



Region-wide Call Count Monitoring of Coromandel Brown Kiwi 2023

Kiwi at Home – Kiwi i te Kāinga

Monitoring Date:
13 – 29 June 2023



PREDATOR FREE
HAURAKI COROMANDEL
COMMUNITY TRUST
KIWI I TE KĀINGA PROJECT

Acknowledgements

Thank you to all the kiwi listeners who participated in the 2023 PFHCCT Kiwi Call Count Monitoring in June 2023. This year has been particularly challenging for Hauraki - Coromandel in the wake of Cyclone Gabrielle and other extreme weather conditions. Your time and effort are invaluable, and we sincerely appreciate your contributions.

We also wish to acknowledge the Kiwi i te Kāinga, Jobs for Nature funding through Save the Kiwi, which made this monitoring possible.

The 2023 PFHCCT Kiwi Call Count Monitoring was coordinated and documented by Sasha Dowling and Renee Denby from the Predator Free Hauraki Coromandel Community Trust.

Abstract

In 2022 Predator Free Hauraki Coromandel Community Trust (PFHCCT) began the first of a three-year kiwi monitoring programme through Jobs for Nature Funding under the Kiwi i te Kāinga project. This report contains the findings from Year 2 of this study with comparisons of the data and insights gathered in Year 1.

The kiwi species in Hauraki-Coromandel is Coromandel Brown Kiwi (CBK), a distinct taxon of the North Island Brown Kiwi (*Apteryx mantelli*). In the past decade there has been an increase in CBK attributed to kiwi focused predator control measures. This monitoring programme examines areas beyond known kiwi habitats and areas with suspected kiwi absence. The objective is to provide insights into where population dispersal may have occurred, potentially revealing new CBK habitats and informing future management decisions in the Hauraki-Coromandel region.

Kiwi call count monitoring was used in this study based off the methodology outlined in the DOC Kiwi Best Practise Manual. Kiwi call data was obtained by volunteer listeners and automated acoustic recorders. Within a flexible 16-day window, volunteers were required to complete 480 minutes of listening over four evenings. Listening evenings encountered substantial challenges due to extreme wet weather conditions during June 2023. Listening sites were categorised into four geographical clusters: Northern, Western, Eastern and Southern.

In Year 2 the monitoring scope was expanded, encompassing 54 sites, up from the 45 sites in Year 1. Findings show no statistical difference between Years 1 and 2 ($P = .61$). Dense kiwi call rates were recorded in the Northern and Eastern clusters of the region, consistent with the patterns identified in Year 1 findings. In line with expected observations three-quarters of calls recorded were male, and one-quarter were female.

This study underscores the impact of regional collaboration in biodiversity monitoring amongst community-based conservation groups by demonstrating how collective action can enhance the understanding of taonga species in Aotearoa.

Table of Contents

Acknowledgements	1
Abstract	2
1. Introduction	4
1.1 Objective	4
2. Methodology	5
2.1 Monitoring Preparation.....	5
2.2 Listening Sites	5
2.3 Site Clusters.....	6
2.4 Volunteer Training.....	7
2.5 Data Recording.....	8
2.6 Automated Acoustic Recorders	8
2.7 Data Processing.....	10
3. Results	11
3.1 Call Rates	11
3.2 Sex Ratios	15
3.3 Weather.....	16
4. Discussion	17
4.1 Call Rates	17
4.2 New Listening Sites	18
4.3 AAR Sites.....	19
4.4 Kiwi Sex Ratios	20
4.5 Weather.....	20
4.6 Limitations.....	20
4.6 Recommendations.....	21
5. Conclusion	22
6. References	23
Appendices	24
Appendix A	24
Appendix B	26
Appendix C	27
Appendix D.....	28
Appendix E.....	31

1. Introduction

In pursuing effective kiwi conservation management, establishing a baseline for monitoring North Island Brown Kiwi (*Apteryx mantelli*) (Figure 1) populations in Hauraki-Coromandel has emerged as a vital component of ongoing efforts. This report presents the findings from Year 2 of the Predator Free Hauraki Coromandel Community Trust (PFHCCT) Region-wide Kiwi Call Monitoring. The monitoring was conducted by the Kiwi i te Kāinga Project, which is part of the Jobs for Nature Initiative funded by Save the Kiwi. This report is Year 2 of a three-year baseline monitoring programme aiming to identify areas where Coromandel Brown Kiwi (CBK) have exhibited growth or movement beyond areas known as *kiwi hotspots*.

To prevent bias, sites with high known kiwi populations (i.e., kiwi hotspots) were avoided, as these areas may already be at carrying capacity. The primary objective is to assess population growth overtime, therefore only sites that allow for kiwi growth are included. Accordingly, the findings are an incomplete representation of kiwi populations in the region. This study is an investigation into areas CBK are beginning to populate. The design of this monitoring study encompasses areas bordering well established conservation groups, smaller conservation groups, areas with minimal predator control and areas with no control.

1.1 Objective

The objective of this monitoring programme is to establish a baseline of CBK populations throughout Hauraki-Coromandel to assist in the measurements of population changes over time and to explore whether population expansion has occurred. This monitoring will also provide recommendations for future studies, and over time help to inform future management decisions.



Figure 1. North Island Brown Kiwi

2. Methodology

The methodology for this monitoring maintains the same as the previous year, drawn directly from the Department of Conservation (DOC) Kiwi Best Practice Manual (Colbourne et al.), ensuring consistency across the baseline study (Appendix A).

2.1 Monitoring Preparation

In preparation for the monitoring, feedback was requested from volunteers who participated in the 2022 monitoring. Feedback was collected via an online survey form and then used to identify improvements for the 2023 monitoring.

2.2 Listening Sites

The original 45 sites from the 2022 monitoring were included in this year's monitoring, however, two of last year's sites had to be moved as they were no longer accessible at their previous locations. HAU203 Te Karo was relocated 500 metres north and assigned a new site code HAU208, and HAU206 Silverstream was moved 400 metres north-west and renamed HAU207. Every effort was made to ensure that these were as close as possible to the previous locations while also trying to guarantee ongoing access to these areas so that they do not have to be moved again. These repositioned sites were given new site codes as they are in different, although nearby, locations and thus cannot be compared directly to the Year 1 sites.

In addition to 2022's 45 sites, five additional crewed sites and five automated acoustic recorder (AAR) sites were included in this year's monitoring (Figure 3). There was increased interest from volunteers and community groups which prompted an increase in monitoring sites (Figure 2). To expand coverage in the central area of the Coromandel Forest we introduced two AAR listening sites: HAU221 Karaka and HAU223 Crosbies into quadrant 22. This considerably increased the studies reach as quadrant 22 was not included in the 2022 monitoring (Figure 3).



Figure 2. The PFHCCT team helping new and established volunteers get set up.

