Rotoiti Nature Recovery Project Annual Report 2016/17

Nelson Lakes Mainland Island, Nelson Lakes National Park

J Waite, E McCool, P van Diepen, G Rapley, P Hale

Department of Conservation
Te Papa Atawhai

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Mustelid control continued in the RNRP in 2016/17 using the DOC200 and DOC250 network. The first year of a two year trial testing the effectiveness of stoat bedding material as a lure in traps was undertaken in Big Bush. Tracking tunnel monitoring showed that mustelid tracking was kept below the five percent target in the RNRP treatment area, while mustelid tracking remained high at the Rotoroa non-treatment site.

Possum control was increased in the RNRP by closing the spacing between sentinel traps on lines from 200m to 100m. Monitoring from waxtags showed possum activity was kept below the five percent target in the both the Core area and Big Bush. No feral cat control was carried out by RNRP staff this year. The Friends of Rotoiti carried out cat control in the St Arnaud village and surrounding rural areas, with 81 feral cats caught.

The kākā encounter rate remained at low levels, similar to those of the last two years. It appears that the kaka population has decreased since 2013/14 and encounter rates are now similar to those observed in 2007. No kaka nesting was observed this year. There were three kea nesting attempts in 2016/17. One was lost to predation of eggs by a stoat while the other two successfully fledged two chicks each.

Foliar browse monitoring carried out on three species of mistletoe in the Core area found no possum browse on plants. Monitoring of *Pittosporum patulum* and *Powelliphanta sp. snails* was not scheduled for the 2016/17 year. There was increased hunter interest in the RNRP in 2016/17, with five deer and four chamois shot. Pig trapping at the northern end of the St Arnaud Range caught four pigs.

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

Great spotted kiwi remain the only species to have been re-established in the RNRP. Three adult and four sub-adult kiwi were monitored in 2016/17, with no breeding attempts recorded. The Friends of Rotoiti were successful in obtaining funding so that a further 20 adults can be translocated into the RNRP and increase the number of founder individuals to 40.

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;

The first year of a two year trial testing the effectiveness of stoat bedding material as a lure in mustelid traps was undertaken in Big Bush.

A rodent control operation was undertaken in the RNRP in August 2016. This operation was a field trial comparing the bait take of diphacinone in D-blocks from Philproof bait stations to Pestoff stations. Overall bait take was low, with only 27% of bait removed. Philproof stations recorded lower bait take with 55% of stations having no bait removed, compared to 30% of Pestoff stations. The operation was not successful in reducing rat tracking to below five percent, with tracking decreasing from 40% prior to the operation to 29% after.

Wasp control using Vespex poison was carried out late in February 2017 as wasp numbers were not as high as in previous seasons, likely due to a very wet spring. The operation was successful in decreasing wasp activity at monitored nests and increasing the amount of available honeydew.

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. Analysis of the long-term dataset was carried out by Kelly Whitau at the University of Canterbury for her Masters thesis. Low levels of beech seedfall was recorded for all three beech species in 2016/17. Low levels of alpine tussock flowering was recorded at Mt Misery.

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

No new species were reported in 2016/17, although the first rock wren sighting since 2007 was made near the Clearwater trapline.

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

Kelly Whitau (University of Canterbury) analysed several RNRP datasets for her thesis looking at responses to pest control in beech forests.

Jamie McAulay (University of Otago) took samples from the RNRP for his thesis looking at the diet of alpine stoats.

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

Other than the Annual report a field trial report assessing the effectiveness of diphacinone in D-blocks was produced. The Minister for Conservation and media attended an event within the RNRP to highlight the success of Vespex as a wasp control tool.

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 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 to include over 5,000 ha on the western St Arnaud Range and southern Big Bush. 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 which were then replaced by DOC-series traps. From 2012 to 2014 the RNRP was involved in a national trial of self-resetting traps for landscape-scale pest control, testing the use of the Goodnature Ltd A24 traps 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 which successfully established within the RNRP. Limited breeding has taken place over the past twelve years, with nine wild-raised kiwi chicks successfully fledging. From 2009 to 2014, GSK management focused on using Operation Nest Egg™ (ONE) to overcome the poor breeding success of GSK in the RNRP and increase the number

of founder individuals to 40. However, ONE has not proven to be successful at this site, with six of thirteen released ONE chicks known to have died, and the status of four unknown. 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 into 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 a considerable number 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.

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 effective at controlling 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. Between 2010-2013 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. Following this operation, no rat control was carried out in the 2015 season. 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 trialling raised set Timms. The cat trapping programme finished at the end of 2015/16 due to limited staff resourcing and is now carried out by the Friends of Rotoiti.

Possums (*Trichosurus vulpecula*) have been controlled within the RNRP using both toxins and kill traps. Currently possums are targeted along mustelid trap lines using Sentinel kill traps within the RNRP. Following the aerial 1080 operation in December 2014, wax tag monitoring showed that possum numbers were reduced in the Travers valley. 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

The involvement of the local and wider community in the RNRP is essential for the success of the project. Hundreds of days of work in support of the project have been undertaken by volunteers over the past 19 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 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, 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 RNRP. 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 *Powelliphanta "Nelson Lakes"*

2.1.1 Introduction

The RNRP Strategic Plan 2014-19 (Harper & Brown, 2014) identified seven threatened species present in the Rotoiti area prior to the establishment of the RNRP. These species and their New Zealand Threat Classification System rankings are as follows (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 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 in 2013 its threat status of 'naturally uncommon' was upgraded to 'nationally endangered' (Robertson, et al., 2013). Evidence suggests a continuing slow decline in kea numbers in Nelson Lakes National Park (Steffens, 2009; Harper, et al., 2011). The primary threats to kea are predation by introduced brushtail possums (*Trichosurus vulpecula*) and stoats

(*Mustela erminea*) on eggs, nestlings and incubating adults (Taylor, Moorhouse, Kemp, Elliott, & Bruce, 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, et al., 2015).

The kākā is an endemic forest parrot that is threatened by predation. The main threats to kākā are predation of eggs, chicks and nesting adults by stoats and possums (Moorhouse, 2003). Stoats are controlled within the RNRP via an extensive trapping programme, with Fenn MkVI traps initially used which were upgraded to DOC200 and DOC250 traps from 2007 to 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 irruption. Possums are controlled in the RNRP using Sentinel 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 resources this was ceased in 2015 and is now carried out by the Friends of Rotoiti. 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 the successful reduction of possum numbers up the Travers Valley where historically there has been no possum control. This will aid in reducing reinvasion pressure into the RNRP from the south. Possum control is considered 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 of 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. Hunters are allocated one of four blocks within the area and all animals shot are recorded. Hares (*Lepus europeaus*) represent another likely 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 within the RNRP and are a threat as their rooting activity degrades snail habitat. Pig control has only been implemented in the RNRP since the 2015/16 year.

2.1.2 Mustelid control and monitoring

Introduction

Landscape-scale ground-based mustelid control has been carried out in the RNRP since 1998. Mustelid control continued throughout 2016/17 using the existing network of DOC series traps. The Friends of Rotoiti (FOR) community group also maintain 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 (Taylor, Moorhouse, Kemp, Elliott, & Bruce, 2009; Greene, 2004).

Methods

Control

RNRP mustelid trap lines cover approximately 5,000 ha to the east and north of Lake Rotoiti (Figure 1). 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.

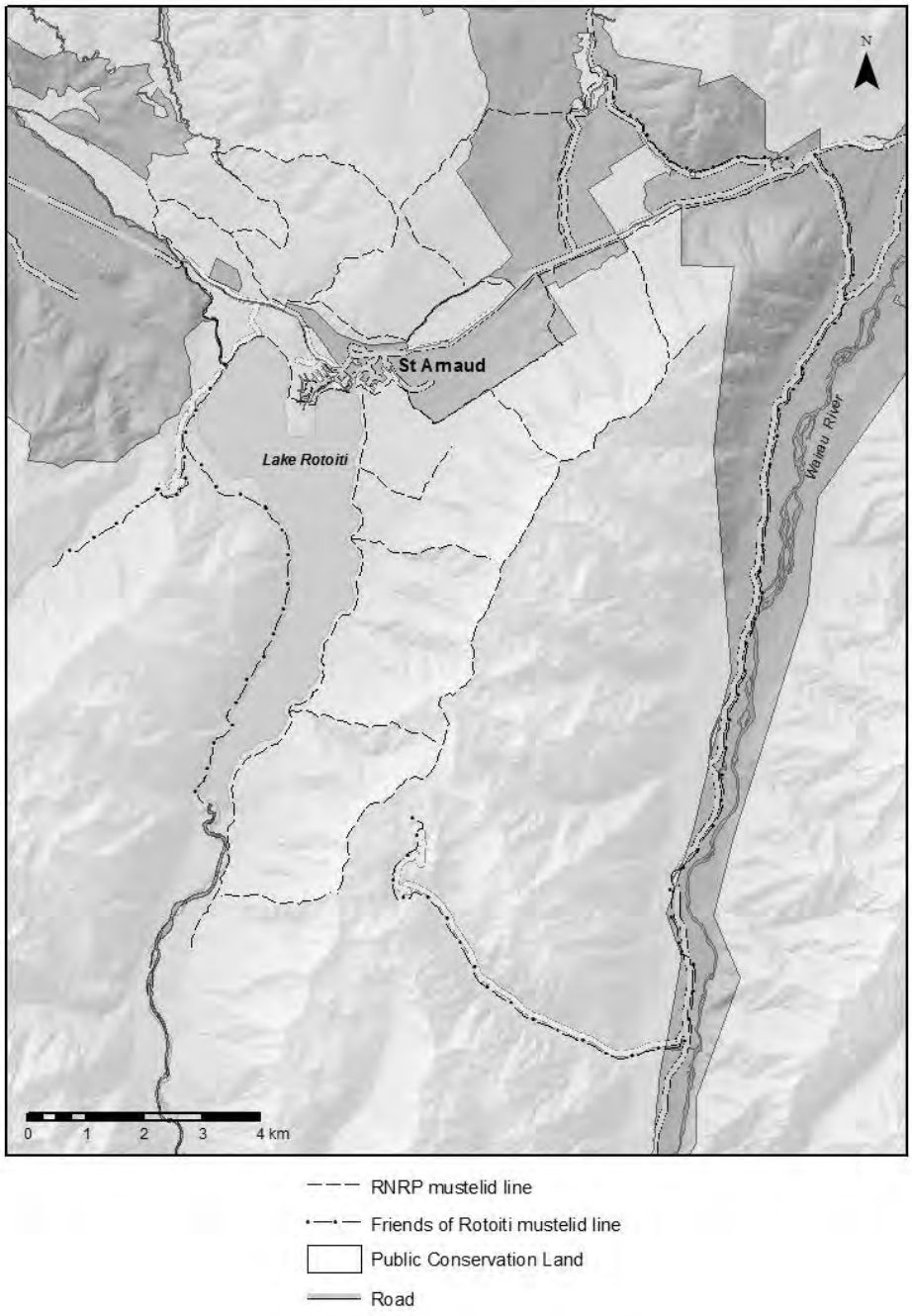


Figure 1: Location of the Rotoiti Nature Recovery Project and Friends of Rotoiti mustelid trap lines in 2016/17.

In July 2016 a two-year trial was initiated in conjunction with Zero Invasive Predators trialling the effectiveness of stoat bedding material from oestrus stoats as a lure. This trial would compare the number of stoats caught between traps baited with Erayz and bedding material to traps baited with only Erayz. The trial was carried out in the Big Bush area of the RNRP using 308 DOC200 and DOC250 traps. On lines with only DOC200's alternating traps were baited with the different lures, while on lines with

DOC200's and 250s alternating pairs of traps were baited with different lures (Figure 2). In the second year of the trial the type of lure a trap contained would be swapped to the opposite lure type to avoid trap site bias. In February 2017, the trial design was changed to compare stoat bedding material only to Erayz. Stoat bedding material was supplied from captive oestrous stoats at Lincoln University. This bedding material was placed in tea strainers which were placed into the egg holder of a trap. All traps included in the trial were checked and rebaited monthly.

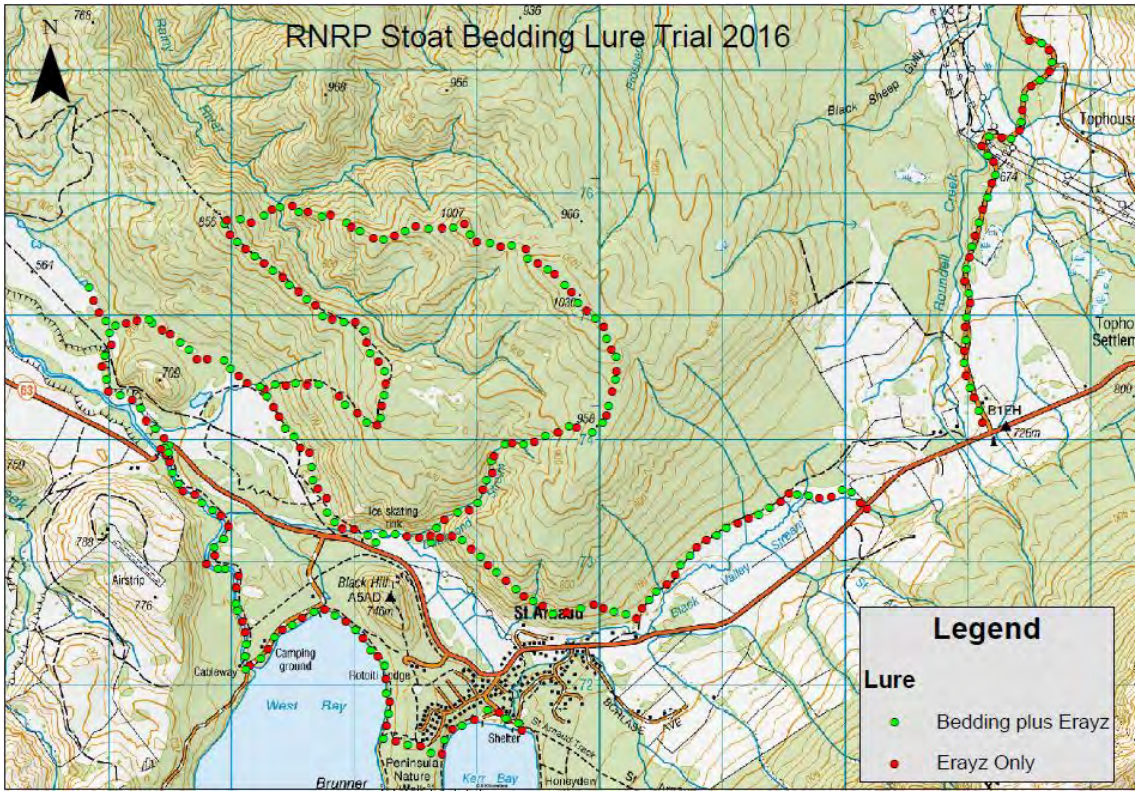


Figure 2: Map showing stoat bedding lure field trial with location of traps containing different lure types. In February 2017 the trial was changed to compare traps with Erayz only to traps with bedding lure only.

For traps within the RNRP not included in the lure trial the frequency of trap checks was similar to the 2015/16 year, with eight checks on lines with historically low catches and ten checks on all other lines. Traps were baited with hen eggs, Connovation Erayz #8 blocks (a rabbit-based compound) or fresh rabbit.

Between April 2016 and June 2017, the region of the body by which an animal was caught was recorded for all animals captured in DOC200 and DOC250 traps to determine the humanness of the two trap types.

Monitoring

Mustelid monitoring to determine the effectiveness of mustelid control within the RNRP is carried out using three nightly tracking tunnel indices. Standard 60cm coreflute tracking tunnels with Black Trakka™ inked cards are used, with five tunnels at 100m spacings along lines with a minimum of 1km between lines. Standard monitoring is carried out in the Rotoiti treatment site (trapping) and the Rotoroa non-treatment site (no trapping) in November and February. Fresh rabbit is used as a lure placed in the middle of the card, and left out for three fine nights (Gillies, 2013). 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.

Results

Control

During 2016/17, 184 stoats, 10 weasels and one ferret were caught within the RNRP (Table 1). The number of stoats caught was lower than that of 2014/15 beech mast year when 273 stoats were caught but similar to previous non-mast years (Table 2). Ten weasels were caught, which was similar to previous years but much lower than the 2014/15 mast year when 83 were caught. Three juvenile weka were caught this year which is higher than most years. Two were caught in November 2016 in DOC250s along the Black Sheep Gully line (traps 32 and 34), and one was caught in January along Borlase Boundary Fenn line in a DOC200.

Table 1: Trap catches and sprung traps in the Rotoiti Nature Recovery Project in DOC200 and DOC250 traps from July 2016 to June 2017.

Species	Number caught
Stoat (*Mustela erminea*)	184
Ferret (*Mustela furo*)	1
Weasel (*Mustela nivalis*)	10
Rat (*Rattus* sp.)	678
Mouse (*Mus musculus*)	30
Hedgehog (*Erinaceus europaeus*)	161
Rabbit (*Oryctolagus cuniculus*)	37
Cat (*Felis catus*)	13
Weka (*Gallirallus australis*)	3
Possum (*Trichosurus vulpecula*)	1
Sprung	314

Table 2: Total number of stoats caught each year in DOC200 and DOC250 traps in the Rotoiti Nature Recovery Project since 2009.

