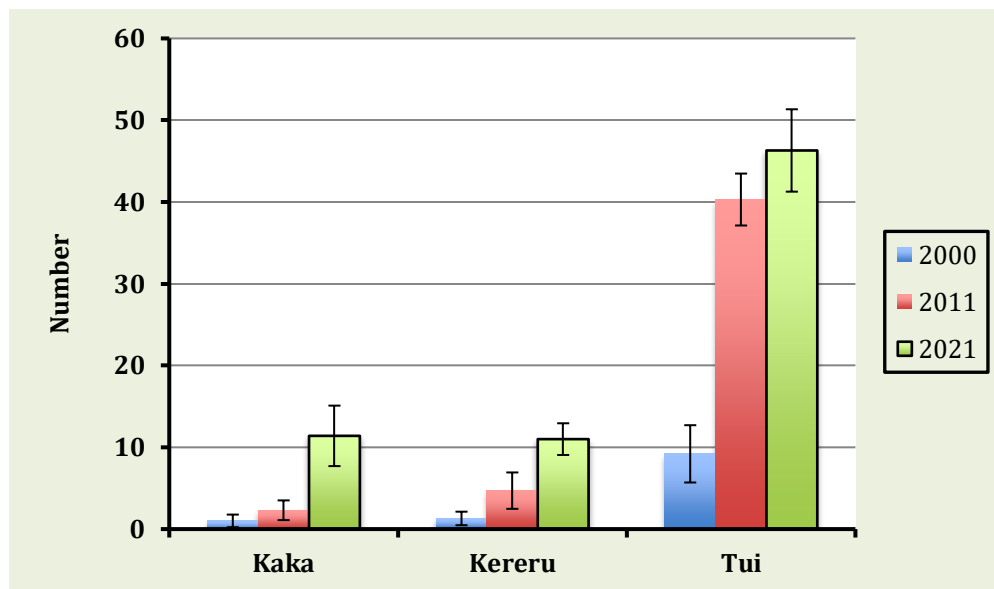


# WINDY HILL ROSALIE BAY CATCHMENT TRUST



## TRENDS IN BIRD ABUNDANCES AT WINDY HILL 2000 – 2021



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## TRENDS IN BIRD ABUNDANCES AT WINDY HILL 2000 – 2021.

### Executive Summary:

- ° Five-minute bird counts made on 10 days at each of 10 locations in the Windy Hill Sanctuary in 2000, 2011 and 2021 are presented graphically and statistically analysed.
- ° Kaka, kereru and tui all show consistent increases in frequency over this time period.
- ° Small, mainly insectivorous birds, (fantail and grey warbler) fluctuate in frequency and show no clear trends. There is possibly a small increase for grey warbler.
- ° Silvereeye also shows large annual fluctuations, but 2021 counts were significantly higher than 2011.
- ° These trends are supported by other independent count data.
- ° Comparison of the results with independent data collected over two decades from elsewhere on Great Barrier Island indicates that coordination and combined data analyses between different groups undertaking bird monitoring will lead to greater certainty in assessing trends in bird abundance.
- ° The observed trends are probably a consequence of: (1) a gradual shift in forest canopy composition away from kanuka and towards broadleaved species; (2) an increase in food available in gardens throughout the Medlands – Tryphena area, and (3) a reduction in predation pressure from rats in the rat-managed area, allowing greater nesting success and more availability of food supplies.

*Forest in transition: old kanuka being replaced by broad-leaf trees*



## TRENDS IN BIRD ABUNDANCES AT WINDY HILL 2000 – 2021.

### *Introduction*

This report presents the results from three sets of five-minute bird counts made by Dean Medland at ten stations at Windy Hill Sanctuary between 2<sup>nd</sup> to 29<sup>th</sup> May 2000, 31<sup>st</sup> May to 21<sup>st</sup> June 2011 and 3<sup>rd</sup> to 30<sup>th</sup> May 2021. The data comprise 10 repeat counts at each of 10 stations.

These three data sets are additional to the three-minute bird counts made along transect lines throughout the Windy Hill-Rosalie Bay study area and reported separately each year (initially more frequently) from 2001 to 2018<sup>1</sup>.

### *Methods*

On each recording day counts were made at ten locations. Count starting time varied from day to day and between stations, but all were made between 8.0AM and 3.57 PM, with the majority between 9.0 and 12.0 AM. The sampled area was unbounded – i.e. no attempt was made to record the distance of the seen/heard birds from the station. The locations are described in Appendix 1. The area covered is approximately 15 hectares situated near the central (inhabited) area of the Windy Hill – Rosalie Bay Catchment. The sample stations were sufficiently separated so that the same individual birds, heard or seen, were very unlikely to be recorded at more than one station. At each station, the recorder counted the number of individuals of each species heard or seen in a five-minute period.

### *Data entry and analysis*

At each site birds seen and/or heard were recorded. In dense foliage it was difficult to be sure that all calls were from different birds, or that two sightings of a species represented different individuals. Consequently, there will be a tendency to over-estimate abundance. In order to make some allowance for this, when the data were entered into an excel spread-sheet, if a species was both heard and seen more than once in the 5-minute period, only the largest number seen or heard was entered; for example, if a species was seen three times, and heard twice, only 3 (rather than 5) was entered. This has the effect of reducing the estimated abundance.

