Aotea Bird Count

Results from the December 2020 survey

Image credit: Guy Macindoe

Prepared by Quinn Asena, August 2021

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This report is dedicated to the memory of Emma Waterhouse, recognising her love and guardianship of the environments of Aotea

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Summary

This report presents the analysis of the Aotea Bird Count (ABC) data collected in 2020. The bird count is organised by the Aotea Great Barrier Environmental Trust, Auckland Council and the sanctuaries located on Aotea, and is carried out by community volunteers. The objective of the ABC is to establish longitudinal monitoring of species abundances in response to management interventions and pressures. A standard five-minute bird count method is used that is employed widely throughout New Zealand. In this report, the bird count data are analysed for:

- Island-wide species abundances.
- Site-level species abundance, richness and diversity.
- Site-level abundances of four key target species (kākāriki, kākā, tūī and kererū).
- Differences in species composition among sites.

Analysis of the data highlight some key patterns in the abundances of bird species across Aotea-Great Barrier Island:

- The most frequently observed species on the island during the survey are kākā, tūī, grey warbler (riroriro), kingfisher (kōtare), and fantail (piwakawaka).
- The number of individuals observed (seen and heard) among sites ranged between [72, 235]. Species richness (number of species present) had a range of [7,23], and species diversity ranged between [1.54, 2.89]. The highest species richness and diversity were found in the Medlands and Motu Kaikoura, while the lowest values were at Cooper's Castle and Te Paparahi.
- Of the four target species, kākā and tūī were observed widely across Aotea. Kererū were present in low abundances at most sites, and kākāriki were only observed at Okiwi.
- Species composition is not homogeneous across the sites, and forms three primary groups based on statistical analyses for site similarity.

Additionally, a graphical comparison of changes in species richness and diversity between 2019 and 2020 is presented. Data from the ABC are a valuable source of information on species abundances and diversity across Aotea. If repeated at regular intervals, data from the ABC will provide the basis for tracking species abundances through time and space, especially of vulnerable endemic species such as the kakariki and pāteke. Additionally, such data can inform the success of management interventions such as the proposed Tū Mai Taonga project, which aims to promote the recovery of species, including black petrel (tāiko) and pāteke.

Contents

1 – Introduction

This report is the second in a series from the Aotea Bird Count (ABC) survey, mainly based on the data collected in 2020. The first report (Simmonds, 2020) was based on data collected in 2019. This report focuses on analysing the data from 2020 because meaningfully analysing patterns of change requires more than two years of data. However, visualisations of species richness and diversity changes between the data from 2019 and 2020 are presented. In the longer term, the ABC will be a valuable dataset of the birds of Aotea and changes in their abundance and distribution. In addition, data from the ABC can contribute to the development and evaluation of management interventions on, for example, the abundance of key species in managed areas.

1.1 – Aotea, Great Barrier Island

Aotea, Great Barrier Island (henceforth Aotea) is a small island (c. 27,761 ha) located approximately 17 km northeast from the north island of New Zealand (Figure 1), and includes many small surrounding islands (Russell and Taylor, 2017). Aotea comprises ten major habitat types, including wetlands, coastal cliffs, forests, and dunes, making it home to diverse animal and plant life (Armitage, 2004). The east coast primarily comprises wetlands and infilled marine embayments, and the west coast drops sharply into the sea. A central ridge of mountains reaching an elevation of 627 m.a.s.l runs down the island (Perry *et al.*, 2010). Predator control projects have been developed on Aotea with Glenfern sanctuary (83 ha) established as a restoration area in the late 1990s, and Windy Hill sanctuary (800 ha), established in 2000 (Clout and Russell, 2006; Perry *et al.*, 2010). In addition, the Tū Mai Taonga is currently proposed to encompass the northern half of Aotea to reduce feral cat numbers and protect species such as the tāiko and pāteke (Tū Mai Taonga, 2020). Community projects control rats in some locations, including Okiwi, Awana and Oruawharo Medlands, and Auckland Council and the Department of Conservation carry out feral cat control on roadsides, on Hirakimata and in the Whangpoua basin.

1.2 – Birds of Aotea

Aotea is home to many native and endemic bird species ranging from seabirds and wetland birds to open country birds and bush birds. Species include the tāiko, blue penguins (korora), Australasian gannets (tākapu), pāteke, banded rails (mioweka), tomtits (ngirungiru), and the iconic tūī, kākā and kākāriki (Armitage, 2004). This diverse group of bird species is key to both the cultural heritage and biological importance of Aotea.

Aotea is unique in that some of the predatory mammals, such as the Norway rat (*Rattus norvegicus*) and mustelids (weasels, stoats and ferrets) brought to New Zealand by Europeans, never became established (Armitage, 2004). The absence of mustelids is important to the persistence of species still extant on the island today but absent or vulnerable on the mainland, such as pāteke, kākā and banded rail. Cats (*Felis catus*) and ship rats (*Rattus rattus*) are thought to have been rare or absent from Aotea in the mid 19th century. Thus, species vulnerable to their predation, such as kakariki, persisted on Aotea more successfully than on the two main islands of New Zealand after European arrival (Armitage, 2004). However, while many introduced pests did not establish on Aotea, two species of rat (*Rattus rattus and Rattus exulans*), mice (*Mus musculus*), rabbits (*Oryctolagus cuniculus*), feral cats (*Felis catus*), and pigs (*Sus scrofa*) are present today, posing a threat to the island's birdlife (Ogden and Gilbert, 2009, 2011). The last remaining kōkako on Aotea were moved to

nearby predator-free Hauturu (Little Barrier) in 1994, and several bird species, including the tomtit and kākāriki are at risk of local extinction (Russell and Taylor, 2017). Historically, much of the loss of the native and endemic birdlife was probably due to the introduction of the Polynesian rat (*Rattus exulans*) and dogs (*Canis familiaris*) that accompanied the first human settlers of Aotea, and the loss of forest due to fire and logging during Māori (since the late 13th / early 14th century) and European settlement periods (Clout and Russell, 2006; Perry *et al.*, 2010).

1.3 – Key target species

Stakeholders on Aotea have identified four bird species as crucial target species for the ABC (Simmonds, 2020): kākā (*Nestor meridionalis*), kererū (*Hemiphaga novaeseelandiae*), kākāriki (*Cyanoramphus novaezelandiae*), and tūī (*Prosthemadera novaeseelandiae*).

Kākāriki are a small endemic parrot once common throughout New Zealand, but now almost absent from the two main islands (Ortiz-Catedral and Brunton, 2009). The kākāriki has a national conservation status of an at risk relict population (Robertson *et al.*, 2016); there is one confirmed breeding population on Aeotea, at the Okiwi site (Simmonds, 2020).