Year	Total Number of Stoats
2009/10	198
2010/11	164
2011/12	164
2014/15	273
2015/16	215
2016/17	184

The rate of stoat and weasel captures varied by season over 2016/2017 (Figure 3). Captures of stoats was low through winter and spring of 2016 with 14 stoats caught in the winter months (July and August 2016), and 18 caught in spring (September to November 2016). The capture rate increased over summer with 99 stoats caught from December to February, with 55 in the January trap checks (Figure 3). Captures of stoats dropped off through the autumn months (March to May 2017) with 48 caught. Only low numbers of weasels were caught this field season, with captures concentrated across the autumn months (March to June 2017) (Figure 3).

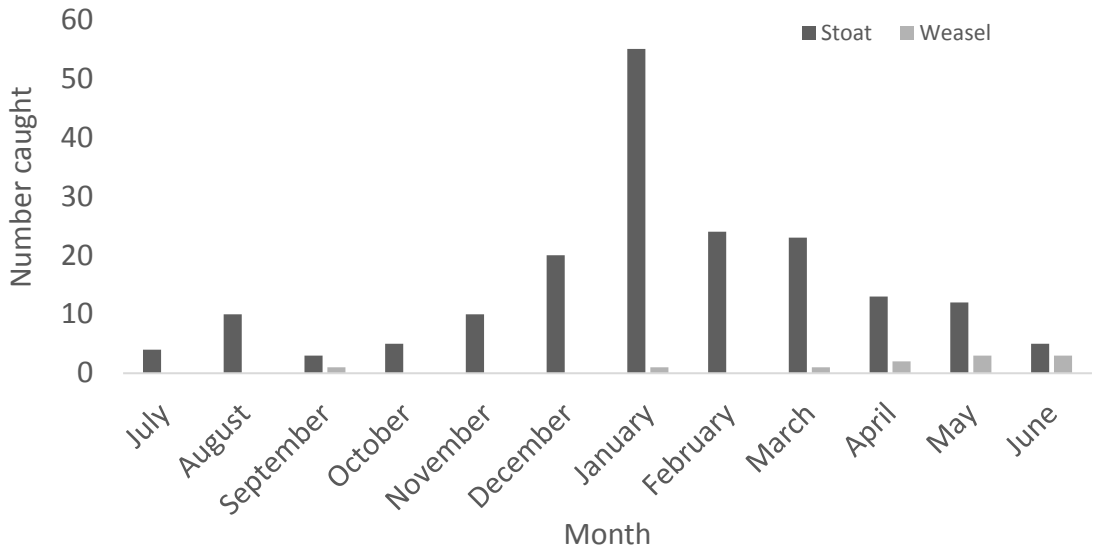


Figure 3: Total number of stoats and weasels caught each month in the Rotoiti Nature Recovery Project in DOC200 and DOC250 traps from July 2016 to June 2017.

Data recording the area of the body animals were caught by in traps showed that 97.7 percent of scored captures were considered humane with the animal being caught either by the head and body, just the head or just the body (Table 3). A total of 30 captures (2.3%)were considered inhumane with the animal being caught either by the front leg, back leg, tail or the snout (Table 3 and Table 4).

Table 3: Number of animals caught by areas of the body in DOC200 and DOC250 traps from 1293 captures in the Rotoiti Nature Recovery Project from April 2016 to June 2017.

Area of the body caught by	Number Caught
Head & Body	454
Body	414
Head	395
Front Legs	6
Back Legs	15
Tail	5
Snout	4

Table 4: Inhumane captures recorded in DOC200 and DOC250 traps in the Rotoiti Nature Recovery Project from April 2016 to June 2017 by area of the body caught in trap.

Area caught by	Rat	Stoat	Cat	Hedgehog	Possum
Front Legs	2	1	3	0	0
Back Legs	9	6	0	0	0
Snout	0	0	0	3	1
Tail	4	1	0	0	0

Monitoring

Mustelid tracking rates at the Rotoiti site remained below the recommended five percent tracking with no mustelids tracked in November, and only 1% (SE±1) in February (Figure 4). At Rotoroa tracking was considerably higher with a tracking rate of 30% (SE±10) in November and 22% (SE±10) in February.

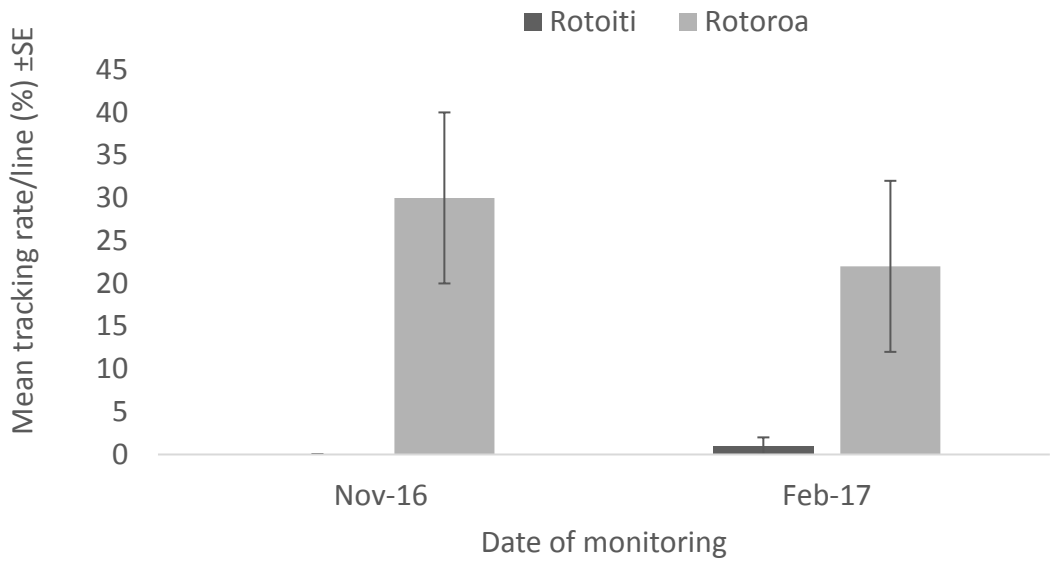


Figure 4: Rotoiti Nature Recovery Project mustelid tracking rates from tracking tunnels at Lake Rotoiti (trapping) and Lake Rotoroa (no trapping) in 2016/17.

Discussion

During 2016/17 mustelid control within the RNRP was successful at maintaining tracking indices from 3 nightly surveys to below the five percent target, with indices of 0 and 1 percent recorded (Figure 4). In comparison at Lake Rotoroa where no mustelid control is carried out, mustelid tracking was high in both monitoring periods and well above five percent tracking (Figure 4). This result shows that the intensity of trapping within the RNRP and reduced trap check frequency is able to control the mustelid population to low levels.

The number of stoat and weasel captures for the 2016/17 year was low in comparison to the previous two years which followed on from the 2014 beech mast, but similar to capture rates during other low beech seed years. Tracking tunnel results show that even though lower levels of mustelids were caught the population was maintained below five percent tracking. The high catch rate of stoats in January is similar to that of previous years. In the 2017/18 season the mustelid control programme will continue unchanged with the bedding lure trial to run for one more year.

Considerable effort has been put into carrying out maintenance along mustelid control lines during the 2016/17 season. Storm damage from 2013 and 2014 has created large areas of windthrow along trap lines in the Big Bush area and until now the project lacked the capacity and skills to clear these areas. In 2016/17 work began

on this and will continue in the 2017/18 season with the goal of having all lines cleared by the end of the financial year. In April 2017 the State Highway trap line was moved due to the November 2016 Kaikoura earthquake which resulted in closure of SH1 between Blenheim and Kaikoura and the redirection of traffic along SH63 through St Arnaud. The significant increase in traffic made it unsafe to check these traps and the decision was made to move the trap line into the bush behind the Kehu subdivision and join up with the Borlase Boundary line creating the new State Highway Traverse trapline.

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 298 DOC200 and 96 DOC250 traps in operation:

- Rainbow Valley: DOC200s (77) in run-through boxes alternating with DOC250s (76).
- Six Mile/Dip Flat lines: Each has four DOC 200s.
- Seasonal Rainbow Ski Field Line: 20 DOC250s from the Rainbow gate followed by 50 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 were used for most of the year and changed every eight weeks. During the year the bait type was changed to Erayz which was changed monthly.

The Rainbow line is currently being run as a trial to compare DOC200s in a run-through tunnel design to DOC250s baited with Erayz which is changed monthly. This

new trial started in November 2016 with DOC250 boxes fitted with mouse excluders to prevent mice from eating the Erayz bait. Mouse excluders are cage boxes made from 8mm square mesh that attaches to the DOC250 box end and closes over the Erayz bait when the box is closed.

Results

Friends of Rotoiti recorded higher stoat captures (n = 151, Table 5) during the 2016/17 year compared to the previous year (2015/16 n = 58). Stoat catches were highest during the summer months with 64 caught in December, 53 in January and 13 in February (Figure 5). Outside of this period stoat captures were low at less than ten per month.

Table 5: Trap catches and sprung traps on the Friends of Rotoiti mustelid traplines in DOC200 and DOC250 traps from July 2016 to June 2017.

Species	Number caught
Stoat (*Mustela erminea*)	157
Ferret (*Mustela furo*)	4
Weasel (*Mustela nivalis*)	6
Rat (*Rattus* sp.)	214
Mouse (*Mus musculus*)	18
Hedgehog (*Erinaceus europaeus*)	71
Rabbit (*Oryctolagus cuniculus*)	23
Cat (*Felis catus*)	9
Introduced Birds	3

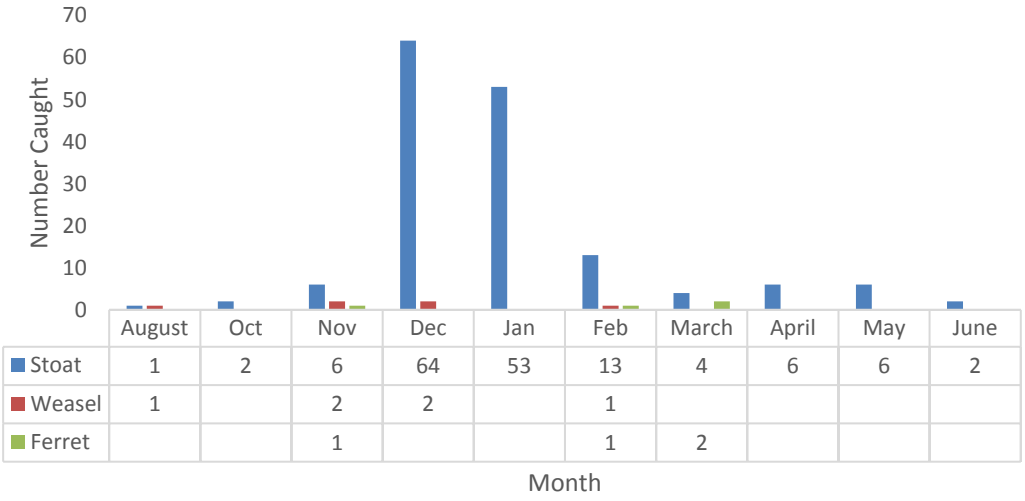


Figure 5: Number of each mustelid species caught on Friends of Rotoiti mustelid trap lines in DOC200 and 250 traps in 2016/17 by month.

Preliminary results from the Rainbow Valley Trial which began in November 2016, show that 54 mustelids were caught in DOC250s baited with Erayz, and 46 in unbaited run-through traps (Figure 6). A higher number of hedgehogs were caught in run-through traps (n = 38, Figure 7) compared to DOC250 traps (n = 11, Figure 7). A juvenile cat, juvenile possum and hedgehog were found caught by the front foot in run-through traps and recorded as inhumane catches. No inhumane captures were recorded in DOC250s.

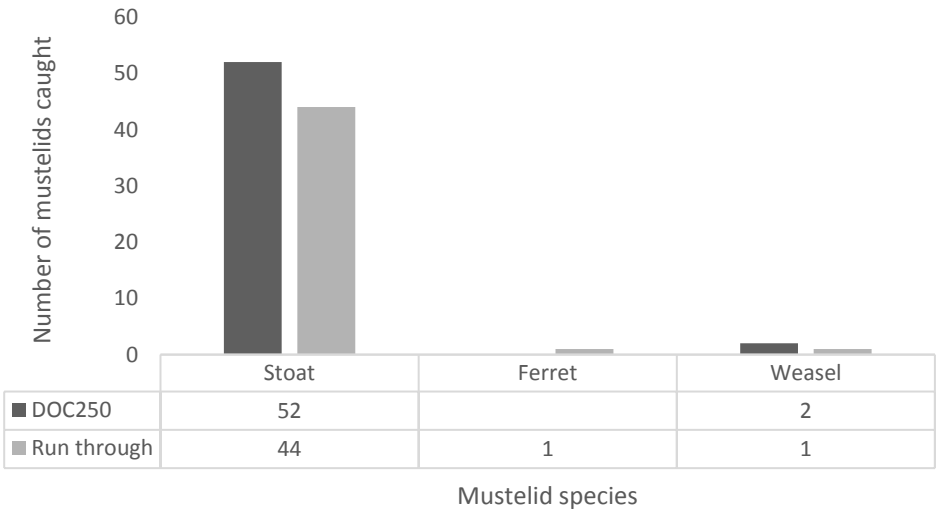


Figure 6: Number of mustelids caught in DOC250s baited with erayz compared to baitless DOC200s in run-through tunnels in the Rainbow Valley from November 2016 to June 2017.

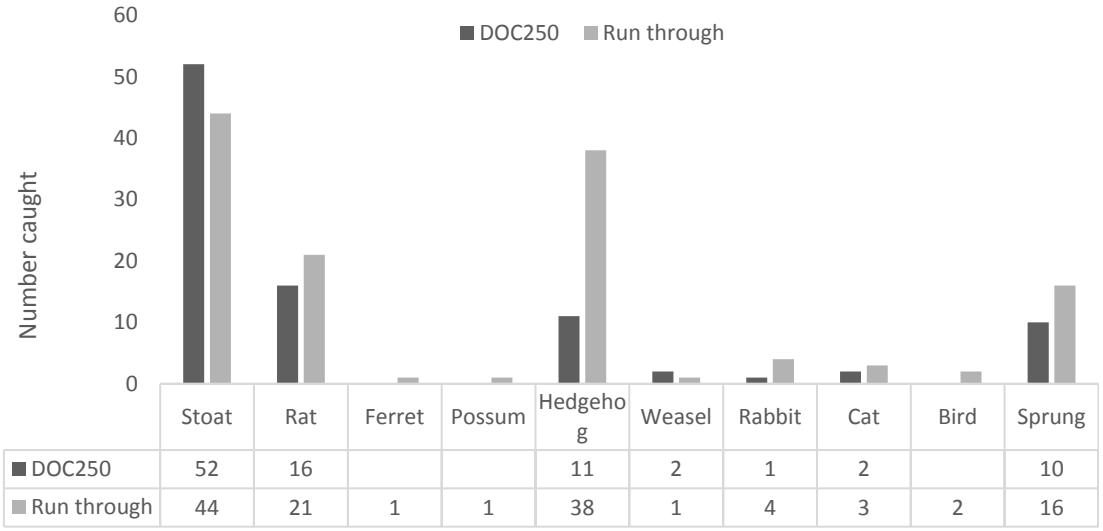


Figure 7: Trap catches and sprung traps on the Friends of Rotoiti Rainbow valley trapline from November 2016 to June 2017 in DOC250s baited with Erayz and DOC200s in baitless run-through tunnels.

2.1.4 Feral cat control

No targeted trapping of feral cats was undertaken in the RNRP during 2016/17. However, DOC200/250 traps targeting mustelids continued to catch juvenile cats.

Results

Thirteen cats were caught in DOC200 and 250 traps during 2016/17, with nine in DOC250s and four in DOC200s. Nine were caught in traps baited with Erayz, three with rabbit and one with egg. Most cats were caught in traps in grass areas along the forest edge, with five caught along the Borlase Boundary, three along Black Valley swamp, and one on each of Korere-Tophouse Road, Teetotal Road and Lakehead. Only two were caught in the core area of the RNRP with one along the Grunt trap line and one along the Lakeedge trap line.

Discussion

Cage trapping, normally undertaken within the RNRP to target areas with high cat presence, was discontinued at the end of the 2014/15 season due to limited resources. Cats continue to be caught as bycatch within DOC series traps, although fewer were caught this season (n=13) compared to previous years when approximately 20 were caught annually. Of this year's captures, one cat was recorded as inhumanely caught by the front leg, three were caught by the body and the remaining nine were caught by the head. Most cats were caught in traps baited with Erayz (n=9).

2.1.5 Friends of Rotoiti feral cat control

Methods

Cats are occasionally caught as bycatch in FOR mustelid traps, particularly on the Rainbow and Whisky trap lines. FOR members and local supporters maintain 23 cage traps with 19 targeting cats in the St Arnaud village and rural areas adjacent to the Nelson Lakes National Park, particularly the Tophouse Road area. Several local volunteers also maintain their own live-capture cage traps targeting cats at points around the St Arnaud village and Tophouse Road area. Feral cats are killed using a .22 rifle while cats identified as pets are released from the cage.

Additionally, a number of Timms traps either on raised platforms or attached to the side of run-through boxes placed on the ground were used along the Whiskey Falls line baited with rabbit.

Results

Nine cats were caught as by-catch in FOR mustelid traps, eight in Rainbow Valley, with four in run through traps, three in DOC250s and one in a DOC200. One cat was caught in a DOC200 along the Whiskey Line. No cats were caught in Timms along the Whiskey Line. Cage trapping by local volunteers resulted in 81 feral cats being caught during 2016/17.

