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Social assessment of inhabited islands for wildlife management and eradication

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ABSTRACT

Eradication of introduced species from inhabited islands requires consideration of both technical and social feasibility. Historically, biologists have struggled to engage successfully in the social components of eradication planning. Island communities have unique features that require consideration in eradication planning. Social impact assessment is a powerful planning tool used widely outside of wildlife management. We outline the core components of a social impact assessment as it could be applied to eradication planning on inhabited islands. We summarise previous experience in social impact assessment and community engagement for introduced predator eradication on inhabited islands, and as an example develop a social profile for inhabited islands of the Hauraki Gulf of New Zealand. We conclude that social impact assessment has great potential to improve eradication feasibility assessment, and should be applied routinely in eradication scoping on inhabited islands.

KEYWORDS

Eradication; invasive species; islands; New Zealand; social impact assessment; wildlife management

Introduction

Islands are a focus for wildlife management and particularly introduced predator control (Jones et al. 2016). Generally, islands targeted for introduced predator eradication are relatively small but vary in distance from nearby larger islands or continents. Because of their comparatively larger size and greater species richness, inhabited islands tend to be high priority sites for biodiversity management and threatened species conservation (Kier et al. 2009), especially in the face of climate change (Courchamp et al. 2014). However, from a social sciences perspective, the eradication of introduced animals from inhabited islands has emerged as a vexing problem in the field of wildlife management (Oppel et al. 2011). In particular, biologists and managers have struggled to engage island communities and stakeholders effectively in the process of introduced mammal eradications (Glen et al. 2013). Their challenge reflects layers of both technical and social complexity (Santo et al. 2015). Eradication is a special case of introduced species management. Complete pest eradication from an island differs from undertaking pest control, and similarly the process of obtaining community support for eradication differs markedly from that required to undertake pest control. Complete pest eradication from an island requires

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almost total community buy-in. So, while recognising eradication is only one option for pest management, the level of community support required for eradication must be more complete than that which is required for control alone.

Options for introduced animal eradication on islands are further confounded by the limited number of eradication tools available to managers; for example, cost-efficient rodent eradication on large islands is almost exclusively achieved with aerial distribution of second-generation anticoagulant brodifacoum baits (USFWS 2013). This limited choice of tools further complicates the challenges required to obtain community support, making alternative management options that do not achieve complete pest eradication possible compromises within a comprehensive conservation decision-making framework (Redpath et al. 2013). Eradication of an introduced animal from an island is also a conservation investment that requires biosecurity effort to prevent reinvasion. An island community thus also plays a major role in the long-term success of an island restoration project, when it includes introduced animal eradication and subsequent biosecurity (Bassett et al. 2016). Also, the implementation of biosecurity on an island following eradication is sometimes perceived as a significant barrier to eradication due to the social cost imposed by the increased logistical burden (e.g. tourist visits to resort islands of the Seychelles, Merton et al. 2002).

Characterising island communities

What constitutes an inhabited island needs to be defined to frame the social challenge of undertaking eradications. We adopt a definition of inhabited island that incorporates physical, social and economic elements. In physical terms, we propose that an inhabited island incorporates the basic infrastructure to enable a community to function socially and economically, such as schools, churches, community buildings or general shared spaces, alongside enterprises delivering goods and services, and opportunities for residents to pursue a range of livelihood opportunities in the public and private sectors. This in turn would enable development of a community. This definition, consistent with social impact analysis in small communities (e.g. Wilkinson 1991), excludes islands where people may live permanently but their particular circumstances would exclude them from requiring social impact assessment during eradication planning, although consultation might still be required. Examples of islands excluded may be those with only government staff (rangers, meteorological, military) and single families (e.g. farming). Our definition of 'inhabited' thus encompasses a community. Such communities can potentially although not necessarily exhibit diverse opinions that can be leveraged for or against the implementation of pest eradication.

While acknowledging some islands are highly urbanised, and some are nation states or territories (McCall 1994), the focus of this article is on islands with relatively small populations and lower population density when compared to a mainland population. This commonly means a more limited range of economic activity and employment opportunities from which residents can derive livelihoods, with a strong focus on primary production. Isolation and difficulty of access is another island feature, although this varies depending on the regularity of transport by sea or air. The length and difficulty of the sea passage is a vital factor in defining the character of many island populations, leading to the characteristics of ruggedness, independence and stoicism frequently attributed to their populations

(Dillon 2006). Another feature is the strong sense of place that comes from the strong physical definition of the island's coastal boundary. There is a shared identity and history of occupation, and often a robust pursuit of survival of the population and their way of life. This identity can be reflected in common definitions of people by length of residence ('birthright') – old-timers versus new comers, and insiders versus outsiders.

Political economy characteristics of island populations and small island states centre around issues of dependence on outside sources of labour, capital and technical skills, and limited capacity to implement development projects. The Intergovernmental Panel on Climate Change (IPCC) chapter on small islands notes that with their relatively small size and physical characteristics – being surrounded by oceans – islands have particular vulnerabilities to climate change, natural disasters and sea-level rise. They typically struggle with low adaptive capacity, and limited resources for economic development, employment or livelihoods and poverty alleviation (Mimura et al. 2007). Furthermore, there is the often-described dependency on external financial assistance (aid) and remittances from workers living off the island.

Much diversity and social change is evident on islands, where small settlements often have their own particular sense of identity. Because of their dependence on primary production (e.g. fishing, aquaculture), conservation work and tourism, which are dependent on the wider national and global economy, island economies are more vulnerable to the vagaries of economic fluctuations (Barker 1984; Leppens 2005). As a result, people commonly come and go with employment opportunities, so islands face a high turnover of residents (Alexander 2015). Young people often leave the island temporarily for education purposes, and later for employment, some returning later in life. Public servants and specialised workers (e.g. doctors or teachers), for which islands commonly depend on outsiders, typically circulate on a regular basis. Where holiday homes and accommodation are available, visitors turn over on a regular daily, weekly or seasonal basis. The definition of an inhabitant of an island, in the sense that they have a legitimate voice with regard to pest eradication, thus also becomes important. In the broadest sense, inhabitants of an island must include land-owners, whether resident or absent ('off-island'), as well as anyone who considers the island their primary place of abode or employment, regardless of their origin.

While an island social effect is recognised in the social science literature, there is a clear conclusion drawn from our observations and the literature that this effect varies considerably with local and other contingent factors. For instance, Grydehøj and Hayward (2014) found in a comparative study of the islands of Scilly and the Isle of Wight that there are distinct differences depending on whether the island in question is on its own or part of an archipelago. In our experience, there are often distinct differences among islands depending on their relative land area and resource base, population, degree of isolation, the availability of regular transport services, and the presence or otherwise of an administrative centre. Our definition of inhabited islands and their inhabitants also includes community-driven groups, which themselves can be important stakeholders in wildlife management. Many other stakeholders can be present on islands and their involvement in wildlife management planning is important. These might include local government agencies, non-government organisations, private company interests and visitors. These stakeholders bring important independent voices to bear on wildlife management, noting here that

island inhabitants may have both their own voice and a voice which belongs to other stakeholder groups.

