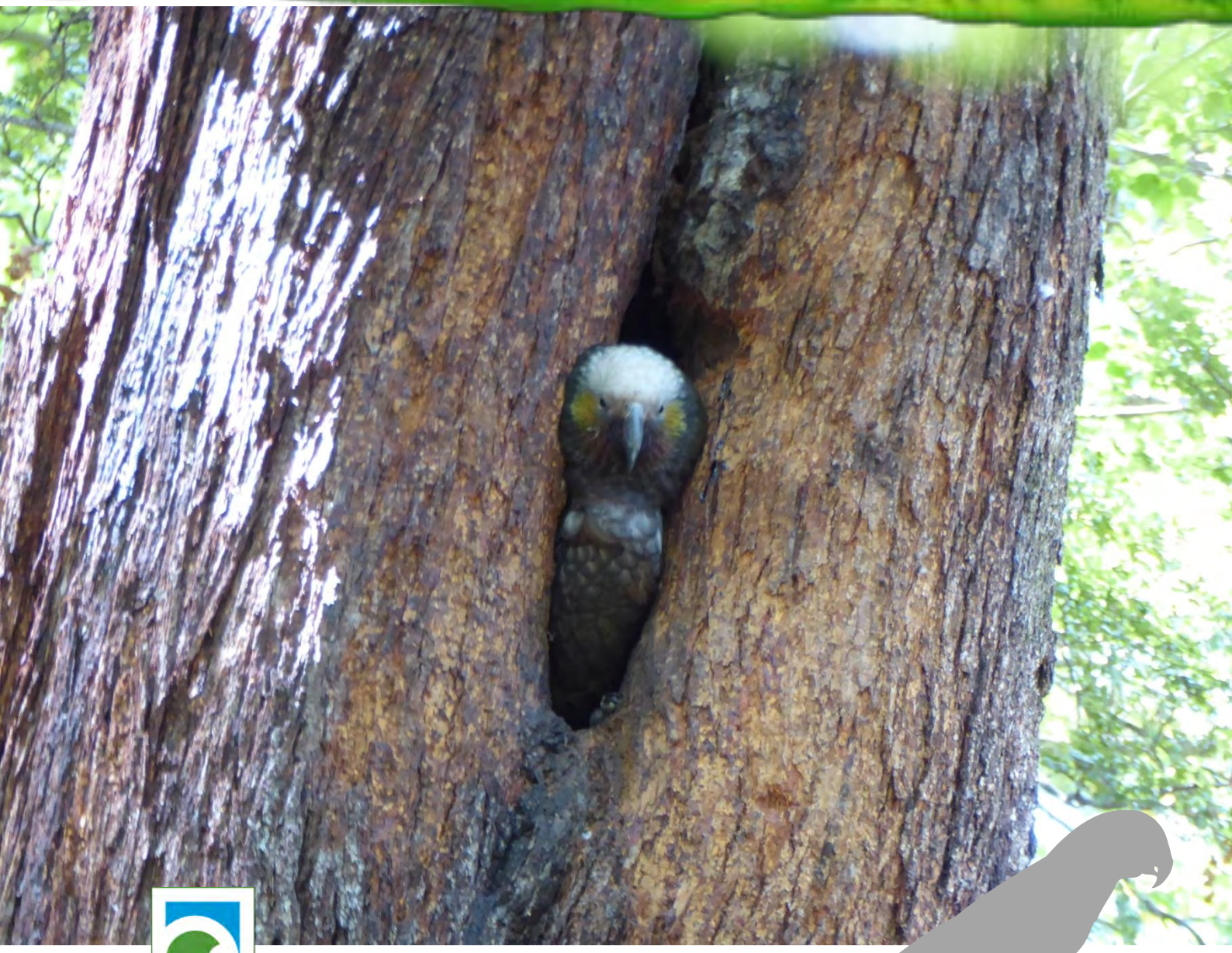
Rotoiti Nature Recovery Project
Annual Report 2015/16

Nelson Lakes Mainland Island, Nelson Lakes National Park

J. Waite, P. van Diepen, G. Andrews, E. McCool, and J. Long



Department of Conservation
Te Papa Atawhai

Cover: Kākā (Nestor meridionalis) in Big Bush. Photo: Russell Chilton

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Mustelid control continued in the RNRP in 2015/16 using the network of DOC200 and DOC250 traps. Trap check frequency was reduced to between eight and ten checks a year to reduce workload. Tracking tunnel monitoring showed that the trapping programme again kept mustelid tracking below the five percent target, while tracking remained high at the Rotoroa non-treatment site. No feral cat control was carried out by RNRP staff this year. Instead the Friends of Rotoiti carried out cat control in the St Arnaud village and surrounding rural areas, with 133 feral cats caught. Possum trapping continued in the RNRP as in previous years with no monitoring undertaken this year. There was limited hunting carried out in the RNRP in 2015/16 partly due to the caution period following the aerial 1080 operation which was lifted in September 2015. The pig population at the northern end of the St Arnaud Range has increased and the beginning of a pig trapping programme were implemented towards the end of the 2015/16 year.

The kaka encounter rate remained at low levels in 2015/16 similar to those of the previous year. Twenty-nine historic nest sites were observed for signs of nesting activity from Mid-October to mid-November 2015, with one found to be active. Five kaka were monitored for nesting attempts that chicks could be harvested from for Project Janzoons captive rearing programme, with three of these kaka breeding. In total four nests were monitored with two failing. Four chicks were removed from the other two nests for captive rearing. Six kea nests were protected in 2015/16 with all failing due to predation. No mistletoe, *Pittosporum patulum* or *Powelliphanta sp. snails* monitoring was scheduled to be undertaken in 2015/16.

Establish and maintain populations of whio (*Hymenolaimus malacorhynchos*), great spotted kiwi (*Apteryx haastii*), rock wren (*Xenicus gilviventris*) and other native species.

The final two Operation Nest Egg chicks were released in the RNRP in January in 2016. Both died soon after release with one predated by a ferret or cat, and the other falling down a hole. Within the transmittered adult kiwi one breeding attempt was observed, however this was abandoned likely due to stoat interference. One monitored adult kiwi was found dead in the RNRP in 2015/16.

Learning objectives

Test the effectiveness of control methods for stoats (*Mustela erminea*), rats (*Rattus spp.*), cats (*Felis catus*), possums (*Trichosurus vulpecula*), wasps (*Vespula spp.*) and other potential pest species in a beech forest and alpine ecosystem.

Following the aerial 1080 operation in December 2014 no rodent control was undertaken in the RNRP in 2015/16.

Wasp control using Vespex poison was carried out in the RNRP in 2015/16, with all bait stations now on a 300m by 50m contouring grid. Wasp monitoring showed the operation decreased wasp activity at all monitored nests to zero, while the amount of available honeydew increased.

Maintain long-term datasets on bird abundance and forest health in response to ongoing management and predator population cycles.

Five-minute bird counts were undertaken at Lakehead, on the St Arnaud Range track, and at the Rotoroa non-treatment site. Not all counts were completed in February or November. Only small amounts of beech seed were recorded in the RNRP, with larger amounts at Rotoroa. High levels of tussock flowering was observed for both *Chionochloa australis* and *Chionochloa pallens* at Mt Misery.

Record observations of previously unreported native and non-native species in the RNRP area.

No new species were recorded in the RNRP in 2015/16.

Facilitate research to improve our understanding of the ecology and management of beech forest, alpine and wetland ecosystems.

Kelly Whitau (University of Canterbury) began analysing RNRP datasets for her analysing factors influencing bird and mammal responses to pest control in mixed beech forests.

Dr Grant Harper has begun analysing the history of ground-based poison operations in the RNRP for rodent control.

Chris Niebuhr (University of Otago) completed his third and final field season in the RNRP in April 2015 for his PhD investigating the role avian malaria may be playing in native bird declines in the area.

Analyse and report on the effectiveness of management techniques, and ensure that knowledge gained is transferred to the appropriate audiences to maximise conservation gain.

Research carried out within the RNRP in 2010 into whether clustering wasp bait stations is an effective way to control wasp populations was published (Harper, Joice, Kelly, Toft, & Clapperton, 2016):

Community objectives

Foster relationships with likely partners to produce conservation gains within both the Mainland Island and the local area.
Pre-existing partnerships have been maintained and developed with local iwi, Friends of Rotoiti and the Kea Conservation Trust.

Increase public knowledge, understanding and support for mainland islands and ecological restoration nationally through education, experience, and participation.
A range of public advocacy has continued through the year, including displays and talks at public events.

1 Introduction

The Rotoiti Nature Recovery Project (RNRP) is a Mainland Island project that was established in 1996 to enable the recovery of a representative portion of an alpine honeydew beech forest ecosystem at Lake Rotoiti in Nelson Lakes National Park.

The project began with infrastructure development and baseline monitoring across 825 ha of forest on the western St Arnaud Range. Comprehensive pest control began in 1997. The project was established with treatment and non-treatment sites, so that responses to management techniques at Lake Rotoiti could be compared with the non-treatment site at nearby Lake Rotoroa. The first Annual Report covered the 1997/98 business year.

South Island kākā (*Nestor meridionalis meridionalis*) have been a key focus since the beginning of the project. Staff from the Department of Conservation's (DOC's) former Science and Research Unit (now the Transformation and Threats Unit of the Science and Policy Group) put considerable effort into radio-tracking kākā and monitoring nesting success in response to mustelid (stoat *Mustela erminea*, ferret *M. furo* and weasel *M. nivalis*) control. Kākā nesting success improved considerably and adult female mortality declined as a result of predator control when treatment sites were compared with non-treatment sites (Moorhouse, 2003).

In 2001/02, the extent of mustelid trapping was increased considerably, so that over 5,000 ha on the western St Arnaud Range and southern Big Bush is now under sustained mustelid control as part of the Mainland Island. Trapping is also carried out by a local volunteer group, Friends of Rotoiti (FOR), in adjacent areas encompassing an additional 5,000 ha. Trapping has historically been done using Fenn mkVI then DOC-series traps, however the RNRP was one of the sites involved in a national trial of self-resetting traps for landscape-scale pest control over 2012-2014, specifically testing use of the Goodnature Ltd A24 trap to target stoats. In the RNRP the A24s were not successful at controlling stoats below the target tracking rate and the DOC-series traps were reinstated in 2014.

Management of great spotted kiwi (GSK; *Apteryx haastii*) began in 2004 with the introduction of adult individuals from Gouland Downs in Kahurangi National Park. Additional introductions since then have

ensured the successful establishment of a population. Limited breeding has taken place over the past twelve years, and despite their vulnerability to mustelid predation, nine wild-raised kiwi chicks have successfully fledged. Over recent years GSK management has focused on using the Operation Nest Egg™ (ONE) to overcome the poor breeding success of GSK in the RNRP. However, ONE has not proven to be successful as a way of increasing the GSK population at this site, with six of thirteen released ONE chicks known to have died, and the status of four unknown. Five ONE chicks were monitored in the 2015/16 season. In contrast, all adults or experienced juveniles released have survived and remained within the RNRP protected area. The ONE programme has now finished, with the focus now on translocation of adult kiwi to the RNRP to increase the founder population to 40 individuals.

In partnership with the Kea Conservation Trust (KCT), kea (*Nestor notabilis*) nest protection was initiated in spring 2011 at three nest sites, one within the RNRP's intensive pest control area and two outside. Following ongoing support from the KCT the number of nests and extent of protection around nests has been increased, with six nest sites currently protected. Despite removing considerable numbers of pests, protected nests can still fail due to predation supporting the need for landscape-scale pest control to protect vulnerable species. As kea are one of the more at-risk species from aerial 1080 operations, the RNRP collaborated with the KCT to trial a proposed mitigation method during the 2014 Battle For Our Birds (BFOB) aerial 1080 operation, the first such operation to take place in the RNRP.

The RNRP has been a leader in the large-scale control of introduced wasps (*Vespula spp.*). Under an experimental use arrangement, historically with Landcare Research—Manaaki Whenua and more recently with the Nelson-based company Entecol, the Mainland Island has been used as a trial site for determining effective means of wasp control. Experiments have been undertaken using various toxins, particularly Fipronil, and the toxin Vespex is now commercially available. The spacing and configuration of bait stations and the development of effective monitoring methods have been the focus of RNRP research over recent years. Since late 2013/14 the RNRP has also supported Landcare Research in its investigation into the potential of a newly-discovered wasp mite as a biocontrol agent, by collecting queens hosting the mite for analysis.

Rodent (rat *Rattus spp.* and mouse *Mus musculus*) control has had a chequered history in the Core Area of the Mainland Island. Initially, ground-based operations using brodifacoum and 1080 were effectively used to control rodents, particularly rats, between 1997 and 2000. However, after a DOC review of the use of brodifacoum, there was a switch to snap-trapping at a density of one trap per hectare, which proved ineffective at controlling rat populations. The first rat control toxin operation in over four years was carried out in the spring of 2010, covering 600 ha of the Core Area using diphacinone in bait stations. Following initial success, operations were extended to cover almost 1,000 ha. Over the 2010-2013 period these operations had mixed success for environmental and operational reasons. In 2014, the RNRP experienced its heaviest beech masting event since records began, with similar heavy masting widespread over the South Island. This led to a national DOC response in the form of the Battle For Our Birds (BFOB) programme, which involved carrying out pest control over the largest area in DOC's history, primarily using aerially-applied 1080. In December 2014 one of these BFOB operations was carried out in Nelson Lakes National Park, covering a large part of the RNRP and extending up the Travers and East Sabine catchments. Whether aerial pest control becomes the norm in the RNRP in the future remains to be seen. The continued use of five-minute bird counts provides an outcome measure for rodent control.

In previous years, the RNRP has trapped feral cats (*Felis catus*), although trapping effort has varied between years. Methods used have included Belisle traps set in wooden boxes with chimneys, cage traps and trialing raised set Timms. In 2014/15 experimentation of remote checking of live capture cage traps was done using recycled bird transmitters, which could greatly decrease the effort required to carry out cage trapping. However, this was ceased as did not meet the standard of checking live capture within 24hrs. The cat trapping programme finished at the end of 2015/16 due to limited staff resourcing.

The trapping of possums (*Trichosurus vulpecula*) using Sentinel kill traps has continued. Following the aerial 1080 operation in December 2014 wax tag monitoring showed that possum numbers were reduced in the Travers valley. A sharp drop in possum catches along the Travers Valley trap lines was also observed. The success of the 1080 operation in reducing possum numbers in the Travers Valley may subsequently reduce reinvasion pressure to the core RNRP for some time. Other pest species under

management include red deer (*Cervus elaphus scoticus*) and pigs (*Sus scrofa*).

The response of browse-sensitive plants to pest control is also being monitored. Three species of beech mistletoe, (*Peraxilla colensoi, P. tetrapetala* and *Alepis flavida*), continue to respond positively to possum control with levels of browse decreasing. Surveys carried out in 2008 and 2013 have shown an overall increase in plant health. However, the critically threatened understorey plant *Pittosporum patulum* is not responding to management. This is likely the result of preferential browsing by red deer (Townsend, 1999). Beech seedfall and *Chionochloa* tussock flowering are monitored as ecological drivers of rodent and subsequent mustelid population increases, and 20×20m vegetation plots are monitored to determine the trends and responses of native vegetation to multi-species pest control.

Invertebrate monitoring has included monitoring of *Powelliphanta* "Nelson Lakes" snails on the St Arnaud Range, as well as beech scale insects which as honeydew producers are ecological drivers in the honeydew beech forest ecosystem.

In addition to the core work undertaken by RNRP staff and volunteers, students also conduct research in the Mainland Island. This adds to our understanding of the functioning of the alpine beech forest ecosystem and can identify changes required to improve threatened species and pest control management. During 2015/16 Chris Niebuhr, a PhD student from the University of Otago studying the role avian malaria may be playing in native bird declines, carried out a third and final season of fieldwork in the Mainland Island with some support from RNRP staff.

The involvement of the local and wider community in the RNRP is essential for the success of the project. Maintaining and developing strong positive relationships with partners such as FOR, KCT and the local iwi are a fundamental focus of RNRP staff. Hundreds of days of work in support of the project has been undertaken by volunteers over the past nineteen years. This has including members of FOR, RNRP volunteers, Nelson Marlborough Institute of Technology Trainee Rangers, Hot Shots, Conservation Corp crews and the Over-50s tramping club. RNRP staff have also given time to other DOC and community initiatives, and have attended workshops and conferences to transfer knowledge to the wider community. Advocacy has included presentations to many school and

community groups, guided walks, displays in the Nelson Lakes Visitor Centre, information panels within the Mainland Island, and various printed media. Many events and achievements from the RNRP have also been picked up by local and national media, including the area being listed as one of the Top Twenty-Five Ecological Restoration Sites in Australasia in 2008 (Brown & Gasson, 2008).

Following DOC's change in strategic direction in late 2013 to one with an increased focus on fostering partnerships to achieve conservation goals, a new RNRP Strategic Plan 2014-19 (Harper & Brown, 2014) was implemented in April 2014, replacing the previous RNRP Strategic Plan 2008-13 (Brown & Gasson, 2008). The objectives of the new plan retain the same fundamental aims as the previous one, but reflect the increased focus on creating and developing partnerships outside of DOC.

Although day-to-day work in the RNRP progresses in response to annual or multi-annual ecosystem cycles, no project of this scale can operate without a vision and objectives to provide guidance in the medium term. To this end, the RNRP Strategic Plan 2014-19 provides the planning framework and goals for the project and highlights three major themes encompassed within the primary goal of the project, namely:

1. Increasing our knowledge of how to carry out ecological restoration nationally, while restoring local biodiversity and retaining the biodiversity gains achieved thus far

2. Advocating the value of ecological restoration to the public leading to increased public support

3. Create new, and develop existing, partnerships to achieve greater conservation goals

It is essential that these themes remain the core values for ongoing work within the Mainland Island into the future. A Technical Advisory Group and external advisors play an important role in overseeing and guiding these themes.

Additional information pertaining to this project, including datasets, advisors and project management details can be found in Appendix 1: and Appendix 2.

2 Biodiversity restoration objectives

2.1 Restore and maintain populations of kea (*Nestor notabilis*), South Island kākā (*Nestor meridionalis*), mistletoe (*Peraxilla spp.* and *Alepis flavida*), *Pittosporum patulum* and a *Powelliphanta* snail

2.1.1 Introduction

The RNRP Strategic Plan 2014-19 (Harper & Brown, 2014) identified seven threatened species being present in the Rotoiti area prior to the establishment of the RNRP. These populations and their New Zealand Threat Classification System rankings are (Robertson, et al., 2013; de Lange, et al., 2013)

- Kea (*Nestor notabilis*), Nationally Endangered
- South Island kākā (*Nestor meridionalis meridionalis*), Nationally Vulnerable
- Three species of beech mistletoe (*Peraxilla colensoi, P. tetrapetala* and *Alepis flavida*), all Declining
- *Pittosporum patulum,* Nationally Endangered
- Carnivorous land snail *Powelliphanta "Nelson Lakes",* Range Restricted

The RNRP also contains other threatened species that may benefit from pest control. However, the above populations were specifically identified because all except the kea have had considerable amounts of work already invested in monitoring and managing them since the RNRPs inception.

