A Community's Perspectives of Wild Pigs (*Sus scrofa*) – Is the Harvest of Wild Pigs a Potential Threat or Benefit to Conservation?

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Abstract

Wild pigs (*Sus scrofa)* are recognised on a global scale as a tantalising and delicious food source. But, they are also a major pest species and cause millions of dollars of destruction each year. Due to their negative effects on biodiversity, Regional Councils and Governing Bodies in New Zealand seek to control pig numbers. Nevertheless, stakeholder views and values have not been considered in the management process. Therefore, leaving local and national officials open for criticism and strong opposition from other stakeholders. The aim of this study is to provide the first insight into a community's values to determine whether the harvest of wild pigs would be a potential threat or benefit to conservation. A series of semi-structured interviews was conducted with notable individuals from different stakeholder groups and their views and their values collected and analysed against the research objectives. There are several responses affirming or denying whether the harvest of wild pigs would potentially be a threat or a benefit to conservation. However, whilst the benefits (social, cultural, environmental, economic) for and against wild pigs in the environment are wide ranging, all stakeholders (Government, Iwi, Agencies, NGO's, and the public) must express their views and reach a collective agreement to guide future wild pig management.

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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."

Signed .....  .....

Dated .....29/09/2017.....

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Ethics Approval

Ethics approval for this research was Approved by the Auckland University of Technology Ethics Committee (AUTEC Reference number 16/327) on 12 October 2016 (see Appendix 1)

CHAPTER 1 - INTRODUCTION

1.1 Overview

Wild pigs (*Sus scrofa)* are recognised on a global scale as a tantalising and delicious food source. This may explain their presence on every continent except for Antarctica (Long, 2003; Amici et al, 2015). However, they are also a major pest species and cause millions of dollars of destruction each year (Barrios-Garcia and Ballari, 2012). This creates opposing views in how society values wild pigs. Due to their negative effects on biodiversity, many Regional Unitary Authorities in New Zealand seek to control pig numbers (Parkes et al, 2017). However, the views and values of all stakeholders have not been considered in the management process. This leaves local and national officials open to criticism and strong opposition from the public and other interested parties (See NZPCA 2009). The lack of consultation is a major issue that hinders management processes. The contrast between community/stakeholder views and conservation management views are the cause of socio-ecological conflict (Gadgil & Guha, 2000; Naughton-Treves & Treves, 2005). This thesis aims to explore perspectives collected from a community of people with current or previous interest in, or experience in, wild pigs and/or wild pig management. The rationale behind this is to determine whether the harvest of wild pigs would potentially be beneficial or detrimental to conservation. Furthermore, what might be the potential barriers for both resource managers and communities moving forward, to manage this resource in such a way, to enable communities to cater for their social, cultural and economic needs, whilst fulfilling environmental obligations.

1.2 Invasive species.

Invasive species is one of many nomenclatures used in recent times to describe nonindigenous species (Colautti & MacIsaac, 2004). Biological invasions are another term used. Prentis et al, (2008), make use of the term 'biological invasion', and describe introduced species as, 'the introduction, establishment, and spread of species outside of their native range'.

It is believed that New Zealand's unique flora and fauna is a manifestation of the rift that occurred as New Zealand began to break away from the ancient supercontinent Gondwanaland approximately 80 million years ago. New Zealand is unique in that unlike the rest of the world, there were no terrestrial mammals here prior to human arrival apart from two species of bat (Bull & Whitaker, 1975). New Zealand's terrestrial fauna pre-arrival of humans consisted mainly of avifauna, with the dominant species being ratites (flightless birds), more specifically, the speciose moa (*Aves: Dinornithiformes*) for example (Holdaway, 1989). The rich and diverse terrestrial fauna also included many insects such as weta (*Orthoptera: Anostostomatidae*) (Trewick & Morgan-Richards, 2005), invertebrates, that comprised of large land snails (*Powelliphanta*) (Meads, Walker & Elliott, 1984), relict herpetofauna, amphibians like New Zealand's endemic Archey's frog (*Leiopelma archeyi*) (Bell *et al*, 2004) and reptiles that include ancient species such as the iconic tuatara (*Sphenodon spp.*) as well as skinks (*Scincidae:Oligosoma*) and geckos (*Gekkota*) (Towns & Daugherty, 1994; Lee *et al*, 2009). However, this abundant terrestrial fauna evolved in the absence of mammalian predators (Holdaway, 1989; Schofield & Ashwell, 2009).

Human introduction of non-native animals and plants to Aotearoa, firstly by Polynesian explorers (later renamed māori) approximately 1000 years ago, and then by European settlers around 1800, had changed the landscape significantly. With them māori brought

their commensal animals, the Polynesian dogs (*Canis lupus familiaris*) or kurī, and the Polynesian rat (*Rattus exulans*) or kiore, as well as the sweet potato plant (*Ipomoea batatas*) or kūmara as it is known by māori (Roberts, 1991). Meanwhile, early European settlers brought with them animals such as cattle (*Bos taurus*), sheep (*Ovis aries*), goats (*Capra hircus*), and domestic pigs (*Sus scrofa domesticus*), along with several plant varieties for agricultural purposes. They also brought companion animals such as cats (*Felis catus*) and different breeds of dogs which performed different duties (family pet, protection, farm work and hunting). Other animals brought to New Zealand with early settlers included varied species of deer such as the red deer (*Cervus elaphus*), sika deer (*Cervus nippon*), and tahr (*Hemitragus jemlahicus*) a relative of the goat, for recreational hunting. These plus many other species of animals, plants, invertebrates, and birds were introduced by early European settlers to re-create the settings that they had left behind in their respective homelands abroad (Atkinson & Cameron, 1993). Mustelids such as weasels (*Mustela nivalis*), ferrets (*Mustela furo*) and stoats (*Mustela ermina*) were introduced to New Zealand as a bio-control method for the now out of control rabbit (*Oryctolagus cuniculus*) population that were also brought over for food and sport. Similarly, hedgehogs (*Erinaceus europaeus*) were introduced for the control invertebrate pests. Of all the introduced animals, the Australian brushtail possum (*Trichosurus vulpecula*), which were brought to New Zealand to start a fur trade, have become one of the most contentious of the introduced species. Whether biota was intentionally introduced (e.g. as a resource, biological control agent, or for recreation) or un-intentionally released (e.g. stowaways) may influence the perception of their value versus their negative impact on conservation (Parkes & Murphy, 2003). This is especially true in the case of stowaways (rat and mice spp) that hitched a ride with the early settlers and explorers which resulted in extensive biodiversity loss that is still being experienced today (Atkinson, 1973; Towns & Broome, 2003; Towns *et al*, 2011).

Whilst early Polynesians carried kiore with them, a smaller relative of rats and mice, it was understood that they were an alternative food source and not just stowaways (Roberts, 1991; Atkinson & Towns, 2001). But, this taonga species, also became a massive contributor to biodiversity loss, much the same as pigs. Therefore, it seems that deliberate introductions (e.g. wild pigs) are valued greater than stowaways.

1.3 Pigs as invasives

Pigs, whether domestic or wild have a global distribution which spans to every continent except Antarctica (Barrios-Garcia and Ballari, 2012). The first recorded introduction of pigs to New Zealand was in 1769 by noted French explorer Jean Francois Marie De Surville, and second and third introductions were then made by Captain James Cook and Captain Tobias Furneaux from 1773. A fourth attempt to introduce pigs by Cook in 1777 saw a sow and a boar presented to a māori chief in Queen Charlotte Sound. Most of pig liberations around New Zealand and the Pacific were made by James Cook, thus having a breed named 'captain cookers'. Multiple pig liberations since the arrival of the first explorers were continued by sealers, whalers, and traders who kept pigs on islands as a resource for shipwrecked crew and as a form of currency (Clarke & Dzieciolowski, 1991). Pig numbers rapidly grew due to events such as liberations, abandonment, and escapes. So, because of these liberations and escapes, the once domesticated pig was now being defined as "feral". Feral is a term which refers to animals that were once domesticated and are now living in the wild (Clarke & Dzieciolowski, 1991a). However, once an animal reverts to the wild phenotype, the domestic phenotype is lost and the feralisation process complete. Therefore, researchers agree that all free-ranging, escaped, or released pigs be referred to as "wild pigs" (Price, 1984; Keiter *et al*, 2016) in their introduced range. Unless, it is specifically known that the population is either of pure wild boar ancestry or from a recently liberated domestic

breed. This is to remove ambiguity and to ensure clarity when communicating to audiences of all levels of understanding, and to have a single common name that is globally recognised instead of the numerous expressions that wild pigs are known by at present. The number of attempts made to introduce pigs (domestic or wild) to the New Zealand landscape over 200+ years ago coupled with continued illegal liberations around the *motu* (country), clearly shows the desire to retain this introduced species and its perceived value in some communities. This highlights the conflicting views of this species, which is seen to be harmful to biodiversity and humans by some, but also valued as a potential asset to humans.

1.4 Wild pigs as vectors of disease

Of increasing concern in ecosystems worldwide is the ability of wild pigs to vector disease (Coleman, 2001; Li et al 2010; Krull 2013b; Bassett et al, 2017). Diseases such as *Mycobacterium bovis,* bovine tuberculosis (bTB) which is initially spread by its primary host the brushtail possum (*Trichosurus vulpecula*), with wild pigs acting as reservoir hosts (Nugent et al, 2012; Barron et al, 2015). Other contagious and economically crippling diseases include, classic swine fever (CSF), (Moennig, 2000; Paton & Greiser-Wilke, 2003), foot and mouth disease (FMD), (Pech & McIlroy, 1990; Ward *et al*, 2007), and the recently discovered *Phytophthora agathidicida* (kauri dieback) disease (Weir *et al*, 2015). Kauri dieback is a soil and water-borne pathogen that is currently killing the endemic kauri tree (*Agathis australis:* Araucariaceae) of New Zealand (Krull *et al*, 2013b). Kauri dieback infection is said to be virulent and non-discriminatory and it attacks the roots causing root rot, collar rot causing basal lesions, chlorosis, ending in tree mortality. This is an issue because after being exploited by early settlers, this only left small remnants fragmented mainly across Northland and Auckland. Kauri is taonga to māori and an iconic species to all

New Zealanders and tourists to Aotearoa-New Zealand. As such, the fear of losing kauri to dieback can be exacerbated by humans visiting or hunting in kauri forests, and by dogs and wild pigs transporting the infection as well (Waipara *et al*, 2013; Jamieson *et al*, 2014; Weir *et al*, 2015; Bassett *et al*, 2017). Leptospirosis bacterium which causes Weil's disease (Simpson, 2002) in humans, is transmitted from the urine of infected animals, then to humans through contact made by hunters during handling (through open wounds) or when field dressing wild pigs, or through food or water that has been tainted by the infected urine. *Brucella suis* which is a species of the genus *Brucella* (Young, 1995) is another transmittable disease that can be contracted generally by people who have long associations with animals such as hunters, farmers and other industry type people who may encounter infected product. This was the case in Wallis and Futuna, a French Pacific Island in North-East Fiji. A considerable proportion of the pig population had been infected with *B. suis*, and speculation suggests that people had contracted the disease through poor rearing and husbandry practices, slaughtering and handling practices, and food preparation practices carried out on the island. Surprisingly, it was discovered that the number of infected people was relatively low compared to the number of infected pigs, which was rather high. Pigs are important animals to these island people, as they are used as currency for trading and they are a main item used in traditional ceremonies, much like all Pacific cultures (Guerrier *et al*, 2011). However, if precautions are not taken early, especially by hunters and farmers, in terms of hygiene, then the impacts and spread of this disease may have serious long term virulent effects (Paton *et al*, 2001; Eales, Norton & Ketheesan, 2010) which can, and will, cause social-ecological conflict through local authorities putting an end to these activities, for health reasons, and possible eradication of this valued resource.

1.5 Ecological and Economic impacts of wild pigs.

Wild pigs have many negative impacts in both their native and invasive range (Ballari & Barrios-Garcia, 2014). Declines in native biodiversity have increased as wild pig populations worldwide have increased (Cuthbert, 2002; Krull, 2013a). Direct feeding on whole plants and parts of plants (shoots, seeds, flowers, and bulbs) means that the diversity and abundance of native flora is likely to be reduced in certain areas and replaced by unwanted species (Hone, 2002; Massei & Genov, 2004). Furthermore, declines in biodiversity due to the activities of wild pigs such as herbivory and predation (on native bird eggs and chicks, amphibians, worms, etc.), and indirect impacts that wild pigs have on the diversity of native fauna, also has significant consequences (Challies, 1975; Ballari & Barrios-Garcia, 2014). While the omnivorous habits of wild pigs are recognised as detrimental to ecosystems, ground disturbance by wild pigs is of most concern for ecologists and land managers worldwide (Singer, Swank & Clebsch, 1984; Hone, 1988; Seward et al, 2004; Campbell & Long, 2005; Mapston, 2007; Fagiani & Fipaldini, 2014). For example, the deleterious effects of pig rooting (turning over soil) in Great Smoky Mountains Park has decimated whole plant communities and lead to localised extinctions of some species (Bratton, 1974). Similarly, in Hawaii, snaring has been used as a management tool in remote areas to alleviate rooting/trampling damage and halt further biodiversity loss caused by wild pig populations (Anderson & Stone, 1993).

In Aotearoa-New Zealand, the effects of ground disturbance by wild pigs on seedling recruitment and soil ecology were tested in the Waitutu Forest, south Fiordland. Stomach contents of wild pigs were examined to determine their diet in this area, the site was examined to determine the extent of ground disturbance by wild pigs, and what impacts, if any, occurred in the soil or to seedlings in the area. Results showed

that while it was clear that disturbance occurred, these events happened primarily to search for a below-ground food source (seeds, invertebrates, vertebrates, plants). Soil composition of disturbed sites generally remained the same as undisturbed sites. Whilst it is true that density and height of seedlings is lower in areas disturbed by wild pigs, it was also discovered that wild pigs generally revisit previously disturbed sites rather than impact new ones. While the effects of ground disturbance by wild pigs on seedlings had minor consequences (growth, abundance), vegetation fates were determined later by other herbivores (deer, possum) that were present (Parkes, 2015).

Wild pigs are said to be responsible for lost agricultural yield (Barrios-Garcia and Ballari, 2012; Bengsen et al, 2016). This includes predation of lambs and other economically important livestock such as new-born cattle and goats, and the destruction of economically important crops (sugarcane, wheat, corn and hay) (Pavlov & Hone, 1982; Seward et al, 2004). In the 1990's, the estimated cost of agricultural damage caused by wild pigs in Australia was approximately $100 million per annum. What was also interesting to note was approximately $10 – 20 million worth of revenue derived from the export of wild pig meat to Europe, $5 million of that was reported to go to shooters (hunters) and chiller operators. In addition, further revenue was generated into the communities through the purchase of equipment and supplies by hunters (Choquenot, McIlroy and Korn, 1996).

1.6 Indirect effects of pig hunting

The direct and indirect effects of wild pigs on the environment and ecology have been well documented and discussed (Wootton, 1994; Seward et al, 2004, Bengsen, West & Krull, 2017) as has pig hunting as a control measure and a recreational activity (Choquenot, McIlroy & Korn, 1996; Tisdell, 2013; Zavaleta, Hobbs & Mooney, 2001; Cruz et al, 2005; Parkes et al, 2010). However, there is virtually no literature regarding the indirect effects of pig hunting itself. The act of hunting is to seek, find, and dispatch the intended target. In this case the target is wild pigs, but may include other animals such as deer and goats (Parkes, 1990; Nugent & Fraser, 1993). The intended effect of hunting pigs is the reduction of pig numbers (McIlroy, 2001). However, the indirect effects of this action can have both positive and negative outcomes (Courchamp et al, 2003; Pejchar & Mooney, 2009). The indirect positive outcomes of pig hunting can be categorised as ecological, social, and financial gains. The expected ecological gain from reducing wild pig populations through hunting is the restoration and recovery of biodiversity (Zavaleta et al, 2001). Social gains associated with pig hunting or hunting in general can be significant, complex, and even holistic (Reis, 2009; Woods & Kerr, 2010). The general perception of many (especially non-hunters) regarding hunting is that it is all about the kill and the adrenalin rush acquired pre-and post the kill. Comradeship, a rite of passage and legitimised killing are also used to describe this ancient practice (Elbert, Weierstall & Schauer, 2010). However, for most hunters, especially the seasoned ones, it is about more than just the kill. In fact, the hunt involves a diverse range of processes, skills and emotions (Marvin, 2005). The kill is merely the final act in the hunt which also encompasses field dressing, butchery of the catch, and consumption of the animal (O'Connell & Hawkes, 1988; Fraser, 2012). For experienced hunters, spending considerable time out in the field without getting an animal is just as rewarding as

catching one (Nugent & Mawhinney, 1987). The economic gains made through hunting are added through the purchase of hunting licences, equipment sales, travel expenses (transport; e.g. helicopter, boat, fuel, flights), and guided tours through game parks (Tisdell, 1982, Choquenot et al, 1996). In Aotearoa-New Zealand, wild animal populations are managed mainly through hunting (commercial or recreational), and as a result, numbers of "big game" animals (pigs, deer, thar, goat) in some areas appear to be in decline (McIlroy, 2001; Parkes & Murphy, 2003). For some (e.g. conservationists, agriculturalists), this is great, but for others (e.g. hunters, game park owners, tourist operators) this is detrimental to their needs. Consequently, translocation or illegal liberations/release of animals occurs in many areas of Aotearoa-New Zealand and around the world, (Fraser, Cone & Whitford, 2000; McIlroy, 2001; Kreith,2007; Krull, 2012; Seddon, Strauss & Innes, 2012; Nugent, Gortaza & Knowles, 2015; Wilson et al, 2015) primarily as a means of replenishing stocks for hunting purposes. Illegal pig releases are not a new phenomenon. The rapid expansion of feral pig populations in New South Wales, Australia, in the 1960s and 1970s, may have been attributed to unlawful releases (Caley, 1997).

Rapid expansion of pigs into new, and even current locations across Australia have also been accredited to illegal releases (Spencer & Hampton, 2005). The issue with releasing invasive animals into new areas is that these areas then become susceptible to the same unwanted effects (predation, soil disturbance, competition for resources, water quality disturbance, disease transmission, crop damage) that they caused in the area that they were liberated from.

Hunters can be placed into three different classes, commercial, recreational, and trophy hunters (Nugent and Choquenot, 2004). Commercial hunters take animals for a financial gain (Parkes, 2006). Recreational hunters take animals for personal use (meat for the family), especially in remote communities, and sport (Nugent et al,

1996; Gigliotti, 2000), but trophy hunters, at most times are solely interested in taking large (often male) animals for their heads (Parkes & Tustin, 1988; Davys, Forsyth & Hickling, 1999). The indirect negative effect of this is that the rest of the animal is at most times left *in situ* once the desired parts have been extracted from the animal. Thus, other animals (e.g. pigs, stoats) that feed on these remains may be at risk of contracting disease (bTB, foot and mouth FMD) and becoming vectors for disease transmission, as discussed earlier. Another indirect effect of hunting on natural biodiversity is the potential for dogs (used for hunting) to unintentionally catch and kill kiwi (*Apteryx australis*). The reasons dogs may do this is due to their training (or lack of), or from dogs being lost and strays (Miller & Pierce, 1995; McLennan *et al*, 1996).

1.7 Wildlife damage control.

Wildlife damage control is the control of wildlife and the damage that it may cause to the environment, biodiversity and/or humans. As Hone, (2007) suggests, if pests are species that have undesirable effects, then wildlife (in this case wild pigs) can often be considered as pests. As such, this can cause conflict for the agencies conducting the control, as the pest or pests in question may also have utilitarian values as well. It is not the abundance of the pest species in question that is the issue most of the time, but their impact (E.g. the reduction in agricultural yield) that classifies them as pests. The aim of wildlife damage control should be to reduce the damage rather than to focus on controlling pest numbers *per se* (Hone, 2007). Also, if the aim is to reduce the damage then it is imperative to "demonstrate" and "not assume" that the damage is being caused by the pest species in question, and not in fact, by a multitude of species. A threshold capacity has been suggested to determine the extent of pest damage caused in relation to the abundance of the pest species that has caused the damage. This is

important for control operations as it may mean that not all pests have to be removed to minimise or halt the damage caused. For example, as pest (wild pigs) density increased in a semi-arid rangeland in Australia, yield (lambs produced) decreased. There were thought to be several reasons for this, 1) was that due to high densities of wild pigs, intraspecific competition (competition within the same species for resources) had occurred, and 2) ewes that gave birth to twins made the lambs more susceptible to predation by wild pigs. This process has also been termed a compensation effect, where a reduction in the density of wild pigs also reduces intraspecific competition thus releasing once unavailable resources. This in turn decreases the likely impacts on the lamb population due to more resources being available, therefore theoretically increasing, or stabilising the lamb population (Choquenot, Lukins & Curran, 1997; Hone, 2004). In a further example in the Waitakere Ranges, Auckland, New Zealand, wild pig populations were reduced by hunters to lessen the amount of ground disturbance. Long term control regimes, for example six to 12 month culls were inexpensive and reduced pest density, although not much more than if no control had occurred, and damage was also reduced. However, a 3-month intensive control program whilst expensive, would reduce density by half the population, and significantly reduce damage (Krull *et al*, 2016). As the two variables that hinder conservation managers/ land managers worldwide are financial constraints and time, the only issue here is whether conservation or land managers want to opt for a costly short-term regime or a cheaper, less effective long-term regime. Furthermore, the decision to minimise wild pig populations or completely remove them from a significant area such as the Waitakere Ranges needs to be considered. Whichever term is taken, or whatever management decisions are made, will invariably depend on budget, and the goals of the organisation.

1.8 Can traditional ecological knowledge (TEK) be incorporated and successfully utilised in conservation management?

Traditional ecological knowledge (TEK), or, "ways of knowing" is a practice that has been carried out by indigenous and non-indigenous cultures for hundreds, if not thousands of years (Berkes, Colding & Folke, 2000; Dickison, 2009). Essentially, traditional ecological knowledge is gathering insight over prolonged periods of time and observing the relationship between the environment and its inhabitants, which includes humans. Observations are committed to memory so that they can be communicated, usually to family groups or tribes, in the form of stories, songs, or through the various mediums of art (Johnson, 1992). Although these methods are qualitative (especially in earlier times) rather than quantitative, it has allowed communities to regulate the use of limited resources at their disposal, in the present, and for future generations (Berkes, Folke & Gadgil, 1995). The affiliation between nature (the environment) and humans is important in indigenous cultures as it is a symbiotic relationship rather than an anthropocentric one. All participants (humans, flora, fauna, land, sky, and the elements) in this relationship are considered equal, which is why it is essential, from an indigenous perspective, that all other parts are examined carefully and treated with respect. Therefore, traditional ecological knowledge, or indigenous customs, were often regarded as unconventional by practitioners of Western Science because indigenous customs involved holism, culture, and even religious beliefs, rather than documented "concrete evidence" (Gadgil, Berkes & Folke, 1993; Berkes & Berkes, 2009). However, there has been a shift in the thinking amongst western scientists who now agree, whilst both practices have differences in ontology, epistemology, and methodology, both practices (indigenous knowledge and western science) do in fact have similar aspects to one another, and both have something to offer in terms of creating favourable outcomes, especially in the fields of social science, ecology, and biodiversity (Agrawal, 1995).

Examples of successful partnerships between conventional science and TEK can be found in Alaska, Canada and in Aotearoa-New Zealand. A decision by the International Whaling Commission (IWC) in 1977 to ban the harvest of bowhead whales (*Balaena mysticetus*) in Alaska prompted indigenous Eskimos to form their own commission. The Alaska Eskimo Whaling Commission (AEWC) was comprised of one representative from each of the bowhead-hunting communities, and whose sole objective was to fight the ban on traditional hunting practices. The AEWC eventually won the fight but then a quota system was imposed on them restricting the number of animals they could harvest. Unhappy with this decision the AEWC battled again for an increase in allowable harvest to better suit their needs. The quota system was imposed because it was believed that bowhead numbers were declining significantly based on the results of a visual census conducted by scientific researchers. The AEWC refuted these claims and made a counterclaim stating that their (AEWC) tracking methods were far superior than those of the researchers. Finally, a joint operation between the researchers and the whalers was carried out using a combination of technology and traditional knowledge which resulted in an increase in population estimates to around 6000-8000 bowheads, thus vindicating the indigenous hunters (Huntington, 2000).