Islands often have indigenous people present, commonly coastal people, traditionally reliant on the natural resources of the coastal environment as well as available land. Here indigeneity is inferred from recognition of a distinct cultural group, with a particular language and cultural traditions. They have customary social organisation and political systems different from those of the dominant society and, most importantly for wildlife management, a strong collective attachment to land and ocean resources with their own systems of management (after World Bank 2005). Indigenous people can have both a unique voice as inhabitants and a vested stakeholder voice as treaty partners, as is the case in New Zealand.

Given our definition of what constitutes an inhabited island for framing the consequent challenges to wildlife management, we suggest that it should be possible to learn from the characteristics of social life in other relatively small and isolated rural communities. In other words, inhabited islands are a special case of small and isolated communities. For example, strong ties of kinship and associated processes of reciprocity are a key part of the social capital of small rural populations responding to a major policy change (Sampson et al. 2007), and a feature identified in island communities (Arbuckle 1971). Similarly, findings about the importance of multiple job holding add to our understanding of the economic resilience of rural populations (Robertson et al. 2008) and are observed to apply strongly to island populations, with strategic implications for skill development across sectors including farming, fishing, conservation and tourism (Taylor Baines and Associates 2002).

To summarise in respect to island social characteristics, it is evident that even with small populations, inhabited islands can have relatively complex social characteristics with considerable potential diversity of views. Management is therefore almost always about working with different social groups, not just a few individuals. This social diversity provides a context where tools from the social sciences can assist in planning for, implementing and managing wildlife management strategies, including pest eradications.

Social impact assessment

Social impact assessment (SIA) can be defined as the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions and any social change processes invoked by those interventions (Taylor et al. 2004). SIA is used internationally to predict and manage the social impacts of a project, plan, policy or program, often alongside environmental impact assessment, although typically less often (Burdge 2002; Esteves et al. 2012). The process generally combines independent social research and monitoring (during project implementation), public involvement and elements of social and community development (Taylor et al. 2004). In most applications, SIA has been required by legislation, such as the *Resource Management Act 1991* (RMA) in New Zealand, or by institutional requirements such as the operational policies of the World Bank or International Finance Corporation; both of which are examples of triggers for undertaking SIA (Taylor & Burdge 2004). Furthermore, SIA is often seen more broadly as a vital component of socially driven, sustainable development and therefore undertaken as part of corporate

responsibility in development planning (Esteves et al. 2012), in due diligence by government departments (Cosslett et al. 2004) and as an integral part of the social licence to operate (Harvey & Bice 2014).

We consider SIA should be a key tool in the planning and implementation of wildlife management, particularly pest eradication, on islands. It is a way of working constructively with island inhabitants and stakeholders to consider the feasibility and planning of eradication, including any technical options for undertaking the eradication, and opportunities for local involvement in them. Just as identifying the biodiversity outcomes of an eradication programme is important (Jones et al. 2016), so too is determining the social impacts on island inhabitants and communities in the short and longer term. Examples include the impacts that eradication activities and ensuing ecological changes have on local land uses including agriculture, tourist activity, employment, island collective actions, identity and the level of cohesion in the community. With community support, these social changes will have an important influence on the successful implementation and viability of biosecurity to prevent pest reinvasion (Bassett et al. 2016). SIA should be conducted autonomously from the agencies undertaking the eradication to maintain impartiality and ensure community buy-in to the process. However, those undertaking SIA must also have the requisite level of technical understanding of how any eradication might be undertaken.

The process of SIA generally proposed for planning and implementation of projects and programs, such as island eradications, will require a number of elements: scoping, profiling, participatory approaches, scenario assessment, monitoring and management (Taylor & Warren 2001; Taylor et al. 2004). We consider each of these here, with an emphasis on social profiling. In each of the elements, an important aspect of the SIA approach is to ensure that ecological effects of eradication, including through the stages of planning, implementation and ongoing management, are always linked to their potential social consequences. It is therefore insufficient to limit our understanding of say the impacts of an aerially distributed toxin on a waterway to water quality and ecology, and necessary to consider the impacts on all human stakeholders of the waterway, such as those sourcing it for agriculture or drinking water, or recreational uses, and the potential effects on their health, lifestyles or cultural values.

Scoping sets the scene for an SIA by defining the nature of the problem, the key issues likely to be faced, the basic nature of the island people and communities (initial social profile) and the potential for, and best approach to, public involvement (including collaborative methods that can be applied). Scoping will include the initial steps in the social profile, such as identifying variables of social data, useable sets of data and key sources of these data. Scoping will also identify whether the island in question should be treated as a single population or comprises a number of settlements or subpopulations. It will also be important for identifying the presence or interest of indigenous populations, and key stakeholders or partners in the planned eradication, including island leadership and systems of social organisation and collective action.

Profiling is the overview and analysis of the current social context, often referred to as the social baseline, and sits alongside the ecological baseline as an essential part of planning any eradication. The work involved in social profiling should follow naturally from the activity of scoping and can be initiated to some extent in conjunction with the scoping

exercise. In this case, the two activities, and any report produced, might more conveniently be referred to as a preliminary assessment.

Social profiling involves analysis and overview of the current social context, and also of historical trends. The social characteristics and history of the area being assessed should be described, as a point of departure for estimating effects of change. A social overview should be developed from the findings of the scoping, for assessments of plans or decisions that potentially have important social effects. The overview contains an interpretation of data on social issues and trends and will serve as a source of information prior to the estimation and comparison of effects for alternative options or a selected option. The selection of matters to include in a profile will be guided by key aspects of island social life, including the derivation of livelihoods from the natural environment, and the ability of an island community to participate in and accommodate the social and economic changes that will accompany wildlife management interventions such as pest eradication.

The social overview should include (after Taylor et al. 2004):

- a description of social trends and current conditions such as trends in population and demography, visitors and lifestyles, community organisations, leadership and social capital;
- an analysis of significant social and cultural values existing in the assessment area and the relationship of these values to the proposed change, including the presence of indigenous values;
- a description of the local and regional economy, sources of livelihoods and potential economic links between the proposed eradication and the island community;
- maps depicting areas of influence of public agencies such as local authorities and their land use zones, tribal boundaries, and a narrative description of this institutional layer;
- a plan for the assessment of social effects, including social factors to be used, and definitions or interpretations of key variables and their sources;
- documentation of data sources and a discussion of assumptions underlying their analysis and projection into the future; and
- discussion of the reliability of data, biases, inconsistencies or gaps in the data that might affect the analysis.