The data do not allow estimates of the density (no./unit area) of bird species. All that can be gathered from them is either 'total number of occurrences' (sightings and/or hearings) or relative frequency. Frequency is the number of times a species

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<sup>1</sup> See separate reports. Most recent (2019) is for December 2018.

was heard or seen out of a maximum possible 100 (10 stations on 10 days). It can be thought of as the probability of hearing or seeing the species in question in a 5-minute period at any of the stations. Frequency is also strongly influenced by the 'conspicuousness' of the species, which varies greatly between species, and within species is influenced by time of day and other variables. However, frequency is otherwise a robust measure for making comparisons at different times, especially when, as in this case, repeat estimates have been made at the *same time and place, and by the same observer*.

Frequency was calculated for each species in each year by recording the number out of 100 station/days at which it was recorded. This provides a single figure for each species in each year without any estimate of variance.

In order to assess variance and carry out significance tests the raw count data were summed for each species on each day to provide ten values representing the sum of all the stations – one value for each day of sampling. These 10 values were averaged, and their means, standard deviations and standard errors were obtained. The variance represents different days (ie weather, time etc). In the previous analysis (2011) averaging by stations was shown to give similar statistical results (see Report JO July 2011) so was not carried out in 2021. Different years were compared pairwise using the 't' test function in EXCEL for each species. A two tailed, paired test was employed.

### *Results*

The overall frequency data are given in the appendices and summarized in Fig 1. Because error bars cannot be attached to the frequency data, they are also presented as counts with confidence limits (bars) in Figs 2 and 3. As expected these two figures reflect the frequency data depicted in Fig 1. Kingfishers are excluded from the numerical figures and the statistical comparisons because none were recorded in 2021. 'Total bird' numbers (i.e. all species together) are also not shown on the figures to avoid distorting the other species.

The statistical comparisons between the three data sets (2000, 2011, 2021) and comparable results from other studies are given in Table 1. Overall, these comparisons indicate that native bird numbers have increased on Aotea over the last two decades. Totals for all birds combined increased from an average of 70 birds heard/seen each day at the ten stations (in 10 x 5-min counts) in 2000 to an average of 108 in 2021; this 54% increase over 21 years is statistically significant. However, individual species show this increase to differing degrees.

The three large, mainly frugivorous species – kaka, kereru and tui - all show highly significant increases in this study (Fig 2). Although only three sampling years are included here, independent studies (and anecdotal data) support the results (Table 1).

The smaller insectivores (grey warbler, fantail) and the omnivorous silvereye show much variation from year to year and between studies, so trends are not so clear (Fig 3).

The overall 2000-2021 comparison demonstrates significant decreases for fantail and silvereye, although both species apparently showed a strong recovery during the last decade (2011-2021). These sorts of fluctuations are hard to interpret, but probably numbers do vary considerably from year to year and seasonally, and the situation is also complicated by conspicuous flocking in silvereye, and by the tendency of fantail to be attracted to human observers.

Grey warbler is not singing frequently in May, so the low numbers recorded in each of the three years of this study probably reflect this. However, slightly more have been recorded each year. This situation mirrors that in the December counts in the Windy Hill Sanctuary, where a gradual increase has been recorded (2008 – 18). The ABC count compared with the earlier GBIET counts (2007 cf 2019) also suggested a small (non-significant) increase. Overall, it appears that a small increase has occurred, perhaps obscured by seasonal and daily variability in weather-related singing frequency.

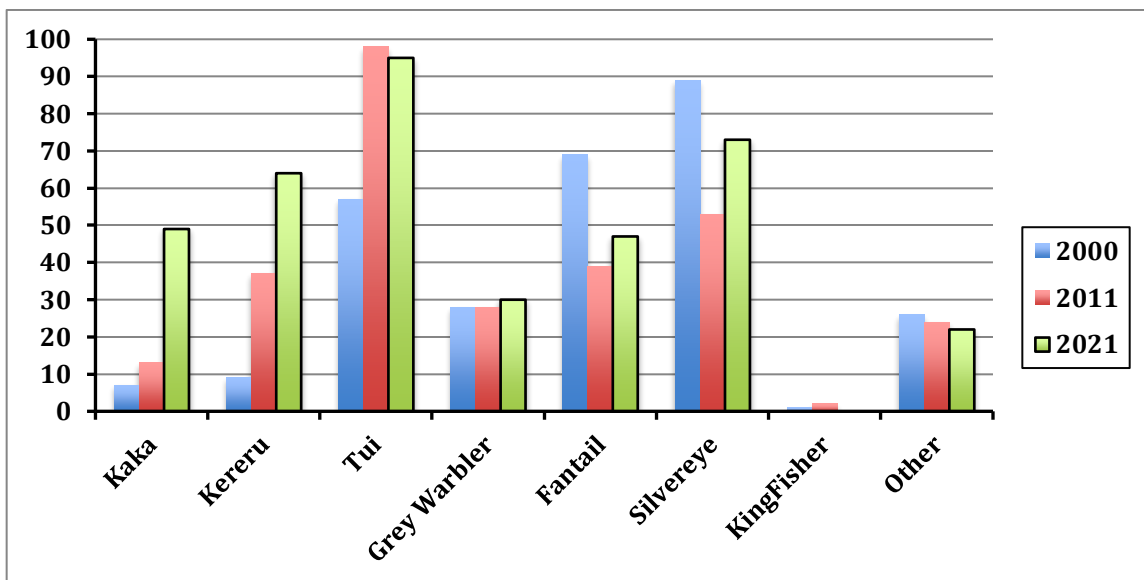


Fig 1. Frequency in 100 five-minute bird counts in winter: 2000, 2011 and 2021.

