

# Oikonos Ecosystem Knowledge

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## **Rakiura Titi Restoration Project**

Mitigation of the *Command* oil spill injury by eradication of rats from Sooty Shearwater breeding colonies in New Zealand

FINAL  
2012 Annual Report

Prepared for the Command Restoration Council

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## *Rakiura Titi Restoration Project*

*Mitigation of the Command oil spill injury by eradication of rats and other introduced predators from Sooty Shearwater breeding colonies in New Zealand*

### **Abstract**

The Rakiura Titi Restoration Project seeks to repair the injury to Sooty Shearwater (*Puffinus griseus*) caused by the T/V Command oil spill in September 26, 1998 through the eradication of introduced black rats (*Rattus rattus*) and Polynesian rats or Kiore (*R. exulans*), and weka (*Gallirallus australis*) from shearwater breeding colonies on four Big South Cape Islands, New Zealand: Taukihepa, Pukeweka, Rerewhakaupoko and Mokonui Islands. The primary objectives include (1) eradicate non-native rats and weka, (2) establish quarantine protocols to prevent re-introduction of rodents and ensure long-term benefits, (3) monitor and predict restoration success of the project, and (4) create education and outreach products to inform the people in California and New Zealand about the project.

To date the Rakiura Titi Restoration Project has successfully completed phases of permitting and planning (phase I), implementation of rat and weka eradication (II), and initiation of post-eradication monitoring and quarantine (III). To date, we have presented the results of the project in two publications (Nevins et al. 2009, McClelland et al. 2011), two scientific meetings, 2010 Pacific Seabird Meeting and the 2011 World Seabird Conference, and several public lectures.

Here we report on project activities up to 31 December 2012; encompassing seven years since the 2006 eradication campaign on four southern Titi Islands. These activities included post-eradication quarantine measures to maintain rodent-free islands, monitoring of shearwaters and monitoring of land birds and plant diversity to document ecosystem response to the restoration action. Surveys of land birds conducted in four years (2006, 2008, 2010 and 2012) indicated a positive ecosystem recovery.

Since 2006, NZ partners Ka Mate Nga Kiore (KMNK) and Department of Conservation (DoC) responded to one potential re-infestation incident on Taukihepa with support of the birding community; no other rat sign has been found. Throughout the project, KMNK has promoted the quarantine message, "Keep the Titi Islands Rat Free" and implemented outreach by holding community meetings, distributing calendars and maintaining signage at transport locations. As a result of the "rat-free" status of the islands, KMNK and DoC were able to transfer 78 rare endemic Tieke (Saddleback, *Philesturnus carunculatus*) back to Taukihepa Island (40) and Mokinui (38) Island in 2011, after a 53 year extirpation from their native islands.

## Introduction

Sooty Shearwaters (*Puffinus griseus*) are the most abundant seabird off central California during May to September. They aggregate in coastal waters in large flocks, which may extend for many kilometers and number in the 10-100,000s, which makes them vulnerable to oil spills. On September 26, 1998, Tank Vessel *Command* leaked oil off central California causing injury to Sooty Shearwaters and other seabirds. As most Sooty Shearwaters that occur off California migrate from New Zealand breeding colonies, where they are known as “titi” by Rakiura Maori (New Zealand’s southern indigenous people), a cross-collaborative international project was developed to compensate for the oil spill damages.

The Rakiura Titi Restoration Project (hereafter, “project”) seeks to repair the injury to Sooty Shearwater caused by the T/V *Command* oil spill (the spill) through the eradication of introduced mammalian and avian predators from breeding colonies on four southern islands of New Zealand. The restoration team combines the traditional Knowledge of the “kaitiaki” (Māori environmental stewards) represented by the Ka Mate Nga Kiore Incorporated Society (KMNK) with technical and scientific expertise of the New Zealand Department of Conservation (DoC), a University of Otago team of ecologists, and United States environmental education and seabird experts from Oikonos Ecosystem Knowledge (Oikonos).

