

Annual Kiwi Surveys: 2004 to 2022



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1. Introduction

1.1 Objectives

The annual call count survey is the main tool used by MEG to monitor the outcomes of the stoat trapping network on kiwi survivorship. This report looks at the annual surveys done between 2005 and 2022 analysing:

- The number of kiwi present
- The call count rate per hour

1.2 Background

Brown kiwi (*Apteryx mantelli*) are an endemic nationally threatened species considered to be in serious decline without management (Miskelly *et al.* 2008). Unmanaged mainland brown kiwi populations were noted to be declining at an annual rate of 3%, primarily due to the predation of young kiwi by stoats (Holzapfel *et al.* 2009). Kiwi on the Coromandel are considered to be a genetically distinct form of brown kiwi endemic to the Coromandel Ecological Region (Burbidge *et al.* 2003) which was estimated to contain 1,000 individuals in 2008 and projected to increase to about 2,000 by 2018 (Holzapfel *et al.* 2009). Actively managed populations are increasing, but outside of the managed areas Coromandel kiwi are in decline. Coromandel kiwi have lost at least 40% of their known range in the last 20 years (Stewart 2013).

In 2000 the Department of Conservation (DOC) established five “Kiwi Sanctuaries” at key sites throughout New Zealand to reverse the national decline in kiwi (DOC & MfE 2000). One of these selected sites was in the northern Coromandel in the Moehau area, comprising 18,000 ha of both public and private land, extending from the northern tip of the Coromandel peninsula to the road between Colville and Waikawau Bay.

From the inception of the DOC Moehau Kiwi Sanctuary in 2000, efforts to protect kiwi on Moehau focussed on adult survivorship and minimising the predation of young birds caused primarily by stoats (Holzapfel *et al.* 2009). This was accomplished by establishing a landscape-scale stoat trapping network of 1,723 traps between March 2001 and August 2003 resulting in a total trapped area of 16,745ha with an average trap density of one trap/10ha (de Monchy and Forbes 2006).

Following initial successes by DOC, Moehau Environment Group extended this area in 2004 and 2005 by adding another 800 traps over 7,900ha. In 2011, Moehau Environment Group added a further 1000 ha of kiwi protection in the hills above Coromandel town (see Fig. 1). This has been extended further over to time to infill gaps, plus now includes some of the trap lines in the Port Charles area that were formerly done by DOC and were picked up by MEG when funding for them was removed in 2019. The area of stoat lines in Kennedy Bay once known as the Harataunga Kiwi Project has lapsed unfortunately for various reasons outside of MEG’s control and is not shown on Fig. 1. The MEG sanctuary area currently covers about 15,000 hectares and has 1370 traps.

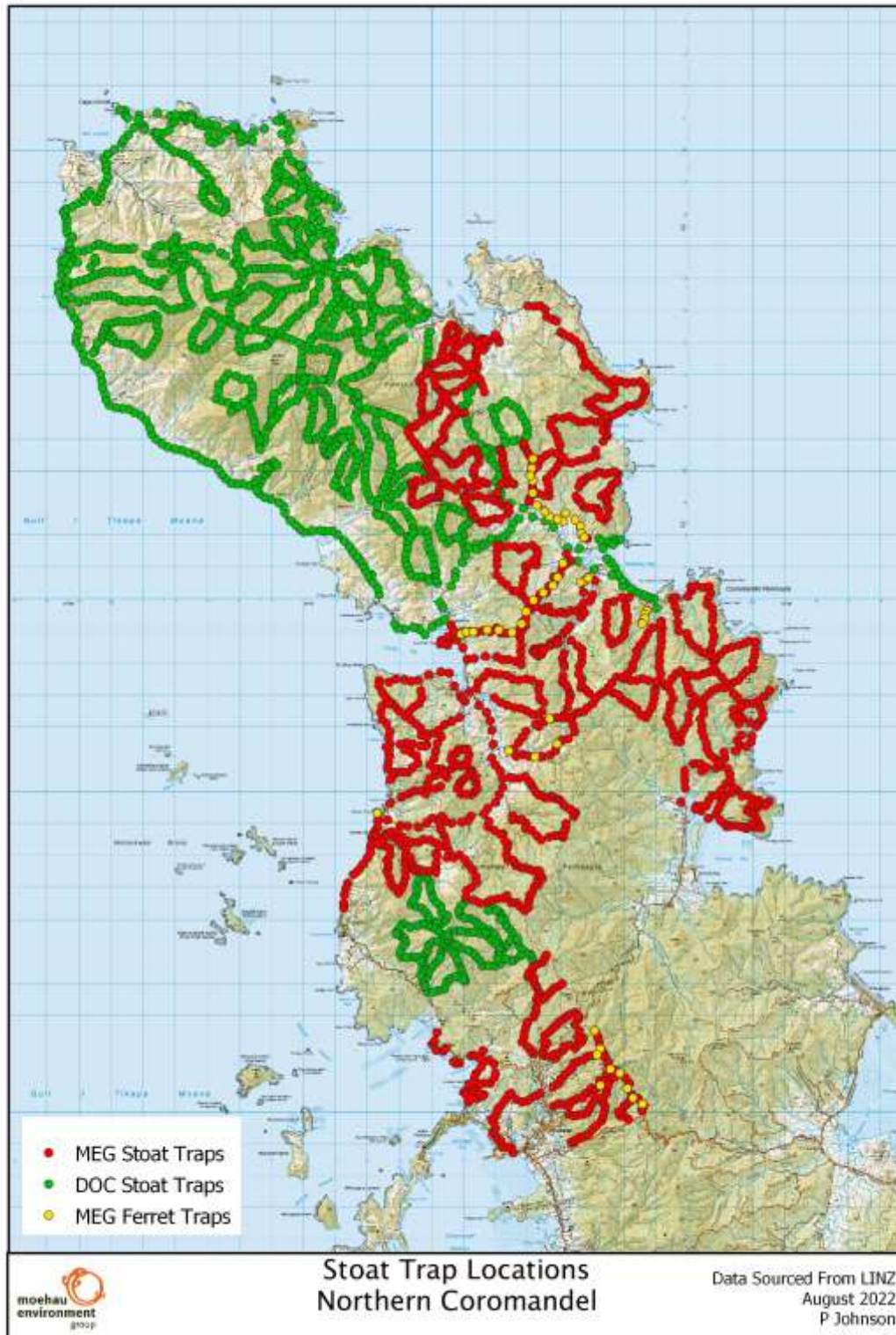


FIG 1. Stoat trap lines for kiwi protection in the northern Coromandel in 2022

Outcome monitoring for the survivorship of kiwi in the MEG Kiwi Sanctuary area is undertaken through call count surveys. These have been undertaken annually over 5 sites since 2004 and the number has now grown to 9 annual sites. This is a sample of the area covered by MEG's stoat trapping regime and is designed to give a snapshot of what is happening within the area on an annual basis. A full area survey that we have termed a "census" is undertaken by MEG every 10 years. The first in 2005 and then 2015. The next full "census" is due to be undertaken in 2025.

Other biodiversity management practices in the Sanctuary

There are a wide range of land management and predator control practices throughout the area. Alongside MEG's trapping efforts, many other private landowners/occupiers undertake backyard trapping for rats, mustelids, or possums and there are also several intensive integrated restoration programmes targeting a range of animal pests and aiming to improve ecological values. The community at Te Kaue O Maui have been actively controlling possums and rats on their lands; the Habitat Tuatēawa Group regularly trap and poison rats and possums in their area, a network of Good Nature traps for rats and possums has been established in Little Bay, Ko Moehau Ki Tai is an iwi-led initiative by the Pare Hauraki collective undertaking extensive native tree planting, the Colville Junction's Ko Moehau ki te Moana group are assisting farmers with planting their riparian zones, and the Department of Conservation have a 4-yearly baiting cycle of aerial 1080 on Moehau and in the past have used toxin in bait stations in other areas of forest in public conservation land. Closer to town, Driving Creek Railway and neighbouring land owners also undertake trapping regimes. Our apologies if we have missed naming any other groups acting in the Sanctuary area.