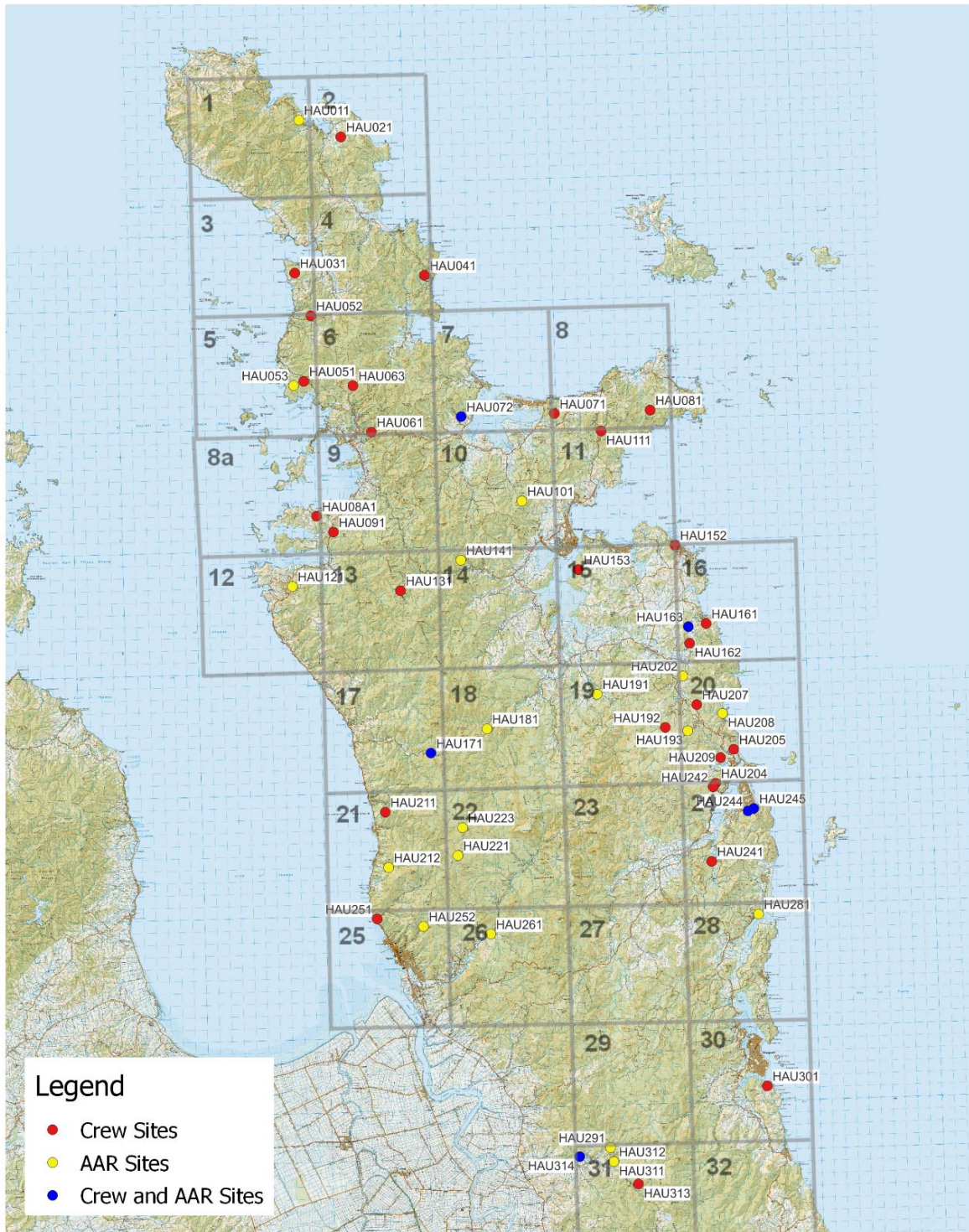


Figure 3. Map of the monitoring quadrants and each monitoring site.

2.3 Site Clusters

Listening sites were organised into one of four geographical clusters (Northern, Western, Eastern or Southern) as they were last year. Newly identified sites were integrating into their respective cluster (Table 1).

Table 1. Each of the monitoring sites sorted into four geographical clusters.

Northern	Western	Eastern	Southern
HAU011 Stony Bay Road	HAU081A Te Kouma Farm	HAU152 Grange Road North	HAU291 Wires Track
HAU021 Port Charles	HAU091 Kahurangi Block	HAU153 Red Hill	HAU301 Waikaukau
HAU031 Tukituki	HAU121 Mana Retreat	HAU161 Te Puia	HAU311 Maratoto Northwest
HAU041 Adam's Place	HAU131 Mahakirau	HAU162 Hinds Farm	HAU312 Komata
HAU051 McMillan	HAU141 Wairua Lodge	HAU163 Tirohanga	HAU313 Golden Cross
HAU052 Waitete	HAU171 Square Kauri	HAU191 Kapowai	HAU314 Te Hui*
HAU053 Whisky Bay*	HAU181 East T-C Road	HAU192 Te Moata Centre*	HAU321 Mataora Bay
HAU061 Driving Creek	HAU211 Waiomu/Te Puru	HAU193 Te Moata Far Hills*	
HAU063 Flays Road	HAU212 Ngarimu Bay	HAU202 Mangaiti Farm	
HAU071 Matarangi Bluff	HAU213 Crosbies*	HAU204 Red Bridge Pines	
HAU072 Mana Manu	HAU221 Karaka*	HAU205 Tairua North	
HAU081 Rimu Tree	HAU251 Tararu	HAU207 Silverstream	
HAU101 Whangapoua Forest	HAU252 Waiotahi*	HAU208 Te Karo	
HAU111 Ngāti Hei Hukarahi	HAU261 Kauaeranga Valley	HAU209 Golf Course*	
		HAU241 Pauanui Lakes	
		HAU242 Red Bridge Lookout	
		HAU244 Eagle's Nest	
		HAU245 Mount Ave	
		HAU281 Ōpoutere	

* New sites introduced in 2023.

2.4 Volunteer Training

Part of the feedback received was that volunteers wanted an online platform to listen to a range of kiwi calls leading up to monitoring nights to become more familiar with said calls. We created online flashcards with various kiwi and ruru (*Ninox novaeseelandiae*) calls which we sent to participants prior to the monitoring and training sessions so that they could practice call identification in their own time.

Due to road closures attributed to an exceptionally wet season and the impact of Cyclone Gabrielle, four refresher training sessions were conducted across the peninsula in the following locations: Coromandel, Tairua, Tapu, and Whitianga. Volunteers were not required to attend training this year, but all were encouraged to do so. The training sessions covered the instructions for the monitoring, how to complete the datasheet, and identifying and distinguishing kiwi calls. Each site host that attended was given a monitoring kit which included a PFHCCT tote bag with a clip board, datasheets, kiwi monitoring pencil and instruction booklet (Appendix B, C, D). If a site host did not attend a training session their monitoring kit was mailed to them or dropped at a pickup point.

2.5 Data Recording

Monitoring for 2023 was set to occur around the New Moon on June 17 to have volunteers listening during the darkest phase of the lunar cycle with the four monitoring nights occurring from Friday 16 June to Monday 19 June. However, the weather report from the start of the week indicated that the weather for that weekend would be poor, therefore, we let volunteers know that the monitoring period was able to begin on Tuesday 13 June and continue until Thursday 29 June. We asked volunteers to complete their monitoring as close to the original dates as possible because the moon phases further from those dates meant brighter nights which are not ideal. We also encouraged them to choose fine nights for their monitoring to ensure the most accurate data and to avoid any volunteers monitoring in adverse weather. A table of the nights monitored at each site is available in Appendix E.

Where possible, the same participants were stationed at each site over the four monitoring nights. They recorded kiwi calls heard and any noticeable changes in weather or noise within the monitoring timeframe of 6 pm to 8 pm. The time of the kiwi call, the sex of the kiwi, the direction of the call and its perceived distance were recorded on a datasheet along with other site variables and animal calls (Appendix B).

2.6 Automated Acoustic Recorders

We deployed AARs to 25 sites across the peninsula, 19 AAR Only sites and six sites that were also crewed (Table 2). Unchanging from last year, we deployed recorders to sites that were too remote to access nightly and sites where there were no volunteers available to crew them. The number of these sites increased from last year as the adverse weather earlier in the year made several sites difficult to access. In addition to these sites, we deployed recorders to several new sites and a few crewed sites that we had interesting results for in the 2022 monitoring. Sites with both a crew and AAR (AAR + Crew) included sites with high kiwi call rates from Year 1 such as HAU163 Tirohanga, HAU171 Square Kauri

and HAU281 Ōpoutere. AAR + Crew sites were also located at new sites with new listeners where possible including HAU244 Eagle’s Nest, HAU245 Mount Ave and HAU314 Te Hui.

Table 2. Sites with automated acoustic recorders (AAR) deployed to them.