Specifically, the objectives of the project were:

- Eradication —of introduced black rats (*Rattus rattus*), Polynesian rats (*R. exulans*), and weka (*Gallirallus australis*) from Sooty Shearwater breeding colonies on four of the Big South Cape Islands, New Zealand: Taukihepa, Mokonui, Rerewhakaupoko, and Pukeweka;
- Quarantine —to prevent reintroduction of introduced predators to the Big South Cape Islands to ensure long-lasting benefits of the project;
- Monitoring — to estimate the success of the eradication by measuring the impact of rats on shearwaters pre- and post- eradication by the use of population models;
- Education — of the people in California and New Zealand about the eradication project, and the cultural and environmental importance of these birds.

Actions described in this report have been specifically approved through a resolution or other means by the Command Trustee Council (hereafter “council”). The council is comprised of representatives from the natural resource trustee agencies for the spill including the U. S. Fish and Wildlife Service, National Ocean Atmospheric Administration, California Department of Fish and Game, California Department of Parks and Recreation, and California State Lands Commission.

## Study Area

We targeted a predator eradication campaign on four of the Big South Cape Islands (47°13.9'S, 167°23.0'E) southwest and offshore of Rakiura (Stewart) Island off the south end of the South Island of New Zealand including Taukihepa (929 ha), Mokonui (97 ha), Rerewhakaupoko (28 ha) and Pukeweka (5 ha), and Islands (Fig. 1).

Sooty shearwaters nest on more than 30 islands surrounding Rakiura Island (collectively called “Titi islands”; Fig. 1). We chose the Big South Cape Islands for restoration of shearwaters for several reasons, including the island size and therefore benefit to the population, the feasibility of the operational aspect of the project –as it would be managed by a NZ expert team, and the low potential of reintroduction of rats from the mainland of Rakiura Island.

We also chose the islands for their cultural and historical significance and multiple ecological benefits<sup>1</sup>. In 1964, a shipwreck was responsible for introducing ship rats to Taukihepa resulted in a globally-significant ecological disaster. This “rat spill” had a huge impact on the fragile island ecosystem —the rat introduction caused the extinction of three endemic land birds, a large flightless beetle, and a rare ground-dwelling bat (Greater short-tailed bat, *Mystacina robusta*). After the rat spill, a last ditch effort was made to translocate 36 individual South Island Saddlebacks or Tieke (*Philesturnus c. carnuculatus*) from the rat-plagued islands to a nearby predator-free island (Poutama or Evening Island). The current population of over 700 birds is descended from the survivors of the 36 saddlebacks rescued in 1964. Restoring the Big South Cape Islands for reintroduction of endemic species, such as the saddleback, was a major long-term ecological goal of this project.

## Methods

### Eradication

The primary objective was for complete eradication of introduced black rats from three breeding colonies (Taukihepa, Pukeweka, Rerewhakaupoko) and polynesian rats (kiore) from a fourth (Mokonui Island). Secondly, we planned to eradicate weka (*Gallirallus australis*), an introduced ground-dwelling bird, from these islands. During initial planning for the eradication, Harper (2006) documented weka as being potentially more destructive to nesting shearwaters than rats<sup>2</sup>.

During the eradication, we used aerial application of Brodifacoum-poisoned pellets to kill rats (see McClelland operational plan for greater detail<sup>3</sup>). Weka were killed incidentally during the aerial campaign via secondary poisoning, and were later targeted directly with ground-based trapping with lures, calls and dogs. During the ground efforts, we used extensive trapping, hunting, ‘passive indicators’, dogging, listening for weka calls and the playing of recorded to locate and cull weka.

The eradication would not have been accomplished without significant in-kind contributions from Ka Mate Nga Kiore, New Zealand DoC, and the University of Otago research team. The project has received considerable international and national recognition for its innovative approach to conservation of migratory seabirds.

### Quarantine

The objective of establishing quarantine measures was to (1) provide outreach to people traveling to the islands through main ports of entry (e.g. harbors, airports) to prevent

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<sup>1</sup> Nevins, HM, J Adams, H Moller, J Newman, M Hester, and KD Hyrenbach 2009. Forum: International and cross-cultural management in conservation of migratory species. *Journal of the Royal Society of New Zealand*: 39(4):1175-8899 (Online); 0303-6758.