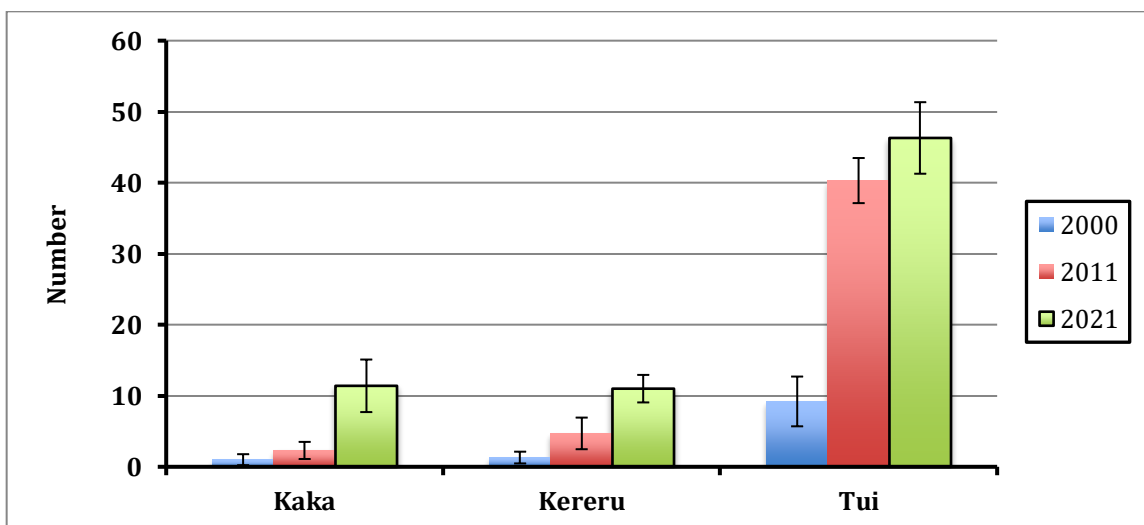


Fig. 2. The large frugivores. Mean number in 10 counts per day at 10 sites, with 95% Confidence Limits (bars). Three years.

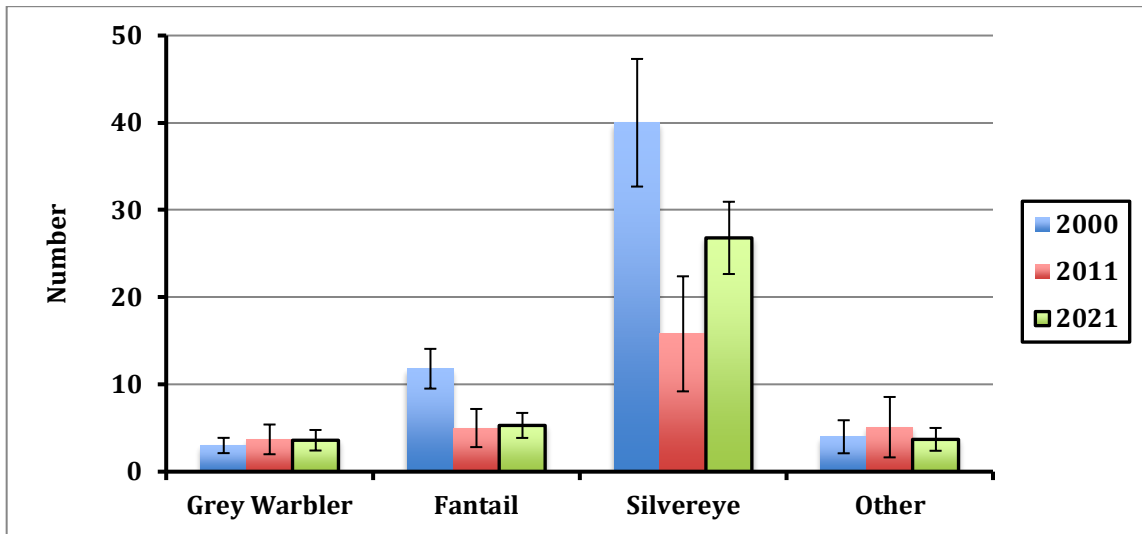


Fig. 3. Small insectivores, omnivores and 'others'. Mean number in 10 counts per day at 10 sites, with 95% Confidence Limits (bars). Three years.

Table 1. Probability ( $p$ ) values for t-test differences in counts between years for each species and comparisons with independent data sets. Increases (incr) and decreases (decr) indicated. Asterisks indicate level of statistical probability of change (see note below).