Site Code	Site Name	AAR Only	AAR + Crew	New in 2023
HAU011	Stony Bay Road	✓		
HAU053	Whisky Bay	✓		✓
HAU072	Mana Manu		✓	
HAU101	Whangapoua Forest	✓		
HAU121	Mana Retreat	✓		
HAU141	Wairua Lodge	✓		
HAU163	Tirohanga		✓	
HAU171	Square Kauri		✓	
HAU181	East Tapu-Coroglen	✓		
HAU191	Kapowai	✓		
HAU193	Te Moata Far Hills	✓		✓
HAU202	Mangaiti Farm	✓		
HAU208	Te Karo	✓		
HAU212	Ngarimu Bay	✓		
HAU223	Crosbies	✓		✓
HAU221	Karaka	✓		✓
HAU244	Eagle’s Nest		✓	✓
HAU245	Mount Ave		✓	✓
HAU252	Waiotahi	✓		✓
HAU261	Kauaeranga Valley	✓		
HAU281	Ōpoutere	✓		
HAU291	Wires Track	✓		
HAU312	Komata	✓		
HAU314	Te Hui		✓	✓
HAU321	Mataora Bay	✓		

DOC AR4 recorders were generously loaned to us by Waikato Regional Council and DOC Thames for the duration of the monitoring period. They were hung on tree branches at approximately shoulder height and placed where wind would not knock them into a tree (Figure 4). The recorders were set following DOC Kiwi Best Practise Guidelines, set to record on the low setting for the duration of the monitoring i.e., from 6 pm to 8 pm. The recorders were in the field at each of their sites for at least the

length of the monitoring time, but most were out for longer because of logistics around deploying and retrieving the devices.

As with volunteers selecting nights to monitor, the unfavourable weather meant that all four of the original monitoring nights from June 16 to June 19 could not be used for each AAR site. For sites with AARs only, the four nights closest to the original monitoring dates that had fine weather were selected for data collection (Appendix E). Acoustic recorders deployed to sites that also had a crew were only used to corroborate crew data and thus the same nights were used for both AAR + Crew sites.



Figure 4. An automated acoustic recorder being placed in the field.

2.7 Data Processing

Automated acoustic recorder data was analysed using Raven Lite software. Call rates were calculated by mean total calls per hour, and the ratio of female to male calls. Statistical significance of the findings was determined through a paired t-test.

3. Results

3.1 Call Rates

27 of the 54 monitoring sites recorded kiwi calls, 26 recorded zero calls and one site did not complete the monitoring, 17 sites did not complete the full 480 minutes of listening time which affects the mean call rate of the sites and thus these should be interpreted with caution; these are marked in Table 3. All but one site listened for at least 360 minutes which is equivalent to three full nights of monitoring; HAU081A Te Kouma Farm, listened for only 90 minutes. There were 556 kiwi calls over approximately 407 hours of listening. The mean call rate across all 53 sites with data was 1.34 calls per hour which is less than the mean call rate of 1.62 calls per hour from 2022 but the difference between these two years is not statistically significant ($P = .61$). The mean call rate for 2023 across the 42 sites which recorded data in both Year 1 and Year 2 was 1.67 calls per hour which also is not significantly different to those same sites in 2022 ($P = .93$).

Table 3. Total calls and mean call rates (per hour) at each site, by cluster.

Cluster	Site Code	Site Name	Total Calls	Mean Calls Per Hour
Northern	HAU011†	Stony Bay Road	4	0.63
	HAU021	Port Charles	15	1.88
	HAU031	Tukituki	27	3.38
	HAU041	Adam's Place	22	2.75
	HAU051*	McMillan	14	2.33
	HAU052	Waitete	2	0.25
	HAU053†	Whisky Bay	10	1.25
	HAU061	Driving Creek	46	5.75
	HAU062	Kennedy Bay	No monitoring	
	HAU063	Flays Road	13	1.63
	HAU071	Matarangi Bluff	51	6.38
	HAU072♦	Mana Manu	0	0.00
	HAU081*	Rimu Tree	79	10.44
	HAU101†	Whangapoua Forest	7	0.88
	HAU111	Ngāti Hei Hukarahi	14	1.75
Western	HAU081A*	Te Kouma Farm	0	0.00
	HAU091*	Kahurangi Block	41	5.66
	HAU121†	Mana Retreat	0	0.00
	HAU131	Mahakirau	2	0.25
	HAU141†	Wairua Lodge	0	0.00
	HAU171*♦	Square Kauri	2	0.25
	HAU181†	East T-C Road	0	0.00

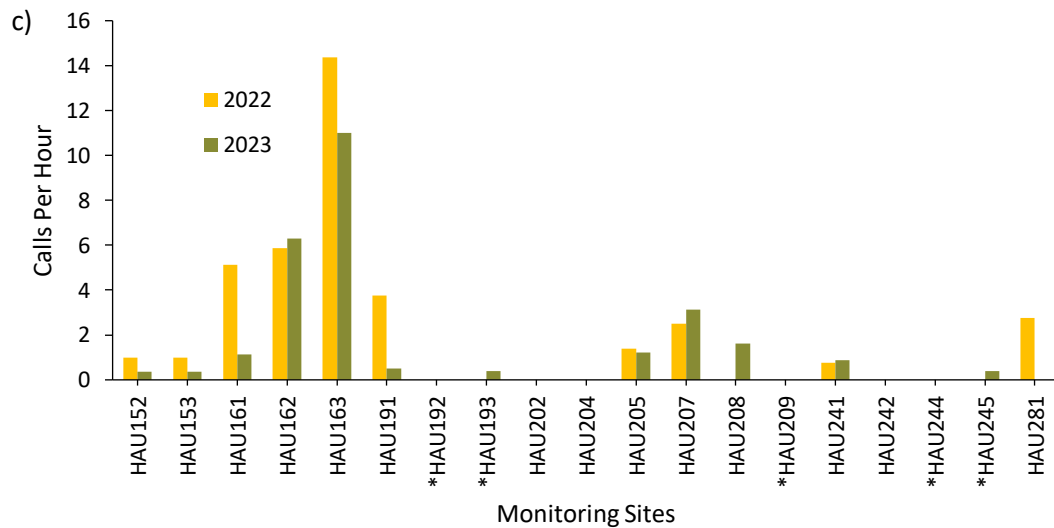
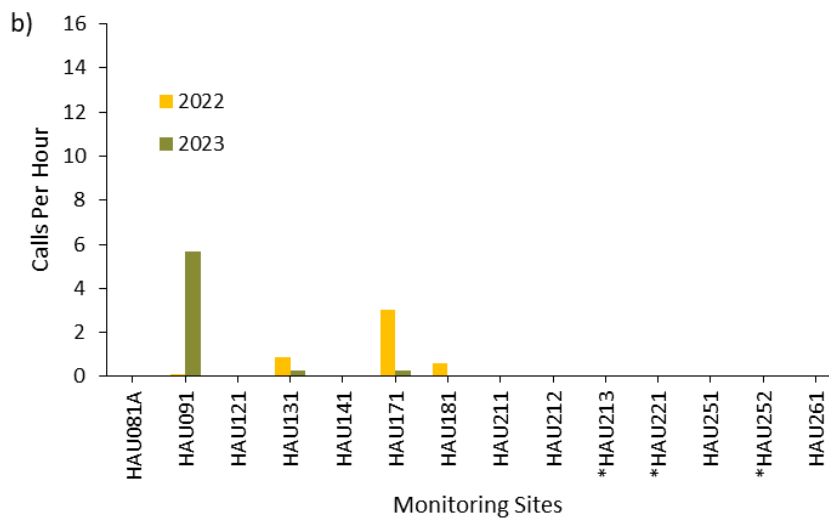
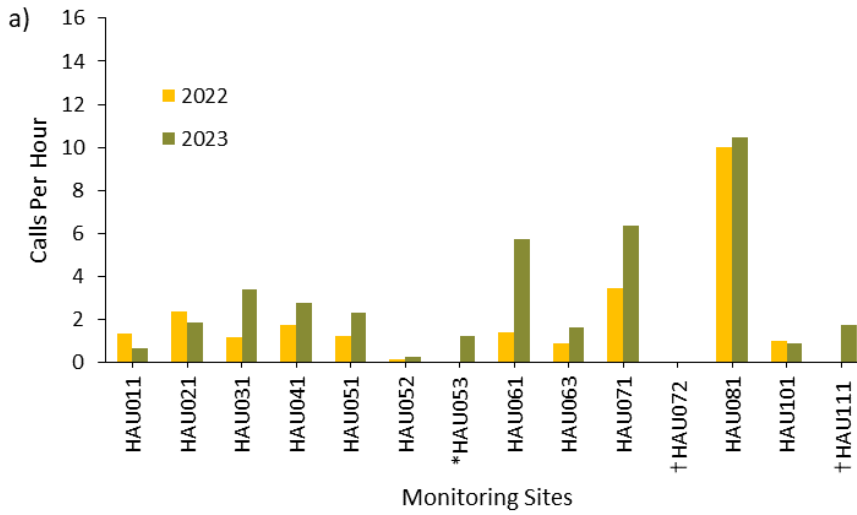
	HAU211*	Waiomu/Te Puru	0	0.00
	HAU212†	Ngarimu Bay	0	0.00
	HAU213†	Crosbies	0	0.00
	HAU221†	Karaka	0	0.00
	HAU251	Tararu	0	0.00
	HAU252†	Waiotahi	0	0.00
	HAU261†	Kauaeranga Valley	0	0.00
Eastern	HAU152	Grange Road North	3	0.38
	HAU153	Red Hill	3	0.38
	HAU161	Te Puia	9	1.13
	HAU162*	Hinds Farm	41	6.31
	HAU163♦	Tirohanga	88	11.00
	HAU191†	Kapowai	4	0.50
	HAU192*	Te Moata Centre	0	0.00
	HAU193†	Te Moata Far Hills	3	0.38
	HAU202†	Mangaiti Farm	0	0.00
	HAU204*	Red Bridge Pines	0	0.00
	HAU205*	Tairua North	8	1.22
	HAU207	Silverstream	25	3.13
	HAU208†	Te Karo	13	1.63
	HAU209*	Golf Course	0	0.00
	HAU241	Pauanui Lakes	7	0.88
	HAU242†	Red Bridge Lookout	0	0.00
	HAU244*♦	Eagle's Nest	0	0.00
	HAU245*♦	Mount Ave	3	0.38
	HAU281†	Ōpoutere	0	0.00
Southern	HAU291†	Wires Track	0	0.00
	HAU301*	Waikaukau	0	0.00
	HAU311	Maratoto Northwest	0	0.00
	HAU312†	Komata	0	0.00
	HAU313*	Golden Cross	0	0.00
	HAU314*♦	Te Hui	0	0.00
	HAU321†	Mataora Bay	0	0.00