In addition to the extensive stoat trapping network, MEG also intensively traps 450 ha in Port Charles for rodent control, regularly keeping rat numbers below 5% Small Mammal Index and are installing self-resetting NZ Autotraps AT220 traps for rats and possums. MEG also has a network of rat traps and additional cat, ferret and mustelid traps around the wetlands in Waikawau Bay to protect the other rare birds found there, like matuku/Australasian bittern.

Kiwi protection and monitoring

Threats to adult kiwi by dogs were addressed through an advocacy and dog aversion training programme initiated on the Coromandel in 1995 by Adele Smaill as the Bank of New Zealand Kiwi Recovery Advocate. This has been continued by the Department of Conservation's staff in the 2000's and Moehau Environment Group's Co-ordinator since the late 2000's and once again has been undertaken by DOC.

Ferrets were not initially managed despite their threat to kiwi as they were considered to be absent from Moehau in the 2000's. However, over the last four years seven ferrets have been caught on occasions, prompting an addition of 25 ferret traps to the MEG trap regime.

All life stages of kiwi were monitored by a radio telemetry operation on Moehau and results from the 2000 - 2008 year period showed mean chick survivorship was 67% (N= 157 chicks), well above the project target level for population replacement of 20% (Robertson, 2004).

Subsequent modelling of the population using data from the telemetry project showed that the population on Moehau was increasing at a rate of 10.1% a year and that life expectancy of kiwi that reach adulthood on Moehau is about 39.75 years (Pim de Monchy, unpubl. data). This work also confirmed that sub adult kiwi can range over large areas once they leave the natal areas and this has implications for survivorship and population recruitment if they migrate out of protected areas (Forbes, 2009). This was one of the primary drivers for MEG to expand the area under control further south from the DOC Moehau Sanctuary.

2. Field method

From 2004 until the present day five sites were programmed to be surveyed annually within the MEG trapped area. In 2018, as the MEG sanctuary grew, a further 4 sites were added to the annual survey. Two of these were annual listening sites in Port Charles that DOC had surveyed since 2000 and abandoned as their control area shrunk. These being: Quarry Corner and Bull track ridge. The other two sites adopted by MEG were: Shag Shack in Little Bay Heights and Kennedy Bay Rd near the top between Coromandel town and Kennedy Bay. See Figure 2.



FIG 2. Map of Annual Kiwi Listening sites

The survey method was described in the Kiwi Best practice manual (Robertson *et al*, 2003).

All sites were attempted to be surveyed on five separate nights for a period of two hours, according to the best practice manual without any soliciting, i.e., no kiwi calls were broadcast through loud speakers (as is done in the 10 yearly “census” survey).

A Kiwi Call Scheme Card was completed for each survey (see Appendix 1 for example).

2.1 Data Analysis Methodology

Individual kiwi estimation

Estimation of the individual kiwi present is very subjective and is ideally done by the same person every year to minimise biases. The last 12 years of data have been analysed by the author, Diane Prince. Kiwi can move surprisingly quickly at night from one point to another. However calling adult kiwi are territorial.

When there are very few kiwi in the area it is a very simple process of looking at angles and distances and a fairly good guess can be made of individuals. Simply noting A, B, C ... beside each call to denote individuals across the five nights of listening.

When the reported kiwi densities are high differentiating between one individual and another at the one site with certainty is very difficult. Over the last four years of looking at this data I have changed my analysis technique to “map” each call on a diagram (Fig 2.1), now using different colours for each night and marking M or F for gender. The raw magnetic compass bearing is plotted. No allowance is made for the magnetic declination when plotting the compass bearing.

With medium density population the resultant diagram can show the kiwi in obvious clusters over the five nights. When 2 calls occur in quick succession but off on different angles a line is drawn between the two marks to denote different individuals. Then a circle is put around the calls belonging to each male – female pair taking their position and call timing into account.

These sheets can also be looked at from one year to the next sometimes seeing quite distinct changes in the territorial population.

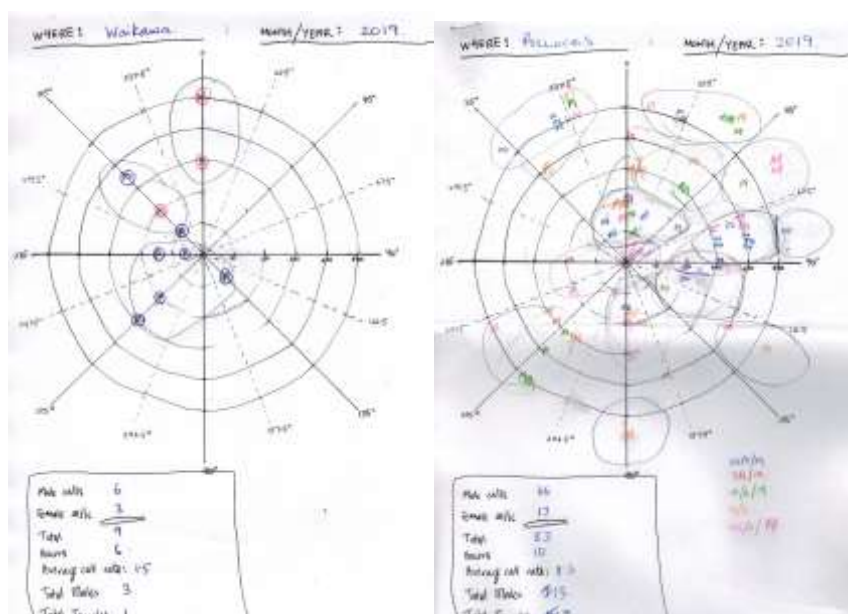


FIG. 2.1 Examples of work sheets for estimation of kiwi numbers based on compass bearings

Call Count Rate

The call count rate is calculated by adding up all of the calls heard from all sites over all nights and then dividing by the total number of hours listened. No mean or standard deviation is calculated by this method.

3. Results

3.1 General comments

Table 1 and 2 detail the data collected from 2004 – 2022. The data set is not complete for various reasons, e.g. changes in volunteers. Some years not all sites were listened at five times. However, this still provides a comprehensive record of kiwi calls at the survey sites.

It must be remembered that this is not a full “census” survey of kiwi present in the MEG Kiwi Sanctuary. This is carried out every 10 years and is covered by another report.

The number of calls heard is empirical data and dependent on the ability of the listener to hear. The number of individual kiwi identified is very subjective. With more calls per hour and more birds present the ability to distinguish one individual from another is very difficult as is the case at the Pollocks site.