<sup>2</sup> Harper, G. 2006. Weka (*Gallirallus australis*) depredation of sooty shearwater/titi (*Puffinus griseus*) chicks. *Notornis* 53: 318-320.

<sup>3</sup> P. J. McClelland, R. Coote, M. Trow, P. Hutchins, H. M. Nevins, J. Adams, J. Newman and H. Moller. 2011. The Rakiura Titi Islands Restoration Project: community action to eradicate *Rattus rattus* and *Rattus exulans* for ecological restoration and cultural wellbeing. pg x-xx *In: Veitch, C. R.; Clout, M. N. and Towns, D. R. (eds) 2011. Island Invasives: Eradication and management. IUCN, (International Union for Conservation of Nature), Gland, Switzerland. 2011. [In press]*

reintroduction of rats and other pests to the Big South Cape Islands to ensure long-lasting benefits of the project and (2) to establish contingencies on targeted islands in the case of an pest introduction.

Rats are likely to be re-introduced from boats traveling to the Titi Islands to offload passengers and gear, originating from either the South Island at Bluff, or from Stewart Island at Halfmoon Bay. Fishing vessels may also pose a problem, as they may originate from various southland ports and occasionally visit the islands, but may not stop at a local port (i.e. Halfmoon Bay) prior to transiting to remote Titi Island. Helicopters also are used to transport gear directly from personal homes to island sites.

The implementation of quarantine measures included providing information to the island-traveling community regarding staging and preparing "rat-free" gear by means of yearly calendars, signs at loading/departure areas, brochures and public displays. KMNK quarantine personnel target quarantine efforts with both the helicopter and boat charters at the most likely points of re-introduction.

Introduced predator specialists from DoC, with guidance from *Ka Mate Nga Kiore*, developed action plans for quarantine protocols to avoid reintroduction of rats and other invasive pests to restored islands (see 2006 Annual Report).

## **Monitoring**

The objective of monitoring was to determine the success of the predator eradication by measuring indices of shearwater population growth and proxies for ecosystem recovery through land-bird and vegetation surveys. Monitoring was conducted in three phases. Phase I, which has been completed, included measuring the impact of rats and weka on shearwaters prior to eradication. In phase II, we modeled the impact of the predators (rat and weka) on shearwaters (based on data collected by the University of Otago research team), and were then able to estimate the potential success of the restoration project given different scenarios of success. In phase III, we conducted bird counts post-eradication (see 2006 Annual Report for methods). Finally, in phase IV (2011-2013), we will directly measure the number of burrows of breeding birds with island surveys post-eradication. We will use two techniques – multiple one meter radius circular plots and pre-established transects encompassing 20 burrows. Vegetation cover in the understory and canopy will be quantified on a percentage of cover in each plot or transect.

The research team will re-survey treatment islands (rats killed):Taukihepa, Mogonui, Rerewhakatoko, and Pukeweka, and make comparison where data is available for rat-free shearwater islands. In the original study design, additional surveys were proposed that are no longer viable or appropriate. Islands Tia and Joss' were the rat-infested controls to be re-surveyed and compared, however these islands are now rat-free.

## **Education**

The objective of the education component of the project was to create awareness of the project by people in California and New Zealand and develop understanding of the cultural and environmental importance of this migratory seabird. The main outreach component of the project was to produce a documentary video.

## Results & Accomplishments

### Eradication

The main goal of the project was to enhance Sooty Shearwater breeding habitat by removing introduced predators –rats and weka– on nesting islands. To date, we have successfully completed the first and main objective to remove introduced rodents on four islands. In July 2006, we deployed bait to eradicate black rats on Taukihepa, Pukeweka, Rerewhakaupoko Islands and Kiore on Mokonui Island, New Zealand (Fig. 1). Since the bait drop in 2006, six birding seasons have passed without signs of recent rat activity on any the targeted islands. In 2011, there was “rat scare” in which when rodent feces were found in some gear that arrived on Taukihepa, however, after a targeted effort was initiated to control this potential re-invasion, no other sign was found (see 2011 Final Report). These islands have been declared rat free—a major accomplishment for this project.