Kererū are an endemic pigeon widespread throughout New Zealand. They are the fifth heaviest pigeon globally (c. 650 g) and feed on fruits, flowers, and leaves (Wotton and Kelly, 2012). Kererū are important seed dispersers feeding on at least 70 different plant species (McEwen, 1978) and, due to their large size, they can swallow large fruits and have a long gut retention time (Clout and Hay, 1989; Wotton and Kelly, 2012). The long gut passage time of these large birds makes it more likely that kererū disperse seeds further from the parent plant than smaller dispersers, despite their sedentary behaviour (Wotton and Kelly, 2012). Kererū prefer a variety of forest types, including native forest and exotic plantations.

The kākā is an endemic hole-nesting parrot that is reasonably frequently observed across common throughout Aotea, although they are nationally classed as an at risk, recovering species. The kākā now occupies a fraction of its former range due to predation and habitat loss (Moorhouse *et al.*, 2003). Their abundance on Aeotea is likely due to the absence of stoats (*M. erminea*) and Norway rats (*R. norvegicus*), to which their nests are vulnerable (Armitage, 2004).

The tūī is an endemic species common across New Zealand and needs little introduction. Their distinctive calls and white throat feathers make them an easily recognisable New Zealand icon. Tūī are honeyeaters feeding primarily on nectar, fruit and invertebrates (Stewart and Craig, 1985). Tūī have complex calls and exhibit regional variability in their song, similar to that of the bellbird (Hill and Ji, 2013; Hill *et al.*, 2013).

1.4 – Objectives of the Aotea Bird Count

The ABC is a citizen-science project providing an island-wide assessment of bird species and their locations on Aotea. The ABC is planned to be repeated biannually or annually, building a dataset that can be analysed for changes in species over time. In the long-term, such information will be invaluable in informing and evaluating management interventions (e.g., pest control), changes in bird populations across the island, and tracking the abundances of key target species.

2 – Methods

2.2 – Data collection

Seventeen sites across Aotea (Figure 1) were surveyed using the five-minute count method (Hartley, 2012) for the bird species present. Each of the 17 sites consisted of 4-5 survey locations approximately 200 metres apart and was surveyed twice with at least a one-hour interval between replicates. Information on the local conditions (wind, rain, noise and temperature) were recorded for each of the two replicates. Groups of up to three observers undertook the surveys with at least one person trained in bird identification. At each point in the site, the species, number of birds seen or heard, and distance from the observers (inside or outside of a 25-metre radius) were recorded for five minutes. Counting started after two minutes of silence to reduce the disturbance caused by the observers. Additional data on birds flying overhead or observed between the survey locations were also recorded.

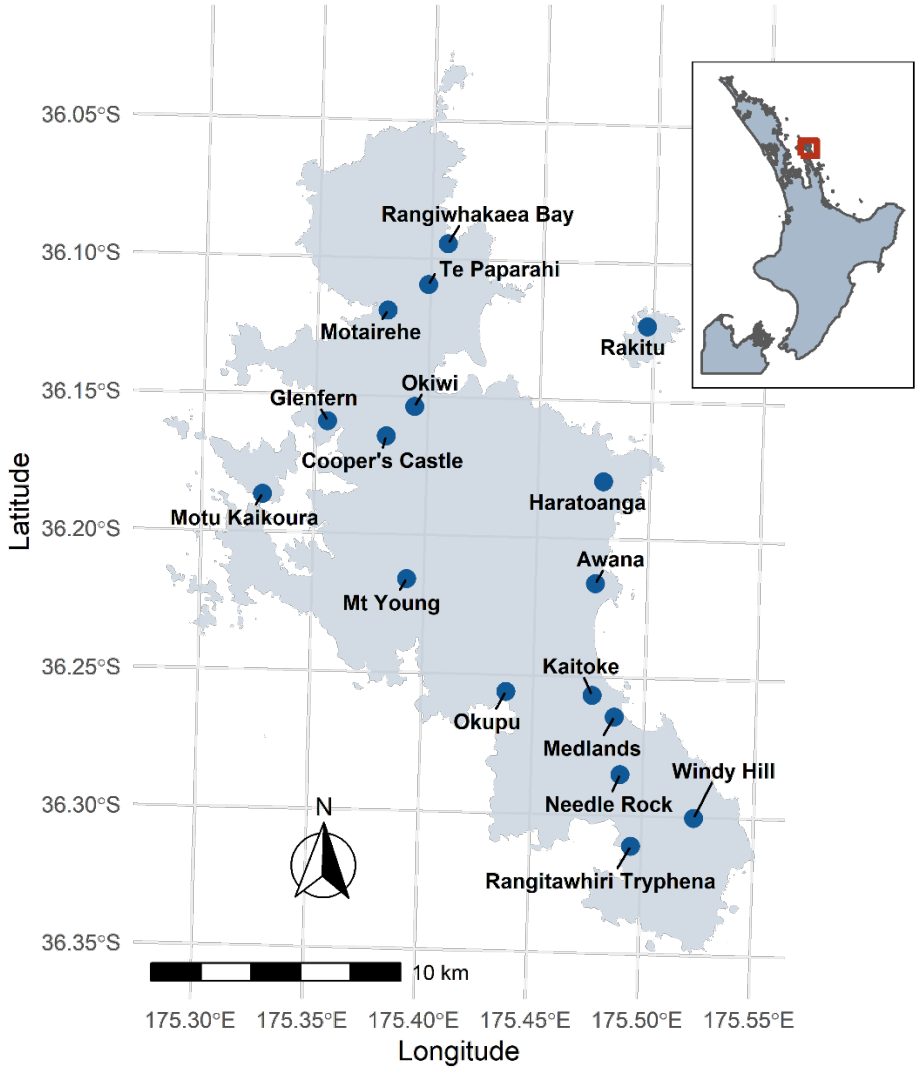

Figure 1: Locations of the 17 sites surveyed in 2020 on Aotea, Great Barrier Island.

Bird names are reported as recorded by the observers with preference for the Te reo Māori name if both the European and Māori names were recorded. A list of bird names including their Te reo Māori, Latin, and European names is provided in Appendix A.

2.3 – Analysis

A range of analyses were used to describe the diversity across the island and differences among sites. Analyses are conducted on observations including both the seen and heard birds identified by the surveyors. Some records of unknown species or species not identified to the species level (e.g., 'finch') were filtered from the data. Data were analysed at the island-level, site-level, and for differences among sites:

- First, total bird counts were calculated across the island by summing the counts of each species across all sites.
- Second, bird counts were analysed at the site-level by calculating species richness and diversity. Additionally, the occurrence and abundance of the four target species (kākāriki, kākā, tūī and kererū) are shown for each site.
- Finally, the dissimilarity among the sites was calculated from differences in their species composition.

All analyses were conducted in R version 4.1.0 (R Core Team, 2021). The vegan package (Oksanen, 2020) is used to calculate the Bray-Curtis index and Shannon's diversity index (described below). The data and scripts used in this report are reproducible and stored on a public repository (available at: https://doi.org/10.17608/k6.auckland.14865372).

