Rotoiti Nature Recovery Project Annual Report 2019/20

Nelson Lakes Mainland Island, Nelson Lakes National Park

M.J. Griffin, E.J. McCool, J.A. Newell, G. Rapley, S. Wotherspoon and R.A. Mitchell

Department of Conservation
Te Papa Atawhai

Rotoiti Nature Recovery Project

Annual Report

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Department of Conservation (Rotoiti/Nelson Lakes)

Executive summary

The Rotoiti Nature Recovery Project (RNRP) biodiversity team had a large changeover in the 2019/20 season, with a number of staff departing over the summer months, leaving holes in the available skill set while new staff were being inducted into the team. Consequently, some work was not able to be completed due to understaffing for a few months and a reprioritisation of tasks.

The end of this financial year was also a little unusual due to the COVID-19 pandemic and the government-enforced lockdown in late March. This meant that the whole team was working from home and all field work was largely put on hold until mid-May. During this time, some trap checks were missed and some scheduled work had to be dropped to ensure priority work was completed in the time available.

Biodiversity restoration objectives

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

   The trial testing the use of double-set DOC 200 traps in new trap boxes for the mustelid control network was continued this season and completed in March 2020. Tracking tunnel monitoring showed that mustelid tracking could not be kept below the 5% target in the RNRP treatment area and was also high at the Rotoroa non-treatment site. This was most likely due to the mega beech mast resulting in elevated numbers of rats (*Rattus* rattus). Possum (*Trichosurus vulpecula*) control continued using Sentinel traps. Feral cat (*Felis catus*) control was not as successful this season, with only one cat being caught in 5 weeks of trapping, although the Friends of Rotoiti caught 126 cats throughout the season.

   The kākā encounter rate was lower this season, with similar numbers to the 2015/16 season, and no kākā breeding occurred. The five transmitted chicks continued to be regularly monitored and were still within the RNRP.

   Three kea nesting attempts were observed this season: two by Aphrodites, both of which failed, and one by Scuffles at nest 9, which resulted in two chicks successfully fledging.

   No monitoring of mistletoe or *Powelliphanta* sp. snails was undertaken this season.

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

Roroa is the only species to have been re-established in the RNRP. In 2018, monitoring of the kiwi population moved to acoustic monitoring in March of each year. However, technical problems meant that this was not completed in March 2020, so it was rescheduled for November 2020. The translocation of a further 20 adults is scheduled from 2021.

Learning objectives

3. 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

   A field trial comparing the effectiveness of the current DOC best practice double-set DOC 200 trap box with a modified run-through trap box design with double-set DOC 200 traps was started in 2018/19 and continued through until March 2020.

   A ground-based rat control operation using pindone in bait stations took place in spring 2019 to compare the effectiveness of different Philproff bait stations. This operation was unsuccessful in lowering rat tracking indices to below 5% in a mast year.

   Wasp control was carried out in February 2020 and was successful in decreasing wasp activity and increasing the amount of available honeydew.

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

   Five-minute bird counts were completed in the RNRP in 2019/20.

   Low levels of beech seed and tussock flowering were observed in the RNRP this season. However, rodent tracking indices increased to high levels in both the RNRP and the Rotoroa non-treatment site in response to the high levels of beech seed resulting from the 2018/19 mega mast.

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

   Alpine skinks were found in the Middle of the Range basin on the St Arnaud Range. Formal identification has not yet been carried out, but they are likely to be speckled skinks (*Oligosoma infrapunctatum*).

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

   No external research was carried out in the RNRP in 2018/19.

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

   Reports were written for the ground-based pindone rat control operation and the double-set trap trial.

Community objectives

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

   Pre-existing partnerships have been maintained with local iwi, the Friends of Rotoiti and the Kea Conservation Trust.

9. Increase public knowledge, understanding and support for mainland islands and ecological restoration nationally through education, experience and participation

   RNRP staff continued to be involved in teaching courses on animal pest control methods and running community trapping workshops. No presentations were given this year.

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1. Introduction

The New Zealand Department of Conservation (DOC) established six mainland island ecological restoration projects between 1995 and 1996. Among these, the Rotoiti Nature Recovery Project (RNRP) was established to enable the recovery of a representative portion of an alpine honeydew beech forest ecosystem at Rotoiti in Nelson Lakes National Park.

The RNRP is predominantly mixed honeydew beech forest but also contains shrubland, alpine grassland and an alpine wetland. The project began in spring 1996 with establishment of the site, followed by the initiation of baseline monitoring with comprehensive pest control in 1997. The original project treatment area was 825 ha of forest on the western St Arnaud Range, which was subsequently extended in 2002 to 5000 ha across more of the St Arnaud Range and part of Big Bush Conservation Area. Trapping has also been implemented in adjacent areas encompassing an additional 5000 ha by a local volunteer group, Friends of Rotoiti (FOR). Two non-treatment areas were also established at the head of Lake Rotoroa and in the Lakehead area of Lake Rotoiti (Figure 1) so that responses to management techniques could be compared. However, the Lakehead area was incorporated into the treatment area when predator control was expanded in 2002.

Over the 20 years since the RNRP was established, there have been several key learnings and outcomes in both pest control techniques and species management. Highlights include the development of management prescriptions for the recovery of South Island kākā *(Nestor meridionalis meridionalis*) by controlling stoats (*Mustela erminea*) and brushtail possums (*Trichosurus vulpecula*); the development of best practice for the wasp (*Vespula* spp.) control toxin Vespex®, which is now commercially available; the translocation of roroa / great spotted kiwi (*Apteryx haastii*) and the trialling of Operation Nest Egg (ONE) for this species; the trialling of swathe rates for aerial 1080 application; the recovery of mistletoe species; and collaboration and partnership with the local community group FOR. In addition, several long-term datasets on rodent and mustelid monitoring and five-minute bird counts (5MBCs) have been maintained over the lifetime of the RNRP that are now of national importance.

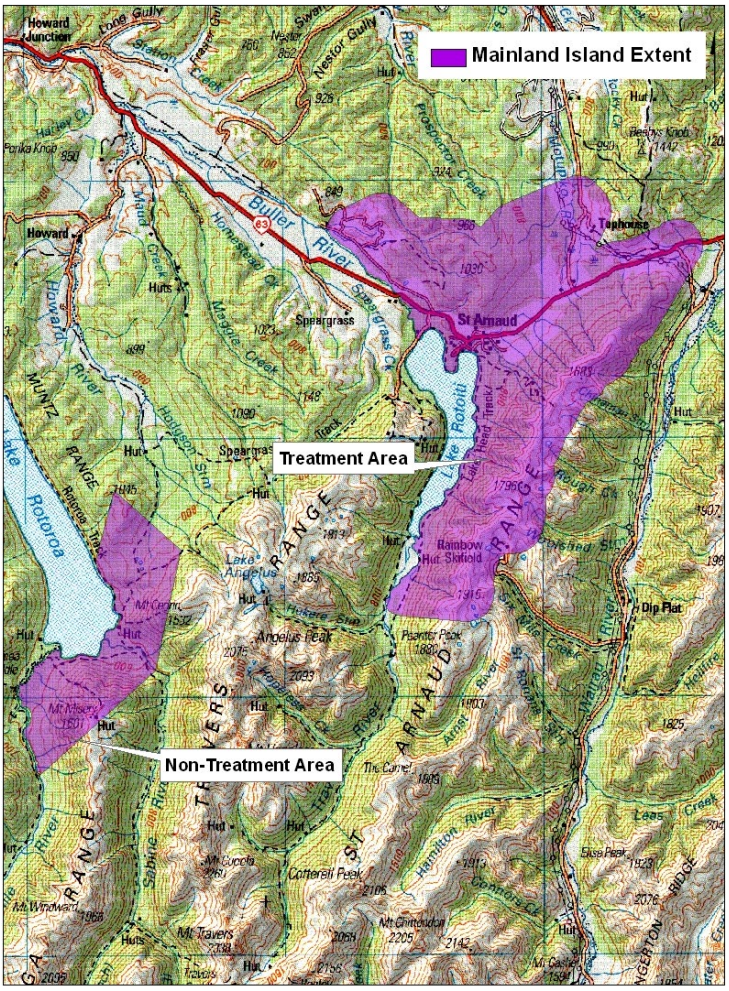

Figure 1. Map showing the locations of the Rotoiti Nature Recovery Project treatment and non-treatment areas.

The RNRP is guided in its principles and objectives in 5-yearly cycles. The RNRP Strategic Plan 2014–2019 (Harper & Brown 2014) provides the planning framework and goals for the project, which attempts to balance restoration with research on tools to control pests and restore species. The primary goal set out by the Strategic Plan comprises three major themes.

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 to increase public support.
3. Maintaining existing and developing new partnerships to achieve greater conservation gains.

This report summaries work and outcomes for the RNRP strategic objectives between July 2019 and June 2020.

2. Biodiversity restoration objectives

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

2.1.1 Introduction

The RNRP Strategic Plan 2014–2019 (Harper & Brown 2014) identified seven threatened species that were present in the Rotoiti area prior to the establishment of the RNRP. These species and their New Zealand Threat Classification System rankings (de Lange et al. 2013; Robertson et al. 2016) are:

- kea (*Nestor notabilis*), Nationally Endangered
- South Island kākā (*Nestor meridionalis meridionalis*), Nationally Vulnerable
- three species of beech mistletoes (*Peraxilla colensoi, P. tetrapetala* and *Alepis flavida*), all Declining
- *Pittosporum patulum*, Nationally Endangered
- the 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, with the exception of kea, considerable amounts of work have already been invested in monitoring and managing them since the RNRP's inception. The kea was not included in earlier strategic plans but was added after its threat status was upgraded from Naturally Uncommon to Nationally Endangered in 2013 and following recognition that the species forms an integral part of the South Island alpine ecosystem (Robertson et al. 2016). Evidence suggests that there has been a continuing slow decline in kea numbers in Nelson Lakes National Park, despite a nest protection programme starting in 2011 (Steffans 2009; Harper et al. 2011).

The kākā is an endemic forest parrot that is threatened by predation, particularly of eggs, chicks and nesting adults by stoats and possums (Moorhouse 2003). Stoats and possums are controlled within the RNRP via an extensive trapping programme, which is keeping both species at low levels. However, a trial of A24 self-resetting traps carried out between 2012 and 2014 failed to control stoats, with mustelid tracking rates exceeding the 5% threshold levels during what was likely to be a big kākā breeding season, and this appears to have impacted the kākā population. The control of feral cats (*Felis catus*) 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 over a small area in previous years. However, this was ceased in 2015 due to limited resources and is now carried out by FOR. Other native bird species that are present are also likely

to benefit from this predator control, particularly roroa and kārearea / New Zealand falcon (*Falco novaeseelandiae*), which also nest on the ground.

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

In addition to being threatened by possums, *Pittosporum patulum* and *Powelliphanta* "Nelson Lakes" populations may also be threatened by red deer (*Cervus elaphus scoticus*). Red deer browsing has had detrimental effects on juvenile *Pittosporum patulum* plants, and concentrated browsing and trampling of the mountain beech (*Fuscospora cliffortioides*) / tussock ecotone may impact *Powelliphanta* habitat. Deer control is not currently a regular component of the RNRP pest control programme but has been supplemented by the initiation of limited access to the RNRP for recreational hunters in 2010.

Hares (*Lepus europaeus*) 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. Additionally, pigs (*Sus scrofa*) are known to be present near the snail colony within the RNRP and represent a threat to them, as their rooting activity degrades snail habitat. Consequently, regular pig control has been implemented in the RNRP since the 2015/16 season.

2.1.2 Mustelid control and monitoring

Introduction

Landscape-scale ground-based mustelid control has been carried out for many years in the RNRP with the aim of suppressing mustelids to a tracking rate below 5%, which is considered the level that will enable kākā and other native birds to breed successfully (Greene 2004; Taylor et al. 2009). The FOR community group also maintains several trap lines in areas outside the RNRP, which act as a buffer to help minimise reinvasion.

In 2018/19, the RNRP network of traps was upgraded to double-set trap boxes with Tiakina Ngā Manu funding. This included undertaking a trial that compared two double-set trap box designs. This trial was finished in March 2020 and the complete report can be found at (Waite et al. 2021).

Methods

CONTROL

RNRP mustelid trap lines cover approximately 5000 ha to the east and north of Lake Rotoiti, running along the boundaries and within the RNRP at intervals of 1–3 km (Figure 2). The network is comprised of 902 double-set DOC 200 traps, spread at 100-m intervals along 24 trap lines. The traps are checked monthly and baited with Erayz.

The trial compared the efficacy of two trap box designs: the best practice double-set trap box and a modified run-through design. Trap lines were moved during the setup to infill large gaps between existing lines. More details of the trial can be found in the field trial plan (Waite 2018).

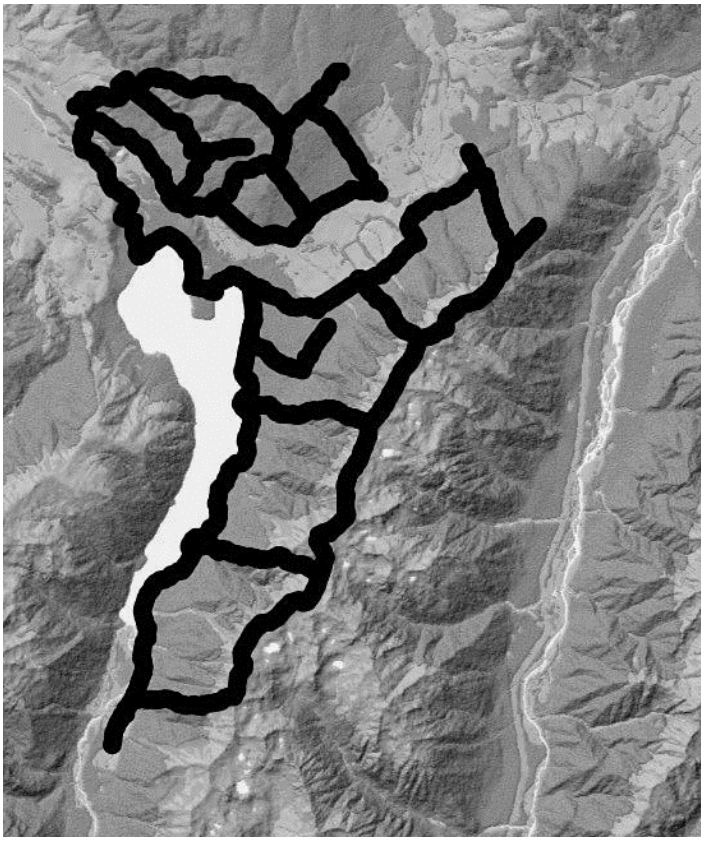

Figure 2. Rotoiti Nature Recovery Project mustelid trap lines following a trap upgrade in 2019.

