Tiromoana Bush

Bird monitoring 2022

Report prepared for

Transwaste Canterbury Ltd

Prepared by

RMA Ecology Ltd

Report number and date

Job 2262

April 2023

BETTER ECOLOGICAL OUTCOMES

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Project No. 2262

Version date: April 2023

Version status: Issued

Citation:

RMA Ecology Ltd. April 2023. Tiromoana Bush Bird Monitoring: 2022. Report prepared for Transwaste Canterbury Ltd, Waipara. 15 pages.

Revisions

Revision	*Date*	*Description*

Contents

1.0 Background and scope

1.1 Site

Tiromoana Bush (407 ha) includes most of the catchment of Kate Valley below the landfill, as well as a small area adjacent to Selby Road and the coastal faces connecting lower Kate Stream and Tiromoana Scenic Reserve (**Figure 1**). The site lies close to the southern limit of North Canterbury coastal hill country in the Motunau Ecological District (43° 06' S, 172° 51' E). Aside from the main valley floor of Kate Stream, the site is hilly and extends from sea level to 346 m a.s.l. at the summit of Ella Peak.

Historically the area would have been forest (mainly mixed podocarp–angiosperm, but with smaller areas of coastal angiosperm and black beech forest), which was likely cleared 500–700 years ago as a result of fires associated with early Māori settlement.

Since European settlement, the property had a long farming history prior to the start of the restoration project and was typically farmed as an extensive sheep and beef property. While pasture was dominant at the start of the project, the current vegetation is a mix of kānuka and mixed-species shrubland and low forest, gorse and European broom shrubland, restoration plantings, wetlands and rank pasture. Three ponds are present. Kate Pond was constructed by Transwaste Canterbury Ltd as part of the Tiromoana Bush project to enhance the natural wetlands in the area. A third pond was constructed as a water supply (hereby referred to as Water Supply Pond). Both of these constructed ponds have significant areas of wetland vegetation on their margins, dominated by raupo (*Typha orientalis*).

1.2 Consent and Management Plan

Transwaste Canterbury Limited have committed to a comprehensive ecological restoration project as part of the mitigation for Canterbury Regional Landfill at Kate Valley, which has been granted a 35-year resource consent. The ecological restoration project is being carried out in the designated Tiromoana Bush Conservation Management Area (CMA), located in the Motunau Ecological District in coastal North Canterbury (**Figure 1**). Restoration of the CMA is being undertaken to protect and enhance a substantial area of lowland forest, which is a nationally rare and poorly represented vegetation type (Norton 2004).

The Tiromoana Bush Restoration Plan 2022-27, states as one of its 35-year outcomes:

> *At the end of the 35-year resource consent period of the Kate Valley landfill (2039), the following outcomes will have been achieved as a result of our management within Tiromoana Bush:*
>
> *2. The existing korimako (bellbird) population has expanded and kereru (native pigeon) are now residing within the area. The species and abundance of native water birds have also been enhanced [2].*
>
> *[2] Water birds have been added here as they are likely to respond to the wetland restoration efforts.*

The main objectives of monitoring birds in the CMA are to evaluate bird count trends over time as conservation management within the CMA develops and use the monitoring results to inform best management practices to improve avian biodiversity and habitats for birds.

Conservation management since 2004 has involved removal of domestic stock, baseline monitoring for vegetation and birds, annual restoration planting, weed control, establishment of a deer fence exclusion area (Norton 2012), and more recently pig control and predator control.