Richness and diversity

For each of the 17 sites, the richness and diversity of species present were calculated. Species richness is simply the number of species present, while species diversity considers the species relative abundances. For example, if 100 individuals across ten species were observed richness would be 10; diversity would vary from highest if all ten species had ten individuals or lowest if one species accounted for 91 individuals and the other nine just one. Species diversity was calculated using Shannon's H index. Species, richness and diversity are mapped to Aotea by site to visualise the results. Additionally, a visual comparison of species richness and diversity between 2019 and 2020 count data is shown.

Total count and target species

For each of the 17 sites, the total bird count (i.e., number of individuals) and the counts of the four target species (kākāriki, kākā, tūī and kererū) were calculated. Count data mapped onto Aotea provides an overall picture of the bird abundance at each site, complementing richness and diversity measures.

Hierarchical cluster analysis

Additionally, we were interested in how different the species composition is among the 17 sites. The Bray-Curtis dissimilarity index is commonly used in ecology to quantify the difference between sites based on their species composition (Faith, Minchin and Belbin, 1987). Hierarchical cluster analysis groups (classifies) sites into units based on their similarity. To group the sites into clusters, we used

the unweighted pair group method with arithmetic-mean method. In short, hierarchical cluster analysis is a bottom-up clustering method that successively groups similar sites until all of them have been placed into a group.

3 – Results

3.1 – Overall observations

Across the 17 sites, 2,373 individuals were counted and identified across 42 species (excluding some unknown or unidentified to the species level). Of the 42 identified species, 27 were either native or endemic, with the most frequently observed species being kākā, tūī, grey warbler, kingfisher and fantail (Figure 2). Figure 2 shows the 25 most frequently observed species on Aotea during the ABC-2020; counts for all 42 identified species are provided in Appendix B.

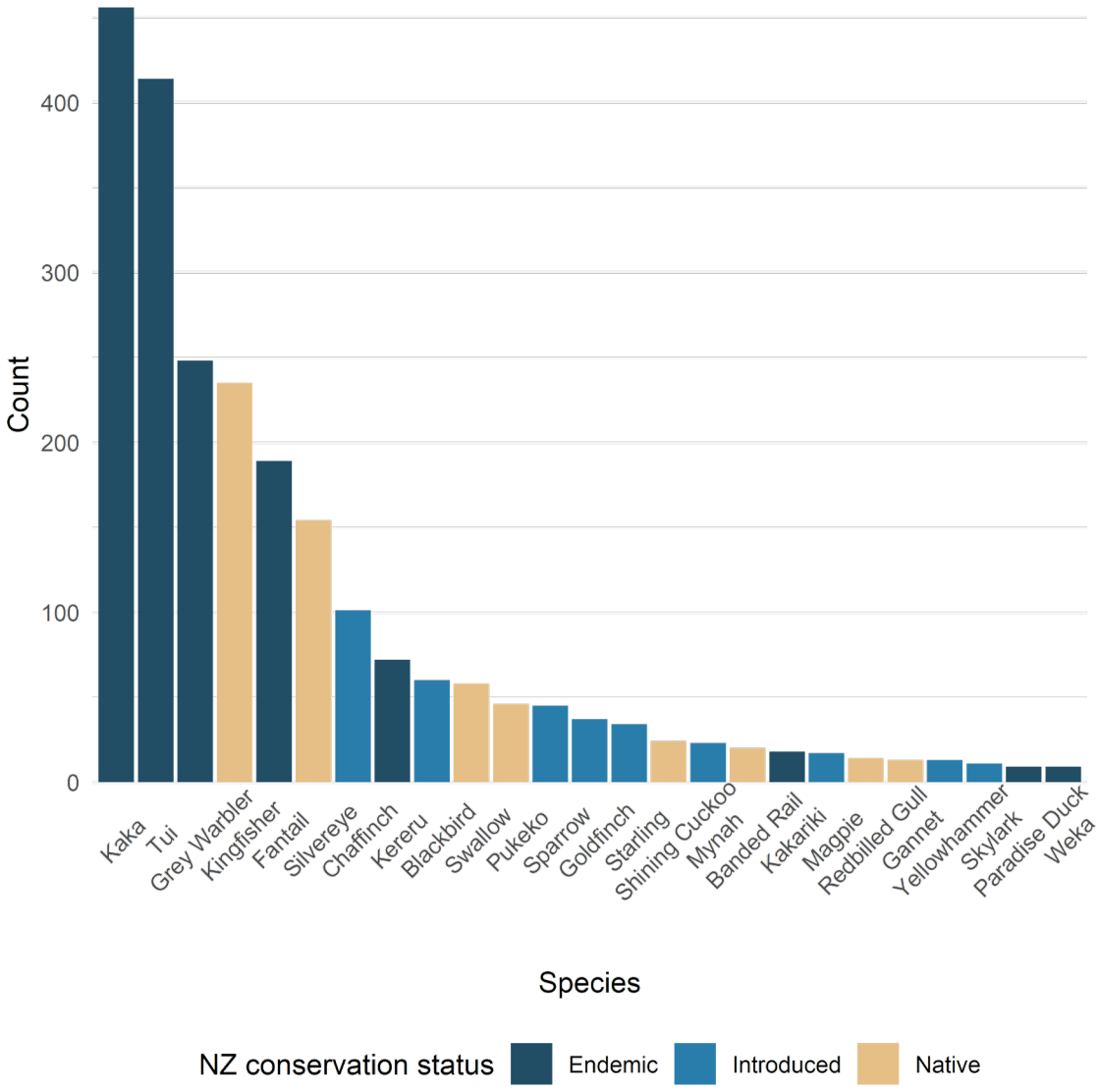

Figure 2: Total counts of the 25 most frequently observed (seen or heard) species across all 17 sites. Forty-two species were identified from 2,373 individuals, with the most abundant being kākā, tūī, grey warbler, kingfisher and fantail.

3.2 – Richness and diversity

Species richness and diversity do not vary much across the seventeen survey sites (Figure 3 A and B). The highest species richness and diversity occurred at the Medlands site, followed by Motu Kaikoura, Okupu and Kaitoke (Figure 3 A and B, and Table 1; see Figure 1 for mapped site names). The lowest levels of richness and diversity were observed at Cooper's Castle and Te Paparahi.

