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Call count monitoring of Northland brown kiwi 2021

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Department of
Conservation
Te Papa Atawhai



**Te Kāwanatanga
o Aotearoa**
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1. Introduction

1.1 Objective

The objective of this report is to provide a summary of the 2021 results for Northland brown kiwi (*Apteryx mantelli*) call count monitoring, and to provide recommendations for future monitoring.

1.2 Background

Northland populations of kiwi had declined mainly due to predation by dogs (*Canis familiaris*), stoats (*Mustela erminea*), ferrets (*M. furo*) and cats (*Felis catus*), along with increasing land development pressures throughout the region (Pierce et al. 2006). In the early 1990s, a network of kiwi call count listening stations was established nationally to determine trends (stable, increasing or decreasing) in kiwi populations over time (McLennan 1992). In 1993, 24 stations were established in four geographic areas in Northland (Northern, Eastern, Southern, Western) where kiwi were known to be present, with kiwi call count monitoring carried out annually since 1995. Call count surveys are one of the main tools used for assessing trends in kiwi populations and are used in Northland to:

- Monitor the trends in call counts (and hence relative abundance) over time at the 24 original (1993) listening stations in the four geographic areas (Northern, Eastern, Western, Southern).
- Monitor the trends in kiwi populations at the growing number of kiwi management areas throughout Northland (currently 20 distinct clusters - fewer than in 2020 due to some clusters within the same contiguous habitat being grouped).

1.3 Northland listening sites

The 24 original kiwi listening stations that were established in 1993 at the four geographic areas (Pierce & Westbrooke 2003) are mapped in Figure 1 and listed in Table 1. In the Northern cluster six stations were established either in or on the edge of extensive forest in the Herekino-Raetea-Puketī Forests area. In the Eastern cluster six stations were established in forest remnants and extensive exotic forestry in the Bay of Islands area spanning Purerua Peninsula-Waitangi-Russell Peninsula. In the Western cluster five stations are in extensive forest (two in Waipoua) or forest remnants (Kaitui, Trounson and Paerata). The Southern cluster comprises seven stations within 30 km of Whangārei, all northwest or northeast of the city and involving forest remnants, including two that are exotic forests (Glenbervie 7A & 9A). Over the years since 1993 many additional listening stations have been added, predominantly

in areas where community groups are working to protect kiwi. The extensive involvement of local communities in the protection of kiwi and the associated expansion of the number of kiwi listening stations provides strong information on the current distribution and density of Northland brown kiwi throughout its range. (Fig. 1). Populations now extend across both public and private land in Northland and beyond, from Whakaangi in the Far North to Ponui Island in the south.

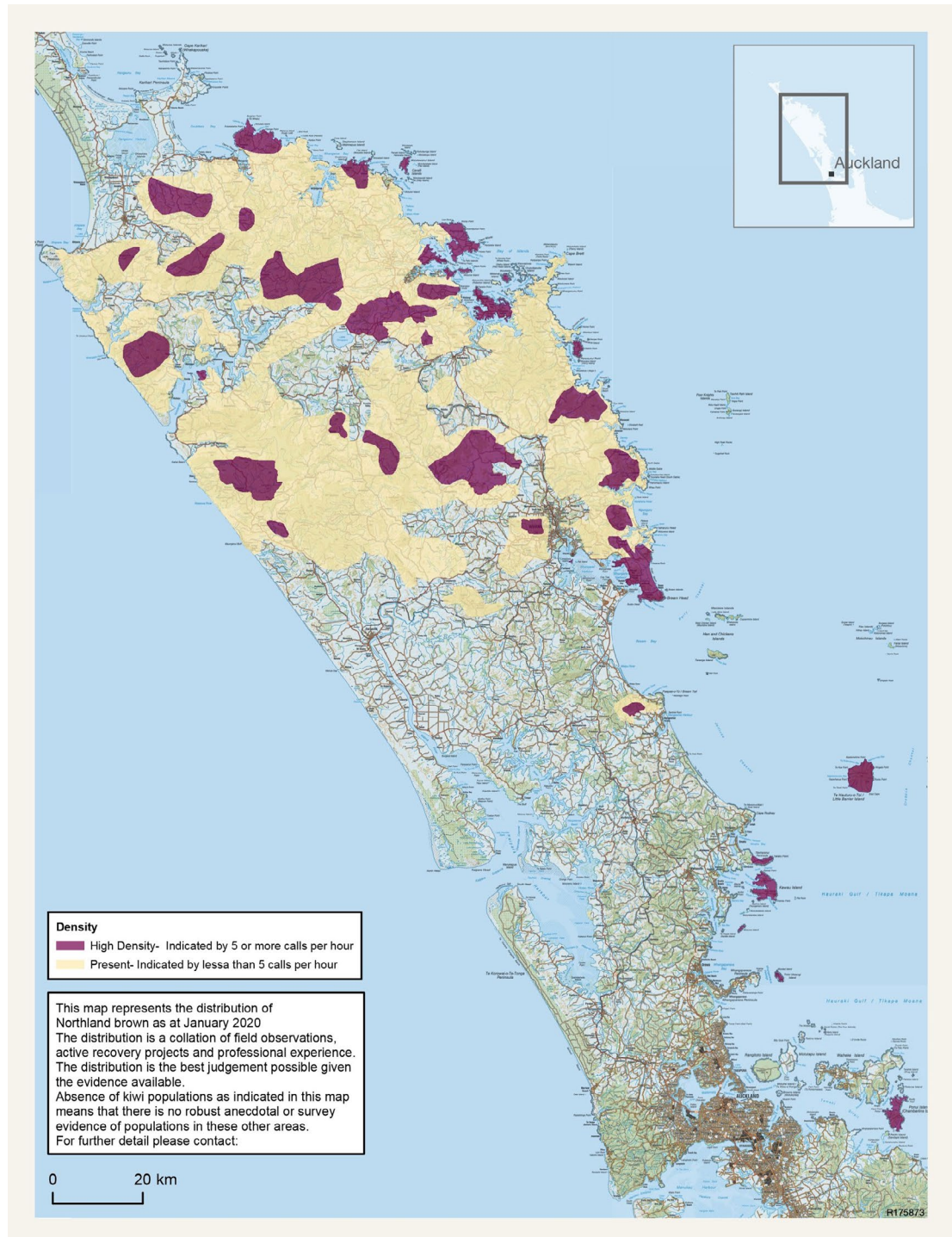


Figure 1. Northland kiwi distribution and relative abundance as known in 2020.

Table 1. The original Northland kiwi listening stations, grouped by geographic area with corresponding station numbers.

NORTHERN	EASTERN	WESTERN	SOUTHERN
1 Diggers Valley	10 Marsden Cross	16 Kaitui	21 Glenbervie 7A
2 Takahue	11 Puketotara	17 Trounson	22 Glenbervie 9A
4 Gartons	12 Rangitane	18 Cathedral	23 Marlow Road
5 Kaiaka	13 Waitangi No 12	19 Waipoua L/Out	24 Purua N
7 Puketī Forest	14 Mt Bledisloe	20 Paerata	25 Rarewarewa S
8 Puketi Scenic Reserve	15 Tikitikiore		26 Mimiwhangata
			27 Sandy Bay

2. Methods

The 2021 Northland brown kiwi call count survey followed the recommendations made in the Kiwi Best Practice Manual (Robertson & Colbourne 2003, 2017 and Colbourne et al. 2020); the relevant instructions from the latter are included in Appendix 1) and aligns with the findings of Colbourne & Digby (2016). Kiwi calls were listened for and counted during the first 2 hours of darkness, and during the dark phase of the moon, for 4 nights per station (n = 8 hours). A human listener was typically used to collect the data, but in some cases an ALD (artificial listening device) was used instead (as noted in Appendix 2). These results were comparable, as humans and ALDs have similar listening abilities (Castro et al. 2019). Wherever possible quiet conditions were favoured, with little or no wind, rain, or background noise. At times the survey conditions varied slightly from those described above. This is noted in the report when it is relevant to the results presented. Kiwi listening was carried out from 29 May to 18 June, with a back-up window from 28 June to 17 July 2021. Although there were some noticeable dry spells and less than average rainfall for Northland over the 2020/21 summer, the rainfall for the whole year was considered near normal for the region (<https://www.nrc.govt.nz/environment/environmental-data/hydrology-climate-report/>), so lack of rainfall was unlikely to have materially affected kiwi call count rates in 2021. Thus the 2021 recommendation was to complete listening during the first window, with the second window only used if weather and/or other variables prevented all 4 nights from being completed during the first window. This differs from 2020, when it was recommended that both windows were used because of the severe drought and likely delayed courtship combined with a relatively early May listening window. The 2021 recommendation was followed, with 39% of stations using the second window for some (30%) or all (9%) of the nights, cf. 65% in 2020.

2.1 2021 kiwi listening data

In addition to the original clusters, kiwi listening data for 2021 were received from the following management areas:

- Mangatete
- Whaakangi
- Bay of Islands
- Puketī
- Waimate North
- Hupara
- Russell

- Motatau-Marlow
- Purua-Rarewarewa
- Tutukaka Coast (a new cluster combining data from Tutukaka, Sandy Bay and Whananaki)
- KiwiLink (a new cluster)
- Glenbervie (a new cluster)
- Pukenui
- Whangārei Heads (a new cluster combining data from Manaia-The Nook, Kauri Mountain, and Bream Head-Taurikura)
- Piroa/Brynderwyn (a new cluster combining data from Marunui and Piroa)
- Mataia
- Tāwharanui

No data were received for Honeymoon Valley, Mahinepua-Radar Hill or Kawau Island in 2021. The Waipoua/Trounson cluster was removed, as the data used to create the mean had such high cross-over with that of the original Western cluster. Trends for this area can be monitored via the Western cluster.

3. General patterns

3.1 Northland monitoring trends since 1995

Trends in call count data collected since 1995 at the 24 original listening stations (see Table 1) in the Northern, Eastern, Southern and Western survey areas are graphed for comparison in Fig. 2 and the 2021 data for all Northland listening stations are presented and summarised in Appendices 2, 3 and 4.

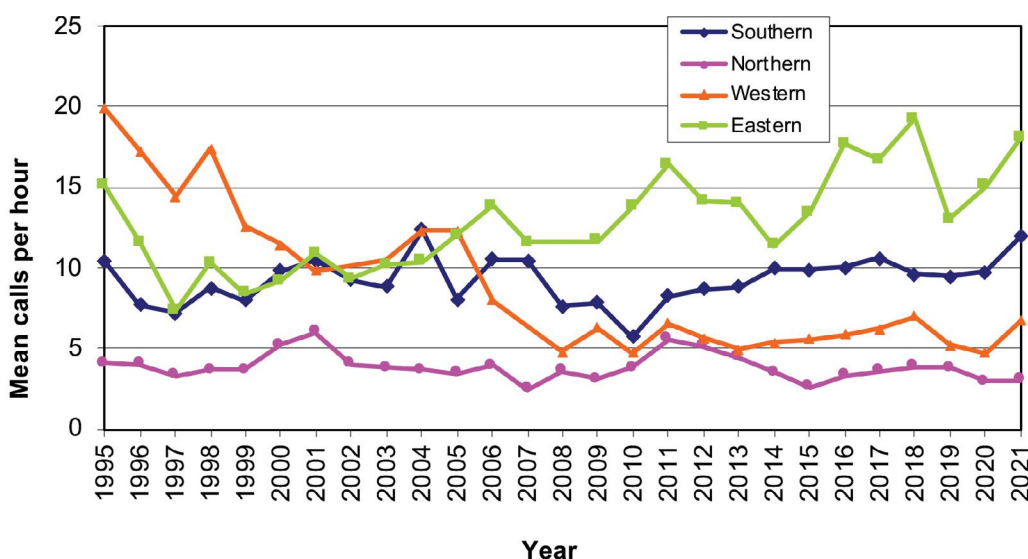


Figure 2. Mean kiwi call rates (calls/hr) for each of the original four Northland monitoring areas 1995–2021. The 2021 mean for the Northern cluster was estimated using the 2016 data for one station (Takahue), and by using the 2020 data for two stations (Digger’s Valley and Kaiaka [note: Kaiaka did have kiwi listening completed in 2021, but outside the kiwi listening windows. There was a mean of 1.0 calls/hr, cf. 3.0 calls/hr in 2020]). The 2021 mean for the Eastern cluster was estimated using a mean from 2.83 nights of listening for one station (Mt Bledisloe). The 2021 mean for the Western cluster was estimated using the 2014 data for one station (Paerata) and using a mean from 3.5 nights of listening for one station (Katui). The 2021 mean for the Southern cluster was estimated by using an ALD for two stations (Glenbervie 7A and Glenbervie 9A) and a mean from 3 nights of listening for two stations (Purua North and Mimiwhangata).

Northern Area

A mean of 3.0 kiwi calls/hr was recorded for the Northern Area in 2021, which was very similar to the 2020 result (2.98 calls/hr; Fig. 2). The mean for this area has not varied much since 2014 (range: 2.6–3.9 calls/hr). The data received for 2021 were from three of the six listening stations, which were listened from for 4 nights. The mean kiwi calls per hour for Puketī Forest (Station 7) and Gartons (Station 4) increased slightly when compared with 2020; and decreased slightly for Puketī SR (Station 8). All figures were within the recent ranges typically heard at these stations. Continuing to collect data from all six stations is advisable for future kiwi call count surveys.

Eastern Area

The mean kiwi call rate for the Eastern Area increased from 15.0 calls/hr in 2020 to 18.0 in 2021 (Fig. 2). This is the second highest mean recorded for this area, with only the 2018 rate (at 19.2 calls/hr) being higher. It was good to see the call rates in this cluster continue an upward trend, especially after the sharp decrease observed in 2019. All six stations were listened from, and all for 4 nights (with the exception of Mt Bledisloe/Station 14, where only

3 nights of listening were completed). It is useful to have such a full data set for this area. Four of the stations listened from had results from within the previously observed range, two of which were higher than recorded in 2020 (Rangitane/Station 12 and Waitangi No. 12/Station 13) and two of which were lower than in 2020 (Mt Bledisloe/Station 14 and Tikitikiore/Station 15). The remaining two stations both had mean call rates that were the highest on record: 42.38 calls/hr for Marsden Cross/Station 10, and 17.88 for Puketotara/Station 11).

Southern Area

As with the Eastern Area, in 2021 the Southern Area recorded its second highest mean call rate (11.9 calls/hr), an increase of more than 2 calls/hr from 2020 (9.8 calls/hr). The highest mean call rate for this area was 12.4 calls/hr (recorded in 2004). Data were received from seven stations, and of these, four had higher mean call rates in 2021 compared with 2020. Three stations had lower call rates in 2021, of which two were noticeably lower (Glenbervie 7A/Station 21 decreased from a mean of 6.1 calls/hr in 2020 to 1.8 in 2021 [the 2020 result was unusually high]; Mimiwhangata/Station 26 almost halved from a mean of 11.1 calls/hr in 2020 to 6.3 in 2021. This is the lowest recorded rate for this station since 1999 and is noticeably lower than what is typically observed). Glenbervie 9A/Station 22 had only a slight decrease in mean call rates between 2020 and 2021. Of the four stations where call rates trended up, only one (Sandy Bay/Station 27) was within the previously recorded range. The other three stations (Marlow Road/Station 23, Purua North/Station 24 and Rarewarewa South/Station 25) all recorded their highest ever mean call rates in 2021. Two stations (Purua North/Station 24 and Mimiwhangata/Station 26) had only 3 nights of listening completed; all other stations had all 4 nights completed. Two stations (Glenbervie 7A/Station 21 and Glenbervie 9A/Station 22) had data collected via ALDs; for all other stations in the cluster it was via human listeners.

Western Area

As with the other three original recording areas, mean kiwi call rates in the Western Area increased in 2021 (from 4.8 in 2020 to 6.7 in 2021; Fig. 2). The 2021 result was similar to that recorded in 2018. Data were not received for Paerata/Station 20, but they were recorded from the other four stations, which is a great improvement on 2020, when only two stations were listened from. The stations listened from in 2021 were Katui/Station 16, Trounson/Station 17, Cathedral Grove/Station 18 and Waipoua Lookout/Station 19. Katui/Station 16 had 3.5 nights of listening completed, the remainder had 4 nights. All four stations had increases in mean kiwi call rates in 2021 compared with 2020 (of between 0.04 and 3.6 calls/hr). The 2021 results were all within the typical range recently observed for each station. It was positive to see the mean for Cathedral Grove/Station 18 return to the typically observed range after an unusually low result in 2020.