Appropriate data sources of the following types should be consulted:

- available statistical data – census reports and other data compiled by local and central government agencies, as well as by private organisations;
- written social data – letters to editors, newspaper articles, written testimonies, histories, graduate theses, annual reports and research studies pertaining to the local area;
- observation and interaction data – talking and participating with people in the area, in their work, leisure and other social settings; and systematically observing variables selected on the basis of the preliminary investigation and other important variables that may emerge;
- survey data – survey methods and results where structured interviews are carried out or mail or internet questionnaires are administered (preliminary investigation must precede any survey as part of an SIA, to validate the method, selection of questions and the variables the questions represent);

- expert panels – collectives of recognised experts convened independently or specifically for the SIA can provide both external and local knowledge;
- public participation data – information gathered during the public participation process (data may be in any of the above forms); and
- agency or project personnel – these are a source of descriptive data for communities within which they live and work.

For the purposes of social profiling of island communities, the variables and data sources in Table 1 are suggested as a starting point.

Participatory approaches involve or collaborate with the community, but can vary considerably in the extent of that involvement and the level of empowerment that communities attain (Howitt 2011). According to the spectrum of public involvement (Roberts 2003), the level of participation can range from the elementary activity of informing people about opportunities and decisions, through collaboration (sharing of power to

Table 1. Framework for social profiling applicable to pest eradication on inhabited islands.

Social aspect	Description	Data sources
Geography and history	Island location, size, land and climate characteristics	Maps and books
	Settlement history	Scientific publications
	Pest species summary and management history	Local/traditional knowledge
Governance and planning strategy	Relevant governing structures and overview of current strategies	Regional and local governing body reports and agencies
	Overview of government conservation management and influence	Indigenous people's organisations
	Overview of building and resource consents and conservation concessions	Books and scientific publications
		Local authority (e.g. building consents)
		Directly requested data (e.g. conservation concessions)
Infrastructure	Reticulated services	Governing body and supplier management reports
	Settlement areas and pattern	Books and maps
	Transport facilities and services	Internet website search
	Emergency services	
	Health and education facilities	
Population overview	Population number and change over time	Census data
	Number of occupied versus unoccupied dwellings	Agency data and reports
		School rolls
	Age, sex, ethnicity, income, qualification, and employment sector overview	
Visitor overview	Annual visitor arrivals, with seasonal trends	Local governing body reports
	Visitor bed availability (or guest night data where applicable)	Industry reports and books
	Visitor attractions and tour operators	Personal communications with transport operators and commercial operator websites
		Census data (census night count vs. usually resident count)
Community influences and social cohesion	Community organisations and groups, with a particular focus on environmental and conservation influence	Website search
		Online newspaper archives including national press and local press for each island where applicable
	Social communication networks (e.g. radio, newspaper)	
	Articles in press news trend overview	
Attitudes towards pest control	Participation in conservation	Environmental attitudes survey
	General attitudes towards pest control	Reports
	Direct experience of pest control	Public dialogue and meetings
	Support for pest eradication on the island	

decide and implement), to full empowerment or delegation of authority to plan, decide and implement. The nature and timing of participatory involvement can be critical to the success of a project. For example, it can be critical to include opposing voices about an eradication programme, whatever their argument, as early as possible in the planning process, to avoid entrenching systematic opposition. A participatory approach can also help identify what relative demand there might be for top-down versus bottom-up governance of pest eradication, especially where there are already existing pest control initiatives or community-based approaches to solving local problems.

Scenario assessment is an essential part of the predictive aspect of an SIA, especially when there is considerable uncertainty around biophysical and social interactions (Taylor & Mackay 2016). Here the focus is on working with the affected population to consider the social impacts of eradication by considering one or more potential futures. Scenarios can include a number of projection elements, such as likely impacts on populations, land uses, employment, visitor numbers, social organisation and social capital, lifestyles, and the values of subpopulations and social groups. Examples might include considering how eradication of an introduced species may lead to increased visitor numbers, and what impact this would have on the island's character, community cohesion, economy and biosecurity. Scenario assessment also provides a way to understand trade-offs communities may or may not be willing to make with regard to pest eradication. With reference to invasive mammal eradications, examples may include trading-off antitoxin values to achieve rodent-free status, or sacrificing community control to allow external (off-island) agencies to manage an eradication campaign.

Monitoring, mitigation and management affect the social impacts of an eradication over time and the social response to planning and implementation, reflecting the absorptive capacity of a community and how it adapts. Consideration of mitigation and management can begin during scenario assessment. The outcome of monitoring should identify where additional capacity building may be required during the implementation of pest eradication and any strategies necessary to help the community adapt to it.

SIAs have a history of application on islands outside of wildlife management, for example with regard to tourism resorts (Shera & Matsuoka 1992), forestry (Forests Monitor Ltd, 1997) and oil and gas developments (Barker 1984; Regeneris Consulting Ltd 2013). Sutton (1992) presents an SIA for visitor management on Kapiti Island, New Zealand, prior to mammal eradication, and Topajka Shaw Consulting Limited (2006) undertook SIA on the neighbouring community for rodent eradication from uninhabited Pomona Island. SIA has also been used in other terrestrial and marine reserve contexts in New Zealand (Taylor & Buckenham 2003; Cosslett et al. 2004). Given the important history of applying SIA as part of project development on islands, we propose that SIA should be considered integral in the development of eradication feasibility studies on inhabited islands.

Eradications on inhabited islands

Using a different working definition of an inhabited island comprising more than 10 island residents, eradications of introduced species have occurred on over 100 inhabited islands around the world, although generally these have been eradications of spatially limited plant or invertebrate incursions that threaten human health or agriculture

(Glen et al. 2013). Most introduced mammal eradications have been on uninhabited islands where they threaten biodiversity values, although a small number have occurred on islands with residents, the exact number depending on the definition of 'inhabited'. A number of inhabited islands around the world are now being considered for introduced mammal eradication, although to date we are not aware of any formal SIAs being included in the planning. Here, we consider a selection of these islands as case studies and discuss how social engagement with communities and stakeholders has occurred to date, and how the circumstances of each island may have contributed to the current status and progress in introduced mammal eradication.

Rodent eradication from Lord Howe Island, Australia, was first proposed in 2001 and planning commenced in 2006 (Wilkinson & Priddel 2011). Opposition to rodent eradication on the island was initially thought to be by a small number of residents; however, in 2015, dialogue on the island culminated in a referendum that was only narrowly in favour (52 versus 48 per cent) of rodent eradication. As appealing as a democratic approach such as this might be to island eradications, we do not believe that this is an appropriate consensus developing framework, particularly when governance on Lord Howe Island is more participatory than autocratic (Reis & Hayward 2013).