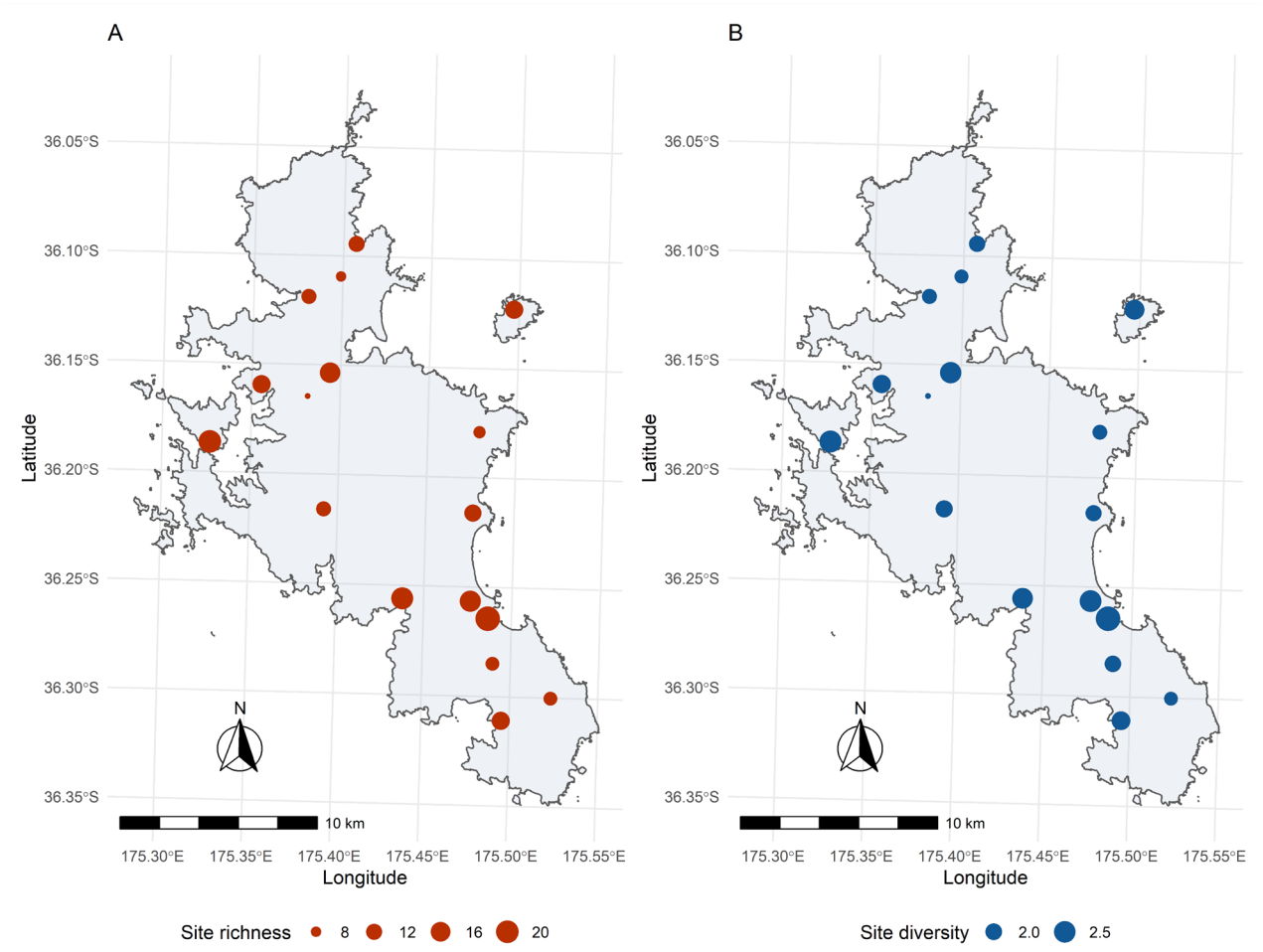

Figure 3: The species richness (A) and diversity (B) of the 17 sites across Aotea. The size of the data points is scaled by value, with larger points indicating a higher value.

Species richness, diversity and total counts vary among sites with ranges of [7, 23], [1.54, 2.89], and [72, 235] (values inside the square brackets indicating the minimum and maximum), respectively (Table 1). Of course, some variation is expected due to local conditions during the bird counts and among observer groups. Species richness is likely to increase with the number of individuals counted at a given site. Rarefaction (a statistical tool used to correct for such biases) can account for the differences in richness with sample size (Oksanen, 2020) but, in this case, made little difference (except for a slight reduction in richness at Motu Kaikoura, where the count was highest). Thus, the raw (i.e., not using rarefaction) richness data are reported alongside the total count.

Table 1: Species richness, diversity and count for the 17 sites.

Site	Species richness	Species diversity	Total count
Awana	13	1.96	72
Cooper's Castle	7	1.54	106
Glenfern	14	2.16	118
Haratoanga	9	1.87	140
Kaitoke	18	2.55	141
Medlands	23	2.89	165
Motairehe	11	1.88	98
Motu Kaikoura	20	2.57	235
Mt Young	11	2.04	187
Needle Rock	10	1.99	116
Okiwi	17	2.47	155
Okupu	19	2.41	151
Rakitu	14	2.30	131
Rangitawhiri Tryphena	14	2.21	141
Rangiwhakaea Bay	12	1.98	117
Te Paparahi	8	1.80	115
Windy Hill	10	1.78	185
Total			**2373**

3.3 – Total counts

The highest total bird count was observed on Motu Kaikoura, with 235 birds identified in total (Figure 4 A and Table 1). Motu Kaikoura had the second-highest species richness and diversity. Medlands, which had the highest richness and diversity, had a total count of 165 birds identified. Kākāriki, the endemic species almost absent from the two main islands of New Zealand, was observed only at the Okiwi site, where a breeding population is known to be established; this result is consistent with the 2019 ABC report (Simmonds, 2020). There has been a substantial investment in predator control at Okiwi to maintain the existing kākāriki population (Simmonds, 2018). In 2019, Glenfern was surveyed by a single observer, but the species observed to be present were remarkably similar between 2019 and 2020.