Weka were eradicated from all three of the smaller islands (Mokonui, Pukeweka, and Rerewhakaupoko), but not the fourth and largest island, Taukihepa (2295 ac). By the end of 2006 it was clear more weka survived the bait-drop on Taukihepa than was expected. The large size of Taukihepa likely reduced the chances that every weka was exposed to poison. It should be noted that the weka taken during the bait drop was considered incidental to the main objective of eradicating rodents. During 2007-2008, concerted efforts by the birding community and DoC trapping teams were made to control weka. KMNK consulted with birders through the manu supervisors regarding weka removal and received agreement on removing the weka from the four target islands. Three DoC contractors spent time trapping and shooting weka on Taukihepa, Pukeweka, and Mokonui/Mogoiti Islands during July 2007 (see 2007 Annual Report).

After considerable evaluation, Ka Mate Nga Kiore and DoC decided in 2009 that the weka eradication on Taukihepa would not be financially possible. It would require significantly more resources (~\$260k USD) than available through the Command fund. Robert Coote (KMNK) remarked that “The 2007 and 2008 weka trips to Taukihepa did not appear to translate into a perceptible curtailment of weka population growth in the subsequent birding seasons”. Currently, KMNK is leading efforts within the birding community to control weka. A larger funding source is needed to attempt a future total eradication of weka on Taukihepa. To date no funding source has been identified for this work.

### Quarantine

New Zealand partners KMNK continued to promote “Keep the Titi Island Rat Free” message through outreach at community meetings, calendars, DVDs and signage. There is a continuing discussion on quarantine taking place within the birding community, KMNK and with input from specialists in DoC. Several milestones have been met and the community has found innovative ways to spread the message of preventing re-introduction of invasive mammals to the Titi Islands. The Rakiura Titi Islands Rodent Quarantine Strategy was approved and the long term contingency plan for re-invasion will be covered under the DoC Biosecurity Plan per Andy Roberts, Southland Conservancy (see update 3 May 2006). The quarantine poster and brochure have been printed and widely distributed. The quarantine poster was turned into a 2006 calendar, which proved very popular. New calendars were reprinted in 2007- 2011. A quarantine message of “It’s up to you...keep our islands rat-free” was printed with catchy graphics on a calendar for 2008 and distributed to members of the birding community who visit the islands regularly. Calendars were also distributed to helicopter and boat charter companies who transport people and gear to the islands. We noted that the pictures from previous years were posted in ferries and at public terminals around Rakiura Island. In 2009-2010 ballpoint pens with the message “Look after your Taonga” (treasured birds) were made and distributed. These types of outreach are simple, cost-effective and have a wide impact within the community.

Finally, we have developed novel quarantine protocols, methods, and educational materials to support the restoration activities, including creating a documentary film. In 2008 we completed a 50 min educational film entitled “The Titi Islands: A Paradise Restored” (South Coast Productions, Te Anau, NZ) about this unique project. This DVD is available online in NZ to support continued quarantine work and the first 2,500 copies were made freely available in the US and NZ for educational purposes through Oikonos.org. In 2012, KMNK continued to promote “Keep the Titi Island Rat Free” message through outreach at community meetings, calendars and signage. Because of the rodent scat detection in gear in 2011, partner KMNK will work to gain increased vigilance among the community members when packing for the islands and inspecting gear upon arrival. At this stage, preventing potential reintroduction of rodents to the Titi Islands becomes more important than ever.

## Monitoring

### *Shearwater Monitoring*

Baseline monitoring of shearwaters was completed by Henrik Moller and the titi research team at the University of Otago prior to the 2006 eradication. In 2005-2006, the titi team surveyed shearwater nesting habitat on targeted and control islands to estimate burrow density and occupancy, and vegetative cover in study plots. From these data, Peter Dillingham and others of the titi team modeled the expected positive response of shearwaters equivalent to the projected damages within 10 years post-eradication (see 2009 Report “Predation Report”). This projection will be compared with empirical data to be collected in the final phase of the project during 2012 – 2013.