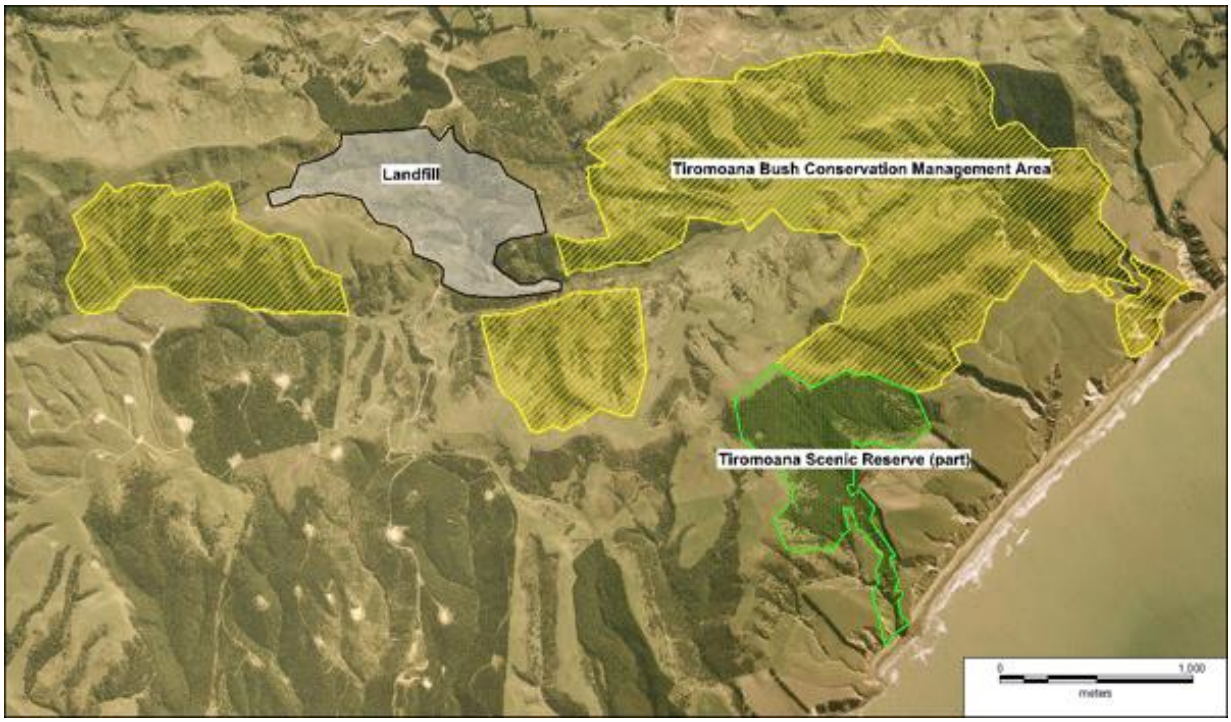

Figure 1. Tiromoana Bush Conservation Area (yellow hatched) in relation to the Canterbury Regional Landfill and adjacent public conservation land (Norton 2012).

1.3 Monitoring and predator control

Forest bird monitoring commenced at Tiromoana Bush during October 2005 and was undertaken each October until 2009 by Rhys Buckingham, providing five consecutive years of monitoring. This was the commencement of a 'pulsed' monitoring programme designed to be carried out over a 35-year period. The second pulse of monitoring was conducted each October from 2017-2019, by a new observer (Jeroen Lurling – the author of this 2023 report). Wetland and waterfowl monitoring was also initiated over this period, as significant habitat and birdlife had established in and around the constructed ponds.

Tracking tunnel and wax tag monitoring at Tiromoana bush in 2018 indicated the presence, in moderate to high numbers, of a suite of small mammals that are known to prey on native fauna (Maddigan 2018). Species identified were mice, rats, mustelids (weasels, stoats and ferrets) cats, hedgehogs and possums.

As a result of this monitoring, the decision was made to commence an active predator control programme in October 2019 focusing on these species. This control is based on a network of 200 paired DOC200 and Timms traps spread through the bush (**Figure 2**). The traps are serviced monthly, and all animals killed are recorded.

Figure 2. Small mammal trap network comprising paired DOC200 and Timms traps.

Over 2.5 years this resulted in the killing of 226 mice, 394 ship rats, 282 weasels, 68 stoats, 17 ferrets, 96 cats, 312 hedgehogs and 183 possums. Mustelid and possum kills have declined with time, indicating suppression of these species. Cat and hedgehog catches have remained relatively steady (Fraser Maddigan pers. comm). Rodent numbers have increased, perhaps because some of their main predators (mustelids) have been suppressed (meso-predator release is a common result of pest control operations). The increase in grass seed after several La Nina seasons may also play a part.

2022 is the first year of bird monitoring since predator control was initiated. The primary aims are to provide an indication as to whether bellbird relative abundance has increased and kereru have established, as per consent conditions. Monitoring of other forest birds, wetland birds and waterfowl will also provide indications as to the effectiveness of wider restoration goals within the Tiromoana Bush Management Plan.

2.0 Methods

2.1 Forest birds

The survey method, described in Buckingham (2005), entailed a modification of the standard five-minute bird count method for estimating the relative abundance of forest birds (Dawson & Bull 1975). The modification involved using simplified distance sampling techniques (Barraclough 2000; Moffat & Minot 1994). As in previous years, bird species not typically associated with forest or scrub such as

welcome swallow and yellowhammer, were not included in the surveys. All individuals of forest bird species seen or heard within 200 m of a counting site were recorded during a formal five-minute counting period. Information recorded included: the individual's species, whether it was first seen or heard, and which of three distance intervals (0–20 m, 20–50 m and 50–200 m) from the counting site the individual was in when it was first seen or heard. Rare species such as kereru and tomtit were noted even if they were not observed on formal counts. Species excluded from five-minute forest bird counts (as they are not normally associated with this habitat type) are: spur-winged plover, yellowhammer, welcome swallow, and Australasian harrier.

Counts were undertaken at thirteen transects, each with three count sites spaced at *c.* 50 m intervals (**Figure 3**). Right truncation at 200 m gives a survey area of 12.6 ha around each count site and, with 39 sites, a total survey area of 490 ha. Each count was repeated three times, on different days, and where possible, at different times of day (morning and afternoon). Counts on the scrub transect were repeated 5 times, to increase sample size, as there is only one transect in this habitat type. A total of 123 five-minute bird counts were completed.

