Motivations included a need to keep pests from re-invading neighbouring pest-free islands; a potential to increase biodiversity and the economic status of the island through becoming a pest-free environment and a strong personal drive. These motivations were also indicators for setting pest management goals. Conservation planners can effectively develop management goals that people will readily adopt through insights gained from people's values and motivations.

Conservation actors equally faced challenges that limited their ability to achieve set conservation goals. These challenges included opposition from people with different views; overwhelming responsibilities for volunteers; disagreement on methods and tools for managing pests; lack of adequate funds and resources to execute desired projects; and conflicting values by new residents on the island, which could include values that are not environmentally-friendly (Fig. 12). These challenges are not new, but solutions have not been straightforward. One reason why these challenges persist could be duplicated efforts at combating similar problems experienced by different small conservation groups. One of

the benefits and roles of Living Lab approach is to enable groups to act collectively for the individual good, by helping groups to collectively channel their resources and energy into developing a plan that each member values. Also, by acting together as a group, innovative ways of addressing old problems could be developed, tested and adopted, with little opposition (Mulvenna et al., 2010; Ståhlbröst & Holst, 2012). However, conservation actors must desire to act collectively to enjoy such benefits. In addition, by collaborating with external organisations, whose role in the planning process might differ from the local conservation actors, chances of successful outcomes are increased.

Conservation actors on Waiheke Island were very knowledgeable about issues associated with pest management; however, they did not agree completely on what pest species to prioritise for eradication or control. An ambiguous definition for pest species could have contributed to a lack of agreement on determining the status of some animal species, e.g. cats. In addition, conservation actors' opinions varied in what they described as acceptable pest management methods. These variations could be as a result of divergent values held by the conservation actors. Prevalent reasons for public opposition among communities are often differences in values (Goldson et al., 2015; Robinson & Whitehead, 2003), or use of toxins such as 1080 (Towns et al., 2011); but subtle sources of opposition were uncovered including fear of handling a dead rat, time constraints, family or other responsibilities, organisational policy; for example, the TNR policy for stray cats by SPCA in New Zealand and pest management not being a priority. In addition, if there were power-play issues between groups, the opposition could develop outside the reasons mentioned above; i.e. particular groups may attempt to lead the process of implementing management against the wishes of the broader community. Employing the Living Lab principles could help uncover and address such opposition and strengthen the potentials for networking and collaboration among conservation groups.

Results suggested that conservation actors were in agreement on the need for pest management projects to be locally-driven. The need for local conservation actors to oversee management projects is substantiated by indications that external conservation organisations, whom they looked up to for guidance on managing similar projects, were not acting responsibly, or up to their expectations. As such, the efforts of local conservation

actors seem to be undermined when compared to the failure of these external organisations to act in fairness to their environmental obligations; a condition leading to loss of motivation or "sucker effect" (Buchanan & Russo, 2015). While conservation actors were in support of a locally-driven project, they equally recognised the role of other stakeholders in the planning process. For example, younger residents should be deliberately targeted and engaged in pest management activities to enable them to build an interest that might lead to sustainable management practices over time. A network of pest management clubs could be built in schools and linked with other groups within the community.

Several unsuccessful attempts were made to engage iwi groups (Māori tribes) in the discourse of managing pests on Waiheke Island. The study was explained during a meeting in the marae (Māori Meeting ground) and several follow-ups were made to conduct a focus group meeting aimed at understanding pest management from a Māori perspective. Due to time constraints for this study, follow-ups were discontinued. A Māori adviser suggested that even if communication were established, Māori individuals who had the mana whenua (authority or legitimacy to control resources) to make decisions on cultural issues were not resident on the island, thus, the resident iwi groups could not act on behalf of the larger tribes (J. Perrott, personal communication, October 29, 2015). Following this experience, future pest management plans should be committed to identifying and including Māori groups who have the mana to act on the island. Inclusion starts by building trust and partnerships through deliberate relationships, which might take time; so, an early start is encouraged.

While this study has provided a mechanism for engaging communities in developing pest management strategies, further research is needed to substantiate the results that were presented.

5.6 Conclusion

The principles of value, influence, realism, sustainability and openness were tested in this study, also considered through a Research Living Laboratory designed to enable stakeholders in developing pest management strategies for their community. The application of these principles in the research process have provided a platform for engagement; encouraged stakeholders to influence the research process; assisted in identifying values, aspiration and challenges in implementing a project plan; generated practical suggestions for resolution which matched up with identified challenges; supported a mechanism or product of engagement which stakeholders own and could employ in the future; enabled a productive collaboration between the researcher and local conservation actors, and empowered stakeholders to be involved in designing the study, interpreting social network data and facilitating focus group discussions.

This study has also demonstrated the use of inclusive processes through which communities can make decisions that would benefit and assist them in realising their goals. In addition is the potential for successful collaborations on pest management projects between diverse community groups and between community groups and external organisations. Additional meetings are being planned for the results of this study to be shared among interested individuals, local conservation groups and external organisations. The data obtained to date have provided relevant information and clarified those assumptions scientists, managers and planners might have about engaging local communities in developing pest management strategies, especially on inhabited islands.

CHAPTER 6

Community engagement

In this chapter, I will describe the differences and similarities in the views and perspectives of local residents and conservation actors to achieve my fourth research objective:

Objective 4: Investigate aspects of convergent or divergent views in the wider community with respect to stakeholders' perspectives on pest management

To achieve this objective, I conducted a community-wide survey to understand the views of local residents and determine their preferences in the adoption of a pest management plan. The outcomes of the analysis of conservation actors' discourse (Chapter 5) were used to design the survey questions, thereby increasing relevance and providing a basis for comparison. Comparison between the perspectives of local residents and conservation actors might provide planners with further clarity on issues that might still appear controversial and also enable planners to determine how and when to go about implementing a plan based on levels of community buy-in. I also triangulated the results of the previous chapter (Chapter 5) with the present chapter (Chapter 6) to give a more robust understanding of the issues surrounding pest management planning. I formulated hypotheses to measure and test variables using statistical methods. My study further demonstrates the importance of identifying, understanding and incorporating the perspectives of local communities in pest management planning. I concluded that communities could be empowered to act in favour of a management plan when they feel that their views are respected.

6.1 Abstract

Communities have sometimes been excluded from decision-making processes in conservation due to a narrow definition of stakeholders. Such exclusions have often resulted in deliberate attempts by community members to sabotage the implementation of management initiatives. However, community members, who are equally affected by management decisions, have the potential to generate the momentum needed to achieve conservation goals, when included in the planning process. I employ a quantitative approach, following a qualitative approach (in Chapter 5), to engage 380 island residents in developing strategies for addressing pest management problems within an inhabited island. I develop hypotheses and test them statistically using SPSS. I triangulate both quantitative and qualitative data sources to provide a robust understanding of the values, aspiration, setbacks and challenges and resolution identified by conservation actors and island residents. In this chapter, I report on the points of convergence and divergence between the perspectives and views of conservation actors and island residents. I demonstrate that engaging the community in pest management planning is beneficial as it could help to re-define conservation goals; correct assumptions about local conservation issues; gauge the readiness and willingness of community members to act in favour of pest management goals; uncover social variables that might likely impact negatively on conservation goals, and assist in the development of locally-relevant and readily adoptable plans.

6.2 Introduction

Stakeholders are any individual or group that will be affected by management decisions, including local residents in a community (Mountjoy et al, 2014). The process of developing pest management plans can be controversial and ambiguous; hence, coordination and collaboration with all affected individuals is a necessity (Brody, 2003). By involving stakeholders (including the public), management strategies can be developed that are relevant to local people and thus, are more likely to be accepted and adopted (Bonnell & Koontz, 2007). Engaging the public could also be seen as a process for building collective capacity for community members to implement conservation actions and volunteers for

example, have contributed immensely to the success of conservation projects (Mountjoy et al., 2014).

Effective community engagement entails a bottom-up approach, delegated decision-making power and a shift of emphasis from leadership to collaboration (Selman, 2004). Also, when community members are included in a management plan, they can generate momentum and create a ripple effect in the community, such that members are individually or collectively working actively towards the realisation of conservation goals (Ståhlbröst & Bergvall-Kåreborn, 2011). It is natural for community members to desire to be included in decision-making processes about issues that affect them (Juujärvi & Pesso, 2013). Participation by community members could be achieved in varying ways, including manipulation, therapy, informing, consultation, placation, partnership, delegated power and citizen control (Arnstein, 1969). The different types of participation will not necessarily be equally effective and may result in varying outcomes.

Waiheke Island, like most communities, has a local governance system, numerous conservation groups and leaders or champions who could be vested with the authority to make decisions and empowered to act on behalf of community members. Community members could also be engaged in defining the problems and suggesting appropriate solutions. The more stakeholders are involved, the better the strategies and plans developed. However, it is important to note that local governance or administration cannot replace other forms of governance; for example, regional or national governance. But when conservation planners rely on community efforts to achieve implementation strategies, the place of local governance, community engagement and collaboration cannot be over-emphasised (Selman, 2004).

Community-based conservation attempts to avoid approaches that deliberately or inherently exclude some affected stakeholders, which otherwise has led to public opposition by excluded individuals or groups (Mulrennan et al, 2012). Public opposition of community members to conservation goals they do not approve of could be explained by the theory of "reactance" (Brehm, 1966), which suggests that people breach regulations placed on them by others whom they consider as external, in order to regain their sense of freedom or

independence (Brook et al., 2003). Thus, when communities feel conservation goals are being imposed on them, it is only natural for them to react. However, if these conservation goals were developed locally, perceived to have local inputs, or if community members were involved in the planning process, they are more likely to conform (Margerum, 2007). While it might seem practically impossible to include the entire residents of a community in designing a pest management plan, it is important to provide opportunities where their views and perspectives can be genuinely considered and included. Innovative and creative ways need to be developed so that community members that are affected by management planning can be involved in the decision-making process; for example, the use of photovoice techniques (Bergvall-Kåreborn et al., 2010). With the expectation of innovative tools for managing pests (Russell, et al., 2015), it is advisable to involve users in testing these tools and make use of their input and feedback to improve the quality and usability of new technology (Ståhlbröst, 2012).

In the previous chapter (Chapter 5), Living Lab principles (see Chapter 5, 5.4.6, Table 6) were used to engage stakeholders in developing pest management strategies. These principles could also be applied when engaging community members in pest management planning. This chapter is an extension of the processes employed in the previous chapter, though I employed a different method with a different stakeholder group. I triangulated my findings from the focus groups with conservation actors who were already involved in pest management, with the general community members who would be affected by management decisions. Triangulating the results enabled a more robust and comprehensive understanding of the issues that were identified. I demonstrate that engaging the community in pest management planning is beneficial and practical, knowing that there are various levels of participation and varying roles that could be played by community members.

6.3 Methods

After the focus groups have been conducted (Chapter 5), the wider community was involved in the discourse through a community survey consisting of open and close-ended questions (Appendix F). I anticipated that the views of the wider community might slightly differ from those of the conservation actors who were already involved and experienced in

managing pests. In order to identify any significant differences or correlations in views and to understand how certain social variables affected peoples' engagement in pest management, I assumed five hypotheses.

6.3.1 Hypothesis

The following hypotheses (H_a) were assumed for the variables measured in the survey for the close-ended questions:

Hypothesis 1 (H_a) - There is a significant relationship between land ownership and pest management. I expect to find that landowners are more likely than non-landowners to engage in pest management activities;

Hypothesis 2 (H_a) - There is a significant relationship between beliefs, resolution and objection of respondents to pest management. I expect to find that each of the stated variables is likely to influence or interact with one another. For example, respondents with stronger beliefs are likely to have higher resolution for pest management initiatives; respondents with stronger beliefs are less likely to object or oppose pest management initiatives; while respondents with stronger resolution are also less likely to object or oppose pest management initiatives;

Hypothesis 3 (H_a) - There is an association between respondents' positions on pest management and their respective beliefs, resolution and objection. I expect to find that respondents who show a strong interest in pest management issues and actively support pest management actions are most likely to score highly on beliefs, be highly resolved and less likely to oppose pest management initiatives, when compared to respondents who are sympathetic, unsympathetic or actively opposed to pest management;

Hypothesis 4 (H_a) - There is a significant relationship between the demographic characteristics of respondents and their respective beliefs, resolution and objection to pest management. I expect to find that respondents' beliefs, resolution and objection to pest management differ across age groups, levels of education and household income. The

demographic variables stated in the present hypothesis are ordinal or rank variables; hence, gender, which is a categorical or nominal variable, will be tested in hypothesis 5.

Hypothesis 5 (H_a) - There is a significant difference in means for gender, land ownership and engagement in pest management activities and respective beliefs, resolution and objection. Socio-demographic characteristics such as gender, have varying influences on environmental behaviour (Bronfman, Cisternas, López-Vázquez, Maza, & Oyanedel, 2015), where females have shown greater concern for the environment. Hence, I expect to find that respondents' beliefs, resolution and objection are likely different for male and female; landowners and non-landowners; and respondents already engaged in managing pests or not. Female respondents might, therefore, hold stronger beliefs, greater resolution and lesser objection for pest management initiatives than their male counterparts. I expect to find similar differences among landowners versus non-landowners; and respondents engaged in pest management versus those who are not.

6.3.2 Study design and data collection

Based on the results of the focus group discussions, survey questions were derived from conservation actors' responses to pest management issues; this ensured that relevant issues were addressed and enabled a better understanding of issues at large. Survey items were rated on a 5-point Likert response scale ranging from "strongly agree" to "strongly disagree". A "no opinion" option was included in the response scale to account for indifferent responses as described by Jorgensen & Stedman (2006), which were excluded from the analysis. Community members were initially invited to participate in the survey (Appendix F) through editorial advertisement in a local newspaper called "the Waiheke Marketplace". The surveys were later inserted in the newspaper and distributed to various households. An electronic version of the survey was also made available through Survey Monkey. In addition, the surveys were distributed to community members via other means such as Facebook pages, community websites, emails and community market stalls. Participants were provided with drop-off boxes at several locations for physical submissions. The boxes were located at Matiatia ferry terminal, the local market centre, Waiheke library and Waiheke Island Service Centre. Eight hundred participants were

targeted from the total population of about 8,000 residents. A stratified random sampling method was used to arrive at this sample size as described by Kandola, et al. (2014). Hence, about 80 participants were sought from each of these geographical settlements on the island – Oneroa, Palm Beach, Onetangi, Rocky Bay, Surfdale, Ostend and Blackpool, Matiatia, Orapiu and others (Enclosure, Church, Herekua, Awaawaroa, Whakanewha and Sandy Bays). A total of 380 responses were returned yielding a 47.5% response rate.

6.3.3 Data analysis

Prior to distribution of surveys to the community residents, survey questions were tested for content validity through a group of independent respondents to determine whether the survey questions measured the constructs under study (Pallant, 2013) (see Chapter 2, 2.9). The questions were then revised following some suggestions from the pilot-test respondents (for example, Brook et al., 2003). After collecting survey responses, the analysis was carried out in two stages of qualitative and quantitative data analyses.

6.3.3.1 Qualitative data analysis

Open-ended responses in the survey were analysed using thematic analysis. The themes were developed within Nvivo 10, a data management software (see Chapter 3, 3.3 and Chapter 5, 5.3.3). To aid comparison of the views and perspectives of conservation actors with those of the island residents, the codes and themes developed during the focus group analysis (see the codebook in Appendix E) were replicated in the present analysis. A codebook was equally developed (Appendix G) illustrating reference statements for the themes.

6.3.3.2 Quantitative data analysis

The close-ended questions in the community survey were initially categorised into components based on hypothetical variables derived from the focus group analysis. These variables included values, beliefs, aspiration, attitudes, benefits and solutions to pest management issues (Appendix F). However, after data collection, a Principal Component

Analysis (PCA) was carried out in Statistical Package for the Social Science (SPSS) to determine how the variables (questions) within the dataset could be categorised into main components. In addition, the scree plot provided recommendations for the number of components to be retained or extracted based on eigenvalues. The scree plot gives consistent measures for sample sizes of more than 200 (Field, 2013).