The aboriginal people of Canada and Alaska have been using TEK to observe and predict a diverse number of phenomena that occur in their surrounding environment. One such observation is the amount of fat seen on an animal, (e.g. caribou (*Rangifer tarandus*)), as an indicator of animal condition, health, and wellbeing. An animal with low fat can indicate low food availability due to unfavourable conditions and competition for resources, which can also be an indicator of overpopulation (population dynamics). Low fat content can also indicate range extension or how far the animal may have travelled. Again, traditional knowledge and conventional science methods combined are found to be more beneficial than either method on their own (Moller *et al*,

2004). There are also several examples from New Zealand, but none more notable than the tītī, mutton-bird, or sooty shearwater (*Puffinus griseus*) harvest in Rakiura. Rakiura, commonly known as Stewart Island, lies roughly 30 km south of the South Island of Aotearoa-New Zealand, across the Foveaux Strait. Rakiura māori (the furthermost iwi/tribe in Aotearoa-New Zealand) have been conducting tītī harvests for centuries, which are culturally and economically significant to the South Island iwi (tribe). Harvest is governed by Rakiura māori who have written records from at least the early 1900s. Rakiura māori are able to whakapapa (show genealogical links) to tītī and the mutton-bird islands (Newman & Moller, 2005; Kitson & Moller, 2008). Tītī, much like all other natural resources, were, and still are, used mainly as a food source, especially in the colder winter months (Anderson, 1996). Rakiura māori have self-imposed rāhui (informal, temporary prohibition) and formal regulations placed on harvest periods. Tītī chicks are harvested from the 1st of April until the end of May, this incidentally coincides with the emergence and fledging patterns of the tītī (Lyver, 2000). Two traditional types of methods are used for harvesting tītī. One is called the "nanao", which when translated means to grab or feel with the hand. This method is used just before emergence and chicks are taken while they are still in the burrow. The second method is "rama", meaning light, or to catch by light. So, this method is used when tītī chicks have emerged from their burrows and are picked up at night, and only the fatty looking chicks were taken (Hunter, Moller & Kitson, 2000). Declines in tītī abundance were observed over a 20-year period from 1979 to 1998. Reasons for the decline were not known at the time but tītī harvesters were baffled as to why populations were also declining on one island of the 36 that they were not harvesting from. The mutton-birders, as a measure of kaitiakitanga (guardianship), decided to reduce the number of birds taken, and at some intervals halt harvest all together.

While these measures may have helped reproduction in a small way this did not halt the decline in numbers. A joint research project between the haukāinga (true home people) and Otago University then discovered that there were several possibilities for the decline in tītī populations. While frequency and intensity of harvest may have played a small role, this was not the sole cause for population decline and neither was it due to a lack of food resources for the birds as first thought by the home people. The declines were most likely due to climatic events that not only caused, but continue to cause, anomalies within the environment that lead to low breeding seasons because of less breeding pairs and adults, as well as many other anthropogenic activities (Lyver, Moller & Thompson, 1999; Lyver, 2005). Initially there was apprehension from māori in terms of intellectual property rights of mātauranga (knowledge), but, once both sides (māori & researchers) participated in open conversation, a fully functioning and cooperative partnership was formed and research continues using TEK and modern conventional science and technology (Lyver & Moller, 1999; Moller, Kitson & Downs, 2009; Moller *et al*, 2009). TEK and Western science have also combined to research costs and benefits for the traditional harvest of grey-faced petrels (*Pterodroma macroptera gouldi*) from offshore islands in the North Island of New Zealand (Lyver *et al*, 2008; Bellingham *et al*, 2010; Lyver & Moller, 2010; Jones *et al*, 2011; Whitehead *et al*, 2014), the conservation of tuatara (Ramstad *et al*, 2007), the conservation of the New Zealand native wood pigeon (*Hemiphaga novaeseelandiae*), kererū (Lyver, Jones & Doherty, 2009), and kūkupa (Innes *et al*, 2004) for possible return for customary use (Lyver & Moller, 2010), and returning the mauri back to forests, in Aotearoa, and abroad (Becker & Ghimire, 2003; Lyver *et al*, 2016). TEK can be incorporated and successfully utilised in conjunction with modern methods for conservation management and the continued protection of taonga (treasures), and the key to success of such

endeavours are held with all parties involved giving credence to all aspects of this practise.

1.9 Taonga spp

The simplest and most common meaning of taonga is property (Ryan, 1974), but taonga can be defined as a treasure or a prized possession. Anything of value, either socially or culturally can be defined as taonga (Moorfield, 2011). However, taonga, from a māori perspective, tends to encompass more than that. Taonga encapsulates not only the prized possession but also the animate and inanimate *mauri* (life force) that accompanies it. For example, a tūī (*Prosthemadera novaeseelandiae*) is considered a taonga because of its beauty and for the songs that it sings. But it is also a national identity in Aotearoa-New Zealand and it holds some form of *mana* (power, prestige) much like other native *manu* (birds). The more mana a taonga has, the more *tapu* (sacred, set apart) a taonga becomes. Tapu is placed upon certain taonga for protection, and the only way to lessen or lift tapu is through *karakia* (incantation, chant). The tūī is often referenced in *tauparapara* (traditional introduction) because like the tūī, it is the intention of the orator to make himself heard and to let their words be melodious. The zig zag flying pattern of the tūī is said to be emulated by *kaiwhatu* (weavers) when they are making *korowai* (cloak) to clothe the people, and from the distinctive patterns in korowai and *tukutuku* (lattice work), *whakapapa* (genealogy) can be traced. But it is only through *kōrero* (talk, discussion) that these concepts, and others, which are also considered taonga are kept alive (Tapsell, 1997). And it is through *kōrero* and *whakapapa* that the issue of taonga is kept alive for māori in terms of the Treaty. Te Tiriti o Waitangi -The Treaty of Waitangi 1840, article the second, stipulates that māori are guaranteed full and undisturbed access of their lands, forests, fisheries, me o rātou taonga katoa (and all their treasured possessions). And it is the latter part of this which causes the most contention. Māori and non-māori have different belief systems, they then also have

different interpretations of things. Where non-māori have a single interpretation of a word, māori have many, and they incorporate holistic beliefs. Therefore, due to these different beliefs and different interpretations between versions (English & māori) of the treaty, māori believe they are being marginalised and their rights under this treaty are not being upheld (Treaty of Waitangi Act, 1975; Stokes, 1992; Bess, 2011). For example, kūkupa, kererū are names for the endemic New Zealand wood pigeon (*Hemiphaga novaeseelandiae*), also a national icon, a taonga with mana, but also a taonga like many others that is protected by law, which lead to a prohibition on traditional harvest of this species in 1921. However, this taonga is highly significant and cherished under māori lore, which therein lies the socio-ecological conflict, which has also lead to reclamations put before the Waitangi Tribunal, claims known as WAI 262, to redress treaty issues and *whakahokia te mana*, give back the power, prestige to māori, to conserve taonga for use (Gibbs, 2003; Lyver *et al*, 2008; Lyver *et al*, 2009; Lyver & Moller, 2010; Sullivan & Tuffery-Huria, 2014). But, conflict must arise (spiritually, ethically, culturally) within communities (whānau, hapū, iwi) when something that is considered a taonga, is impacting negatively on another taonga species. An excellent example is kiore, which are a taonga that came in the great migration with early Polynesians as a food source, but are also accredited for the widespread decimation of endemic flora and fauna on the mainland of Aotearoa-New Zealand and many of its offshore islands (Atkinson & Towns, 2001; Towns & Broome, 2003; Wilmshurst & Higham, 2004). Similarly, weka (*Gallirallus australis*), an endemic flightless rail bird of Aotearoa-New Zealand which is considered a taonga and used as a food resource, but also depredates on other endemic taonga within its natural range, such as tītī (mutton-bird) (Harper, 2006; Harper, 2007; Towns *et al*, 2011). Furthermore, conflict must arise even further, when a taonga, in this case wild pigs an introduced species, significantly

impacts negatively on all endemic and native flora and fauna, kūkupa, kiwi, and kauri to name a few (Nugent *et al*, 1996).

1.10 Socio-ecological conflict

Socio-ecology is a combination of two disciplines, sociology, and ecology. Sociology studies the human dimension, human development, structure, and how humans function to sustain ourselves. Ecology on the other hand is the study of the relationship between organisms and their physical environment. So, in its simplest form socio-ecology is the interrelationship between humans and nature and the processes required to attain mutualism, or at the very least commensalism, in a socio-ecological system (Berkes and Folke, 1998). Other terms used to describe this relationship (human and nature) are, coupled human and natural systems (CHANS) (Liu et al, 2007b), social-ecological systems (Collins *et al*, 2010), and political ecology (Turner, 2004). Socio-ecological conflict can be defined as differences of opinion between a variety of factions whose focus is fixed on gaining equal rights to, allocation of, and governance over, natural resources for their social, environmental, economic and cultural needs (Pichler & Brad, 2016). Examples of socio-ecological conflict can be found everywhere across the globe, as people from all backgrounds strive to get a piece of the pie. For example, communities have considerable concerns about the perceived, and real, environmental impacts that mining operations bring, but they also have greater concerns over the lack of participation and representation in the decision-making process to either allow or prohibit operations to persist. Another concern for communities was the distrust of local officials and the lack of compensation afforded to them if operations caused harm to their environment or their livelihoods. However, with the advent of advanced technology, more mining companies are venturing into socially vulnerable and ecologically valuable

communities with full permission from the community's head of state only. This is due to top-down governance and the unequal distribution of power and money (Conde, 2017). In the Conga mine, Peru, violent clashes occurred resulting in lost lives between local peasant farmers and a mining company made up of multi-national conglomerates, over natural resources. The peasant farmers needed the water to sustain the land, so the land could sustain the cows that provided the milk which was the farmers livelihood. Conversely, the miners needed the land, to extract the minerals (gold and copper), and the water was required to run internal processes and used for flushing waste. The conflict here is evident, the farmers were aggrieved at the loss of water quality and quantity required to sustain themselves and their farms, and their surrounding environment. Tensions also rose because their land was being encroached on by the miners leaving the farmers with diminishing land to live on and farm. Conflict and subsequent loss of life may have been avoided if the President of Peru had not reneged on his electoral promise to stop the mining (Silva-Macher & Farrell, 2014). Other socio-ecological conflicts include, conservation conflicts (biodiversity loss) versus development (rising population density) in Africa (Balmford *et al*, 2001), and artisanal fishermen versus the oil industry and commercial fisherman in Lobitos, north of Peru (Maya-Jariego *et al*, 2017). Examples of socio-ecological conflict here in New Zealand include, conflicts between stakeholder groups and their interests in the marine environment (Cocklin, Craw & Mcauley, 1998; McGinnis, 2012; LeHeron *et al*, 2016), and traditional harvest rights of māori (Lyver & Moller, 2010). There are substantially more socio-ecological conflicts that exist on a global scale, but the one issue that is highly contentious worldwide, is the discourse over freshwater (Sneddon *et al*, 2002). More precisely, how it is appropriated, how it is governed, and the conflict that can occur. Six case studies from different organizations in Canada, Scotland, the Scottish-England Borderlands, and New Zealand focused on such issues.

It was clear that communities or stakeholders were dissatisfied with the way natural resources were being managed (Cook *et al*, 2013). In New Zealand, the Integrated Catchment Management (ICM) Group of Motueka (which comprises of stakeholders from residents, industry, local government, agencies, etc.) formed an alliance due to their dissatisfaction with the way top-down governance, or lack thereof, of natural resources within their catchment were being managed. The Waimea River Catchment in the South Island of New Zealand is valued by a diverse range of community members for economic (agriculture, forestry, tourism), ecological (habitat for fish & birds, native forest), and recreation (fishing, swimming, water sports) needs. The issue, 3700ha of the plains in the catchment are irrigated, principally from shallow groundwater. However, this then causes the Waimea river to occasionally run dry. The conflict then occurs when other stakeholders who rely on the river are disgruntled with farmers and vice versa. The solution, rather than bind even more valuable resources (time, money, lost revenue from lost production) in court, a committee representing all stakeholders, comprised of affected stakeholders was formed to collaboratively produce solutions to mitigate their issues. Resource managers employed strategies that involved research into the inter-relationships of all users and their specific requirements, the impacts of those requirements, and the trade-offs that all parties were expected to make for a successful outcome (Cook *et al*, 2013). From this it is evident that communication, whether from top-down or bottom-up governance, can be a barrier towards successful management programs when dealing with natural resources. And in the case of this study, where wild pigs are considered an invasive pest, and in some cases an asset, communication and collaboration needs to be at the forefront of the agenda for all stakeholders to facilitate successful outcomes.

1.11 Community discourse

All too often the lines of communication between governing bodies and communities appear to confuse and frustrate community members when community concerns are being considered. Traditional top-down, Central Governance was being challenged by bottom-up local management type controls. This came about due to frustrations from stakeholders regarding the way current resource managers were controlling natural resources. From all six-case studies, three common principles were identified (Jentoft, 1998; Cook *et al*, 2013). "Trust", was the overarching principle that stakeholders believed to be the most desired over all others. The other two principles recognised were collaborative decision making, and trade-offs, of which were termed win-wins. So, to successfully fulfil the three principles, conversations must occur, ergo, communication.

At present a common global theme exists, especially in the realm of conservation, the call for greater public participation is being hailed and a conscious effort to move from "government" to "governance" (Thomas & Memon, 2007) and a shift from "consultation" to "collaboration" (Waitakere City Council, 2008). Public participation in conservation matters is not new, though there has always been a call for public participation in conservation management, but viewed from a unique perspective, the hierarchical, top-down approach to conservation management meant that the "call" was only a means of "paying lip service" to the consultation and public participation process. Therefore, consensus dictated that these proceedings have never been utilised appropriately in the manner that they were intended (Reed, 2008). At least, this has been the perception of many communities around the world, especially amongst indigenous cultures who feel frustrated and disillusioned by management decisions and an ever-waning trust in central and local government (Castro & Nielsen, 2001; Tyrrell, 2008; Bennett *et al*, 2012). These frustrations were portrayed by the first

nations people and original land owners of Australia. In the Daley River catchment, north-western Northern Territory (NT), beef grazing is the dominant land use with dry-land, intensive, irrigated cropping becoming more prominent. The catchment area is thinly populated, but a well serviced area. In 2003, the NT government proposed plans to subdivide pastoral leases and clear land for mixed farming. The issue here was that they tried to do this without a natural resource management (NRM) plan. The main point of contention was the likely impact of water abstraction and altering of the values associated with land-use change. This was an issue purely because water is an extremely precious resource in this tropical region. A moratorium on these plans was set later in 2003 until NRM plans had been completed. A Daley Region Community Reference Group (CRG) was mobilised to represent all stakeholders of the region. However, some members of the aboriginal community protested and voiced their opposition over the lack of representation of indigenous people on the CRG committee, and at the haste at which proceedings were being conducted. This resulted in traditional land owners withdrawing their representative in 2004. The moratorium was then set in place for a further three years to 2007 (Jackson, 2005).

Further communication struggles are evident here in Aotearoa-New Zealand, where discourse transformations from discursive struggles in socio-cultural practices were discussed, and where the consultation process in New Zealand for natural resource management had never really been successful.

On the 22nd of July 1991, the Resource Management Act 1991 (RMA), was established in New Zealand. The purpose of this statute was to promote the sustainable management of natural and physical resources in New Zealand. The meaning of "sustainable" in this piece of legislation is, "managing the use, development and protection of physical and natural resources in a way, or at a rate which enables people or communities to provide for their social, economic, and

cultural wellbeing, now and for future generations whilst safeguarding the life-supporting capacity of air, water, soil and ecosystems, while avoiding, remedying or mitigating any adverse effects of activities on the environment" (Resource Management Act 1991).

Subsequently, with the introduction of the RMA this meant more meetings and more energy spent on writing reports by Regional Councils, as they were the ones charged with administering natural resources. However, initial resistance to public relations training by council staff meant that the consultation/communication process was hindered before it even began. Consultation is not a communication process, it is a technical requirement by law, this was a comment made by a member of council staff to a public relations trainer on day one of training. Thus, the rest of the staff requested that they be taught the minimum requirement to fulfil their duties. Symmetrical communication in this context meant that all participants actively contributed to the conversation and the outcome of the conversation would not have been determined in advance, but determined because of the proceedings, which was the main objective of public participation and consultation. Furthermore, it was implied that consultation was to be used to create the "illusion" of symmetrical communication, therefore, the trainers task should be to teach them techniques on how to create those illusions. Given these types of attitudes at the coal-face, there is no wonder why cynicism has become rife from all corners of the community. One further example comes from supposed consultation between the Department of Conservation (DoC) and a community on the east-coast of New Zealand. The government required the DoC to develop a 10-year conservation management strategy, so, initial consultation was carried out on the East Coast. The consultation process was used as a research tool to collect information to, 1) Inform people about the DoC and the nature of their duties, and 2) Collect information regarding attitudes and views of people consulted about

DoC issues. On the surface, everything appeared to be copacetic and symmetrical in nature. Unfortunately, this was not the case, the results from the first round were supposed to be used to design the second round, and the data was to be used to learn how to communicate with communities, and what information was to be communicated. But instead, the objectives for the second round had been predetermined but made to appear as though they were derived through true consultation. Consequently, further devaluing the consultation process and community faith in conservancies and other government organisations (Motion & Leitch, 1995; Nye Jr, 1997).

In 2002 the Local Government Act (LGA) was amended to give statutory powers to local government to act for, and with, their respective communities in terms of promoting their social, economic, environmental and cultural wellbeing for now and into the future (McKinlay, 2006). The main purpose of the act was to provide for democratic and effective local governments that recognise the diversity of New Zealand communities. The act stated the purpose of local government, and provided a framework and powers for local authorities to decide which activities they undertake and the way they will undertake them. Lastly, the act aimed to promote the accountability of local authorities to their communities, and provide for local authorities to play a broad role in meeting the current and future needs of their communities for good-quality local infrastructure, local public services, and performance of regulatory functions (Local Government Act 2002).

A review of the RMA 1991 and the LGA 1974 and its amendments highlighted that central governments (CG) intentions were, in terms of LGA reform, did not work in the way that they (CG) had intended (Perkins & Thorns 2000). It was CGs intention to introduce the RMA and reform the LGA to limit local authority's urban social planning. But instead, the now reformed LGA gave local authorities more scope to

manage as they saw fit because they were essentially, “released from the constraints of the old system”, and the decision-making process became more ambiguous, open to interpretation, and open to challenge and objection. However, when some local authorities tried to exercise these new powers, they were subjected to petty name calling by CG. Again, further diminishing relationships and creating dissension between local and national government, (Cook et al, 1995). The contradictory nature of national government actions as they tried to devolve resource management decisions, costs and responsibilities to local authorities whilst retaining all the decisive power, caused tension between themselves and local government, thus inevitably causing discord amongst all stakeholders which included the public. A significant part of the LGA 2002, acknowledges consultation and the consultation process. But, many believe it is time to move on from “mere” consultation and roles as advisors, for playing the understudy in the production is no longer good enough! A statement made regarding māori becoming co-managers for natural resource management in New Zealand (Taiepa *et al*, 1997). Co-management is a term coined by many about the sharing of power and responsibility between government, NGOs, and all resource users (Plummer & Fitzgibbon, 2000; Carlsson & Berkes, 2005; Yandel, 2006; Plummer & Fennell, 2007; Pomeroy & Berkes, 2007; Memon & Kirk, 2012; Dodson, 2014).

Social learning, has been cited as a critical component in understanding the intricacies and reservations essential to the management and/or co-management of natural resources. So, in the context of this discussion social learning was defined as, learning that occurs when people engage each other, sharing diverse experiences and perspectives to develop a common framework of understanding as a basis for combined action (Shusler, Decker & Pfeffer, 2003). Deliberation is one such mechanism that is suggested in this commentary and it is described as one of several

kinds of general processes, along with communication and education. Deliberation is also a synonym of consultation, except that there are subtle differences in meaning. Deliberation tends to be purposeful and inclusive, whereas consultation tends to towards arbitrary discussion. This may explain why deliberation is more favoured to best represent public participation and co-management (Abelson *et al*, 2003). Regardless of what methods of communication are used, all stakeholders must acknowledge that any issues are shared issues. Involved parties must decide on clear and achievable solutions, share and own the solutions for the betterment of the proposed project/s (Redpath et al, 2013). Furthermore, all parties involved must be willing to engage openly, honestly, transparently, and be prepared to make, and accept, trade-offs (Hirsch et al, 2011).

1.12 Aims

Is the harvest of wild pigs a potential threat or benefit to conservation? There are a few different scenarios and possibilities to answer this question. The main threats to conservation from wild pig harvests is the potential spread of pathogens and biodiversity loss. The spread of pathogens can be carried out through pig hunters and their dogs moving through the bush whilst unknowingly transporting these pathogens on their footwear, paws and snouts, as well as through illegal translocations of wild pigs from an infected area to a non-infected area. Biodiversity loss can occur through habitat loss and predation by hunter's dogs if lost or not suitably trained. However, the potential benefits of wild pig harvest are in the control and management of wild pig populations. As discussed earlier, the aim of many Regional Councils and Unitary Authorities (Auckland Council) in New Zealand is to reduce pig numbers to mitigate their negative impacts for conservation purposes and the preservation of our endemic and native taonga. However, community views and values surrounding wild pigs have not been investigated and may oppose the removal of these animals causing problems for management operations. Many animals introduced into New Zealand were done so for sport, a food source and for trade as hide and fur. After some time, many introduced animals eventually became classed as pests and population control efforts then undertaken. However, these species are still regarded as important resources by many including hunters, tourist operators and rural communities (Parkes and Murphy 2003). The specific aim of this research is to gather insights from a collective of people whom, as discussed earlier, have had, or continue to have, an interest or experience in wild pigs and the management of wild pigs. It is then from these insights where speculations can be made regarding the future of these animals that are regarded as pests as well as a culturally significant resource. Bearing in mind that the word "culture" in this context is

used in a broader sense to mean more than just a particular people or society, but in fact, whether these distinct groups of people (hunters, non-hunters, biosecurity officers, māori or non-māori) overall, have similarity or not regarding their views around the current and future management of wild pigs. The suppositions arrived at from this small sample size (n=12) are to tease out what the views might be that could possibly represent the views of the wider community.

1.13 Thesis outline

Chapter 2 – Considers the methodological approach used regarding our study objectives, and the methods used to achieve this.

Chapter 3 – Discusses the qualitative results derived from analysis of the semi-structured interview data to answer the study objectives.

Chapter 4 – Displays quantitative illustrations for the enhancement of the qualitative findings.

Chapter 5 – In depth discussion of the findings resulting in a response to the main research question, recommendations for further research and for future management.

CHAPTER 2 – ANALYSIS OF INTERVIEW DATA

2.1 Overview of the methodology

2.1.1 Ethnographic approach

Ethnography has deep developmental roots in sociology, anthropology, and psychology. Ethnography is the study of people, their relationships, their mutual or distinct differences, and their culture (Locke, 2011). Culture, is generally understood to mean the customs, social behaviour, and social organisation of a single ethnic group, or a specific group of people (largely refers to indigenous cultures). However, in the context of this research culture will mean varied opinions or points of view from more than one ethnicity, and dissimilar backgrounds, and how these different "cultures" value the same resource (Walters, 1980).

Traditional ethnographic study observes culture, customs, and social behaviour and although my research encompasses aspects of an ethnographic approach, I have not used this method in the traditional sense. Instead, I have taken a different direction and focused on people's views and values rather than the behaviour itself. A major component of an ethnographic study is time spent in the field. But, the actual length of time spent in the field should not matter to gather sufficient data (Jeffrey & Troman, 2004). These authors discussed three different approaches using three different methods or modes of time. So, for my research, where time is critical due to prescribed time constraints, a modified version of the compressed time mode was employed. The benefits of this time mode include, gaining a snapshot of participants attitudes toward wild pigs and conservation to understand possible attitudes on a broader scale. Gaining true, unadulterated opinions through the semi-structured interview process. Inherent financial costs associated with traditional ethnographic studies is significantly reduced, and all this conducted in a matter of hours and days as opposed to months or years. A

disadvantage though is the potential to miss subtle intricacies that are characteristic of a traditional ethnographic study.

2.1.2 Thematic analysis

Thematic analysis, (Braun & Clarke, 2006) was used as a basis for developing our detailed methodology around the semi-structured interview process. Thematic analysis has been widely used in research projects, especially in the medical fields of psychology (Braun & Clarke, 2006) and nursing (Fereday & Muir-Cochrane, 2006; Vaismoradi et al, 2013). Thematic analysis draws on the core features of a textual data set and looks at common themes within that data set. The analysis uses three distinct groups (basic themes, organising themes, global themes) at three distinct levels of the process. Each group, at each level, organises and orders the initial data set in such a way that by the global theme stage the size of the data set has reduced. For example, at the basic theme stage there may be at least 10 different sets of basic themes with common coded data in them. From that, organising themes are created, of which, may end with four groups only. Finally, a single global theme is created, consolidating all the information together to create a conclusion (Attride-Stirling, 2001). By employing a thematic approach, the views and values articulated by this study's participants can be identified from the interview data and expressed in response to the study objectives.

2.1.3 Mixed methods research

Mixed methods research is a combination of both qualitative and quantitative methods into a single study. Mixed methods research has also been recognised in recent times as the third research paradigm (Johnson, Onwuegbuzie & Turner, 2007; Denscombe, 2008; Denzin, 2010; Venkatesh, Brown & Bala, 2013) and has been used extensively in the disciplines of health (Hanson et al, 2005; Creswell & Clark, 2007; Creswell et al, 2011; Ostlund et al, 2011), social science (Collins, Onwuegbuzie & Jiao, 2006; Collins, Onwuegbuzie & Jiao, 2007; Teddlie & Yu, 2007), education (Fry, Chantavanich & Chantavanich, 1981; Collins, Onwuegbuzie & Sutton, 2006; Leech & Onwuegbuzie, 2009) and information systems research (Kaplan & Duchon, 1988; Gable, 1994; Mingers, 2001; Venkatesh, Brown & Bala, 2013). There has been much debate and conjecture about the strength, reliability, and validity of mixed methods research, especially from those who sit within the purist class of each method (quantitative or qualitative) (Sale, Lohfeld & Brazil, 2002; Johnson & Onwuegbuzie, 2004; Onwuegbuzie & Leech, 2005; Abowitz & Toole, 2009). Regardless, mixed methods research is becoming more popular as researchers accept the inherent benefits of integrating both quantitative and qualitative methods. A major benefit of an integrated methods approach is the potential to maximise the strengths, and minimise the weaknesses of both quantitative and qualitative methods alone (Sandleowski, 2000; Johnson & Onwuegbuzie, 2004; Johnson, Onwuegbuzie & Turner, 2007; Tashakkori & Creswell, 2007; Greene, 2008; O'Cathain, Murphy & Nicholl, 2010). The benefit for applying a mixed methods approach to my research is to visually enhance the qualitative findings through quantitative methods (graphs), and to use those visual cues to validate the qualitative commentary.