Monitoring

The effectiveness of the RNRP mustelid control is monitored by calculating the tracking tunnel index over 3 nights in November and February each year (Gillies 2013). Ten coreflute tracking tunnels are spaced at 100-m intervals along lines spaced a minimum of 1 km apart in the Rotoiti treatment site (trapping) and Rotoroa non-treatment site (no trapping) and fresh rabbit lure is placed in the middle of the card for 3 fine nights. As different mustelid species cannot be reliably distinguished by footprints, the tracking index is for all mustelid species combined.

Results

Control

In total, 221 stoats, 102 weasels (*M. nivalis*) and 1 ferret (*M. furo*) were caught in the RNRP in 2019/20 (Table 1). High numbers of rats (*Rattus rattus*) were also caught in the new traps, reflecting the increase in the rat population in response to the large amounts of beech seed.

Table 1. Trap catches in the Rotoiti Nature Recovery Project from 1 July 2019 to 30 June 2020 by trap box design.

Capture	**Modified run-through double**	**DOC 200 double**	**Total**
Sprung	812	641	1453
Stoat	107	114	221
Weasel	61	41	102
Ferret	0	1	1
Cat	16	18	34
Rat	2219	1883	4102
Hedgehog	55	47	102
Mouse	41	46	87
Rabbit	6	3	9

Monitoring

Mustelid tracking rates in the RNRP trapping area were 3% ± 2% (mean ± SEM) in November 2019 and undetectable (0%) in February 2020. At the Rotoroa non-treatment site where no trapping is undertaken, tracking was 9% ± 4% in November 2019 and 42% ± 12% in February 2020.

Discussion

The RNRP mustelid trap network successfully maintained tracking indices below the 5% target, whereas mustelid tracking indices were well above 5% at Rotoroa, where no mustelid control was carried out. The upgrade of the RNRP trap network in 2018/19 was a large project undertaken by the team that involved replacing the old boxes and installing double-set traps and will allow increased stoat captures.

A recommendation arising from the report on the double-set trap trial was to continue recording trap catches in the network (Waite et al. 2021). Since the trial was undertaken during a beech mast with increased rat numbers, the results may be different in non-mast years. Therefore, we will continue to collect catch type and humaneness data for each of the traps at each check.

2.1.3 Friends of Rotoiti mustelid control

Introduction

A total of 407 mustelid traps are maintained by FOR as a buffer to the RNRP.

- 82 DOC 200s on the Whisky Falls line
- 43 DOC 200s on the Speargrass and Mt Robert Road lines
- 43 DOC 200s on the Tophouse Road line
- 239 stoat traps (mix of DOC 200s and DOC 250s) on the Rainbow lines, all of which are maintained in summer and 160 of which are maintained in winter

Methods

The Mt Robert Road, 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), while the Rainbow lines are checked weekly or fortnightly from October to April and fortnightly or monthly during the colder months depending on catch rates. Erayz is used in all baited traps. Due to COVID-19 restrictions, trap checks were missed for approximately 6 weeks in April–May 2020 and then all traps were checked fortnightly once checking resumed.

The Rainbow lines are currently being run as a trial to compare DOC 200s in a baitless run-through tunnel design with DOC 250s baited with Erayz which is changed monthly. This trial started in November 2016 with DOC 250 boxes fitted with mouse (*Mus musculus*) excluders to prevent mice from eating the bait. Mouse excluders are 8-mm square mesh cages that attach to the DOC 250 box end and close over the bait when the box is closed (for further design details, visit www.friendsofrotoiti.org.nz).

Results

FOR recorded the same number of stoat captures in 2019/20 as in 2018/19 (Table 2). As with the previous year, the greatest proportion of stoat captures occurred on the Rainbow lines. The greatest number of stoat captures also occurred in the summer months, with 86 stoats caught between December and February (Figure 3). In the Rainbow Valley trap trial, a larger number of stoats and hedgehogs (*Erinaceus europaeus*) were caught in the run-through trap boxes, while more rats, mice and cats were caught in the baited DOC 200 traps (Table 3). It is also important to note that more of the run-through boxes were sprung without a capture. Therefore, data from the

entire duration of the trial will need to be collated and analysed to draw conclusions around the more effective trap methods in this area.

Table 2. Trap catches and sprung DOC 200 and DOC 250 traps on the Friends of Rotoiti mustelid trap lines from July 2019 to June 2020.

Trap line	Stoat	Rat	Ferret	Weasel	Hedgehog	Rabbit	Mouse	Bird	Cat	Sprung
Rainbow	90	918	4	25	54	12	19	1	26	135
Whisky Falls	11	573	0	5	0	0	0	0	10	33
Speargrass & Mt Robert Road	4	279	0	0	1	0	0	0	4	20
Tophouse Road	5	122	1	2	9	4	3	0	4	13
Total	**110**	**1892**	**5**	**32**	**64**	**16**	**22**	**1**	**44**	**201**

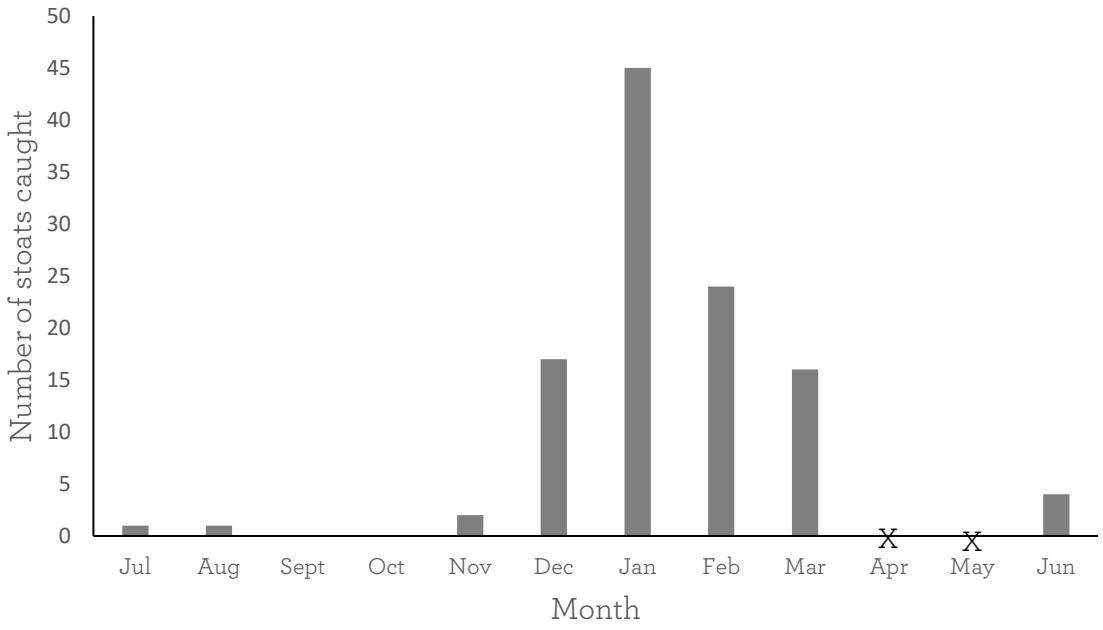

Figure 3. Number of stoats (*Mustela erminea*) caught between July 2019 and June 2020 on the Friends of Rotoiti mustelid trap lines. No check were made in April and May due to COVID-19 restrictions.

Table 3. Trap catches and sprung traps in the Friends of Rotoiti Rainbow Valley trial comparing DOC 200/250 traps baited with Erayz and baitless run-through trap boxes from July 2019 to June 2020.

Trap type	Stoat	Rat	Weasel	Ferret	Hedgehog	Mouse	Rabbit	Cat	Bird	Sprung
Baited *DOC 200/250*	26	420	11	2	13	15	2	16	1	53
Baitless *run-through* box	40	303	10	1	40	1	10	8	0	79

2.1.4 Feral cat control

Introduction

Feral cat control in the RNRP has been problematic due to the presence of weka (*Gallirallus australis*), with several trapping methods having been trialled unsuccessfully. As a result, cat control has been sporadic and varied in effort due to the low return for effort, with most cat trapping in the area being undertaken by FOR. The most successful method to date has been live cage trapping in autumn. DOC 200 traps targeting mustelids continue to catch juvenile cats.

Methods

RNRP Control

Live capture trapping is undertaken at Teetotal Recreation Reserve. Traps are baited with fresh rabbit and checked daily.

FOR Control

FOR volunteers and local supporters maintain 19 Havahart® live-capture cage traps targeting cats in St Arnaud village and rural areas adjacent to Nelson Lakes National Park, particularly the Tophouse Road area. Any feral cats that are trapped are killed humanely with a .22 rifle, while cats that are identified as pets are released from the cages. FOR members also work with DOC staff to undertake trapping in the Teetotal Recreation Reserve. The use of raised-set Timms traps was discontinued in 2017/18 due to a lack of captures

Results

RNRP Control

A total of 34 cats were caught as bycatch in DOC 200s in the mustelid trap network in the RNRP (Table 1). Over the 5 weeks of live trapping, only one cat was caught.

FOR Control

The live cat trapping resulted in 82 feral cats being caught in 2019/20. In addition, 44 cats were caught as bycatch in the FOR mustelid traps in 2019/20 (Table 2). This follows a general increase in the amount of cat sign in and around Nelson Lakes National Park over this period. Feral cats are also occasionally caught in mustelid traps as bycatch. In the past, this has been particularly common on the Rainbow and Whisky trap lines.

Discussion

The mega mast in the 2018/19 season increased rat numbers, leading to cats in the RNRP and surrounding area having an incredibly successful breeding season. Cats were often observed and reported to DOC staff in and around the National Park.

Live trapping was largely unsuccessful this season. Most cats that were caught were kittens and juveniles that were small enough to fit inside the DOC 200 trap boxes.

2.1.5 Possum control and monitoring

Introduction

Possum control has been undertaken in the RNRP since 1997 using a combination of toxins and kill traps. Possum control is carried out to maintain possums at low numbers to allow the recovery of threatened plant species that are damaged by possum browse and provide protection to nesting kākā that are at risk from possum predation (Moorhouse 2003).

Monitoring to determine the effectiveness of possum control in the RNRP is undertaken 2-yearly using 7-night wax tag monitoring. The target of the possum control programme within the RNRP is to keep the Possum Activity Indices (PAIs) below 5%. This monitoring is next scheduled for March 2021.

Methods

Sentinel kill traps are set at 100-m spacings along existing mustelid trap lines below the bush line in the RNRP. An additional trap line runs up the Travers Valley to limit reinvasion into the control area from the south. However, this line was not run in 2019/20.

The Sentinel traps are attached to trees 1500 mm above ground level and fitted with white coreflute covers to help prevent non-target bycatch. The traps are baited with Trappers Cyanide Ltd's Possum Dough on the bait clip attached to the trap, and Connovation's Ferafeed Smooth-in-a-Tube is used as a lure on the tree leading up to the trap. Trap checking and rebaiting are undertaken in conjunction with the monthly mustelid trap checks. Due to the mustelid trap upgrade, trap checking was ad hoc during 2019/20.

Results

A total of 119 possums were caught in the RNRP in 2019/20, among which 91 were captured in Big Bush and 28 were captured in the core area (Table 4 &Table 5). This is similar to the previous season, when 101 possums were caught (85 in Big Bush and 16 in the core area).

Table 4. Possum (*Trichosurus vulpecula*) captures in the Big Bush block of the Rotoiti Nature Recovery Project from 1 July 2019 to 30 June 2020.

Trap line	**No. of possums caught**	**No. of traps**	**Catch per trap**
Black Sheep Gully	10	19	0.53
Black Valley Stream	6	19	0.32
Boundary	6	20	0.30
Little Dog	17	63	0.27
Dome Ridge	33	46	0.72
Duckpond Stream	10	20	0.50
Old Dump Site	9	12	0.75
Total	**91**	**199**	**0.46**

Table 5. Possum (*Trichosurus vulpecula*) captures in the core area of the Rotoiti Nature Recovery Project from 1 July 2019 to 30 June 2020.

Trap line	No. of possums caught	No. of traps	Catch per trap
Hubcap	7	23	0.30
Snail	3	15	0.20
Grunt	2	23	0.09
Middle of the Road	4	17	0.24
Clearwater	8	17	0.47
St Arnaud Track	4	14	0.29
Total	**28**	**109**	**0.26**

Discussion

As in previous years, the trap lines in Big Bush caught the highest number of possums, with the Dome Ridge trap line on the northern boundary having the highest catch rate. The highest catch rates in the core area were on the Hubcap and Clearwater lines at the northern and southern boundaries. This difference in catch rates is due to the core area having a long history of possum control, whereas areas north of the Big Bush control block do not have any possum control, resulting in reinvasion from these areas.

2.1.6 Friends of Rotoiti possum control

Introduction

FOR has been using Sentinel kill traps along its possum trap lines since 2010. There are 38 traps in the Rainbow Valley, 39 on the Whisky Falls line, 14 on the Speargrass line and 5 on the Mt Robert Road line.

Methods

Sentinel traps are baited with Trappers Cyanide Ltd Possum Dough on the bait clip, and Connovation's Ferafeed Smooth-in-a-Tube is used as a lure on the tree leading up to the trap. Traps

are checked and rebaited monthly. COVID-19 restrictions meant that no trap checks were completed in April or May 2020.

Results

A total of 148 possums were caught across the FOR trap lines in 2019/20. The traps along the Speargrass line had a much higher catch rate than the other three lines (Table 6). High numbers of possums were caught in July and then a smaller peak occurred in December and January (Figure 4). The peak in June is likely due to the traps remaining unchecked for 2 months due to COVID-19 restrictions. It is also close to 6 years since the last 1080 operation in this region, so possum numbers are likely beginning to increase.

Table 6. Possum (*Trichosurus vulpecula*) captures on the Friends of Rotoiti trap lines from 1 July 2019 to 30 June 2020.