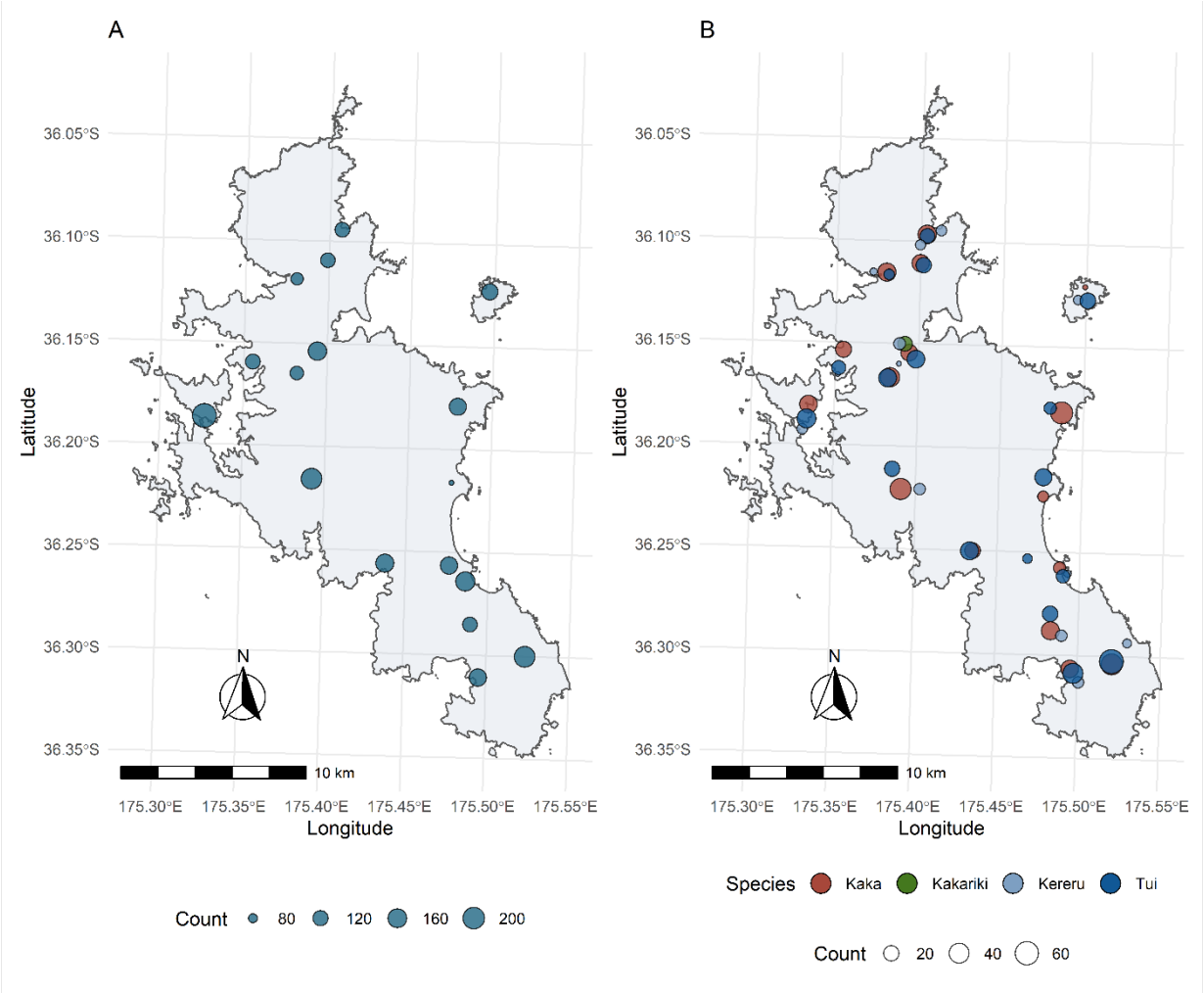

Figure 4: Total counts of birds by site (A) and total count of the four target species (kākāriki, kākā, tūī and kererū) by site (B).

Of the four target species (kākāriki, kākā, tūī and kererū), kākā and tūī were observed at almost every site, except for Kaitoke, where no kākā were observed (Figure 4 B and Table 2). Kererū were observed at 12 of the 17 sites, although in lower numbers than kākā or tūī. Eighteen observations of kākāriki were recorded, all at Okiwi (Figure 4 B and Table 2).

High counts of tūī and kākā were made at both Windy Hill and Haratonga. Okiwi had high abundances of all four species (Figure 4 B and Table 2). Kaitoke, one of the most diverse sites, had few observations of the target species, with only five tūī recorded.

Table 2: Total counts of the four target species at each site.

Site	Tūī	Kākā	Kākāriki	Kererū
Awana	27	8	0	0
Cooper's Castle	31	37	0	1
Glenfern	16	23	0	1
Haratoanga	11	53	0	0
Kaitoke	5	0	0	0
Medlands	14	11	0	2
Motairehe	7	32	0	2
Motu Kaikoura	36	30	0	7
Mt Young	20	47	0	9
Needle Rock	21	32	0	9
Okiwi	30	25	18	10
Okupu	31	21	0	0
Rakitu	22	1	0	5
Rangitawhiri Tryphena	41	29	0	9
Rangiwhakaea Bay	18	33	0	7
Te Paparahi	20	28	0	6
Windy Hill	64	46	0	4

3.4 – Site dissimilarity

Three primary groups emerge from the cluster analysis. Two of the most diverse sites (Figure 1 B and Table 1), Medlands and Kaitoke, are separated from the other sites (Figure 5; red branches). Awana forms a cluster with Okupu, Okiwi and Rangitawhiri Tryphena (Figure 5; blue branches). All other sites form a single large cluster, indicating that they are similar in species composition. Motu Kaikoura, the second most diverse site, is included in the large cluster, rather than with Medlands and Kaitoke (the first and third most diverse sites, respectively).

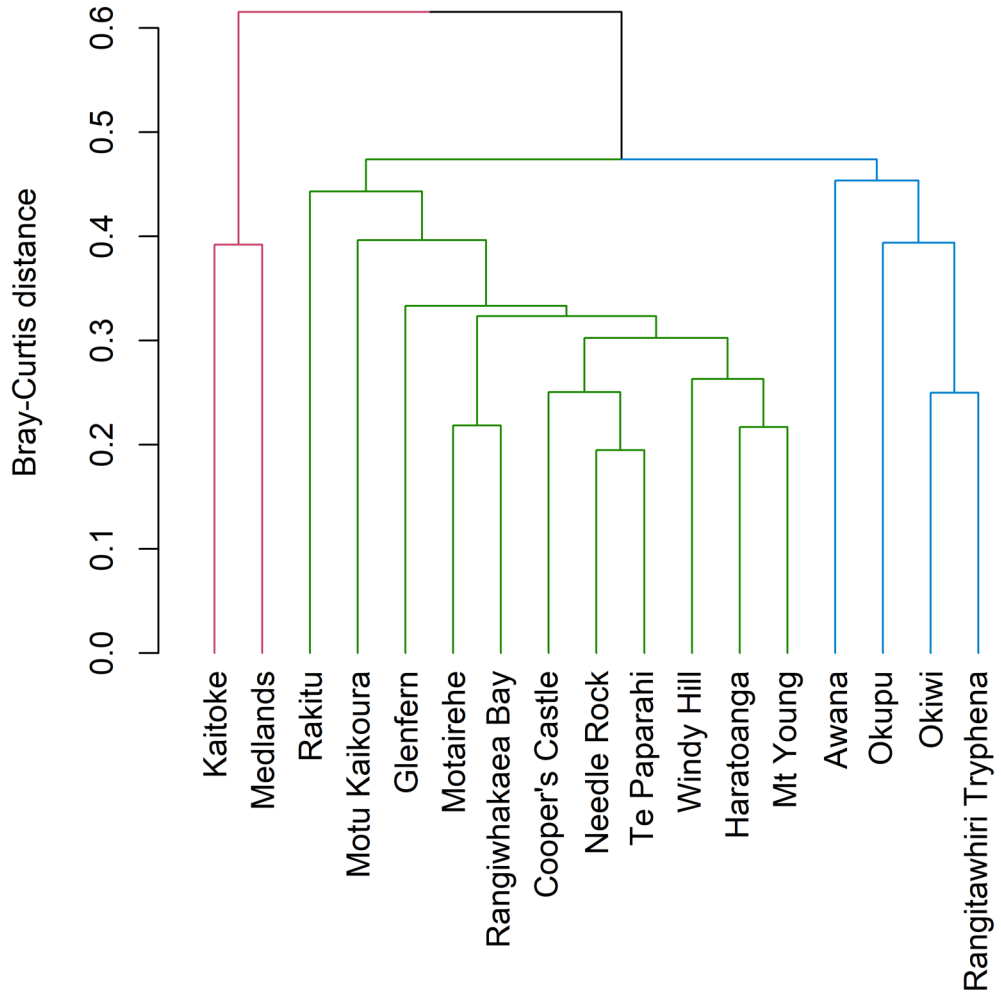

Figure 5: Hierarchical cluster analysis of sites using Bray-Curtis distance and unweighted pair group method with arithmetic mean. Three clusters are identified in the data as indicated by the colour of the branches.