We had expected to begin post-eradication shearwater monitoring during the 2011 birding season, but a late delay of our research permit made it impossible to complete this task within the narrow timeframe that researchers are typically allowed on the islands (March – April). In a letter from Alison O’Sullivan, Rakiura Titi Islands Administering Body (RTIAB), she indicated the committee “would look favourably on an application for next [2012] season to complete the resurvey work, and would welcome your presence at their permit day to discuss this work.” To ensure our commitment to the project within the eyes of the community, we will be sending the US project manager to the permit day meetings at the end of the year to make our application. Because Grant Harper works with the DoC, he was able to make a short trip to Taukihepa to make additional land bird observations (see below, Monitoring Ecosystem Response).

The 2012 field work went very well. The field team successfully completed shearwater surveys on 3 targeted and 2 control islands. Two of the same biologists who conducted the pre-eradication surveys (Newman, Scott) led the team in 2012. The team covered an amazing amount of ground, conducting circular plots in resurveying 166 areas that had been previously counted. Preliminary data indicate that burrow density has not significantly increased on either the treatment ( $12.6 \pm 2.3$  vs.  $12.0 \pm 2.9$ ) or control ( $18.5 \pm 2.9$  vs.  $19.3 \pm 4.4$ ) islands, comparing pre- and post-eradication.

### *Monitoring Ecosystem Response*



Post-eradication, Harper initiated a native bird study designed to measure the impacts of rats prior to eradication and the benefits to the island ecosystem post-eradication. In 2008, the first post-eradication monitoring report indicated a positive beneficial response of vegetation, insects and land birds to the removal of rats (2009 Annual Report). A 2010 survey and report by Harper indicated continued increases in the proxy indices – land bird abundance – of successful seabird habitat restoration (s. The

abundance of native birds on Taukihepa has increased in the three surveys since the 2006 eradication of rats (see 2011 Report).

In 2012, biologists reported positive signs of island recovery (see photos, Appendix A):

*“Revisiting the Titi Islands this year [2012] provided a great opportunity for us to observe first hand changes that have occurred since rat eradication six years ago. I know the islands well, having spent many years working on them prior to 2006, but this was my first visit since the eradication so I was keen to look around. On Taukihepa the most obvious differences, to me, were the increased abundance of understory plants & seedlings including the megaherb Bunui (Stilbocarpa) which was almost non-existent on the island before) and the increase in abundance of terrestrial insects and birds. I was also excited to see a species of skink (native lizard, likely Common Skink, Oligosoma polychroma) on the island (never seen before). Weka were more abundant than ever and we observed the remains numerous titi chicks eaten by weka. It was hard to tell but perhaps Mottled Petrels were more abundant on the ground at night? The changes on Moganui were less obvious (during our brief visit) although the absence of weka was noted. The birders were unanimously happy with the rat eradication and excited by the changes on their islands.”*

- Jaime Newman, seabird biologist, Titi Islands Restoration Project

## Education & Outreach

In 2008, Ka Mate Nga Kiore worked with South Coast Productions, NZ, to produce the final version of a video entitled “Restoring Paradise” documenting the story of the shearwaters killed by the Command spill and the unique restoration plan to eradicate rats on shearwater nesting islands in New Zealand. A second 45 minute video entitled, “The Titi Islands: the Return of the Taonga” was produced by South Coast Productions to highlight the international partnership, and the unique conservation action to return the South Island Saddleback/Tieke to its former islands. Oikonos has a limited number of these videos for distribution contact [Hannah@oikonos.org](mailto:Hannah@oikonos.org) for additional copies.

## 2013 Work Plan

**Monitoring:** In our research plan, we have one remaining island to resurvey, Whenua Hou or Codfish Island. This island is significant for two reasons, it was part of the initial survey of the islands and it is the island from where the known tagged shearwater that was killed in the Command Oil Spill originated. We plan to detail findings of this work in a manuscript in collaboration with NZ partner Henrik Moller and others at the University of Otago. All activities should be finished by Dec 2013 and a draft report on the project is expected by June 2014 and finalized by December 2014.