The following questions and statistical tests were determined as relevant for testing the hypotheses and automated in SPSS. The questions given below were analysed individually but in order to reduce redundancy, results were reported as one table per hypothesis in the results section.

Hypothesis 1 (H_a) - There is a significant relationship between land ownership and pest management. Hypothesis 1 was tested using Chi-square test to determine if there was a relationship between the two categorical, independent variables.

- Is there any significant relationship between land ownership and pest management?

Hypothesis 2 (H_a) - There is a significant relationship between beliefs, resolution and objection of respondents to pest management. Hypothesis 2 was examined using Pearson's correlation test to measure the relationship between the variables.

- Is there any significant relationship between beliefs and resolution?
- Is there any significant relationship between beliefs and objection?
- Is there any significant relationship between resolution and objection?

Hypothesis 3 (H_a) - There is an association between respondents' positions on pest management and their respective beliefs, resolution and objection. Hypothesis 3 was examined using Spearman's correlation test to measure the degree of association between two variables.

- Is there any difference between respondents' positions to pest management and their beliefs in pest management?
- Is there any difference between respondents' positions to pest management and their resolution for pest management?

- Is there any difference between respondents' positions to pest management and their objections to pest management?

Hypothesis 4 (H_a) - There is a significant relationship between the demographic characteristics of respondents and their respective beliefs, resolution and objection to pest management. Hypothesis 4 was also evaluated using Spearman's correlation.

- Are there any differences across respondents' age groups/levels of education/income and their beliefs in pest management?
- Are there differences across respondents' age groups/levels of education/income and their resolution for pest management?
- Are there differences across respondents' age groups/levels of education/income and their objection to pest management?

Hypothesis 5 (H_a) - There is a significant difference in means for gender, land ownership and engagement in pest management activities on respective beliefs, resolution and objection. Hypothesis 5 was examined using a series of one-way analyses of variance (ANOVA) to determine whether or not there are differences among levels of the three independent variables on each of the dependent variables.

- Are there differences between males and females/landowners and non-landowners/people who managed pests or not on their beliefs about pest management?
- Are there differences between males and females/landowners and non-landowners/people who managed pests or not on their resolution for pest management?
- Are there differences between males and females/landowners and non-landowners/people who managed pests or not on their objections to pest management?

6.4 Results

In order to enable a comprehensive understanding of pest management issues and engage as many individuals as would be affected by management decisions, an analysis of community survey in combination with the focus group discussions was necessary. Demographic characteristics of survey respondents revealed that the largest cohorts were females (60%), were 65 years old and above (36%), identified as New Zealand Europeans (90%), had

postgraduate qualifications (30%) and an average household income of $100,001 or more (26%) (Fig.13).

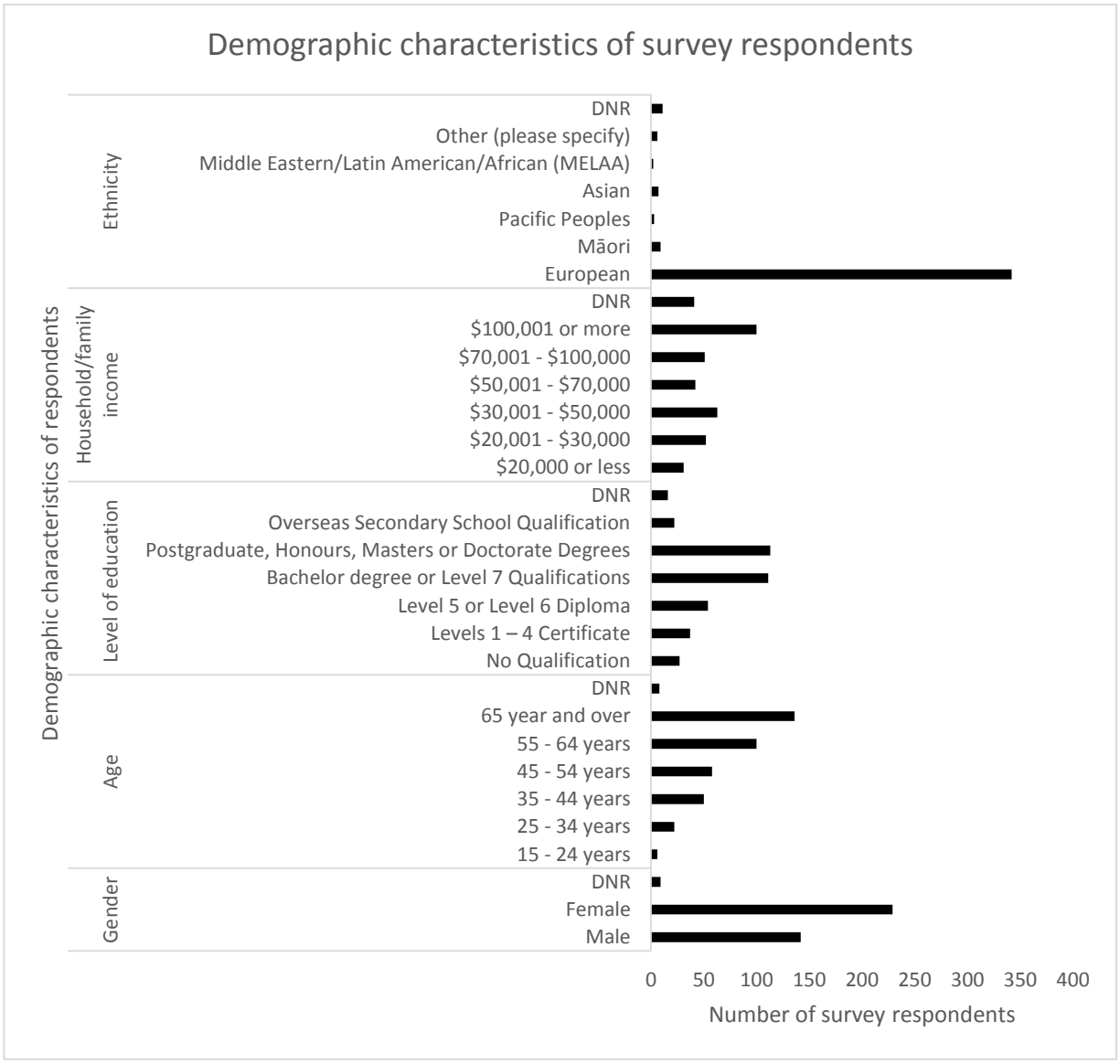


Figure 13. Demographic characteristics of survey respondents

(DNR represents individuals who "did not respond" to the question in each category)

6.4.1 Qualitative results

While the themes from the focus group analysis were replicated for the present analysis, not all the themes were finally retained. At the end of the thematic analysis, nine basic themes, which were not represented by any reference example, were discarded; while five new ones were developed and included in the codebook (Appendix G). Notations for reporting qualitative results have been previously explained (see Chapter 5, 5.4.1).

Basic themes that were discarded included the *strength of minority opposition*, *changing sense of place* and *deficient resources* from the major theme setback and challenges; and *external conformity*, *story-telling*, *biodiversity monitoring*, *goal-setting*, *awakening consciousness* and *local resources* from the major theme resolution.

Basic themes that were developed included *community potential* (under the major theme of community values); *distrust for external agencies* and *insufficient information* (under the major theme of Setbacks and challenges); *economic benefits* (under aspiration) and *subsidised solutions* (under resolution).

6.4.1.1 Additional themes affecting pest management

The major themes replicated for the purpose of the present analysis were community values; setbacks and challenges; aspiration and resolution. Additional basic themes were developed for each of the major themes.

Community values

Respondents identified *community potential* as an additional value within Waiheke Island. Examples were given as:

"It allows me to do things easily that would have been harder to achieve in Auckland"

"[We have the] potential to be a world leader in a self-sustainable environment with +50,000 people living in harmony with each other and the environment"

Setbacks and challenges

Respondents expressed *distrust for external agencies* and identified *insufficient information* as negatively affecting pest management on the island. Examples of some of the statements illustrating these themes were:

"I strongly resent that Auckland Council do very little to manage pest plants on Council-owned property, yet have the guts to require private landowners to do so on their land"

"The Council should be ashamed of their reserves. The number of weeds, rabbits and rats on the island has a lot to do with their lack of action"

"Unfortunately I don't think many residents or tourists have even a basic understanding of how pest-ridden Waiheke is"

"I have not seen any publicity or comments in local newspapers about the increasing numbers of rabbits and whether the council is aware of the increase, or has the power or the means to act…Where do they live? What are they doing to the environment? How quickly will they reproduce and their numbers multiply?"

Aspiration

Respondents' views differed as to whether *economic benefits* would indeed increase motivation for engaging in pest management activities on the island or not. Examples given were:

"I think more people would get involved in pest management if money benefit of pest-free environment was spelt out, e.g., if the money value to our visitor and tourist industry, of or outstanding coastal possum-free pohutukawa [a type of tree endemic to New Zealand] was widely appreciated"

"I think the island population is at about its sustainable maximum, so, I do not wish to see it become more attractive to new residents or to encourage economic growth and benefits"

Resolution

Respondents suggested that providing *subsidised solutions* might increase the involvement of people in managing pests on the island. Examples given were:

"All residents need to take responsibility for eliminating pests from their property. This could be subsidised by Auckland City Council"

"It is great if people are willing to offer their time to helping out their local environment. There should also be money available for more intensive pest control contractors. Rat bait or other resources should be made available at cost price, [external agencies] should provide funding and personnel"

6.4.1.2 Distinct divergent perspectives among respondents to particular themes

This sub-heading is not an attempt to unnecessarily repeat references within the codebook (Appendix G) but to highlight some likely perspectives affecting pest management within the community of study. While respondents agreed to some themes, they were divided over others. One major recurring element within the reference statements could be attributed to whether respondents owned a companion animal (dog or cat) or did not.

Social dynamics

Initially characterised by the difficulty of working with many people to execute a pest management project, the tone of *social dynamics* seemed to shift to that of resignation at the impracticality of eradicating predator species from the island. Examples were given as:

"It is my view that many people will be indifferent to and careless of any serious attempt to eradicate predator"

"Waiheke has far too many people living here now and you would be wasting a lot of money trying to get rid of ALL the pests"

Behavioural inhibitions

Behavioural inhibitions is a recognition of the challenges to pest management necessitating a change in behaviour or beliefs. However, some residents seemed to be more concerned about rationalising the activities and effects of companion animals on native species. Examples were given as:

"My cats kill about four small birds a year. The bird numbers remain high. A small price to pay. My cats kill about 8 rats/mice a year. Rats raid bird nests; therefore, my cats come out about even!"

"We would be deluding ourselves if we excluded cats and even dogs from the list of serious threats to the fauna/bird life of Waiheke. Sure, get rid of rats, stoats etc. but cats have to go too. No matter how dear the moggies are to some people!!"

"Most cat owners are more interested in their cats than in native birds and are in denial about their cats' night-time activities! A waste of good kiwis!"

Defining pests

A basic definition of pest seemed to quickly divide respondents into dog/cat owner or otherwise. Examples were given as:

"If 'pests' include domestic cats, I don't agree with 'pest-free'"

"There are also a different point of views of what is a pest. For me, dogs and cats are pests too… despite their status as household pets"

Necessary evil

While some respondents did not mind the use of 1080 for pest control or eradication, some others were strongly opposed to its use. Examples were given as:

"… I worry that too many people on the island believe that we can manage pests with impractical approaches. This work has to be done with the most effective and cost-effective strategies as outlined by experts. We cannot solve problems with cider vinegar and fermented garlic. If we need glyphosate and 1080, then so be it"

"Happy enough to use targeted poison in traps, like rat baiting. No desire to do blanket poison drops like 1080, or use massive amounts of roundup for weeds"

Release of kiwi

Generally, respondents did not recommend the release of kiwi; however, for different reasons, including the fear of further restrictions on dogs and cats. Examples given were:

"With regards to the kiwi: there is no point in releasing these birds when there are still so many land-based predators on Waiheke. The effort to re-establish bell birds also did not work, as the environment is not quite ready for it, here"

"I disagree with kiwi release as I imagine this would have to involve restrictions on access to more parts of the island on humans and companion animals"

Potential for pest-free status

Again, a companion animal is firstly considered in determining support for a pest-free environment. An example is given as:

"People wanting a pest-free status can go to Tiri! I walk with my dog most days on the beach. I clean the rubbish from the sand as I go!"

Policy change

Respondents were divided on whether a change or development of policies to restrain the effects of companion animals on native species was necessary or not. Examples were given as:

"Cats need to be micro-chipped and if trapped and not identifiable, then euthanised/killed"

"Dogs need to be controlled at all times and not allowed to wander off owner section. Aim is no replacement of either species"

"Dogs are already ridiculously restrained! Already limited access to bush walks by leads on beaches"

"No rules for cat owners. It's not realistic to try and keep them indoors at night"

6.4.2 Quantitative results

The results of the analysis of the close-ended items within the community survey are presented in this section. Outcomes of the PCA and hypotheses testing within SPSS are explained below.

6.4.2.1 Principal Component Analysis (PCA)

Based on the output from the scree plot, three components were extracted from the dataset, namely: beliefs, resolution and objection (Table 7). For each component, the variable items or questions are listed. Also, the mean of each component and reliability values are given. The reliability scores, α, for beliefs (.868), resolution (.978) and objection (.665), suggested that the items measured within the components were consistent and reliable (Bettany-Saltikov & Whittaker, 2014).

Table 7. Principal Component Analysis of close-ended items within survey

Variable indicator	Mean Score	Factor Loading	% of total variance	Component Mean	Reliability (Cronbach's alpha)
BELIEF			16.349	2.26	.868
I would like to see kiwi released on Waiheke island as soon as possible	2.66	0.378			
I would like to see our native animal and plant life flourish	1.25	0.387			
The island would be more attractive to residents if we became pest-free	1.94	0.550			
The island would gain economic benefits if we became pest-free	2.23	0.517			
I believe we have the responsibility to keep pests from going to neighbouring islands where there are no longer pests	1.31	0.468			
I would like to be involved in making Waiheke Island a better place for future generations	1.85	0.508			
I believe that pest species can be totally removed from Waiheke Island	2.64	0.455			
I would prefer that all of the pest species are removed as on Tiritiri Matangi	2.41	0.499			
I am willing to kill pests using anything including poison	2.96	0.360			
Landowners who don't live on the island should be responsible for managing pests on their land	1.95	0.411			
We have to let our tourists and visitors know about our way of life here on Waiheke and make sure that they respect it	1.64	0.477			
We have local expertise on Waiheke Island that could successfully oversee a pest management project	2.47	0.373			
If I was consulted at the early stages of planning a pest management program on Waiheke, I would be more likely to support that programme	2.27	0.551			
I am happy to manage pests on the island if I can see a personal benefit for doing so	2.77	0.614			
I might become involved in pest management activities if I have opportunities to connect more with nature	3.08	0.613			

I am happy to manage pests on the island because as a resident, I feel responsible for my environment	1.95	0.620			
More information about pest management projects on the island could increase my level of involvement	2.26	0.636			
Variable indicator	**Mean Score**	**Factor Loading**	**% of total variance**	**Component Mean**	**Reliability (Cronbach's alpha)**
I am willing to engage in managing pests if my neighbour is also involved	2.91	0.651			
I am willing to engage in managing pests if I am asked to get involved	2.51	0.667			
People should be paid to carry out pest management on Waiheke; volunteers shouldn't have to do it for free	3.02	0.412			
Landowners who cannot manage pests on their land should be willing to pay for someone else to do it	2.14	0.523			
Policies should be developed to assist with the management of pests on the island	1.76	0.545			
A companion animal could become a pest if not properly cared for	1.91	0.441			
RESOLUTION			8.364	6.49	.978
I will begin to contribute in any way I can to manage pests on my land or those of others around me	6.36	0.941			
I might be joining a pest management group very soon	6.65	0.946			
I look forward to getting involved in pest management on Waiheke Island	6.45	0.936			
OBJECTION			7.445	4.50	.665
I do not see pests as a problem at all	4.60	0.554			
I believe that there are no pests on Waiheke island	4.77	0.592			
Even if there are pests on Waiheke island, I am not interested in managing their effects	4.57	0.585			
It is too expensive to manage pests on the island	4.38	0.373			
I would prefer that some pest species remain on the island	4.23	0.499			
I don't think we should kill pests	4.43	0.580			

Mean values for each item (n=380) were calculated across each component.
Extracted components were belief, resolution and objection.