* Sites with less than 480 minutes of listening time.

♦ AAR + Crew sites.

† AAR Only sites.

Sites HAU163 Tirohanga and HAU081 Rimu Tree recorded the highest call rates in both 2022 and 2023 (Figure 5b). Of the sites that recorded data in Year 1, 13 recorded higher call rates in Year 2, 11 recorded lower call rates in Year 2, and three sites recorded calls in Year 1 but had zero calls in Year 2 (Figure 5). These three sites, HAU181 East Tapu-Coroglen, HAU202 Mangaiti Farm and HAU281 Ōpoutere, were all crewed in 2022 but were deployed with AARs in 2023. All but one of the sites in the Northern Cluster recorded calls (Figure 5a). The Northern Cluster features two strong-hold kiwi conservation groups, Project Kiwi and Moehau Environment Group. In comparison, the Southern Cluster, where no calls were recorded at any of the sites, is some distance from the nearest longstanding primarily kiwi focused conservation group.



* Sites new in 2023.

† Sites where no monitoring was conducted in 2022

NB: No calls recorded at any sites in the Southern Cluster during Years 1 or 2.

Figure 5. Mean call rates in 2022 and 2023 at Northern Cluster sites (a), Western Cluster sites (b), and Eastern Cluster sites (c).

The areas with the most kiwi calls remained the same over Year 1 and Year 2 of the monitoring (Figure 6). These were located around Hot Water Beach and Kūaotunu. There are a few areas near the centre of the peninsula that had hot spots in 2022 which are noticeably absent in 2023.

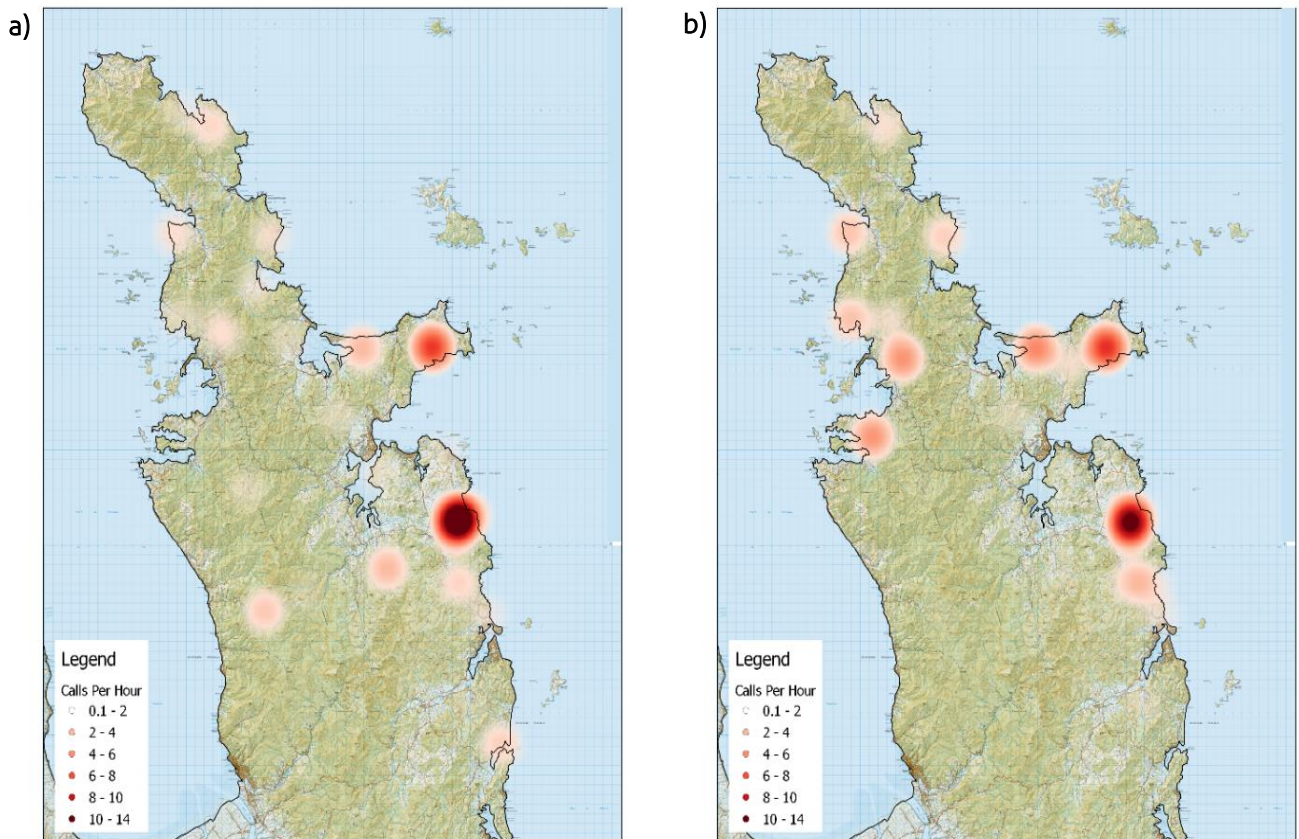


Figure 6. Heat map of kiwi call hot spots on the Hauraki-Coromandel Peninsula in 2022 (a) and 2023 (b).