Comparison	Kaka	Kereru	Tui	Grey Warbler	Fantail	Silvereeye	Other	Total
$p$ paired t-test 2011 - 21	incr***	incr**	incr (NS)	incr (NS)	incr (NS)	incr*	decr (NS)	incr**
$p$ paired t-test 2000 - 21	incr***	incr***	incr***	incr (NS)	decr**	decr**	decr (NS)	incr***
WH 2008 - 19 (1)	incr (NS)	incr (NS)	incr***	incr*	incr (NS)	decr (NS)	decr (NS)	incr (NS)
ABC 2007 - 19 (2)	incr (NS)	incr*	incr***	incr (NS)	decr (NS)	incr (NS)	incr (NS)	incr (NS)
<b>Overall trend</b>	<b>increase</b>	<b>increase</b>	<b>large increase</b>	<b>Small increase</b>	<b>variable</b>	<b>variable</b>	<b>decrease(3)</b>	<b>increase</b>

Notes. Significance levels are: \*\*\*  $p < .0001$ ; \*\*  $p < .001$ ; \*  $p < .01$ ; NS not significant  $p > .05$ . (1) WH, Windy Hill annual bird counts (December). (2) Aotea Bird Count, Great Barrier Environmental Trust data (GBIET 2020)<sup>2</sup>. (3) Mostly introduced passerines.

Excepting finches, introduced birds (Passerines) may have reduced somewhat at Windy Hill (Table 1, and Fig 4). Mynas were actively removed after 2011, but the declines in blackbirds and thrushes may be natural and real, although numbers are very low so that trends are impossible to judge with confidence. Some winter movement to lower altitude (as with kingfishers, is likely. No yellowhammers were recorded in 2011 or 2021, but it is possible they were included with 'finches'. This category appears to have shown a steady increase, and comprised most of 'others' in 2021. Most of the observations were probably chaffinches, which is the commonest introduced passerine in the bushed areas at Windy Hill, but could include goldfinches or house sparrows seen or heard at a distance.

<sup>2</sup> Great Barrier Island Environmental Trust 2020. *Comparisons between ABC 2019 bird-count results and 2006-07 GBICT counts, and 2018 Windy Hill data*. Report to GBIET, J. Ogden, June 2020,

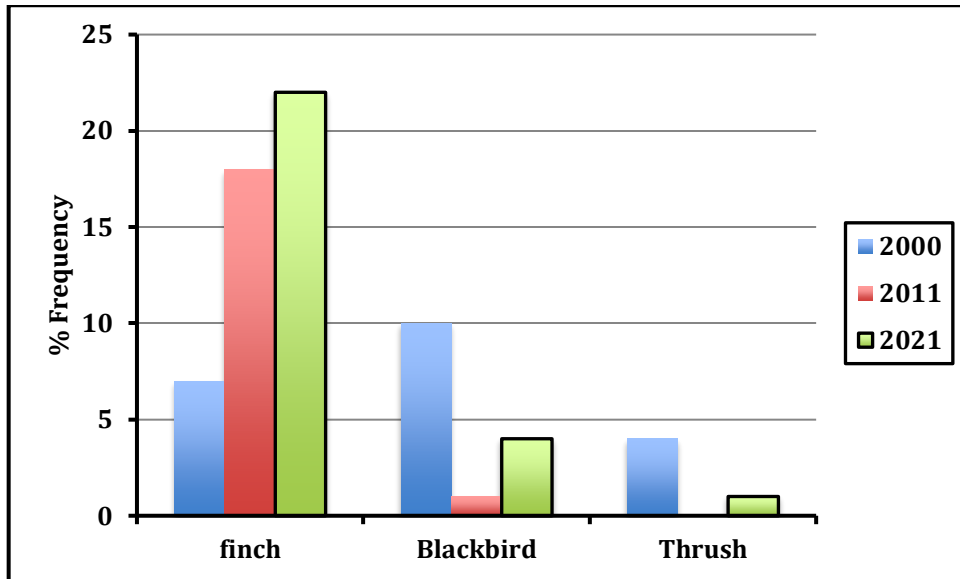


Fig 4. Changes in % frequency of introduced species grouped under “others”.

### Discussion

As all three counts were made in winter they exclude certain species (e.g. shining cuckoo) and record low values for other species known to move away from the area at this time (kingfisher). A proportion (probably c. 50%) of kaka leave Aotea in winter also<sup>3</sup> so the strong increase recorded here is due either to a real increase in abundance, or to increased winter residence. The former is supported by other studies.

The relative abundances of the various native species have remained similar over the twenty-one year period, although the larger frugivores have certainly increased, while the small insectivorous species have probably not. This is in keeping with the gradual succession from kanuka forest with abundant spiders and insects, to more mixed broadleaf forest with fruit-bearing shrubs and trees occurring at Windy Hill and elsewhere on Great Barrier.

Grey Warbler, silvereye, and to a lesser extent, fantail, are species characteristic of kanuka forest, especially in winter, when they often form mixed flocks. All three species are to varying degrees insectivorous, presumably more so in the winter when alternative foods (fruit and nectar in the case of silvereye) are less available. Consequently, as forest succession moves from kanuka dominance towards more broadleaved species, the preferred habitat for these species may decline, at least during the winter months. These vegetation trends have been clearly demonstrated at Windy Hill<sup>4</sup>. Likewise, if this trend is the driver, we would expect the observed increases in frugivorous species such as kaka, kereru, and tui. This

<sup>3</sup> Ogden, J 2011. Boxing day kaka count – and some conclusions. Environmental News. 24: 7 -11. Great Barrier Island Environmental Trust.

