




Social dimensions in island restoration: some case studies from Aotearoa – New Zealand

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ABSTRACT

Islands have been a focus for biodiversity conservation in Aotearoa – New Zealand for more than 50 years. Recognition of the impacts of invasive predators, the significant outcomes that can be anticipated following their removal, and growing capacity to eradicate suites of pests from larger islands have underpinned this progress. Increasingly, attention is being directed at treating larger inhabited islands as well as mainland restoration sites where people live nearby and where the social dimensions become increasingly important. The case studies presented here illustrate changes to better acknowledge, consult and collaborate with tangata whenua (local Indigenous people). A focus on forging and maintaining relationships with other local stakeholders such as landowners and community groups is also illustrated. Other social dimensions such as political advocacy and securing institutional and financial support are also outlined in the case studies. We conclude that while much is being learned about opportunities to address social dimensions, those involved in promoting and implementing island restoration will need to remain flexible and apply locally nuanced approaches that reflect social as well as other circumstances at each site.

Keywords: Ahuahu – Great Mercury Island, Antipodes Island, Aotea – Great Barrier Island, biodiversity outcomes, community-led conservation, eradication, invasive species, iwi Māori, locally nuanced approaches, The Noises Islands, Tiritiri Matangi Island.

Introduction

Actions to eradicate invasive mammals from islands constituted an important development in the evolving story of biodiversity conservation in Aotearoa – New Zealand (hereafter referred to as New Zealand) (Towns *et al.* 2018). The initial focus was on removing farm animals and eradicating feral goats (*Capra hircus*) and pigs (*Sus scrofa*) to protect habitats and plant communities, with recovery of native communities sometimes enhanced by revegetation (Forbes and Craig 2013; Parkes 2021).

Despite earlier doubts about the feasibility of eradicating rodents from islands, successful operations on small islands in the 1980s, and evidence from the consequent ecological outcomes quickly led to progressively larger islands being treated (Towns and Broome 2003; Russell and Broome 2016). Today the eradication of rodents, often along with suites of other mammals, from islands has emerged as the preferred strategy for biodiversity conservation of the Department of Conservation (DOC) (Towns 2011). By the early 2000s, the eradication of invasive mammals, especially predators, and the re-introduction or introduction of threatened species to island refuges were key actions in recovery plans for an array of invertebrates, reptiles and birds. Island eradication operations against invasive mammals have now become almost routine technical exercises for DOC, building on the knowledge and lessons learned from earlier experimentation and the development of best practice procedures (Keitt *et al.* 2015; Broome *et al.* 2019; Samaniego *et al.* 2021).

As the size and habitat complexity of islands being treated grew, along with an increasing ability to eradicate multiple pests, goals to re-establish biological communities and restore

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island ecosystems were promoted (Towns et al. 2009, 2018). The initial focus for these eradication and restoration initiatives in New Zealand was on highly protected government-administered island reserves with restricted public access. However, there has been increasing public involvement ranging from assisting with restoration on islands administered by DOC to initiating invasive mammal eradications and subsequent restoration on islands that are privately owned (Towns et al. 2013), including some that are inhabited. Island restoration has thus shifted from scientific, technical and logistical considerations to complex arrays of social issues that must also be satisfied if eradication is to be achieved (Russell et al. 2015; Parkes et al. 2017), restoration goals sustained, and the islands secured against pest reinvasions (Morrison et al. 2011; Phillips et al. 2019).

Island restoration successes have also stimulated initiatives to control suites of pests to near-zero densities at sites on the main islands of New Zealand, at so-called 'mainland islands' to achieve island-type responses (Saunders and Norton 2001). Apart from challenges in defending mainland sites from pest reinvasions from adjoining areas, mainland islands also differ from islands surrounded by water in that more people such as adjoining landowners, recreational and resource users and conservation groups are likely to have views on how the site should be managed, and on how they might wish to be involved. Accommodating different interests and engaging stakeholders has emerged as an important component of these ongoing control programmes. Despite these complexities, successes in island eradications, and more recently in controlling pests to low densities at mainland sites, have transformed restoration strategies and led to a proliferation of community-led pest control programmes throughout New Zealand (Innes et al. 2019), many of which are now part of the national Predator Free 2050 programme (Russell et al. 2015).

Crucial to the success of restoration initiatives and biodiversity conservation more generally in New Zealand, has been the support of iwi Māori (indigenous tribes of New Zealand) who are the kaitiaki, or guardians of the sites and of native species present. This guardianship role derives from statutory requirements for central and local government agencies to give effect to the principles of the Treaty of Waitangi, which was signed between the Crown and iwi Māori in 1840 (Anderson et al. 2014). For example, DOC has facilitated dialogue with iwi and is supporting the development of partnerships involving multiple organisations and supporting co-governance arrangements – on islands and elsewhere (Towns et al. 2019).

A series of case studies is used to determine how different social factors can influence activities and outcomes at island restoration projects. These island-based initiatives have a longer history than those on the mainland (e.g. Innes et al. 2019), and should provide many lessons applicable to similar approaches being attempted elsewhere. The case

studies illustrate how diverse and dynamic local stakeholder needs, as well as more strategic requirements, can require approaches to addressing social dimensions that are sophisticated, ongoing and adaptive. Furthermore, these responses will often be site and community-specific. It is concluded that locally 'nuanced' approaches to island restoration based on shared values, common understandings and agreed goals and priorities are likely to be the most productive and sustainable.

A summary of the locations, descriptions and biodiversity outcomes of the five case studies are in Table 1.

The case studies were prepared by:

- Stephen Horn, Antipodes Island; Sue Neureuter and Katina Conomos, The Noises Islands; Peter Corson, Ahuahu – Great Mercury Island; Mel Galbraith, Tiritiri Matangi Island; Judy Gilbert, John Ogden and Kate Waterhouse, Aotea – Great Barrier Island.
- Authors of the case studies are identified by their initials.
- Opinions expressed in the case studies are those of the individual authors.