2.1.6 RNRP possum control and monitoring

Introduction

Ground based possum control is carried out within the RNRP to maintain the possum population at a low level, allowing the recovery of threatened plant species that are damaged by possum browse and providing protection to nesting kākā and kea that are both at risk from possum predation and disturbance (Moorhouse, 2003) (J. Kemp pers. comm.). Since 1997 possum control has been undertaken using a combination of toxins and kill traps. Control now focuses on using Sentinel kill traps placed along mustelid trap lines.

Results monitoring is undertaken two-yearly to determine how successful the current trapping regime is at controlling the possum population, using seven nightly wax tag indices within the Big Bush and the Core Area of the RNRP. The results target of the possum control programme within the RNRP is to keep the Possum Activity Indices (PAI) from wax tag monitoring below five percent.

Outcome monitoring is undertaken on a subsample of the mistletoe population within the Core Area of the RNRP to assess the effectiveness of the possum control programme at allowing the recovery of browse threatened species. This monitoring is carried out using a modified foliar browse index to assess the health of tagged individuals of three species of mistletoe (*Alepis flavida, Peraxilla colensoi and P. tetrapetala*) and is repeated every four years. Mistletoe monitoring was carried out in January 2017 and is reported in section 2.1.12.

Methods

Control

In 2016/17 sentinel kill traps were used along existing mustelid trap lines to control possums within the RNRP (Figure 8). These were attached to trees 1500mm above ground level and fitted with white coreflute covers to help prevent non-target bycatch and direct the target species into the kill-zone.

Possum traps along some lines (Borlase Boundary, SARN, Duckpond stream, Black Sheep Gully, Struth, and a short length of Dome Ridge) have in the past been positioned at every second stoat trap site 200m apart. During the 2016/17 year these spaces were filled in so that now all sentinel traps in the RNRP are spaced 100m apart along trap lines where vegetation allows.

The lure regime during 2016/17 was the same as previous years with 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.

Monitoring

Two-yearly RNRP possum population monitoring was undertaken this season during March 2017. This monitoring was completed following the National Pest Control Agency's (NPCA) established wax tag seven-night survey method.

Wax tags, made from unflavoured orange coloured wax blocks, were mounted 30cm above the ground on tree trunks, with a glow-in-the-dark tab added at the tree attachment point. Each monitoring line had 20 wax tags spaced 10m apart. In Big Bush 15 lines of wax tags were deployed on a compass bearing of 38 degrees, while in the Core Area on the St Arnaud Range 13 lines were deployed on a bearing of 260 degrees (Figure 8). The bearings and start points used were the same as in previous years of wax tag monitoring.

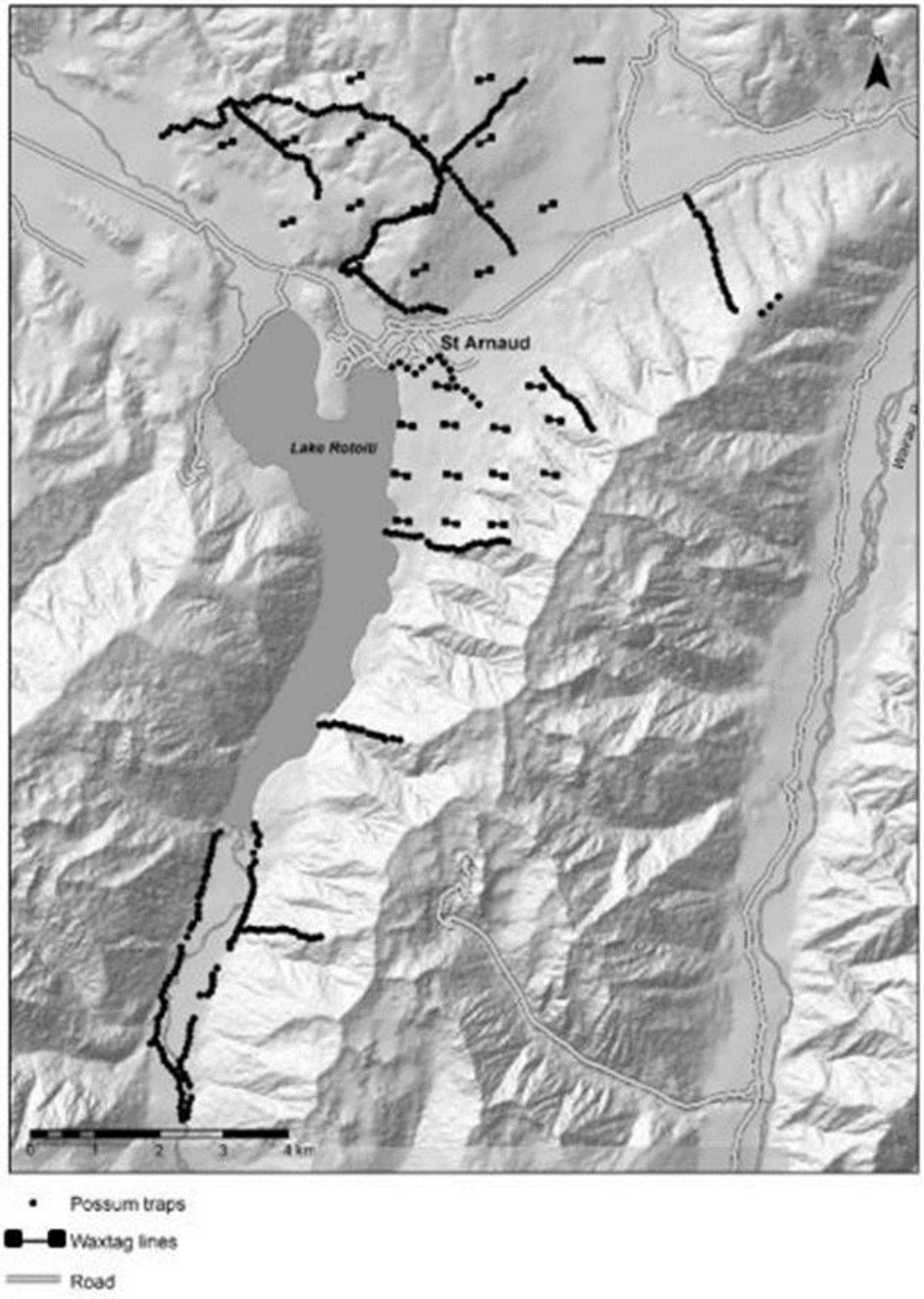


Figure 8: Map showing location of possum traplines and waxtag monitoring lines in the Rotoiti Nature Recovery Project.

Results

Control

In 2016/17 135 possums were caught in the RNRP, similar to the 2015/16 year when 139 were caught (Table 6). The capture rate was highest within Big Bush with 86 possums caught, while only 25 were caught on the St Arnaud Range. Captures on the Travers buffer line remained low this year with only 24 caught (Table 6).

Table 6: Possum trap catches within the Rotoiti Nature Recovery Project and traplines buffering the project from July 2016 to June 2017.

Trapline	Total Possums caught	No. of traps	Catch per trap
Black Sheep Gully	11	28	0.39
Black Valley Stream	13	19	0.68
Dogleg	25	23	1.09
Dome Ridge	32	46	0.70
Duckpond Stream	3	20	0.15
Struth	2	17	0.12
Big Bush Total	86	153	0.56
Borlase Boundary	2	14	0.14
Clearwater	4	17	0.24
Grunt	2	23	0.09
Hubcap	5	23	0.22
MOR	6	17	0.35
SARN	2	3	0.67
Snail	4	15	0.27
RNRP St Arnaud Range Total	25	112	0.22
Coldwater	10	49	0.20
Lakehead	14	45	0.31
Travers Valley Total	24	94	0.26
Total	135	359	0.38

Monitoring

The Possum Activity Index (PAI) is the percentage of wax tags deployed in each area showing evidence of possum bite marks on their wax blocks. Monitoring in Big Bush recorded a PAI of 4% (SE ±2%) and a PAI of 2% (SE ±1%) in the RNRP Core area. These results are similar to monitoring undertaken in March 2015 where a PAI of 6% (SE ±4%) was recorded in Big Bush, and 1% (SE ±1%) in the RNRP Core.

Discussion

Monitoring carried out in March 2017 shows that the current intensity of possum control within the RNRP is successfully maintaining possum numbers at a low number. Furthermore, outcome monitoring measuring the level of foliar browse on native mistletoe species in January 2017 in the core area of the RNRP showed that possums are controlled to a low enough level to allow recovery of browse sensitive species (see section 2.1.12 Mistletoe monitoring for further details).

Possum captures have remained at low levels on the St Arnaud Range for the past two years. This is likely the result of the ongoing effect of the 2014 aerial 1080 operation along the St Arnaud Range and Travers Valley. Historically possum numbers were high in the Travers Valley as no control was undertaken in this area. This resulted in high reinvasion pressure into the southern areas of the RNRP. The 2014 1080 operation was successful in reducing possum numbers in the Travers with three-nightly wax tag monitoring showing a PAI of 19% prior to the operation and 4% after. There was also a drop in the number of possums caught along the buffer trap line set up in the Travers valley, with 400 possums caught in the first year of trapping in 2013/14 and less than 20 caught in each of the two years since the 1080 operation.

There has been an increase in the number of possums caught in Big Bush, with approximately 80 possums caught in each of 2015/16 and 2016/17, compared to 27 in 2014/15. This 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 possum numbers rebuild, reinvasion pressure into the Big Bush area will increase, hence the need for an increase in possum control may be required to keep possums at low density. 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 of high priority (Moorhouse, 2003). Results monitoring is next due in March 2019, and the results from Big Bush will be an indicator as to how well the current trapping programme is preventing reinvasion from the northern areas.

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 kill traps in early 2010. The number of traps along lines has been increased over the years. Currently there are 33 traps in the Rainbow Valley, 23 on

the Whisky Falls line, eight on the Speargrass line and five 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 traps at different times throughout 2016/17, with the dowels being changed through the year to bait clips with possum dough which is easier to change, and the lure appears to be more attractive. On the tree leading up to each trap 3-4 smears of Connovation's Ferafeed Smooth in a tube were applied.

Results

In 2016/17, 119 possums were caught, slightly fewer than previous years with 134 caught in 2015/16 and 145 caught in 2014/15 (Table 7). High numbers of possums were caught along the Whiskey Falls line with 48 captures (Table 7). The one Trapinator trap deployed along the Speargrass trap line has not been successful in the past, however in 2016/17 it caught its first possum.

Table 7: Total number of possums caught on Friends of Rotoiti traplines from July 2016 to June 2017.

Trapline	Number caught
Rainbow Valley	31
Mt Robert	7
Speargrass	27
Whisky Falls	48
Black Hill Contour	6
Total	119

2.1.8 Deer control and monitoring

Methods

A volunteer hunter system operates within the RNRP whereby approved recreational hunters can 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, et al., 2015).

Results

Deer and deer sign continue to be seen throughout the RNRP by DOC staff and volunteers. In previous years interest in the RNRP hunting blocks from the public has been limited, likely as low numbers of deer are thought to be present. However, in the 2016/17 year there has been increased interest in volunteer hunting in the RNRP with approximately 30 known recreational hunting days and five deer and four chamois shot. This compares to the 2015/16 year with only ten hunting days and one deer shot.

Discussion

Although numbers of ungulates within the RNRP appear to be low or have a very patchy distribution, they are likely having 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 attracting members of the public to hunt within the RNRP in the past, so it is encouraging that increased interest has resulted in a high number of ungulates removed from the project. Hopefully this level of interest can be maintained and allow recovery of *P. patulum* within the RNRP, with monitoring of this threatened plant next due in November 2017.

2.1.9 Pig control and monitoring

Introduction

Regular pig control is not carried out in the RNRP, with some previous pig trapping and hunting with dogs undertaken. Pig activity in the area is particularly noticeable along Dome Ridge in Big Bush, and just below the bush line on the northern-most tip of the St Arnaud Range. Sign is occasionally found elsewhere within the RNRP core. A large pig population has recently built up in the northern area of the St Arnaud Range.

Methods

The pre-existing 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 in May 2016 with a pair of trail cameras to monitor activity.

A pre-existing trap inside, but 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. In May 2016 pre-baiting was started 100m away from the existing trap and monitored with trail cameras. After approximately a month, feeding was observed and bait was also placed at the trap site. Two weeks later once feeding at the trap site was observed, bait was placed inside the trap to encourage feeding inside the trap. This process was followed to avoid the trap shyness that is expected from intelligent animals such as pigs.

An additional trapping site was set up later in 2016/2017. Trail camera monitoring around the south side of Alpine Meadows Drive started in January 2017. This site has extensive pig rooting right through a large area of north facing mixed bracken/manuka on the edge of the National Park. A large amount of pig activity was seen hence a pre-baiting regime was initiated in May 2017. This was at a site suitable for setting up a pig trap as it is located within the National Park near an area of observed high pig activity.

The bait initially used at the Grunt and Beech Hill Rise sites was fermented whole grain barley. This was purchased in 25kg sacks and soaked in water for a week to allow fermentation. From August 2016, Founder Brewery in Nelson supplied spent grain in 50-60 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. Molasses and hot water were added to the spent grain to encourage wild yeasts to start fermentation and increase the scent of the bait.

Results

No pig activity was observed at the Grunt site over a period of three months and baiting was stopped mid-August 2016.

From trail camera footage at the Beech Hill Rise trapping site, at least nine individual pigs were identified visiting the area. Pigs were identified by size, coat colour and

markings. During September 2016, groups of pigs were observed feeding inside the trap and the trap was set. A total of four young (<50lb) pigs were caught and shot within approximately two weeks of setting the trap. The trap was re-baited to attract further pigs and wired open so that it did not need daily checking. Pigs were seen occasionally feeding in the trap for two weeks following. However, the last images from a trail camera appear to show the group of pigs becoming spooked by something off-camera. Fortnightly baiting continued, though they were not seen again. Baiting at the site was stopped in early November 2016.

At the Alpine Meadows Drive site, trail cameras recorded sixteen individual pigs. Pre-baiting started in May 2017. At the end of the 2016/17 year, the trap had been set up, but was still in the pre-bait phase.

Discussion

Pig trapping was selected as a management method due to insufficient staff time available for hunting in the large blocks required to cover an area effectively. While the pig trapping undertaken in the RNRP involved fewer staff hours than hunting, the amount of time required to get pigs comfortable with entering the trap as a group makes it a long process. The pre-baiting work at the Beech Hill site involved approximately ten hours of staff time over May and August. Once the trap was set in September it needed to be visited daily, taking at least an hour of staff time each day.

Volunteer hunting with dogs is likely to be the most cost-effective way of managing pigs. However, this method is also very likely to educate large numbers of pigs to hunting pressure. Pig dogs are typically unable to bail more than one pig at a time when encountering groups in open vegetation such as beech forest. This may make it even harder to catch pigs over time.

At present, a mixture of the methods is planned. Trapping is expected to continue over winter months when staff time is available in small but consistent amounts. This will be limited to areas where hunting with dogs is not possible due to proximity to residential areas, such as the Alpine Meadows and Beech Hill Rise trapping sites. This should allow groups of pigs to be caught in areas undisturbed by hunting.

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 carried out between the 1st October 2016 and 31st April 2017. 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.

Translocation to captive breeding population

In October 2015 staff from Project Janzoon fitted transmitters to five kākā (three male and two female) caught within the RNRP core. These kākā were monitored by Project Janzoon staff from October to March for nesting attempts that chicks could be taken from for captive rearing and release into Abel Tasman National Park.

Results

Encounter rate monitoring

In 2016/17, 23 kākā were seen or heard over 146 hours of surveying, giving an encounter rate of 0.16 encounters per hour (Figure 9). Kākā were only encountered along seven of 19 lines surveyed this year (Table 8).

Translocation to captive breeding population

No nesting attempts were observed from any of the five kākā monitored in the 2016/17 year.

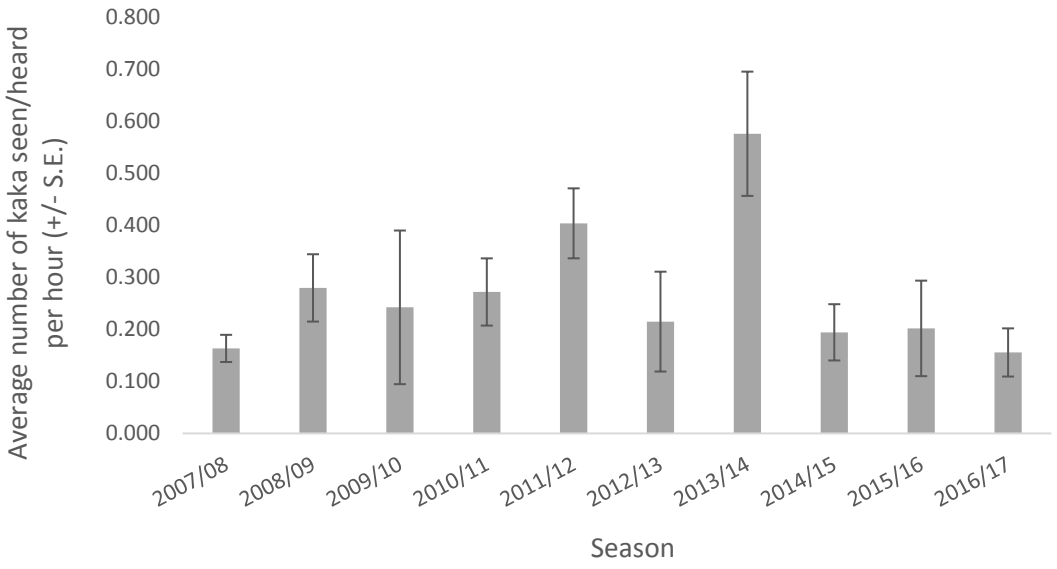


Figure 9: Mean (±SE) kākā encounter rates (number of birds seen/heard per hour) in the Rotoiti Nature Recovery Project.