3.5 – Comparison between 2019 and 2020

In the long term, citizen bird count data can be used to monitor the trajectory of populations and specific species across Aotea. Graphical comparisons of the change in species richness (Figure 6) and diversity (Figure 7) show some differences in sites between 2019 and 2020; however, some variability is expected due to differences in site conditions and observers. Overall, greater species richness was observed in 2019 than in 2020 (Figure 6). Species diversity shows a mix of increases and decreases among sites between years (Figure 7). These patterns need to be interpreted cautiously as short-term data inherently have a level of inherent uncertainty; they should not be used to identify trends.

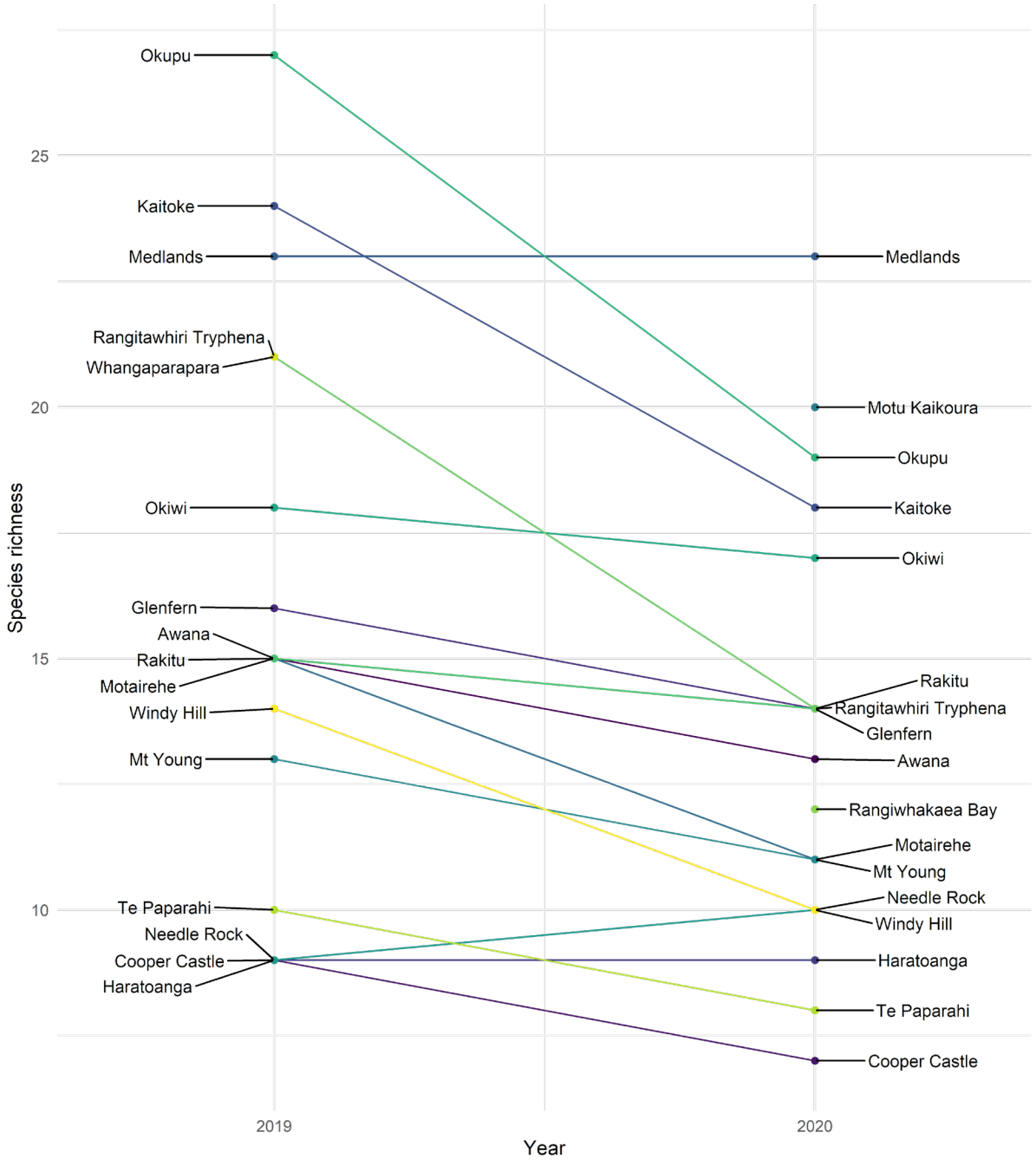

Figure 6: Bump plot of the change in species richness between 2019 and 2020.

If repeated on an annual or bi-annual basis, bird count data from the ABC can highlight long-term trends in richness and diversity and inform the success of management interventions. Additionally, statistical methods that require more than two years of data can be applied to the data in the future. Thus, it is recommended that ABC surveys continue to build and evermore valuable long-term dataset.