Kea, the only truly alpine parrot in the world, was not included in previous strategic plans. This changed following recognition that the species forms an integral part of the South Island alpine ecosystem and its threat status of 'naturally uncommon' was upgraded to 'nationally endangered' in 2013 (Robertson, et al., 2013). Evidence suggests a continuing slow decline in kea numbers in Nelson Lakes National Park (Steffens, 2009; Harper G. , et al., 2011), the primary threat being predation by introduced brushtail possums (*Trichosurus vulpecula*) and stoats (*Mustela erminea*) on kea nestlings and incubating adults (Taylor, 2009). Localised stoat and possum control has been put in place around nests that lie outside the

RNRP's intensive pest control area, and it is planned to address other threats such as lead flashing and nails in DOC huts. An aerial 1080 operation was carried out over part of the RNRP for the first time in 2014 as part of DOC's national Battle For Our Birds (BFOB) programme, with extra monitoring and mitigation measures put in place to minimise the risk to kea of ingesting poison baits (Long, 2015).

The kākā is an endemic forest parrot that is threatened by predation. Stoats are the main predator, however all three introduced mustelids (stoats, ferrets and weasels) are targeted by pest control measures. Mustelid trapping has been shown to protect the local kākā population (Moorhouse, 2003) and will continue. An upgrade from Fenn MkVI traps to DOC200 and DOC250 traps commenced in 2007 and was completed in late 2009. A two-year trial of A24 self-resetting traps took place between 2012 and 2014, after which the DOC-series traps were reinstated. In December 2014, an aerial 1080 operation was carried out in response to the heavy beech masting to prevent a rat and subsequent stoat population explosion. Possums are another known predator of nesting kākā, eggs and chicks (Moorhouse, 2003) with possum control undertaken in the RNRP using Sentinel kill traps. The control of feral cats may help to protect fledging kākā chicks which spend a significant amount of time on the ground between emerging from their nest holes and being able to fly. Cat control was carried out in previous years over a small area, however due to limited resouces this was not carried out in 2015/16. Other native bird species present are also likely to benefit from this predator control, particularly great spotted kiwi (*Apteryx haastii*) and kārearea/New Zealand falcon (*Falco novaeseelandiae*), which also nest on the ground.

The three species of beech mistletoes, *P. patulum* and the snail *Powelliphanta "Nelson Lakes"* are all threatened as a result of predation by the introduced brushtail possum. Possum numbers have been reduced within the RNRP, mainly through a sustained trapping programme. The aerial 1080 operation carried out in late 2014 resulted in a successful reduction in possum numbers up the Travers Valley where historically there has been no possum control. This will aid in reducing reinvasion pressure to the RNRP from the south. Possum control is considered to be effective at protecting these species and will continue in order to protect biodiversity values.

In addition to being threatened by possums, *P. patulum* and *Powelliphanta "Nelson Lakes"* populations may also be threatened by red

deer (*Cervus elaphus scoticus*). Detrimental browsing of juvenile *P. patulum* plants has been attributed to red deer, and red deer may deleteriously impact *Powelliphanta* habitat through concentrated browsing and trampling in the mountain beech (*Fuscospora cliffortioides*)/tussock ecotone that is favoured by both animals. Deer control is currently not a regular part of the RNRP pest control programme, but has been supplemented by the initiation of limited access to the RNRP for recreational hunters in May 2010, principally through local NZ Deerstalkers' Association branch members in a volunteer capacity. Hunters are allocated one of four blocks within the area and all animals shot are recorded. Hares (*Lepus europeaus*) represent another probable problem species for high montane and alpine species, as they degrade habitat through browsing, however no hare control is being undertaken in the RNRP. Pigs (*Sus scrofa*) are known to be present near the snail colony, their rooting activity degrades snail habitat. Pig control has only been implemented in the RNRP in the 2015/16 year.

2.1.2 Mustelid control and monitoring

Introduction

Landscape-scale ground-based mustelid control has been carried in the RNRP since 1998. Ground-based mustelid control continued throughout 2015/16 using the existing network of DOC200 traps. The Friends of Rotoiti (FOR) community group also maintains several trap lines in areas outside the RNRP, which act as a buffer, helping minimise reinvasion.

The aim of ongoing ground-based mustelid control is to reduce mustelids numbers to a tracking rate below 5%, the target that is considered to enable kākā and other native birds to breed successfully (Greene, 2004; Taylor, 2009).

Methods

Control

RNRP mustelid trap lines cover approximately 5,000 ha to the east and north of Lake Rotoiti. A total of 902 single-set traps are spaced 100m apart along 24 trap lines. The majority are DOC200 traps, with 92 DOC250 traps spread along lines adjacent to farmland to target ferrets. The wooden trapboxes are a FOR design that hinges open at one end, and meet "best practice" standards for use in areas where weka (*Gallirallus australis*) and kiwi are present.

In 2015/16 the frequency of trap checks was reduced to a maximum of 12 a year due to limited staffing levels. The exact number of checks carried out for a particular line was determined by historic catch data. The number of checks for lines with historically low catch rates was reduced from monthly to eight a year. These lines included areas that are often inaccessible due to snow in the winter. Total catch numbers (all species) were monitored and if the catch percentage on any line exceeded 20% additional checks were added to the schedule.

Traps were primarily baited with hen eggs, with Connovation Erayz #8 blocks (a rabbit based compound) used in December, rabbit in July and salted rabbit in August.

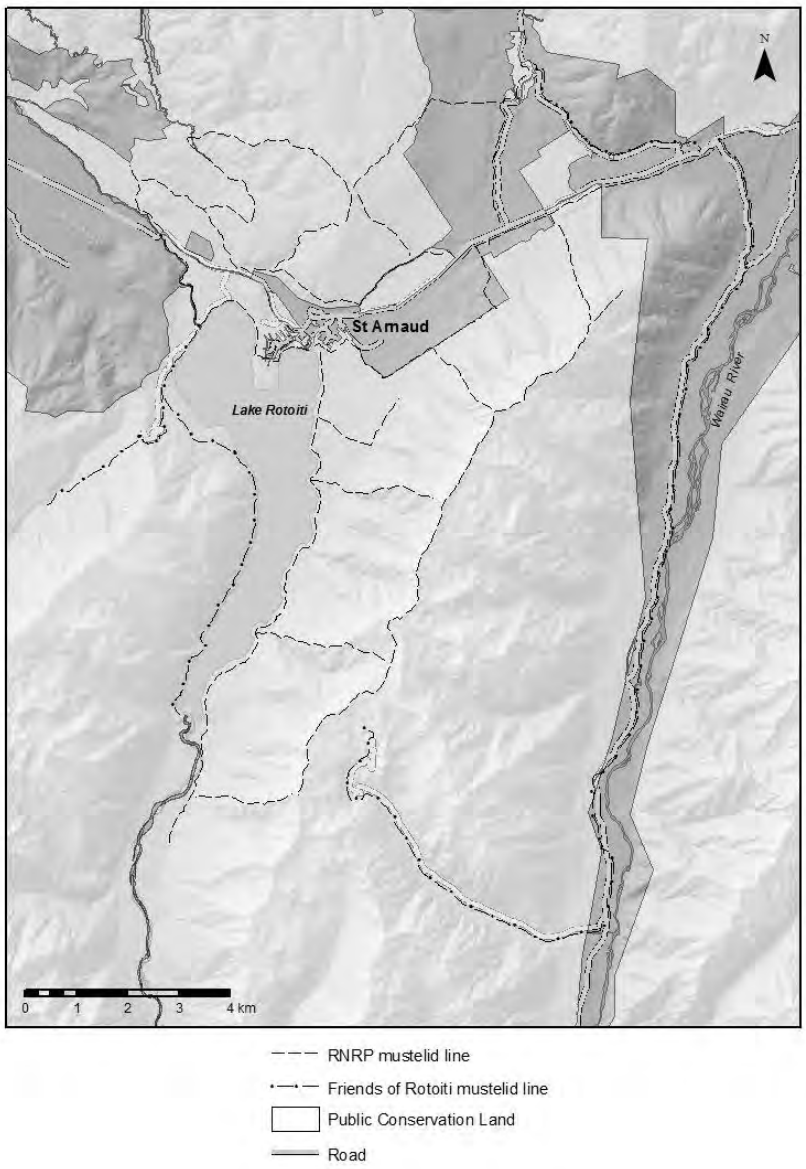

Figure 1: Location of the Rotoiti Nature Recovery Project and Friends of Rotoiti mustelid trap lines in 2015/16.

DOC 200 trap boxes had been manufactured using different material and one difference was the baffle inside the box just before the trap. Some were solid, constructed from wood and some were "see-through", constructed of mesh. Boxes were checked during the year to see what type of baffle they contained and numbers of stoats caught by traps with different baffle types was compared.

Monitoring

Mustelid monitoring is carried out using standard 60cm coreflute tracking tunnels with Black Trakka™ inked cards. Tracking rates were compared between the Rotoiti treatment site (trapping) and the Rotoroa

non-treatment site (no trapping). As different mustelid species cannot be reliably distinguished by footprints, mustelid prints from ink cards are not identified to the species level. Therefore, the mustelid tracking index is for all mustelid species combined.

Standard monitoring is carried out at both sites in November and February. Tunnels were baited with fresh rabbit used as a lure placed in the middle of the card, and left out for three fine nights (Gillies, 2013).

Extended tracking tunnel monitoring was carried out in addition to the standard three-night surveys, as standard surveys are not considered particularly effective for monitoring mustelids when they are at low density (C. Gillies, *pers. comm.*). The method used in this survey was a protocol developed by DOC scientist Josh Kemp for testing during the 2014/15 Battle For Our Birds operations to see if this method would yield more informative result. Extended surveys were carried out at both sites in November with cards and lure left out for 11 nights. The lure used was a piece of salted rabbit in a sealed metal mesh parcel, attached at the mid-point of the inked card using a zip-tie.

Results

Control

During 2015-16, 215 stoats, 33 weasels and 4 ferrets were caught within the RNRP (Table 1). The number of stoats caught was slightly higher than most years, but lower than that caught following the 2014/15 mast year. The number of weasels caught was higher than most years, however much lower than the 83 caught in the previous season. The number of rats caught as bycatch was almost a third of the 1760 that where caught the previous season (Table 1). One weka was caught in a DOC250 along the Borlase Boundary trapline.

Table 1: Trap catches and sprung traps in the Rotoiti Nature Recovery Project in DOC200s and DOC250s from July 2015 to June 2016.

Species	Number caught
Stoat (*Mustela erminea*)	215
Ferret (*Mustela furo*)	4
Weasel (*Mustela nivalis*)	33
Rat (*Rattus* sp.)	631
Mouse (*Mus musculus*)	3
Hedgehog (*Erinaceus europaeus*)	157
Rabbit (*Oryctolagus cuniculus*)	41
Cat (*Felis catus*)	21
Other	2
Sprung	258

Other = 1 weka and 1 thrush

The spatial distribution of mustelid captures over the four seasons in 2015/16 show that catches of stoats was relatively consistent across the seasons with 55 in Spring, 64 in summer, 35 in Autumn and 61 in winter (Figure 2, Figure 3, Figure 4, Figure 5). Weasel catches were highest in Winter (n=17) and spring (n=12) with few caught in summer (n=3) and only 1 in Autumn.

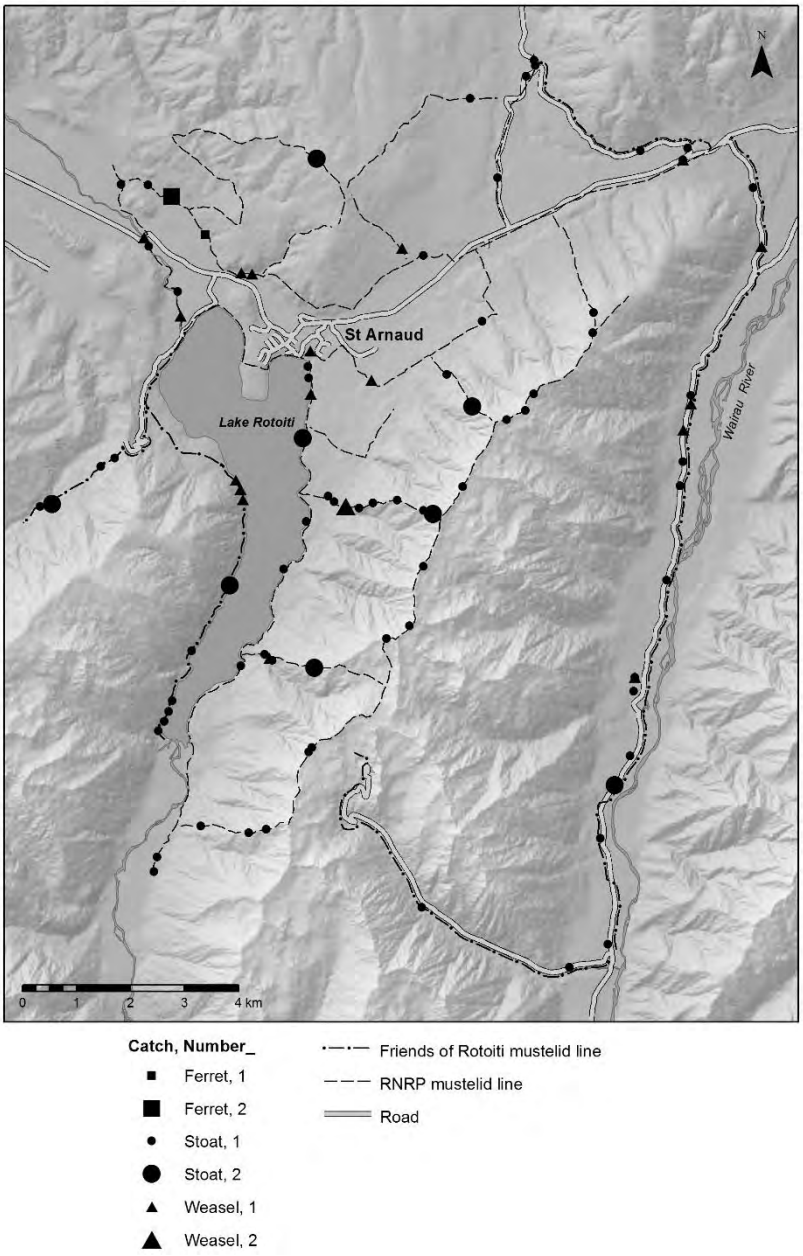

Figure 2: Mustelid captures along the Rotoiti Nature Recovery Project and Friends of Rotoiti traplines during September – November 2016.

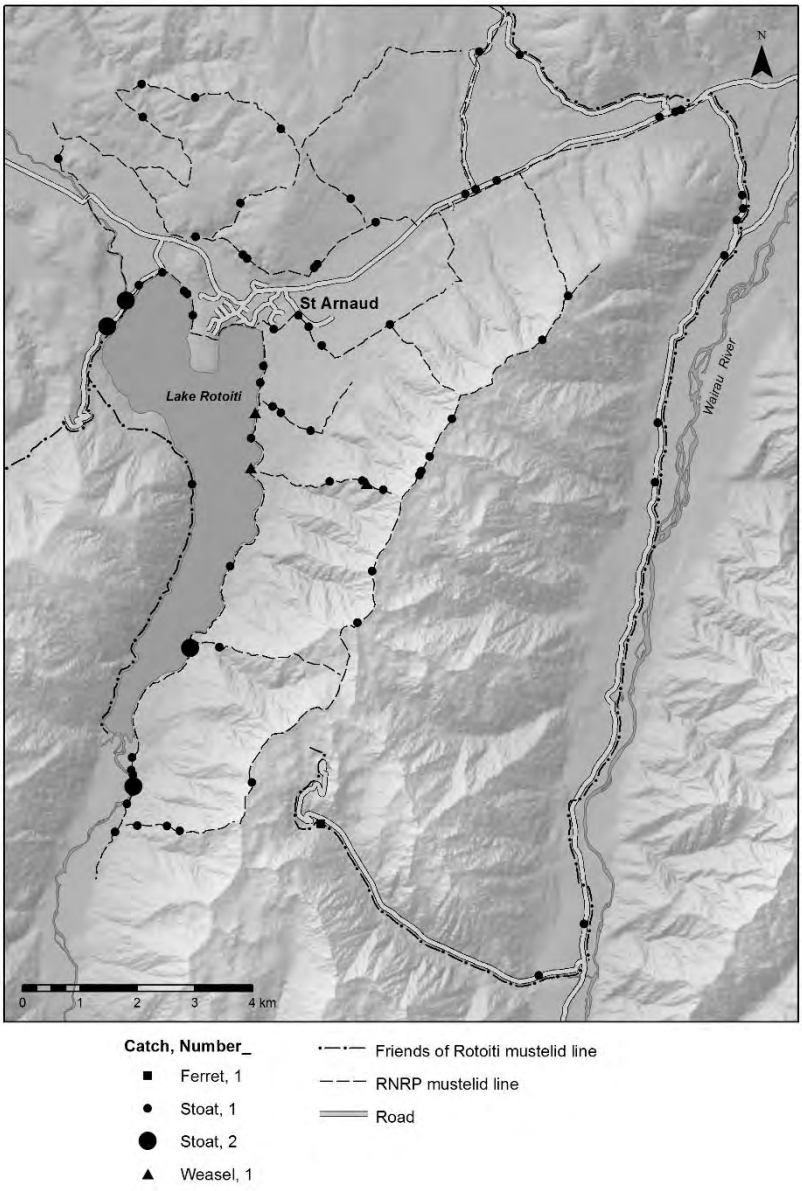

Figure 3: Mustelid captures along the Rotoiti Nature Recovery Project and Friends of Rotoiti traplines during December 2015 to February 2016.

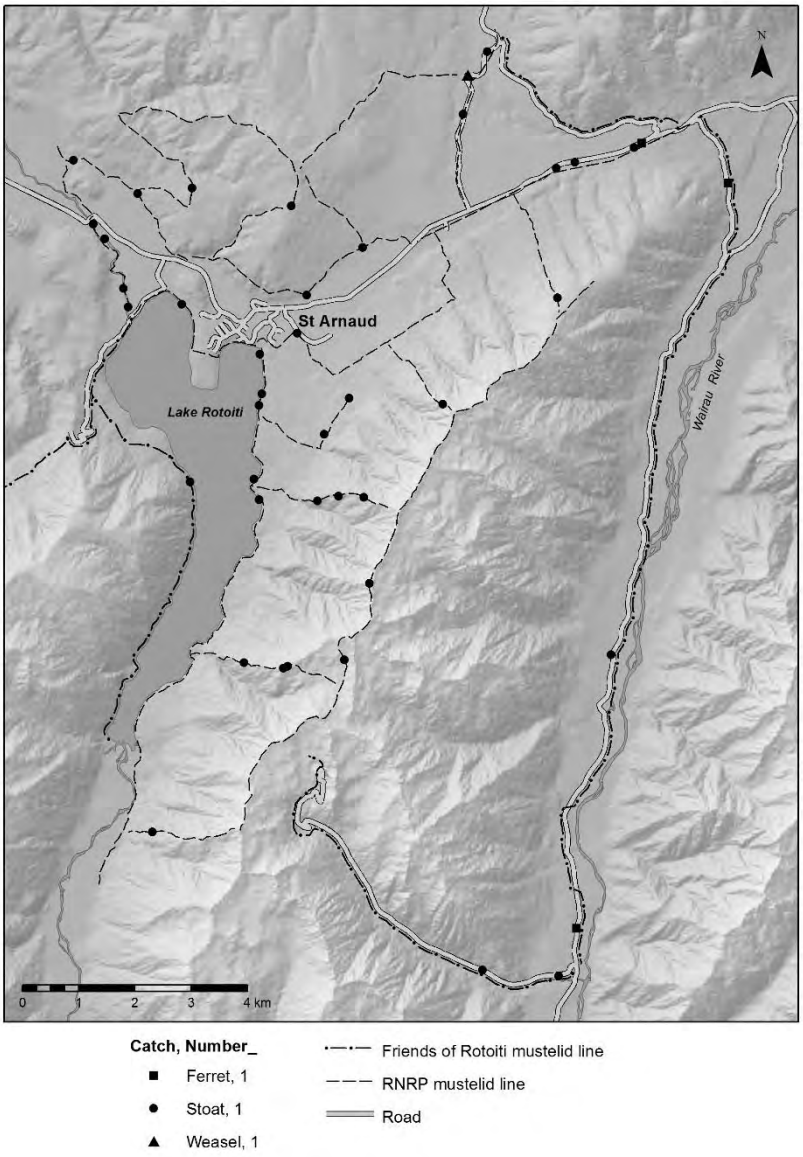

Figure 4: Mustelid captures along the Rotoiti Nature Recovery Project and Friends of Rotoiti traplines during March-May 2016.