Table 8: Encounter rates of kākā on traplines within the Rotoiti Nature Recovery Project between October 2016 and April 2017.

Trapline	Hours Surveyed	Number of kākā		Encounter rate per hour (Seen and heard)
		Seen	Heard	
Angler's Walk	2.0	0	0	0
Borlase Boundary	3.5	0	0	0
Black Sheep Gully	10.8	0	1	0.09
Black Valley Stream	14.3	0	0	0
Cedar	7.0	0	0	0
Clearwater	2.5	1	0	0.40
Dogleg	15.9	6	6	0.75
Dome Ridge	19.8	2	0	0.10
Duckpond Stream	9.8	2	0	0.20
Grunt	12.0	3	1	0.33
German Village	3.5	1	0	0.29
Hubcap	6.6	0	0	0
Lake Edge	12.3	0	0	0
Lakehead	6.5	0	0	0
MOR	8.3	0	0	0
Peninsula	4.5	0	0	0
Snail	2.0	0	0	0
Struth	2.5	0	0	0
Teetotal Road	4.0	0	0	0
Total	147.8	15	8	0.16

Discussion

From 2007/8 to 2013/14 the kākā encounter rate seemed to be increasing, with the highest encounter rate observed in 2013/14. However, since 2013/14 the encounter rate has dropped back to 2007/8 levels. The high encounter rate observed in 2013/14 may be partly a result of a large kākā breeding season in response to heavy beech flowering, with breeding behaviour increasing the call rate of kākā in the area. It is possible that the kākā population was recovering prior to 2013 and that the A24 trial undertaken from 2012 to July 2014 may have contributed to a recent decline in the kākā population.

Kākā nest in tree cavities and as a result are at high risk of predation of eggs, chicks and adult females by stoats during the nesting period (Moorhouse, 2003). When stoat numbers are high the success rate of kākā breeding can decrease significantly, with adult females also at high risk of predation on the nest. The 2001/02 kākā breeding

season at Duckpond Stream immediately followed a large beech mast in 2000. At this site no pest control was carried out, and of the eight nests that were monitored all failed, with all seven monitored females predated on the nest (Taylor, Moorhouse, Kemp, Elliott, & Bruce, 2009). Subsequent mustelid trapping at this site showed that maintaining mustelids below five percent tracking reduces this risk and increases the success rate of nests (Taylor, Moorhouse, Kemp, Elliott, & Bruce, 2009). Since this time mustelid trapping carried out within the RNRP has aimed to keep mustelid tracking to this level to restore the kākā population.

In the spring of 2013 a large beech flowering event was recorded at Rotoiti that would have triggered breeding in kākā. Unfortunately, this breeding season coincided with a period of high mustelid tracking in the RNRP during the A24 trial undertaken from 2012 to 2014. From August to March 2013 monthly mustelid monitoring showed that in all months except December (4%) mustelid tracking exceeded five percent with 19% in January and 20% in March (Long, Waite, Joice, & Grose, 2014). When the tracking rate exceeding the 15% threshold set for the trial, the trial was abandoned and A24s were removed and DOC200s reopened in July 2014. As kākā nest from October to July kākā nesting would have occurred during this period of high mustelid tracking, therefore it is likely that many nests were lost to predation, and that adult females may also have been predated. Mustelid tracking results returned to below five percent in October 2014 and have been kept at this level, however it is possible the losses incurred to the kākā population during 2013/14 have had a negative impact on its long-term recovery.

It is also possible that although mustelids are at almost undetectable levels in the RNRP, they are still having an impact on kākā, as of four nests monitored in 2015, two failed at the chick stage and the outcome of the other two was unknown. It is recommended that more intensive mustelid monitoring is implemented alongside the standard three-night tracking tunnel indices. In 2017/18 21-night monitoring will be carried out, following the methodology being implemented by other projects.

Another indication that the kākā population has not increased as expected is the low numbers of kākā that were caught in mist netting undertaken in October 2015 with only nine caught in two weeks. In addition, most birds were male (7:2) suggesting there is a sex ratio bias. As kākā nest in tree cavities, populations can become male biased when adequate protection from predators is not provided and adult females are predated. Whilst males are more likely to respond to calls used in catching and as such it might not be the most reliable indicator of sex ratio in the population, mist netting undertaken in Waitutu Forest has shown an improvement in sex ratio of 6

male to 1 female in 2005-07 to 1.7 males to 1 female in 2016 (DOC, Media Releases, 2018). Although the RNRP sample sizes is small, the low number of kākā caught indicates that the population has not recovered as expected and may be male biased.

Given the importance of kākā within the RNRP, more intensive monitoring would be beneficial to ensure the population is recovering and that in breeding years predator control is providing adequate protection to nesting kākā.

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 Rotoiti/Raglan Range area over recent years (J. Kemp pers. comm.). This monitoring shows that possum and stoat predation on kea nestlings and incubating adults is likely to be the primary cause of kea decline in the area. There is also new DNA evidence that feral cats have predated on female adult kea in the Hawdon Valley (Dr L. Young, pers. comm.) and nest camera footage has also shown cats visiting kea nests in Rotoiti (KCT). Furthermore, there is 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 the declining kea population in the Nelson Lakes area and that one of the principal agents of decline is likely to be nest predation, 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.

Methods

In 2016/17 nine kea nests were protected, one of which was within the RNRP management area (Figure 10). There is a lot of variation in the kea nest trap networks as they were set up in different years and have expanded slowly over time, in addition the difficult terrain makes tidy grid patterns unfeasible. In 2016/17, the trap networks were as follows:

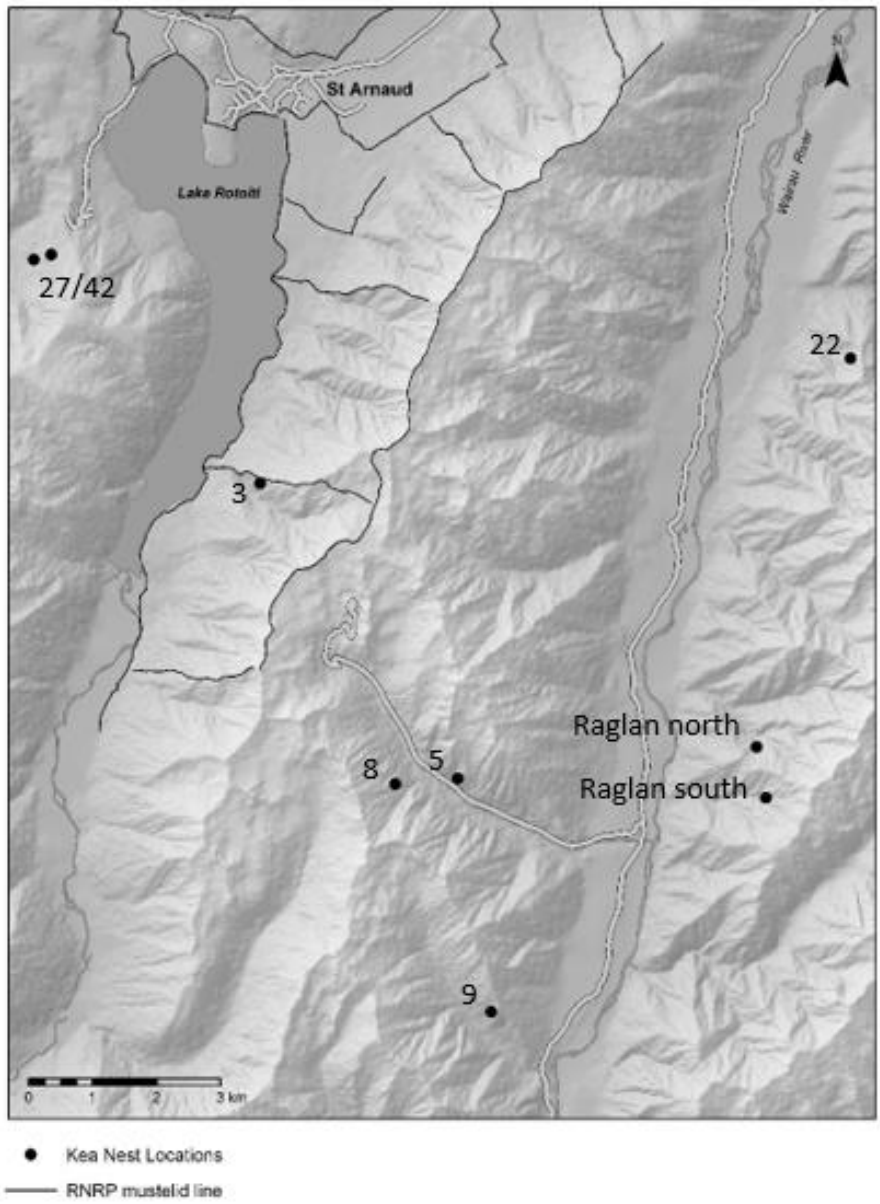


Figure 10: Locations of kea nests in Nelson Lakes National Park receiving protection in 2016/17

Nest 5:14 Sentinel possum traps covering approximately 300×300m (9ha) around the nest as well as one A12, nine 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: 13 Sentinel possum traps covering approximately 150×300m (4.5ha) around the nest, five DOC200 and five A24 stoat traps. 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 the nest is located. Five sentinel possum traps, five DOC200 stoat traps beneath the nest along the 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, two DOC200 stoat traps and three A24s in a 700×200m grid around the three nest sites (14ha), and 24 DOC200 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.

Nest 22: Protection to this nest located on the northern part of the Raglan Range is carried out by the Kea Conservation Trust.

Nest 3: Within the RNRP management area on the MOR Ridge. No additional protection was provided.

Beginning late May, all kea nest protection trap networks were opened, baited and serviced monthly to provide protection to nesting kea from the start of the breeding season. 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 non-active nests were closed. Trail camera monitoring was used to determine nest fate and provide identification in cases of predation.

Results

In 2016/17 there were nesting attempts at two sites in the Raglan ranges and one site on the St Arnaud Range. Monitoring indicated that two other pairs mated but failed to nest. The remaining cavities that were monitored were not used this year. Below are the results for each of the monitored nest cavities:

Nest 5: Pair mated but did not attempt to nest. Early interference by a stoat was observed at the nest.

Nest 9: Female successfully nested and fledged two chicks.

Raglan 1: Female successfully nested and fledged two chicks.

Nest 22: Female attempted to nest, but trail camera footage identified a stoat entering the nest and predating eggs. The female tried to nest several times but was unsuccessful.

Nest 3 (MOR ridge): Pair mated but did not attempt to nest. Early interference by a stoat was observed at the nest.

Nest 27 & 42: No activity was recorded at the nest sites this year.

The number of stoats caught this year was lower than the previous two years, although still high at Nest 9 and nests in the Raglan Range (Table 9). A high number of possums were caught in traps around some nests (Table 9). Trap check frequency was monthly where possible, but some months were missed due to snow conditions and the Kaikoura earthquake damaging the Dip Flat cableway.

Table 9: Trap catches from kea nest protection trap arrays from nests in the Nelson Lakes area, 2016/17.

Kea Nest	Stoat	Possum	Rat	Mouse	Hedgehog
8	1	5	0	0	0
5	1	5	0	4	0
9	7	27	0	0	2
Raglan	12	18	5	2	2
27	3	9	10	0	2
42	1	16	1	0	0

Discussion

In 2016/17, three pairs of kea had nesting attempts with two successfully fledging chicks and the third failing due to stoat predation of eggs. Two other pairs mated however do not appear to have had nesting attempts due to stoat interference at nest sites, with stoats recorded present at cavities on trail cameras prior to the nesting period. Since nest protection started in 2011, 17 nesting attempts have been recorded with only five successful (29 percent). While this result may seem low, in comparison a 2009 to 2014 study in Kahurangi showed only two percent of nests were successful when predators were not controlled at all (DOC, 2016). Two of three nesting attempts were successful last year which may be a result of improvements to the trap networks over the years. While these changes were made in 2014 the mast year of 2014/15 and the high number of stoats caught in that year indicate that trapping can provide adequate protection to kea nests in non-mast years, but is not enough during a beech mast year and the year following the mast.

Two additional pairs did not nest due to stoat interference at nest sites prior to nesting. One of these nests was inside the RNRP area and it was the first time since trail camera monitoring began that a stoat was recorded at this cavity. The trap networks are opened in late May well before nesting attempts begin to try to reduce this interference, but are shut down when fledglings are likely to be present to reduce the risk to these birds. Given the risk to juvenile kea from traps this regime will

continue. While the scale of the trapping networks is not always sufficient to provide protection to nests and prevent stoat interference at nest sites, it does provide some level of protection to nesting kea. Given the decline that has occurred in the Nelson Lakes kea population, recruiting new birds into the population is of high importance and this work will be a priority in 2017/18. Additionally, recent findings suggest that cats will predate adult kea and harass nest sites. This is especially true in high rat years when cats incur higher into montane beech forest. Cat control around the fringes of kea habitat would be worth investigating for future seasons.

2.1.12 Mistletoe monitoring

Introduction

New Zealand native mistletoes are particularly susceptible to browse by introduced herbivores. Therefore, mistletoe are used as an outcome monitoring tool to assess the effectiveness of possum control in the Core Area of the RNRP, with monitoring carried out every four years.

Methods

In January 2017, the health of tagged mistletoe from three species (*Alepis flavida, Peraxilla colensoi and P. tetrapetala*) was assessed along the existing mistletoe survey lines in the Core Area (Figure 11). Since the last survey in 2013, the Foliar Browse Index method has been updated to represent Departmental best practice, and the new method was followed this season. The data from this season was converted to the old format in order to directly compare with the previous survey, however future surveys will be able to use the data without conversion.

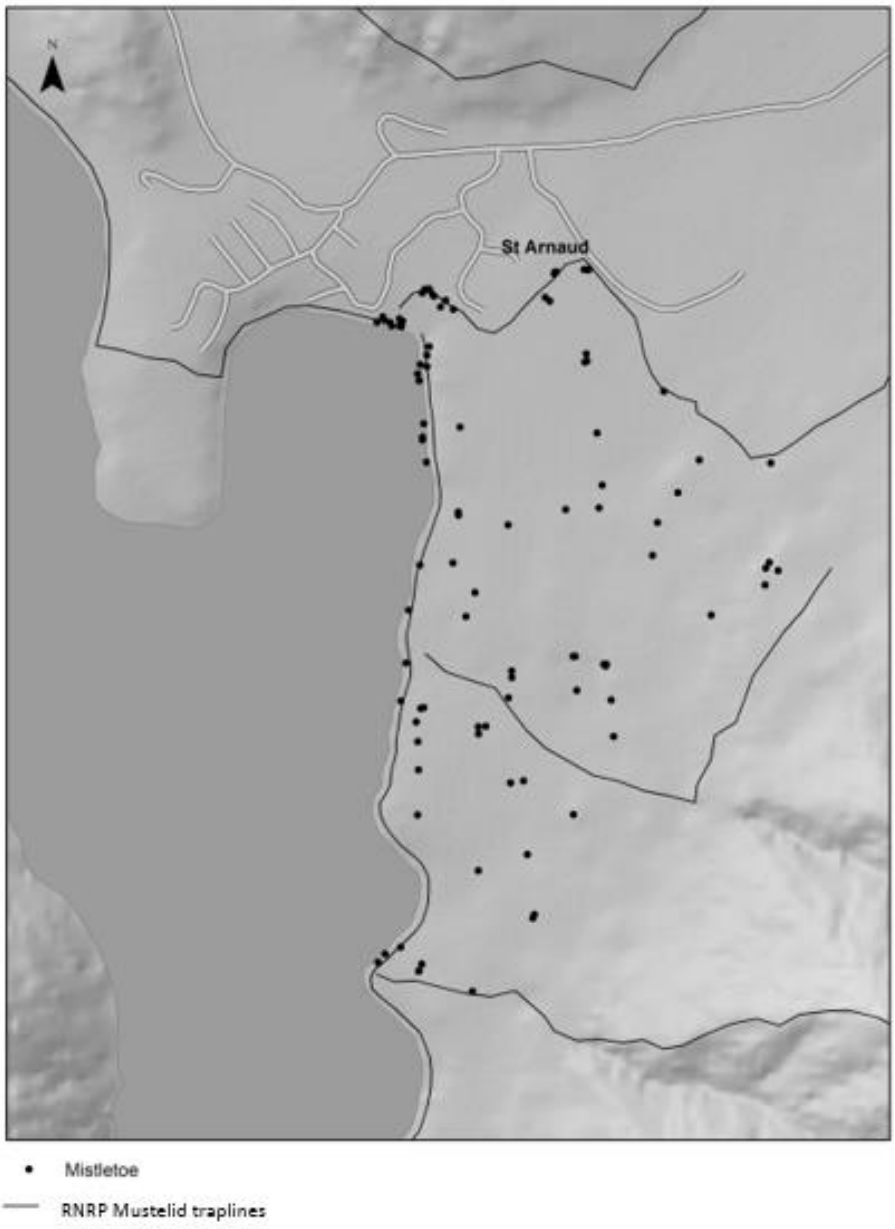


Figure 11: Map showing locations of surveyed mistletoe in the core area of the Rotoiti Nature Recovery Project.

Results

A total of 101 mistletoe were surveyed for foliar browse in 2017 (30 *A. flavida,* 40 *P. colensoi* and 31 *P. tetrapetala*). Overall health of the population was good with no possum browse recorded (Table 10) and only low levels of insect browse. There was an increase in mean foliage cover for the two *Peraxilla* species and little change in *A. flavida* (Figure 12).