New Zealand's third and fifth largest inhabited islands (Rakiura or Stewart Is. and Aotea or Great Barrier Is.) are considered important islands where introduced cat and rodent eradication is currently technically feasible (Beaven 2008; Ogden & Gilbert 2009). Both islands have more recently had very different assessments undertaken. Morgan and Simmons (2014) undertook an economic cost–benefit analysis of predator eradication from Rakiura. They found that eradication was unlikely to have a net positive economic gain from tourism alone, but became positive with the addition of ecosystem service valuation. However, an SIA is more than simply a cost–benefit analysis of a development. McEntee and Johnson (2015) undertook a broad participatory study of community values on Aotea. This study revealed complex relationships among environment, economy and community, which could not be easily disentangled, such as when partitioning pest control off as only a biodiversity exercise. Further, deeper conflicts in the community that would affect the social feasibility of pest eradication were also revealed. These included conflicts about the benefits and risks of using toxins for pest eradication, and towards increased tourism benefiting the economy while threatening the isolation.

Both islands have had important rodent eradications from their satellite but not main islands (Clout & Russell 2006). The most important of these is the eradication of rats in 1992, and again in 2011 following reinvasion, from Ulva Island, which is now a major tourism revenue contributor to Rakiura; and the unsuccessful eradication of rats in 2008 from Kaikoura Island, where they are now controlled until reinvasion from Aotea can be prevented. The respective successes and failures of each of these rat eradications, within the wider social context of each island, may have had important consequences for subsequent support and capacity for other rat eradications on satellite islands (e.g. Taukihepa off Rakiura and Rakitu Island off Aotea).

After an unsuccessful eradication attempt in 1992, and a halted eradication process due to opposition from one resident in 1997, rats were finally eradicated in 2002 from Rakino Island (Bassett et al. 2016). The island has a small population of about two dozen permanent residents, with a community hall, library and island committee, thus meeting our definition for being inhabited. For each attempt, no formal SIA was undertaken, but

the two operations prior to the successful one might have served as sensitising operations for the local community. In addition, each operation was ground-based and thus did not raise the potentially controversial issue of aerial distribution of baits (Russell 2014). Additional mammal eradications on New Zealand islands with a small number of permanent residents, but lacking social infrastructure, include Moturoa, Rotoroa and Pakatoa Islands (Clout & Russell 2006).

In the United Kingdom, a number of rat eradications have also taken place on islands with permanent residents (Lock 2006; Bell et al. 2011). However, most of these islands do not meet our definition of inhabited, although in 2013, rats were eradicated from St Agnes and Gugh Islands in Scilly, with a combined population of just under 100, a primary school and church. As for New Zealand's Rakino Island, all these eradications were ground-based, rather than aerial, which may have contributed to the capacity to work through on-island opposition, although off-island animal rights and welfare activists did oppose these operations. On the inhabited UK overseas territory of Tristan de Cunha, South Atlantic Ocean, rodent eradication by aerial delivery of toxin was proposed in 2004. Local community and government consultation was undertaken in 2008, with consultation about eradication of mice from uninhabited Gough Island (Varnham et al. 2011). The Tristan de Cunha community focused on risks from the eradication to their livelihoods, and sought compensation by way of water tanks and stock protection. Ultimately, rodent eradication on Tristan de Cunha was considered currently unfeasible (Varnham et al. 2011).

Social profile for Hauraki Gulf islands

Social impact assessment methods were used to consider social characteristics of the Hauraki Gulf, New Zealand, inhabited islands to enhance planning for ongoing pest eradications and management. We present here a social profile from this work based on a literature review, secondary data and a public attitudes survey of four contrasting inhabited islands in the Hauraki Gulf Marine Park (Figure 1). New Zealand has a total of 335 islands of 0.05 km^2 (5 ha) or more in size. Of these, 31 are classed by Atkinson and Taylor (1991) as inhabited, with residents who are not connected with government ranger or meteorological stations. This set excludes islands that are farmed but not permanently inhabited. Following our stricter definition only 10 of these islands are inhabited in a sense that meaningfully affects eradication implementation and could benefit from SIA.

Initially created in 1967 as the Hauraki Gulf Maritime Park, and from 2000 the Hauraki Gulf Marine Park, the aim of the park was to achieve integrated management of the area (Bassett et al. 2016). The park covers an area of 1.2 million hectares of ocean on the east coast of the Auckland and Waikato regions, and includes the Waitemata Harbour, Firth of Thames, and eastern coastline of the Coromandel Peninsula. Within the area are six marine reserves, over 15 protected islands requiring a permit to land, and 13 coastal regional parks (Barbera 2012). In addition, the area is home to New Zealand's naval base and biggest commercial harbour and port, numerous smaller ports and marinas, and is part of the largest recreational and tourist area in the region. In 2008, there were an estimated 2.9 million nature-based tourist trips within the Hauraki Gulf, 26 per cent of the national total (Barbera 2012).