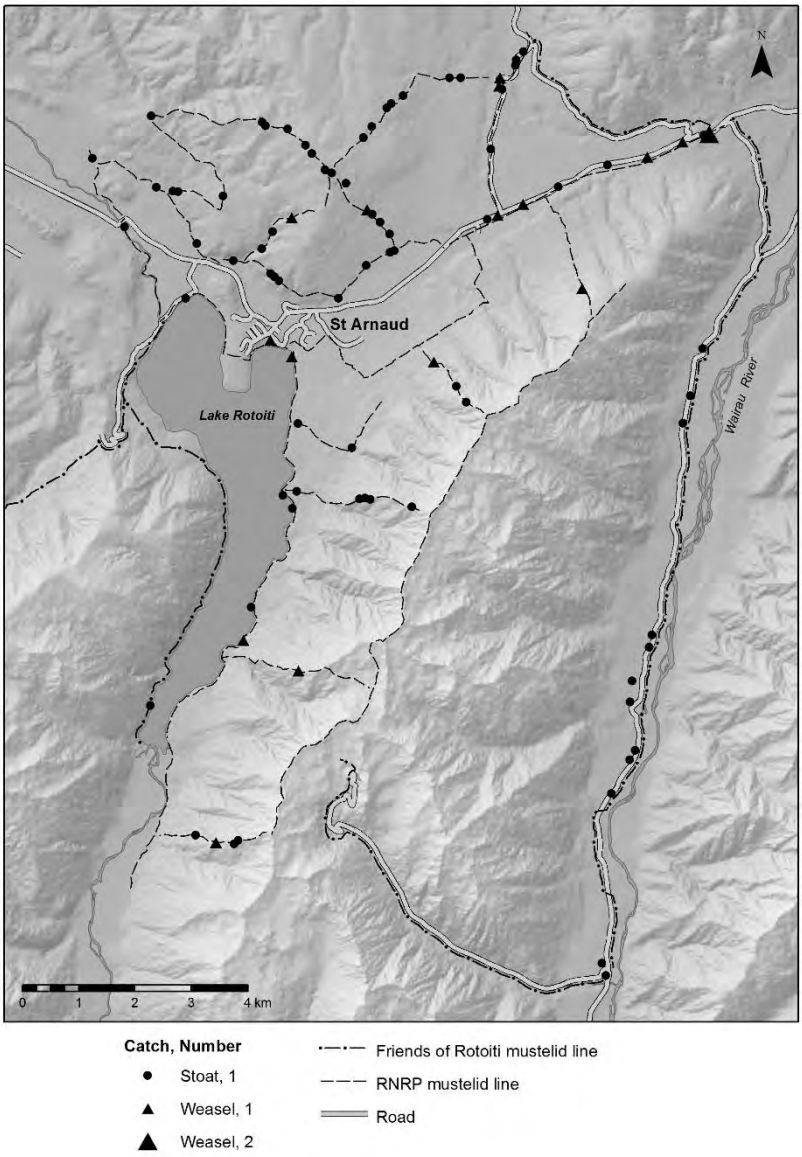

Figure 5: Mustelid captures along the Rotoiti Nature Recovery Project and Friends of Rotoiti traplines during July-August 2015 and June 2016.

There was no difference in catch rate of stoats in traps with different baffle designs in 2015/16, with mesh and wood baffles having a catch rate/trap of 0.227 and 0.252 respectively (Table 2).

Table 2: Catches of stoats in trap boxes with wooden internal baffles compared to mesh internal baffles in the Rotoiti Nature Recovery Project 2015/2016.

Stoat Catches vs Internal Baffles			
Baffle	Traps	Catches	Catch/Trap
Mesh	471	107	0.227
Wood	377	95	0.252
Unknown	54	13	0.241
Total	902	215	0.238

Monitoring

Mustelid tracking rates were lower within the Rotoiti trapping area compared to the nontreatment area at Lake Rotoroa (Figure 6). Mustelids were almost at non-detectable levels at Rotoiti during all monitoring periods, with 1% (±1) tracking in November and no mustelids tracked in either February or May. In contrast, at Rotoroa tracking was considerably higher with a tracking rate of 52% (±18) in November and 20% (±9) in February. Extended surveys carried out in November show a similar trend with 7% (±4) tracking at Rotoiti and 59% (±10) at Rotoroa.

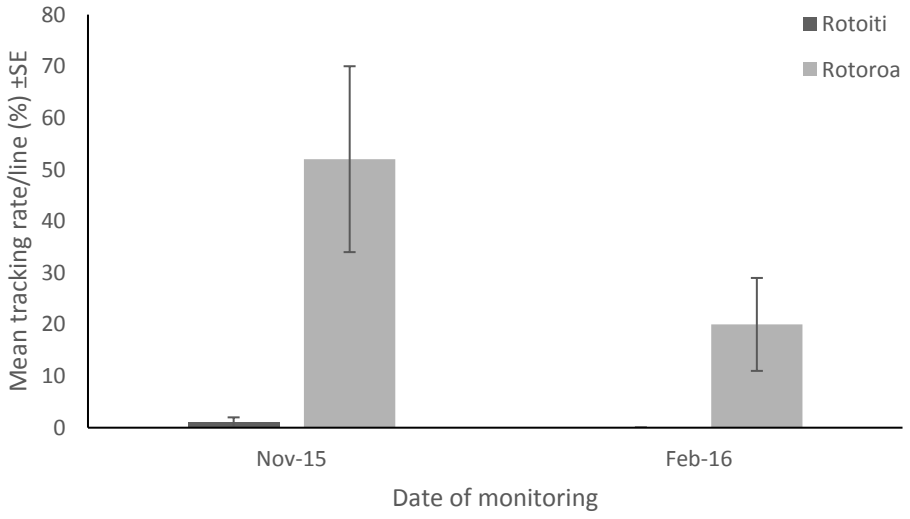

Figure 6: Rotoiti Nature Recovery Project mustelid tracking rates from tracking tunnels at Lake Rotoroa (no trapping) and Lake Rotoiti (trapping) in 2015/16.

Discussion

During 2015/16, mustelid tracking rates from standard tracking tunnel monitoring were below the five percent threshold within the Rotoiti Nature Recovery Project, whereas at Lake Rotoroa where no mustelid control is carried out, mustelid tracking was well above this threshold (Figure 6). This result suggests that the reduction in trap check frequency implemented this year has had no effect on the ability of the trapping programme to keep mustelid populations at low levels. The number of checks carried out was reduced this year to meet staff resources with monthly winter checks and fortnightly checks during summer reduced to monthly checks on most lines. For trap lines with low historical catch rates, checks were reduced to eight annually.

The number of mustelids caught in the 2015/16 season was higher than most years, but lower than that of the 2014/15 mast season. This increased catch rate is likely an ongoing effect of the 2014/15 mast, with high numbers of stoats caught in the winter and spring of 2015 (50 in July and August 2015, 55 from September-November 2015), periods when stoat catches are normally very low. The number of stoats caught in August was particularly high, with a total of 34 caught. However, during this period fresh rabbit was used as bait instead of eggs and may have contributed to the high catch rate compared to other years when only eggs were used. Although this is questionable, given stoat catch rates were also high during the spring period when eggs were used as the lure.

A similar trend is seen in the catch rate of weasels, with a high number of weasels caught in the 2015/16 season compared to most years when very low levels are typically caught, with the exception of the 2014/15 mast year (Long, 2015). Again weasels followed a similar seasonal trend to that of stoats with high numbers caught in winter (n=17) and spring (n=12) of 2015 before reducing considerably with only four caught during the rest of the year.

The increase in weasel numbers trapped in the RNRP was also observed in other BFOB sites in the northern South Island following the 2014 BFOB 1080 operations. This raises questions as to whether the effective control of rats and stoats, in the absence of adequate mouse control, leads to a mouse-weasel predator-prey system during mast years. More research is needed to determine if this is the case, and if so how can effective mouse control be achieved.

Results from the November extended tracking data showed a 7% (±4) rate compared to the standard monitoring method carried out in the same month which returned a rate of 1% (±1). As tracking rates are an indicator of activity rather than abundance, it is unknown whether this higher tracking rate reflects higher mustelid abundance picked up by the extended survey compared to the standard surveys. More research is needed into this methodology.

2.1.3 Friends of Rotoiti mustelid control

Methods

Mustelid trap lines are maintained by the Friends of Rotoiti (FOR) as a buffer to the RNRP, with a total of 292 DOC200 and 106 DOC250 traps in operation:

- Rainbow Valley / Six Mile / Dip Flat Line: 85 DOC200s (77 in Run-Through boxes) and 77 DOC250s. In August 2015, the bait-less run-through trial was completed. The run-through boxes (with DOC 200 traps have been left in place along the Rainbow Valley and alternate with DOC 250 traps. The Six Mile and Dip Flat lines each have four DOC 200s.
- Seasonal Rainbow Ski Field Line: 70 DOC200s. These traps are put out in mid to late October to run through the summer months (exact timing is always seasonally dependent on when the snow falls at the beginning of the season and when the ski field closes at the end of the season).
- Mt Robert Line: 18 DOC200s.
- Whisky Falls Line: 82 DOC200s.
- Tophouse Road Line: 43 DOC200s.
- Speargrass Line: 24 DOC200s.

The Mt Robert, Speargrass, Whisky Falls and Tophouse Road lines are checked fortnightly during spring/summer (November to April), and then monthly during autumn/winter (May to October). The Rainbow Valley, Dip Flat, Six Mile and Rainbow Ski field lines are checked weekly or fortnightly from October to April, and fortnightly or monthly during the colder months depending on catches.

Polymer baits (from Trappers Cyanide Ltd) are used, and baits are changed every eight weeks.

A bait-less run-through trial began in August 2013, to compare results from non-baited run-through traps with baited standard DOC200 traps. The trial includes trap numbers 1 – 153 on the Rainbow Valley trap line. In the first year up until August 2014, even-numbered traps were run-through traps, and odd-numbered traps baited. The order was then switched for the second year of the trial. The trial finished in August 2015.

Results

Over the two-year trial period 66 stoats were caught in run-through traps compared to 35 in the traditional baited traps (Brown & Ward, 2016). These results suggest that the run-through traps are more effective at catching stoats than the traditional baited trap boxes.

The spatial distribution of mustelid captures along FOR trap lines are shown in Figure 2, Figure 3, Figure 4 and Figure 5. The distribution of FOR mustelid captures by month is shown in Figure 7 and non-target species caught as bycatch in the FOR mustelid traps are summarised in Table 3.

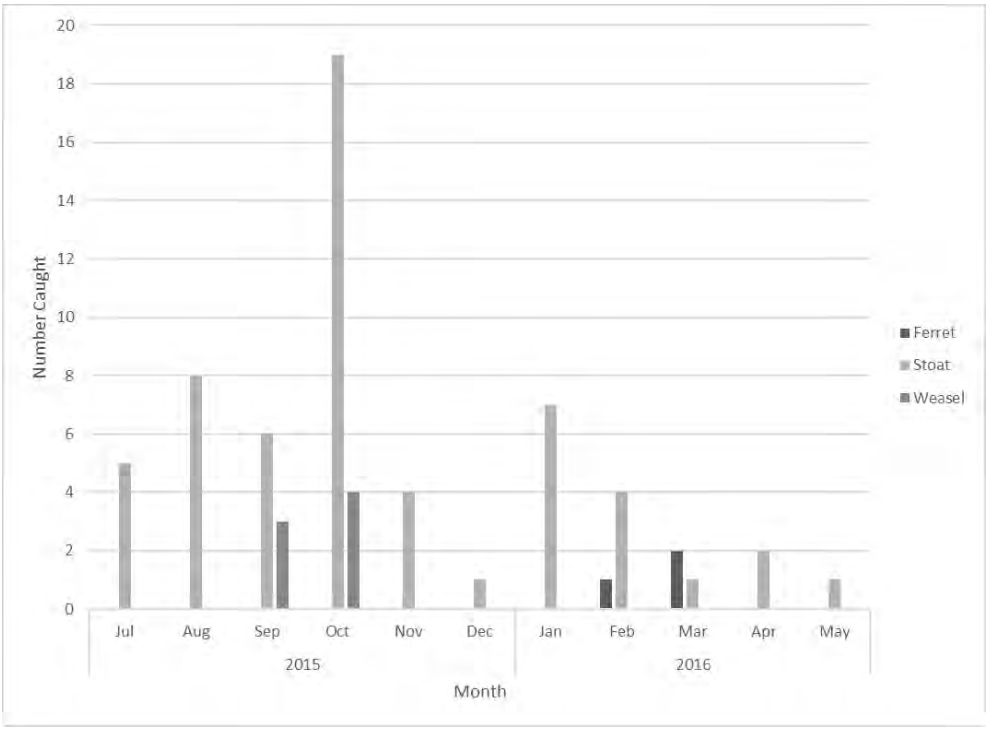

Figure 7: Total number of each mustelid species caught on Friends of Rotoiti mustelid trap lines in 2015/16 by month.

All birds caught were introduced species and included a sparrow (*Passer domesticus*), a starling (*Sturnus vulgaris*) and one unknown (Table 3).

Table 3 Non-target captures on Friends of Rotoiti mustelid trap lines in 2015/16.

Species	Number caught
Hedgehogs (*Erinaceus europaeus*)	61
Rats (*Rattus* spp.)	236
Rabbits (*Oryctolagus cuniculus*)	29
Cats (*Felis catus*)	5
Mice (*Mus musculus*)	6
Birds	3

2.1.4 Feral cat control

No targeted trapping of feral cats was undertaken in the RNRP during the 2015/16 season. However, DOC200/250 traps targeting mustelids continued to catch juvenile cats.

Results

Twenty cats were caught in DOC200/250 traps during 2015/16, ten in DOC250s and ten in DOC200s. Sixteen were caught in traps baited with chicken eggs, while four were caught in traps baited with eggs and erayz. All captures were on boundary lines, as opposed to in the core of the RNRP, with ten caught on the Borlase Boundary.

Discussion

Cage trapping, normally undertaken within the RNRP to target areas with high cat presence was discontinued at the end of 2014/15 season due to limited resources. Despite the cessation of targeted cat trapping a similar number of juvenile cats were caught as bycatch within DOC series traps to previous seasons. In previous seasons, most cats have been caught in DOC series traps baited with salted rabbit to target ferrets, however this

was not the case this season with all caught on eggs or erayz. This season two of the 20 cats caught were still alive when found, while a third cat was caught by the paw and had starved to death. The humaneness of catches will be monitored more closely in the 2016/17 season, and improvements will be made to try to improve this aspect of mustelid trapping.

2.1.5 Friends of Rotoiti feral cat control

Methods

Cats are often caught as bycatch in FOR mustelid traps, particularly on the Rainbow and Whisky trap lines. Several local volunteers also maintain their own live-capture cage traps targeting cats at points around the St Arnaud village and Tophouse Road area.

Results

Five cats were caught as by-catch in FOR mustelid traps, three in Rainbow Valley, one along Whisky line and one on the Tophouse Road line. Targeted cage trapping by local volunteers resulted in 133 feral cats being caught during the 2015/16 year.

2.1.6 Possum control and monitoring

Introduction

Ground based possum control has been carried out in the RNRP since 1997 using a combination of toxins and kill traps. Control now focuses on kill traps placed on mustelid control lines. Possum monitoring is completed using the National Pest Control Agency's (NPCA) waxtag seven-night survey method. This was last completed during 2014/15, and is conducted at two yearly intervals with the next monitoring to be undertaken in 2016/17.

Methods

In 2015/16 sentinel kill traps where used along existing mustelid trapline to control possums within the RNRP (Figure 8). These were attached to trees ~1.5m above ground level, and fitted with white coreflute covers to help prevent non-target bycatch and direct the target species into the kill-zone.

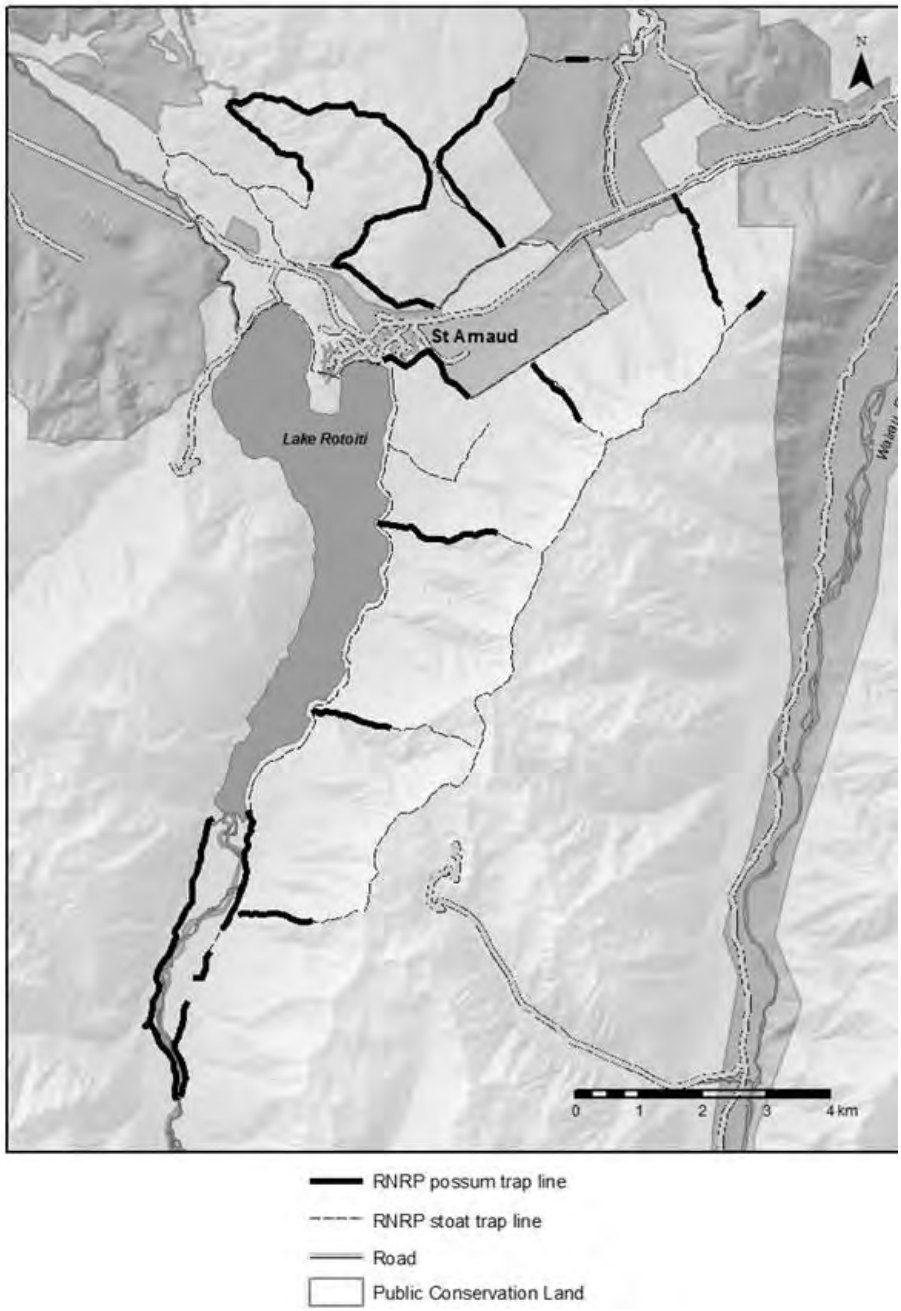

Figure 8: Locations of possum traps along mustelid trapline within the Rotoiti Nature Recovery Project in 2015/16.