4. Trends at managed populations

Each year, the same selection of listening stations are used to compare call rates over time to provide population trends for management areas. Only these core stations contributed data for the mean hourly call rate calculations depicted in the graphs for each management area provided below. It is important that kiwi coordinators prioritise kiwi listening from the core stations each year to ensure that the most accurate depictions of population trends in management areas are obtained. The stations that were used in the analysis are listed and data summarised in Appendix 3 for each management site and should be referred to when organising kiwi listening each year.

4.1 Summary of sites

4.1.1 Mangatete

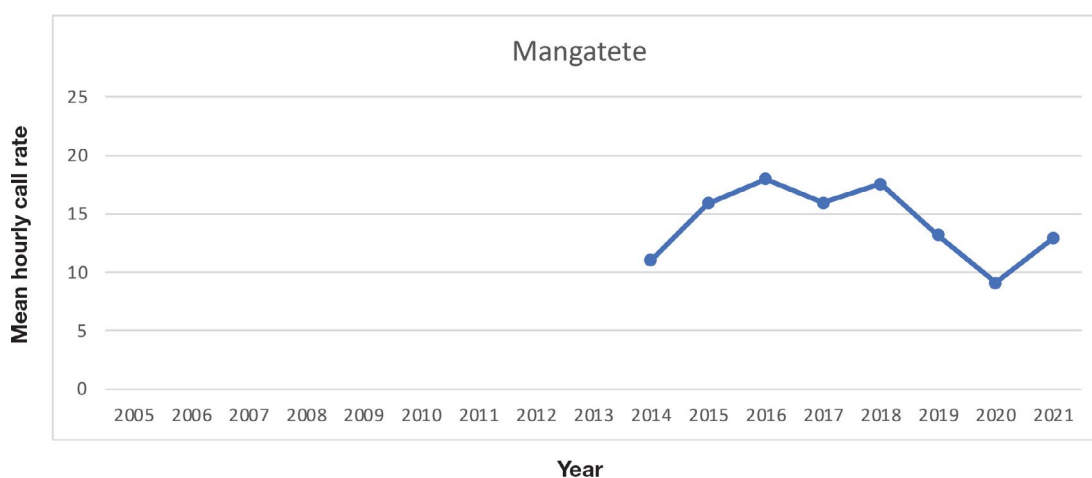


Figure 3. Trends in mean kiwi call rates (calls/hr) at Mangatete 2014–2021.

For the first time since 2018 there was an increase in the mean kiwi call rate recorded for the Mangatete cluster, which rose from 9.1 calls/hr in 2020 to 12.9 in 2021. The 2021 result was similar to that observed in 2019 (13.2 calls/hr; Fig. 3). These data were collected from two stations, both of which were listened from for 4 nights. Both stations recorded an increase of around 4 calls/hr compared with the 2020 results. It is not known why the 2020 call rates were unusually low, but such a swift recovery would suggest that the decrease was unlikely to indicate a significant change in the kiwi population. Although the 2021 mean for this station was lower than typically observed for this cluster, it is still more than double the threshold for which call rates are considered to indicate high kiwi density (5 calls/hr), so should not be of concern at this stage.

4.1.2 Honeymoon Valley

No data were received from the Honeymoon Valley cluster for 2021. It would be useful to have data for this cluster once again in the future.

4.1.3 Whakaangi

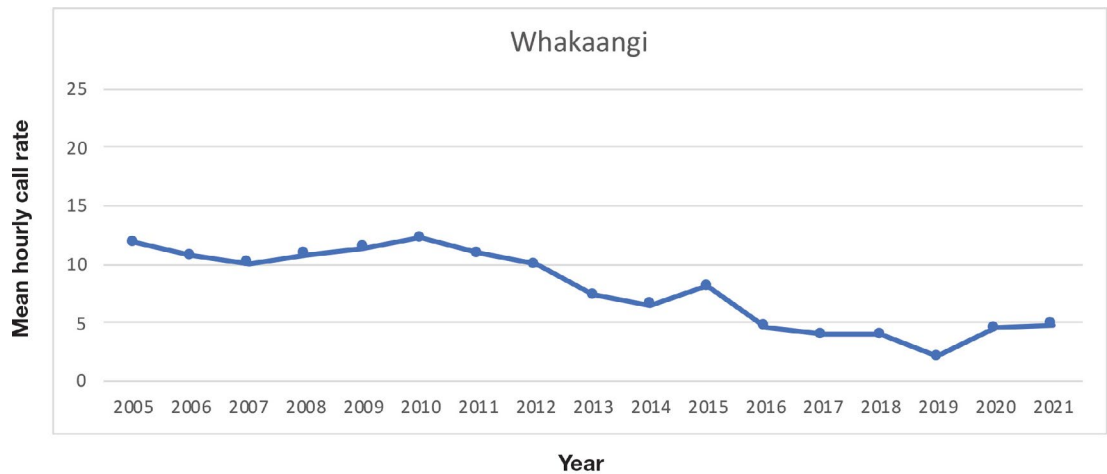


Figure 4. Trends in mean kiwi call rates (calls/hr) at Whakaangi 2005–2021.

After a general downward trend for almost a decade, it was positive to see another modest increase in the mean kiwi call rate at the Whakaangi cluster (from 4.5 calls/hr in 2020 to 4.8 in 2021; Fig. 4). This is just below the 5 calls/hr threshold that is considered to indicate a high kiwi population density, but hopefully the upward trend will continue, and this cluster may return to the previous norm of >10 calls/hr. Data were received from six stations for this cluster, all of which were listened for for 4 nights. Two of the stations (Stations 130 and 134) hadn't been listened from since 2009 and 2013 respectively, so it was good to be able to include data from these stations again. Of the other four stations, two had higher and two had lower mean call rates compared with 2020. These results were all in the typical range observed in recent years, but low compared with earlier listening surveys.

4.1.4 Mahinepua-Radar Hill

No data were received from the Mahinepua-Radar Hill cluster for 2021. It would be useful to have data for this cluster again.

4.1.5 Puketī Forest

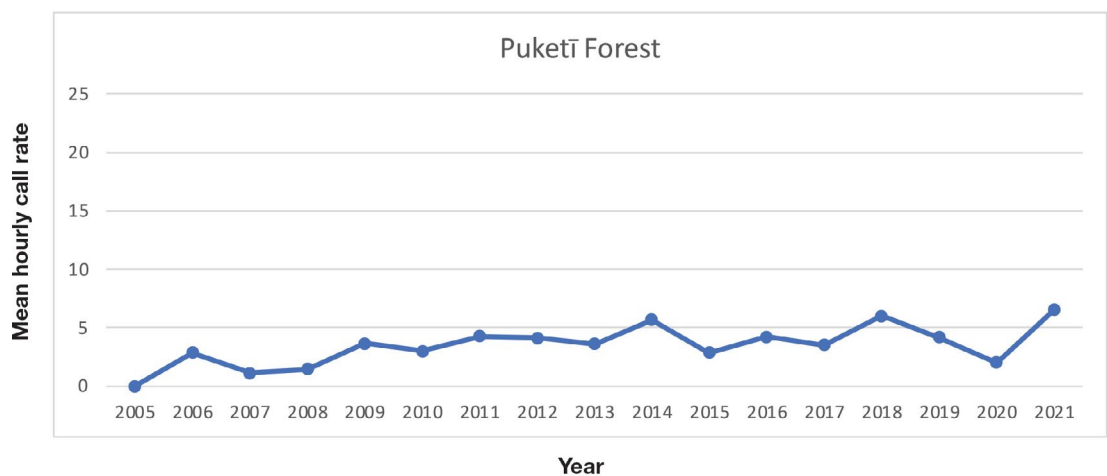


Figure 5. Trends in mean kiwi call rates at Puketī Forest 2005–2021.

In 2021, the mean kiwi call rate at Puketī cluster was the highest recorded so far in this area (6.5 calls/hr). This year was the third since 2005 with a mean call rate for the cluster greater than 5 calls/hr (the threshold denoting a high kiwi population density (Fig. 5)). The 2021 result was an increase of 4.5 calls/hr compared with 2020, when 2.0 calls/hr were heard. Four stations were listened from, for 4 nights. All four stations had higher mean call rates in 2021 than in 2020. Two of these stations recorded rates within the usual range in 2021 and two (Stations 104 and 108) were the highest on record, albeit not exceptionally higher than the previous known range. It is positive that the results for this cluster have returned to the previous pattern of generally increasing calls over time, and that the result was once again >5 calls/hr. As postulated in the 2020 report (Craig 2021), it seems that the 2020 data were an outlier, potentially resulting from the year’s seasonal drought.

4.1.6 Waimate North

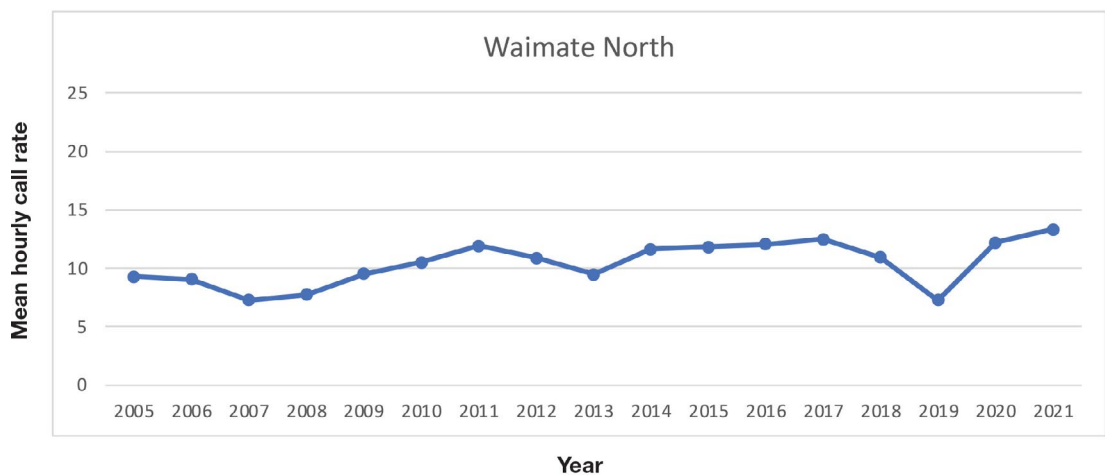


Figure 6. Trends in mean kiwi call rates (calls/hr) at Waimate North 2005–2021.

In 2021, the mean kiwi call rate for the Waimate North cluster was 13.3 calls/hr, 1.1 calls/hr greater than in 2020 and the highest mean ever recorded for this cluster (Fig. 6). All six stations were listened from for 4 nights each. Having a complete data set adds validity to the improved mean call rate recorded. During the 17 years depicted in Fig. 6, the mean call rate for this cluster was >10 calls/hr in 10 (59%) of the years. It is a positive sign to have such a consistently high and stable mean call rate. The low result recorded in 2019 was likely not due to a significant change in kiwi density, as a biological event (e.g. mortality or emigration) would take longer to recover from than is observed, and as noted in previous reports (Craig 2020 and Craig 2021), having data from Station 113 missing in 2019 likely skewed the mean. Three of the six stations recorded more calls in 2021 than in 2020, with fewer at the other three stations. It is notable that the three stations that had more calls in 2021 (Stations 113, 114 and 122) had higher mean kiwi call rates than in any previous years (38.3, 11.9 and 11.3 calls/hr, respectively).

4.1.7 Hupara

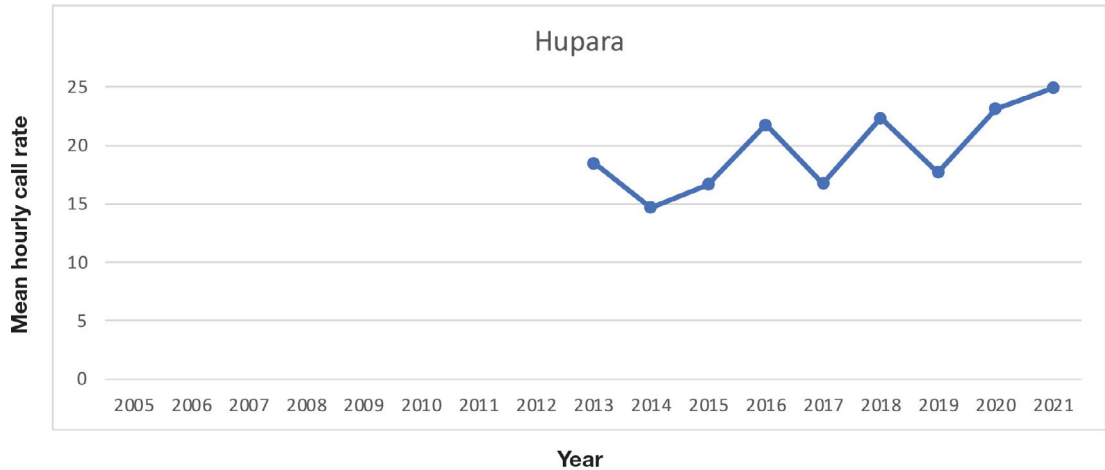


Figure 7. Trends in mean kiwi call rates (calls/hr) at Hupara 2013–2021.

The mean kiwi call rate at the Hupara cluster increased from 23.1 calls/hr in 2020 to 24.9 in 2021 (Fig. 7). This is the highest mean call rate on record for any of the clusters, in any of the survey years. As with previous data analysis, the mean was derived from only two stations. Both stations had 4 nights of listening completed. Station 258 increased by about 6 calls to a mean of 38.3 calls/hr, and Station 257 decreased from 13.9 to 11.6 calls/hr. Overall, the results for this cluster are variable but consistently very high. The variability most likely reflects natural fluctuation in call rates rather than significant changes in kiwi density. Reinstating the other two stations in this cluster (Station 245, last listened from in 2020 and Station 246, last listened from in 2013) is recommended as it would likely help to even out some of this fluctuation.

4.1.8 Russell

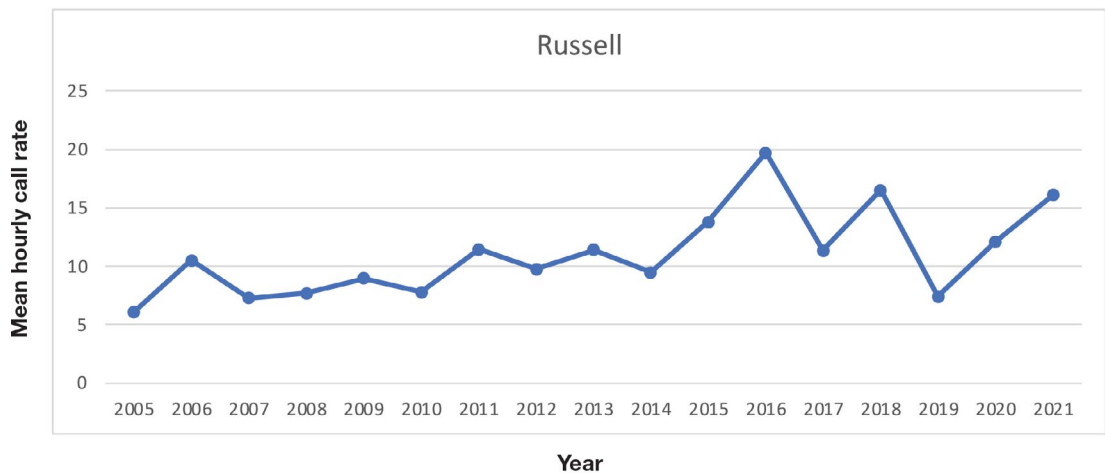


Figure 8. Trends in mean kiwi call rates (calls/hr) at Russell 2005–2021.

For the second year in a row there was an increase of around 4 calls/hr in the mean number of kiwi calls heard at the Russell cluster, from 7.4 in 2019 to 12.1 in 2020 and 16.1 in 2021 (Fig. 8). The 2021 result is the third highest on record for this cluster. The mean was calculated using all five listening stations. Four stations had 4 nights of listening completed, and the fifth station had 2 nights of listening (there were a further 2 nights of listening, but these fell outside the listening period so were not able to be included in the analysis). Four of the five stations had higher mean call rates in 2021 than in 2020, and one of these (Station 59) had

the highest mean call rate recorded in 2021 (30.4 calls/hr). Although this exceptionally high mean is something to celebrate, it is worth noting that Station 59 often has different listeners, so observer bias could account for some (or all) of the large increase in kiwi calls recorded. Utilising the same listeners for each station across different years is recommended to maximise the accuracy of the data collected.