Trap line	No. of possums caught	No. of traps	Catch per trap
Rainbow Valley	31	38	0.82
Whisky Falls	57	39	1.46
Speargrass	50	14	3.57
Mt Robert Road	10	5	2.00
TOTAL	**148**	**96**	**1.54**

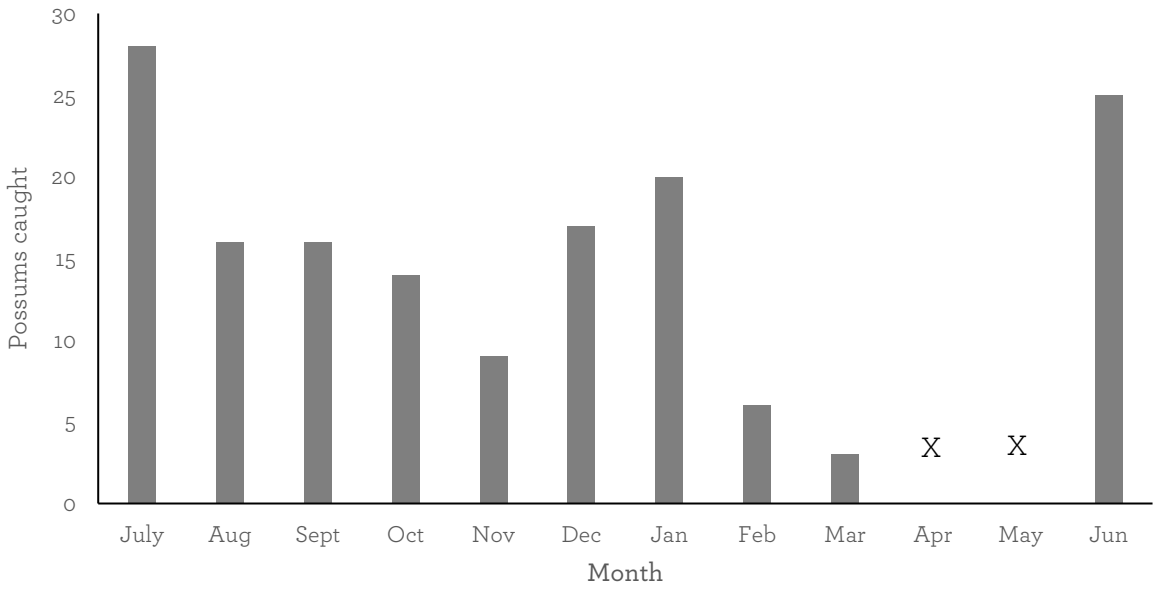

Figure 4. Monthly possum (*Trichosurus vulpecula*) catches on the Friends of Rotoiti possum trap lines between July 2019 and June 2020. Fewer checks in March and no checks done in April and May due to COVID lockdown.

2.1.7 Deer control and monitoring

Introduction

A volunteer hunter system operates within the RNRP that allows approved recreational hunters to access hunting blocks.

Methods

There was limited interest in hunting in the RNRP in 2019/20, with only three known recreational hunting days occurring. This is likely due to the pindone operation in spring 2019 and the associated withholding period.

Results

Deer and deer sign continued to be seen throughout the RNRP by DOC staff and volunteers. One chamois (*Rupicapra rupicapra*) was shot during the three known recreational hunting days.

Discussion

The biodiversity team should continue to work with reliable volunteers that can hunt safely in this busy section of the National Park. Additional volunteers may need to be recruited to ensure that deer numbers in the RNRP are suitably managed and prevented from reaching unmanageable levels.

2.1.8 Pig control and monitoring

Regular pig control has been carried out in the RNRP since 2016 in response to an increase in the number of pigs observed in the area, particularly on the northern end of the St Arnaud Range. Since 2016, trapping has been trialled as a pig control method on the northern St Arnaud Range and some ground hunting has been carried out. However, no pig trapping was undertaken in the 2019/20 financial year.

2.1.9 Kākā monitoring

Introduction

Monitoring of South Island kākā populations and their breeding success has been a key focus of the RNRP since its establishment. This work has shown that mustelid trapping provides protection to the local kākā population and keeping mustelid tracking indices below 5% improves kākā breeding success (Moorhouse 2003).

Intensive kākā research in the RNRP ceased after 2005/06 and was replaced by low-effort encounter rate monitoring as a means of observing long-term changes in the population.

Monitoring was increased in 2015, as Project Janszoon planned for kākā in the RNRP to be a source population for re-establishing a population in Abel Tasman National Park. In October 2015, Project Janszoon staff fitted transmitters to five kākā (three males and two females) caught within the RNRP core area. These kākā were monitored for nesting attempts in subsequent breeding seasons so that their chicks could be taken for captive rearing and release into Abel Tasman National Park. The five transmittered chicks from the 2018/19 breeding season are also regularly monitored for dispersal.

Methods

The annual kākā encounter survey was carried out between 1 October 2019 and 15 March 2020, which is a slightly shorter period than in previous years due to the inability to undertake field work during COVID-19 lockdown. The surveys are carried out concurrently with mustelid trap checks along 21 trap lines that traverse suitable kākā habitat below the bush line. Observers recorded the survey start and finish times, number of kākā encountered, closest trap box location, and whether the birds were seen or heard.

Results

In 2019/20, 38 kākā were encountered over 164.8 hours, giving an encounter rate of 0.231 encounters per hour (Table 7). No kākā were encountered on half (10) of the lines. As in all previous seasons, this included the Anglers Walk, Black Valley Stream and Peninsula lines.

The kākā encounter rate in 2019/20 was lower than in the previous season and more comparable to the 2014/15 and 2015/16 seasons (Figure 5).

At the end of June 2020, all five transmittered birds were still within the RNRP.

Table 7. Encounter rates of South Island kākā (*Nestor meridionalis meridionalis*) on trap lines within the Rotoiti Nature Recovery Project between October 2019 and March 2020.

Trap line	Hours surveyed	No. of kākā		Encounter rate per hour
		Seen	Heard	(seen & heard)
Anglers Walk	3.7	0	0	0.000
Boundary	3.4	0	2	0.588
Borlase Edge Traps	10.9	0	0	0.000
Black Sheep Gully	7.0	0	0	0.000
Black Valley Stream	3.4	0	0	0.000
Cedar	12.3	4	1	0.407
Clearwater	11.6	0	1	0.086
Dome Ridge	11.2	0	4	0.357
Duckpond Stream	5.1	2	3	0.980
Grunt	10.7	0	2	0.187
Hubcap	8.0	0	0	0.000
Lake Edge	5.5	0	1	0.182
Lakehead	7.5	0	3	0.400
Littledog	26.6	4	3	0.263
MOR	10.0	0	0	0.000
Old Dump Site	3.2	0	0	0.000
Peninsula	5.9	0	0	0.000
Snail	10.3	7	1	0.777
St Arnaud Range Track	2.8	0	0	0.000
Teetotal Road	5.7	0	0	0.000
Total	**164.7**	**17**	**21**	**0.231**

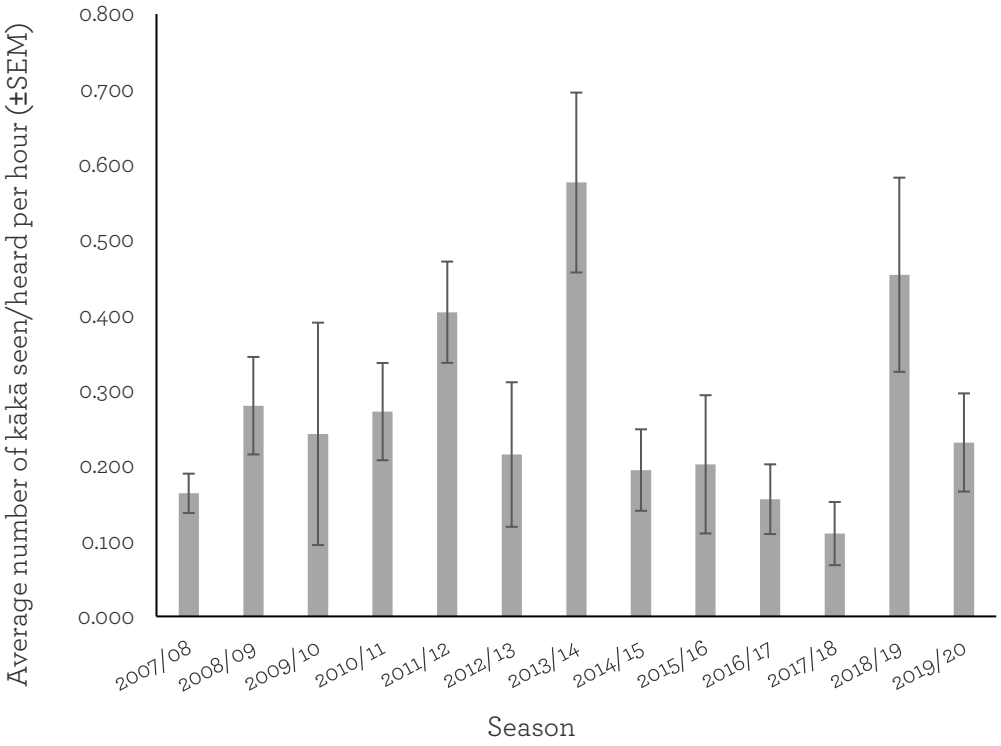

Figure 5. Mean (± SEM) kākā (*Nestor meridionalis meridionalis*) encounter rates (numbers of birds seen/heard per hour) in the Rotoiti Nature Recovery Project from October 2019 to March 2020.

Discussion

The kākā encounter rate was lower in 2019/20 than in the previous season. Unlike 2018/19, there was no beech mast this season, so it is possible that the kākā encounter rate is a measure of how noisy the kākā are rather than an index of the population size, with more calling occurring in large breeding seasons.

The identification skills of the observer may also have affected the results. Volunteers carry out a large number of trap checks but only undertake kākā surveys if staff are confident in their ability to identify these birds. This is reducing both the number of survey hours achieved and the number of surveys carried out on some lines, with volunteers doing the easier trap checks. In addition, the shorter than usual survey period due to the COVID-19 lockdown may have impacted the results this year.

It remains unknown how useful this tool is as a measure of the kākā population size. Therefore, the effectiveness and feasibility of alternative methods should be considered.

2.1.10 Kea nest protection

Introduction

Kea are present in low numbers in Nelson Lakes National Park and monitoring indicates that the population is continuing to slowly decline (Steffans 2009). The primary cause of this decline is likely possum and stoat predation on kea nestlings and incubating adults (Elliot & Kemp 2004). There is also evidence that lead roofing nails and flashings on buildings in the alpine zone (eg huts and ski field buildings) have caused lead poisoning in kea, and many huts in the National Park still have lead components (C. Mosen, Kea Conservation Trust, pers. comm.).

To address the declining kea population in the area, the RNRP entered a partnership with the Kea Conservation Trust (KCT) in 2011/12 to establish nest protection by placing stoat and possum traps around known active nests on the St Arnaud and Raglan ranges.

Methods

In 2019/20, three kea nests were protected in the Wairau Valley, along with an additional nest within the RNRP management area (Figure 6). There is a lot of variation in the level of protection given due to the kea nest trap networks having been established in different years and having expanded slowly over time combined with the difficult terrain making tidy grid patterns unfeasible.

- **Nest 9:** Seven Sentinel possum traps, seven DOC 200 stoat traps and five A24 stoat traps run in a straight line up the ridge where the nest is located; and five Sentinel possum traps and five DOC 200 stoat traps are set out in a line beneath the nest along the valley floor.
- **Nest 5:** Fourteen Sentinel possum traps, ten DOC 200 stoat traps and seven A24 stoat traps are set out in a grid around the outcrop where the nest is located. An existing FOR trap line of DOC 200 and Sentinel traps along the Rainbow Ski Area road also runs 200 m below the nest.
- **Nest 27:** Eleven Sentinel possum traps and eight DOC 200 stoat traps are set out in a 400 × 200 m (8-ha) grid around the nest.
- **Nest 42:** Eleven Sentinel possum traps, three DOC 200 stoat traps, three A12 possum traps and seven A24 stoat traps are set out around the nest. An existing FOR trap line of DOC 200 and Sentinel traps along the Speargrass Track also passes within 150 m of the nest.

To provide protection from the start of the breeding season, kea nest protection trap networks were opened and baited in early July and then serviced monthly. As monitoring of radio-tagged kea and nest sites provided more information on which kea were nesting and where, trap networks around inactive nests were closed. Trail camera monitoring was used to determine nest fate and provide identification in cases of predation.

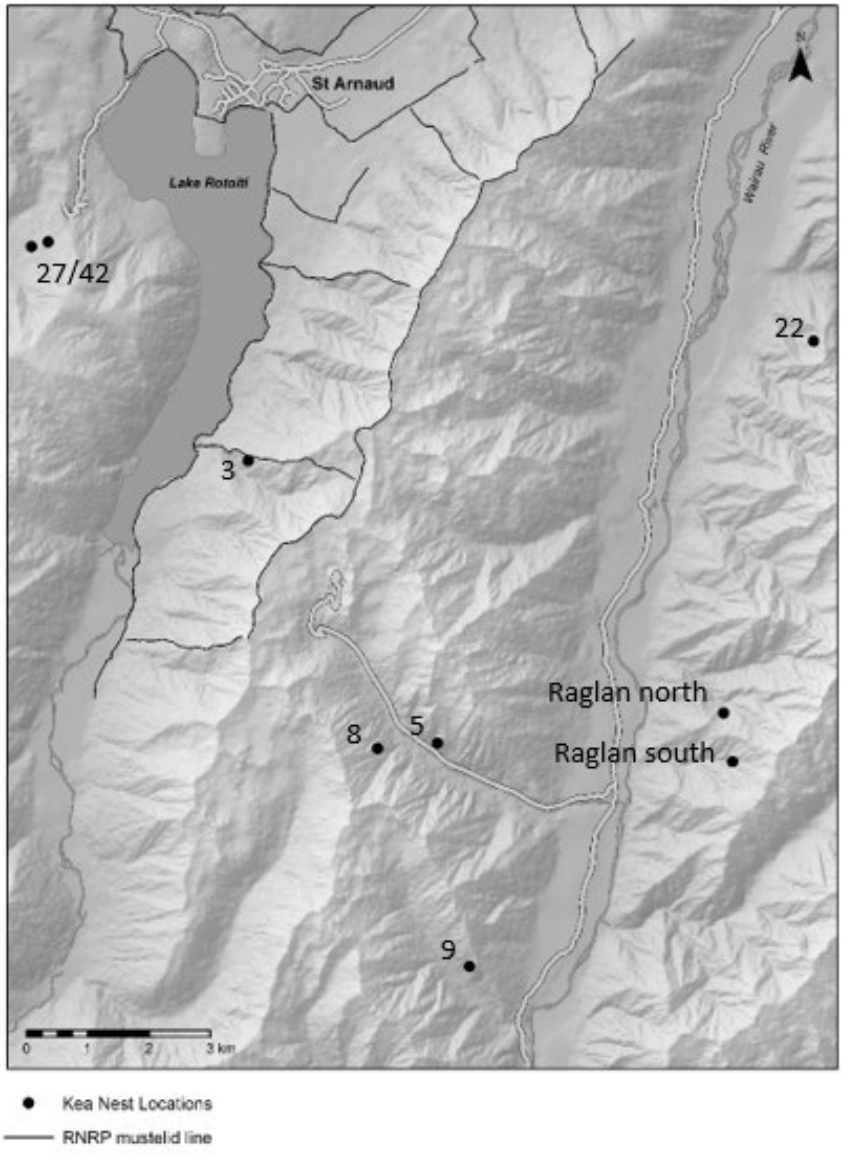

Figure 6. Locations of kea (*Nestor notabilis*) nests in Nelson Lakes National Park in relations to the Rotoiti Nature Recovery Project (RNRP) trap lines.