Traps along some lines (Borlase Boundary, SARN, Duckpond stream, Black Sheep Gully, Struth, and a short length of Dome Ridge) are positioned at every second stoat trap site 200m apart. All other RNRP possum traps are at 100m spacing, generally located with RNRP stoat traps below bushline.

The lure regime in 2015/16 was the same as in recent years with a combination of Connovation's Ferafeed Smooth in a Tube lure on the tree

leading up to the trap, and Trappers Cyanide Ltd.'s Possum Dough on the bait clip attached to the trap.

Results

The total number possums caught within the RNRP was lower in 2015/16 than previous seasons, with 139 caught compared to 217 in 2014/15. This season the Big Bush area had the possum catches, with 88 caught and a catch rate of 0.74 catches/trap (Table 4). The Travers valley trap line, which buffers the RNRP, caught relatively few possums (n=30) this season resulting in a catch rate of only 0.32 catches/trap. Fewer possums were also caught within the St Arnaud Range area (Table 4).

Within the Big Bush area half of the captures were on the Dome Ridge trapline, which is the northern boundary of the RNRP. Ten possums were also caught on Grunt trapline which is in the centre of the St Arnaud Range, which was the highest catch rate of all the St Arnaud Range lines.

Table 4: Possum trap catches from traplines within the Rotoiti Nature Recovery Project and buffering the project in 2015/16.

Trapline	Total Possums caught	No. of traps	Catch per trap
Black Sheep Gully	11	13	0.85
Black Valley Stream	11	19	0.58
Dogleg	11	23	0.48
Dome Ridge	42	45	0.93
Duckpond Stream	9	10	0.90
Struth	4	9	0.44
Big Bush Total	88	119	0.74
Borlase Boundary	0	14	0.00
Clearwater	5	17	0.29
Grunt	10	23	0.43
Hubcap	3	23	0.13
MOR	2	17	0.12
SARN	0	3	0.00
Snail	1	15	0.07
RNRP St Arnaud Range Total	21	112	0.19
Coldwater	16	49	0.33
Lakehead	14	45	0.31
Travers Valley Total	30	94	0.32
Total	**139**	**325**	**0.43**

Discussion

The low number of possums caught within the RNRP is thought to be largely a result of the 1080 operation undertaken within the RNRP and Travers in December 2014. Historically possum numbers have been high within the Travers valley which is south of the RNRP, as no control has been undertaken here. In 2013/14 a trapline was established to reduce reinvasion from this area into the RNRP. Catches along this line have been high with 399 possums caught during the first year of trapping. In 2014 the BFOB 1080 operation reduced the possum population in the Travers valley, with waxtag monitoring showing the Possum Activity Index reduced from 19% in October 2014 to 4% after the operation in February 2015. After the 1080 operation the number of possums caught along the Travers trap line was also reduced which has reduced the number of overall possum captures for the RNRP.

The increased number of possums caught within Big Bush is likely a result of the Animal Health Board reducing the number of possum control operations carried out to the north of this area, as no TB has been detected for some time. As possum numbers are now rebuilding in these areas, reinvasion into the RNRP area of Big Bush is increasing. Waxtag monitoring scheduled to be undertaken in 2016/17 will help determine whether the current trapping regime along existing mustelid traplines is adequate for the control of possums within the Big Bush area, or whether a more intensive control programme is needed. Given the abundance of kākā activity in Big Bush and the fact that possums are known predators of nesting kākā, their eggs and chicks, this work is considered to be high priority (Moorhouse, 2003).

2.1.7 Friends of Rotoiti possum control

Methods

Friends of Rotoiti possum control started with Warrior kill traps in 2005, which were changed to Sentinel traps early in 2010. The number of traps across various lines has been increased over the years. Currently there are 33 traps in the Rainbow Valley, 20 on the Whisky Falls line, 19 on the Speargrass line and nine on the Mt Robert road line. One Trapinator possum trap is being used on the Speargrass line.

Possum Dough (Trappers Cyanide Ltd) and aniseed soaked wooden dowels) were used as lures in the Sentinel kill traps at different times.

Results

In 2015/16 134 possums were caught, which is fewer than in 2014/15 (145), however this does not take into account any variation in effort between the years. Catch numbers by month are shown in Figure 9. The highest total catch per month was in October 2015, when twenty-three possums were caught.

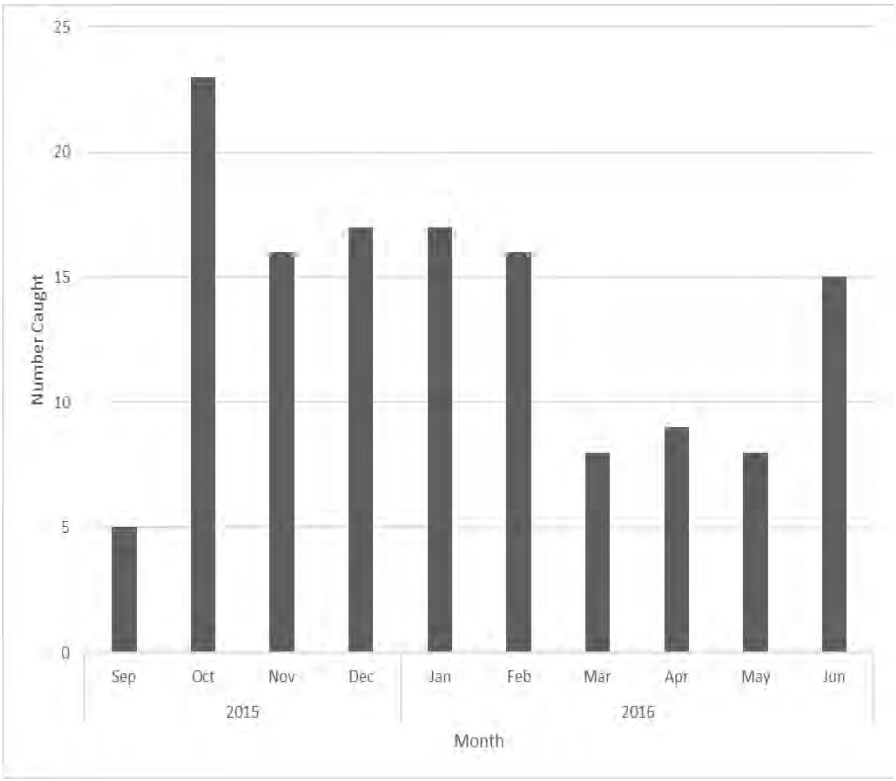

Figure 9 Possum captured on Friends of Rotoiti possum trap lines by month in 2015/16

2.1.8 Deer control and monitoring

Methods

A system was established to allow recreational hunters to book access to hunting blocks within the RNRP. The BFOB aerial 1080 operation in December 2014 may have also contributed towards controlling deer within the Travers Valley and East Sabine catchments (Long, 2015).

Results

Deer and deer sign continue to be seen throughout the RNRP by DOC staff and volunteers, but interest in the RNRP hunting blocks from the public has been limited, likely as low numbers of deer are thought to be present.

No hunting was permitted over a large portion of the RNRP during the caution period following the BFOB aerial 1080 operation between the 3rd of December 2014 and the 3rd September 2015. Live deer and fresh deer sign have been seen since the BFOB aerial 1080 operation in both the Travers and East Sabine catchments so the operation did not exterminate the entire deer population in the area.

There were approximately ten known recreational hunting days in the RNRP during 2015/16, with one deer shot.

Discussion

Although numbers of ungulates within the RNRP appear to be low or have a very patchy distribution, they are likely to have a negative effect on preferred species of native plants, such as *Pittosporum patulum*. Therefore, the number of browsers within the RNRP needs to be kept very low to reduce the impact on rare plant species.

The RNRP hunting block system has not been particularly effective in encouraging members of the public to hunt within the RNRP, so ground-based deer control has been largely carried out by interested local DOC staff. This system needs to be revisited to ensure that it is compatible with current Health and Safety requirements, and to publicise it to increase deer control effort in the RNRP.

2.1.9 Pig control and monitoring

Introduction

Regular pig control is not carried out in the RNRP. Pig activity in the area is particularly noticeable along Dome Ridge in Big Bush, and just below the bushline on the northern-most tip of the St Arnaud Range. Sign is occasionally found elsewhere within the RNRP core. The current pig control regime is typically reactive, in response to significant sign being observed or problem pigs creating health risks on tracks.

Scavenging of possum carcasses from trap lines by pigs up the Travers Valley has been a problem in previous years. This resulted in the need to

replace missing/damaged traps, wasting limited resources as well as creating health hazards to trampers through the spreading of carcasses along the Lakehead and Coldwater tracks. In 2014 a live pig trap was set up approximately 500m from Lakehead hut to target a boar thought to be responsible for the scavenging. After approximately six months of trapping, the boar was caught and scavenging ceased.

Using lessons learnt from this trapping operation, more pig trapping was planned for the 2015/16 year in two other areas of the RNRP.

Methods

The trap at Lakehead was dismantled with the intention of relocating it to within the RNRP "Core" area. Trail cameras on deer wallows had identified two separate boars of large size roaming the RNRP. Surveys for pig sign just north of the Grunt trap line found recent boar sign about 300m from the lake edge, and a pre-baiting scheme at the site was started with a pair of trail cams to monitor activity. The methodology behind pre-baiting the trap area has been developed to circumvent the suspicious nature of pigs. The best practice process for setting up a new trapping site is to locate fresh sign, deploy bait, deposit trap materials, deploy more bait, setup trap, pre-bait again and then finally set the trap.

A pre-existing trap close to the National Park boundary (50m) behind Beech Hill Rise was identified as the least labour intensive trap site to start management on the large pig population at the northern end of the RNRP. Pre-baiting was started 100m away from the existing trap and monitored with trail cameras. Once feeding was observed, bait was also placed at the trap, then inside the trap, and finally only inside the trap to encourage free feeding inside the trap.

The bait initially used at both sites was fermented whole grain barley. This was purchased in 25kg sacks and soaked in water for a week to allow fermentation. However Founders Brewery in Nelson later supplied spent grain in 60 litre amounts free of charge. Spent brewing grain is a mixture of malty grains that have been rolled and crushed, then "mashed" in hot water to extract the sugars. At the RNRP molasses and hot water was added to allow wild yeasts to start fermentation. The bait shows increased scent after a few days and when fermented, grain has been shown to attract pigs from up to 1km away.

Results

At the end of the 2015/16 year, the trap sites were in the pre-bait phase of the trapping process.

Discussion

Pig control is not a high priority in the RNRP and wider area, mainly due to limited resources being directed towards the management of pest species that pose a greater threat to the ecosystem. However, regular pig control would be beneficial to the RNRP given the increasing amount of sign being seen and the unknown impact pig activity is having on Powelliphanta snail colonies in the area. Re allocation of resources is being considered at present towards management of the pig problem and associated monitoring.

2.1.10 Kākā (*Nestor meridionalis*) monitoring

Introduction

Monitoring of South Island kākā (*Nestor meridionalis meridionalis*) populations and breeding success has been a key focus of the RNRP since its beginning. This research found that mustelid trapping provided protection to the local kākā population, and that keeping mustelid tracking indices below 5% improved kākā breeding success (Moorhouse, 2003).

Intensive kākā research in the RNRP ceased after 2005/06, with low effort encounter rate monitoring taking its place as a means of observing long-term changes in the population. In 2015 monitoring was increased again, with Project Janzoon using the RNRP as a source population for chicks to be hand reared and then released into Abel Tasman National Park to begin re-establishing the population.

Methods

Encounter rate monitoring

The annual kākā encounter survey was conducted from the beginning of October 2015 to the end of April 2016. The surveys are carried out concurrently with mustelid trap checks along nineteen trap lines that traverse suitable kākā habitat below the bushline.

Observers record the date, start and finish time, number of kākā encountered, closest trap box location, time of each kākā encounter and whether the birds were seen or heard.

Nest occupancy monitoring

Thirty historical kākā nesting sites identified in a 1996 to 2006 study, were monitored for occupancy to test the occupancy rate of known nests as a tool for monitoring population trends. Observers would watch a nest for visitation and look for signs of recent use of the cavity from the ground. Nests were to be monitored during the peak laying period from mid-October to mid-November. A nest would be considered inactive if no visitation was observed in 3.5hrs.

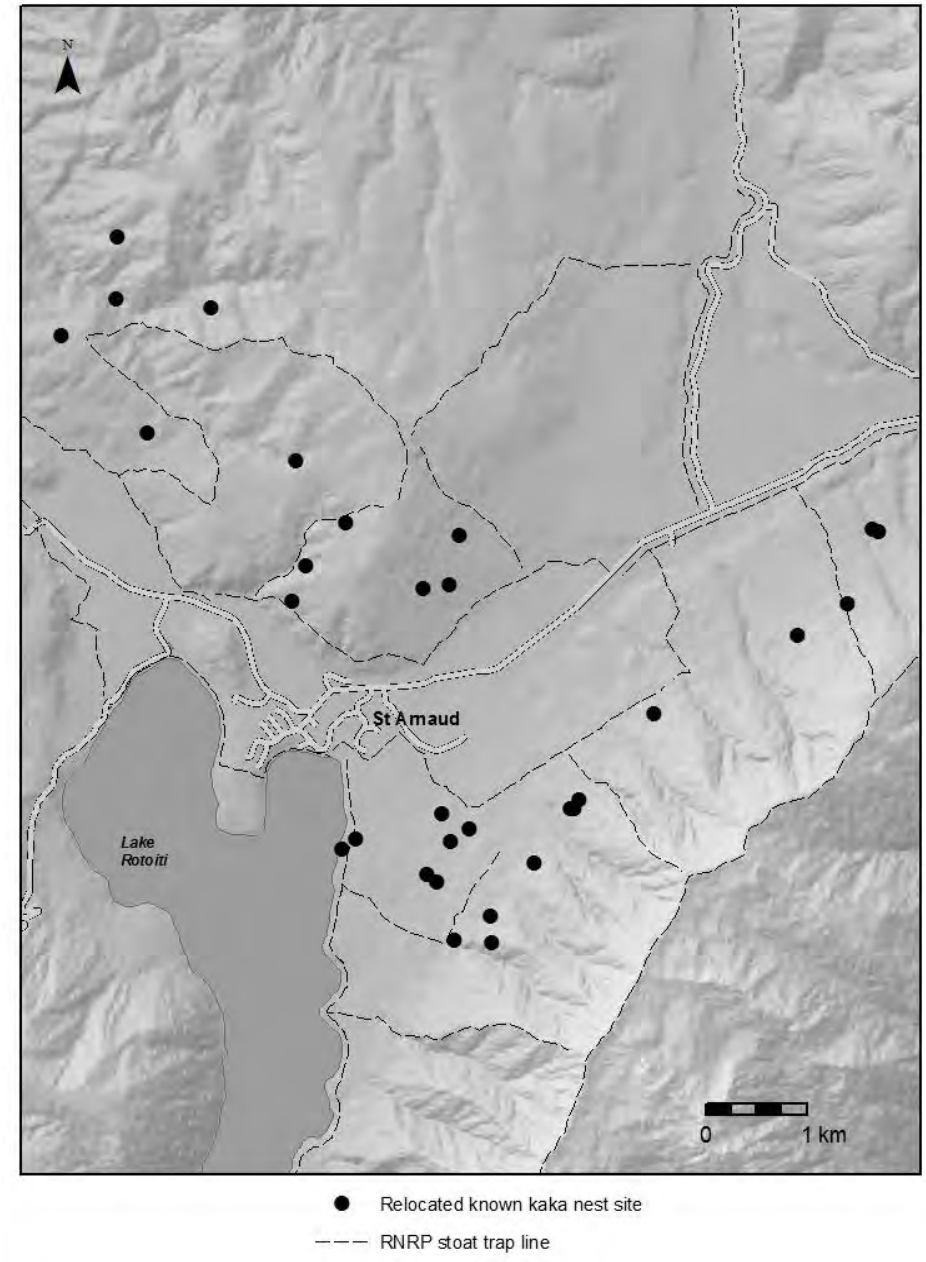

Figure 10: Kākā nest sites used during a 1996-2006 study in the Rotoiti Nature Recovery Project that were monitored for occupancy in 2015/16.

Translocation to captive breeding population

In October 2015 staff from Project Janzoon caught nine kākā within the RNRP core area using mistnets. Five of the birds (three male and two female) were fitted with transmitters to track their movements. Between October and November the birds were visited weekly to determine if any nesting behaviour was taking place. Extra protection was provided for nests found by placing a metal band on the tree above and below the nest entrance. Nests were monitored and one to two chicks were removed from each nest for rearing at Natureland in Nelson for later release into Abel Tasman National Park. Trail cameras were then set up on nests to determine whether remaining chicks fledged successfully.

Results

Encounter rate monitoring

In 2015/16, 28 kākā were seen or heard over 139 hours of surveying, giving an encounter rate of 0.20 encounters per hour (Figure 10). No kākā were encountered on Angler's Walk, Borlase Boundary, Black Sheep Gully, Clearwater, German Village, Lake Edge, Lakehead, MOR, Peninsula or Teetotal Road trap lines (Figure 11).

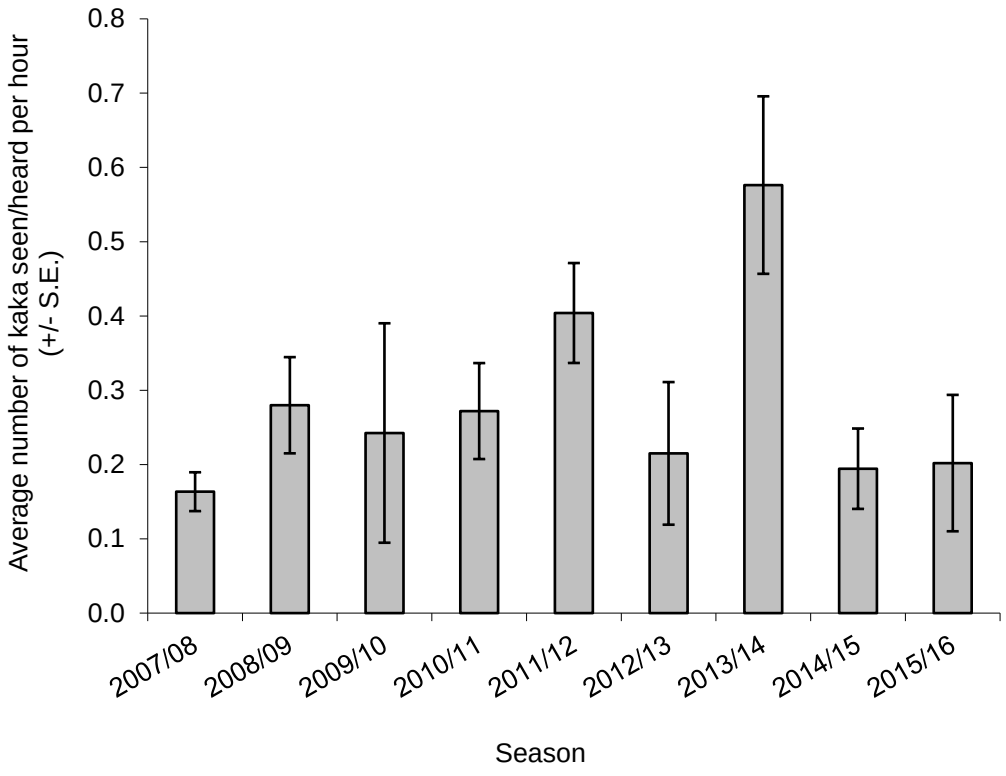

Figure 11: Mean (±SE) kākā encounter rates (number of birds seen/heard per hour) in the Rotoiti Nature Recovery Project.