4.1.9 Motatau-Marlow

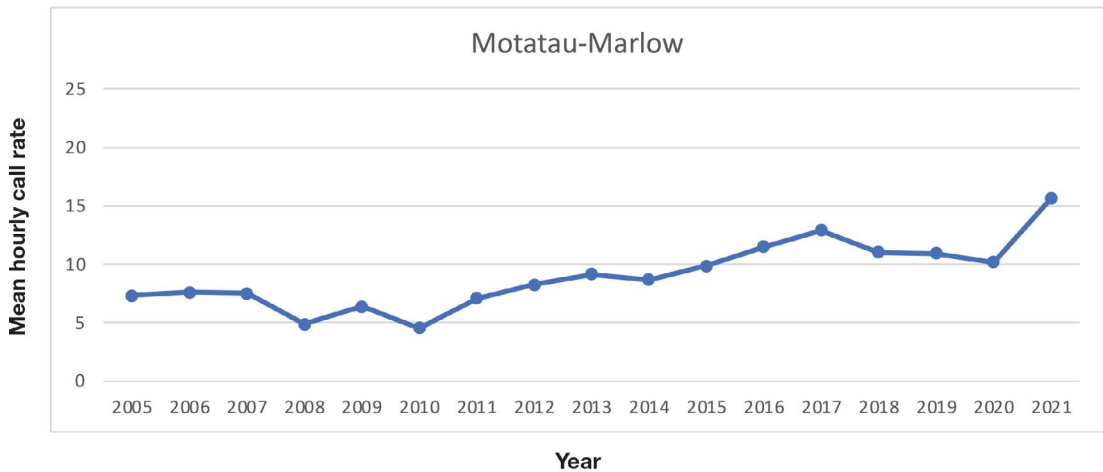


Figure 9. Trends in mean kiwi call rates (calls/hr) at Motatau-Marlow 2005–2021.

There was a positive result for the Motatau-Marlow cluster in the 2021 kiwi listening survey, with mean call rates increasing by >50% from 2020, to a high of 15.6 calls/hr in 2021 (Fig. 9). This mean was derived from only three stations, and two of these (stations 68 and 129) had only 2 nights of listening completed. Station 23 had 4 nights of listening completed, and the mean number of calls heard tripled from 8.3 calls/hr in 2020 to 24.4 in 2021. The 2021 result was the highest observed for this station, but close to the typical range. The 2020 result was unusually low, so it was good to see a higher number of calls in 2021. Station 129 also had a record high number of calls heard in 2021 (14.0 calls/hr). Stations 34, 35 and 36 weren't listened from in 2021 (and haven't been since 2015, 2013, and 2011 respectively). It would be useful to recommence listening surveys from these stations to compare with the historical data. It is also important to ensure the surveys are conducted in accordance with the recommendations, including listening for 4 nights per station (see Appendix 4 for full details).

4.1.10 Purua-Rarewarewa

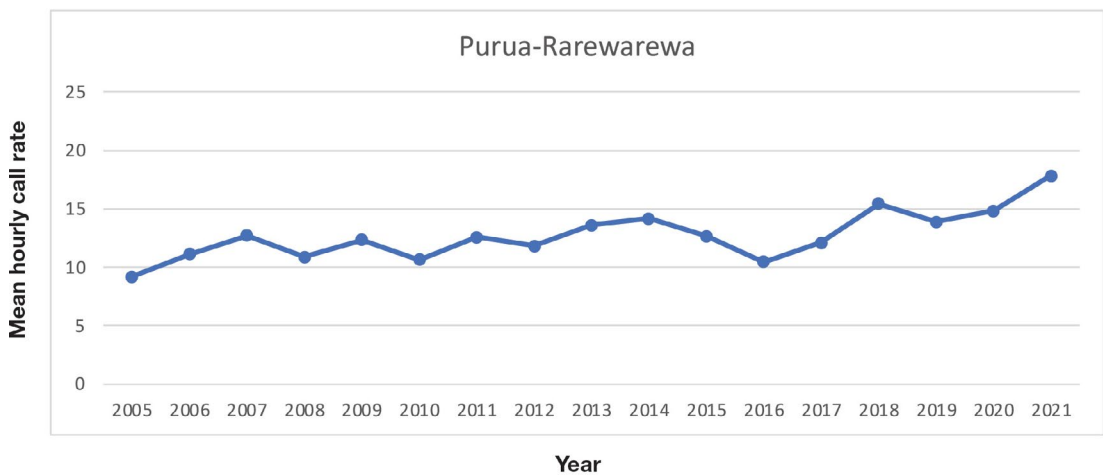


Figure 10. Trends in mean kiwi call rates (calls/hr) at Purua-Rarewarewa 2005–2021.

The mean kiwi call rate at the Purua-Rarewarewa cluster increased from 14.8 calls/hr in 2020 to 17.8 in 2021 (Fig. 10). The 2021 result was the highest mean recorded for this cluster and was more than 2 calls/hr higher than the previous peak recorded in 2018 (15.4 calls/hr). This cluster has typically quite high annual mean call counts, reflecting the high kiwi population density in the area. All five stations were listened from; three for 4 nights; one for 3 nights (Station 24); and one for 2 nights only (Station 139). It is preferable to complete 4 nights for all stations as per the standard methodology, so that data can be confidently compared across years. Four of the five stations had higher call rates recorded in 2021 than in 2020, and two of these had higher rates in 2021 than any previous years (stations 24 and 25). Only one (Station 82) showed a downward trend, although this was minor (from 11.9 to 10.9 calls/hr) and within the typically observed range.

4.1.11 Tutukaka Coast

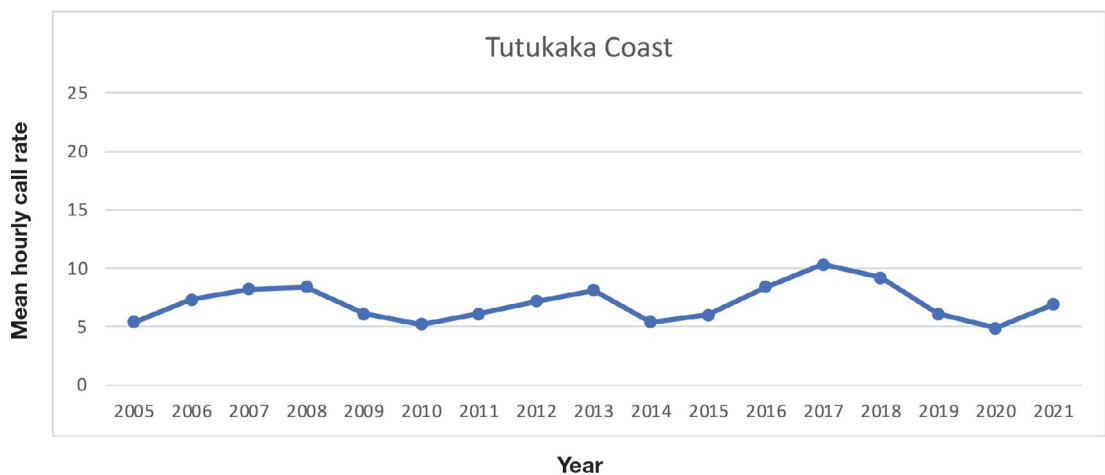


Figure 11. Trends in mean kiwi call rates (calls/hr) at Tutukaka Coast 2005–2021.

Tutukaka Coast was a new cluster formed for the purpose of this report, by combining data from Tutukaka and Sandy Bay (and potentially in the future, also from Matapouri and Whananaki). This was because the original areas are contiguous and kiwi can move freely throughout them, therefore it is preferable to view them as one cluster. The previous stations used in the Tutukaka cluster (stations 28, 125, 126, 142, 143 and 144) were combined with the previous stations used in the Sandy Bay cluster (stations 27, 260 and 261) to calculate the 2021 mean call rate. The previous years from 2005 to 2020 were also adjusted retroactively on the graph to reflect the new cluster. The mean for the Tutukaka Coast cluster in 2021 was 6.9 calls/hr. This is 2 calls/hr higher than the mean of 4.9 calls/hr recorded in 2020 (Fig. 11). Stations 142, 143 and 144 were not listened from in 2021. Of the remaining 6 stations that were included in the 2021 survey, two (stations 260 and 261) utilised ALDs. All other stations had human listeners. Station 261 was listened from for 3.5 nights, and the other stations were listened from for 4 nights. Most (four) of the stations had more calls heard in 2021 than 2020. One had fewer calls than in 2021 and one was listened from in 2021 but not 2020. The 2021 results were within the range typically observed for this consistently variable cluster.

4.1.12 Pukenui

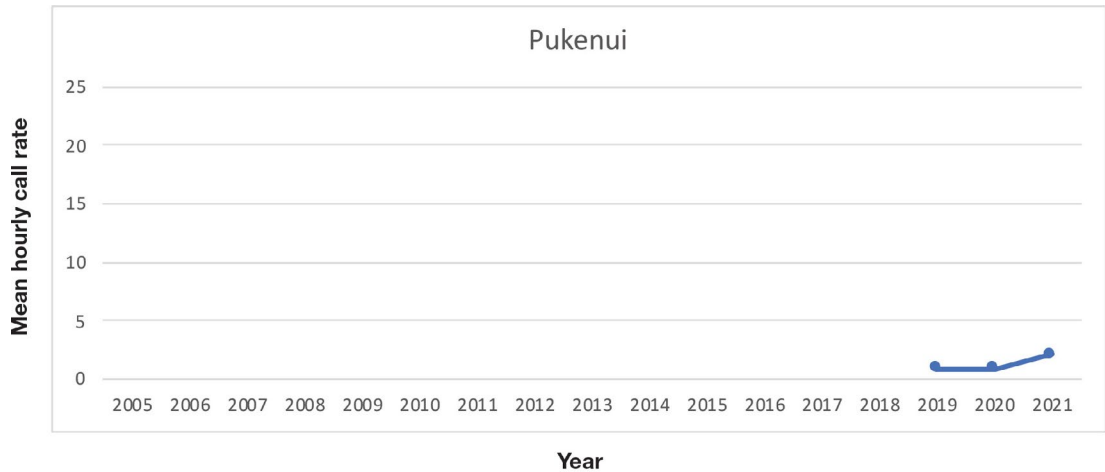


Figure 12. Trends in mean kiwi call rates (calls/hr) at Pukenui 2019–2021.

There are now 3 years of listening data available for the Pukenui cluster, making it possible to create a graph showing the trends in mean kiwi call rates (Fig. 12). This is a new and burgeoning population, as the call counts reflect. Ten different stations have been listened from in this cluster, but only three of them have been listened from consistently for all 3 years. These three (stations 285, 288 and 289) were used to calculate the mean call rate. All three were listened from for 4 nights and had their highest recorded call rates in 2021. It was positive to see an increase in call rates for this cluster.

4.1.13 Whangārei Heads

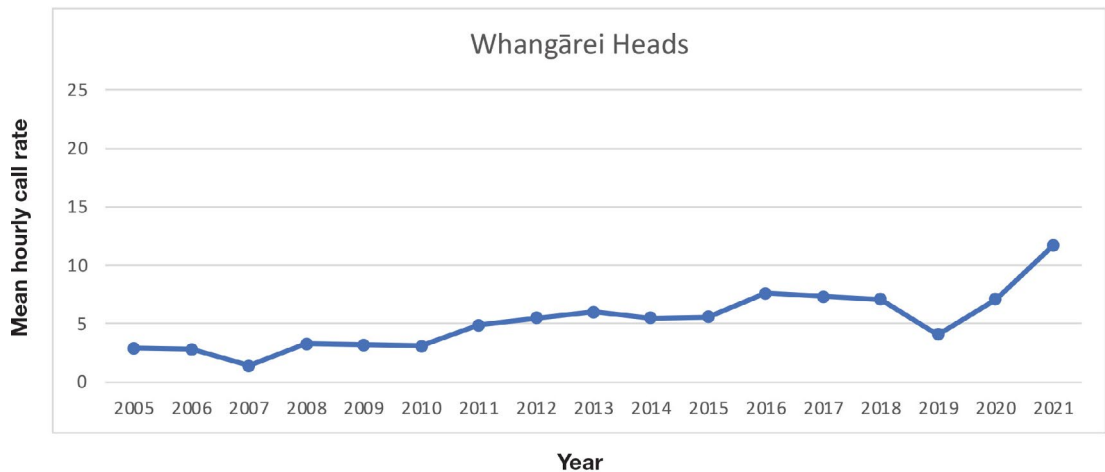


Figure 13. Trends in mean kiwi call rates (calls/hr) at Whangārei 2005–2021.

Whangārei Heads is a new cluster formed for the purpose of this report by combining data from Manaia-The Nook, Kauri Mountain and Bream Head-Taurikura. The wider Whangārei Heads area is considered contiguous kiwi habitat, therefore it is preferable to view the kiwi in this area as one population. The stations from the previous clusters of Manaia-The Nook (stations 47–49, 56, 71), Kauri Mountain (stations 54, 72–74, 141), and Bream Head-Taurikura (stations 39, 41–42, 69) were amalgamated and re-analysed to create mean annual call counts for the new Whangārei Heads cluster (Fig. 13). It was unwieldy to have so many stations (14) used to create a single mean, but counterintuitive to remove any of these long-standing stations, so they were all included. All 14 stations were listened from for 4 nights, which was

an admirable achievement. Two stations had data collected using an ALD (Station 71 in full and Station 73 in part). All other stations were listened from using human observers. The mean kiwi call rate in this cluster in 2021 was 11.7 calls/hr, the highest recorded to date. Of the 14 stations, call rates at 13 trended up, and only one (Station 71) trended down when compared with the 2020 survey (from a mean of 6.5 calls/hr to 4.5); however, the 2021 result was still within the previously observed range. Of the 13 stations where call rates trended up, nine (69%) had their highest recorded mean in 2021, and two of these results were more than double the previously observed highest means (Station 41 had 20.4 calls/hr, the previously highest mean was 8.6 calls/hr in 2013 and 2014; Station 69 had 13.6 calls/hr; the previously highest mean was 6.8 calls/hr in 2013). The increasing call rates are a positive sign for the kiwi population in the Whangārei Heads area.

4.1.14 Piroa/Brynderwyn

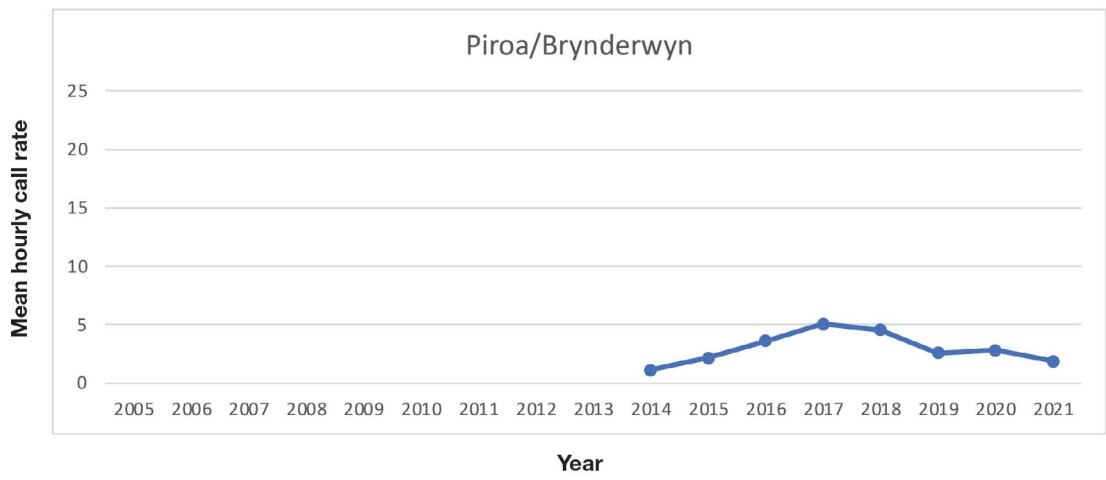


Figure 14. Trends in mean kiwi call rates (calls/hr) at Piroa/Brynderwyn 2005–2021.

The Piroa/Brynderwyn cluster was formed in 2021 by combining two former clusters - Piroa (Station 290) and Marunui (stations 253 and 275). These previous clusters were both within the Brynderwyn Range, and as this is contiguous habitat under kiwi protection it was assumed that kiwi move freely within the range. It is therefore preferable to treat the area as one population. Data from 2014 to 2021 were graphed (Fig. 14) to reflect the new grouping. Piroa/Brynderwyn was the only cluster to record a lower mean call rate in 2021 than in 2020, decreasing from 2.8 to 1.9 calls/hr. The 2021 result was the second lowest on record (the lowest being 1.1 calls/hr, observed in 2014). Individually, all three stations returned lower mean call rates in 2021 than they had for several years. It was not known why this cluster returned a result that was different to the otherwise consistent trend, but the actual change was >1 call/hr, so not a large difference. It would be good to have 6–8 stations listened from consistently within this cluster to provide more robust mean call rates, and to enable natural fluctuations in call rates to be differentiated from those reflecting population changes.