6.4.2.2 Outcome of hypothesis 1

H_a - There is a significant relationship between land ownership and pest management.

Pearson's Chi-Square test of independence was conducted to determine if a significant relationship existed between land ownership and pest management. The result suggested that landowners are more likely than non-landowners to engage in pest management activities, n=367, χ^2 (4) = 81.162, p < .001.

6.4.2.3 Outcome of hypothesis 2

H_a - There is a significant relationship between beliefs, resolution and objection of respondents to pest management.

A Pearson's product-moment correlation was carried out to assess the relationship between belief, resolution and objection of respondents to pest management (Table 8). Results suggested that there was neither a correlation between belief and resolution; nor belief and objection to pest management. However, there was an indication of a positive correlation between resolution and objection.

Table 8. Pearson's product-moment correlation test of relationship between respondents' beliefs, resolution and objection

		Belief	Resolution	Objection
Belief	Pearson Correlation	1.000	-.052	
	Sig. (2-tailed)		.327	
Resolution	Pearson Correlation		1.000	.191**
	Sig. (2-tailed)			.000
Objection	Pearson Correlation	-.065		1.000
	Sig. (2-tailed)	.216		

**Correlation is significant at the 0.01 level

6.4.2.4 Outcome of hypothesis 3

H_a - There is an association between respondents' positions on pest management and their respective beliefs, resolution and objection.

A Spearman's correlation was carried out to determine the presence of an association between respondents' positions on pest management and their respective beliefs, resolution and objection. Respondents' positions on pest management were classified as being active, sympathetic, indifferent (i.e. neither sympathetic nor unsympathetic), unsympathetic or actively opposed to any action on pest management issues as described by Theodori & Luloff (2002). Results suggested that there was a positive correlation between respondents' positions on pest management and their beliefs, r (364) = .263; $p < .001$; a significant negative correlation between respondents' positions and resolution, r (358) = -.396; $p <$ .001; and a significant negative correlation between respondents' positions and objection to pest management, r (361) = -.287; $p < .001$.

6.4.2.5 Outcome of hypothesis 4

H_a - There is a significant relationship between the demographic characteristics of respondents and their respective beliefs, resolution and objection to pest management.

A Spearman's correlation test was further carried out to determine if there was an association between respondents' demographic characteristics (e.g., age, levels of education and household income) and their respective beliefs, resolution and objection to pest management (Table 9). Results suggested that there was a positive correlation between age and respective beliefs, resolution and objection. However, there was neither a correlation between levels of education nor household income and beliefs, resolution and objection respectively.

Table 9. Spearman's correlation test: relationship between respondents' age, levels of education and household income and respective beliefs, resolution and objection to pest management

		Age	Levels of education	Approximate household or family income
Belief	Correlation Coefficient	.104*	.050	.040
	Sig. (2-tailed)	.047	.341	.449
Resolution	Correlation Coefficient	.109*	.030	.006
	Sig. (2-tailed)	.040	.576	.907
Objection	Correlation Coefficient	.124*	.033	.072
	Sig. (2-tailed)	.018	.529	.169

*. Correlation is significant at the 0.05 level

6.4.2.6 Outcome of hypothesis 5

H_a - There is a significant difference in means among gender, land ownership and engagement in pest management activities on respective beliefs, resolution and objection.

A series of one-way analyses of variance (ANOVA) were conducted to examine the mean differences among gender, land ownership and engagement in pest management activities on respective beliefs, resolution and objection (Table 10).

Results suggested that for belief, there was a significant mean difference in engagement in pest management, with people that are not engaged in pest management activities scoring higher (M = 2.42) than those already engaged in pest management activities (M = 2.17), though the effect appeared small (η^2 = .04). There was no significant mean difference in beliefs among males and females and among landowners and non-landowners.

Similarly, results suggested that there was a significant mean difference in resolution for land ownership and engagement in pest management. Landowners scored higher than non-landowners on resolution, with a small effect size (η^2 = .07). Individuals who were already

engaged in managing pests scored higher than those who were not engaged in pest management on resolution, with a large effect size ($\eta^2 = .88$). There was no significant mean difference in resolution among males and females.

Lastly, results suggested that there was a significant mean difference in objection for land ownership and engagement in pest management. Landowners scored higher than non-landowners on objection, with a small effect size ($\eta^2 = .02$). Individuals who were already engaged in managing pests scored higher than those who were not engaged in pest management on objection, with a small effect size ($\eta^2 = .08$). There was no significant mean difference in objection among males and females.

Table 10. One-way ANOVA: differences among respondents based on gender, land ownership, engagement in pest management on respective beliefs, resolution and objection to pest management

BELIEF			Mean	SD	η^2	F (1^a, 361^b)	Sig.
	Gender				.01	2.38	.12
		Male	2.17	.55			
		Female	2.31	.73			
	Land ownership				.01	1.05	.31
		Yes	2.24	.65			
		No	2.29	.74			
	Engagement in pest management				.04	14.63	.00*
		Yes	2.17	.69			
		No	2.42	.66			
RESOLUTION			Mean	SD	η^2	F (1^a, 355^b)	Sig.
	Gender				.00	.99	.32
		Male	6.33	2.40			
		Female	6.58	2.33			
	Land ownership				.07	25.49	.00*
		Yes	6.84	2.14			
		No	5.36	2.67			
	Engagement in pest management				.88	2320.24	.00*
		Yes	7.99	.15			
		No	3.19	1.41			
OBJECTION			Mean	SD	η^2	F (1^a, 358^b)	Sig.
	Gender						
		Male	4.49	.54	.00	.27	.61
		Female	4.49	.58			
	Land ownership				.02	5.37	.02*
		Yes	4.54	.57			
		No	4.38	.49			
	Engagement in pest management				.09	9.29	.00*
		Yes	4.58	.51			
		No	4.28	.54			

[a]=degrees of freedom (df) between groups; [b]=df within groups; SD = standard deviation; η^2= eta squared (effect size).

*The mean difference is significant at the .05 level

6.5 Discussion

In this chapter, I demonstrate that social variables such as belief, resolution and objection could determine whether people managed pests or not; hence, could also indicate whether or not they would readily adopt new pest management initiatives. In addition, views and perspectives could differ between different groups of stakeholders. Such differences could aid a better understanding of pest management issues which might be harnessed to develop management plans that would add value and be relevant to stakeholders.

6.5.1 Influence of belief, resolution and objection on pest management

A significant relationship was observed between landowners and pest management, suggesting that land ownership could determine or enhance engagement in pest management activities. Landowners might be able to contribute positively towards eradicating pests if consulted and included in management planning. However, some residents reported not being able to manage pests even if they wanted to, either because they did not personally own a land, or were not allowed by their property owners. Some residents also reported a desire to be involved in managing pests through the association of landowners in their neighbourhood. Leaders of landowners' associations could potentially encourage the involvement of new residents and implement pest management plans within the neighbourhoods. It would also appear that people who were already involved in pest management have favourable views and would readily adopt new pest management initiatives since they were already motivated. Thus, planners could develop a programme to target landowners who are not already involved in managing pests within the community, with the aim of increasing engagement.

Similarly, results suggested that the beliefs of a respondent about pest management, their resolution towards engagement for a better management and objection against pest management are all likely influenced by the respondent's position on pest management (for example, Theodori & Luloff, 2002). Thus, for instance, if a respondent is actively involved in pest management activities, they are likely to express positive belief, resolve to engage more when an opportunity arises and less likely to object to certain pest management

methods. Similarly, if a respondent is opposed to pest management activities, they are likely to express negative belief, resolved not to engage in any activity and more likely to oppose any form of pest management. For example, some residents suggested that they were not aware of the presence of pests in quantities sufficient to impact on biodiversity; unaware of pest management groups on the island; uninformed about pest management methods; thought their cats were responsible for managing pests and denied a cat's status as invasive. These beliefs might have contributed to an indifference to pest management issues. Thus, if residents' beliefs could be influenced in practice; then, increased visibility of pest management groups, sharing successful project outcomes and profiling of pest species in accessible forms might address certain beliefs negatively impacting on managing pests. Planners and managers could therefore potentially develop strategies that aim to shift people's position on pest management with the aim of gradually combating opposition and increasing resolution among communities. That is, people could gradually be influenced to shift their position from being opposed, to being indifferent and sympathetic and finally, to being active.

Results suggested that belief has no likely connection with resolution, neither was belief likely associated with an objection to pest management. However, a resolution was likely associated with an objection. There is, therefore, an assumption that the more a respondent is resolved to engage in pest management activities, the less likely they are going to object to pest management strategies. While this study did not quantitatively explore motivations for engaging in pest management activities, qualitative data from open-ended responses suggested that people were motivated, or could be motivated for different reasons including *personal drive*, *neighbourly responsibility*, *sustainable biodiversity* and *economic benefits*. Also, resolution could be closely related to motivations (McKenzie-Mohr & Schultz, 2014; Roberts et al., 1995). Hence, planners and managers could develop strategies to increase motivation for pest management among community members, which might likely trigger resolution for positive actions in favour of the environment.

Survey results suggested that the beliefs, resolution and objection respondents had about pest management were not different across levels of education or household income. However, belief, resolution and objection varied across age groups. Several studies found

varying age influences on social variables (Bronfman, et al., 2015; Nordlund & Garvill, 2002; Stern & Dietz, 1994). In this study, there is an assumption that older respondents were more inclined to positive or stronger belief, better or consistent resolution and unlikelihood of objection to pest management. A respondent likely supported this assumption with an open-ended response stating "I will continue with pest control work in my area and on my property until I fall over - which may be soon, as I'm 77 years old". Planners and managers could tap into the motivation of older people, while also developing strategies to encourage younger individuals to be engaged in pest management activities.

Furthermore, results suggested that respondents' beliefs about pest management were not different between males and females (see Korfiatis, Hovardas, & Pantis, 2004; McDougle, Greenspan, & Handy, 2011; Stern & Dietz, 1994) and also between landowners and non-landowners. However, people who were not engaged in pest management were likely inclined to hold positive or stronger belief than those who were already engaged in managing pests. There could be an assumption that stronger or more positive belief might not make any difference for those who were already involved in pest management since they were already involved. However, for those who were not involved, holding strong or positive belief might ease the attempt planners and managers might likely make to encourage a positive view of pest management within communities.

Also, landowners likely had higher resolution to engage in managing pests than non-landowners. As explained previously, land ownership might be an influencing factor for engaging in pest management. Similarly, respondents who were engaged in pest management were more likely to have higher resolution than those who were not engaged. While the reasons for the difference in resolution were not evident in this study, it is likely that those already engaged were personally motivated and might further be encouraged by the outcomes of engagement; for example, improved or flourishing biodiversity. Resolution for pest management were however not different between males and females.

In addition, while objection for pest management were not different between males and females; landowners significantly differed from non-landowners in their objections for pest management. Also, respondents who managed pests likely differed in their objections from

respondents who did not. This suggested that if people were already engaged in managing pests, it is less likely that they would oppose pest management strategies. However, increasing engagement might not automatically guarantee that people would act more favourably towards managing pests, as engagement could be influenced by other social variables (for example, Bronfman et al., 2015; Larson, Stedman, Cooper, & Decker, 2015).

6.5.2 Harmonising views and interests of stakeholders

While island residents echoed some of the conservation actors' views on pest management, there were areas of divergence. For example, while conservation actors aspired to release kiwi and increase the island's potential for tourism through a pest-free status; residents did not view a pest-free status as synonymous to increased tourism. Island residents did not generally appreciate the need to introduce kiwi due to a previously failed attempt to introduce bellbirds on the island; the presence of predator species such as cats, and the fear of additional restrictions on dog owners preventing them from walking their dogs in certain areas in order to encourage kiwi populations.

However, both conservation actors and residents were of the opinion that total eradication of animal pests was impractical because of human residents on the island; disagreement in acknowledging companion animals as potential pests; disapproval in using chemicals and poison bait drops and other challenges. As such, any planned initiatives might accommodate tolerable levels of invasive species, plus encourage and more effectively enforce responsible dog and cat ownership. Conservation actors and residents also agreed that absentee landowners should be responsible for managing pest species on their lands and should consider paying for pest management services if they did not have the time. In addition, pest management initiatives could be more effective and encourage community buy-in, if projects were locally-driven and led by community experts, with external organisations providing funds, technical support and necessary advice. A lack of trust in external organisations due to failed projects and neglect of responsibilities was cited by both conservation actors and residents. Thus, external organisations involved in managing pests on the island need to re-build trust and commitment if residents were to appreciate the roles played by these external agencies. Conservation actors and residents were divided

between the potential use of chemicals and poison bait drops for pest eradication. While some considered the use of poison baits as a necessary evil and an alternative strategy; others were totally opposed to using poison baits in any form but rather favoured the use of toxin-free humane traps as Fraser (2006) reported in his review of public attitudes to pest control.

6.5.3 Towards achieving a pest-free Waiheke

My study found minimal consensus on the definition of pests, classification of some mammalian species as pests, prioritisation of pest species for eradication or control and acceptable methods for pest management as Game et al. (2013) and Goldson et al. (2015) also found in their studies. These divergent views indicated the need for a re-definition of goals and objectives to provide clarity on what is achievable or not, or to further describe what "pest-free" means. Would "pest-free" then be synonymous to "zero-pest" or "negligible presence of controlled pests"? Theoretically, if all the challenges and likely opposition identified were addressed, then there could be a "zero-pest" environment. Practically, the unlikelihood of addressing all of the challenges, the unpredictable nature of humans and insufficient models of total eradication on inhabited islands, pose a real challenge. These challenges, however, should not undermine the efforts made by various individuals and groups to manage pests. Efforts should be consolidated and further attempts made to resolve challenges. In addition, achieving pest management goals require perseverance as timeframes might be prolonged. Tapping into personal and group motivations could enhance residents' engagement with pest management activities. For instance, the natural drive for community members to enhance their environment has been under-utilised. This drive could be harnessed if new ways are developed by which members could be engaged in issues that directly affect them (Juujärvi & Pesso, 2013). Individuals and groups who also managed pests but were not publicly recognised should be identified and included during a consultation. For example, pig hunters who also hunted other predators, landowners who might be personally motivated to manage pests, pest management companies offering services and manufacturing pest products, and cultural groups such as Kaitiaki (guardian) groups whose cultural obligations to protect the environment motivated them (see Roberts, et al., 1995). In addition, technical inputs and

scientific recommendations cannot be overlooked but have to be requested, understood and appreciated by local stakeholders before a community can buy-in and properly implement pest management plans. Likewise, community's beliefs and desire to oversee local projects have to be considered and included in a management plan for technical and scientific recommendations to be implemented on ground. In essence, I share the view of Chalmers (2013) that all stakeholders have to cooperate and work together to achieve their common goals and objectives.

Several respondents referred to a successful model of pest eradication in Rocky Bay neighbourhood on Waiheke Island. A joint partnership between Auckland Council, Rocky Bay Rat-busters and residents resulted in widespread awareness and willingness to install, maintain and monitor rat bait stations in various sections within Rocky Bay (C. Cullum, personal communication, February 15, 2016). Resident volunteers were actively engaged in setting traps, distributing baits, monitoring and reporting findings. At the end of the project cycle, residents reported on evidence of increased bird life and reduced rat activities on their properties. Further plans were being made, at the time of writing this report, to introduce the model to other neighbourhoods within Waiheke Island. Cases of successful outcomes such as the Rocky Bay Rat-busters offers the possibility of engaging residents through social diffusion leading to behaviour change (for example, McKenzie-Mohr & Schultz, 2014; Steg & Vlek, 2009).