2.2 Methods

2.2.1 Study area

New Zealand's unique flora and fauna is a manifestation of the rift that occurred as New Zealand began to break away from the ancient supercontinent Gondwanaland approx. 80 Mya. New Zealand is unique in that unlike the rest of the world, there were no terrestrial mammals here prior to human arrival apart from two species of bat (Bull & Whitaker, 1975). The uniqueness of New Zealand's biodiversity is still being marvelled at today by the rest of the world, and as such is noted as being one of 25 of the most biodiverse "hotspots" on the planet (Myers *et al*, 2000). In terms of my study area, Auckland and Northland (Figure 1) are two out of 16 ecological regions within Aotearoa-New Zealand and are highly significant in terms of the natural biodiversity that is present there. There is growing concern as these ecological regions are being threatened by influences (human or non-human) that may exacerbate the decline of endemic and natural flora and fauna.

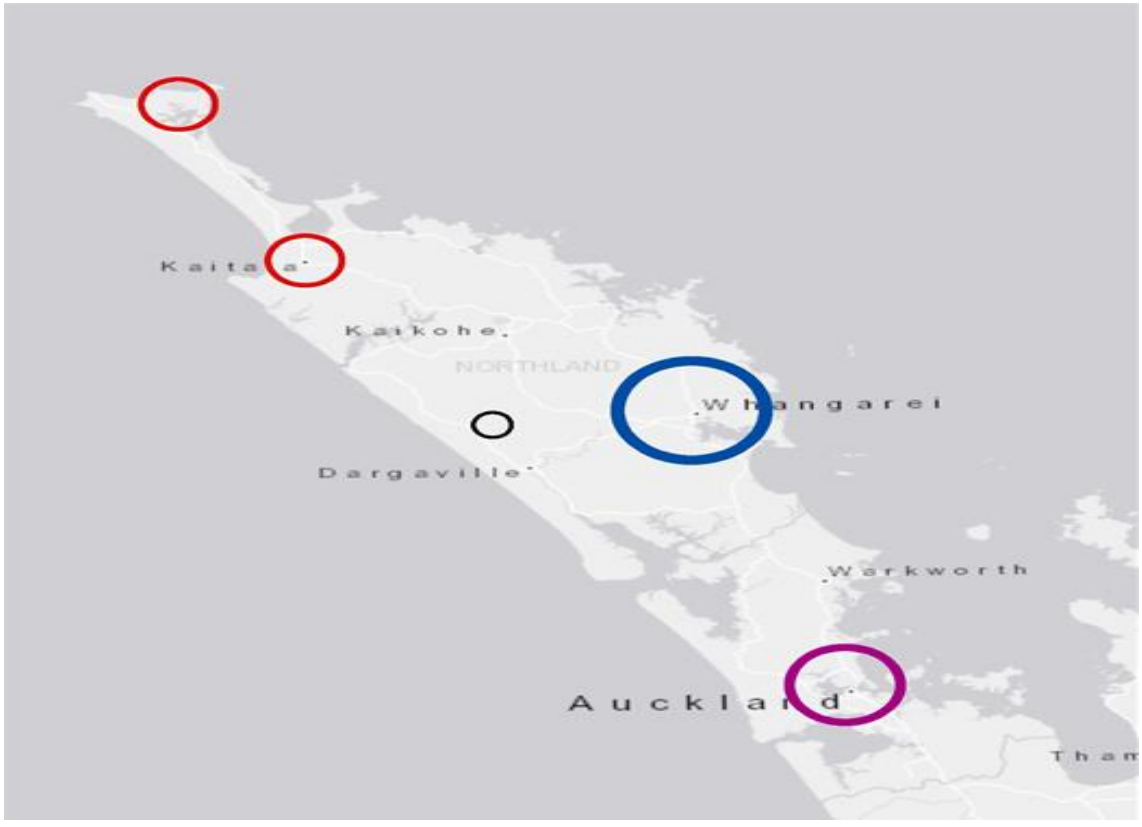

Figure 1: Map of my study area, Auckland to Northland, developed in ArcMap showing the number of actors recruited (n = 12) for this socio-ecological study, and the general area in which they were recruited from. The colour of the circle, the size and thickness of the circle indicates the number of actors recruited from that area. For example, the outline thickness for the Auckland area (purple) is 3, therefore indicating three actors had joined the study from the Auckland area. Whangārei (blue) had the largest sample (n = 4), Kaitaia and Te Hāpua (red) both had two participants, and Waipoua (black) had one.

As discussed earlier the overarching aim of this research is to provide the first insight into community values of wild pigs, a conservation pest and hunting resource in New Zealand. Semi-structured interviews were conducted with participants (n = 12) from varying backgrounds. For example, participant one (PAR1) is a non-māori male who is not a hunter but has extensive experience in biosecurity who works for the DoC. PAR1 has limited dealings with wild pigs *per se*, but has extensive knowledge in the effects caused by wild pig activities. Participant eight (PAR8) is a māori male who also has extensive biosecurity experience and whom also works for the DoC, but who is a hunter, especially of wild pigs. Both of these gentlemen work and live in the Northland Region, one in Whangārei (PAR1) and one in Kaitaia (PAR8). Participants two and seven (PAR2 & 7) are both māori males who also live in the Far North Region, and are both passionate hunters who work for their local community. Participants three and four (PAR3 & 4) are both non-māori males who again have extensive knowledge in biosecurity, but more importantly years of experience in pest management, namely wild pig management. Again, both of these gentlemen work and reside in the Northland Region, PAR3 is a hunter since his early childhood days, and PAR4 is not. Participant five (PAR5) is a māori female hunter of all game, especially pigs, who is also passionate about conservation. The rationale behind approaching PAR5 was not only because she was an avid hunter, but because she was a female hunter and to gain a female perspective on this matter. Participant six (PAR6) is a non-māori male who is a keen hunter of deer but not pigs, has extensive knowledge and experience in biosecurity and is currently employed by the Hawkes Bay Regional Council. His inclusion in this study was due to his previous work with wild pig control in the Auckland Region, especially in the Waitakere and Hunua Ranges. Participants nine, 10, and 12 (PAR9, 10, 12) are all māori males who are passionate exponents of mātauranga māori (māori knowledge), tikanga (ways of knowing and doing) and te taiao (the environment). The

most common trait they all share is that they are not hunters. PAR 9 and 10 live in the Northland Region, whilst PAR12 lives and works in the Auckland Region in biosecurity. Participant 11 (PAR11) is a non-māori male who is not a hunter, and at the time of conducting interviews was also a student at the University of Auckland nearing completion of his work towards a Master degree where his project involved camera surveillance of wild pigs in the Hunua Ranges. Therefore, as discussed earlier, the rationale for choosing these participants was due to their current or previous knowledge, current or previous interest in wild pigs and wild pig management. All participants that were invited to join this study accepted. I developed indicative or guiding questions (appendix 1) in conjunction with questions drawn and modified from Koichi, (2012). Guiding questions were designed to elicit information from participants regarding their views about wild pigs and natural biodiversity, and how these two entities currently coexist, and whether they may or may not coexist in the future. Indicative or guiding questions, concepts, were used to lead the process off, but then the interview continued along the path of free and unstructured conversation to tease out the valuable information. This approach was thought to be more appropriate for this type of research as it fits in with the goals and aspirations of the project. Although this research involved tangata māori and kaupapa māori concepts (*whakawhanaungatanga* – relationship building, *tika* – truth, *whakapono* – trust), the expected benefits from this research are for the whole community, irrespective of their ethnicity. Furthermore, the responses to these guiding questions aided in answering the following objectives,

1. What are the community values and beliefs regarding both pig hunting and conservation?
2. Are wild species favoured more than native species, and how do they value either or both?
3. Do māori and non-māori differ regarding their perspectives about wild pigs?

Further to this, the responses given from these objectives will aid in answering our overarching research question. Ethics approval was granted by the University prior to data collection (appendix 2? If you've said that the guiding questions are appendix 1). Initial contact was made with prospective interviewees and they were invited to join this study where they received official documentation via email (information sheet, consent form, indicative questions – see appendix 2-4) outlining the purpose, methods, and other essential information for this study. Similarly, they received a consent form to acknowledge acceptance or non-acceptance to participate in this study, along with a copy of the indicative questions for their perusal before the interview process. Prospective interviewees (terminology you've use before) were chosen based on their knowledge, experience, and interest in conservation and/or wild pigs and wild pig management, and all who were invited accepted the invitation.

2.2.2 Semi-structured interviews

The semi-structured interview process involved both parties (researcher & participant) engaging in an open and frank conversation style (Lyver & Moller, 2010). The semi-structured interview process was used rather than questionnaires or surveys, to allow the participants to feel comfortable so that the information sought after flowed freely. Furthermore, it was felt that this method could also draw out unique characteristics from participants that would not necessarily be picked up through questionnaires or surveys. Characteristics such as, emotion (empathy, angst, passion, determination) through body language, facial expression, or speech (Huntington, 2000). An initial contact person was identified through public sources and from there other participants were found by recommendation from the previous, also known as 'snowball sampling'.

2.2.3 Snowball sampling and potential bias

The snowball sampling was employed when assembling participants for my study. Snowball sampling is an empirical technique for sampling social networks which can be centered from a single person, and from that person others are drawn in based on their relationship to one another and the cycle continues along that same path thus growing the network. The mere name of this technique (snowball sampling) is appropriate as it fits the analogy of a single snowball that starts off small then attaches more snow as it gathers momentum and increases in size as it travels. However, a cautionary approach is advised as inherent biases may occur due to these relationships (Newman, 2001). In the case of this study, the fear is that the views and values of the participants may skew results based on the strength of perceived relationships. Although some of the participants may have had previous relationships with one another, it was established that by and large, no prior relationships had been established amongst the participants as a collective. Nevertheless, the views gathered for this study were clearly the views of the individual being interviewed. This was demonstrated in the semi-structured interview process where it was evident that these views were their own and unbiased by anyone else's through the way in which they freely gave the information, and the raw emotion displayed as it was given. Therein lies a benefit of the semi-structured interview process, where the ability to capture these unique characteristics cannot be seen through other methods (questionnaire, survey). Further biases may have been a conflict of interest on the part of the researcher as I am originally from Northland. Nevertheless, I have not resided in Northland for the past 22 years, and have never had contact with the participants prior to the commencement of this project. Furthermore, I have come from a background in biological science, more specifically, marine science. And whilst I am a māori researcher whose *whakapapa* (genealogy) is from Te Tai

Tokerau – Northland region, this only made creating *whakawhanaungatanga* (relationship) links with both māori and non-māori easier.

2.2.4 Data collection

All interviews were conducted, audio recorded, transcribed, and analysed by myself. All interviews were either face to face or over the phone, and were 38 – 78 minutes in duration. Face to face interviews were conducted at a location and time specified by the interviewee. Face to face interviews was the preferred technique. However, due to the time constraints of a Master's project and the logistical difficulties of setting up physical meetings with some participants, phone interviews were accepted as the next suitable method. After consultation with experts it was decided that to gain full insights into the data it would be best to personally transcribe the interviews (Wellard & McKenna, 2001). All 12 interviews were transcribed in verbatim (Halcomb & Davidson, 2006) using Express Scribe Pro version 5.87 transcription software and an Infinity USB foot pedal for ease of operation and to save time. As interviews finished they were transcribed at the earliest possible time to retain and record the subtle nuances observed during the interview. Each one hour audio recording took approximately three and a half to four hours to transcribe (Sandelowski, 1994; Britten, 1995).

A phone interview, was outsourced for transcription by professional's due to quality issues (excessive background noise muffling the recording) found in the recording. Also, time pressures involved meant that it made sense to outsource this one interview. Further to this the transcriptionist was local and remuneration for this service was reasonable with a quick turnaround time. However, upon checking over the transcript, small errors were found throughout the document where the spelling of māori words was incorrect, and clear misinterpretation of dialogue was found when played back against the audio.

But these errors were minor bearing in mind the quality of the audio to begin with and were corrected by myself as they were found. Literature suggests, that while transcription services are professional, providing information which might be prudent beforehand (cultural concerns, levels of confidentiality, language, emotional content, etc.) will assist greatly during transcription (MacLean, Meyer & Estable, 2004).

CHAPTER 3 – QUALITATIVE COMMENTARY OF THE OBJECTIVES

3.1 Qualitative findings

This chapter comprises of commentary received by the participants (hunters & non-hunters = 50-50 split) or, actors in this socio-ecological composition about the views and values expressed regarding wild pigs. Also, for the purposes of this chapter the qualitative commentary revealed in each section will be in response to my study objectives discussed earlier. Furthermore, for the qualitative commentary, actors will be identified as (*PAR*) participant, with a corresponding number indicating the number of actors in this study (n = 12), e.g., *PAR9*, participant number 9 in this study. N.B. the numbers allocated to each actor has no hierarchical meaning or researcher bias in this study.

3.2 What are community values and beliefs regarding both pig hunting and conservation?

3.2.1 Views toward pig hunting

To understand the attitudes of actors towards pig hunting they were asked a series of guiding questions, one of which was what pig hunting meant to them. Responses varied and included the generic, to get food, and to get outdoors. So, while food gathering was a common theme amongst all actors, it appears that the food aspect was secondary to other motivations for going hunting. As it turned out, six of the 12 actors identified as being hunters and six identified as not being hunters. But as participant one explains, although they do not hunt, they have some sort of opinion as to why people are motivated to hunt.

PAR1 – "I'm not a hunter but I know that we had a guy here that did a huge amount of pig hunting. Ummm, I think they're used for recreation as much as anything else. There is a lot of people that just want to go into the bush and umm you know, that's their excuse for going out for a pig hunt".

Others who are hunters, such as participant two, discussed that while the result of going pig hunting, or hunting in general, is to put a *kai* (food) on the table, there are ultimately other goals or other drivers associated with the act of hunting that appeals to them more than just food gathering.

PAR2 – "Out there to get kai (food). It's a mixture of a lot of stuff. One will be just keeping connected to our whenua (land). And the other one will be because I love the sport. And umm number three will be, I'm always after the trophy pig! You know what it's like when you're a pig hunter you're always after the big boar! And of course, to teach my young fullas. That's one way to keep them connected to our whenua (land)".

Similar sentiments were echoed by participant five, who acknowledged that the ability to spend time with family and friends was a main attraction for them to go hunting, whilst also acknowledging a variety of different emotions associated with the act of hunting. Emotions that range from excitement, to adrenalin fuelled, to ones of compassion, sympathy, and possibly sadness. Nonetheless, hunting for them was a way of life and an activity that they loved and grew up participating in, whilst also acknowledging the importance of utilising the catch (pig, deer, or fish) to its fullest, as a sign of respect for that animal who gave up their life for the social, economic, cultural, and environmental needs of their pursuer.

PAR5 – "When I think of pig hunting, my mind automatically flicks back to good times shared with a lot of good people family and friends alike. I used to get a buzz out of the kill when I was younger now I don't necessarily like watching them die but I know that we won't ever waste anything we catch/kill so I know that the animal will not die in vain".

Moreover, participant six, who is a hunter (mainly deer and goats) but not of wild pigs, and who also identifies as a biosecurity officer, disapproves of the sport of pig hunting. Reason being is the cruelty and harm that occurs to both the pig and the dogs, if dogs are used. Although, this actor acknowledges from their professional perspective as a biosecurity officer, that now, pig control operations using dogs is the most effective (besides 1080 and other poisons) and efficient, overall socially acceptable, and economically viable method.

PAR6 – "I am a hunter, but I don't target feral pigs. I hunt deer and what not, but I am around pig hunters a lot. I've got family members who are active pig hunters. And so, I personally think it's barbaric (pig hunting), and that is primarily because you've got a pack of dogs basically pulling pigs apart. So, it's a bit of a brutal sport and that's basically why I would never get into it. Using that exact method, I was talking about (hunting with dogs). It's the best control tool we have for feral pigs, so it's just one of those things and we've got to use the best tool available".

Other questions to extract actor's views and values toward pig hunting included asking people about what values they associated with wild pigs. Or from a nonhunters point of view, what did they think people's values were, and values they felt people held for wild pigs. Responses varied and as participant 11 discusses here, hunters can become very territorial over the resource if they feel it is under any threat.

PAR11 – "Yeah I guess my experience with pig hunters has been sort of, people who just really value it, they're sort of fairly environmentally savvy and they just, it's a food source for them and it's important. And I've also met some pig hunters that are, I don't know, they want to hunt pigs and they get very protective of their resources, and any sort of threat to that is a big frown! A sort of, like I was saying I had that run in with pig hunters where I accidentally called them (pigs) a pest, and they were calling up the council and they were getting really angry and sort of aggrieved that we were impinging on their pigs".

3.2.2 Views about conservation

Actors were asked for their views about conservation, and from a hunter's perspective, whether conservation was taken into consideration when out hunting. Responses varied with 10 out of the 12 actors acknowledging the importance of conserving our endemic and native species. But, that is not to say that the remaining two actors did not think conservation was unimportant. They just believe that conservation and pig hunting possibly sit on an equal level in their hierarchical structure. As was noticed by the commentary from participant seven who gave a colourful interpretation of whether conservation was taken into consideration when out hunting.

PAR7 – "So, when you were saying about the plant life, when you're running to your dogs that are getting ripped up and your finding dead dogs on the track, you're not worried about conservation!! You're worried about stabbing that bugger that just killed your dog!! You know, you get in positions like that you're not worried about conservation, you're thinking far out! this is my life! I gota kill this prick (the wild pig)!"

Commentary from participant six showed a different side, where conservation was very important to them and this passion lead them to spread the word so to speak, around their family and friends resulting in a positive change in attitude and hunting practices.

PAR6 – "So, the first part is yes, conservation is taken into consideration when I am out hunting. And I do that by shooting everything I see. I never leave an animal behind, just don't see the logical point. I remember I fenced off a gorge on our family farm and started restoring it, so my brother thought it'd be a fantastic place to release deer, because he didn't get it (conservation concept). He didn't understand that connection between deer and damage. Now, having hunted with him quite a bit and just through talking to him it's changed a lot, and that's the same with my friends as well".

Perspectives were sought from those who were not hunters, and this was to determine whether they thought conservation was part of the hunter's psyche. Of the six (50%) participants that did not identify as a hunter, all acknowledged and agreed that whilst conservation is very important to themselves, whether hunters thought about, or had, conservative hunting practices while out in the environment, was totally up to them.

PAR11 – "I guess it really seems to depend on the hunters, I guess from stories I've heard there are some hunters that are really good (in terms of conservation), they are sort of trudging their boots, and are sort of quite aware of different umm things like kauri dieback and things like that. And then, other hunters sort of you know, sort of a lot of illegal hunting and pig releases that go on in the Hunua's so as you can imagine they are probably less concerned about things like that".

3.3 Are wild species favoured over native species?

Once actor's views had been established for the objectives in the previous section, the conversation then moved on to their thoughts on whether wild or introduced species, in this case wild pigs, were favoured more over our endemic and native species. To test this, actors were asked for their opinion about *taonga*, which in *te reo māori* (māori language) the most common translation that is used is treasure, or a treasured possession, and what this meant to them especially in terms of endemic and native species.

For all 12 actors, taonga meant the same thing, but it also held different meanings as well. For instance, commonality was observed between the actors as the generic

examples of animals and plants were given as responses to what does taonga mean to you. Examples given by all actors included *wai māori* (fresh water), *pūpū kauri* (kauri snail), *pūpū harakeke* (flax snail), endemic and iconic birds such as *kōkako* (*Callaeas wilsoni*) and *tūī* (*Prosthemadera novaeseelandiae*), and all manner of plants and trees (kauri) for aesthetic pleasure, and not to mention plants suitable for *rongoā* (medicinal purposes). For participant seven though, taonga meant looking outside of the perceived norm and citing ancient burial caves and their surrounding mountains as well. Similarly, participant nine spoke of the impending decline in *mātauranga māori* (māori knowledge) since many of our *kaumātua* (elders) that held this knowledge are slowly in decline also.

PAR7 – "Yeah taonga to me is mostly what's been mentioned already but also our caves, Kapowairua (Spirits Bay, Northland) and that. You know it's about protecting our taonga while we're still alive so that they can be kept for many years further on. And I respect our mountains as a taonga. Because to me, I don't know if I'm right but, that's how I think of it all out there. Treasures of our whenua (land), our people, our iwi".

PAR – "I think our kaumātua, the real kaumātua, they're taonga because they are so rare. And so, a lot of times like people say to us, oh kauri that must be an amazing taonga for you guys because it's so big. And I don't know if that's a creeping in of western ideals but there is certainly an affixing a value to things that are large. And then when you talk to our old people they say, ah hōhā (bah humbug), kahikātoa (mānuka, Leptospermum scoparium) was our taonga tree because it was small, versatile, useable and provided sustenance for the people, go on, go and cut down a kauri for your firewood".

The meaning and significance of taonga is explained here by participants one and 10. Here they describe the word taonga as anything and everything that surrounds you and that can be of use to yourself and others. Taonga, from the view of participant one, can also potentially mean internal conflict, spiritually, mentally, and culturally. The views expressed here can essentially be deemed as significant, as both actors are *kaumātua* (elderly gentlemen), both are highly respected in their fields, both identify as non-hunters, although participant 10 grew up hunting in their early life. And, both perspectives are from a māori and a non-māori point of view.

PAR1 – "Well in terms of māoridom my understanding is that, māoridom works very holistically so in terms of taonga, virtually anything is taonga from what I can understand. Um, so I can see some conceptual problems when say a kiwi is taonga which is being impacted by a pig that is taonga. So, yeah, I don't know how to resolve that, that's something that's very much within the realm of the people who are having to deal with those situations in a marae setting".

PAR10 – "You know, even that word, he kupu hou ano kē tēnā kia ahau (that word is new to me), taonga species. Everything in nature, everything that has been provided to us, you know water is taonga, umm you mentioned the snail. But ahh anything that is of use so, to me rongoā (māori medicine) is taonga. Tūpākihi (Coriaria arborea) is classed as a poisonous weed. A weed is basically a plant growing where you don't want it, so you don't want tūpākihi growing near beehives because you get that tutin toxin in your honey. But, tūpākihi, even though it's poisonous it's a very good rongoā (medicine). So, that has its place. So, I don't pick certain species and say, na he taonga nui ki ahau (that is a significant treasure to me). You know, I've seen that word (taonga) used more by academics and that. Anything that's of value, that you would value, that should be a taonga. Everything has its place".

To tease this topic (taonga) out even further, as to whether wild species were favoured over native taonga species, conversations were had about places the actors thought were very important to them. All 12 actors spoke about highly significant areas such as native forest plantations in various parts of the *motu* (country) where they had fond memories of growing up. Some also spoke about ancient *pā* (fortified settlement) sites and *wāhi tapu* (sacred site, burial ground) where their *tūpuna* (ancestors) once lived or were buried. And what everyone had in common was, how much damage pigs (wild or domestic) and other animals, can potentially, and are doing to these places of significance. But what stood out from all the rest was the commentary from participant 11. This person spoke about their *marae* (traditional meeting place) as their place of significance. And, that their *marae* and everything in it, around it, and the people there, especially elders, were taonga to them. The *kōrero* (discussion, stories) that went on there about what the surrounding land and native forests produced once upon a time. The native birds that inhabited there, the plentiful *tuna* (eel) that teemed in the once pristine *awa* (stream) next to the *marae* that is now so *paru* (not clean) that the water is barely drinkable. For this actor, their memories of pigs were seeing them being brought in by their cousins and their elders, as this actor did not partake in the practice of

hunting themselves, in large numbers for *marae hui* (occasions). Although, these days the *whānau* (family) had to drive further afield to catch a pig or two.

PAR11 – "You know I was talking to you about the degradation of the water, you look down the Te Arai river and it's horrific and it's eroding the banks, and the banks are full of invasive weeds. The whole area is destroyed really, in terms of what it used to be. My dad used to tell me even when I was a child that we use to have kākā (Nestor meridionalis) around that area. We have little patches of ngahere left which are full of invasive walnuts and possums. There's not many pigs there, you need to go way up into the hinterland because it's (marae area) surrounded by agriculture now. But it's a very special place! Especially when you hear the kaumātua speak about how it used to be. And you hear their kōrero (discussion), and they're still alive, so it wasn't that long ago. A few decades ago we use to have kākā, we use to have clean water, we use to have tuna (eels). You know, you could look after yourself, you didn't have to go to Pak-N-Save.