Results

There were no nesting attempts at on Pourangahau/Mt Robert at nests 27 and 42. Kea were sighted near nest 5, but no nesting attempt was observed. Three chicks fledged from nest 9 (Scuffle).

Discussion

The overall success rate of kea nests in the protection network has been low, with nest 9 having a high proportion of the successes (fledged two chicks in the previous season). This suggests that the location of the nest (nest 9 is in a bluff system) may have a greater effect on nest success than the control work been carried out. Providing adequate protection at nest sites is an ongoing issue.

2.1.11 Mistletoe monitoring

Threatened mistletoe species in the RNRP are monitored to assess the effectiveness of the possum control programme in allowing the recovery of browse-threatened species. This monitoring uses a modified foliar browse index to assess the health of tagged individuals of three species of mistletoe (*Alepis flavida*, *Peraxilla colensoi* and *P. tetrapetala*). It is undertaken every 4 years and is next scheduled for 2020/21.

2.1.12 Pittosporum patulum monitoring

Pittosporum patulum is an endangered plant species that is endemic to the South Island. The RNRP has patches of *P. patulum*, mostly juveniles, which are susceptible to browse by deer and possums. Monitoring of *P. patulum* is used to assess the effectiveness of herbivore control in the RNRP. No *P. patulum* monitoring was undertaken this year. Monitoring is scheduled for the 2022/23 financial year.

2.1.13 *Powelliphanta* sp. monitoring

There is a population of *Powelliphanta* "Nelson Lakes" at the northern end of the St Arnaud Range. This population is threatened by habitat degradation due to ungulates and hares grazing on the alpine plant communities and the rooting activity of pigs, as well as direct predation by exotic birds, rodents and pigs.

Permanent snail monitoring plots were established in 1997 and 1999, which were intended to be measured at 5-yearly intervals to monitor population trends. These were last measured in 2014/15 and were scheduled to be re-measured in 2019/20. However, this could not be fitted into the work schedule due to the COVID-19 lockdown.

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

2.2.1 Introduction

At the time of writing, only roroa have been reintroduced to the RNRP. However, similar reestablishments of whio, tuke and other native species that are known to have previously been present in the area remain as goals for the future.

2.2.2 Roroa population monitoring

Introduction

Roroa were likely present in the Nelson Lakes area early in the 20th century before becoming locally extinct (Steffans 2009). Sixteen roroa 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. However, breeding activity was not as high as expected, so ONE was initiated in 2009 to supplement the population with chicks sourced as eggs from the Gouland Downs and Stockton Mine. In total, 13 chicks and 1 sub-adult were released into the RNRP, but 6 of these chicks died soon after release. The ONE programme finished in the RNRP in January 2016 due to the poor success rate of chicks compared with adult releases.

These translocations resulted in 24 founder roroa establishing in the RNRP, although three subsequent adult mortalities are known to have occurred. The Kiwi Recovery Group advises that translocated kiwi populations should have 40 unrelated founder birds to establish a genetically robust population. Therefore, future roroa management in the RNRP will focus on translocating more adult roroa into the population. In 2016, FOR received funding for this work to be carried out, and 20 roroa are planned to be translocated into the RNRP during 2021 and 2022.

Kiwi call count monitoring was carried out in the RNRP in 2009 and 2011 in an attempt to establish a method for monitoring the trend of the kiwi population. However, low numbers of calls were heard during these sessions and this work was not repeated. In March 2018, acoustic monitoring was carried out for the first time in the RNRP to determine the trend of the kiwi population over time.

Methods

Twenty AR4 acoustic recorders were placed within and around the RNRP (Figure 7). These recorders were placed approximately 1.5 km apart along the St Arnaud Range and up the Travers Valley. The recorders are placed out in March and left in the field for 12 nights. We aim to have 3-4 fine nights in this time to collect good recording data. The recorders are analysed using FreeBird software and compared to pervious years data.

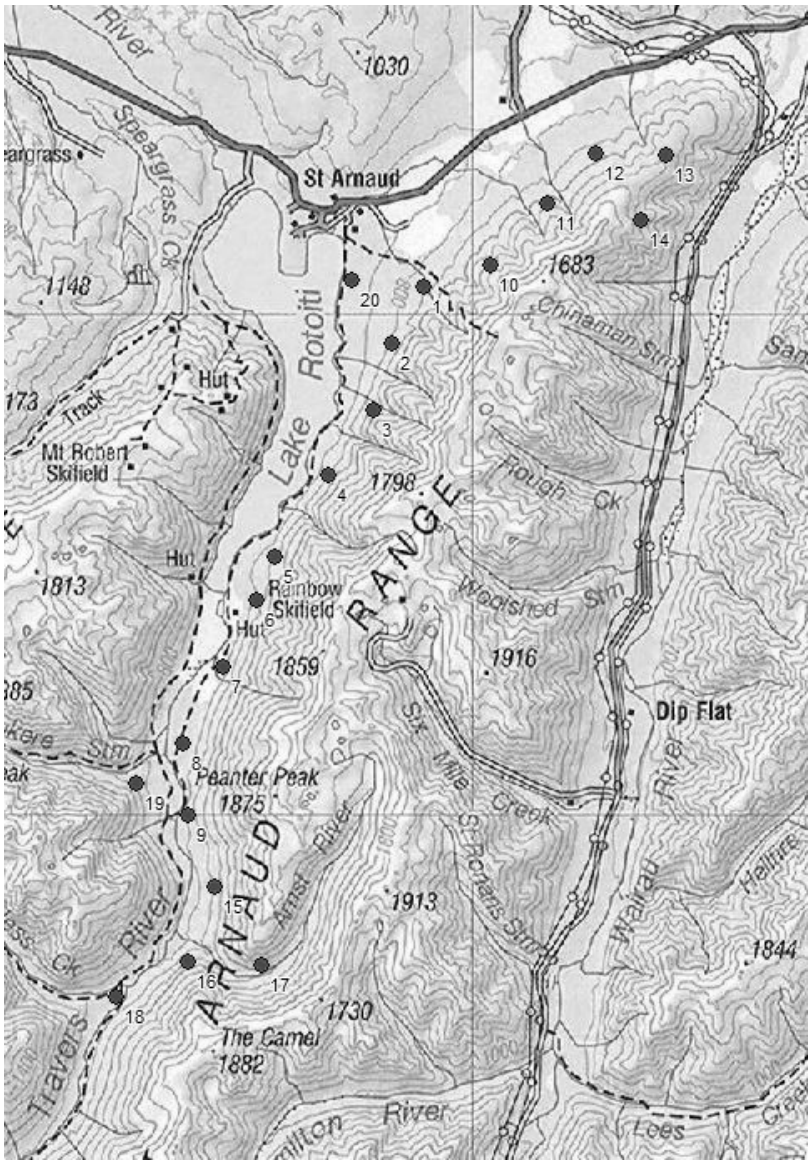

Figure 7. Map showing the locations of acoustic recorder sites for monitoring the roroa (*Apteryx haastii*) population in the Rotoiti Nature Recovery Project.

Results

No data were collected on the location of roroa this season due to problems when programming the recorders and the COVID-19 lockdown reducing the field time.

Discussion

We plan to undertake another round of acoustic monitoring in March 2021 in preparation for territory mapping for the translocation of new individuals in 2022. In 2020/21, monitoring will be undertaken further south in the Travers Valley to determine if roroa are in this area.

3. Learning objectives

3.1 Test the effectiveness of rodent control tools

3.1.1 Introduction

Rodents have a number of impacts on ecosystems, including the predation of birds, invertebrates and seeds and driving of stoat populations (Blackwell 2003; Innes 2010). Rodent control within the RNRP aims to reduce rodent tracking indices to below 5% to protect native passerines from rat predation and prevent associated increases in the stoat population.

Beech seed is an important food source for a number of native species and a driver of their breeding success. However, it also drives rodent population dynamics in beech forests, with large numbers of seeds providing a food source that allows extended breeding of rats and increased rat populations, which cause subsequent increases in stoat populations (Blackwell 2003; Dilks 2003). In upland beech forest, such as is present in the RNRP, ship rats (*R. rattus*) are therefore a periodic threat to forest birds following beech mast events both directly through increased predation as well as indirectly through subsequent increases in stoat numbers.

Ground-based rat control has been carried out in the RNRP using a variety of methods with mixed levels of success. Rat control using the toxins 1080 and brodifacoum was carried out in the core area of the RNRP over 3 years from 1997 to 2000. However, while this was successful in reducing rat numbers, the method was abandoned due to concerns regarding secondary poisoning by second-generation anticoagulants in a suite of non-target mammalian predators and native birds (Spurr 2005). The effectiveness of snap trapping was trialled from 2000 to 2007 but consistently failed to achieve the performance target. A 'detection and staged response' model using 1080 was then trialled during the 2006/07 season but failed to reduce the rat population. No rat control was undertaken in 2007–2009 due to budgetary constraints and concerns about possible non-target effects. Operations using first-generation anticoagulants with pulsed control in spring have been

carried out since 2010 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 a wide-scale beech mast.

Rat control operation decision making is based on a combination of rat tracking indices, beech and tussock seedfall data, and a planning flow chart (Figure 8). Monitoring carried out at the start of 2018 showed that there were low amounts of beech seed (see section 3.3.5 Beech seed monitoring) and low amounts of tussock flowering at Mt Misery (see section 3.3.6 Tussock monitoring). Although tracking rates in the RNRP were high in August 2018 at 45% ± 9%, no rodent control was planned for 2018/19 due to the failure of previous ground-based operations.

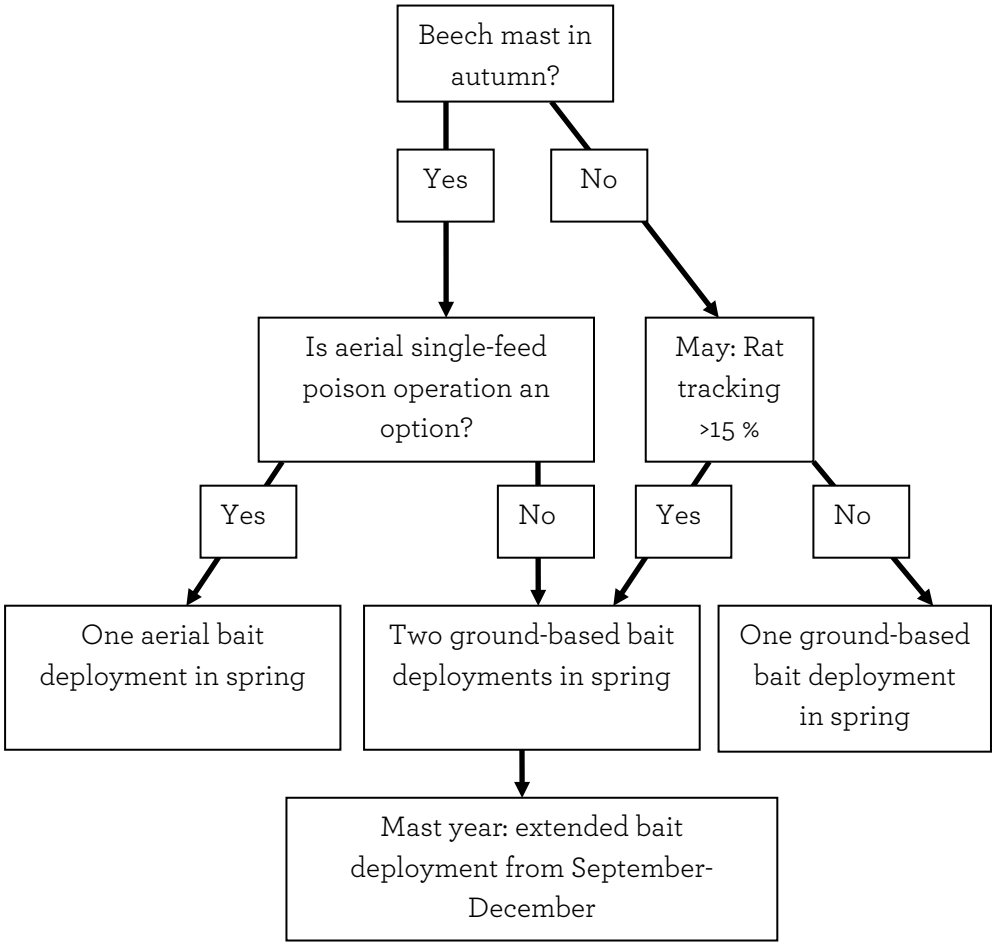

Figure 8. Flow chart for planning preliminary rodent control in the Rotoiti Nature Recovery Project.

3.1.2 Rodent control operation

Introduction

In 2018/19, a large beech mast event occurred in the South Island, including in the RNRP at Lakes Rotoiti and Rotoroa, where record high levels of all three beech species were recorded. In response to this, rat tracking rates started to increase at all three monitoring sites (St Arnaud Range, Big Bush and Lake Rotoroa) and rat tracking in the core area of the RNRP reached 75% ± 8% in May 2019. In June 2019, funding was secured for a pindone operation.

Methods

Prior to undertaking the 2019 rat operation, three different Philproof bait station set ups were trialled to determine if the set up effected accessibility and bait removal by rats. This included a smaller plastic internal baffle designed by Dave Edwards (https://predatorfreenz.org/bait-station-modification-baffles-bait-stealing-possums) and a wire bar across the front of the station.