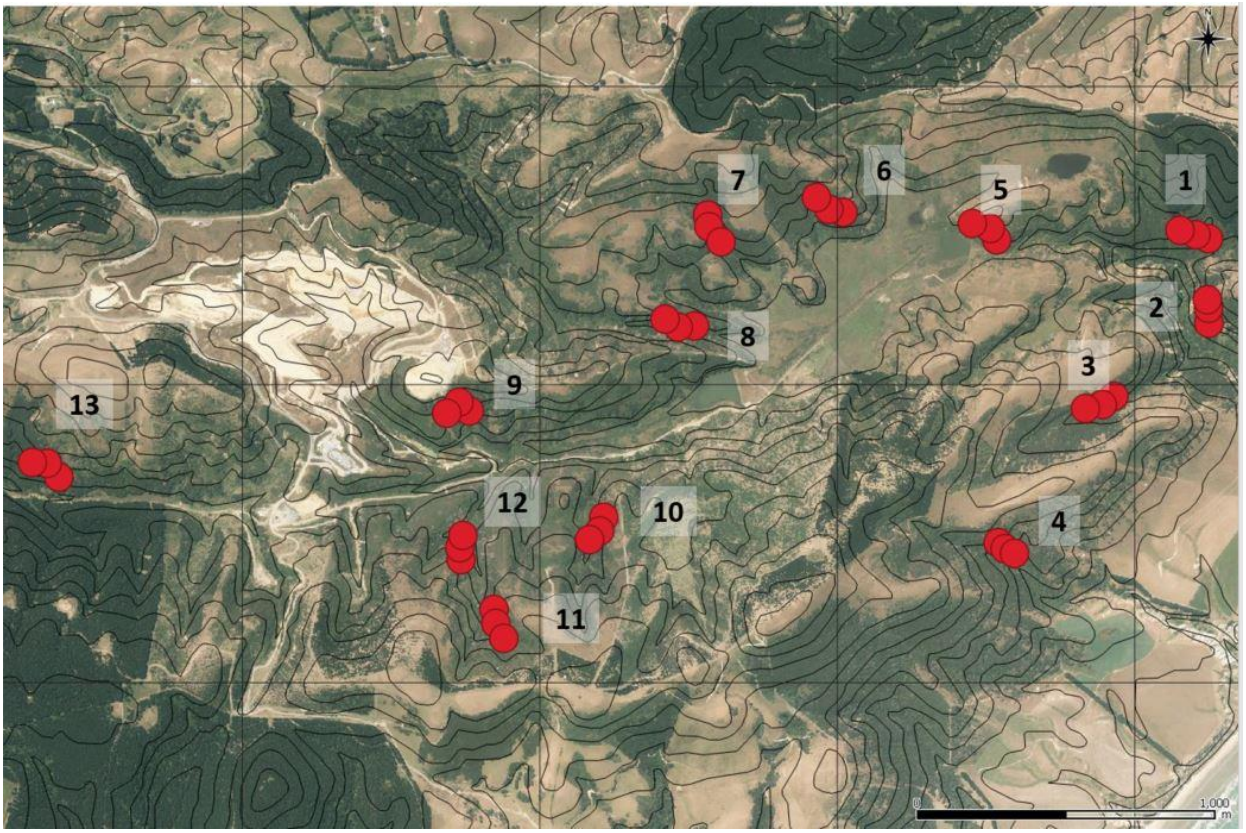

Figure 3. Five-minute bird count transects at Tiromoana Bush Conservation Area. Red circles represent count stations.

Surveys were only undertaken between 08:00 hrs and 17:30 hrs NZDT during suitable weather conditions: without strong wind or heavy rain. Environmental conditions during each survey were described by scoring five variables: *Sun* (0 to 5), *Temperature* (0 to 5), *Wind* (0 to 3), *Rain* (0 to 3) and *Noise* (0 to 3) as per Dawson and Bull (1975).

Counts this year were shared between Jeroen Lurling (as per 2017-2019, 72 point counts) and a new observer (Fraser Maddigan, 54 point counts). Counts were undertaken between 14 and 23 November 2022.

2.2 Waterfowl

Waterfowl on the open water dams and ponds were surveyed by visual counts with binoculars by Jeroen Lurling, as in 2017-2019. A methodical approach was used to establish a standard survey method for comparisons between years. Survey stations were established at high vantage points with good overviews of the entire waterbody, with one point overlooking each of the three waterbodies; Kate pond, Ella pond, and water supply pond (**Figure 4**). Counts were conducted for 10 minutes, and repeated at each survey station on three separate days, ensuring that these replicates took place at different times of day.