At this point, the topic of whether wild species (wild pigs) were favoured has not been approached. This is because the direct question of whether the actors favoured wild species more was not asked. However, questions relating to what their experiences with wild pigs were, and what values they associated with wild pigs were asked instead. From this it was anticipated that the information drawn out would give more open-ended type responses to these questions, instead of the generic yes or no response if the question about favouring wild species was asked directly. The outcome of this is still unclear as to their preference without asking the question directly. Nevertheless, what it does show is a broader perspective about wild pigs' value to people, especially hunters. Wild pig's value is described through distinct categories such as connection, opportunity, as well as food. So, whether they are valued more than native species, in this instance is seen from a broader perspective than just the usual "yeah because I do", or, "nah I don't", type of responses.

PAR9 – "No not a hunter, I prefer to go to the beach, but my experience with pigs involves my work with kauri die back. And the value of them, I mean from a, in terms of a historical context

and the role that they played. I guess māori have moved from pre-European times to tending to use them as a trade good. I suppose one of the important things is that sort of role in terms of the mana (prestige) associated with the gathering of food and the distribution of food. So, as we have changed over to buying all our stuff at 4 Square it's probably one of the remaining activities that puts people in touch with their ngahere (bush, forest). Plenty of us still go to the beach, but there's not that many people that still gather kai (food) from within the ngahere (bush, forest). So, I guess it's a bit of a dying art, knowledge of the bush, and then there's that mana (prestige) and the idea of koha (gifts, gifting) and utu (repay, reciprocity) and manaaki (support, care) and tohatoha (distribute, share) and that's kind of neat you know it's good to see that".

PAR3 – "Started hunting them (wild pigs) when I was about eight, with the old man. So, in terms of experiences with pigs, I've been all over New Zealand, from the bottom of the South Island to Cape Reinga. Seen pigs in big numbers, I've seen them in small numbers, and I've seen what they can do when they are in high numbers, and how benign they can be in limited numbers. They've (wild pigs) got a social value, an economic value, an environmental, and to an extent they even have an environmental role. They're sort of filling the roles of some of our things we've lost, but in a unique way and probably now, overcompensating for what something else may have been doing, certainly when they get into higher numbers. And so socially they're a food source and recreational therapy. They're (wild pigs) an asset as well as a pest".

3.4 Do māori and non-māori differ in their perspectives about wild pigs?

Views and values were extracted from the interview data with common themes that was pertinent to answer the above objective. The themes investigated include, whether actors considered pigs as taonga, how reliant were actors on hunted animals (wild pigs) to supplement the family food budget, and what were their (actor's) thoughts regarding wild pig management.

3.4.1 Are pigs considered taonga?

There were slight differences of opinion between the actors when considering if pigs were taonga. However, these minute differences were from the actors as a collective, in terms of contrast between māori and non-māori, opinions were homogenous in that for 67% of the sample size (n = 12), eight of the 12 actors did not consider pigs to be taonga mainly because they are an introduced animal. Although they are an introduced animal that tastes delicious, and satisfies certain social and cultural aspects for many community members. They also cause too much damage from an environmental and economic perspective.

PAR5 – "No. They are an introduced species and came with the European settlers in the early 19th century?? Or thereabouts lol. I do recognise that some families still heavily rely on the meat from pigs to feed themselves and for special occasions. I reckon that they have become quite important in not just the Māori culture, but the NZ way of life".

PAR10 – "No I wouldn't. But that's what I was saying earlier about your distinct stages in life. One time I would have. Like I said, everything had its uses. Whereas many things also have their disuses, if that's even a word. Because I think also that pigs destroy the environment as well and yet they are also a part of the environment. You know deer is another good example where they destroy forests and I'm not a fan of deer either yet many people love venison and that. So, some people would say a pig, he taonga ano tēnā mea te poaka (a pig is also a treasure). You know the word taonga if you take it, it's literal meaning, it means a treasured possession. So, I wouldn't class wild pigs as my treasured possession, e au e rapuhia ana au tētahi āhua ke pēhea te patu ēnā mea kia pou mukua (So, I would rather find ways to make them extinct), and yet they still have their place in the world you know. So, good luck in what you're doing".

Participants two, three, seven and 12, are four of the 12 actors that stated that in their opinion, pigs (wild and domestic) are taonga. Rationales for this included the length of time they have coexisted in the presence of māori and non-māori, and not to mention the persistent hunting pressures applied on them for over 200 years. Further to this, as participants three and 12 stated, pigs are a taonga not only because they can be a valuable food source, especially for rural and remote communities. But they are also important on a social, cultural and economic level. Socially they are important for hunters to get out in the wild to satisfy their primal urges. Culturally they are important for māori and non-māori alike because they (pigs) provide for their sense of national identity. And economically they can provide an income through pest control and prospective hunting safaris.

PAR3 – "Umm, yeah. So, for me I would say they are. And that's because they are a big part of our culture, NZ culture. And taonga to me is something that's valuable. And pretty much anything that's tied into our culture is something that's valuable. So, that's following in that fact that they are a recreational resource, which is about people's wellbeing. They're a food source and they will always be, unless they start picking up a nasty disease that can be transmitted to humans. And in that context, they sit a little bit above your common type stuff that don't need looking after, so your more resilient type stuff. So yeah, I think for me they are a taonga".

PAR12 – "Absolutely yes! While they have a value for my whānau, they have a value for a lot of people. I see that for a lot of New Zealanders so, you know they were brought here from the first human settlements here. So, they've got a place in our environment now whether we like them or not. And so, they are a taonga species. We eat taonga species, we harvest taonga species, we grow taonga species. So, in terms of pigs, they're taonga but we can manage them as well".

Of the eight actors that considered pigs (wild or domestic) not to be taonga, four were māori and four were non-māori. Of those four māori, two were hunters, and two were not. Similarly, of the four non-māori, one was a hunter, and three were not. In the case of those who considered pigs (wild or domestic) to be taonga, three were māori, and two of those were hunters, and one was not. This left one actor remaining, who happened to be a hunter who was also non-māori.

3.4.2 Levels of reliance on wild pigs to supplement family food budget

Actors were asked how much they relied on the natural resource (wild pigs) to supplement their family food budget. For the majority, 10 (83%) of the 12 participants did not rely on this resource to supplement their family food budget. All of them acknowledge that at some point in their history they may have, and all acknowledge that many people may still rely on this resource, especially in remote rural areas.

PAR3 – "Umm, as a student and when your pretty poor, you pretty much keep your freezer full. Ahh but I was always eating game food because it was cheaper and I was enjoying my hunting. And so, I'd go out and always make sure I kept my freezer full. So, I ate a lot more then. But nowadays because I farm, I've got everything, the freezers full of everything, and I've become more selective in eating".

PAR7 – "Yeah well mines, well we like to have a feed on the table for manuhiri (guests). The pork's in the freezer as well. Ready for whānau to come up. But yeah, I haven't had work for a few years and we live off that meat there that we get. Yeah, a lot of our mates support themselves off the land".

3.4.3 Thoughts about wild pig management

Questions pertaining to how actors felt about wild pig management were tabled. First, they were asked if wild pigs should be managed. Second, they were asked if the current levels of management, if any were in place, were good enough. And third, if management levels were increased, would this take the resource away from local hunters. Again, 10 of the 12 actors agreed that wild pigs do in fact need to be managed, simply because of the environmental damage they cause to our endemic and native biodiversity, water sources, and landscapes. The potential economic damage they cause through crop damage, and livestock predation. And most importantly, their ability to contract and spread pathogens to environmentally and economically important resources.

PAR5 – "Yeah that's an easy one. Yes, they should be controlled because if left to breed it will lead to over population and therefore more damage to farmland and native species".

PAR1 – "Okay well my main concern obviously is the spread of pathogens, by anything, and pigs just happen to be one of the things that do it. I have the same concerns about people. But in terms say of movement of soil and association with kauri dieback, they obviously are a greater risk than many other species in terms of just the way they work. And I think you must look at the practical realities of what control really means in terms of pigs. Because as soon as we start putting hunters into an area they (wild pigs) tend to leave and go somewhere else".

In terms of current levels of control and whether they were adequate, okay, or inadequate, four actors said yes, current levels are adequate. A further four said they had no opinion on the matter, and four actors out of the 12 said that current management levels were inadequate and that more work needs to be done. Of the four that said current levels were okay, the majority were māori (n = 3), and one was non-māori. However, all four identified as hunters. The four who had no real opinion on this, and those who said more could be done in terms of pig control, there was an equal split between māori and non-māori.

PAR12 – "No! definitely not (enough pig control)! With respect, I think a lot of the agencies managing pigs are scared. I do know some councils like I think Marlborough District Council

and DoC have gone hard on pigs down in the Marlborough, Kaikoura area. Because it was found that pigs were vectoring TB or there was TB in the population. So of course, that was risking agriculture. So, I think they went quite hard on the pigs there. But a lot of agency's like DoC are just starting to grapple with those whole values. So probably because of the taonga status and the cultural status of pigs and the lack of knowledge and the lack of research really showing a lot of our ecosystems, their damage, and their impacts and how much you should hunt to stop it. I don't think there's a political will by a lot of agency's yet. So, we probably could afford to go a little harder (control) in some places".

On the issue of whether pig control would take the resource (wild pigs) away from local hunters, four of the 12 actors said yes, depending on the level of control, pigs may be taken away. Only one of the 12 actors thought that control will not take this resource away. And the remaining seven of the 12 actors either had no real opinion on the matter, or initially they thought yes but then during the conversation they decided that they couldn't answer the question with any confidence, and then for others the question was not broached.

PAR11 – "I guess yeah it will. Again, it probably depends on the circumstance. I mean in some cases yes potentially, umm but yeah i guess if we're looking at these conservation areas that are sort of managed for everyone sake then maybe it is".

PAR8 – "I'd say yes, they would. And the impact or the risk I see around that is, if you reduce numbers of pigs in an area where some of the locals want the pigs to be, then they're gona support the release and translocation of other pigs. And right now, up north, thankfully we don't have that go slow (muscle disease in dogs thought to be transmitted by wild pigs). And taking pigs from one area to another could be translocating, not only the pigs but that go slow as well. So, for me it's going to probably make fast impacts on trying to manage the pigs down to a low level. If they did try and bring them back, they could be bringing them back with a disease.

CHAPTER 4 – FROM QUALITATIVE INTERVIEW TO QUANTITATIVE ENHANCEMENT

4.1 Quantitative outcomes

As discussed earlier semi-structured interviews were conducted with 12 actors (participants) in this socio-ecological study. The make-up of these consenting actors consisted of 11 (92%) males and 1 female (8%). This appears to be consistent with other studies of female participation in hunting and wildlife management. What is seen is that males are more likely to have experienced hunting at least once in their lives than females. It is also said that females are far less likely to participate in hunting if their fathers are not hunters. Similarly, hunting and wildlife management is more likely to be undertaken by males than females because historically this has been a male dominated profession. There is also a perception that females are not? innately predisposed to hunting due to their less aggressive and inherent nature as nurturers (Goodman *et al*, 1985; Kellert & Berry, 1987; Stedman *et al,* 2001). The participants in this research were chosen purely for their experience and/or interest in wild pigs or wild pig management.

Of those 11 male actors, 6 (50%) were identified as having māori heritage, and the remaining 5 (42%) males were identified as non-māori (of European heritage), and the solitary female, of māori descent (Figure 2). Qualitative results were presented in the previous chapter to determine the responses to the study objectives. Following in this chapter, visual results of the qualitative interview data were constructed by extracting further themes from parent themes and ensuring that data saturation is achieved. The quantitative visualisations (graphs) are used to enhance the qualitative commentary.

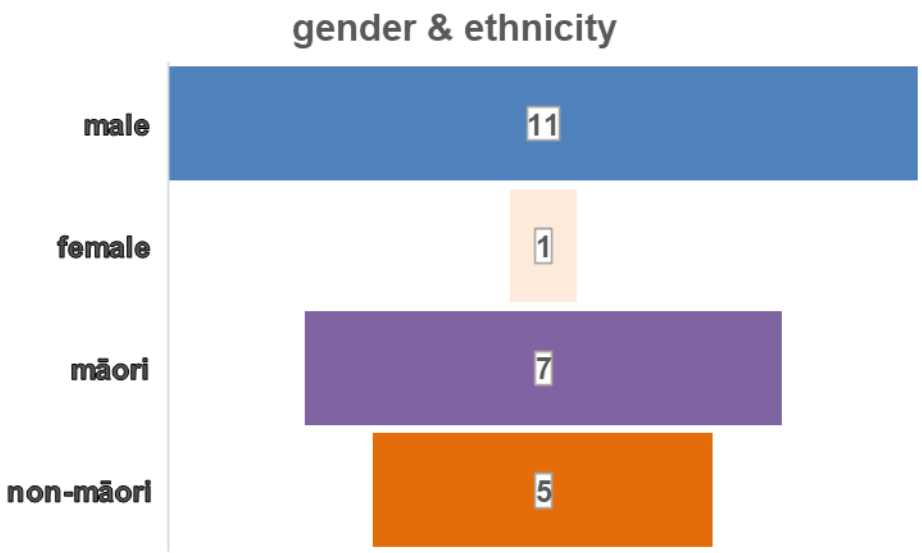

Figure 2. Demographics (gender and ethnicity) of study participants. The block size is in relation to the number of participants in each class (gender, ethnicity) divided by the sample size (n=12). The funnel chart shows proportion size (in this case participant numbers) and progressively decreases as participant numbers decrease

The actors for this study had diverse backgrounds (Figure 3) with the majority coming from biosecurity and conservation – 7 (58%), followed closely by those who identified as hunters – 3 (25%).

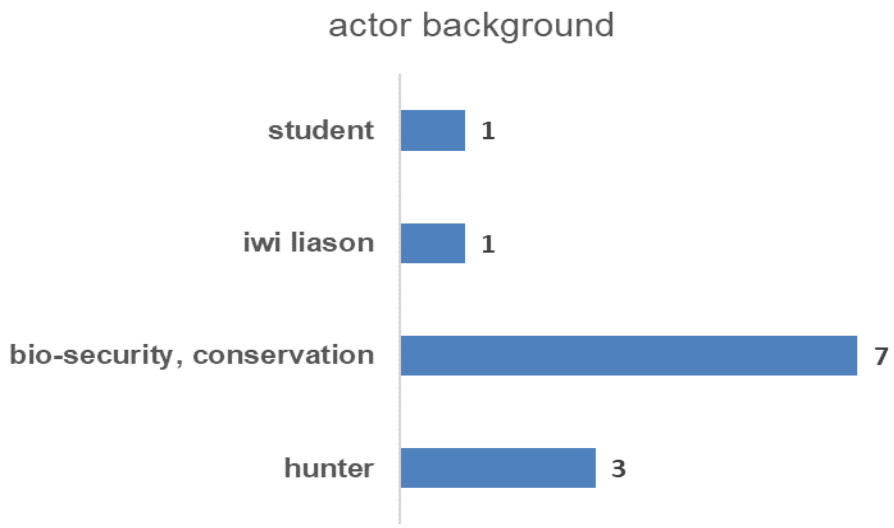

Figure 3. Background information for the interviewees, most actors come from biosecurity and conservation. Incidentally, three of the actors from the biosecurity/conservation designation also identified themselves strongly with being hunters as well. A clustered bar chart is used when comparing values across several categories or when the category text is too long

4.2 What are community values and beliefs regarding both pig hunting and conservation?

4.2.1 Views toward pig hunting

The views and values of the actors to hunting was drawn out from the interview data and displayed in a word cloud (Figure 4). The top five most frequently used words in this illustration appropriately has the word hunting as the key word, which is not only the most frequently used word but is also the central topic in this objective. The word dogs, is the next highest in the order of frequent use and of some significance as dogs are the second most important component in the arsenal of pig hunters behind themselves (hunters, people) and a good knife or firearm. Finally, number five of the five most frequently used words in this objective, is food. The key result of pig hunters using their dogs to catch the pig is for sport and recreation, but also for kai (food).

The notion of food as the main driver for people to go hunting appears to be true (Figure 5). However, 7 (58%) of the 12 actors cited going pig hunting for sport and recreation as more important than the food aspect. The remaining 5 (42%) cited other opportunities other than food. But all 12 (100%) acknowledged food as the result of hunting, and if an animal was caught then that was a bonus.

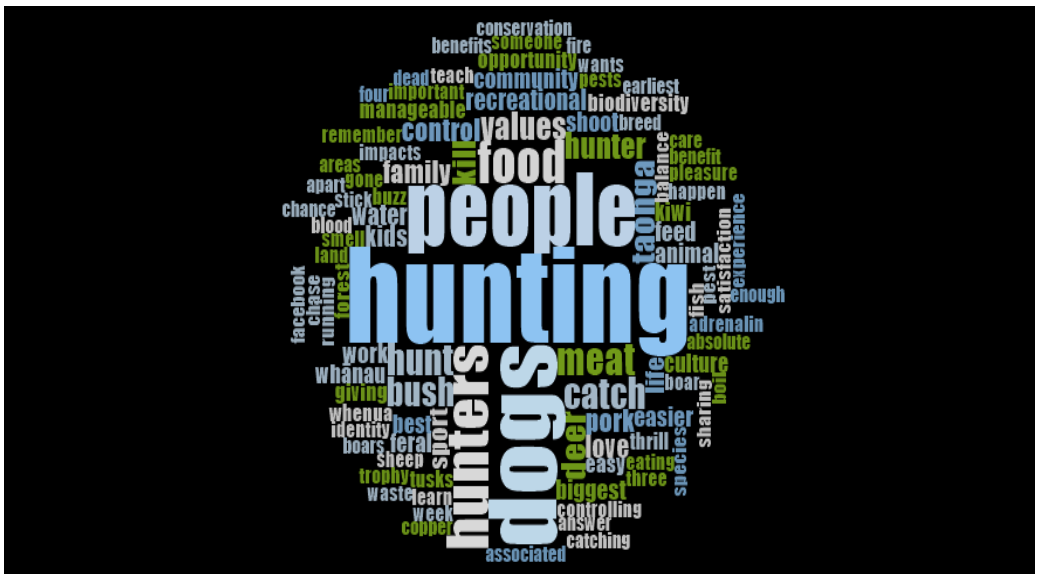

Figure 4. The top 1000 frequently used words depicting what pig hunting and hunting in general means to the study participants (n = 12) generated in the NVivo 11 Pro for Windows software program. The font size and colour of the word indicates how frequently the word is used in the text, or how important the word is within the text

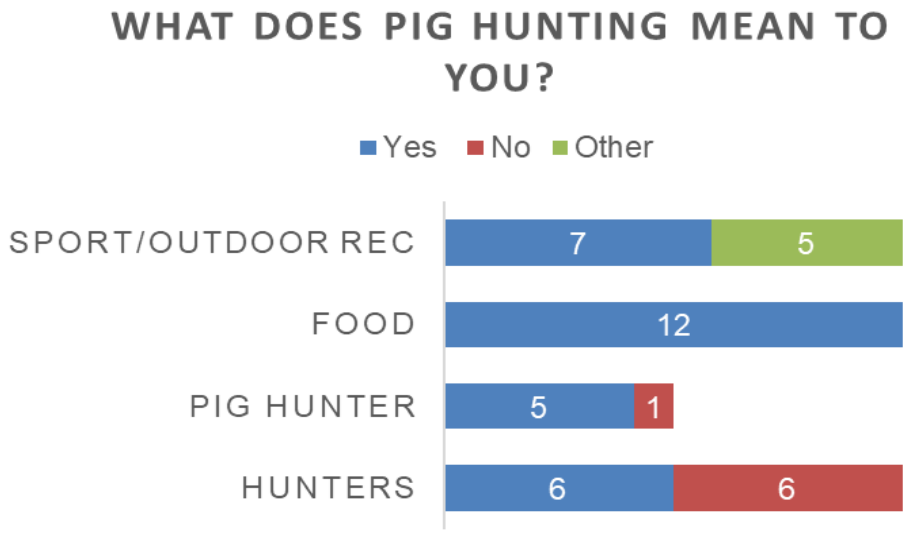

Figure 5. Ratio of hunters (blue) vs. non-hunters (red) for sample size (n = 12), the ratio of pig hunters (blue) vs. non-pig hunters (red) from the proportion that identify as hunters. All actors acknowledge higher motives for hunting, sport & rec (blue), other opportunities (green), other than food.

4.2.2 Views about conservation

The views of all actors concerning conservation was again extracted from the interview data and displayed in the following illustration (Figure 6). Actors spoke of kauri forest and other taonga (treasure) which have significant values for them.

Figure 6. 1000 of the most frequently used words from interview data showing the views of interviewees (n = 12) concerning conservation. For example, the top 5 most frequent words used were, PEOPLE the most frequent, followed in order of significance by kauri, forest, taonga and values

These views were again reiterated here (Figure 7), except this time the objective was to detect if conservation was important, or not important. The results show that conservation is favoured by all actors, even though for two of the actors, conservation was neither important or unimportant. What is significant to note here is that 0% believe that conservation is not important.

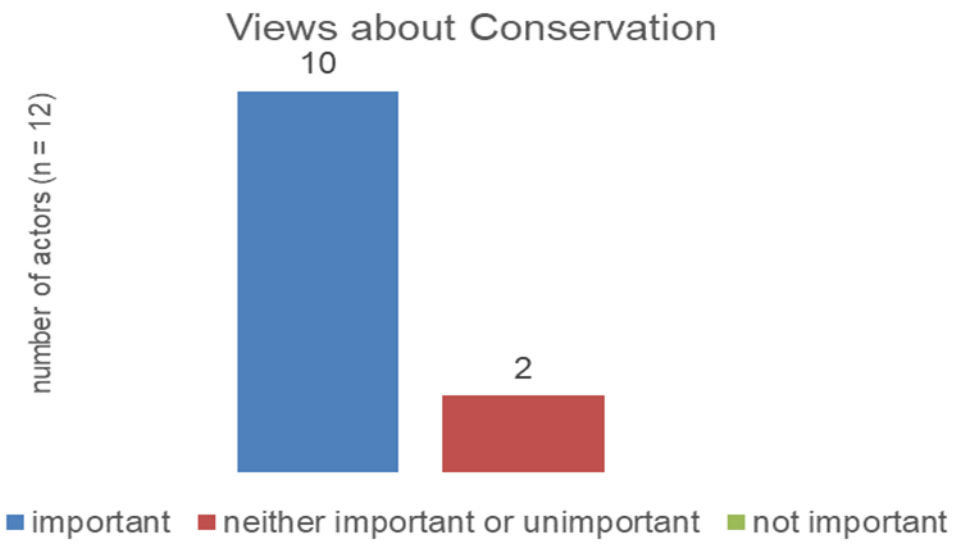

Figure 7. Proportion of actors within this study sample (n = 12) who spoke about conservation and whether it was important (blue), neither important or unimportant (red), or not important at all (green). A clear indication that conservation is important is displayed here with 10 of the 12 making their views known (blue).

4.3 Are wild species favoured more than native species?

4.3.1 Wild species

To answer the above objective further analysis of the interview data was conducted to extrapolate the necessary information. Two main child themes were extracted from the parent themes, ‘experiences with wild pigs’, and, ‘values associated with wild pigs’. The first child theme was food, and the second, connection. Connection, was then teased apart further, to reveal additional values associated with wild pigs (Figure 8).

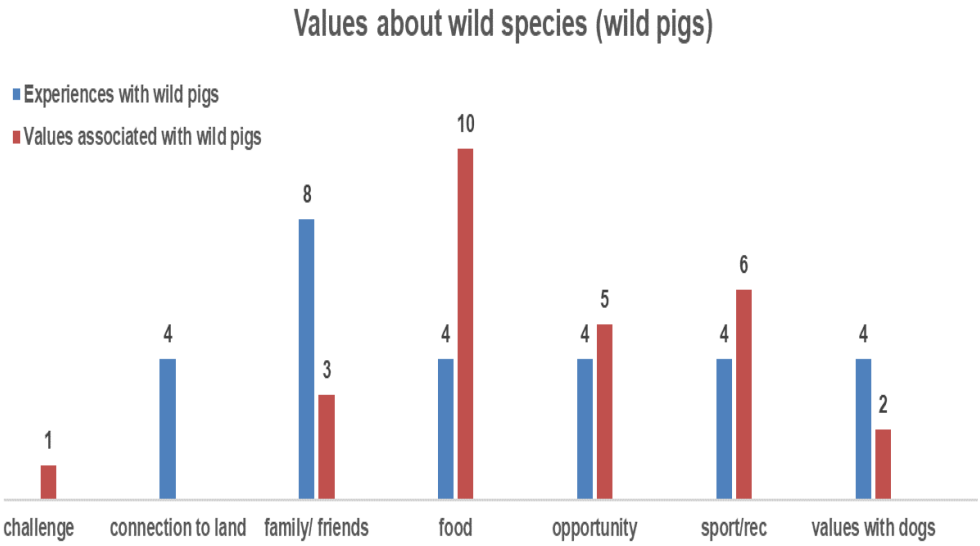

Figure 8. The values of the actors towards wild animals, in this case wild pigs, using the themes, ‘experiences with wild pigs’(blue), where overall values were homogenous, however, family & friends featured highly as a main motivator. For the theme, ‘values associated with wild pigs’(red), although food appears to be the main feature, other factors such as opportunity & sport were the major values expressed in conversations about wild pigs

4.3.2 Native species

To understand the actor's perspectives regarding whether wild species (in this case wild pigs) were favoured more than native species (endemic biota). To assess this their views and values in relation to the themes, thoughts about *kaitiakitanga* (guardianship), what does *taonga* (treasured possession) mean to you, and, a place of significance, were analysed, and the results arranged in the following chart (Figure 9).

