Heaphy and Denniston Biodiversity Projects

Annual Report

1 July 2023 – 30 June 2024

The Heaphy and Denniston Biodiversity Projects are Department of Conservation programmes established using compensatory funding from Bathurst Resources in recognition of the adverse effects of coal mining activities on Brunner Coal Measure ecosystems at Denniston Plateau.

Compiled by Jane Williams
All photos by Jane Williams unless otherwise specified.
Cover photo: Native pingoa growing in an area that had a marram grass infestation in 2020. Toropūihi beach, northern Heaphy coast.

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Introduction

The Denniston and Heaphy biodiversity management programmes commenced operations in 2014 as compensation, following the granting of Resource Management Act 1991 consents to Bathurst Resources (BR) and an Access Arrangement with the Department of Conservation (DOC) allowing the company to undertake opencast mining activities on Denniston Plateau.

Two sites were selected where funds are spent to manage biodiversity values and threats – Denniston Plateau and parts of the Heaphy River catchment. Biodiversity management activities to be undertaken by DOC at each site were agreed and documented in each of two biodiversity management plans, DOC Denniston Plateau Biodiversity Management Plan 2013–2063 (Farrell 2013a) and DOC Heaphy *Whakapoai* Biodiversity Management Plan 2013–2048 (Farrell 2013b). These plans identify the management areas and describe the management and monitoring activities required to achieve and measure anticipated biodiversity outcomes as specified in the Access Arrangement and Resource Consent.

Details of the allocation and spread of funds between the two sites are set out in a Compensation Deed that forms part of the Access Arrangement and resource consent conditions.

2023/24 is the tenth financial year that compensation funds have become available to implement the Denniston and Heaphy biodiversity management programmes. The Denniston programme focuses on biodiversity threat management, with Bathurst Resources (BR) undertaking the majority of threatened species outcome monitoring. The Heaphy programme covers a wide range of biodiversity management, including biodiversity outcome and result monitoring, inventory, research projects, survey, and pest management.

In the project's tenth year of operation, $495,000 was available to administer and implement biodiversity management plan actions across both sites. This report summarises progress towards achieving the management and monitoring activities set out in the two biodiversity enhancement management plans.

Work achievements against the biodiversity management plan prescriptions and priorities discussed at the Bathurst Project Technical Advisory Group (TAG) meeting are annually updated and are presented in *Appendix 1* (Denniston) and *Appendix 2* (Heaphy). The memo in *Appendix 3* was created to summarise how the project sits within the DOC system.

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Denniston

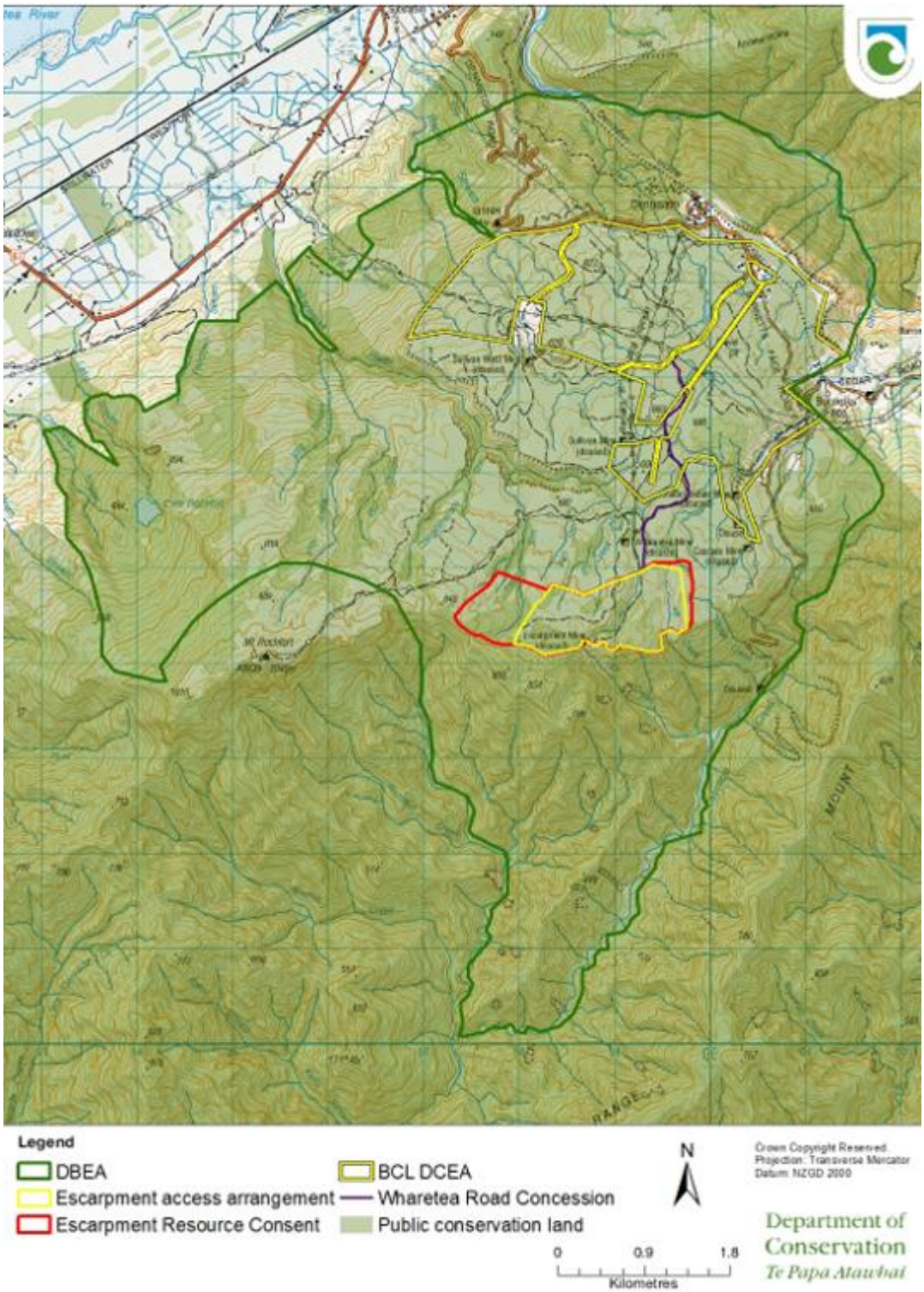


Figure 1. The project area on the Denniston Plateau, including the Denniston Biodiversity Enhancement Area (DBEA) and the Denniston Core Enhancement Area (DCEA).

Highlights

- Recognition of two Nationally Critical species, Avatar moth and a flatworm, within the DOC biodiversity work by the creation of two base plans for future funding.
- Advocacy and very high recapture rates in the lizard monitoring for the only known population of polymorphic forest geckos in New Zealand.
- Widespread control of heath rush along DOC managed tracks in the second of year of targeted control.

The area to be managed by DOC for biodiversity enhancement under the Denniston Plan is the Denniston Biodiversity Enhancement Area (DBEA, 4,400ha) in Figure 1 as identified in Schedule 3 of the Compensation Deed. This area includes the Denniston Plateau and adjacent forested areas in the north, west and south. The Escarpment Mine footprint (106ha) and associated infrastructure are located within the DBEA, as are the Cascade Mine and Denniston township, situated within the northern part.

The DBEA sits ~600m above coastal plains on a steep escarpment. Its geology and vegetation are unique and complex.

The vegetation around and originally within the Escarpment Mine footprint is/was the threatened *Chionochloa juncea* grassland and southern rata/pink pine/mountain beech forest. The majority of the DBEA is part of the Mt Rochford Conservation Area 7546ha and the Denniston Scenic Reserve 683ha (Fig 2).

Figure 2. Public Conservation Land of Mt Rochford Conservation Area (green) and Denniston Scenic Reserve (northern blue area).

Biodiversity management

The purpose of monitoring key species in the Denniston Biodiversity Enhancement Area is to determine whether weed and animal pest control, along with disturbance and habitat loss, are achieving statistically significant and sustained improvements in threatened species populations; a goal specified in the Resource Consent conditions (cl.148) and the outcomes for the Department of Conservation in their task of protecting species in accordance with the Conservation Act 1987: a full range of ecosystems on land, water and sea are protected and enhanced; indigenous species are not threatened with human-induced extinction (DOC Integrated Strategy).

The Compensation Deed (2013) between DOC and BR, a condition of the Resource Consent, outlines DOC will manage threats, pest and weed control in the DBEA (4400ha) and BR will manage species outcome monitoring in the DCEA (~660ha, see Figure 1) to assess these statistically significant and sustained improvements in the threatened species populations listed in Table 1.

Table 1 lists the species within the DCEA listed for outcome monitoring by BR to determine statistically significant and sustained improvement in population abundance as outlined in the Compensation Deed.

Species	Status
South Island fernbird	Declining
Great Spotted Kiwi	Nationally Vulnerable
West Coast green gecko	Nationally Vulnerable
Powelliphanta patrickensis (carnivorous snail)	Nationally Critical
Forest gecko	Declining
Rifleman	Not threatened

Achievement of the specific biodiversity outcomes for the DCEA and the measurement thereof are the responsibility of BR. BR are also responsible for all biodiversity management within their mining footprints and weed control along access roads and within the Sullivan's mine licence area (Fig 3).

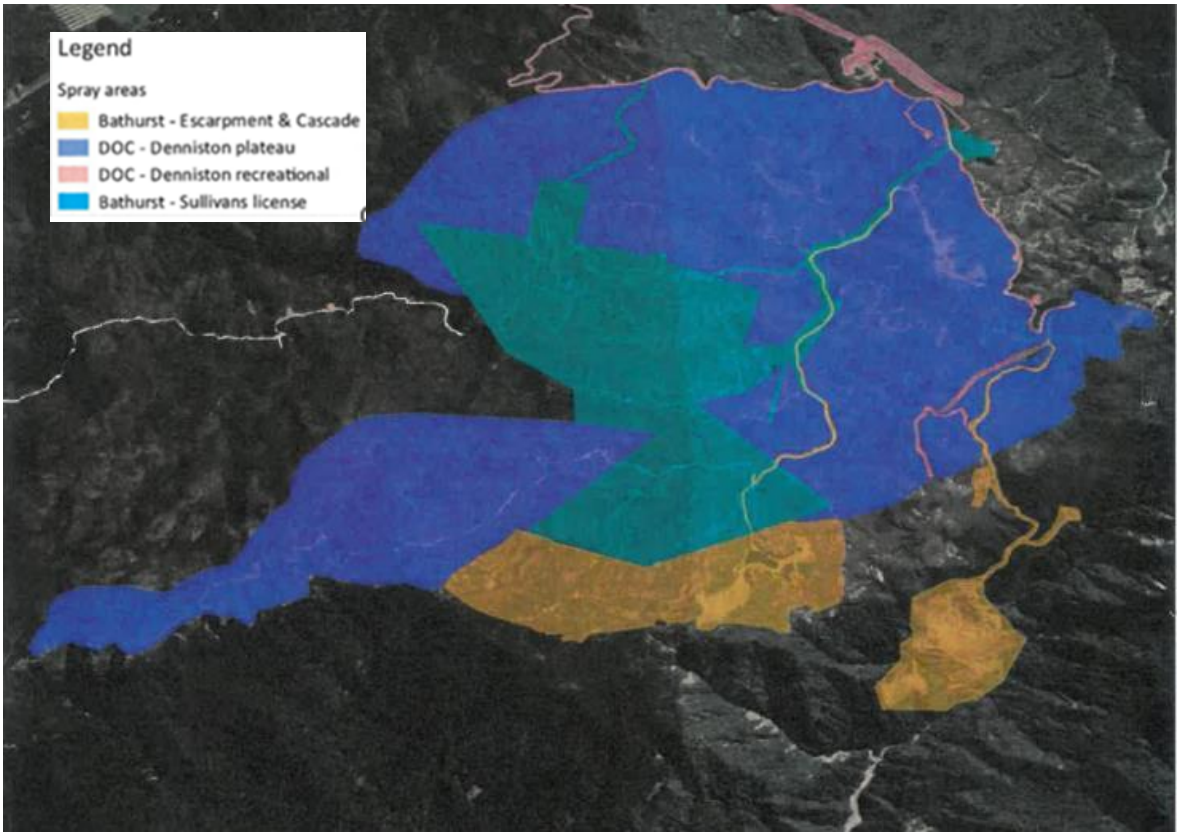


Figure 3. Weed control is managed by the Bathurst Project for the area in ultramarine blue. Weed control in the turquoise (Sullivans Mine licence) and yellow areas (Escarpment and Cascade Mines) are the responsibility of BR.

The Department of Conservation Denniston Plateau Biodiversity Management Plan 2013-2063 outlines many endemic and threatened species threatened by habitat loss, pests and weeds. Table 2 has these and other known threatened species and ecosystems listed on the plateau, along with their threat status.

Table 2. Known threatened species and unique habitats on the Denniston plateau listed in the Denniston Plateau Biodiversity Management Plan 2013–2063 (Farrell 2013a).

Species	Threat classification
Ecosystems[1]	
Manuka shrublands	Nationally Vulnerable
Chionochloa juncea grasslands[2] (Nth Westland snow tussock)	At Risk-Declining
Mountain beech-pink pine forest	Nationally relatively rare
Southern rata forest	Nationally Vulnerable
Ephemeral wetlands	Critically Endangered
Sandstone erosion pavements	Endangered
Seepages	Endangered
Boulderfields of acidic rock	Rare ecosystem
Cliffs, scarps and tors of quartzose rock	Rare ecosystem
Brunner Coal Measures	Internationally significant
Flora	
Chionochloa juncea	At Risk – Declining
Leptospermum scoparium var. scoparium - manuka	At Risk - Declining
Metrosideros umbellate - southern rata	Nationally Vulnerable
Peraxilla tetrapetala[3] - red mistletoe	At Risk – Declining
Euphrasia wettsteiniana - eyebright	Nationally Vulnerable
Carex carsei	At Risk – Declining

Dracophyllum densum	At risk – Declining
Bulbinella modesta	At risk – Naturally Uncommon
Carex dallii	At Risk – Naturally Uncommon
Mitrasacme montana var. helmsii	At Risk – Naturally Uncommon
Sticherus tener – silky fern	Nationally Critical
Sticherus urceolatus	Nationally Critical
Pseudowintera traversii	At Risk- Naturally uncommon
Astelia subulata	At Risk- Naturally uncommon
Metrosideros parkinsonii[4]	Nationally vulnerable
Saccogynidium decurvum (liverwort)[5]	Nationally vulnerable
Isolembidium anomalum var. *anomalum* (liverwort) [5]	Nationally critical
Allisoniella scottii (liverwort) [5]	Nationally critical
Telaranea inaequalis (liverwort) [5]	Nationally endangered
Neogrollea notabilis (liverwort) [5]	Nationally endangered
Pycnothelia caliginosa (lichen)	Nationally endangered
Icmadophila splachnirima (lichen)	Nationally vulnerable
Austropeltum glareosum (lichen)	Nationally endangered
Pertusaria dennistonensis (lichen)	Data deficient
Fauna	
Apteryx haastii[6]- Great Spotted Kiwi	Nationally Vulnerable
Bowdleria punctata punctata- SI Fernbird	At Risk – Declining
Anthus novaeseelandiae novaeseelandiae- Pipit	At Risk – Declining
Gallirallus australis australis- weka	At Risk – Declining
Acanthisitta chloris chloris – SI rifleman	At Risk - Declining
Naultinus tuberculatus – West Coast green gecko	Nationally Vulnerable
Mokopirirakau granulatus- Forest gecko	At Risk – Declining
Oligosoma newmanii – speckled skink	At Risk – Declining
Powelliphanta patrickensis- carnivorous snail	Nationally Critical
Kokira miharo - caddisfly	Nationally Vulnerable
Dodonidia helmsii - butterfly	At Risk – Declining
Tmetlophota blenheimensis - moth	At risk – Naturally Uncommon
Kokira miharo - caddisfly	Nationally Vulnerable
Arctesthes avatar - Avatar moth	Nationally Critical
Spathula neara- flatworm	Nationally Critical
Rygmodes alienus	Threatened or At Risk
Paranephrops planifrons - koura	Declining
White-faced cave weta	Nationally Endangered
536 indigenous invertebrate species, 12 new 2013	
36 bird species, 31 indigenous, 13 Threatened or At Risk	

[1] Naturally rare ecosystems are defined as ecosystems that naturally have a total extent of less than 0.5% (<134,000ha) of New Zealand's land area (Williams *et al.* 2007). Six of these ecosystems occur on the Denniston Plateau, with three considered threatened

[2] Endemic of Brunner coal measure habitats, has its stronghold on the Denniston Plateau.

[3] They represent the largest known occurrence of this species in the Ngakawau Ecological District.

[4] Disjunct distributions making their occurrence on the Denniston Plateau regionally significant. (Overmars 2012).

[5] These liverworts are from only the Escarpment Mine area, one or two other threatened liverwort species exist in other parts of the plateau, including undescribed species not known about in 2013 (David Glenny, Landcare Research, pers. comm. 3 August 2024).

[6] On the Denniston Plateau, Great Spotted Kiwi, *roroa,* have been found around the entire periphery of the upper Plateau in or near adjacent forest, and throughout the area south of the Whareatea River and west of the Escarpment Mine road.

Lizard Management

In February 2014, BR contractors deployed 450 artificial cover objects at five sites (90 per site at a density of 10/ha) in the DCEA. The sites were randomly chosen.

The ACOs are made of 2 layers of 0.5m x 0.5mm onduline (Fig 4) separated with 10mm wooden dowel. Monitoring of forest geckos was done for two seasons 2014-2016, following the Escarpment Lizard Management Plan which lists the monitoring outputs:

(1) Determine baseline lizard distribution and abundance

(2) Detect population changes over time

(3) Detect effects (positive or negative) of pest control on lizards

Figure 4. Artificial Cover Object (ACO).

In 2021/22 DOC sourced advice from conservation scientist Nathan Whitmore on modelling to seek the power needed to detect trends and population change in forest and green geckos in a 10-year timeframe. Following recommendations based on this modelling DOC began a mark and recapture study in 2023 using photo ID of dorsal markings to determine abundance within a season and survival between seasons.

In a closed experimental design, DOC staff and volunteers conducted lizard counts in four grids, three times within one month in Autumn. Forest geckos (Fig 5 and 6), and the occasional skink caught as by-catch, were measured.

Figure 5. Forest gecko, *Mokopirirakau granulatus*, from Denniston Plateau. This population is the only polymorphic population known in New Zealand. Polymorphism (occurrence of two-colour variants in the same area) confers to a species resilience to environmental variability. Maintenance of this population is therefore important to ensure the long-term viability of forest geckos nationally (Tocher 2012).

In this second year of a three year mark and recapture study, Grid A continues to be the most populous. From 90 artificial cover objects 65 geckos were captured, 2/3 were recaptures. The average recapture rate over three checks for all Grids was 40%, compared to 41% in 2023. There was a noticeable increase in juvenile gecko captures and noticeably less variation of colour and pattern. The results can be seen in Table 3 for 2023 and Table 4 for 2024.

The average % of juveniles this year was 63% as opposed to 24% in 2023. In Grid A no geckos were found when there were ants nests under the tiles. A recommendation has been made to move the eight ACOs affected and to identify the ant species.

Members of the DOC lizard TAG group say 5-10% recapture for gecko or skink species is high with mark and recapture studies. Grid A continues to have the highest abundance and highest recapture rate at 66% (69% in 2023).

There was an increase in number of geckos caught for Grids B, C and E. Grid C had 27 geckos, 9 more than the previous year, and an average 56% recapture rate. Grid E had 8 geckos, 4 more than the previous year, with a 38% recapture rate.

There is huge variability in abundance between the grids. “These results signify there is a large variation in suitable habitat for these geckos on the plateau and checks for good habitat would need to be thorough and early if disturbance where to occur, due to the time it takes the geckos to move into the ACOs.” (Marieke Lettinck, lizard consultant, 2023)

Figure 6, left. Forest gecko *(Mokopirirakau granulatus*) from Denniston.

Table 3. Results of forest gecko monitoring from 2023.

Grid - 2023	A	B	C	E
Measured	85	1	18	4
Recaptured	59	0	8	2
Recapture rate	69%	0	44%	50%
Juveniles>10g	24	0	8	1
Live Powelliphanta	0	8	4	3
Disturbed	0	0	1	9
Skinks	12	10	0	0

Table 4. Results of forest gecko monitoring 2024.

Grid - 2024	A	B	C	E
Measured	65	3	27	8
Recaptured	43	0	15	3
Recapture rate	66%	0	56%	38%
Juveniles>10g	26	3	17	4
Live Powelliphanta	4	6	5	5
Disturbed	8 (ant nests)	0	2 (+mouse)	4
Skinks	22	10	3	0

Also found under ACOs in 2024 were-

- An increase in number of Newman's skinks (35:22)
- An increase in disturbance in Grids A and C within the 10-day checks (by humans)
- An increase in the number of live *Powelliphanta patrickensis* under ACOs (20 in 2024: 15 in 2023)
- Ground weta still found in good numbers
- One gecko with a condition, Pseudobuphthalmos, caused by the blockage of a tear duct (Fig 7).

Figure 7. Forest gecko with Pseudobuphthalmos. This condition subsided over the three checks.

Snail Plots

The publication "Conservation status of indigenous terrestrial Gastropoda taxa in the family Rhytididae (carnivorous snails) found in New Zealand, 2022" moved the threat status of *Powelliphanta patrickensis* (Fig 8), found only on the Denniston Plateau, to Nationally Critical. The contributing factors for this classification are-

- fragmented population
- in one location only
- habitat degradation/loss
- climate change impact
- predation

"The land snail *Powelliphanta patrickensis* is endemic to the Denniston and Stockton Plateaux. Its distribution coincides markedly with the extent of Brunner coal measures in the area suggesting that the species is an obligate coal measure species. *P. patrickensis* occurs throughout the Denniston Plateau, down to about 500m asl in the north and as far west as V72 Stream and Mt Rochfort. The areas adjacent to the Whareatea River gorge support some of the highest population densities known for this species." (Farrell 2013, DBEMP)

Currently there is a regime of aerial predator control on the Plateau every 3 years for the protection of threatened species. The last operation was September 2023, previously September 2020.

Snail plot monitoring of 21 plots was carried out by the Biodiversity Monitoring Team in March 2024. Compared to 2021 the monitoring showed less live snails and more rat and weka predation.

Figure 8. Juvenile Powelliphanta patrickensis under an ACO (left).

Summary by Biodiversity Monitoring Ranger, Daniel Papworth.

Full report in Appendix 4.

Powelliphanta patrickensis is an endangered species, endemic to the Denniston and Stockton Plateaus. The primary threats to this snail are loss of habitat, primarily through mining activities, predation from introduced predators, and changing climactic factors. Monitoring of the snail on the Denniston Plateau started in 2007 to assess predation and follow population trends over time and has since been repeated in 2012, 2017, 2021, and 2024. The 2024 data found fewer numbers of live *P. patrickensis* compared to 2021. There is a declining trend in live snail numbers since monitoring started in 2007. However, this trend has not displayed statistical significance, this is primarily due to the large variation in the data set so far. Nearly half (44%) of all shells found were whole empty shells. There is an increased number of rat preyed shells found during 2024, this has been increasing since 2012. It is suggested rat control may be beneficial over the Denniston plateau. We also recommend continuation of the monitoring, next due in 2027.

Results

Since 2007, 41% of plots have never recorded a live snail and most (77%) have recorded snail presence (either a live snail or a snail shell). When excluding the abandoned plots 23% have never recorded a live snail and 100% have recorded presence. Plots 5 and 43 have contained the most live snails on average over time (4), and plot 5 also has the most shells found on average over time (19.4). Plots sample a mix of habitat types across the Plateau, and there appears to be little correlation between habitat types and snail density, with live snails found at varying densities across a range of the habitats.

The 2024 data shows that the absolute number of shells preyed on by rats has increased since the 2021 measure (Fig 9). This upwards trend is statistically significant (P=0.01). We also found that the absolute number of live snails found was the lowest since monitoring began. However, this difference was not statistically significant (P>0.05) due to the large variability in the data set.

Whole shells are consistently the most common type of empty shell found in all years. The percentage of live snails found on the monitoring plots has declined overall since 2012 with a slight increase in 2021, falling back to similar levels as found in 2017. The proportion of shells found to be preyed upon by rats increases after 2012 whereas the proportion found to be preyed upon by weka and possums remains relatively constant, but low, over time.

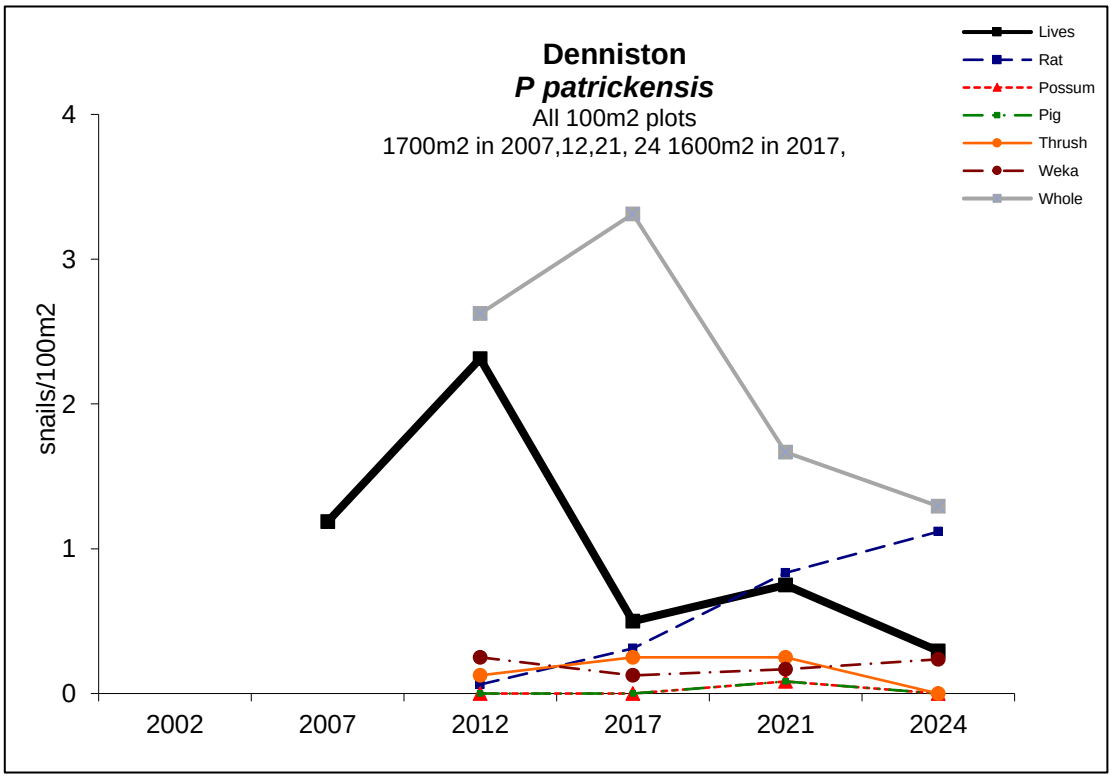


Figure 9. Number of live snails and snail shells (by predator) per 100m^2 on the Denniston Plateau. Data from empty shells collected during the first measurement (2002) of the initial 17 snail plots have not been included in the results, because the time over which the shells accumulated on the plots is unknown, meaning the data are not comparable to subsequent measurements.

Threatened Plants

Euphrasia wettsteiniana, common name “eyebright” (Inset Fig 10), is streamed for management due to its threat status as Nationally Vulnerable. Its threat status highlights the need to keep a mosaic of this herb across the Denniston Plateau intact, to prevent extinction from continuing habitat fragmentation, habitat loss and encroaching weeds.

In 2023-2024 Jane Marshall, DOC botanist, studied samples of *Euphrasia wettsteiniana* and *Euphrasia disperma* to discern if all flowers found on Denniston were *Euphrasia wettsteiniana.* There have been historical identifications of *Euphrasia disperma* on Denniston. Jane was confident all the individuals at all three sites/altitudes studied on Denniston hill, fit within the description of *E.wettsteiniana*. The higher altitude plants had shorter corollas than downhill but were still larger than the biggest *E.disperma*. There was a lot of variation in colours. Jane recommends a molecular study be carried out.

Figure 10. Botanist Jane Marshall measuring *Euphrasia wettsteiniana* above 600m a.s.l on Denniston Plateau. Inset: *Euphrasia wettsteiniana* flowers.

Pest plant management

In 2023-2024 there were 641 hours of weed control undertaken over 140ha (map Fig 11). Table 5 shows the breakdown of contractor/DOC hours spent on weed control, and focus areas.

Table 5. Contributors to weed control on Denniston plateau 2023/24 and areas treated.

Weed Controller	Hours	Weed Species	Area
DOC	216	Gorse, broom, heath rush, matt grass	Along roads/tracks- Burnett's Face Rd, Whareatea Mine Rd, Coalbrookdale track, Brakehead.
MBC	48	Gorse, banana passionfruit, Kahili ginger	Denniston Rd gorse, ginger, banana passionfruit control.
West Coast Ecological Services	150	Gorse, heath rush	NE plateau along tracks and road.
Wildlands	227	Gorse, broom, heath rush	Wharatea Rd to Mt Rochfort, Coalbrookdale track, Burnett's Face Rd.

A range of weeds have been introduced to Denniston plateau, primarily associated with human activity. Gorse (*Ulex europaeus*), matt grass *(Nardus stricta*), and heath rush (*Juncus squarrosus*) with localised pockets of broom (*Cytisus scoparius*) are distributed around sites of road and track development, human habitation, and centres of historic mining activity.

A range of other introduced plants have established around old house and community building sites. Gorse has a 70-year seed bank in soil therefore requires constant vigilance and follow-up control. Heath rush and matt grass outcompete native species and are an anathema to the threatened snail and lizard populations on Denniston.

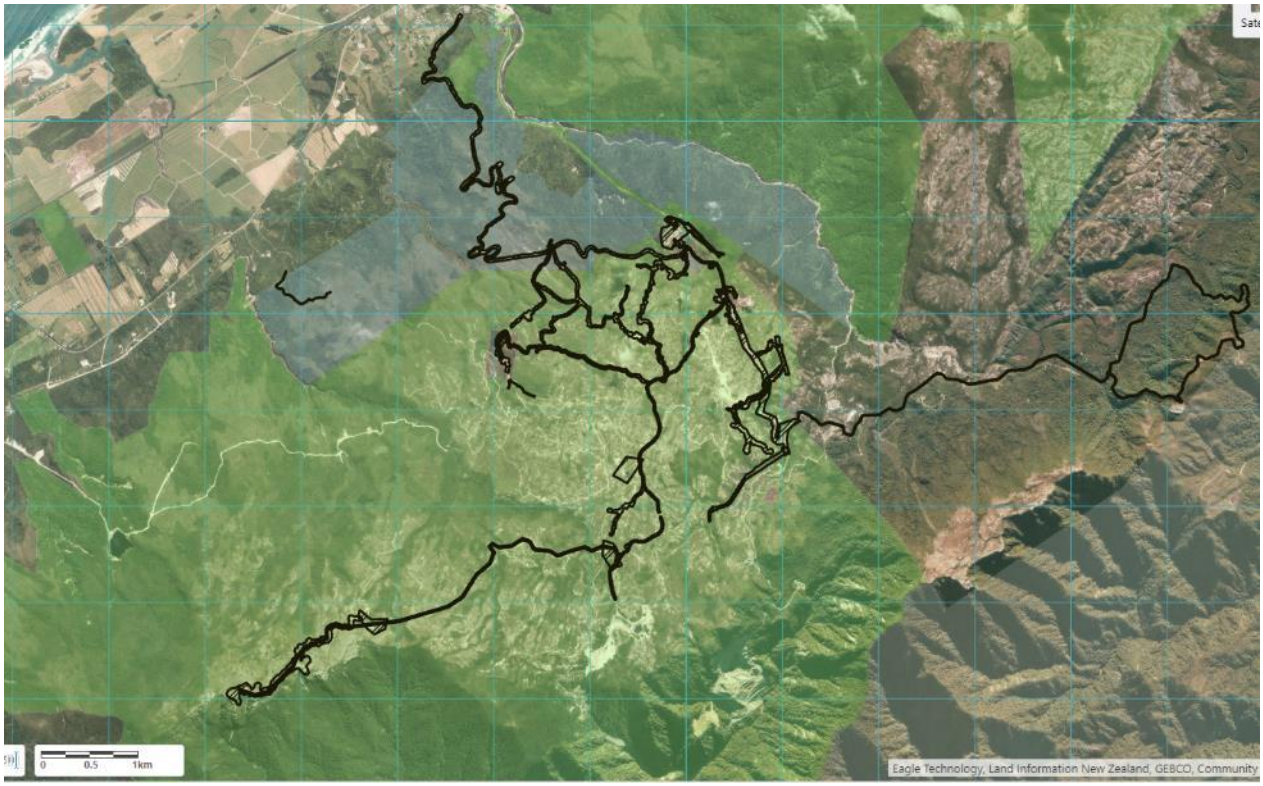


Figure 11. Areas of weed control in black, carried out by DOC, Wildlands, WCES and MBC in the 2023/24 FY.