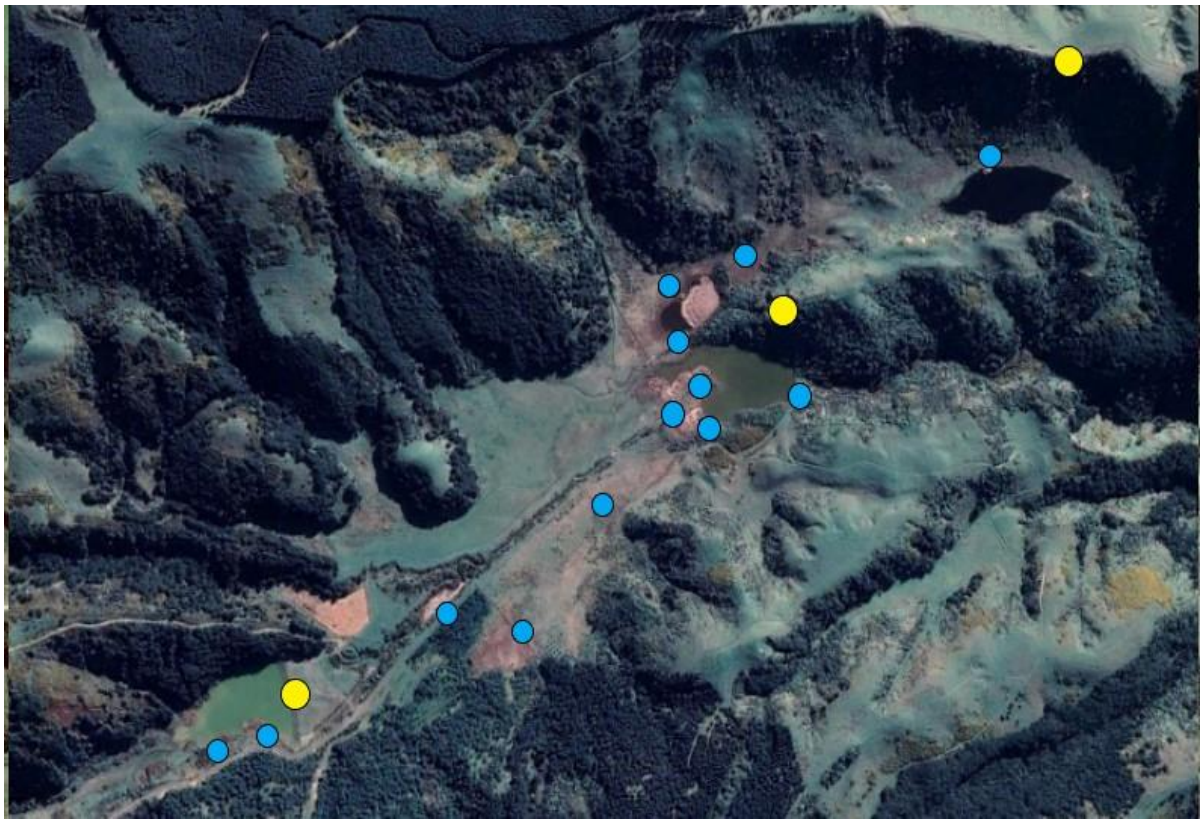

Figure 4. Locations of wetland bird playback counts (blue circles), and waterfowl visual counts (yellow circles) at Tiromoana Bush CMA.

2.3 Wetland Birds

The more secretive wetland birds were surveyed using call playback, the standard detection method for these species (O'Donnell 1994). Bittern, fernbird, spotless crake and marsh crake calls were played at dusk, between the hours of 8 pm and 11:30 pm. Playback calls were downloaded from the *nzbirdsonline.co.nz* website and played using a 'UE WonderBoom' bluetooth speaker and smartphone at moderate volume for crakes and fernbird, and maximum volume for bittern. The surveyor stood 10-15 m from the speaker, so any call responses during playback could be heard. Approximately 30 seconds of each species' call was played, followed by several minutes of listening, repeat of playback and then listening, adding to a total time of five minutes.

Calls were played at set count stations to ensure full coverage of all suitable wetland habitat and to standardise effort between years (**Figure 4**). Areas covered include the water supply pond, the small raupo pond downstream, the raupo wetland amongst the redwood plantation, *Carex secta* plantings to the east, Kate pond, Ella pond and *Carex secta* between these ponds. A total of 13 count stations were surveyed, and repeated on three separate evenings with little or no wind or rain.

3.0 Results

3.1 Forest birds

Five-minute bird count results indicate an increase in native forest birds between the period 2017-19 and 2022 (**Figure 5**).

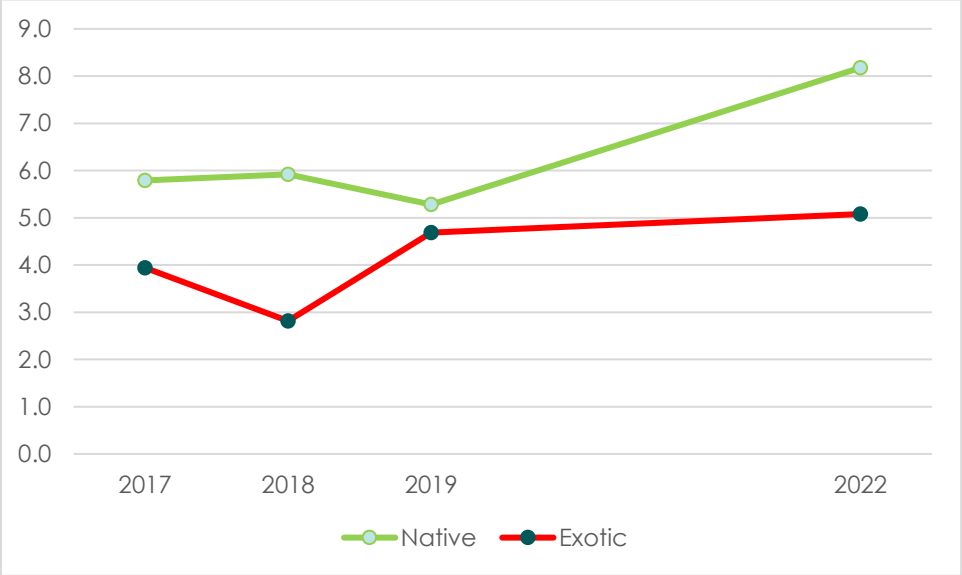

Figure 5. Averaged five-minute bird counts for native forest birds and for exotic forest birds at Tiromoana Bush CMA from 2017-2019 (pre-predator control) and in 2022 (post predator control).

This includes an increase in bellbird and kereru counts, and in some of the less common species such as kingfisher and shining cuckoo **(Figure 6).** A small resident population of kereru is established and appears to be growing.