Case studies

Antipodes Island mouse eradication (SH)

Background

Antipodes Island (2050 ha) is an uninhabited island administered by DOC in New Zealand's sub-Antarctic islands area (Table 1, Fig. 1). It is a World Heritage site recognised for its outstanding biodiversity values and endemism (World Heritage Convention 1998). Mice (*Mus musculus*) were accidentally introduced around 1908 (Veale et al. 2018) and were the only mammalian pest species present. They caused severe damage to the vulnerable ecosystem, suppressing endemic land-bird taxa, which includes parakeets (*Cyanoramphus unicolor* and *C. hochstetteri*), pipit (*Anthus novaeseelandiae*) and snipe (*Coenocorypha aucklandica*) (S. Horn, unpubl. data), degrading the invertebrate fauna and associated ecosystem functions (Marris 2000; McIntosh 2001; Russell et al. 2020) and suppressing populations of smaller species of small burrow-nesting seabirds including black-bellied storm petrels (*Fregetta tropica*) and grey-backed storm petrels (*Garrodia nereis*) (Imber et al. 2005).

Eradicating mice from Antipodes Island was logistically challenging. The expedition-style operation required marine vessels to transport three helicopters, 18 staff, 65 tonnes of bait and 30 tonnes of helicopter fuel 800 km south-east of mainland New Zealand where a temporary camp and helicopter hangar were established on arrival. Two applications of bait were completed between 18 June and 12 July 2016, before deconstructing temporary infrastructure and returning to mainland New Zealand on 6 August 2016 (Horn and Hawkins 2017, Fig. 2).

Table 1. Location, description and biodiversity outcomes from the five case studies.

Island and location	Description	Management history	Biodiversity outcomes	References
Antipodes Island (49.40°S, 178.46°E)	Largest (2050 ha) of two uninhabited Nature Reserve islands within New Zealand Sub-Antarctic Islands UNESCO World Heritage area	Mice eradicated by aerial spread of rodenticide using helicopters in 2016; declared mouse-free in 2018	Increased abundance of invertebrates and higher encounter rates of pipits and snipe	Horn <i>et al.</i> (2019); Russell <i>et al.</i> (2020)
The Noises Islands (36.41°S, 174.57°E)	Privately owned archipelago of three main islands (1–22 ha) and associated rocks and reefs	Norway rats eradicated beginning on Maria Island (1 ha) in 1960 and completed with Otata (22 ha) and Motuhoropapa (9 ha) in 2003; long history of research on rodent eradication and biosecurity	Recovery of storm petrels on Maria and recolonisation by at least two species of burrowing seabirds on the two largest islands; substantial increases in the abundance of geckos	
Ahuahu - Great Mercury Island (36.35°S, 175.55°E)	Largest (1872 ha) and only privately owned island in Mercury Islands archipelago	Goats eradicated 1981, ship rats, kiore and cats eradicated 2014 through aerial spread of rodenticide and trapping; declared pest free in 2016; Argentine ant and weed control under way	Bartlett's rata from nursery stock planted 1980s; rare invertebrate (tusked wētā) and near flightless forest bird (tīeke) from neighbouring islands reintroduced 2021; natural recolonisation by rare teal and at least three species of seabirds; increased abundance of forest birds	D. Towns, unpubl. data
Tiritiri Matangi Island (36.60°S, 174.88°E)	One main island (220 ha) and one neighbouring islet; retired farm regenerating to coastal forest	Kiore eradicated 1993 through community-led initiative; active replanting and reintroductions/translocations of birds, reptiles and invertebrates beginning 1974; ongoing monitoring/management of invasive species	Recovery of vegetation cover from 6 to 60%; translocation of 11 species of birds, at least six of which now form self-sustaining populations; tuatara and three species of lizards reintroduced and one species of giant wētā (flightless crickets); two species of seabirds recolonising; reappearance of one gecko species formerly unknown to be present	Galbraith and Cooper (2013); Graham <i>et al.</i> (2013)
Aotea - Great Barrier Island (36.20°S, 175.41°E)	Large offshore island (28 512 ha) with associated islands and archipelagos including Motu Kaikoura (564 ha) and Rakitū (315 ha)	Goats eradicated 2006; private initiatives include development of sanctuaries at Windy Hill with feral cat and rat control; and peninsula with predator-fence at Kotuku Peninsula; eradication attempts against localised invasions of Argentine ants and Australian rainbow skinks	Reintroduction of toutouwai (North Island robin) to Windy Hill	Ogden and Gilbert (2011)

Monitoring was carried out two summers later with no sign of mice detected and success was declared in 2018 (Horn *et al.* 2019). This outcome continues a long history of conservation success in the region to relieve affected islands from the impacts of invasive vertebrate pests (Torr 2002; McClelland 2011).

The project had been a long-term objective of DOC but differed from previous projects through its initiation via a philanthropic partnership and public outreach to partly crowd-fund the work. Inspired by conservation concerns in the Southern Ocean (Simmons and Morgan 2012), The Morgan Foundation partnered with DOC to launch the

'Million Dollar Mouse' project (MDM) to raise NZD1 million towards eradicating mice from Antipodes Island (Horn and Hawkins 2017). In 2012, The Morgan Foundation led a high-profile media campaign seeking public donations to be matched dollar for dollar. Fundraising activities ranged from auctioning conservation experiences in collaboration with DOC, to project talks and some schools launching their own fundraising initiatives in response to educational visits.

High levels of community engagement was achieved in launching the project despite Antipodes Island being extremely remote, accessible by permit only and largely unrecognised. Public campaigning raised over NZD200 000



Fig. 1. Antipodes Island, looking to Stack Bay. Photo Finlay Cox.