TABLE 1: SUMMARY OF KIWI CALLS DETECTED AT THE FIVE ORIGINAL MEG SURVEY SITES, 2004 to 2022

YEAR	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total hrs listened	0	18	28	28	20	20	10	10	20	40	44	30	44		45	42	44	50	49.5
Males calls heard	0	4	35	35	31	44	29	34	47	106	136	89	110		165	139	85	139	154
Female calls heard	0	2	14	14	9	16	4	9	16	38	44	22	33		45	35	28	26	31
Kiwi calls per hour	0.3	1.8	1.8	2.0	3.0	3.3	4.3	3.2	7.2	4.5	3.4	3.7	3.3	2.0	4.7	4.1	2.6	3.3	3.8
Individual males	3	11				4	5	14	12	21	24	20	24	16	27	22	25	35	36
Individual females	1	8				2	3	4	6	9	8	7	12	6	11	10	12	17	22
Total Individuals	4	19				6	8	18	18	30	32	27	36	22	38	32	37	52	58

TABLE 2: SUMMARY OF KIWI CALLS DETECTED AT THE FOUR NEW MEG SURVEY SITES, 2018 to 2022

YEAR	2018	2019	2020	2021	2022
Total hrs listened	12	26	40	38	36
Male calls heard	113	79	47	87	103
Female calls heard	53	32	19	20	36
Kiwi calls per hour	13.8	4.3	1.7	2.8	3.9
Individual males	7	9	15	16	23
Individual females	4	5	9	8	12
Total Individuals	11	14	24	24	35

3.2 Numbers of kiwi present

The numbers of kiwi estimated to be present at the five long term listening sites has slowly grown over the years as can be seen in the two graphs in Figure 3 and Figure 4. It appears numbers are generally trending upwards.

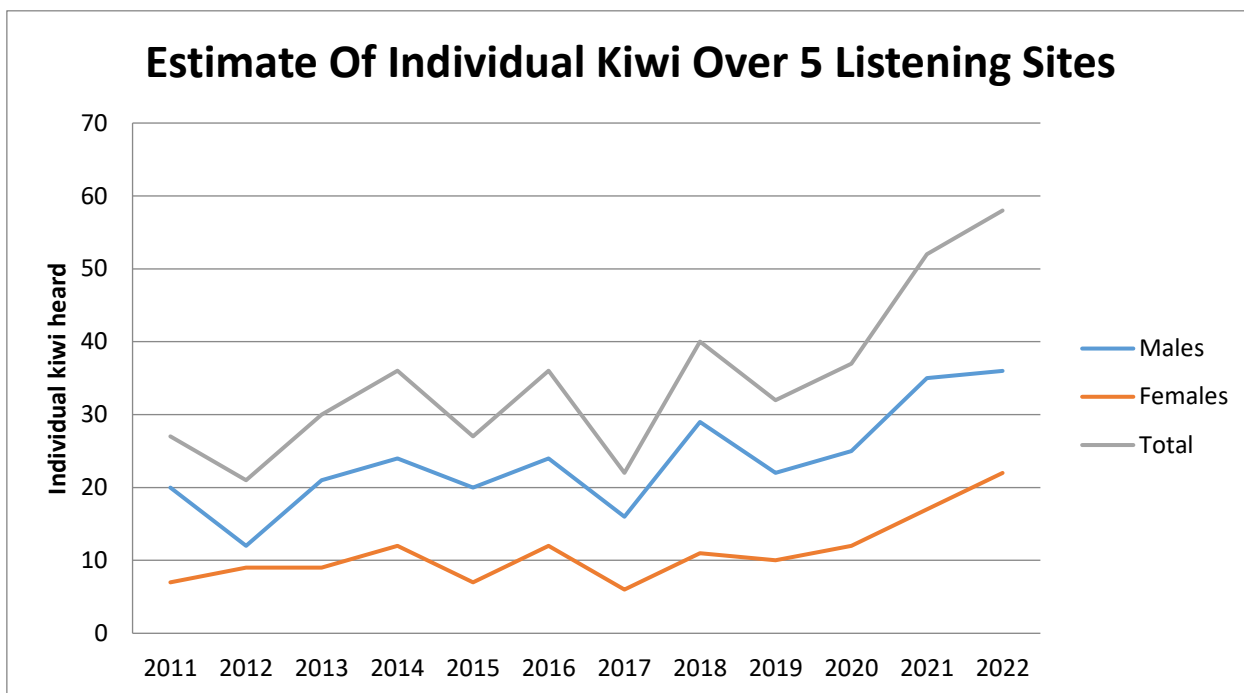


FIG. 3. Kiwi numbers by gender at the 5 long term listening sites since 2011 when estimates by D. Prince began

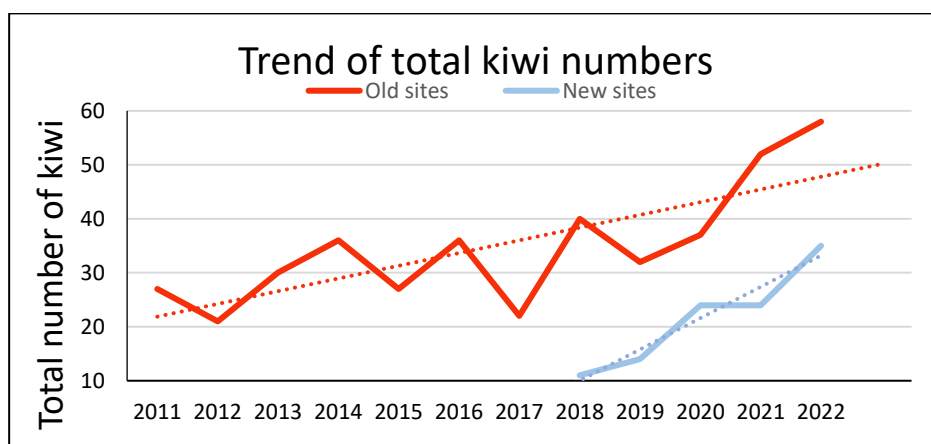


FIG. 4. Change in estimated numbers of kiwi at all annual listening sites

3.3 Call Rate

The numbers of calls heard per hour varies considerably at any one site from night to night. The data below in Fig. 5 is the call rate over all sites for all five nights pooled together with some outlier data removed where the number of survey occasions was too few. The graph shows a trend of increase in call rate of 1.8 in 2005 to 3.8 in 2022. An increase of 111%.

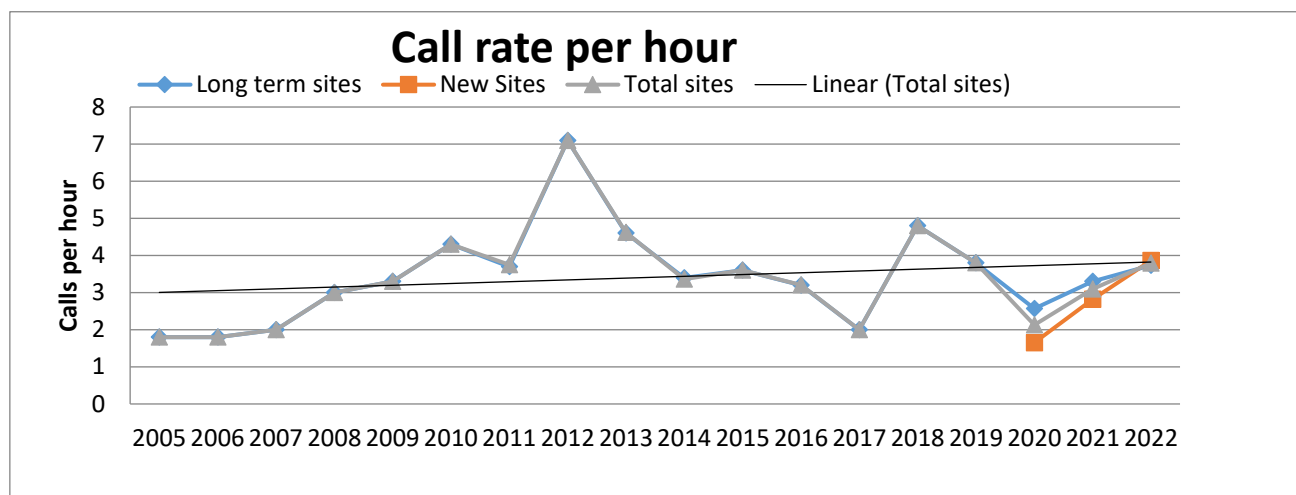


FIG. 5. Call rate per hour of all annual sites

3.4 Individual Sites Over Time

I thought it would be interesting to have a look at the data from each site as it changes over time.