Following guidance from the *Denniston Weed Control Plan 2020-2025* (Huggins 2020), this year's weed control continued along and around roads, tracks throughout the DBEA. Figures 12 and 14 show successful heath rush control along Wharatea Rd and the Coalbrookdale track respectively. Figure 13 shows broom control, before and after control.

Figure 12. Heath rush was controlled along roads and tracks by West Coast Ecological Services.

Figure 13. Broom taking hold, on left. Controlled by the DOC biodiversity ranger Carmen Greenland (right).

Figure 14. Heath rush control along the Coalbrookdale Track carried out by WCES (left) and along Wharatea Rd to Mt Rochfort by Wildlands (right), showing natives coming through.

Figure 15 shows a heath rush infestation within an area of the high powelliphanta density on the central plateau within the Sullivan Mine licence area. 2023/24 was the second year of intensive heath rush control by DOC and contractors in the northern section of Denniston plateau.

Figure 15. Heath rush infestation on the central Denniston Plateau.

Pest animal management

Seed fall monitoring

Potential irruptions of rats, mice and subsequently stoats can be predicted by monitoring production of seed from canopy beech and podocarp trees. These tree species exhibit periodic mass seed production (seed masting) which provides a large food source for rats and mice and the stoats that feed on them, triggering rapid population growth for these species. When the seed supply is exhausted in autumn, rats and mice turn to other food sources and when the numbers of rats and mice decline, stoats turn to native animals such as birds and lizards with potentially catastrophic consequences for local populations of these species.

The predominant canopy species present on, and adjoining, Denniston Plateau, that may drive rodent irruptions through seed masting events are mountain beech (*Fuscospora cliffortiodes*), silver beech (*Lophozonia menziesii)*, hard beech (*Fuscospora truncata*) and, possibly, rimu (*Dacrydium cupressinum*).

26 funnels were set February to May inclusive, to catch seeds. The results contribute to the National Predator Control Program's predictions for mast events. Seed caught in 8 mountain beech, 6 hard beech, 6 silver beech and 6 rimu funnels was cleaned, sorted by species, counted, and checked for viability (seed in which the endosperm has developed is viable). When large numbers of seed are collected, viability is determined from a subsample of 100 seeds per species for each funnel. Seed counts were done by Barry Chalmers. There was more leaves and debris in the stockings than seen previously due to the increased wind this season.

Mountain beech seeded the most with over 1000 seeds per m2. Results are shown in Figure 16.

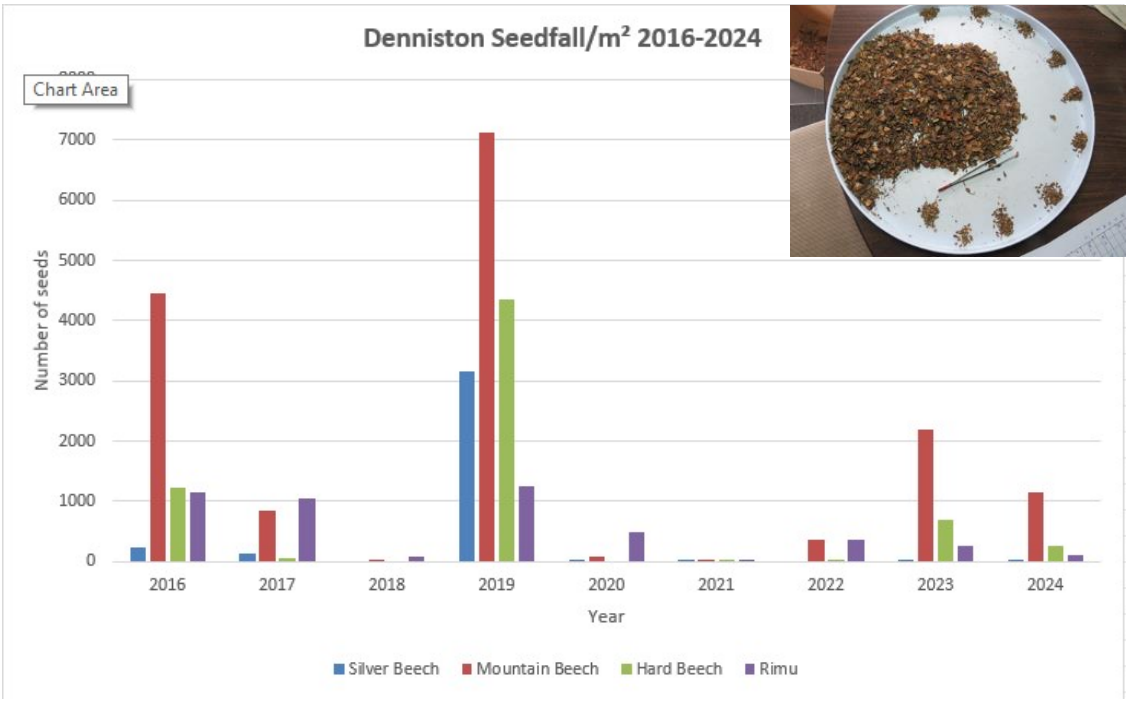


Figure 16. Seed fall per m^2. Inset: mountain beech seed sorted by Barry Chalmers. Photo by Barry Chalmers.

Viability of seeds cut can be seen in Table 6. It was a relatively good year for hard beech viability with 48% of 308 cut seeds viable. If a seed is viable, it is more likely to be eaten by rodents increasing their population. Nutrition for pests is better if the food is not empty or rotten.

Table 6. Percentage of seeds cut that were viable for each tree species. Comparison between 2023 and 2024.

Species	Number of seeds cut 2024	**% Viable 2024**	Number of seeds cut 2023	**% Viable 2023**
Hard beech	308	48	437	28
Mountain beech	455	4	744	7
Silver beech	2	0	49	2
Rimu	171	11	443	5

The total seed count for 2024 was 3188 seeds, less than half the amount from 2023 and 1/10th of the 2019 mast seed count (31842 seeds).

Seed fall data and seasonal temperatures are used to determine the likelihood of mast events. The Delta T Map in Figure 17 shows there is no mast predicted for 2025 on Denniston Plateau or in the Heaphy catchment.

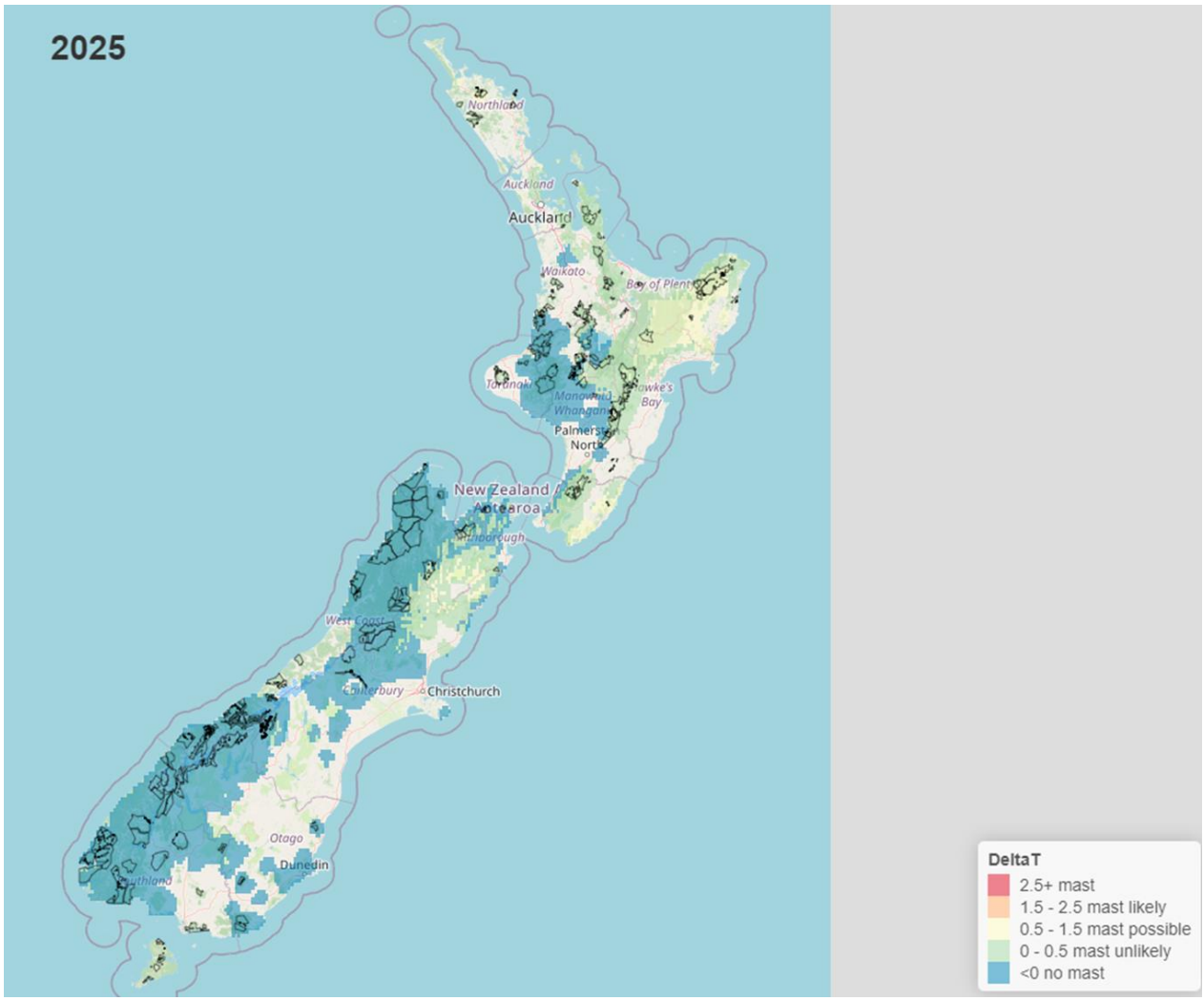


Figure 17. Seed fall data and seasonal temperatures are used to determine the likelihood of mast events. This Delta T map shows there will be no mast in 2024 on the Denniston Plateau.

Aerial predator control

The New Creek Aerial Predator Control operation took place over 56,081ha (Fig 18) which included the Denniston Biodiversity Enhancement Area (DBEA). The operation was funded by Save Our Iconic Kiwi (SOIK). Vector Free Marlborough (VFM) were contracted to manage the operation. The objective was to reduce stoats via secondary kill to protect kiwi.

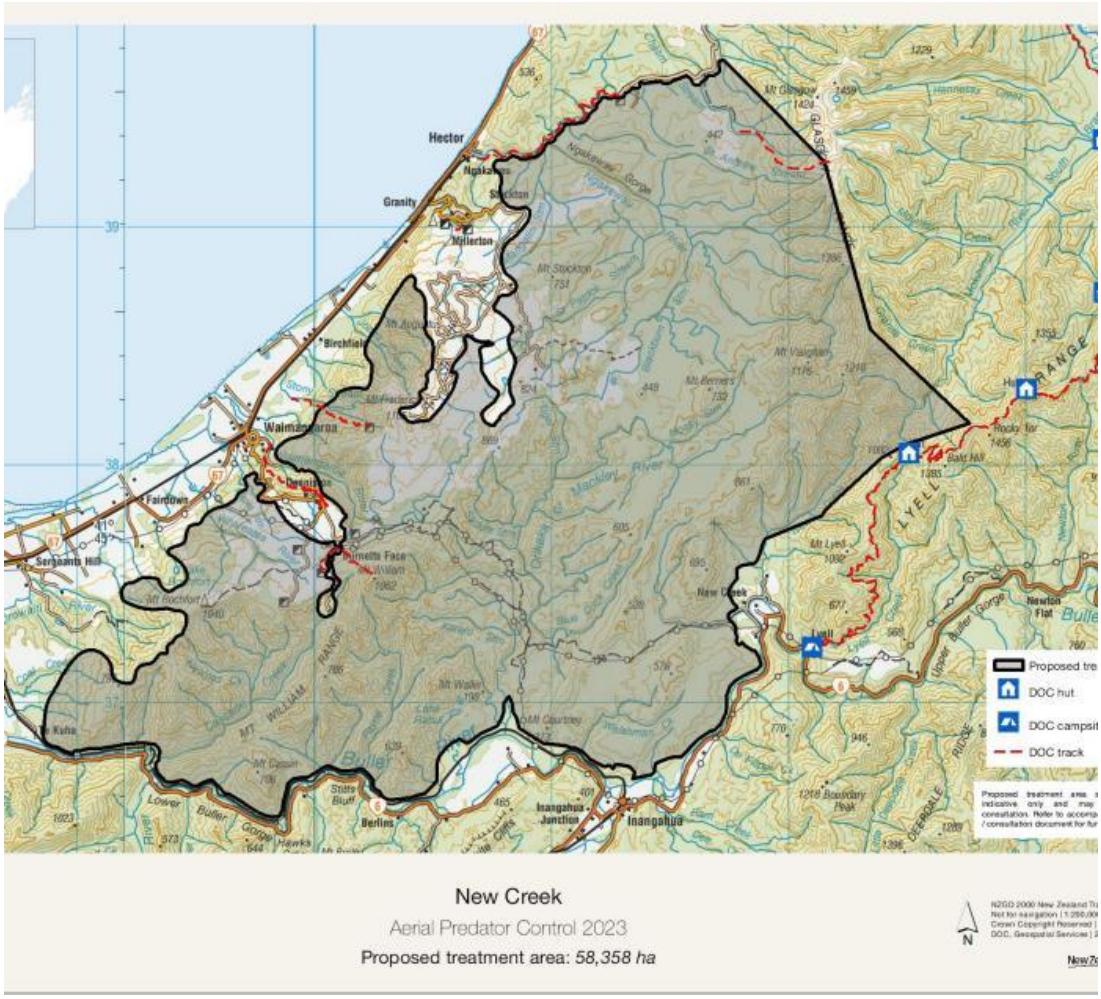


Figure 18. Predator control treatment in September 2023 for the protection of Great Spotted Kiwi.

Aerial predator control operations have result and outcome targets.

The outcome targets or the New Creek area currently identified as:

1. Great spotted kiwi population is increasing as indicated by call rate trends across ARD surveys.

2. Live Powelliphanta density in repeat measured plots is increasing.

3. Long-tailed Bat abundance is increasing, evaluated by pass rate trends across ARD surveys.

Great Spotted Kiwi (GSK) call count data has been collected from four sites between the upper Waimangaroa and Orikaka Rivers east of the Denniston Plateau since 1993 by DOC. Call rates decreased notably between 1995 and 2000, and although there is variability between sites, between years, the overall trend is a slow decline in call rates, which may indicate a stable or declining population. (Kate Simister, DOC, pers. comm., 6 August 2024).

The DOC National Science Team is undergoing long-term territory mapping every 5 years in the New Creek area and ARDs are used annually in the Orikaka with live listening every 5 years. ARDs are also used as part of the National Predator Control Program protocol on the 11 Denniston tracking tunnel lines (Fig 19). This data is processed by the NPCP team to understand trends nationally.

Live powelliphanta are decreasing (see Report Appendix 4). Long-tailed bats have not been detected on any ARDs on the NPCP tracking tunnel lines on Denniston. However, the outcomes are for 58,358ha of the New Creek area and long-tailed bats have been identified within this area.

Small Mammal Indices

Tracking tunnel (TT) cards, used to measure rodent footprints, provide information about when aerial predator control operations are needed. They also help to build a national picture about the relationship between seed production and rodent population levels. In 2023/24 tracking tunnel operations were run in November, February and May following DOC's best practice protocols. This result monitoring followed a protocol created by the DOC National Predator Control Program (NPCP) whereby acoustic recording devices (ARDs) and trail cameras are put on a selection of tracking tunnel lines between November and February, in addition to the recommended 1-day operation on 10 tracking tunnel lines per 4000ha. Tracking tunnel line locations are shown in Figure 19. The practice of running mustelid tracking tunnels over 21 nights in February is also a part of the nation-wide Protocol.

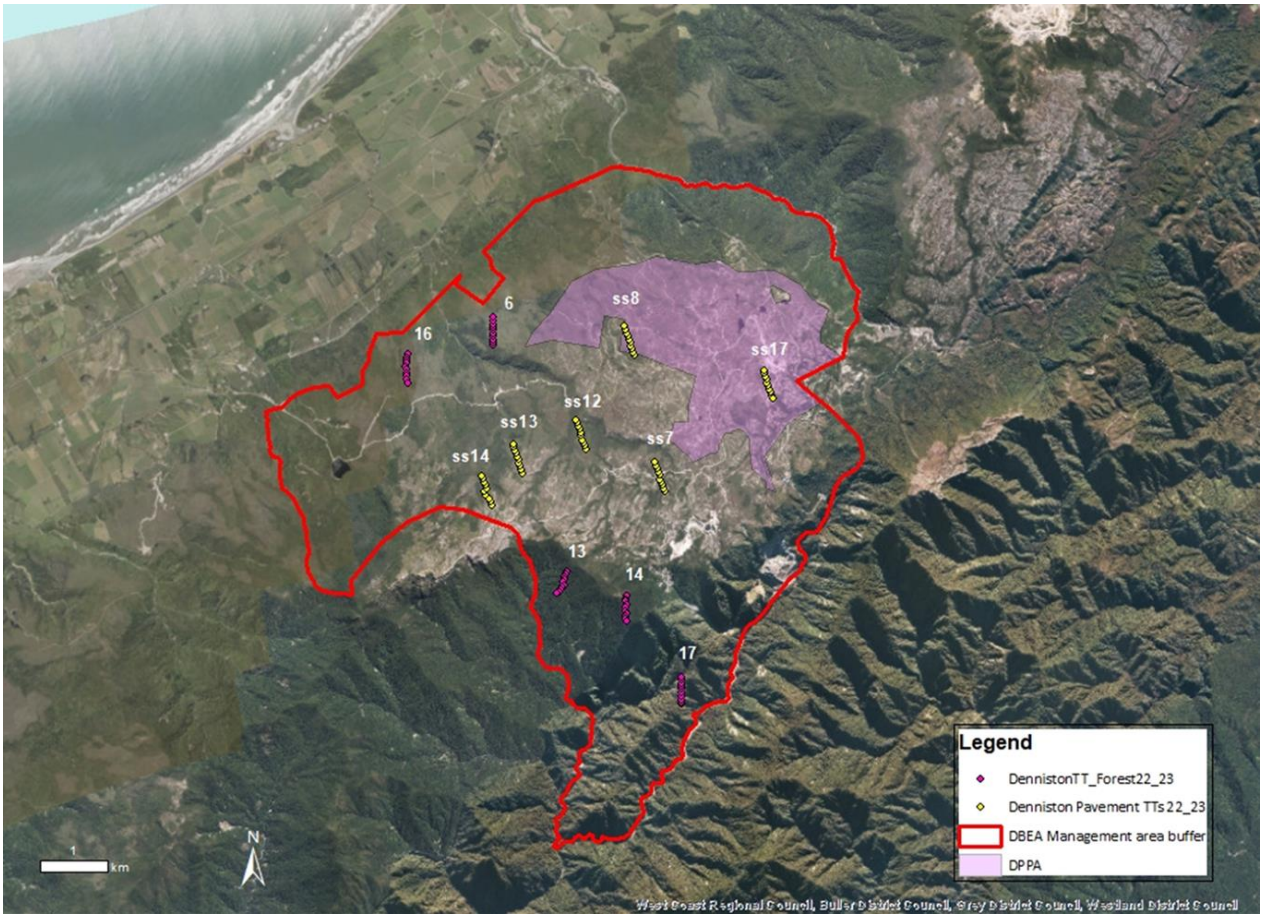


Figure 19. Five forest (purple lines) and six pavement (yellow lines) tracking tunnel lines run for the National Predator Control Program.

Kakariki were heard between Forest lines 14-17, kea and kaka were heard along Forest line 14, four goats were seen in Cascade Creek near line 17.

Tracking tunnel operations were run by contractors and DOC. Results can be seen in Figure 20 for the combined forest and pavement lines. Tracking tunnels show a steep rise in mouse tracking in May due to the availability of seed, which begins falling from March, providing nourishment for the 20 day reproductive cycle of a mouse. This in turn provides more food for stoats (they eat mice/rats).

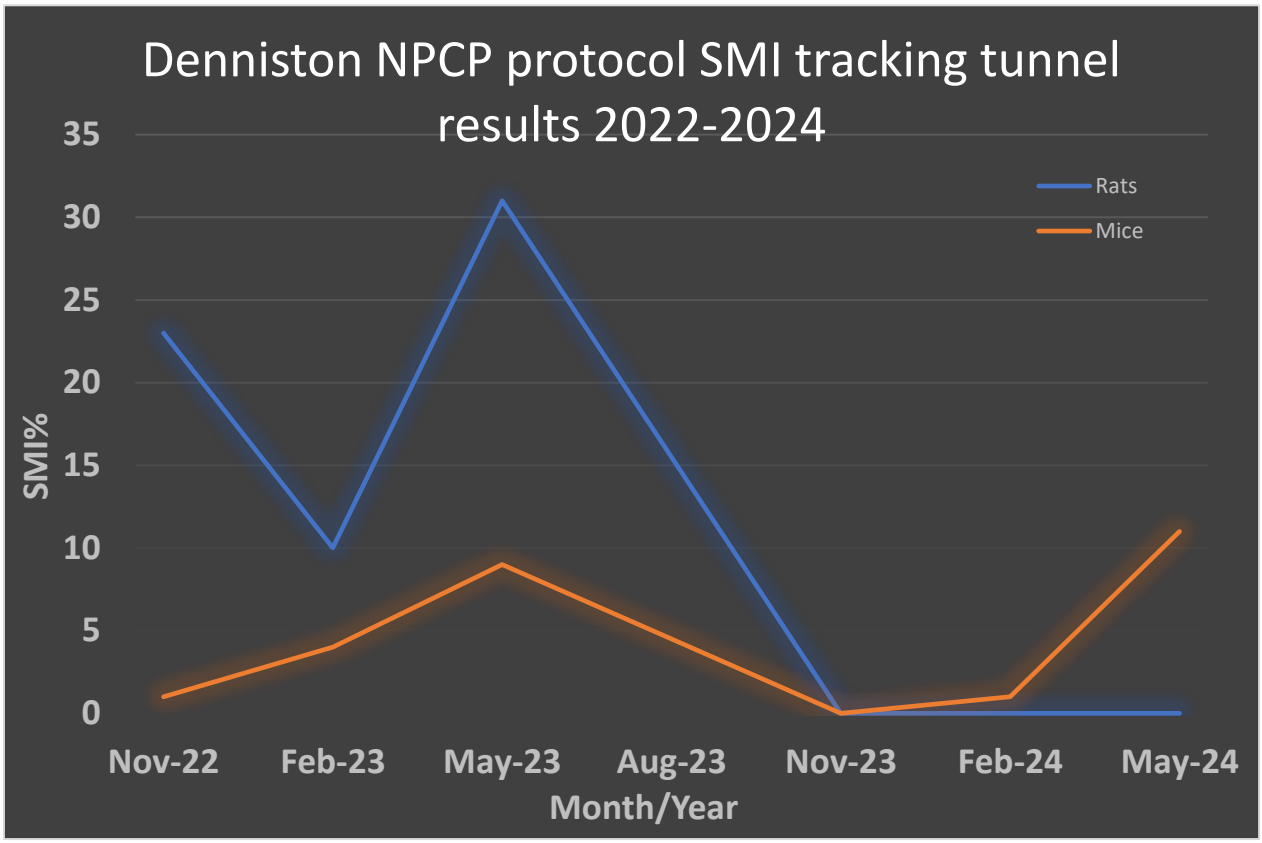


Figure 20. Results for rodent tracking tunnels run over 1-day for eleven TT lines.

The 1-day tracking tunnel operations for November 2023, February 2024 and May 2024 showed 0% tracking for rats following the aerial predator control. Mice in May 2024 showed 11% tracking, an increase from 1% tracking in February 2024. This result achieves the result targets set below.

Result targets From New Creek DOC Operation Plan-

- Reduce rat tracking indices at all surveyed sites within the aerial treatment area to **less than 5% rat tracking within 3 months of the operation. This was achieved after 2, 5 and 7 months with 0% tracking for rats.**
- Reduce stoat tracking indices at all surveyed sites within the aerial treatment area to **less than 1% Footprint Tunnel Index** (FTI) at the next February 21 day stoat TT run.

On the February 2024 Denniston lines one from 110 tunnels showed mustelid tracking over 21-days. This achieved the less than 1% stoat tracking target for the Denniston area.

Acoustic recording devices were set between November and February recording both bats and bird calls. This information is processed by the NPCP to indicate national trends and prioritise aerial predator control areas for treatment.

The May 2024 tracking tunnel operation was run by DOC. It revealed maintenance of tracking tunnels is required before the next season's monitoring (photo above).

Stoat camera indices

For a measure of stoat abundance, trail cameras were stationed at tracking tunnel station number 5 on each TT line from November 2023 to February 2024 as part of the DOC nation-wide National Predator Control Program protocol. This requires one camera per line set for 3 months. Bait was rabbit, set up as recommended in the *Interim DOC trail camera guide v1.0.3: Using camera traps to monitor feral cats, mustelids and rats*. Trail cameras were set to capture three photos in rapid succession separated by 5-minute intervals and are triggered by motion. Animals on any, or all, of the three photos in rapid succession are considered one capture.

Results are comparable to last year by comparing detections per 1000 Camera Hours (CH) averaged over the number of tracking tunnel lines (Figure 21).

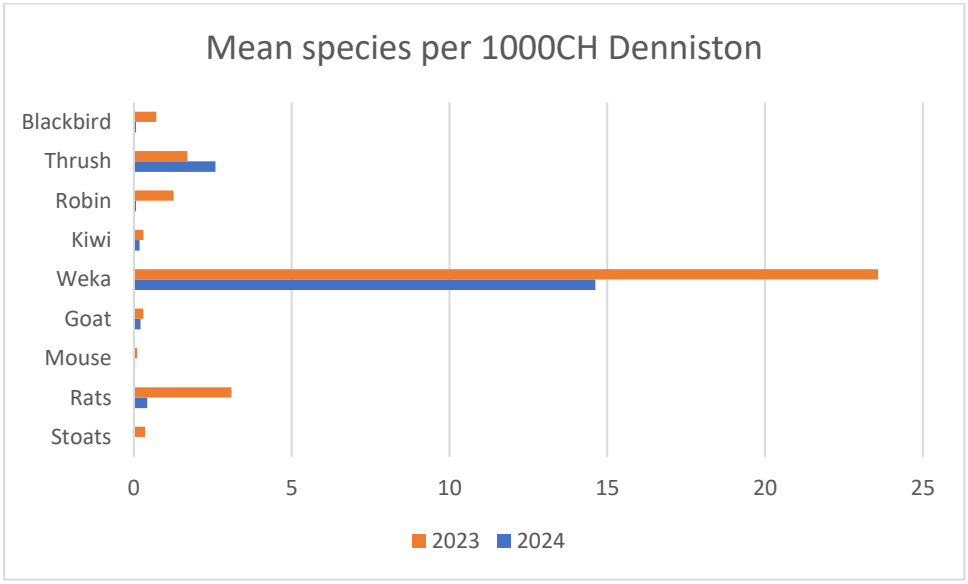


Figure 21. Mean species detection per 1000CH 2023 and 2024.

No tomtit or fernbirds were seen on camera this year. However, fernbirds where often heard when doing lizard monitoring and weed control.

Weka, rats, mice, goats, stoats, robin, kiwi, fantails, blackbirds and redpoll were seen on the cameras. Weka attracted by the rabbit bait were by far the most numerous animals captured on camera. Mean species detection was highest for weka at 14.62 captures/1000CH, followed by song thrush at 2.58 captures/1000CH (Figure 23). Between 2023 and 2024 there was a 60% reduction in stoat detection, 86% reduction in rat detection likely due to the aerial predator control. There was a 34% increase in song thrush detection.

Spot the redpoll in camouflage amongst the sundew in Figure 22. Compared to last year the species mean detection showed less of all animals captured on camera, except for song thrush.

Interestingly the number of captures for 28,000 hours was 521 in 2023-24. The number of captures for 20,000 hours was 634 in 2022-23. 29% more time in the field this year with 18% less captures.

NPCP is processing the ARD data which records bats and birds at night in two separate protocols November to May for national trend data. My preview of the bat data showed there were no bats detected from the ARDs placed on the Denniston tracking tunnel lines.

Figure 22. Two redpolls camouflaged near rabbit bait.

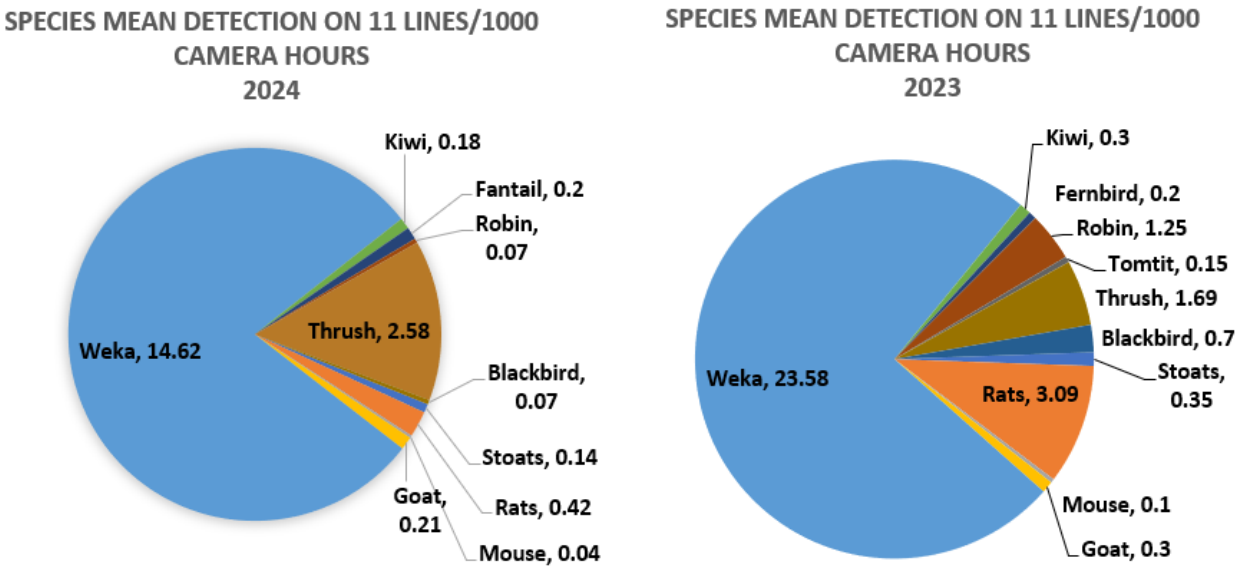


Figure 23. Mean detections per line per 1000CH from 11 cameras on the Denniston tracking tunnel lines (Fig 19) comparing 2023 and 2024 results.

Financial 2023/24

Costs for work carried out for the Denniston Plan management are listed in Table 7.

Table 7

Programme	Costs
Weed Control –DOC, WCES, Wildlands, MBC, herbicide	$48,000
Seed fall monitoring	$500
SMI monitoring, November and February TTs, ARD and trail cameras DOC May tracking tunnel operation	NPCP funded $2,500
Lizard management – DOC staff	$3,000
Snail Plots – Biodiversity Monitoring Team	$9,000
Total Denniston Actual	$63,000
Planned	$63000

Denniston workplan 2024/25

The proposed workplan for 2024/25 for Denniston biodiversity management is listed in Table 8.

Table 8.

Programme	Costs
Weed Control –DOC, WCES, Wildlands, MBC, herbicide	$62,000
Seed fall monitoring	$1,000
Small mammal index monitoring, ARD, trail cameras DOC DOC TT management/maintenance and May operation	NCPC funded (24K) $7,000
Lizard management –DOC/consultants/analysts	$13,000
Total Denniston planned	$83,000

Heaphy/Whakapoia

Highlights

- Bird monitoring detected increases in relative abundance, frequency of detection, population densities and distribution for several native forest species, suggesting that the predator management implemented in the area benefits local bird populations.
- 3 new genera and 6 new species of amphipod discovered, yet to be formally described.
- Significant increase in average call rate for Great Spotted Kiwi within the Heaphy Valley.
- Some Lepidium flexicaule and Spinifex sericeus threatened plants thriving along the Heaphy coast.
- Toropūihi beach free of gorse and marram with native dune species increasing in abundance.
- Continuing positive trend in bat passes.
- Continuing gorse and lupin suppression along the coast and Heaphy and Gunner Rivers.