Fig. 2. Aerial baiting, Antipodes Island. Photo Stephen Horn.

in direct donations. A further NZD100 000 was donated through WWF-New Zealand and Island Conservation also contributed NZD100 000 with additional in-kind support. The Morgan Foundation matched those contributions, donating close to NZD400 000. National Geographic sponsored NZD50 000 towards a preliminary research voyage in 2013 and the remaining cost (NZD2 724 465) was funded by DOC, which underwrote the project. The project was undertaken between 2014 and 2018 for a total cost of NZD3.574 million (Horn and Hawkins 2017). A significant level of in-kind support was also provided by DOC and The Morgan Foundation. There were also donated services, discounts or indirect support. Examples included ISO Ltd donating Stevedoring services for loading and unloading the ship and an international amateur radio group visiting the island which subsidised preparatory infrastructure and work.

Initiation and commitment to the project in 2012 rapidly began once philanthropic interest was established. This commitment occurred without a prior feasibility study being completed and as a result, cost estimates at project

initiation were based on limited detail and were overly optimistic regarding the logistical challenges of shipping, helicopters and infrastructure (McClelland 2012). A feasibility study was subsequently drafted, which pointed out the likely underestimation of costs. Detailed operational planning commenced in 2014 and included an assumption that all shipping would be provided by the NZ Navy. However, this assistance was not feasible and created a large cost pressure relative to initial estimates. Partnership with external backers and public supporters was an important motivator for DOC and partners to stay committed despite serious challenges. These included a disruptive organisational restructure for DOC in 2013; damage to the field hut on Antipodes Island from a landslide in 2014; a delay in implementation from 2015 to 2016 due to the difficulty in sourcing a ship and helicopters; two successive years of cyclones in the Pacific interrupting NZ Navy support for preparations; and higher than expected costs (Horn and Hawkins 2017). Operational challenges were overcome through perseverance and motivated and creative suppliers who bought into the outcome and went to extraordinary effort to co-design solutions (Horn et al. 2019).

Important lessons

Public engagement was overwhelmingly positive. Communications outreach was amplified by partners promoting the work across their networks. Real time imagery was an important tool for engaging audiences and satellite internet access on Antipodes Island opened communications opportunities previously unavailable to remote projects. Blogs were regularly posted on a project website sharing ecological and historical context and operational progress (New Zealand Department of Conservation and The Morgan Foundation 2018). A North Island primary school integrated the project into their curriculum and letters and a skype call were shared with the team on the island. The media team achieved considerable mainstream coverage including seven primetime TV news articles and several radio, newspaper and magazine stories. Social media engagement peaked at over 70 000 views per month on the MDM Facebook page and DOC social media pages. A film captured the project's success story and a borrowed Google Earth camera recorded 360° views to showcase the island on Street View (Reardon and Padgett 2018) and inspire future work beyond the life of the project.

Social feasibility is essential for projects eradicating pests on inhabited islands (Russell et al. 2018) and increasingly valuable for restoration on uninhabited islands as projects grow in scale, complexity and cost. The MDM project highlighted the power of storytelling to bring people along for the journey, engaging them to value and protect places – even when they are out of sight and where humans are not the focus. Importantly, a social commitment created an expectation that parties will stay the course when the going

gets tough. This gave project managers the confidence to create momentum through engagement and to invest appropriately to solve complex problems and reduce reputational risk. The momentum created by the MDM project subsequently led DOC to complete a feasibility study into eradicating feral pigs, feral cats (*Felis catus*) and mice from Auckland Island (46 000 ha), now the last of New Zealand's sub-Antarctic islands where mammalian pests remain (S. Horn, unpubl. data).

The Noises Islands (SN and KC)

Background

Located in the Hauraki Gulf Marine Park 25 km from Auckland, The Noises are a group of islands, rock stacks and reefs with a diverse range of marine habitats (Table 1, Fig. 3). The islands have been clear of invasive predators since 2003, contain some of the most intact indigenous vegetation in the inner Hauraki Gulf (Fig. 4), and are now home to a range of endemic species including geckos and giant flightless crickets (*Deinacrida heteracantha*).

Currently under the guardianship of the Neureuter family, the islands provide safe breeding grounds for seabirds with



Fig. 3. The Noises Islands. Photo Joseph Neureuter.



Fig. 4. Coastal vegetation, The Noises Islands. Photo Rod Neureuter.

the highest seabird diversity in the inner Gulf. Although the terrestrial environment is recovering, without care and protection of the surrounding marine environment, the unique relationships between seabirds and other components of the marine ecosystem can be expected to continue to decline. (<http://www.thenoises.nz>).

There has been extensive coastal and marine degradation over the past century due largely to overharvesting, sedimentation and pollution. Kina (sea urchin; *Evechinus chloroticus*) barrens have replaced kelp forests once dominated by *Ecklonia radiata*. Dredges have scoured sandy bottoms. Rocks that were once carpeted by green-lipped mussels; (*Perna canaliculus*) are now bare. Seabird numbers, particularly little blue penguins (*Eudyptula minor*), have declined dramatically and spotted shags (*Stictocarbo punctatus*) that were once common have all but disappeared (Anon 2020a).

The Neureuters' ambition for The Noises is bold: 'To enable restoration and regeneration of the marine environment surrounding The Noises islands, to deliver holistic protection – of the land and the sea'. The geographic location of The Noises, along with their attributes as seabird islands has encouraged the Neureuters to promote this initiative as an opportunity to demonstrate the benefits of protection that links terrestrial and marine ecosystems.

Despite the challenges, establishing a Marine Protected Area is essential for the recovery of The Noises marine environment. In partnership with the Auckland Museum and University of Auckland, the family is working to identify potential opportunities to enhance marine protection such as resolving resource use conflicts and increasing political support.