Tuateawa M113

This site is on the side of the road at a high point between Little Bay and Tuatēawa. It is one of the listening sites undertaken in a Coromandel wide survey by Sid Marsh in 1993.

From 2004 until recently it was surveyed annually by Tommy Herbert. More recently by Libby McColl and Rachel Cotter.

The call rate in 1993 was a very high 7 per hour, dropping to just 0.4 calls per hour in 2004. The next six years showed a steady increase to 4.3 per hour followed by a levelling off until 2019 when it appears to have dropped again.

This appears to correlate with increasing kiwi numbers from 2004 to 2010 which then remained generally steady until the present day.

	1993	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
E2739461 N6505150																				
Total hrs listened	8	6	10	10	10	10	10	10	10	10	10	10	6	10		9	10	10	10	10
Total males heard	1	3	7	16	19	29	34	25	27	30	43	15	30		27	15	12	10	16	
Total females heard	2	0	6	6	7	4	9	11	5	5	2	2	9		3	3	4	3	3	
Kiwi calls per hour	7	0.4	0.5	1.3	2.2	2.6	3.3	4.3	3.6	3.2	3.5	4.5	2.8	3.9	1.3	3.3	1.8	1.6	1.3	1.9
Individual males	1	1				4	5	4	4	3	6	3	4	3	7	4	5	3	6	
Individual females	1	0				2	3	3	3	2	1	1	3	1	1	3	2	2	3	
Calls solicited	Yes?		Yes	No	No	no	no	no	no	no	no	no	Yes	No	no	no	no	no	no	no

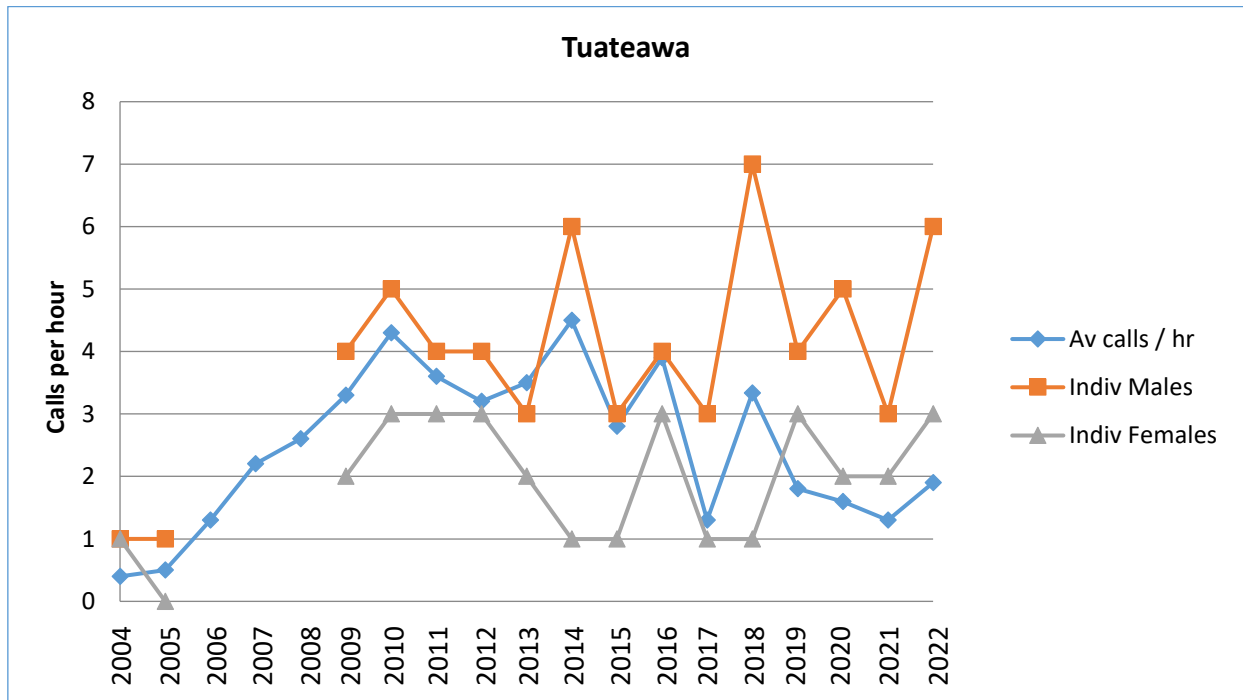


FIG. 6. Record of kiwi calls per hour at the Tuataewa listening site

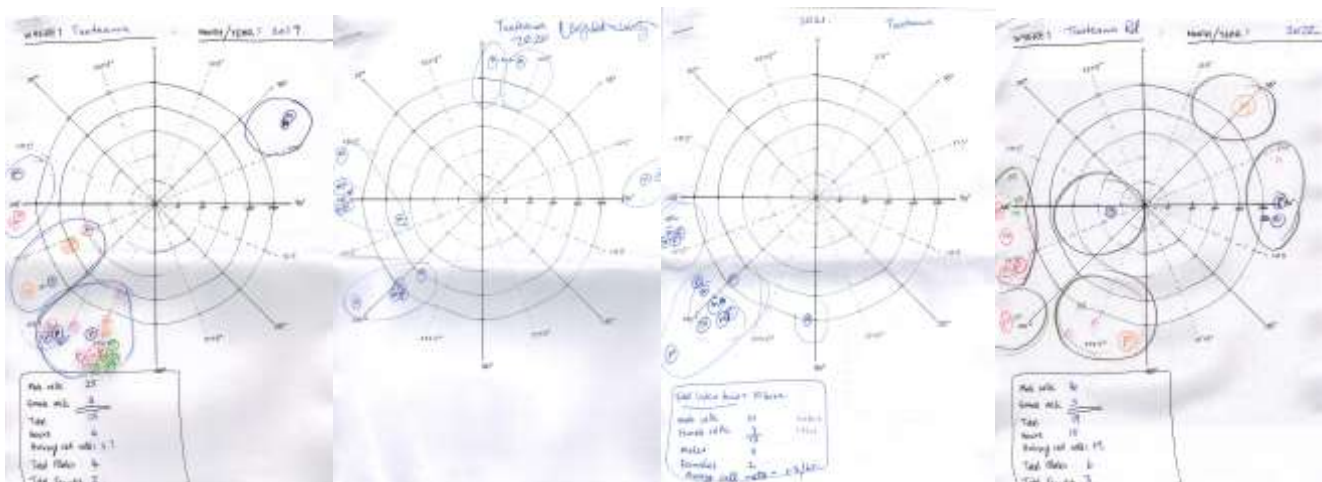


FIG 7. Example of kiwi call worksheets showing changes in patterns of kiwi habitat use from 2019 -2022

Te Whanahou M101

This site is on private land just off the Colville to Waikawau Bay road. It is at the top of a ridge with mostly farmland on the Western side and bush dropping down to the east and Moehau to the north. It was originally surveyed by the author in 2004 and 2005. No kiwi were heard in these two years. It was not surveyed again until 2011 when kiwi were detected. Kiwi numbers have appeared to increase since then with another increase of individuals heard in 2022.