The set ups of Philproofs trialled were:

- New set up: plastic internal baffle and a wire bar across the front of the stations (Figure 2a)
- Mixed set up: metal internal baffle and a wire bar across front of station (Figure 2b)
- Old set up: metal internal baffle, no wire bar

The stations were filled with cinnamon lured pre-feed pellets and trail cameras were used to monitor rat access of the stations for ten days between July and September 2019.

The pindone operation used Philproof bait stations with plastic internal baffles. The rat control was modified from a 100 × 100 m trapping grid to stations spaced at 50-m intervals along lines that were 100-m apart and followed the contour lines. Pindone pellets were used as the bait, which are green-dyed cereal-based pellets containing 0.5 g/kg pivalyn.

The operation was timed to start on 1 September 2019, with an initial fill of all stations with 500 g of pellets (which was measured in the field by volume, by filling each bait station to the marked line). The operation ended 3 months later, with all remaining stations being brought in by 13 December.

To ensure a continuous supply of bait through the operation, the stations were checked and refilled to the 500-g line during September and October. Trail camera monitoring of the stations during the pre-feed period showed that rats were finding and emptying the stations quickly towards the end of August, so the first check of the stations was made 5 days after the initial fill. Two checks were then undertaken at 7-day intervals after this, and two further checks were made in October as required.

The relative abundance of rodents and mustelids was monitored before, during and after the rat control operation using tracking tunnels within the rat baited area, a mustelid controlled area (using double set DOC 200 traps) and a no control management area.

These sites were monitored in February, May, August (pre-control) and November (Mid way through control) 2019 and February 2020 (post control). An additional monitoring was undertaken in the rat control area in December at the end of the operation.

Further details on the control operation methodology can be found in the Operational Plan (Waite 2019).

Results

The control operation started on 3 September 2019, with the initial fill occurring on 3–5 September for stations in the core area and 11–12 September for stations in the South Blocks (X, Y and Z) (see appendices for additional maps of the bait station lines). Rat tracking rates were low in high-altitude areas, so bait stations were only filled up to 1100 m elevation, giving an operational area of 867 ha.

In the first fill of the bait stations, 1062 kg of bait was put out, which was more than the 963 kg expected to be used if each station was filled with 500 g of bait, reflecting the difficulty in being exact when filling the bait stations by volume in the field.

From 9 September to 1 November, the bait stations were checked for the amount of bait remaining and refilled to the 500-g level if bait had been taken. These checks were undertaken six times in the core area and five times in the South Blocks (although not all lines were checked each time). A further 298 kg of bait was put out during the refills.

A low percentage of bait was taken through September to mid-October, with less than 15% of bait having been taken at each check during this time (Table 8 & Table 9). However, bait take was higher when the final check was made at the end of October, with 21% of bait taken in the core area and 32% in the South Blocks. Random bait stations were checked during November to monitor the levels of take, but no further refills were made.

Table 8. Checks and refills carried out in the core area of the Rotoiti Nature Recovery Project rodent control operation in 2019. There were 1177 stations in this area at the beginning of the trial. All bait was removed from the stations during the December checks.

Date	Check number	No. of stations checked	Person days	Bait take (kg)	Percentage take (%)
9–11 September	1	978	13	21.3	8.7
19 September	2	642	12	37.5	12.5
24 and 27 September	3	368	4	21.5	12.0
3–4 October	4	569	7	38.6	13.6
14 and 16 October	5	349	4	18.5	12.7
30 October and 1 November	6	319	4	28.5	20.6
4–13 December	Pull in	1161		400.5	69.0

Table 9. Checks and refills carried out in the South Blocks of the Rotoiti Nature Recovery Project rodent control operation in 2019. There were 749 stations in this block at the beginning of the trial. All bait was removed from the stations during the December checks.

Date	Check number	No. of stations checked	Person days	Bait take (kg)	Percentage take (%)
18 and 20 September	1	249	8	6.3	5.1
1 October	2	387	4	22.1	11.4
7 and 11 October	3	247	5	16.6	13.5
15 October	4	268	5	21.3	15.8
29 and 31 October	5	330	5	52.8	32.0
4–9 December	Pull in	747		304.2	82.0

The final check and removal of any remaining bait was undertaken from 4 to 13 December. Bait take had increased considerably at this time, with 69% of bait (approximately 400 kg of the 581 kg of available bait) taken in the core area and 82% of bait (304 kg of the 374 kg of available bait) taken in the South Blocks. Over the entire operation, 1360 kg of bait was put out and 238 kg of uneaten bait was pulled in the following December. Thus, total bait take from the operation was 1122 kg or 82.5%, which gives a sowing rate of 1.29 kg/ha.

Bait take was quite evenly distributed over the treatment area, with the exception of one patchy area of low take in the middle (Figure 9). Altitude did not have a noticeable effect on bait take. Only a small number of stations (9%) had no bait taken, with most having between 250 g and 750 g of bait taken (63.6%) (Table 10). The average bait take was 514.6 ± 6.9 g per station.

Table 10. Variation in bait take (g) across the stations in the Rotoiti Nature Recovery Project rat (*Rattus* spp.) treatment area.

Bait take (g)	No. of stations	Percentage of stations (%)
0	175	9.1
1–250	238	12.3
250–500	876	45.5
500–750	348	18.1
750–1000	198	10.3
1001–1500	81	4.2
1501–2000	10	0.5

Figure 9. Map showing bait take (g) from individual bait stations in the Rotoiti Nature Recovery Project.

TRACKING TUNNEL MONITORING

Tracking tunnel monitoring showed an increase in rat tracking in the RNRP between February 2019 and May 2019 (Figure 10), which coincided with the mast beech seedfall event. Prior to the rat control operation in August, rat tracking was high in the treatment area at 62% ± 9%. No monitoring was carried out at the Rotoroa 'no control' site in August due to boat issues, but the May monitoring indicated that rat numbers would also likely have been high then.

Part way through the operation in November, rat tracking in the rat control area had decreased slightly to 54% ± 8%, while tracking in the other two areas had remained at the same level (Figure 10). After the completion of the operation in December, monitoring was carried out in the rat control area only, where rat tracking was 60% ± 5%. By February 2020, rat tracking was at similarly high levels across all three treatment areas (rat control, mustelid control and no control).

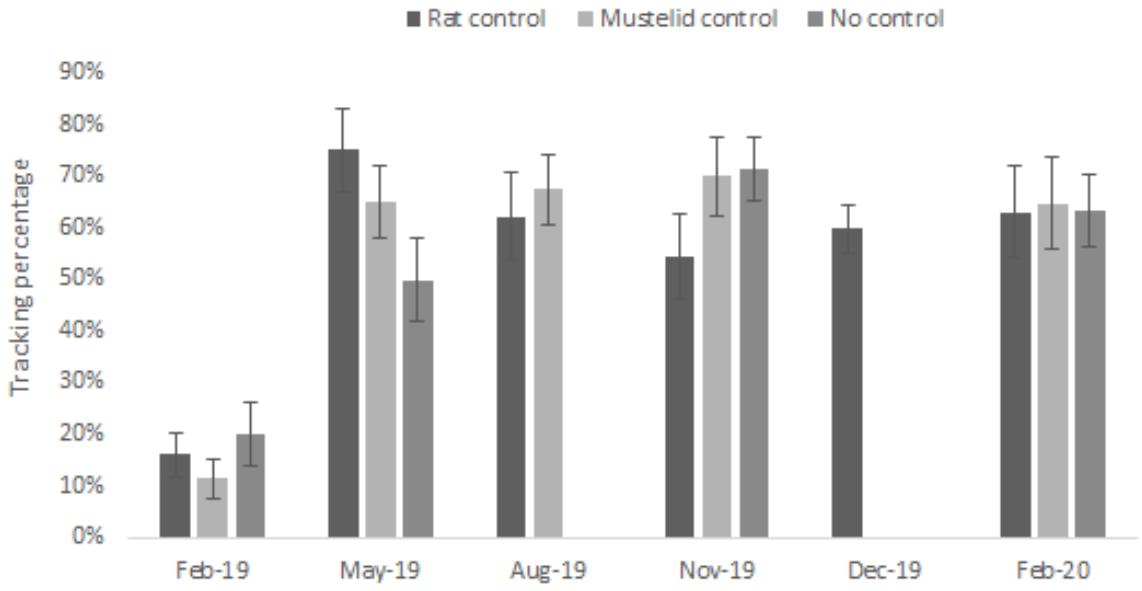

Figure 10. Rat (*Rattus* spp.) tracking tunnel indices in the Rotoiti Nature Recovery Project in 2019/20.

Discussion

The 2019/20 control operation was not successful in reducing rat activity indices below 5% in the core area or South Blocks of the RNRP, with rat tracking indices remaining above 50% for the entire treatment period. Station checks carried out 5 days after the initial fill showed low amounts of bait take, suggesting that it takes longer than 5 days for rats to find and enter stations. The excess of food (beech seed) available in the environment may have also discouraged the rats from seeking out alternate food sources.

Camera monitoring of the old and new bait station set ups showed that rats were entering the front of stations with the new set up more often, although incidences of bait removal were similar between the two designs. Observation of rats at the stations also showed that rats found it easier to enter the new stations, with nearly all individuals using the wire to climb into the front of the

station and stand on, whereas rats used sticks or bridged between the stick and the side of the station with the old set up and it was not uncommon to see individuals fall out. The higher uptake of bait in this operation compared to previous years also suggests that the new set up increased rat access.

The new set up has not being fully tested for native non-target access by weka and kea. Preliminary trials at Abel Tasman National Park showed that small weka were able to reach over the baffle to remove cheese. However, this took some effort and it is unclear whether they would go to the same amount of effort to obtain pellets. Two weka were recorded on camera near stations in the RNRP but showed no interest in bait stations.

Bait take was low until the end of October and then increased to a high level through November. High beech seed germination was also observed from mid-October to mid-November. Therefore, it is likely that rats were more likely to enter stations and increase bait take as the beech seed food source became scarcer.

Bait take during this trial was greater than has been observed with previous ground-based rat control in the RNRP (Harper et al. 2014). However, this did not translate into lower rat tracking indices. This operation may have been more successful had it been allowed to run for a longer period, as rats were taking bait at higher rates later in the operation. More checks in November may also have allowed a continuous bait supply during this time, which could have lowered the tracking rate, although checks of random bait stations during this time showed that bait uptake was patchy.

While there has been mixed success with pindone at many sites, it has been successfully used in many operations at three sites in Fiordland during beech masts between 2009 and 2015 (Hill 2015), with pindone cereal baits in bait stations (one per hectare) having successfully reduced rat tracking to below 1% during beech mast years. These pindone operations have been coupled with possum baiting to reduce possum numbers and non-target bait take. One key difference between operations in the RNRP and Fiordland is that those in Fiordland do not use internal baffles in Philproof stations (made possible by the low possum numbers), which may provide the rats with easier access to the bait. Although plastic baffles appear to be better than metal baffles at allowing rat access, they may still be an impediment. Possum numbers are generally low in the rat treatment area in the RNRP but the presence of weka requires the installation of baffles.

Based on the results of this trial, we do not recommend pindone ground-control operations in beech mast years. However, this leaves few options if aerial control is not feasible. Rat activity indices in the RNRP are high even in non-beech mast years due to the successful control of stoats, which has resulted in observed declines in long-term 5MBCs for native passerines (Whitau 2017). The trialled control method was not able to reduce rat tracking indices sufficiently to protect nesting passerines (ie below 5%), but there is clearly a need for ongoing rat control in the RNRP. Therefore, we recommend trialling this new Philproof set up in a non-beech mast year when rat numbers are not as high.

A full report of the findings of this trial can be found at (Waite 2019).

3.1.3 Rodent monitoring

Introduction

The rodent tracking rate in the RNRP is measured four times each year. This work contributes to a long term data set monitoring the effect of stoat and rodent control on rat populations in the Mainland Island. Rodent control within the RNRP aims to reduce rodent tracking indices to below 5% to protect native passerines from rat predation and prevent associated increases in the stoat population. Comparison are made between the RNRP and the non-treatment control site at Lake Rotoroa.

Methods

Rodent abundance monitoring is carried out in the RNRP and at Rotoroa (non-treatment control) in August, November, February and May each year. However, in 2019/20, Rotoroa was not monitored in August due to boat issues and the May monitoring was delayed to June due to the COVID-19 lockdown. Monitoring is carried out by calculating 1-night tracking tunnel indices using standard 60-cm coreflute tracking tunnels with Black Trakka™ inked cards placed at 50-m intervals along lines spaced a minimum of 200 m apart. Peanut butter is placed on both ends of the base of the tunnel as a lure and left out for 1 fine night (Gillies 2013).

Results

Rat tracking was slightly higher in the mustelid control area (Big Bush) than in the rat control area (core area) in August (

Figure 11). The pindone control subsequently had some effect on rat tracking, with the core area having the lowest tracking in November. Tracking in the core area then increased in February, with all three sites having similar tracking rates at this time. Rat tracking at all three sites decreased considerably between February and June. Mouse tracking was highest in the mustelid control area in August and peaked at the other sites in November, following which it steadily declined until June (Figure 12).

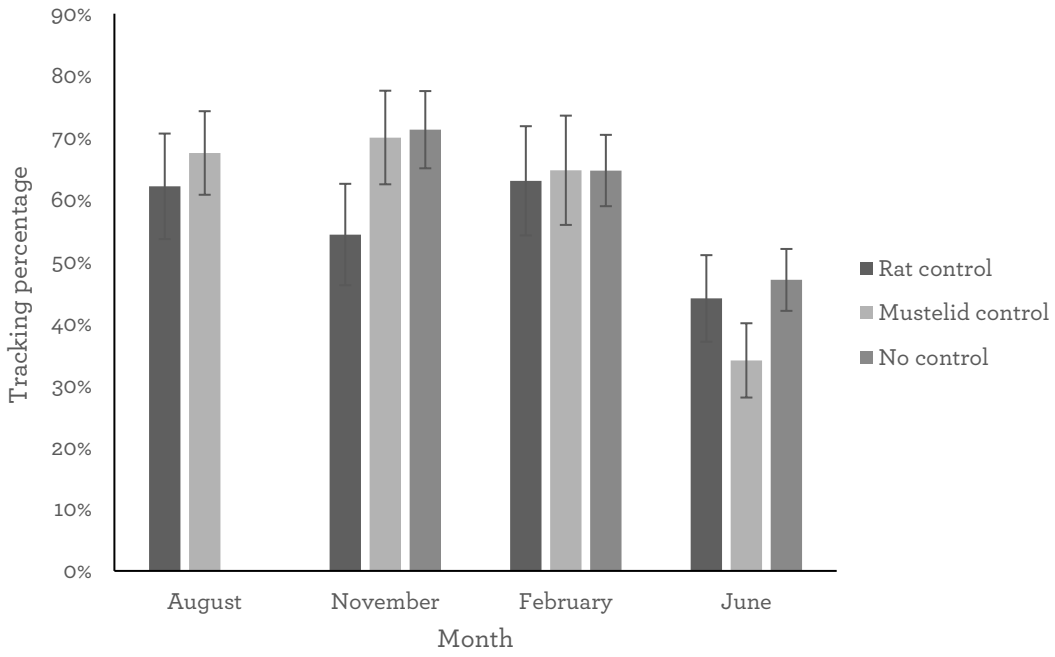

Figure 11. Rat (*Rattus* spp.) tracking rates in the Rotoiti Nature Recovery Project and Rotoroa non-treatment site in 2019/20.