Biodiversity management

Great Spotted Kiwi

To monitor for trends in the Great Spotted Kiwi, roroa, population over time, live kiwi call count monitoring was established in the Lower Heaphy area in the 1990's, and later on Mackay Downs in 2015. Acoustic recorders were deployed, starting from March 2017, and repeated annually since 2019.

Acoustic Recording Devices (ARDs) recorded 45 minutes after sundown for a period of 3 hours at the locations marked in Figure 24. Great Spotted Kiwi calls were counted, and sex recorded over 6 fine nights by Biodiversity Monitoring Team ranger Klayre Cunnew. The Freebird program was used to count the calls.

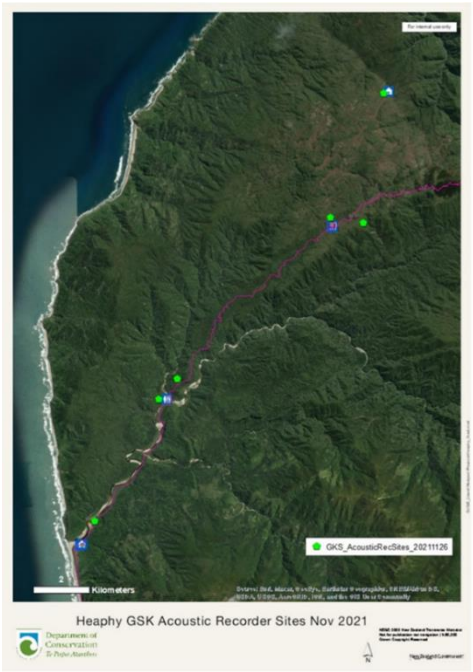


Figure 24. Kiwi acoustic recorders sites (green dots) in the Heaphy Valley and on Mackay Downs.

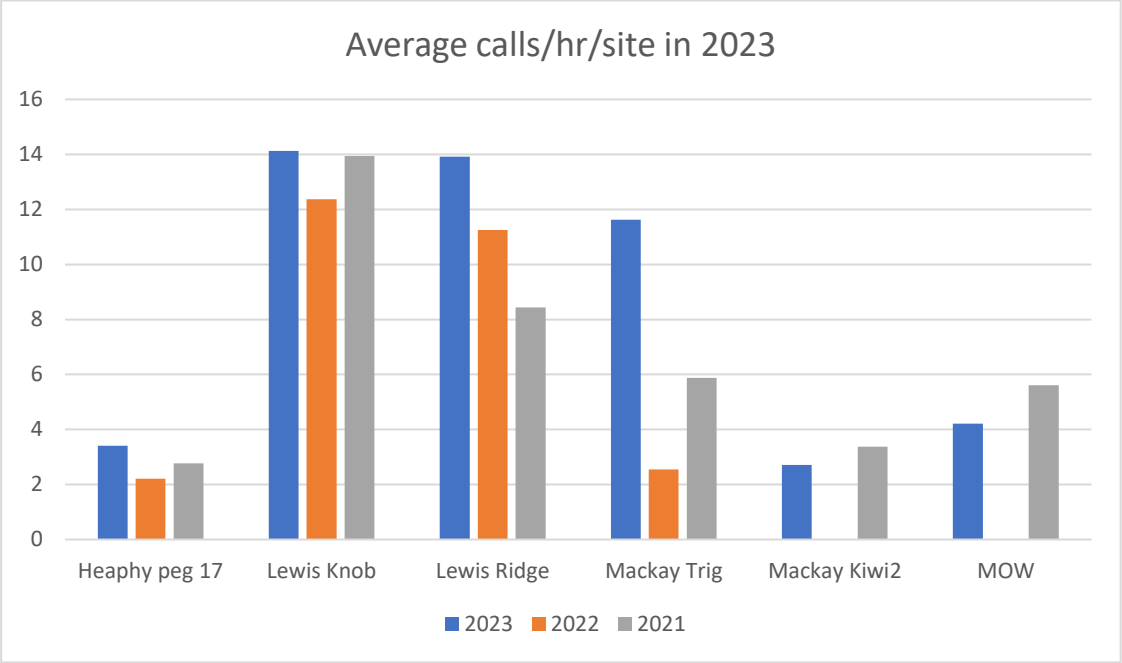


Figure 25. Call counts per hour in blue for December 2023.

Figure 25 shows the call rates from 2021, 2022 and 2023. In 2023, the four western-most sites showed higher call rates per hour than the preceding two years. At the Mackay Trig there was an increase of at least 8 calls per hour.

In 2024 the current acoustic recorder monitoring for the Bathurst Project was reviewed by DOC's Design and Evaluation team. The advice from this review was that the current monitoring (6 ARDs) was not sufficient for reporting on changes in roroa abundance and distribution and should be increased to approximately 20 acoustic recorders spread throughout the project area. Based on this advice we will expand the existing acoustic recorder monitoring by adding an acoustic recorder device (ARD) to every tracking tunnel line located in the project area. This will ensure data collected in the future will have improved precision for providing data to report on outcomes.

"Regarding outcome targets, the problem with relying solely on call rates/acoustic recorders is that there is such a lag between kiwi being recruited into the population (i.e. surviving to a safe weight) and starting to call in any meaningful way, so there is a lag in detecting actual changes in the population. Ideally, you'd rely on a combination of monitoring methods to provide more detailed information i.e. ARDs for long term trend and something more intensive that will give you some information on demographics i.e. recruitment rates etc. I think it would be appropriate to think about some sort of decision triggers so that if the monitoring detects significant decreases in call rates (maybe overall or at sites) over 2? or more years it prompts a response of investigating further to get a better idea of what's happening (maybe systematic searches with dogs or intensive camera surveys." (Oliver Gansell, DOC, pers. comm., 9 July 2024).

Roroa (*Apteryx haastii*) are a threatened species, currently listed as Nationally Vulnerable. Within Kahurangi National Park is an important stronghold where roroa appear to be more abundant than in the rest of their distribution. The average call rate for 2023 over all six sites was 8.33 calls/hr. In 2021 the average call rate was 6.67 calls/hr. Although two Mackay Downs sites had lower call rates in 2023, compared to 2021, the Mackay Trig site had a 100% increase in call rate/hr and the Lewis Ridge site had a 65% increase in call rate/hr.

Kiwis are again resident in the Heaphy Hut area and have been seen regularly 1km west of Mackay Hut along the Heaphy Track (Fig 26).

Figure 26. Juvenile kiwi photographed by Heaphy Track users in January 2024. Photos: Kate Dobbin.

Bird counts

5-minute bird counts and distance sampling were carried out in the Heaphy Biodiversity Enhancement Area (HBEA). The report in Appendix 5 compares data from 2015 to 2023.

Summary by Cielle Stephens.

"This report presents the results from bird monitoring at the lower altitudes (< 500m asl) of the Heaphy valley. The monitoring was undertaken to assess management efficacy, as the Heaphy area is managed for biodiversity enhancement in compensation for biodiversity losses elsewhere. We conducted five-minute bird counts and distance sampling on randomly placed monitoring grids to assess the status and trend of local bird populations between 2015 and 2023. The monitoring detected increases in relative abundance, frequency of detection, population densities and distribution for several native forest species, suggesting that the predator management implemented in the area benefits local bird populations. Recommendation to continue with the annual monitoring to keep track of trends that may demonstrate benefits achieved by the management."

The 108 points visited in the 6 Heaphy grids and 100 points visited in the 4 Mackay grids can be seen in Figure 27.

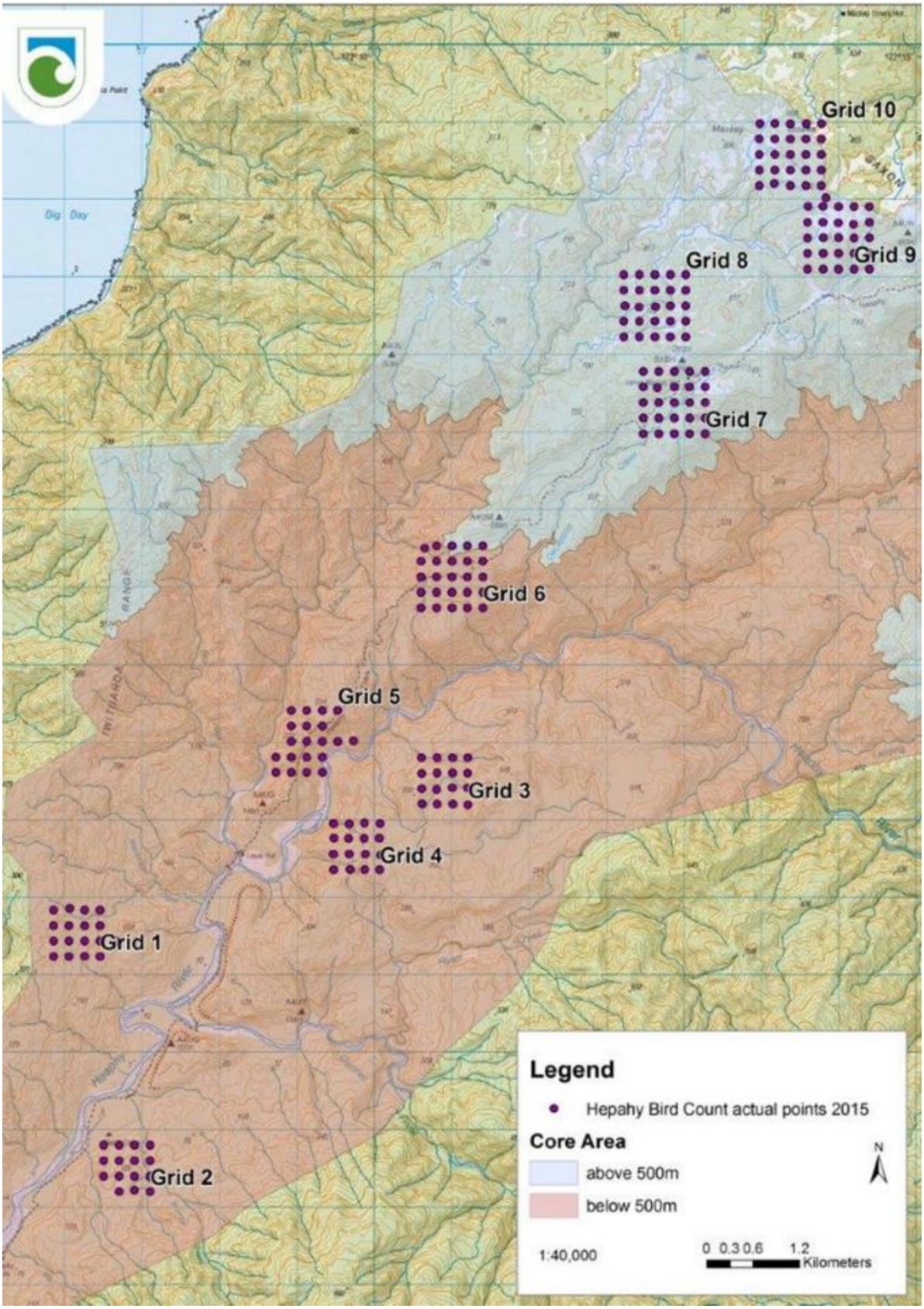


Figure 27. Locations of bird count Grids in the Heaphy *Valley.* The map shows the two areas above 500m asl and below 500m asl.

There were no additional species detected in 2023 and there has been 31 bird species observed within the 9 years of monitoring. Of these 31 bird species 5 are threatened (NZ falcon, fernbird, kaka, kea, and great spotted kiwi), 23 are native and 8 are introduced (blackbird, chaffinch, dunnock, goldfinch, greenfinch, redpoll, skylark, and song thrush).

Five native species (riflemen, robin, tomtit, tui and weka) showed significant increases in relative abundance over time. Robin, tomtit, kaka, tui and weka showed an increase in frequency of detection over time. Graphs in the report illustrate an increase in range, frequency of detection and relative abundance of robin, tui and weka (Table 9).

Table 9. Forest birds increasing in range, abundance and frequency of detection in the Heaphy Valley.

Increase					
Relative abundance	*robin*	*tomtit*	*rifleman*	*tui*	*weka*
Frequency of detection	*robin*	*tomtit*	*kaka*	*tui*	*weka*
Range and abundance	*robin*			*tui*	*weka*

The estimated annual change in mean relative abundance can be seen below. The significance of the annual change is listed in Table 10. Several native bird species appear to be increasing, both in relative abundance and distribution, percentage increases listed below.

Lewis

Rifleman 9.57%

Robin 12.91%

Tui 29.1%

Weka 21.3%

Mackay

Chaffinch 14.01%

Grey Warbler 17.86%

Tomtit10.1%

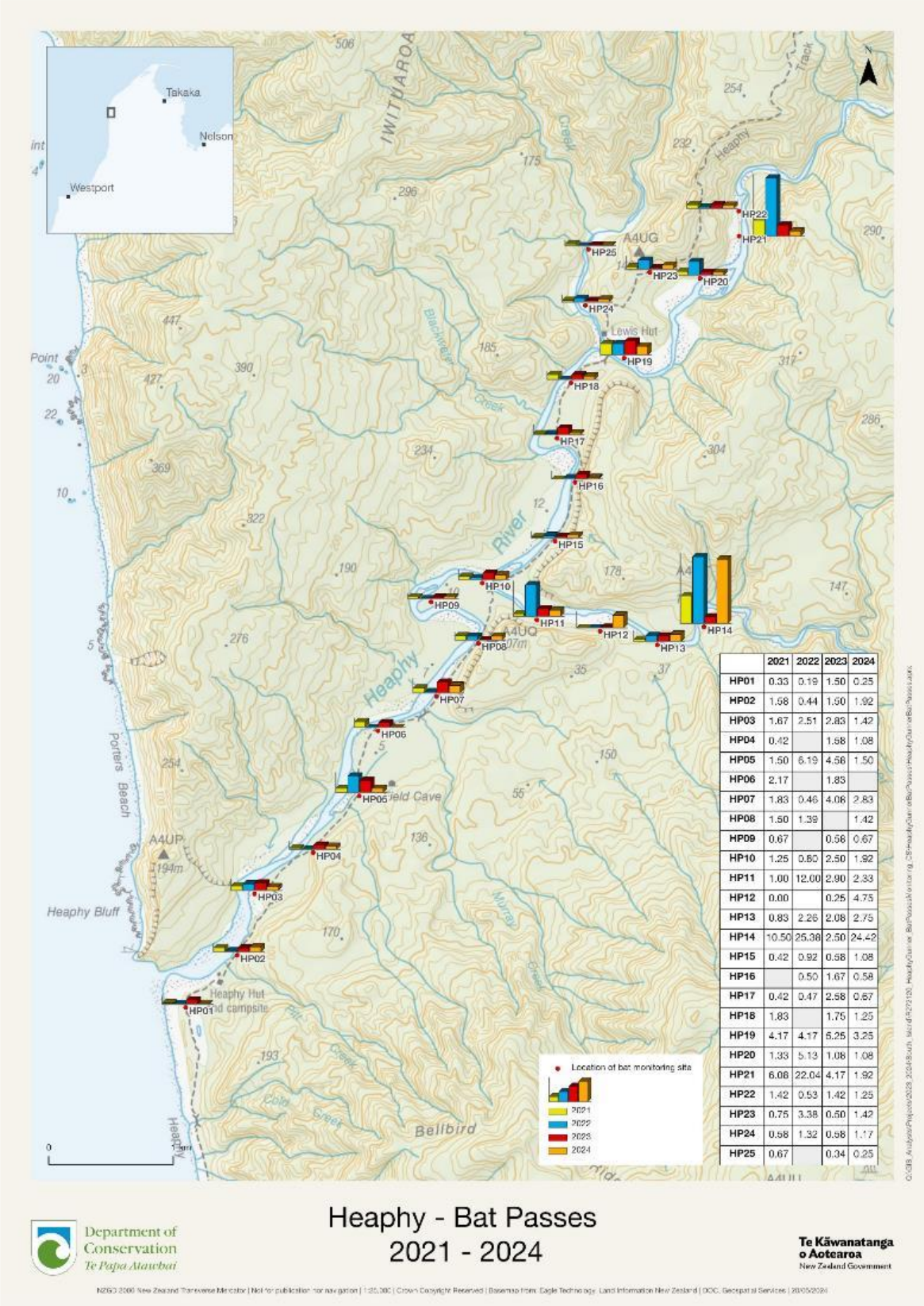
Weka 1.05%

Table 10 shows the significance of the annual changes in mean relative abundance for the species listed.

Species	**Lewis**		**MacKay**	
	Estimated annual change (%)	**p-value**	**Estimated annual change (%)**	**p-value**
Bellbird	1.46	0.24	6.1	0.12
Brown creeper	NA	NA	10.4	0.0624
Chaffinch	1.01	0.152	**14.01**	**0.017**
Fantail	1.68	0.52	NA	NA
Grey Warbler	0.39	0.81	**17.86**	**<0.0001**
Kakariki	6.1	0.264	NA	NA
Redpoll	NA	NA	-3.53	0.73
Rifleman	**9.67**	**0.0403**	NA	NA
Robin	**12.91**	**<0.001**	-0.26	0.95
Silvereye	0.3	0.402	NA	NA
Tomtit	**7.2**	**0.0002**	**10.1**	**0.0037**
Tui	**29.1**	**<0.001**	NA	NA
Weka	**21.2**	**<0.001**	**1.05**	**0.0029**

After eight years of monitoring the results are encouraging for forest bird species in the Heaphy.

Long-tailed bats



	2021	2022	2023	2024
HP01	0.33	0.19	1.50	0.25
HP02	1.58	0.44	1.50	1.92
HP03	1.67	2.51	2.83	1.42
HP04	0.42		1.58	1.08
HP05	1.50	6.19	4.56	1.50
HP06	2.17		1.83	
HP07	1.83	0.46	4.08	2.83
HP08	1.50	1.38		1.42
HP09	0.67		0.58	0.67
HP10	1.25	0.80	2.50	1.92
HP11	1.00	12.00	2.90	2.33
HP12	0.00		0.25	4.75
HP13	0.83	2.26	2.08	2.75
HP14	10.50	25.38	2.50	24.42
HP15	0.42	0.92	0.58	1.08
HP16		0.50	1.67	0.58
HP17	0.42	0.47	2.58	0.67
HP18	1.83		1.75	1.25
HP19	4.17	4.17	5.25	3.25
HP20	1.33	5.13	1.08	1.08
HP21	6.08	22.04	4.17	1.92
HP22	1.42	0.53	1.42	1.25
HP23	0.75	3.38	0.50	1.42
HP24	0.58	1.32	0.58	1.17
HP25	0.67		0.34	0.25

Figure 28. Average bat passes/night over 12 fine nights in February 2021-2024 at 25 locations along the Heaphy and Gunner Rivers.

The Conservation Status of Bats in Aotearoa, NZ was released by O'Donnell *et al* in 2022. Long-tailed bats are listed as Nationally Critical and are declining at a rate of 5-9% per annum, equating to an 84-96% decline over three generations (estimated 36 years) in places where their predators are not managed to very low levels (less than 5% rat tracking).

For long-tailed bats (pekapeka) straight line distances between roosts and foraging grounds have been calculated at 10-25kms, and they can range up to 150km^2 even in one night.

Annually, in February, 25 acoustic bat recorders are deployed along the Heaphy and Gunner Rivers (Fig 28). Analysis of bat passes over 12 fine nights in 2024 showed a continuing increasing trend this year (Fig 29).

Recent comparisons by DOC technical advisor Moira Pryde with mark and recapture and acoustic recorders with a Whirinaki population of long-tailed bats, have indicated a correlation between bat passes and the survival of adult females. As the Gunner River long-tailed bat population is the only known breeding population in Kahurangi National Park, these results are an encouraging sign, confirming the achievement of the outcome goals for the lower Heaphy predator control management.

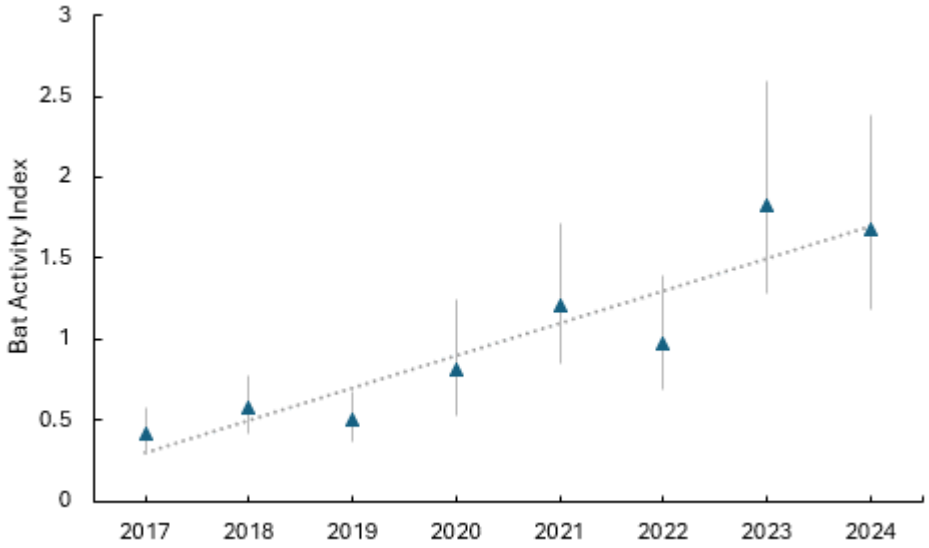
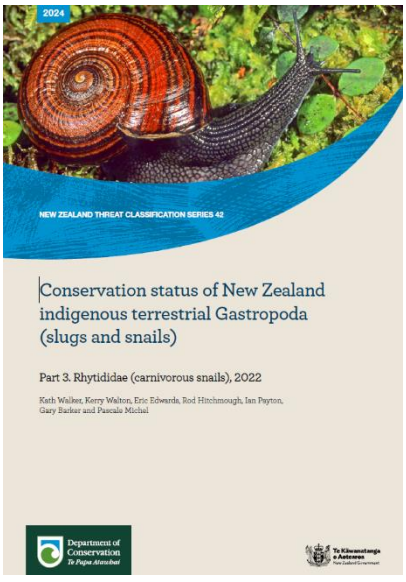


Figure 29. An increasing trend in average bat passes/night 2017 to 2024. Graph by Moira Pryde, DOC bat advisor.

Powelliphanta

The Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails). Part 3. Rhytididae (carnivorous snails), K.Walker *et al* (pictured right) was released this year. 109 species were assessed, 48 declined in status while only six have improved. 28 taxa of *Powelliphanta* having declined to "Nationally Critical" threat status.



In the Heaphy Biodiversity Enhancement Area *Powelliphanta* now classified as Nationally Critical are-

- *Powelliphanta annectens*
- *Powelliphanta superba harveyi*
- *Powelliphanta superba prouseorum*

- *Powelliphanta gilliesi* "Heaphy"
- *Powelliphanta superba* "Gunner River"

" Dr Walker says climate change is killing *Powelliphanta* and other snail species by reducing soil moisture in summer.

"High numbers of feral pigs, goats, deer, possums and hares are exacerbating climate change problem by drying, removing and degrading the leaf litter that nourishes snail habitat and their earthworm prey.

"A warming climate also means rats are invading some *Powelliphanta* species' mountain-top homes, which previously were predator-free." ["Native Snails Heading For extinction on DOC Intranet- Penny's Panui Feb 26 2024.]

Powelliphanta plot monitoring was carried out by the Biodiversity Monitoring Team in March 2024 on the Lewis/Gunner River plots (Fig 30). Full report is in Appendix 6.

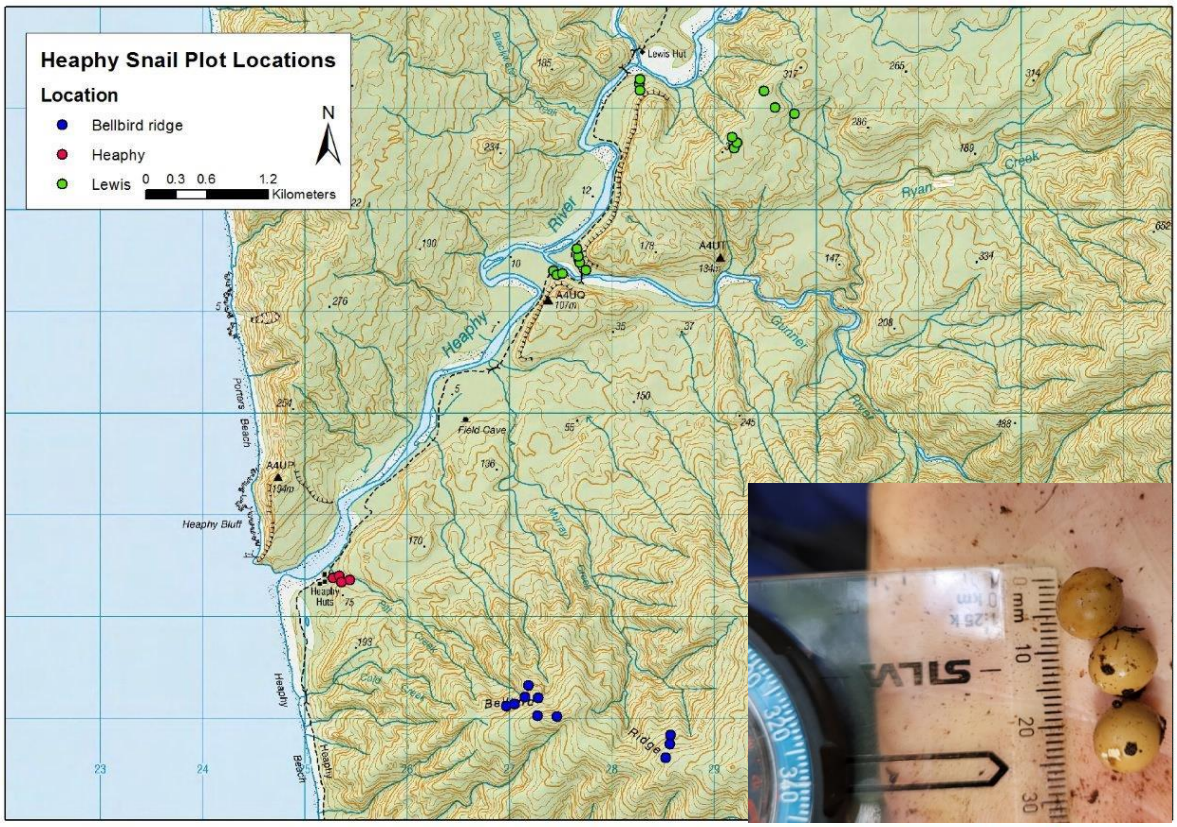


Figure 30. Location of snail plots in the Heaphy valley. Only the Lewis plots (*P. superba* "Gunner River" and *P. gilliesi* "Heaphy", green) were monitored. Data for the Lower Heaphy, red and Bellbird Ridge plots, blue (*P. annectens* and *P. superba* "Gunner River") are not included in this report as they have been destroyed by slips and windfall.

Summary by Biodiversity Monitoring Team Ranger Klayre Cunnew.

This report would usually present findings on the monitoring of three species of Powelliphanta found in the Heaphy valley, *Powelliphanta annectens, Powelliphanta superba* "Gunner River" and *Powelliphanta gilliesi* "Heaphy". Unfortunately, the permanent plots in the lower Heaphy valley were destroyed by flooding and landslips when cyclone Dovi hit the area in February 2022 and could not be remeasured. As such, this report

will focus on findings from plots further up the valley where *P. superba* "Gunner River" and *P. gilliesi* "Heaphy" are found.

The number of live snails found on permanent plots increased marginally this year. The number of whole shells also increased while the number of weka predated shells fell. Rats were again the most prominent introduced predator consistent with previous years since 2015, suggesting that aerial 1080 drops in the catchment were not always effective at controlling rats. Possum control, in contrast, has been effective and has substantially limited possum predation on snails. The management objectives of zero predation by introduced predators and an increasing snail population have not yet been achieved. Longer term monitoring is required to confidently assess population densities and trends, with the next measurement to occur in 2027. Research into the causes of the relatively large number of whole empty shells should be considered.

Invertebrates

There is over 1500 million insects for every person on earth. 90% of insects in New Zealand are unique to this country. Insects are where the bulk of New Zealands's biodiversity is found.

2023-2024 was the 3rd year of an invertebrate study comparing invertebrate community composition in limestone hardwood and lowland nikau forest within an area receiving regular aerial predator control treatment (Heaphy valley) and an area with no treatment (Scotts Beach) within Kahurangi National Park (Fig 31). Pitfall trapping is used for capturing invertebrates that are active on the ground. It is used to investigate habitat associations, distribution and community structure for these largely data deficient species.

Figure 31. Pitfall traps are set up in a group of four traps within 3-5m of each other at 6 sites tagged L and F along the Heaphy River (left) and at sites R and S at Scotts Beach (right). The red square is an aerial predator control exclusion zone.

Sampling invertebrate diversity aims to-

- Detect trends over time.
- Detect patterning or patchiness in the landscape.
- Reveal invertebrate diversity. Many rarely recorded spiders, micro-snails, land hoppers, beetles, wētā and a cryptic bush swordtail cricket have been identified.

48 pitfall traps at Scotts Beach, and 48 between the Heaphy Hut and Gunner River were set, and samples collected monthly December to April. The samples are identified, counted and were entered into a spreadsheet. Some species were sent to entomologists for identification: harvestmen spiders to Phil Sirvid of Te Papa and Sebastian Doak (DOC); amphipods to Oliver Ball (Northtec); stag beetles to Chris Green (DOC); flies to Steve Kerr; snails, microsnails and leaf litter to Frank Climo and Karin Mahlfeld (DOC). Oliver Ball identified 3 new genera and 6 new species of amphipods. An assasin bug and peripatus were new additions to the reference library this year (Figure 32). There are currently 121 species in the Heaphy Invertebrate Reference Library.

Figure 32. Clockwise from left, an assassin bug, microsnail, peripatus, a new amphipod found in the pitfall traps.

A paper by Danilo Hegg on New Zealand small crickets was published in September 2024 in the European Journal of Taxonomy- *Small crickets of New Zealand (Orthoptera: Grylloidea: Trigonidiidae and Mogoplistidae)*, with the description of two new genera and species. It contains descriptions for several species, and includes three undescribed species, the Kahurangi cricket among them (with type locality at the Heaphy River). This cricket was named by Ngati Waewae as Tarakihi Kahurangi (Fig 33).

Figure 33. Holotype, adult ♂, Heaphy River, Kahurangi National Park (NZAC 03037179), dorsal view. Scale bar = 2 mm. The cricket species named by Ngati Waewae Tarakihi Kahurangi now has a scientific name, *Austronemobius chelates*. Photo: Danilo Hegg.

A longer time series and measuring rodent density was suggested for the 2023-2024 season. If a factor of trend in relative density of rodents is added to the study, then we may have the power to detect ground dwelling invertebrate responses to predator control (Eric Edwards, DOC Entomologist pers. comm., 2023).

To get the measure of rat indices in the areas trapped for invertebrates, cameras were set for 3 months from January to March. The cameras were set up with no bait- five amongst the Scotts Beach pitfall traps and six amongst the Heaphy Flats pitfall traps. One camera was stolen from the Scotts Beach site.

Both tracking tunnels and trail cameras were used to determine rodent density within the pitfall trap areas. The results can be seen in Figure 31 for the mean species density per 1000CH for the trail camera captures. Scotts Beach had considerably more rats for the same period. More stoats, weka, possums and kiwi were seen on the Scotts Beach cameras than the Heaphy Valley cameras.

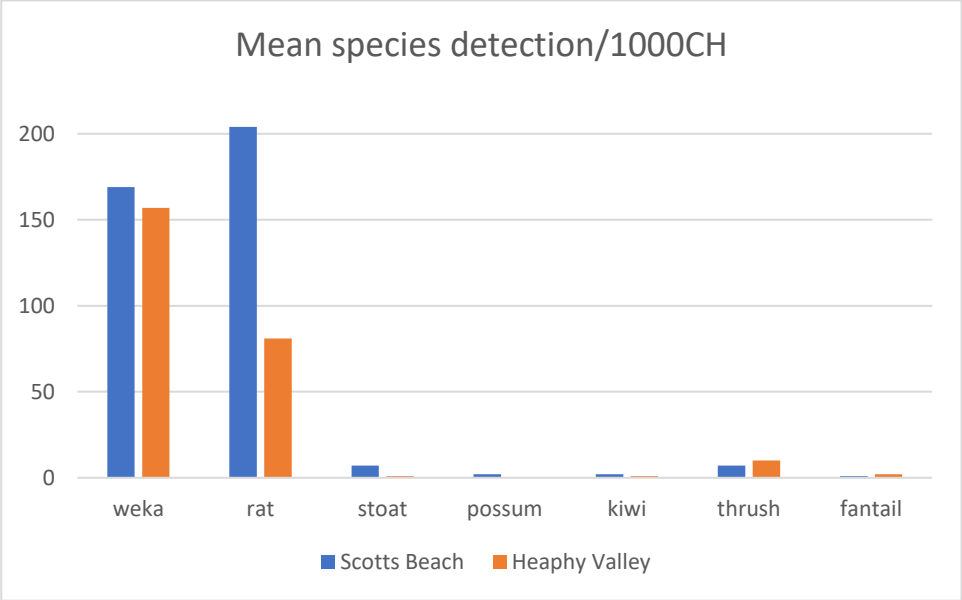


Figure 34. Mean species detection per 1000 camera hours comparing Scotts Beach and the Heaphy Valley.