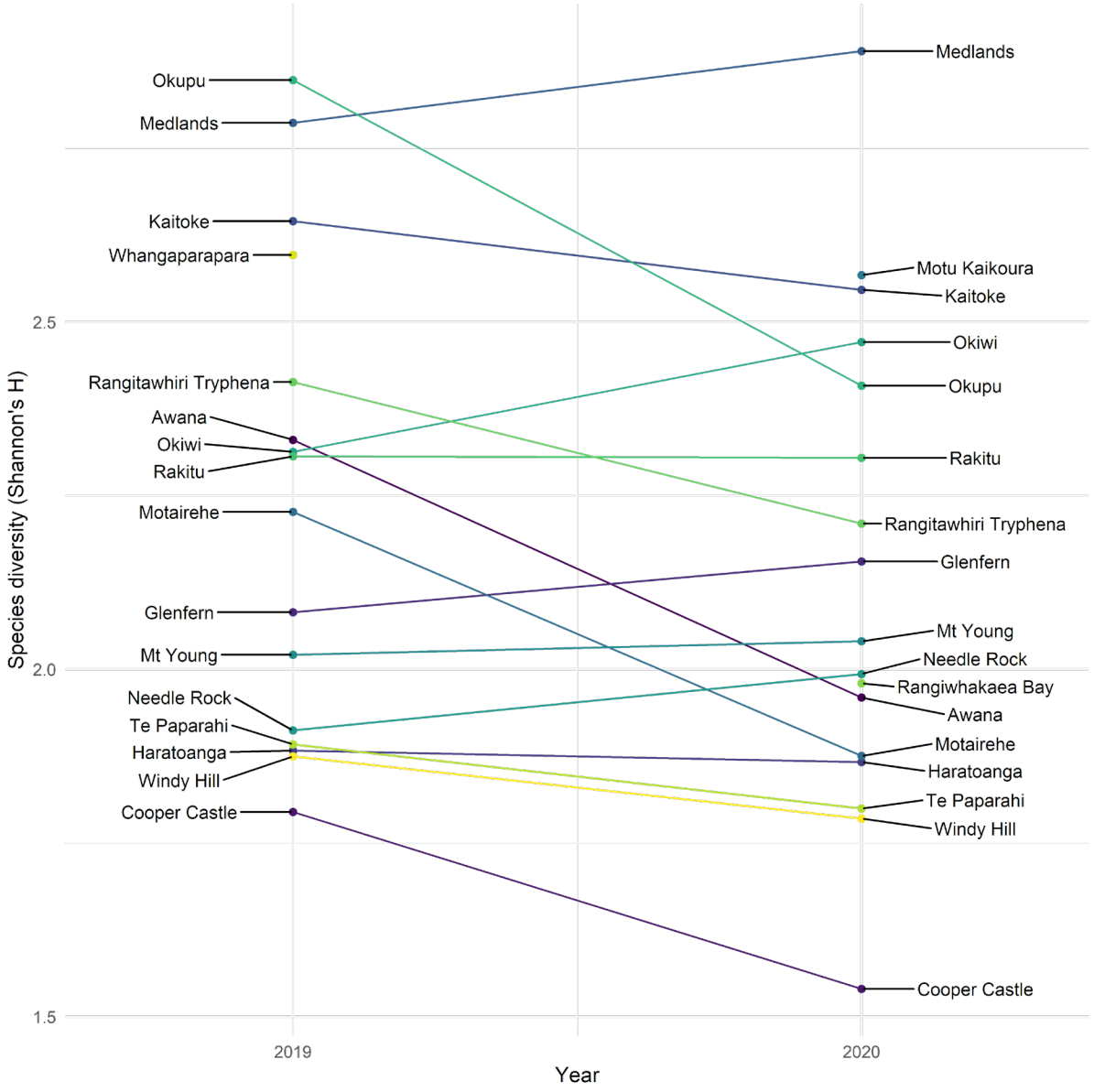

Figure 7: Bump plot of the change in species diversity between 2019 and 2020.

4 – Discussion

We analysed the ABC data for the primary, island-wide patterns of abundance; site-specific patterns of abundance, richness, and diversity; and site dissimilarity. Analysis of the aggregated data shows the most frequently observed species on Aotea during the ABC-2020 to be the kākā, tūī, grey warbler, kingfisher and fantail (Figure 2). Of course, bird species are not uniformly distributed across the island. For example, Kaitoke had few records of tūī, and none of the kākā, and the only observations of kākāriki were at Okiwi. The hierarchical cluster analysis assesses the differences in species composition among the sites. Not surprisingly, the sites tend to cluster according to their habitat type. The Kaitoke and Medlands survey locations are wetland habitats, hence the lack of bush birds like the kākā and tūī, and high counts of pūkeko, swallows and kingfishers (see also Anderson, 2003). The Awana site (clustered with Okupu, Okiwi and Rangitawhiri Tryphena; Figure 5, blue branches) was cleared in the early 20th century for farming and underwent annual controlled burning until about 1940. Parts of the Awana basin now comprise mānuka–kānuka scrubland with some exotic species such as *Hakea* and pine (Perry *et al.*, 2010). Awana has a relatively low bitd diversity (Table 1), with the community dominated by tūī, kingfishers, and kākā. All the other sites were more similar in their species composition to each other (Figure 5); the branches forming the cluster from Rakitu to Mt Young are largely montane sites.

Of the four target species, tūī and kākā were common in all the sites of the large cluster identified by the cluster analysis (Figure 5, blue branches). Although present at most sites, lower counts of kererū were recorded across Aotea, with higher abundances at Mt Young, Needle Rock, Okiwi, and Rangitawhiri Tryphena (Table 2). Kākāriki were absent from all sites apart from Okiwi, reaffirming the dependence of kākāriki on intensive pest management. Comparisons of species richness and diversity between surveys from 2019 and 2020 must be interpreted cautiously since variability is to be expected in the data. However, they provide examples of how the data can be used to highlight trends if repeat surveys are conducted biannually or annually. Furthermore, as more data become available, more sophisticated statistical methods designed to characterise changes in community composition and structure may also be used.

In the interests of reproducible data analyses and use for the analyses of future bird counts, both the data and the scripts are archived in an online repository. Data can be found at: https://doi.org/10.17608/k6.auckland.14865372.

4.2 – Limitations

Some sources of uncertainty exist in the data collection methods that must be accounted for during analysis and interpretation (see MacLeod *et al.*, 2012 for a detailed comparison of methods). The primary limitations in the data are:

- Location bias: survey locations are typically along a track or accessway. Bird counts from such locations may not be closely representative of the true abundance of a given area.

- Detection bias: birds species are not all equally likely to be observed due to size, sound and behavioural differences. Some birds, such as the tūī, are conspicuous and loud, while others, such as the tomtit, are small and inconspicuous.

- Identification bias: not all bird species are equally identifiable visually or audibly. For example, some species such as the kererū are visually easy to identify, while ones such as the yellowhammer may be more easily confused with another such as the goldfinch.

While some limitations exist (as with any observational ecological data), some can be mitigated. For example, survey groups have at least one trained observer to reduce identification error, and statistical methods exist to correct observation bias in data analysis. Thus, despite sources of uncertainty, important patterns can be derived from the data.

4.3 – Conclusion

Counts from the ABC offer valuable insights into patterns of species richness, diversity and abundance. If repeated annually or biannually, data from the ABC can also be analysed for change over time in the abundance and distribution of species. Thus, it is recommended that the ABC is repeated at regular intervals to build a reliable long-term dataset. It is also important that data and code used in analysis are archived so that they are easily accessible to interested stakeholders and researchers. Such data can help track changes in the abundance of species (especially endemic declining species such as the pāteke) and the success of management interventions.

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Appendix A

Table 3: List of names and conservation status, including their Māori, Latin, and European names. Note some species have multiple Māori or European names that are not included. Names are sourced from New Zealand Birds Online (New Zealand Birds Online, 2013).