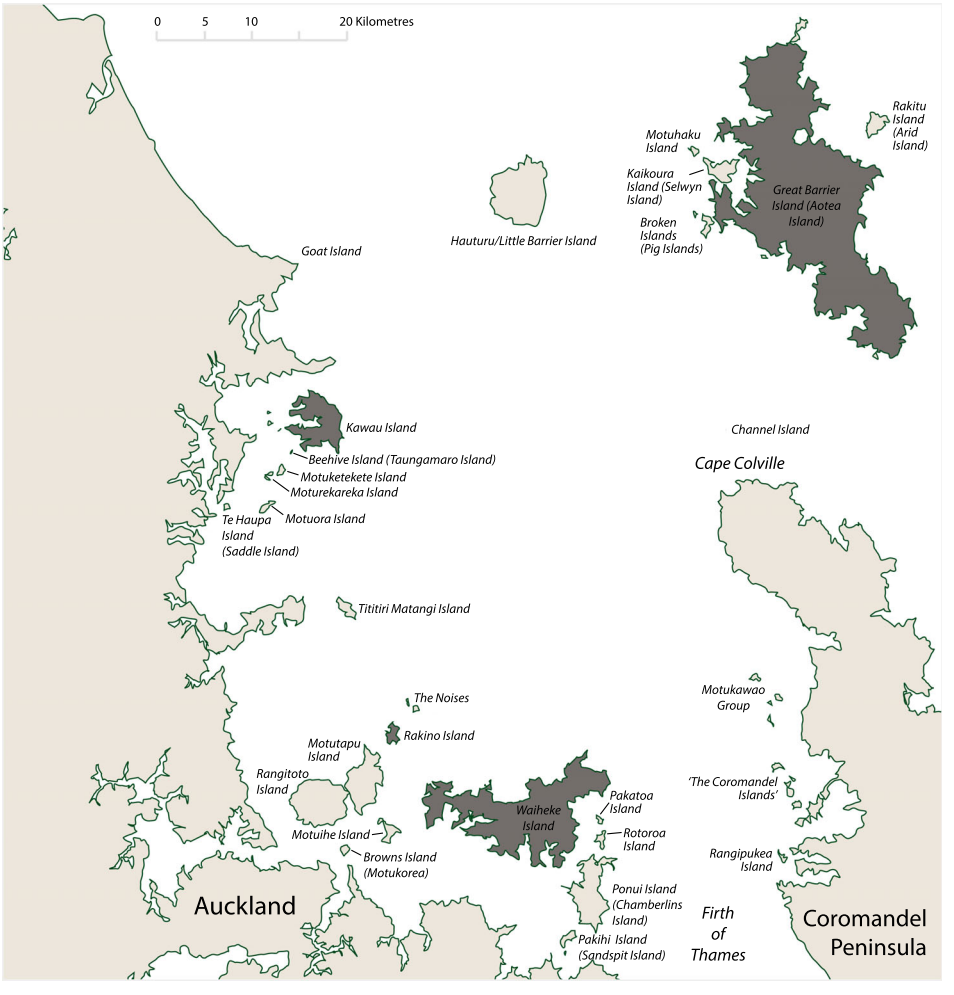

Figure 1. Islands of the Hauraki Gulf Marine Park. Inhabited islands as defined and included in the social profile are highlighted (modified from Bassett et al. 2016).

The islands of the Hauraki Gulf provide an opportunity for exploring the role of community in island pest eradications. While invasive mammals have been eradicated from many of the smaller uninhabited islands and one small inhabited island, several of the larger inhabited islands continue to have one or more introduced mammal species present (Bassett et al. 2016). This illustration of social profiling considers four of these inhabited islands: Rakino, Kawau, Aotea and Waiheke.[1] Baseline profiles for each island from which invasive mammal eradication and management options can be assessed as part of the wider SIA process provide a basis for a comparative analysis and synthesis of key factors for future management strategies.

The baseline profile was developed from published and online sources, including official statistics from the 2001, 2006 and 2013 New Zealand censuses, regional and local government reports and strategies, published resources (books and scientific journals), and commercial operator websites (Table 1). The public attitudes survey draws on a wider research survey undertaken from 24 August to 24 December 2015 regarding these

communities' environmental and pest control attitudes, enabling a context-specific insight. A self-administered postal survey was sent to all property owners on Rakino, Kawau and Aotea, and a random sample of 20 per cent of property owners on the more populated Waiheke. Environmental attitudes were studied using a number of benchmarked survey questions including environmental citizenship and environmental concern. Pest control attitudes were identified through respondents' knowledge and experience of pest control, open comments and responses to a series of general statements relating to pest control.

The social profile reflects and illustrates a wide range of social and cultural influences normally associated with a baseline social profile, such as population composition, livelihoods, tourism and visitor trends, and other likely influences associated with wildlife management and pest eradication. These include a general overview of the geography and typology of the islands, permanent versus holiday-home property ownership, governance and resource planning and strategy, including a focus on conservation strategy, and social services, community networks and social cohesion. A summary of some of the key population data for the four islands, the Auckland region and New Zealand is provided in Table 2. General visitor numbers and growth indicators, such as building consents, are provided in Table 3, and more specific environmental and pest control attitude data are summarised in Table 4.

Some common themes are identified when comparing the population data (Table 2). All four islands have a high rate of unoccupied dwellings on census night, indicating a level of absentee ownership, therefore raising potential for the exclusion of non-resident property owners if not adequately included within social dialogues. This increases the possibility of later conflict within the community. Typically, there are higher occupation levels for the agriculture and fisheries sectors compared with the national trend, along with elementary occupations such as labourers. This suggests a higher level of engagement with the land and outdoors and therefore likely increased exposure to eradication methods and experience of their impact on the natural environment. Three of the islands have a declining population, with only Waiheke tracking the positive New Zealand growth trend. The high levels of self-employment and low-median incomes are likely to be associated with the declining populations (on Kawau and Aotea in particular). This, in turn, may be linked to livelihoods associated with visitors, given the disparity between these islands and Waiheke's visitor numbers (Table 3) but a similar reliance on service occupations (Table 2). These factors combined suggest potentially less tolerance for, and ability to absorb, any immediate downturn in primary industry income that may occur during the eradication process, such as temporary removal of stock during eradication, or subsequent moratoriums on marine harvesting or constraints on visitor activities. However, in the longer term, the declining populations on some islands may experience benefits associated with successful eradication operations, from a likely increase in wildlife, with potential to increase visitor numbers if marketed successfully, as occurred on neighbouring uninhabited predator-free Tiritiri Matangi (Russell et al. 2015). These considerations should be made in association with the governance and planning strategies of each island alongside infrastructure such as transport networks, to enable a more informed view. While this information is not summarised here, it produces interesting insights, with Waiheke having a higher frequency and capacity of transport than all other islands, along with more visitor attractions. However, both Kawau and Aotea, and in particular Aotea,

Table 2. Summary of population statistics for the usually resident population from the 2013 New Zealand census, and per cent change from 2001 to 2013 for population, median income and school rolls.

	Rakino[a]	Kawau	Aotea	Waiheke	Auckland region	New Zealand
Area and population						
Island/region size (km^2)	1.5	19	285	92	4894	268,021
Usually resident population (*n*)	16	78	885	8238	1,415,550	4,242,048
Population density (per km^2)	11	4	3	90	289	16
Population per cent change 2001–2013	−43%	−26%	−13%	15%	22%	13%
Age						
Youth (<15 years)	15%	7%	16%	18%	21%	21%
Working (15–64 years)	75%	58%	63%	64%	68%	65%
Elderly (≥65 years)	10%	35%	21%	18%	11%	14%
Ethnicity						
European	89%	95%	91%	90%	59%	74%
Maori	11%	4%	18%	11%	11%	15%
Pacific peoples	6%	NA	3%	3%	15%	7%
Asian	6%	NA	1%	3%	23%	12%
Middle Eastern, Latin American, African	NA	NA	1%	1%	2%	1%
Other	NA	4%	3%	2%	1%	2%
School roll per cent change 2001–2013						
Primary school (Year 1–8)	NA	NA	−39%	13%	7%	−1%
Secondary school (Year 9–13)	NA	NA	NA	−2%	29%	14%
Qualification (tertiary level)[b]	23%	31%	14%	27%	20%	20%
Income						
Median income	$30,600	$25,300	$19,000	$27,200	$29,600	$28,500
Residents earning above NZ$50,001	20%	15%	11%	26%	29%	27%
Median income per cent change 2001–2013	178%	102%	61%	77%	40%	54%
Source of income						
Wages	67%	24%	36%	47%	57%	58%
Self-employed	20%	38%	31%	27%	14%	15%
Pension	13%	48%	27%	25%	15%	19%
Interest and dividends	33%	43%	26%	25%	19%	21%
Benefits	13%	14%	25%	17%	17%	17%
Work insurance	NA	NA	1%	<1%	<1%	1%
Other	7%	NA	2%	<1%	2%	2%
None	NA	5%	3%	<1%	10%	7%
Occupation sector						
Legal/administrators/managers	8%	27%	17%	19%	18%	15%
Professionals	8%	18%	11%	16%	19%	17%
Technicians	25%	9%	10%	14%	15%	13%
Clerks	NA	NA	8%	7%	11%	10%
Service and sales workers	NA	9%	12%	14%	13%	14%
Agriculture and fishery workers	25%	NA	10%	7%	2%	6%
Trades workers	NA	9%	8%	8%	7%	7%
Plant and machine operators and assemblers	NA	NA	8%	4%	5%	7%
Elementary occupations	17%	9%	16%	10%	10%	11%
Unoccupied dwellings	60%	85%	52%	32%	6%	10%