4.1.15 Mataia

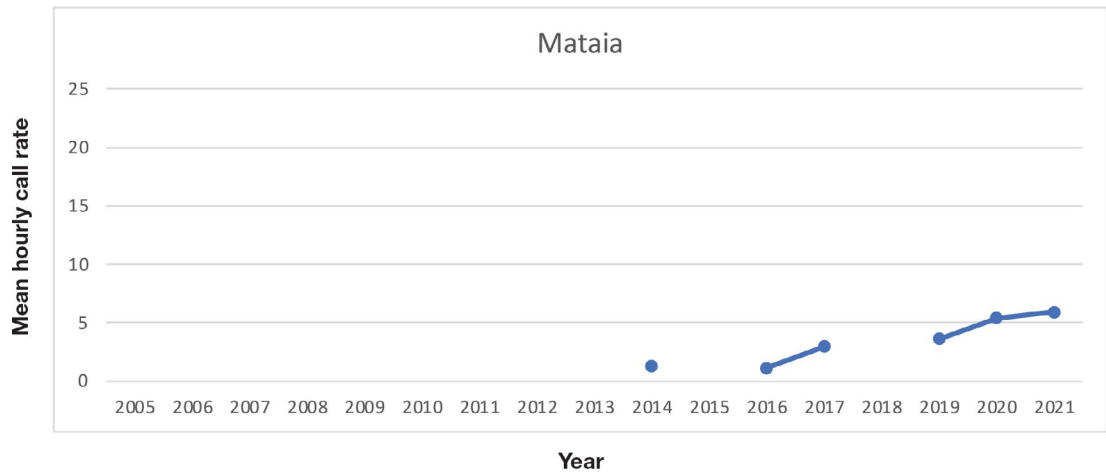


Figure 15. Trends in mean kiwi call rates (calls/hr) at Mataia 2014; 2016–2017; 2019–2021.

There was a slight increase in mean kiwi call rates at the Mataia cluster in 2021 (from 5.4 calls/hr in 2020 to 5.9 in 2021; Fig. 15). It was good to see two consecutive years of mean call rates above the 5 calls/hr threshold for high kiwi density. This was positive news for a relatively new population during the expansion phase. Data were received from two stations, both of which were listened from for 4 nights. Station 254 decreased 1.4 to a mean of 6.4 calls/hr. This was still a strong result for this station and was the second highest mean rate recorded following 7.8 calls/hr in 2020. The mean call rate at Station 255 almost doubled from 3.0 calls/hr in 2020 to 5.4 in 2021, which was the highest recorded result for this station. Adding more stations to this cluster and listening from them consistently each year would improve our ability to monitor call count trends in the area.

4.1.16 Tāwharanui

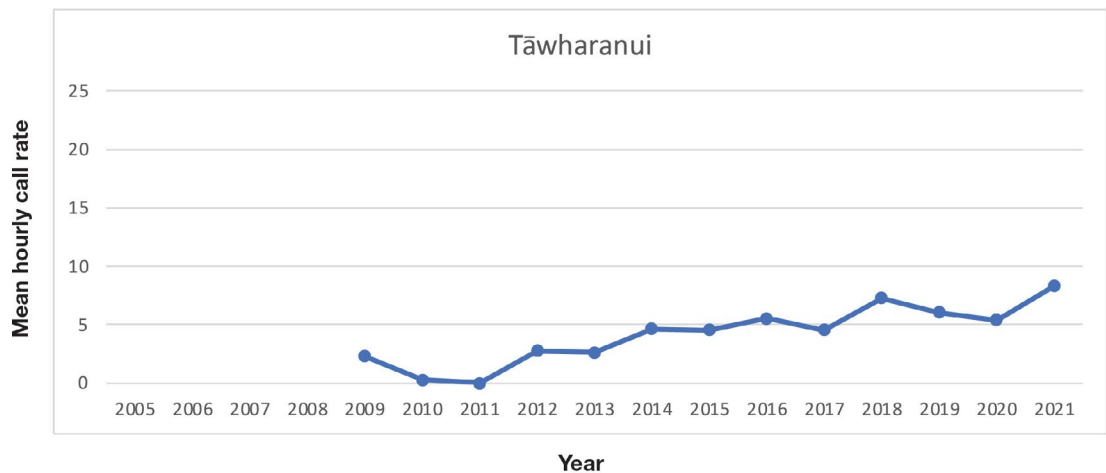


Figure 16. Trends in mean kiwi call rates (calls/hr) at Tāwharanui 2009–2021.

The mean kiwi call rate at the Tāwharanui cluster increased from 5.4 calls/hr in 2020 to 8.3 in 2021 (Fig. 16). The 2021 rate is the highest on record for this cluster. It is also positive that the mean call rate over the last 4 years has been higher than the 5 calls/hr that signifies a high-density kiwi area. Six stations were listened from in 2021, and each for 4 nights. Once again, it was very useful to have such a complete dataset for this cluster. Call rates at all six stations increased between 2020 and 2021 and two stations (165 and 166) recorded their highest

mean call rates so far. Station 163 recovered from the decrease observed in 2020 (Craig 2021). The mean call rate at Station 166 was 18.4 calls/hr, substantially higher than any other rates previously heard in the Tāwharanui cluster. These results likely reflect a robust and increasing kiwi population.

4.1.17 Kawau Island

No data were received from the Kawau Island cluster in 2021. It would be useful to have data for this cluster once again in the future.

5. Discussion and general recommendations

It was very positive to see that mean kiwi call rates for the four original clusters trended up between 2020 and 2021. This year was the first time since 2016 that all the original clusters had concurrently increasing call rates. Although kiwi call count surveys can only provide general trend data rather than population densities (Robertson & Colbourne 2017), the pattern of increasing call rates is a positive indication of growing kiwi density. There are now 27 years of data available to track the trends at these core stations. The longevity of this dataset makes it extremely valuable and well worth the continuation of annual monitoring.

The overall pattern of increasing call rates was also evident throughout the additional clusters, with 13 of the 17 having higher rates in 2021 than in 2020. Three clusters did not provide data for 2021, and call rates trended down at only one cluster. It was interesting that the same pattern occurred throughout the survey range of Northland brown kiwi. Some factors will broadly affect kiwi in the same way (e.g. the region-wide drought in 2020: <https://www.nrc.govt.nz/news/2020/may/drought-firmly-locked-in-in-northland/>), but it is unusual to see a pattern of increasing call counts across almost all the clusters, and at many of the individual listening stations.

It may be that the drought in 2020 and the corresponding recovery from it as more food became available caused a boom in courtship in 2021, and higher than typical associated calling. If the drought caused reduced breeding attempts or success in 2020, then kiwi may have been in better than average condition (e.g. greater fat stores) for the 2021 breeding season, and/or there may have also been a stronger than usual desire to maximise the breeding potential of the 2021 season by putting extra effort into establishing courtship and breeding. This would likely result in higher call rates; both for duetting, and for defining territories. It may also be that the higher call rates observed in 2021 reflect a genuine increase in kiwi density and range. Kiwi conservation (primarily through the trapping of predators, and through advocacy for dog control and road awareness) has been increasing within the range of Northland brown kiwi for the last 30 years. The success of this effort was reflected by North Island brown kiwi (of which Northland brown kiwi are one taxa) recently being re-classified as Not Threatened under the New Zealand Threat Classification System. This is remarkably good news, but it comes with the caveat that the new ranking is conservation dependent; the species is still in partial decline and is vulnerable to recruitment failure (Robertson et al. 2021). In summary, the change in status of North Island brown kiwi is due to the conservation efforts of individuals and communities, but if this effort reduces the birds' conservation status will also decline.

Kiwi listening surveys are useful as part of the suite of tools for monitoring. It has long been known that kiwi call counts can give a measure of range, presence/absence and general population trends over time, but no direct measure of abundance (Robertson & Colbourne 2017). It would be beneficial to have a tool to be able to measure kiwi abundance in a remote and non-invasive way. There is some recent research which shows promising results in being able to create a measure of abundance from kiwi calls (<https://www.birdsnz.org.nz/wp-content/uploads/2021/07/2107-Overview-article-Alberto-de-Rosa.pdf>). Any advances in tools of this nature will add even more value to the kiwi call count data set. It is important to remember that any advances which would enable kiwi call count surveys to measure abundance would still only record the mature adults - typically those at least 3-4 years old. Thus, the monitoring of changes in population via recruitment from chicks would be delayed until that cohort was 3-4 years old.

Currently some listeners do attempt to record the number of individual kiwi heard during their survey hours. This is easier to achieve when listening directly, rather than by analysing the data at a later time. It can be achieved by plotting the calls (distance and direction)

visually, then grouping those calls that are likely to be the same individual kiwi so they don't get counted more than once. It would be helpful for listeners to add this analysis to their kiwi listening surveys to provide an estimate of individual males and females present for each survey night. It is not possible to estimate the number of kiwi present using ALDs as no directional bearing is available.

Many kiwi listeners appreciated the option of the Kiwi-Coast created mobile app for the direct entry of their kiwi calls. The app not only reduces the workload for the listener, but it also ensures accurate and consistent data. You can find out more and download the app from the Kiwi Coast website (<https://kiwicoast.org.nz/kiwi-listening-app>). It is encouraged but not essential to use the app, but if the app is not used it is very important that the 2018 version of the kiwi listening spreadsheet template is used to store and collate the data. Paper field sheets are still required if this method is used. If listeners have any trouble with accessing or using the Kiwi Coast app or the correct template, they can contact the local kiwi listening co-ordinator or the Whangārei DOC office.

It is important that coordinators ensure that all core stations are listened from, and that listeners include all the relevant data, regardless of which data collection method is used. When carrying out kiwi listening, the following should be adhered to:

- The station is identifiable to those who enter and analyse the data for this report, and to future listeners who will repeat listening at the same station. This means that every kiwi listening card must include the individual station number (see Appendix 1), and this number must not be changed. If it is a new station that will be listened from consistently, please add the comment 'station number required' or similar in the comments field, and a number will be assigned in the subsequent report. Each card must also include an up-to-date GPS reference for the site. Both the station's number and GPS reference need to be written on every card, every night.
- Kiwi call cards need to be filled out in full, including all the fields, each night.
- Groups are required to enter their kiwi listening data into the spreadsheet. This needs to be sent to Tamra Gibson at the DOC Whangārei Area Office, no later than 31 August in the year in which it was collected. If it is not submitted by 31 August, it will not be included in the report.
- Please ensure the data are accurate. If you notice any errors or inconsistencies in the data used for this report, please advise Tamra Gibson immediately.
- There is consistency in kiwi listeners. Ideally this will mean the same person will listen from the same station for each of the 4 nights used for listening, and in subsequent years. If this is not practical, aim for at least having the same person covering the same stations for all 4 nights. The exception to this would be if the listener is no longer able to adequately detect kiwi calls, in which case a permanent replacement should be sought.
- Each station needs to be covered for 4 nights if possible. If this can't be finished in the first kiwi listening window it is possible to use the second window. It is more important that fewer stations are listened from for 4 nights than more stations for only 1-2 nights. This will produce more robust data and will give a more accurate measure of kiwi in your area.
- The core stations (those used to calculate the mean call rate for each cluster) are listened from each year. If it is not possible for a person to listen from each station then the use of ALDs should be considered. Both methods are thought to have similar listening ability (Castro et al. 2019).
- Please ensure the data are accurate. If you notice any errors or inconsistencies in the data used for this report, please advise Tamra Gibson immediately.

5.1 Other recommendations

- Provide new listeners with adequate training. This not only includes how to identify the difference between male/female kiwi calls, other species' calls that may be mistaken as kiwi, compass use and judging distances; but also how to fill out the forms fully, correctly and legibly. The Kiwi Best Practice Manual (Colbourne et al. 2020) is a useful tool.
- Try to map the location of calling birds during the 4 nights of listening. This will help to identify the minimum number of individuals and pairs heard from each station. These data are not used in this report at present, but it may be in the future. In the meantime, those groups who are analysing these data themselves are finding some interesting results.
- If you add a new listening station in your area, please identify it very clearly as a new station so that it can be allocated a consistent station number. Please make sure you also provide GPS co-ordinates for the station, a name that will make sense to everyone, and any other identifying or necessary information about the station.
- Please check the station numbers listed in Appendix 1. If any of these numbers are not accurate, please let Tamra Gibson (tgibson@doc.govt.nz) know as soon as possible.

5.1.1 Kiwi listening 2022 and 2023

Kiwi listening for 2022 should preferably be carried out from 19 May to 8 June, with a back-up window from 17 June to 7 July. The aim should be to complete listening during the first window, with the second window only used if weather and/or other variables prevent all 4 nights from being completed during the first window. The first 2 hours of darkness are around 6-8 pm.

Kiwi listening for 2023 should be carried out from 9 May to 28 May, with a back-up window from 7 June to 26 June. As with 2020, these windows are relatively early. It may be advisable to spread the listening across both windows if summer drought and/or other variables indicate a later than typical kiwi courtship period.

Information about kiwi listening can be found on the Save the kiwi website <https://savethekiwi.nz/about-kiwi/kiwi-facts/kiwi-calls/>, or on the Kiwi Coast website <https://kiwicoast.org.nz/kiwi-listening-app/>.

6. Acknowledgements

Thank you to all the people who carried out kiwi listening in 2021, your effort and contribution were invaluable, and your time and enthusiasm in obtaining information about kiwi in your area is very much appreciated.

Thanks to the local kiwi listening co-ordinators and to those who took the time to enter the data into the spreadsheets and to guide users through the use of the app again this year.

Thank you to KiwiCoast for progressing the app and providing training on the updated features, for new users and coordinators so everyone could get the most out of it.

Sincere thanks to NRC and Kiwi Coast for providing funding for the writing of this report.

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Appendix 1

Mean call count data for all Northland stations 1995–2021

STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Northern																															
1	Diggers Valley	1.1	2.4	4.1	2.5	2.1	3.3	4.1	3.8	3.0	3.9	3.9	2.7	1.3	2.0	1.7	-	2.5	-	-	-	-	2.8	0.9	-	-	-	0.6	-		
2	Takahue	4.3	3.5	5.5	5.4	6.3	8.4	7.9	4.5	3.3	4.8	5.3	5.0	3.6	4.9	3.1	4.8	11.4	6.9	5.3	2.4	0.1	0.0	-	-	-	-	-			
4	Gartons	5.6	5.0	1.2	-	0.8	2.0	8.6	-	1.5	4.1	4.9	7.1	1.5	1.3	0.0	0.1	0.3	0.8	0.3	0.3	0.0	0.1	-	-	-	-	0.4			
5	Kaiaka	1.7	1.3	2.4	3.4	1.6	3.5	3.0	2.1	1.9	3.8	2.8	1.5	0.0	0.8	-	1.6	1.1	0.3	1.6	1.6	2.0	-	-	-	-	3.0	-			
7	Puketī	6.6	5.4	2.1	3.0	6.0	7.6	6.4	3.5	5.0	3.4	1.5	2.3	0.8	3.9	4.0	6.9	9.4	6.3	6.3	5.9	5.6	5.6	9.8	8.3	7.4	4.0	5.3			
8	Puketi SR	5.4	6.5	4.4	4.0	5.1	6.5	6.1	6.4	8.3	9.4	2.3	5.1	7.4	8.9	9.0	7.9	9.0	11.8	9.8	7.6	5.4	9.3	9.0	12.1	12.4	10.1	8.8			
Mangatete																															
3	Lightning Hill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.5	13.5	10.0	17.6	20.5	17.1	17.6	16.0	8.1	12.0			
256	Baigents home drive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	14.1	15.4	14.8	17.5	10.4	10.1	13.9			
Honeymoon Valley																															
271	H-moon Valley Green Bach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	0.5	-	0.0	-	0.3	-			
272	H-moon Valley Lost Valley track	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-	-			
273	H-moon Valley Central Ridge of Beth's	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.6	-	-	-	-	-	-			
274	H-moon Valley Greg's driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-			
301	NZFRT reserve, campsite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6	5.1	4.4	-	1.8	-			
-	Toa Toa Ridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-			
Whakaangi																															
130	Whakaangi 1	-	-	-	-	-	-	-	-	-	-	9.0	10.4	4.6	7.6	6.3	-	-	-	-	-	-	-	-	-	-	-	-	3.8		
131	Whakaangi 2	-	-	-	-	-	-	-	-	-	-	14.9	25.0	15.3	20.8	17.1	16.1	9.4	8.0	4.8	3.1	14.1	4.9	-	2.8	-	-	-			
132	Whakaangi 3	-	-	-	-	-	-	-	-	-	-	13.5	14.6	9.0	10.8	12.2	12.2	5.5	3.1	6.8	3.9	4.4	5.9	-	4.2	-	4.3	-			
29	Whakaangi 4	-	-	4.5	-	2.9	1.9	6.3	3.8	4.9	6.6	2.3	6.8	6.3	4.9	5.8	9.8	5.0	-	-	-	-	-	-	-	-	5.3	4.4			
133	Whakaangi 5	-	-	-	-	-	-	-	-	-	-	9.8	13.8	10.1	-	8.3	-	7.9	4.1	-	3.5	7.1	6.8	-	5.2	-	4.5	6.9			