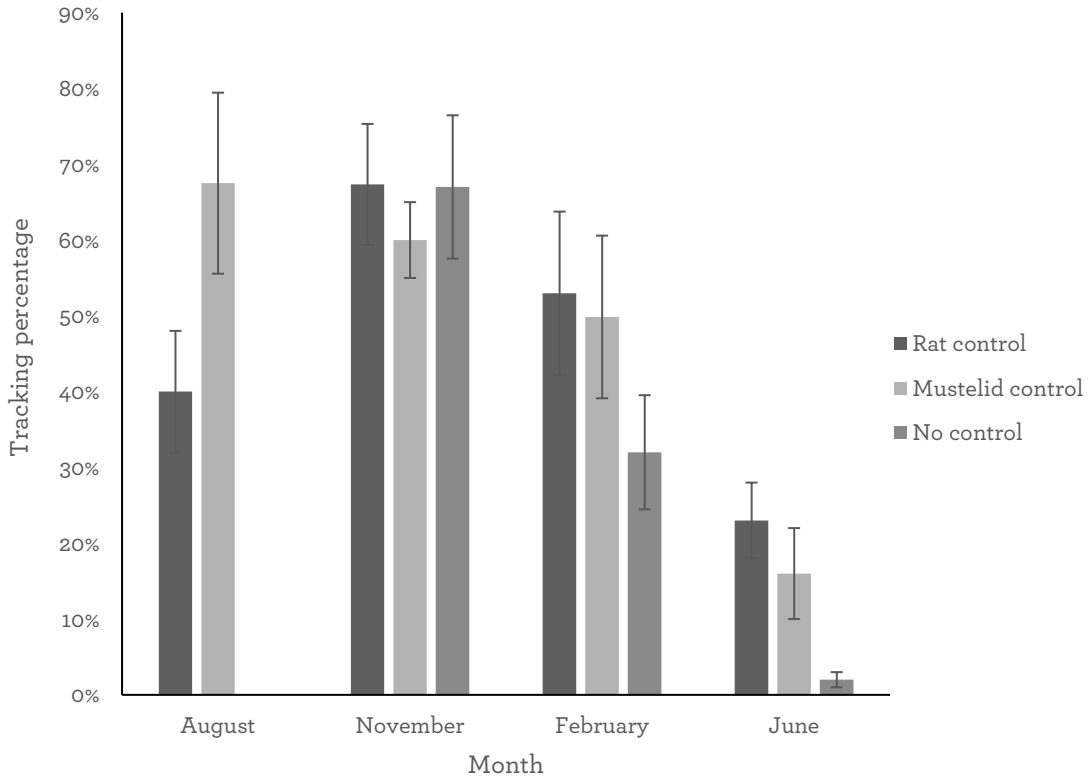

Figure 12. Mouse (*Mus musculus*) tracking rates in the Rotoiti Nature Recovery Project and Rotoroa non-treatment site in 2019/20.

3.1.4 Toutouwai / South Island robin monitoring

The toutouwai / South Island robin (*Petroica australis australis*) is an endemic passerine that has declined dramatically since European settlement, primarily due to habitat loss and mammalian predation, and is classified as Conservation Dependent (Bell 1986; Townsend 1999; Robertson et al. 2016). Toutouwai have been monitored within the core area of the RNRP since 1998/99 to measure the effectiveness of rat control operations. This monitoring was ceased in 2015 due to insufficient resourcing, but a census was carried out in September 2017 as outcome monitoring for the 2016 rodent control operation. No toutouwai monitoring was undertaken in 2019/20.

3.2 Test the effectiveness of wasp control tools

Introduction

Introduced common wasps (*V. 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 honeydew – this reduces the availability of honeydew as a food for native birds, invertebrates and herpetofauna (Harris 1991; Evans et al. 2015)
2. Predating on invertebrates (Harris 1991)
3. Killing bird nestlings (Moller 1990)

Wasps have been controlled in the core area of the RNRP since 1998. This has involved trialling various protein-based baits that mainly contain the toxins Finitron® or fipronil and establishing best practice for wasp control.

Methods

Control operation

The control operation covered approximately 1129 ha of the RNRP and approximately 150 ha of Tasman District Council road reserve around St Arnaud village that adjoins the RNRP. Yellow Wasptek™ bait stations were placed on a 300 × 50 m grid following contour lines and approximately 20 g of Vespex™ bait was placed in each bait station. Any remaining bait was collected 3–8 days later and weighed to determine the amount of bait take.

It is standard practice to monitor wasp visitation on non-toxic protein-based baits prior to a poison operation to ensure the operation will be effective. An average of one wasp per bait is the trigger point for initiating the decision-making process to start a poison operation (for further details, refer to the RNRP field manual (Waite 2020)).

Bait was deployed in the core area and Big Bush area over 11 and 12 February 2020 and all bait was pulled in on 17 and 18 February 2020.

Result monitoring

To determine the effectiveness of the operation in reducing wasp numbers within the treatment area, wasp nest flight counts were monitored using the wasp abundance monitoring protocol (Joice, 2011). Ideally, 10 nests located in each of the treatment area and non-treatment area should be monitored. However, only six nests were found and monitored in the core area and no nests could be found in the Beeby's Knob car park, despite the presence of a large number of wasps and multiple people looking for nests. Therefore, prior to the control operation, the numbers of wasps entering and exiting the six nests in the core area were recorded over 1 minute, with three replicate counts being made. This was then repeated 1 week and 1 month after the control operation.

Outcome monitoring

To determine whether the control operation had reduced the wasp density to a low enough level to provide benefits to biodiversity, the quantity of available honeydew was monitored using the honeydew monitoring protocol (DOC-1529461). Quantities of available honeydew were measured within permanently marked 5 × 50 cm plots on 24 beech trees in each of the core area and Beeby's Knob carpark. The number of honeydew droplets within each plot was counted twice prior to the operation and this was then repeated 1 week and 1 month after the operation.

Results

Control operation

The total bait take by wasps was high in both the core area and Big Bush area, with over 86% of the bait being taken during the week the bait was present in the bait stations (Table 11).

Table 11. Vespex bait take during the 2019/20 wasp (*Vespula* spp.) control operation in the core area and Big Bush area of the Rotoiti Nature Recovery Project.

Total put out (g)	Total brought in (g)	Total taken (g)	Percentage taken (%)
27 237.2	3696	23 541.2	86.43

Result monitoring

Average wasp flight counts at monitored nests within the core area decreased from 57.7 ± 5.9 wasps/min before the operation to 0.2 ± 0.1 wasps/min at 1 week after the operation. Flight counts were not made in the non-treatment area this season.

Outcome monitoring

The quantity of available honeydew within the core area increased an average of 2.46 ± 0.2droplets/plot immediately prior to the operation to 6.7 ± 0.4 droplets/plot at 1 week after the operation and 29 ± 1.8 droplets/plot at 1 month after the operation (Figure 13). By contrast, the quantity of available honeydew in the non-treatment area decreased from 1.5 ± 0.01 droplets/plot immediately prior to the operation to 0.67 ±0.51 droplets/plot at 1 week after the operation and then increased to 5.5 ± 0.5 droplets/plot at 1 month after the operation (Figure 13). This increase at the non-treatment site was at a much slower rate than that observed at the treatment site.

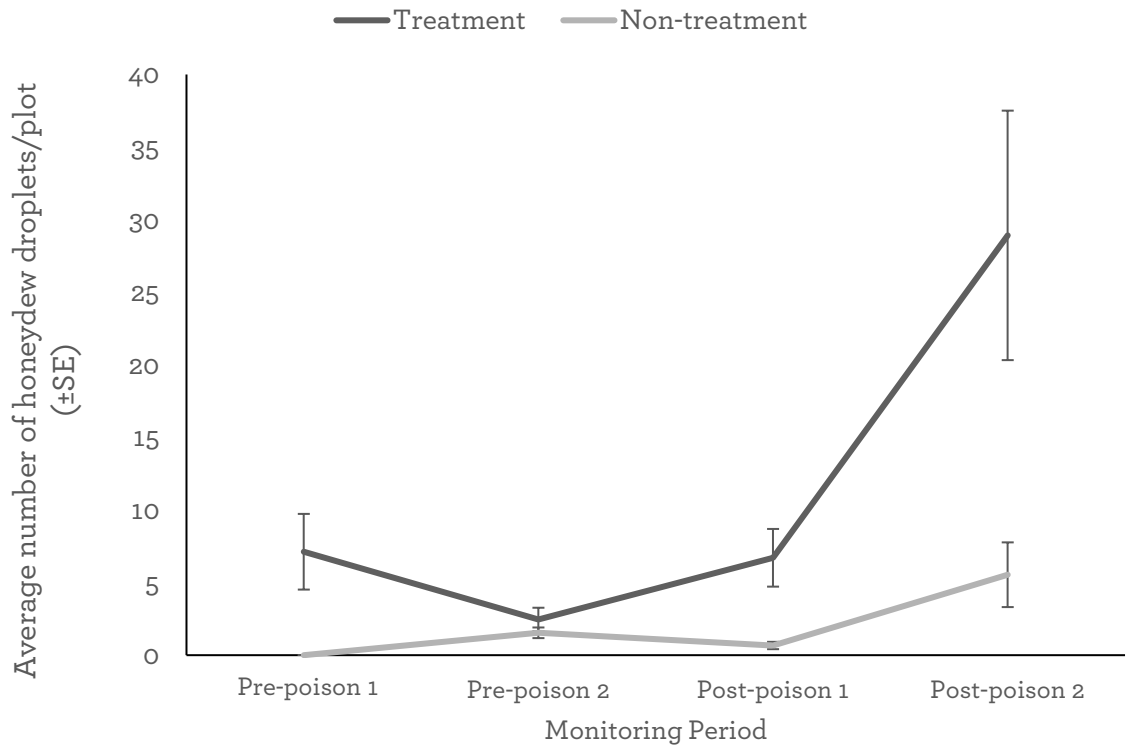

Figure 13. Average (± SEM) number of honeydew droplets per plot within the Rotoiti Nature Recovery Project wasp (*Vespula* spp.) treatment area and non-treatment 1 at one month and 1 week before treatment (Pre-Poison 1 and 2 respectively) and 1 week and 1 months after the baiting operation (Post-Poison 1 and 2 respectively)

Discussion

The wasp control operation met the target of reducing wasp flight counts by 90%, with a total reduction of 99.7% being achieved. The reduction in wasp numbers was also successful in increasing the quantity of available honeydew by the target amount of 80%, with around 12 times more honeydew being available 1 month after the operation than in the pre-operation monitoring in early February.

The success of the wasp operation in the RNRP varies from year to year. In 2019/20, the early summer was wet with much higher levels of rainfall recorded than normal, which likely resulted in a slower increase in wasp numbers and a delay in the time when they moved from carbohydrates to a protein food source. Unfortunately, the inability to find wasp nests at the non-treatment site meant that the wasp flight counts were not a reliable measure of the success of the operation this season.

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

5MBCs are conducted on the St Arnaud Range Track in the core area at Lakehead and along the Mt Misery Track at Rotoroa using the technique detailed by Dawson & Bull (1975). Each site is surveyed three times in each of November, February and May. Count data are analysed periodically, with a recent analysis having been undertaken for data from 1998 to 2015 by Canterbury University Masters student Kelly Whitau (Whitau 2017).

3.3.2 Bat monitoring

Introduction

Long-tailed bats (*Chalinolobus tuberculatus*) are present at Lakes Rotoiti and Rotoroa, although likely in low numbers (Butler 2003). Surveys for lesser short-tailed bats (*Mystacina tuberculata*) have also been conducted within the RNRP but none have been found to date (Butler 2003; Harper et al. 2011). In summer 2018, a pilot study was undertaken using automatic bat detectors to measure a coarse index of abundance of long-tailed bats, and this was repeated in 2019. This monitoring could be repeated annually as a long-term monitoring project to determine how effective pest management within the RNRP is in providing protection to long-tailed bats.

No bat monitoring was undertaken this season.

3.3.3 Lizard monitoring

No lizard monitoring was undertaken in 2019/20.

3.3.4 Vegetation plot monitoring

No vegetation plot monitoring was carried out in 2019/20.

3.3.5 Beech seed monitoring

Introduction

Beech species are an important driver of populations of both native and pest species in beech forests. Mast events, where beech seed is produced in large quantities, can lead to rodent population irruptions and subsequent increases in stoat populations.

Beech seeding levels are monitored to inform pest control decision making, and modelling is used to predict the levels of beech seeding that are likely to occur in different areas of the country. Local monitoring is carried out by collecting branches from the canopy of beech trees at different altitudes using a helicopter and counting the number of cupules. Seedfall tray data are also collected in the RNRP to determine the quantity of seed that will become available to rodents on the forest floor.

Methods

There are 20 seedfall trays located in the RNRP core area and along the Mt Misery track at Lake Rotoroa. Collection bags are fitted in February, replaced in mid-April and removed in mid-June each year. Any seed collected is separated into species, counted and then tested for viability.

Results

Low levels of viable beech seed were found in both the RNRP (16 seeds/m^2) and Mt Misery sites (34 seeds/m^2) in 2019/20 (Figure 14).