Table 10: Percentage of mistletoe plants with no possum browse observed in surveys undertaken in the Rotoiti Nature Recovery Project from 2008 to 2017.

Species	2008	2013	2017
Alepis flavida	90.0	93.8	100
Peraxilla colensoi	61.3	97.1	100
Peraxilla tetrapetala	60.0	93.5	100

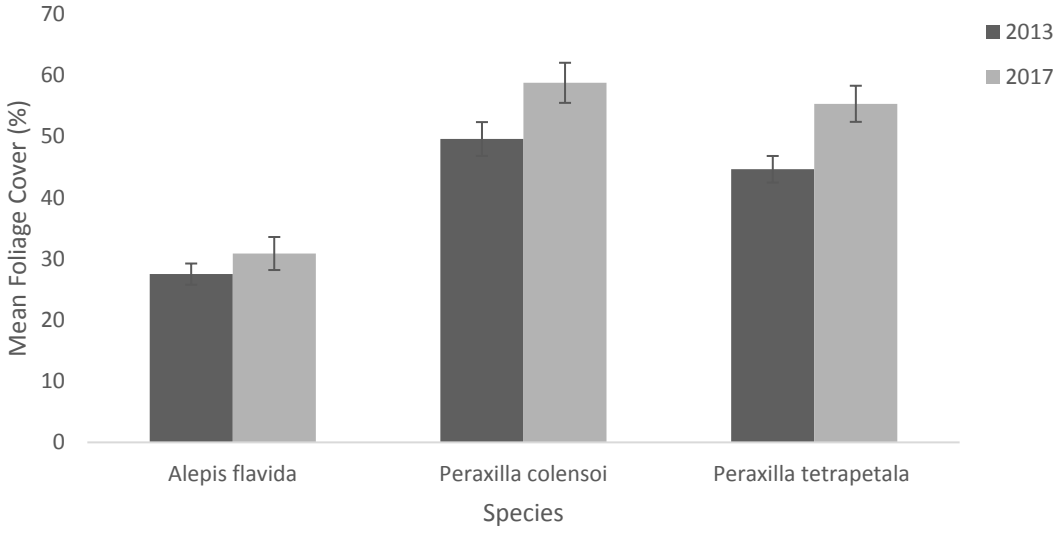


Figure 12: Mean foliage cover (% ±SEM) of mistletoe species within the Rotoiti Nature Recovery Project Core Area in 2013 and 2017 Foliar Browse Index surveys.

Thirty *A. flavida* were surveyed in 2017, twenty-four of which were measured in 2013, and six new plants. An increase in size was observed in 42% of plants, with only 8% of plants having decreased in size (Table 11). However, 29% had decreased in foliage cover and 50% had greater levels of dieback than in 2013 (Table 11).

Table 11: Changes in the health of 24 monitored *Alepis flavida* in the Core area of the Rotoiti Nature Recovery Project from 2013 to 2017.

	Decreased	Equal	Increased
Size	2	12	10
Foliar Cover	7	5	12
Dieback	3	9	12
Insect Browse	7	14	3

Forty *P. colensoi* were surveyed in 2017, thirty-five of which were measured in 2013, and five new plants. While 74% had increased in foliar coverage, 31% of plants had decreased in size, and 40% had increasing levels of dieback (Table 12).

Table 12: Changes in the health of 35 monitored *Peraxilla colensoi* in the Core area of the Rotoiti Nature Recovery Project from 2013 to 2017.

	Decreased	Equal	Increased
Size	11	14	10
Foliar Cover	4	5	26
Dieback	1	20	14
Insect Browse	7	19	9

Thirty-one *P. tetrapetala* were surveyed in 2017, twenty-seven of which were measured in 2013, and four new plants. Of these 70% had increased in foliar cover and 85% had either increased in size or stayed the same (Table 13). Dieback had increased in 48% of plants.

Table 13: Changes in the health of 27 monitored Peraxilla tetrapetala in the Core area of the Rotoiti Nature Recovery Project from 2013 to 2017.

	Decreased	Equal	Increased
Size	4	18	5
Foliar Cover	4	4	19
Dieback	2	12	13
Insect Browse	12	15	0

Discussion

Mistletoe within the Core Area were generally healthy, with no possum browse observed. This result shows that the current possum control regime is successfully keeping possums at low enough levels to allow recovery of these three mistletoe species.

Sample sizes for all three species were increased this year. The RNRP Vegetation Review (2007) recommends more than thirty plants of each species to be monitored, and only *A. flavida* is now below this sample size (n=24). Plants from all species will continue to be added to the monitored sample to allow for natural losses from the population and to ensure that an adequate sample size is maintained.

Monitoring is next due in the 2020/21 year to reassess the health of mistletoe in the RNRP core and to continue to monitor the effectiveness of the possum control programme. Carrying out monitoring work in January meant that not all mistletoe were able to be measured due to wasp activity. In future, in the interest of staff health and safety, monitoring should be done outside of the wasp season.

2.1.13 *Pittosporum patulum* monitoring

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

2.1.14 *Powelliphanta sp.* Monitoring

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

2.1.15 Invasive Plants

Invasive plants are a minor issue within the Rotoiti Nature Recovery Project (RNRP). Maintaining vigilance is the key to ensuring this remains the case in the long term.

A large Douglas Fir (*Pseudotsuga menziesii*) was found by a hunter on the large scree near the MOR trap line. This was cut down by and no cones were observed on the tree.

A Grey Willow (*Salix cinerea*) was found on the Lakehead Scree and removed.

Rowan (*Sorbus aucuparia*), Cotoneaster (*Cotoneaster franchetii*), and wilding conifers (*Pseudotsuga* and *Pinus spp.*), have been controlled on the periphery of the RNRP to prevent further spread.

Broom (*Cytisus scoparius*) and Gorse (*Ilex europaeus*) are controlled through our local council's RPMP (Regional Pest Management Plan).

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

Introduction

Great Spotted Kiwi (GSK) are the largest kiwi species found in New Zealand and 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 RNRP via two translocations in 2004 and 2006.

The reintroduced birds settled and established territories and have since produced at least nine chicks. However, breeding activity was not as high as expected and Operation Nest Egg (ONE) was initiated in 2009 to supplement the population with chicks sourced as eggs from the Gouland Downs and Stockton mine. From 2009 to 2011 ten eggs were uplifted from radio-tagged adults at the Gouland Downs and seven chicks hatched from these eggs were introduced to the RNRP between 2010 and 2012. Four of these chicks died soon after release. From 2012 the RNRP received additional ONE chicks from the Stockton mine area under an agreement relating to the expansion of mining operations at Cypress mine. Six chicks and one sub-adult were received between January 2012 and January 2016, with two of these chicks dieing soon after release. The ONE programme finished in January 2016 due to the poor success rate of chicks in comparison to adult releases, with all adult kiwi released into the RNRP surviving compared to only seven of the 13 ONE chicks.

Through both translocations of adult GSK and chicks through the ONE programme, 24 founder GSK have established in the RNRP, with three subsequent adult mortalities known to have occurred. The Kiwi Recovery Group requires translocated kiwi populations to have 40 unrelated founder birds to establish a genetically robust

population. Therefore, future GSK management in the RNRP will focus on translocating more adult GSK into the population. In 2016 the Friends of Rotoiti received funding for this work to be carried out and twenty GSK will be translocated into the RNRP in 2018 and 2019.

Methods

Monitoring of radio-transmittered 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 2016/17, three adults and four sub-adult kiwi were monitored.

Results

No breeding attempts were detected in the 2016/17 year.

During the year the number of transmittered kiwi reduced from three adults and four sub-adults to two adults and one sub-adult. Motupipi, an adult males' transmitter failed during the year. Three transmitters were dropped by sub-adult kiwi shortly before their annual scheduled change in April/June 2017. At the time of writing none of these birds have been re-caught for transmitter attachment.

Discussion

Historically within the RNRP there has been poor productivity and a low number of breeding attempts each year, so it is not unexpected given the small number of monitored pairs that no breeding attempts were recorded this year.

Every year the number of transmittered GSK fluctuates due to transmitters failing or dropping off. The electrical tape used to create the harness is of high quality, however is still expected to disintegrate within two years to prevent birds carrying failed transmitters that are unable to be removed for long periods of time. The harnesses should be able to last the 12 months in between checks. However, the high number of harness failures within the past two years means that the harnesses will be checked more frequently on the newly translocated birds with six monthly harness checks carried out.

While the sample size of monitored pairs could be increased by catching kiwi within the RNRP and attaching new transmitters, the cost of carrying out this work and ongoing costs of transmitters and maintaining harnesses on the birds is high. Future monitoring will focus on using acoustic recorders annually to monitor call rates as a means to determine the long-term population trend.

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

3.1.1 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. 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 native 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 and a subsequent increase in the stoat population (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 out 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. While this was successful in reducing rat numbers the method was abandoned due to concerns regarding 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 this 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 rat population. No rat control was undertaken in 2007-09 due to budgetary constraints and concerns about possible non-target effects. From 2010 to 2013 operations have used either diphacinone or pindone with pulsed control in spring with mixed results. In December 2014, aerial 1080 was used within the RNRP as part of a nationwide Battle For Our Birds operation triggered by wide-scale beech masting, to prevent the irruption of rat populations and control rats at the landscape scale (Fairweather, 2015).

Rat control operation decision making is carried out using a combination of rat tracking indices, beech and tussock seedfall data and a planning flow chart (Figure 13). Seedfall monitoring carried out at the start of 2016 showed there were only small amounts of mountain and red beech seed on the ground in the RNRP (refer to section 3.3.3 Beech seed monitoring). A high amount of tussock flowering was recorded at Mt Misery which likely produced large quantities of seed in the alpine (see section 3.3.4 Tussock seed monitoring). Tracking rates from May 2015 were 32% for rats within the Rodent Control area of the RNRP and 10% for the Mustelid Control Only areas. Based on this information a decision was made to carry out a ground-based rat control operation in the core area of the RNRP using two deployments of bait in spring (Figure 13).

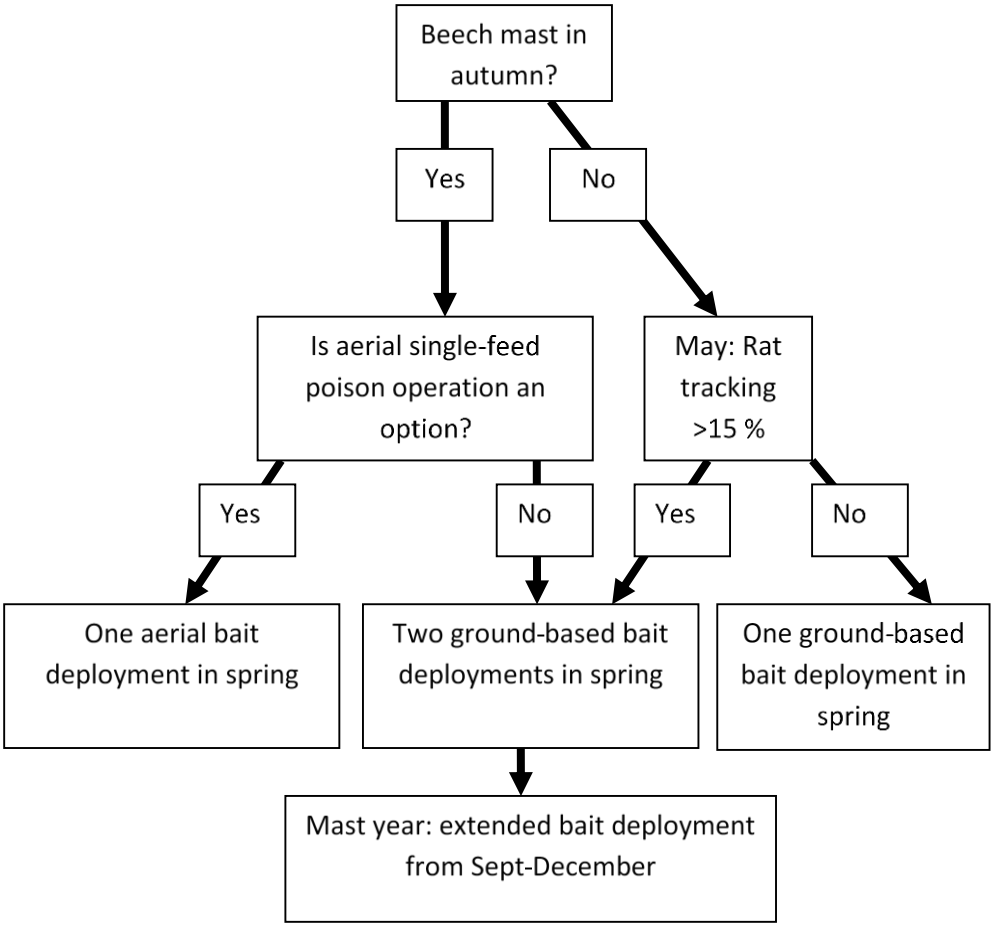


Figure 13: Flow chart for planning preliminary rodent control in the Rotoiti Nature Recovery Project

3.1.2 Rodent control operation

Method

A ground-based rat control operation using diphacinone was carried out in spring 2016. The bait formulation used was Connovation D-Block 0.05g/kg and a field trial was carried out to determine whether this formulation of bait would reduce rat tracking index to ≤5%. For the purposes of this trial and buffering future 1080 operations, the lower core area that had been excluded from aerial sowing in the 2014 Battle For Our Birds operation was turned into a 100x50m bait station grid, by placing ACP Pestoff tunnel stations between existing Philproof stations. This would also serve as a trial to determine if there was a measurable bait station preference between run-through style ACP Pestoff stations and tree mounted Philproof stations (Figure 14). Bait take data was collected during station checks and when remaining bait was

removed at the end of the operation, for comparison between station types and operational review.

Figure 14: The two different bait station types; ACP Pestoff (left) and Philproof (right) used in the Rotoiti Nature Recovery Project 2016 rodent control operation.

The initial fill of stations was to be five blocks (140g) per station. The stations were to be lured with Connovation spray on chocolate lure each fill. Bait take was then to be assessed weekly and a second fill to take place when stations were half empty so that a constant supply of bait could be maintained. Bait take analysis was done in Excel and then mapped spatially in Arc Map.

Results

The initial bait station fill took place in September 2016. The chocolate lure did not arrive in time for the operation so Ferafeed paste was used as a lure instead. Bait take checks did not occur until between 10 and 14 days after the initial fill, and some stations had 100% bait take recorded. A partial station re-fill took place on lines below 800m in the core. The higher altitude lines were not refilled as bait take was not high enough. Bait was removed from stations at the end of the operation in early December 2016.

Bait take in the operational area was 27% overall, with 42.7% of bait removed from ACP Pestoff stations in the 100x50m area compared to 22.3% from Philproof stations. Bait take was patchily distributed throughout the operational area with some areas having very high uptake and others very low (Figure 15). In the first check after the

initial fill, 770 bait stations in the lower core were checked for bait take and refilled. This check found that 80.1% of checked stations had had no bait taken or not enough taken to warrant adding another bait block to the stations (Table 14). Only 4% of checked stations had high bait take, with enough bait removed to warrant replacement of all 5 bait blocks, with another 3.6% having moderate bait take with 3 or 4 blocks being replaced (Table 14).

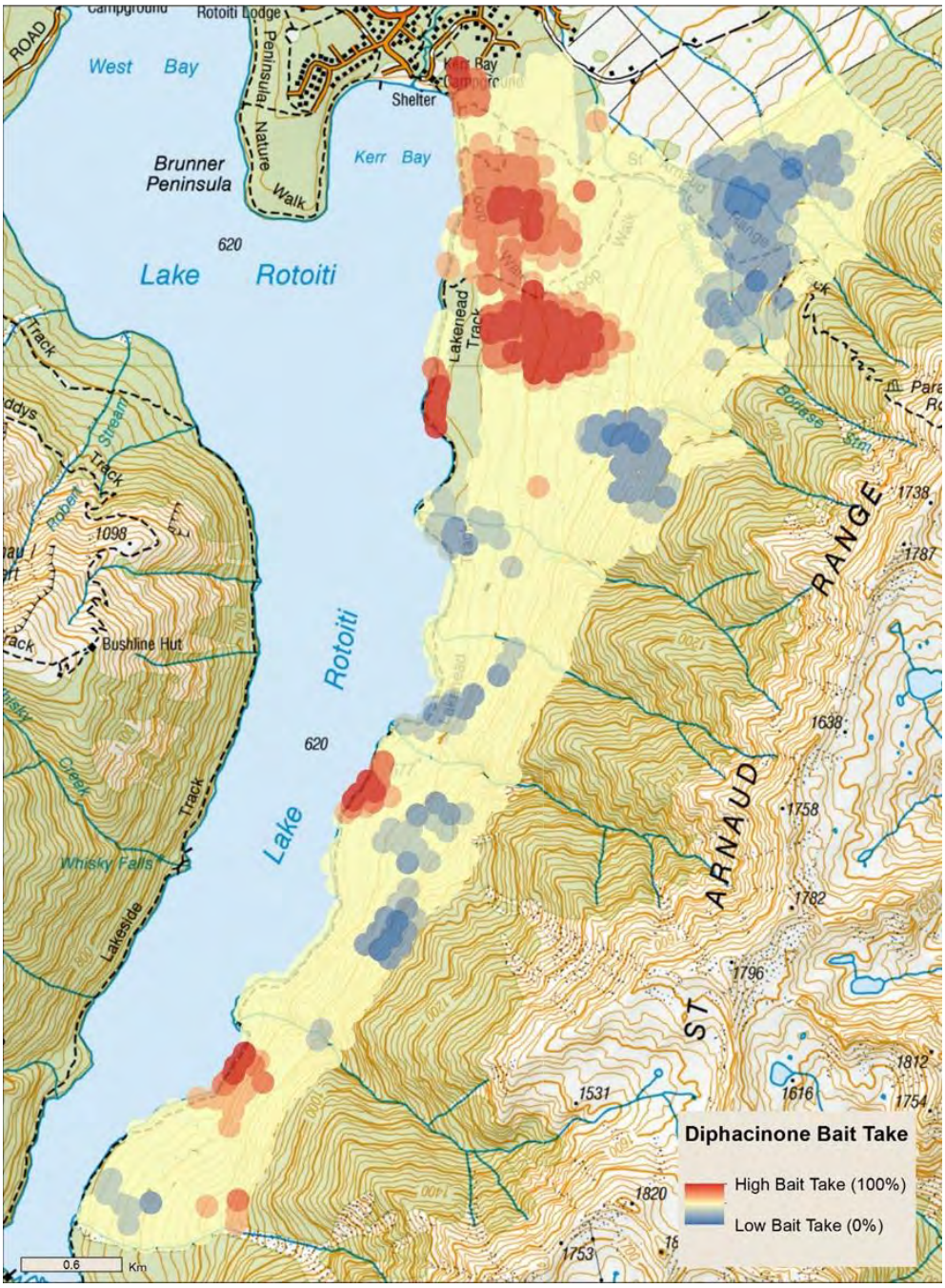


Figure 15: Heat map showing bait take from ACP Pestoff and Philproof baitstations filled with Diphacinone poison in D-blocks in the 2016 rat control operation within the Rotoiti Nature Recovery Project.