[a] Statistics New Zealand data for Rakino are summarised within a larger mesh block, in which uninhabited Rangitoto and Motutapu (Islands) are included. Figures shown here are re-calculated for Rakino only.

[b] Tertiary-level qualification includes Bachelor Degree, Honours and above. Source: Statistics New Zealand.

Due to random rounding of Statistics New Zealand data, and respondents being permitted to tick multiple categories, not all percentages within a sub-section total 100.

have future strategic outcomes relating to increasing visitors, suggesting some motivation of the community in this regard. Rakino has the lowest transport frequency and capacity of all the islands, no on-island services and visitor attractions, and no future plan identified towards increasing visitor numbers, suggesting increased tourism is not currently a motivation of this community.

Table 3. General social profile indicators relating to visitors, building activity and conservation concessions.

	Rakino	Kawau	Aotea	Waiheke
Estimated visitor numbers per annum	NA	~20,000[a]	~40,000[b]	~700,000[c]
Number of building consents issued per annum[d]	1	9	3	37
Total value of residential building work undertaken per annum ($ = NZD)[d]	$263,000	$3,611,650	$2,270,000	$31,293,853
Total value of non-residential work undertaken per annum ($ = NZD)[d]	$80,000	NA	$102,000	$4,806,150

[a] Source: Thompson (2010).
[b] Source: Auckland Council (2014).
[c] Source: Baragwanath (2010).
[d] Source: Statistics New Zealand (2013).

Table 4. Social profile data relating to attitudes towards pest control for four islands in the Haruaki Gulf.

Social aspect	Rakino	Kawau	Aotea	Waiheke
Participated in conservation last 12 months	52%	64%	57%	49%
Member of an environmental organisation	21%	41%	37%	26%
Have done rat control (home or conservation)	59%	87%	84%	73%
Support for rat eradication on each island[a]	93%	82%	67%	75%

Source: authors' survey data.
[a] Support for rat eradication on each island is based on the respondent's attitude to the island on which they own property, with % for 'yes' responses shown (as opposed to the other options of no, unsure, and depends).

One similarity among all four islands is a strong sense of environmental awareness, with many survey respondents actively involved in conservation within the last 12 months (Table 4). This highlights the level of engagement and motivation of these communities in pest control, and the value they place on their environment. Additionally, while all four islands have some form of on-island social representation regarding environmental issues, engagement is particularly strong for Kawau and Aotea. These islands have had an ongoing discourse regarding pest control and eradication for many years. On Kawau, there is high support for rat eradication although there is a more contentious history regarding introduced wallaby management, without resolution to date. On Aotea, while outright support for rat eradication is still strong, it is notably less than for the other three islands. Lower support might be an outcome of past engagement in the community, which resulted in misinterpretation and misinformation (Ogden & Gilbert 2011), which has added to social barriers regarding pest eradication.

These examples of social profiling from the Hauraki Gulf Islands highlight how social aspects are interrelated and few, if any, can be considered independently (McEntee & Johnson 2015). For example, there are strong linkages among aspects of governance and planning, population, infrastructure, livelihoods, visitors and community influence, demonstrating the complexity associated with a broader overarching identity of each island. This complexity confirms the need to apply a tool such as SIA when developing plans for island pest eradication and ongoing control.

Conclusions

Pest eradications on islands are a significant environmental, social and technological intervention for both the ecological and human communities. SIA has been used as a robust

tool during other interventions of similar potential scale of impact, including on islands, and is well suited to the process of both planning and implementing an eradication on an inhabited island, and subsequent management of biosecurity. Key aspects of SIA are scoping, the social profile, assessments of effects, monitoring, mitigation and management, and processes of public involvement. We demonstrated how a social profile of four inhabited islands in the Hauraki Gulf of New Zealand, using a multi-method approach, revealed the four communities were in fact quite diverse and each must be treated distinctly. Just as ecologists would recognise the context-specificity of pest identity (e.g. foxes *Vulpes vulpes* are different from cats *Felis catus*) and habitats in planning eradications, it is equally important to acknowledge differences among islands in their social make-up, and likely differences in how they will respond to an eradication proposal, as has been reflected by international experience.

At this early point in social research for eradication implementation on inhabited islands, it is useful to consider some key themes in reviewing progress and utility in using a social profile framework. Four key aspects of a social profile are vital to consider: values, livelihoods, absorptive capacity and collective action. The values which residents attach to their physical, ecological and social environment, and the multiple ways the extant ecosystem contributes to the social and economic well-being of island residents, will play a critical role in assessing impacts. The maintenance of livelihoods from a diverse economic base, including self-sufficiency from the land and marine environment, is often a key in these island communities and their attitudes to change. A key theme in developing projects from a community base is the capacity of the community to accommodate or drive change around its leadership, skills, social capital and organisational structures. Often island communities have a range of internal conflicts and past negative experiences that work against their ability to develop a cohesive, collective approach to managing change either internally or externally driven.

On any inhabited island, the challenge is not necessarily the people *per se*, but how they are engaged. SIA should therefore be considered alongside technical feasibility (e.g. Lord Howe Island Board 2009; Bell & Bramley 2013) in preparatory studies for island eradications. Where a complete eradication is deemed either technically or socially too challenging or risky at the current time, it will be necessary to consider a revised strategy such as ongoing pest control as a pathway to future eradication when circumstances change. In this regard, eradication proponents must be prepared for concessions. However, the objectives of any pest control strategy and the chances of achieving them are likely to be enhanced if they consider social aspects and take the views of residents and stakeholders into account from the start.

Note

1. Following convention, the use of 'island' after each place name is now dropped when using the original Maori names.

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References

Alexander, R 2015, 'Career decision making in island communities: applying the concept of the Aquapelago to the Shetland and Orkney Islands', *Shima: The International Journal of Research into Island Cultures*, vol. 9, pp. 38–52.