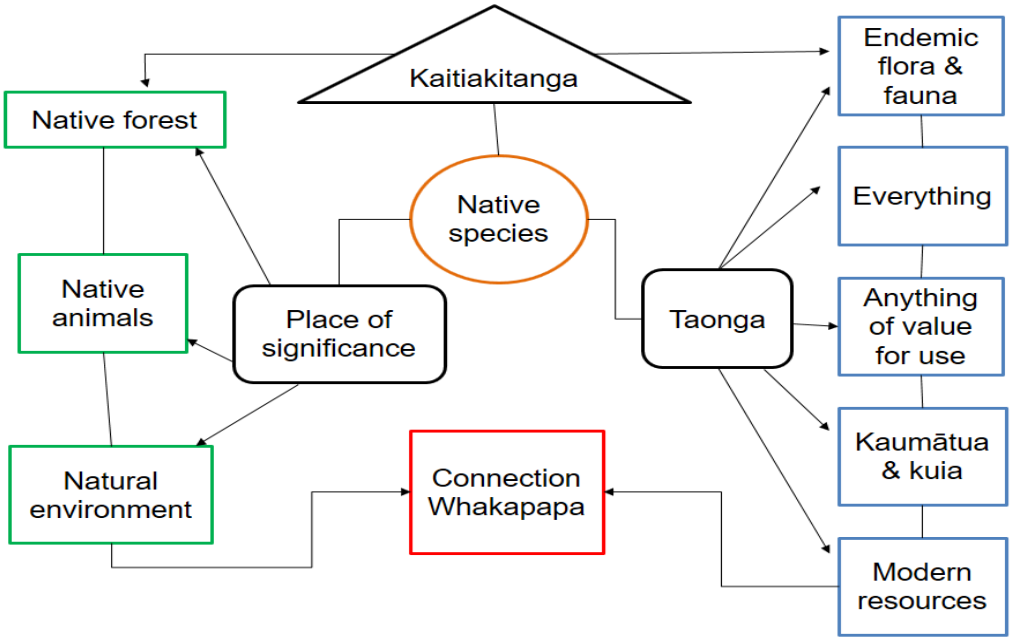

Figure 9. Mind map depicting the views of actors (n = 12) about native species (centre) in Aotearoa-New Zealand, extracted from the themes, 'tell me about a place you think of as significant', 'what does kaitiakitanga (guardianship) mean to you', and, 'what is your understanding of taonga'. Kaitiakitanga sits on top as the roof or umbrella, and all other concepts and views are sheltered beneath

4.4 Is there a contrast between māori and non-māori in their views around wild pigs?

To determine if a contrast between māori and non-māori existed in their views toward wild pigs, several themes had to be investigated further.

4.4.1 How much of the family food budget relies on hunted animals (wild pigs)?

The actors in this study were asked whether their food budget relied on hunted animals (more specifically wild pigs), and if so how much did they rely on it. Overall,10 (83%) out of the 12 said that hunted animals were neither important or unimportant to supplement their family food budget, but they understood that they may be important to others (Figure 10).

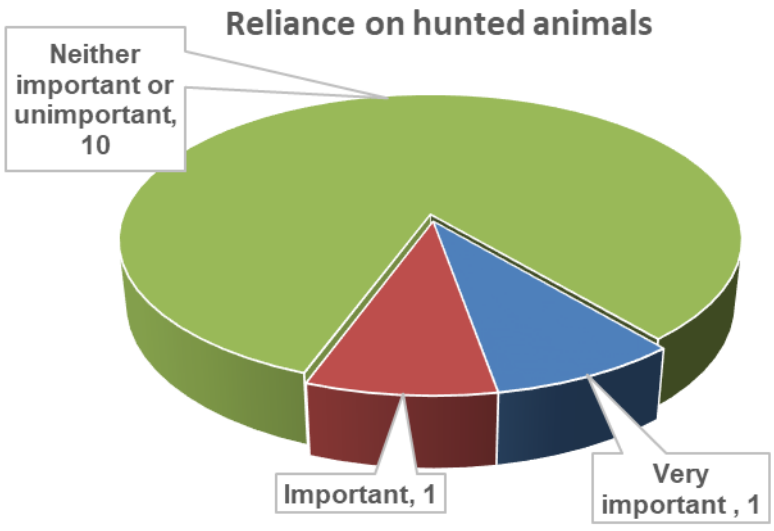

Figure 10. Proportion of actors stating the level of reliance they held on hunted animals to supplement their family food budget. Three levels were stated with the majority, 10 actors (green) stating that hunted animals were neither important or unimportant, 1 actor stating that they (hunted animals) were important (red). And 1 stating that hunted animals was very important (blue)

4.4.2 Pigs as taonga

To further determine whether there were contrasting views between māori and non-māori towards wild pigs the actors were asked if they thought pigs were a taonga. Already knowing the actor's views regarding what they consider to be taonga, a little over half of the sample population, eight (67%) stated that pigs were not considered a taonga to them, but they maybe to others, especially some māori (Figure 10). Four (33%) of the 12 actors in fact did consider them taonga.

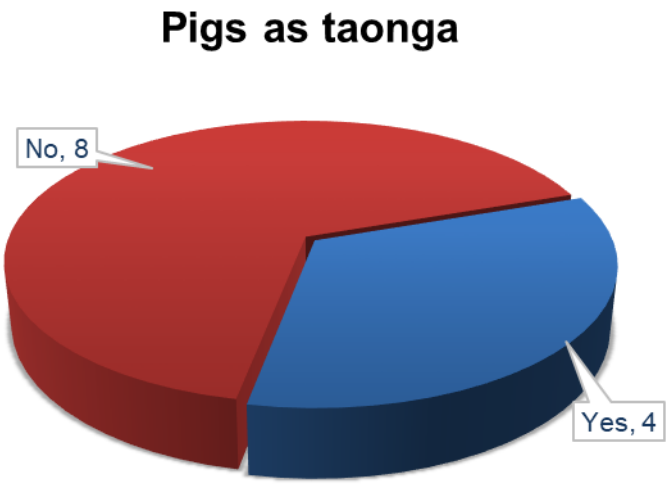

Figure 11. Proportion of actors who considered pigs/wild pigs to be taonga (treasure) (blue), not a taonga (red)

4.4.3. Wild pig management

The determining factor to see if there was contrast between māori and non-māori towards wild pigs was through analysis of the themes, should wild pigs be managed, are current levels of management sufficient, and will management take wild pigs from local hunters. Overall, results show that there is no contrast in views (Figure 12). However, although most actors 10 (83%) of the 12 agree that wild pigs should be controlled, they also agree that eradication is not necessary, but is a possibility if circumstances dictate.

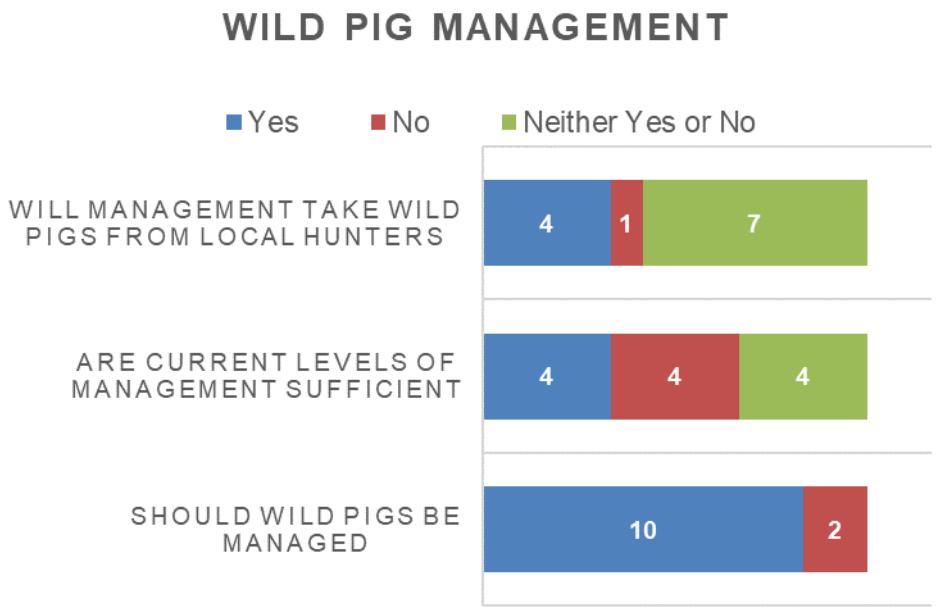

Figure 12. Views of actors concerning wild pig management where three possible answers were taken to further determine if contrast exists between māori and non-māori. The answers Yes (blue), No (red), and Neither Yes or No (green) are used in response to the themes

4.4.4 Synthesis of Results

Results (qualitative & quantitative) from the study objectives show different, but at the same time, similar views overall from the 12 actors in this socio-ecological study (Table 1). For instance, participant one is non-māori and not a hunter but they understand that there is a significant part of the New Zealand population that are hunters. Further to that, while they may favour having endemic and native species over the introduced wild species, they also understand that these introduced species such as wild pigs, have been co-existing with us the inhabitants of Aotearoa-New Zealand for over 200 years. And, while they themselves do not consider pigs (wild or domestic) to be taonga, they understand and acknowledge that they may be to others, especially some māori whānau, hapū, and iwi. Also, they believe that management is needed to reduce populations to minimise their damaging effects on the environment, but they do not think total eradication will be socially or culturally accepted, or that wild pigs are the only contributor to biodiversity degradation or loss to the extent that they need to be totally eradicated. Furthermore, while they themselves do not rely on this resource to supplement their family food budget, they acknowledge that others may. Similarly, participant 9, who is māori, shares the exact same views. Participants three (non-māori) and 11 (māori) share virtually the same perspective except for when the reader is viewing the wild species column. What it shows is that participant three as a hunter is in favour of wild species but not to the detriment of endemic and native taonga. This is the same for participant 11 who is not a hunter, and who would rather have endemic and native species, but understands that wild species are culturally, socially, and even economically accepted. What is clearly visible is that conservation and native species are wanted by all actors, regardless of their ethnicity or their status as a hunter or non-hunter. And, the majority also agree that management is needed but eradication may not be the best solution, but all understand that it is possible. Finally, for the majority, this

resource is not relied on to supplement their family food budget.

Table 1. Overall views of the 12 actors from māori (black) and non-māori (red) perspectives regarding the study objectives (PAR: Participant; ✓: Yes; ✗: No; ✗✓: No & Yes; ✓✗: Yes & No). N.B. for Yes & No and No & Yes, the first designation is how the actor feels about the issue themselves, and the second designation is in response to how they recognise how others may feel.

	OBJECTIVES						
Participants	Hunting	Conservation	Wild species	Native species	Pigs as taonga	Manage pigs	Reliance on pigs
PAR 1	✗✓	✓	✗✓	✓	✗✓	✓✗	✗✓
PAR 2	✓	✓	✓	✓	✓	✗	✗✓
PAR 3	✓	✓	✓✗	✓	✓	✓✗	✗✓
PAR 4	✗✓	✓	✗✓	✓	✗✓	✓✗	✗✓
PAR 5	✓	✓	✓✗	✓	✗	✓	✓✗
PAR 6	✓	✓	✓✗	✓	✗	✓✗	✗✓
PAR 7	✓	✓	✓	✓	✓	✗	✓
PAR 8	✓	✓	✓✗	✓	✗✓	✓✗	✗✓
PAR 9	✗✓	✓	✗✓	✓	✗✓	✓✗	✗✓
PAR 10	✗✓	✓	✗✓	✓	✗	✓✗	✗✓
PAR 11	✗✓	✓	✗✓	✓	✗✓	✓✗	✗✓
PAR 12	✗✓	✓	✗✓	✓	✓	✓✗	✗✓

CHAPTER 5 – DISCUSSION AND MOVING FORWARD

5.1 Overview of the issue

The rationale for this research was to investigate whether the harvest of wild pigs could potentially be a benefit, or a threat to conservation in Aotearoa-New Zealand. The findings from my research suggest that there are several possible responses to this. Many New Zealanders, māori and non-māori have become accustomed to the availability and utility of wild pigs as a resource. In some cases, New Zealanders have gone as far as to classify them (wild pigs) as a taonga (treasure), and as such they should remain a part of our environment in perpetuity. Whilst the negative impacts of wild pigs (disease transmission, biodiversity and habitat loss, land degradation) are known and recognised, people are prepared to overlook these capabilities to retain them for their perceived social, cultural, and in some cases economic, wellbeing (Nugent *et al*, 1996; Nugent et al, 2012; Krull *et al*, 2013b; Barron et al, 2015). Notwithstanding this, those who have strong environmental values, disagree entirely, and support the removal of wild pigs. However, those in favour of removing wild pigs also understand and acknowledge the length of time they (wild pigs) have co-existed with humans in Aotearoa-New Zealand, and of their importance to others (Nugent, 1992; Parkes & Murphy, 2003).

5.2 Synthesis of the objectives

5.2.1 Pig hunting or Conservation?

Pig hunting and conservation, two concepts that can either work in conjunction with each other to protect biota and the environment from invasive species (in this case wild pigs), or, they can be negatively opposed to one another, and at times result in conflict (between hunters and land managers, land owners, and/or conservation groups). This conflict can invariably involve mate against mate, or family against family. Types of conflict include heated discussions, court proceedings, and even destructive behaviours bordering on violence. This was the case for some of the actors in this study who were either on the receiving side or the giving side of such acts. Actors on the receiving side spoke of locks on gates and the gates themselves being vandalised on DoC land. Land managers spoke of company vehicles being tampered with, tyres slashed, along with all manner of activities that cannot be published here. On the opposing side, actors spoke of performing the acts that were just mentioned, along with verbal and at times physical abuse. Because of the anguish that they felt, actors on the giving side also went as far as involving the media to get their point across. All this angst had been created due to a lack of communication, or, because of non-existent communication between the parties in the first instance. Internal conflict was also an issue. This type of conflict could be seen from several the actors in terms of modern day technology, and modern-day hunting practices. One actor, who was raised in the traditional sense, remembers going hunting with their father and their grandfather, uncles, cousins, and the whole *whānau* (family) unit. These hunting expeditions involved walking for very long periods of time, or on horseback for lengthy periods of time. But the prolonged periods of time were not spent idly wandering through farmland or rugged bush searching for their quarry. It was described by this actor that the journey was likened to being in the classroom where they learnt *reo* (language) through the different place names, names of flora and fauna,

geography lessons about the different landscapes and best places to go hunting and at what times and days. History lessons through *kōrero* (stories) told them by their *matua* (father, uncles) and their *kaumātua* (grandfather, elders). Lessons in *Te Pūtaiao* (science), *mātauranga māori* (māori ways of knowing) pertaining to *Te Waonui a Tāne* (the world of Tāne-mahuta) the *atua* (deity, god of forests and birds), the son of *Ranginui* the sky father and *Papatūānuku* the earth mother. Lessons about *Tangaroa,* Tāne's brother who is known as the *atua* (deity, god) of the sea but who is also the guardian of rivers, lakes and all water bodies. Further aspects learnt on these adventures were health and safety. Not just the health and safety of themselves and their family members, but the health and safety of the animals that accompanied them (dogs & horses), and the health and safety of their quarry and the natural surroundings. These exact traits can be seen in many indigenous communities throughout the world, especially in our *whanaunga* (relatives, relations) the first nations people of Australia (Koichi, 2012). The internal conflict here this actor is the use of modern technology to post photos of animals that have been caught on social media platforms in such a way, that portrays hunting, especially pig hunting, as a barbaric, blood lust activity, creating negative and unsubstantiated publicity. These perceptions about the sport are further confirmed in society as barbaric when hunters drive around town especially in highly urbanised areas, parading their quarry out in the open for all to see, blood and all. These acts are generally seen to be carried out by either the younger generation of hunters or those new to the sport. Perspectives from the older generation of hunters feel that these types of practices not only give hunting unwarranted publicity, but it could potentially mean a wasted days effort due to the animals caught not having the proper duty of care (meat chilled, covered to reduce fly infestation) afforded to them, resulting in the meat becoming unusable, which is a practise known to māori as *moumou* (to waste or be wasteful). Furthermore, this does the hunting fraternity no favours, especially today

when there is an increasing number of community members who are pro-animal rights advocates who see the use of dogs to catch pigs, and the act of dog vs. pig, a barbaric spectacle. On the other hand, hunters and non-hunters alike spoke about the benefits of modern technology especially from a biological control point of view. With technology, such as tracking collars and GPS, hunters can not only manage certain areas of their choice but they can do this more effectively and efficiently whilst fulfilling social, cultural, environmental, and economic capabilities. In the past, hunting for recreation or biological control had hunters walking long distances and for sustained periods of time, exhausting not only themselves but their dogs as well. But with the advent of tracking collars and GPS, dogs can be tracked easily and the hunters did not have to expend so much energy trying to find their dogs, or trying to keep up with their dogs. Nonetheless, there are also inherent disadvantages with either method (before & after technology) especially if the dog strays or got lost (Miller & Pierce, 1995). The potential then is for these dogs to prey on endemic and native species such as kiwi (*Apteryx australis*) (McLennan *et al*, 1996). This has occurred in the past causing tension and conflict between various people and organisations within communities (Taborsky, 1988). Dogs are a pack animal who originated from the wild, so if not trained properly, and given the chance, they are likely to revert to their wild instincts. Fortunately, kiwi aversion programs are now run by the Department of Conservation and have been for some time now. It is a requirement that any dog that goes onto DoC estates (for hunting or otherwise) must have completed the kiwi aversion training program (Dale *et al*, 2013). Aside from the potential harm dogs can cause to the endemic and native birds of Aotearoa-New Zealand, they are now being used more and more to track threatened species such as kiwi and others (Robertson & Fraser, 2009). Dogs have also been trained and used successfully in ongoing biosecurity monitoring (Griffiths *et al*, 2015). Internal conflict must inevitably arise within indigenous cultures when something that

they class as *taonga* (treasure or treasured possession) impacts on other and more significant taonga. This is the case for māori and non-māori alike here in Aotearoa-New Zealand. Pigs (wild and domestic) have been described by some as taonga and the conflict here is that they are an introduced species which impacts negatively on the environment and the endemic and native flora and fauna. Wild pig's reciprocity in the nature-nature, human-nature relationship besides providing a food source and possibly a mechanism for seed dispersal, is virtually non-existent. Pigs root up soil, prey on endemic birds, chicks, and their eggs, devour invertebrates and vertebrates, and consume substantial amounts of vegetation such as nikau palm (*Rhopalostylis sapida*). Not to mention the deleterious effect they have by vectoring diseases. So, it is no wonder that biosecurity officers, land managers, landowners, conservationists, and other environmental groups are advocates for the reduction in pig numbers. However, advocacy for hunting (pigs or otherwise) in Aotearoa-New Zealand by hunting lobbyists is just as strong. Hunting in this country is a cornerstone culture, the bastion of all New Zealanders, māori and non-māori (Nugent et al, 1996). After all, these animals and many others were introduced here by our forebears over 200 years ago for the exact purpose of hunting (Veblen & Stewart, 1982). Other reasons people hunt pigs, in addition to food gathering and sport, was to allow for different experiences and opportunities. By that, it was meant that for the hunters, it gave them the opportunity to spend time with family and friends. It also gave them the opportunity to use the hunting experience as an educational tool, especially in terms of youth development. It also gave hunters, especially in rural and remote areas where unemployment was high, a sense of *mana* (validity), sense of *whakahī* (pride) in being able to contribute to their *marae* (traditional gathering place), their *hapū* (sub-tribe), their *iwi* (tribe), by providing meat from hunting. Others looked at opportunity from a totally unique perspective and had a vision of using pig hunting and wild pig management to uplift communities, especially

those communities that were in remote areas where typically high unemployment rates were being experienced due to lack of jobs. Notwithstanding the many perceived social and cultural benefits of pig hunting, the fact remains that impacts caused by wild pigs are damaging to the environment and our endemic and native biodiversity (Challies, 1975; McIlroy, 2001; Cuthbert, 2002; Hone, 2002; Massei & Genov, 2004; Krull, 2013a; Ballari & Barrios-Garcia, 2014). Moreover, conservation, as results show (chapter 3 & 4), whilst at times hampered by different variables, continues to be highly favoured for the reintroduction and maintenance of our endemic and native biodiversity. However, hunting is also favoured and will always be an important activity especially in the rural and remote communities where unemployment is high. Therefore, communities and management organisations need to collectively agree on areas that can be set aside for hunting, and areas set aside where management can occur.

5.2.2 Are wild species favoured over native species?

As in the previous section, pig hunting and hunting in general, appear to be a highly favoured sport, recreational activity, and *tikanga* (custom, practice) for people of Aotearoa-New Zealand (Nugent et al, 1996). Similarly, results (chapter 3 & 4) also show that conservation was highly favoured. Therefore, it was important to determine whether wild species, i.e., wild pigs, or our endemic and native, *taonga* (treasures) species were favoured more. All the actors agreed that whilst pigs (wild and domestic) are important to fulfil certain social, cultural, and economic needs, New Zealand's endemic and native taonga are equally, or even more important to fulfil those (social, cultural, economic) needs as well as our environmental obligations. For instance, in a conversation held with the actors in this socio-ecological representation, the construct of *taonga* (treasure or treasured possession) was broached. One actor described "everything" as being taonga. Anything that you use, or anything that can be of use should be classed as taonga. This actor described uses for the plant *tūpākihi* (*Coriaria arborea*) a native plant to Aotearoa-New Zealand which is poisonous. What they said was that you wouldn't want to have *tūpākihi* anywhere where you would keep bees. This is because of the toxin (tutin) that is produced by tūpākihi. Honeybees can inadvertently feed on honey dew secreted from the passion vine hopper. This is an issue especially if the passion vine hopper has fed off the *tūpākihi* plant, which it is known to do. Therefore, making the likelihood of honey produced, to be infected. Conversely, *tūpākihi* although poisonous, is also used in *rongoā māori* (māori medicine). The actor who spoke of this plant described using it to bring out and alleviate the effects of bruising, among other things. So, whilst tūpākihi is poisonous and detrimental to honey production, it also has its benefits. Similar could be said for pigs (wild or domestic) could it not?

However, this same actor along with other actors disproved this statement and in response stated that while pigs (wild or domestic) are useful as a food source, and a recreational activity, that is all they are and they are not taonga. The actors would not consider pigs to be taonga, a treasure, or a treasured possession. Which, upon observation, appears to be a contradiction. Actors described taonga as something of value or something that is useful. So, if the uses for tūpākihi are compared with that of wild pigs, then it would appear they are of a similar nature. By that analogy it is meant that tūpākihi is a native plant with the toxin tutin in it. If it is taken in inadvertently by bees, then it will affect the honey, rendering it (honey) virtually unusable. Similarly, pigs are not native to Aotearoa-New Zealand, but, there could possibly be an argument put forward changing this status due to the length of time that they have coexisted with humans here (over 200 years). Also, the first introduction of pigs (wild or domestic) was in 1773, whereas the first early settlers arrived around 1800. Pigs had already been established in this country for nearly 30 years. Furthermore, pigs had arrived and established, at least nearly 70 years before the signing of the Treaty of Waitangi where the Queen of England, under Article 2, guaranteed māori, undisturbed rights to their forests, lands, fisheries, and taonga. So, returning to the comparison between tūpākihi and wild pigs, tūpākihi is poisonous and potentially detrimental to honey production, but has its uses as medicine, and, not to mention that the bees themselves are an introduced species. On the other side, wild pigs can vector disease and is detrimental to the environment and endemic and native flora & fauna, not to mention the economic harm pigs can cause to people's livelihoods, but, at the same time being a useful food resource especially for the rural and remote communities where unemployment is generally high. Therefore, because of high unemployment and reduced living conditions, the ability to drive maybe 40-100 kilometres or more to the nearest major town centre frivolously is not an option. This is possibly due to budgeting constraints

and meaning a trip that far uses too many resources (fuel, time, and other associated costs) when a trip to the bush which is a five-minute horse ride away is more viable solution. However, although there may be some similarities in these two examples, and although there could possibly be a case to change the status of wild pigs, the noticeable differences are that the harmful impacts that wild pigs produce, are visible and confronting. And as I have said earlier, their reciprocity, or their lack of meaningful reciprocity, to the nature-nature, nature-human relationship, for most people, far outweighs their perceived benefits on a social, cultural, or economic level. The debate over hunting vs. conservation will continue for some time yet, but what is clear from my research is, conservation of our native species or our *taonga* is significant to all the people that I spoke with. It is just that for some hunting is just as important, and others, hunting is important but not at the expense of our taonga. I think the definition of taonga and the interpretation of the objectives in this section (wild species vs. native) denoting the overall feeling of all 12 actors was best described by participant eight and participant one.

PAR8 - "I'd say my understanding about taonga would be different to others. And everyone would be different I'd say. I'd say taonga could be measured differently in people's hearts, in people's opinions, and in people's stories. So, for me my understanding about taonga or native species, being in my mahi has given me the Western Science side of things, and the opportunity to learn. And being a local has given me the connecting to the whenua part".