Table 14: Bait take from 770 bait stations that were checked and refilled 10-14 days after the initial bait station fill of five bait blocks in the Rotoiti Nature Recovery Project 2016 rodent control operation.

Number of bait blocks removed	Number of stations	Percentage of stations
0	617	80.1
1	67	8.7
2	27	3.5
3	14	1.8
4	14	1.8
5	31	4.0

3.1.3 Rodent population monitoring

Method

Results monitoring to determine the effectiveness of the rodent control operation within the core area of the RNRP is carried out using one-night tracking tunnel indices. Standard 60cm coreflute tracking tunnels with Black Trakka™ inked cards are spaced 50m apart along lines with minimum 200m between lines (Figure 16). Monitoring is carried out in the Core area (rodent and mustelid control), Mustelid Control Only areas of the RNRP, and the Rotoroa site (no control) in August, November, February and May. Peanut butter is used as a lure placed on both ends of the base of the tunnel and left out for one fine night (Gillies, 2013).

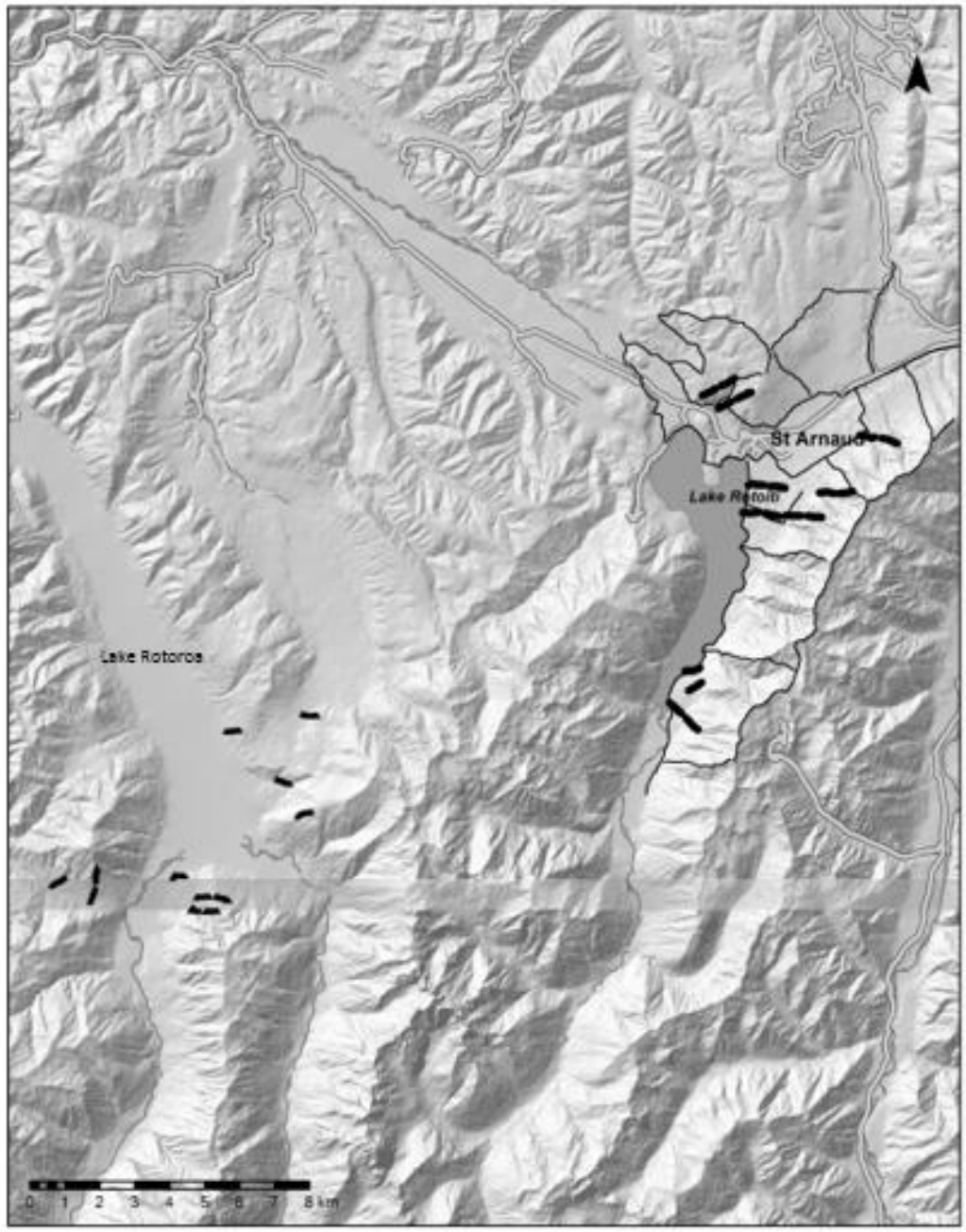


Figure 16: Map showing location of rodent tracking tunnel lines in the Rotoiti Nature Recovery Project at Lake Rotoiti and the non-treatment site at Lake Rotoroa.

Results

In August 2016 prior to the rat control operation, rat tracking was highest in the Rodent and Mustelid Control area (Core) with 40% (±7%) tracking, while the Mustelid Control Only areas were 19% (±7%) (Figure 17). The rat control operation was carried out from September through to December 2016, with November tracking rates showing little change in tracking in both areas. After the control operation, monitoring in February showed the Core tracking decreased to 29% (±8%), similar to the Mustelid Control Only areas which showed 30% (±10%) tracking. In May tracking within the Core had stayed at the same level, while within the Mustelid Control Only areas they had decreased. Tracking in the No Control site remained below 5% all year.

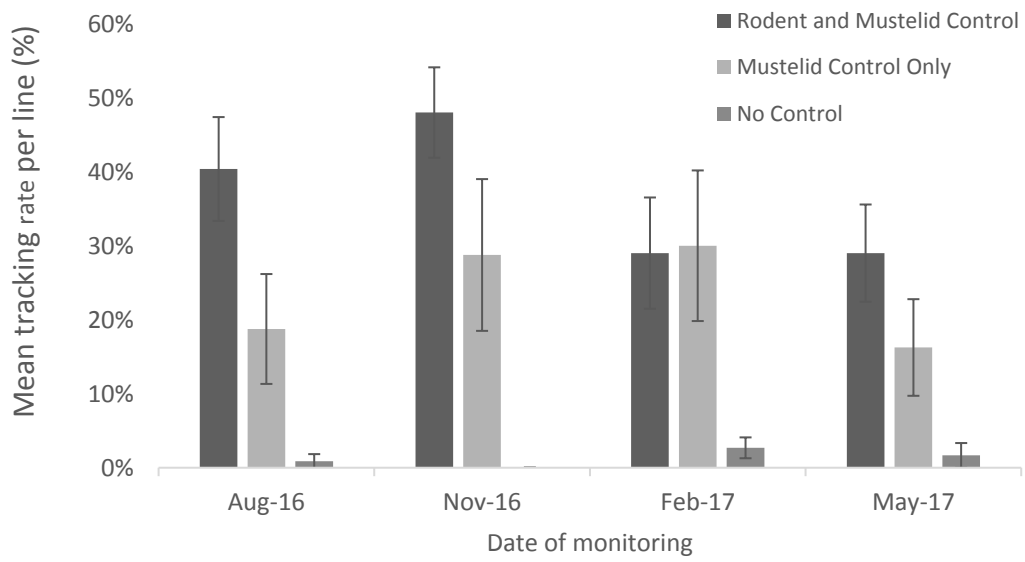


Figure 17: Rat tracking rates in different control areas within the Rotoiti Nature Recovery Project 2016/17.

Mouse tracking was lowest in the Core areas throughout the year (Figure 18). Mouse tracking rates increased from August to November in both the Mustelid Control Only areas and No Control site (Figure 18). Mouse tracking continued to increase over February and May in the No Control site, but stayed at a similar level in the Mustelid Control Only areas.

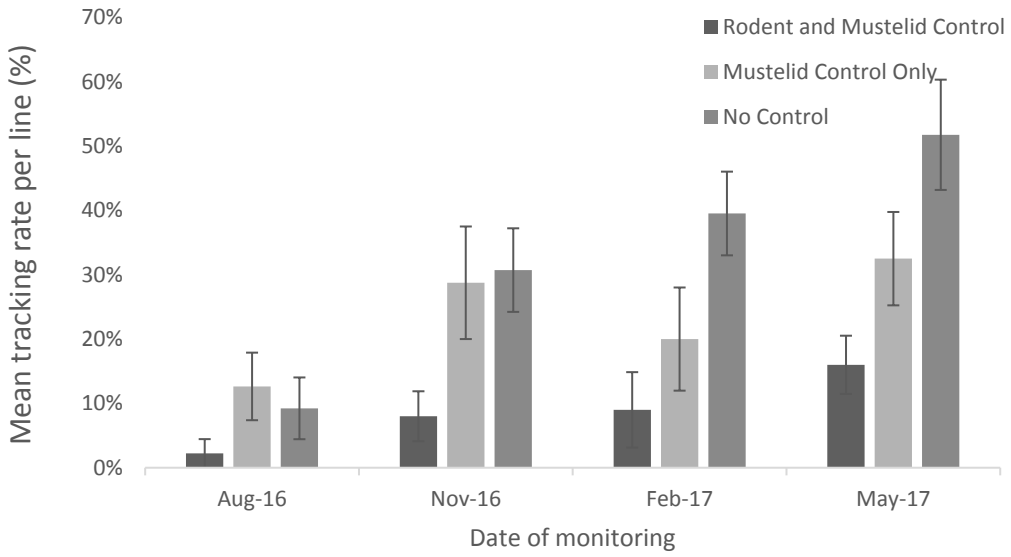


Figure 18: Mouse tracking rates in different control areas within the Rotoiti Nature Recovery Project 2016/17.

3.1.4 South Island robin monitoring

The South Island robin (*Petroica australisis*) 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 in the RNRP 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 robin monitoring ended in 2015, however the outcome target for this rodent control operation was to increase the robin density to seven pairs within the 162ha robin monitoring site in the RNRP Core Area by spring 2017. This monitoring will take place in September 2017 by carrying out a census of the robin population within the core area.

3.1.5 Discussion

Results monitoring carried out in February 2017 shows the 2016 rodent control operation was not successful, as although rat tracking decreased from 40% to 29%, it did not meet the target of reducing tracking to below 5%. Bait take during the operation was low, with only 27% of bait removed from stations and 47.3% of stations having no bait removed. A possible reason for the low bait take could be the availability of other food sources. There was a patchy amount of beech seed on the

forest floor which may have provided an easy alternative food source. D-blocks are a bait block wired to the station which means an animal cannot remove the bait and must remain within the station to feed. Given the presence of other available food sources this could be a factor in the low take of bait and a trial of take away baits compared to blocks could be useful.

Lower bait take was recorded for the Philproof stations compared to the Pestoff stations with 54.9% of Philproof stations having no bait taken compared to 30.4% for Pestoff. The Philproof bait stations were retrofitted with internal baffles in 2009 to prevent weka and kea from accessing bait. However, despite successful rat operations in the RNRP since the baffles were fitted several have failed and it is possible that these baffles are affecting rats gaining access into bait stations. The Pestoff stations also contain internal baffles, however these are more of a run-through design and less likely to be limiting rat access. If future ground-based rat operations are to occur, then the effect of baffles on rat access into Philproofs should be investigated further.

After a review, it was deemed that operational factors may have impacted on the success of the operation. Diphacinone is a first-generation anticoagulant that relies on sustained intake over a period to cause mortality. Best practice dictates that baiting must be continuous over at least five days to ensure rats ingest sufficient toxin to kill them. An issue with this operation is due to operational constraints a continual supply of bait was not able to be maintained at all stations, with the bait take analysis showing hotspots of high take occurring in some areas (Figure 15). Firstly, not enough bait may have been put out in the first bait station fill. In past diphacinone operations, stations were initially filled with 300g, while for this operation only 150g was put out. It was assumed, based on the bait take levels from previous operations where rat indices were much higher, that 150g per station would be enough.

Additionally, timing of the station refills was too slow to prevent the emptying of some stations in areas of high rat density. Checks of bait stations that were scheduled to occur one week after the initial fill did not occur until 10 to 14 days after. This is due to not enough staff being available to deploy the first round of bait and this part of the operation taking longer than expected with seven working days required. By the time the last of the first fills were completed the refills of the southern blocks should have been occurring to prevent 100% bait take. How much of an impact this had on the operation is unclear as a check of stations during the operation found 4% empty and 3.6% had moderate take, while at the end of the operation 10% of all stations were completely empty.

Given the two factors discussed above, best practice for diphacinone bait was not meet for all stations and this may have had an impact on the success of the operation and field trial. As a result, we are not able to answer the original field trial question of how effective diphacinone in D-blocks is at controlling rodent populations. A larger initial bait fill and a more persistent baiting strategy in hotspots may have been needed for this operation to have met best practice standard and given a fair trial of the effectiveness of D-blocks. However, the high number of stations with no bait take recorded shows that getting rats to enter bait stations and take bait when there are other available food sources is still a big issue.

The RNRP has had mixed success with ground-based rodent control and has yet to successfully establish a methodology that can consistently control rats to below five percent tracking. Low uptake of bait is a continual issue and could be a result of other more easily available food sources or baffles affecting rat access into bait stations. In 2016/17 low levels of both beech and tussock seed were recorded in the RNRP, and although rodent tracking indices remain at moderate levels within the project, due to the failure of previous ground-based bait station operations and limited resources no ground-based operation is planned for the 2017/18 season. A robin census as outcome monitoring for the rodent operation will be undertaken within the RNRP in September 2017 to determine the effect of the rodent control operation on the robin population. If ground-based operations are to occur in the future they should ensure adequate staffing is available to carry out the operation before the operation commences, investigate the effect of baffles in bait stations and trial bait in block formation compared to pellet.

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 and tourists at risk of anaphylactic shock after being stung, and negatively influencing the experience of 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 throughout 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. Findings from both of these are now established as best practise for wasp control operations using Vespex.

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 supported 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. For further details on wasp monitoring and the decision-making process, refer to the RNRP Field Manual (DOC-431791).

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 19). Bait stations were on a 300×50m grid following contours, with a mixture of KK bait stations and yellow Wasptek bait stations which are designed specifically to dispense wasp bait. Approximately 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.

Control Operation

On 10 January 2017 (prior to the operation), an average of 1.45 wasps/bait (SE±0.3) were observed on non-toxic baits on two monitoring lines within the core area. Monitoring was repeated at a larger scale on 16 January, but the number of wasps visiting non-toxic baits had reduced (Table 15). Monitoring was repeated twice in February, but wasp counts did not exceed the threshold of an average of one wasp/bait (Table 15). The decision to move to the toxic bait operation was based on the 9th of February result, as although the overall average for the site was below one wasp/bait, wasp numbers were found to be very patchy with high numbers in some areas and very low in others and one monitoring line had returned an average of 1.5 wasps/bait (SE±0.43). The control operation was carried out in the next available weather window with bait deployed on the 22nd and 23rd of February and stations emptied on the 27th and 28th February.