6.6 Conclusion

This chapter builds on guidance provided by Living Laboratory to design the survey used to better understand issues surrounding pest management in the community. Community members were able to state their views, which would assist stakeholders to design relevant pest management projects. By opening up the process for planning pest management initiatives, affected individuals can contribute to developing goals and objectives and defining conservation actions. Social variables such as belief and objection do indeed affect the adoption of management plans; hence, it is important to investigate what beliefs people hold and reasons for objection. The positive attributes of these variables could be emphasised to increase engagement, while the negative aspects could serve as indicators of

what not to include in a management plan. In addition, the negative attributes could also provide a cue for behavioural aspects to change; for example, if a behaviour change is required for a conservation action. In this chapter, I demonstrated that engaging the community in pest management planning is beneficial as it could help to re-define conservation goals; correct assumptions about local conservation issues; gauge the readiness and willingness of community members to act in favour of pest management goals; uncover social variables that might likely impact negatively on conservation goals and assist in the development of locally-relevant and readily-adoptable plans.

Chapter 7

Discussion

The aim of this thesis was to investigate how engaging a community could aid in developing new conservation initiatives. I hoped to achieve this aim through four objectives:

Objective 1: Identify community values and the role of Sense of Place in facilitating or hindering the implementation of conservation goals in isolated communities

Objective 2: Understand local governance among multiple conservation actors through their social networks

Objective 3: Test the Living Laboratory approach in engaging stakeholders

Objective 4: Investigate aspects of convergent or divergent views in the wider community with respect to stakeholders' perspectives on pest management

In this chapter, I review the core outcomes of my thesis, assess each of the objectives, highlight the major challenges and limitations to the study, give directions for future research and examine the prospect of a predator-free Waiheke and New Zealand at large. I also present an open methods approach or mechanism for including social considerations in pest management planning.

7.1 A synopsis of research contributions

This thesis addresses a controversial subject in conservation – pest management – by developing a mechanism for incorporating social considerations into pest management planning through community engagement. The process of engaging communities in developing management plans can sometimes be elusive to conservation planners, who are mostly skilled in ecological or biological sciences (Bieling, et al., 2010; Simberloff et al., 2013). Hence, by providing direction for how communities can be engaged, planners can effectively channel their resources and efforts into developing a plan that people will ideally adopt and implement on-ground with little or no opposition. Special consideration is given to developing pest management strategies on inhabited islands as inhabited islands pose a unique challenge in planning eradication programmes.

In Chapter 3, I reviewed responses that revealed evidence for how a Sense of Place could evoke engagement or detachment of communities when planning pest management strategies. I also reviewed case studies that demonstrated the implications of undermining a community's sense of place. The outcomes in Chapter 3 established the context for whether or not communities would adopt a particular management plan. In essence, any long-term strategy involving pest management should account for the Sense of Place and other social processes at play between individuals in a community, among community members as a collective and through their relationship to their environment. Waihekeans and any other community are likely to support a pest management strategy but only if they are deeply involved in all aspects of planning and implementation. I concluded that Sense of Place and other social processes within a community should be identified and incorporated into pest management plans at the inception phase.

In Chapters 4 to 6, I carried out three separate but connected studies to investigate effective engagement of stakeholders. The studies undertaken in these chapters were a sequence and the results of the earliest phases informed the direction for the latter phases. The studies were designed using a pragmatism paradigm and mixed methods approach. The pragmatism paradigm assumes that reality is dynamic and embraces a process of collaboration where participants jointly create knowledge and solutions to problems based

on shared values, meanings and understandings (Popa, et al., 2015). In 2012, a vision to eliminate invasive predators from New Zealand was proposed (Russell et al., 2015). This study presented a unique opportunity to investigate the feasibility of a Predator Free New Zealand concept in an inhabited island, using Waiheke Island as a case study.

In Chapter 4, I identified conservation actors as a type of stakeholder actively engaged in conservation projects on Waiheke Island. I analysed the structure of the relationship between these actors using social network analysis. The results suggested that a few actors played a major role in the network of conservation stakeholders within the community. These actors created a core or centre of influence within the network, which on the other hand, is not sustainable if their continuous presence within the network cannot be guaranteed. The results further suggested that the structure of local governance within the network of conservation actors on the island is not sufficient to sustain effective collaboration or build a strong local capacity for the implementation of management plans. However, I recommended that the network can be influenced to enable optimal functioning, strengthen existing connections, create new links and facilitate individual power and influence.

In Chapter 5, I applied Living Laboratory principles – value, influence, realism, sustainability and openness – to engage stakeholders in developing strategies for addressing pest management issues within Waiheke Island (Bergvall-Kåreborn & Ståhlbröst, 2009; Ståhlbröst, 2013). Prior to bringing stakeholders together, pest management problems were defined by key conservation actors identified from the outcomes of the social network analysis (Chapter 4). Stakeholders' discourses were captured during the focus group sessions and analysed using thematic analysis, with the help of Nvivo software. Major themes identified by conservation actors were *values*, *aspiration*, *setbacks and challenges* and *resolution.* This study demonstrated that communities indeed do understand issues facing them and can make decisions that would benefit and assist them in realising their goals. In addition, employing the Living Laboratory principles in the research process empowered stakeholders to influence and design the study in collaboration with the researcher; hence, knowledge was jointly co-created. Living Laboratories have the potential to initiate and sustain successful collaborations on pest management projects between

diverse local conservation groups and between local conservation groups and external organisations.

In Chapter 6, I employed a quantitative approach, following the outcomes of a qualitative process (Chapter 5), to engage island residents in planning management strategies. I developed hypotheses and tested them in order to evaluate the significance of the effects of social variables on the adoption of management plans. I triangulated both quantitative and qualitative data sources to provide a robust understanding of the issues identified by conservation actors and island residents. I also reported on where the perspectives and views of conservation actors and island residents differed or matched. I concluded that community members, who are equally affected by management decisions, have the potential to generate the momentum needed for achieving conservation goals when included in a management plan. In fact, the engagement of all stakeholders in the design of a management plan has great potential for helping to re-define conservation goals; correct assumptions about local conservation issues; gauge the readiness and willingness of stakeholders to act in favour of pest management goals; uncover social variables that might likely impact negatively on conservation goals and assist in the development of locally-relevant and readily adoptable plans.

7.2 Embrace and incorporate values in practice

Objective 1: Identify community values and the role of Sense of Place in facilitating or hindering the implementation of conservation goals in isolated communities

New Zealand has recorded successes in numerous pest eradication projects, though these eradications have been mostly limited to uninhabited islands (Towns et al, 2013). Inhabited islands pose a unique set of challenges often culminating in public opposition (e.g. Varnham et al., 2011). However, the imminent opposition could be predicted by understanding the relationships, emotional connections, dependency and likeness people develop for places they reside (Jorgensen & Stedman, 2001; Stedman, 2003). These connections with physical spaces, known as a sense of place, could trigger the development of environmentally friendly behaviours (Carrus, et al., 2005). Hence, understanding

people's experiences of their location and what these experiences mean to people, could give insight into planning conservation strategies that embody people's relations to their environment and thus, the adoption of such strategies.

In Chapter 3, I identified how island residents have developed a collective identity from their environment and community values. I also reported that when a sense of place was perceived to be undermined, a developmental project within the community was halted; a case for an independent local government was reinstated; a local development strategy was reviewed to re-assert the island's unique identity; and a marine reserve that would enhance the island's unique dependence was supported by a large number of residents. In addition, there seemed to be a perception that the sense of place was changing as a result of a change in the resident population's social, economic and environmental structures (Waiheke Local Board, 2014). This changing sense of place has triggered strong reactions to internal and external threats in order to maintain the island's identity and uniqueness (Bonaiuto et al., 2002). As a result, I predicted that pest management strategies that challenged or undermined an individual's sense of place will likely be rejected or strongly opposed. Therefore, I recommended that an effective pest management plan should seek to retain community values and identity and promote residents' relationship with the environment while encouraging residents to adopt and implement conservation actions.

7.2.1 Limitations

Incorporating community values into management goals might seem to be impractical, as values could be diverse and vary widely. Waiheke might be viewed as a non-homogeneous community because individuals have differing opinions, views and interests on specific issues. These diverging views could further contribute to in-group conflicts among residents and out-group conflicts between residents and external individuals or organisations. Also, community values are not necessarily synonymous with conservation values nor they will guarantee the achievement of conservation goals. Planners might, therefore, be quick to dismiss community values; nevertheless, incorporating communities' values and views into pest management planning could forestall public opposition when implementing pest management plans.

In addition, while residents valued biodiversity on their island and would strive to improve or maintain the state of the environment; they might not be willing to maintain biodiversity at the expense of some values; for example, the use of aerially spread toxins. Hence, community values might conflict with proven and tested pest management methods. However, not all residents might oppose the use of toxins. Thus, an effective management plan could include multiple options for conservation actions to accommodate people's values and motivations.

7.2.2 Future research

Island communities whose values have been undermined and excluded from previous conservation strategies might be naturally suspicious of new development plans; hence, there needs to be a genuine interest to incorporate community values into conservation or pest management planning. It is not, however, clear if developing multiple conservation actions to accommodate people's values and motivations will lead to the realisation of conservation goals and while at the same time fulfil community goals. If compromises were to be made, how do planners negotiate community values without sabotaging conservation values and vice versa? Future work could explore and test innovative and practical ways of reaching such compromises and setting priorities in values.

I propose that there could also be a distinction between individual and collective identities, as communities cannot be treated as homogenous. This study only found indications for an individual and collective identity through emotional connections with each other. If there were aspects of the physical environment that could help develop an individual and collective identity, which of these identities would facilitate conservation values? For instance, would the creation of reserves, which might restrict the use of resources but foster biodiversity, be considered a value that resonates with individual or collective identities? Future research should investigate what aspects of the physical environment could develop an individual or collective identity. In addition, differences in the values of cultural individuals and groups (e.g., Māori and non-Māori) with respect to the physical environment should be studied. For example, is the Sense of Place concept really just a

western construct or does it have an equivalent cultural application (Smith, 2004)? Would the themes developed during the analysis of the interviews (Chapter 3, 3.4.1) be identical if the views and perspectives of Māori individuals and groups were explored? A comprehensive knowledge of identities that would positively impact conservation values would enable planners to concentrate on the more favourable identity. Quantitative approaches could also be employed, in addition to the qualitative approach used in this study, to capture and understand which conservation values constitute individual and collective identities.

7.3 Making sense of local conservation actors' networks

Objective 2: Understand local governance among multiple conservation actors through their social networks

The structure and nature of relationships among conservation actors could reveal the capacity for collective conservation actions and promote the implementation of conservation plans (Mills et al., 2014; Prell et al., 2009). The stability and resilience of local conservation networks could determine stakeholders' capacity for local governance and predict how well communities can facilitate social processes such as collective action, consensus, or the resolution of conservation problems. In addition, social networks aid the identification of influential actors whose position in the network indicates their capability to make and drive favourable decisions on a long-term, sustainable basis (Sobczak et al., 2013). Information on conservation actors' ability and influence through analysing and understanding their network structure is crucial for conservation and invasive species management. If conservation actors could influence the behaviour of other network members, then buy-in for invasive species management strategies and collective action within a community could be enhanced. Such understanding could also assist in gaining valuable insight into how to initiate local support, increase the chances of collaboration and prevent public opposition during the implementation of a management plan for invasive species.

In Chapter 4, I identified conservation actors on Waiheke Island and analysed the structure of their relationship using social network analysis (SNA). A relationship existed between

the position of conservation actors and their ability to influence the network. Results suggested that a few actors exerted a strong power and influence on the other members within the network due to the positions they occupied. Because of the position of conservation actors within the networks, the roles that each of them could effectively play also varied. For example, the actor who could quickly spread information, rally resources and support for the other members was different from the actor who could initiate new connections with local conservation actors as well as with crucial external industry players and resolve conflict within dissenting groups. However, connections within the network were sparse and exchange of ties was very low. I, therefore, concluded that the structure of local governance within the island was not strong enough to sustain effective collaboration or build a strong local capacity for the implementation of management plans. However, I recommended that the network could be influenced to enable optimal functioning, strengthen existing connections, create new links and facilitate individual power and influence.

In addition, in working towards implementing a predator-free New Zealand and a pest-free Waiheke, there needs to be an understanding of the network structure of stakeholders involved. I recommended that in order to initiate and sustain productive dialogue and collaboration among conservation actors and other stakeholders, the pattern of relationships among them needs to be identified, analysed, understood and utilised in developing conservation or pest management strategies.

7.3.1 Limitations

While few actors created a core or centre of influence within the network, the network was neither well-suited for collective action nor sustainable as the continuous presence of those actors within the network could not be guaranteed. Actors who exerted a powerful influence on other members within the network could misuse their position for personal gains and manipulate resources and information meant for other network members (see Hoppe & Reinelt, 2010). The network structure was likely affected by the unwillingness of some conservation actors to be involved in the survey, therefore the network did not provide a complete picture of all the conservation actors within the community.

In addition, negative network questions, which could give indications of actors who could likely oppose conservation plans, were considered inappropriate and had to be removed from the network questions. Building trust and partnerships could encourage stakeholders to respond to such negative questions as they become aware of the importance of their responses. For example, unhealthy networks harbouring potential opponents to implementation plans could be uncovered at an early stage. During this phase of the research, trust was still being developed between the researcher and stakeholders, which could have further influenced response rates. The snowball function within the data collection system – organisational network analysis – could complicate the process of obtaining information on actors' networks and even result in response errors. Therefore, the design and function of the snowball function have to be reviewed for optimal data collection. While efforts were made to include cultural conservation actors in the network, there was no success in regard to this; probably because key actors were not resident on the island or were not willing to identify as key actors. Also, conservation groups operated on different scales within a local context; as such, there might be little room for interaction with other groups whose scopes were different.

It is important to note that while I have employed SNA to understand the pattern of relationships among actors in this chapter, structural measures alone are not sufficient to interpret the nature of relationships or predict the roles of an actor within their networks as Hoppe & Reinelt (2010) cautioned. However, using SNA to identify the central actors within the conservation network on Waiheke Island gave me an insight into actors that could easily and quickly connect with other members of the network. I closely worked with these actors throughout my research. In addition, these central actors interpreted the positions they occupied within the network through the network diagrams. Their interpretations corroborated with the results of the study. Therefore, conservation planners can take advantage of the benefits of SNA to promote the implementation of conservation plans through the positive influence of key conservation actors within conservation networks.

7.3.2 Future research

While individual actors were somewhat limited in their ability to interact across the network due to the different range of conservation activities they were involved in, creating consistent opportunities for them to communicate and work together might increase collaboration and strengthen local capacity. Therefore, future research should identify and develop practical ways by which stakeholders within a non-sustainable network could work or communicate more together, despite being engaged in slightly different activities.

Future research could also investigate if duplicating actor roles could actually empower other members within the network or increase their individual capacity to carry out important management functions for conservation and invasive species. Although the social network survey used in this thesis excluded negative network questions due to complaints from some network members, responses to negative network questions could uncover potential opponents to management strategies at an early stage of planning. Therefore, future research should investigate the possibility of including negative questions in a social network survey and whether responses to such questions could indeed help uncover likely opponents. Also, while outliers did not show evidence of communication within the conservation network, it might be beneficial not to overlook them because some might pose a potential source of opposition if not identified and included in a new conservation initiative. Outliers might also constitute potential sources of new links as they are already close to, though not within the network. Hence, the role of outliers and possibility of integrating them within the network should be studied.

Social Network Analysis enables the identification of influential actors whose position in the network indicates their capability to make and drive favourable decisions on a long-term, sustainable basis. In working towards a predator-free NZ, the role of SNA in the evaluation of stakeholders' roles and capacity to function within a conservation network should be investigated.

7.4 Open up the planning process

Objective 3: Test the Living Laboratory approach in engaging stakeholders

Conservation outcomes can be improved by increasing collaboration among multiple and different stakeholders (Brody, 2003). For collaboration to be effective, the following challenges need to be addressed: lack of definition and understanding of the problem; assumptions about the needs of stakeholders; a deliberate or unintentional exclusion of some stakeholders; making decisions without adequate stakeholders' consultation; and equating "have your say" programmes with actively engaging affected individuals whose inputs might not influence conservation planning. These challenges are not new, but addressing them requires innovative approaches.