There are three main strands to this initiative: (1) developing relationships with iwi Māori; (2) building the science and knowledge; and (3) strengthening government relationships and lobbying.

Iwi Māori relationships. Crucial to success is developing trusting relationships with local iwi who identify with and to the islands. The largest island in the group, Ōtata, contains a substantial midden. Auckland Museum, in collaboration with the Neureuter family and iwi have undertaken two archaeology excavations of the midden. The results will not only provide a baseline for understanding and measuring the changing marine environment around Ōtata but will also provide further information about historical occupation of the island and the Gulf more widely.

Building the science and knowledge. The University of Auckland is conducting surveys where a marine biodiversity dataset for The Noises is being built. Auckland Museum is developing a framework and long-term monitoring programme to track ecological changes – using biological indicators in both terrestrial and marine environments. This work underpins efforts to document degradation and to guide a restoration programme. It is also proposed to

develop indicators of change in a Mātauranga Māori (traditional knowledge) framework, working alongside iwi and the Neureuter family who have observed closely The Noises environment for generations. Local trials are also being undertaken to actively manage kina barrens and to enhance regeneration of marine communities.

Government relationships and lobbying. Legislative tools for marine protection are inadequate. Currently, marine protected areas make up just 0.4% of New Zealand waters. The 1971 Marine Reserves Act has not kept pace with the development of relationships and expectations between the Crown and Treaty of Waitangi Partners (iwi Māori). In the Hauraki Gulf Marine Park, six small marine reserves have been created under the Marine Reserves Act, covering 0.3% of the Park. The Neureuter family regularly hosts government decision-makers and policy advisors at The Noises to foster a better understanding of ongoing impacts on the marine environment. These visits are an opportunity to emphasise that a new path forward is needed that provides for appropriate cultural recognition and co-governance for marine protection and management in New Zealand, and which recognises the importance of ecosystem-based management.

Important lessons

At the outset, embarking on a project to establish a form of marine protection around the islands seemed like a linear project. However, activities have not been linear and the need to be flexible, patient, urgent and adaptive if restoration goals are to be achieved have been important lessons.

Although it can be expected that this project will demonstrate the interconnectedness of ecosystems, for ecosystem-based management to be applied here, it must extend to recreational and commercial fisheries management and environmental management more broadly. This is imperative as conservation practitioners face a wider set of issues and emerging challenges such as climate change and the impacts of growth and development.

Project partners have realised that they are seeking systemic political and institutional change. Strong networks will be crucial if experiences and impacts are to be shared. Although difficult to quantify, partners are confident that progress is being made and the project is having a ripple effect elsewhere, as well as being influenced by progress made in other restoration projects throughout the Gulf. A momentum for change is building as the level of public understanding is growing. Partners have recognised that in addition to building stakeholder support, encouraging political will for change is also important.

Most importantly, project partners have also learned that embracing indigenous knowledge and honouring relationships with iwi Māori affords a window into a different and valuable world view. Māori believe there is a deep kinship between humans and the natural world. All life is connected. People are not superior to the natural order; they are part of it.

‘Kaitiakitanga’ involving guardianship, protection and preservation is a way of managing the environment based on the traditional Māori world view and incorporating a more holistic approach. Project partners see this as both a privilege and a responsibility.

Ahuahu – Great Mercury Island (PC)

Background

Ahuahu is the only island within the Mercury Islands archipelago in private ownership (Table 1). The other islands are nature reserves managed by DOC where public access is limited (Fig. 5). The two smallest islands in the group have always been pest-mammal free and provide a benchmark for restoration activities elsewhere (Towns and Atkinson 2004; Towns et al. 2016). The entire Mercury Islands archipelago is now free of mammalian predators following a series of eradication projects, the final being the removal of two species of rats (ship rats; *Rattus rattus* and kiore; *R. exulans*) and feral cats from Ahuahu in 2014.

The Mercury Islands are listed internationally as an important bird area and are included in tentative lists for UNESCO World Heritage status due to their rich seabird and reptile fauna, and endemic invertebrate species such as the large Mercury Islands tusked wetā (*Motuweta isolata*) (Fig. 6). Ahuahu (1872 ha) is now New Zealand’s eighth largest (and the largest privately owned) pest-free island. It is almost five times the combined area of all the other islands in the archipelago. People have been able to access Ahuahu through an open invitation from the landowners since the 1970s. This has provided opportunities for public engagement in Mercury Islands conservation issues over the years. About 14–16 people are resident on the island across six households and are mostly employed by the owners to manage a dry stock farm, which covers about a third of the island.

Ahuahu has significant cultural importance for Māori people with oral histories indicating Pari-nui-te-ra, the white



Fig. 5. Ahuahu – Great Mercury Island with crown – managed Mercury Islands in background. Photo Rob Chappell.

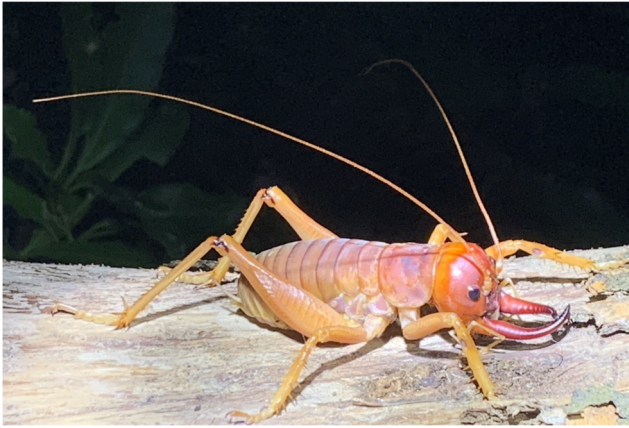


Fig. 6. Male Mercury Islands tusked wētā. Photo Peter Corson.

cliffs on the eastern side of Ahuahu, as the first point of New Zealand seen by Polynesian navigators (Gudgeon 1892). Ahuahu is recognised as the heart of Ngāti Hei's rohe (traditional territory) with an unbroken connection to the island since time immemorial (Ngāti Hei Deed of Settlement 2017). There are over 100 years of unbroken relationships between Ngāti Hei and Ahuahu's owners including the current owners since 1975. Archaeological work undertaken for a decade on Ahuahu as a partnership between the owners, Ngāti Hei, Auckland University and Auckland Museum has revealed nationally significant evidence of early occupation (Furey *et al.* 2017; Holdaway *et al.* 2019).