Continued on next page

Appendix 1 continued

STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
134	Whakaangi 6	-	-	-	-	-	-	-	-	-	-	6.0	7.3	3.9	-	9.5	7.0	-	-	4.5	-	-	-	-	-	-	-	1.9	
135	Whakaangi 7	-	-	-	-	-	-	-	-	-	-	21.9	28.0	24.5	27.0	25.9	21.9	23.4	19.1	11.9	13.6	9.0	5.3	0.5	2.6	3.3	1.5	5.3	
136	Whakaangi 8	-	-	-	-	-	-	-	-	-	-	14.1	29.0	11.8	18.8	15.3	10.5	20.0	15.3	12.8	13.0	10.9	4.5	6.8	7.3	1.3	7.0	6.4	
137	Whakaangi 9	-	-	-	-	-	-	-	-	-	-	4.8	8.4	5.6	6.5	4.9	8.1	5.0	-	-	2.6	3.0	0.8	4.8	1.8	1.8	-	-	
138	Whakaangi 10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.8	4.0	5.8	4.3	3.8	2.9	0.5	-	-	-	-	-	-	
140	Whakaangi 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.6	7.6	3.9	7.1	7.3	7.6	7.6	8.9	2.8	-	4.5	
247	Whakaangi 12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	-	5.3	-	
248	Whakaangi 13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.8	-	
250	Seon's Gate 17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.7	1.5	
Mahinepua-Radar Hill																													
90	Mahinepua 0	-	-	-	-	-	-	-	-	-	-	-	-	2.9	2.9	3.4	3.6	4.0	7.1	4.4	3.3	4.9	5.6	5.4	6.1	2.0	1.9	-	-
83	Mahinepua 1	-	-	-	-	-	-	-	-	3.5	-	2.6	4.1	3.5	2.6	2.4	2.3	3.1	7.5	6.8	4.3	4.8	4.3	7.9	8.1	2.1	2.8	-	-
84	Mahinepua 2	-	-	-	-	-	-	-	-	4.2	0.8	2.3	4.8	4.3	2.8	3.3	3.3	4.3	6.8	4.8	3.6	4.3	7.3	6.3	12.3	2.8	5.8	-	-
85	Mahinepua 3	-	-	-	-	-	-	-	-	5.6	4.8	4.0	5.5	5.4	3.3	5.9	5.3	5.3	10.3	5.0	5.9	5.4	7.3	6.4	12.5	5.8	8.1	-	-
88	Mahinepua 4	-	-	-	-	-	-	-	-	6.1	4.1	3.0	7.8	4.7	4.1	9.5	4.8	5.4	10.6	7.1	8.0	6.9	9.3	7.5	-	8.0	17.8	-	-
87	Mahinepua 5	-	-	-	-	-	-	-	-	-	-	-	-	2.4	0.9	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-
86	Mahinepua 6	-	-	-	-	-	-	-	-	1.0	2.5	2.3	-	0.4	0.8	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-
89	Mahinepua 7	-	-	-	-	-	-	-	-	0.9	5.9	1.8	4.8	1.9	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
181	Mahinepua 8	-	-	-	-	-	-	-	-	-	-	-	-	0.8	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
182	Mahinepua 9	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
183	Mahinepua 10	-	-	-	-	-	-	-	-	-	-	-	-	1.6	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
184	Mahinepua 11	-	-	-	-	-	-	-	-	-	-	-	-	2.9	1.3	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-
98	Mahinepua 12	-	-	-	-	-	-	-	-	-	3.5	2.3	3.8	2.5	3.4	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-
99	Mahinepua 13	-	-	-	-	-	-	-	-	-	3.9	3.8	7.4	7.3	5.0	9.4	7.8	9.5	16.0	9.6	6.9	11.0	10.9	9.3	-	-	22.5	-	-
92	Mahinepua 14	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.3	1.1	1.4	0.8	-	-	-	-	-	-	-	-	-	-	-
91	Mahinepua 15	-	-	-	-	-	-	-	-	-	-	-	-	1.0	1.1	1.6	1.8	3.1	-	-	-	-	-	-	-	-	-	-	-
93	Mahinepua 16	-	-	-	-	-	-	-	-	-	-	-	-	1.3	6.0	2.0	2.6	5.3	-	-	-	-	-	-	-	-	-	-	-
94	Mahinepua 17	-	-	-	-	-	-	-	-	-	-	-	-	2.5	4.9	5.0	3.4	6.9	-	-	-	-	-	-	-	-	-	-	-
95	Mahinepua 18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern																													
10	Marsden Cross	20.9	18.3	9.6	16.7	14.5	19.9	21.9	17.9	18.5	22.0	19.3	30.6	23.0	-	20.3	24.5	34.9	30.9	30.3	19.3	30.4	38.6	38.8	39.6	30.8	-	42.4	-
11	Puketotara	10.0	13.8	8.1	11.6	9.7	8.0	-	2.5	7.5	3.6	-	7.1	13.7	10.6	6.2	9.5	9.3	9.1	9.8	14.0	12.8	-	11.0	14.0	16.1	-	17.9	-

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STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
12	Rangitane	14.0	5.6	8.4	10.5	7.5	8.4	11.5	10.5	8.6	8.0	8.0	11.5	9.1	15.9	15.3	11.4	10.8	12.8	11.3	12.8	9.5	10.9	10.1	18.1	10.1	12.6	16.5
13	Waitangi No 12	7.6	7.6	6.3	8.9	5.3	7.1	11.5	15.1	18.4	13.8	11.5	15.5	6.3	-	-	-	-	6.8	7.4	3.0	4.8	7.5	11.5	6.0	5.8	4.0	8.0
14	Mt Bledisloe	27.1	10.9	5.5	7.9	8.8	5.1	6.4	6.8	4.9	8.9	9.1	5.5	9.6	11.3	8.3	11.4	13.7	7.4	10.8	6.8	7.9	10.9	8.3	12.8	7.6	8.0	7.3
15	Tikitikiore	10.8	13.5	6.1	6.1	4.5	6.5	2.9	3.3	3.1	6.1	3.4	13.0	7.9	11.0	12.25	12.3	13.5	17.8	14.5	12.4	15.1	25.5	20.4	24.6	7.8	18.6	16.1
									(12.3)	(7.1)						(5.25)												
Bay of Islands																												
146	Kauri Cliffs 1 (Pink Beach)	-	-	-	-	-	-	-	-	9.0	-	-	4.0	4.3	1.8	5.0	6.5	-	-	-	-	-	-	3.3	-	-	-	0.6
147	Kauri Cliffs 2 (Puriri)	-	-	-	-	-	-	-	-	-	-	-	1.5	3.0	2.8	1.0	-	-	-	-	-	-	-	-	-	-	-	-
148	Wiwiki Beach	-	-	-	-	-	-	-	-	-	-	-	32.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
149	Mataka Stn Gate, Purerua	-	-	-	-	-	-	-	-	-	-	-	4.0	4.1	8.3	6.8	18.5	3.3	10.0	6.9	-	-	-	-	-	-	-	43.6
150	McKenzie Rd, Purerua	-	-	-	-	-	-	-	-	-	-	-	9.5	12.1	10.3	5.0	7.5	-	2.5	-	-	-	-	-	-	-	-	-
151	Mtn Landing (Lot 30) Purerua	-	-	-	-	-	-	-	-	-	-	-	12.3	10.2	18.8	12.6	25.0	22.8	20.3	-	-	-	-	-	-	-	-	-
152	Waitoto Block	-	-	-	-	-	-	-	-	-	-	-	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
153	Aroha Island	-	-	-	-	-	-	-	-	6.9	-	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
154	Napia Bay	-	-	-	-	-	-	-	-	-	8.7	5.5	4.6	4.0	4.5	3.3	5.6	7.5	3.6	4.0	-	-	-	-	-	-	-	-
155	Stirlings Quarry	-	-	-	-	-	-	-	-	7.3	9.8	13.0	12.4	10.2	8.3	4.0	8.5	-	-	-	-	-	-	-	-	-	-	-
97	Kurapari Rd	-	-	-	-	7.1	-	-	-	12.7	8.8	9.3	10.4	5.5	6.0	6.8	4.8	2.3	5.5	7.0	-	-	-	-	-	-	-	-
138	Hupara	-	-	-	-	-	-	-	-	-	25.6	19.3	27.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
185	Akeake Reserve, Kerikeri	-	-	-	-	-	-	-	-	-	-	-	-	-	2.8	0.5	-	6.0	-	-	-	-	-	-	-	-	-	-
186	Cunningham Gardens, Aroha Island	-	-	-	-	-	-	-	10.8	8.6	-	-	-	-	-	-	-	8.2	-	-	-	-	-	-	4.8	-	8.1	
187	Gaitens, Rangitane Rd, Kerikeri	-	-	-	-	10.0	-	12.8	6.3	6.9	10.0	12.0	12.6	14.7	10.5	8.0	7.3	7.5	4.8	-	-	-	-	-	-	-	-	-
188	Blacksmiths Bay (east), Kerikeri (Lex Rennes)	-	-	-	-	-	-	-	10.3	10.3	7.7	8.3	6.2	6.0	8.0	4.5	6.9	8.8	6.4	0.0	-	-	-	-	-	-	-	-
189	Doves Bay, Kerikeri (Lockyer)	-	-	-	-	4.2	-	-	2.0	-	3.8	2.5	-	-	4.5	7.5	15.3	18.3	-	-	-	-	-	-	-	-	-	-
190	Rangitū, Opito Bay Road, Kerikeri	-	-	-	-	-	-	-	-	-	-	-	-	9.1	16.0	15.5	15.5	-	-	-	-	-	-	-	-	-	-	-
191	Tikorangi Road, Opito Bay, Kerikeri	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	4.5	4.0	-	-	-	-	-	-	-	-	-	-	-

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STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
192	Kraus, Hansen Rd, Purerua	-	-	-	-	-	-	-	-	-	3.3	-	-	-	-	11.0	-	-	-	-	-	-	-	-	-	-	-	-	
193	Mataka Beach, Mataka Station, Purerua	-	-	-	-	-	-	-	41.5	-	30.0	39.0	32.7	24.5	41.8	30.0	41.3	-	30.8	30.9	-	-	-	-	-	-	-	56.9	
194	Mataka Station, Ninepin Track, Purerua	-	-	-	-	-	-	-	-	-	30.0	-	-	-	50.8	43.5	-	18.0	-	24.0	-	-	-	-	-	-	-	-	
195	Mountain Landing (Lot 30) Wharengaere, Purerua	-	-	-	-	-	-	-	-	-	-	-	12.3	10.2	18.8	12.6	25.0	22.8	20.3	13.3	-	-	-	-	-	-	-	-	
196	Mountain Landing, Mataka Ridgeline, Purerua	-	-	-	-	-	-	-	-	-	-	-	7.5	10.1	18.0	25.5	14.3	22.0	-	-	-	-	-	-	-	-	-	64.4	
197	Mountain Landing, Paddle (Entrance), Purerua	-	-	-	-	-	-	-	-	-	-	-	8.5	10.2	12.5	14.3	17.0	-	-	-	-	-	-	-	-	-	-	-	
198	Mountain Landing, Poranui Point	-	-	-	-	-	-	-	-	-	-	-	-	7.3	14.5	16.0	13.8	-	-	-	-	-	-	-	-	-	-	36.3	
325	Top Vineyard Villa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36.9	28.9	-	-	
199	Twin Tanks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42.6	32.9	-	47.1	
200	Landing vineyard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199	Paoneone	-	-	-	-	-	-	16.7	-	-	-	-	-	-	-	-	-	37.6	-	11.3	-	-	-	-	-	-	-	-	
200	Pattersons Big Hill	-	-	-	-	-	-	9.0	-	-	-	30.5	-	4.0	20.5	70.3	33.0	35.5	-	-	-	-	-	-	-	-	-	-	
201	Pattersons, Rocky Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	16.5	19.5	17.7	11.7	-	-	-	-	-	-	-	-	-	-	
202	Tapuaetahi	-	-	-	-	-	-	-	-	-	-	-	5.0	-	3.0	3.3	16.5	-	-	7.4	-	-	-	-	-	-	-	-	
203	Wharengaere Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.5	15.5	-	-	-	-	-	-	-	-	-	-	
204	Wiroa Station	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	6.7	-	-	-	-	-	-	-	-	-	-	
205	Wiroa Station Hill 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	
206	Maintenance Facility, Kauri Cliffs	-	-	-	-	-	-	-	-	-	-	-	-	-	6.5	5.0	13.1	-	-	-	-	-	6.9	-	-	-	-	-	
207	Waiaua Bay, Matauri X	-	-	-	-	-	-	-	-	2.3	-	-	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	
208	Waterfall, Kauri Cliffs, Takou Bay	-	-	-	-	-	-	-	-	6.0	-	-	5.5	2.3	4.5	3.5	-	-	-	-	-	-	-	-	-	-	-	2.2	5.8
209	Hikurua Rd (end)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	
212	Drivers Whitehills farm	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	2.0	8.0	8.0	7.9	-	-	-	-	-	-	-	-	-	
213	Landcorp Takou Kiwi covenant	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	0.8	3.0	-	-	-	-	-	-	-	-	-	-	-	

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STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
214	Maori Block	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.3	-	-	-	
215	Otaha Station (south end)	-	-	-	-	-	-	-	-	-	-	-	-	1.5	3.0	-	3.5	-	-	-	-	-	-	-	-	-	-	-	
216	Just past Clinton's	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	
217	End of Te Ra Rd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	-	-	-	-	-	-	-	-	-	-	-	
219	Achtzehner, Bulls Gorge, Kerikeri	-	-	-	-	-	-	-	-	-	-	-	7.0	-	6.0	11.8	5.8	2.8	-	1.9	-	-	-	-	1.0	0.9	-	-	
220	Airstrip Rd (Baigent-Mercer)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	3.3	-	-	-	-	-	-	-	-	-	
221	Airstrip Rd (Sharp)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	-	-	-	-	-	-	-	-	-	-	-	
222	Candy Bush, Pukefī Road, middle ridge	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	6.0	-	-	-	-	-	-	-	-	-	-	-	-	
223	Candy Bush, Pukefī Road, red cliffs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	-	-	5.8	-	-	-	-	-	-	-	-	-	
224	Candy Bush, Pukefī Road, white/yellow path	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.0	-	-	11.0	-	-	-	-	-	-	-	-	-	
225	Kauri Hills, Totara North	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	6.3	-	-	-	-	-	-	-	-	-	
226	Poultons, Kerikeri River, Mangapararua Rd	-	-	-	-	-	-	-	-	-	-	-	-	-	9.0	-	6.5	-	5.4	4.6	-	-	-	-	12.3	9.0	-	-	
227	Puketotara Rd = 709	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.0	-	-	-	-	-	-	13.8	-	11.5	-	9.0	
228	Puketotara Rd = Kearney	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	
324	Puketotara Paddock 35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.5	
229	Waipapa Rd West, Kerikeri (Anne C.)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	
230	Waipapa Rd West, Kerikeri (Isabella C.)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	0.5	-	-	-	-	-	-	-	-	-	-	-	-	
231	Waitoto, 500 m west of Rhyolitic dome, Mangapararua	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.8	0.6	-	-
232	Waitoto, Rhyolitic dome, Mangapararua Road	-	-	-	-	-	-	-	-	-	-	-	-	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
233	Wharau Rd, Kerikeri (Manning)	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	4.6	8.0	5.0	-	-	-	-	-	-	2.6	0.3	-	-	
234	Wharau Rd, Kerikeri (Starr)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.6	2.5	-	5.5	3.5	4.5	-	-	-	7.0	
234	Wharau Rd, Kerikeri (Starr)	-	-	-	-	-	-	-	-	-	-	-	-	-	6.3	7.0	-	-	-	-	-	-	-	-	-	-	-	-	