PAR1 – "I wouldn't consider them (wild pigs) taonga because I wouldn't consider a possum taonga, I wouldn't consider a stoat taonga. Umm, because of the interrelationship that they're having and the impact that they are still having on other species that I work with and consider indigenous, endemic and unique to New Zealand. Taonga as a concept for me is very much a values statement and I think it probably differs with every individual".

For many māori, and non-māori alike, the *hononga* (connection) to *te taiao* – the natural world or environment is very important and that is taonga. Therefore, as we would *manaaki* (care for, protect) our *tamariki* (children), our *mātua* (parents) or our *tupuna* (elders), we also have an obligation to look after and protect the *wairua* (spirit), the *mauri* (life essence) and the *ora* (state of wellbeing), of te taiao – the environment.

Similarly, these same concepts or constructs are described to be highly significant to the original landowners and first nations people of Australia. It was described that the worldview of Aboriginal people is one of identifying themselves as caretakers of their country, their land, having a sense of place, and a social obligation to not only care for their land, their natural flora and fauna, but to also have an obligation to pass this knowledge on to their successors that follow them, through the traditional and customary methods that they are accustomed to (Koichi, 2012). These concepts were echoed by many of my participants?

5.2.3 Do māori and non-māori really have contrasting viewpoints when it comes to wild pigs?

So far, the opinions of a community who have interests or experiences with either hunting wild pigs or conservation of endemic and native taonga species have been considered. In this section, further analysis of the same community's perspectives regarding whether contrast exists between māori and non-māori on this *kaupapa* (subject) is reviewed. The grounds for determining whether difference of opinion exists between the two ethnicities of Aotearoa-New Zealand is simply because, although hunting in general is practiced by all New Zealanders, the general perception is that most of pig hunters are māori. Most of pig hunting is also conducted in many of our rural and remote communities where there are elevated levels of unemployment, and a predominant proportion of residents in these communities happen to be māori (Nugent et al, 1996). From my investigation, it appears that the opinions between māori and non-māori concerning wild pigs are homogenous. Most of the actors in this socio-ecological study acknowledged that wild pig populations needed to be managed to slow the rate of biodiversity loss, to reduce the economic losses through the destruction of land and economically important resources, and to halt the development and spread of disease (Choquenot, McIlroy & Korn, 1996; Barrios-Garcia & Ballari, 2012; Bengsen et al, 2014). Similar views are held in Australia where an increasing awareness of concepts like protection of biodiversity and native species for stakeholders in the Wet Tropics World Heritage Area (WTWHA) are being embraced more and more. This is because all stakeholders are mindful that the rainforest is being degraded and needs protection from further perturbation. The rationale for their concerns is not because of the instrumental values (value to other animals which includes humans) derived from the ecosystem services of the rainforest, but because of the intrinsic values that it possesses (Trudgill, 2001; Koichi, 2012).

Which is why, in this section, themes such as actor's thoughts about management of wild pigs, current control levels of wild pigs, how important are pigs, and are pigs considered taonga, amongst other themes were investigated to tease out responses for this objective.

Ten out of the 12 actors agree that wild pigs need to be managed. But many of these actor's, hunters and non-hunters, also agree that managing populations does not necessarily mean eradication.

PAR1 – "I think that they (wild pigs) are actually a very difficult species to manage. And if they're in fern land or rough farm land or whatever, then they don't impinge on my values if they're in those sorts of environments. However, if we're trying to keep them out of kauri areas to prevent dieback movement, obviously yes, I would say yes, they must be controlled. But that might not mean hunting them to no existence, that just means keeping them out of there. With all respect, I haven't ever seen a situation where anybody's got them down to a level where they're at zero! So, I think I need to be practical about whether I think that they can be eradicated. I certainly believe they probably can be from small bush patches and in various places like that. In the wider environment, well they're also a farm animal so they're not the sort of thing that we're going to get political acceptance for removing them from New Zealand".

Many experts agree with this but recommend that if eradication is possible then it should be considered, particularly in high value conservation areas, and especially in areas that are relatively small so that there is no chance of recolonization. This type of method is known as local eradication (Bomford & O'Brien, 1995; Choquenot *et al,* 1996). Experts also suggest that reasons for promoting eradication must be beneficial and that those benefits outweigh all costs. Furthermore, if eradication is the preferred and only course of action then it must be carried out to its fullest extent. If not, then it is a complete waste of resources. These same beliefs were expressed by participant 11 in my study where they expressed concerns about committing resources for control in highly modified and less significant areas with substantial pig populations.

PAR11 – "Yeah i think definitely in some areas it's worth controlling pigs, particularly if you have an area that's got some really important conservation value in there. I think it makes sense to control pigs to stop the impact that they are having on those things. But maybe in places like pine forest or where we've got significant pig populations, maybe it's not worth spending the money on controlling them there".

Another example of this can be seen through the management aims of pig control that occurred in the Namadgi National Park (NNP) in south-eastern Australia. The aim was to protect the park and surrounding areas from the impacts of pigs and other pest and plant species. That meant any action necessary which included reducing either the damage by at least 10%, or a reduction in the pig population by 10%. Although, it was implied that 100% complete protection would be desirable, but that meant eradication, which was not a stated aim of this management plan. Furthermore, it was felt that eradication was unrealistic as the potential for reintroduction of pigs from surrounding areas was highly likely. Also, some parts of the park are not easily accessible so pig control in those areas would be difficult to administer (Hone, 2002). Meanwhile, back here in Aotearoa-New Zealand, the same thoughts about commitment to management plans was discussed in our conversations during the interview process. Six of the 10 actors that agreed that pigs do need to be managed, also agreed that if a commitment to managing pest species, in this case wild pigs, was to be undertaken, then that commitment must be upheld and executed to its fullest extent. These exact thoughts were fervently expressed by participant six which came as no surprise, as I learnt early in the conversation of their passion for hunting (except pigs) but their desire for conservation of nature even stronger.

PAR6 – "Pig control, to be frank is one thing that you commit to or you don't. There's no real middle ground for pigs, they breed real fast. So, yeah you either do it or you don't. It's a very hard species to have a balance, and that's partly because of their impacts. So, getting a fine balance between getting enough numbers for people to hunt them, but for them (wild pigs) to have minimal impact on biodiversity, it doesn't exist. I'm sorry but it's one or the other".

Continuing further on with the topic of management. If the idea of eradication in some areas was unrealistic, and the idea of retaining some wild pig populations was entertained, then at what levels would this be to sustain our endemic and native biodiversity. And at what levels would this be to sustain wild pig populations to placate the hunting community. Participant 11 spoke earlier about maybe having populations in

highly modified landscapes and non-native forest blocks for hunting purposes. Participant 12 had discussed similar options where pigs should be managed out of high value areas but find places where pigs already are, again, in low value areas to be maintained by hunting, and to be maintain for kai values. Participant four, even though they are a non-hunter, would like to see populations, if they are to be maintained, kept in open low value pastures, scrubland, highly modified landscapes, and private land if those land owners wish to keep them. This actor also sees enormous potential benefits for communities through pig control (social, economic, environmental), especially rural and remote communities where unemployment is high. Participant nine discussed similar prospects for their rural community where the potential for employment through pig control was a beacon of hope for the local people, instead of contracting people from outside of the community, in some instances contracting people from outside of the region.

Overall, all 12 actors that were interviewed agree on some level that pig control is necessary. The two actors that vehemently don't support management have these views because they believe that the hunters in their area are doing the *mahi* (work) sufficiently already. But for the 10 actors where control is a must, there is a belief that a balance can be struck between conservation and hunting, and areas set aside for hunting. Balance, was a word raised several times by a fair number of actors through the interview stage of my research. And I guess the aspirations discussed by many of the actors earlier is summed up best by participant three.

PAR3 – "It's totally about trying to find a balance where all those different interests and all those different values that people have are being catered for, and every site is so different. Every place has got its own sort of social things around it. So, what we're doing over at Te Roroa is a good example in the Waipoua forest where they're keen to see the pigs controlled in the kauri forest. They want to see the pigs on the coast retained as an area for the local guys to go and have their fun. And there's still a steady supply of pork coming into the freezers. And yeah so, we work under those, sort of overarching principles. And all they (locals) want to see is a bit of employment and things for the boys and the guys that are doing the hunting".

When I enquired as to what these acceptable levels might be or what these levels might look like, the responses were varied but overall not one person could give me a definitive answer. But, what they did say is that constant pressure was required, and that is exactly what is happening now according to some of the actors. Pig numbers are said to be at an acceptable level in this current climate according to five of the 12 actors interviewed. If anything, they are too low for two out of those five actors. This is due to an increase in the numbers of people, especially the younger generation, taking up pig hunting, and hunting in general. Some are saying that with the influx of new hunters and the sustained pressure through pig control efforts, there are actually far less pigs around to hunt, compared to say 10 – 15 years ago.

According to some experts, this should be the perfect scenario for conservation, low densities of pigs, should mean less damage. These experts have also said that there is no need to eradicate some populations of pests completely to stop damage in order to see a positive response in forest health. The trick here is to apply sustained pressure on the target species and to take their numbers down to a certain threshold to see the results transpire. What that threshold is will undoubtedly be determined by the data obtained from monitoring these control regimes, the aim and rationale for control, and of course efficacy and feasibility of control (Choquenot & Parkes, 2001; Hone 2007; Krull *et al*, 2016).

Another topic of discussion on a global scale is whether traditional ecological knowledge (TEK) can help management regimes when dealing with ways to reduce the effects of biological invasives on endemic and native diversity. To understand what TEK may look like here in Aotearoa-New Zealand, actors in my study were asked for their views about the concept of kaitiakitanga and whether it was relevant in the context of this study. While there were diverse explanations of the concept of kaitiakitanga, overall views were consistent in that, regardless of whether the traditional ecological knowledge is from an indigenous framework or from a traditional Western framework, it is all traditional knowledge that should be amalgamated and utilised appropriately, and for the benefit of the whole community, *I whakakotahi, tahi ki te tahi* (united, together as one). The construct of kaitiakitanga is being used on a regular basis in recent times, more so since its introduction into the Resource Management Act, 1991 (RMA, 1991; Kawharu, 2000). And I wonder if, *te mea tika o tēnei kupu* (the correctness of this word) is being applied. The use of the word kaitiakitanga can be seen in many disciplines throughout Aotearoa-New Zealand, especially where caring for someone (health) or something (environment, conservation) is concerned (Panelli & Tipa, 2007).

If the word kaitiakitanga is taken and broken down, you get *kai*, which can mean to eat or, food. *Tiaki* means to look after or guard. *Kai*, can also be a prefix added to the beginning of verbs to change them into words that denotes a person who performs an action. For example, *kaikōrero* – speech maker or speaker, *kaiako* – teacher, or a *kaitiaki* – guardian or someone who looks after someone or something (Ryan, 1974; Kawharu, 2000). So, if a *kaitiaki* looks after resources (e.g. flora, fauna) for current or future use, then that to me, is kaitiakitanga. These exact words were spoken to me by a well-respected *kaumātua* (elder) who said,

PAR10 – "That word kaitiakitanga, no tata ake nei tēnei kupu (that word has only arisen in more recent times). As a kid, I never, ever heard any of my mātua tupuna (grandparents) using the word kaitiakitanga in the way that it is used today. But it is now used in the RMA so, while I understand fully what kaitiakitanga is, like the māori tikanga (protocol, customs) was always that, they were kaitiaki (caretaker) for use. They did not preserve say manu, pigs and possums or whatever it was, they did not preserve them just for the sake of preserving them. They were preserved for use".

Kaitiakitanga, whether it is interpreted as guardianship (Taiepa *et al*, 1997, Kawharu, 2000) or as stewardship (Kahui & Richards, 2014), must be used for all intents and purposes, of honouring both the word and its correct meaning, for misuse and misinterpretation of the word will cause harm, even if it was unintended. An example of this is still being felt today throughout *te ao māori* (the māori world, the natural world) in the ambiguity of the interpretation of texts (māori and English versions) of The Treaty of Waitangi 1840 (Durie, 2005). One of the concepts discussed earlier in the introduction is how communication is important, and how it is essential that communication be at the forefront if future management regimes are to be successful.

PAR4 – "Dictating never works for anybody no matter who you're talking to. If you go to them (communities) and say, this is the new rule, man they're gona break you. So, you must go to them and ask them, you should have that conversation. And I tell you what, a lot of the time they come up with some great ideas! Like those hunters that came up with working those shorter rounds. It turned out better for both man and dogs. And the data collected also proved that, that was the better way".

In addition to this, several people and organisations have stated that a new regime is required, and a shift from "consultation" that was not working, to open, honest, and true "collaboration" (Taiepa *et al*, 1997; Thomas & Memon, 2007; Waitakere City Council, 2008). These sentiments were echoed in a recent national biosecurity conference (New Zealand Biosecurity Institute Annual Conference 2017) that I attended, where the emphasis was on collaboration between agencies, councils, government departments, NGOs, and communities in biosecurity. All who were in attendance understood and agreed that, better, and regular communication and true collaboration will be needed, especially if targets for the pest free NZ 2050 initiative are going to be achieved (Russell *et al*, 2015).

Participant 12 in this study voiced these exact words during our conversation, stating that the elephant in the room needs to be addressed. Now it should be said that this person is correct. If pigs (wild or domestic) are the issue, if deer and other ungulates are the issue, then like this actor also rightly points out, the elephant in the room needs to be addressed and we need to stop smoke screening with possums, rats, mustelids, and cats, and start including them in these conversations. Though the conversations will be difficult to have, it is necessary that they ultimately commence now rather than later. The impacts, the effects, the methods, and the cost benefit of control for these smaller introduced species is known. Likewise, the impacts and cost benefit of control for these larger ungulate species is also known. However, there appears to be some apprehension by governing bodies and communities in broaching this issue for discussion. Sodium fluoroacetate, commonly known as 1080, is another controversial topic of discussion that falls under the elephant in the room umbrella. The issue here is that the experts say 1080 is the best method of control we have at our disposal now until other methods are developed. Meanwhile, strong public opposition to the use of 1080 hinders the use of this method. A main concern for communities is the number of non-target native species that are struck down during 1080 operations as well as wild animals which includes game birds, deer, and pigs, not to mention the potential harm that is caused to dogs (Green & Rohan, 2012).

It has already been mentioned several times that if there is a way forward, then to achieve this successfully all stakeholders must come together as a single, cohesive unit to collectively build true relationships for positive outcomes. For example, here in Aotearoa-New Zealand, Tiritiri Matangi, an island in the Hauraki Gulf, has gained international recognition for the restoration efforts that have been achieved through community engagement, proper communication, and true collaboration (Galbraith, 1990; Galbraith, 2013; Galbraith & Cooper, 2013; Galbraith *et al*, 2016). Other

examples include further island restoration work that has been carried out on many of our offshore islands (Towns, Atkinson, & Daugherty, 1990). Collaboration between Rakiura māori and Otago University in understanding forces that drive change in tītī populations in terms of their customary harvest management, and collaboration between Ngāti Hine iwi and Landcare Research in restoring local forest ecosystems for the return of kūkupa populations (Lyver, 2005; Moller *et al*, 2009).

5.3 Summing up the objectives

In summing up the objectives to be able to answer our main research question we first, investigated what the views of the 12 actors in this socio-ecological production were regarding pig hunting and conservation. What our investigation has uncovered is that yes, pig hunting and hunting animals in general is a favoured sport and recreational activity that has been practiced since the arrival of early Polynesians (later renamed māori) along with the first early settlers more than 200 years ago.

Pig hunting and hunting in general offers more to the individual than just sport or food. The opportunities appear to be vast and range from time away from the *wahine* (women), time out with the *whānau* (family & friends), through to education (outdoor), *whakapapa* links (people, places, land), fulfilling *wairua* (spiritual), *tikanga ā iwi* (cultural practice), *ngā hiahia o te taiao* (needs of the environment), *me ngā hiahia o te ohaoha* (economic needs) through employment in pest control and tourism, as well as the offshoot benefits of both activities. Offshoots such as licenses and permits (gun, hunting), and the vast array of paraphernalia that accompanies guns and hunting. Conversely, conservation is highly prized for *ngā tāngata katoa o Aotearoa, ahakoa ko wai koe, ahakoa no hea koe* (for all the people of New Zealand, no matter who you are, no matter where you are from). Conservation is essential for fulfilling environmental, social, cultural, and economic obligations. Therefore, from what I have seen and heard,

through semi-structured interviews *kanohi ki te kanohi* (face to face) and phone conversations, and, through exhaustive analysis of the interview transcripts I have been able to deduce that conservation is favoured more than hunting. Furthermore, although this is the case (conservation favoured over hunting), all the actors are not insensitive to hunters or underprivileged community's needs.

Second, the investigation into whether wild species were favoured over native species revealed that, for the same reasons delineated above, native taonga, native species were favoured more over wild introduced species. Although, there may be a case for pigs to exist in perpetuity under the Treaty of Waitangi 1840, or for the mere fact they have co-existed with humans, especially in the presence of constant and sustained pressure for over 200 years. Regardless of the latter statements, the fact remains that the reciprocity that pigs (wild or domestic) contribute to the nature-nature, human-nature relationship besides being a food source is insignificant.

Coupled with the harmful effects and multiple negative impacts (disease transmission, biodiversity loss, economic instability) that these animals can cause places them high, or should place them high, on the agenda for "real" management.

Third, was there contrasting views between māori and non-māori in terms of wild pigs and wild pig management? There were differing views on a range of different subjects, but overall, I would say no, there is no real difference between māori and non-māori regarding this topic. Diverse groups, consisting of both māori and non-māori actors, hunters coupled with non-hunters, all had different but similar views pertaining to wild pigs and their management. For example, eight of the 12 actors who thought pigs (wild or domestic) were not taonga consisted of four māori and four non-māori. The four who thought pigs were taonga were three māori and one non-māori. However, the views, values, and the *āhua* (character) of this non-māori person made you think twice and

gave the impression that they were māori. Similarly, 10 of the 12 actors acknowledged that while this resource is important to fulfil certain social, cultural and economic needs, they are not relied on to supplement their family food budget. But, all 10 actors acknowledge and understand that this resource may be important to some, especially to rural and remote communities. For these 10 actors, the makeup consisted of five māori and five non-māori. Therefore, confirming for me that yes, while there were different views and opinions, overall, *ngā whakaaro rerekē* (the difference in opinion) between māori and non-māori was homogenous.

Fourth, in answering our main research question about whether the harvest of wild pigs will potentially be a benefit for conservation or a threat, for me the simple answer is yes and no. Yes, the harvest of pigs will benefit conservation because they will be managed in such a way as to not impinge or impact on conservation values deemed significant by all stakeholders that are too numerous to mention. These conservation values will then be set for areas that all stakeholders (all New Zealanders, māori and non-māori) deem to be of significance. The quadruple bottom line capabilities (environmental, social, cultural, economic) can then be addressed, as there are numerous that could potentially be beneficial for all. But, difficult issues and conflict must be addressed at the outset and conversations need to start now rather than later. The hard conversations between everyone, māori and non-māori alike, hunters and non-hunters alike. Like a well-known *whakataukī* (proverb) asks, *he aha te mea nui o tēnei ao, māku e kī atu, he tangata, he tangata, he tangata* - what is the greatest thing on this earth, I would be compelled to say, it is people, it is people, it is people. That is not to say that man, or people, are not more important than anything else, but people have a hand in the events that occur on this earth (good or not so good), therefore, people should also assist in the advancement and maintenance of the good, and ameliorate or remedy the not so good.

Attendees at a recent biosecurity conference that I spoke with who were hunters and non-hunters all agreed that hunting was a rite of passage, a birth right of all who consider themselves kiwi. And to take that away will be akin to taking the All Blacks and rugby away. But, if the majority decide that unfortunately pigs do not fit into the long term *moemoeā* (dreams, vision) of the collective, then alternatives or trade-offs need to be discussed. Furthermore, if pigs are to go then all other ungulates used for hunting purposes (deer, goats, thar, etc.) must be addressed at the same time. The potential risks to conservation associated with the removal of pigs and other animals used for hunting purposes does not have to be discussed. This is because these risks are already being experienced at present (illegal translocations, and liberations). Further to this, the benefits to conservation from an environmental standpoint is that the need to worry about invasive species of this size degrading and decimating biodiversity will no longer be an issue, and the associated costs should decrease, and the perceived benefits should dramatically increase.

However, will conservation benefit from the alternative or trade-offs made in lieu of pigs and other large ungulates. As an example, let us take for instance that the traditional harvest of *manu* (birds) is put back on the table as an alternative. How many birds, for instance kūkupa (native wood pigeon), will need to be harvested to fill the void left by two pigs and two deer for a *hui* (gathering, meeting). Or, how many birds of varied species that are currently protected, or *kaimoana* (seafood) limits that should be increased as a result.

'Whatungarongaro te tangata, toitu te whenua' – As man disappears, the land remains. This is about our *tupuna kuia* (elder female) Papatūānuku. In the context of this research for me this means, regardless of the actions of man, whether we choose to keep pigs or not, at the end of the day, once we are all gone, humans, pigs and others, Papatūānuku will still be here.

5.4 Conclusion & recommendations

In conclusion, conservation appears to be favoured over pig hunting, and native taonga are favoured over introduced wild species. Yes, the harvest of pigs (wild or domestic to feral through liberations) will benefit conservation. Not only will it benefit conservation but it will benefit the social, cultural, and economic circumstances of many communities that do not have the luxuries of many urban dwellers. But, with that, strict rules and regulations must be put in place. These regulations must be adhered to always, and with major consequences if they are not. Enforcement of these regulations need to be policed by all stakeholders (Government CG & LG, NGO's, Iwi, community which includes hunters, non-hunters). As discussed above, areas need to be set aside to appease all stakeholders for hunting and conservation, and these areas need to be chosen on their merits, e.g., high valued areas for retention of water quality and proliferation of natural flora and fauna. As opposed to low value scrubland, exotic forests etc. for hunting purposes.

However, this research is but the start of what is needed before any concerted decisions can be made on whether pigs would benefit conservation or not. Further research is needed with a larger sample size, and it needs to include hunters, non-hunters, *whānau* (family), *hapū* (sub-tribe), and *iwi* (tribe), especially from those areas that could potentially loose this resource. The public needs to join in the discussion, especially those who would not know that pigs are such an issue. If all New Zealanders are going to be affected one way or the other, then all people of Aotearoa-New Zealand should be informed. In saying all of this, it all must start with simple conversation. Government agencies, especially the DoC, Local, and Regional Councils, have for some unknown reason become highly unfavourable of all the agencies when it comes to conservation matters pertaining to the environment. The mere mention of their name turns some people right off, which I have experienced first-hand during my research. Whether this

reputation is rightly justifiable or not, efforts must be made to rectify this moving forward. All facets of Government (Central and Local, associated agencies) must be prepared to converse with communities and communicate in such a way that everyone will understand, *i.e.* speak in plain language and not baffle the audience with technical language and jargon so that they get *hōhā* (frustrated) and just accept what is happening. Conversely, communities must reciprocate and be prepared to listen without any preconceptions or angst to make well informed decisions moving forward. The way forward is clear, and it starts with simple and honest dialogue. No hidden agendas, no misinterpretation, just open and honest *kōrero* (conversation). Even if those conversations are perceived to be difficult. In the end allowances must be made and alternative solutions agreed upon.

'Whāia te iti kahurangi ki te tūohu koe me he maunga teitei' - Seek the treasure you value most dearly, if you bow your head, let it be to a lofty mountain.

This *whakataukī* (proverb) is about striving for what you think is truly valuable. Be persistent, be vigilant, and do not let any obstacles get in your way from achieving your goals.

'He aha te kai a o tatou Rangatira? He kōrero, he kōrero, he kōrero'

What is the food of our leaders? It is knowledge, it is communication.

References

Abelson, J., Forest, P. G., Eyles, J., Smith, P., Martin, E., & Gauvin, F. P. (2003). Deliberations about deliberative methods: issues in the design and evaluation of public participation processes. *Social science & medicine*, *57*(2), 239-251.

Abowitz, D. A., & Toole, T. M. (2009). Mixed method research: Fundamental issues of design, validity, and reliability in construction research. *Journal of Construction Engineering and Management*, *136*(1), 108-116.

Agrawal, A. (1995). Dismantling the divide between indigenous and scientific knowledge. *Development and change*, *26*(3), 413-439.

Amici, A., Cifuni, G. F., Contò, M., Esposito, L., & Failla, S. (2015). Hunting area affects chemical and physical characteristics and fatty acid composition of wild boar (Sus scrofa) meat. *Rendiconti Lincei*, *26*(3), 527-534.

Anderson, A. (1996). Origins of Procellariidae hunting in the Southwest Pacific. *International Journal of Osteoarchaeology*, *6*(4), 403-410.

Atkinson, I. A. E. (1973). Spread of the ship rat (Rattus r. rattus L.) III New Zealand. *Journal of the Royal Society of New Zealand*, *3*(3), 457-472.

Atkinson, I. A., & Cameron, E. K. (1993). Human influence on the terrestrial biota and biotic communities of New Zealand. *Trends in Ecology & Evolution*, *8*(12), 447-451.

Atkinson, I. A. E., & Towns, D. R. (2001). Advances in New Zealand mammalogy 1990–2000: Pacific rat. *Journal of the Royal Society of New Zealand*, *31*(1), 99-109.

Attride-Stirling, J. (2001). Thematic networks: an analytic tool for qualitative research. *Qualitative research*, *1*(3), 385-405.