3.2 Sex Ratios

There were more male calls than female calls at all but three of the monitoring sites that recorded kiwi calls (Figure 7). Sites HAU171 Square Kauri and HAU205 Tairua North had equal male and female calls while site HAU245 Mount Ave only recorded female calls. Three quarters of the total calls recorded from all monitoring sites were male while only one quarter were female (Figure 8).

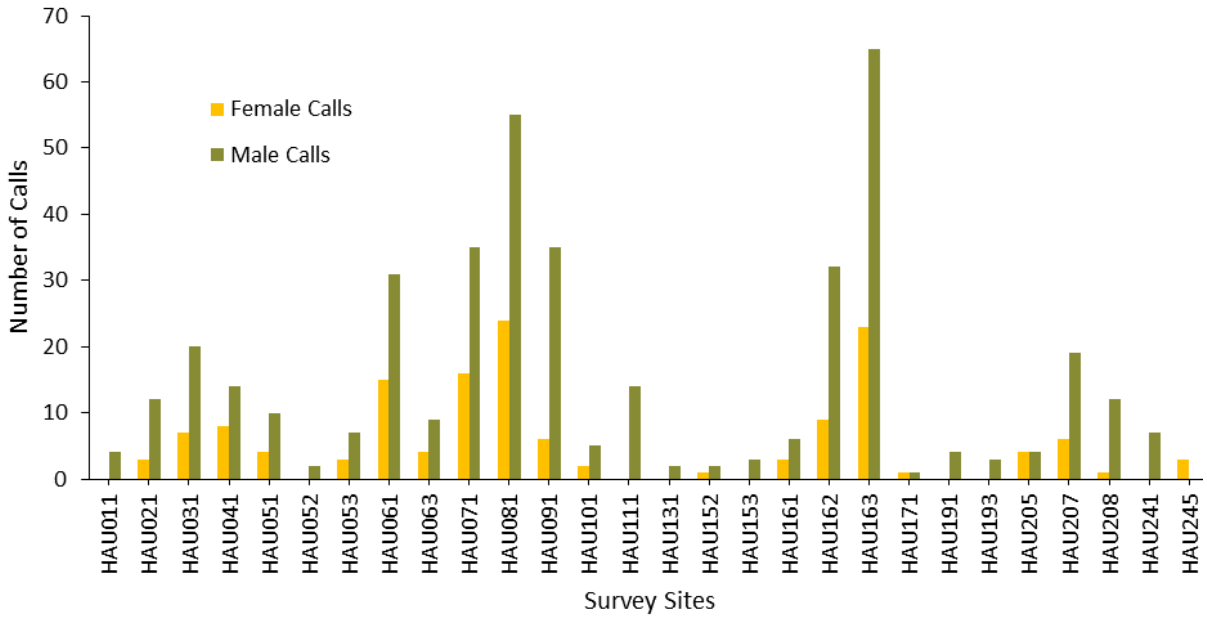


Figure 7. Number of female and male calls at each site where calls were recorded.

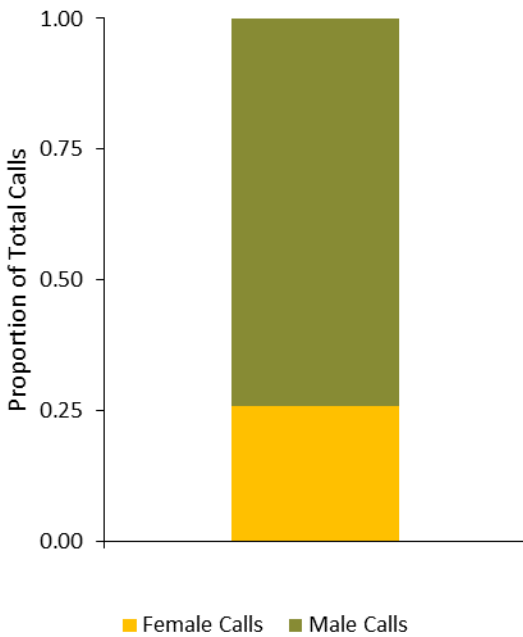


Figure 8. The proportion of female calls to male calls for all sites.

3.3 Weather

Exactly a third of crewed monitoring nights were undertaken during unfavourable conditions. Nights that had moderate rain, a bright moon, and/or moderate to strong winds were considered unfavourable. However, the mean call rate for nights that were considered unfavourable was not statistically different to the mean call rate for nights that were considered suitable ($P = .66$).

4. Discussion

In this monitoring, the second year of a three-year baseline, some trends and disparities were observed, however, it is important to note that being Year 2 of a three-year programme, current observations are preliminary and should be interpreted with discretion.

4.1 Call Rates

The mean call rate across all sites was lower in 2023 than it was in 2022 which may initially appear noteworthy. However, the same number of sites recorded kiwi calls in 2023 as in 2022 but with additional sites in Year 2, ten more sites recorded zero calls in 2023, considerably impacting the average. When comparing the mean of only the sites that recorded data in both years, they are very similar which is promising for establishing a baseline. Additionally, the differences between each of these means were not statistically significant.

HAU163 Tirohanga, located at Hot Water Beach again reported the highest call rate from all monitoring sites, with 11.00 calls/hr, showing a decrease from last year's 14.38 calls/hr. An AAR was stationed at HAU163 Tirohanga for the purpose of validating the high call rate, which it was successful in doing. Tirohanga is located near the boundary of Whenuakite Kiwi Care Group (WKCG) at an optimal listening point atop a high rock formation offering almost 360° acoustics over the monitoring area. This suggests that kiwi calls heard at this site could originate from birds within the WKCG protected area as well as from individuals that have moved beyond WKCG's boundary. Therefore, this site should maintain high kiwi call rates providing the area's predator control remains at its current high standard.

Two sites that maintained high call rates, HAU081 Rimu Tree and HAU162 Hinds Farm, are located near kiwi focused community conservation groups, Project Kiwi and WKCG respectively, which is presumably the primary reason for the consistent high call rates. HAU081 Rimu Tree recorded similarly high levels of activity across both years with 10.44 calls/hr in Year 1 and 10.00 calls/hr in Year 2. HAU162 Hinds Farm had an increase in the call rate at that site with 6.31 calls/hr in Year 2, slightly up from the previous year's 5.87 calls/hr. The consistency in these sites could suggest stable kiwi populations, however this will become more evident in future monitoring.

Several sites exhibited considerable differences in call rates between Year 1 and Year 2. HAU071 Matarangi Bluff had the third highest call rate this year with 6.38 calls/hr, an increase from last year's

3.47 calls/hr. HAU061 Driving Creek in Coromandel Town reported 5.75 calls/hr this year, which is much higher than the 1.38 calls/hr in 2022, and HAU091 Kahurangi Block at 5.66 calls/hr in Year 2 is a substantial increase from 0.13 calls/hr last year. The inverse occurred at HAU161 Te Puia located at Hot Water Beach which exhibited a notable drop in call rates from 5.13 calls/hr last year to 1.13 calls/hr this year. Such increases and decreases in call rates could be attributed to several factors including changes in kiwi populations and territories, changes in volunteers and/or weather conditions during monitoring nights. The purpose of this three-year monitoring is to establish a baseline and thus a more accurate conclusion of the call rates from the sites mentioned here will be more apparent next year. It is advisable to install AARs at these sites in future years for validation.

4.2 New Listening Sites

Of the ten new sites included in Year 2, seven recorded zero calls which was not unexpected as many of these were in areas where there are available listeners but not necessarily kiwi populations established yet. In future years, we hope to see this change to have kiwi in many of the sites currently recording zero calls. For example, Te Moata Retreat Centre had two sites in Year 2, HAU192 Te Moata Centre which recorded zero calls and HAU193 Te Moata Far Hills which recorded three calls over the monitoring period. Site HAU193 Te Moata Far Hills is in close proximity to WKCG and Kapowai Kiwi Group so it is likely that the kiwi heard at this site have migrated from their former home in those areas. In future monitoring, we hope that kiwi will also be recorded at HAU192 Te Moata Centre as the kiwi continue to disperse and predator control continues to intensify.