<sup>4</sup> Perry, G.L.W., Ogden, J. Enright, N.J. & Davy, L.V. 2010. Vewgetation patterns and trajectories in disturbed landscapes, Great Barrier Island, Northern New Zealand. *New Zealand Journal of Ecology* 34(3):311-323.

trend would be accentuated by reduced fruit predation by rats, for example on nikau and puriri. Nikau in particular has been shown to have increased seedling abundance (and fruit yield) in response to rat management at Windy Hill<sup>5</sup>. The negative relationship between bird and rat abundances has been clearly shown at Windy Hill by comparison between the managed and control areas<sup>6</sup>.

An increase in the frugivores is also in keeping with the expansion of gardens and other winter food resources. Kaka may be benefitting in winter from the increased abundance of mature cone-bearing pines<sup>7</sup>. Tui have certainly increased throughout the Island. Their increase in the unmanaged control areas at Windy Hill<sup>8</sup> suggests that the managed areas are 'exporting' this species. There is no doubt that some species leave the Sanctuary for other areas, presumably searching for better food resources and/or vacant territories (e.g, introduced robins moving to Hirakimata).

The generalist silvereye shows great variability but may have increased in the last decade despite suffering some mortality from rat trapping in the area. Winter flocks were prominent in 2021.

The conclusion that bird numbers generally are increasing on the Island is supported independently by 3-minute 'distance estimated' bird counts reported from various locations in the Windy Hill Rosalie Bay Sanctuary and Benthorn Farm between the dates reported here, and by other counts elsewhere (Table 1). This positive conclusion could not have been safely reached without frequent counts over twenty years by various organisations, strongly lead by the projects at Windy Hill.

Three factors appear to be driving the increase in tui, kereru and kaka numbers at Windy Hill:

1. A gradual shift in forest canopy composition away from kanuka and towards broadleaved species;
2. An increase in food available in gardens throughout the Medlands – Tryphena area;
3. A reduction in predation pressure from rats allowing greater nesting success and more availability of food supplies.

The first of these may have a *negative* impact on fantail and silvereye.

Previous analyses<sup>9</sup> have noted a trend of decreasing abundance in introduced passerines (sparrows, finches, blackbirds, starlings etc.) at Windy Hill since 2000. These birds are normally associated with man-made habitats and seem not to

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<sup>5</sup> Samanka, D.M. in :Ogden, J. & Gilbert, J. 2009. Prospects for the eradication of rats from a large inhabited island: community based ecosystem studies on Great Barrier Island, New Zealand. *Biological Invasions* 11: 1705-1717. See also Campbell, D. J. & Atkinson, I.A.E. 2002. Depression of tree recruitment by the Pacific rat (*Rattus exulans*) on New Zealand's northern off-shore islands. *Biological Conservation* 107: 19-35.

<sup>6</sup> Ogden, J. 2011. Windy Hill Rosalie Bay Catchment Trust, Bird Counts December 2010. Report JO

<sup>7</sup> Ogden, J (footnote 1 above), and personal communication. Todd Lander, Auckland Council Research and Evaluation Unit.

<sup>8</sup> Windy Hill Rosalie Bay Catchment Trust. Bird Counts December 2018. Ogden, J. 2019.

<sup>9</sup> Ogden, J. 2009. Windy Hill Rosalie Bay Catchment Trust, Bird Counts December 2008. Report JO 1.



thrive in dense native bush, so that this decline can also be associated with vegetation succession from open paddocks, through manuka/kanuka, and from that to denser forest. With the marked exception of the 'finches', Fig 4 appears to support that trend. The decline in blackbirds and thrushes may be illusory, as in both cases conspicuousness is very much influenced by singing, which rarely occurs in May. Chaffinches on the other hand tend to flock with other finches and sparrows in winter and become more conspicuous along roadsides.

### *Conclusions*

Some highly significant trends have been confirmed by this comparison of bird counts at Windy Hill over twenty-one years. In particular some of the larger frugivorous forest birds (kereru, tui and kaka) have increased, while smaller generalist and insectivorous species (grey warbler, silvereye and fantail) have fluctuated in abundance but generally remained unchanged, with the possible exception of a slight increase in grey warblers. The diversity of introduced passerines may have declined, though chaffinches have probably increased. All these trends are supported by other, independent, analyses of 3-minute bird counts in summer and winter throughout a wider area surrounding that covered in this report. The increasing trends are likely driven by increased food availability for the large forest birds as a consequence of reduction in rat numbers, forest succession, and increased food (flowers, fruit) in gardens. Decreases in small insectivores may also be driven by food, in this case reduced winter availability as the kanuka forest gradually succeeds to a more mixed broadleaved canopy structure.

The results demonstrate the value of long-term monitoring using standardized methods and dates. Because bird populations are intrinsically very variable, and counts are influenced by many factors including specific conspicuousness, results from several independent studies are helpful in reaching conclusions. This in turn implies that coordination of different studies, and an overview of all the results, should be an integral part of future bird monitoring on Aotea.