Tracking tunnels were run at Scotts beach in November, February and May to determine rodent densities. The results can be seen in Figure 32.

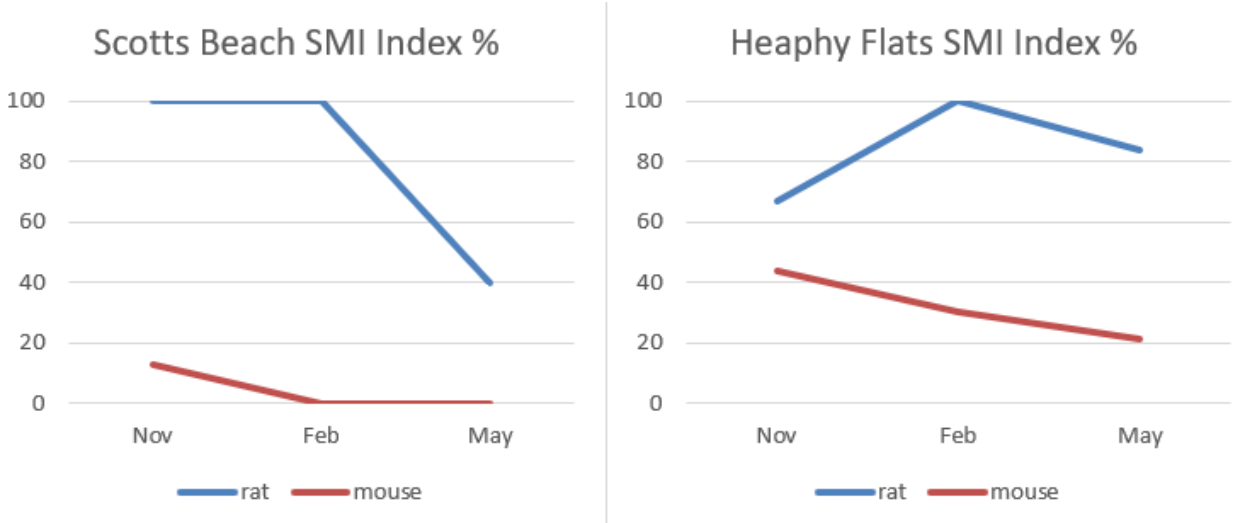


Figure 35. The small mammal index determines the trend in relative density of rodents. We used Line 5 of the Lower Heaphy TT lines as a comparison. Line 5 runs through the Heaphy flat pitfall invertebrate area. Results showed both areas had 100% tracking in November 2023 for rats and the index reduced for May 2024 in both places, yet more sharply at Scotts Beach.

Freshwater

Freshwater eDNA samples were taken within the Heaphy catchment in March 2024 at the locations marked in Figure 36.

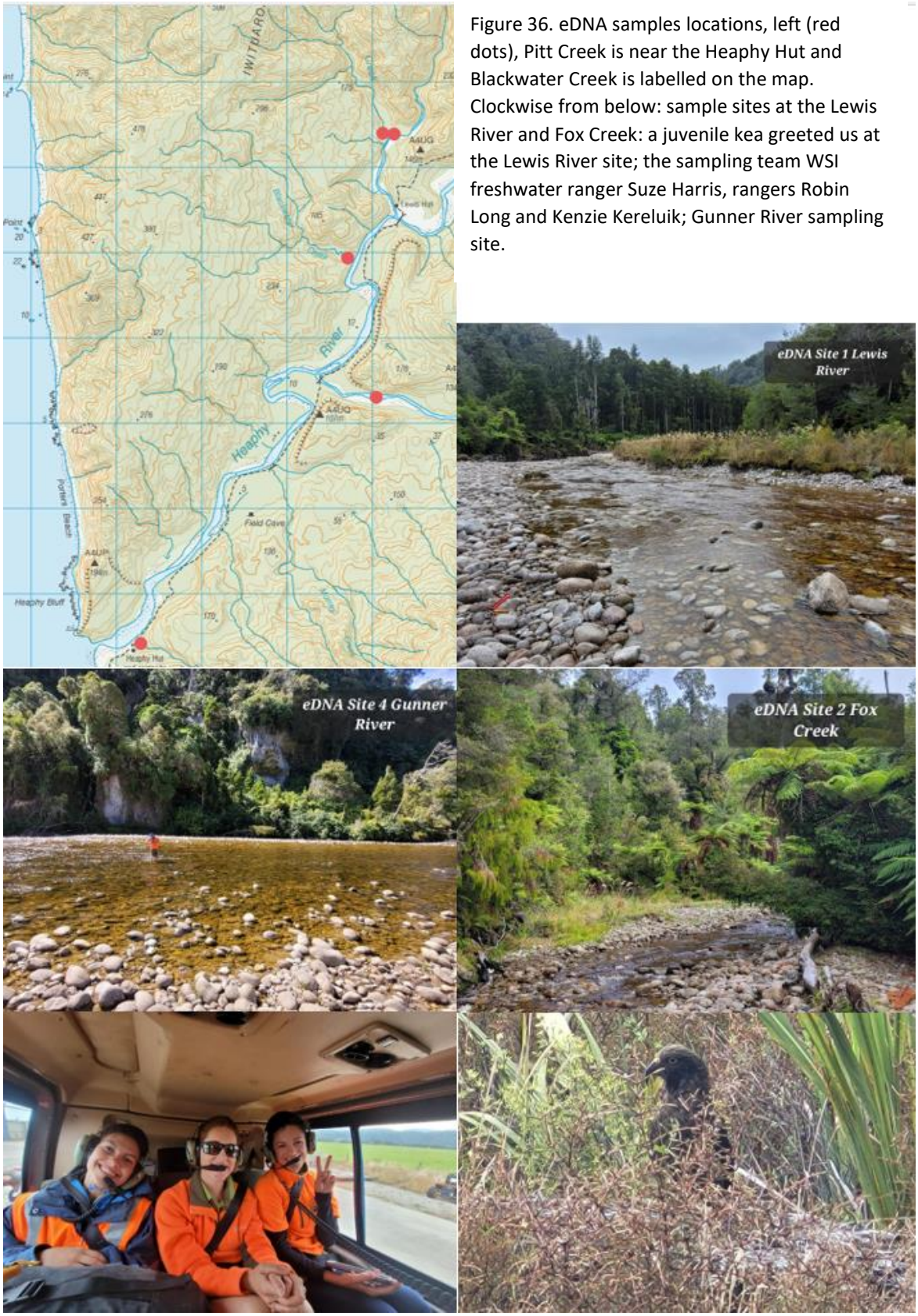


Figure 36. eDNA samples locations, left (red dots), Pitt Creek is near the Heaphy Hut and Blackwater Creek is labelled on the map. Clockwise from below: sample sites at the Lewis River and Fox Creek: a juvenile kea greeted us at the Lewis River site; the sampling team WSI freshwater ranger Suze Harris, rangers Robin Long and Kenzie Kereluik; Gunner River sampling site.

Two samples underwent comprehensive analysis funded by the Bathurst Project and three had basic analysis funded by the WSI Freshwater Team. Wilderlab processed the samples. The results can be seen in Table 11.

Table 11. Presence/absence of native fish species and a few pests, form the Heaphy waterbodies sampled.

Species	Fox Creek	Lewis River	Blackwater Creek	Gunner River	Pitt Creek
Redfin bully	Y	Y	Y	Y	N
Bluegilled bully	Y	Y	N	Y	N
Giant bully	N	Y	Y	Y	N
Torrentfish	Y	Y	N	Y	N
Long-finned eel	Y	Y	Y	Y	Y
Short-finned eel	N	N	Y	Y	N
Koaro	Y	Y	N	Y	Y
Koara	Y	Y	Y	Y	N
Banded kokopu	Y	Y	Y	Y	Y
Lamprey	N	N	Y	Y	N
Shortjaw kokopu	N	Y	N	Y	N
Inanga	Y	Y	Y	Y	N
Giant kokopu	N	N	Y	N	Y
Brown trout	Y	Y	N	Y	N
Kea or kaka	N	N	Y	N	N
Red deer	Y	N	N	Y	N
Possum	N	Y	N	N	N
TICI rating	Pristine (92-94 quantile)		Excellent (78-84 quantile)		

Interesting finds were lamprey in the Blackwater and Gunner Rivers. One lamprey was found by NIWA in 1992 during an electric fishing spot survey from a tributary on the true right of the Heaphy River. There are no other historic records of lamprey in the Heaphy Catchment. Lamprey are a data deficient species due to their elusive nature and lack of natural or manmade structures on West Coast rivers which serve as funnels for migrating adults (the life stage where they are mostly observed by people). The eDNA records and visual observation of a lamprey ammocoete in Blackwater Creek confirm lamprey are present in the catchment after a 30+ year gap of freshwater fish surveys in the area.

There is very little knowledge nationally on the location of lamprey and they become rarer as you travel north. Recent surveys on the West Coast are pointing to the Buller region as a hotspot for this species.

For shortjaw kokopu the last datapoints for the Heaphy were from the mid-1990s. Shortjaw kokopu were detected in the Lewis and Gunner Rivers. The finding in the Gunner River confirms the shortjaw are still there. DOCs conservation efforts are centred around four threatened species- lamprey, shortjaw kokopu, eels and inanga. (Susan Harris, DOC, pers. comm., 10 September 2024).

Short and long-finned eels were found in Blackwater Creek and the Gunner River.

The Taxon Independent Community Index (TICI) rating for Fox Creek was Pristine and for Blackwater Creek Excellent. For more information on TICI ratings visit www.wilderlab.co.nz.

Threatened Plants

Several plants along the Heaphy coast are threatened due to coastal erosion, competition with pest and weed species and narrow ecological niches. Coastal cress ***Lepidium flexicaule*** (Fig 37, top left) is Nationally

Endangered (2017 Conservation status of New Zealand indigenous vascular plants DOC). Its survival is considered conservation dependent.

Figure 37. Clockwise from above: a No Spray area marked for *L.flexicaule* protection on the Heaphy track; *L. flexicaule* in flower; large, healthy coastal cress plants on the old Scotts Beach track; erosion of suitable habitat along the Heaphy coast;.

In February 2024 from Toropiūhi Creek to Scotts Beach along the Heaphy coast, 235 plants were counted in the annual census. Figure 38 shows an increase of 10 plants from the 2023 survey. 129 of 235 adult plants were reproductive. More seedlings were seen than previous years. A seedling is considered less than 20mm in diameter. 68 plants were planted after the census in April 2024.

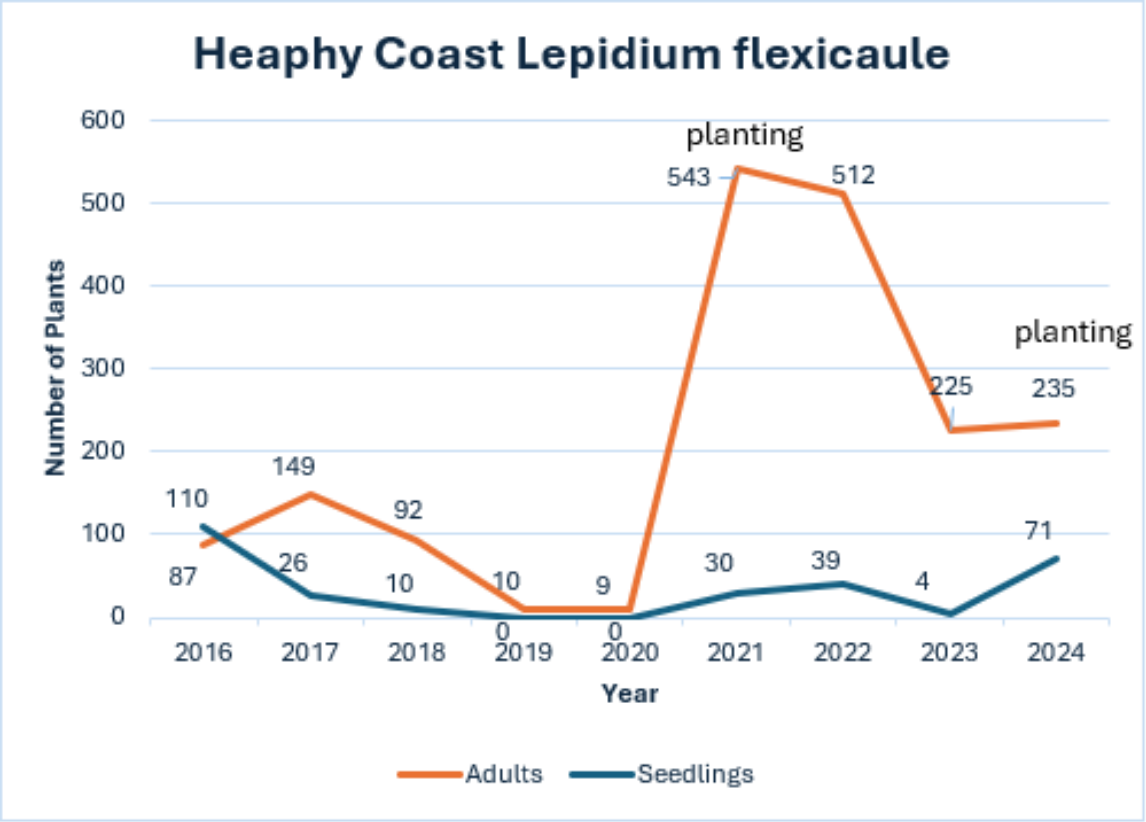


Figure 38. Number of coastal cress (*Lepidium flexicaule*) plants 2016-2024 differentiating adults and seedlings.

Poa billardierei **(sand tussock)** is a threatened plant with At Risk-Declining status. On Whakapoia Point north beach**,** a natural and planted population (59 planted in 2004-2006) has reduced from 311 plants in 2017 to 42 plants by the 2023 census (Fig 39). Plantings occurred in April and September 2023 and April 2024 (Fig 37) to increase plant numbers above the minimum of 200 plants recommended by DOC botanists. The reason for the decline in plant numbers seems to be sea inundation, erosion, seed predation and to a lesser extent, competition from other plants. Natural reproduction in-situ has not been evident since 2020.

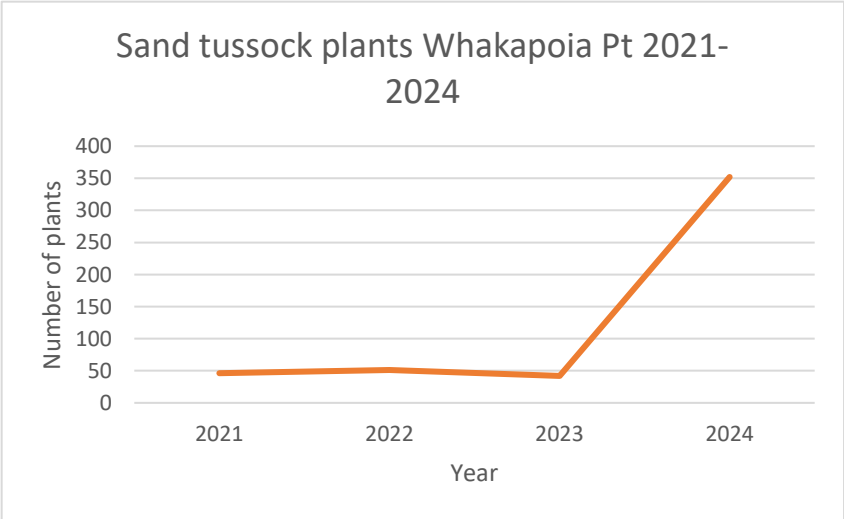


Figure 39. Sand tussock plant numbers 2021-2024. The increase is due to plantings.

Figure 40. Plants from the Cavehouse Nursery for planting along the northern Heaphy coast (left). A sand tussock planted late 2023.

Figure 41. Whakapoia Pt north beach has a thriving population of the dune-forming native grass *Spinifex sericeus*.

Spinifex sericeus has a population on Whakapoia Pt north beach which is the southern-most extremity for this plant. In the 1900s Townson found these plants as far south as Tauranga Bay. In the 1990s DOC Buller planted some seeds at Tauranga Bay and last year a plant was found there. Still surviving but not thriving. Townson records them as far south as Tauranga Bay in the early 1900s. There is plenty of fresh sand coming and going from the beaches so potential to invest in more restorative planting and seed distribution (Jane Marshall, DOC, pers. comm., May 2024). Bathurst Project TAG member and DOC botany advisor Jane Marshall has suggested planting seed on Scotts Beach south. Seed was collected as per DOC best practice, from the plants in Figure 41 for the Scotts Beach planting late 2024.

Other species

Figure 42. (left to right) Tawaki, Fiordland crested penguin, seen injured on Scotts beach. A full recovery was made thanks to volunteer bird rescuer, Julie Leighton; an emerging stinkhorn; bolete fungi; red pouch fungi.

Pest plant management

The Heaphy Weed Plan 2020-2025 (Huggins, 2020) determines focus areas for weed control in the Heaphy management unit. As the highest priority, surveillance for new weed incursions was carried out in all three zones- south coast, north coast and the Heaphy River and track, during weed control, seed and pest trap checks, and threatened plant work. The second priority, controlling selected species to zero density, was focussed on German ivy and Kahili ginger at Kohaihai Shelter.

The Jobs for Nature/KMTT spent 80 hours controlling Kahili ginger at Kohaihai Shelter (dots Fig 43). The blue cloud areas on the map in Figure 40 are suggested areas for ginger survey in 2024-2025 to see the extent of the Kahili ginger range.

DOC staff spent 12 hours controlling gorse and blackberry in the Buffer Zone from Mossy Burn to Kohaihai Shelter. Contractor Kongahu Bushworks spent 60 hours on gorse and lupin control along the Heaphy and Gunner Rivers. Areas of control are in blue in the map Figure 44 (left).

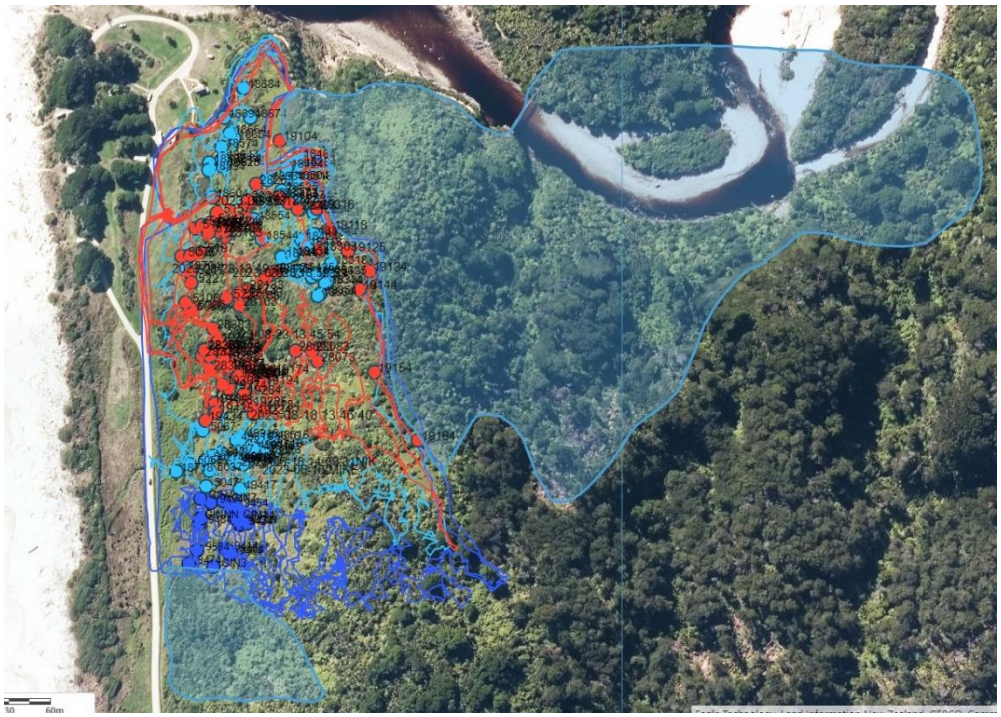


Figure 43. 170 ginger plants controlled at Kohaihai Shelter by Jobs for Nature/KMTT.

Figure 44. Map of weed control areas (left), sea spurge, *Euphorbia paralias* (right).

Sea spurge

The Scotts Beach sea spurge incursion site was surveyed for sea spurge seedlings every 2-3months. No plants were seen. DOC and the Ministry for Primary Industries (MPI) have agreed the site will be surveyed for another 6 years. DOC has also agreed to survey the coast for sea spurge annually to 2030 from Wekakura Point to the Oparara River, 15km either side of the Scotts Beach incursion. These surveys are carried out in the course of our other work.

There has been a total of 252 seedlings from the one Scotts Beach sea spurge plant identified in July 2020. One plant left in-situ from October 2020 for study purposes was removed in February 2022 when it began to flower after 16 months. One extracted in March 2023 (Figure 44 right) grew from obscurity amongst driftwood to flowering within 2-4 months. There are currently 22 sea spurge incursions in New Zealand, most on the west coast of the North Island.

Sea spurge is on the MPI unwanted list. Keith Briden wrote “It is an aggressive weed. An adult plant can produce 5000 seeds per year. Once established in South Australia and Tasmania it became the dominant weed, spreading rapidly on coastlines with plant density in Tasmania recorded as high as 180,000 plants per hectare. Limited data from a prior incursion in New Zealand shows sea spurge grows faster, taller and may flower more often than in Australia. It can invade pasture and is toxic to stock and humans. Its seed can live up to 7 years in sea water. The first incursion was in Raglan in 2012. The Scotts Beach incursion is the 4th on the west coast.”

Pest animal management

Seed fall monitoring

Installation of 21 seed fall traps; silver beech (7), hard beech (8) and rimu (6), allow more accurate predictions of potential rodent irruptions within the Heaphy catchment. Seed fall funnel traps are located under key canopy species where heavy seeding is likely to drive rodent irruptions. Seed funnel trap locations are shown in Figure 45. Rimu and hard beech produce large seeds which provide a good food source for rodents and are mainly present in forests at lower elevations, while silver beech produces much smaller seeds of lower food value to rodents but is a widespread canopy tree.

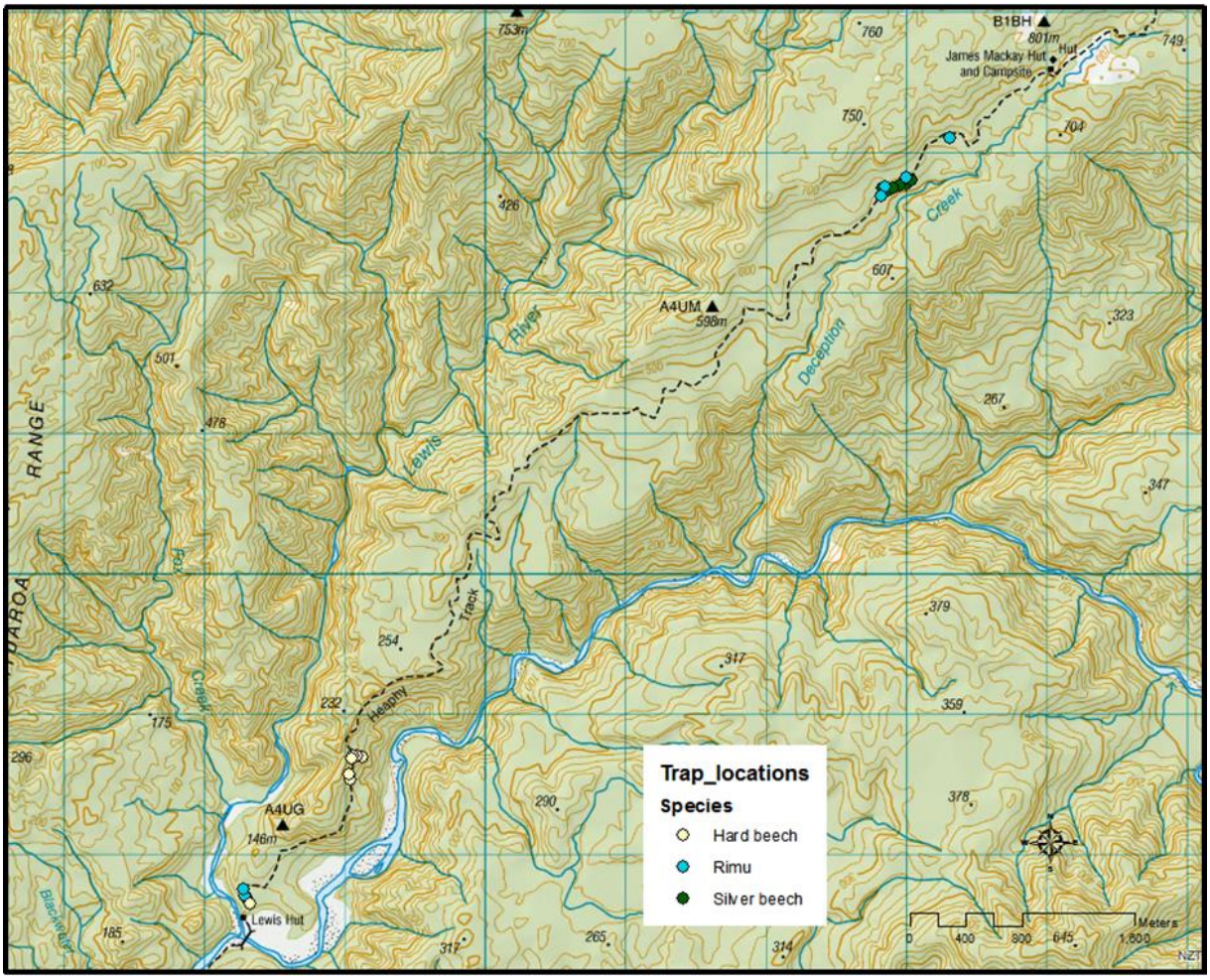


Figure 45. Funnel seed trap locations along the Heaphy track. Inset: large amount of leaf litter in traps this year due to more wind this season. Photo: Barry Chalmers.

Seed funnels were put out for four months, February to May. Seeds were counted by Barry Chalmers and some seed cut for viability. 2023-24 showed poor seed fall for rimu and silver beech and a slight decrease in hard beech seed numbers. 1 silver beech seed was collected. Figure 46 shows seed collected for each species per m^2.

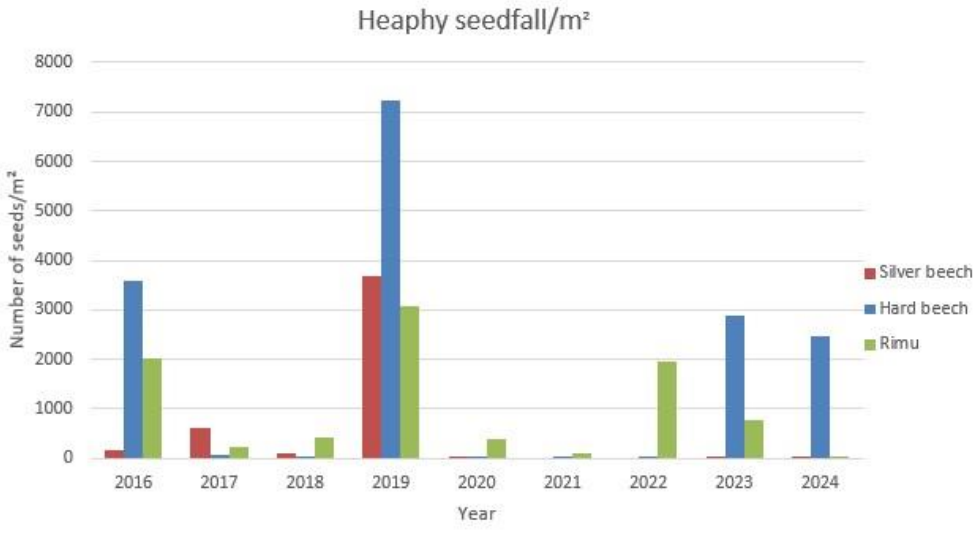


Figure 46. Heaphy seed fall collected February to May 2024 per m2/species.

0% of 200 rimu seeds cut were viable, 3% of 362 hard beech seeds were viable. The more viable, the more likely the seed will be eaten by rodents increasing their population. Nutrition for pests is better if the food is not empty or rotten.

Actual count of seeds collected was 5061 compared to 8103 in 2023 and 13950 in 2019. Silver beech and rimu seed fall was negligible.

Mast years are predicted with temperatures from the two preceding summers, and by checking the seed abundance on the trees in the preceding year. The Delta T map for 2024 (Figure 15), released in April annually, indicated for 2024 in the Heaphy Lowland there is no chance of a mast occurring. Despite this, rat tracking remains high in the Heaphy Valley from plentiful hard beech and rimu seed fall in 2023 and 2024.

Aerial predator control

No aerial predator control took place in the Heaphy Lowland 2023-2024. An operation was planned for February 2024. This was delayed until November 2024 on the advice of the National Predator Control Program Technical Advisory Group. The TAG group recommends implementation of aerial predator control treatment nationally, based on the timing of mast events. A "Nip it in the bud" operation before masting events (Figure 47) will be the focus, with an operation post-mast for areas of the highest biodiversity values across New Zealand.

New boundaries have been created within the Kahurangi National Park for a more integrated KNP aerial predator control treatment plan. The Heaphy Biodiversity Enhancement Area is now part of both the Oparara and Gouland blocks.