In response to demand and volunteer availability two new sites were established in Pauanui, HAU244 Eagle's Nest and HAU245 Mount Ave. Given that these sites were crewed by new volunteers, AARs were stationed at both sites. No calls were recorded by crew or AAR at HAU244 Eagle's Nest but HAU245 Mount Ave recorded three female calls and was the southernmost site to record any calls.

HAU111 Ngāti Hei Hukarahi recorded a call rate of 1.75 calls/hr. It is worth noting that Ngāti Hei Hukarahi is not a newly established site this year, it was newly monitored this year due to accessibility issues last year. Another new site was established at HAU314 Te Hui, located in the Maratoto Valley (AAR + Crew Site). No calls were recorded at this site or any of the Maratoto based sites. This is not unexpected as these sites are a fair way from the most southern site where kiwi were heard in this monitoring and where they are generally believed to be present on the peninsula. Furthermore, apart from anecdotal evidence that kiwi have been heard in the area, they have not been confirmed to be there for many years.

4.3 AAR Sites

In Year 1 of the monitoring, HAU171 Square Kauri volunteers reported a higher-than-expected call rate (3.00 calls/hr). HAU171 is located close to the Thames Coast Kiwi Care (TCKC) network, however there was uncertainty from community group members of kiwi being in this area. To confirm this observation an AAR was placed with the same volunteers at this site in Year 2. Volunteers recorded one call (0.25 calls/hr) over the four monitoring nights. Unfortunately, we were neither able to validate or disprove this call on the AAR due to the placement of the AAR being exposed to high winds, therefore, this solo call was included in the monitoring data. This site will continue to be equipped with an AAR next year, but its position will be carefully considered to avoid interference from high winds.

We decided to place a recorder at site HAU281 Ōpoutere as the crew last year reported kiwi calls (2.75 calls/hr) which were the only ones south of the Kopu-Hikuai Road. Crew were not available for the Ōpoutere site this year; thus, it was an AAR Only site. We wanted to corroborate 2022's data as it would have been the first time in many years that kiwi had been recorded that far south on the peninsula. The recorder did not pick up any kiwi calls over any of the eight days it was in the field, but it did record ruru and kākā (*Nestor meridionalis*), either or both of which may have been mistaken for a kiwi last year. The previous years high call rate potentially underscores the importance of training in accurately identifying calls. However, it is of course possible that kiwi were heard last year but were not picked up on the recorder in 2023 or had moved out of the site. Future monitoring will help determine kiwi presence in this area.

Two new AAR only sites HAU053 Whisky Bay and HAU193 Te Moata Far Hills both recorded kiwi calls 1.25 calls/hr, 0.38 calls/hr respectively. The proximity of these sites are close to established kiwi care groups and ongoing monitoring may represent sufficient evidence of expansion into newer protected areas.

The three new AAR Only sites behind Thames in the Coromandel Forest (HAU223 Crosbies, HAU221 Karaka, and HAU252 Waiotahi), where no predator control is currently in effect, yielded no kiwi calls. This absence may underline the importance of predator control measures for the presence of kiwi in these areas especially considering Thames Coast Kiwi Care operates just north of Thames. The kiwi in the area that is fiercely protected by TCKC are likely to be dispersing into new areas which could include these sites from the monitoring, however, they may not be successful as a population if there is no predator control taking place as kiwi are a conservation dependent species (Save the Kiwi, 2021).

4.4 Kiwi Sex Ratios

The ratio of female kiwi to male kiwi across all sites remained the same in 2023 as it was in 2022 with three quarters of the calls belonging to males and only one quarter belonging to females. This is the appropriate ratio for a healthy population of kiwi and does not indicate that there are more males but simply that they call more frequently (Colbourne & Digby 2016). If the ratio becomes considerably smaller or larger then there would be cause for concern.

4.5 Weather

There was concern that the numerous extreme weather events that occurred during the first few months of 2023 would have had a detrimental effect on the kiwi populations on the peninsula. We were unable to identify any formal research into how particularly adverse weather affects kiwi behaviour, but it is expected that it would have some impact on them as rainfall and wind does influence other birds' behaviour (Mainwaring et al., 2021). Reports from Northland following Cyclone Gabrielle indicate that some kiwi burrows were lost or blocked during the weather event, but new burrows are fairly easy to dig, and birds usually have multiple burrows in their territories that they can use which is very positive. Additionally, as kiwi feed by probing in the soil, excessive rain does not have such a negative impact on their feeding habits as a drought would (Sullivan, 2023). Thus, we consider the effect on kiwi populations from the extreme weather to have been minimal.

4.6 Limitations

One of the most notable limitations from the 2023 monitoring was the suboptimal weather conditions, which coincided with the monitoring dates resulting in the dates being extended from a four-day period (16 June to 19 June) to a 16-day period (13 June to 29 June). According to the NIWA climate summary for June 2023 the rainfall in the Coromandel during this period was >149% higher than average (NIWA, 2023), this was coupled with extremely high winds and gusts. Rainfall and wind can severely affect the functionality of AAR devices, for example, heavy rain can introduce background noise, impair microphone sensitivity, and possibly result in the under-reporting of kiwi calls (Borker, 2020).

A limitation mentioned in last year's monitoring that remains for the 2023 monitoring is that we cannot know for certain the ability of volunteers to identify and distinguish kiwi calls. The three sites that recorded calls in Year 1 when they were crewed but recorded no calls in Year 2 when they were deployed only with an AAR suggest that there may still be some ambiguity in distinguishing kiwi calls. However, this year's inclusion of six sites that were both crewed and deployed with an AAR has

supported our confidence in the volunteers as the recordings from sites married up with the results from the volunteers. Furthermore, the volunteers mentioned that they felt that their ability to identify kiwi calls improved with the use of the online flashcards and kiwi call refresher workshops.

It is notable that 17 out of the 54 monitoring sites did not complete the full 480 minutes of listening time, affecting the mean call rate. This partial data collection should be interpreted with caution. Specifically, HAU081A Te Kouma Farm where only 90 minutes of listening was completed, considerably less than the advised time. Future monitoring should encourage more consistent monitoring durations across all sites to ensure more reliable data.

4.6 Recommendations

- Additional AARs should be secured for Crew Only sites that have demonstrated considerable variations in call rates through Years 1 and 2.
- There is a need for continued Kiwi Call Refresher Training Workshops for at least one listener from each site to ensure accurate and consistent monitoring and data collection methods.
- Additional listening sites should be established in quadrants 23, 27, and 29 to ensure complete geographical coverage. These sites will likely employ AARs, given their central location in the Coromandel Forest.
- The AAR location at HAU171 Square Kauri was exposed to high winds. It is essential to relocate this recorder to a more sheltered location.
- To account for the unpredictable nature of weather, greater flexibility should be introduced to the monitoring schedule.

5. Conclusion

This monitoring, the second year of a three-year baseline monitoring, offers valuable preliminary insights toward establishing a baseline and understanding of Coromandel Brown Kiwi populations in the Hauraki-Coromandel region. The consistently high call rates at sites HAU163 Tirohanga, HAU081 Rimu Tree, and HAU162 Hinds Farm may suggest stable populations — promising results when the objective is establishing a robust baseline. Variations in call rates at various sites require further investigation to understand whether these fluctuations are due to kiwi population changes, environmental factors, or inconsistencies in data collection. Concerning the objective of informing future management decisions, the sex ratio suggests a healthy CBK population. This is a critical piece of data that will help in long-term management and conservation strategies for CBK. To conclude, future years of this monitoring will be essential for drawing more robust conclusions in the growth and movement of CBK populations.