YEAR	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total hrs listened	4	6						2		10	8	6	10		12	10	10	10	10
Total males heard	0	0						7		4	9	19	21		39	21	16	26	30
Total females heard	0	0						0		2	6	5	2		13	7	7	6	10
Kiwi calls per hour	0	0						3.		0.	1.		2.	3.	4.	2.	2.	3.	
Individual males	0	0						4		2	3	4	3	3	3	3	4	3	5
Individual females	0	0						0		1	1	2	1	1	2	2	3	2	4
Calls solicited	Y	Y						N		N	N	Y	N		no	no	no	no	no

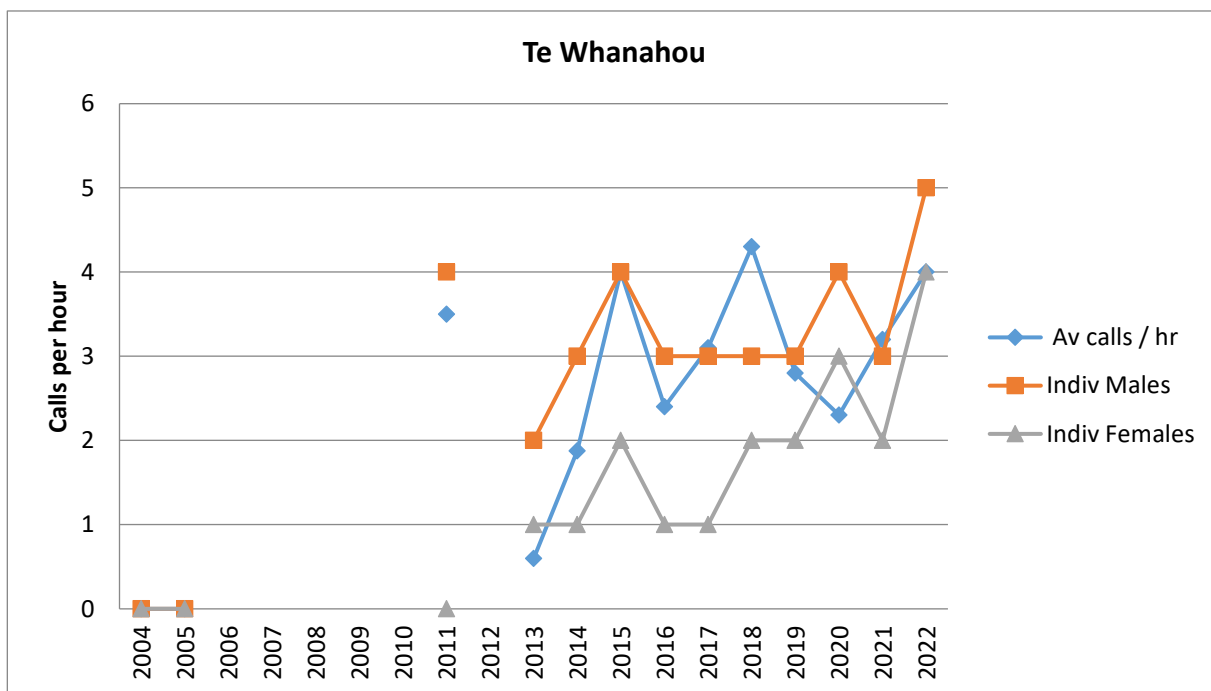


FIG. 8. Record of kiwi calls per hour at the Te Whanahou listening site

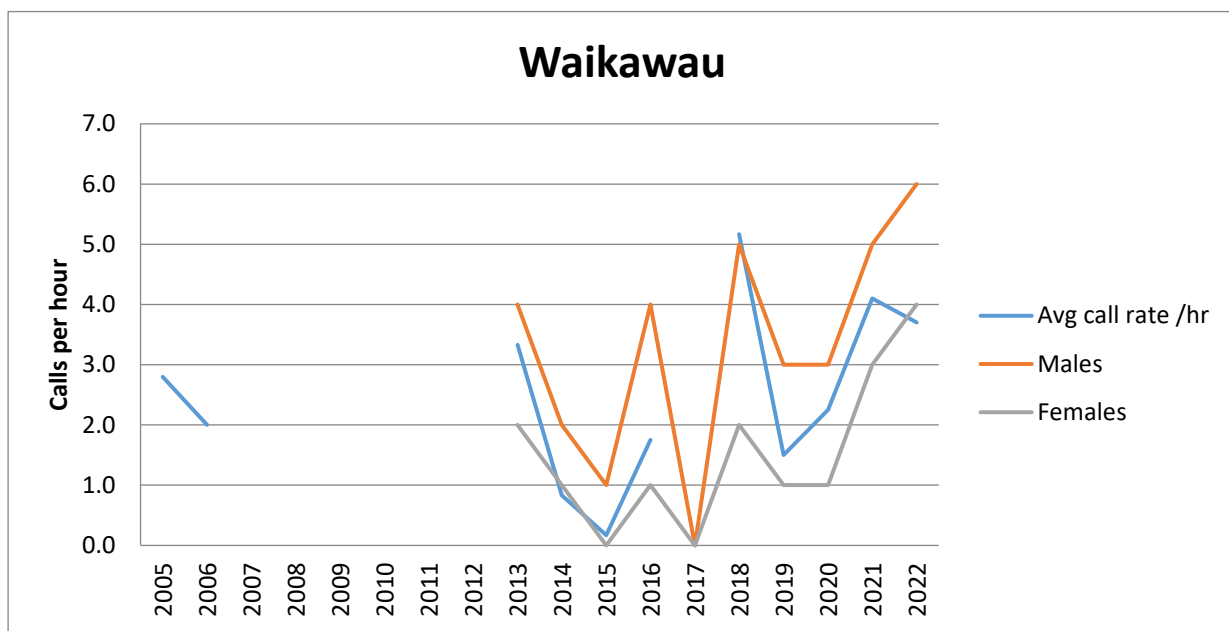
Waikawau M102

This site is on private land on the dividing ridge between Waikawau Bay and Colville. It is surrounded by bush. It is the hardest of the sites to access and so was not surveyed some years.

The numbers of kiwi and call rate have been up and down over the years suggesting that it is an area where kiwi love to live but perhaps get killed on a regular basis. The overall trend is up since 2005 and the last two years have shown good increases.

Moehau Environment Group – Annual Kiwi Survey, 2004 - 2022

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
E2733374 N6507562																			
Total hrs listened	6	2					2		6	6	6	4		6	6	4	10	10	
Total males heard	10	3					3		13	3	6	6		22	6	6	30	25	
Total females heard	7	1					0		7	2	1	1		9	3	3	11	12	
Kiwi calls per hour	2.8	2.0					1.5		3.3	0.8	0.2	1.8		5.2	1.5	2.3	4.1	3.7	
Individual males	2						3		4	2	1	4	0	5	3	3	5	6	
Individual females	1						0		2	1	0	1	0	2	1	1	3	4	
Calls solicited	Yes	No					No		No	No	Yes	No		no		no	no	no	