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STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		
	Lodore Rd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.9	-	12.0	-	-		
	Paddock 35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.1	9.1	-	-		
	Rangihoura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34.4	-	-		
282	Palm Drive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	-		
303	Te Puke	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	9.6	7.5		
304	Blue Penguin Drive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.1	14.4		
305	Rangitane River Park	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.3	-	-	
322	Cunningham Gardens Waiare Rd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	
323	Opua Forest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	
327	Harlens Taupo Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.4	
	Puketi Forest																													
102	Bramley's Rd	-	-	-	-	-	-	-	-	-	-	-	2.5	0.5	2.0	2.0	2.8	2.8	2.5	2.0	-	3.4	2.4	2.3	3.9	1.0	-	-		
103	Pirau Ridge	-	-	-	-	-	-	-	-	-	-	-	0.0	-	0.0	1.0	0.5	1.3	1.4	1.4	0.5	1.6	0.9	1.0	-	2.3	-	-		
104	Pond	-	-	-	-	-	-	-	-	-	-	-	4.5	1.0	3.8	5.0	3.5	8.0	6.9	4.6	5.9	3.3	4.9	2.9	9.5	6.1	3.8	10.0		
105	Pudding Bowl Hill	-	-	-	-	-	-	-	-	-	-	-	0.3	0.8	1.1	2.0	2.0	1.0	-	3.0	-	-	-	-	-	-	-	-		
106	Takepau Track	-	-	-	-	-	-	-	-	-	-	-	0.0	1.0	0.0	2.5	3.3	2.4	2.6	1.4	-	1.1	1.9	4.9	4.5	5.4	2.3	3.5		
107	Takepau/Pirau Rd Junction	-	-	-	-	-	-	-	-	-	-	-	0.5	-	1.0	2.8	1.4	3.5	1.5	1.1	0.9	1.6	1.5	1.4	3.6	1.6	2.6	3.3		
108	Totara Ridge	-	-	-	-	-	-	-	-	-	-	-	5.8	-	0.8	7.1	3.5	6.1	4.6	5.9	5.0	1.8	4.1	2.4	6.8	5.4	1.1	8.1		
109	Waihoanga Gorge	-	-	-	-	-	-	-	-	-	-	-	2.0	-	3.8	5.4	3.3	6.3	4.5	4.3	-	5.8	5.5	4.4	8.1	7.1	4.4	8.4		
110	Waihoanga Gorge 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	2.5	1.5	-	4.5	-	-	-	-	-	-	-	-		
111	Walnut	-	-	-	-	-	-	-	-	-	-	-	4.3	2.5	1.3	3.3	3.0	5.3	4.0	4.8	6.1	4.9	7.9	5.3	5.4	3.1	0.9	4.4		
112	Stoat line 9 – Puketi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1	4.0	3.6	1.4	4.0	1.0	3.6	3.4	4.0	0.3	2.1		
259	Puketi Nature Trail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	-	3.3	-	-	-	-	-	-	3.3	3.8	1.3	
	Waimate North																													
113	W1	-	-	-	-	-	-	-	-	-	23.5	15.8	24.8	-	-	25.5	25.8	23.6	23.1	23.8	27.1	30.8	34.5	31.4	26.6	-	27.4	38.3		
114	W2	-	-	-	-	-	-	-	-	-	12.3	7.0	9.5	7.9	11.5	5.8	14.5	11.6	12.5	7.1	5.1	8.6	4.8	8.8	7.6	6.8	6.9	11.9		
115	W3	-	-	-	-	-	-	-	-	-	14.9	-	-	-	-	-	-	1.0	0.0	1.0	1.4	2.0	1.3	1.1	-	-	-	-		
116	W4	-	-	-	-	-	-	-	-	-	9.4	10.5	6.0	-	8.0	-	8.5	13.5	10.5	10.9	8.5	8.0	7.0	12.1	9.4	7.6	13.9	15.9		
117	W5	-	-	-	-	-	-	-	-	-	5.9	1.8	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Continued on next page

STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
118	W6	-	-	-	-	-	-	-	-	-	22.3	11.0	5.7	8.5	7.3	9.1	5.6	10.6	8.0	7.5	10.4	11.0	13.3	10.9	15.9	9.8	19.4	10.4	
119	W7	-	-	-	-	-	-	-	-	-	-	5.3	6.5	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	
120	W8	-	-	-	-	-	-	-	-	-	13.8	2.8	1.0	8.1	8.0	5.5	8.1	9.1	11.9	9.1	11.3	8.1	7.1	5.3	5.6	5.1	3.9	3.5	
121	W9	-	-	-	-	-	-	-	-	-	5.2	3.5	2.1	2.3	3.5	-	-	-	-	1.0	5.5	2.9	7.3	2.6	-	-	4.3	3.0	
122	W10	-	-	-	-	-	-	-	-	-	-	-	7.3	8.3	5.9	5.3	4.1	7.3	5.1	4.1	8.0	4.4	5.3	-	4.4	7.0	10.1	11.3	
123	W11	-	-	-	-	-	-	-	-	-	7.1	7.8	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
124	W12	-	-	-	-	-	-	-	-	-	18.9	9.8	6.1	3.6	5.9	6.0	7.9	6.3	4.6	5.1	8.0	8.1	7.4	6.1	5.5	7.8	5.8	4.8	
178	W13	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	2.8	-	-	-	-	-	-	-	-	-	-	-	-	
127	W14 Sacro Bosco	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.9	0.5	0.0	-	-	-	-	-	2.9	0.9	-	1.4	1.9	
128	W16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9	2.2	-	-	-	-	-	-	-	-	-	-	-	
Hupara																													
258	Hupara Land Care 1 (Bill's Plateau)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.3	15.1	21.4	25.0	26.4	21.4	24.8	24.1	32.4	38.3	
245	Hupara Land Care 2 (Mike Sullivan's)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.9	11.0	16.0	-	-	-	-	-	-	
246	Hupara Land Care 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.4	-	-	-	-	-	-	-	-	
257	Hupara Land Care 4 (Home Orange Tree)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.6	9.0	17.1	12.1	19.9	11.3	13.9	11.6	
294	Hupara Land Care Harrison's Property	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35.3	-	-	-	38.5	-	
Russell																													
59	Opito Farms	-	-	-	-	-	5.7	-	9.9	-	-	4.6	13.1	6.1	9.1	6.8	4.3	5.3	8.1	6.9	11.5	10.1	-	13.5	13.5	10.1	13.3	30.4	
60	Flagstaff/Te Maiki	-	-	-	-	-	3.7	1.3	1.3	-	-	4.3	-	-	6.4	-	2.5	4.3	3.9	3.3	3.3	3.9	3.4	5.8	5.0	4.9	15.4	-	
61	Milne Ct	-	-	-	-	-	-	-	-	-	-	-	6.3	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
62	Uruti Rd	-	-	-	-	-	10.8	7.6	10.5	-	-	7.6	14.4	7.9	5.0	12.8	12.3	12.8	11.5	13.9	6.9	15.0	21.6	11.1	17.1	11.9	13.8	16.6	
156	Russell Heights	-	-	-	-	-	-	-	-	-	-	-	9.8	4.8	5.0	2.5	5.0	-	-	-	-	-	-	-	-	-	-	-	
170	Nikau Block	-	-	-	-	-	-	-	-	-	-	12.9	10.0	12.0	12.0	8.9	14.3	9.1	20.8	14.6	14.9	12.0	10.4	16.1	5.8	9.1	20.5		
171	Mace/Farmer	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6	4.8	17.6	10.4	6.3	4.0	4.0	14.3	12.8	21.6	32.2	19.4	20.5	34.5	
172	Pipiroa Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	3.0	2.0	2.8	6.0	5.4	5.6	3.0	3.3	3.6	4.8	7.0	5.4	3.9	
173	Shortlands	-	-	-	-	-	-	-	-	-	-	2.0	2.0	2.5	1.4	1.1	1.3	-	2.3	1.1	2.0	-	-	1.3	11.1	1.4	5.5	7.8	
174	Johnsons	-	-	-	-	-	-	-	-	-	-	-	10.0	9.8	12.8	10.0	10.0	11.4	8.5	10.1	10.3	11.3	12.8	12.3	11.9	5.6	12.0	16.1	
176	Jarvis	-	-	-	-	-	-	-	-	-	-	5.4	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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Appendix 1 continued

STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
177	Soloman's Gate	-	-	-	-	-	11.5	6.4	-	-	-	-	-	-	-	-	-	5.4	6.3	4.9	14.0	9.5	-	9.3	-	5.5	7.0	14.6	
210	Paroa Bay, Russell	-	-	-	-	-	-	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
211	Eagles Nest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	-	-	-	-	-	-	-	-	-	-	-	-	
326	Whangamumu Track	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.4	
	Ngaiotonga	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.9	-	-	
	Southern																												
23	Marlow Road	22.4	13.9	14.0	17.8	19.8	21.3	22.9	-	19.8	17.6	12.1	10.0	13.3	11.1	10.3	7.3	13.1	15.4	14.0	18.4	20.1	18.8	21.1	18.4	16.4	8.3	24.4	
24	Purua North	12.1	13.0	10.3	10.5	10.6	15.0	12.8	12.5	13.3	10.9	12.6	13.6	18.3	18.3	9.9	13.5	10.0	16.1	16.0	17.6	14.9	16.3	13.8	13.5	-	11.0	17.5	23.8
25	Rarewarewa-early listen	-	-	-	8.0	10.4	4.6	7.0	6.5	4.6	5.9	5.6	4.8	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
25	Rarewarewa South	7.5	8.0	8.5	6.6	8.3	6.6	7.0	5.8	6.5	6.6	5.3	6.3	6.6	6.4	8.9	4.0	7.9	6.5	4.6	7.5	7.5	9.1	11.3	10.3	12.9	13.7	15.5	
26	Mimiwhangata	11.0	5.6	3.5	3.6	0.3	9.4	19.1	20.3	13.8	20.3	14.3	21.0	19.5	12.9	11.0	8.4	-	11.0	9.0	12.1	9.6	10.8	14.6	9.8	11.1	-	6.3	
34	Motatau 1	-	-	-	-	8.8	-	10.0	15.0	6.8	7.5	5.6	6.5	7.5	8.8	6.0	-	4.9	2.5	-	-	4.9	-	-	-	-	-	-	
35	Motatau 2	-	-	-	-	-	-	2.7	-	-	-	1.5	3.0	2.5	-	-	-	4.3	-	5.5	-	-	-	-	-	-	-	-	
36	Motatau 3	-	-	-	-	-	-	4.8	1.5	2.8	5.5	3.5	4.6	4.0	0.9	-	-	5.5	-	-	-	-	-	-	-	-	-	-	
38	Motatau 5	-	-	-	-	-	-	1.5	1.3	0.9	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
68	Motatau 9/ Marlow 1	-	-	-	-	-	-	-	11.7	11.8	17.6	13.5	10.5	9.3	2.9	7.1	3.0	9.8	9.9	9.3	5.4	-	11.9	11.8	9.5	10.5	10.3	8.5	
81	Purua South	-	-	-	-	-	-	-	-	14.8	15.9	14.4	14.1	14.6	10.5	12.5	11.1	17.5	10.8	7.3	18.6	9.5	7.3	11.5	29.8	19.5	20.0	24.6	
82	Rarewarewa North	-	-	-	-	-	-	-	-	9.8	6.6	4.0	8.5	7.9	10.4	11.4	11.9	12.1	10.0	7.9	6.9	-	8.1	6.3	13.4	11.9	10.9		
129	Motatau 10/ Marlow 2	-	-	-	-	-	-	-	-	-	7.1	7.5	10.9	9.0	5.8	2.2	3.4	5.0	5.4	7.8	2.3	4.5	3.9	5.9	5.2	5.9	12.0	14.0	
139	Hodges Bush	-	-	-	-	-	-	-	-	-	-	9.8	13.0	16.1	17.8	15.5	16.6	9.5	13.8	28.6	22.0	23.1	11.8	16.0	15.5	12.8	10.8	14.3	
145	Whangaruru	-	-	-	-	-	-	-	-	-	-	6.0	6.0	10.3	13.4	10.8	24.3	13.5	9.4	7.8	4.4	10.0	5.4	3.5	6.0	6.1	6.8		
167	Kaikanui Rd	-	-	-	-	-	-	-	-	-	-	-	8.5	11.6	15.0	8.4	7.3	3.8	2.9	-	-	-	-	-	-	-	-		
168	Worsp Rd	-	-	-	-	-	-	-	-	-	-	-	-	1.8	2.4	2.0	5.8	1.4	-	-	-	0.1	2.0	-	-	-	-		
264	Whau Valley Dam	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-		
	Tanekaha 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0	-	-	-	
	Tanekaha 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1	-	-	-	-	
276	Hay Rd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	-	-	-	
	Tutukaka Coast																												
125	TLC 1	-	-	-	-	-	-	-	-	9.8	5.9	7.1	8.8	10.9	11.6	8.1	8.6	12.4	12.0	12.1	9.6	7.4	11.5	13.8	17.6	12.5	8.8	14.9	
126	TLC 2	-	-	-	-	-	-	-	-	-	8.4	7.8	9.8	10.3	6.5	-	7.4	2.8	10.0	-	6.8	10.9	9.5	16.9	14.9	-	7.5	8.8	
142	TLC 3	-	-	-	-	-	-	-	-	-	-	3.0	4.6	3.6	3.0	-	-	9.3	8.5	7.1	5.4	4.1	8.6	-	5.6	-	2.9	-	
28	TLC 4	-	7.3	-	-	8.0	4.4	-	-	10.7	7.3	4.4	10.0	-	-	8.2	4.5	-	-	-	6.5	-	-	-	12.0	10.1	-	5.8	
143	TLC 5	-	-	-	-	-	-	-	-	-	-	4.1	6.0	3.3	7.1	4.0	2.3	3.8	-	-	3.5	-	-	-	-	-	-	-	

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STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
144	TLC 6	-	-	-	-	-	-	-	-	-	-	9.2	-	13.0	15.2	6.5	8.8	-	-	-	-	-	-	-	-	-	-	-	
160	TLC 7	-	-	-	-	-	-	-	-	-	-	-	4.4	-	-	4.8	4.9	-	5.5	2.1	3.0	-	-	-	-	-	-	-	
100	Kaiatea 1	-	-	-	-	-	-	-	-	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
101	Kaiatea 2	-	-	-	-	-	1.2	2.0	1.3	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
27	Sandy Bay 1	3.6	3.4	2.8	8.0	6.1	3.3	3.5	-	3.0	-	2.5	-	4.5	6.8	3.8	5.3	-	4.2	5.5	4.3	3.9	5.8	6.3	6.0	3.6	2.4	5.9	
260	Sandy Bay 2	-	-	-	-	-	-	-	-	-	-	-	4.5	-	-	3.8	3.5	2.5	4.5	-	3.0	5.9	6.4	9.3	3.6	2.4	0.8	2.9	
261	Sandy Bay 3	-	-	-	-	-	-	-	-	-	-	-	4.5	-	-	-	1.0	-	4.0	7.5	3.9	3.9	8.5	5.5	4.8	1.6	3.4	3.3	
	Rayonnier Forest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1	-	-	-	-	
292	Sandy Bay Farms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.8	6.1	-	4.7	
293	Te Toiroa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.0	5.1	-	5.3	
	Pukenui Rd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.1	-	-	-	
295	Ngahere Pines	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.0	-	13.6	15.4	
306	Gunther	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.8	12.1	
308	Otito N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	
	Reserve Matapouri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
309	Morrison Ridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	
	Track Matapouri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
310	North	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	1.4	
	Onekainga Whananaki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
311	Harman Farms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	0.8	
	Lookout Whananaki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
312	Dawson's	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.5	3.4	
	Property Whananaki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
313	Hailes Road Whananaki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.3	2.3	
319	Kakariki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.3	
320	Tutu Quarry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.4	
	KiwiLink																												
302	Owhiwa Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-	0.0	0.0	
	Kauri Villas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
314	Kumara Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	
315	Ohuatahi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.7	
316	Sue's bus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9	