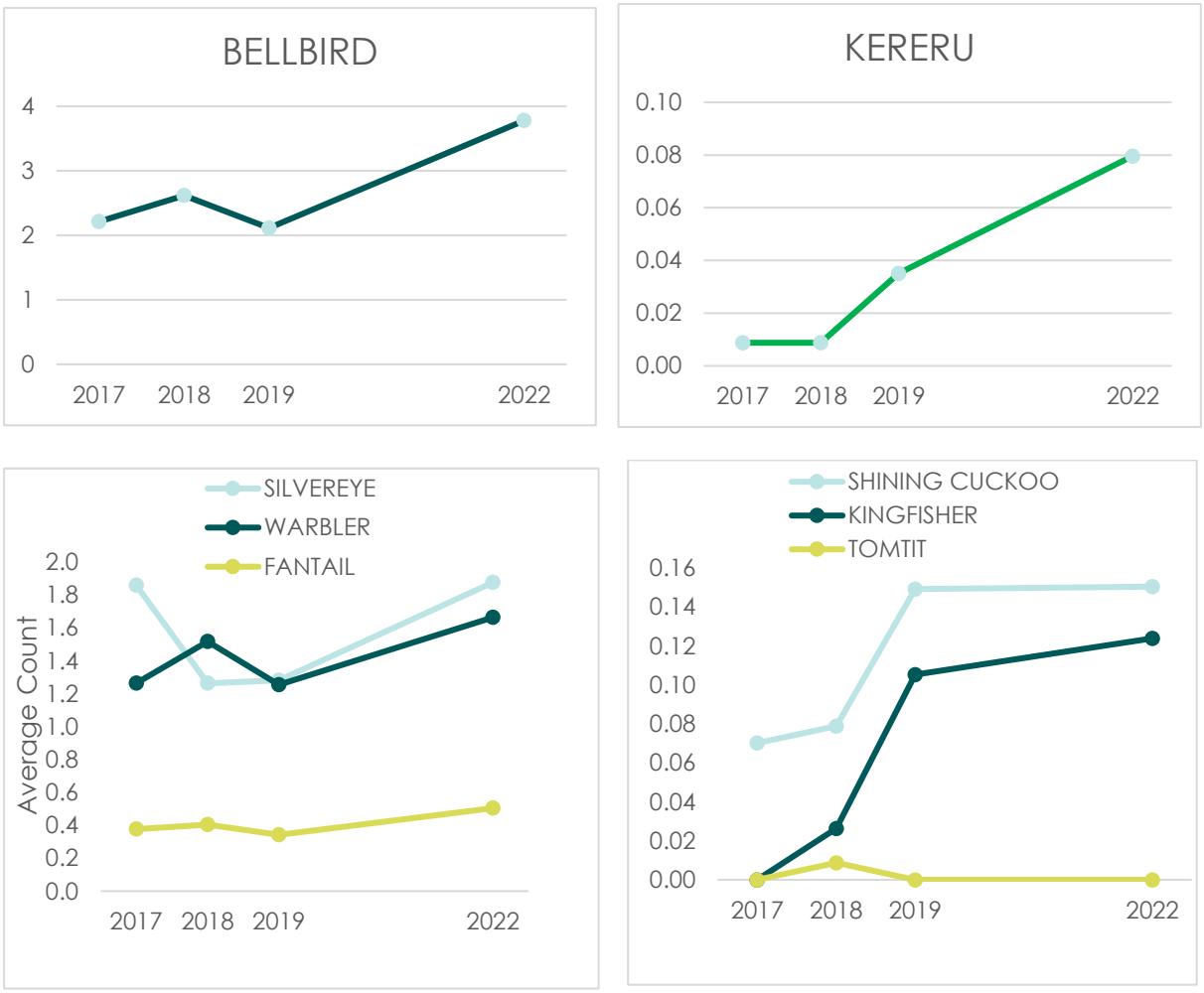

Figure 6. Average five-minute bird counts for (a) bellbird, (b) kereru and (c-d) other native forest bird species at Tiromoana Bush CMA from 2017-2019 (pre-predator control) and in 2022 (post predator control).

Part of the increase in mean bird count of native species may be attributable to observer differences in number of birds counted. Almost half (40.5 %) of counts were carried out by a new observer (observer 2), and these counts were higher for bellbird and other native bird species except for silvereye and kereru (**Figure 7**). Observer 2 counted 33 % more native birds than observer 1. As observer 2 completed 40.5 % of the total counts in 2022, these potential observer differences may account for approximately 13 % of the observed 46 % increase in native bird abundance between 2017-19 and 2022. These differences can arise from differences in hearing and visual observation, as well as decisions around whether multiple calls are from the same bird or from multiple birds.

Note, this is not a pure calibration, as each observer counted at different sites and times, so some natural variation in bird numbers would have also existed. Increases in kereru counts appear independent of these observer differences, and the small population appears to be growing steadily.