Table 5: Encounter rates of kākā on traplines within the Rotoiti Nature Recovery Project between October 2015 and April 2016.

Trapline	Hours Surveyed	Number of kākā		Encounter rate per hour (Seen and heard)
		Seen	Heard	
Angler's Walk	2.8	0	0	0
Borlase Boundary	13.4	0	0	0
Black Sheep Gully	3.5	0	0	0
Black Valley Stream	4.7	1	0	0.21
Cedar	6.5	1	2	0.46
Clearwater	7.3	0	0	0
Dogleg	6.8	1	2	0.4
Dome Ridge	14.8	4	0	0.27
Duckpond Stream	5.8	4	0	0.69
Grunt	8.8	0	2	0.22
German Village	4.6	0	0	0
Hubcap	5.7	3	6	1.59
Lake Edge	16.0	0	0	0
Lakehead	10.8	0	0	0
MOR	7.1	0	0	0
Peninsula	3.3	0	0	0
Snail	1.7	0	1	0.6
Struth	1.9	1	0	0.52
Teetotal Road	13.5	0	0	0
Total	**139**	**15**	**13**	**0.20**

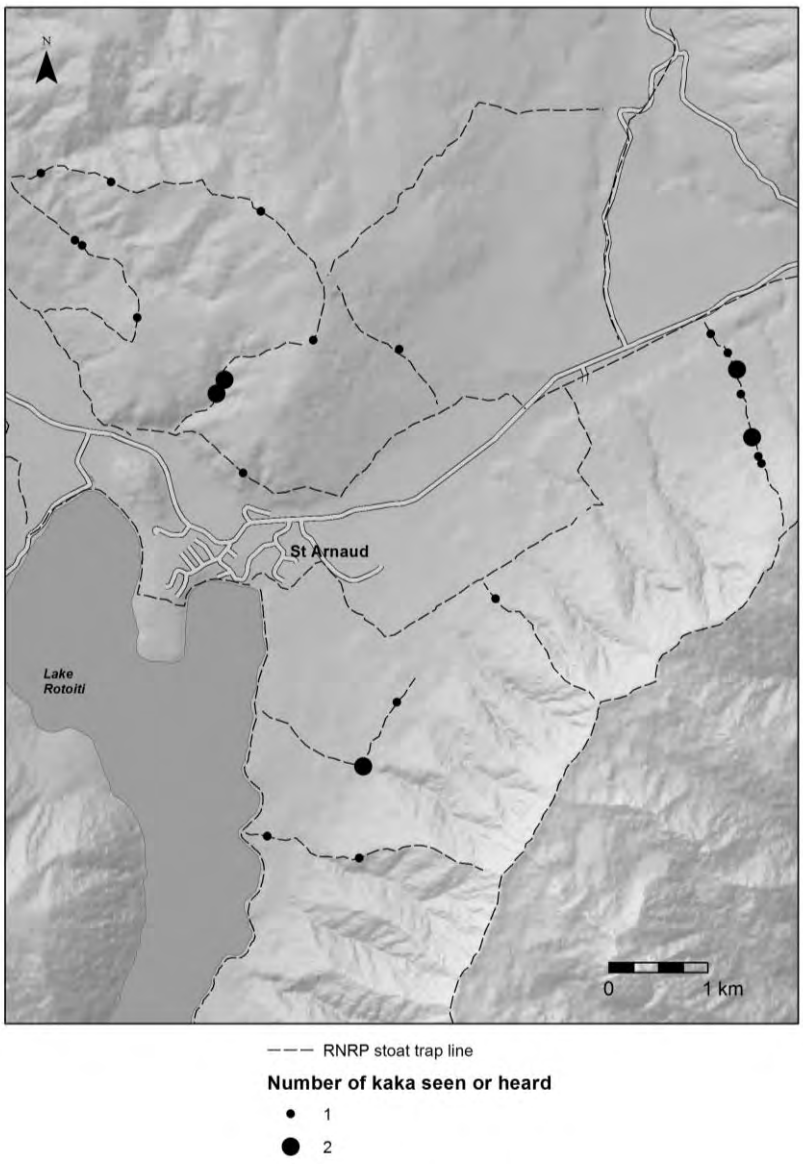

Figure 12: Locations of kākā encounters on Rotoiti Nature Recovery Project traplines (October 2015 - April 2016).

Nest occupancy monitoring

Between 30 November and 14 December 2015, 29 nests were observed for one to three hours. One active nest was found, with the other 28 having no activity recorded at them.

Translocation to captive breeding population

Mistnetting carried out in the core of the RNRP caught 9 kākā, with two of these males caught twice. The sex ratio of these birds was one females

to 3.5 males, which is a higher ratio than that of previous mist netting projects in the RNRP.

Table 6: Sex ratio of kākā caught in Nelson Lakes National Park during different projects from 1984.

Year	Site	No. females	No. males	Sex ratio (F:M)
2015	Rotoiti	2	7	1:3.5
2000-02	Rotoiti	21	21	1:1
2000-02	Rotoroa	6	14	1:2.3
1996-99	Rotoiti	6	11	1:1.8
1996-99	Rotoroa	19	22	1:1.2
1989-91	Rotoiti and Rotoroa	7	16	1:2.8
1984-89	Rotoiti and Rotoroa	10	20	1:2

Three of the five monitored kākā had nesting attempts in 2015/16. A further nest was found in Big Bush by a volunteer observing a historic nest site.

Nest 1: Transmittered male Kieran and untransmittered female. Found nesting 18/11/15. On the 6/1/16 the tree was climbed and the nest was found to have recently failed with parents still visiting. No remains were found and cause of failure was unknown.

Nest 2: Transmittered female Krusha. Nest found 26/11/15. On the 7/1/16 the nest was checked and four chicks were present. On the 29/1/16 two male chicks were removed and taken to Natureland. No trail camera footage was gained from nest. One dead chick was found in the nest when inspected 11/3/16.

Nest 3: Transmittered female Kalm. Nest found 15/12/15. On the 25/2/16 two chicks were found in the nest and one was removed and taken to Natureland. No trail camera footage was gained. Nothing was found inside the nest when inspected 17/3/16.

Nest 4: Untransmittered parents. Nest found 10/12/15. 20/1/16 three chicks were found and two removed. No trail camera footage was gained and nothing was found in the nest when checked 14/3/16.

Of the four chicks taken to Natureland. One was found to have metabolic bone disease and euthanized. Another ate gravel and then developed pneumonia and was euthanized.

Discussion

The kākā encounter rate in 2015/16 was similar to that observed in previous seasons, but lower than that of 2014/15 (Figure 11). The high encounter rate of 2014/15 was likely caused by abundant beech flowering stimulating high levels of kākā breeding activity, rather than by an actual increase in population.

In the 2015/16 season beech flowering was high enough to trigger some kākā breeding, with three of five monitored pairs having nesting attempts. A fourth nest was found in cavity historically used by kākā as a nesting site. All nests were banded with metal rings above and below the entrance to provide some protection from predators. Despite this two nests failed at the chick stage, with the remains of a chick found in one of the nests. Trail camera monitoring of nests was unsuccessful so the causes of failure are unknown and could be due to natural circumstances, however the absence of remains in one of the nests suggests either predation or scavenging has occurred. The outcomes of the other two nests are also unknown with no footage gained showing either failure or chicks successfully fledging.

There was a low re-occupancy rate of historic nest sites with only one of 29 nests monitored found to be reused. This was the first year this method of watching old nest sites had been trialled and there was uncertainty as to how successful it would be as this is a low-density kākā population with many natural cavities for bird to choose for nesting. Female kākā are also known to sit tight on nests for extended periods during incubation. The methodology for monitoring stated that a nest would be considered unoccupied if no activity was observed within a 3.5 hour period. However, most nest observations were for between one and two hours, with the longest observation being three hours 15minutes. Therefore we cannot be sure if all re-occupied nests were located, or if the current results are an accurate reflection of the occupancy rate of historic nest sites. In contrast, for the Eglinton population 11 of 33 historic nests were checked by

climbing the tree and found to be occupied (M. van der Wetering, pers. Comm.). It is uncertain whether the higher re-occupancy rate reflects differences in kākā populations o in the method of monitoring. The method of observing nests in the RNRP is unlikely to be used again and may be replaced with climbing of trees to check historic nest sites in beech flowering years.

Historically intensive monitoring of kaka nesting success has occurred within the RNRP. This finished in 2006 and concluded that keeping mustelid monitoring below five percent resulted in adequate kaka nest protection (Taylor, 2009). In 2007/08 kaka encounter rate monitoring was initiated as a low effort long term population monitoring tool to determine whether the population was responding to the level of predator control provided. The RNRP has generally been successfully in keeping mustelid tracking below this level, with some increases associated with the 2012-14 A24 trial. However, there has not been the observed increase in encounter rate as would have expected to see as the population recovered, with encounters initially increasing up until 2012 and then decreasing again. Stoats when at low densities can be difficult to detect, so while RNRP monitoring shows stoats at almost undetectable levels they are still present and hence be having a negative effect on the kaka population.

In 2013, more intensive monitoring was initiated with checking of historic nest sites for occupancy, as kaka are known to reuse nest cavities. Three sites were checked, with two in use and the third unoccupied but containing the predated remains of an egg, likely from the previous season. Of the occupied nests, one was found to have failed with the adult female predated, and the second failed at the chick stage. In 2015 nest occupancy checks and monitoring of radio transmittered adults was carried out with two of four monitored nests failing. This result of five of seven monitored nests failing is disappointingly high. While the sample size is small and the cause of failure are unknown, such a high proportion of nests failing is concerning and may reflect a wider trend in the population.

Predation of adult females has the greatest impact on kākā populations (Moorhouse, 2003). In populations where no predator control is carried out, adult females are more at risk of being predated during nesting than males so can suffer higher mortality rates (Moorhouse, 2003). Over time this can result in skewed sex ratios with more males within the population than females. The sex ratio of kaka caught within the RNRP area has been

slightly male biased, and kākā caught in October 2015 had a more male biased sample than that of previous work (Table 6). While this is a small sample size and may not accurately reflect the larger population, this could nevertheless be indicative of a potential issue. Given there was no observed increase in encounter rate, combined with a high rate of nest failure in the small sample of monitored nests, indicates that predator control within the RNRP is not providing adequate protection to kaka. To determine whether this is the case more intensive monitoring is required. This would include monitoring of nesting success as well as reassessing the sex ratio of the kaka population to provide a more accurate picture of the health of the population.

2.1.11 Kea (*Nestor notabilis*) nest protection

Introduction

Kea are present in low numbers in Nelson Lakes National Park and there is evidence of a continuing slow decline (Steffens, 2009). This finding is further supported by kea surveys and monitoring carried out by the Kea Conservation Trust (KCT) in the Lake Rotoiti/Raglan Range area over recent years (J. Kemp pers. comm.), suggesting that possum and stoat predation on kea nestlings and incubating adults is the primary cause. There is also evidence that lead roofing nails and flashings on buildings in the alpine zone (e.g. huts and ski field buildings) have caused lead poisoning in kea (C. Mosen pers. comm.).

Considering an apparently declining kea population in the Nelson Lakes area and the fact that one of the principal agents of decline is likely to be predation at nests, the RNRP embarked on a partnership with the KCT in 2011/12 to set up nest protection in the form of stoat and possum traps around known active nests on the St Arnaud and Raglan ranges. The number of kea nests protected and the extent of protection provided to each nest has increased each year since then, with new trap networks installed around two further nest sites this year.

Methods

In 2015/16 six kea nests were protected (Figure 13). Because the kea nest trap networks were set up in different years and have expanded slowly over time, in addition to the difficult terrain making tidy grid patterns

unfeasible, there is a lot of variation between them. In 2015/16, the trap networks were as follows:

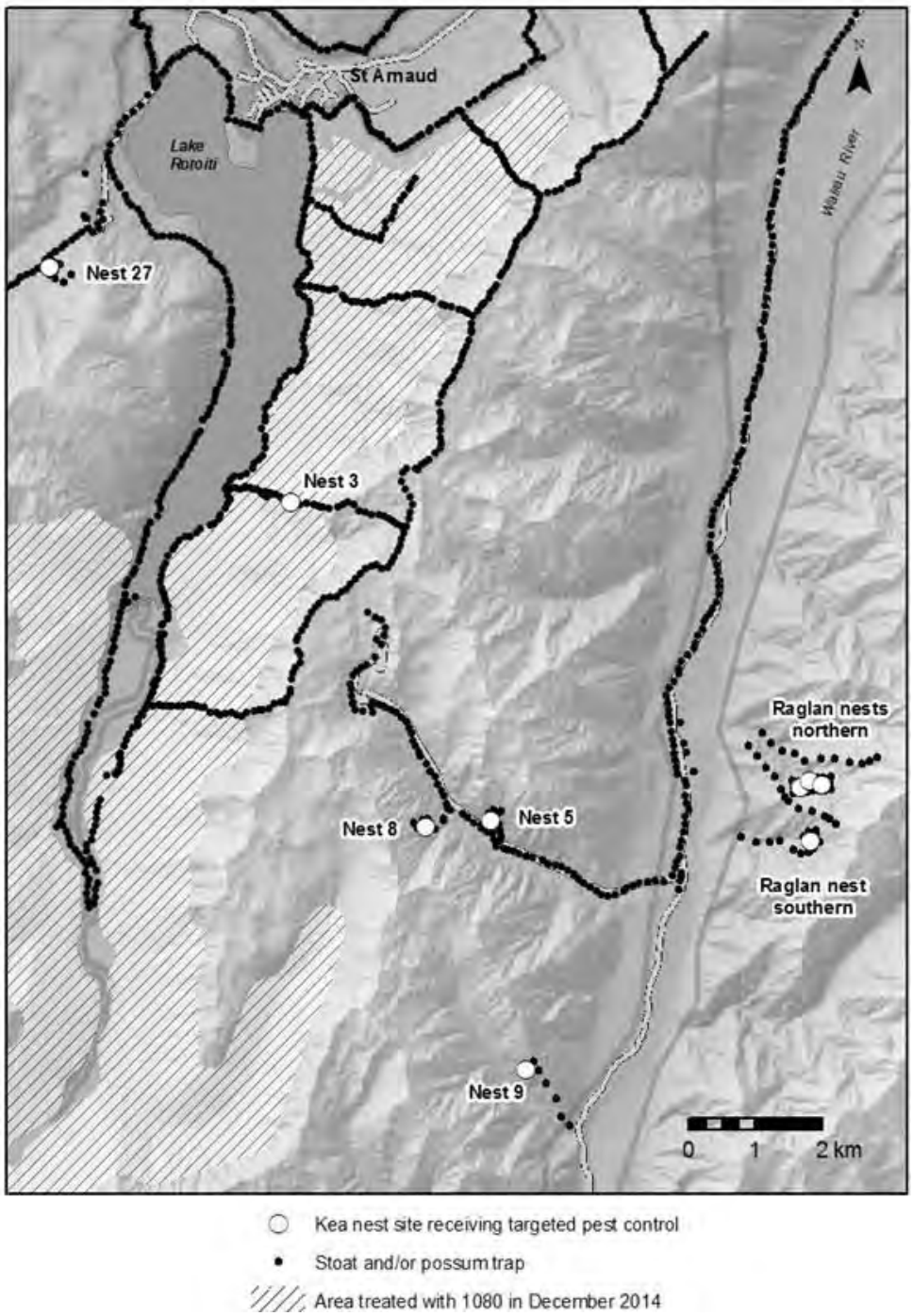

Figure 13: Locations of kea nests in Nelson Lakes National Park receiving protection in 2015/16.

Nest 5:14 Sentinel possum traps covering approximately 300×300m (9ha) around the nest as well as one A12, three DOC200 stoat traps and six A24

around the nest. An existing Friends of Rotoiti trapline of DOC200 traps along the ski field road passes within 200m of the nest.

Nest 8: Nine Sentinel possum traps covering approximately 150×300m (4.5ha) around the nest, two DOC200 and five A24 stoat traps approximately 20m from nest entrance. An existing Friends of Rotoiti trapline of DOC200 traps along the ski field road passes within 200m of the nest.

Nest 9: Six Sentinel possum traps, six DOC200 and five A24 stoat traps in a straight line up the ridge where nest is located. Five sentinel possum traps, five DOC200 stoat traps along a line beneath the nest along valley floor.

Nests 27 and 42: Eleven Sentinel possum traps and eight DOC200 stoat traps in a 400×200m grid around the nest 27(8ha). Eleven sentinels, three DOC200, three A12s and seven A24s around nest 42. An existing Friends of Rotoiti trapline of DOC200 and Sentinel traps along the Speargrass Track passes within 150m of the nest.

Raglan northern nest sites: Twenty-one Sentinel possum traps in a 700×200m grid around the three nest sites (14ha), and 24 DOC200 stoat traps in two lines of 12 going straight up the ridges either side of the nest sites.

Raglan southern nest site: Nine Sentinel possum traps in a 200×200m grid around the nest (4ha), and 12 DOC200 stoat traps (three of these are double-set) in a line up a creek and then ridge leading to the nest site.

To provide protection from the start of the breeding season, initially all kea nest protection trap networks were opened, baited, and serviced monthly, beginning in July 2015. As monitoring of radio-tagged kea and nest sites by Corey Mosen (KCT) provided more information on which kea were nesting and where, trap networks around nonactive traps were closed.

All traps were closed in December/January to protect juvenile kea from being caught in the traps, as they are considered more likely to investigate traps than the breeding adults.

Results

The number of stoats caught in nest protection trap networks varied between nests, with high numbers caught at kea nest nine and the Raglan nest (Table 7). Possum catches were high at most nests. All kea nests failed due to predation in the 2015/16 season.

Table 7: Trap catches from kea nest protection trap arrays from nests in the Nelson Lakes area, 2015/16.

	Trap Catch			
Kea Nests	Rat	Possum	Stoat	Hedgehog
27	5	16	7	2
42	0	23	0	1
5	0	3	2	0
8	0	4	1	0
9	0	24	26	0
Raglan	0	11	34	1

Discussion

The failure of all nests this breeding season suggests the current nest protection trap networks do not provide adequate protection following a beech mast. High numbers of stoats were caught around some nests this season which is a result of the large beech mast that occurred in 2014/15 which subsequently triggered an increase in the stoat population. This shows in years following beech masts when stoat numbers are predicted to be high, the current trapping network alone is not enough to protect nests from predation.

Lead remains present in the Nelson Lakes area in the form of nails, flashing and the like on older huts/bivs. Lead is a major threat to kea (C. Mosen, pers. comm.) and more effort should be put into removing lead from the huts and ski field buildings where it remains. No work was carried out to address this threat in 2015/16.