Ballari, S. A., & Barrios- García, M. N. (2014). A review of wild boar Sus scrofa diet and factors affecting food selection in native and introduced ranges. *Mammal Review*, *44*(2), 124-134.

Balmford, A., Moore, J. L., Brooks, T., Burgess, N., Hansen, L. A., Williams, P., & Rahbek, C. (2001). Conservation conflicts across Africa. *Science*, *291*(5513), 2616-2619.

Barrios-Garcia, M. N., & Ballari, S. A. (2012). Impact of wild boar (Sus scrofa) in its introduced and native range: a review. *Biological Invasions*, *14*(11), 2283-2300.

Barron, M. C., Tompkins, D. M., Ramsey, D. S. L., & Bosson, M. A. J. (2015). The role of multiple wildlife hosts in the persistence and spread of bovine tuberculosis in New Zealand. *New Zealand veterinary journal*,*63*(sup1), 68-76.

Bassett, I. E., Horner, I. J., Hough, E. G., Wolber, F. M., Egeter, B., Stanley, M. C., & Krull, C. R. (2017). Ingestion of infected roots by feral pigs provides a minor vector pathway for kauri dieback disease Phytophthora agathidicida. *Forestry: An International Journal of Forest Research*, 1-9.

Becker, C. D., & Ghimire, K. (2003). Synergy between traditional ecological knowledge and conservation science supports forest preservation in Ecuador. *Conservation ecology*, *8*(1).

Bell, B. D., Carver, S., Mitchell, N. J., & Pledger, S. (2004). The recent decline of a New Zealand endemic: how and why did populations of Archey's frog Leiopelma archeyi crash over 1996–2001? *Biological Conservation*, *120*(2), 189-199.

Bellingham, P. J., Towns, D. R., Cameron, E. K., Davis, J. J., Wardle, D. A., Wilmshurst, J. M., & Mulder, C. P. (2010). New Zealand island restoration: seabirds, predators, and the importance of history. *New Zealand Journal of Ecology*, *34*(1), 115.

Bengsen, A. J., Gentle, M. N., Mitchell, J. L., Pearson, H. E., & Saunders, G. R. (2014). Impacts and management of wild pigs Sus scrofa in Australia. *Mammal Review*, *44*(2), 135-147.

Bengsen, A. J., West, P. & Krull, C. R. (2016). Feral pigs in Australia and New Zealand: range, trend, management and impacts of an invasive species.

Bennett, N., Lemelin, R. H., Koster, R., & Budke, I. (2012). A capital assets framework for appraising and building capacity for tourism development in aboriginal protected area gateway communities. *Tourism Management*, *33*(4), 752-766.

Berkes, F., & Berkes, M. K. (2009). Ecological complexity, fuzzy logic, and holism in indigenous knowledge. *Futures*, *41*(1), 6-12.

Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological applications*, *10*(5), 1251-1262.

Berkes, F., & Folke, C. (1998). Linking social and ecological systems for resilience and sustainability. *Linking social and ecological systems: management practices and social mechanisms for building resilience*, *1*, 13-20.

Berkes, F., Folke, C., & Gadgil, M. (1995). Traditional ecological knowledge, biodiversity, resilience and sustainability. In *Biodiversity conservation* (pp. 281-299). Springer Netherlands.

Bess, R. (2011). New Zealand's Treaty of Waitangi and the doctrine of discovery: Implications for the foreshore and seabed. *Marine Policy*, *35*(1), 85-94.

Bomford, M., & O'Brien, P. (1995). Eradication or control for vertebrate pests? *Wildlife Society Bulletin (1973-2006)*, *23*(2), 249-255.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101.

Britten, N. (1995). Qualitative research: qualitative interviews in medical research. *Bmj*, *311*(6999), 251-253.

Bull, P. C., & Whitaker, A. H. (1975). The amphibians, reptiles, birds and mammals. In *Biogeography and ecology in New Zealand* (pp. 231-276). Springer Netherlands.

Caley, P. (1997). Movements, activity patterns and habitat use of feral pigs (Sus scrofa) in a tropical habitat. *Wildlife Research*, *24*(1), 77-87.

Campbell, T. A., & Long, D. B. (2009). Feral swine damage and damage management in forested ecosystems. *Forest Ecology and Management*, *257*(12), 2319-2326.

Carlsson, L., & Berkes, F. (2005). Co-management: concepts and methodological implications. *Journal of environmental management*, *75*(1), 65-76.

Castro, A. P., & Nielsen, E. (2001). Indigenous people and co-management: implications for conflict management. *Environmental Science & Policy*, *4*(4), 229-239.

Challies, C. N. (1975). Feral pigs (Sus scrofa) on Auckland Island: status, and effects on vegetation and nesting sea birds. *New Zealand Journal of Zoology*, *2*(4), 479-490.

Choquenot, D., Lukins, B., & Curran, G. (1997). Assessing lamb predation by feral pigs in Australia's semi-arid rangelands. *Journal of Applied Ecology*, 1445-1454.

Choquenot, D., McIlroy, J., Korn, T., & Bomford, M. (1996). Managing vertebrate pests: feral pigs. *Bureau of Resource Sciences*

Choquenot, D., & Parkes, J. (2001). Setting thresholds for pest control: how does pest density affect resource viability? *Biological Conservation*, *99*(1), 29-46.

Clarke, C. M. H., & Dzieciolowski, R. M. (1991). Feral pigs in the northern South Island, New Zealand: I. Origin, distribution, and density. *Journal of the Royal Society of New Zealand*, *21*(3), 237-247.

Clarke, C. M. H., & Dzieciolowski, R. M. (1991a). Feral pigs in the northern South Island, New Zealand: II. Breed composition of present populations. *Journal of the Royal Society of New Zealand*, *21*(3), 249-260.

Cocklin, C., Craw, M., & Mcauley, I. (1998). Marine reserves in New Zealand: use rights, public attitudes, and social impacts. *Coastal Management*, *26*(3), 213-231.

Colautti, R. I., & MacIsaac, H. J. (2004). A neutral terminology to define 'invasive' species. *Diversity and distributions*, *10*(2), 135-141.

Coleman, J. D., & Cooke, M. M. (2001). Mycobacterium bovis infection in wildlife in New Zealand. *Tuberculosis*, *81*(3), 191-202.

Collins, K. M., Onwuegbuzie, A. J., & Jiao, Q. G. (2006). Prevalence of mixed-methods sampling designs in social science research. *Evaluation & Research in Education*, *19*(2), 83-101.

Collins, K. M., Onwuegbuzie, A. J., & Jiao, Q. G. (2007). A mixed methods investigation of mixed methods sampling designs in social and health science research. *Journal of mixed methods research*, *1*(3), 267-294.

Collins, K. M., Onwuegbuzie, A. J., & Sutton, I. L. (2006). A model incorporating the rationale and purpose for conducting mixed methods research in special education and beyond. *Learning disabilities: a contemporary journal*, *4*(1), 67-100.

Collins, S. L., Carpenter, S. R., Swinton, S. M., Orenstein, D. E., Childers, D. L., Gragson, T. L., ... & Knapp, A. K. (2011). An integrated conceptual framework for long- term social–ecological research. *Frontiers in Ecology and the Environment*, *9*(6), 351-357.

Conde, M. (2017). Resistance to mining. A review. *Ecological Economics*, *132*, 80-90.

Cook, B. R., Atkinson, M., Chalmers, H., Comins, L., Cooksley, S., Deans, N., ... & Marshall, D. (2013). Interrogating participatory catchment organisations: Cases from Canada, New Zealand, Scotland and the Scottish–English Borderlands. *The Geographical Journal*, *179*(3), 234-247.

Council, W. C. (2008). Effective Relationships and Collaborative Arrangements between Central and Local Government.

Courchamp, F., Chapuis, J. L., & Pascal, M. (2003). Mammal invaders on islands: impact, control and control impact. *Biological Reviews*, *78*(03), 347-383.

Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research.

Creswell, J. W., Klassen, A. C., Plano Clark, V. L., & Smith, K. C. (2011). Best practices for mixed methods research in the health sciences. *Bethesda (Maryland): National Institutes of Health*, 2094-2103.

Cruz, F., Donlan, C. J., Campbell, K., & Carrion, V. (2005). Conservation action in the Galapagos: feral pig (Sus scrofa) eradication from Santiago Island. *Biological Conservation*, *121*(3), 473-478.

Cuthbert, R. (2002). The role of introduced mammals and inverse density-dependent predation in the conservation of Hutton's shearwater. *Biological Conservation*, *108*(1), 69-78.

Dale, A. R., Statham, S., Podlesnik, C. A., & Elliffe, D. (2013). The acquisition and maintenance of dogs' aversion responses to kiwi (Apteryx spp.) training stimuli across time and locations. *Applied animal behaviour science*, *146*(1), 107-111.

Davys, T. R., Forsyth, D. M., & Hickling, G. J. (1999). Recreational Himalayan thar (Hemitragus jemlahicus) hunters in Canterbury, New Zealand: a profile and management implications. *New Zealand Journal of Zoology*, *26*(1), 1-9.

Denscombe, M. (2008). Communities of practice: A research paradigm for the mixed methods approach. *Journal of mixed methods research*, *2*(3), 270-283.

Denzin, N. K. (2010). Moments, mixed methods, and paradigm dialogs. *Qualitative inquiry*, *16*(6), 419-427.

Dickison, M. (2009). The asymmetry between science and traditional knowledge.

Dodson, G. (2014). Co-governance and local empowerment? Conservation partnership frameworks and marine protection at Mimiwhangata, New Zealand. *Society & Natural Resources*, *27*(5), 521-539.

Durie, M. (2005). Indigenous knowledge within a global knowledge system. *Higher Education Policy*, *18*(3), 301-312.

Eales, K. M., Norton, R. E., & Ketheesan, N. (2010). Brucellosis in northern Australia. *The American journal of tropical medicine and hygiene*, *83*(4), 876-878.

Elbert, T., Weierstall, R., & Schauer, M. (2010). Fascination violence: On mind and brain of man hunters. *European archives of psychiatry and clinical neuroscience*, *260*(2), 100-105.

Fagiani, S., Fipaldini, D., Santarelli, L., Burrascano, S., Del Vico, E., Giarrizzo, E., ... & Mortelliti, A. (2014). Monitoring protocols for the evaluation of the impact of wild boar (Sus scrofa) rooting on plants and animals in forest ecosystems. *Hystrix, the Italian Journal of Mammalogy*, *25*(1), 31-38.

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International journal of qualitative methods*, *5*(1), 80-92.

Fraser, J. (2012). Hunting: connecting hunter, animal and environment.

Fraser, K. W., Cone, J. M., & Whitford, E. J. (2000). A revision of the established ranges and new populations of 11 introduced ungulate species in New Zealand. *Journal of the Royal Society of New Zealand*, *30*(4), 419-437.

Fry, G., Chantavanich, S., & Chantavanich, A. (1981). Merging quantitative and qualitative research techniques: Toward a new research paradigm. *Anthropology & Education Quarterly*, 145-158.

Gable, G. G. (1994). Integrating case study and survey research methods: an example in information systems. *European journal of information systems*, *3*(2), 112-126.

Gadgil, M., Berkes, F., & Folke, C. (1993). Indigenous knowledge for biodiversity conservation. *Ambio*, 151-156.

Gadgil, M., & Guha, R. (2000). Ecological conflicts and environmental movements in India. *Development: Challenges for development*, *6*, 254.

Galbraith, M. P. (1990). Volunteers' view of the ecological restoration of an offshore island. *Ecological restoration of New Zealand islands. Conservation Sciences Publication*, (2), 170-174.

Galbraith, M. (2013). Public and ecology-the role of volunteers on Tiritiri Matangi Island. *New Zealand Journal of Ecology*, *37*(3), 266.

Galbraith, M., & Cooper, H. (2013). Tiritiri Matangi-an overview of 25 years of ecological restoration. *New Zealand Journal of Ecology*, *37*(3), 258.

Galbraith, M., Bollard-Breen, B., & Towns, D. R. (2016). The community-conservation conundrum: is citizen science the answer? *Land*, *5*(4), 37.

Gibbs, M. (2003). Indigenous rights to natural resources in Australia and New Zealand: Kereru, Dugong and Pounamu. *Australasian Journal of Environmental Management*, *10*(3), 138-151.

Gigliotti, L. M. (2000). A classification scheme to better understand satisfaction of Black Hills deer hunters: the role of harvest success. *Human Dimensions of Wildlife*, *5*(1), 32-51.

Goodman, M. J., Griffin, P. B., Estioko-Griffin, A. A., & Grove, J. S. (1985). The compatibility of hunting and mothering among the Agta hunter-gatherers of the Philippines. *Sex roles*, *12*(11), 1199-1209.

Green, W., & Rohan, M. (2012). Opposition to aerial 1080 poisoning for control of invasive mammals in New Zealand: risk perceptions and agency responses. *Journal of the Royal Society of New Zealand*, *42*(3), 185-213.

Greene, J. C. (2008). Is mixed methods social inquiry a distinctive methodology? *Journal of mixed methods research*, *2*(1), 7-22.

Griffiths, R., Buchanan, F., Broome, K., Neilsen, J., Brown, D., & Weakley, M. (2015). Successful eradication of invasive vertebrates on Rangitoto and Motutapu Islands, New Zealand. *Biological Invasions*, *17*(5), 1355-1369.

Guerrier, G., Daronat, J. M., Morisse, L., Yvon, J. F., & Pappas, G. (2011). Epidemiological and clinical aspects of human Brucella suis infection in Polynesia. *Epidemiology and infection*, *139*(10), 1621-1625.

Halcomb, E. J., & Davidson, P. M. (2006). Is verbatim transcription of interview data always necessary? *Applied Nursing Research*, *19*(1), 38-42.

Hanson, W. E., Creswell, J. W., Clark, V. L. P., Petska, K. S., & Creswell, J. D. (2005). Mixed methods research designs in counselling psychology. *Journal of counselling psychology*, *52*(2), 224.

Harper, G. (2006). Weka (Gallirallus australis) depredation of sooty shearwater/titi (Puffinus griseus) chicks. *Notornis*, *53*(3), 318.

Harper, G. A. (2007). Detecting predation of a burrow-nesting seabird by two introduced predators, using stable isotopes, dietary analysis and experimental removals. *Wildlife Research*, *34*(6), 443-453.

Hirsch, P. D., Adams, W. M., Brosius, J. P., Zia, A., Bariola, N., & Dammert, J. L. (2011). Acknowledging conservation trade- offs and embracing complexity. *Conservation Biology*, *25*(2), 259-264.

Holdaway, R. N. (1989). New Zealand's pre-human avifauna and its vulnerability. *New Zealand journal of ecology*, 11-25.

Hone, J. I. M. (1988). Feral pig rooting in a mountain forest and woodland: distribution, abundance and relationships with environmental variables. *Austral Ecology*, *13*(4), 393-400.

Hone, J. (2002). Feral pigs in Namadgi National Park, Australia: dynamics, impacts and management. *Biological Conservation*, *105*(2), 231-242.

Hone, J. (2004). Yield, compensation and fertility control: a model for vertebrate pests. *Wildlife Research*, *31*(4), 357-368.

Hone, J. (2007). *Wildlife damage control*. CSIRO publishing. 15 – 29.

Hunter, C. M., Moller, H., & Kitson, J. (2000). Muttonbirder selectivity of sooty shearwater (titi) chicks harvested in New Zealand. *New Zealand Journal of Zoology*, *27*(4), 395-414.

Huntington, H. P. (2000). Using traditional ecological knowledge in science: methods and applications. *Ecological applications*, *10*(5), 1270-1274.

Innes, J., Nugent, G., Prime, K., & Spurr, E. B. (2004). Responses of kukupa (Hemiphaga novaeseelandiae) and other birds to mammal pest control at Motatau, Northland. *New Zealand Journal of Ecology*, 73-81.

Jackson, S. (2005). Indigenous values and water resource management: a case study from the Northern Territory. *Australasian Journal of Environmental Management*, *12*(3), 136-146.

Jamieson, A., Bassett, I. E., Hill, L. M. W., Hill, S., Davis, A., Waipara, N. W., ... & Horner, I. J. (2014). Aerial surveillance to detect kauri dieback in New Zealand. *New Zealand Plant Protection*, *67*, 60-65.

Jeffrey, B., & Troman, G. (2004). Time for ethnography. *British educational research journal*, *30*(4), 535-548.

Jentoft, S., McCay, B. J., & Wilson, D. C. (1998). Social theory and fisheries co-management. *Marine policy*, *22*(4-5), 423-436.

Johnson, M. (1992). Research on traditional environmental knowledge: its development and its role. *Lore: capturing traditional environmental knowledge. Dene Cultural Institute, Hay River*.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, *33*(7), 14-26.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of mixed methods research*, *1*(2), 112-133.

Jones, C. J., Clifford, H., Fletcher, D., Cuming, P., & Lyver, P. O. (2011). Survival and age-at-first-return estimates for grey-faced petrels (Pterodroma macroptera gouldi) breeding on Mauao and Motuotau Island in the Bay of Plenty, New Zealand. *Notornis*, *58*(2), 71-80.

Kahui, V., & Richards, A. C. (2014). Lessons from resource management by indigenous Maori in New Zealand: Governing the ecosystems as a common. *Ecological economics*, *102*, 1-7.

Kaplan, B., & Duchon, D. (1988). Combining qualitative and quantitative methods in information systems research: a case study. *MIS quarterly*, 571-586.

Kawharu, M. (2000). Kaitiakitanga: a Maori anthropological perspective of the Maori socio-environmental ethic of resource management. *The Journal of the Polynesian Society*, *109*(4), 349-370.

Keiter, D. A., Mayer, J. J., & Beasley, J. C. (2016). What is in a “common” name? A call for consistent terminology for nonnative Sus scrofa. *Wildlife Society Bulletin*, *40*(2), 384-387.

Kellert, S. R., & Berry, J. K. (1987). Attitudes, knowledge, and behaviors toward wildlife as affected by gender. *Wildlife Society Bulletin (1973-2006)*, *15*(3), 363-371.

Kitson, J. C., & Moller, H. (2008). Looking after your ground: resource management practice by Rakiura Maori titi harvesters. In *Papers and Proceedings of the royal Society of tasmania* (Vol. 142, No. 1, pp. 161-176).

Koichi, K. (2012). ResearchOnline@ JCU.

Kreith, M. (2007). Wild pigs in California: the issues. *University of California Agricultural Issues Center. AIC Issues Brief*, (33).

Krull, C. R. (2012). *Feral pigs in a temperate rainforest ecosystem: ecological impacts and management* (Doctoral dissertation, ResearchSpace@ Auckland).

Krull, C. R., Choquenot, D., Burns, B. R., & Stanley, M. C. (2013a). Feral pigs in a temperate rainforest ecosystem: disturbance and ecological impacts. *Biological invasions*, *15*(10), 2193-2204.

Krull, C. R., Waipara, N. W., Choquenot, D., Burns, B. R., Gormley, A. M., & Stanley, M. C. (2013b). Absence of evidence is not evidence of absence: Feral pigs as vectors of soil- borne pathogens. *Austral Ecology*, *38*(5), 534-542.

Krull, C. R., Stanley, M. C., Burns, B. R., Choquenot, D., & Etherington, T. R. (2016). Reducing wildlife damage with cost-effective management programmes. *PloS one*, *11*(1), e0146765.

Lee, M. S., Hutchinson, M. N., Worthy, T. H., Archer, M., Tennyson, A. J., Worthy, J. P., & Scofield, R. P. (2009). Miocene skinks and geckos reveal long-term conservatism of New Zealand's lizard fauna. *Biology Letters*, *5*(6), 833-837.

Leech, N. L., & Onwuegbuzie, A. J. (2009). A typology of mixed methods research designs. *Quality & quantity*, *43*(2), 265-275.

Le Heron, R., Lewis, N., Fisher, K., Thrush, S., Lundquist, C., Hewitt, J., & Ellis, J. (2016). Non-sectarian scenario experiments in socio-ecological knowledge building for multi-use marine environments: Insights from New Zealand's Marine Futures project. *Marine Policy*, *67*, 10-21.

Li, A. Y., Williams, N., Adams, P. J., Fenwick, S., & Hardy, G. S. J. (2010). The spread of Phytophthora cinnamomi by feral Pigs.

Liu, J., Dietz, T., Carpenter, S. R., Folke, C., Alberti, M., Redman, C. L., ... & Taylor, W. W. (2007). Coupled human and natural systems. *AMBIO: a journal of the human environment*, *36*(8), 639-649.

Local Government Act 2002.

Locke, K. (2011). Field research practice in management and organization studies: Reclaiming its tradition of discovery. *The Academy of Management Annals*, *5*(1), 613-652.

Long, J. L. (2003). *Introduced mammals of the world: their history, distribution and influence*. Csiro Publishing.

Lyver, P. O. B. (2000). Sooty shearwater (Puffinus griseus) harvest intensity and selectivity on Poutama Island, New Zealand. *New Zealand Journal of Ecology*, 169-180.

Lyver, P. B. (2005). Co-managing environmental research: lessons from two cross-cultural research partnerships in New Zealand. *Environmental Conservation*, *32*(4), 365-370.

Lyver, P. O. B., Akins, A., Phipps, H., Kahui, V., Towns, D. R., & Moller, H. (2016). Key biocultural values to guide restoration action and planning in New Zealand. *Restoration Ecology*, *24*(3), 314-323.

Lyver, P. O. B., Jones, C., & Moller, H. (2009). Looking past the wallpaper: Considerate evaluation of traditional environmental knowledge by science.

Lyver, P. B., & Moller, H. (1999). Modern technology and customary use of wildlife: the harvest of Sooty Shearwaters by Rakiura Maori as a case study. *Environmental conservation*, *26*(4), 280-288.

Lyver, P. O. B., & Moller, H. (2010). An Alternative Reality: Māori Spiritual Guardianship of New Zealand's Native Birds. *Ethno*, 241.

Lyver, P. O. B., Moller, H., & Thompson, C. (1999). Changes in sooty shearwater Puffinus griseus chick production and harvest precede ENSO events. *Marine Ecology Progress Series*, 237-248.

Lyver, P. O. B., Taputu, T. M., Kutia, S. T., & Tahi, B. (2008). Tūhoe Tuawhenua mātauranga of kererū (Hemiphaga novaseelandiae novaseelandiae) in Te Urewera. *New Zealand Journal of Ecology*, 7-17.

Lyver, P. O. B., Timoti, P., Jones, C. J., Richardson, S. J., Tahi, B. L., & Greenhalgh, S. (2016). An indigenous community-based monitoring system for assessing forest health in New Zealand. *Biodiversity and Conservation*, 1-30.

MacLean, L. M., Meyer, M., & Estable, A. (2004). Improving accuracy of transcripts in qualitative research. *Qualitative Health Research*, *14*(1), 113-123.

Mapston, M. (2007). Feral hogs in Texas. *Texas FARMER Collection*.

Marvin, G. (2005). Sensing nature: Encountering the world in hunting. *Etnofoor*, 15-26.

Massei, G., & Genov, P. V. (2004). The environmental impact of wild boar. *Galemys*, *16*(especial), 135-145.

Maya-Jariego, I., Querevalú-Miñán, J. F., Varela, L. G., & Ávila, J. (2017). Escape the lion cage: Social networks by catch zones of small-scale fisheries in the oil settlement of Lobitos (Peru). *Marine Policy*, *81*, 340-349.

McGinnis, M. (2012). Greening Aotearoa's Marine Policy. *Policy Quarterly*, *8*, 17-28.

McIlroy, J. C. (2001). Advances in New Zealand mammalogy 1990–2000: feral pig. *Journal of the Royal Society of New Zealand*, *31*(1), 225-231.

McKinlay, P. (2006). The challenge of democratic participation in the community development process. *Community Development Journal*, *41*(4), 492-505.

McLennan, J. A., Potter, M. A., Robertson, H. A., Wake, G. C., Colbourne, R., Dew, L., & Reid, J. (1996). Role of predation in the decline of kiwi, Apteryx spp., in New Zealand. *New Zealand Journal of Ecology*, 27-35.

Meads, M. J., Walker, K. J., & Elliott, G. P. (1984). Status, conservation, and management of the land snails of the genus Powelliphanta (Mollusca: Pulmonata). *New Zealand journal of zoology*, *11*(3), 277-306.

Memon, P. A., & Kirk, N. (2012). Role of indigenous Māori people in collaborative water governance in Aotearoa/New Zealand. *Journal of Environmental Planning and Management*, *55*(7), 941-959.

Miller, P. J., & Pierce, R. J. (1995). Distribution and decline of the North Island brown kiwi (Apteryx australis mantelli) in Northland. *Notornis*, *42*, 203-211.

Mingers, J. (2001). Combining IS research methods: towards a pluralist methodology. *Information systems research*, *12*(3), 240-259.

Moennig, V. (2000). Introduction to classical swine fever: virus, disease and control policy. *Veterinary microbiology*, *73*(2), 93-102.

Moller, H., Berkes, F., Lyver, P. O. B., & Kislalioglu, M. (2004). Combining science and traditional ecological knowledge: monitoring populations for co-management. *Ecology and society*, *9*(3).

Moller, H., Charleton, K., Knight, B., & Lyver, P. (2009). Traditional ecological knowledge and scientific inference of prey availability: harvests of sooty shearwater (Puffinus griseus) chicks by Rakiura Maori. *New Zealand Journal of Zoology*, *36*(3), 259-274.