Despite decades of conservation work across the archipelago, it was a chance encounter in 2009 between one of the owners and a DOC ranger that led to an ecological survey of Ahuahu carried out by volunteer biologists. The ensuing conversations and surveys led to a partnership agreement between DOC and the owners that facilitated the eradication of ship rats, kiore and feral cats in 2014, 22 years after the rest of the archipelago had become pest free (Corson and Hawkins 2016). Since 2014, an ecological management plan has been developed between DOC and Ahuahu's owners, with input from Ngāti Hei (Corson *et al.* 2018).

An attempt to eradicate Argentine ants (*Linepithema humile*) is currently ongoing on Ahuahu, funded primarily by the island owners. This work has attracted thousands of volunteer days from people wanting to contribute to the island's conservation. The relationships between the owners of Ahuahu, iwi Maori, DOC and archaeologists remains crucial to managing restoration objectives across the archipelago.

Important lessons

During the eradication (2012–2016). The amount of time devoted to community communication (3011 h) was

greater than that for operational planning elements for the eradication (2360 h), illustrating the importance placed on effective stakeholder engagement. Having eradication best practice (Broome *et al.* 2017) as a basis for discussion was useful in conversations with owners and residents, particularly when articulating how risks changed if deviating from best practice.

One of the most important lessons from managing the partnership between DOC and the owners of Ahuahu was to keep the management group small. During the eradication project, the governance group consisted of just three people: (1) an owners' representative; (2) a senior DOC manager; and (3) a chairperson with technical skills and access to technical advice. A project manager was employed by DOC and reported to the governance group. This model allowed the Ahuahu eradication to deliver on time and on budget and continues to be used to guide ecological management across the archipelago.

Teamwork was a key success of the Ahuahu experience with island residents, DOC staff and contractors working as partners for the eradication operation and subsequent biosecurity. Teamwork was fostered by having well communicated project objectives jointly owned by everyone involved. An important learning was the need to respect and retain existing local relationships, such as with suppliers, supporters, the boating community and regular island visitors. A long-standing relationship between the owners of Ahuahu and Ngāti Hei remains a key attribute.

An agreement between DOC and the island's owners underpinned a joint funding arrangement. This project highlighted the need for business and financial management support systems that can inform decisions and satisfy accountability requirements for multiple parties whilst also supporting flexibility to adapt to changing local conditions and emerging opportunities.

Following the eradication (2016–2021). Staff turnover, both within DOC and on-island, has required further time to build and sustain the partnership. For example, a biosecurity plan and surveillance infrastructure prepared for Ahuahu sometimes languished or was inadequately implemented. However, the partnership with DOC has been rejuvenated with recent (March–April 2021) translocations of tusked wētā and forest birds (tīeke, *Philesturnus rufusater*) to Ahuahu and invertebrates from Ahuahu to other islands in the archipelago (see also Table 1).

The restoration of Ahuahu and its place in the Mercury Islands archipelago demonstrates the need for equitable partnerships based on shared understandings and mutual respect, especially on privately owned islands. Further opportunities exist to broaden the restoration focus by extending the partnership to a wider group of stakeholders within the community, as on Tiritiri Matangi Island. Additionally, the funding base for the ant eradication could be broadened to improve the chances of success and to

extend and enhance the significant ecological and archaeological research. This engagement is central to longevity of the project, which relies on local people understanding the need for biosecurity and the risks posed by vessels visiting Ahuahu.

Perhaps the key principle comes from the whakataukī (Māori proverb): *Ehara taku toa I te toa takatahi, engari he toa takitihi. My successes are not mine alone, but from many.*

Tiritiri Matangi Island (MG)

Background

Tiritiri Matangi Island is a 220 ha scientific reserve situated 3 km from the mainland in the Hauraki Gulf, New Zealand. The island is managed by DOC in partnership with local iwi Māori, Kawerau ā Maki and Ngāti Paoa, who have mana whenua (traditional guardianship) over the island.

Tiritiri Matangi is typical of an inshore island degraded over a long history of human occupation, culminating with European farming practices between the 1850s and mid-1970s. Despite the almost total loss of vegetation during this occupation, small populations of the more resilient native species persisted on the island. A restoration programme, started in 1984 has sought to re-establish ecological integrity through activities that have included revegetation, introduction of selected taxa and eradication of invasive species (Table 1, Fig. 7). The island, often promoted as a successful model of environmental stewardship, has international recognition, and gained a listing as one of the top 25 restoration projects in Australasia by the Global Restoration Network in 2009 (McDonald 2009). The island's history and the restoration programme are described in detail elsewhere; e.g. Craig *et al.* (1995), Rimmer (2004), Galbraith and Cooper (2013) and Towns *et al.* (2018).

Public access has always been an objective of the restoration programme and was essential to achieve restoration goals on an island with, at least initially, limited access. Wide exposure of the restoration activities through local media created and has maintained a high public profile. That in turn has generated substantial interest from volunteers to assist with the restoration activities (Fig. 8). Through their involvement with the project, avocational¹ volunteers from a wide spectrum of the community have gained an appreciation of conservation principles and many have developed a strong personal identification with the island.