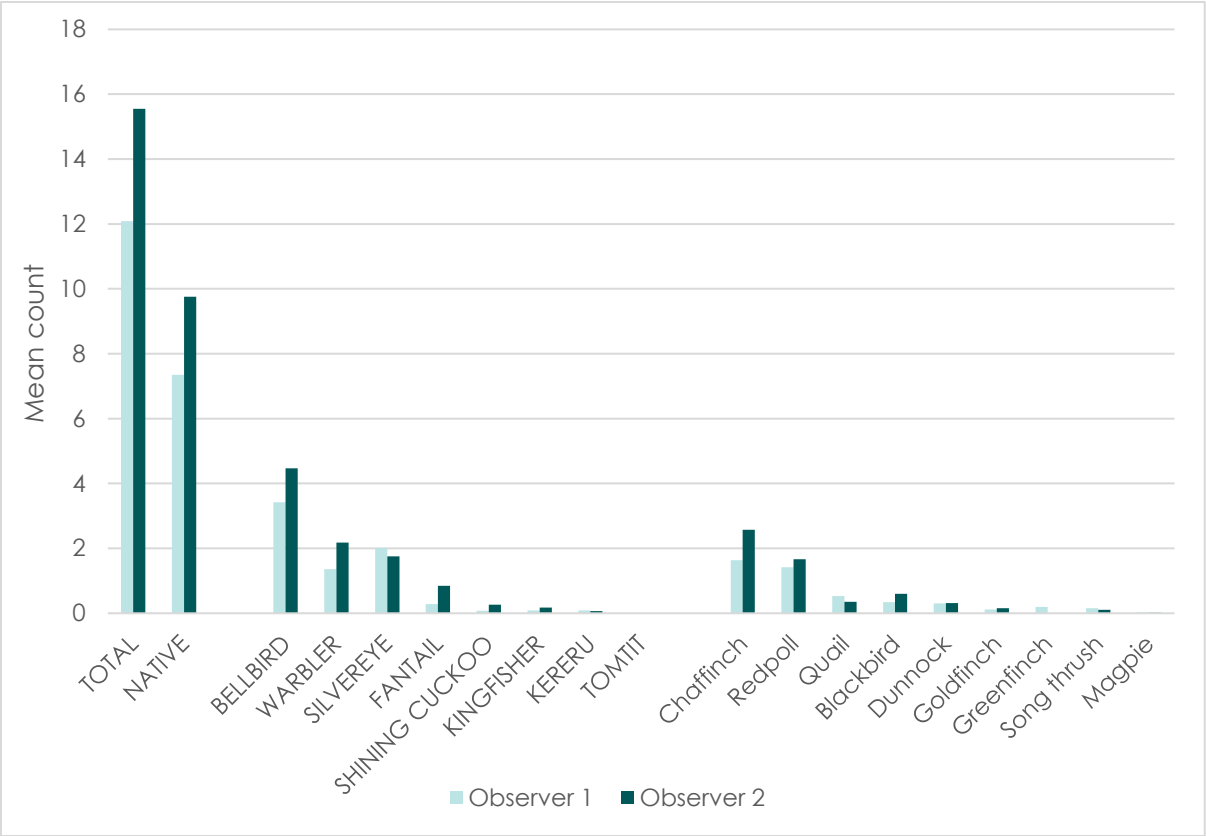

Figure 7. Mean number of birds counted per five-minute bird count for observer 1 (light blue bars) and observer 2 (dark blue bars) at Tiromoana Bush in 2022.

Note, transect 13 was originally set up as a control site. However, it is approximately 500 m from the nearest traps, while stoats and ferrets can travel 45-65 km and have average home ranges of 147-200 ha. The control site is likely receiving some effect from predator control at Tiromoana bush and so cannot be considered an effective control within a BACI study design (before-after, control-impact). Furthermore, there could be movement and 'spillover' from birds between this control site and the nearby treatment area. As it cannot be considered a full treatment site either, it was removed from analyses.

3.2 Wetland birds and waterfowl

The ponds and wetlands are important habitat for a large number and diversity of waterfowl. They provide a food source for mobile flocks of native waterfowl, and at least four native waterfowl species have been observed to breed here. A significant resident population of crakes is present at Kate Pond, water supply pond and the wetlands in between, dominated by spotless crake, with the occasional marsh or unknown crake heard. Counts between 2017 and 2022 suggest no clear trend in the crake population (**Figure 8**). An initial dip in numbers in 2018 is followed by a gradual rise, with numbers recorded ranging from four to eight. Variability is high and sample sizes are low.