**Quarantine:** As in previous years, NZ partners will continue to make and distribute outreach material within the Titi Islands community to promote awareness of preventing re-introductions of rodents to seabird islands.

**Project administration:** Oikonos will continue to coordinate all activities with NZ partners and provide reporting to Command council. NZ partner KMNK will facilitate communications with tribal entities and landowners.

## **Budget**

### **Budget Justification**

Since the project began, we have met project objectives while remaining within estimated budgets. We have made significant cost saving in most years with additional in-kind support from NZ partners (KMNK, University of Otago), and Oikonos. The continuing US economic slump, however, has decreased the value of the US dollar thus resulting in higher than expected costs for the project. Despite these changes, we are confident in our ability to complete these tasks within our estimated budget.

In 2011, we spent \$13,596 (less than expected) due to the rejection of our research permit, we were not able to do any shearwater monitoring work (resulting in \$11,519 unspent funds for this work), but we were able to complete this work in the 2012 field season.

In 2012, we spent \$ 51,981 USD to support ongoing financial/ and administrative management of the project by NZ partners (\$3,290); production and distribution of quarantine materials and attendance at island committee meetings (\$5,774); shearwater monitoring salary, transport and equipment (\$5,581); and report writing, preparation and meeting attendance by US project managers (\$3,016); and 30% indirect project administration costs (\$11,996; Expense Report, Table 1). The monitoring costs in 2012 were slightly higher than predicted, because monitoring work planned for in 2011 was not actually completed until 2012 (See 2011 Report).

For 2013, we have requested \$41,921 USD for restoration activities. Specifically, we require funds to support ongoing financial/ and administrative management of the project by NZ partners (\$ 3,188); production and distribution of quarantine materials and attendance at meetings (\$ 5,585); shearwater monitoring salary, transport and equipment (\$ 6,243); data entry and checking (\$2,861); report writing, preparation and meeting attendance by US project managers (\$ 11,445); and 30% indirect costs (\$ 9,674; Table 2). All of these tasks meet the outlined objectives in the scope of work for the Rakiura Titī Restoration Project have been approved previously by the Command Trustee Council.

## **Summary & Conclusions**

To date the Rakiura Titī Restoration Project has successfully completed phases of permitting and planning (phase I), implementation of rat and weka eradication (II), and initiation of post-eradication monitoring and quarantine (III). The project has received a favorable letter of support from the NZ Minister of the Environment, Chris Carter, acknowledging the importance of this international conservation effort and garnered significant funds by NZ partner Ka Mate Nga Kiore from the NZ National Biodiversity Fund (~70k NZD). Partnerships with the NZ Department of Conservation provided significant in-kind support for the operation amounting to ~39k USD (~55k NZD).

Surveys since the poisoned-baits were dropped on The Big South Cape Islands in July 2006 indicated there been one incidence of rat sign found on one of the focal islands. In 2011, our partners, KMNK detected rodent dropping in transport to the island and mounted a response to this event in coordination with the DoC team.

We were successful in removing the remaining weka from Mogonui/Mogoiti, Pukeweka, and Rerewhakaipo. In 2006-07, a team concentrated weka trapping and culling efforts on the three smaller islands. Removal of weka from the large area of Taukihepa, however, will require a greater commitment of time, effort and money. The islander community is dedicated to controlling this invasive species during the shearwater nesting season.

We conducted re-surveys of shearwater colony areas on 4 target and 2 control islands in 2012. Preliminary results indicate there has been no measureable difference in treatments. Further data analyses will be conducted by the University of Otago team in 2013.

Repeated surveys of native bird abundance (Harper 2006, 2008, 2010; Adams, Newman and Scott 2012) indicates that the eradication of rats from Taukihepa and surrounding islands has made significant changes in abundances of land birds in a short time (i.e., <2 years) and is still evident 6 yrs post-eradication. Continued monitoring of land birds as well as other ecosystem and biodiversity indicators (bats, insects, herptofauna) have provided metrics of the success of this restoration project.

The US economic recession has unfavorably reduced the cost-effectiveness of the project in the past two years. However, we have had considerable cost savings from in-kind salary, supply and transportation support through NZ partnerships with KMNK and DoC.