2.1.12 Mistletoe (*Alepis* and *Peraxilla spp.*) monitoring

No mistletoe monitoring was scheduled to be undertaken this season. Monitoring is scheduled for the 2016/17 season.

2.1.13 *Pittosporum patulum* monitoring

No *Pittosporum patulum* monitoring was scheduled to be undertaken this season. Monitoring is undertaken four yearly and scheduled for the 2017/18 season.

2.1.14 *Powelliphanta sp.* Monitoring

No *Powelliphanta species* monitoring was scheduled to be undertaken this season. Monitoring is undertaken five yearly and scheduled for the 2019/20 season.

2.2 Establish and maintain populations of whio (*Hymenolaimus malacorhynchos*), great spotted kiwi (*Apteryx haastii*), rock wren (*Xenicus gilviventris*) and other native species

2.2.1 Introduction

At the time of writing, only Great Spotted Kiwi have been reintroduced to the RNRP. However, similar reestablishments of Whio, Rock Wren, and other native species known to once have been present in the area remain as goals for the future.

2.2.2 Great Spotted Kiwi population management

Introduction

Great Spotted Kiwi (GSK), the largest kiwi species found in New Zealand, were likely present in the Nelson Lakes area early in the 20th century but have since become locally extinct (Steffens, 2009). Sixteen GSK sourced from a population at the Gouland Downs in Kahurangi National Park, were reintroduced to the Mainland Island via two translocations in 2004 and 2006. The reintroduced birds settled well and have since produced at least eight chicks.

Breeding activity has not been as high as expected and a proposal to supplement the population with up to fourteen Operation Nest Egg (ONE) chicks, sourced as eggs from the Gouland Downs, was approved in 2008. The operation commenced in early 2009 with the radio-tagging of adults at the Gouland Downs followed by three seasons of egg-lifting, with the final eggs lifted in December 2011.

Additional ONE chicks have been translocated to the RNRP from the Stockton mine area under an agreement relating to the expansion of mining operations at Cypress mine.

Methods

The RNRP's final ONE translocations from the Stockton area took place during the 2015/16 season. Eggs were removed from monitored pairs on the Stockton Plateau and reared at the Paparoa Wildlife Trust crèche, before being translocated to the RNRP once they had reached a healthy weight. All chicks were placed into artificial burrows within a holding pen

(approximately 200m^2) and released after one night, due to their age, appropriate weight, and good condition. Previously chicks have been released from the pen after one week.

Monitoring of both ONE and wild chicks continues wherever possible. Birds are weighed and checked regularly within their first year, and any mortality signals from transmitters are investigated promptly.

Ongoing predator control in the RNRP is thought to have benefitted kiwi, principally through the control of stoats and cats, which can prey on kiwi chicks (see Mustelid control and monitoring and Feral cat control sections).

Dogs remain one of the biggest threats to kiwi nationally. Signs at the main entrances to the National Park are maintained to remind people that dogs are prohibited. It is likely that one adult kiwi death in 2010 was caused by a dog (Harper G. , et al., 2010). Publicity about the threat of dogs to kiwi is ongoing, and appears regularly in the local paper and at the Visitor Centre.

Results

Two kiwi from the Stockton ONE program were placed into an artificial burrow inside the release pen on the 10th January 2016. The pen was opened the next morning. It was thought that as these birds were older and heavier than previous failed ONE releases, they would not need the full week of acclimatisation and protection that other birds had been given in the pen. Both birds were of an unknown sex, and had weights of over 1600g. They were fitted with radio transmitters, and the first post release weigh in was planned for one month after release. Regular telemetry checks were scheduled to monitor dispersal and check for any unusual activity readings that could indicate poor health.A trail camera placed at the gate to the pen captured the exit of both the birds on the night that the gate was opened. A cat was recorded the night following their exit.

The bird Mangatini was released at a weight of 1820 grams, and thought to be female. A mortality signal was found on 15th February, with data showing mortality occurring on the 14th February. An autopsy revealed fractures to the skull caused by a large predator, likely a ferret or cat.

Te Atarangi Wairua was released at a weight of 1670 grams. Signal checks the week after release showed the bird still near the pen, with normal activity levels. After the first two weeks, the signal of the bird was lost. Complications with a kākā transmitter on the same frequency in the area meant that the bird wasn't rediscovered until mid- February. The search on the 16th February discovered a mortality signal coming from the transmitter. The bird was found at the bottom of a 1.5m, 30-50cm wide, smooth sided vertical shaft. An autopsy was deemed unnecessary, and the death is thought to be due to dehydration/starvation. The transmitter's data stream indicated a switch to mortality signal 26 days before discovery. This suggests that the bird fell into the shaft approximately one week after release.

Discussion

Over the past five years, the management of GSK has focussed on using the ONE programme to potentially overcome the poor breeding success of GSK in the RNRP. It was suggested low productivity in the RNRP may be due to birds being old or infertile, and the release of young birds may circumvent this problem.

However, ONE has not proven to be particularly successful overall, with six of 13 ONE chicks released known to have died, and only three chicks currently monitored. Of these deaths three were from misadventure, two from weight loss and one from predation. This suggests that predator control provided is adequate to protect ONE chicks and that the lack of parental care of chicks may cause the higher death rate. By contrast, all adults or experienced juveniles released have survived and remain within the RNRP. As such the RNRP ONE programme has now ceased and the programme will now focus on increasing the founder population to 40 individuals by translocating adult birds into the population.

The management of GSK has provided not only an opportunity for establishing a new population at Nelson Lakes but also allowed us to learn about the behaviour and population dynamics of a previously little-known species.

2.2.3 Great Spotted Kiwi population Monitoring

Methods

Remote monitoring of radio-tagged kiwi for mortality and breeding has continued, using Sirtrack GSK V2.0 radio transmitters. These transmitters log daily activity levels, which is used to detect breeding attempts. Every year the number of radio-tagged GSK fluctuates due to transmitters failing or dropping off, and through the re-location of individuals allowing new transmitters to be re-fitted. In 2015/16, four adults from pairs and four juvenile kiwi were monitored. Only one transmittered pair recorded a breeding attempt which was monitored using trail cameras.

Results

Breeding activity was observed with Motupipi (male) and likely partner Waitapu (female, not transmittered). In mid-November, Motupipi's low level of activity indicated incubation. Over the period of a week, using close fixes and triangulation, it was deemed that he was roosting in the same area and potentially preparing a nest. Two cameras were placed watching likely tracks into the nest. Consistent footage was captured of the two kiwi coming and going at different times from the possible nest. After two weeks, it was deemed the burrow was no longer being used and the nest had been abandoned. High amounts of cat scat were found in close vicinity to the site but cats were never observed in footage. A stoat was seen entering the burrow the day after the last sighting of the birds. No evidence of a breeding attempt or predation was found inside the burrow, and the cause of abandonment is unknown.

One adult kiwi was found dead within the RNRP this season. The adult male Te Matau was found dead near the Loop track on 30 October 2015, after his transmitter had switched to mortality mode. Autopsy results showed an enlarged heart and scar tissue which could be due to old age or previous heart damage, and he appears to have suffered a heart attack (Pathology Report DOC2635364). Damage to the skin of the bird looked like bite marks, however autopsy result found no evidence of predation or internal damage or trauma that would be expected with a dog attack. It is possible this kiwi was picked up by a dog prior to death causing a heart attack or shortly after death.

Discussion

The nesting by Motupipi for each of the past four years is encouraging, as prior to this consecutive nesting years had only been recorded once in the RNRP. At low altitude sites, such as the Paparoa Range, most GSK pairs will produce an egg each year (G. Newton *pers. comms.* 2012). This was thought to occur in the RNRP possibly due to a trade-off between egg production and the maintenance of body condition. This deserves further investigation as it has implications for the management of GSK in the RNRP as well as other high altitude sites where GSK populations are being re-established.

However, the low success rate of Motupipis attempts, with only one of the four successful, is disappointing. As cameras are not placed inside nests it can be difficult to know the cause of abandonment. One prior failed nest was determined to be through predator disturbance, and the recording of a stoat the day after the 2015/16 nest was abandoned suggests the same cause. While the consecutive nesting attempts of Motupipi suggest productivity may be higher within the RNRP than previously recorded, the success rate of these nests is not encouraging for increasing the GSK population. While adult GSK are large enough to protect themselves from predators, eggs and young chicks will always be vulnerable and adults are quick to abandon nests when disturbed. If the RNRP population is to be self-sufficient then the low success rate of nests monitored in recent years needs to be addressed to determine whether this is wider spread across the population and there is a problem with the current pest control regime, or if it is just the result of a low sample size.

3 Learning objectives

Test the effectiveness of control methods for stoats, rats, cats, possums, wasps and other potential pest species in a beech forest and alpine ecosystem

3.1 Test the effectiveness of rodent control tools in a beech forest ecosystem

Introduction

Rodents impact on ecosystems through predation of eggs, chicks and incubating birds, predation of seeds and invertebrates and through driving stoat populations. (Blackwell, 2003; Innes, 2010). Rodent control within the RNRP aims to reduce rodent tracking indices to below five percent, which is the threshold below which impacts on fauna are low. Protection of native passerines from rat predation and preventing associated stoat population increases are the principal reasons for rat control within the RNRP.

Beech seed is an important food source for a number of species and a driver of breeding success. It is also a driver of rodent population dynamics in beech forest, with heavy seeding supplying a food source that allows extended breeding of rats and increased rat populations, which causes stoat population increase (Blackwell, 2003; Dilks, 2003). In upland beech forest, such as that present in the RNRP, ship rats are therefore a periodic threat to forest birds following beech mast events.

Ground-based rat control has been carried in the RNRP using a variety of methods, with mixed levels of success even during non-mast years. Three years of rat control using the toxins 1080 and brodifacoum was carried out in the Core Area of the RNRP from 1997-2000. This was abandoned due to concerns with secondary poisoning by 2nd generation anticoagulant in a suite of non-target mammalian predators and native birds (Spurr, 2005). The effectiveness of snap trapping was trialled from 2000 to 2007. Throughout that period, snap trapping consistently failed to achieve the performance target of a sustained rat tracking index of ≤ 5%. During the 2006-07 season a 'detection and staged response' model using 1080 was

trialled, but failed to reduce the population. No rat control was undertaken in 2007-09 due to budgetary constraints and concerns about possible non-target affects. From 2010 to 2013 operations have used either diphacinone or pindone with pulsed control in spring. In December 2014, aerial 1080 was used within the RNRP as part of a nationwide Battle For Our Birds operation triggered by widescale beech masting, to prevent the eruption of rat populations and control rats at the landscape scale (Fairweather, 2015).

3.1.1 Rodent control

Following the aerial 1080 operation in December 2014, no rodent control was carried out within the RNRP in the 2015/16 season.

3.1.2 Rodent monitoring

Methods

Tracking tunnels are used to provide a relative abundance index of rodents within areas with rat and mustelid control (Core Area and Lakehead), no rat control but mustelid control (Big Bush) and areas with no species control (Lake Rotoroa).

Rodent monitoring is carried out using Black Trakka™ cards set in 600mm black corflute tunnels, with peanut butter applied to both ends of the wooden base as a lure (Gillies, 2013).

Results

In August 2015, following the 1080 operation in December 2014, rat tracking was highest within the rat control area at 59% (±10%), but only 25% (±17%) within the Mustelid Control Only area. The tracking rate in November decreased in the rat control area to 25% (±6%), similar to Mustelid Control Only areas 13% (±8%). Tracking rates were relatively unchanged in February in all sites. In May tracking within the rat control area had increased to 32% (±5%) while remaining lower in Mustelid Control Only areas at 10% (±6). Tracking in the No Control area remained below 5% all year.

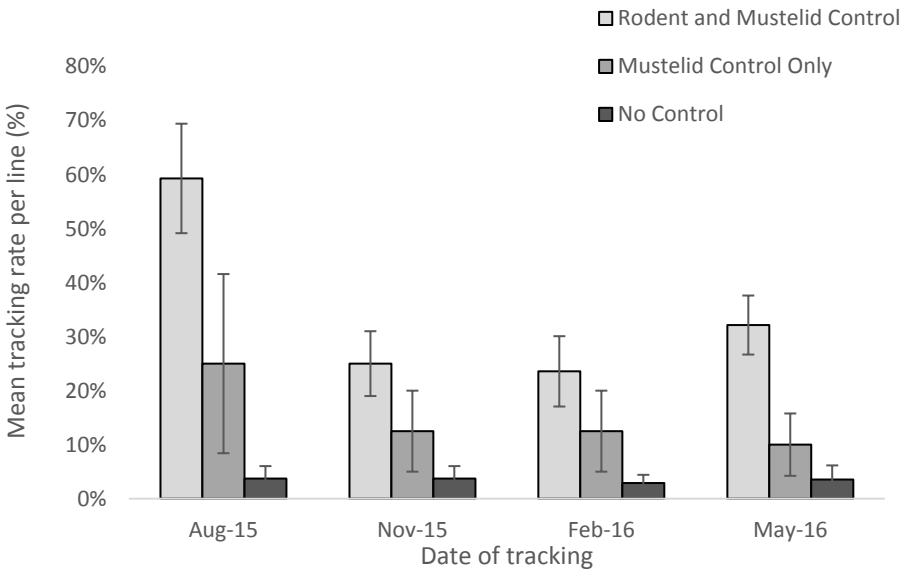

Figure 14: Rat tracking rates in different control areas within the Rotoiti Nature Recovery Project 2015/16.

Mouse tracking rates were low within all areas throughout 2015/16. In August the rodent control area had 13% (±4%) while the Mustelid Control Only area recorded 10% (±4%) (Figure 15). These rates dropped down to below five percent in all other monitoring. No mice were tracked in the No Control area.

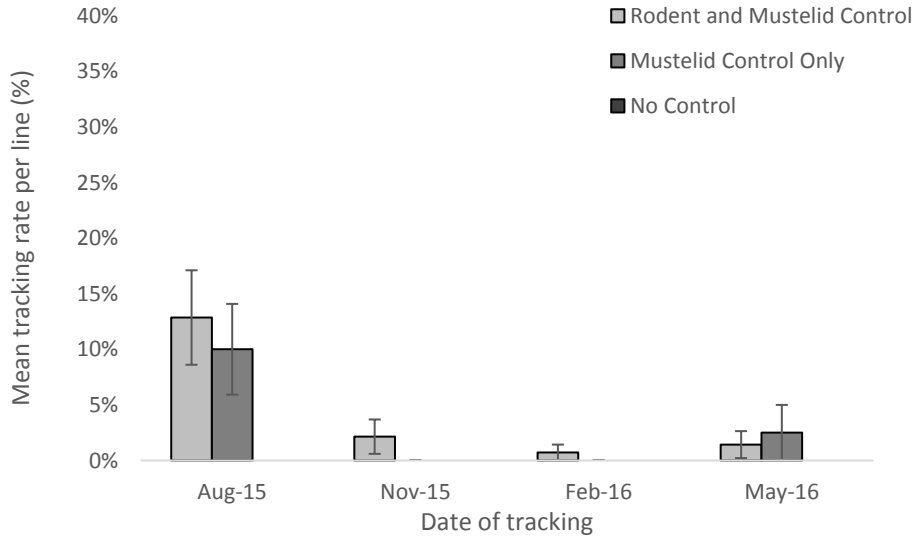

Figure 15: Mouse tracking rates in different control areas within the Rotoiti Nature Recovery Project 2015/16.

Discussion

Rat tracking rates within the RNRP were high throughout 2015/16 in both the rodent control and mustelid only control areas. Following the 1080 operation in December 2014, no rodent control was carried out in the RNRP in 2015/16, and rodent tracking indices within the RNRP were above the five percent tracking target throughout this period. Three different 1080 treatment types were used within the RNRP in December 2014, but rat numbers recovered quickly following this operation in all areas, with the reason for this explored in Long et al. 2015. The high tracking rates observed within the RNRP rodent control area are most likely a direct result of the beech mast of 2014 causing an irruption in the rodent population, and then failure to effectively control these populations. This is reflected in the high tracking rate observed in February with 59% tracking in the RNRP core which reduced to 25% in November as food supplies were exhausted.

The tracking rate of rats was lower in the mustelid control only area than the rodent control area during August and May, but similar in November and February. This could be due to higher mustelid numbers reducing rat numbers, as high numbers of stoats were caught in July and August, however by November mustelid tracking tunnels recorded low activity in this area. Tracking rates for rats remained low at Lake Rotoroa where stoats are not controlled and rat predation is high.

The underlying strategy for the rodent control operations is namely to protect native birds during the breeding season and to prevent associated increases in the stoat population. There is no "one plan fits all years" approach and it is recommended that future rat control continues to be responsive to likely spring rat densities. Future rat control should continue to follow the planning flow chart; with tracking rates monitored for the six-month period prior to the operation and careful consideration given to whether there are alternative food sources available to determine the type of rat control operation that should occur (Figure 16).

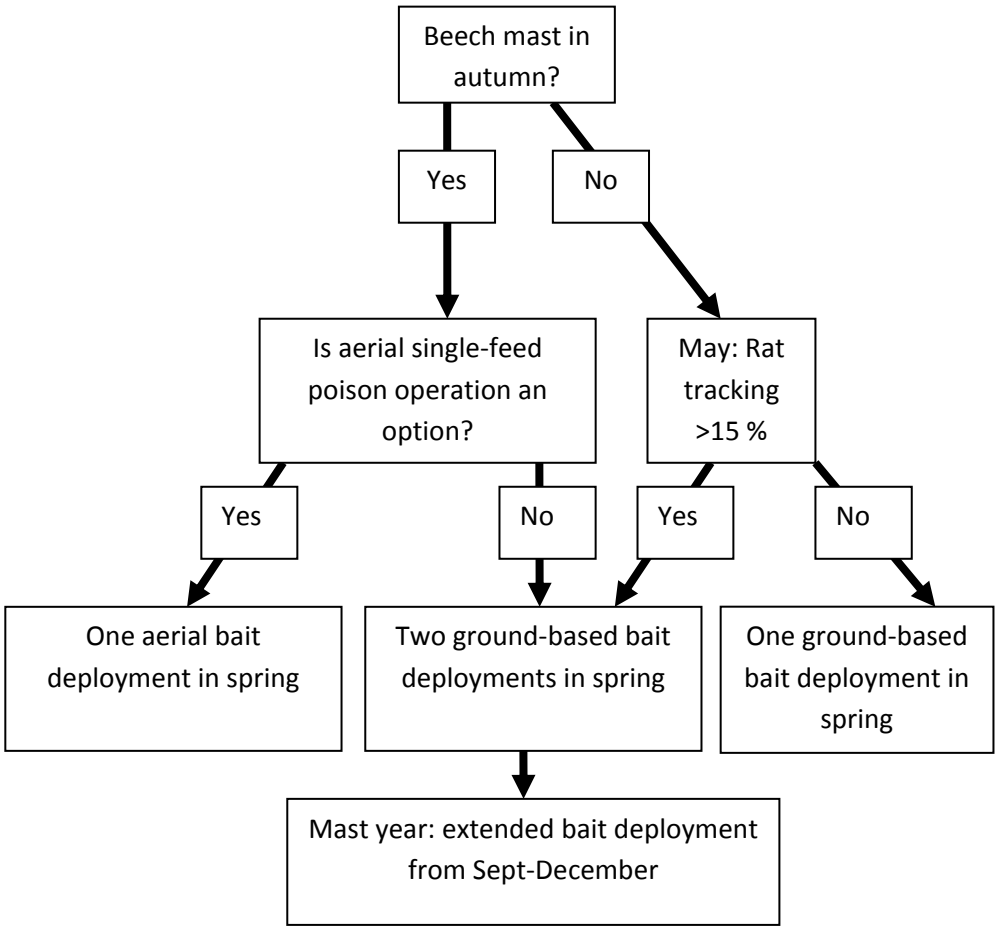

Figure 16: Flow chart for planning preliminary rodent control in the Rotoiti Nature Recovery Project

3.1.3 South Island Robin monitoring

The South Island robin is an endemic passerine, and although the species is classified as not threatened (Miskelly, 2008), it has declined dramatically since European settlement, primarily due to habitat loss and mammalian predation (Bell, 1986). Robins breed from August to March and are known to be impacted by rodent predation during nesting. As such they have been monitored within the Core area of the Mainland Island since 1998 as a measure of the effectiveness of rat control operations via an annual census within the core area as well as nesting success monitoring. Due to limited resources this monitoring ended in 2015.