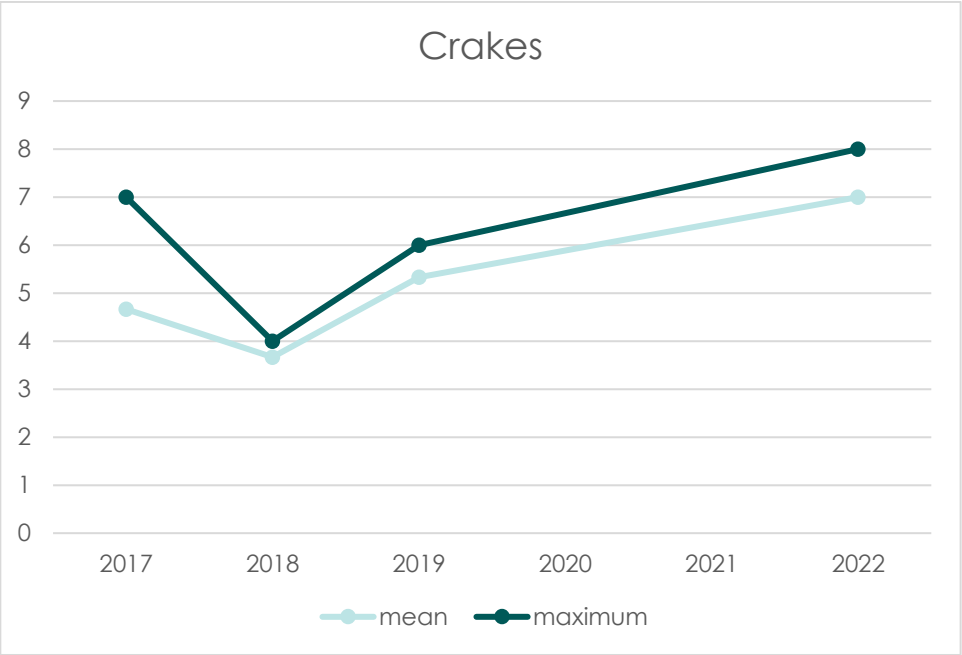

Figure 8. Mean and maximum number of crakes detected per call playback survey at Tiromoana bush wetlands and ponds over 2017-22. Numbers include spotless, marsh and unknown crakes.

No clear trend in waterfowl counts is apparent over the period 2017 to 2022 (**Figure 9** and **Table 1**). Being highly mobile, flocking birds, numbers vary greatly. A similar suite of species exists over the four years, with occasional vagrants. Waterfowl species observed to be breeding include mallard, grey duck hybrid, grey teal, paradise duck, black swan and Canada goose.

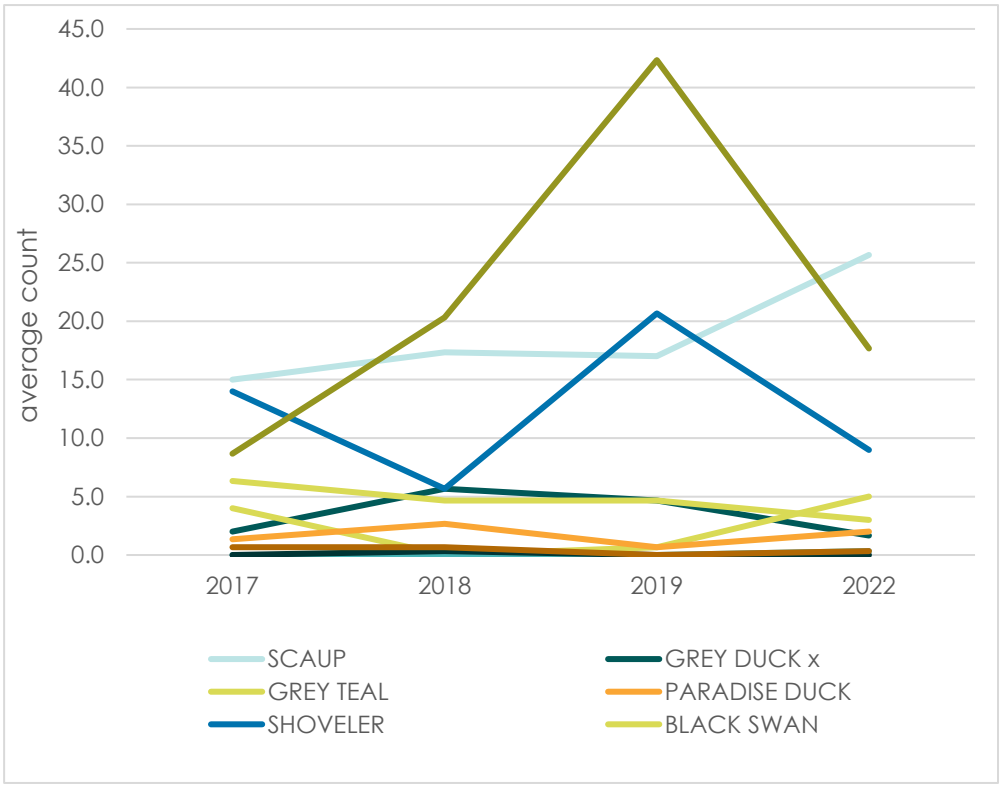

Figure 9. Counts of native waterfowl at Tiromoana bush ponds over from 2017 to 2022. Note predator control was initiated at the end of the 2019 counts. Grey duck x refers to grey duck with low level of hybridisation with mallard.

Table 1. Average counts of waterfowl on ponds at Tiromoana bush from 2017 to 2022. Native species names are displayed in capitals.

	2017	2018	2019	2022
NZ SCAUP	15.0	17.3	17.0	25.7
GREY DUCK HYBRID	2.0	5.7	4.7	1.7
GREY TEAL	4.0	0.0	0.7	5.0
PARADISE DUCK	1.3	2.7	0.7	2.0
AUSTRALASIAN SHOVELER	14.0	5.7	20.7	9.0
BLACK SWAN	6.3	4.7	4.7	3.0
LITTLE SHAG	0.0	0.0	0.0	0.3
PIED SHAG	0.0	0.3	0.0	0.0
WELCOME SWALLOW	8.7	20.3	42.3	17.7
WHITE FACED HERON	0.7	0.7	0.0	0.3
Canada goose	24.3	29.7	17.0	11.0
Domestic goose	0.0	0.0	0.0	0.7
Mallard	15.3	6.3	8.3	8.0

3.3 Incidental observations

3.3.1 Invasive fauna

Anecdotal observations of pigs, piglets and grubbing indicate pigs are relatively abundant, breeding, and still appear to be having a major impact on understory and sapling vegetation, as well as erosion and potentially slope stability. This appears to be contributing to sedimentation in streams, especially in gullies with steep slopes, and where rutting occurs on stream banks. Die-back of most of the raupo on Kate pond north may be due to pig rutting (Fraser Maddigan pers. comm.). This represents a major loss of habitat for marsh crake, spotless crake (present) and bittern (not recorded but could be vagrant). The raupo appears to be slowly regenerating.