### *Recommendations*

- ° The stations should be GPSed and the locations marked and recorded in Appendix 1.
- ° The five minute count provides another insight into bird population change – it should continue to be carried out at 5 or 10 year intervals at the marked locations.
- ° Coordination between different groups undertaking bird monitoring should be seen as the best way of achieving comparable results, the overview of which will lead to greater certainty in assessing trends in bird abundance
- ° Population fluctuation in grey warbler, fantail and silvereye warrants further study. To what extent are rats involved in reducing breeding success? To what extent is food supply dependent on kanuka forest? This would make an excellent PhD topic.

### *Acknowledgements*

It is rare that a community group gets to have over 20 years of input from a single individual as we have had from Dean Medland. Dean started with the Trust in 1999 and is still involved in a range of capacities. He has been the single observer for the three bird counts over 20 years and we are much indebted to his knowledge and commitment.

The Trust acknowledges the Windy Hill Sanctuary field team - Kevin Parsons, Corey Hardstaff, Dan Williams, Maxine Bowerman, and Dave Harland – who are the engine room of this project creating the right conditions for the increase in bird abundance.

Thank you also to Trustees : Judy Gilbert ( also Trust Manager), Derek Bell, John Ogden and Rose Harland

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APPENDIX 1. Station locations.

Number	Description	GPS location
1	Don McGregor's driveway on road	
2	Just below Scrimshaw's driveway on road	
3	On the flat coming into Windy Hill	
4	Meeting House	
5	By Ian's caravan	
6	Up at CT's old shack (Liz and Paul's)	
7	Mid driveway to Judy Gilbert's	
8	Front of Judy Gilbert's house	
9	On track I 1	
10	On track I 3	

APPENDIX 2. Data for 2000. (kingfisher, 1 record, excluded). "Other" includes all introduced passerines. More detailed spreadsheets available from: [johnogden@farmside.co.nz](mailto:johnogden@farmside.co.nz)

Station	Month	Repeat	Kaka	Silvereye	Tui	Grey Warbler	Fantail	Kereru	Other	Total
1	29-May	1	1	4	1		1			7
2	29-May	1		3		1				4
3	29-May	1		2			1			3
4	29-May	1		2	1		1			4
5	29-May	1			2		2			4
6	29-May	1		4			2		1	7
7	29-May	1	2		1	1				4
8	29-May	1		5	1		1			7
9	29-May	1		8	2		1	1		12
10	29-May	1		3	2	1				6
1	27-May	2		5	3	2				10
2	27-May	2		4		1	1		1	7
3	27-May	2		3	2					5
4	27-May	2		5			2		3	10
5	27-May	2		4			1			5
6	27-May	2		3						3
7	27-May	2		5	1					6
8	27-May	2		3						3
9	27-May	2		6	1	1	2		1	11
10	27-May	2		4	1					5
1	22-May	3		4			1		1	6
2	22-May	3		3	2		1			6
3	22-May	3		25			1		1	27
4	22-May	3		3					1	4
5	22-May	3		4	1		1			6
6	22-May	3		3			1			4
7	22-May	3		4		1	1			6
8	22-May	3		2	3	1				6
9	22-May	3			2				2	4
10	22-May	3		5			1	1	1	8
1	17-May	4		10				1	1	12
2	17-May	4		4			1			5
3	17-May	4		5	2		3			10
4	17-May	4		10	2		2			14

5	17-May	4		3					1	4
6	17-May	4		8	1		1		2	12
7	17-May	4		6	1		3			10
8	17-May	4		4	1		2			7
9	17-May	4		10	1	1	3	2		17
10	17-May	4		3	1	1	3			8
1	15-May	5		2	2	1	1	1		7
2	15-May	5		3			2			5
3	15-May	5		4	3		2		1	10
4	15-May	5		10						10
5	15-May	5		5	1					6
6	15-May	5		3		1	2		6	12
7	15-May	5		10					1	11
8	15-May	5		4			1		1	6
9	15-May	5		4			1			5
10	15-May	5		3	1		2			6
1	10-May	6	1		1	1	2			5
2	10-May	6		2	2	1				5
3	10-May	6		5	1		2			8
4	10-May	6		3					1	4
5	10-May	6		3	1		1			5
6	10-May	6					1			1
7	10-May	6		10	2		2			14
8	10-May	6		10			2			12
9	10-May	6			2	1	2			5
10	10-May	6		3	1		2			6
1	9-May	7		5			2			7
2	9-May	7		3	1	1				5
3	9-May	7		4	1		2			7
4	9-May	7	3	10			3			16
5	9-May	7								
6	9-May	7						1		1
7	9-May	7		3			3			6
8	9-May	7		3		1	2			6
9	9-May	7		10	1		1			12
10	9-May	7		1		1				2
1	5-May	8	1	8	1		1	2	1	14
2	5-May	8		3	1					4
3	5-May	8	1	3	2		2			8
4	5-May	8		3	3	1			5	12
5	5-May	8		5	2	1	3			11
6	5-May	8			1	1	1		1	4
7	5-May	8		5	3		2	2		12
8	5-May	8		4	3	1	2		1	11
9	5-May	8			2		1			3
10	5-May	8		4	3	2				9
1	3-May	9	1	4	2		3	2	2	14
2	3-May	9		2	2		4			8
3	3-May	9		4	2					6
4	3-May	9		6	2					9
5	3-May	9		2	1	1	2			6
6	3-May	9		2		1				3
7	3-May	9		2	2	1	2			7
8	3-May	9		2	1	1	1			5
9	3-May	9		2	1		1			4