3.2 Test the effectiveness of wasp control tools

Introduction

Common wasps (*Vespula vulgaris*) are a major threat to biodiversity within the RNRP as they can reach extremely high densities within the honeydew beech forest (Thomas, 1990). They have three known impacts on honeydew beech forest biodiversity:

1. Taking of honeydew. This reduces its availability as a food for native birds (e.g. kākā and tui), invertebrates and herpetofauna (Harris, 1991; Evans, 2015).

2. Predation of invertebrates (Harris, 1991).

3. Killing of bird nestlings (Moller, 1990).

And two potential impacts:

1. Competition with other detritivores due to removal of animal carcasses.

2. Impacts on the scale insect that produces honeydew, suggested as a possibility following field observations of damaged scale insect filaments by DOC Nelson Lakes staff.

Wasps also severely affect the activities of people using the area in summer, putting DOC staff and volunteers at risk of anaphylactic shock after being stung, and negatively influencing the experience of public visitors to the area.

Wasps have been controlled in the Core Area of the RNRP since 1998, using various protein-based baits that mainly contain the toxins Finitron® or fipronil. This work was originally carried out in close association with Landcare Research and more recently with the Nelson-based company Entecol, which is currently the only supplier of the toxic bait Vespex™ (0.1% fipronil).

Fipronil has proven to be the more effective of the two toxins and since the 2007/08 season, only X-stinguish™ (now renamed Vespex™) has been used for wasp control operations in the RNRP. Until 2015 access to this toxic bait was constrained by commercial imperatives with DOC Nelson Lakes only able to use it under an experimental use arrangement. In 2015,

a DOC pilot trial using X-stinguish™ for landscape-scale wasp control was completed successfully at five sites, one being the RNRP. This was a key step towards an agreement between DOC and BASF (the company that produces fipronil) which has seen the commercial restrictions on fipronil use lifted, and the toxin Vespex™ is now more widely available for wasp control in New Zealand.

The most recent RNRP research has focussed on determining the widest possible spacing between wasp bait lines whilst still achieving the desired reduction in wasp densities, as well as getting a better understanding of the quantity of bait necessary per bait station.

Over recent years it has appeared that some unknown factor may be reducing wasp numbers, possibly by affecting nest establishment by queens or the health of workers. Landcare Research is researching a mite that was recently discovered on common wasp queens, and whether it holds any potential for use as a biocontrol agent. The RNRP has been supporting this work by collecting queen wasps hosting the mites for researchers.

Methods

To ensure that the poison operation will be effective, wasp visitation on non-toxic protein-based baits is monitored prior to an operation. An average of one wasp per bait is considered the trigger point for initiating the decision making process to start a poison operation. The operation started in late January once the protein-take trigger point was reached. For further details on wasp monitoring and the decision-making process, refer to the RNRP Field Manual (DOC-431791).

Control

The control operation covered ~1129ha of the RNRP, as well as approximately 150ha of Tasman District Council road reserve around the St Arnaud village which adjoins the RNRP (Figure 17). Bait station were on a 300×50m grid following the contours, with a mixture of KK bait stations and yellow Wasptek bait stations which are designed specifically to dispense wasp bait. 20g of Vespex™ bait was applied to each bait station. Any remaining bait was collected three to five days later and weighed to determine the amount of bait take.

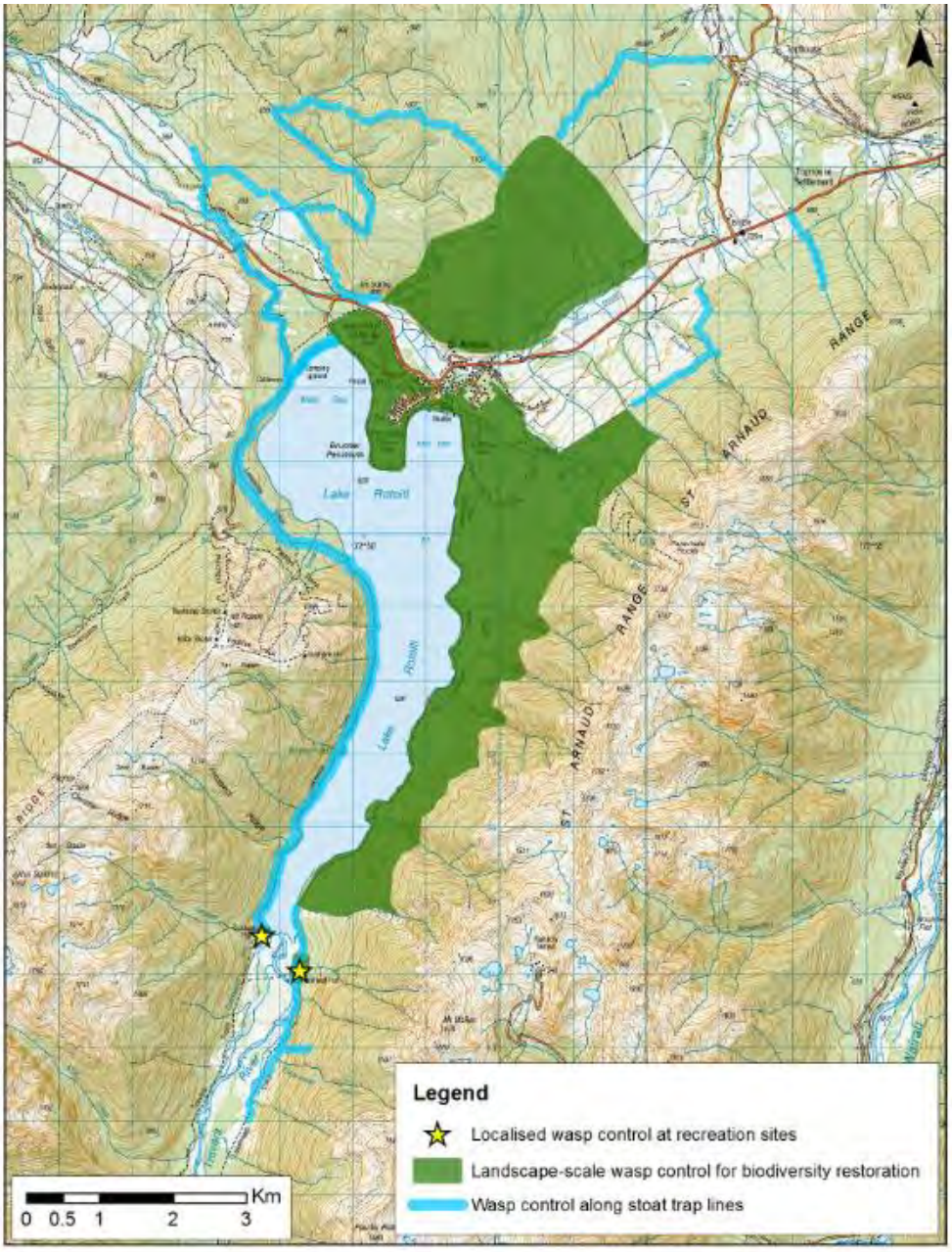

Figure 17: Map showing location of wasp control in the Rotoiti Nature Recovery Project in 2015/16.

Monitoring

Monitoring of available honeydew and wasp abundance was carried out before and after the control operation to determine its effectiveness. Two monitoring sites were used; one within the treatment area, the other outside the treatment area (Beebys).

Quantities of available honeydew were measured within permanently-marked 5×50cm plot on 24 beech trees in each of the treatment area and

non-treatment area. The number of honeydew droplets within each plot was measured twice prior to the operation, a week after the operation and a month after.

Wasp abundance was measured using wasp nest flight counts and was carried out at ten nests within the treatment area, and 12 nests within the non-treatment area. The number of wasps entering and exiting each nest was recorded over one minute and repeated three times. Nests were located and monitored once prior to the operation, a week after the operation and a month after.

For more detail on monitoring methods, see the Honeydew monitoring protocol (DOC-1536769) and Wasp abundance monitoring protocol (DOC-691729).

Results

On the 5th January 2015 (prior to the operation), an average of 1.6 wasps were observed on non-toxic baits within the core area. On the 20th January, monitoring was repeated in the core with an average of 0.8 wasps per non-toxic bait, and at two nontreatment sites with an average of 0.4 wasps within Big Bush and 0.15 at Hubcap (Figure 17). The initial monitoring was above the one wasp per non-toxic bait threshold, so the poison operation was initiated.

In total, 36.3kg of toxic bait was deployed this season and 18.9kg (53%) of this was removed by wasps. Bait take was highest in the new Lakeside extension (76%), followed by the Core Area (67%) and the St Arnaud village (52%) with bait take lowest in Big Bush (29%).

The quantity of available honeydew increased within the treatment area after the control operation from 5.7 (±0.8) droplets/plot immediately prior to the operation, to 26.3 (±7.0) one month after the operation (Figure 18). The quantity of available honeydew in the nontreatment area stayed relatively constant throughout the same period (Figure 18).

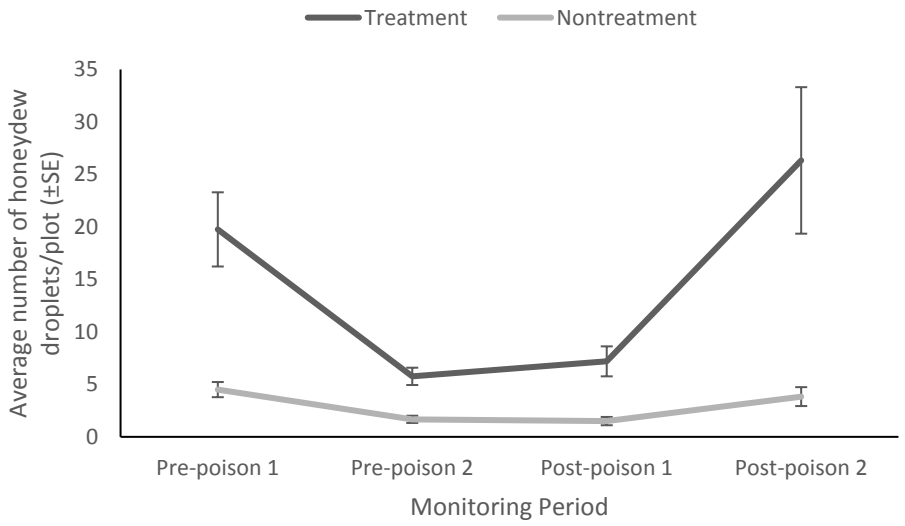

Figure 18: Average number of honeydew droplets per plot within the Rotoiti Nature Recovery Project wasp treatment area and nontreatment area, before and after the 2015/16 wasp control operation.

Within the treatment area, average wasp flight counts at monitored nests showed a reduction of 46.7 wasps/min to 0 wasps/min one month after the operation (Table 8). Over the same period flight counts increased in the nontreatment area from an average of 46.7 wasps/min to 43.5 one week after the operation, and one month later had dropped to 35.1 (Table 8).

Table 8: Average number of wasps recorded entering and exiting marked nests within the wasp control treatment and nontreatment areas of the Rotoiti Nature Recovery Project before and after the 2015 wasp control operation.

Site	Pre-poison 1 (±SE)	Post-poison 1 (±SE)	Post-poison 2 (±SE)
Treatment	26.7 (±2.4)	0.1 (±0)	0 (±0)
Nontreatment	40.9 (±4.1)	43.5 (±5.5)	35.1 (±3.7)

Discussion

The wasp control operation was again successful in reducing wasp numbers within the RNRP and around the St Arnaud village. Wasp activity within the treatment area was observed to decline within a few

days of the operation and the amount of available honeydew increased. Wasp activity monitoring shows wasp numbers did not recover after the operation.

Wasp foraging indices were lower than in previous years. It is possible some unknown factor is reducing wasp numbers, possibly by affecting nest establishment by queens or worker health. Landcare Research is currently conducting research into a mite discovered on some common queen wasps, to determine whether it has potential as a biocontrol agent.

3.3 Maintain long-term datasets on bird abundance and forest health in response to ongoing management and predator population cycles

Introduction

The RNRP continues to play an important role in monitoring bird abundance and forest health as part of DOC's commitment to measuring long term biodiversity trends. The monitoring of beech seedfall adds to the national picture of forest seedfall and enables the project to plan appropriate management responses.

3.3.1 Five-minute bird counts

Methods

Five-minute bird counts (5MBC) were conducted using the technique detailed by (Dawson, 1975) on the St Arnaud Range Track in the Core Area, at Lakehead and along the Mt Misery Track at Rotoroa. Each site is sampled three times in November and February and May, however this was not possible due to constraints on insufficient staff available. In November two counts were done at Lakehead, one at St Arnaud Range and none at Rotoroa. In February three counts were done at each of Lakehead and St Arnaud Range, two were done at Rotoroa. In May all counts were completed.

Results

The raw bird count data is stored in the RNRP 5MBC database (see section 9.1) and has been sent to Kelly Whitau, a Masters student at Canterbury University, for analysis.

Discussion

Competing requirements for limited staff resources meant that a full set of 5MBCs for the RNRP project was not able to be completed this year. Given this is a long-term dataset, more priority should be given to getting all counts done in the future.

3.3.2 Vegetation Plot Monitoring

No vegetation plot monitoring was carried out this year.

3.3.3 Beech seed monitoring

Introduction

Beech seed is an important driver of rodent and consequently stoat population dynamics in beech forest. Mast events, where beech seeds are produced in quantities several orders of magnitude higher than in non-mast years, can lead to rodent population irruptions and subsequently stoat irruptions. This in turn can have devastating impacts on the nesting success and survival of native birds. It is therefore important to monitor beech seed levels to be able to plan and implement the necessary increase in rodent and stoat control effort during mast years.

There are now several phases in the process of monitoring beech seed to inform pest control decisions.

Firstly, modelling is done by scientists in DOC, Landcare Research and the University of Canterbury to predict which areas of beech forest are likely to experience a mast. While the results of this modelling are indicative only and must be followed up with local monitoring, they are very useful in providing early warning of whether a large-scale response to a mast event is likely to be necessary.

Secondly, shotgun sampling is carried out where branchlets are removed from the canopy of beech forest by having the branch shot off from below. The number of cupules are counted to give an indication of the levels of cupules present for each beech species at different altitudes in an area. This has been done in January in the RNRP since 2012, and provides a more specific local estimate of mast severity. This estimate is still only indicative as the seeds must mature and fall to the ground before they become available to rodents to fuel a plague, and natural events such as strong winds or heavy frosts can disrupt this process.

Finally, seedfall tray data is collected where the number of seeds that become available to rodents are counted. This has been carried out in the RNRP since its inception, and gives the most accurate indicator of the likelihood of a rodent plague. However, the results are not available until much later than the other monitoring methods.

Methods

Shotgun Sampling

Samples were collected from beech located on the Grunt stoat trapline, from ten red beech (*Fuscospora fusca*), ten silver (Lophozonia menziesii) and 12 mountain beech (*Fuscospora cliffortioides*) between the lake edge and 1200m. Two branches were collected from each individual tree, with branches selected from the canopy where no shading occurred. From each branch the number of cupules on 20 branchlets were counted. A branchlet is measured by taking the outermost leaf of the branch and measuring 20cm back towards the main branch. This is used to calculate the average number of cupules per branch.

Seedfall trays

Twenty seedfall trays are located at each of the Core Area of the RNRP and along the Mt Misery track at Lake Rotoroa. Collection bags are fitted in early March, replaced in mid-April, and finally removed in mid-June. Any seed collected is separated into species, counted, and then tested for viability.

Results

Shotgun sampling data showed that seed production for all beech species in the 2016 season was likely to be low (Figure 19).

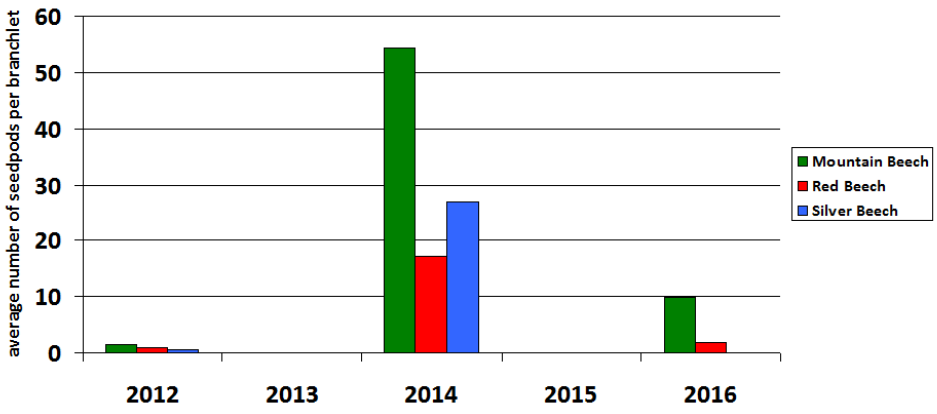

Figure 19: Average number of seedpods/branchlet for beech species from shotgun sampling on Grunt ridge in the Rotoiti Nature Recovery Project 2012-2016.

Beech counts from seedfall trays showed a small seeding event occurred in 2015/16, with total viable seed of 428/m^2 recorded in the RNRP and 1242/m^2 at Mt Misery (Figure 20). While this is higher than recorded in most years, it is much less than that recorded in mast years of 2000, 2006 and 2014, when seedfall quantities where in the thousands per square metre (Figure 20).

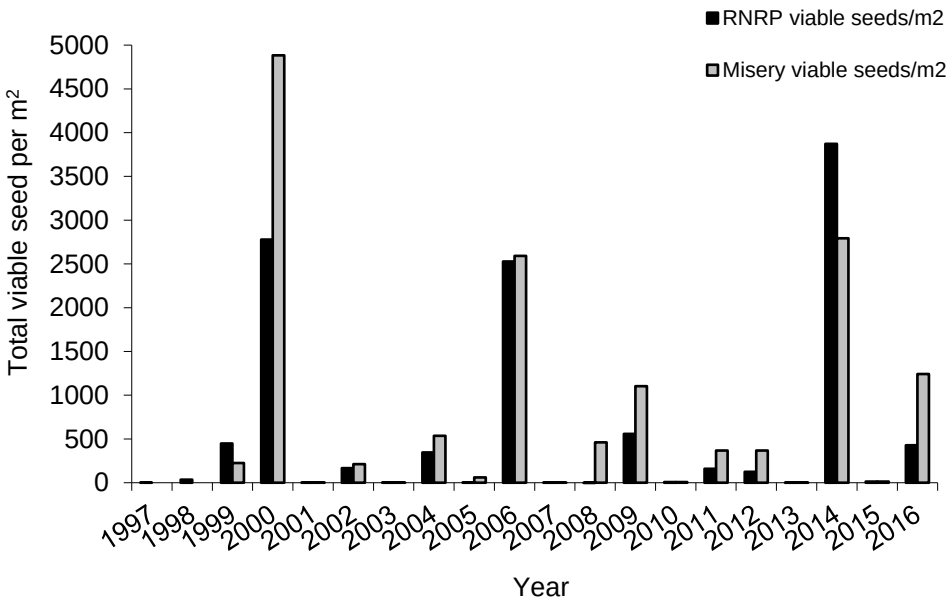

Figure 20: Total viable beech seeds per m2 from the Rotoiti Nature Recovery Project (Lake Rotoiti) and Mt Misery (Lake Rotoroa), over the period 1997-2016.