Māori name	Latin name	European name	Conservation status	NZ conservation status
Kāhu	*Circus approximans*	Harrier Hawk	Not Threatened	Native
Kaireka	*Alauda arvensis*	Skylark	Introduced and Naturalised	Introduced
Kākā	*Nestor meridionalis*	Brown Parrot	Recovering	Endemic
Kākāriki	*Cyanoramphus novaezelandiae*	Red-crowned parakeet	Relict	Endemic
Karoro	*Larus dominicanus*	Black-backed Gull	Not Threatened	Native
Kawau tūi	*Phalacrocorax sulcirostris*	Little Black Shag	Naturally Uncommon	Native
Kererū	*Hemiphaga novaeseelandiae*	Wood Pigeon	Not Threatened	Endemic
Kōtare	*Todiramphus sanctus*	Sacred Kingfisher	Not Threatened	Native
Makipae	*Gymnorhina tibicen*	Magpie	Introduced and Naturalised	Introduced
Manu Pango	*Turdus merula*	Blackbird	Introduced and Naturalised	Introduced
Matuku Moana	*Egretta sacra*	Reef Heron	Nationally Endangered	Native
Mioweka	*Gallirallus philippensis*	Banded Rail	Declining	Native
Mohua	*Mohoua ochrocephala*	Yellowhead	Recovering	Endemic
Ngirungiru	*Petroica macrocephala*	Tomtit	Not Threatened	Endemic
Pahirini	*Fringilla coelebs*	Chaffinch	Introduced and Naturalised	Introduced
Pāteke	*Anas chlorotis*	Brown teal	Recovering	Endemic
Pīpīwharauroa	*Chrysococcyx lucidus*	Shining Cuckoo	Not Threatened	Native
Pīwakawaka	*Rhipidura fuliginosa*	Fantail	Not Threatened	Endemic
Pūkeko	*Porphyrio melanotus*	Purple Swamphen	Not Threatened	Native
Pūtangitangi	*Tadorna variegata*	Paradise Duck	Not Threatened	Endemic
Riroriro	*Gerygone igata*	Grey Warbler	Not Threatened	Endemic
Ruru	*Ninox novaeseelandiae*	Morepork	Not Threatened	Native
Tākapu	*Morus serrator*	Gannet	Not Threatened	Native
Tarāpunga	*Larus novaehollandiae*	Red-billed Gull	Declining	Native

Tauhou	*Zosterops lateralis*	Silvereye	Not Threatened	Native
Tiu	*Passer domesticus*	Sparrow	Introduced and Naturalised	Introduced
Tōrea pango	*Haematopus unicolor*	Oystercatcher	Recovering	Endemic
Tūī	*Prosthemadera novaeseelandiae*	Parson Bird	Naturally Uncommon	Endemic
Tūturiwhatu	*Charadrius spp.*	Dotterel	NA	NA
Warou	*Hirundo neoxena*	Swallow	Not Threatened	Native
Weka	*Gallirallus australis*	Woodhen	Not Threatened	Endemic
-	*Emberiza citrinella*	Yellowhammer	Introduced and Naturalised	Introduced
-	*Acridotheres tristis*	Mynah	Introduced and Naturalised	Introduced
-	*Vanellus miles*	Spur-winged Plover	Not Threatened	Native
-	*Turdus philomelos*	Song Thrush	Introduced and Naturalised	Introduced
-	*Ardea cinerea*	Grey Heron	Vagrant	Native
-	*Anas platyrhynchos*	Mallard Duck	Introduced and Naturalised	Introduced
-	*Carduelis carduelis*	Goldfinch	Introduced and Naturalised	Introduced
-	*Carduelis flammea*	Redpoll	Introduced and Naturalised	Introduced

Appendix B

Counts of each of the identified species on Aotea. Colours indicate their New Zealand conservation status (native, endemic, introduced, or NA for birds unidentified to the species level).

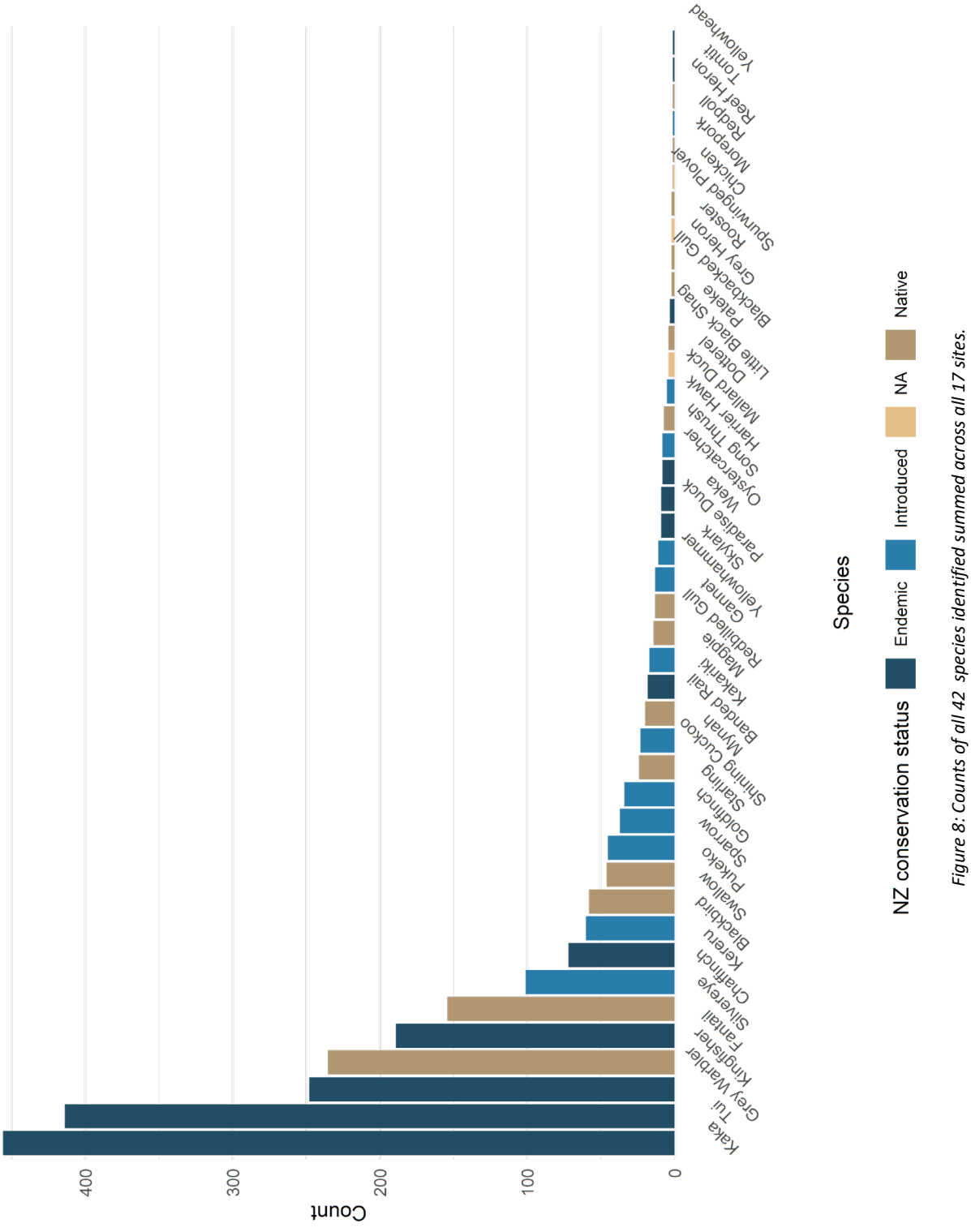

Figure 8: Counts of all 42 species identified summed across all 17 sites.