10	3-May	9	1	2					3	
1	2-May	10	3			1		1	5	
2	2-May	10	2		1	1			4	
3	2-May	10	3			2			5	
4	2-May	10	4			1		1	6	
5	2-May	10	3			1		1	5	
6	2-May	10	2			3		1	6	
7	2-May	10	4			2			6	
8	2-May	10	2			3			5	
9	2-May	10	3	1		1			5	
10	2-May	10								
FREQUENCY		100	7	89	57	28	69	9	26	98

APPENDIX 3. Data for 2011. (kingfisher, 2 records, excluded). "Other" includes all introduced passerines.

Station	Month	Repeat	Silver		Grey		Fantail	Kereru	Other	Total
			Kaka	eye	Tui	Warbler				
1	31-May	1			4			1		5
2	31-May	1			2		2	1	1	6
3	31-May	1			1			1		2
4	31-May	1		5	3	1	1			10
5	31-May	1		3	6		1	1	1	12
6	31-May	1		2	3		1	1		7
7	31-May	1		5	3	1	1	1		11
8	31-May	1	2	20	4			2		28
9	31-May	1		3	3		5		2	13
10	31-May	1		4	4		2	1		11
1	1-Jun	2		2	2			1		5
2	1-Jun	2	2	3	3				2	10
3	1-Jun	2			3	1	1			5
4	1-Jun	2		5	3			1		9
5	1-Jun	2			4				1	5
6	1-Jun	2		3	1	1	1	2		9
7	1-Jun	2		2	5		2			9
8	1-Jun	2		2	6		1		1	10
9	1-Jun	2			3	2				6
10	1-Jun	2		4	4		2	1		11
1	2-Jun	3			3			1		4
2	2-Jun	3			2		1		1	4
3	2-Jun	3			4		1		1	6
4	2-Jun	3		1	3					4
5	2-Jun	3			2	1			1	4
6	2-Jun	3		1	3		1			5
7	2-Jun	3		2	5				1	8
8	2-Jun	3			6					6
9	2-Jun	3			4					4
10	2-Jun	3			5					5
1	8-Jun	4		2	3					5
2	8-Jun	4	1		2		1			4
3	8-Jun	4		2	2	1				5
4	8-Jun	4			3		1			4
5	8-Jun	4			4	1				5
6	8-Jun	4		3	4			1		8
7	8-Jun	4			5					5
8	8-Jun	4		3	5					8

9	8-Jun	4			5			1		6
10	8-Jun	4		2	6					8
1	9-Jun	5		2	2	2				6
2	9-Jun	5		2						2
3	9-Jun	5		1	4				1	6
4	9-Jun	5			2	2	1			5
5	9-Jun	5		5	6	1	1			13
6	9-Jun	5			3			2		5
7	9-Jun	5		2	7		1			10
8	9-Jun	5	2	1	4		1	1	2	11
9	9-Jun	5		2	7		2		1	12
10	9-Jun	5			4		1		2	7
1	13-Jun	6			4			1		5
2	13-Jun	6	3	2	3	1	2	2	1	14
3	13-Jun	6		5	3			1		9
4	13-Jun	6	2	2	3	3		2		12
5	13-Jun	6			6	1				7
6	13-Jun	6		4	4	2		1		11
7	13-Jun	6			6	1	1	1		9
8	13-Jun	6		4	8			1		13
9	13-Jun	6		3	5	1	1	1		11
10	13-Jun	6			5	1	1	2		9
1	15-Jun	7			2					2
2	15-Jun	7			2				4	6
3	15-Jun	7			4					4
4	15-Jun	7			2			1		3
5	15-Jun	7			3	1	1			5
6	15-Jun	7		1	4	1			16	22
7	15-Jun	7		5	5		1			11
8	15-Jun	7	2	2	9					13
9	15-Jun	7		2	8			1		11
10	15-Jun	7		1	7	1				9
1	16-Jun	8	1		3		1		2	7
2	16-Jun	8	1	3		1		1	2	8
3	16-Jun	8		5	2			2	1	10
4	16-Jun	8			4	1	1			6
5	16-Jun	8	2	2	4	1	1			10
6	16-Jun	8	2	3	4			3	1	13
7	16-Jun	8		1	5		1	1		8
8	16-Jun	8		2	7		1			10
9	16-Jun	8			5		1			6
10	16-Jun	8			4					4
1	20-Jun	9	1	2	3		1	1		8
2	20-Jun	9			2			1	1	4
3	20-Jun	9			4	1				5
4	20-Jun	9			3					3
5	20-Jun	9		5	5					10
6	20-Jun	9			4	3				7
7	20-Jun	9			5		2			7
8	20-Jun	9		2	8	2				12
9	20-Jun	9			6		1			7
10	20-Jun	9	2	1	4				3	10
1	21-Jun	10			3		1			4
2	21-Jun	10		3	3					6
3	21-Jun	10		2	4					6

4	21-Jun	10			5			2	7	
5	21-Jun	10			5	1			6	
6	21-Jun	10		2	6			2	10	
7	21-Jun	10			4				4	
8	21-Jun	10			8			1	9	
9	21-Jun	10			5			1	6	
10	21-Jun	10			3				3	
FREQUENCY		100	13	53	98	28	39	37	24	100

APPENDIX 4. Data for 2021. Finches: see text. Other = 4 blackbirds, 1 thrush.