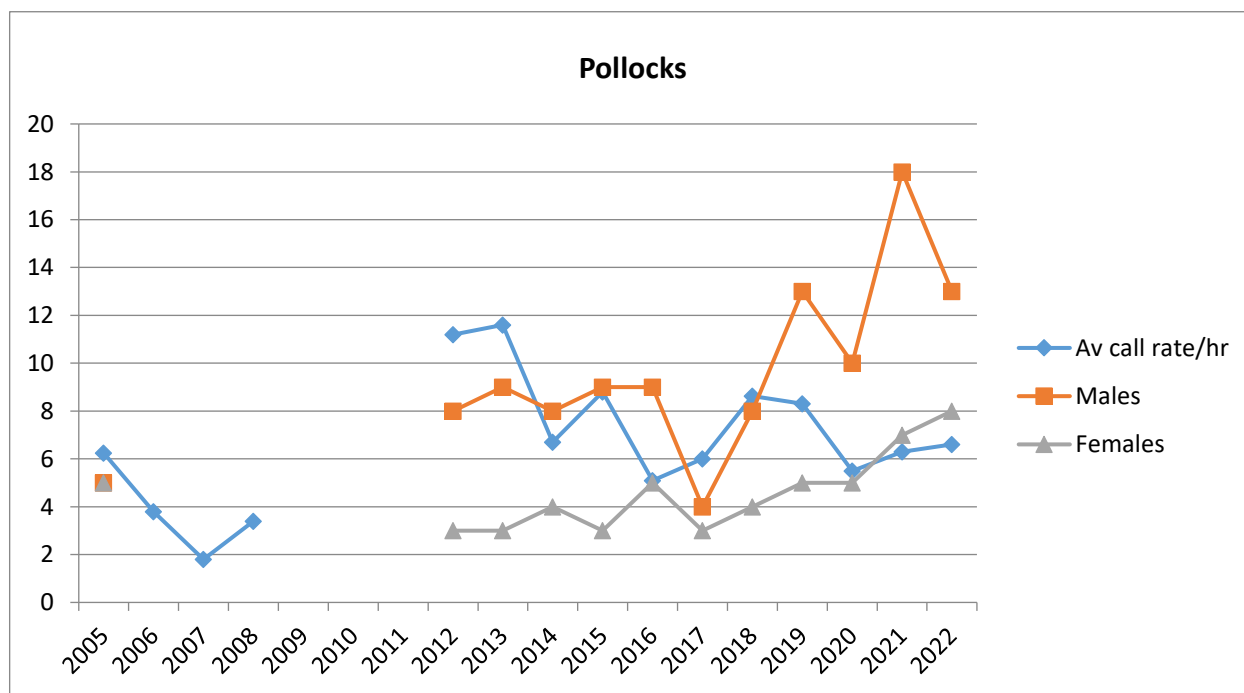
Pollocks M114

This site is a high point on private land that looks into Waitete Bay and Colville. It has been surveyed annually by Nathan and Nicole McCaulley since 2005. Big thumbs up to him climbing up that hill 5 times every year in the dark. The high point is surrounded by bush and it is a hot spot for kiwi.

Kiwi numbers have appeared to increase from 2005 to the present day. However the call count rate has dropped since 2012.

There is a significant drop in kiwi heard in 2017. A roaming dog was reported in the Waitete Bay area that year.

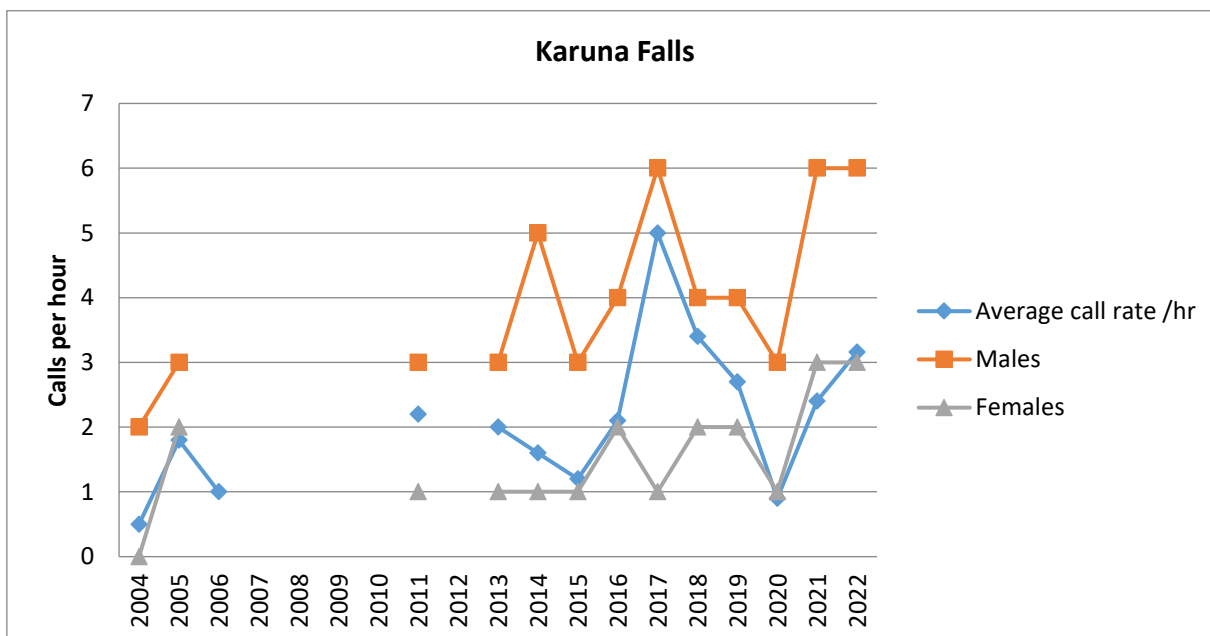
E27309291 N6502064	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total hrs listened	4	6	10	10				10	10	10	6	10		8	10	10	10	10
Total males heard	14	16	15	25				79	82	51	44	36		52	66	43	53	56
Total females heard	11	7	3	9				33	34	16	9	15		17	17	12	10	10
Kiwi calls per hour	6.3	3.8	1.8	3.4				11	12	6.7	8.8	5.1	6	8.6	8.3	5.5	6.3	6.6
Individual males	5							8	9	8	9	9	4	8	13	10	18	13
Individual females	5							3	3	4	3	5	3	4	5	5	7	8
Calls solicited	Yes							No	No	No	yes	No		no		no	no	no



Karuna Falls M105

This site has been diligently surveyed by Kathi Parr since 2004. Only this last year was it done by Beth Pearsall. Kiwi numbers appear to have grown at this site from 2004 until 2017 where numbers dropped off through to 2020. Numbers over the last two years appear to have grown again.

Karuna Falls M105		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
E2734754 N6505619																				
Total hrs listened		6	6	10					6	4	10	6	10		10	10	10	10	10	9.5
Total males heard		3	8	9					12	7	15	5	17		25	21	8	20	27	
Total females heard		0	3	1					1	1	1	2	4		9	6	1	4	3	
Kiwi calls per hour		0.5	1.8	1					2.2	2	1.6	1.2	2.1	5	3.4	2.7	0.9	2.4	3.2	
Individual males		2	3						3	3	5	3	4	6	4	4	3	6	6	
Individual females		0	2						1	1	1	1	2	1	2	2	1	3	3	
Calls solicited	Yes?		Yes						No	No	no	Yes	No		no	no	no	no	no	

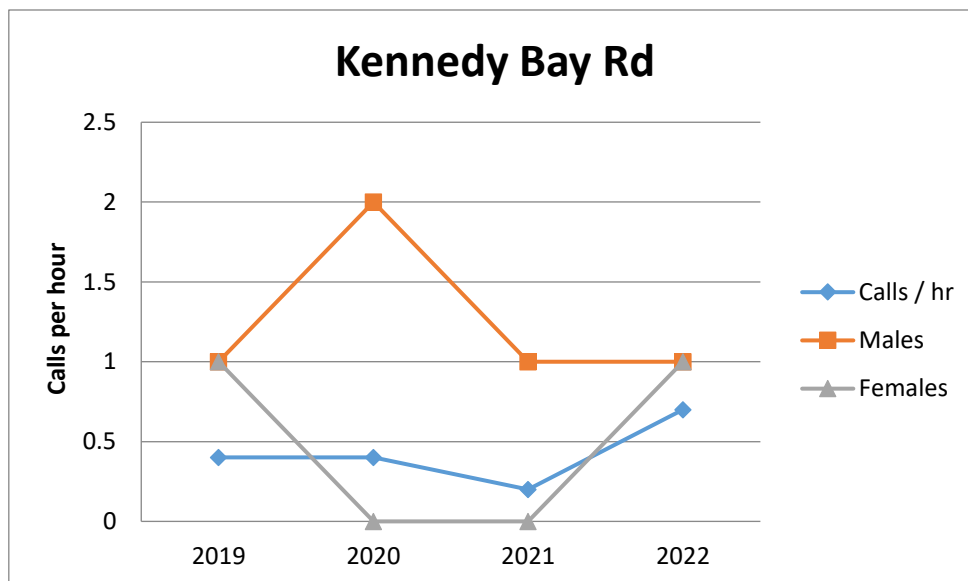


Kennedy Bay Rd M124

This site is on the side of the road near the top of the dividing ridge between Coromandel town and Kennedy Bay. It has been surveyed by Wally Gilmer for MEG. Kiwi are present but in low numbers.