In Chapter 5, I applied Living Laboratory (LL) principles – value, influence, realism, sustainability and openness – to engage stakeholders in pest management planning (Bergvall-Kåreborn & Ståhlbröst, 2009). Conservation actors identified what they valued about the island; discussed the various challenges they experienced in the course of executing their conservation goals; explained how they were able to sustain their engagement in pest management activities, despite the challenges involved, and deliberated on several processes and methods for resolving identified challenges. Conservation actors also suggested various elements that had to be present in a successful pest management plan and explored likely reasons for opposition to a pest management plan.

In developing conservation or pest management projects, planners can align community goals with conservation goals to make them locally relevant. However, I agree with Minteer & Collins (2005) that all parties have to be involved in the integration of both goals so as to clarify assumptions made by either party. Local challenges that might affect the implementation of conservation goals on other geographical scales need to be identified and addressed as a way of empowering local stakeholders to effectively execute conservation actions, as echoed by Mulvenna et al. (2010). Likely opposition to a pest management plan need to be identified and addressed before implementing the plan. These opposition might even vary from one community to another and thus, should not be assumed. Employing the Living Lab principles to stakeholders' engagement enabled

stakeholders to produce new knowledge and practical conservation actions that would enable technical developers design relevant product or service; develop solutions that matched up with pest management needs; actively collaborate with the researcher throughout the research process; interpret their own social network data and influence aspects of the research process.

This study suggested that communities might be in the best position to make decisions that would benefit them based on a clear understanding of the issues facing them. However, the prevalent traditional methods of participation or engagement do not allow for the full benefits of such engagement to be realised (Goldson et al., 2015). I concluded that the outcomes of this study have provided important information that would clarify assumptions made by scientists, managers and planners about engaging local communities and would be of significant benefit on inhabited islands. I recommended that employing the principles of Living Lab in designing management plans would open up the process and encourage innovative solutions that are desperately needed to solve management problems.

7.4.1 Limitations

Conservation actors attempted to prioritise invasive species for eradication or control but were not able to reach an agreement due to the ambiguous definition and status of some invasive species (e.g., Berkes, 2004). One of the challenges identified by actors was the concern that young adults have not been assimilated into the conservation culture, giving rise to a perceived fear of the future of conservation on the island due to a dwindling interest in the upcoming generation. Demographics of local actors who participated in the focus groups revealed that young adults were not represented during the focus groups; neither were they represented in the social network (Chapter 4). Some other groups of stakeholders such as landowners, hunters, Māori individuals, were noticeably absent from the focus groups.

7.4.2 Future research

While Living Labs have a potential to facilitate collaboration among several stakeholders, it is not clear who should initiate collaboration and what effect the initiator might have in the collaboration process. Having a clear understanding of which stakeholder should initiate the collaboration process could be beneficial for conservation and pest management planning. In addition, the roles of each stakeholder should be clearly delineated within the planning process to aid effective governance within the Living Lab. Hence, research should be carried out to address these issues.

This study did not identify cultural values peculiar to pest management due to non-representation of Māori cultural groups during the process. Hence, while the study highlighted the mechanisms for engaging local non-cultural actors in the planning process, it did not give information on engaging cultural actors. I anticipated that integrating cultural values and perspectives could pose new challenges and setbacks for conservation planning on inhabited islands. In addition, new ways of motivating younger adults should be explored. For example, creating opportunities for the youth to improve on work-related skills or life skills such as developing relationships through engaging in conservation-related activities (see Larson et al., 2015; McDougle et al., 2011). Lastly, more studies are needed to corroborate the findings in this study and explain whether results are unique to Waiheke Island or applicable to other inhabited islands.

7.5 Social variables could drive the direction for a management plan

Objective 4: Investigate aspects of convergent or divergent views in the wider community with respect to stakeholders' perspectives on pest management

Often, the perspectives of volunteers and the public are not included or solicited when planning conservation strategies; yet these groups of stakeholders are mostly responsible for implementing conservation actions. A bottom-up approach has been advocated as a means of advancing public participation in decision-making; however, a bottom-up

approach alone cannot guarantee effective conservation outcomes (Arnstein, 1969; Selman, 2004).

In Chapter 6, a quantitative approach was employed to complement the qualitative approach employed in Chapter 5, to investigate preferences and mechanisms for engaging island residents in planning management strategies. I developed several hypotheses to test key social variables and examined how they affected conservation planning. I combined responses from local conservation actors during the focus groups with residents' responses to better understand how to engage communities in conservation planning. I demonstrated that social variables such as belief, resolution and objection determined the engagement of people in pest management; and that these variables were affected by age, but not an educational qualification or income. In addition, how individuals identified or viewed themselves in relation to pest management issues, i.e. as active or indifferent, affected individual's belief, resolution and objection to engaging in pest management activities. Views and perspectives also differed between different groups of stakeholders within the same community.

Again, pest management strategies that take into consideration the beliefs of the community are more likely to be implemented than strategies that exclude such variables. However, what constitutes belief, for example, needs to be identified and defined as such concepts may vary across communities; though they may not vary across the demographic characteristics of residents within communities. Also, if individual's identity in relation to pest management determined their beliefs towards pest management projects, planners could increase engagement of communities by either designing plans that resonate with their identities, or by developing ways to shift their identities to becoming more favourable towards management strategies. Some of the challenges encountered by communities required a top-management solution by conservation experts, such as the lack of clarity on the status of certain invasive species and clear definition of invasive species. I concluded that community members and indeed all relevant stakeholders, could generate the momentum needed for achieving conservation goals when included in a management plan.

7.5.1 Limitations

The ethnicity of survey respondents within the community revealed that Māori respondents were marginally represented in relation to respondents who identified as New Zealand Europeans. This might be due to insufficient research time to develop and build relationships with cultural groups so as to earn trust and increase engagement. A lack of consistent definition of pests and clear classification of invasive species may have affected respondents' ability to give informed and accurate responses, as was reported by some respondents. Response rates for the survey could have been affected by an overwhelming request for survey participation by other researchers at the time of the study. While social variables such as belief and values determined the engagement of people in pest management; these variables are not constant over time (Knight et al, 2010) and thus, could be affected by other variables as well and could negatively impact on pest management strategies. Open-ended responses suggested that some residents did not have enough information about pest management and did not even know where to source for such information. They were not also aware of pest management groups and their activities on the island. This lack of information might have negatively impacted on the quality of some responses received.

7.5.2 Future research

Survey results indicated a strong link between land ownership and involvement in pest management; however, it is not clear if a cause and effect relationship also existed. For example, would owning an area of land particularly guarantee that such individual would engage in pest management activities? Or is engaging in pest management a direct effect of owning an area of land? More research to uncover the nature of the relationship between these two variables might be required.

Further research is also needed to investigate if conservation goals would be better achieved by designing conservation plans that resonate with identities of communities, or by developing ways to influence their identities to match that of conservation goals. If beliefs and values were variable, then, practical ways to address and mitigate the impacts of

negative belief on pest management could be developed. For example, information sources could negatively impact what residents believed. Some suggestions were given by stakeholders (Chapter 5, 5.4.1.4) but these need to be tested for efficacy. Practical methods of deliberately engaging Māori participants in pest management planning also need to be investigated. Employing Living Lab principles would uncover social variables likely to affect conservation plans at an early stage and enable stakeholders to make decisions on management plans based on existing information.

In Chapter 6, I demonstrated that engaging the community in pest management planning is beneficial as it could help to re-define conservation goals; correct assumptions about local conservation issues; uncover social variables that might likely impact negatively on conservation goals and assist in the development of locally-relevant and readily adoptable plans. I recommend an open approach to conservation planning that deliberately includes all affected stakeholders and genuinely integrates their perspectives in designing pest management strategies.

7.6 Engaging a community to develop new conservation initiatives

Aim of thesis: Investigate how engaging a community could aid in developing new conservation initiatives

In this thesis, I investigated how engaging a community could aid in developing new conservation initiatives. Within a pest management context and in collaboration with stakeholders on an inhabited island, a mechanism for engaging stakeholders in conservation planning was created (Fig. 14). An open methods approach or mechanism for engaging communities in management planning is illustrated.

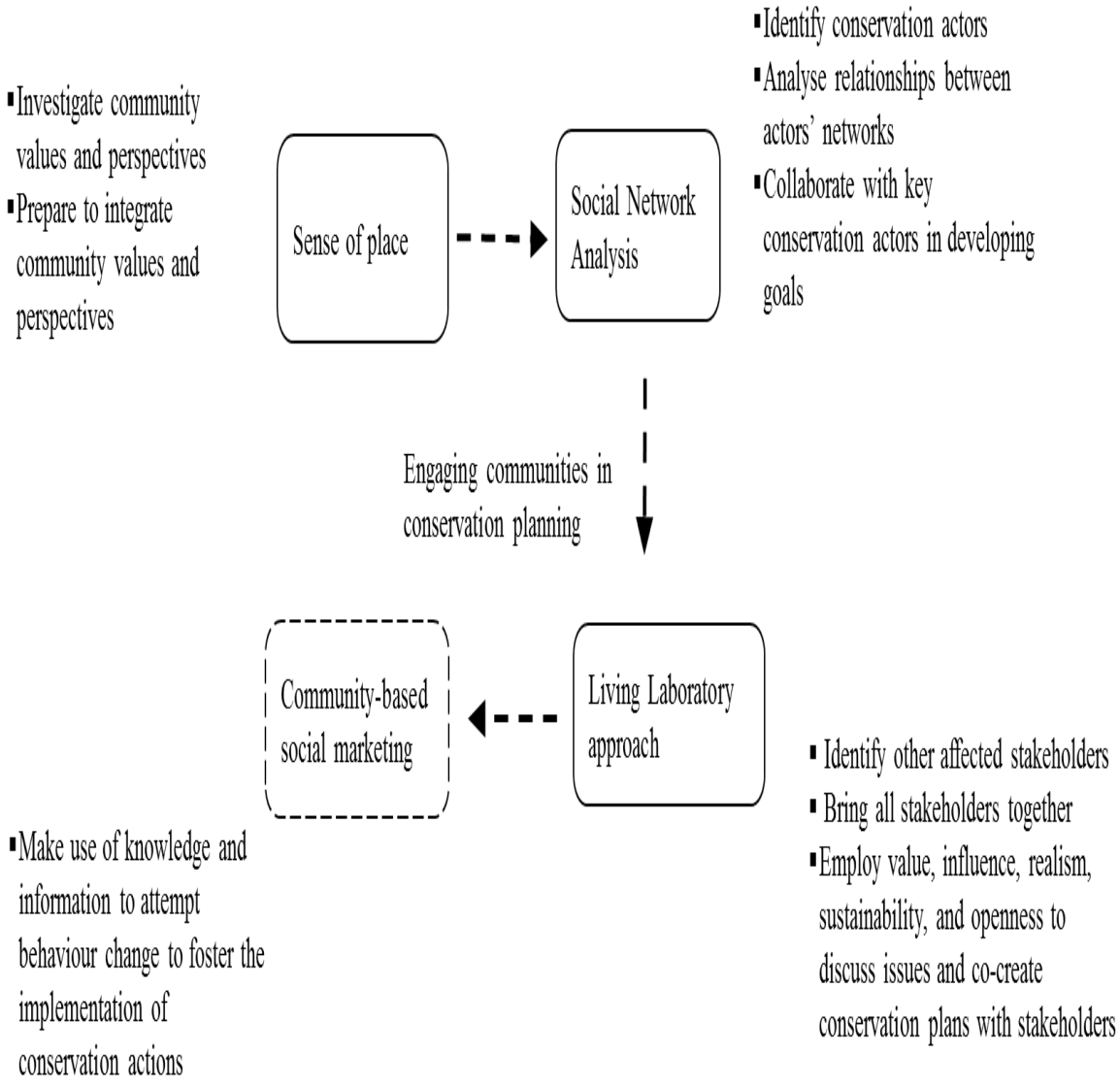


Figure 14. An Open Methods approach developed in this thesis for engaging stakeholders in developing conservation strategies and the major activities carried out for each stage of the engagement process.

(Diagram illustrates the last phase of the research. Community-based social marketing was not investigated in this thesis due to time constraints but is presented here as was originally envisaged).

While there has been enormous and continuing research related to pest management planning, only one side of the equation which is the effect of invasive species on native biodiversity, has been addressed. This study attempted to address the other side of the equation which is the social component of managing invasive species, to bring about a balance in management planning in New Zealand. The results of this thesis are anticipated

to give direction to developing strategies for the Predator Free New Zealand concept. The findings particularly have implications for how to approach planning a pest management project with residents of an inhabited island, using Waiheke Island as a case study.

Most Waihekeans and New Zealanders have already established a strong conservation ethic (for example, McDougle et al., 2011). In addition, a culture and aspiration for a flourishing biodiversity have helped to develop a unique "kiwi" identity (New Zealanders fondly refer to themselves as kiwis, after the iconic kiwi bird). In maintaining a sense of place, most people are active and loudly uphold what they believe and want, even if they were a minority. However, individuals whose values are defined by a collective identity are more willing to act in favour of the environment (see Nordlund & Garvill, 2002). As such, tapping into group motivations could foster the adoption of conservation goals. In changing behaviours, I recommend building momentum for defining a new social norm that is closely aligned with the values of people and yet, would serve as a means of achieving a definite conservation goal. For example, people can begin to think and feel that it is socially unacceptable to have their cats or dogs roaming unattended. Hence, cat or dog owners can begin to act in a socially responsible manner. With respect to encouraging the development of new social norms, a day could be designated for eradication purposes within communities, for example, rat day. Creating a common symbol that enables people to work together could lead to an interest and persistence in the activity among individuals that were not initially engaged in the activity. Such symbols could increase motivation in people over time; however, motivation can only be sustained if activities were related to the values people hold (for example, Carr & Walton, 2014). Also, definition of appropriate collective symbols might best be determined within the Waiheke community.

When stakeholders are collaboratively developing a plan, there needs to be clarity and distinction of the roles and capacity of each stakeholder. Assumptions about roles are not good enough. Knowledge of the social networks and patterns of relationship among stakeholders could help address the challenges of governance and power. If roles were assigned based on the position and capacity of each stakeholder within the network, effective execution of conservation actions can safely be assumed. The structure of local conservation actors and groups that were analysed did not lend credence to a solely

"bottom-up" approach which is typical of most community engagement studies. In fact, in practice, it is doubtful if only a bottom-up approach would be sufficient to address the complex challenges facing large-scale conservation initiatives. Likewise, a solely "top-down" approach has not yielded sustainable outcomes (Bonnell & Koontz, 2007; Mills et al., 2014). I propose that each stakeholder should recognise, respect and embrace the uniqueness of their role and combine their strengths in developing a sustainable management plan. In addition, when developing conservation goals, it is important to proactively forestall public opposition, even if there were no indications that opposition was imminent. At an early stage, planners need to identify potential individuals or groups that could hamper the implementation of conservation plans, investigate likely reasons for opposition and address their grievances. These opponents could be identified through the social networks of conservation actors within communities. The magnitude of opposition that could be caused also needs to be predicted and commensurate action taken.

It would appear that the biggest challenge to eliminating opposition might be behavioural inhibitions; threats perceived through a change of social norm which would necessitate the adoption of new conservation values on the part of the community residents, or willingness to consider community values on the part of conservation planners. Local actors need to be assured that their values are important and would be incorporated in a management plan; while conservation planners must be willing to make sacrifices and compromises to collaborate effectively with local actors to develop goals that would be relevant and readily adopted. There needs to be a deliberate attempt to incorporate social values and interests into pest management planning. It is a learning curve planners must be willing to navigate.