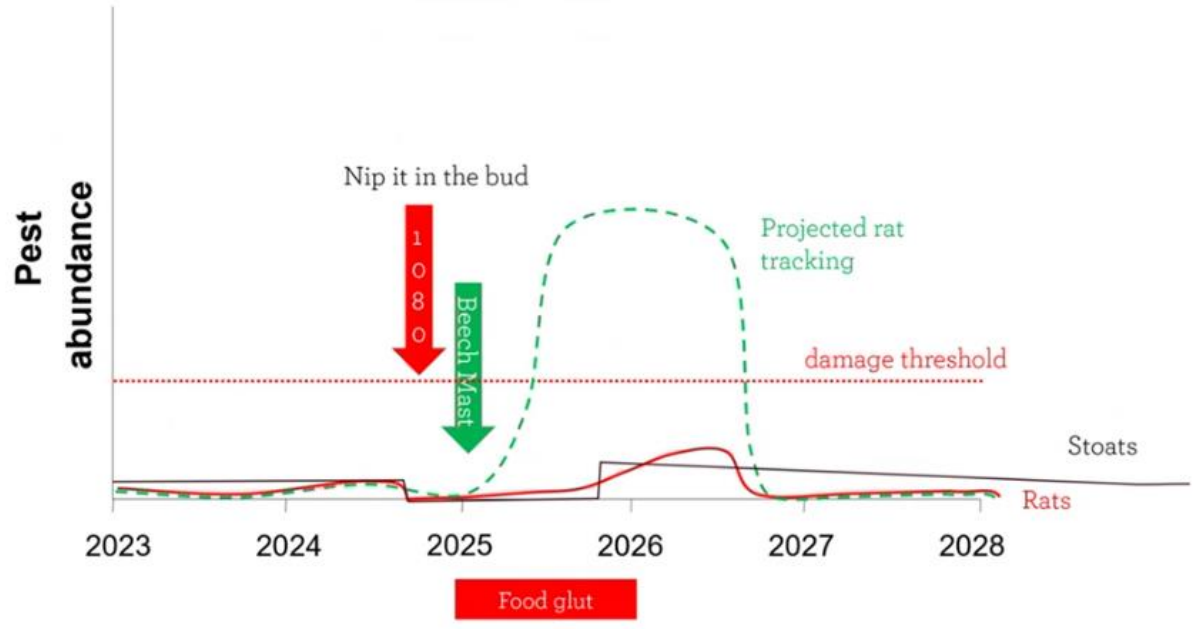


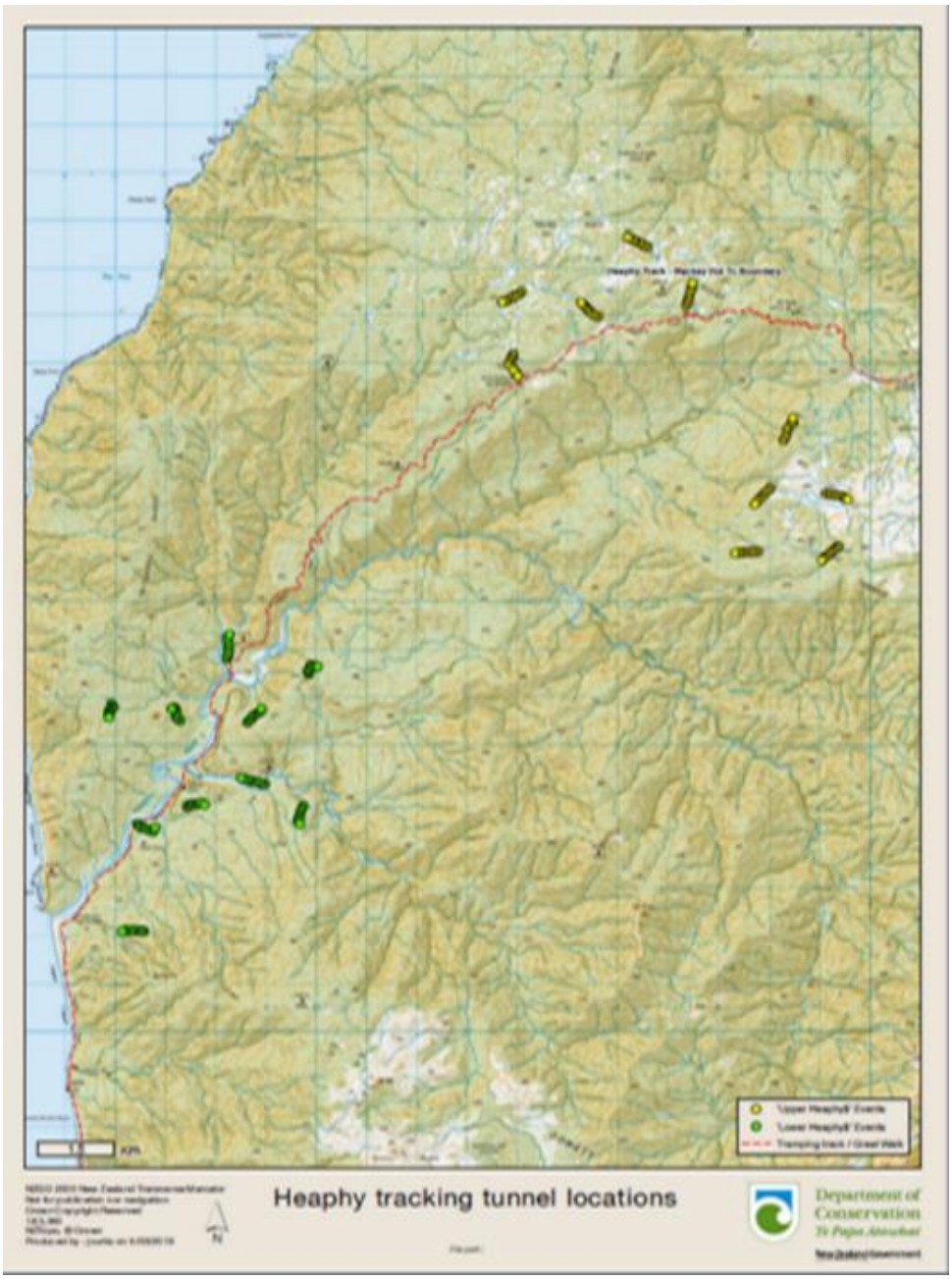
Figure 47. Graph showing the NPCP modelled "Nip it in the bud" effect on rat and stoat populations.

Small Mammal Indices

Rodent tracking lines have been established and run by DOC since 2015 in the Heaphy catchment. The resulting Small Mammal Indices (SMI) show a percentage of tunnels tracked by rats and mice over 1 fine night. Ecosystem health is maintained below 5% rodent tracking.

Twenty tracking tunnel lines are currently established within the Heaphy project area. There are ten Upper Heaphy and ten Lower Heaphy lines (map below). The Upper Heaphy north lines 1-5 are now coupled with the Kahurangi Point lines and are managed by National Predator Control Program.

Tracking tunnel operations were run in November, February and May by contractors MBC Environmental. Results can be seen in Figure 48.



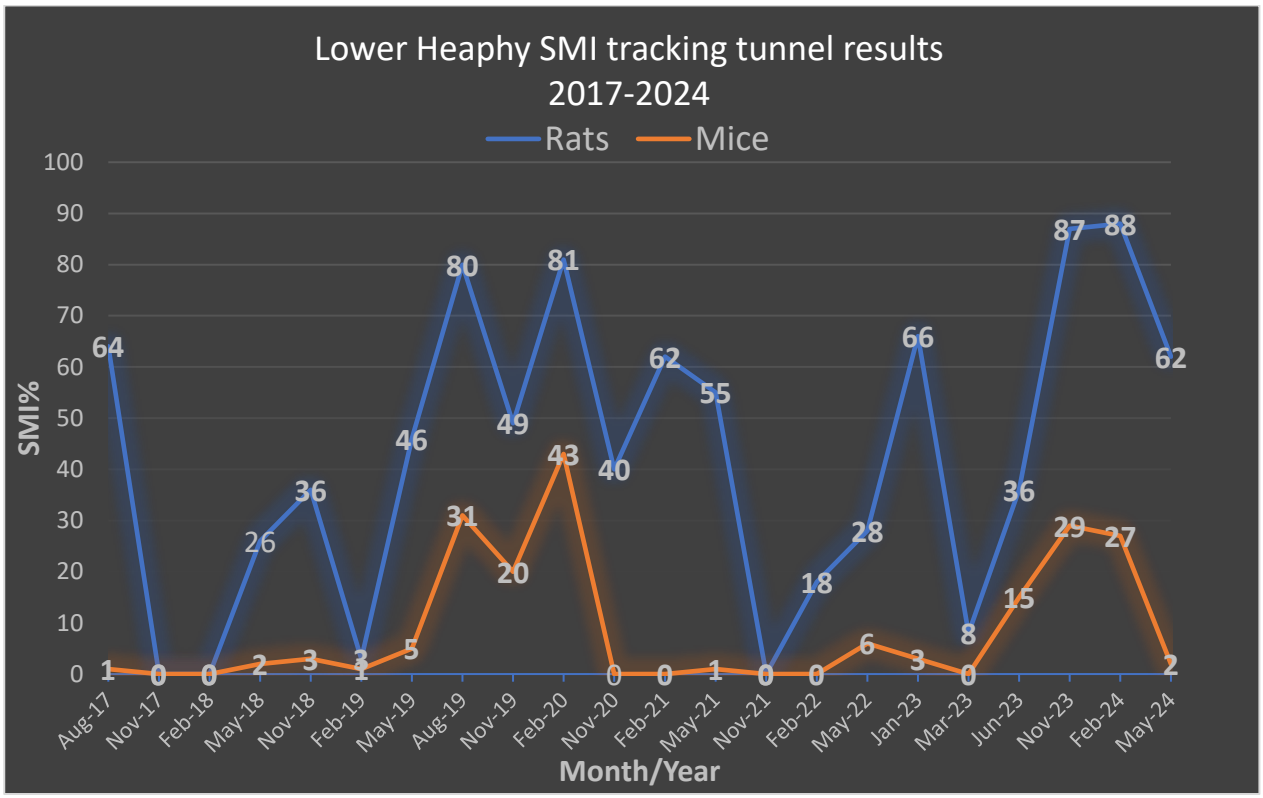


Figure 48. Rodent foot tracking indices 2017 to 2024.

Rat tracking November 2023 to February 2024 was the highest recorded in the Lower Heaphy in at least the past 7 years, at 87-88%. In May 2024 it was still high at 62% tracking. Hunting contractors noted it was the first time in 4 years rats were abundant at camp sites. Mouse tracking, at low levels since November 2020, ascended to 29% tracking in November 2023.

Rat tracking indices remain low in the Upper Heaphy due to the cold temperature at a high altitude and less food availability. Rat tracking indices were 10% November 2023, 13% February 2024, 0% May 2024. Mouse tracking in the Upper Heaphy was the highest recorded in at least 7 years with 42% tracking in November 2023. By May the mouse tracking had fallen to 4%.

Stoat camera indices

Heaphy result monitoring became a part of the DOC nation-wide National Predator Control protocol in 2022-2023. This requires one camera per line set for 3 months November to February. Bait was rabbit set up as recommended in the *Interim DOC trail camera guide v1.0.3: Using camera traps to monitor feral cats, mustelids and rats* (Inset Fig 49). Five trail cameras in the Upper Heaphy and ten in the Lower Heaphy (Fig 49) were set to capture three photos in rapid succession separated by 5-minute intervals. Animals on any, or all, of the three photos in rapid succession, are considered one capture.

Results are comparable to previous years by comparing detections per 1000 Camera Hours (CH) averaged over the number of tracking tunnel lines (Table 12). 2024 results showed 77% more stoats, 15% more rats, 41% more weka, 37% more thrush, 94% more blackbirds, 80% less robin and 38% less kiwi.

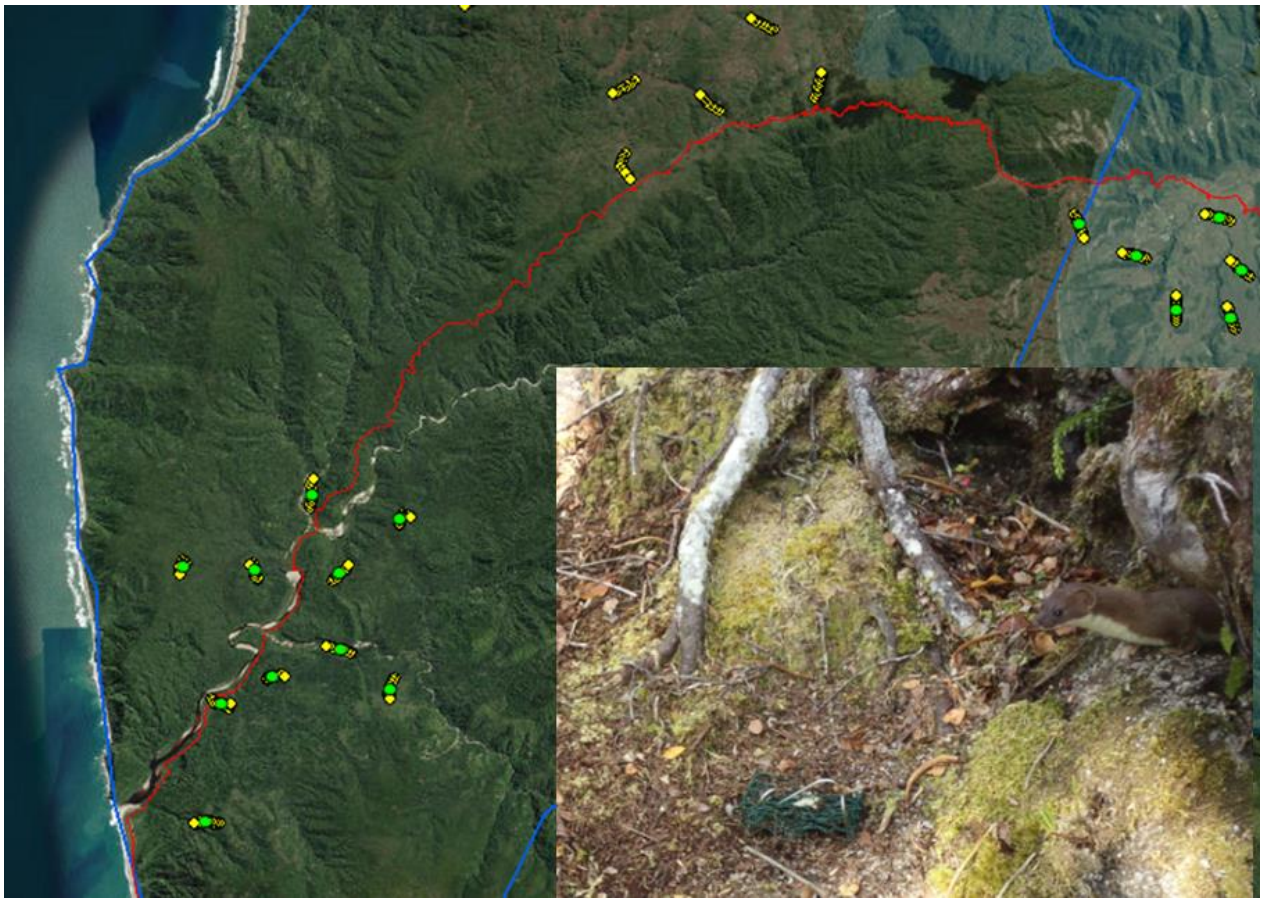


Figure 49. This map shows trail camera locations in the middle of the 10 lower Heaphy and 5 Upper Heaphy tracking tunnel lines. Inset: Stoat den next to rabbit bait captured on camera.

Table12. Mean detection per 1000CH comparison 2023 to 2024 with one camera per TT line.

Species	Stoat	Rat	Weka	Robin	Kiwi	Thrush	Tomtit	Mouse	Possum	Blackbird	Kea
2024	77%↑ 2.2	15%↑ 30.0	41%↑ 80.4	80%↓ 1.2	38%↓ 1.5	35%↑ 2.0	↓ 0	39%↓ 4.8	25%↑ 0.4	94%↑ 3.3	↑ 0.1
2023	0.5	25.5	47.5	6.0	2.4	1.3	1.3	7.9	0.3	0.2	0

Weka and rats were the most detected animals. Stoat detection increased along with thrush, possums and blackbirds. One kea was seen and a few native forest birds. Figures 50 and 51 show the mean detection comparison between 2023 and 2024 in the Lower Heaphy and Upper Heaphy lines respectively.

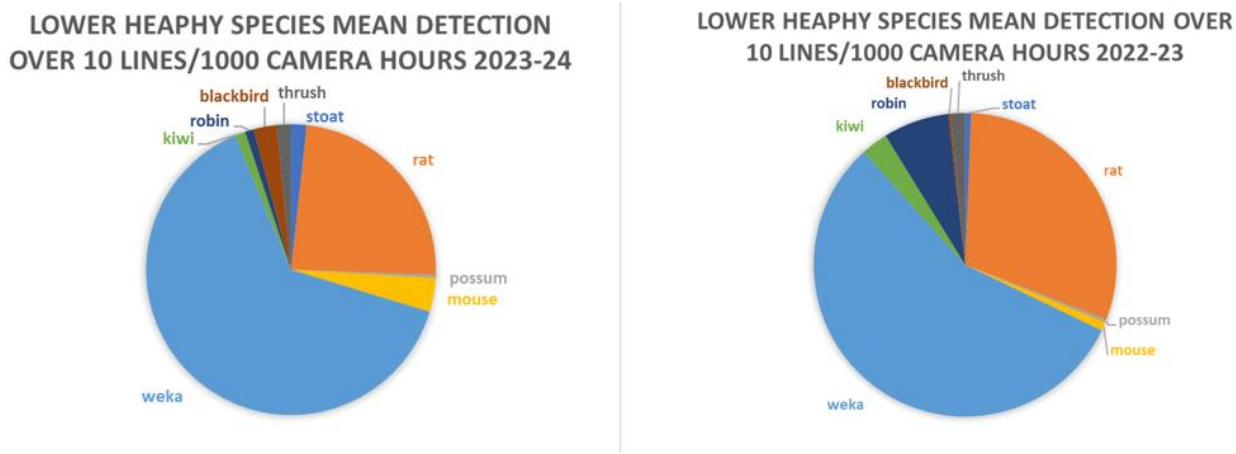


Figure 50. Charts comparing the mean species detection in the 10 lower Heaphy lines per 1000 camera hours.

Table 13 shows the species caught on trail cameras per 1000CH on the five Upper Heaphy lines. Mean species detection per 1000CH in the Upper Heaphy detected no rats. Stoats, mice and thrush were seen in 2024 but not in the 2023 captures. No fernbird or tomtit were seen. There was a 48% decrease in weka captures and an 83% decrease in robin captures. In both the Upper and Lower Heaphy cameras robin were over 80% less in captures per 1000CH/line confirming this species is particularly sensitive to high rat numbers in temperate forests.

Table 13. Mean detection per 1000CH comparison 2023 to 2024.

Species	Stoat	Mouse	Weka	Robin	Fernbird	Tomtit	Thrush
2024	0.3 ↑	0.7 ↑	11.6 ↓ 48%	0.2 ↓ 83%	0 ↓	0 ↓	0.3 ↑
2023	0	0	22.2	1.2	0.5	0.9	0

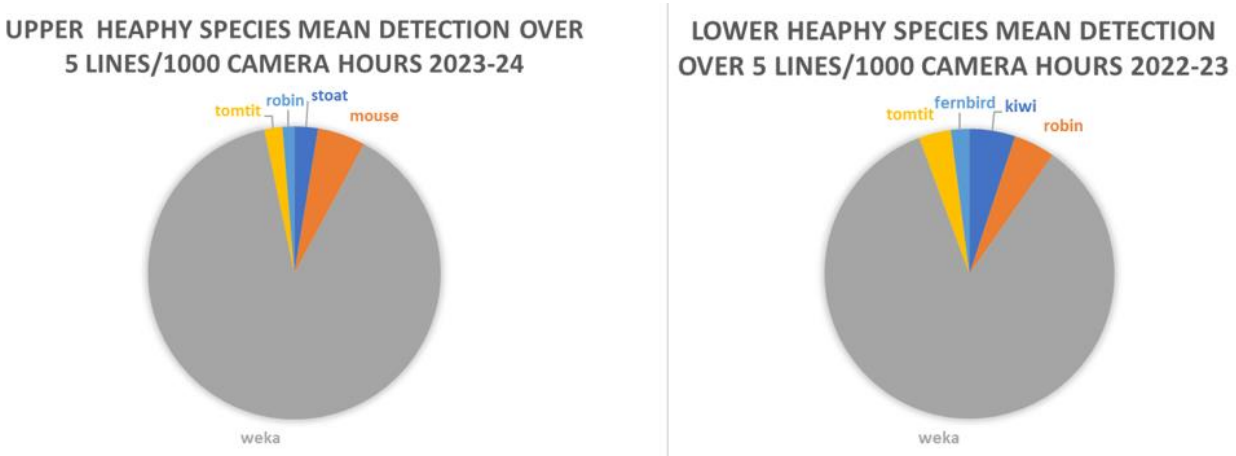


Figure 51. The pie charts show the mean species detection over 5 Upper Heaphy lines per 1000CH 2023 vs 2024.

More stoats, mice and thrush, less weka, robin, fernbird, tomtit were detected in 2024, than in 2023.

Traplines

There are currently four trap areas in the Heaphy Biodiversity Enhancement Area. Self-resetting A12s (possums), A24s (rats) and double DOC200 box traps (stoats) are located within the hut areas to reduce rodents around areas of human habitation and to attract native species for the Heaphy Track Great Walk. Counters are on all self-resetting traps, weka excluders are on all A24 traps. Self-resetting traps are checked every four months. Box traps are checked ten months of the year when other work is being carried out in the area, often by contractors and hut wardens.

Table 14 and Figure 52 show similar trap catch numbers for the past two years around the Heaphy Hut.

All traps are listed on the Trap NZ website. Results in maps Figures 52-54 are colour-coded based on catch. Green, no catches, red, above four catches, yellow and orange graded in-between.

Table 14. Heaphy trap catch 2023-2024 compared with the previous year.

Heaphy	**22-23**	**23-24**
A24	85	87
A12	13	6
DOC 200 Box	25	29

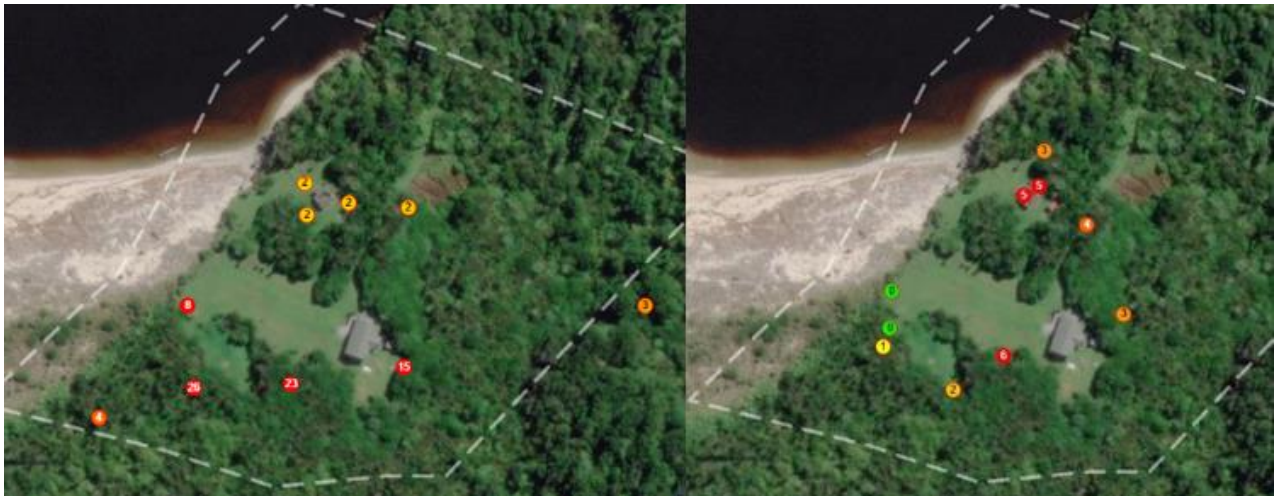


Figure 52. Heaphy Hut A24 trap catch map from TrapNZ (left), box trap catch (right).

Table 15 and Figure 53 shows the trap catch numbers for the past two years around the Lewis Shelter. The decrease in the A24 trap catch is likely due to the malfunction of traps eaten by rats. This has led to trap checks for A24s every 2 months when rodent tracking is high. Possum catch remains low.

Table 15. Lewis Shelter trap catch 2023- 2024 compared with the previous year.

Lewis	22-23	23-24
A24	183	124
DOC 200 Box	27	25
A12	2	2

Figure 53. Lewis Shelter A24 trap catch map from TrapNZ (left), box trap catch (right).

Table 16 and Figure 54 shows the trap catch numbers for the past two years around the Mackay Hut. The A24 rat catches at the Mackay Hut more than doubled in 2023-2024.

Table 16. Mackay Hut trap catch 2023-2024 compared with the previous year.

Trap type	22-23	23-24
A24	51	119
DOC200 Box	6	25

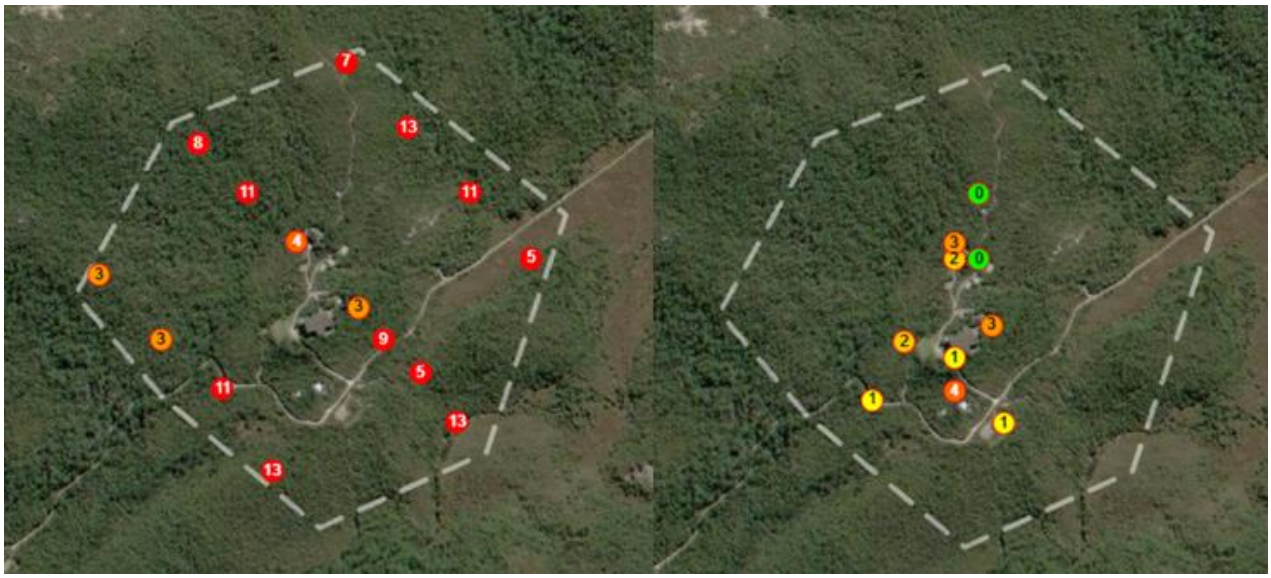


Figure 54. Mackay A24 trap catch map from TrapNZ (left), stoat box trap catch (right). Possums are rare at the altitude of 630m around the Mackay Hut.

Figure 55 shows the trap catch for the Gunner traps which averages 5 rat catches per month

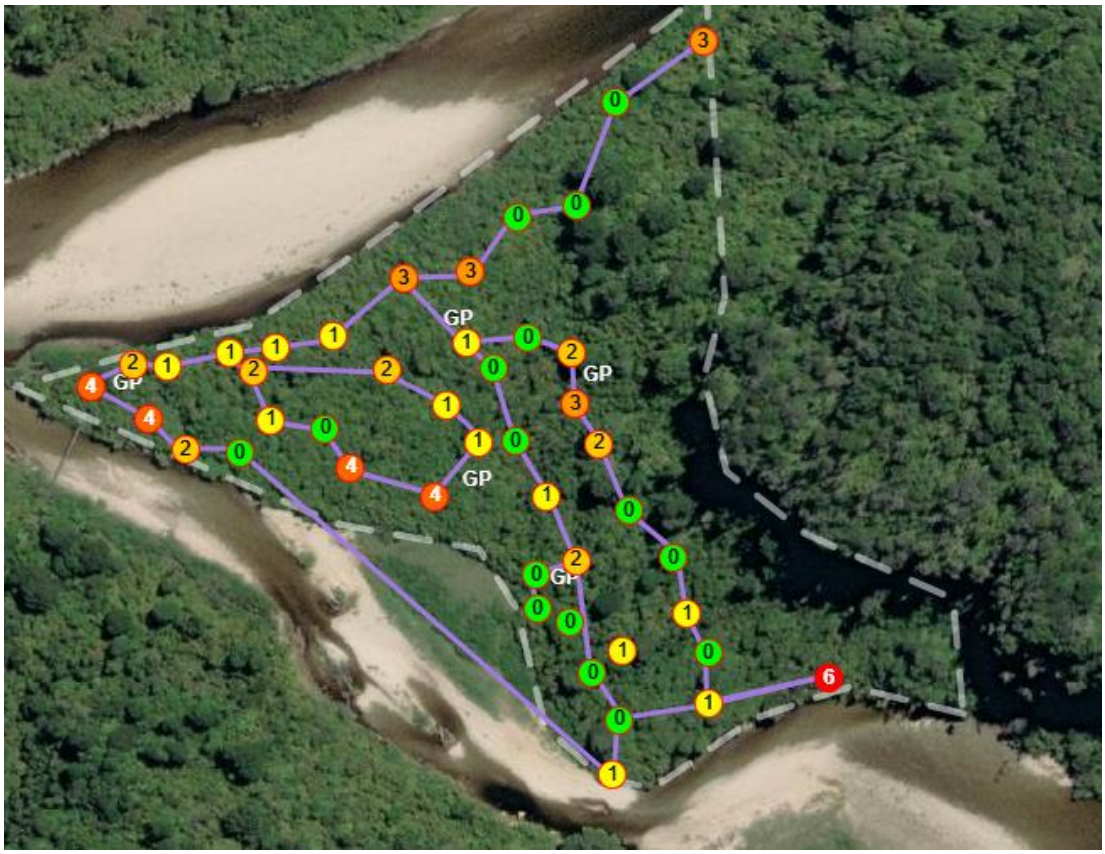


Figure 55. The Gunner River DOC200 trap grid for the protection of *Powelliphanta superba* "Gunner River" has averaged 5 rat catches per month in the last two years.

Pig hunting

Contractors undertook three pig hunting trips of 100 hours in 2023-2024. On the map in Figure 56 the blue area had thermal hunting in June 2024 for chamois, the pink areas are the ground control carried out by contractors Wild Balance and Hoof and Fur. The yellow area is the Heaphy Biodiversity Enhancement Area for management by the Bathurst Project, with a lighter yellow buffer area.

Aerial thermal imaging in June 2024 was used to detect ungulate populations in the northern Heaphy area. This work was funded by the National Wild Animal Program. Aerial thermal hunting saw a total 70 chamois shot in KNP, one 500m from the MOW hut and 2.5km south of the Kahurangi lighthouse.

A total of six pigs and eight unborn piglets were controlled by ground hunting in the Heaphy Valley and Big Bay blocks in October 2023. One pig was controlled in the Heaphy Valley in April 2024.

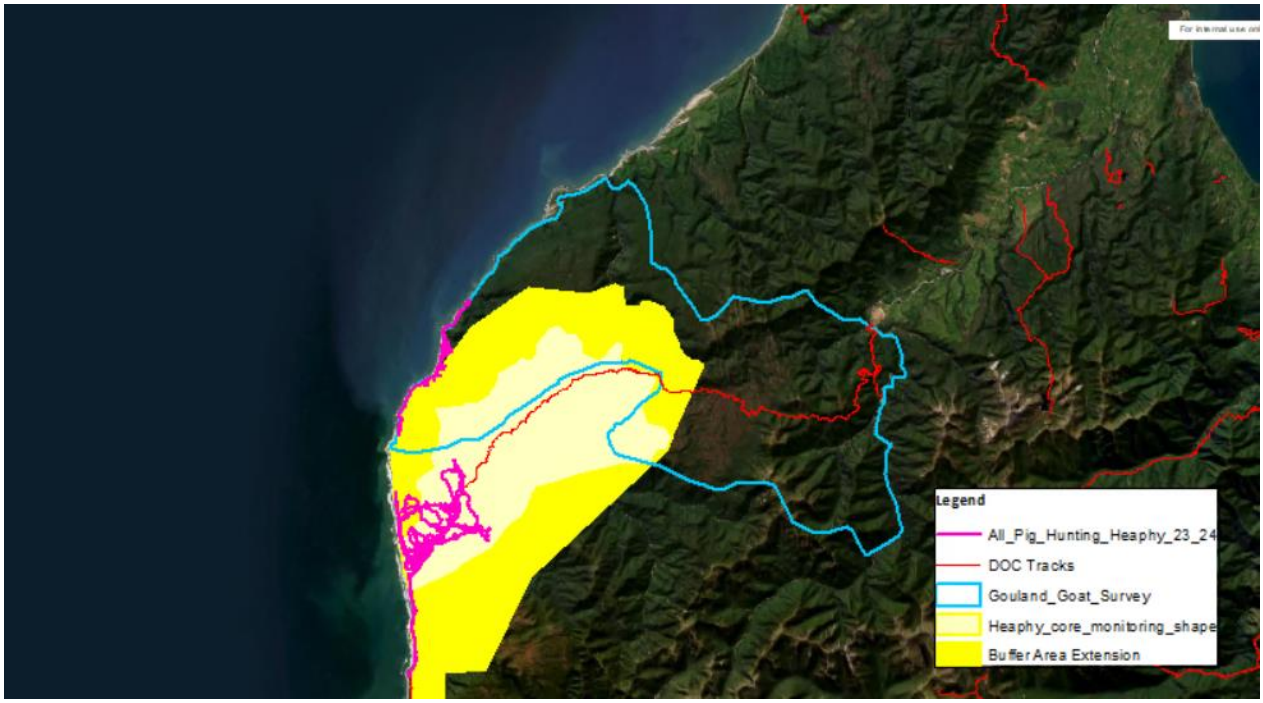


Figure 56. Heaphy hunting areas. Pink tracklogs for ground pig control with dogs, blue polygon shows the aerial survey and control for goats. The light-yellow area is the Heaphy Biodiversity Enhancement Area (HBEA). The dark yellow area is the HBEA buffer zone.

Trips 1 and 2. Big Bay and Heaphy Valley, October 2023, 200 hours.

Summary by Liam Ball.

In the Heaphy River pig control block, there was the most sign encountered in the past 7 years. This sign was concentrated in the lower 4 kms of the northern side of the Heaphy River, particularly on the river flats. Older sign was encountered around the lower reaches of the Gunner River, these pigs looked to have moved out of the area and most likely back to the northern side of the Heaphy River. The damage on the northern side of the Heaphy was extensive, it is difficult to determine if it was caused by the 2 pigs caught and killed living there or if other pigs had recently moved out of that area.