**Kennedy Bay Rd
M124**

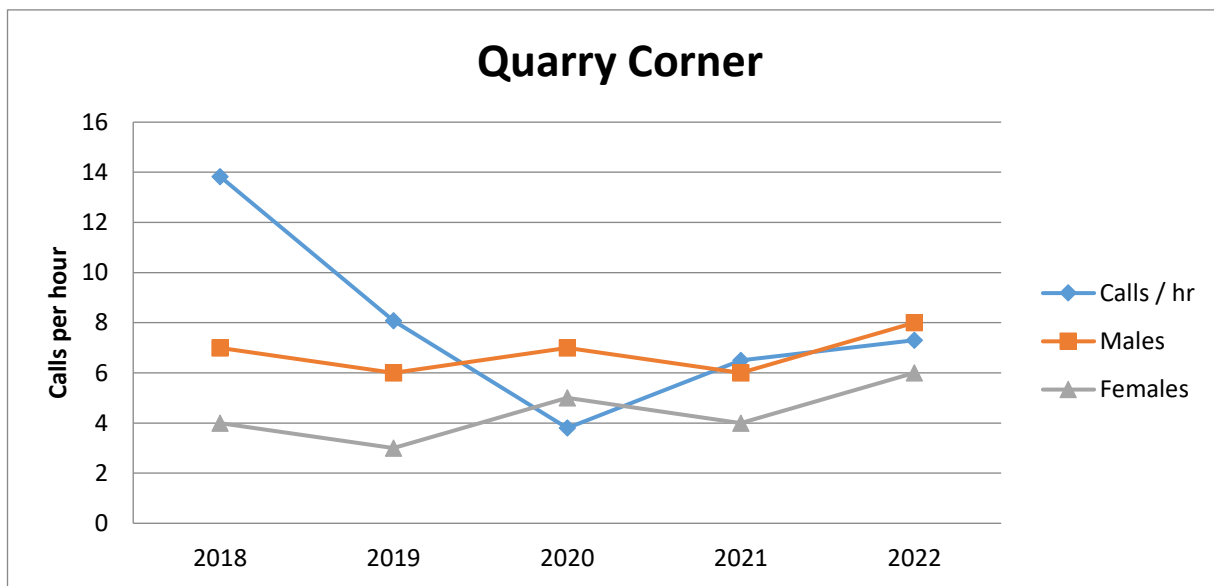
	2019	2020	2021	2022
Total hrs listened	10	10	10	10
Total males heard	2	4	2	4
Total females heard	2	0	0	3
Kiwi calls per hour	0.4	0.4	0.2	0.7
Individual males	1	2	1	1
Individual females	1	0	0	1
Calls solicited	no	no	no	no



Quarry Corner Port Charles

This site has been surveyed by Lettecia Williams for DOC annually since 2000 and was picked up by Katarina Hecht for MEG in 2018. This was always a hot spot for kiwi until 2018 when a dog or ferret killed all of the radio tagged kiwi present in the area. Several non-tagged kiwi were also found dead.

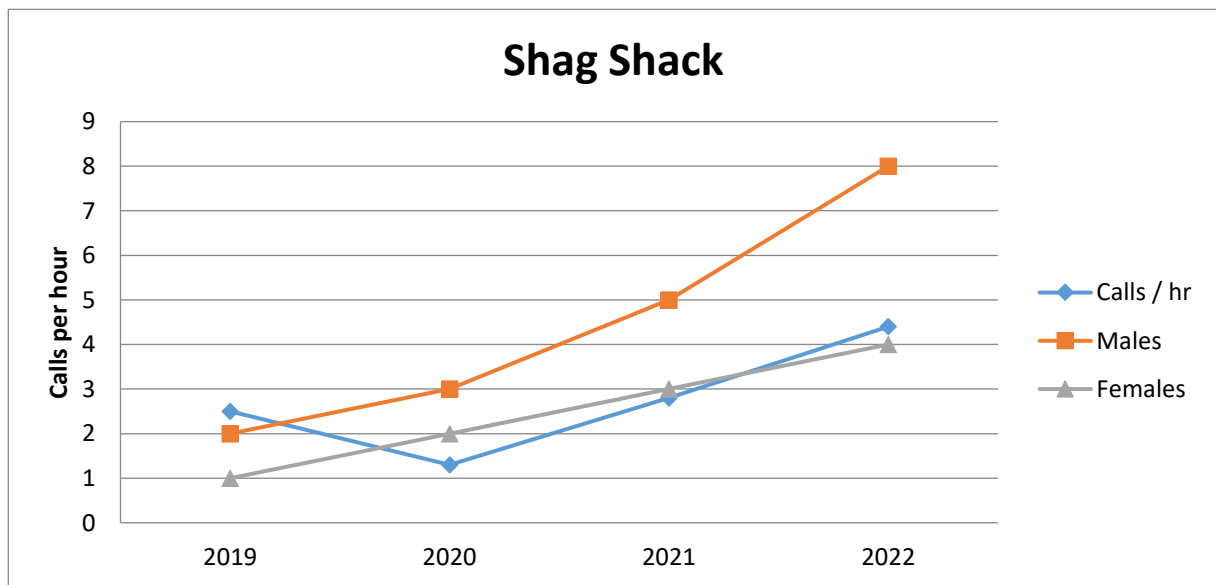
Quarry Corner					
	2018	2019	2020	2021	2022
Total hrs listened	12	12	10	10	10
Total males heard	113	69	25	55	54
Total females heard	53	28	13	10	19
Kiwi calls per hour	14	8.1	3.8	6.5	7.3
Individual males	7	6	7	6	8
Individual females	4	3	5	4	6
Calls solicited	no	no	no	no	no



Shag Shack, Little Bay Heights

This site has been surveyed by Paul Johnson and Steph Parkyn since 2019. Kiwi numbers have steadily increased since 2019.