The results of the community survey indicated how residents classified their positions on pest management as active (46.7%), sympathetic (49.2%), indifferent (i.e. neither sympathetic nor unsympathetic) (3%), unsympathetic (0.5%) or actively opposed (0.5%). While the figures seemed favourable for the adoption of pest management goals, planners need to investigate the process by which community members create such identity for themselves. For example, how do people become active, sympathetic or opposed to conservation or pest management issues? What are the influencing factors for the creation of such identities? While these questions were not explicitly investigated in this research,

several assumptions could be made. Residents could develop a conservation identity through the influence of their social networks, or possibly through other sources where they obtained information on conservation activities, for example, media (Clyde & Steve, 2009; Ogden & Gilbert, 2009). If these assumptions were accurate, then planners could make use of those sources to positively influence beliefs about conservation.

The results of this study offer expectation for the feasibility of a predator-free New Zealand; however, the issues identified in this thesis have to be addressed before this expectation can become a reality. For example, what model of governance works best on inhabited islands? This study indicated that a predator free Waiheke might be achieved through a locally-driven and island-led governance, which also acknowledges the role of external agencies and collaborates with them to achieve conservation goals. But this might not be true for all inhabited islands in New Zealand; hence, there is a need to investigate if this idea is unique to Waiheke Island, or to all other inhabited islands in New Zealand. However, the nature of public opposition reported on some other inhabited islands (for example, Ogden & Gilbert, 2009) reflects the possibility that some of the conclusions I reached for Waiheke Island may not be directly transferable to other communities undertaking pest control projects.

Another consideration would be how local conservation goals would fit within central management strategies, for example, the National Pest Management Plan (NPMP), which offers strategic options for pest eradication in New Zealand. Results of this study indicated that local actors and residents have developed a unique identity of self, which has translated into the desire for local decision-making, governance and control of conservation actions. Actors referred to a "Waiheke way" of formulating conservation strategies, thereby iterating their uniqueness and differentiating themselves from external agencies. Often, the goals, aspiration and objectives of local conservation actors are similar to those of the institutionalised agencies; but are formulated to preserve local values and identities (for example, Waiheke Local Board, 2014). Living Labs can be used to define the direction of conservation actions. The Living Lab process could be employed in communities to assist them to develop goals that are relevant and unique to their environment. These goals could then be integrated into more comprehensive goals; for example, the NPMP. Asking

communities to develop goals based on a set of predetermined scheme from "the top" management planners might flag a warning and inhibit community engagement. Hence, while noting the importance of a national plan, I recommend that the guidelines within the plan should be flexible enough to accommodate varying community values; preserve local identity and allow communities to influence the decision-making process. On the other hand, double standards and disparity in national and local actors' plans further perpetuate the ambiguity and complexity involved in defining pests, prioritising species for eradication and selecting an effective eradication or control method. For example, while the Predator Free New Zealand concept is still at the budding phase, there is confusion about how best to manage companion animals, that is, dogs and cats and as such, these animals have been excluded from the programme (Russell et al., 2015). However, local conservation actors and residents on Waiheke have identified these companion animals as targets for control, even though they might not agree on a management method. Some conservation groups on Waiheke are already building momentum towards the control of cats by distributing information to households and encouraging responsible cat ownership. During the focus groups, local actors suggested that a *policy change* at National Government level would be necessary to support and empower them to take further actions on companion animals within the island.

Lastly, a number of references were made to a successful model of pest eradication in Rocky Bay neighbourhood on Waiheke Island. A joint partnership between Auckland Council, Rocky Bay Rat-busters and residents resulted in widespread awareness and willingness to install, maintain and monitor rat bait stations in various sections within Rocky Bay. This model indicates that a predator-free New Zealand is a possibility but the people have to be involved in all aspects of the project. In addition, cases of successful outcomes such as the Rocky Bay Rat-busters offers the possibility of engaging island residents towards a pest-free environment.

7.6.1 Limitations

The outcomes of engaging communities in developing conservation strategies cannot be predicted due to fluctuating social variables involved in the process. In addition, although the process is time-consuming, it is worthwhile, as it might otherwise result in serious negative consequences if overlooked in management planning. Diverse methods and strategies have been suggested by stakeholders for increasing engagement. Adopting all of the methods might be expensive and not feasible; hence, planners need to work with stakeholders to prioritise methods of engagement based on perceived effectiveness or tested outcomes. Developing a social network survey and analysing and interpreting network data might appear too technical for community members. Hence, there is a need to collaborate with experts who might be able to employ technical methods to provide the required information.

7.6.2 Future research

Future research is recommended to engage Māori stakeholders using the Living Lab approach and determine whether the outcomes of the process would be similar or vary widely from the outcomes presented in this thesis. While the Rocky Bay example presented in this thesis indicated the possibility of effectively engaging with residents on inhabited islands to implement pest management strategies, further successful outcomes of engagement are needed especially on other inhabited islands. Practical behaviour change tools and strategies have been recommended but have not been previously applied to pest management (for example, McKenzie-Mohr & Schultz, 2014). Further research is needed to evaluate how applicable and effective these behaviour change tools would be in improving community engagement. Various methods for changing residents' behaviour to pest management could be investigated by developing a program specifically aimed at targeting behavioural issues.

7.7 Conclusion

In this thesis, I investigated how engaging a community could aid in developing new conservation initiatives, with a special consideration of inhabited islands. The results of the investigation have further highlighted the complexities involved in understanding the social processes within communities; and the challenges involved in engaging communities in solving conservation problems, such as invasive species management. While addressing the challenges explored and the suggested recommendations in this thesis could be daunting, incorporating social dimensions into developing conservation initiatives is not unattainable.

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Glossary

Term	Definition
Alter	In a network with a focal node or individual, other nodes that are directly connected to this focal node are referred to as "alters" (Borgatti, 2005)
Betweenness centrality	Betweenness centrality measures the number of times a node acts as a bridge along the shortest path between two other nodes within the network (Borgatti, 2005)
Bottom-up approach	An approach that seeks to manage social issues by empowering grassroots or individuals from the "bottom" of the system, through to the leaders at the "top" of the system (Selman, 2004)
Centrality	The centrality of a network is a measure of how significant its most central node is in relation to how central all the other nodes are to one another (Borgatti, 2005)
Champions	Individuals that are respected by members of the community and can take a lead on projects within the community (Armitage, 2005)
Cliques	A clique is a sub-set of a network in which the actors are more closely tied to one another than to other members of the network. A perfectly connected network is called a 'clique' and has a density of 1 (Borgatti, 2005)
Closeness centrality	Refers to how easily an actor can reach the other members of network within the shortest average path length, or more quickly than anyone else (Borgatti, 2005)
Co-creation	The process of creating knowledge, products or services by collaborating with end-users of the product or service (CoreLabs, 2007; Corallo et al., 2013)
Conservation actors	Individuals, groups or organisations who act in favour of conservation or are actively involved in the management of natural resources (Bonnell & Koontz, 2007)
Degree centrality	The number of direct ties or connections that a node has in a network. A node with a high degree has a large number of interactions. Hence, the higher the degree, the more directly connected the person becomes (Borgatti, 2005)
Density	A measure of how connected members within a network are to one another. The closer to the value '1', the denser the network; so, networks can be said to be fairly dense, sparsely dense etc. (Borgatti, 2005)
Eigenvector centrality	A measure of the power and influence of a node within a network based on the strength of the connections of the other nodes around him or her (Borgatti, 2005)
Hapu	Group of whanau (family) that descended from the same ancestor (Health Research Council of New Zealand, 2010)
Isolate	An isolate is a member of a network with no connections at all to any other members within that network (Borgatti, 2005)
Iwi	Tribe, nation (Health Research Council of New Zealand, 2010)

Kaitiaki	Māori concept of guardianship, for the sky, the sea and the land. A kaitiaki is a guardian, one who looks after nature (Roberts et al., 1995)
Mana whenua	Authority over a particular area of land (Health Research Council of New Zealand, 2010)
Node	Nodes can be individuals, groups or organisations within a social network (Borgatti, 2005)
Photovoice	A research technique that aims to empower people as they document the community's needs and resources from their experience, especially through photography (Bergvall-Kåreborn et al., 2010)
Pilot-test respondents	Independent respondents (different from the target respondents) who respond to survey questions before the survey is distributed or open to the intended respondents (Brook et al., 2003)
Reciprocity	A measure of connections or interactions that are mutual within a network (Borgatti, 2005)
Snowball sampling	A non-probability sampling method where existing research participants recruit further participants from their friends or close circles (Kandola et al., 2014)
Social network	A social network is an individual's social interactions and personal relationships (Blanchet & James, 2012)
Social network analysis	Social network analysis (SNA) aims to measure, map and analyse the structure and pattern of social relationships and interactions among individuals, groups or organisations (Freeman, Borgatti, & White, 1991; Prell et al., 2013)
Stakeholders	Stakeholders are individuals or organisations who have interest in and may influence a project's outcomes through their interactions and through individual or collective actions (Mountjoy et al., 2014; Selman, 2004)
Tangata whenua	Indigenous people of an area or country (Health Research Council of New Zealand, 2010; Roberts et al., 1995)
Technical risk	The probability of people opposing the use of scientific tools or technologies developed for pest management (Towns et al., 2012)
Thematic map or network	A diagram that illustrates how themes interact within a qualitative dataset (Vaismoradi et al., 2013)
Ties	Ties are the different types of connections, links or interactions present among nodes within a social network (Borgatti, 2005)
Transcription	A qualitative research process of translating between forms of data, for example, converting audio recordings to text formats (Bailey, 2008; Braun & Clarke, 2006)
Triangulation	Triangulation involves using multiple data sources in a single research to provide a better and robust understanding of the phenomenon being studied (Creswell, 2003; Waylen et al., 2013)

Appendices

Appendix A. Social network survey

Connecting conservation stakeholders' survey.

Kia Ora!,

Because you are a leader or member of a conservation group on Waiheke Island, I am inviting you to participate in the above project.

The goal of this project is to help the community with its initiative to develop and maintain a pest-free Waiheke Island.

The first stage of the research is a "Social Network Survey". Survey questions relate to:

- Conservation groups on Waiheke Island
- The roles they play
- How well you think they are connected and assist one another
- The individuals within the groups.

You were selected because you are interested, active, experienced and might be willing to collaborate with other groups of people towards achieving a pest-free Waiheke. You may also have been selected because your contact details are publicly available online, or through snowballing (a reference from someone who knows and believes you will be interested in this project).

It should take about 20 minutes or less to respond to the items in the survey.

I will not use actual names when reporting on the survey, so your personal information will be confidential. Participation in this project is voluntary and based on informed consent. You have the right to withdraw from participating in this project at any time prior to the completion of data collection.

If you have any questions, please contact Dr Barbara Breen (bbreen@aut.ac.nz) or Harriet Achi (harriet.achi@aut.ac.nz)

Regards,

Dr Barbara Breen
Approved by the Auckland University of Technology Ethics Committee on 9th December, 2014 AUTEC Reference number 14/358.

Questions – Identifying Conservation Groups you belong to.

The following question aims to find out the various conservation groups you identify with and the role(s) you play in the groups.

1. Please list all the conservation groups you identify with and the roles you play for each of the groups you have listed: (individual names selected here constituted the general network)

……
……

Demographics

The next few questions are about your personal details. Actual names will not be used in the report, so your personal information will be confidential.

2. Please state your full name:

……
…

3. What is your gender?

   ☐Male

   ☐Female

   ☐I would rather not say

4. What age bracket do you belong to?

   ☐Less than 20 years

   ☐20 – 29 years

   ☐30 – 39 years

   ☐40 – 49 years

   ☐50 – 59 years

   ☐60 – 69 years

☐70 years or older

5. What is the highest qualification you have completed?

   ☐High School Certificate

   ☐Post-Secondary Certificate

   ☐Apprenticeship

   ☐Undergraduate

   ☐Postgraduate

   ☐None

6. Please indicate the ethnic group you identify with:

   ☐European/NZ European

   ☐Māori

   ☐Asian

   ☐Pacific peoples

   ☐Middle Eastern/Latin American/African (MELAA)

   ☐Other ethnicity

7. Are you willing to participate in a subsequent focus group?

   ☐Yes ☐No

8. Are you willing to participate in a subsequent survey?

   ☐Yes ☐No

9. Would you like to receive information about the current survey?

   ☐Yes ☐No

10. If you answered yes to any of the questions immediately above, how would you like me to contact you?

    ☐By email

    ☐By phone

    ☐By post

11. Please state your details for the preferred mode of contact chosen:

……

……

I WORK WITH …

12. From the list of names provided below, please select the people you have worked with in the course of your conservation activities. (SNA list provided) (names filtered here constituted the work network)

(If a name is not included, click on the '+' sign to add it to the list)

(Node addition)

a. What is the full name of this person?

b. Which conservation group does this person belong?

c. State the email address for this person

I COMMUNICATE WITH …

13. Which of these people did you communicate with during the previous 12 months, about conservation-related issues? (SNA list) (names filtered here constituted the communication network).

Conclusion and thank-you message.

Many thanks for completing the survey. Your response has been recorded and you can close the browser window. If you would like to change your response to any question, click on the email which included a link to this survey.

If you have any questions, please contact Dr Barbara Breen (bbreen@aut.ac.nz) or Harriet Achi (harriet.achi@aut.ac.nz)

Appendix B. Ethical approval

AUT UNIVERSITY
TE WĀNANGA ARONUI O TAMAKI MAKAU RAU

AUTEC SECRETARIAT

9 December 2014

Barbara Breen
Faculty of Health and Environmental Sciences

Dear Barbara

Re Ethics Application: **14/358 Invasive Species Countdown: How do we better engage communities in sustainable conservation strategies that would lead to a 'pest-free' environment?**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 9 December 2017.

As part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through http://www.aut.ac.nz/researchethics. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 9 December 2017;
- A brief report on the status of the project using form EA3, which is available online throughhttp://www.aut.ac.nz/researchethics. This report is to be submitted either when the approval expires on 9 December 2017 or on completion of the project.

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to obtain this. If your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply there.

To enable us to provide you with efficient service, please use the application number and study title in all correspondence with us. If you have any enquiries about this application, or anything else, please do contact us at ethics@aut.ac.nz.

All the very best with your research,

Kate O'Connor
Executive Secretary
Auckland University of Technology Ethics Committee

Cc: Harriet Achi

Auckland University of Technology Ethics Committee
WA505F Level 5 WA Building City Campus
Private Bag 92006 Auckland 1142 Ph: +64-9-921-9999 ext 8316 email ethics@aut.ac.nz

Appendix C. Māori Research Facilitation Committee approval

AUT UNIVERSITY

Private Bag 92006
Auckland 1142, NZ
T: +64 9 921 9999
www.aut.ac.nz

25 November 2014

Harriet Achi
School of Applied Sciences
AUT University

Tēnā koe

This letter is in relation to the study entitled '*Invasive species countdown: How can we better engage communities in initiating sustainable conservation strategies that would lead to a pest free environment?'* presented by PhD student Harriet Achi, Dr Barbara Bollard-Breen, Primary Supervisor and Dr John Perrott, Cultural Advisor, to the Auckland University of Technology (AUT) Faculty of Health and Environmental Sciences Māori Research Facilitation Committee on 13 November 2014.

The Committee comprises representatives from the District Health Boards and community Hauora Māori sectors, along with senior AUT academics. The purpose of the Committee is to foster research engagement between faculty research staff and Māori communities or groups and research practice responsive to issues important to Māori health and Māori development and advancement.

The Committee acknowledges the value of the study, supports it and also acknowledges the sound credentials and experience of the members of the supervisory team. The following recommendations are qualifications to this support:

- Make explicit within all project documentation the Kaitiakitanga role of iwi. Based on this recommendation there may be changes required in the methodology that necessitate a revisiting of ethics for the project.
- Engagement with mana whenua is central to this research and should be seen as a priority.
- The researchers should give thought to the Te Ao Māori, Maori world-view that there is no such thing as a 'pest'.

Harriet Achi is required to submit a progress report to the Faculty administrator within one year of this presentation, i.e. no later than 13 November 2015. No further presentations to the Māori Research Facilitation Committee can occur until progress in response to the recommendations outlined above, has been reported.