- At **Big Bay** 2 large mature boars were killed (Figure 57). These were estimated at 3 – 5 years of age. 1 large mature sow was killed with 8 unborn piglets inside, estimated at 3+ years of age. No pig sign

was found north of Big Bay. This area has historically been a hotspot. There was a moderate amount of sign around Big Bay with some serious damage to the dune environment (Fig 57 right).

- In the Big Bay camp rats and mice were an issue in camp, this is the first time since approx. 6 years ago we have had a problem with rodents.
- Coverage is difficult in the Big Bay block due to the thick coastal bush and windfall. Hunting effort was concentrated in the ideal feed areas e.g. Nikau flats and faces.
- Pigs continue to populate around the Kahurangi Lighthouse moving south to Big Bay and the Heaphy Valley.

- In the **Heaphy River** pig control block 2 boars were killed, 1 younger boar, estimated at 2 years of age (Fig 58 left), 1 old mature boar estimated at 4+ years of age.
- In areas in the Heaphy River large numbers of very small nikaus had been ripped from the ground with the bases chewed by pigs.

Of the 5 pigs killed the stomach contents consisted mainly of nikau and inside one of the pigs there were the remains of either a large native worm or snail (Fig 58 left). Deer numbers were low in both the Heaphy and Big Bay. Map of area hunted is in Figure 59.

Figure 57. Pig hunted from the Heaphy (left), pig rooting of pingoa on Wekakura Pt south beach (right). Photos: Liam Ball.

Recommendations:

- If work is going to be done in the Heaphy River next winter, I would recommend it is done slightly earlier as we seemed to be the tail end of the sign.
- We also need to be informed of any fresh pig sign as soon as possible, in the case of pig sign south of Wekakura Point we were informed too late to be able to effectively hunt these areas.

Figure 58. Stomach content of nikau and maybe pingoa roots, left. Large boar from Big Bay, right. Photos: Liam Ball.

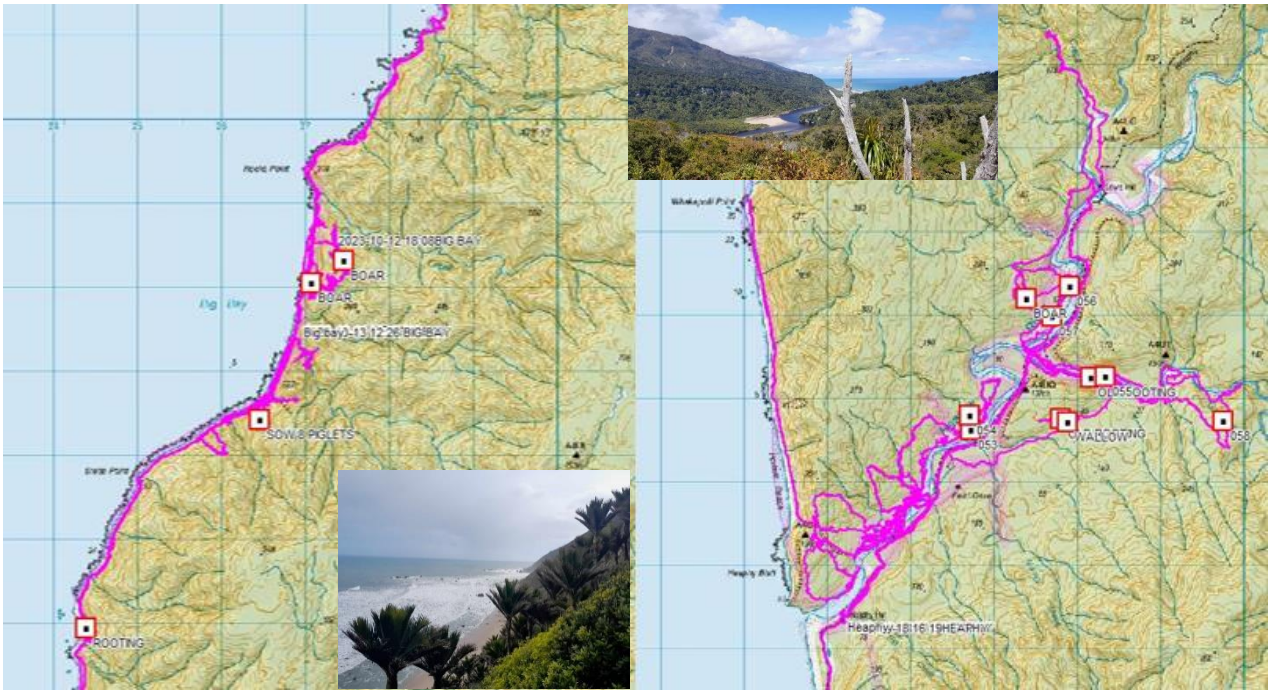


Figure 59. Location of pig kills and rooting at Big Bay (left). Inset: Big Bay. Photo: Liam Ball. Location of Heaphy Valley pig kills and rooting (right). Inset: Heaphy River. October 2023.

Pig sign from the Heaphy Valley hunt in April 2024 by Wild Balance, can be seen flagged in Figure 56.

Trip 3. Heaphy Valley, April 2024, 100 hours.

Summary by Tom Hopkirk.

We completed 100 hours of pig ground hunting with bailing dogs between 22nd – 26th April 2024. In total one pig was destroyed. The bush was thick meaning travel was slow, and pig numbers were low. The pig that was caught was the only fresh scent we encountered. There was sign of one other mature pig in the Heaphy River that was about a week old.

From what we saw on this trip and on previous trips with Hoof and Fur, we believe the pigs mainly reside on the coast and occasionally cross over into the Heaphy for food, where they stay for a short time before returning to the coast.

The pig that was destroyed on this trip was tracked from the Heaphy River right up and over the top ridge and down to almost the coast; the blue track (Figure 60) is the dog track from that particular hunt. The distance the pig was tracked was 3.84 km, we can assume that the pig would have travelled at least an extra 1 km on this (previous to the dogs hitting its scent). With pigs moving large distances such as in this case, tracks and more frequent visits will help catch them, along with good long distance finding dogs.

Figure 60. Pig sign marked with red flags in the Heaphy Valley (top left), pig rooting alongside the Heaphy track in June 2024 (top right), uprooted nikau seedlings (bottom left) and sapling damage by pigs (bottom right). Photos: Tom Hopkirk.

Recommendations

- With pigs moving large distances, tracks and more frequent visits will help catch them, along with good long distance finding dogs.
- Some tracks cut throughout the block would be beneficial for access into the heads of the gullies on the coast and to increase distances covered each day.
- This in turn will increase the chances of crossing fresh pig sign. You could put a helicopter landing pad in the top of the ridge between the Heaphy and the coast, this could be scoped out and discussed once hunter tracks are done.
- More frequent visits to the Heaphy River rather than long trips would be more beneficial, especially if the recommended hunter tracks can be put in.
- Keep doing trips up the coast to reduce pig numbers up there and therefore reduce the number of pigs moving into the Heaphy River.

Financial 2023/24

Heaphy Programme	**Costs** ($)
Weed control- Kongahu Bushworks, DOC	25,000
Pig control ground- contractor Heaphy Valley, Big Bay	32,000
SMI tracking tunnel monitoring/maintenance- MBC/Kongahu	50,000
Rodent, mustelid and possum control	12,000
Seed fall monitoring	4,000
Bat acoustic recorders	2,000
Kiwi call ARDs and analysis	8,000
Lewis snail plot monitoring	18,000
5 min bird counts and analysis	22,000
Threatened plant management	14,000
Invertebrate inventory -pitfall traps	24,000
Freshwater survey, eDNA processing x3	7,000
Project management, biodiversity rangers Band C, 8- and 2-month contracts, training, TAG meeting venue hire/catering, TA travel costs, ranger field equipment.	155,000
Total Heaphy Actual	373,000

Heaphy workplan 2024/25

Heaphy Programme	**Costs** ($)
Weed control- Kongahu Bushworks, DOC	40,000
Pig control ground- contractors, pig trapping	40,000
SMI tracking tunnel monitoring/maintenance- MBC/Kongahu	50,000
Rodent, mustelid and possum trapping around Huts	20,000
Aerial predator control operation ($500,000) and support ($7,000)	507,000
Seed fall monitoring	5,000
Bat acoustic recorders	5,000
Kiwi call ARDs and analysis	5,000
5 min bird counts and analysis	19,000
Snail plot installation	17,000
Threatened plant management	23,000
Lewis Forest Interpretation sign	7.000
Invertebrate inventory -pitfall traps	20,000
TAG meeting- room hire, catering, TAG attendance/accommodation	4,000
Project management Band E, training, contract bio ranger Band C (6 months)	110,000
Planned	872 ,000

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Appendices

Appendix 1 Project tasks achieved Denniston

Type	**Task**	**Summary**	**Rank** Priority 1-10; Secondary High - L**ow**	**Status 23/24**
DOC				
Control	1080 aerial full	Aerial 1080 for possum, stoat and rat control over 4400ha. Apply at least every 4 years, either when possum density > 25% BMI, when required by TB control, or when beech seed fall and rat monitoring indicate a mast year and predicted rodent irruption. Apply as per NPCP best practice. Previously September 2020 (NPCP), September 2023 (SOIK).	1	Achieved
Control	Possum/rat ground	Ground possum control over areas of Denniston plateau where aerial baiting cannot be used ,such as the area around Denniston township and water catchment at Lake Stream/Christmas Stream.	2	Not programmed
Result	Seed fall monitoring	Set up 28 seed fall traps- 7 rimu, 7 silver beech, 8 mountain beech, 6 hard beech. Open traps every year beginning of Feb and collect seed early June. Assess viable seed and seed counts by species.	3	Achieved
Result	SMI monitoring	Random placement of 11 rodent tracking tunnel lines in forest and on pavement. Tracking tunnel operations November, February and May plus, if mast indicated, August. Follows NPCP protocol from 2023 ongoing.	4	Achieved
Result	Possum/rat wax tag and chew card monitoring	Minimum 11 lines wax tag/chew card method, random start points in forest and scrubland strata. Following each aerial control operation and at 2-3 year intervals for trend monitoring. Last by Ospri 2022-2023.	5	Not programmed
Control	Rat and Stoat control	Stoat by-kill from aerial possum and rat control. Localised trapping or poison baiting when SMI survey indicate rats or stoats in habitat patches on the plateau. Use captive 1st generation rat baits, rodent kill traps and DOC 200 kill traps in tunnels if stoats indicated.	6	Not programmed

Control	Weed control/ monitoring	Year round. Ground spraying of target weeds. Weed surveillance. Follow Denniston Weed Control Plan 2020-2025. Use weed ID photos booklet for advocacy/training. Weed photopoints every 3 years, next 2025-26. Gorse waypoints tbc.	7	Achieved
Research	Lizard counts	Lizard counts (visual searching and ACOs). Power analysis determines sampling effort required to detect population trend in two gecko species. Recommended green gecko monitoring on hold due to resource constraints. DOC ACO population monitoring by mark and recapture method for forest geckos 2023-2025 in progress.	8	Achieved
Result	Euphrasia wettsteiniana	To determine incursion of Juncus squarrosus into threatened species territory. Transect lines setup 2021. 3 yearly after two years baseline data collected. Next 2024-25.	8d	Not programmed
Result	Stoat cameras	Set up on TT lines as per the DOC NPCP Protocol November- February.	10	Achieved
Control	Goat control	Aerial search 3x per year first 2 years then reduce - target all DBEA potential goat habitat. Ground hunters with indicator dogs search potential goat habitat - 400 hours per year initially then reduce.	M	Not programmed
Control	Deer Control	Aerial hunting 3x PA in conjunction with goat control. Ground hunting 400hours PA then reduce to appropriate level	M	Not programmed
Control	Cat control	As required. Where necessary use cage traps to capture and remove cats	M	Not programmed

Appendix 2 Project tasks achieved Heaphy

Type	Task	Summary	Rank Priority 1-10; Secondary High-Low	Status 2023-24
Control	Possum/rat full aerial 1080	Aerial 1080 for possum and rat control over 25,000ha. Apply approximately every 4 years when possum density > 25% BMI. Apply as per NPCP Best Practice. Ground control around huts & water supplies. Operation timing from NPCP TAG recommendations. Next November 2024.	1	Not programmed
Control	Stoat control	By-kill from aerial 1080 operations.	1	Not programmed
Control	Possum rat 1080 ground aerial excluded area	Aerial baiting exclusion zones around huts will require regular localised possum and rat control. This will be achieved by: • Placement of A12 gas operated possum kill traps in areas within 200m of Heaphy Hut and Lewis Shelter. • Weka-proof A24 traps serviced at least twice per year. • opportunistic live capture traps for cats and possums around Heaphy hut serviced by casual staff and pig hunters. • DOC200 box traps serviced by hut wardens or when other work is being carried out in the area.	2	Achieved
Result	Seed fall monitoring	Set up 21 seed fall traps. Open traps every year beginning of February and collect seed t end of May. Assess viable seed and counts by beech species and rimu.	2	Achieved
Result	Rat index monitoring	Annual. Stratified, 3-4 per year. Tracking tunnels (rats) Low valley/coastal strata < 500m asl– 10 lines (Lower Heaphy), >500m asl mid upper slopes and infertile uplands– 10 lines (Upper Heaphy). Run November, February, May. Pre-post aerial predator control operations as required. NPCP currently manage Upper Heaphy Lines 1-5.	2	Achieved

Control	Stoat Monitoring	Trail cameras along TT lines as per 2019 DOC Best Practice. Indices per 1000hrs captured. Also shows relative abundance of other species eg, fernbird, thrush, robin, kea, possum, kiwi, rat.	2	Achieved
Result	Possum index monitoring	Biannual and between aerial operations. Forest stratified. WaxTags (possums). NPCA protocol. 40 lines in 4 forest strata.	3	Not programmed
Control	Weed control/monitoring	Year round. Aerial and ground spraying of target weeds. Weed surveillance annually.	3	Achieved
Outcome	Bat monitoring	Develop and implement measures for monitoring long-tailed bats. Power analysis showed 7 years to detect a 5% annual change with 80% power. 2021 analysis indicated increasing trend of 30% over 4 years. ARDs set for 12 fine nights in February annually for bat pass counts.	4	Achieved
Outcome	Snail monitoring	Permanent plots – Four sites: Mackay, Lewis/Heaphy, Gunner Downs (originally a control site). Monitored every three years. Gunner Downs March 2023. Heaphy March 2024	4	Achieved
Control	Threatened plant management	Several management activities will be undertaken to enhance populations of threatened or At-Risk plant species: LEPfle: collection and scattering of seed at suitable sites along the coastline, annually. Propagation and planting as required. Aim-to sustain an average 200 plants over 20 years Tiropiuhi to Scotts Beach. Extend range from Kahurangi Point to Cape Foulwind (JM/SC pers. comm. 23 February 2022). Southern range is to Chatham Islands. POAbil: Collect seed, divide and plant tillers at the same or adjacent beaches, annually. Locate other plants on West Coast. Pingao and spinifex: opportunistic seed collection (late Feb-Mar), planting, scattering. COPtal: Locate populations to reduce threat ranking, seed collection for NZISB. PERtet: Propagation trial Lewis and Mackay Hut areas 2021-	5	Achieved

Outcome	Whio monitoring	After initial assessment in 2020-2021 it was determined in order to obtain a population trend over time a 5 yearly survey with detection dogs was sufficient. Feasibility to do walkthroughs (cost and time) when river flows are high and walkable terrain patchy would not produce much insight for the effort involved. The outcome target is to achieve a sustained increase in the population with birds occupying all suitable rivers in the project area. Translocate birds as recommended by technical advice. 5 yearly censuses with detection dogs to coincide with the Oparara/Ugly security site, next 2026.	6	Not programmed
Outcome	Kiwi monitoring	Kiwi call count monitoring over a range of altitude and vegetation types. To compliment the three existing call count stations in the Heaphy Valley, an additional 3 were established on Mackay Downs. Three hours of call counts done for six nights at each listening station. This procedure was repeated at each station for three consecutive years, at the same time of year, to establish a baseline in call counts and then repeated every 3 years to measure changes over time. Adaptive management to acoustic recorders annually for better trend analysis. Next 2023.	6	Achieved
Result	Ungulate - pig	Annual pig hunting and survey. Cull if observed during aerial or ground search and surveillance operations. Record search areas, sign observations and kills with GPS. Targeted control with hunters and dogs.	7	Achieved
Outcome	Foliar Browse Index FBI	Aerial survey and establish; then 4 yearly. 3spp x100. Next 2026-27.	8	Not programmed
Outcome	5MBC	Set up approximately 200 bird monitoring stations, a minimum of 200m apart. Lower strata >500m monitored annually, upper strata <500m monitored every three years to pick up trends.	9	Achieved
Survey	Survey and Inventory	As required kaka, kea, freshwater fish, invertebrates, lizard monitoring.	10	Achieved (invertebrate, freshwater communities)
Outcome	Seedling Ratio Index SRI	3 yearly; 20 lines 200m apart in deer/goat used habitat; Forest stratified.	H	Not programmed
Survey	Ungulate - goat	Surveys to establish locations for control and establishment of SRI plots.	H	Not programmed
Control	Goat control	Annual. Aerial search and cull operations x3 per year. Record search area with GPS and observations/kills.	M	Achieved

		Ground search and cull operations 200 hours. Record search areas with GPS and sign observations and kills		
Control	Deer Control	Annual. Aerial search and cull operations x3 per year in spring and autumn. Record search area with GPS and observations/kills. Ground search and cull operations x1 per year. Record search areas with GPS and sign observations and kills.	M	Not programmed
Outcome	5x5 canopy gap exclosures establish	Establish and measure up to 40 5x5 vegetation plots. The first year will require a flight around the Heaphy management unit to locate gaps in the canopy to place plots. The initial set up on the plots will be labour intensive due to the establishment of the exclosures. The plots will be monitored on a 5 yearly basis. But the exclosures should be checked yearly to ensure they still exclude ungulates (due to windfall etc). Forest stratified. Annual maintenance.	M	Not programmed
Outcome	Threatened plant monitoring	Plant populations, in particular sand tussock, pingoa, gossamer grass, coastal cress, Coprosma talbrockiei and Gratiola concinna will be monitored to measure their response management activities. Permanent transects or total counts will be used depending on distribution and abundance. The management target is to achieve an increase in abundance or extent for all species. Red mistletoe will be monitored by repeatedly assessing individuals for mortality, growth, foliage cover and browse damage. Mistletoe recruitment will be assessed by searching for new plants in permanent plots. This may be achieved as part of the permanent vegetation plots and FBI monitoring (see 9.2.1.1. and 9.2.1.2.).	M	Achieved
Survey	Small predator surveys	Surveys will be undertaken to establish the presence of other predators such as feral cats, hedgehogs and hares in the management area. By trail camera, NPCP Protocol.	M	Achieved
Control	Stoat control targetted (WhiONE)	Establish kill trap lines using DOC 200 kill traps in double trap wooden boxes along sections of river (to be determined after survey). Assess new stoat killing devices, traps or poisons, as developed. Service monthly.	L	Not programmed
Outcome	20x20 establish and remeasure	Yr1 establish 20 plots in "cool" forest ecosystems. Stratified by forest. Remeasure plots already established in Mesic forest ecosystems, plus 20 plots to be established cool forest. Remeasure 10 yearly (split in two - 5yrs)	L	Not programmed

Appendix 3 Bathurst Project Justification

Document Reference DOC-7549564

The Bathurst Project- What is it?

The Bathurst Project uses mining compensation funding for the enhancement of biodiversity on the Denniston Plateau and in the Heaphy catchment in the Buller District, Western South Island. Like the Project River Recovery or the kakapo, takahe and tokoeka programs it sits beside DOC's core biodiversity work as a separate project.

Beginning in 2013, the biodiversity work goals are ecosystem health and threatened species persistence. The Project contributes to DOC's wider programs- National Predator Control Program, Predator Free 2050, National Wild Animal Control Program and biosecurity (with MPI). For example, since 2020 the Bathurst Project has contributed over $1,000,000 to the National Predator Control Program for aerial predator control in the Heaphy and Denniston areas and it funds the control of ungulates in the Heaphy catchment. It also undertakes sustained suppression of weeds and led the eradication of sea spurge, working with MPI. The Project also has trapping programs and contributes to research projects.

How did it come about?

Bathurst Resources (then Buller Coal Limited) was granted a Resource Consent to open cast mine on the Denniston Plateau. The **Resource Consent** conditions were to "offset the residual adverse effects on biodiversity values from the Escarpment Mine" cl.145-155. Those conditions outline:

- the compensation funding amount for Denniston and Heaphy;
- the timeframe;
- the legal protection of the Denniston Permanent Protection Area (DPPA or DCEA);
- the biodiversity enhancement objectives and attributes to be protected; and
- the creation and required content of the Denniston and Heaphy Biodiversity Enhancement Plans.

A **Compensation Deed**, signed by the Minister of Conservation and Bathurst Resources, contains particulars on how the funds are spent and the minimum requirement to be included in the biodiversity enhancement plans.

Biodiversity Management Plans outlining the enhancement work to be undertaken were prepared by the Department for the Heaphy catchment (Department of Conservation Heaphy *Whakapoai* Biodiversity Management Plan 2013-2048) and Denniston Plateau (Department of Conservation Denniston Plateau Biodiversity Management Plan 2013-2063) in consultation with Bathurst Resources.

An **Access Arrangement** was entered into between the Minister of Conservation and Bathurst Resources under the Crown Minerals Act 1991 to undertake mining on Denniston Plateau.

Funding

The Resource Consent specifies Bathurst Resources pay $18,375,000 for 35 years of Heaphy biodiversity enhancement work and $3,000,000 for 50 years of Denniston biodiversity enhancement work. The funding arrangement is outlined in the Compensation Deed and subsequently the Access Arrangement between DOC and Bathurst Resources.

These funds are specifically designated for biodiversity enhancement programmes in the Heaphy River catchment and on the Denniston Plateau as per the Resource Consent conditions.

Who are the parties involved?

The two management plans identify a Technical Advisory Group (TAG) which provides technical guidance in the implementation of the plans.

The Bathurst Project TAG is made up of DOC science advisors and local staff, Bathurst Resources environmental managers, and iwi.

The principal purpose of the Technical Advisory Group is the provision of current, objective, and robust technical and tactical advice to the Buller/Kawatiri Operations Manager in support of the delivery of the Denniston Plateau and Heaphy catchment biodiversity enhancement work. The 15 members evaluate the biodiversity and monitoring data resulting from the work undertaken under the management plans.

What are we protecting?

The Project protects unique ecosystems including lowland nikau forest, tussock communities, old growth podocarp/hardwood forest, ephemeral wetlands and sandstone erosion pavement.

28 threatened species are listed for management in the Heaphy catchment. Several of the most threatened species have been selected as indicator species including the great spotted kiwi, long-tailed bat, lizards, powelliphanta, invertebrates and forest birds. Weed control benefits the threatened plants that are conservation dependant.

8 threatened species are listed for management at Denniston. Indicator species are the green gecko, forest gecko, south island fernbird, rifleman, great spotted kiwi and powelliphanta. The Nationally Critical Avatar moth has recently been added to this list. Protecting these species from habitat loss and predators is the greatest challenge.

What are we doing?

- Pest control- aerial 1080, trapping, hunting and result monitoring.
- Weed control- weed plans, surveillance and biosecurity.
- Threatened species management- survey, planting, outcome monitoring, research projects and power analyses.
- Annual Reporting.
- Carbon reduction initiatives
- Working with the TAG, Ngati Waewae, community volunteers, contractors and DOC staff.

Ranked project tasks are reviewed annually by the TAG based on result and outcome monitoring.

How are we making a difference?

In the Heaphy catchment all species benefit from landscape predator control every two years, partly funded by the Bathurst Project. Monitoring has indicated relative abundance of forest birds, great spotted kiwi and long-tailed bats has increased over a 10-year period. The coastal threatened plants have quadrupled in the past four years and are kept above a minimum 200 plants. One inland plant has had its status reduced from Nationally Critical due to survey. An unwanted dune species has been eradicated, *Euphorbia paralias*, sea spurge. Solar energy at huts and electric bikes are being used to reduce carbon emissions by less helicopter use. Trapping around huts improves the visitor experience. New invertebrate species are being discovered.

On Denniston a study to determine the population dynamics of forest geckos is underway. Weed control along tracks and roads suppresses movement onto the plateau of gorse, broom and heath rush which threaten the lizard, powelliphanta and threatened plant habitat.

On both Denniston and in the Heaphy, tracking tunnel, trail camera, recorder data and seed collection contribute to the National Predator Control Program and decisions on landscape predator control timing due to mast events and high rodent numbers.

What are the results?

Achieves objectives, policies, and desired outcomes for Kawatiri and Karamea places as outlined in the current CMS 2010-2020.

- Heaphy and Denniston (Buller Coal Plateaux) are priority sites for biodiversity management (2007), (p187, p197) and priority sites for integrated biodiversity management (p79).
- The Heaphy and Denniston Natural heritage values are maintained and, where practicable, protected and enhanced. p186, p199.
- Management objectives and policies as outlined in the CMS on p86-87 for Threatened Species and Ecosystems. p78-79.

Appendix 4 Denniston Powelliphanta snail monitoring report 2024

by Biodiversity Monitoring Ranger Daniel Papworth.

Report Reference: DOC-7678263 *Date:* 1 July 2024

Summary

Powelliphanta patrickensis is an endangered species, endemic to the Denniston and Stockton Plateaus. The primary threats to this snail are loss of habitat, primarily through mining activities, predation from introduced predators, and changing climactic factors. Monitoring of the snail on the Denniston Plateau started in 2007 to assess predation and follow population trends over time and has since been repeated in 2012, 2017, 2021, and 2024. The 2024 data found fewer numbers of live *P. patrickensis* compared to 2021. There is a declining trend in live snail numbers since monitoring started in 2007. However, this trend has not displayed statistical significance, this is primarily due to the large variation in the data set so far. Nearly half (44%) of all shells found were whole empty shells. There is an increased number of rat preyed shells found during 2024, this has been increasing since 2012. It is suggested rat control may be beneficial over the Denniston plateau. We also recommend continuation of the monitoring, next due in 2027.

Introduction

Powelliphanta patrickensis is listed as a threatened species, recently recategorized as Nationally Critical (Walker et al 2024). *P. patrickensis* has a naturally localised range, as it is confined to the infertile, poorly drained Brunner coal measures, siltstones and mudstones of the Buller Plateau (Walker 2003). The snails live in stunted manuka and wire rush shrubland where they shelter beneath Gahnia sedges and mountain flax, or in more open red tussock/bog pine/manuka shrubland, and occasionally at lower altitudes in southern rata-mountain beech/podocarp forest (Walker 2003). The Plateau is a cold and wet environment, frequently covered by mist.

As outlined by in a recent report into the conservation status of New Zealand indigenous terrestrial Gastropoda many *Powelliphanta* taxa could see populations decline by 96% over the next 30 years, with climate change, habitat degradation, and predation being highlighted as the major contributing factors to population decline (Walker et al. 2024). In this report *P. patrickensis*'s conservation status was changed from Nationally Endangered to Nationally Critical.

Much of the *P. patrickensis*'s habitat has already been lost to mines, overburden dumps, human made lakes, extensive roads and fires. Open-cast coal mining is planned for much of the remaining high-quality snail habitat on both the Stockton and Denniston Plateaus in the coming decades. There is little evidence that moving some of the snails before their habitat is destroyed or efforts to return the land to the high-quality environment could maintain healthy populations of *P. patrickensis* once mining operations end (Walker et al. 2024).

Loss of habitat in combination with the introduction of thrushes (*Turdus philomelos*), possums (*Trichosurus vulpecula*) and rats (*Rattus spp*.) as new, efficient predators has put *P. patrickensis* and other *Powelliphanta* species at serious risk (Walker 2003). Predator management on the Buller Plateau has been undertaken to help counteract this. For information on this management see the West Coast Possum summaries document (Phillips 2016) and, specifically for the Denniston Plateau,

the Department of Conservation Denniston Plateau Biodiversity Management Plan 2013-2063 (Gruner 2013).

To assess the effectiveness of this management and follow trends in the snail population over time, monitoring of *P. patrickensis* was established in 2007 with 17 permanent 10x10m plots randomly distributed over the Denniston Plateau (Anderson 2006, Gruner 2012). The plots were located across a range of vegetation types ranging from open tussock through to mixed tussock/scrub, dense scrub and low forest (Figure 1). Methods followed Phillips (2003). Plots have now been measured five times (2007, 2012, 2017,2021, and 2024), although five plots have since been abandoned (1, 19, 22, and 40 have never recorded live snails or snail shells, these plots have not been measured since 2017 and plot 29 hasn't been measured since 2012 as it was destroyed by a new opencast coal mine) so to increase sample size, five additional plots were established in 2017 (see Figure 1).

Walker (2003) states that the long-term recovery goals for *P. patrickensis* are the maintenance of a strong core population through habitat protection and predator control, and an increase in distribution through rehabilitation of former habitat. The two main objectives of management are, firstly, to protect the snail habitat from any further reduction in quality or size, and secondly, to increase population density and size by sustained predator control.

This report relates to the second objective, being the impact of predators on *P. patrickensis* and the success of their control. *Powelliphanta* snails are vulnerable to predation by possums, rats, thrush, pigs (*Sus scrofa*) and hedgehogs (*Erinaceus europaeus*). The individual predators can be identified from the characteristic damage they cause to the snails' shells (Farrell 2013). The monitoring involves thoroughly searching the plots for live snails and empty shells. The data therefore provide an index of live snail density and an index of predation by predator type.

This report details the findings of the latest measure, undertaken in 2024. The Denniston Plateau snail monitoring occurred between March 5th-10th, and was conducted by Sonya McArthur, Lil Cosslett, Leigh Roderick, Klayre Cunnew, and McKenzie Kereluik.

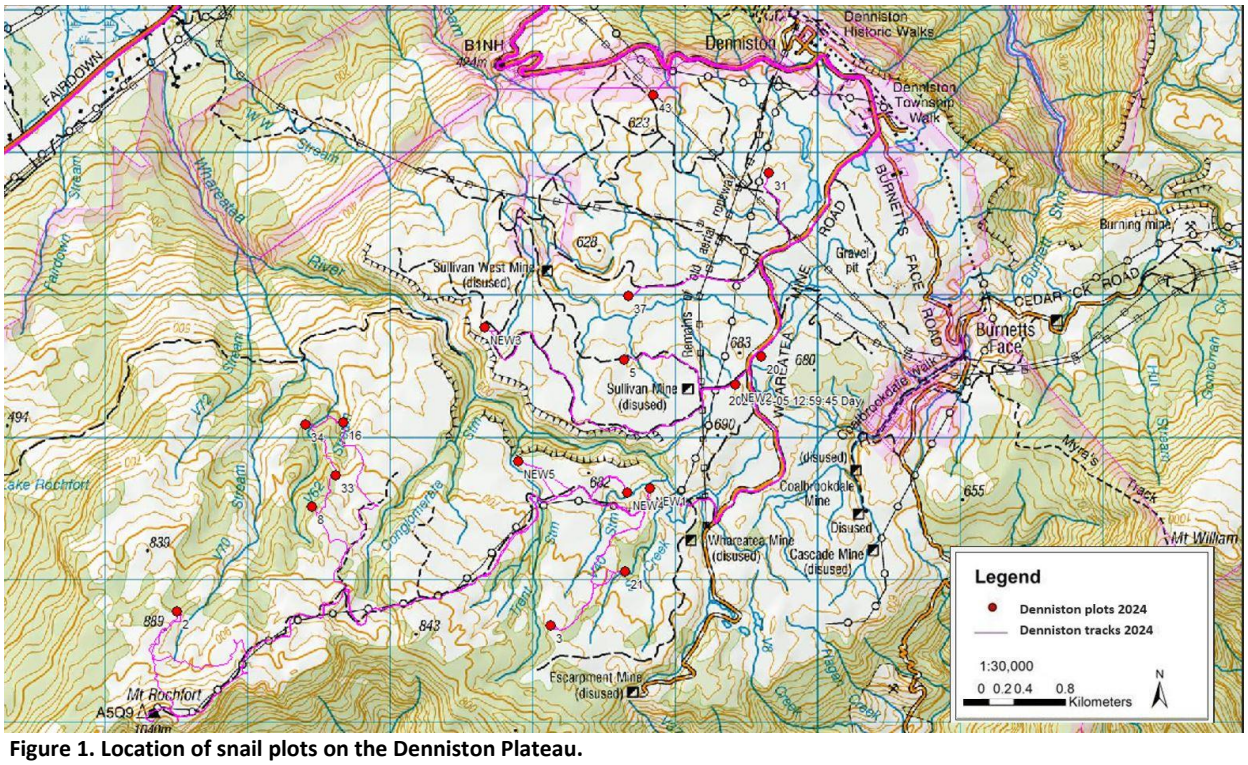

Figure 1. Location of snail plots on the Denniston Plateau.