Arbuckle, GA 1971, *The Chatham Islands in perspective*, Hicks Smith & Sons, Wellington, p. 113.

Atkinson, IAE & Taylor, RH 1991, *Distribution of alien mammals on New Zealand islands*, Contract Report No. 91/50, DSIR Land Resources, Lower Hutt and Nelson, New Zealand.

Auckland Council 2014, *Aotea Great Barrier local board plan 2014*, Auckland Council, Auckland, p. 63.

Baragwanath, L 2010, *The Waiheke project: overview of tourism, wine and development on Waiheke Island*, The University of Auckland, Auckland, New Zealand, p. 69.

Barbera, M 2012, *Towards an economic valuation of the Hauraki Gulf: a stock-take of activities and opportunities*, Auckland Council technical report TR2012/035, Auckland Council, Auckland, New Zealand, p. 125.

Barker, P 1984, *Peat mining on the Chatham Islands: proposals, context and social concerns*, Studies in Rural Change no. 11, University of Canterbury, New Zealand, p. 59.

Bassett, IE, Cook, J, Buchanan, F & Russell, JC 2016, 'Treasure Islands: biosecurity in the Hauraki Gulf Marine Park', *New Zealand Journal of Ecology*, vol. 40, pp. 250–266.

Beaven, B 2008, *Scoping the potential to eradicate rats, wild cats and possums from Stewart Island/Rakiura*, Stewart Island/Rakiura Community & Environment Trust, New Zealand, p. 139.

Bell, E, Boyle, D, Floyd, K, Garner-Richards, P, Swann, B, Luxmoore, R, Patterson, A & Thomas, R 2011, 'The ground-based eradication of Norway rats (*Rattus norvegicus*) from the Isle of Canna, Inner Hebrides, Scotland', in CR Veitch, MN Clout & DR Towns (eds.), *Island invasives: eradication and management*, IUCN, Gland, Switzerland, pp. 269–274.

Bell, P & Bramley, A 2013, *Eliminating predators from Stewart Island: scoping report to investigate issues of technical feasibility*, Department of Conservation, Wellington, New Zealand, p. 23.

Burdge, RJ 2002, 'Why is social impact assessment the orphan of the assessment process?' *Impact Assessment and Project Appraisal*, vol. 20, pp. 3–9.

Clout, MN & Russell, JC 2006, 'The eradication of mammals from New Zealand islands', in F Koike, MN Clout, M Kawamichi, M De Poorter & K Iwatsuki (eds), *Assessment and control of biological invasion risks*, IUCN, Gland, Switzerland and Cambridge, UK, and Shoukadoh Book Sellers, Kyoto, Japan, pp. 127–141.

Cosslett, C, Buchan, D & Smith, J 2004, *Assessing the social effects of conservation on neighbouring communities: guidelines for Department of Conservation staff*, Department of Conservation Technical Series 29, Department of Conservation, Wellington. p. 68.

Courchamp, F, Hoffman, BD, Russell, JC, Leclerc, C & Bellard, C 2014, 'Climate change, sea-level rise and conservation: keeping island biodiversity afloat', *Trends in Ecology and Evolution*, vol. 29, pp. 127–130.

Dillon, D 2006, 'Islands, islandness and nursing : advanced nursing practice in rural remote and small island areas', Unpublished MNurs thesis, Otago Polytechnic, New Zealand.

Esteves, AM, Franks, D & Vanclay, F 2012, 'Social impact assessment: The state of the art', *Impact Assessment and Project Appraisal*, vol. 30, pp. 35–44.

Forests Monitor Ltd 1997, *Environmental and social impact assessment: Sabel timber company operations on Santa Isabel Island, Solomon Islands*.

Glen, AS, Atkinson, R, Campbell, KJ, Hagen, E, Holmes, ND, Keitt, BS, Parkes, JP, Saunders, A, Sawyer, J & Torres, H 2013, 'Eradicating multiple invasive species on inhabited islands: the next big step in island restoration?', *Biological Invasions*, vol. 15, pp. 2589–2603.

Grydehøj, A & Hayward, P 2014, 'Social and economic effects of spatial distribution in island communities: comparing the Isles of Scilly and the Isle of Wight, UK', *Journal of Marine and Island Cultures*, vol. 3, pp. 9–19.

Harvey, B & Bice, S 2014, 'Social impact assessment, social development programmes and social licence to operate: tensions and contradictions in intent and practice in the extractive sector', *Impact Assessment and Project Appraisal*, vol. 32, pp. 327–335.

Howitt, R 2011, 'Theoretical foundations', in F Vanclay, & AM Esteves (eds), *New directions in social impact assessment: conceptual and methodological advances*, Edward Elgar, Cheltenham pp. 78–95.

Jones, HP, Holmes, ND, Butchart, SHM, Tershy, BR, Kappes, PJ, Corkery, I, Aguirre-Muñoz, A, Armstrong, DP, Bonnard, E, Burbidge, AA, Campbell, K, Courchamp, F, Cowan, P, Cuthbert, RJ, Ebbert, S, Genovesi, P, Howald, GR, Keitt, BS, Kress, SW, Miskelly, CM, Oppel, S, Poncet, S, Rauzon, MJ, Rocamora, G, Russell, JC, Samaniego-Herrera, A, Seddon, PJ, Spatz, DR, Towns, DR & Croll, DA 2016, 'Invasive-mammal eradication on islands results in substantial conservation gains', *Proceedings of the National Academy of Sciences*, vol. 113, pp. 4033–4038.

Kier, G, Kreft, H, Lee, TM, Jetz, W, Ibisch, PL, Nowicki, C, Mutke, J & Barthlott, W 2009, 'A global assessment of endemism and species richness across island and mainland regions', *Proceedings of the National Academy of Sciences*, vol. 106, pp. 9322–9327.

Leppens, J 2005, 'Fishing for tourists: perceptions from the Stewart Island community's of the creation of Rakiura National Park', Unpublished PhD thesis, Lincoln University, New Zealand.

Lock, J 2006, 'Eradication of brown rats *Rattus norvegicus* and black rats *Rattus rattus* to restore breeding seabird populations on Lundy Island, Devon, England', *Conservation Evidence*, vol. 3, pp. 111–113.

Lord Howe Island Board 2009, *Draft Lord Howe Island rodent eradication plan*, Lord Howe Island Board, Lord Howe Island, p. 110.

McCall, G 1994, 'Nissology: a proposal for consideration', *Journal of the Pacific Society*, vol. 17, pp. 1–14.

McEntee, M & Johnson, S 2015, *Enabling an ecological vision for Aotea Great Barrier Island: understanding community perspectives and aspirations*, Aranovus Ltd., Auckland, New Zealand, p. 67.