Public participation in the island's restoration was formalised through the formation of a community group in 1988 as Supporters of Tiritiri Matangi (SoTM). The group, currently with a membership of about 1500, started primarily with a fund-raising function but has evolved through experience and a gain in credibility to embrace a variety of more complex managerial and ecological roles. SoTM



Fig. 7. Hihi – stitchbird, Tiritiri Matangi Island. Photo Mel Galbraith.



Fig. 8. Tiritiri Matangi Island. Photo M. Godfrey.

members' experiences have included revegetation, species conservation, biodiversity monitoring, invasive species management and conservation advocacy. This range of restoration experiences is more comprehensive than those of participants in younger projects (Galbraith *et al.* 2021) where the restoration focus is more likely to be dominated by revegetation and control of invasive species (Galbraith *et al.* 2016). For example, for species translocations, which are complex management actions (Price 2012), invariably have SoTM volunteers involved, and one translocation, that of the rifleman (*Acanthisitta chloris*), was initiated and managed by SoTM volunteers.

Participants associated with Tiritiri Matangi regard the existence of monitoring and research as a significant contribution to the project's success (Galbraith *et al.* 2021).

¹Avocational is used here to indicate a difference between volunteers providing labour only and those that contribute a degree of expertise (Galbraith *et al.* 2016). It is suggested that the term is most appropriate as it is indicative of the skills that practitioners gain through their participation in projects.

The Tiritiri project was ‘born out of scientific research’ (Galbraith and Cooper 2013) with a decade of research in place before public involvement in the restoration got under way. Through SoTM, volunteers have the opportunity to participate in the research activities, reflecting an increased willingness by managers and researchers to accept non-specialised contributions to research. Research continues to have a high profile for the island, with ongoing collaboration between SoTM volunteers, DOC personnel (including species recovery groups), ecological professionals and post-graduate researchers. The SoTM advocacy network also provides a mechanism for researchers to disseminate ecological findings about the island. Tiritiri Matangi exemplifies the benefits of local communities participating in ecological research predicted by Saunders (1998).

Visitors to the island have the option to join walks led by volunteer SoTM guides who emphasise conservation and the restoration process, have contributed to positive reporting displayed though the ‘Tripadvisor’ online travel review website. A visit to Tiritiri Matangi is posted as ‘#1 of 203’ things to do for the local area (Tripadvisor 2021). Increased public environmental literacy must be an inherent outcome where the visitors’ experience is such that it elicits a high satisfaction score. SoTM have established a process to subsidise the cost of the visits for many schools, further contributing to the understanding of conservation within the local communities.

A Memorandum of Understanding between SoTM and DOC has provided a basis for a shift towards ‘participatory governance’ (Edwards 2001), and has ensured the sharing of management decision making, albeit on a local scale. The memorandum will guide the future restoration trajectory of the island, with volunteers continuing to work collaboratively with DOC and in consultation with other stakeholders.

Important lessons

Perhaps the true success of the project is exemplified by the ecological confidence that the restoration practitioners now have. The longevity of the project has allowed volunteers to demonstrate their commitment and learnings, and gain credibility, trust and respect over that time. These attributes have in turn, facilitated avocational participants to expand their contribution to the project to include strategic planning for biodiversity and the island’s infrastructure, and almost sole responsibility for the visitor experience.

Although overall management of the island is the legislated responsibility of DOC, many restoration activities are initiated increasingly by SoTM (Galbraith 2013). This reflects the adoption of a deliberate policy by government to foster public engagement in conservation, to establish and maintain partnerships, and to support communities to develop the capability they need to do conservation work (Bell 2003).

Aotea – Great Barrier Island (JG, JO and KW)

Background

At 28 000 ha, with almost 90% forest coverage, and free of possums (*Trichosurus vulpecula*), mustelids, feral goats, deer, Norway rats (*Rattus norvegicus*) and hedgehogs (*Erinaceus europaeus*), Aotea should be a biodiversity ark (Fig. 9). But it is not; much of its biodiversity is affected by some of the highest densities of ship rats and kiore to be found in New Zealand, alongside an abundance of feral cats and pigs.

Alongside this loss of biodiversity are overlaying factors including limits on DOC’s capacity to support management of public conservation land covering a large portion (60%) of the island, as well as the challenges associated with achieving agreement and support from a small, ageing, low income population with strong views on the need to protect the island from the impact of mammalian pests, but a lack of consensus on how this is best achieved (Ogden and Gilbert 2009, 2011). This is a community that values highly its independence, holds alternative to mainstream views, and has a history of resistance to institutional leadership.

However, over the past 20 years, community-based conservation has flourished. It has been led by three sanctuaries – Windy Hill Sanctuary (800 ha), Motu Kaikoura (564 ha) and Kotuku Peninsula (230 ha, including Glenfern Sanctuary) – representing a mix of public and private land (Table 1, Fig. 10). Their research, monitoring reports and experience of engaging their immediate communities alongside the advocacy of the Great Barrier Island Environmental Trust (GBIET), a supportive Local Board and a number of Māori and other landowners actively managing pests is resulting in a growing understanding of the need to protect the island’s biodiversity and how to do it. For those projects that commenced in the early 2000s, the increase in funding and support from local Councils has been dramatic. As the country has taken on the Predator Free 2050 vision,



Fig. 9. Aotea-Great Barrier Island. Te Hauturu-o-Toi – Little Barrier Island in distance. Photo Kelvin Floyd.



Fig. 10. Windy Hill Sanctuary, Aotea – Great Barrier Island. Photo Windy Hill Sanctuary Collection.

ecological restoration has become more mainstream, even urban (Russell *et al.* 2015). Indeed, it is in the ‘urban’ areas of the island where the bulk of new pest management effort is taking place.