If further information is required please contact Brigitte van Gils, Administrator, Faculty Postgraduate and Research Office, on 09 921 9999 extension 7775, or e-mail: bvangils@aut.ac.nz

Nāku noa, nā

Kate Haswell, Associate Dean (Māori Advancement)

Appendix D. Questions developed by key conservation actors for focus group discussions

1. What do you value about Waiheke? Why did you come to settle or live here?
2. What are your personal values, concerns and aspiration with regards to pest management? How might those values be impacted or affected by pest management strategies? What are the biggest conservation issues on Waiheke Island?
3. What do you think is a pest? Which examples of plants and animals fall under the category "pest"?
4. Do people think we need to manage pests? If so, what pests and why? If not, why not?
5. What future (ecological) visions do we have for a pest-free Waiheke? What are our goals?
6. Just because a species is large in number, does it make it a pest species?
7. Should we just come straight on ones we know damage native flora and fauna or damage our economic base on Waiheke?
8. What would make a plan to be successful? What are the critical success factors for a pest-free project on Waiheke? What are the risk factors as well?
9. Why did some projects fail on Waiheke? What did or did not work in the past?
10. In what ways would you feel empowered to engage in conservation activities?
11. How should we structure an organisation that will deliver a pest-free Waiheke?
12. What relationship does Waiheke have with other islands in the Hauraki Gulf? Do conservation actors want to get more involved as a whole or become more integrated into the wider Hauraki Gulf in the management of pests?
13. What methodologies are you aware of? Which ones are you happy to use? Is there a consensus on pest control management - animal or weed?
14. Do you manage pests yourselves? If yes, which ones and how? If not, why not?

Appendix E. Codebook containing general themes, description of themes and reference statements from the focus group discussions

Code name (themes)	Description	Reference statements
COMMUNITY VALUES	What people loved and valued about living on Waiheke Island	
Diversity	Illustrates diverse and varied people, ideas etc. in the community	Diverse population; A diverse community…
Small and remote	Refers to attributes such as small size, remoteness from the city (Auckland), or geographical isolation	Best of both worlds; we are able to be remote if we want to be but it's close to the city when we choose to go (there)
Slower development	Slow development to combat rising population	I hear these stories of Auckland having to deal with about a million people in 20-30 years and all that and I fear…. I hope it doesn't get much more developed than it is now
Passionate people	Talks about the love and warmth of people who live on the island	I think it's that people care, I love the fact that people care and are passionate.
Environment	Includes the natural beauty of beaches and bush areas and the opportunity such an environment offered e.g. raising children. Also physical and emotional attributes of an environment	I like that....most places are so quiet and you can easily find a place that there is nobody else around; the beaches are so beautiful, bush areas are lovely; it's tranquil, it's peaceful
SETBACKS AND CHALLENGES	Explores various forms of setbacks in relation to managing pest on the island	
People	Issues relating to people as a major challenge	
Absentee landowners	The inability of property owners (or private landowners or part-time	We have a problem on Waiheke of absentee landowners who have a number of invasives, you know....if there was

	population) to deal with invasive species.	some requirements for property owners to deal with the invasives
The strength of minority opposition	Opposition by individuals or groups who view things differently or want different goals in the community	.....there is still bias in favour of the minority opposition…even if there are 7,000 people on this island who long to have the rat eradication, if there were 20 objections, they would get a lot of coverage, it's astonishing to me; the way the opposition always get much more....it's not a democratic thing, it's like if your opponents can canvass the display.....
Volunteer-champion burn-out	Volunteers or champions are over-worked and overtime, lose enthusiasm for a project especially when they are not being compensated	We often get burn-out from our volunteers or our champions on projects as well. So, there'd be a few people in the community that are really enthusiastic and love the project and love the idea and get really involved…and by 12 months' time, they've lost that enthusiasm
Social dynamics	The difficulty of working with people; the more they are, the more difficult it becomes	For islands, a popular issue is the overall effect of people making it nearly impossible because of the social dynamics to achieve your goals and its' the social dynamics of the x-no of people, e.g. 8,000 people, that probably have a sort of correlation to the more people you get, the more difficult it becomes socially
Behavioural inhibition	Refers to behavioural challenges to pest management and the need for a change in behaviour	I think we need to do a huge psychological change … and that's around the hearts of the people….the whole shift of consciousness still hasn't happened
Environment	Issues relating to nature or the environment	
Unconnectedness to nature	People do not have a connection with nature, are not able to appreciate it and consequently, can't protect it	I think either it's complete lack of awareness and we are not connected, we are just up here (points to the head), we are not connected down here (points to the heart)
Changing sense of place	Instances of perceived shift in the values held by the community, influenced by for e.g., the influx of new arrivals to the community	There's a lot of new members of the community too who.....you know they see the vineyard, the urban, the attraction of the urban cafe, society, that's a drawcard for them moving here...it's that greenery suburb of Auckland rather than biodiversity, so, that's a challenge

Cost	Cost and related issues	
Finance	The high cost of managing pests on the island	I think its money, I guess it's going to be expensive
Deficient resource	Volunteers or conservation actors felt that external organisations have abandoned their duty of care to their land and passed it on to them	I guess my comments stem from all of us at the bottom end of serving, that DOC had no money to spend on their land, they didn't manage their own land and so because there was no resource and so, I suppose there's a suspicion there about we now doing their job for them
Methods	Refers to the challenges of using particular methods for pest management	
Acceptable level of exotic species	A model that accepts a minimum level of introduced species assuming that they cannot be totally eradicated because the community is inhabited	We have to have a model that is built to an idea of people living within an improved environment and a model that has to accept a level of exotic species and that model will also have to accept a level of introduced animals
Defining pest	Definition of pest species	I guess anything that's impinging on the development of the bush and bird life flourishing on Waiheke, as with rodents or people?
Conservation is killing	The challenge that conservation involves killing in New Zealand	I find it horrific and challenging that New Zealand conservation involves killing
Unrealistic conservation goals	Setting conservation goals that are not achievable	We've talked about these so many times that.....I want to see that happen 20-30 years ago, right? And this is why people get frustrated with the whole system because you're talking about the same things all the time…It's going to be a continuing battle because we are never going to get rid of these pests completely
Necessary evil	The irony of using poison against personal preferences because of its perceived benefits over other pest management methods	…Which is sadly why I poison and don't have traps because I don't want to have to deal with half-dead rodents...it's a really tricky one

Prioritising eradication	The process by which participants placed/classified pests in order of eradication or control	I think people have to make a conscious choice; do we want birds or what do we want ....and if we want birds, maybe we have to have an iconic bird that we want, we want kiwis or whatever
ASPIRATION	Motivations for involving in conservation activities; suggests the goals and motivations of the community	
Release of kiwi	The release of kiwi on the island as a driving motivation for pest management	It's achievable, to me, if you could release kiwi in 2-3 years' time, it will be a huge morale-booster to the island and then, you can build on that....."hey, we've got kiwi, we want more"
Potential for tourism	The potential for tourism based on achieving a pest-free status and a thriving biodiversity	Tourism too … the potential for tourism based on pest-free status and thriving biodiversity is a huge value
Potential for pest-free status	A potential to achieve a pest-free status and a thriving environment	I can see that we have potentials to live in Tiritiri Matangi; with all those beautiful beaches
Personal drive	Personal reasons and motivations for engaging in pest management activities	Love of nature; it's compelling, it just draws you to do it and that you can, if you have, even if you don't have your own plot, there's a lot of opportunities to go and commune with nature that way
Neighbourly responsibility	Guardianship role: community members have a duty of care to ensure they don't re-infest surrounding pest-free islands	We are near so many islands that had money spent on eradicating pests, we don't really want to infect these islands with our pests, therefore we have a neighbourly responsibility
Sustainable biodiversity	Having a sustainable biodiversity (e.g. bush and the coastal environment) as a motivating factor	My motivation is to actually find a way to have a sustainable biodiversity… to do something so that there would be biodiversity; it won't be just aliens, cockroaches and rats
RESOLUTION	Refers to a process - The Waiheke way – of engaging community residents as it relates to pest management	

Communication	Dealing with control and eradication issues by exploring multiple channels of communication	
External conformity	Asking visitors and tourists to conform with the way of doing things on Waiheke	It's about high levels of communication with each other, with our tourists about saying, this is who we are, this is how we look after our place, if you want to be here, conform
Story-telling	Telling stories based on evidence of successful outcomes of pest management	But I think what I'm trying to say too is that it's…socialising with neighbours, getting these people on board, really low-key and so, it's down-to-earth…it's done at drinks parties, it's done at...that's how it all happens and so, you just start telling your stories, but you're doing it in a really non-threatening way. And then, you might follow-up later...or whatever
Next door advocacy	Gradual recruitment through low-key, one-on-one contact with the aim of gaining support or buy-in of targeted individuals or parties	Yeah, you can expand it from existing conservative areas, we do have a dog-free colony on the island; so, you could start from say A's land and you could go to those non-dog-free areas with that idea
Engagement	Engaging residents and getting community buy-in	
Biodiversity monitoring	Practical engagement of residents in project monitoring	To me, I think, you know, we talked about having a story we could tell people like, I'm really fascinated about biodiversity monitoring which talks about rat monitoring; you put your 5 minute bird count on a transect; you've got wetland monitoring; a whole range of those biodiversity that people can buy into
Paid absenteeism	Suggests absent landowners and property managers become responsible for taking care of invasive species on their land areas	And there's a lot of people I know who have big chunks of land who just can't take the time...., they are more than happy to have someone come around, set and check their traps and they pay for it

Tapping into motivations	Engaging with the different motivations people already have towards pest management	You know people who have different motivations and if you can tap into the different motivation, just so to achieve the same end goal, people who you know hunt pigs for the pleasure of pig-hunting, bring them in because a greater goal is we are eradicating pigs for example
Methodology	Methods and processes for achieving a successful management	
Paid drivers	Explores decision on when to employ volunteers or pay individuals during a project cycle	I mean, it depends. If it's a little baby project that you can achieve within 6 months, it's got a clear goal from start to finish and it's realistic, volunteers can run that, but if you've got a big 5-year pest eradication project, you've got to have paid drivers
Early consultation	Consulting with the community at the early stages of a project in order to enable participation and buy-in	Consultation at the start with as many people as possible. For some of these, objections might have been apparent very early as opposed to apparent half-way through the process
Research	The process of making informed choices based on what has already been done elsewhere	We need to find out what's been done, map it all out and then look at that against what do we want to achieve?
Goal-setting	Setting achievable, cost-and-time-effective goals	I think it's having some clear messages, some visionary messages, so, you can go to the community and then you move in from there together as a group to create something more concrete
Locally-driven projects	Community-led projects with solicited inputs from external organisations including DOC, Auckland Council, universities etc.	I think it's important that it's not a Council (project), we probably know that DOC... you know, for those reasons...so the general public don't feel it's been forced upon them by the local or national government. It's got to be something locally and that's got to be locally-driven
Education	The process of increasing awareness on pest management issues	

Experiencing nature	Exposing community members to nature i.e. birds, to increase their consciousness, awareness and appreciation of nature	I guess we are saying the consciousness isn't there yet because the exposure hasn't been there yet. Many people haven't been to Tiritiri Matangi or been out in the bush…. you've got to have a parallel education system that appeals to the heart and that might be actually touching the furry creatures, or you know.....inviting them to come and see penguins
Practical education	Education based visual benefits and direct relevance	Educating people as to what benefits are there to see, removing disease for instance and removing threats to native species. I think it will be much more effective relating it to human process, human health…. that's more personal, it's more....motivational and they think, oh, their children are at risk
Awakening consciousness	A conscious effort to gradually make community members aware of their natural environment and be able to connect with nature as an individual	It's like 'pushing the opening doors' approach rather than banging really hard on the closed doors and then, as you can show the backdoors, then, the more and more the doors start to pull open and people start to slightly look out and be a bit more open-minded…..people start to wake up
Local expertise	Building on what's already been done through the local expertise on the island	
Local resources	Expanding resources on the island to support overstretched officers	It's not just political will but it's about resourcing as well… do we have a role of community conservationist, to support those people who are working in the political arena and who could maybe get more resources because I'm not sure that there are enough resources for those people
Policy change	Developing governmental policy to positively affect or influence conservation activities e.g. regarding cats	You know cats are specifically exempt from the law… we could remove that specific exemption so that cats could be contained. And it's a workable thing; there are cat curfews in all of the major Australian cities, it's not as if it's an impossible thing

Appendix F. Community survey questions

Survey Information Sheet

Invitation to participate in the research project: "Invasive Species Countdown: How do we better engage communities in sustainable conservation strategies that would lead to a 'pest-free' environment?"

Dear,

As a resident of Waiheke Island, I am inviting you to participate in a community survey. The goal of this survey is to obtain information that would support the community with any initiative to develop and maintain a pest-free Waiheke Island.
Survey questions are about your community values; status of pest management; vision for Waiheke Island; challenges and possible solutions for managing pests; and your contribution towards pest management on Waiheke Island.

It should take less than 15 minutes to respond to the items in the survey.

Your name will not be used when reporting on the survey, so your personal information will remain confidential.

Participation in this project is voluntary and based on informed consent. You have the right to withdraw from participating in this project at any time prior to the completion of data collection.

If you are 18 years and above and willing to participate, please choose "yes" to continue; otherwise, choose "no" to discard the survey.

☐Yes, please. I want to continue
☐ No, thanks. I don't want to continue

If you have any questions, please contact Dave Towns (dtowns@aut.ac.nz) or Harriet Achi (harriet.achi@aut.ac.nz)

Regards,
Dave Towns

Approved by the Auckland University of Technology Ethics Committee on 9th December, 2014 AUTEC Reference number 14/358.

SURVEY DRAW

On completion of the survey, you are entitled to enter our prize draw.

If you would like to enter the draw for a free 10-trip ferry ticket, please send an email to waihekeislandcommunitysurvey@gmail.com to register your interest.

The winner will be notified two weeks after the deadline for survey completion and submission. Thanks for your assistance.

Thank you for your time and support!

INSTRUCTIONS

Please answer the following questions. Choose **ONLY ONE** option – the one you consider to be the most appropriate.

A. ABOUT YOU

Briefly, answer the following questions about yourself.

14. What suburb do you live in on Waiheke Island?

……

15. What is your gender?

☐Male ☐Female

16. What is your age?

☐15 - 24 years ☐25 - 34 years ☐35 - 44 years ☐45 - 54 years ☐55 - 64 years ☐65 year and over

17. What is the highest level of education you have completed?

☐ No Qualification ☐ Levels 1 – 4 Certificate ☐ Level 5 or Level 6 Diploma

☐ Bachelor degree or Level 7 Qualifications ☐ Postgraduate, Honours, Masters or Doctorate Degrees

☐Overseas Secondary School Qualification

18. What is your approximate household or family income?

☐$20,000 or less ☐$20,001 - $30,000 ☐$30,001 - $50,000

☐$50,001 - $70,000 ☐$70,001 - $100,000 ☐$100,001 or more

19. Which race/ethnicity best describes you? (Please choose only one):

☐European ☐Māori ☐Pacific Peoples

☐Asian

☐Middle Eastern/Latin American/African (MELAA) ☐ Other ethnicity

B. COMMUNITY VALUES

This section aims to find out what you love and value about living on Waiheke Island.

20. What do you value **most** about living on Waiheke Island? Classify each of the value statements **from highest (5) to lowest (1),** by writing one number for each.

Values	**Rankings (5 – >1)**
I like the diversity of people and ideas	
I like that it is small and remotely away from the city	
I like the passionate people that live here	
I like the environment – the beautiful beaches, bushes, birds etc.	
I like the restaurants, wine and vineyards	

☐Other – please state here

……

C. STATUS ON PEST MANAGEMENT.

A pest is defined as a plant or animal that is viewed as a problem to people and their concerns for health and native biodiversity.

21. Which of the following best describes your position on pest management? (Choose **one only**)

    ☐ Active in pest management issues ☐ Sympathetic to pest management issues

    ☐ Neither sympathetic nor unsympathetic to pest management issues

    ☐ Unsympathetic to pest management issues

    ☐ Actively opposed to any action on pest management issues.