Moller, H., Kitson, J. C., & Downs, T. M. (2009). Knowing by doing: learning for sustainable muttonbird harvesting. *New Zealand Journal of Zoology*, *36*(3), 243-258.

Moorfield, J.C. (2011). Māori – English, English – Māori Dictionary

Motion, J., & Leitch, S. (1996). A discursive perspective from New Zealand: Another world view. *Public Relations Review*, *22*(3), 297-309.

Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, *403*(6772), 853.

Naughton-Treves, L., & Treves, A. (2005). Socio-ecological factors shaping local support for wildlife: crop-raiding by elephants and other wildlife in Africa. *CONSERVATION BIOLOGY SERIES-CAMBRIDGE-*, *9*, 252.

Newman, M. E. J. (2001). *Ego-centered networks and the Ripple effect: why all your friends are weird*. Working Paper, Santa Fe, NM: Santa Fe Institute, 7.

Newman, J., & Moller, H. (2005). Use of Matauranga (Maori traditional knowledge) and science to guide a seabird harvest: getting the best of both worlds? *Senri Ethnological Studies*.

Nugent, G. (1992). Big-game, small-game, and gamebird hunting in New Zealand: hunting effort, harvest, and expenditure in 1988. *New Zealand journal of zoology*, *19*(3-4), 75-90.

Nugent, G., & Choquenot, D. (2004). Comparing cost-effectiveness of commercial harvesting, state-funded culling, and recreational deer hunting in New Zealand. *Wildlife Society Bulletin*, *32*(2), 481-492.

Nugent, G., & Fraser, K. W. (1993). Pests or valued resources? Conflicts in management of deer. *New Zealand journal of zoology*, *20*(4), 361-366.

Nugent, G., Gortazar, C., & Knowles, G. (2015). The epidemiology of Mycobacterium bovis in wild deer and feral pigs and their roles in the establishment and spread of bovine tuberculosis in New Zealand wildlife. *New Zealand veterinary journal*, *63*(sup1), 54-67.

Nugent, G., & Mawhinney, K. (1987). Recreational hunter's views on fallow deer management in the Blue Mountains, Otago. *New Zealand forestry*, *32*, 32-35.

Nugent, G., Parkes, J. P., Dawson, N., & Caley, P. (1996). Feral pigs in New Zealand as conservation pests and as potential hosts of bovine tuberculosis. *Unpublished Landcare Research Contract Report LC9596/54*.

Nugent, G., Whitford, J., Yockney, I. J., & Cross, M. L. (2012). Reduced spill over transmission of Mycobacterium bovis to feral pigs (Sus scofa) following population control of brushtail possums (*Trichosurus vulpecula*). *Epidemiology and Infection*, *140*(06), 1036-1047.

Nye Jr, J. S. (1997). In government, we don't trust. *Foreign Policy*, 99-111.

O'Cathain, A., Murphy, E., & Nicholl, J. (2010). Three techniques for integrating data in mixed methods studies. *Bmj*, *341*, c4587.

O'Connell, J. F., Hawkes, K., & Jones, N. B. (1988). Hadza hunting, butchering, and bone transport and their archaeological implications. *Journal of Anthropological research*, *44*(2), 113-161.

Onwuegbuzie, A. J., & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International journal of social research methodology*, *8*(5), 375-387.

Östlund, U., Kidd, L., Wengström, Y., & Rowa-Dewar, N. (2011). Combining qualitative and quantitative research within mixed method research designs: a methodological review. *International journal of nursing studies*, *48*(3), 369-383.

Panelli, R., & Tipa, G. (2007). Placing well-being: a Maori case study of cultural and environmental specificity. *EcoHealth*, *4*(4), 445-460.

Parkes, J. P. (1990). Eradication of feral goats on islands and habitat islands. *Journal of the Royal Society of New Zealand*, *20*(3), 297-304.

Parkes, J. P. (2006). Does commercial harvesting of introduced wild mammals contribute to their management as conservation pests? In *Biological Invasions in New Zealand* (pp. 407-420). Springer Berlin Heidelberg.

Parkes, J. P., Easdale, T. A., Williamson, W. M., & Forsyth, D. M. (2015). Causes and consequences of ground disturbance by feral pigs (Sus scrofa) in a lowland New Zealand conifer-angiosperm forest. *New Zealand Journal of Ecology*, *39*(1), 34.

Parkes, J., & Murphy, E. (2003). Management of introduced mammals in New Zealand. *New Zealand Journal of Zoology*, *30*(4), 335-359.

Parkes, J. P., Nugent, G., Forsyth, D. M., Byrom, A. E., Pech, R. P., Warburton, B., & Choquenot, D. (2017). FORUM PAPER. *New Zealand Journal of Ecology*, *41*(1), 0-0.

Parkes, J. P., Ramsey, D. S., Macdonald, N., Walker, K., McKnight, S., Cohen, B. S., & Morrison, S. A. (2010). Rapid eradication of feral pigs (Sus scrofa) from Santa Cruz Island, California. *Biological Conservation*, *143*(3), 634-641.

Parkes, J. P., & Tustin, K. G. (1988). The trophy potential of Himalayan thar (Hemitragus jemlahicus) in New Zealand. *New Zealand journal of ecology*, *12*, 121-124.

Paton, D. J., & Greiser-Wilke, I. (2003). Classical swine fever–an update. *Research in veterinary science*, *75*(3), 169-178.

Paton, N. I., Tee, N. W. S., Vu, C. K. F., & Teo, T. P. (2001). Visceral abscesses due to Brucella suis infection in a retired pig farmer. *Clinical Infectious Diseases*, *32*(8), e129-e130.

Pavlov, P. M., & Hone, J. (1982). The behaviour of feral pigs, Sus scrofa, in flocks of lambing ewes. *Wildlife Research*, *9*(1), 101-109.

Pech, R. P., & McIlroy, J. C. (1990). A model of the velocity of advance of foot and mouth disease in feral pigs. *Journal of Applied Ecology*, 635-650.

Pejchar, L., & Mooney, H. A. (2009). Invasive species, ecosystem services and human well-being. *Trends in ecology & evolution*, *24*(9), 497-504.

Perkins, H. C., & Thorns, D. C. (2001). A decade on: reflections on the Resource Management Act 1991 and the practice of urban planning in New Zealand. *Environment and Planning B: Planning and Design*, *28*(5), 639-654.

Pichler, M., & Brad, A. (2016). Political ecology and socio-ecological conflicts in Southeast Asia. *Austrian Journal of South-East Asian Studies*, *9*(1), 1-10.

Plummer, R., & Fitzgibbon, J. (2004). Co-management of natural resources: a proposed framework. *Environmental management*, *33*(6), 876-885.

Plummer, R., & Fennell, D. (2007). Exploring co-management theory: Prospects for socio-biology and reciprocal altruism. *Journal of Environmental Management*, *85*(4), 944-955.

Pomeroy, R. S., & Berkes, F. (1997). Two to tango: the role of government in fisheries co-management. *Marine policy*, *21*(5), 465-480.

Prentis, P. J., Wilson, J. R., Dormontt, E. E., Richardson, D. M., & Lowe, A. J. (2008). Adaptive evolution in invasive species. *Trends in plant science*, *13*(6), 288-294.

Price, E. O. (1984). Behavioural aspects of animal domestication. *The quarterly review of biology*, *59*(1), 1-32.

Ramstad, K. M., Nelson, N. J., Paine, G., Beech, D., Paul, A., Paul, P., ... & Daugherty, C. H. (2007). Species and cultural conservation in New Zealand: Maori traditional ecological knowledge of Tuatara. *Conservation Biology*, *21*(2), 455-464.

Redpath, S. M., Young, J., Evely, A., Adams, W. M., Sutherland, W. J., Whitehouse, A., ... & Gutiérrez, R. J. (2013). Understanding and managing conservation conflicts. *Trends in Ecology & Evolution*, *28*(2), 100-109.

Reed, M. S. (2008). Stakeholder participation for environmental management: a literature review. *Biological conservation*, *141*(10), 2417-2431.

Reis, A. C. (2009). More than the kill: hunters' relationships with landscape and prey. *Current issues in tourism*, *12*(5-6), 573-587.

Resource Management Act 1991.

Roberts, M. (1991). Origin, dispersal routes, and geographic distribution of Rattus exulans, with special reference to New Zealand. *Pacific Science*,*45*(2), 123-130.

Robertson, H. A., & Fraser, J. R. (2009). Use of trained dogs to determine the age structure and conservation status of kiwi Apteryx spp. populations. *Bird Conservation International*, *19*(2), 121-129.

Russell, J. C., Innes, J. G., Brown, P. H., & Byrom, A. E. (2015). Predator-free New Zealand: conservation country. *BioScience*, *65*(5), 520-525.

Ryan, P. M. (1974). The New Dictionary of Modern Māori

Sale, J. E., Lohfeld, L. H., & Brazil, K. (2002). Revisiting the quantitative-qualitative debate: Implications for mixed-methods research. *Quality and quantity*, *36*(1), 43-53.

Sandelowski, M. (1994). Focus on qualitative methods. Notes on transcription. *Research in nursing & health*, *17*(4), 311-314.

Sandelowski, M. (2000). Focus on research methods combining qualitative and quantitative sampling, data collection, and analysis techniques. *Research in nursing & health*, *23*(3), 246-255.

Scofield, R. P., & Ashwell, K. W. (2009). Rapid somatic expansion causes the brain to lag behind: the case of the brain and behavior of New Zealand's Haast's Eagle (Harpagornis moorei). *Journal of Vertebrate Paleontology*, *29*(3), 637-649.

Seddon, P. J., Strauss, W. M., & Innes, J. (2012). Animal translocations: what are they and why do we do them. *Reintroduction Biology: integrating science and management*, 1-32.

Seward, N. W., VerCauteren, K. C., Witmer, G. W., & Engeman, R. M. (2004). Feral swine impacts on agriculture and the environment. *Sheep & Goat Research Journal*, 12.

Schusler, T. M., Decker, D. J., & Pfeffer, M. J. (2003). Social learning for collaborative natural resource management. *Society & Natural Resources*, *16*(4), 309-326.

Silva-Macher, J. C., & Farrell, K. N. (2014). The flow/fund model of Conga: exploring the anatomy of environmental conflicts at the Andes–Amazon commodity frontier. *Environment, development and sustainability*, *16*(3), 747-768.

Simpson, V. R. (2002). Wild animals as reservoirs of infectious diseases in the UK. *The Veterinary Journal*, *163*(2), 128-146.

Singer, F. J., Swank, W. T., & Clebsch, E. E. (1984). Effects of wild pig rooting in a deciduous forest. *The Journal of wildlife management*, 464-473.

Sneddon, C., Harris, L., Dimitrov, R., & Özesmi, U. (2002). Contested waters: Conflict, scale, and sustainability in aquatic socioecological systems. *Society &Natural Resources*, *15*(8), 663-675.

Spencer, P. B., & Hampton, J. O. (2005). Illegal translocation and genetic structure of feral pigs in Western Australia. *Journal of Wildlife Management*, *69*(1), 377-384.

Stedman, R. C., & Heberlein, T. A. (2001). Hunting and rural socialization: Contingent effects of the rural setting on hunting participation. *Rural sociology*, *66*(4), 599-617.

Stokes, E. (1992). The treaty of Waitangi and the Waitangi tribunal: Maori claims in New Zealand. *Applied Geography*, *12*(2), 176-191.

Sullivan, B., & Tuffery-Huria, L. (2014). New Zealand: Wai 262 report and after. *Journal of Intellectual Property Law & Practice*, *9*(5), 403-410.

Taborsky, M. (1988). Kiwis and dog predation: observations in Waitangi State Forest. *Notornis*, *35*(3), 197-202.

Taiepa, T., Lyver, P., Horsley, P., Davis, J., Brag, M., & Moller, H. (1997). Co-management of New Zealand's conservation estate by Maori and Pākehā: a review. *Environmental conservation*, *24*(3), 236-250.

Tapsell, P. (1997). The flight of Pareraututu: An investigation of taonga from a tribal perspective. *The Journal of the Polynesian Society*, *106*(4), 323-374.

Tashakkori, A., & Creswell, J. W. (2007). Editorial: The new era of mixed methods.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of mixed methods research*, *1*(1), 77-100.

Thomas, S., & Ali Memon, P. (2007). New Zealand local government at the crossroads? Reflections on the recent local government reforms. *Urban Policy and Research*, *25*(2), 171-185.

Tisdell, C. A. (2013). *Wild pigs: environmental pest or economic resource?* Elsevier.

Towns, D. R., Atkinson, I. A. E., & Daugherty, C. H. (1990). Ecological restoration of New Zealand islands–introduction. *Ecological restoration of New Zealand islands. Wellington, Department of Conservation. Pp. iii–iv*.

Towns, D. R., & Broome, K. G. (2003). From small Maria to massive Campbell: forty years of rat eradications from New Zealand islands. *New Zealand Journal of Zoology*, *30*(4), 377-398.

Towns, D. R., & Daugherty, C. H. (1994). Patterns of range contractions and extinctions in the New Zealand herpetofauna following human colonisation. *New Zealand journal of zoology*, *21*(4), 325-339.

Towns, D. R., Vernon Byrd, G., Jones, H. P., Rauzon, M. J., Russell, J. C., & Wilcox, C. (2011). Impacts of introduced predators on seabirds.

Treaty of Waitangi Act, 1975

Turner, M. D. (2004). Political ecology and the moral dimensions of "resource conflicts": the case of farmer–herder conflicts in the Sahel. *Political geography*, *23*(7), 863-889.

Tyrrell, M. (2008). Nunavik Inuit perspectives on beluga whale management in the Canadian Arctic. *Human Organization*, *67*(3), 322-334.

Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & health sciences*, *15*(3), 398-405.

Veblen, T. T., & Stewart, G. H. (1982). The effects of introduced wild animals on New Zealand forests. *Annals of the Association of American Geographers*, *72*(3), 372-397.

Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS quarterly*, *37*(1), 21-54.

Waipara, N. W., Hill, S., Hill, L. M. W., Hough, E. G., & Horner, I. J. (2013). Surveillance methods to determine tree health, distribution of kauri dieback disease and associated pathogens. *New Zealand Plant Protection*, *66*, 235-241.

Walters, J. M. (1980). What Is Ethnography? *EDRS PRICE, MF01/PC06 4us Postage.*, 31.

Ward, M. P., Laffan, S. W., & Highfield, L. D. (2007). The potential role of wild and feral animals as reservoirs of foot-and-mouth disease. *Preventive Veterinary Medicine*, *80*(1), 9-23.

Weir, B. S., Paderes, E. P., Anand, N., Uchida, J. Y., Pennycook, S. R., Bellgard, S. E., & Beever, R. E. (2015). A taxonomic revision of Phytophthora Clade 5 including two new species, Phytophthora agathidicida and P. cocois. *Phytotaxa*, *205*(1), 21-38.

Wellard, S., & McKenna, L. (2001). Turning tapes into text: Issues surrounding the transcription of interviews. *Contemporary Nurse*, *11*(2-3), 180-186.

Whitehead, A. L., Lyver, P. O. B., Jones, C. J., Bellingham, P. J., MacLeod, C. J., Coleman, M., ... & Duncan, R. P. (2014). Establishing accurate baseline estimates of breeding populations of a burrowing seabird, the grey-faced petrel (Pterodroma macroptera gouldi) in New Zealand. *Biological Conservation*, *169*, 109-116.

Wilmshurstl, J. M., & Higham, T. F. (2004). Using rat-gnawed seeds to independently date the arrival of Pacific rats and humans in New Zealand. *The Holocene*, *14*(6), 801-806.

Wilson, N., Blaschke, P., Thomson, G., Nghiem, N., & Horrocks, J. (2015). Public health aspects of feral deer, goats and pigs in New Zealand: A review to inform eradication decisions. *New Zealand Geographer*, *71*(3), 177-188.

Woods A, Kerr GN 2010. Recreational game hunting: motivations, satisfactions and participation. Land, Environment and People Report No. 18. Lincoln University, Canterbury, New Zealand. 48 p.

Wootton, J. T. (1994). The nature and consequences of indirect effects in ecological communities. *Annual review of ecology and systematics*, 443-466.

Yandle, T. (2006). Sharing natural resource management responsibility: examining the New Zealand rock lobster co-management experience. *Policy Sciences*, *39*(3), 249-278.

Young, E. J. (1995). An overview of human brucellosis. *Clinical infectious diseases*, *21*(2), 283-290.

Zavaleta, E. S., Hobbs, R. J., & Mooney, H. A. (2001). Viewing invasive species removal in a whole-ecosystem context. *Trends in Ecology & Evolution*, *16*(8), 454-459.

Appendices

Appendix 1. Ethics Approval

AUTEC Secretariat

Auckland University of Technology
D-88, WU406 Level 4 WU Building City Campus
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

12 October 2016

Cheryl Krull
Faculty of Health and Environmental Sciences

Dear Cheryl

Re Ethics Application: **16/327 A community's perspective of wild pigs (Sus scrofa)**

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 12 October 2019.

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 12 October 2019;
- A brief report on the status of the project using form EA3, which is available online through http://www.aut.ac.nz/researchethics. This report is to be submitted either when the approval expires on 12 October 2019 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.

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: Peter Edwards, pekakiri@vodafone.co.nz; Dave Towns; John Perott

Appendix 2. Participant Information Form

Date Information Sheet Produced:
02 August 2016

Project Title
A community's perspective of wild pigs (*Sus scrofa*)

An Invitation
Tēnā koe (Greetings) my name is Peter Edwards and I am a Master's student at the Auckland University of Technology. I am of Te Aupōuri, Te Rarawa, Ngā Puhi and NZ European descent and I wish to cordially invite you, the reader, to become a participant in my research project. Through the successful completion of this project I will obtain a Master's of Science qualification (MSc) in Applied Conservation from AUT.

What is the purpose of this research?
Wild pigs have been many things to a wide range of different people since their introduction to Aotearoa, New Zealand by Captain James Cook and others, hundreds of years ago. To some they are a valuable resource for food. To others they are an excellent sport and recreational challenge. However, to several others wild pigs are a pest and a threat to native plants and animals, and local livelihoods.
The purpose of this research is to collect the views and values of stakeholders (local council, iwi, hunting groups, conservation NGO's and the public) within a community to understand differing issues or opposition to conservation initiatives. The overarching aim of this research is to provide the first insight into community values of wild pigs here in New Zealand.
Please note: I wish to make it perfectly clear that; 1) this project is for my interest and it is only focused and aligned with the collection of people's views and values. 2) this project is not concerned with the practice of hunting specifically, and it is certainly NOT my intention to collect this information for the eradication of wild pigs. 3) this project will be conducted in an open and respectful manner to convey transparency (be clear), and to maintain a neutral position always.
This research will result in a completed Master's thesis and two published papers.

How was I identified and why am I being invited to participate in this research?
You have been identified as a member of your community who has a particular skillset or interest in wild pigs and the management of wild pigs, which is why you have been chosen to participate in this project. I obtained your contact details through public sources or via word of mouth from another local community member.

How do I agree to participate in this research?
If you decide to participate in this research please sign the consent form attached. Please note that your participation in this research is totally voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time prior or during the process. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed, or by allowing it to continue to be used. Please note however, once the findings have been produced, removal of your data may not be possible.

What will happen in this research?
The views and values of the individual participants will be collected via semi-structured interviews. The semi-structured process involves both parties (researcher & participant) engaging in an open and frank conversation style interview process. This is done in order to allow both parties (researcher and participant) to feel comfortable and at ease, so that the information flows freely. The purpose for collecting this data will be to gain an analytical and first-hand insight into community's/stakeholder's perspectives regarding the hunting/management of wild pigs for either the preservation of conservation and/or for hunting as a food source or both. All interviews will be recorded using voice recording technology. Please note: This data may be kept on file for comparison with data from other areas around the country at a later date. However, all data that is collected through this project will remain confidential at all times

What are the discomforts and risks?
It is anticipated that due to the unobtrusive and open nature of the interview process it will be very unlikely that participants will be subjected to any discomfort or risks as the interviews will be structured in a way that will be sensitive to any particular cultural or social demographic. At all times during the project individual participant's privacy will be protected and full confidentiality will be given. Also, if for any reason you experience discomfort during the interview process, please feel free to discontinue proceedings at any time.

How will these discomforts and risks be alleviated?
However, in the event that participants feel any discomfort about any particular part of the project at any time, they may choose not to answer any questions and the following shall happen;
If the interviews appear to become heated which may cause discomfort or embarrassment for any reason, the discussion topic will be changed, or the interview may be halted until such a time as it is deemed that it is acceptable to continue, or the interview may cease altogether.
Individuals and their associated interviews/data will be kept confidential.
Otherwise, if any participant experiences discomfort or embarrassment at any stage of the research, he or she is free to discontinue participation or choose not to respond to a certain issue.

What are the benefits?
The benefits for me will be that your interview will contribute to the collection of data for my master's project and the successful completion of the Masters qualification. However, the benefits for you the participant are that your opinions and views could shape the way any conservation project is approached in the future. Community engagement, community participation and a united community/stakeholder voice working together in harmony with government organisations to successfully achieve the same conservation outcomes from the outset to completion, which is the intended result for this project.

How will my privacy be protected?
Participants privacy and confidentiality is of paramount importance at all times (prior, during and post research). All data collected and information shared shall remain private and confidential. All information collected shall be for research purposes only. The information collected by myself (Peter Edwards) will not be traceable to any one individual and all audiotapes shall be appropriately stored at AUT until such a time when they will be disposed of in accordance with AUT rules and regulations.

What are the costs of participating in this research?
The amount of time that is predicted for each interview is likely to be approximately 1 hour and not exceeding 2.

What opportunity do I have to consider this invitation?
Could you please let me know within two weeks of receiving this invitation?

Will I receive feedback on the results of this research?
Yes, you the participant will receive your transcript back for review in order to check the accuracy and authenticity. It will be at this time when any amendments should be made. Participants will also receive a brief summary of the research findings upon study completion. Also, the results of this kaupapa (research) will be conveyed back to the community so as to fulfil the true meaning of participation. Please note, the results will be conveyed in such a way that all participants shall remain private and confidential (no individual shall be directly identified).

What do I do if I have concerns about this research?
In the event that individual participants have any concerns regarding the nature of this project, please feel free to direct enquiries to the project supervisor in the first instance. Cheryl Krull, email: cheryl.krull@aut.ac.nz, ph: 09 921 9999, ext. 6559.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz*, 921 9999 ext. 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

Peter Edwards, email: pekakiri@vodafone.co.nz

Project Supervisor Contact Details:

Cheryl Krull, email: cheryl.krull@aut.ac.nz, ph: 09 921 9999 ext. 6559.

Approved by the Auckland University of Technology Ethics Committee on 12 October 2016
AUTEC Reference number 16/327

Appendix 3. AUT Consent Form

AUT
TE WĀNANGA AROHNUI O TĀMAKI MAKAURAU

Consent Form

Project title: ***A community's perspective of wild pigs (Sus scrofa)***

Project Supervisor: ***Dr Cheryl Krull***

Researcher: ***Peter Meynell Edwards***

- O I have read and understood the information provided about this research project in the Information Sheet dated 02 August 2016.
- O I have had an opportunity to ask questions and to have them answered.
- O I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- O I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.
- O I understand that if I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.
- O I understand that this data may be used in future studies but will NOT include any of my personal information or any traceable information relating specifically to me.
- O I agree to take part in this research.
- O I wish to receive a summary of the research findings (please tick one): YesO NoO

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

.....

.....

.....

.....

Date:

Approved by the Auckland University of Technology Ethics Committee on 12 October 2016

AUTEC Reference number 16/327

Note: The Participant should retain a copy of this form

Appendix 4. Indicative Questions

Indicative questions for the semi structure interviews.

Views and Values

1. What are your experiences (hands on contact, observations, or impressions) with wild pigs?
2. What values (importance, worth, usefulness) do you associate with wild pigs?

Use

3. How do you use wild pigs?
4. What does pig hunting mean to you?
5. How much of your diet and family food budget relies on hunted animals?

Tikanga (customs, ways of doing things)

6. In your opinion, what does kaitiakitanga (guardianship) mean to you?
7. How do you practice kaitiakitanga? (In relation to wild pig management)
8. What is your understanding about taonga (treasured) or native species?
9. Do you regard wild pigs as a taonga species? If yes, why? If no, why not?
10. Did you know pigs are not native to NZ? Does this change your views on whether you consider them taonga?
11. Do you have any concerns about wild pigs damaging taonga species or the environment? What are your concerns? If yes, what are they? If no, why not?

Environmental/Conservation management

12. Tell me about the various places or aspects (particular part or feature) of your community that you consider significant.
13. What are your values or opinions surrounding these places of significance that you have spoken about?
14. How do wild pigs affect those values?
15. Some people think pigs should be controlled, do you? If yes then why do you think this is? If you think they should not then what is your reasoning?
16. What do you think about the current level of pig control in this area? Is it enough? Or not enough? And why so?
17. Do you think pig control is taking pigs away from local hunters?
18. Do you think traditional ecological knowledge would benefit conservation management? If yes then how? If no, then why not?
19. Is conservation taken into consideration when you are hunting? If yes then how? If no, then why not?
20. Is there anything else about this matter you would like to talk about?