In 2006, the GBIET undertook a ‘referendum’ in the community to gauge attitudes to rat and feral cat management. While most respondents supported management of these pests, the Trust met with vigorous criticism from some sectors of the community. Trespass notices were issued against some members. This highlighted the key challenge of communication – the use of the word ‘referendum’ ignited pushback, where the word ‘survey’ may not have. How the seriousness of biodiversity loss is communicated and through what channels, is probably the biggest challenge still to be faced in supporting the social change needed to embrace a pest-free Aotea (Aley and Russell 2019).

In response, the Aotea Great Barrier Local Board invested in a community-wide visioning process in 2013. Eight years later, the ‘Ecology Vision’ is led by a paid facilitator and several new community restoration projects have commenced, supported by events and education. The Aotea Trap Library (started by GBIET in 2017 and now funded by Auckland Council and WWF) is providing free rat trapping gear, education and advice. The Aotea Bird Count is an annual, collaborative island-wide 5-min count undertaken at 18 sites, to monitor long term changes.

But more collaboration was needed, particularly in the wake of community debate in 2018 over the eradication of ship rats from Rakitū – Arid Island, 4 km off the coast of Aotea. Since 2019, an annual Aotea Conservation Workshop has been held, involving Auckland Council, the Local Board, DOC, mana whenua, local groups, projects and landowners. The purpose is to promote common conservation language and priorities, and to foster collaboration on the island. This face-to-face dialogue, with comprehensive follow-up of

meeting outcomes and agreements, is leading to better communication and a more unified approach to conservation.

The ambitious Tū Mai Taonga project has gained traction from this process. It is a collaborative project to remove feral cats and to reduce rats to low densities across the Aotea Conservation Park and adjacent land – more than half of the island. The long-term goal is to remove these predators from the whole island. The project began in late 2020 with in-home community research in the project area. This found 96% support for the overall goal amongst those surveyed (approximately 80% of residents). It is now in the feasibility phase and has received Predator Free 2050 and DOC Jobs For Nature funding. To underscore the importance of their role, the project is transitioning to being led by Ngāti Rehua Ngātiwai ki Aotea, governed by a joint mana whenua and community steering committee. Resourcing further education and community engagement activities is seen as critical, alongside technical activities and employment considerations.

Important lessons

A key lesson to date has been the need for collaboration between all invested parties from conception, as well as between projects, to ensure the most efficient use of funding and resources. A foundation for this is a partnership with mana whenua. The increase in community conservation funding is enabling traction on the ground by individuals and communities. It is also driving participation, which improves people’s understanding of the problem. This was also found by Aley and Russell (2019). ‘By doing we learn’. Information is empowering and can build trust, especially when shared through trusted channels and people as a constant process. Many of the early conservation issues were aired at public meetings on Aotea. These were not productive conversations. Another important lesson has been that face to face in-home engagement builds more trust and neutralises social pressure, especially where potentially controversial issues are being discussed.

One of the most successful community engagements has been through the four translocations of toutouwai – North Island robin (*Petroica longipes*) to the Glenfern and Windy Hill Sanctuaries between 2004 and 2012. While released birds did not stay in the sanctuaries, their offspring have established a small breeding population on Hirakimatā – Mount Hobson in the centre of the Aotea Conservation Park. Bringing back a locally extinct species makes the purpose of pest management clear and emotionally engages people in a way that killing pests such as rats does not. Local hapū, Ngāti Rehua Ngātiwai ki Aotea, manage the Bring Back Kōkakō project and have completed a feasibility study to reintroduce kōkakō (*Callaeus wilsoni*). In response to predator effects, the last two kokako were translocated from Aotea to Hauturu – Little Barrier Island in 1996. These projects are part of long-term social change, and acknowledge indigenous values of kaitiakitanga (guardianship) and

restoration of the mauri (life force) of the whenua (land) for future generations.

Eradicating pests from inhabited islands has been identified as an important challenge globally (Oppel *et al.* 2011). Aotea has been identified as one of 40 islands throughout the world that could sustain significant biodiversity if they were pest free (Holmes *et al.* 2019). Tools exist that could achieve this today, but the conventional aerial eradications using toxic baits have been identified through social surveys as having the highest resistance of any method. This was clearly the issue driving community resistance in 2018 to the eradication of ship rats from Rakitū. Misinformation, petitions, sit-ins and boat boardings were tactics used by an anti-poison lobby. A small group of activists was able to dominate conversations and intimidated the local DOC staff. Telling the story of the recovery of species that has since occurred on Rakitū will be an essential part of the success of that project and ongoing social change in coming years.

A restored Aotea must eventually be predator free. There is a high level of 'in principle' support emerging on the island for the removal of feral cats and rats. A partnership with Ngāti Rehua Ngāti Wai ki Aotea is crucial to this long-term vision. Their support and leadership has already led to the eradication of rats from the Mokohinau islands, an attempt to remove them from the western Aotea islets including Mahuki, and the successful eradication of Rakitū. Wider social acceptance of the value of restoration will be a slower process. The crucial steps of mana whenua leadership, engaging and educating the wider community, and facilitating further collaboration and participation are, in the case of Aotea, more important than the potential technical solutions.

Biodiversity outcomes from case studies

Despite being highlighted here because of their social implications, the five case studies have also had wide-ranging outcomes for biodiversity (Table 1) and demonstrated how invasive species can impact native biodiversity. For example, the eradication of mice from Antipodes Island has provided rare insights into their effects on native biota through the responses of resident species. Similarly, Raukawa geckos on the Noises Islands are now at abundances not previously experienced.

Unexpected events have included recolonisation of Ahuahu by rare teal and the reappearance of an unreported species of gecko on Tiritiri Matangi. Furthermore, seabird recolonisation of islands such as the Noises and Tiritiri Matangi have the potential to shift ecosystem function back to one driven by bird burrowing behaviour and their subsidy by marine-derived nutrients. The long-term effects of this marine-terrestrial transfer includes greater abundance of litter

invertebrates and increased growth rates of many species of plants (Mulder *et al.* 2011).