Station	Month	Repeats	Kaka	Silver eye	Tui	Grey Warbler	Fantail	Kereru	finch	Other	Total
1	3-May	1	3	3	5	1					12
2	3-May	1			4		1	2			7
3	3-May	1	2	3	7		1	2	1		16
4	3-May	1	2	7	5	1	1				16
5	3-May	1			7	1		2			10
6	3-May	1		5	4		1	2	1		13
7	3-May	1	2		5		1				8
8	3-May	1		2		1		2			5
9	3-May	1		3	5			1			9
10	3-May	1	2	5	6		1	1	1		16
1	4-May	2	3	1	4			1			9
2	4-May	2	3	5	2	1			1	1	13
3	4-May	2	4	7			1	2			14
4	4-May	2		3	5		1		1		10
5	4-May	2		3	8	1			2		14
6	4-May	2	1	3	5			3			12
7	4-May	2			6	1	1				8
8	4-May	2			8	1					9
9	4-May	2	1	3	8			2			14
10	4-May	2		3	5		1	2			11
1	5-May	3	1	10	3		1				15
2	5-May	3		3	2		1	1			7
3	5-May	3	1	2	6			1			10
4	5-May	3			7						7
5	5-May	3			5		1	2			8
6	5-May	3		4	4			3			11
7	5-May	3		1	5		1				7
8	5-May	3		1	8						9
9	5-May	3			7		1	1			9
10	5-May	3		6	5			2			13
1	15-May	4	2	3	4	1	1	1			12
2	15-May	4		3	5						8
3	15-May	4	4	3	7		1	1			16
4	15-May	4		7	5	1			1		14
5	15-May	4	2		7	1		2			12

6	15-May	4		5	4			2	1		12
7	15-May	4			8		1	2			11
8	15-May	4	1	3	4						8
9	15-May	4			5		1				6
10	15-May	4	2	5	8			2			17
1	16-May	5	1	1	4	1		2		1	10
2	16-May	5	4	5	1	1	2	1			14
3	16-May	5	5		4		1	3	1		14
4	16-May	5		15	4		1				20
5	16-May	5	1	2	5			1			9
6	16-May	5	2	7	2		1		3		15
7	16-May	5	3	3	5		2	2			15
8	16-May	5	2		3	1	1	2	1		10
9	16-May	5	2		4		1	2			9
10	16-May	5		4	4		2	3	1		14
1	22-May	6			4						4
2	22-May	6	1	3	3			1			8
3	22-May	6	3	3	3		1		2		12
4	22-May	6	2		3				1		6
5	22-May	6	2	7	6			1			16
6	22-May	6	4		3	1					8
7	22-May	6			3		1				4
8	22-May	6			5		1				6
9	22-May	6				1	1	2		1	5
10	22-May	6		3	7	1	1	1			13
1	27-May	7	2	4	6	1		1			14
2	27-May	7	2	2	4		1	1	1		11
3	27-May	7		3	5			2	1		11
4	27-May	7	1	7	7	1					16
5	27-May	7			5			1			6
6	27-May	7		4	3			2			9
7	27-May	7		2	6			1			9
8	27-May	7	2		4						6
9	27-May	7	2	3	5	1	1	1			13
10	27-May	7		5	7		1	1	1		15
1	28-May	8	3	3	5						11
2	28-May	8		3	4			1			8
3	28-May	8	3	2	6		2	1			14
4	28-May	8		2	3	2			2		9
5	28-May	8	3	2	6					1	12
6	28-May	8	3	4	5	4			3		19
7	28-May	8	4	2	7		1	2			16
8	28-May	8			5			1			6
9	28-May	8	2		5		1	2			10
10	28-May	8	2	3	8	1	2	2			18
1	28-May	9		3	3			1			7
2	28-May	9	3		4	1	1	2			11
3	28-May	9	4					2			6



4	28-May	9		3	5		1		2		11
5	28-May	9	2	2	5				2		11
6	28-May	9	2	2	6	1			2		13
7	28-May	9			8		1				9
8	28-May	9		2	3		2		2		9
9	28-May	9		3	4		1		1		9
10	28-May	9	3	3		1			2		9
1	30-May	10		10	3		1		2		16
2	30-May	10		2	3		1		1		7
3	30-May	10		2	2						4
4	30-May	10		1	3						4
5	30-May	10		5	5				4		14
6	30-May	10		1	4	2			3	3	13
7	30-May	10	1	2	6	1					11
8	30-May	10		4	5						9
9	30-May	10		2	2	2			2		8
10	30-May	10	2	5	5	1	1		2	1	17
			SUM	114	268	463	36	53	110	32	5
			COUNT	49	73	95	30	47	64	22	5
											100