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Appendix 1 continued

STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Glenbervie																												
21	Glenbervie 7A	5.0	6.4	7.1	7.5	5.0	0.5	1.0	2.4	1.0	-	1.3	-	2.4	2.5	1.9	1.8	2.6	1.1	4.3	-	-	-	1.9	3.9	3.1	6.1	1.8
22	Glenbervie 9A	11.2	3.8	4.3	7.3	5.9	12.6	6.8	5.3	4.5	6.5	-	1.8	2.8	2.9	1.4	2.9	1.6	6.8	6.9	2.8	2.0	-	5.3	-	8.1	6.0	5.6
283	Glenbervie 10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	4.0	2.2
284	Glenbervie 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4	2.9	3.5
296	Glenbervie 14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	1.2
Pukenui																												
285	Pukenui Loop Track	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	1.3	2.0
286	Whau Valley Dam	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.0	-
287	Pukenui Loop by B Line	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	3.3	-
288	Steps on Loop Line (between N and O)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.3	4.1
289	Forest Edge Smithville	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	1.0	2.1
297	Woods Road Quarry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-
298	Stonelea Way	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.6
299	Clements Quarry Trig	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	0.3
300	Pukenui	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1	-
318	Taraire Ridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5
Whangārei Heads																												
39	Bream Hd 1	-	-	-	-	-	-	5.0	3.1	5.8	3.1	4.7	5.1	3.5	5.0	6.0	3.0	7.1	9.5	9.6	9.6	10.0	12.1	7.4	11.3	8.0	10.5	13.6
40	Bream Hd 2	-	-	-	-	-	-	1.2	2.0	1.3	2.1	2.4	2.0	2.8	2.0	-	-	1.3	-	-	-	-	-	-	-	-	-	-
41	Bream Hd 3	-	-	-	-	-	-	-	-	-	-	1.5	2.0	1.3	1.6	-	-	-	8.4	8.6	8.6	6.1	6.9	6.0	4.5	3.0	3.0	20.4
42	Bream Hd 4	-	-	-	-	-	-	1.2	2.0	1.3	2.1	2.4	2.0	1.5	3.1	2.0	2.0	5.4	5.3	7.6	2.1	6.3	3.8	6.8	8.5	6.8	10.0	11.4
69	Bream Hd 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9	6.8	4.4	-	5.0	3.3	3.3	-	3.6	13.6
44	Taurikura 1	-	-	-	-	-	-	-	-	-	-	1.5	2.0	-	4.4	4.9	3.1	12.6	9.6	10.8	-	-	-	-	-	-	-	-
45	Taurikura 2	-	-	-	-	-	-	-	-	-	-	-	-	-	9.0	8.5	10.9	10.3	5.5	10.4	11.9	8.6	11.3	10.3	9.8	8.4	9.1	15.4
46	Taurikura 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	1.9	5.9	4.6	4.0	7.5	4.8	6.0	-	4.8	4.0	4.1	6.1
47	Manaia 1	-	-	-	-	-	-	3.5	2.5	4.3	4.0	3.3	3.9	2.1	5.1	3.9	3.3	10.3	2.9	2.8	3.6	1.5	9.4	8.8	13.5	4.5	9.4	14.5
48	Manaia 2	-	-	-	-	-	-	4.0	4.5	4.9	5.8	4.0	5.3	7.4	7.6	8.8	10.8	8.4	16.6	13.3	15.9	15.1	15.6	13.5	15.3	8.9	21.0	28.8
49	Manaia 3	-	-	-	-	-	-	3.3	3.9	2.9	-	2.1	3.0	-	4.0	3.1	3.5	6.3	3.1	5.1	3.6	7.5	7.1	9.3	6.8	-	6.8	11.9
71	Manaia 8	-	-	-	-	-	-	-	1.5	0.3	1.0	1.2	2.0	1.5	1.4	1.9	0.8	2.1	-	4.6	-	3.3	4.8	3.9	3.1	1.8	6.5	4.5
262	Manaia 9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.8	3.6	6.9	9.1	6.0	-	10.0	-	-	-	-
54	Kauri Mtn 1	-	-	-	-	-	-	4.5	1.5	-	3.1	7.4	1.3	-	1.4	3.0	2.1	2.5	3.6	4.6	4.4	3.8	7.4	6.5	5.1	4.5	3.3	7.8

Continued on next page

STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
72	Kauri Mtn 2	-	-	-	-	-	-	-	5.1	3.2	4.3	2.7	2.3	0.4	2.3	3.6	2.4	3.4	5.3	5.0	6.3	6.8	9.6	7.1	5.6	4.9	3.9	7.0			
73	Kauri Mtn 3	-	-	-	-	-	-	-	2.0	1.0	1.0	1.3	2.5	-	5.0	3.4	1.1	6.0	3.3	3.2	5.1	6.9	7.0	6.8	4.8	-	4.4	9.3			
74	Kauri Mtn 4	-	-	-	-	-	-	-	4.8	5.9	2.6	3.0	2.9	-	2.0	2.0	3.4	3.9	3.8	3.3	4.1	4.8	5.6	6.1	5.8	4.5	6.3	6.6			
141	Kauri Mtn 5	-	-	-	-	-	-	-	-	-	-	2.3	1.9	1.3	2.5	3.1	3.3	4.8	4.1	3.0	4.9	4.8	8.9	8.9	6.3	6.4	6.1	6.5			
127	The Nook 1	-	-	-	-	-	-	-	-	-	1.8	1.5	0.9	-	0.7	1.4	1.3	2.3	-	0.9	-	-	-	-	-	3.0	-	3.0			
56	The Nook 2	-	-	-	-	-	-	6.0	2.1	3.3	3.8	4.0	5.3	-	5.0	4.5	7.8	9.3	8.4	6.4	4.1	1.6	3.9	8.5	6.1	4.0	4.3	8.0			
128	The Nook 3	-	-	-	-	-	-	-	-	-	-	-	-	-	3.4	4.8	5.0	3.4	3.4	4.6	-	-	-	-	-	-	-	-			
58	Nook Rd	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8	-	3.7	4.6	1.5	-	-	-	-	-	-	-	-	-			
263	Craig Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.0	14.1	12.3	9.3	13.5	12.3	10.6	14.3	7.0	11.8	14.8			
75	McCleod Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.6	5.9	8.8	7.4	7.3	3.0	6.1	13.8			
	Maungatika Scenic Reserve 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.9	0.4	0.8	0.1	-	-	-			
Western																															
16	Katui	47.6	39.4	20.4	28.2	17.5	16.1	14.4	-	14.9	13.9	-	4.0	-	0.0	-	0.3	-	-	0.0	0.0	-	-	-	1.5	5.0	1.0	1.3	1.3		
17	Trounson North	8.5	17.3	12.5	19.0	16.0	14.3	16.1	-	15.3	19.9	22.2	15.4	-	13.8	22.3	5.8	15.1	12.0	10.0	5.3	7.6	9.4	11.1	13.5	9.4	-	13.0	-		
18	Cathedral	2.3	3.8	5.1	5.5	5.1	1.8	2.8	5.9	5.3	4.9	4.0	4.6	4.4	3.0	1.6	2.8	4.1	2.6	4.4	5.8	7.1	7.1	6.1	6.0	5.2	2.5	5.8			
19	Waipoua L/Out	30.9	24.4	30.8	27.7	21.4	21.8	14.6	8.4	16.9	22.8	23.0	7.9	11.8	6.0	6.0	9.3	15.6	8.9	10.0	12.5	12.4	12.0	11.6	9.6	10.0	-	13.0			
20	Paerata	9.9	1.3	3.1	6.5	2.8	3.1	1.3	-	0.0	-	-	-	-	0.9	1.1	1.6	0.3	0.4	1.1	0.3	0.6	-	-	-	-	-	-	-		
31	Te Matua Ngahere	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.3	4.1	-	-	-	-	1.2	-	3.4	2.0	2.5	2.3	1.5			
33	Trounson South	-	-	-	-	-	-	12.3	-	23.8	19.1	-	-	-	8.2	8.9	-	11.1	12.3	10.0	6.0	7.8	10.5	5.9	7.9	12.5	10.0	13.6			
79	Toronui Track	-	-	-	-	-	-	-	-	1.8	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
96	Kawerau Rd Cr	-	-	-	-	-	-	-	-	3.4	2.0	0.3	0.4	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
157	Opouteke CHH	-	-	-	-	-	-	-	-	-	-	-	6.6	6.1	2.8	11.3	-	-	-	-	-	-	-	-	-	-	-	-			
158	Pipiwai CHH	-	-	-	-	-	-	-	-	-	-	-	7.3	0.5	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-			
179	Marlborough 13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
244	Maunganui Bluff	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-			
265	River Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-	2.6	-	5.0	3.1	-	2.0	2.3			
266	Wekaweka LC 1 (Alf's Cottage)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.2	-	-	-	-	-	-	-	-	-			
267	Wekaweka LC 2 (Rob's Place)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-	0.1	0.1	1.0	-	0.1			
268	Wekaweka LC 3 (Libby's track)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	1.3	1.4	0.8	-	0.1			
	Wekaweka (The Drop)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			

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Appendix 1 continued

STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
	Wekaweka (1052 Wekaweka Road)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	
13b	Site 13	-	-	-	-	5.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
14b	Site 14	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16b	Marlborough Rd Site 16	-	-	-	-	4.4	2.1	1.5	1.4	0.6	2.0	0.4	0.5	1.0	0.0	1.0	-	-	-	-	-	-	-	-	-	-	-	0.6	
18b	Site 18	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
28b	Site 28 SH12	-	-	-	-	6.3	8.9	3.6	4.1	5.1	-	7.6	4.5	8.4	5.1	6.5	-	-	-	-	-	-	-	-	-	-	-	7.2	6.5
30b	Site 30 SH12	-	-	-	-	2.0	3.0	0.9	-	-	-	1.5	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	0.8	
31b	Site 31	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
32b	Site 32	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Piroa/Brynderwyn																													
290	1 PBL Trig	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	1.6	0.4	
291	2 Cullen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	-	-	
321	3 Massey	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	
253	Marunui 1 (House 17 deck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	2.6	4.3	3.3	5.6	3.6	4.0	3.0	
275	Marunui 2 (Pebblebrook Rd)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	3.0	6.9	3.5	-	-	2.4	
317	Marunui 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1	
Mataia																													
254	Mataia 1 KLD (Top of fishing track)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	-	4.0	3.3	4.6	7.8	6.4	
255	Mataia 2 KLD (Mid pa track)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	-	0.5	1.9	-	2.6	3.0	5.4	
	Mataia 3 KLD (Cliffs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	-	-	-	-	-	
280	Mataia 4 (Quarry)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	3.0	2.1	4.9	
281	Mataia 5 (Hooper's Bush)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	2.0	2.8	
Tawharanui																													
161	TWN 1 Marine triangle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.2	0.5	-	1.3	2.3	2.9	2.6	4.0	4.4	4.1	0.9	1.0	3.1	
162	TWN 2 Trig triangle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.2	0.7	-	3.9	1.9	1.3	2.9	6.6	5.9	10.8	7.9	8.0	8.6	
163	TWN 3 Top ecology track	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.3	-	1.6	2.0	4.6	6.0	5.0	4.5	4.4	4.9	2.5	4.4	
164	TWN 4 Possum gully	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	2.8	1.4	8.0	2.8	4.6	2.4	7.0	4.8	4.0	6.8	
165	TWN 5 Twin hills	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.2	0.0	-	2.3	1.9	3.3	3.5	6.8	7.3	4.8	6.4	5.0	8.4	

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Appendix 1 continued

STN No.	STATION NAME	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		
166	TWN 6 South coast water tank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	0.3	-	4.9	6.5	8.0	9.5	6.4	3.0	12.6	11.6	12.1	18.4		
Kawau Island																														
269	Bostaquet Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6	-	-	-	-	-	-	-	-	-	-	-
270	South Cove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-
277	Skid 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	1.1	2.3	2.4	3.5	-	-	-	-
278	Skid 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	1.5	2.8	2.8	2.2	-	-	-	-
279	Harris Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1	3.1	3.5	2.8	2.3	-	-	-	-

Appendix 2

Summary of Northland kiwi listening data for stations listened from in 2021

STN. No.	STATION NAME	LISTENER	1				2				3				4				TOTAL	MEAN
			1	2	1	2	1	2	1	2	1	2	1	2	1	2				
Northern																				
4	Garton's	B Buhler, D Mikrut	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	0.38	
7	Puketi	Dan O	12	3	4	4	4	1	5	12	1	42	1	5.25						
8	Puketi SR	N & E Walker	10	7	4	11	11	11	11	8	8	70	8.75							
Mangateke																				
3	Lightning Hill	L Baigent	9	14	11	4	19	13	13	18	8	96	12.00							
256	Home drive	A Baigent	16	10	21	13	11	13	12	15	111	13.88								
Whakaangi																				
130	Wha 1	Aldrich/Vujcich	4	1	4	6	4	4	4	6	1	30	3.75							
29	Wha 4	G Seon	8	9	2	1	2	2	2	3	8	35	4.38							
133	Wha 5	A & D Bell	10	1	7	14	6	6	6	5	6	55	6.88							
134	Wha 6	K Connop	2	3	2	1	2	2	2	1	2	15	1.88							
135	Wha 7	B Jarvis	12	6	2	8	4	3	3	4	42	5.25								
136	Wha 8	P & P Johnston	8	6	7	7	2	7	10	4	51	6.38								
140	Wha 11	D Wallace	5	8	3	2	3	6	-	-	27	4.50								
250	Seon's gate 17	T Seon	2	5	2	1	2	0	0	0	12	1.50								
Eastern																				
10	Marsden Cross	C Hambrook	45	40	48	39	37	35	44	51	339	42.38								
11	Puketotara	Ann K	16	18	23	16	28	9	23	10	143	17.88								
12	Rangitane	D Bayens-Wright	21	12	20	15	17	14	18	15	132	16.50								
13	Waitangi No. 12	Darran L	9	6	6	8	5	21	8	1	64	8.00								
14	Mt Bleisloe	Hana H	7	16	7	6	2	6	-	-	44	7.33								
15	Tikitikiore	Laurence G	22	13	8	28	18	3	17	20	129	16.13								

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STN. N.O.	STATION NAME	LISTENER	1				2				3				4				TOTAL	MEAN
			1	2	1	2	1	2	1	2	1	2	1	2	1	2				
Bay of Islands																				
146	Kauri Cliffs 1 (Pink Beach)	not stated	0	0	0	3	0	0	0	0	0	2	0	5	0.63					
149	Mataka Stn Gate, Purerua	A. Mentor	49	39	32	44	44	40	44	40	54	47	349	43.63						
186	Cunningham Gardens	not stated	5	11	12	6	10	12	4	5	65	8.13								
193	Mataka Beach	ALD	58	63	62	70	59	36	60	47	455	56.88								
196	Mataka Ridgeline	M Cadogan/A Mentor	62	72	65	74	45	94	45	58	515	64.38								
198	Mountain Landing, Porauenui Pt	ALD	38	33	24	16	39	40	61	39	290	36.25								
233	Wharau Rd, Kerikeri (Manning)	not stated	5	9	4	14	1	5	7	11	56	7.00								
303	Waitangi Forest/Te Puke	not stated	11	6	7	8	6	5	15	2	60	7.50								
304	Blue Penguin Drive	not stated	15	15	13	17	9	9	21	16	115	14.38								
322	Waiare Rd (new)	not stated	0	0	2	1	0	0	3	2	8	1.00								
323	Opua Forest (new)	not stated	1	1	1	3	0	0	1	0	7	0.88								
207	Waiaua	not stated	0	0	1	2	2	2	0	0	7	0.88								
208	Takou Bay	not stated	3	8	7	4	5	6	7	6	46	5.75								
227	Puketotara Rd - 709	Ann K	12	9	5	11	15	8	8	4	72	9.00								
324	Puketotara Paddock 35	Jane H	10	21	14	12	6	10	16	27	116	14.50								
325	Landing Vineyard	ALD	46	65	51	58	46	-	39	25	330	47.14								
327	Harlen's Taupo Bay	I Roger, E Whyte et al.	23	16	20	30	17	10	17	14	147	18.38								
Pukeki Forest																				
104	Pond	A Groot et al.	11	8	11	14	8	10	9	9	80	10.00								
106	Takapau Track	P Hodgson	3	3	1	2	7	2	9	1	28	3.50								
107	Takepau/Pirau Rd Jn	H & J Bonham et al.	6	2	1	3	0	1	5	8	26	3.25								
108	Totara Ridge	N Curtis, A Hawkins et al.	17	2	10	12	7	3	10	4	65	8.13								
109	Waihoanga Gorge	C & R Robinson	4	5	8	5	17	9	14	5	67	8.38								
111	Walnut	G Adams, A Groot	2	5	2	3	9	5	8	1	35	4.38								
112	Stoat line 9 - Pukeki	C Beaver, I Wilson	1	0	2	6	4	2	0	2	17	2.13								
259	Nature Trail	B Sutton	0	0	2	2	0	4	1	1	10	1.25								
Waimate North																				
113	W1	A & R Atkinson	26	33	37	31	37	29	65	48	306	38.25								
114	W2	J & J Dryburg	7	7	8	5	22	8	20	18	95	11.88								