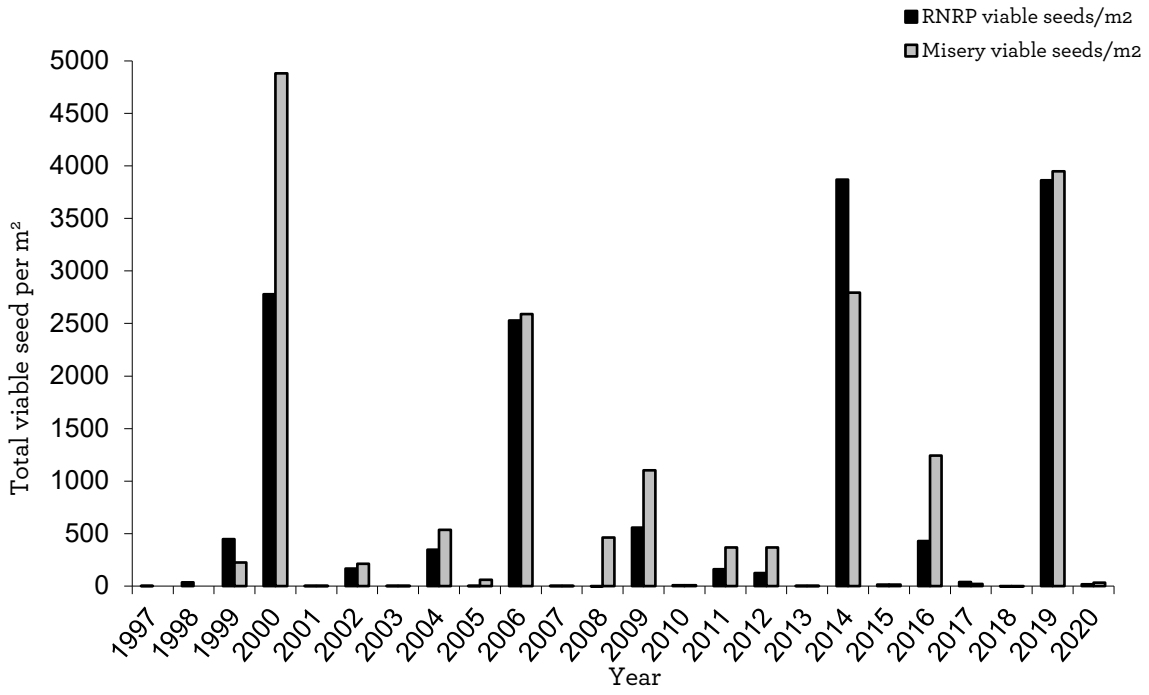

Figure 14. Total viable beech seed from the Rotoiti Nature Recovery Project and Mt Misery from 1997 to 2020.

Discussion

The amount of viable beech seed in the RNRP and on Mt Misery suggest that there was no beech masting in 2020, as levels were the same as in previous non-mast years. Therefore, rodent populations were unlikely to have irrupted.

3.3.6 Tussock monitoring

Introduction

Tussock species in Aotearoa New Zealand are mast seeders and an important driver of mouse population dynamics in the alpine zone (Wilson & William 2010). Tussock monitoring has historically been carried out at Mt Misery and was reinstated in 2010 to continue this long-term dataset.

Methods

The flowering of carpet grass (*Chionochloa australis*) and mid-ribbed snow tussock (*Chionochloa pallens*) was measured on Mt Misery in February 2020 by counting the number of inflorescences of each species within a permanent 20 × 2 m plot.

Results

Low levels of flowering were recorded for both species of tussock in 2020, with a mean of 7.10 ± 1.69 inflorescences/tussock for *C. australis* (Figure 15) and 0.13 ± 0.77 inflorescences/tussock for *C. pallens* (Figure 16). For both species, the level of flowering was much lower than in the previous year and at a similar level to other non-mast years.

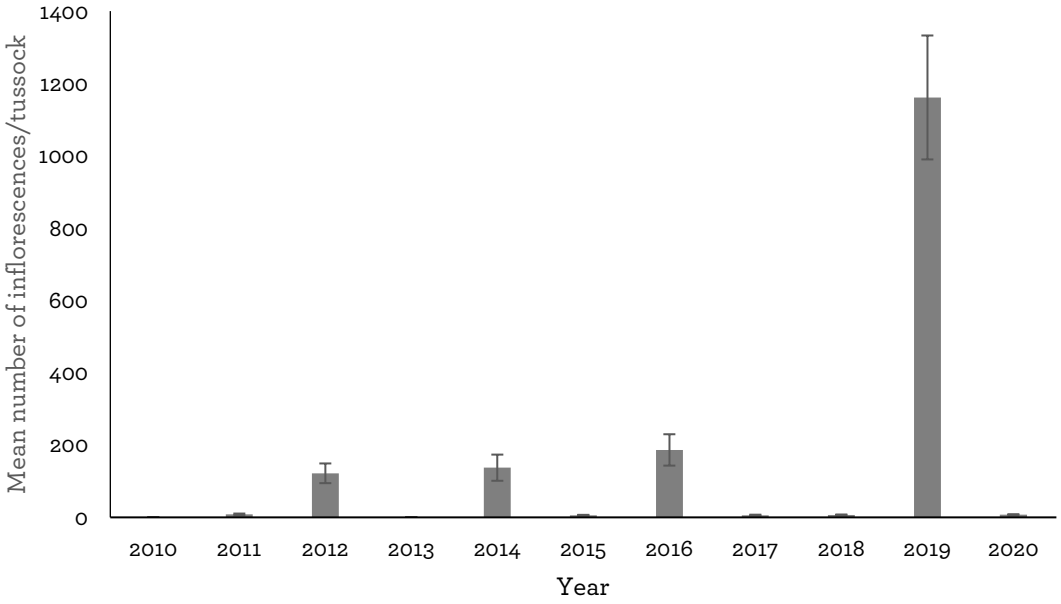

Figure 15. Mean number of inflorescences per tussock recorded in February each year for *Chionochloa australis* within a 20 × 2 m plot on Mt Misery.

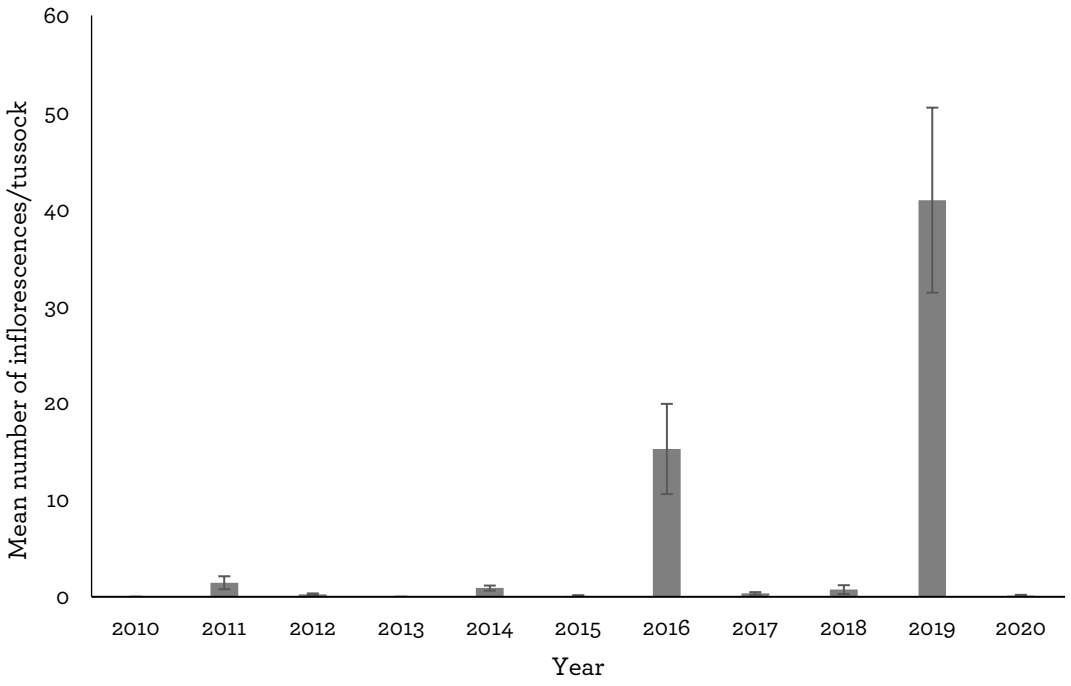

Figure 16. Mean number of inflorecences per tussock recorded in February each year for *Chinonchloa pallens* within a 20 × 2 m plot on Mt Misery.

Discussion

The amount of tussock seeding on Mt Misery suggest that there was no tussock masting in 2020, as levels were the same as in previous non-mast years. Therefore, mouse populations were unlikely to have irrupted in the alpine zone.

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

No new species were observed in the RNRP in 2019/20.

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 there is the possibility of DOC providing logistical support for carrying out field work. However, no external research was undertaken in the RNRP in 2019/20.

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 gains

Analysing and communicating technical information about the effectiveness of management techniques is a key learning objective that links 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

Other than the Annual Report, no reports were generated by the RNRP in 2019/20.

The results of the double-set trap trial and ground-based rat pindone trial completed this season will be published next season.

3.6.2 Hui, workshops, presentations and media articles

No presentations were given by RNRP staff in 2019/20 and no media articles were produced. Staff continued to be involved in assisting with training in an animal pest control methods course and community trapping workshops.

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. Maintaining and continuing to build on relationships with existing partners, such as iwi, FOR and KCT, is considered a high priority, while new partners are also being sought.

4.1.2 Friends of Rotoiti

FOR was formed in 2001 by a group of conservationists who wanted to support the aims of the RNRP. Their efforts are targeted to areas adjacent to the RNRP, providing a line of defence against predators entering it. Volunteers undertake trapping, wasp control, advocacy and species monitoring. In 2016, FOR received funding to carry out the translocation of 20 adult roroa into the RNRP. In 2019/20, FOR volunteers gave 1851 hours of time to various projects, which is the equivalent of 230 person days (based on an 8-hour day).

4.1.2.1 Mustelid control

Mustelid trap lines are maintained by FOR as a buffer to the RNRP, with a total of 302 DOC 200 and 96 DOC 250 traps in operation. Trap lines are checked fortnightly from November to April and then monthly from May to October. Erayz is used in all baited traps and changed monthly.

4.1.2.2 Feral cat control

Cats are occasionally caught as bycatch in FOR mustelid traps, particularly on the Rainbow and Whisky trap lines. FOR members and local supporters also maintain Havahart cage traps targeting cats in St Arnaud village and rural areas adjacent to Nelson Lakes National Park, particularly the Tophouse Road area.

4.1.2.3 Possum control

Sentinel traps are deployed along mustelid trap lines. These traps are baited with Trappers Cyanide Ltd's Possum Dough on the bait clip, and Connovation's Ferafeed Smooth-in-a-Tube is used as a lure on the tree leading up to the trap. Traps are checked and rebaited monthly.

4.1.2.4 Wasp control

FOR volunteers assist DOC staff with the landscape-scale wasp control operation in the RNRP by filling wasp bait stations along the FOR Whisky and Speargrass mustelid trap lines, at St Arnaud Village and along the Travers-Sabine Circuit.

4.1.2.5 St Arnaud village rat trapping

FOR volunteers run a rat trapping programme around St Arnaud village, along the Peninsula Walk, and in the Black Hill and Black Valley Stream areas. Rat trapping is carried out using Victor Professional rat traps in timber tunnels, with mesh ends secured by R-clips to prevent weka interference. Approximately 300 traps are spaced at 25 or 50 m around St Arnaud village. Traps are checked fortnightly and baited with Pics peanut butter.

4.1.2.6 Kiwi monitoring

Following their successful funding application to translocate a further 20 adult roroa into the RNRP, FOR volunteers have been involved in the kiwi monitoring programme. Volunteers have now been trained in data-stream collection and triangulating signals and, in a joint project with DOC staff carry out acoustic monitoring of the RNRP kiwi population.

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

4.2.1 Advocacy

RNRP staff support conservation advocacy at community events. In 2019/20, this included attending the New Zealand Antique and Classic Boatshow and Murchison A&P Show. Staff realise a range of advocacy opportunities by sharing information on items such as local biosecurity issues, home-based predator control and recreation.

4.2.2 Education

DOC's strategy for education is to provide resources for teachers that support conservation teaching and learning or DOC-supported education programmes.

DOC staff at Nelson Lakes National Park have developed a targeted resource for school groups visiting the RNRP called 'A Day at Lake Rotoiti'. This booklet provides an overview of the challenges facing restoration of an area like the RNRP and activities to support primary school students' understanding.

4.2.3 Communication

The quarterly newsletter 'Birdsong'[1] keeps people with an interest in the RNRP and other local DOC activities up to date with the work of staff, volunteers and partners.

The November 2019 edition covered topics such as the mega mast and rat control, as well as items from FOR, the volunteer programme and heritage restoration work.

[1] www.doc.govt.nz/news/newsletters/birdsong/

5. Discussion

The RNRP continues to be a valuable site for undertaking rigorous scientific testing of conservation techniques, as well as protecting the biodiversity values of the honeydew ecosystem. The main body of work undertaken in 2019/20 was the pindone ground-control operation, which attempted to control the rodent population within the core area of the RNRP after the 2018/19 mega beech mast. However, this was not successful in reaching the target of reducing rat tracking to below 5%. Additional funding has been confirmed for the Tiakina Ngā Manu programme to carry out an aerial 1080 operation that covers 33 000 ha of Nelson Lakes National Park and Howard Conservation Area in the 2020/21 financial year.

The nationwide COVID-19 lockdown caused a large disruption to work plans in the RNRP from mid-March to mid-May 2020, and much of the missed work was unable to be rescheduled before the end of the financial year. This work included kiwi acoustic monitoring, snail plot monitoring and pig control, and volunteer deer hunter hours were also likely reduced.

FOR continues to play an important role in the management of the RNRP. The FOR rat and mustelid trap network in St Arnaud village and on the fringe of Nelson Lakes National Park provides a buffer to the control, reducing the reinvasion of predators into the RNRP. FOR has also secured funding to allow the translocation of 20 additional roroa into the RNRP to reach the target of 40 unrelated birds for the founder population.

The Biodiversity team volunteer programme provides an additional boost to staffing levels and ensures that all the fundamental work in the RNRP can be completed over the summer months. The opportunity for the volunteers to be fully immersed in the DOC systems provides them with new field skills and a greater understanding of conservation practice. The experience also gives them contacts within DOC, which stands them in good stead for future employment.

The RNRP strategic plan expired in 2019. Therefore, there is a need for discussion amongst the biodiversity staff around the direction they would like to take with work in the RNRP. This discussion will likely involve input from the Science and Technical teams and may focus on new questions and goals. The future of work in the RNRP will also involve a much greater consideration of environmental sustainability.