We hope that the film will enhance educational displays in state visitor centers and classroom audiences and ensure the longevity of the conservation message this project strives to communicate.

NZ partner KMNK have leveraged considerable time, effort and networking to successfully add to components of this study not explicitly funded by Command, but has served to help restore the island ecosystems damaged by the rats. This includes a historic move to relocate a population of Titi Islands endemic Tieke to the islands they were extirpated from nearly 40 years ago.

## **Recommendations for future management tasks**

We recommend that the council consider other projects in New Zealand to remove invasive species from island and mainland nesting areas for Sooty Shearwaters. We could build upon existing partnerships within NZ, where there are several mainland and islands sites (e.g. Irahuku Long Point) for which great conservation gains could be made to benefit Sooty Shearwaters. The Long Point site has great potential for future restoration as it is owned and actively managed by the Yellow-eyed Penguin Trust, has a small remnant population of shearwaters, and there are future plans to create a seabird visitor center. This project needs support to increase their predator control program around the colony area to benefit both shearwaters and penguins.

We also recommend when mitigation funds allow, the council continue to support international projects to benefit migratory birds. This project has demonstrated that this work is successful, cost-effective, can restore ecosystem function and has multi-species benefits.

## Expense Report

**Table 1.** Summary of budget and actual expenses allocated for 2012 work. Significant in-kind contributions were made to the project from collaborators and partners *Ka Mate Nga Kiore* and NZ Department of Conservation.

Objective	2012	
	Budget	Actual
<b>Eradication</b>		
NZ project management	3,065	3,290
<b>Quarantine</b>		
supplies (outreach) <sup>a</sup>	5,370	5,774
<b>Shearwater-Titi Monitoring</b>		
Implementing Field Surveys		
Salary	12,160	15,514
Supplies	977	1,160
Accomodation	1,053	1,763
Transportation	2,827	3,746
Data entry and checking	2,861	5,722
salary (US project manager)	2,812	3,016
<b>Subtotal</b>	31,125	39,985
Overhead (0.30)	9,338	11,996
<b>Total</b>	<b>40,463</b>	<b>51,981</b>

<sup>a</sup> Education & Outreach materials designed to promote rat quarantine including posters, brochures, articles, signs. Costs based on change in exchange rate from 0.70 to 0.79.

Table 2. Proposed budget for 2013 Rakiura Titi Islands Restoration Project.

Objective				2013 Budget
<b>Eradication</b>				
	NZ project management			3,188
<b>Quarantine</b>				
	supplies (outreach) <sup>a</sup>			5,585
<b>Shearwater-Titi Monitoring</b>				
	Implementing Field Surveys			
		Salary		4,622
		Supplies		244
		Accomodation		610
		Transportation		767
	Data entry and checking			2,861
	Report writing			11,445
	salary (US project manager)			2,925
<b>Subtotal</b>				
	Overhead (0.30)			32,247
				9,674
<b>Total</b>				
				<b>41,921</b>
<sup>a</sup> Education & Outreach materials designed to promote rat quarantine including posters, brochures, articles, signs. Costs based on change in exchange rate from 0.70 to 0.79.				