Continued on next page

Appendix 2 continued

STN. Nc.	STATION NAME	LISTENER	1				2				3				4				TOTAL	MEAN
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4		
116	W4	H Horrobin, M Sharpt	19	13	11	7	8	10	28	31	15.88									
118	W6	D Bailey, T Upperton	15	10	10	7	18	11	7	5	10.38									
120	W8	A Chiaroni et al.	1	3	0	4	3	5	6	6	3.50									
121	W9	A Hookway, D Way	6	7	0	2	2	2	2	3	3.00									
122	W10	J Little	12	8	14	11	10	14	9	12	11.25									
124	W12	D Way	5	6	4	1	6	5	10	1	4.75									
127	W14	A Jones, A Brindle	0	4	2	4	2	0	1	2	1.88									
Hupara																				
258	HLC 1	J Gillanders	28	31	32	30	50	55	40	40	306	38.25								
257	HLC 4	W Atkinson	10	12	5	8	9	17	20	12	93	11.63								
Russell																				
59	Opito Farms	E Harwood	18	37	33	19	35	47	29	25	243	30.38								
62	Uruti Road	C Richmond	19	10	28	18	14	14	18	12	133	16.63								
170	Nikau Block	Laurence G	19	12	21	16	22	23	31	20	164	20.50								
171	Mace/Farmer	M Cadogan	41	44	28	18	41	25	54	25	276	34.50								
172	Pipiroa	M Pasco	4	1	10	1	7	1	5	2	31	3.88								
173	Shortlands	M Cadogan	5	14	5	7	-	-	-	-	31	7.75								
174	Johnsons	Douglas F, M Frankum	8	15	16	27	20	14	12	17	129	16.13								
177	Solomons Gate	Stefan S	10	5	21	20	9	30	6	16	117	14.63								
326	Whangamumu Track	Sandra S	0	5	3	0	9	5	9	4	35	4.38								
Southern																				
24	Purua N	Julia B	34	18	25	25	16	25	-	-	143	23.83								
81	Purua S	Ayla W	22	23	31	25	19	17	33	27	197	24.63								
25	Rarewarewa S	C Robinson	23	14	8	9	15	17	19	19	124	15.50								
82	Rarewarewa N	C Robinson	17	9	21	9	9	5	9	8	87	10.88								
139	Hodges	G Lovell	13	10	16	18	-	-	-	-	57	14.25								
23	Marlow Road	Kallan M	13	10	15	26	32	32	34	33	195	24.38								
145	Whangaruru	R Hughes	8	0	7	3	16	4	12	4	54	6.75								

Continued on next page

STN. No.	STATION NAME	LISTENER	1				2				3				4				TOTAL	MEAN
			1	2	1	2	1	2	1	2	1	2	1	2	1	2				
129	Motatau 10	I King	15	15	14	12	14	12	1	2	1	2	1	2	1	2	56	14.00		
68	Motatau 9	I King	10	10	8	6	8	6	-	-	-	-	-	-	-	-	34	8.50		
26	Mimiwhangata	Manaia A	6	7	6	3	6	3	13	3	13	3	3	-	-	-	38	6.33		
Tutukaka Coast																				
27	Sandy Bay 1	N Pullman	9	10	5	10	5	10	1	4	1	4	7	1	7	1	47	5.88		
260	Sandy Bay 2	ALD	3	4	2	3	2	3	6	2	2	2	2	1	1	23	2.88			
261	Sandy Bay 3	ALD	5	1	9	1	9	1	1	2	1	2	4	-	-	23	3.29			
292	Sandy Bay farms	C Dowd	5	11	3	4	3	4	1	4	1	4	-	-	-	28	4.67			
293	Te Toiroa	ALD	4	5	3	4	3	4	5	11	4	11	6	4	4	42	5.25			
295	TLC Ngahere pines	ALD	18	11	13	14	13	14	15	17	15	17	25	10	10	123	15.38			
125	TLC 1	M Camm	12	13	19	27	19	27	13	9	13	9	15	11	11	119	14.88			
126	TLC 2	Nick D	4	4	8	3	8	3	9	12	9	12	11	19	19	70	8.75			
28	TLC 4	S Seitzer	7	5	4	4	4	4	3	6	3	6	6	11	11	46	5.75			
306	Gunther	ALD	16	14	6	9	6	9	9	12	9	12	18	13	13	97	12.13			
319	Kakariki (new)	ALD	18	16	19	9	19	9	14	12	14	12	6	20	20	114	14.25			
320	Tutu Quarry (new)	ALD	2	4	7	5	7	5	2	3	2	3	3	9	9	35	4.38			
310	North Onekainga	Scott M	4	1	5	1	5	1	0	0	0	0	0	0	0	11	1.38			
311	Harman Farms Lookout	Scott M	0	1	1	0	1	0	0	1	0	1	1	2	2	6	0.75			
312	Dawson's Property Whananaki	Scott M	10	4	0	4	0	4	1	3	1	3	2	3	3	27	3.38			
313	Hailes Road	Scott M	0	0	1	2	1	2	5	2	5	2	3	5	5	18	2.25			
KiwiLink																				
302	Owhiwa Rd Kauri Villas	Pauline G, Robyn B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
314	KiwiLink kumara pit (new)	Carl, Emma, Ross	2	2	3	2	3	2	2	1	2	1	4	2	2	18	2.25			
315	KiwiLink Ohuatahi (new)	Carl, Emma, John	3	2	4	3	4	3	3	1	3	1	-	-	-	16	2.67			
316	KiwiLink Sue's bus (new)	Sue	4	2	2	4	2	4	2	3	2	3	3	3	3	23	2.88			
Glenbervie																				
21	Glenbervie 7A	ALD	0	4	0	0	0	0	0	3	0	3	1	6	6	14	1.75			
22	Glenbervie 9A	ALD	7	5	1	6	1	6	7	5	7	5	6	8	8	45	5.63			
283	Glenbervie 10	ALD	5	1	1	1	1	1	3	2	3	2	-	-	-	13	2.17			
284	Glenbervie 11	ALD	7	5	1	2	1	2	2	4	2	4	-	-	-	21	3.50			
296	Glenbervie 14	ALD	1	0	0	1	0	1	3	2	3	2	-	-	-	7	1.17			

Continued on next page

Appendix 2 continued

STN. N.O.	STATION NAME	LISTENER	1				2				3				4				TOTAL	MEAN
			1	2	1	2	1	2	1	2	1	2	1	2	1	2				
Pukenui																				
285	Pukenui Loop Track	T Thompson	2	1	0	3	4	2	4	2	1	3	16	2.00						
298	Stonelea Way (new)	B Cramp et al.	0	0	1	0	0	1	0	3	0	5	0.63							
288	1st steps N&O lines	Satchet G et al.	7	6	2	5	4	3	2	4	2	33	4.13							
289	Forest edge Smithville	Fiona D	4	2	3	0	4	0	4	1	3	17	2.13							
299	Clements Quarry trig (new)	B Lovell et al.	0	0	1	0	0	1	0	0	0	2	0.25							
318	Taraire Ridge (new)	B Cramp, N Clark et al.	2	1	7	1	5	1	2	1	20	2.50								
Whangārei Heads																				
39	Bream Head 1	W & R Newbold	24	4	31	12	17	6	12	3	109	13.63								
41	Bream Head 3	K Townsend, M McCready	21	18	17	14	27	18	24	24	163	20.38								
42	Bream Head 4	S & C Braithwaite	23	4	9	7	10	8	16	14	91	11.38								
69	Bream Head 6	M Bartelds	14	14	17	7	28	5	21	3	109	13.63								
54	Kauri Mt 1	A Willetts	8	12	9	9	8	2	6	8	62	7.75								
72	Kauri Mt 2	S Sinclair, T Thurley, H Steeds	8	2	6	4	12	10	3	11	56	7.00								
73	Kauri Mt 3	P Olsen, ALD	4	4	10	5	9	10	21	11	74	9.25								
74	Kauri Mt 4	G & R Faber	4	6	8	5	6	3	13	8	53	6.63								
141	Kauri Mt 5	L Brown	4	5	4	8	10	5	15	1	52	6.50								
47	Manaia 1	L Ogle	26	13	11	10	14	10	22	10	116	14.50								
48	Manaia 2	F Clayton	27	21	34	29	27	28	32	32	230	28.75								
49	Manaia 3	P Richards	20	13	7	8	10	12	19	6	95	11.88								
71	Manaia 8	ALD	7	2	6	2	9	6	1	3	36	4.50								
127	Nook 1	ALD	6	5	3	3	0	5	2	0	24	3.00								
56	Nook 2	C Brown	6	12	6	7	17	1	10	5	64	8.00								
45	Taurikura 2	G Pike	15	20	11	16	20	17	13	11	123	15.38								
46	Taurikura 3	K Lange	18	2	3	3	4	4	10	5	49	6.13								
263	Craig Rd	T Hamilton, H Moodie, K Maxwell	27	9	17	5	14	5	24	17	118	14.75								
75	McLeod Bay	W & V Biddle	13	8	19	14	14	15	18	9	110	13.75								

Continued on next page

STN. N.O.	STATION NAME	LISTENER	1				2				3				4				TOTAL	MEAN
			1	2	1	2	1	2	1	2	1	2	1	2	1	2				
Western																				
16	Katui	A Meduna	2	2	4	0	1	1	1	1	1	1	1	1	1	1	1	1	1	9
17	Trounson Nth	M Leach	6	12	14	15	17	15	17	15	17	15	17	15	17	15	17	15	104	
18	Cathedral	J McLaughlin	8	4	6	1	4	4	4	4	4	4	4	4	4	4	4	4	46	
19	Lookout	A Knock	15	8	20	16	12	8	12	8	12	8	12	8	12	8	12	104		
31	Te Matua Ngahere	K Donovan	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3		
33	Trounson Sth	T Flynn-Plummer	28	10	13	12	13	13	13	13	13	13	13	13	13	13	13	109		
265	River Road	A McLeod	1	2	3	2	5	1	5	1	5	1	5	1	5	1	5	14		
16b	Marlborough Rd Site 16	M Calder	0	2	1	0	2	0	2	0	2	0	2	0	2	0	2	5		
30b	Site 30 SH12	K Donovan	0	2	1	0	0	3	0	3	0	3	0	3	0	3	0	6		
28b	Site 28 SH12	M Topia	12	2	7	3	9	7	9	7	9	7	9	7	9	7	9	52		
267	Wekaweka LC 2 (Rob's Place)	ALD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
268	Wekaweka LC 3 (Libby's track)	ALD	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
Piroa/Brynderwyn																				
253	House 17 Deck	J Hawley	3	2	3	2	3	6	3	2	3	6	3	2	3	6	3	24		
275	Pebblebrook Rd	J Hawley	4	4	0	0	4	3	4	3	4	3	4	3	4	3	4	19		
317	Marunui 3	T Wilson	0	1	2	4	4	5	4	5	4	5	4	5	4	5	4	17		
290	1 PBL Trig	Kathryn C	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	3		
321	PBN 3 – Massey Rd (new)	Matt M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2		
Mataia																				
254	Mataia 1	ALD	4	3	4	10	11	3	4	10	11	3	4	10	11	3	4	43		
255	Mataia 2	ALD	4	7	8	5	7	10	8	5	7	10	8	5	7	10	8	51		
280	Mataia 4 (Quarry)	ALD	4	4	7	2	4	11	7	2	4	11	7	2	4	11	7	39		
281	Mataia 5 (Hooper's)	ALD	2	-	2	-	1	-	2	-	1	-	2	-	1	-	2	11		
Tāwharanui																				
161	TWN 1 Marine triangle	M Vanderkolk et al.	3	5	0	1	1	3	0	1	1	3	0	1	1	3	0	25		
162	TWN 2 Trig triangle	D Chambers, M Wakefield et al.	3	6	13	10	16	10	13	10	16	10	13	10	16	10	13	69		
163	TWN 3 Top ecology track	S Richardson, M Bleasdale et al.	3	1	2	6	12	7	2	6	12	7	2	6	12	7	2	35		
164	TWN 4 Possum gully	J Monk, G Daniels et al.	13	13	9	7	4	2	9	7	4	2	9	7	4	2	9	54		
165	TWN 5 Twin hills	Tony, Damien et al.	13	15	5	3	19	11	5	3	19	11	5	3	19	11	5	67		
166	TWN 6 South coast water tank	R Williams, Diti et al.	20	24	20	17	27	18	20	17	27	18	20	17	27	18	20	147		

Appendix 3

Trends in mean kiwi call count rates from annual monitoring at selected stations of managed Northland kiwi populations in 2021

AREA	No. STNS	STATION numbers	2021 STATION numbers	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Mangateke	2	3,256	3,256	-	-	-	-	-	-	-	-	-	-	-	11.0	15.9	17.9	15.9	17.6	13.2	9.1	12.9
Honeymoon Valley	4	271-274	no data	-	-	-	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	-
Whakaangi	7-9	29, 130-137	29, 130,133-136	-	-	11.8	10.7	10.1	10.8	11.7	12.2	10.9	9.9	7.3	6.5	8.1	4.7	4.0	4.0	2.1	4.5	4.8
Mahinepua-Radar Hill	8	83-85, 87-89, 98, 99	no data	-	3.6	2.8	4.9	2.7	1.9	2.5	4.7	5.5	10.2	6.7	5.7	6.5	7.8	7.5	11.0	4.7	11.4	-
Pukeki Forest	6	102, 104-106, 108, 111	104, 106, 108, 111	-	-	-	2.9	1.2	1.5	3.7	3.0	4.3	4.1	3.6	5.7	2.9	4.2	3.5	6.0	4.2	2.0	6.5
Waimate North	6	113, 114, 118, 120, 122, 124	113, 114, 118, 120, 122, 124	-	10.5	4.3	-	6.8	6.5	4.7	8.1	9.0	8.4	6.6	8.6	8.1	7.6	7.8	10.9	7.3	12.2	13.3
Hupara	3-4	245, 246, 257, 258	257, 258	-	-	-	-	-	-	-	-	-	-	18.5	14.7	16.7	21.8	16.8	22.3	17.7	23.1	24.9
Russell	5	15, 59, 62, 170, 173	15, 59, 62, 170, 173	-	-	4.5	4.0	7.0	5.4	4.6	5.5	11.4	9.8	11.4	12.8	13.8	19.7	11.3	16.5	7.4	12.1	16.1
Motatau-Marlow	6	23, 34-36, 68, 129	23, 68, 129	-	-	7.3	7.6	7.5	4.9	6.4	4.5	7.1	8.3	9.1	8.7	9.8	11.5	12.9	11.0	10.9	10.2	15.6
Puruu-Rarewarewa	5	24, 25, 81, 82, 139	24, 25, 81, 82, 139	-	-	9.2	11.1	12.7	10.9	12.4	10.6	12.6	11.8	13.6	14.2	12.7	10.5	12.1	15.4	13.9	14.8	17.8
Tutukaka Coast	9	27, 28, 125, 126, 142-144, 260, 261	27, 28, 125, 126, 260, 261	7.8	7.2	5.4	7.3	8.2	8.4	6.1	5.2	6.1	7.2	8.1	5.4	6.0	8.4	10.3	9.2	6.1	4.9	6.9
Pukenui	3	285, 288, 289	285, 288, 289	-	-	-	-	-	-	-	-	-	-	-	-	1.5	-	-	-	0.9	0.9	2.1
Whangarei Heads	14	39, 41-42, 47-49, 54, 56, 69, 71-74, 141	39, 41-42, 47-49, 54, 56, 69, 71-74, 141	2.3	2.2	2.9	2.8	1.4	3.3	3.2	3.1	4.9	5.5	6.0	5.5	5.6	7.6	7.3	7.1	4.1	7.1	11.7
Piroa/Brynderwyn	3	253, 275, 290	253, 275, 290	-	-	-	-	-	-	-	-	-	-	-	1.1	2.2	3.6	5.1	4.6	2.6	2.8	1.9
Mataia	2	254, 255	254, 255	-	-	-	-	-	-	-	-	-	-	-	1.3	-	1.1	2.9	-	3.6	5.4	5.9
Tawharanui	6	161-166	161-166	-	-	-	-	-	-	2.3	0.3	-	2.8	2.7	4.7	4.5	5.6	4.6	7.3	6.1	5.4	8.3
Kawau	3	277, 278, 279	no data	-	-	-	-	-	-	-	-	-	-	-	-	1.9	1.9	2.9	2.7	2.7	-	-

Note: In previous reports up to 2009: where a single station was not covered, the previous year's results were used. However, some of the stations had not been listened from for several years, so the mean call count rates for the data from 2010 and beyond were calculated only from the relevant stations listened from for that year. If only one station is listened from no mean is given for that cluster. The clusters previously known as Tutukaka and Sandy Bay have been clumped together (along with Whananaki and Matapouri) to form the Tutukaka Coast cluster. The clusters previously known as Manaia-Nook, Bream Head/Taurikura, and Kauri Mountain have been clumped together to form the Whangarei Heads cluster. The cluster previously known as Marunui has now been clumped with Piroa, and re-named Piroa/Brynderwyn.

Appendix 4

Kiwi call survey methods (from the Kiwi Best Practice Manual, Colbourne et al. 2020)

SURVEY METHOD:

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: <https://nzbirdsonline.org.nz/>
2. Choose listening sites that cover a wide listening area, preferably on a prominent knob, spur, hilltop, ridgeline or riverflat, 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 survey.
7. Start your listening period no earlier than 30 minutes after local sunset. Sunset times are available from <https://www.linz.govt.nz/sea/nautical-information/astronomical-information> 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 survey – 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 surveys.
14. Photocopy or scan the card for you own records, and then send the original card or the scanned copy to the Kiwi Call Scheme Coordinator.