6. References

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Appendices

Appendix A


Kiwi Call Monitoring Methods (extracted from DOC Kiwi Best Practice Manual 2020):

1. Go through the Kiwi Call Scheme card methods and fields before you go out. You may also wish to practice or refresh your skills by listening to the calls of kiwi at: <http://nzbirdsonline.org.nz/>
2. Choose listening sites that cover a wide listening area, preferably on a prominent knob, spur, hilltop, ridgeline or river flat, away from loud river, stream, sea, traffic or hut noise. However, do not be put off listening from a campsite in thick bush if that is the most practical way of conducting a count.
3. Neighbouring listening sites should preferably be at least 1 km apart to increase the overall coverage.
4. On a topographical map, or GIS map system, estimate the listening range from each listening site – at many places, a ridge or spur will cut out distant calls from certain directions or the habitat in some directions may be unsuitable for kiwi, and so the listening range may be far from circular.
5. Before departing to the listening sites, remember to synchronise your watch with others who are listening in the same general area, so that you can better determine if a bird was heard at multiple sites.
6. Arrive at the listening site with enough time to get ready for recording. Remember that if your listening site is on a hill, you will require some time to cool off and to then pile some clothing on and prepare your forms before you will be ready to listen. Have all of your clothing and gear handy, so that you do not make unnecessary noise during the monitoring.
7. Start your listening period no earlier than 30 minutes after local sunset. Sunset times are available from <http://www.linz.govt.nz/hydro/nautical-info/astronomical-info> and on many GPS units.
8. Preferably do your listening in the first 2 hours of darkness (from 30 minutes after local sunset). Listening conditions are often best on a dark night, with little or no wind, rain or other noise, but counts in any conditions will still be valuable. Try to listen for a 2-hour period, because call rates will tend to average out, but listening periods of different durations are acceptable. Avoid doing a short listen simply to include a call that you heard when you were not otherwise intending to do a monitoring – in this situation, you are better off filling out a Kiwi Reporting Scheme card. Record any birds that called outside your planned listening period in the 'Notes' section, rather than, for example, adding onto the count the pair that called when you were packing up your gear!


9. At the end of each hour of listening, total up the number of calls heard and estimate the number of individual males and females you heard calling (allowing for movement of birds during your listening period) in the 'Notes' section.
10. Do not solicit calls from kiwi by using tapes or shepherd's whistles in the first hour of listening, and only do so later in the night if it is important to determine if kiwi are present at the site. In this case, make sure that this is clear in your notes, along with the times that the calls were broadcast.
11. If you hear other teams broadcasting calls from another site, record this information on your card, along with the time, estimated distance and direction – it may be that you have heard a bird responding to their broadcast rather than the broadcast itself.
12. At the end of the second hour, summarise your data in the field (while information is fresh in your mind):
 - Total up the number of calls heard in the second hour and estimate the number of individual kiwi you heard calling.
 - Add the two counts together and estimate the total number of birds heard during the 2-hour period, again allowing for movement of birds over the whole 2-hour period. Note that one male calling four times is a quite different biological result from four males which each called once.
13. Describe the listening site well (e.g. at cairn on terrace 5 m south of where the track drops down the true right (eastern) bank of the large stony creek, 1200 m west of Cameron's Hut, North Hurunui Valley) so that the exact same listening spot can be used in future monitoring.
14. Photocopy or scan the card for your own records, and then send the original card or the scanned copy to the Kiwi Call Scheme Coordinator.

Appendix B

Kiwi Call Monitoring Data Sheet



Regionwide Kiwi Call Survey - Kiwi i te Kāinga



Date: _____ **Night:** ___/4 **Site Code:** _____ **Site Name:** _____

Observers

Site Host: _____

Other Listeners: _____

GPS Coordinates

Notes

Rain

Nil
 Light
 Moderate

Moonlight

Light
 Dark
 Black

Temperature

Cold
 Mild
 Warm

Wind Strength

Calm
 Light
 Moderate
 Strong

Ground Condition

Dry
 Damp
 Wet

Non-Weather Noise

None
 Slight
 Moderate

Cloud Cover


Clear
 Partly cloudy
 Overcast

Wind Direction

N S
 NE SW
 E W
 SE NW

Major Habitat Types

Podocarp forest
 Broadleaf forest
 Developed farmland
 Undeveloped farmland
 Logged Exotic
 Burnt Coastal
 Swamp Scrub
 Other



Results

Number of Calls

1st Hour: M: _____ F: _____ Both: _____

2nd Hour: M: _____ F: _____ Both: _____

Total: M: _____ F: _____ Both: _____

Minutes Listened _____

Start Time: Time (24hr)	Sex (M, F)	Direction (XXX°)	Distance (N, M, F)	Notes	Finish Time:				Other Animals Heard Ruru (Morepork) Kākā Possum
					None	Few	Moderate	Many	
0	F	300°	M	EXAMPLE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
14					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
15					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
19					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
20					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
21					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
22					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
23					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
24					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
25					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
26					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
27					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
28					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
29					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
30					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Appendix C

Kiwi monitoring kit equipment contents

Kiwi Monitoring Kit
Participant information booklet
Six Data collection sheets
Pencil
Clipboard
PFHCCT carry bag
Chocolate



Appendix D

Instruction Manual



Regionwide Kiwi Call Survey 2023

Participant Information



Kiwi i te Kāinga

PFHC - Kiwi i te Kāinga

1

Basic Info

The Regionwide Kiwi Call Survey 2023 will take place for four nights from **Friday 16 June to Monday 19 June**. The survey will start at **6 pm** (1800 hours) each night for **two hours**. Volunteers will be listening for a total of eight hours (480 minutes) over the four nights.

Gear You Will Need:

- Torch (preferably with red light) + spare batteries
- Fully charged cell phone
- Compass
- GPS (if you have one)
- Datasheets, one per night
- Pencils (pen ink runs when it is wet so it is always best to use pencil in the field)
- Warm clothing! (fingerless gloves are great for writing down data in the cold!)
- Rain jacket



Weather Contingencies

If the weather is poor over the set dates, we have until Sunday 25 June to complete the survey. However, we encourage all volunteers to complete the survey on the set four nights where possible to make the data set more robust. We will keep you updated if we decide to postpone any survey nights because of the weather and please keep us updated if you personally decide that the weather is too poor for you to complete a survey night.

Instructions

Before The Survey Nights

- Review the instructions for kiwi listening and data recording.
- Familiarise yourself with the datasheets.
- Ensure you are confident with reading and recording compass bearings.
- Listen to some kiwi call recordings and quiz yourself.
- If you are using a smartwatch or cell phone to keep time, they should all automatically be set to the same time via the internet. If you are using a regular watch, make sure it is synchronised to the correct time.
- If you have **questions or need help** with any of this, please contact Sasha or Renee before the survey night. Please use the kiwisurvey@pfhc.nz email as a first point of contact.

Health And Safety

- Ensure that you have appropriate gear for being out in the cold. Remember you are going to be relatively still so wrapping up warm is very important!
- Ensure that you are confident that you can safely get to your site and back, if you have any doubts, please let us know.
- Ensure that at least one of your party members has a fully charged cell phone.
- Take plenty of water and some quiet snacks.
- On survey nights, designate someone from outside of your kiwi listening part as your **Safety Contact** and inform them of your plans. Tell them where you are going, how you will get there, when you plan to leave and when you expect to be back. On survey nights, let them know when you leave and when you return safely. Give them a time that if you have not been in contact to say you are out safely, they will try to be in contact with you. If they cannot contact you at the time, ensure systems are in place to have people search for your party.