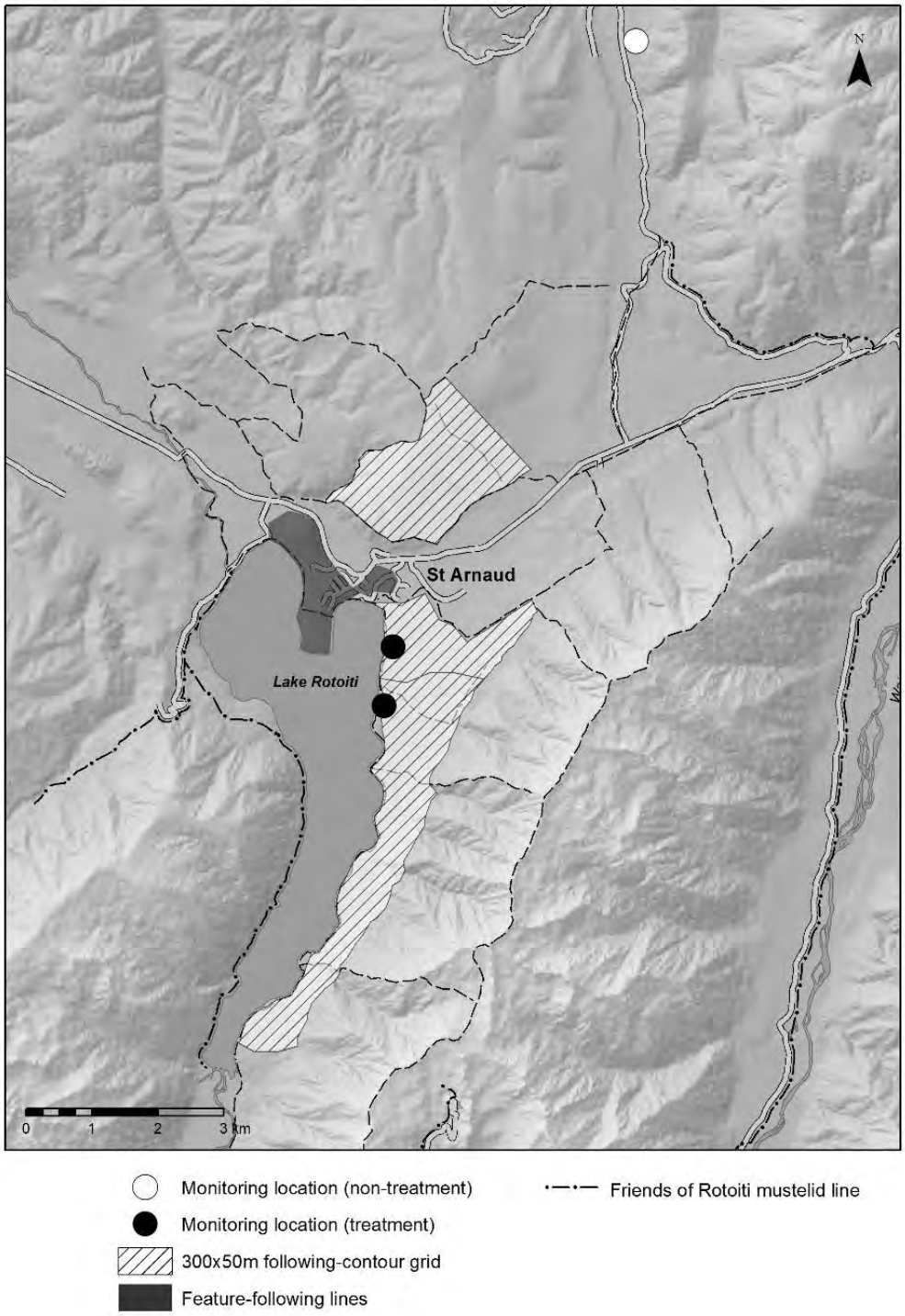


Figure 19: Map showing location of wasp control in the Rotoiti Nature Recovery Project in 2016/17

Table 15: Average number of wasps (±SE) on non-toxic baits in the Rotoiti Nature Recovery Project prior to the 2016/17 wasp control operation.

Site	16/1/17	3/2/17	9/2/17
L block line 1	0	0.3 ±0.15	1.5 ±0.43
L block line 2	0.3 ±0.15	0.3 ±0.15	0.4 ±0.22
BDY block	0.1± 0.1	0	NA
Big Bush	0.2±0.2	0.8 ±0.25	0.3 ±0.15
HBC trapline	0	0	NA
PNW trapline	0	0.1 ±0.1	0.2 ±0.13
All sites	0.1 ±0.05	0.3 ± 0.07	0.6 ±0.15

Results and outcome monitoring were carried out before and after the control operation within the treatment area of the RNRP and at Beebys Knob carpark, a non-treatment site (Figure 19) to determine the effectiveness of the operation.

Results monitoring

To determine the effectiveness of the operation at reducing wasp numbers within the treatment area, monitoring of wasp nest flight counts was carried out using the Wasp Abundance Monitoring Protocol (DOC-691729). Prior to the control operation, ten nests were located in each of the treatment and non-treatment areas. The number of wasps entering and exiting each nest was recorded over one minute and repeated three times. This was repeated a week after the control operation and then one month after the operation.

Outcome Monitoring

To determine whether the control operation had reduced the wasp density to a low enough level to provide benefits to biodiversity, outcome monitoring was carried out by measuring quantities of available honeydew using the Honeydew Monitoring Protocol (DOC-1536769). Quantities of available honeydew were measured within permanently-marked 5×50cm plots on 24 beech trees in each of the treatment and non-treatment areas. The number of honeydew droplets within each plot was counted and this was measured twice prior to the operation then repeated a week following the operation and one month after the operation.

Results

Control Operation

In total, 37kg of toxic bait was deployed this year and approximately 23.3kg (63%) of this was removed by wasps. The highest bait take was recorded along the Whiskey line (75%), followed by the St Arnaud village (69%) and the Core Area (66%). The lowest bait take was in Big Bush (54%). Bait take along stoat trap lines was 60%.

Results Monitoring

Within the treatment area, average wasp flight counts at monitored nests showed a reduction from 29.6 (SE±3.2) wasps/minute to 8.9 (SE±3.2) wasps/minute one month after the operation (Table 16). Over the same period flight counts decreased in the non-treatment area from an average of 49.3 (SE±5.0) wasps/minute to 17.9 (SE±2.4) wasps/minute one month after the operation (Table 16).

Table 16: Average number of wasps recorded entering and exiting nests within the wasp control treatment and nontreatment areas of the Rotoiti Nature Recovery Project before and after the 2017 wasp control operation.

Site	Pre-poison 1 (±SE)	Post-poison 1 (±SE)	Post-poison 2 (±SE)
Treatment	29.6 (±3.2)	19.5 (±4.6)	8.9 (±3.2)
Nontreatment	49.3 (±5.0)	43.8 (±4.8)	17.9 (±2.4)

Outcome Monitoring

The quantity of available honeydew increased within the treatment area after the control operation from 1.04 (SE±0.4) droplets/plot immediately prior to the operation, to 14.9 (SE±3.8) one month after the operation (Figure 20). The quantity of available honeydew in the non-treatment area decreased after the pre-poison 1 monitoring period and then stayed at low levels after the operation (Figure 20).

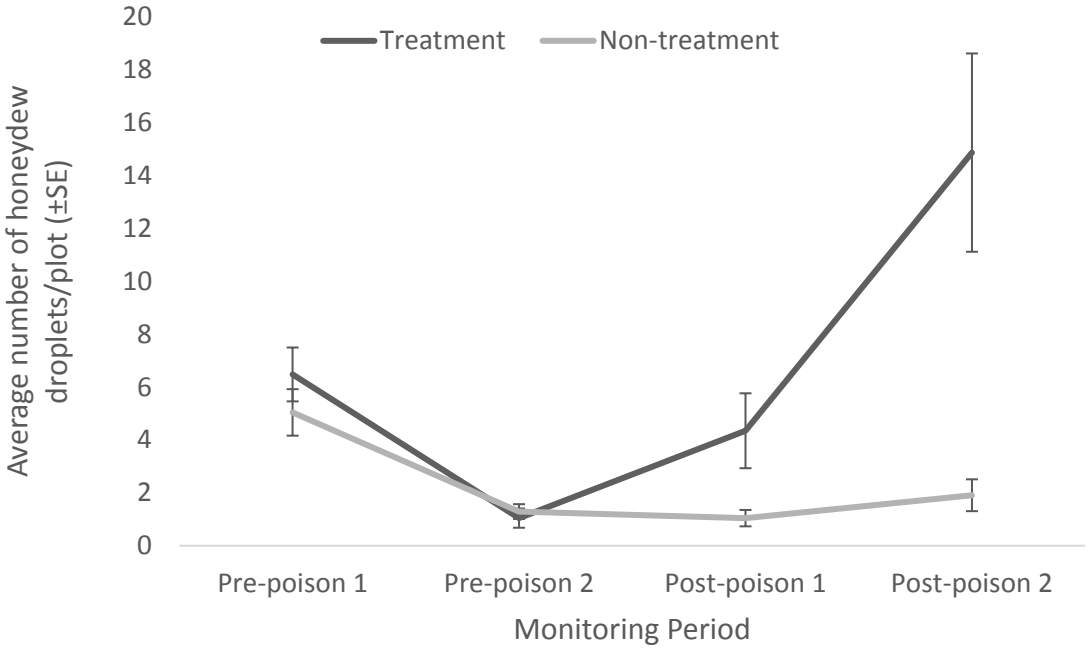


Figure 20: Average number of honeydew droplets per plot within the Rotoiti Nature Recovery Project wasp treatment area and non-treatment area, before and after the 2016/17 wasp control operation.

Discussion

The wasp control operation in 2017 was not as successful as that of previous years. While wasp activity reduced within the RNRP and around the St Arnaud village after the control operation, the results outcome of a 90% reduction in wasp activity in monitored nests was not achieved, with only a 70% reduction. The decrease in wasp numbers observed was enough to meet the outcome monitoring target of an increase in the amount of available honeydew, with an increase in the treatment area and no observed increase in the non-treatment area.

Wasp foraging indices on non-toxic baits were lower than in previous years. Foraging indices were carried out three times from the start of January, with none of these indices meeting the threshold level required for the operation to proceed. The decision to proceed to the toxic operation was made as wasp numbers both within the RNRP and the wider Nelson area appeared to be patchy (Richard Toft, pers. comm.) with high numbers in some areas and low in others. This was also seen in non-toxic bait take monitoring with monitoring in February showing only one of the four monitored lines was above the threshold.

Wasp numbers did not seem as high this year and it was late in the year before numbers started to build. As a result, the control operation was carried out later than that of previous years and did not commence until 22nd February 2017. This spring and summer were particularly wet and cold with several large storms in a period of typically settled weather. Therefore, it is likely many nests were drowned in the early stages hence nest development and wasp diet switch to protein were subsequently delayed. This may explain the low level of interest in protein observed in non-toxic bait foraging indices and the patchy distribution of wasp numbers. This year's operation highlights the importance of non-toxic foraging monitoring prior to the operation, and the need to interpret these results to determine whether the timing of an operation is correct.

This was the first year that wasp control along stoat trap lines was carried out to reduce wasp densities in these areas and protect trappers. However, due to the patchy distribution of wasps it is difficult to say whether the control was effective. This will be carried out again in the 2018 wasp operation with results and outcome monitoring targets set to determine if the spacing of bait stations every 100m is enough to protect trappers.

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

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. In November, February and May each site is surveyed three times. However, in November 2016 only two counts were carried out at each site due to poor weather. In May 2017 only two counts were carried out on the St Arnaud Range as the third staff member was not able to complete theirs due to injury. Count data is analysed periodically and has currently been undertaken for data from 1998 to 2015 by Canterbury University Masters student Kelly Whitau.

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 level 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. Science and Technical are now trialling carrying out this monitoring by removing branches from the canopy of beech trees from helicopters.

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

No shotgun sampling was undertaken on the Grunt Ridge this year due to staff time constraints. Helicopter sampling was carried out by Science and Technical staff around sites within Nelson Lakes National Park, and would be used as an indication of beech seeding level.

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 (Figure 21). Collection bags are fitted in February, replaced in mid-April, and finally removed in mid-June. Any seed collected is separated into species, counted, and then tested for viability.

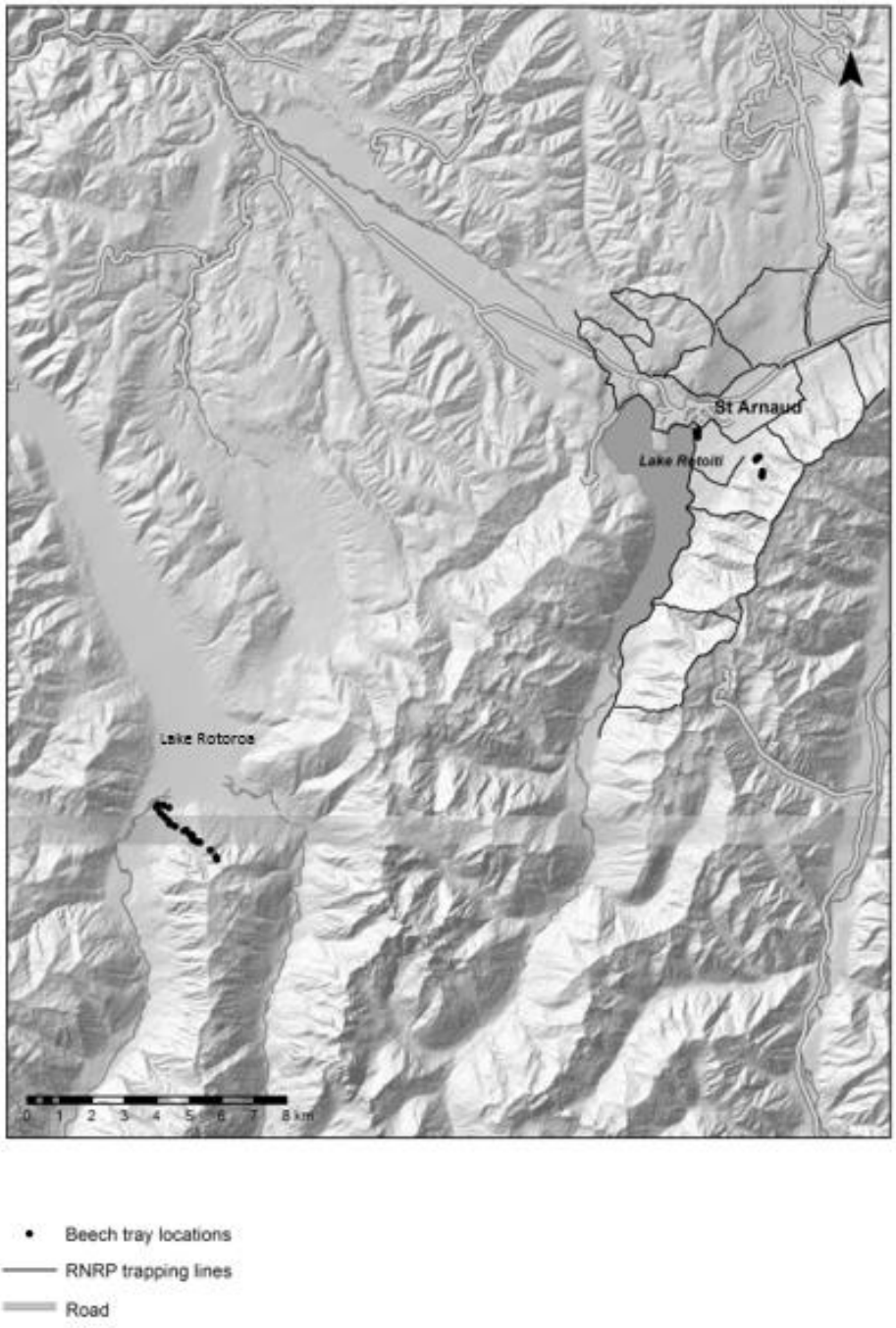


Figure 21: Map showing location of beech seedfall trays in the Rotoiti Nature Recovery Project at Lake Rotoiti and the non-treatment site at Lake Rotoroa.

Results

Beech counts from seedfall trays showed that a very small amount of seed was produced in 2016/17 with a total viable seed of 37/m² recorded in the RNRP and 22/m² at Mt Misery (Figure 22).

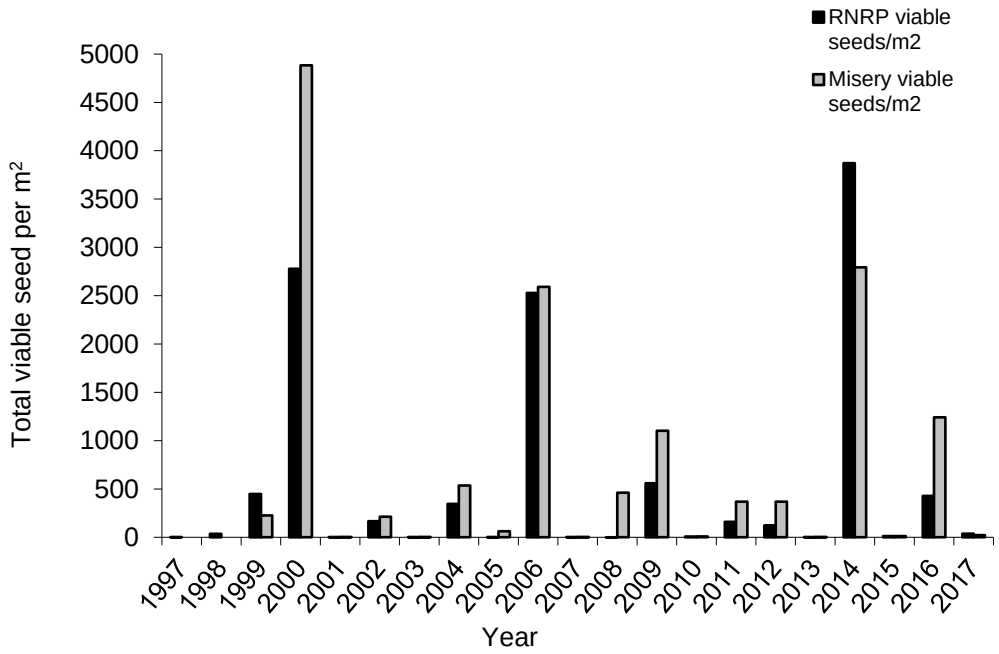


Figure 22: Total viable beech seeds per m^2 from the Rotoiti Nature Recovery Project (Lake Rotoiti) and Mt Misery (Lake Rotoroa), over the period 1997-2017.