With the exception of Tiritiri Matangi, there have not yet been published assessments of the biodiversity outcomes of the restoration projects for plants and invertebrates. However, on other New Zealand islands from which similar species of introduced mammals have been removed, there has been increased abundance of numerous species of invertebrates as well as fundamental shifts in forest composition (Bellingham *et al.* 2010).

Discussion

Conservation is essentially a social enterprise, although the importance of the social component has only been quite recently recognised through the need to understand ethics and politics (Lawton 1997), form relationships based on adaptive co-management (Berkes 2004), and seek ways to facilitate behavioural change (Schultz 2011). The complexities of the multi-layered relationships that may be required for successful conservation outcomes were examined by Berkes (2004, 2007).

In New Zealand, proliferations of community-led conservation initiatives have constituted a major change in the conservation scene over the past 30 years (Towns *et al.* 2019). Examples of the ways communities can be involved in these initiatives are illustrated for islands by the case studies. While invasive mammals were eradicated from all five of the case studies, invasive predators (cats and rodents) were not eradicated on Aotea but were controlled at selected sites to low density for long periods. Pest eradications can involve the use of powerful toxins such as rodenticides, the use of which is often restricted by environmental regulations. For technical and regulatory reasons, the eradications are usually not conducted by the community groups themselves, but usually require partnerships with other agencies (Towns 2011). The case studies provided here illustrate the flexibility and patience required if these partnerships are to endure. Growing public awareness and support for conservation coupled with an evolving history of achievements and restoration successes has underpinned the development of these projects (Galbraith 2013; Peters *et al.* 2015, 2016).

There are also two drivers that influence the way island restoration is approached. The form and history of the first of these is unique to New Zealand. Local and central government agencies such as DOC are required to give effect to the principles of the Treaty of Waitangi. Within these principles, agencies involved in supporting restoration organisations must also appropriately acknowledge and give effect to traditional Māori concepts such as mauri (life force) and mātauranga Māori (traditional knowledge). Advancing programmes that harness both western science and mātauranga Māori offer opportunities to enhance

mutual understanding. Of particular relevance is the view held by Māori and now enshrined in legislation of landscapes as living entities (Daugherty and Towns 2019; Lyver et al. 2019), which further emphasises that restoration is essentially a social enterprise with cultural overlays. In many cases, those involved in island restoration projects are growing in confidence in consulting and collaborating with mana whenua to ensure Taha Māori (Māori issues) are appropriately incorporated into project plans. The use of Māori words and phrases in the case studies presented here, and references to co-governance and co-management, reflect the importance of Taha Māori as a driver of conservation initiatives, including island restoration.

The second driver recognises that conservation is a global commons problem (sensu Berkes 2007), in which biodiversity has multi-dimensional ownership and control. Within New Zealand, this approach adds an extra layer of relevance to the principles of the Treaty of Waitangi. In contrast, the commons view has driven more explicit recognition that conservation issues should not be 'owned' by DOC but by the public at large as well as by local communities where people have a stake in restoration activities and in anticipated outcomes. For example, the Antipodes Island case study demonstrates how DOC involved the public in a restoration initiative despite its remote location, while forming a partnership with philanthropists and engaging an interested public (see also Towns et al. 2019). However, most aspects of the project have been government led. The Tiritiri Matangi example also involves a DOC island reserve, but there many of the activities have been led by a community group with DOC providing infrastructural support based on a participatory governance model.

In contrast, the Noises and Ahuahu examples are both privately led, but have involved government agencies and iwi Māori in the process of restoring terrestrial and marine areas. However, the greatest complexities are demonstrated by the Aotea example, partly because of its large size, but also because of a diverse population of residents, including communities of Māori that have many generations of association with the island.

Centuries of Māori association with the land brings an additional dimension to locations such as Aotea and Ahuahu, which are spiritually significant places. For example, Ahuahu has a significant role in understanding the settlement history of colonising Polynesians in the 13th and 14th centuries. For the Ngāti Hei iwi, Ahuahu is regarded as Hawaiiiki – a place of spiritual origin (Peart 2016; D. Towns, unpubl. data). Biodiversity restoration in locations with such significance can be seen by iwi as strengthening their kaitiakitanga (guardianship) of the physical and spiritual realms (e.g. Lyver et al. 2019), even if the goal for non-Māori is focused on the more physical aspects (biodiversity and landscapes).

Of course, government agencies will often need to conduct cost-benefit analyses of island restoration projects. Such an approach seems feasible for uninhabited islands such as the

Antipodes, for which there are also obligations for the site's World Heritage status. However, as Berkes (2007) observed, this state-run 'blueprint model' approach to conservation becomes increasingly difficult to apply as the layers of complexity increase. Even with this small number of case studies, there is a progression towards non-financial measures of success. For example, the potential links between biodiversity and wellness are now identified in the New Zealand Biodiversity Strategy (Anon 2020b).

Furthermore, the impacts of island restoration projects such as those described here extend well beyond individual islands or single community groups. Wider impacts are mentioned in the Ahuahu study in relation to the extension of activities in the wider Mercury Islands archipelago, and The Noises example emphasises linkages between terrestrial and marine systems and to the wider Hauraki Gulf. Lessons learned from the Antipodes Island eradication operation stimulated DOC to commission a feasibility study for the eradication of mice, and feral cats and pigs from the much larger Auckland Island, also in New Zealand's sub-Antarctic zone.

The over-riding message from the case studies is confirmation of the need for flexibility and locally nuanced approaches to the circumstances presented at each site. This observation is an affirmation of the adaptive co-management approach advocated by Berkes (2004), but also highlights the need to understand cultural and other social contexts.

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