All three beech species produced reasonable quantities of beech seed at both sites, with a higher level of seedfall recorded at the Mt Misery site (Figure 20). Greater quantities of red and silver beech seed were produced at Lake Rotoroa than Rotoiti (Table 9). More mountain beech seed was produced at Lake Rotoiti than Lake Rotoroa, although the viability rate of this mountain beech at Lake Rotoiti was lower than that of Rotoroa.

Table 9: Beech seed counts per m^2 at Lake Rotoiti and Lake Rotoroa in 2015/16

Site	Count type	Red Beech (*Fuscospora fusca*)	Mountain Beech (*Fuscospora menziesii*)	Silver Beech (*Lophozonia cliffortioides*)
Lake Rotoiti	Total Count	2351	2966	1178
	Total Viable seed	1117	734	547
	% viable	47.5	24.7	46.4
Lake Rotoroa	Total Count	5717	956	6440
	Total Viable seed	3285	432	3238
	% viable	57.5	45.2	50.3

Discussion

A small beech seeding event occurred in 2015/16, which produced a small response in rodent tracking indices. This low level of beech seed predicted from shoot gun sampling did not warrant another aerial 1080 operation, and instead was responded to with a ground based diphacinone operation. Although the causal links between rodent abundance and beech seedfall in montane forest is well documented, the exact methods and most effective timing to truncate a rodent irruption when beech seed is plentiful is currently undecide, and requires continued research and long-term monitoring like the work that is carried out in the RNRP.

3.3.4 Tussock seed monitoring

Introduction

Tussock species in New Zealand are mast seeders, and an important driver of mouse population dynamics in the alpine zone, and consequently influence the populations of other pests who prey on mice such as weasels and stoats. Tussock monitoring had been historically carried out at Mt Misery and was reinstated in 2010 to continue this long-term dataset. In the future climate change and its influence on tussock masting may allow rats to regularly inhabit higher-altitude areas than they currently do, providing another rationale for regular tussock monitoring to be carried out.

Historically flowering stems were counted within an 'arm sweep' of the old Department of Scientific and Industrial Research (DSIR) points. Following advice on improvements to the methodology, a new method where flowering stems are counted within a permanently-marked plot was initiated in 2012/13. It was recommended by the Technical Advisory Group (TAG) that counts using both methods should be carried out for several years to allow a comparative analysis, and in 2015/16 the old method of counts was discontinued.

Methods

The flowering of mid-ribbed snow tussock (Chio*nochloa pallens*) and carpet grass (Chio*nochloa australis*) was measured on Mt Misery in February 2016 by counting the number of inflorescences on each tussock within a permanent 20m by 2m plot.

Results

High levels of flowering were recorded for both species of tussock in 2016, with *C. pallens* having a mean of 15.3 inflorescences/tussock (SE±4.7) (Figure 21) which is higher than any year recorded previously, while *C. australis* had a mean of 186.48 (SE±43.4) inflorescences/tussock which was similar to that recorded in 2012 and 2014 (Figure 22).

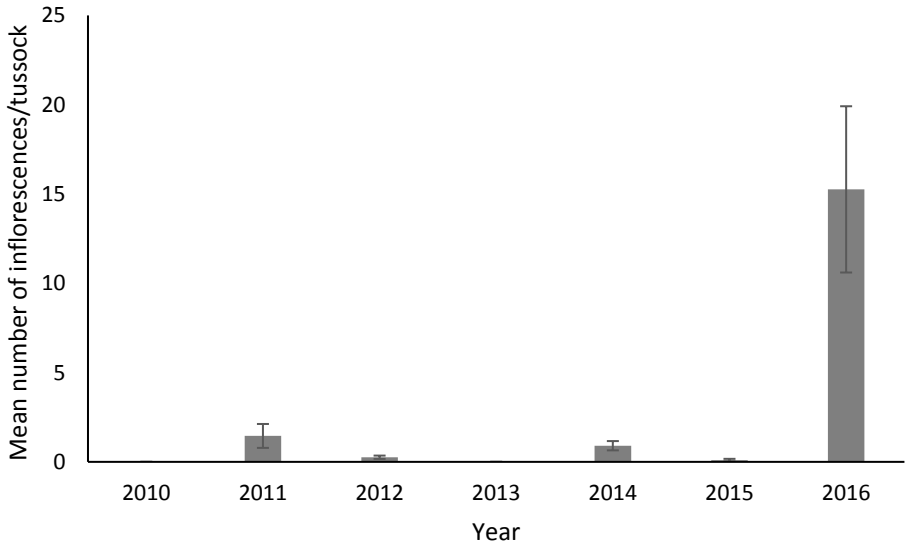

Figure 21: Mean number of inflorescences recorded per tussock for *Chionochloa pallens* within a 20 by 2m plot located on Mt Misery, Nelson Lakes National Park in February from 2010 to 2016.

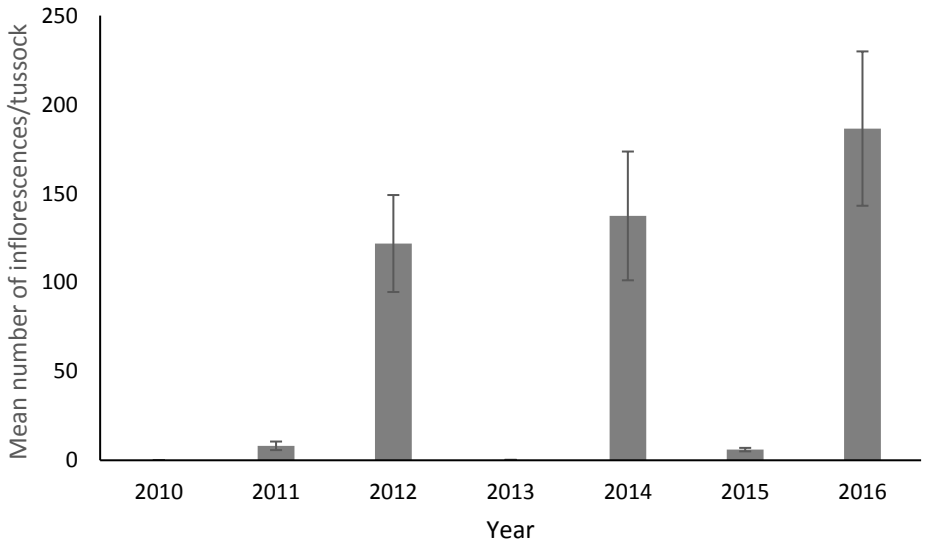

Figure 22: Mean number of inflorescences recorded per tussock for *Chionochloa australis* within a 20 by 2m plot located on Mt Misery, Nelson Lakes National Park in February from 2010 to 2016.

Discussion

The levels of tussock seeding observed on Mt Misery suggest there was at least some degree of tussock masting. This suggests there could be a mouse population irruption in the alpine zone, however no monitoring or response to this is planned.

3.4 Record observations of previously unreported native and non-native species in the RNRP area

The repository for new information is the document Flora and fauna of Lake Rotoiti Recovery Project (DOC-172620). No new species were recorded in the RNRP in 2015/16.

3.5 Facilitate research to improve our understanding of the ecology and management of beech forest, alpine and wetland ecosystems

The RNRP provides an accessible site with a long history of data collection for external researchers and the possibility of logistical support from DOC for carrying out fieldwork.

Kelly Whitau, a Masters student at the University of Canterbury, is using data from the RNRP to analysis factors influencing bird and mammal responses to pest control in mixed beech forests.

Dr Grant Harper has begun analysing the history of ground-based poison operations in the RNRP for rodent control.

Research carried out within the RNRP in 2010 into whether clustering wasp bait stations is an effective way to control wasp populations was published (Harper, Joice, Kelly, Toft, & Clapperton, 2016):

Chris Niebuhr, a PhD student from the University of Otago completed his third and final field season in the RNRP in April 2015. His thesis is investigating the role avian malaria may be playing in native bird declines in the area and has found there is a relationship between avian malaria and the elevational range of birds within New Zealand (Niebuhr, 2016) (Niebuhr, Poulin, & Tompkins, 2016) (Niebuhr & Blasco-Costa, 2016).

3.6 Analyse and report on the effectiveness of management techniques, and ensure that knowledge gained is transferred to the appropriate audiences to maximise conservation gain

Analysing and communicating technical information about the effectiveness of management techniques is a key learning objective, linking directly to national Mainland Island strategic principle two: "Results and outcomes are communicated". The RNRP has transferred information to target groups through various documents including annual reports, field trial reports, and occasional publications, as well as through presentations to technical audiences and input to periodic workshops and hui.

Following the implementation of the DOC restructure in spring 2013 it has been unclear whose role it is to maintain this technical communication. While biodiversity staff have collaborated to produce minimum required reporting (e.g. Annual Reports), the lack of clarity around biodiversity staff responsibilities following the disbandment of the RNRP-specific team, as well as the general reduction in staff resources following the restructure, has led to this objective continuing to lack the focused attention it requires.

Advocacy work continues to be carried out however, and this is discussed in more detail in section 4 Community objectives.

3.6.1 Reports generated during 2015-16

No RNRP reports other than this Annual Report were produced by local DOC staff this year.

3.6.2 Hui, workshops, presentations and media articles

No technical presentations were held in 2015/16.

4 Community objectives

4.1 Foster relationships with likely partners to produce conservation gains within both the Mainland Island and the local area

4.1.1 Introduction

The partnerships model further empowers DOC to look for more opportunities to work with a wider range of people and groups. Relationships with existing partners such as iwi, the Friends of Rotoiti and the Kea Conservation Trust are considered a high priority to maintain and continue to be built on, with new partners also being sought.

4.1.2 Friends of Rotoiti

The community group Friends of Rotoiti (FOR) was formed in 2001 by a group of conservationists who wanted to support the aims of the RNRP. Their effort is targeted to areas adjacent to the project so that they are a line of defence against predators coming into the RNRP.

Volunteers who devote considerable time annually undertaking trapping, wasp control, trap building and maintenance, administration, planning and advocacy tasks. FOR members also contribute to developing more effective trapping methods (for example run-through DOC200 stoat traps), participating in discussions and sharing ideas with DOC staff. FOR continues to attract new volunteers and to maintain the trapping effort that supports the RNRP.

FOR Wasp control

FOR assist DOC staff with the landscape-scale wasp control operation in the RNRP, in particular by filling wasp bait stations along the FOR Whisky and Speargrass mustelid trap lines, as well as around the St Arnaud Village.

FOR village rat trapping programme

Trappers from the St Arnaud village continue to run a comprehensive rat trapping programme around the village. Their work provides conservation gain by removing predators from the popular Brunner Peninsula Walk, Black Hill area, Black Valley stream and Brunner Peninsula residential area.

Visitors to the DOC Visitor Centre comment on the FOR traps, giving staff an advocacy opportunity for conservation and the FOR group itself.

Table 10: Catches in Friends of Rotoiti rat traps in 2015/16.

Trap line	Catch					
	Bird	Mouse	Possum	Rat	Stoat	Weasel
Black Hill Contour		9	2	11	1	1
Black Hill Walk		17		10		
Black Valley Walk		84		26	1	2
Gibbs Walk		21		5		
Holland Street	2	28		21		
Lodge Road		11		8		
Moraine Walk		28		2		
Peninsula Centre Line		27		16	1	
Peninsula Nature Walk		152		58	1	1
Robert Road		18		14		
View Road		22		5		1
Ward Street		11				
Water Tank		19		8		
Total	2	447	2	185	4	5

4.2 Increase public knowledge, understanding and support for Mainland Islands and ecological restoration nationally through education, experience and participation

Local DOC Community staff have undertaken several talks for school and community groups about the RNRP and conservation in 2015/16. These

staff supported conservation advocacy at community events such as the annual Antique and Classic Boat Show at Rotoiti (where a display was created in co-operation with the Friends of Rotoiti and Fish & Game NZ), a kiwi release ceremony with Ngāti Apa ki te Rā Tō and Friends of Rotoiti, Kea Conservation Trust advocacy events and a Matariki event with the wider St Arnaud community.

Articles about activities within the RNRP and the wider Nelson Lakes National Park were also published in local and regional newspapers.

5 Discussion

The period covered in this Annual Report is the third season for the RNRP following the comprehensive restructure of DOC in spring 2013. The restructure has strongly influenced the management of the RNRP due to alterations to role descriptions. There is no longer an RNRP programme manager nor an RNRP-specific field team, instead there is now a flora team and a fauna team, and management of the RNRP now falls within the scope of all Nelson Lakes biodiversity rangers' roles.

In the 2015/16 season the RNRP recorded a small beech seeding event and high levels of tussock seeding. No rodent control operation was undertaken following the aerial 1080 operation in December 2014, and rodent tracking indices remained above the five percent threshold throughout the season, while mustelid tracking remained below this threshold. Kākā nested in response to this beech seeding, however it is unclear how successful this breeding was with two of four monitored nests failing and unknown outcomes for the other two. It is also unclear how well the RNRP kākā population is doing with few successful nesting attempts observed in the last two seasons, and a male bias in the sex ratio of kākā caught within the area. As this is a Tier 1 site for kākā, more effort should be put into maintaining the population within this project. On a similar note, all six kea nests this season were lost to predation, despite high numbers of possums and stoats being caught in nest areas. Given these results it is unclear how effective the RNRP has been this season in protecting biodiversity.

Research to inform biodiversity management throughout New Zealand remains a core focus of the RNRP. Since part of the RNRP was included in the Rotoiti BFOB aerial 1080 operation, the opportunity exists for the RNRP to move towards being a trial site for aerial pest control methods, rather than simply continuing to test ground-based methods. Given that aerial pest control is likely to be increasingly used in South Island beech forest ecosystems such as is present in the RNRP, this seems a logical step to keep RNRP trials relevant in the changing world of conservation practices.

The RNRP still suffers from a lack of resources to carry out monitoring to the planned or historic standard. This year has focussed on reducing labour-intensive tasks such as ground-based stoat control, as well as

dropping work like cat control and robin monitoring so that the work load reflects the resources available. However, this balance has still not been struck with long-term monitoring data sets, like five-minute bird counts, still not being completed, and more prioritisation of work needs to occur so that long term datasets can be maintained. Careful thought also needs to be put into the RNRP's potential contribution to future conservation research to ensure that the RNRP remains relevant, while abandoning neither the guiding principles and objectives of the project, nor its long-term datasets.

The volunteer programme has played a crucially important part in the upkeep of the RNRP after staffing levels were reduced in the restructure. Volunteers essentially act as extra staff members doing fundamental RNRP work rather than additional 'nice to do' work on the side. The full immersion in DOC that volunteers experience gives those who are intending to work in the conservation field new skills and greater understanding of conservation in practice, as well as contacts within DOC which stand them in good stead for future employment.

The current RNRP Strategic Plan 2014-19 (Harper & Brown, 2014) captures the essence of DOC's change in strategic direction towards an increased focus on fostering partnerships to achieve conservation goals. Existing partnerships have been maintained and strengthened during 2015/16 and advocacy of biodiversity conservation to the public continues while potential options to develop new partnerships in the future are explored.

6 Recommendations

- Thoroughly consider the RNRP's potential contribution to future conservation research. Look ahead for opportunities for the RNRP to be involved in pest control trials.

- Identify a control methodology to carry out a spring rodent control operation.

- Commence stoat trapping lure trial in conjunction with Zero Invasive Predators (ZIP), trialling bedding material from oestrus stoats as a lure.

- Promote hunting within the RNRP to increase deer control effort.

- Move all wasp control in the RNRP core onto a 300m by 50m grid.

- Carry out pig control in areas within the RNRP where pig rooting activity is severe.

- Monitoring of re-located known kākā nest sites to be carried out in years of predicted beech seeding using trained staff to climb and check cavities.

- Reassess kea nest protection programme with Kea Conservation Trust and identify ways to provide better protection.

- Finish great spotted kiwi translocation by bringing adult birds into the population to meet the 40 individuals required for a translocated population.

- Restart Kiwi Call Count monitoring within the RNRP as a long-term method of kiwi monitoring.

- Investigate the need for and feasibility of low-level monitoring of species that are not currently receiving attention locally, such as herpetofauna and invertebrates.

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7 Acknowledgements

The RNRP relies on support from volunteers, temporary staff, and technical advisors.

We would like to thank temporary field staff: Graeme Andrews, Sarah Fisher, Marissa Le Lec, Kate Simister, Logan Blythen; and volunteers Frankie Mackie, Thea Eldred, James Stops, Julia Kobetitch, Sophie Reed, Dale Mortiboys, Connie Rowland, Kelly Whitau, Millie Raven.

We would like to thank the Friends of Rotoiti for all their dedicated work in trapping, as well as monitoring kākā nests.

Other staff at the Nelson Lakes office also assisted the project on many occasions, sharing logistics, costs and helping in the field.

Members of the Technical Advisory Group and external advisors provided advice at various times during the year (membership in Technical Advisory Group).

Dr Katrina Seelye who reviewed and edited this report.

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9 Appendix 1:

9.1 RNRP datasets

Datasets referred to within this report, and others that were maintained during the 2015/16 year, are listed below.

Introduced species

Dataset	File location	Contact person
Possum trapping	DOCDM-516760	Pat van Diepen (pvandiepen@doc.govt.nz)
Wasp monitoring	DOCDM-1546039	Jen Waite (jwaite@doc.govt.nz)
Mustelid trapping	DOCDM-1251695	Jen Waite (jwaite@doc.govt.nz)
Mustelid monitoring	DOCDM-1346209	Pat van Diepen (pvandiepen@doc.govt.nz)
Rodent monitoring	DOCDM-1261708	Pat van Diepen (pvandiepen@doc.govt.nz)

Native species

Dataset	File location	Contact person
Five-minute bird counts	DOCDM- 769826	Emma McCool (emccool@doc.govt.nz)
Tussock monitoring	DOCDM-72336	Sandra Wotherspoon (swotherspoon@doc.govt.nz)
Beech seedfall monitoring	DOCDM-1365121	Sandra Wotherspoon (swotherspoon@doc.govt.nz)
Great spotted kiwi monitoring	DOCDM- 747464 DOCDM-1454781	Pat van Diepen (pvandiepen@doc.govt.nz)
Kākā monitoring	DOCDM- 171970	Emma McCool (emccool@doc.govt.nz)
Kea nest protection	DOCDM-1283015	Emma McCool (emccool@doc.govt.nz)

10 Appendix 2.

10.1 Project management

Budget
Staff (salary & wages): $133,226
Operating: $40,711

10.2 Staffing

Nik Joice, Jenny Long, Patrick van Diepen, Emma McCool, Graeme Andrews, Sarah Fisher, Marissa Le Lec, Kate Simister, Gareth Rapley, Sandra Wotherspoon

10.3 Technical Advisory Group

Kerry Brown, Graeme Elliott, Craig Gillies, Dave Kelly.

10.4 RNRP advisors

Josh Kemp, Mike Hawes, Kath Walker.