6. Recommendations

- Continue with annual acoustic monitoring of roroa.
- Carry out kiwi monitoring further up Travers Valley.
- Translocate an additional 20 adult roroa into the population.
- Continue the mustelid trap box trial for another year without a beech mast.
- Research alternative cat control methods.
- Investigate the feasibility of trapping in the Travers Valley.
- Update the RNRP strategic plan.

7. Acknowledgements

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

We would like to thank our seasonal staff and volunteers for their significant contribution to the RNRP.

We would also like to thank the Friends of Rotoiti for all their dedicated work in predator trapping, wasp control and roroa and kākā monitoring.

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

Members of the Technical Advisory Group and external advisors provided advice at various times during the year (see Appendix 2 for membership).

Finally, we would like to thank Phil and Fiona Borlase for access through their property.

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Appendix 1

A 1.1 Rotoiti Nature Recovery Project datasets

Datasets that are referred to within this report, as well as others that were maintained during the 2019/20 year are listed below.

Table A1.1. Introduced species.

Dataset	**File location**	**Contact person**
Mustelid trapping	Walk the Line	Ricki Mitchell (ramitchell@doc.govt.nz)
Mustelid monitoring	DOC-2637712	
Possum trapping	Walk the Line	Ricki Mitchell (ramitchell@doc.govt.nz)
Possum monitoring	DOC-2514853	
Rodent monitoring	DOC-2722431	
Rodent tracking tunnel results	DOCDM-1261708	
Wasp monitoring		

Table A1.2. Native species.

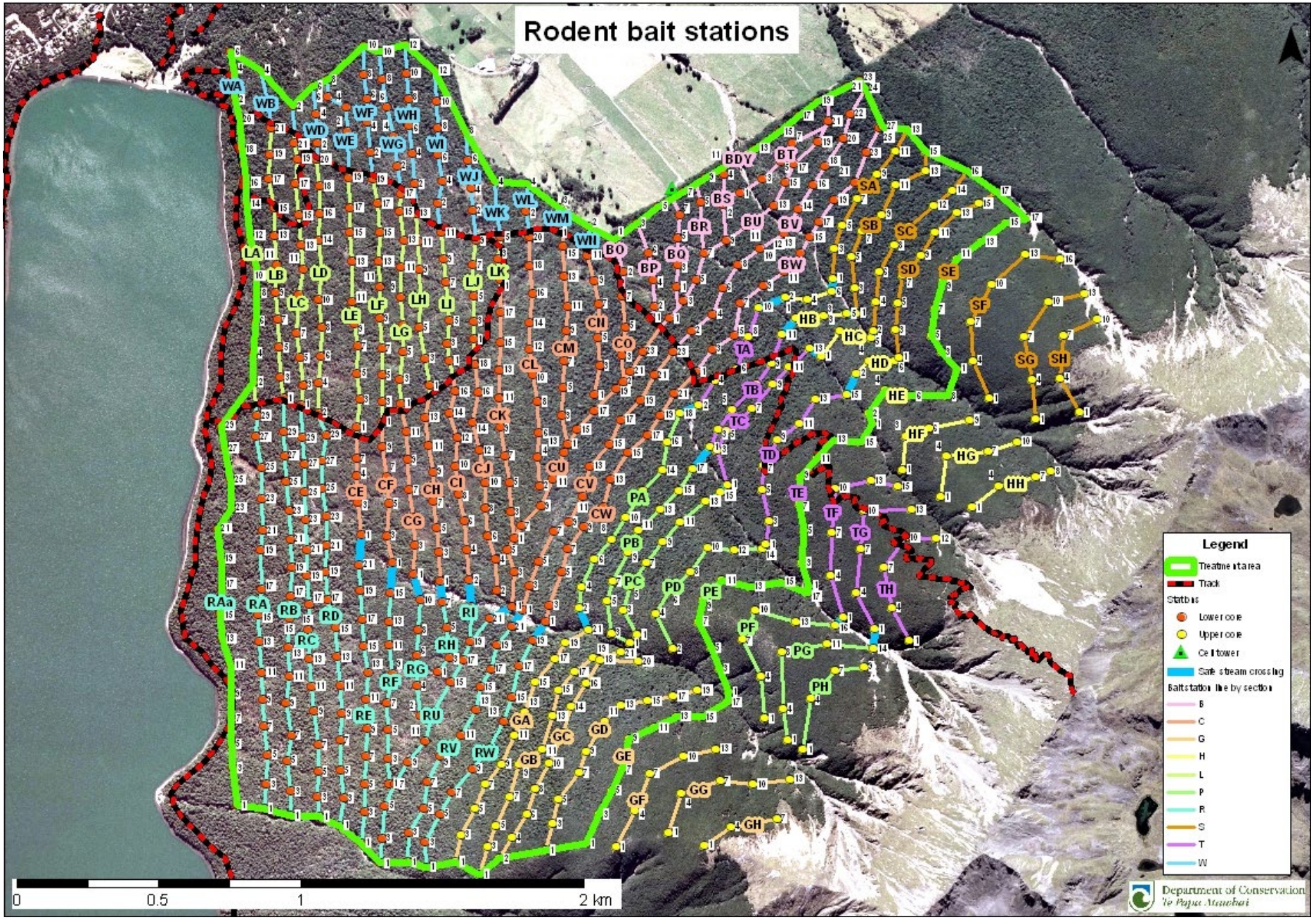
Dataset	**File location**	**Contact person**
Kākā monitoring	DOC-3194334	
Kea nest protection	DOC-1283015	Emma McCool (emccool@doc.govt.nz)
Mistletoe monitoring	DOCDM-72306	Janet Newell (janewell@doc.govt.nz)

Pittosporum patulum monitoring		Janet Newell (janewell@doc.govt.nz)
Kiwi monitoring	DOC-5481521	Emma McCool (emccool@doc.govt.nz)
Bird counts	DOCDM-769826	Emma McCool (emccool@doc.govt.nz)
Beech seedfall	DOC monitoring database	Janet Newell (janewell@doc.govt.nz)
Bat monitoring		Emma McCool (emccool@doc.govt.nz)
Skink monitoring		
Alpine lizard monitoring		

Appendix 2

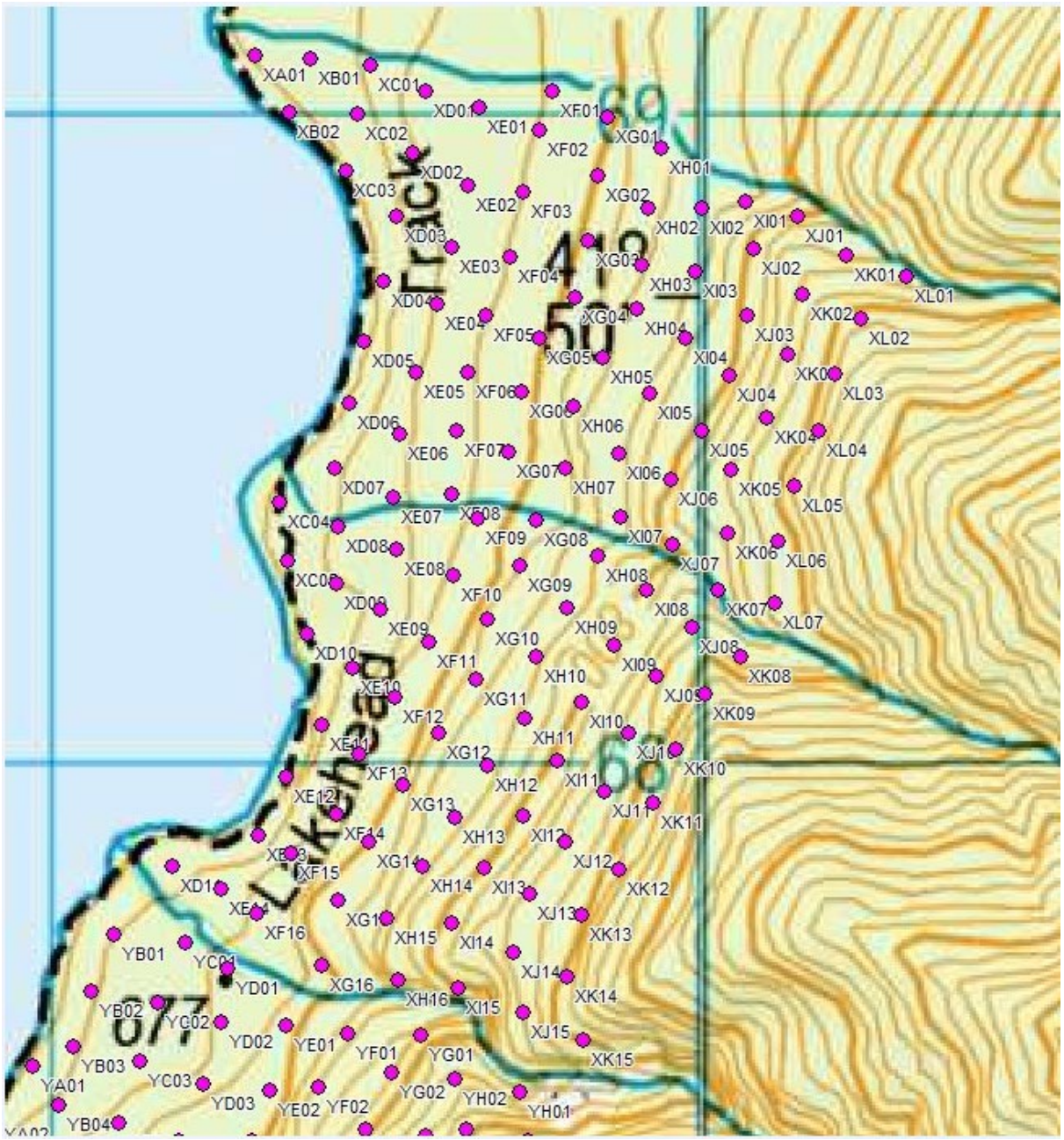
A2.1 Core area bait stations

Location of Pindone bait stations in the Core Area of the Rotoiti Nature Recovery Project. The bold green line indicate the treatment area – stations above 1100m were not baited due to low rat tracking.


Rodent bait stations
Legend
Treatment area
Track
Stations
Lower cone
Upper cone
Cell tower
Safe stream crossing
Bait station line by section
B
C
G
H
L
P
R
S
T
W
0
0.5
1
2 km
Department of Conservation
Te Papa Atawhai

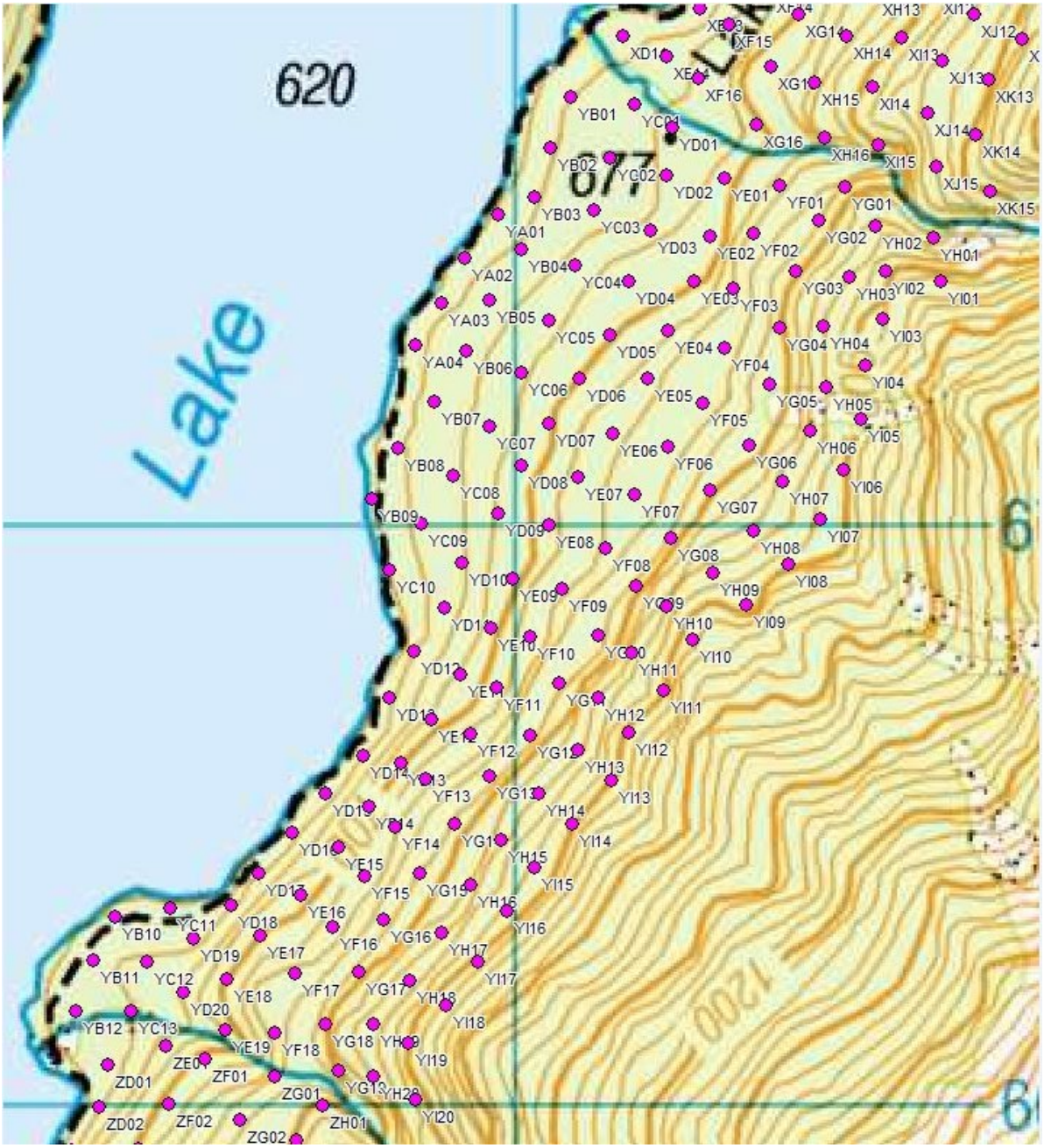
A2.2 X line bait stations

The location of the X line bait stations in the South Block of the Rotoiti Nature Recovery Project. These lines begin where the core lines end.



A2.3 Y line bait stations

Location of the Y line bait stations in the South Block of the Rotoiti Nature Recovery Project.



A2.4 Z line bait stations

Location of the Z line bait stations in the South Block of the Rotoiti Nature Recovery Project.