Results

Since 2007, 41% of plots have never recorded a live snail and most (77%) have recorded snail presence (either a live snail or a snail shell). When excluding the abandoned plots 23% have never recorded a live snail and 100% have recorded presence. Plots 5 and 43 have contained the most live snails on average over time (4), and plot 5 also has the most shells found on average over time (19.4) (Table 1). Plots sample a mix of habitat types across the Plateau, and there appears to be little correlation between habitat types and snail density, with live snails found at varying densities across a range of the habitats.

	Live snails found					Empty shells found					
	2007	2012	2017	2021	2024	2007	2012	2017	2021	2024	Total
Denniston Plot 01*	0	0	0			0	0	0			0
Denniston Plot 02	0	0	0	0	1	7	4	5	4	2	23
Denniston Plot 03	0	0	0	0	0	0	0	2	0	0	2
Denniston Plot 05	1	12	1	3	3	11	22	37	19	8	117
Denniston Plot 08	4	4	0	2	0	6	1	0	2	2	21
Denniston Plot 16	1	0	0	0	0	3	0	0	1	2	7
Denniston Plot 19*	0	0	0			0	0	0			0
Denniston Plot 20	1	0	0	0	0	14	11	6	0	0	32
Denniston Plot 21	0	0	0	0	0	1	2	2	0	1	6
Denniston Plot 22*	0	0	0			0	0	0			0
Denniston Plot 29*	0	0				0	0				0
Denniston Plot 31	5	10	0	0	0	13	13	8	0	0	49
Denniston Plot 33	0	0	0	1	0	8	0	2	4	5	20
Denniston Plot 34	1	2	3	1	1	2	1	8	6	7	32
Denniston Plot 37	0	0	0	0	0	2	4	0	0	0	6
Denniston Plot 40*	0	0	0			0	0	0			0
Denniston Plot 43	6	9	4	1	0	6	5	12	2	4	49
Denniston Plot New 01			1	0	0			5	6	2	14
Denniston Plot New 02			2	0	0			19	4	2	27
Denniston Plot New 03			0	0	0			1	0	0	1
Denniston Plot New 04			0	1	0			1	0	1	3
Denniston Plot New 05			1	0	0			13	10	9	33

Table 1. Number of live snails and empty shells found by plot. *Plot 29 was within the Buller Coal Escarpment Mine project area and has been destroyed. Plots 1, 19, 22 and 40 were not measure as they recorded no live snails or snail shells in three measurements (2002,07,12) and are assumed to be out of snail habitat.

The 2024 data shows that the absolute number of shells preyed on by rats has increased since the 2021 measure (Figure 2) this upwards trend is statistically significant (P=0.01). We also found that the absolute number of live snails found was the lowest since monitoring began (Figure 2). However, this difference was not statistically significant (P>0.05) due to the large variability in the data set.

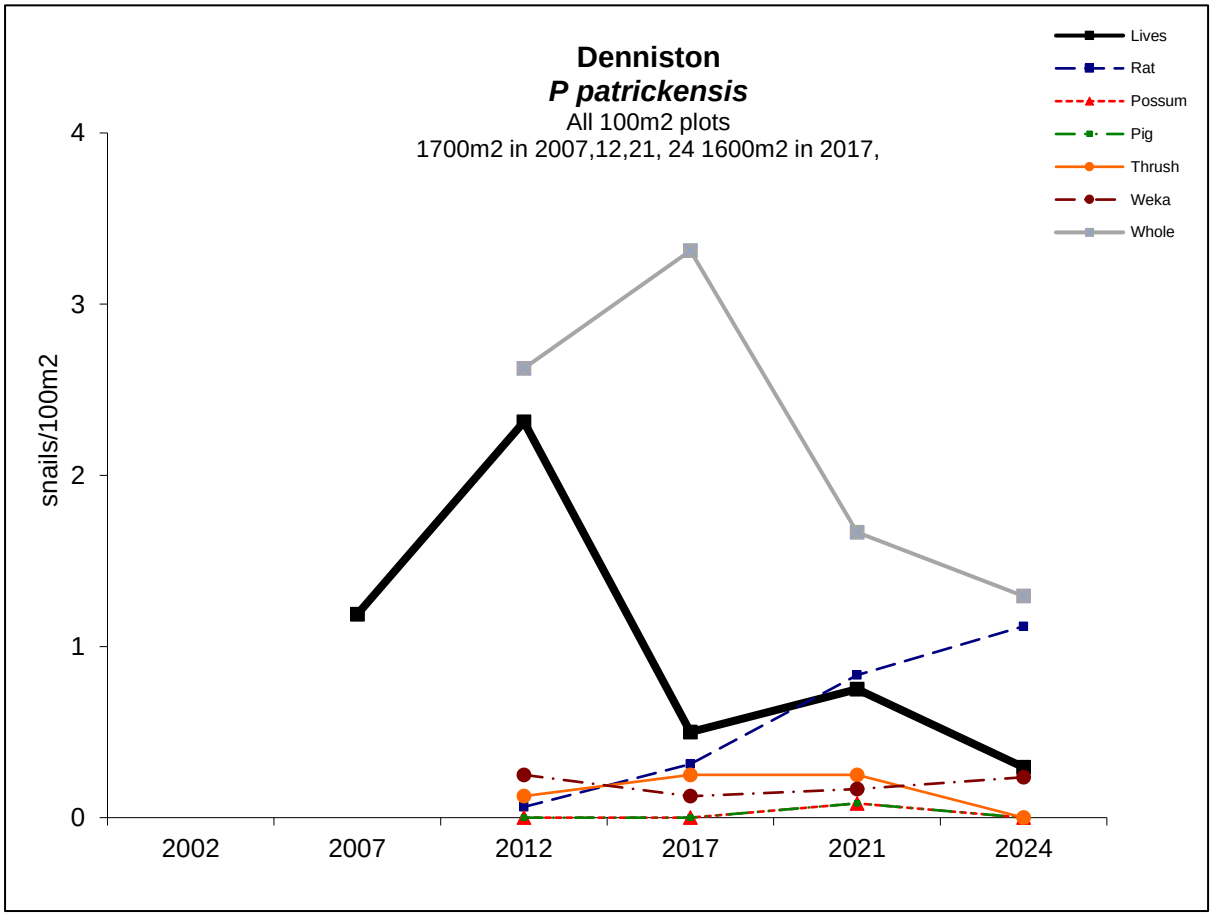

Figure 2. Number of live snails and snail shells (by predator) per 100m² on the Denniston Plateau. Data from empty shells collected during the first measurement (2002) of the initial 17 snail plots have not been included in the results, because the time over which the shells accumulated on the plots is unknown, meaning the data are not comparable to subsequent measurements.

Whole shells are consistently the most common type of empty shell found in all years. The percentage of live snails found on the monitoring plots has declined overall since 2012 with a slight increase in 2021, falling back to similar levels as found in 2017. The proportion of shells found to be preyed upon by rats increases after 2012 whereas the proportion found to be preyed upon by weka and possums remains relatively constant, but low, over time (Figure 3).

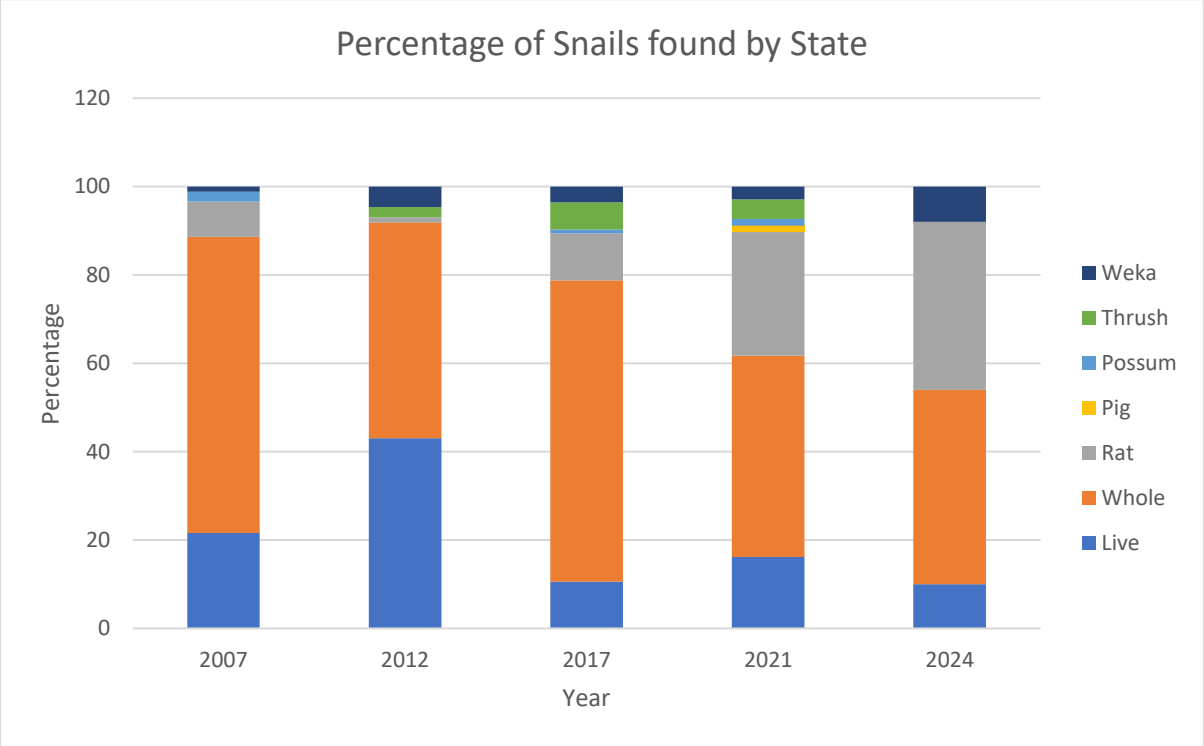

Figure 3. Percentage of live snails, whole empty shells and predated shells found on the Denniston monitoring plots over time. For predated shells, the type of predation is shown.

Discussion

To date, the monitoring of *Powelliphanta patrickensis* on the Denniston Plateau has not shown a statistically significant trend for the population. The low number of live snails observed during the 2017, 2021, and 2024 monitor may have been caused by the fact that monitoring was undertaken slightly earlier than in previous years (in March rather than April). This may have reduced the probability of finding live snails or their shells, as under these conditions snails are likely to dig deeper to find damp litter and avoid desiccation. This is likely exasperated by the ongoing effects of climate change which over the last 30 years has been increasing the summer soil moisture deficits (NIWA n.d.) likely leading to greater susceptibility for snails to desiccate (Walker et al. 2024). Declines in *Powelliphanta* numbers have been found at all sites monitored in Western South Island.

Although the impact of most predators on the Denniston Plateau is relatively unchanged compared with the 2021 measure, rats continue to have a growing effect on *P. patrickensis* mortality. The percentage of shells predated by rats has increased through the 2017 (10% of all shells), 2021 (28%), and 2024 (38%) monitoring events, showing an upwards trend in rat predation on *P. patrickensis*. There is evidence that warmer winters have allowed the altitudinal range of ship rats to expand, leading to increased rat predation (Harris et al. 2022).

The largest number of empty shells recovered in 2024 were whole, with an unknown cause of death. An increase in the number of whole empty shells over time has been observed elsewhere for other *Powelliphanta* species on the West Coast, e.g. in the Heaphy valley (Stephens 2015), MacKay Downs (Stephens 2017a) and Mokihinui (Stephens 2017b) but there is no obvious explanation for this. An increase in the proportion of in whole shells could be indicative of either a declining or an increasing population. Deaths could be caused by disease, e.g. the spread of a fungus, which would be a serious

threat to the persistence of the population. Similarly, if environmental factors caused the deaths, e.g. drowning or freezing, an increase in severe weather events caused by climate change would pose a serious threat. However, if the deaths were caused by natural mortality, an increase in whole shells would indicate an increase in the overall population, although an increase in the number of live snails found would also be expected in this case.

The presence of empty whole shells could also be the result of predation. Weka (*Gallirallus australis*) are apparently able to remove snails from their shells without causing damage (Judy Dix pers. comm.). Observational evidence suggests that weka numbers have increased along the West Coast in recent years (Graeme Quinn, Mal Hansen pers.com., C. Stephens pers.com.). Combined with beech mast events, which are becoming heavier and at a higher frequency, weka and rat populations boom (Walker et al. 2024). Aerial 1080 operations are used to reduce rat numbers however this can then increase weka survival by removing competition with and predation from introduced mammals (Kemp 2013; Tinnemans et al. 2019). Further research into the cause of death of whole shells found on the Denniston Plateau could be useful to better understand the population status of *P. patrickensis*.

Based on data from the monitoring plots, it appears the distribution of *P. patrickensis* on the Denniston Plateau is patchy. Some historic plots yielded no snails in all three assessments, while others consistently contained the highest numbers. The occurrence of *P. patrickensis* seemed also variable over time, as some plots yielded snails in one year, but not in others. These variations did not seem related to habitat type, although some plots are easier to search than others (due to terrain, vegetation, soil depth), and this might bias results. The plot monitoring method as an index for snail abundance could be sensitive to a range of factors, including time of year, weather conditions, substrate moisture and observer bias. Detection of trends, therefore, can only be expected after a larger number of measurements. However, the small number of live animals detected during the last two surveys is of concern, especially in plots where previously relatively large numbers had been found. With continued monitoring the population and mortality trends of *P. patrickensis* should become clearer.

To date, the population monitoring of *P. patrickensis* on the Denniston Plateau has not established whether the recovery objective “to increase population density by sustained possum control” has been achieved. But given the low incidence of possum predation it does not appear they pose a major threat on the Denniston Plateau, rats on the other hand appear to be having an increasing negative impact.

Recommendations

- Continued monitoring of the plots. Next due in 2027.
- Rat control on the Denniston plateau.
- Research into other causes of death, especially regarding whole empty shells, should be considered.

Acknowledgements

This report was peer reviewed by and signed off for release by Cielle Stephens, Senior Ranger Biodiversity.

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Appendix 5 Heaphy and MacKay Management Area Bird Survey 2023

Author: Cielle Stephens, Bio Monitoring Ranger

Report Reference: DOC-7546011

Summary

This report presents the results from bird monitoring at the lower altitudes (< 500m asl) of the Heaphy valley. The monitoring was undertaken to assess management efficacy, as the Heaphy area is managed for biodiversity enhancement in compensation for biodiversity losses elsewhere. We conducted five-minute bird counts and distance sampling on randomly placed monitoring grids to assess the status and trend of local bird populations between 2015 and 2023. The monitoring detected increases in relative abundance, frequency of detection and distribution for several native forest species, suggesting that the predator management implemented in the area benefits local bird populations. We recommend continuing with the annual monitoring to keep track of trends that may demonstrate benefits achieved by the management.

Introduction

The Heaphy area in Kahurangi National Park, in the north-west of the South Island, has long been recognised as a place with high conservation values. The area was initially a regionally highly ranked management unit where possum-vulnerable plants and threatened endemic land snail species (*Powelliphanta*) were managed for persistence. In 2011, the area was selected as a nationally representative Ecosystem Management Unit (Department of Conservation 2013).

Since 2014, Bathurst provides compensation funding to the Department for the loss of biodiversity resulting from the Escarpment Mine operation on the Denniston Plateau. A portion of the compensation funds is specifically designated to enhance, for 35 years, biodiversity values within a management area centred on the Heaphy Valley.

The compensation management area extends from the Moutere River in the north to the Kohaihai River in the south and east to the Gunner and Gouland Downs. It is approximately 29,000ha in size with a core area of about 13,000ha encompassing the lower and mid Heaphy Valley and the Iwituaroa Range. The core area is surrounded by a 3km wide buffer zone to minimise reinvasion of pest species and thus increase effectiveness of pest control in the core area.

Pest control in the Heaphy area was initiated in 1993/94 with localised ground control of possums along the coast and on the Heaphy Valley flats, and a small-scale aerial 1080 operation, also targeting possums, south of the Heaphy River (Department of Conservation 2020). Since then, pest control efforts have increased with the first large-scale aerial 1080 operation including the entire management area, and targeting rats and possums, conducted in 2007/08. Subsequent large-scale aerial operations occurred in 2012/13, 2014/15 and 2016/17. Between November 2017 and 2019, areas below 500m asl in the Heaphy catchment received annual aerial pest control to suppress the local rat population. Since 2019, control has occurred every second year, with the most recent control in 2023.

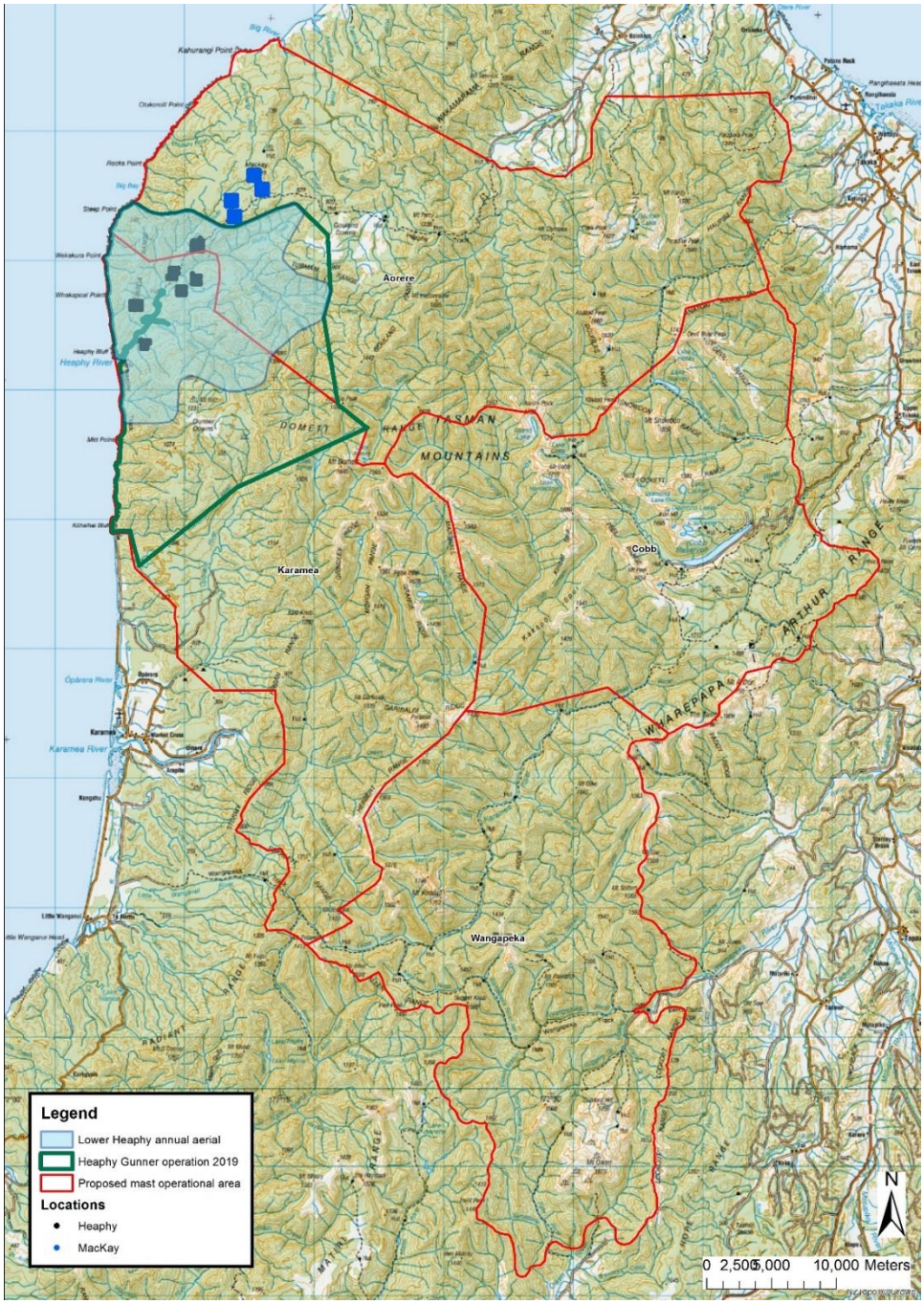

Figure 1. Kahurangi National Park. Extent of aerial pest control operations. The proposed full operational area to be treated after a beech mast is outlined in red. The green outline shows the treatment area following the 2019 mast. Biannual operations have covered the area below 500m asl in the Heaphy valley (shaded light blue). The grey squares show the location of the lower (< 500m asl; Lewis) bird monitoring grids and the blue squares show the upper (> 500m asl; MacKay) grids (see Methods section).

The management plan for the Heaphy compensation project (Department of Conservation 2013; DOC-1226988) includes a comprehensive biodiversity monitoring programme that aims to assess the effectiveness of the management, to identify possible improvements to management practices and enable reporting on biodiversity enhancements achieved over time. This monitoring

programme includes the monitoring of local bird populations, as the intensive predator control is hoped to benefit these.

This report presents the results of annual bird counts done in the lower altitude Lewis area (< 500m asl) and the upper MacKay (>500m asl) of the Heaphy management area over the last nine years. Using distance sampling and five-minute bird count data, it reports on species richness, frequency of occurrence, distribution, relative abundance and estimated population densities of bird species within the survey area over time.

Methods

Ten monitoring grids, each with 25 systematically arranged sample points (Figure 2) were established in the Heaphy management area in 2015. Each grid was set up in a north-south/east-west orientation based on a random starting point (aligned with the Department's spatially balanced monitoring master sample). Six of the grids were located in the lower Heaphy area (< 500m asl, subsequently called 'Lewis'). Within each grid, sample points were spaced 200m apart (as measured by a GPS) to ensure independence of individual counts. Grids and points within grids were mapped using ESRI ArcMap 10.3.1 prior to the first field visit.

During the first visit, not all 25 sample points in each grid were surveyed because of unsafe terrain (e.g., sinkholes, bluffs, windfall) or time constraints. In subsequent years, some sample points were added, but others not measured, again due to time constraints or additional hazards, e.g., slips. This led to a variable number of counts between years (Table 1).

Table 1. The number of sample points visited in the Lewis and MacKay by survey year.

Year	Lewis points visited	Mackay points visited
2015	106	99
2016	110	100 *2
2017	111	98
2018	111	
2019	111	
2020	111	100
2021	110	
2022	111	
2023	108	100

At each sample point, distance sampling (Buckland et al. 2001, 2004) and standard five-minute bird counts (Dawson and Bull 1975) were undertaken. We followed the methodology currently used in the Department's Tier 1 monitoring programme (DOC-828397). This means, at each sample point, birds were surveyed for a total of ten minutes: distance sampling was conducted during the first five minutes followed by a standard five-minute bird count during the second five-minute period. Both types of counts were unbounded, and birds were recorded within predefined distance categories. The distance sampling counts used the following distance categories: 0-8m, 9-16m 17-25m, 26-45m, 46-100m and >100m. The five-minute bird counts used three, coarser categories: Near (0-25m), Far (26-100m) and >Far (100m+). Environmental variables (temperature, wind, noise, duration of sunshine, and precipitation type and amount) were also recorded. Incidental bird observations, i.e. outside of the formal count periods, were recorded for any additional species observed. Both, native and introduced bird species were included.

The main difference between distance sampling and five-minute bird counts is that distance sampling aims to record a snapshot in time of bird presence and location. This means that the

recorded distances are supposed to reflect the location of each bird at one point in time, taken to be the start of the five-minute observation period. Birds moving into or over the sample area during this period are not recorded. Five-minute bird counts, in contrast, record all birds seen or heard during the observation period. Both, distance sampling and five-minute bird counts attempt to record each individual only once. The distance sampling data has not been analysed for this report.

The first three years of bird monitoring in the Heaphy area (2015-2017) were intended as a baseline assessment against which future assessments could be compared. In these three years, monitoring was done in the Lewis and the MacKay Downs area (Heaphy catchment > 500m asl). Subsequently, the Lewis area was surveyed annually, while the MacKay area was put on a three-year re-measurement cycle. The annual monitoring in the Lewis area hopes to detect a trend in the local bird populations in response to the more intensive predator control in the area.

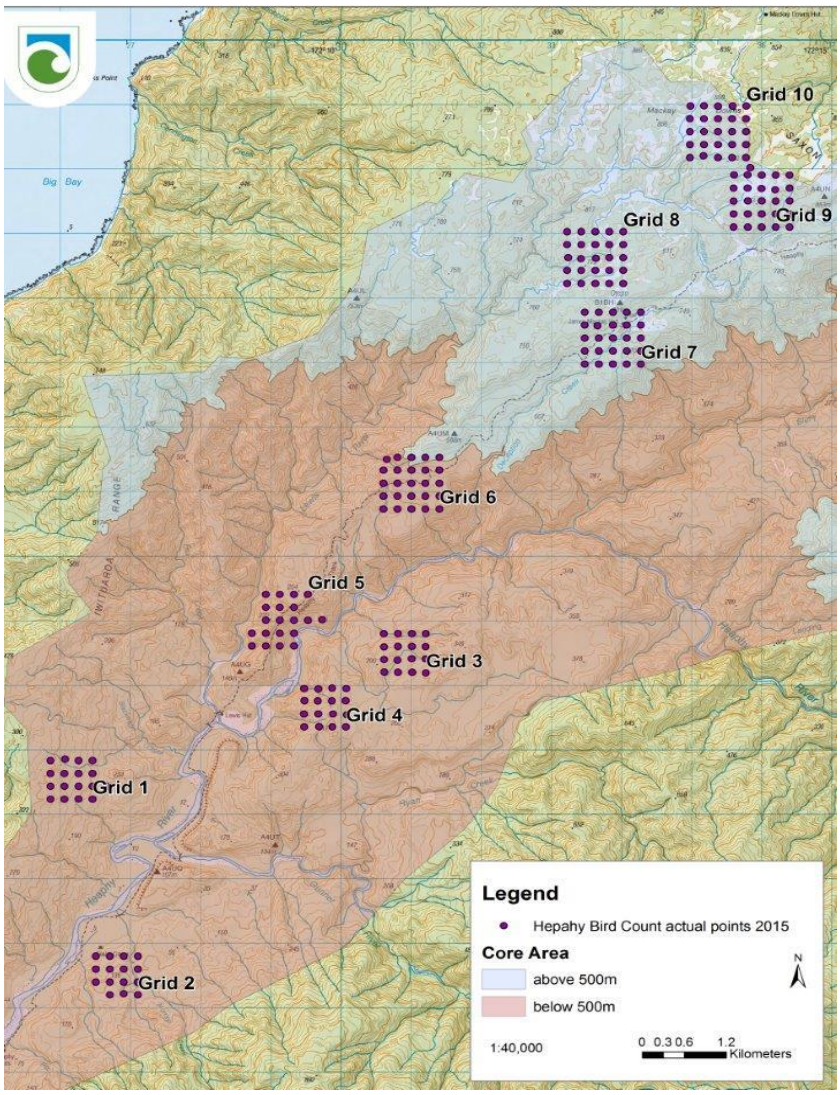

Figure 2. Location of the bird monitoring grids and points in the Heaphy management area, in the area below 500m asl (Lewis, orange shading) and above 500m asl (MacKay, grey shading) as measured in 2015.

The monitoring was undertaken by experienced bird observers in September or October of each year. Counts were completed between 8am and 4pm. The field data sheet template can be found in

DOCDM-828398. A post-operational report detailing the logistics of the field work for the 23/24 season is stored in S:\3_Tech Support\WAM\Post operational summaries\2023_24.

Analysis

The five-minute bird count data (5MBC) are stored electronically in DOC-2600272; the distance sampling data in DOC-2608373. Raw data for both are held in a box file in the Westport DOC office. Data were analysed using Excel 2007 and R statistical software (R Core Team 2016) and ArcMap. Excel based analyses, graphs and pivot tables can be found in DOC-7546633 (5MBC) and DOC-7548711 (distance). The R-code can be found in S:\3_Tech Support\WAM\1. R\Bird\Heaphy\2023 (5mbc) and S:\3_Tech Support\WAM\1. R\Bird\Heaphy\2023\Distance (distance). We analysed the data for following response variables:

Species richness

Species richness reports the total number of bird species detected during the entire nine years of survey, based on the distance sampling, five-minute bird count and incidental observation data. This is to capture the full complement of species present in the area.

Frequency of detection

Frequency of detection represents the percentage of sample points at which a species was encountered each year. It provides a measure of how widespread species occurred throughout the survey area. We used the five-minute bird count data and all species for which at least 20 individuals had been recorded over the eight survey years for this analysis.

Relative abundance

We defined relative abundance as the mean number of individuals of a species detected per sample point. This provides a simple index of species abundance (Dawson and Bull 1975). We used the five-minute bird count data and all species for which at least 30 individuals had been recorded over the eight survey years for this analysis.

We modelled the trend over time for relative abundance of species using generalised linear mixed effects models. We assumed that the bird count data followed a Poisson distribution and analysed the data for each species separately. Models allowed for random effects of observer, grid and sample points within grids. Environmental variables (temperature, wind, noise, sunshine, precipitation type and amount) were included as covariates and eliminated by backwards selection. The year of measurement was retained in the model, as change over time was our main interest. An effect was deemed significant when the relevant p-value was < 0.05. We identified the favoured model based on the lowest AIC.

Results

Species richness

Overall, 31 bird species were observed during the eight years of bird surveys in the Lewis area and 21 in the MacKay area. Eight species are introduced – blackbird, chaffinch, dunnock, goldfinch, greenfinch, redpoll, skylark and song thrush (Table 3 and 4). Five are listed as threatened or at risk – New Zealand falcon, fernbird, kaka, kea and great spotted kiwi (Robertson et al. 2013). While the threatened and at-risk species were only observed occasionally, the increase in kaka observations

was notable: Kaka were not detected during the first three years of monitoring, but have been consistently detected in low numbers since 2018 (Table 3 and 4).

Table 3: Species observed during five-minute bird counts (5MBC) and distance sampling in the Lewis area 2015-2023, with the number of individuals detected in each year. No additional species were recorded incidentally. For scientific species names and threat statuses see Appendix 1.

Species	5MBC |Distance								
	2015	2016	2017	2018	2019	2020	2021	2022	2023
Bellbird	354 |331	304 |271	212 |204	395 |360	432 |404	256 |238	298|271	204|182	369 |310
Blackbird*	2 |1	8 |8	3 |3	12 |7	11 |8	5 |3	1|0	0|1	7 |11
Brown Creeper	5 |6	0 |2	10 |7	10 |11	7 |5	1 |3	3|3	7|4	0 |2
Chaffinch*		19 |15	7 |7	5 |3	12 |13	3 |6	6|6	16|11	17 |15
Dunnock*		0 |1							2 |0
Long Tailed Cuckoo**					0 |2		0|3		0 |0
Falcon, NZ**		1 |2			3 |3				0 |0
Fantail, South Island	39 |41	29 |27	65 |69	84 |65	76 |87	62 |63	31|33	36|35	52 |45
Fernbird, South Island	1 |1			0|2	1 |0	3 |3	2|2	1|0	1 |1
Goldfinch*					7 |5		0|0	3|3	29 |30
Greenfinch*		4 | 0		1 | 1	10 | 4	0| 1	0|1		6 |7
Grey Warbler	108 |112	117 |102	114 |115	137 |126	156 |144	154 |150	127|126	104|101	95 |89
Harrier			1 |0	1 |1	7 |4		1|3		1 |0
Kaka, South Island**				1 |0	5 |5	4 |2	1|1	6|4	2 |2
Kea**	1 |1	1 |0	2 |0	4 |3	4 |0	5 |4	1|2	4|2	3 |1
Kereru	0|3	3 |4		2 |4	6 |4		3|3	2|2	6 |6
Kingfisher				1 |1		3 |3	1|1		0 |0
Kiwi, Great Spotted**			1 |1				0|0		0 |0
Morepork				0 |1			0|0		1 |0
Paradise Shelduck		0|1	2 |2	5 |1	2 |3	1 |0	3|2	5|0	9 |3
Parakeet/Kakariki	6 |4	19 |11	1 |1	12 |9	38 |21	1 |1	6|4	15|7	25 |24
Redpoll*		10 |10			6 |1		0|0	5|0	9 |10
Rifleman, South Island	31 |23	13 |13	9 |8	11 |10	23 |19	23 |22	26|20	19|18	34 |28
Robin, South Island	26 |28	48 |40	63 |65	30 |29	63 |59	68 |71	75|82	69|66	57 |63
Skylark*					1 |1		0|0		0 |0
Silvereye	3 |2	74 |61	64 |49	38 |35	152 |120	51 |48	26|17	29|24	133| 85
Swallow, Welcome				2 |0	2 |1	1 |0	0|0		2 |2
Thrush, Song*	6 |6		2 |2	4 |2	13 |6	5 |4	0|1		26 |20
Tomtit, South Island	76 |76	70 |66	117 |121	115 |117	118 |103	156 |151	153|141	121|112	102 |98
Tui	15 |17	55 |39	25 |23	128 |97	213 |170	87 |76	78|66	348|293	184 |129
Weka, Western	3 |4	19 |16	19 |19	19 |14	63 |53	18 |18	33|40	39|29	54 |47
Grand Total	676 |656	797 |668	717 |698	1016 |902	1431 |1245	909 |867	879|826	1036|895	1229| 1036

* - introduced species

** - threatened species

Table 4: Species observed during five-minute bird counts (5MBC) and distance sampling in the MacKay area 2015-2023, with the number of individuals detected in each year. No additional species were recorded incidentally. For scientific species names and threat statuses see Appendix 1.