Merton, D, Climo, G, Laboudallon, V, Robert, S & Mander, C 2002, 'Alien mammal eradication and quarantine on inhabited islands in the Seychelles', in CR Veitch & MN Clout (eds.), *Turning the tide: the eradication of invasive Species*, IUCN, Gland, Switzerland and Cambridge, UK, pp. 182–198.

Mimura, N, Nurse, L, McLean, RF, Agard, J, Briguglio, L, Lefale, P, Payet, R & Sem, G 2007, 'Small islands', in ML Parry, OF Canziani, JP Palutikof, PJ van der Linden & CE Hanson (eds.), *Climate change 2007: impacts, adaptation and vulnerability*, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK, pp. 687–716.

Morgan, G & Simmons, G 2014, *Predator-free Rakiura: an economic appraisal*, Morgan Foundation, Wellington, New Zealand, p. 52.

Ogden, J & Gilbert, J 2009, 'Prospects for the eradication of rats from a large inhabited island: community based ecosystem studies on Great Barrier Island, New Zealand', *Biological Invasions*, vol. 11, pp. 1705–1717.

Ogden, J & Gilbert, J 2011, 'Running the gauntlet: advocating rat and feral cat eradication on an inhabited island – Great Barrier Island, New Zealand', in CR Veitch, MN Clout & DR Towns (eds.), *Island invasives: eradication and management*, IUCN, Gland, Switzerland, pp. 467–471.

Oppel, S, Beaven, BM, Bolton, M, Vickery, J & Bodey, TW 2011, 'Eradication of invasive mammals on islands inhabited by humans and domestic animals', *Conservation Biology*, vol. 25, pp. 232–240.

Redpath, SM, Young, J, Evely, A, Adams, WM, Sutherland, WJ, Whitehouse, A, Amar, A, Lambert, RA, Linnell, JDC, Watt, A & Gutiérrez, RJ 2013, 'Understanding and managing conservation conflicts', *Trends in Ecology & Evolution*, vol. 28, pp. 100–109.

Regeneris Consulting Ltd 2013, *Socio-economic study of oil and gas development in the falklands*, Regeneris Consulting Ltd, Manchester, UK, p. 58.

Reis, A & Hayward, P 2013, 'Pronounced particularity: a comparison of governance structures on Lord Howe Island and Fernando de Noronha', *Island Studies Journal*, vol. 8, pp. 285–298.

Roberts, R 2003, 'Involving the public', in HA Becker & F Vanclay (eds.), *The international handbook of social impact assessment: conceptual and methodological advances*, Edward Elgar, Cheltenham, UK, pp. 258–277.

Robertson, N, Perkins, HC & Taylor, N 2008, 'Multiple job holding: interpreting economic, labour market and social change in rural communities', *Sociologia Ruralis*, vol. 48, pp. 331–350.

Russell, JC 2014, 'A comparison of attitudes towards introduced wildlife in New Zealand in 1994 and 2012', *Journal of the Royal Society of New Zealand*, vol. 44, pp. 136–151.

Russell, JC, Innes, JG, Brown, PH & Byrom, AE 2015, 'Predator-Free New Zealand: conservation country', *BioScience*, vol. 65, pp. 520–525.

Sampson, KA, Goodrich, CG & Taylor, CN 2007, A social assessment of community response to forest policy change in South Westland, New Zealand', *Society and Natural Resources*, vol. 20, pp. 199–212.

Santo, AR, Sorice, MG, Donlan, CJ, Franck, CT & Anderson, CB 2015, 'A human-centered approach to designing invasive species eradication programs on human-inhabited islands', *Global Environmental Change*, vol. 35, pp. 289–298.

Shera, W & Matsuoka, J 1992, 'Evaluating the impact of resort development on an Hawaiian island: implications for social impact assessment policy and procedures', *Environmental Impact Assessment Review*, vol. 12, pp. 349–362.

Statistics New Zealand 2013, '2013 Census QuickStats about a place', <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=13170#13170>

Sutton, ST 1992, 'Kapiti Island: a case study in social impact assessment (setting the limits)', Unpublished MSc thesis, Lincoln University, New Zealand, p. 199.

Taylor Baines and Associates 2002, *Cooperation and commitment: the Chatham Islands economic review, 2002*, Taylor Baines and Associates, Christchurch, New Zealand, p. 29.

Taylor, CN, Bryan, CH & Goodrich, CG 2004, *Social assessment: theory, process and techniques*, (3rd edn.), Social Ecology Press, Middleton, Wisconsin, USA, p. 194.

Taylor, N & Buckenham, B 2003, *Social impacts of marine reserves in New Zealand, Science for conservation 217*, Department of Conservation, Wellington, New Zealand, p. 58.

Taylor CN & Burdge, R 2004, 'When is social impact assessment required?', in J Rabel & R Burdge (eds), *The concepts, process and methods of social impact assessment*, Social Ecology Press, Middleton, Wisconsin, USA, pp. 147–160.

Taylor, CN & Mackay, M, 2016, 'Practice issues for integrating strategic social assessment into the setting of environmental limits: insights from Canterbury, New Zealand', *Impact Assessment and Project Appraisal*, vol. 34, pp. 110–116.

Taylor, N & Warren, J 2001, 'Social assessment in the tourism sector in New Zealand', in A Dale, N Taylor & M Lane (eds), *Social assessment in natural resource management institutions*. CSIRO Publishing, Collingwood, pp. 218–230.

Thompson, W 2010, 'Mayor bows to outcry from upset islanders', *New Zealand Herald*, 25 August 2010.

Topajka Shaw Consulting Limited 2006, *Pomona island charitable trust: social impact assessment*, Topajka Shaw Consulting Limited, Te Anau, New Zealand, p. 35.

U.S. Fish and Wildlife Service 2013, *South Farallon Islands invasive house mouse eradication project: revised draft environmental impact statement*, U.S. Fish and Wildlife Service, San Francisco, USA, p. 267.

Varnham, K, Glass, T & Stringer, C 2011, 'Involving the community in rodent eradication on Tristan da Cunha', in CR Veitch, MN Clout & DR Towns (eds.), *Island invasives: eradication and management*, IUCN, Gland, Switzerland, pp. 504–507.

Wilkinson, KP 1991, *The community in rural America*, Greenwood Press, Westport, p. 152.

Wilkinson, IS & Priddel, D 2011, 'Rodent eradication on Lord Howe Island: challenges posed by people, livestock, and threatened endemics', in CR Veitch, MN Clout & DR Towns (eds.), *Island invasives: eradication and management*, IUCN, Gland, Switzerland, pp. 508–514.

World Bank 2005, *Operational manual OP 4.10 indigenous people*. World Bank, Washington DC, USA.