More frequent pig control is needed. Action 3.4 in the 2022-27 Tiromoana Bush Management Plan recommends regular pig control to a low level. This is essential to keep numbers from having a major impact on forest regeneration and restoration, as well as potentially wetland habitat and stream water quality. Within the last year, additional resources have been allocated to pig and deer control, and ecological impacts seem to have been decreasing (Fraser Maddigan pers. comm.).

The pedestrian gate in the external deer fence at the track north of Kate pond was observed to be missing, potentially allowing goats and deer to enter Tiromoana Bush. This was reported to Kelvin at the office and urgent repair was recommended. Consideration could be given to inspecting key sections of the fence and the gates more frequently than once per year (as recommended in Action 3.2 of the Restoration Plan).

3.3.2 Invasive flora

Several grey willow (*Salix cineraea*) or grey willow hybrids were noted along the southern shore of the water supply dam. Grey willow should be considered a priority weed species under actions 4.1 and 4.2

in the Restoration Plan. Grey willow is highly invasive and transformative and threatens revegetation goals regarding kahikatea forest and habitat of native wetland birds. Removal is a relatively straightforward at this early stage by cutting and pasting stumps with herbicide, and ensuring all cut fragments are carefully disposed of. Follow up monitoring and thorough surveillance of the surrounding area for seedlings is recommended for a minimum of three years.

3.3.1 Birds

Outside of the survey, between January and April 2023, a tomtit and falcon were recorded onsite during predator control works (Fraser Maddigan pers. comm.). Tomtit have been recorded on several occasions in the past. Falcon have not been heard at the site during previous bird surveys and are likely to be vagrant, or at the edge of an extended home range.

4.0 Discussion

4.1 Bird trends

2022 bird counts indicate a moderate increase in relative abundance of native forest birds at Tiromoana Bush since predator control was initiated. Bellbird and kereru numbers have also increased.

Predator control is the most likely reason for most of the observed increase in native forest birds since 2019. Observer differences between years appear to account for only a part of this increase. Annual variation cannot be ruled out, particularly for birds with low sample sizes such as kereru. A further two years of monitoring is recommended, to provide three years of post-predator control data. Statistical analysis can then confirm whether observed trends are significant and sustained.

For native water birds, ongoing monitoring is also required to determine whether species richness and abundance have been enhanced (as per the thirty-five year outcomes within the 2022-27 Restoration Plan). A small increase in crake counts was observed over 2017-2022, but this may not be significant, as variability between years is high, and sample sizes are low.

For waterfowl, visual counts show no obvious trends in abundance and species richness over time. High variability in counts exists between years, and sometimes between counts several days apart. Additional replication and longer-term data sets are needed to determine whether there is a significant trend over time, or with predator control.

The ponds and wetlands support the majority of species in Tiromoana CMA, and most of its threatened species. Therefore, additional traps are recommended around these areas to match or exceed the trapping density in the forested parts of Tiromoana CMA (see **Figure 2**).

4.2 Automatic recording devices

If future bird monitoring is undertaken using acoustic recording devices (ARD's) as proposed in action 10.3 of the 2022-2027 management plan, calibration to a manual observer count is strongly recommended. This would enable some comparison with historic counts to determine if numbers are increasing. There are significant differences in manual observer and ARD counts, specifically:

- ARDs record the number of calls rather than the number of birds. An observer can determine that multiple calls coming from the same direction and distance are the same bird.
- ARDs do not record visual observations.
- ARDs do not conduct call playback to elicit a response.
- ARDs do not allow for distance counts as far as the author is aware.
- Exclusion of birds over the 200m cut-off would be a challenge with ARDs.

At a minimum, calibration would involve an observer carrying out 5-minute bird counts simultaneously with ARD deployment, and again when collected, for one year of counts. It is also important to maintain consistency in the sensitivity setting of the ARD, and ideally use a similar make and model for the length of the survey (until 2035).

ARDs could be used for wetland bird monitoring without call playback if deployed over a longer time frame. However, this will not be comparable to prior monitoring by an observer. ARDs are less suitable for waterfowl counts, which are best conducted by visual observation.

4.3 Recommendations

- Continue the predator control programme, with deployment of additional traps around the ponds and wetlands (seek advice from Fraser Maddigan regarding design and implementation)
- Prioritise regular and widespread pig control.
- Remove of grey willow at the water supply dam, and ongoing surveillance.
- Reinstall the gate pedestrian gate in the external deer fence at the track north of Kate pond.
- Undertake a further two years (2023 and 2024) of bird monitoring to confirm the effect of predator control on forest birds, waterfowl, and wetland birds.
- Undertake statistical analysis of results after three years of post-predator control monitoring (2024/ 2025 after 2024 monitoring).
- Calibrate automatic recording devices to a manual observer count (2023 and/or 2024).

The next monitoring for this site is due in October 2023.