22. Which conservation group(s) do you belong to or represent? (*Skip to question 10 if you do not belong to any*)

    ……

    ……

    ……

    ……

23. Are you a landowner on Waiheke Island? ☐Yes ☐No

24. Do you manage animal pests on your Waiheke property or on another property on Waiheke Island?

☐Yes ☐No

Additional comments:

……

D. YOUR ASPIRATION FOR WAIHEKE ISLAND

Please indicate your agreement with each of the following statements below. A pest is defined as a plant or animal that is viewed as a problem to people and their concerns for health and native biodiversity.

For this section, choose how much you agree or disagree with the statements about pests.

	Statement	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	No opinion
12	I would like to see kiwi released on Waiheke island as soon as possible	☐	☐	☐	☐	☐	☐
13	I would like to see our native animal and plant life flourish	☐	☐	☐	☐	☐	☐
14	I would like to be involved in making Waiheke Island a better place for future generations	☐	☐	☐	☐	☐	☐
15	I will begin to contribute in any way I can to manage	☐	☐	☐	☐	☐	☐

	pests on my land or those of others around me						
16	I might be joining a pest management group very soon	☐	☐	☐	☐	☐	☐
17	I look forward to getting involved in pest management on Waiheke Island	☐	☐	☐	☐	☐	☐

Additional comments:

……

……

E. SOLUTIONS FOR PEST MANAGEMENT ON WAIHEKE ISLAND

For this section, choose how much you agree or disagree with the statements below.

	Statement	**Strongly agree**	**Agree**	**Undecided**	**Disagree**	**Strongly disagree**	**No opinion**
18	Landowners who don't live on the island should be responsible for managing pests on their land	☐	☐	☐	☐	☐	☐
19	We have to let our tourists and visitors know about our way of life here on Waiheke and make sure that they respect it	☐	☐	☐	☐	☐	☐
20	More information about pest management projects on the island could	☐	☐	☐	☐	☐	☐

21	increase my level of involvement Policies should be developed to assist with the management of pests on the island	☐	☐	☐	☐	☐	☐

Please comment if there is anything else that might motivate you to get involved in managing pests on the island……

……

F. BENEFITS OF PEST MANAGEMENT ON WAIHEKE ISLAND

For this section, choose how much you agree or disagree with the statements below.

22. Are you aware of any pest management group on Waiheke Island? ☐ Yes ☐ No

	Statement	**Strongly agree**	**Agree**	**Undecided**	**Disagree**	**Strongly disagree**	**No opinion**
23	The island would be more attractive to residents if we became pest-free	☐	☐	☐	☐	☐	☐
24	The island would gain economic benefits if we became pest-free	☐	☐	☐	☐	☐	☐
25	I am happy to manage pests on the island if I can see a personal benefit for doing so	☐	☐	☐	☐	☐	☐

Additional comments:

……

G. BELIEFS ON MANAGING PESTS ON WAIHEKE ISLAND

For this section, choose how much you agree or disagree with the statements about pests.

	Statement	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	No opinion
26	I do not see pests as a problem at all	☐	☐	☐	☐	☐	☐
27	I believe that there are no pests on Waiheke island	☐	☐	☐	☐	☐	☐
28	It is too expensive to manage pests on the island	☐	☐	☐	☐	☐	☐
29	I believe that pest species can be totally removed from Waiheke Island	☐	☐	☐	☐	☐	☐
30	I don't think we should kill pests	☐	☐	☐	☐	☐	☐
31	Pest management projects should be conducted by local residents and not by an external organisation like DOC or Auckland Council	☐	☐	☐	☐	☐	☐
32	We have local expertise on Waiheke Island that could successfully oversee a pest management project	☐	☐	☐	☐	☐	☐
33	I might become involved in pest management activities if I have opportunities to connect more with nature	☐	☐	☐	☐	☐	☐
34	People should be paid to carry out pest management on Waiheke; volunteers	☐	☐	☐	☐	☐	☐

	shouldn't have to do it for free						
35	Landowners who cannot manage pests on their land should be willing to pay for someone else to do it	☐	☐	☐	☐	☐	☐
36	A companion animal could become a pest if not properly cared for	☐	☐	☐	☐	☐	☐

H. ATTITUDES ASSOCIATED WITH MANAGING PESTS ON WAIHEKE ISLAND

For this section, choose how much you agree or disagree with the statements about pests.

	Statement	**Strongly agree**	**Agree**	**Undecided**	**Disagree**	**Strongly disagree**	**No opinion**
37	I believe we have the responsibility to keep pests from going to neighbouring islands where there are no longer pests	☐	☐	☐	☐	☐	☐
38	Even if there are pests on Waiheke island, I am not interested in managing their effects	☐	☐	☐	☐	☐	☐
39	I would prefer that all of the pest species are removed as on Tiritiri Matangi	☐	☐	☐	☐	☐	☐
40	I would prefer that some pest species remain on the island	☐	☐	☐	☐	☐	☐
41	I am willing to kill pests using anything including poison	☐	☐	☐	☐	☐	☐
42	If I was consulted at the early stages of planning a pest management program on Waiheke, I would be more likely to	☐	☐	☐	☐	☐	☐

	support that programme						
43	I am happy to manage pests on the island because as a resident, I feel responsible for my environment	☐	☐	☐	☐	☐	☐
44	I am willing to engage in managing pests if my neighbour is also involved	☐	☐	☐	☐	☐	☐
45	I am willing to engage in managing pests if I am asked to get involved	☐	☐	☐	☐	☐	☐

Thank you! Your feedback is highly valued and appreciated.

Kindly return completed surveys in the drop-off box closest to you at any of the following points on Waiheke Island:

- *Waiheke Library;*
- *Waiheke Island Service Centre;*
- *Matiatia Ferry terminal; and*
- *Ostend Saturday markets.*

Please use this space for additional comments. Thanks!

Appendix G. Codebook containing general themes, description of themes and reference statements from the open-ended responses in the community survey

Code name (themes)	Description	Reference statements
COMMUNITY VALUES	What people loved and valued about living on Waiheke Island	
Diversity	Illustrates diverse and varied people, ideas etc. in the community	The artisans, the pace of life, the little shops, the olive oils, the walks, the weather, the not-like-Auckland friendliness.
Small and remote	Refers to attributes such as small size, remoteness from the city (Auckland), or geographical isolation	I like the 'country' feel yet so accessible to the city
Slower development	Slow development to combat rising population	No high rise, no traffic lights, no town water or sewer; low level of urban type development. The low density of housing; rustic and rural feel.
Passionate people	Talks about the love and warmth of people who live on the island	I think it's that people care, I love the fact that people care and are passionate.
Environment	Includes the natural beauty of beaches and bush areas and the opportunity such an environment offered e.g. raising children. Also physical and emotional attributes of an environment	The fact that people generally relate to and value their natural environment - fresh air, birdlife, views over to the Gulf and the islands
Community potentials	The potentials and possibilities that can be achieved on the island	Potential to be a world leader in a self-sustainable environment with +50,000 people living in harmony with each other and the environment
SETBACKS AND CHALLENGES	Explores various forms of setbacks in relation to managing pest on the island	

People	Issues relating to people as a major challenge	
Absentee landowners	The inability of property owners (or private landowners or part-time population) to deal with invasive species.	I do feel that every single individual has to be responsible for the land they own and for the control of pests on that land. My landlord has forbidden me to do anything about the wasp infestation in my rental ... I find this short-sighted and inconsiderate
Volunteer-champion burn-out	Volunteers or champions are over-worked and overtime, lose enthusiasm for a project when they are not being compensated, old, become unhealthy or are not seeing expected results	I'm disillusioned. Having seen groups really strive, going through the "proper channels" and succeed in getting protections into the District Plan and other statutory documents but then seeing this disregarded by planners and decision makers and totally ignored…I don't have the energy
Social dynamics	The difficulty of working with people; the more they are, the more difficult it becomes	Waiheke has far too many people living here now and you would be wasting a lot of money trying to get rid of ALL the pests
Behavioural inhibition	Refers to behavioural challenges to pest management and the need for a change in behaviour or beliefs	We would be deluding ourselves if we excluded cats and even dogs from the list of serious threats to the fauna/bird life of Waiheke. Sure, get rid of rats, stoats etc. but cats have to go too. No matter how dear the moggies are to some people!! My cats kill about four small birds a year. The bird numbers remain high. A small price to pay. My cats kill about 8 rats/mice a year. Rats raid bird nests; therefore, my cats come out about even!
Distrust for external agencies	Loss of confidence in the ability of external agencies to manage pests on the island	I strongly resent that Auckland Council do very little to manage pest plants on Council-owned property, yet have the guts to require private landowners to do so on their land The Council should be ashamed of their reserves. The number of weeds, rabbits and rats on the island has a lot to do with their lack of action

Environment	Issues relating to nature or the environment	
Unconnectedness to nature	People do not have a connection with nature, are not able to appreciate it and consequently, can't protect it	The trick is getting people interested enough in nature to care; and as I see it, we need to reconnect to nature from a heart place, not just a cognitive place
Cost	Cost and related issues	
Finance	The high cost of managing pests on the island	Just think it [pest management] would cost too much Pests are a natural problem; not an unnatural one. It is too expensive to manage pests for me
Methods	Refers to the challenges of using particular methods for pest management	
Acceptable level of exotic species	A model that accepts a minimum level of introduced species assuming that they cannot be totally eradicated because the community is inhabited	Waiheke has far too many people living here now and you would be wasting a lot of money trying to get rid of ALL the pests Waiheke is different to Tiritiri Matangi, people live here, there needs to be a happy middle ground
Defining pest	Definition of pest species	There are also a different point of views of what is a pest. For me, dogs and cats are pests too… despite their status as household pets I don't think cats should be considered as pests and there would obviously be strong opposition to removing them off the island
Conservation is killing	The challenge that conservation involves killing in New Zealand	I would prefer initiatives the stop breeding rather than killing I could not be involved in any method of pest destruction unless it were humane. I strongly oppose unnecessary and avoidable pain & suffering imposed on any sentient creature
Unrealistic conservation goals	Setting conservation goals that are not achievable	New restrictions on residents need to be realistic and well thought out

Necessary evil	The irony of using poison against personal preferences because of its perceived benefits over other pest management methods	Happy enough to use targeted poison in traps, like rat baiting. No desire to do blanket poison drops like 1080, or use massive amounts of roundup for weeds Too many people on the island believe that we can manage pests with impractical approaches. This work has to be done with the most effective and cost-effective strategies as outlined by experts. We cannot solve problems with cider vinegar and fermented garlic. If we need glyphosate and 1080, then so be it
Prioritising eradication	The process by which participants placed/classified pests in order of eradication or control	I don't think all pests are the same in their impacts…species should be evaluated and assessed for their relative harm
Insufficient information	Information on pest management, resources or groups are not enough	Unfortunately, I don't think many residents or tourists have even a basic understanding of how pest-ridden Waiheke is I have not seen any publicity or comments in local newspapers about the increasing numbers of rabbits and whether the council is aware of the increase, or has the power or the means to act…Where do they live? What are they doing to the environment? How quickly will they reproduce and their numbers multiply?
ASPIRATION	Motivations for involving in conservation activities; suggests the goals and motivations of the community	
Release of kiwi	The release of kiwi on the island as a driving motivation for pest management	With regards to the Kiwi: there is no point in releasing these birds when there are still so many land-based predators on Waiheke. The effort to re-establish bell birds also did not work, as the environment is not quite ready for it, here I disagree with kiwi release as I imagine this would have to involve restrictions on access to more parts of the island on humans and companion animals

Potential for tourism	The potential for tourism based on achieving a pest-free status and a thriving biodiversity	Can't see any benefits for tourism as tourists are often pests too
Potential for pest-free status	A potential to achieve a pest-free status and a thriving environment	People wanting a pest-free status can go to Tiri! I walk with my dog most days on the beach. I clean the rubbish from the sand as I go!
Personal drive	Personal reasons and motivations for engaging in pest management activities	I don't need a personal benefit, I do it because someone has to. Despite neighbours, I do.
Neighbourly responsibility	Guardianship role: community members have a duty of care to ensure they don't re-infest surrounding pest-free islands	I am concerned about Waiheke's close proximity to other sanctuary islands
Sustainable biodiversity	Having a sustainable biodiversity (e.g. bush and the coastal environment) as a motivating factor	After visiting other off-shore islands such as Tiritiri Matangi and Kapiti Island I feel very inspired to support pest management on Waiheke. We have an amazing opportunity here to be living among absolutely flourishing wildlife.
Economic benefits	Benefits associated with increasing economy on the island	I think more people would get involved in pest management if money benefit of pest-free environment was spelt out e.g. if the money value to our visitor and tourist industry, of or outstanding coastal possum-free pohutukawa was widely appreciated
RESOLUTION	Refers to a process - The Waiheke way – of engaging community residents as it relates to pest management	
Communication	Dealing with control and eradication issues by exploring multiple channels of communication	
Next door advocacy	Gradual recruitment through low-key, one-on-one contact with the aim of gaining support or buy-in of targeted individuals or parties	I would be more motivated to keep up my efforts on my property if my neighbours were more informed and active. It often feels like a losing battle.

Engagement	Engaging residents and getting community buy-in	
Paid absenteeism	Suggests absent landowners and property managers become responsible for taking care of invasive species on their land areas	Landowners who cannot manage pests on their property should pay someone else to do it UNLESS they are on a very low wage.
Tapping into motivations	Engaging with the different motivations people already have towards pest management	I'm already involved. I will continue with pest control work in my area and on my property until I fall over - which may be soon, as I'm 77 years old.
Subsidised solutions	Providing subsidies for residents willing to be involved in managing pests and to encourage new people	All residents need to take responsibility for eliminating pests from their property. This could be subsidised by Auckland City Council. It is great if people are willing to offer their time to helping out their local environment. There should also be money available for more intensive pest control contractors. Rat bait or other resources should be made available at cost price, [external agencies] should provide funding and personnel.
Methodology	Methods and processes for achieving a successful management	
Paid drivers	Explores decision on when to employ volunteers or pay individuals during a project cycle	There needs to be a balance of volunteers and paid workers. There are many calls on volunteer time and we can't manage to do everything for free! External agencies ought to have a permanent, well-paid professional team to work in conjunction with local volunteers
Early consultation	Consulting with the community at the early stages of a project in order to enable participation and buy-in	It is also important to consult, inform and engage with the community to get both our understanding and co-operation and to get volunteers to help on both our own properties and public land.

Research	The process of making informed choices based on what has already been done elsewhere	We already do what we can on our land. We would like any advice/support to do what we already do better (e.g. conflicting advice from [different external agencies] on best way to manage rats. We have been told that the poison we buy from[one agency] regularly is not what we should be using)
Locally-driven projects	Community-led projects with solicited inputs from external organisations including DOC, Auckland Council, universities etc.	Run by local residents but funded and supported with training by Council and DOC. Joint responsibility works best but need local leadership and outside funding assistance
Education	The process of increasing awareness on pest management issues	
Experiencing nature	Exposing community members to nature i.e. birds, to increase their consciousness, awareness and appreciation of nature	After visiting other off-shore islands such as Tiritiri Matangi and Kapiti Island, I feel very inspired to support pest management on Waiheke. We have an amazing opportunity here to be living among absolutely flourishing wildlife
Practical education	Education based visual benefits and direct relevance	We need more comprehensive information which has been lacking locally and affordable processes. People need to be educated in the harm their pets create if left to wander free. Instead of licensing dogs, license a person to own a dog responsibly. Same for all the wandering cats at night
Local expertise	Building on what's already been done through the local expertise on the island	

Policy change	Developing governmental policy to positively affect or influence conservation activities e.g. regarding cats	Cats need to be micro-chipped and if trapped and not identifiable, then euthanised/killed. Dogs need to be controlled at all times and not allowed to wander off owner section. The aim is no replacement of either species. Dogs are already ridiculously restrained! Already limited access to bush walks by leads on beaches. No rules for cat owners. It's not realistic to try and keep them indoors at night