Species richness

Species	5MBC|Distance				
	2015	2016*	2017	2020	2023
Bellbird, (mainland)	7|7	187|162	21|22	28|30	110|122
Blackbird*	1|1	3|2			
Chaffinch*		105|98	1|4	52|40	76|62
Creeper, Brown	43|33	75|71	22|29	31|30	25|37
Dunnock (Hedge Sparrow) *	1|2	3|4	1|	0 |1	1|
Fantail, Sth Is		7|7	2|3	16|14	7|7
Fernbird, Sth Is	4|6	17|17	4|5	11|11	7|7
Goldfinch*		0|1			1|0
Greenfinch*		4|1			1|0
Kea**		2|1			
Kiwi, Great Spotted**				0|1	
Parakeet spp. / Kakariki spp					1|
Pipit, NZ	2|4	6|8	6|7	18|20	7|8
Redpoll*		78|42	8|5	2|0	62|2
Rifleman, South Is	6|5	7|5	1|1	3|0	2|2
Robin, Sth Is	3|2	58|55	24|20	27|19	11|11
Shelduck, Paradise			0 |1	1|0	
Silvereye		35|48		1|0	7|8
Tomtit, Sth Is	26|34	69|62	51|47	69|57	60|60
Tui		22|12		10|8	10|9
Warbler, Grey	18|16	62|53	24|22	63|62	58|53
Weka, Western	17|14	49|57	15|14	41|37	39|29
Grand Total	129|124	789|706	180|180	380|350	487|486

***all count stations were done twice in 2016**

Frequency of detection

Frequency of detection was highest for bellbird which was detected at almost all sample points in every survey year (Figure 3) in the Lewis. Grey warbler and tomtit were also frequently observed throughout the monitoring period. Tomtit, tui and weka showed notable increases in their frequency of detection over time. In Mackay, greywarbler, tomtits, weka and bellbird (in the last measure) were the most frequently observed (Figure 3).

Figure 3. Frequency of detection (detection rate %) by survey year (2015-2023) based on the five-minute bird count data for species with ≥ 20 counts for both Lewis and Mackay.

Relative abundance

The relative abundance of bird species provided a similar picture to the frequency of detection. In the Lewis, bellbird were generally the most abundant species, until 2022 when tui were the most abundant. This reversed again in 2023. Five native species (rifleman, robin, tomtit, tui and weka) showed significant increases over time (Figure 4, Table 5). MacKay recorded more brown creeper and chaffinches than the Lewis. Greywarbler and tomtits were generally the most abundant species (Figure 4). In Mackay, three native species showed significant increase (grey warbler, tomtit and weka). Chaffinch also significantly increased (Table 5).

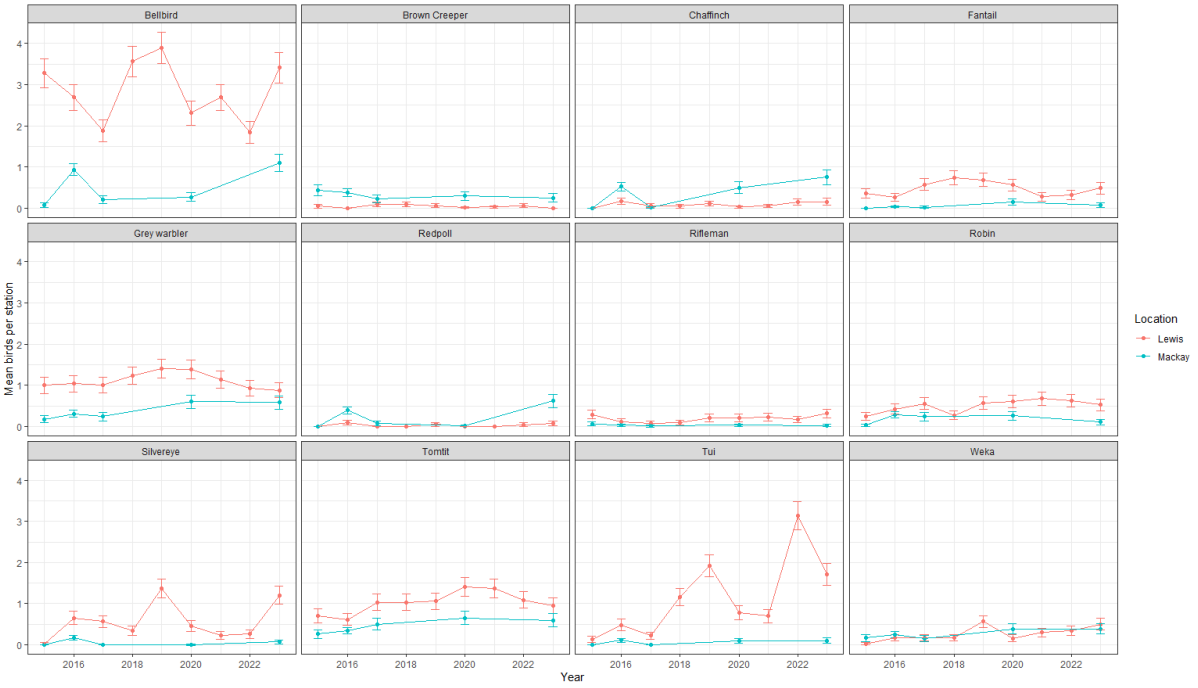

Figure 4. Relative abundance (+/- 95% Confidence Interval) for bird species with ≥ 30 counts during five-minute bird counts in 2015-2023.

Table 5. Estimated annual change in mean relative abundance. Estimates are based on generalised linear mixed effects models accounting for random effects of observer, grid and sample point as well as effects of environmental covariates. Significant trends are in bold (p-value < 0.05).

Species	**Lewis**		**MacKay**	
	Estimated annual change (%)	**p-value**	**Estimated annual change (%)**	**p-value**
Bellbird	1.46	0.24	6.1	0.12
Brown creeper	NA	NA	10.4	0.0624
Chaffinch	1.01	0.152	**14.01**	**0.017**
Fantail	1.68	0.52	NA	NA
Grey Warbler	0.39	0.81	**17.86**	**<0.0001**
Kakariki	6.1	0.264	NA	NA
Redpoll	NA	NA	-3.53	0.73
Rifleman	**9.67**	**0.0403**	NA	NA
Robin	**12.91**	**<0.001**	-0.26	0.95
Silvereye	0.3	0.402	NA	NA
Tomtit	**7.2**	**0.0002**	**10.1**	**0.0037**
Tui	**29.1**	**<0.001**	NA	NA
Weka	**21.2**	**<0.001**	**1.05**	**0.0029**

Discussion

The observed increases in relative abundance of several of the native bird species in the Heaphy valley (rifleman, robin, tomtit, tui and weka) could be a first indication that the intensive predator management in the area is benefitting local bird populations. This was supported by increases in the

frequency of detection for robin, tomtit, tui and weka; kaka also showed a slight increase. The species distribution graphs illustrate an increase in spread and abundance of robin, tui and weka.

It has been documented elsewhere that predation by introduced predators can lead to the decline of bird populations including species generally regarded as common or widespread (Elliott et al. 2010, Innes et al. 2010), and that sustained control of these predators in turn can induce the recovery of these species (Beagley et al. 2019, Elliott & Kemp 2016, O'Donnell & Hoare 2012, Moorhouse et al. 2003).

Rifleman remains mainly restricted to the higher altitudes in the Heaphy valley (Grid 6), extending to occasionally include Grid 1 and 5. If sustained predator control were successful, we would hope to see this species become more common at lower altitudes in the long-term.

The bird monitoring in the Heaphy valley was set up to assess whether the intensive predator management would make a difference for local bird populations. Benefits need to be achieved and demonstrated, as they are meant to compensate for biodiversity losses elsewhere. When the compensation programme began, in 2015, sustained predator control had already been in place in the Heaphy for over 20 years. The programme, therefore, started from a relatively high baseline. The first bird survey in 2015 suggested that the local bird community was relatively intact. It was dominated by native species, and otherwise widespread introduced species were largely absent. However, particularly predator-sensitive native species, such as kaka, were notably sparse or absent (McArthur & Gruner 2016).

After nine years of monitoring, the results are encouraging. Several native bird species appear to be increasing, both, in relative abundance and distribution, although they are all relatively common, not threatened species. Of the threatened or 'at risk' species observed in the area, kaka seem to have increased from non-detection to a level that they are now regularly observed in low numbers.

Five-minute bird count data is characterised by large variability, as counts are influenced by external factors such as weather and observer skill. We accounted for some of these factors when modelling trend over time for relative abundance, and still found significant trends, suggesting that the relative abundance of some species is indeed increasing. We cannot unequivocally prove that these increases are due to the intensive predator management, as we do not have comparable measurements from an unmanaged site. However, long-term bird monitoring using a treatment/non-treatment approach in other areas has clearly demonstrated such benefits of predator control to bird populations (Stephens 2021; Stephens, Gruner, Cieraad in prep.). Whether the achieved benefits are sufficient to compensate for biodiversity losses elsewhere is a different question we cannot answer here.

It is recommended to continue with the annual bird monitoring in the Lewis area to keep track of trends that may demonstrate benefits achieved by the management. As the monitoring is linked with the Department's National Biodiversity Monitoring System, using the System's master sample and standard monitoring methods, the use of both, five-minute bird counts and distance sampling, should continue until a decision in favour of one of the methods has been made at national level.

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Appendix 1

Bird species observed during bird surveys in the Heaphy management area 2015 – 2023 (both Lewis <500m and MacKay >500m).

Threat status according to Robertson et al. (2013).

Common name	Scientific name	Threat status
Bellbird (mainland) /korimako	*Anthornis melanura melanura*	Not threatened
Blackbird *	*Turdus merula*	Introduced
Brown Creeper/pipipi	*Mohoua novaeseelandiae*	Not threatened
Chaffinch *	*Fringilla coelebs*	Introduced
Dunnock (Hedge sparrow) *	*Prunella modularis*	Introduced
Long Tailed Cuckoo	*Eudynamys taitensis*	National vulnerable
Falcon, NZ/kārearea	*Falco novaeseelandiae*	Nationally vulnerable
Fantail, South Island/piwakawaka	*Rhipidura fuliginosa fuliginosa*	Not threatened
Fernbird, South Island/matata	*Bowdleria punctata punctata*	Declining
Goldfinch*	*Carduelis carduelis*	Introduced
Greenfinch *	*Chloris chloris*	Introduced
Grey Warbler/riroriro	*Gerygone igata*	Not threatened
Harrier	*Circus approximans*	Not threatened
Kākā, South Island	*Nestor meridionalis meridionalis*	Nationally vulnerable
Kea	*Nestor notabilis*	Nationally endangered
Kereru/New Zealand Pigeon	*Hemiphaga novaeseelandiae novaeseelandiae*	Not threatened
Kingfisher	*Todiramphus sanctus*	Not threatened
Kiwi, Great Spotted	*Apteryx haastii*	Nationally vulnerable
Morepork/ruru	*Ninox novaeseelandiae*	Not threatened
Paradise Shelduck	*Tadorna variegata*	Not threatened
Parakeet /kakariki spp.	*Cyanoramphus spp.*	Not threatened
Redpoll *	*Acanthis flammea*	Introduced
Rifleman, South Island/titipounamu	*Acanthisitta chloris*	Not threatened
Robin, South Island/toutouwai	*Petroica australis australis*	Not threatened
Skylark*	*Alauda arvensis*	Introduced
Silvereye/touhou	*Zosterops lateralis lateralis*	Not threatened
Swallow, Welcome	*Hirundo neoxena*	Not threatened
Thrush, Song *	*Turdus philomelos*	Introduced
Tomtit, South Island /ngiru ngiru	*Petroica macrocephala macrocephala*	Not threatened
Tui	*Prosthemadera novaeseelandiae novaeseelandiae*	Not threatened
Weka, Western	*Gallirallus australis australis*	Not threatened

* - introduced species

Appendix 6 Heaphy valley Powelliphanta *snail monitoring report 2024*

Author: Klayre Cunnew (Ranger Biodiversity Monitoring)

Report Reference- DOC-7679113

Summary

This report would usually present findings on the monitoring of three species of Powelliphanta found in the Heaphy valley, *Powelliphanta annectens, Powelliphanta superba* "Gunner River" and *Powelliphanta gilliesi* "Heaphy" Unfortunately, the permanent plots in the lower Heaphy valley were destroyed by flooding and landslips when cyclone Dovi hit the area in February 2022 and could not be remeasured. As such, this report will focus on findings from plots further up the valley where *P. superba* "Gunner River" and *P. gilliesi* "Heaphy" are found.

The number of live snails found on permanent plots increased marginally this year. The number of whole shells also increased while the number of weka predated shells fell. Rats were again the most prominent introduced predator consistent with previous years since 2015, suggesting that aerial 1080 drops in the catchment were not always effective at controlling rats. Possum control, in contrast, has been effective and has substantially limited possum predation on snails. The management objectives of zero predation by introduced predators and an increasing snail population have not yet been achieved. Longer term monitoring is required to confidently assess population densities and trends, with the next measurement to occur in 2027. Research into the causes of the relatively large number of whole empty shells should be considered.

Introduction

Powelliphanta superba "Gunner River" and *Powelliphanta gilliesi* "Heaphy" are listed as a threatened species and have recently been reclassified as Nationally Critical, the final status before extinction (Walker et al 2024).

The snails' ranges are naturally limited to the Heaphy catchment in Kahurangi National Park (Walker 2003). The total range of *P. gilliesi* "Heaphy" is thought to be less than 1,000ha, in parts being sympatric with the much larger and more widespread *P. superba* "Gunner River".

The overall decline in Powelliphanta populations in the Heaphy Valley since 2015 suggests they are undergoing pressure, likely from several directions at once.

Walker (2003) states that there are two primary causes for snail decline in the Heaphy and MacKay Downs area: firstly, severe predation by possums and rats since the late 1970s and secondly, high numbers of possums and deer causing extensive canopy dieback and browse damage in the understory.

The latest report by Walker et al (2024) states that goats and pigs reached the Heaphy River area for the first time in 2021, adding to the removal and degradation of the leaf litter that insulates and nourishes the habitat of both Powelliphanta and their earthworm prey.

This latest report also highlights the impacts of climate change which are exacerbating the effects of the above pressures. Rainfall has been decreasing over the last 30 years (The National Climate Database: https://cliflo.niwa.co.nz/), resulting in soil moisture deficits throughout the summer

months leaving the snails more susceptible to desiccation (Solem et al. 1981; Solem 1984; Martin and Sommer 2004).

Possum control has primarily been undertaken with aerial control using 1080 (sodium fluoroacetate) baits with operations in 1994, 1999, 2004, 2008, 2011, 2014, 2016, 2017, 2018, 2019 and 2023. Some ground control has been undertaken along the Heaphy river, using a mixture of poison and traps. For detailed information on the history of pest control in the area please see Department of Conservation (2021) and previous reports on the snail monitoring (Stephens 2018, 2019 and 2021).

The management objective for all *Powelliphanta* species in the Heaphy valley is to increase their population density. The long-term recovery goal for *P. superba* "Gunner River" is to achieve densities of 12 snails/100m^2 and for *P. gilliesi* "Heaphy" to achieve densities of 6 snails/100m^2 (Walker 2003).

To follow trends in snail populations over time and to measure the outcomes of possum control, monitoring of *P. gilliesi* "Heaphy" was established in 1995 with a permanently marked 20x25m plot on the true left of the Heaphy river (plot 8 on Figure 1). Subsequently, this plot could not be relocated, so no re-measurements were done until 2015, when the plot was rediscovered while establishing a network of new plots. To provide for adequate sample size and representativeness of the monitoring data, 15 permanent 10x10m monitoring plots were established on the true left of the Heaphy River in Lewis and Gunner River area in 2015. These plots were located in areas thought to have high densities of snails and high numbers of rats. They extended into the area where *P. gilliesi* "Heaphy" occurs sympatrically with *P. superba* "Gunner River".

Powelliphanta snails represent a useful indicator for introduced predator impacts. They are vulnerable to predation by possums, rats, thrushes, pigs and hedgehogs. The individual predators can be identified from the characteristic damage they cause on the snail shells (Farrell 2013). Repeatedly searching for shells in permanent plots and identifying their predators, therefore, provides an index of predation intensity by predator type since the last measurement. The number of live snails found per plot provides an index of live snail density. This information can be used to assess whether the predator management in the Heaphy area is making a difference to the snail populations and meeting management objectives.

The snail plots are monitored every 3 years. This report presents the data from 1994 to the most recent measure done 19th – 24th March 2024. Monitoring methods followed standard best practice for 10x10m snail plots (Phillips 2010). The 2024 monitoring was carried out by Biodiversity Monitoring Rangers, Anton Keller, Lil Cosslett and Klayre Cunnew with McKenzie Kereluik joining them from the Westport Biodiversity team. The raw data can be found in an Access database that is maintained by Dr Kath Walker.

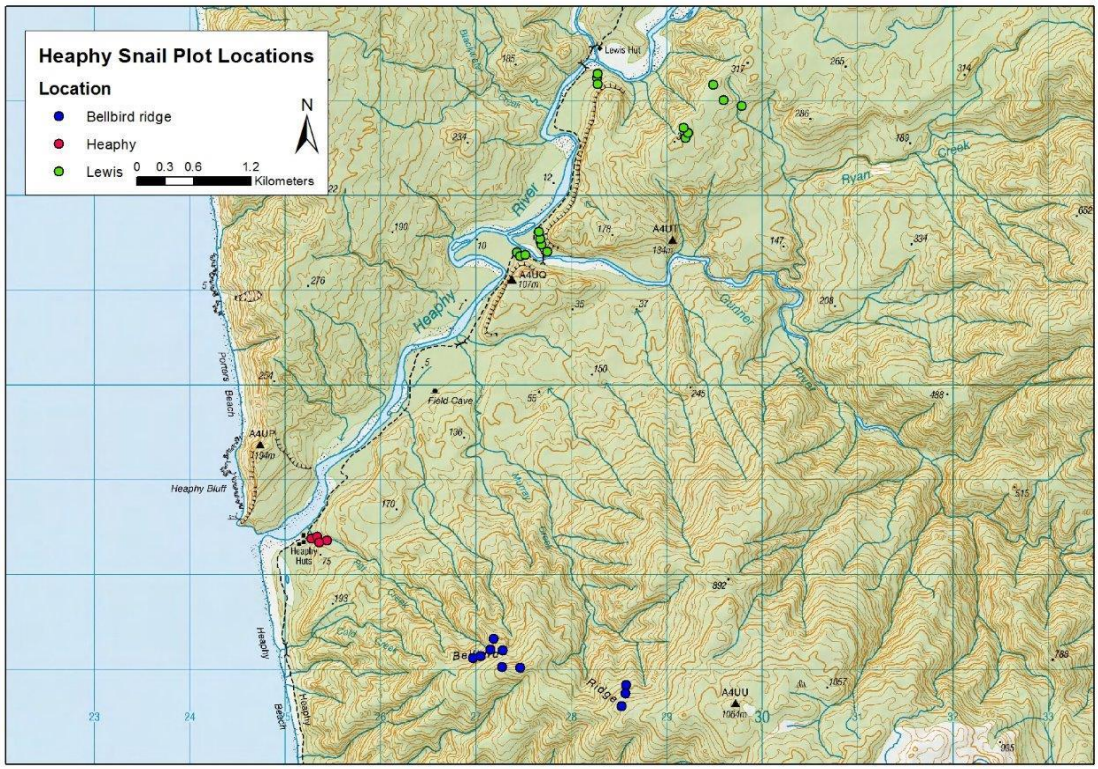

Figure 1. Location of snail plots in the Heaphy valley. This report presents data for the Lewis plots (*P. superba* "Gunner River" and *P. gilliesi* "Heaphy", green). Note: data for the Lower Heaphy, red and Bellbird Ridge plots, blue (*P. annectens* and *P. superba* "Gunner River") are not included in this report.

Results

In the 2024 measure of the 15 Lewis plots, 3 live snails were found (one *P. superba* and two P. gilliesi) an increase from the previous measure in 2021. *P. superba* again recorded higher densities than *P. gilliesi*, with both species following similar trends, except there was an increase in whole and rat predated *P. superba* shells. The number of shells with native predator damage was overall low with a decrease from the 2021 measure in the number of *P superba* shells with weka predation. Damage due to predation by rats was consistent with the last measure; (Figure 3).

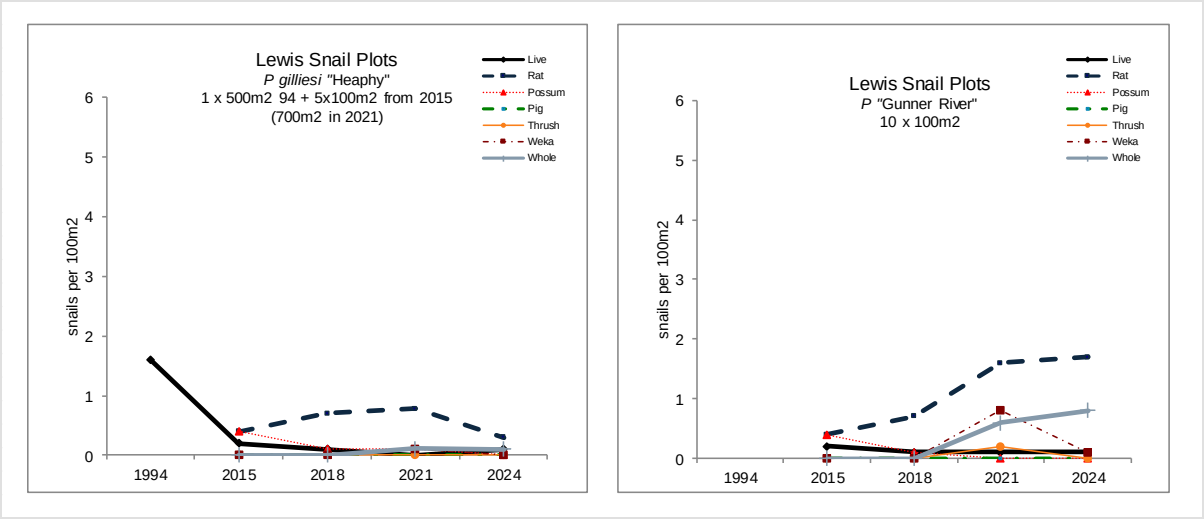

Figure 3. Average number of snails/shells per 100m^2 plot in the Heaphy Valley for *P. superba* and *P. gilliesi*. 'Live' presents the total number of live snails. The other categories present the number of shells by predator. 'Whole' presents the number of empty shells that did not show any damage.

Looking at all entities on the plots (live snails and all empty shells found), overall, the proportion of those which are live snails have been decreasing over time, however the 2021 and 2024 measure saw an increase in live snails found; (Figure 4). Rat damage was seen on around 60% of all shells found in 2024. The proportion of shells damaged by possum predation has continued to decline over time (Figure 4), whereas weka predation shows a non-lineal trend. It has been suggested (Ogilvie 2010) that the spikes in weka predation could be related to the beech masting events seen in 2014, 2016 and 2019, resulting in plagues of mice, providing weka with an abundant food source at the beginning of their breeding season the following spring (Figure 3 & 4).

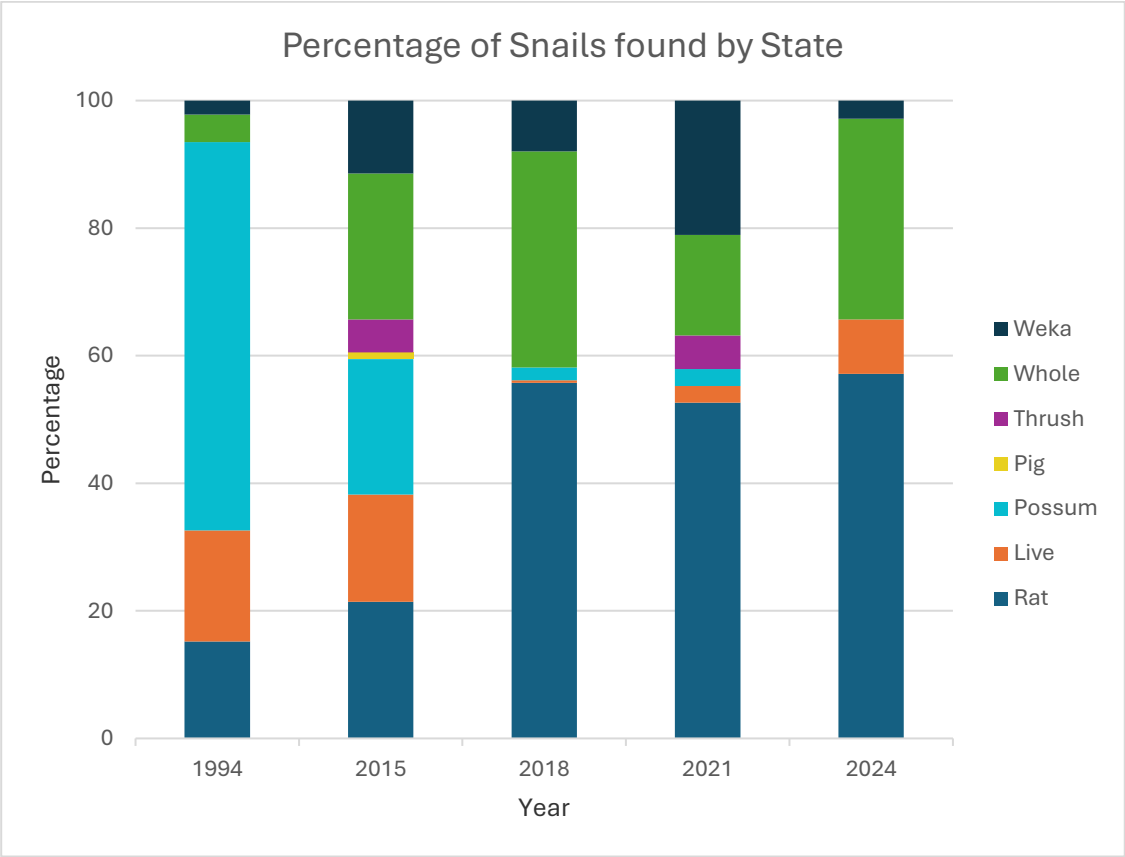

Figure 4. Percentage of live snails, whole empty shells and predated shells found on the Heaphy Valley monitoring plots over time. For predated shells, the type of predation is shown.

In February 2022 a new trap network was established on the true right of the Gunner River mouth to target rats and stoats. As there are permanent snail plots located either side of the river, a comparison can be made of the number of shells that have been predated by rats on either side to see if any benefits have been made due to the trapping effort (Figure 5).

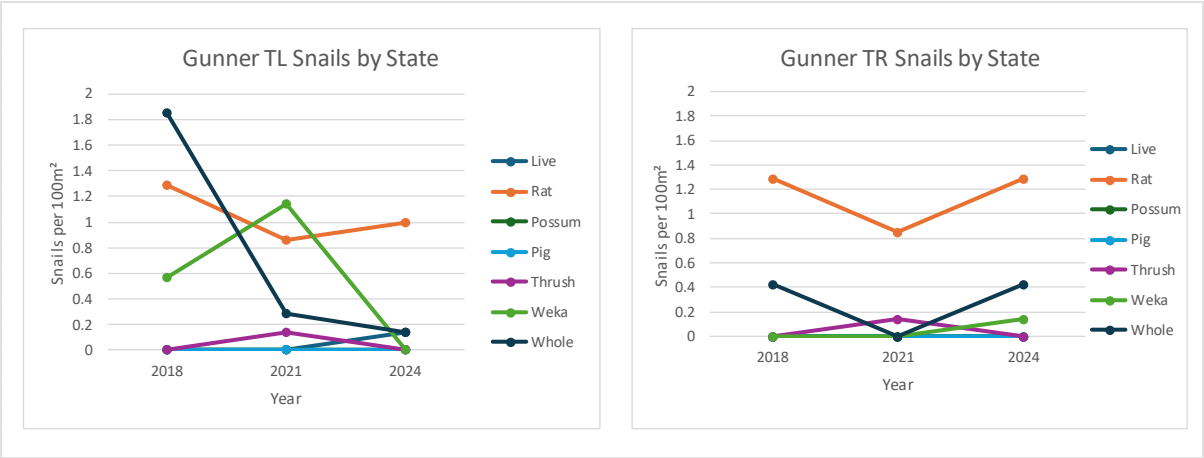

Figure 5. Comparison of the number per 100m² of live, whole and predated snails by predator type found on permanent plots on the true right and the true left of the Gunner River.

The number of rat predated shells found in 2024 suggest that there is little difference between the true left and the true right at this stage. Rats are however, known to be neophobic (Rat facts and control tips - Predator Free NZ Trust) so it may take some time for any difference to show. Comparison of the two sides also assumes that the river provides an adequate barrier to the rat populations on either side, which may not be the case. In the meantime, continued trapping is recommended.

Discussion and recommendations

The primary threat to *Powelliphanta* species found in the Heaphy catchment during the period 2015-2024 appeared to be rat predation. This was likely due to beech masts which occurred in 2016 and 2019, causing an irruption in rat numbers in the Heaphy valley. While both mast years were followed by an aerial application of 1080 poison baits to control predators neither operation were fully successful in reducing the rat population (DOCmon database). In the 2016 and 2017 operations, parts of the Heaphy valley were excluded from the operational area (due to requirements to provide buffers along the Heaphy track and the Heaphy river, and also landowner consenting issues). Therefore, rat numbers may have remained high in several of the snail monitoring plots which were located within these exclusion zones. The exclusion zones were treated in 2019 however, although the operation was still unsuccessful at reducing rats. The rise in rat numbers following the beech masts, especially in 2016 and 2019, is the most likely cause of the increase in rat predation observed in the snail shells found in the Heaphy catchment monitoring plots.

It is hard to determine whether the rise in rat predation of shells is linked to the reduction in live snails found in the monitoring plots, as the number of live snails found can also be influenced by a variety of other factors, such as climate change and observer skill.

The data suggest an overall declining trend in the number of live snails found on plots since 2015 with a marginal increase in the previous two measures. However, Live snail numbers are still far below their management objective and neither of the Powelliphanta species are meeting their recovery goals. As noted above it is difficult to tease out the reasons for this and continued long-term remeasurements of the plots will help to confidently interpret trends in live snail numbers.

Relative to rats, possums now have little impact on the snails, suggesting that control of this predator has been effective.

The relatively large number of whole empty shells observed for both species, particularly *P. superba*, coupled with the increase in their number over time suggest that another, unknown factor may influence *Powelliphanta* population trends. Temporal increases in whole shells on monitoring plots have also been observed for other *Powelliphanta* species at other sites on the West Coast, e.g. Denniston (Stephens 2021), Mokihinui (Stephens 2021a) or St Andrews and Charming Creek (Stephens 2021b).

An increase in whole empty shells could be indicative of either an increasing or a decreasing population. If the deaths were caused by natural mortality, an increase in whole shells would indicate an increase in the overall population. However, in this case, an increase in the number of live snails would also be expected, which was not observed. Whole shells could also be the result of deaths caused by disease, e.g. the spread of a fungus, which would be a serious threat to the persistence of the population. The deaths could be caused by severe weather events, e.g. drowning or freezing. While such events are natural, their frequency may increase due to climate change which could pose a serious long-term threat. Whole empty shells could also be the result of predation. Weka are apparently able to remove snails from their shells without causing damage (Judy Dix pers. comm.), and kiwi could potentially do the same (Stephens 2015). Research into the cause of the large number of whole empty shells should be considered.

Recommendations:

- Establish new snail plots in the lower Heaphy catchment to replace plots lost to cyclone Dovi and those previously to windfall on Bellbird Ridge.
- Repeat monitoring of the plots is suggested to be done in three years' time (in March/April 2027).
- Research into the cause of the large number of whole empty shells should be considered.
- Increase the number of plots to increase sample size and the power of detection. This will make it easier to detect changes in the snail data.

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