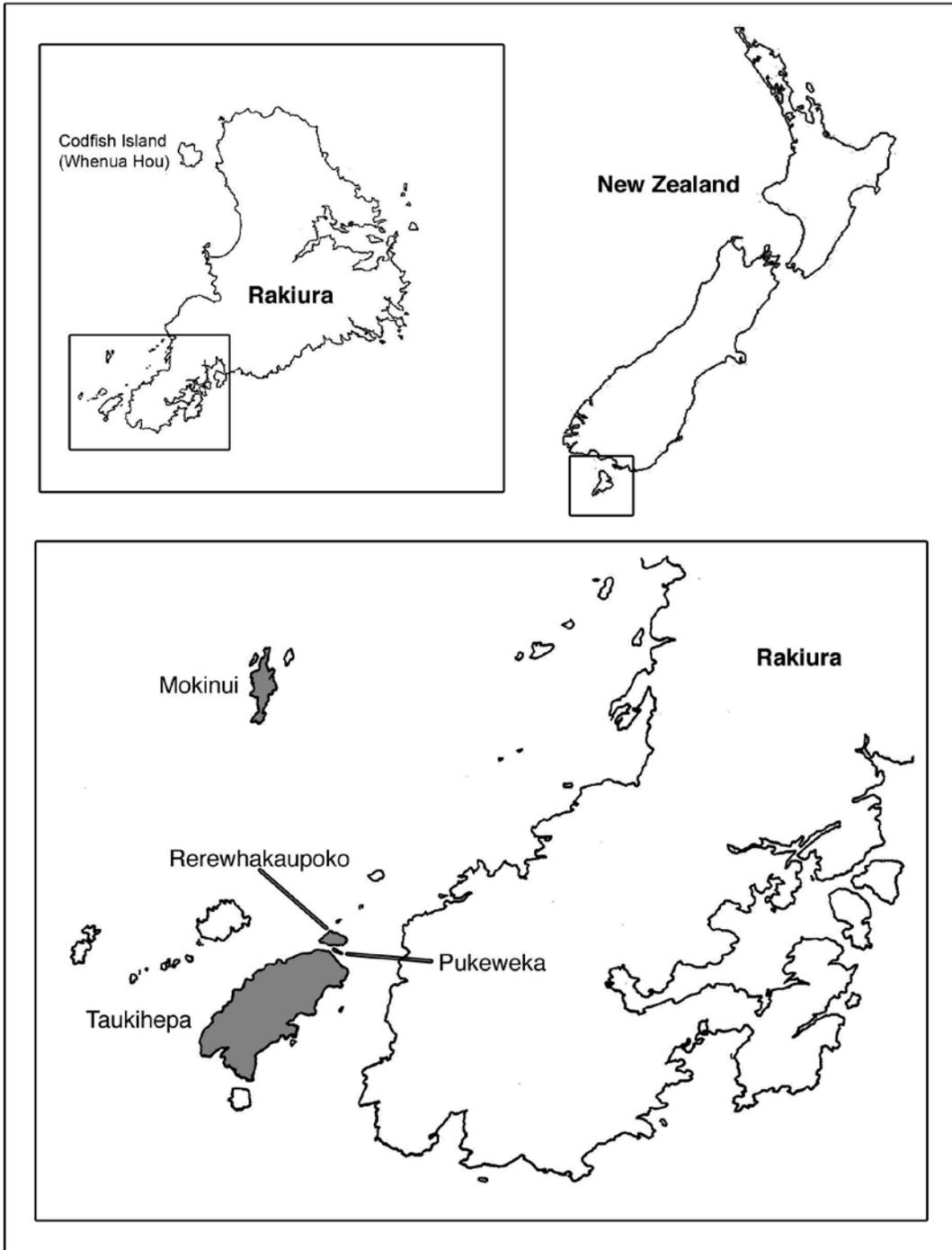


Figure 1. Location of four breeding colonies of Sooty Shearwaters (*Puffinus griseus*) in the Titi Islands targeted for rat eradications. The four islands targeted for rat eradication are Taukihepa, Pukeweka, Rerewhakaupoko (south of Taukihepa), and Mokonui Islands (dark shading). The banded shearwater killed during the 1998 Command oil spill was a breeding bird from Whenua Hou (Codfish Island). Figure from McClelland et al. 2011.

## Appendix A: Photos from 2012 Re-survey Trip



Figure 1. A Sooty Shearwater emerging from a burrow. (photo: © 2012 Jaime Newman/Oikonos).



Figure 2. Sooty Shearwater departs the colony at in the wee hours of the morning. Taukihepa Island, NZ. (photo: ©2012 Jaime Newman/Oikonos).



Figure 3. The small-bodied Mottled Petrels have also benefited from the elimination of rats on the Titi Islands, NZ. (photo: ©2012 Jaime Newman/Oikonos).



Figure 4. Since the rat eradication, flocks of ground foraging Kakariki (Red- and Yellow-crowned Parakeets) have become a more common sight on Taukihepa Is., NZ. (photo: © 2012 Jaime Newman/Oikonos).