All three beech species produced low levels of seed at both sites (Table 17). Viability was also low for all species at both sites with Mountain Beech (*Fuscospora cliffortioides*) recording 0% viability in the RNRP and only 1.7% at Mt Misery (Table 17). Silver Beech (*Lophozonia menziesii*) produced the highest quantity of seed and produced twice as much in the RNRP compared to Mt Misery, however viability was at similar low levels at both sites (Table 17)

Table 17: Beech seed counts at Lake Rotoiti and Lake Rotoroa in 2016/17.

Site	Count type	Red beech (*Fuscospora fusca*)	Mountain beech (*Fuscospora cliffortioides*)	Silver beech (*Lophozonia menziesii*)
Lake Rotoiti	Total count	269	90	1473
	Total viable seed	45	0	164
	% viable	16.7	0	11.1
Lake Rotoroa	Total count	285	60	752
	Total viable seed	42	1	79
	% viable	14.7	1.7	10.5

Discussion

The low level of beech seed and the low viability rate of seed recorded at both Lake Rotoiti and Lake Rotoroa in 2017 indicates that there will not be a readily available food source to cause an irruption of the rodent population.

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. Consequently, tussock also influence the populations of other pests who prey on mice such as weasels and stoats. Tussock monitoring has 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 (*Chionochloa pallens*) and carpet grass (*Chionochloa australis*) was measured on Mt Misery in February 2017 by counting the number of inflorescences on each tussock within a permanent 20m by 2m plot.

Results

Low levels of flowering were recorded for both species of tussock in 2017, with C. pallens having a mean of 0.35 (SE±0.1) inflorescences/tussock (Figure 23), while C. australis had a mean of 6 (SE±1.4) inflorescences/tussock (Figure 24).

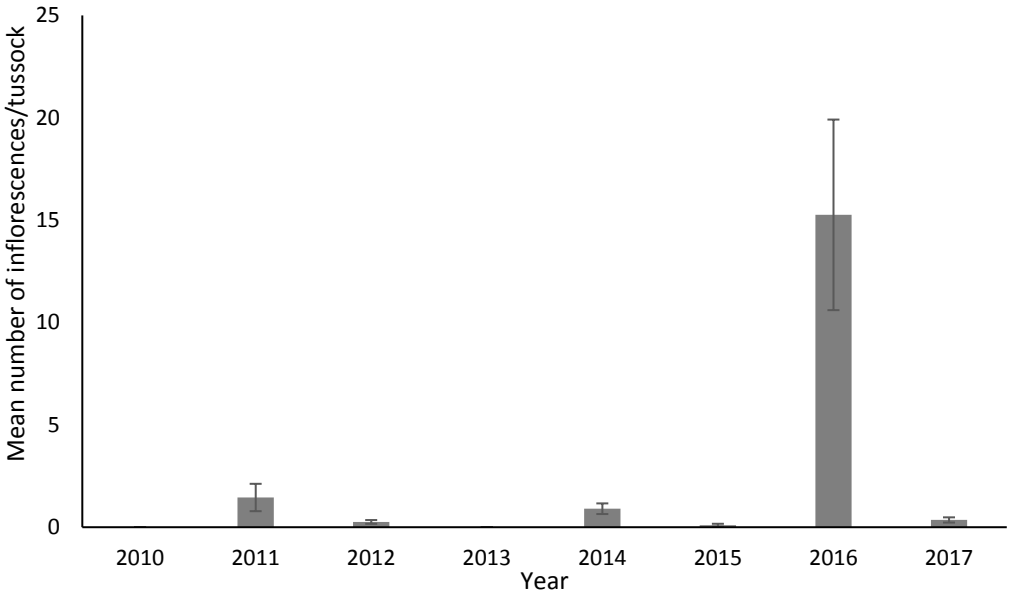


Figure 23: Mean number of inflorescences recorded per tussock for *Chionochloa pallens* within a 20m by 2m plot located on Mt Misery, Nelson Lakes National Park in February from 2010 to 2017.

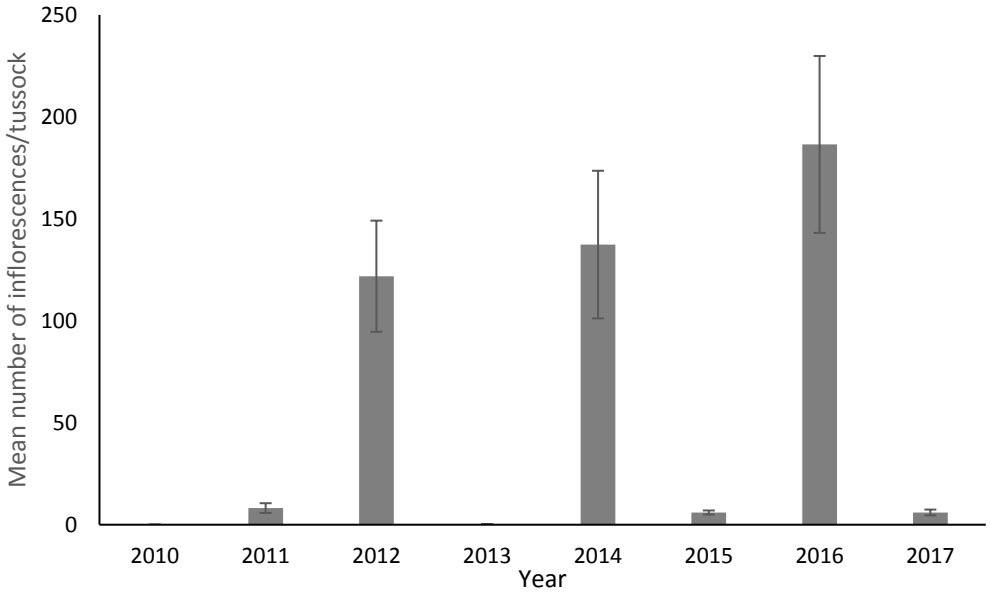


Figure 24: Mean number of inflorescences recorded per tussock for *Chionochloa australis* within a 20m by 2m plot located on Mt Misery, Nelson Lakes National Park in February from 2010 to 2017.

Discussion

As low levels of tussock flowering were observed on Mt Misery there is likely to only be low levels of available tussock seed in the alpine zone. More widespread monitoring was carried out by the Science and Technical team where tussock samples were collected from helicopter to count the number of flowers at sites

throughout the South Island, including Nelson Lakes National Park. Results from this monitoring confirmed low levels of flowering occurring in Nelson Lakes. As a result, an irruption of the mouse or rat population in response to tussock seeding in the alpine is unlikely to occur and no response is planned for the alpine zone of the RNRP.

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 2016/17, although the first rock wren sighting since 2007 was made by a staff member on 10th April 2017 near the Clearwater trap line (Patrick van Diepen, pers. comm.)

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. In 2016/17 the following research was undertaken within the RNRP:

- Kelly Whitau from Canterbury University completed her Masters Thesis investigating factors that influence bird and mammal abundance in response to pest control in areas of mixed beech forest in New Zealand (Whitau, 2017). The RNRP was one of the study sites and long-term datasets including five-minute bird count data, tracking tunnel data and beech seedfall data were used in the analysis.

- Jamie McAulay from Otago University carried out research at several alpine sites around the South Island including the RNRP, for his Masters thesis looking at the diet of alpine stoats and estimating risk to alpine fauna. This thesis is due for completion in 2017/18.

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 2: "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.

3.6.1 Reports generated during 2016/17

Other than the Annual Report one internal report on the diphacinone field trial was generated by the RNRP in the 2016/17 season:

- Animal pest field trial report for assessing Rat control trial using diphacinone blocks (Connovation's D-block) at the Rotoiti Nature Recovery Project (RNRP). DOC3151221.

3.6.2 Hui, workshops, presentations and media articles

In June 2017 the Great Spotted Kiwi practitioners meeting was held in St Arnaud at the Red Door Lodge. RNRP staff were involved in planning and running this event and a presentation on the RNRP kiwi population was given.

The role of the RNRP, and DOC generally, in the development of Vespex wasp bait was highlighted through the 'Wasp-Wipe out" project coordinated by Fairfax Media. Their programme captured public interest due to the series of articles explaining the impact of wasp control on biodiversity and how wasp control was possible with Vespex. Further interest came from a visit by the then Minister of Conservation, Hon Maggie Barry who launched the Wasp Wipeout initiative at Nelson Lakes. Friends of Rotoiti, who have helped develop the means of using Vespex were guests at the launch.

http://www.doc.govt.nz/news/media-releases/2017/minister-welcomes-campaign-to-wipe-out-wasps/

New Zealand Geographic published a long article by Nelson-based environment writer, Dave Hansford called 'The Coming Swarm' (NZ Geographic, Sept/Oct 2017). The author spent time in the field with local staff and his article successfully conveyed the research, logistics and effects of wasp control on beech forest. The article included comments from Nelson Lakes staff.

https://www.nzgeo.com/stories/the-coming-swarm/

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 providing a line of defence against predators coming into the RNRP.

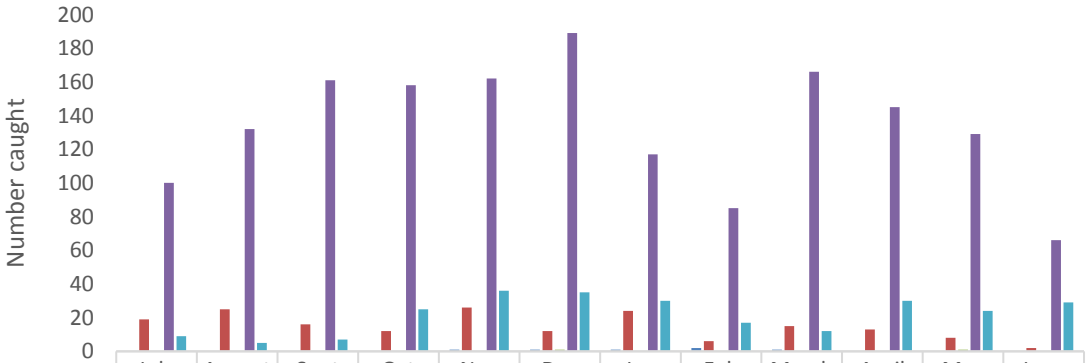
Volunteers devote considerable time annually undertaking trapping, wasp control, trap building and maintenance, administration, planning and advocacy tasks. FOR members also contribute to developing more effective trapping methods (for example run-through DOC200 stoat traps), participating in discussions and sharing ideas with DOC staff. FOR have also become involved in kiwi monitoring and in late 2016 received funding to carry out the translocation of 20 adult great spotted kiwi into 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 (Figure 25). 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.



	July	August	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June
Stoat					1	1	1	2	1			
Rat	19	25	16	12	26	12	24	6	15	13	8	2
Weasel						1					1	
Mouse	100	132	161	158	162	189	117	85	166	145	129	66
Sprung	9	5	7	25	36	35	30	17	12	30	24	29

Figure 25: Catches in the Friends of Rotoiti rat traps around the St Arnaud village in 2016/17.

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

Advocacy

Staff support conservation advocacy at community events. This includes a joint display with the Friends of Rotoiti at the Antique and Classic Boatshow and a display at the Murchison A&P show. A new community event was the 'Swim with the Eels' snorkel day with Experiencing Marine Reserves Trust. This gave DOC and EMR an opportunity to highlight freshwater ecology and species at Lake Rotoiti.

Other advocacy activities promoting the RNRP and wider biodiversity activities include talks to the Nelson Marlborough Institute of Technology's trainee rangers, major concessionaires so they can pass on the messages to clients, Rainbow Skifield staff, Nelson Community Forum, Tasman Biodiversity Forum, and support for the Kea Conservation Trust's winter tour.

Education

DOC's strategy for education (http://www.doc.govt.nz/get-involved/conservation-education/) is to provide resources for teachers to support conservation teaching and learning, or DOC supported education programmes for people to get involved. Nelson Lakes District was involved with three of the significant education programmes during 2016/17. These were the:

- Sir Peter Blake Ambassador programme. Juliet O'Connell was the 2017 recipient based at Nelson Lakes and spent four weeks volunteering with the RNRP https://sirpeterblaketrust.org/posts/2016/9/18/juliet-o-connell-blake-ambassador
- Experiencing Marine Reserves - *Papatai ō roto - Papatai ō raro – Look beneath the surface* – family guided snorkel day in Lake Rotoiti
- Toyota Kiwi Guardians (TKG) - An activity programme for kids to learn about nature, earn rewards and go on epic family adventures. Our TKG follows the Honeydew Walk and allows families to explore the RNRP interpretation panels and biodiversity work. http://www.doc.govt.nz/parks-and-recreation/places-to-go/toyota-kiwi-guardians/sites/kiwi-guardians-around-nelson/nelson-lakes-national-park/

DOC has developed an excellent range of 58 curriculum-linked education resources to support teachers across the educational range. In addition, resources are available to guide site visits (including the popular "A Day at Lake Rotoiti") and links to the extensive network of groups providing education resources and opportunities.

Communication

A new quarterly newsletter, Birdsong, was launched in April 2017. Birdsong informs people with an interest in the RNRP and wider DOC work about the activities of staff, volunteers and partners. It has been well received as a replacement for 'Revive Rotoiti'. Being electronic it is more efficient to produce and distribute, and the format allows video footage and sound files to be embedded, and links to other

websites. It can be more easily shared through social media channels and distributed through a range of networks.

http://www.doc.govt.nz/news/newsletters/birdsong/

5 Discussion

Research to inform biodiversity management throughout New Zealand remains a core focus of the RNRP. While the RNRP still has restricted resources, in 2015/16 a review of the RNRP work programme was carried out, reprioritising tasks and reducing labour-intensive programmes such as ground-based mustelid control so that the workload more accurately reflected the resources available. In 2016/17 the focus of the RNRP has essentially been bought back to core projects and focusing on maintaining long-term datasets. The review of the work programme was successful in reducing both workloads and staff stress levels and has now created capacity so that other work could be reinstated. Careful thought needs to be put into what areas of new monitoring can be picked up to ensure that the work would be sustainable in the long-term and target current knowledge gaps in conservation. Thought also needs to go into the RNRPs potential contribution to future conservation research to ensure the RNRP remains relevant while maintaining the guiding principles and objectives of the project.

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 2016/17 and advocacy of biodiversity conservation to the public continues while potential options to develop new partnerships in the future are explored.

The RNRP has now being running for 20 years and has very valuable long-term datasets. These datasets are now starting to be used to provide insights into the long-term trends and changes occurring in New Zealand ecosystems and the drivers of these changes. As one of the principle reasons for the establishment of the RNRP is to learn and then disseminate the findings of research, there is a need to publish the results of the past twenty years. This work has begun with an analysis of the RNRP rat tracking, beech seedfall and five-minute bird count data being carried out by Kelly Whitau in 2016/17 for her Masters thesis at the University of Canterbury. The dissemination of learnings from the RNRP is high priority for the RNRP and will be more of a focus over the coming years. The first stages of this will be to gather all the RNRP data into one place so that datasets are easily available for use and then for analysis and write up to occur. The best ways for this knowledge to be passed on will be investigated and pursued, so that learnings from the RNRP can affect further progress towards the goal of effective conservation in New Zealand.

6 Recommendations

- Test whether wasp bait-stations at 100m spacings along stoat trap lines are enough to provide protection to trappers from wasps.
- Finish great spotted kiwi translocation by bringing 20 adult birds into the population to meet the 40 founder individuals required for a population.
- Carry out six monthly harness checks of translocated great spotted kiwi to reduce the number of transmitter harnesses that break.
- Start long term monitoring of the RNRP great spotted kiwi using call rates from acoustic recorder monitoring.
- Undertake possum wax tag monitoring in the Travers to determine the level of possum reinvasion three years after the 1080 operation.
- Undertake possum wax tag monitoring within the RNRP core and Big Bush area as scheduled in March 2019 and use this result to inform decision making around Big Bush possum control.
- Trial 21-night mustelid monitoring as a more sensitive measure of mustelid activity indices.
- Run new science and technical ridge to valley tracking tunnels in conjunction with RNRP tunnels where the two overlap, for three years to see if tracking indices differ.
- Carry out pig control at the northern end of the St Arnaud Range using a combination of techniques to limit invasion into the RNRP.
- Carry on with kea nest protection in 2017/18 as a high priority task.
- Restart St Arnaud village skink monitoring project as is an important long-term dataset for the response of skinks to predator control.
- Investigate low-level monitoring of species currently not receiving attention locally.
- Thoroughly consider the RNRP's potential contribution to future conservation research and look ahead for opportunities for the RNRP to be involved in pest control trials.
- Complete second year of mustelid lure trial before making any changes to mustelid control programme.
- Pursue the analysis of the RNRP long-term datasets either through external or internal sources.

7 Acknowledgements

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

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Dr Katrina Seelye who reviewed 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 2016/17 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	Jen Waite (jwaite@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): $155,649
Operating: $27,587

10.2 Staffing

Nik Joice, Jen Waite, Patrick van Diepen, Emma McCool, Graeme Andrews, Gareth Rapley, Sandra Wotherspoon, Emma Williams, Athow Santamaria and Josh Humphries.

10.3 Technical Advisory Group

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

10.4 RNRP advisors

Josh Kemp, Mike Hawes, Kath Walker.