PFHC - Kiwi i te Kāinga

2

PFHC - Kiwi i te Kāinga

3

Getting To Your Site

- Site Hosts are to message Sasha when your listening party is heading to site. Please message us your Site Code, names of all listeners and that you are heading in e.g., HAU123 Sasha and Renee heading to site.
- If the weather conditions prevent you from starting or completing the survey, please message us your Site Code and that you have had to cancel or cut short the survey for that evening.
- Site Hosts message your Safety Contact that you are heading to site.
- Make sure that on your first night you reach your site well before dark so that you are able to familiarise yourself with the location and your surroundings. This is important for getting back out safely and for gauging distances.
- Identify any hazards on your way into the site so that you can be prepared for your walk out in the dark. With the recent weather, it is possible that the route to your site has changed.
- Leave for your site with plenty of time to get to the site, unpack, and set yourselves up to be ready to start listening at 6 pm.
- Take photos of your site, including a photo with the blue site tag. Send any photos to kiwisurvey@pfhc.nz.

Setting Up On Site

- Identify True North with a compass or GPS.
- Familiarise yourself with the landscape around you.
- Turn your phone to silent.
- Have everything you need (clothing, equipment, food etc.) unpacked before you start at 6 pm to avoid noise interference later. If you can, bring food that can be eaten somewhat quietly i.e., not packets of chips that rustle and crunch.
- Fill in all the site details on your datasheet before you begin.

Kiwi Listening

- Listen from the same spot for every call across every night.
- Avoid making unnecessary noises. Listen in silence! Do not mimic or play kiwi calls or calls of any other animals.
- When you need to communicate with your party members, do so in a quiet whisper.
- Listen in the dark, a torch can deter kiwi coming close. Once you have heard a call, you can turn on a torch to fill out the datasheet.
- Make notes about any significant changes in weather or sound that occur during the survey.
- You can sit down during the survey time so you are welcome to bring a chair.

Recording Calls

- When you hear a call, note the time.
- Use your arm to point in the direction of the call.
- Gauge the distance of the bird as near, medium, or far. As all sites are in different habitats and catchments, this is an individual judgement call.
- Using your compass, estimate the location in degrees.
- Wait a few seconds for a potential responding call.
- Record the time, sex, direction, distance and any notes on your datasheet.
- If a male and female in one area alternate calling without an obvious break, they are duetting. Count this as one male and one female and write "duet" in the notes column of the datasheet.
- If there is a distinct break in calling (i.e., a couple of minutes), count these as additional calls.
- To keep the data consistent, the same person is to fill out the datasheet for all four nights.
- If you hear any kiwi calls or see any kiwi outside of the designated survey time, please note them down. We would still love to hear about them!



At The End Of The Survey

- Once you have reached the end of the survey time, pack up all of your gear and head out.
- Once you are safely out, message Sasha with your Site Code, names of all listeners and that you are out safely e.g., HAU123 Sasha and Renee have safely left site. Also message your Safety Contact that you are out safe.
- When you are home, take a photo of both sides of the datasheet and email them to us at: kiwisurvey@pfhc.nz. Please make sure that the datasheet is completed in full, that the photo of the datasheet is clear and that all the information on the sheet is legible. Include your Site Code in the email subject line.

Datasheet Key

- Time (24hr) – e.g., 1800 is 6 pm.
- Sex (M, F) – M: Male, F: Female.
- Direction (XX°) – bearing in degrees e.g., 300°
- Distance (N, M, F) – N: Near, M: Medium, F: Far. There is no set distance for this as all sites are different so use your own judgement.
- Notes – anything that may be relevant to the call.



Habitat Types (select up to three)

- Podocarp forest: native forest consisting primarily of species such as rimu, kahikatea, miro, mataī and tōtara. These are your coniferous species that produce cones to reproduce rather than flowers.
- Broadleaf forest: native forest consisting primarily of species such as māhoe, taraire, pōhutukawa and tawa. These trees have larger leaves and produce flowers.
 - Often a native forest is a conifer-broadleaf forest and consists of a dense canopy of broadleaf species with some taller conifers (podocarps) sticking out the top.
- Developed farmland: typical New Zealand pasture, is well fenced, intensively grazed and has few trees.
- Undeveloped farmland: has rank grasses interspersed with mānuka, gorse and other scrub throughout.
- Logged: forest that has been logged.
- Burnt: a forest that has been recently burnt.
- Swamp: a wetland area.
- Exotic: non-native forest such as pine.
- Scrub: sparse trees, generally mānuka.
- Coastal: habitat that is near the coast.



Datasheet Example

Regionwide Kiwi Call Survey - Kiwi i te Kāinga

Date: 17/06/23 Night: 2/4 Site Code: HAH123 Site Name: Little Farm

Observers: Renee Denby
Site Host: Renee Denby
Other Listeners: Salva Dowling, Aaron Putford

GPS Coordinates: -36.1234S, 175.5432E

Rain: Nil, Light, Moderate
Ground Condition: Dry, Clump, Wet
Major Habitat Types: Podocarp forest, Broadleaf forest, Developed farmland, Undeveloped farmland, Logged, Exotic, Burnt, Coastal, Swamp, Scrub, Other

Notes: Heard a male kiwi as we were walking out

Moonlight: Light, Dark, Black
Non-Weather Noise: None, Slight, Moderate
Temperature: Cold, Mild, Warm
Cloud Cover: Clear, Partly cloudy, Overcast
Wind Strength: Calm, Light, Moderate, Strong
Wind Direction: N, S, NE, SW, E, W, SE, NW

Results: Number of Calls
1st Hour: M: 3, F: 1, Both: 4
2nd Hour: M: 1, F: 0, Both: 1
Total: M: 4, F: 1, Both: 5
Minutes Listened: 120

Time (dd)	Sex	Direction	Distance (m)	Notes
18:12	M	120°		DUCK
18:13	F	130°		DUCK
18:21	M	95°		DUCK
18:45	M	260°		F

Other Animals Heard: None, Frog, Mānuka, Honey

Start Time: 1800 Finish Time: 2000

Appendix E

Table of nights monitored at each site.

Site	Tue 13	Wed 14	Thu 15	Fri 16	Sat 17	Sun 18	Mon 19	Tue 20	Wed 21	Thu 22	Fri 23	Sat 24	Sun 25	Mon 26	Tue 27	Wed 28	Thu 29
HAU011			█	█			█	█									
HAU021				█	█	█	█	█									
HAU031			█				█	█	█								
HAU041		█	█		█	█											
HAU051				█	█	█	█	█									
HAU052						█	█	█	█								
HAU053			█		█		█	█									
HAU061			█				█	█							█		
HAU062*																	
HAU063					█		█	█	█								
HAU071							█	█	█								█
HAU072		█	█			█	█	█									
HAU081			█				█	█	█								
HAU08A1		█	█		█		█	█									
HAU091				█	█		█	█									
HAU101			█		█		█	█									
HAU111							█	█							█	█	
HAU121		█	█				█	█									
HAU131	█	█	█	█													
HAU141		█	█				█	█									
HAU152		█	█				█	█									
HAU153						█	█	█									
HAU161		█	█					█									
HAU162							█	█							█	█	
HAU163		█					█	█	█								
HAU171		█	█	█				█									
HAU181			█				█	█	█								
HAU191					█	█	█	█									
HAU192					█		█	█	█								
HAU193			█				█	█	█								
HAU202		█	█				█	█									
HAU208		█	█				█	█									
HAU204					█		█	█	█								
HAU205					█		█	█	█								
HAU207		█	█					█					█				
HAU209					█		█	█	█								
HAU211							█	█	█								
HAU212			█				█	█	█								
HAU213			█	█			█	█									
HAU221		█	█				█	█									
HAU241		█	█		█		█										
HAU242					█		█	█	█								
HAU244					█		█	█	█								
HAU245		█	█				█	█									
HAU251				█	█	█	█	█									
HAU252					█	█	█	█									
HAU261						█	█	█	█								
HAU281			█				█	█	█								
HAU291			█	█	█		█										
HAU301							█	█	█					█			
HAU311				█	█		█	█									
HAU312			█	█	█		█										
HAU313			█	█	█		█										
HAU314				█	█		█										
HAU321				█	█	█	█	█									

AAR Only Sites
 Crewed Sites