Shag Shack				
	2019	2020	2021	2022
Total hrs listened	4	10	10	10
Total males heard	8	11	19	33
Total females heard	2	2	9	11
Kiwi calls per hour	2.5	1.3	2.8	4.4
Individual males	2	3	5	8
Individual females	1	2	3	4
Calls solicited	no	no	no	no



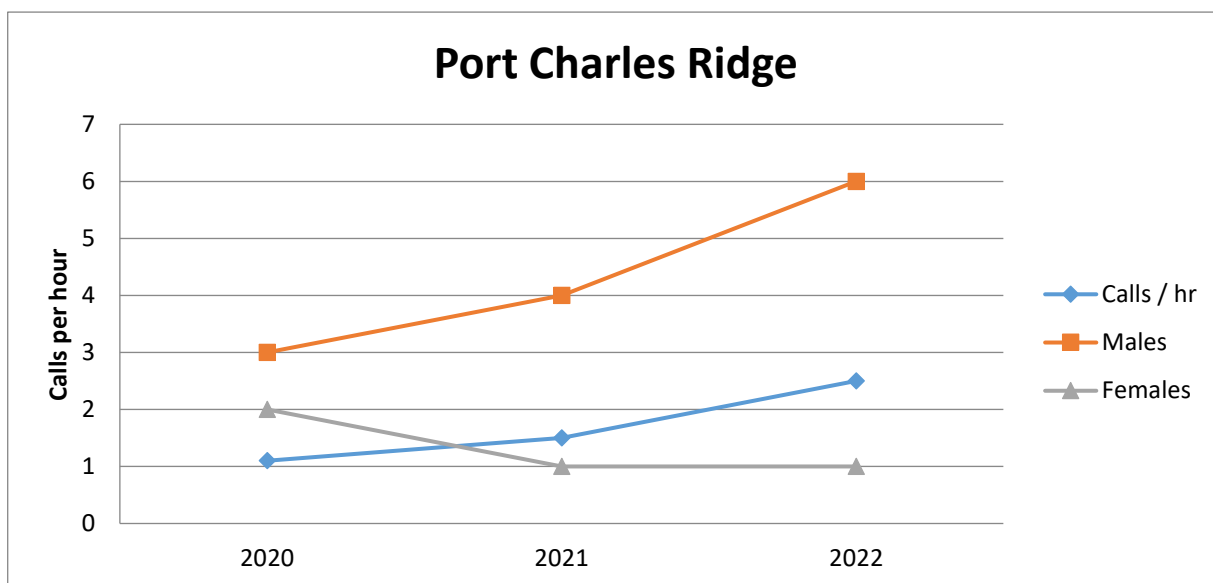
Port Charles Ridge, Bull Line

This site has been surveyed annually by Diane Prince and Lettecia Williams for DOC since 2000. MEG picked up doing this site only recently.

This was always a hot spot for kiwi until 2018 when a dog or ferret killed all of the radio tagged kiwi present in the area. Several non-tagged kiwi were also found dead.

Kiwi numbers have grown since 2020.

<u>Port Charles Ridge</u>			
	2020	2021	2022
Total hrs listened	10	8	6
Total males heard	7	11	12
Total females heard	4	1	3
Kiwi calls per hour	1.1	1.5	2.5
Individual males	3	4	6
Individual females	2	1	1
Calls solicited	no	no	no



4. Discussion

Listening surveys only estimate adult kiwi presence as juvenile kiwi and chicks do not call.

Estimated kiwi numbers over the five original sites have increased over the 17 years we have been surveying with some notable drops in numbers in some years.

A roaming dog that was reported in the Waitete Bay area in 2017 is possibly the cause of many kiwi deaths in that area that year as evidenced by the drop in estimated kiwi numbers at that site.

Ferrets had never been caught in MEG traps until 2019. One was caught in 2019, four in 2020 and another three in 2021. This may explain the drop in kiwi numbers in 2017, but numbers have steadily increased since. MEG is in the process of installing ferret traps through the project.

Is it worthwhile to continue the annual listening survey??

The five, now nine, sites were designed to give a snapshot of what was happening to kiwi numbers in the MEG stoat control area in between the 10 yearly “census” surveys.

The “census” survey showed kiwi increased by 36% between 2005 and 2015. The annual five sites saw an increase from 19 to 27 kiwi individuals in the same period, a gain of 42% giving us confidence that the five sites can roughly predict what is happening over the whole 15,000ha of stoat control.

By 2022, numbers in the five sites increased to 58 kiwi, a 115% increase since 2015. This may be a reflection of the 50% increase in area of stoat control now managed by MEG.

The 2015 “census” found 94 pairs in 2015. If numbers can be extrapolated based on the five site annual survey, estimates may now be close to 202 pairs in the wider “census” area.

The call count rate per hour has increased over the 17 years from 2.7 to 3.9 calls per hour, an increase of 44%. 2018 saw the highest call count rate of 4.8 calls / hour.

The kiwi numbers indicated by the annual call survey over the 17 years increased by 205%. If there had been a direct correlation between kiwi numbers and call count rate the rate should be in the vicinity of 8.1 calls per hour. So, perhaps the call count rate is not necessarily a great predictor of kiwi growth or lack thereof because the same kiwi can call several times in the listening period. However, it is a direct, standard measure that does not require a subjective assessment to estimate individual kiwi. Both measures should be continued to be recorded.

5. Conclusions

This result indicates that MEG’s landscape control of stoats, combined with the efforts of other groups in our area, and our advocacy for kiwi, has resulted in an increase in numbers of kiwi within the MEG stoat control area. Estimated numbers of kiwi heard have increased by 115% since 2015 and 300% since 2005.

The annual call count surveys should be continued as a predictor of kiwi population growth in the larger stoat control area.

6. Acknowledgements

Thanks to all the surveyors who gave up sitting in front of a nice cosy fire to go out in the dark and cold and sometimes wet to listen for kiwi. Mostly volunteering their time year after year.

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I apologise if I have missed you – it was not deliberate.

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Cover photo by Kerstin Langenburger

Final acknowledgement is made to the people who go out and do the hard yards trapping stoats every month. The kiwi numbers would not be on the increase without this mahi. Thank you, thank you, thank you!

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8. Appendices

Appendix 1 : A sample Kiwi Call Scheme Card used during the kiwi survey.

CARD No.		KIWI CALL SCHEME																		
OBSERVER:		Date:	Locality Name:																	
Address																				
Affiliation:		Sheet		Grid Reference																
NOTES:		<table border="1"> <tr> <td>1</td> <td>N</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>S</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>X</td> <td></td> <td></td> <td></td> </tr> </table>	1	N				2	S				3	X						
1	N																			
2	S																			
3	X																			
Number of Kiwi calls.	<p>WIND DIRECTION</p>	<p>WIND</p> <p>1 Calm 2 Light 3 Mod 4 Strong</p> <p>RAIN</p> <p>1 Nil 2 Light 3 Moderate</p> <p>TEMPERATURE</p> <p>1 Cold 2 Mild 3 Warm</p> <p>CLOUD COVER</p> <p>1 Clear 2 Partly cloudy 3 Overcast</p>	<p>GROUND CONDITION</p> <p>1 Dry 2 Damp 3 Wet</p> <p>NOISE</p> <p>1 None 2 Slight 3 Mod</p> <p>MOONLIGHT</p> <p>1 Light 2 Dark 3 Black</p> <p>LISTENING COVERAGE</p> <p>1 Narrow 2 Medium 3 Wide</p>	<p>Major Habitat Types</p> <p>1 Beech forest 2 Podocarp forest 3 Broadleaf forest 4 Exotic forest 5 Scrub 6 logged 7 burnt 8 undeveloped farmland 9 developed farmland 10 grassland 11 tussock 12 swamp 13 coastal 14 beach 15 river terrace 16 alpine 17 other</p>																
Minutes listened																				

4000/7/86-05730E-Y14

OTHER ANIMALS HEARD	1	2	3	4	Start time:	Finish:	Sp	Sex	Time	Bearing	Distance
none	few	mod	many								
none	few	mod	many								
none	few	mod	many								
few	mod	many									

Appendix 2 A sample Data Analysis Sheet

WHERE: _____ MONTH/YEAR: _____

RESULTS

Male calls _____	Estimated Indiv Males: _____
Female calls _____	Estimated Indiv Females: _____
Total calls _____	
Total hours _____	
Average call rate _____	