Native Bird Monitoring

Regional Report

Monitoring and Investigations, Greater Wellington Regional Council

August 2007

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Greater Wellington Regional Council

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Five minute bird counts are conducted in the Wellington Region to determine:

1. Relative abundance of native birds
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5. The response of native bird populations to predator control

Bird monitoring of 13 parks and reserves took place in February and March 2007 in accordance with the with the five minute bird monitoring protocol (Dawson and Bull, 1975). Data was collected either using point-transect or random point sampling. Data was analysed and confidence intervals calculated.

Predictably, the total number of birds counted and reserve size were positively correlated, with larger reserves having higher bird counts. Waikanae was the most abundant and diverse reserve, with a total of 360 birds from 28 different species. The smallest number of birds counted was 24 in Maidstone Park. Riverstone had the lowest diversity with only six species represented.

Most reserves recorded a broad mix of indigenous bird species with a scattering of locally rare or range restricted species such as whiteheads, käkäriki, bellbirds, tomtits and stitchbird. Silvereyes and tui were the most abundant bird species. Fantails and greywarblers were the most widespread and were present in all reserves. A single stitchbird was found in Waikanae for the first time. Keith George still retains the largest populations of whitehead and tomtits, with Pounui having the largest populations of greywarbler, silvereye and tui. Pest control appears to positively benefit fantail and whitehead populations. However, other factors may contribute to population variability.

2. Introduction

The objective of native bird monitoring is to monitor the outcomes of the Regional Pest Management Strategy. That is "*to protect indigenous biodiversity in a comprehensive selection of KNE's*", with the objective of achieving "a *measurable improvement in the ecological health and diversity of KNE using a wide range of indicators*".

A component of this monitoring is to investigate whether bird diversity and/or abundance is likely to increase from pest animal control, and in particular control of possums, rats, mustelids, and feral cats. A desired outcome is to have self sustaining endemic populations of a variety of bird species in different habitat types.

Bird monitoring provides a readily observable change in the environment indicating ecosystem health and identifying environmental issues. Native bird outcomes can be of interest to care groups, local authorities the general public and other stake holders. It is an invaluable tool for decision making.

Native bird monitoring is done using five minute bird counts to measure bird biodiversity, distribution, abundance, the presence of locally rare species (Dawson and Bull 1975), and should detect differences between reserves and changes over time. Although five minute bird counts measure the significance of population changes over time it can not determine absolute bird abundance.

Five minute bird counts rely on large sample sizes and repetition to overcome:

1. Variability between samples
2. Insensitivity to the differences between locations
3. Effect of monitoring at different times at the same location

Five minute bird counts have some key benefits:

1. Surveys are done in a diverse range of locations and habitat types
2. Surveys are done in sites that vary widely in size and number of sample points
3. Data is collected over a short period of time, up to two months
4. Surveys enable comparison of bird population changes annually over the entire region. However, comparing a time period of less than three-years is undesirable (Graham and Veitch 2002) so long term trends are only done for sites monitored for three or more years. This year we have four sites surveyed for three years.

Monitoring sites are selected because they have been assigned 'high priority' using an ecological prioritisation model, or because there is interest from volunteer groups or local authorities.

The 13 sites monitored this year are

- Cloustonville – started 2007 (Upper Hutt)
- Emerald Hill – started 2006 with one new point in Brown Owl added in 2007 (Upper Hutt)
- Greytown Park – started 2007
- Keith George – started 2005 (Upper Hutt)
- Maidstone Park – started 2006 (Upper Hutt)
- Riverstone – started 2007 (Upper Hutt)
- Porirua – started 2005
- Pounui – started 2005
- Sulphur Wells – started 2006
- Tauherenikau – started 2005
- Trentham Memorial Park – started 2007 (Upper Hutt)
- Waikanae River – started 2007
- Witako – started 2006

A preliminary trail was run with four sites in February 2005 and the programme officially started in February 2006. In 2007 Upper Hutt City Council joined the programme with the addition of three new sites and the extension of an existing one (see above). A new site was also added in the Wairarapa and one on the Kapiti Coast.

Since 2002 Wellington City Council has run a native bird monitoring programme in nine reserves with a similar design and protocol to Greater Wellington's. Monitoring occurs in March and April. A brief comparison of results has been included in this report.

3. Methods

All monitoring was done in accordance with the five minute bird monitoring protocol (Dawson and Bull, 1975). Monitoring was done in February and March, starting approximately one hour after official sunrise and finishing approximately 1pm, and was conducted in fine weather with little to no wind.

Data was collected either using point-transect or random point sampling. Transect lines had three bird monitoring points, each, spaced at 200 metre intervals. This differed from the 2005 monitor where points were spaced 100 meters apart. The data analysis includes data only from the sample points at 200 meter intervals. Random points at least 200m apart were used in small reserves where transects could not be fitted.

Each sample point was monitored three times. At each point the observer waited for a period of two minutes. During this period the observer prepared for the five minute bird count, noting any birds visible or calling in the area. During the five minute bird count any birds seen or heard were recorded. Individual birds were recorded once, the first time they were seen or heard.

To balance the impact of sampling at different times of the morning, transects were surveyed in a Latin square design. For example, in Porirua sampling on day one started on transect one, and then transect two, followed by transect three. On day two the sampling started on transect two, then three, with one last and so on.

The monitoring was done by Steve Playle and Geoff Lewis in Sulphur Wells, by Claudia Duncan in Porirua Scenic Reserve, Keith George, Tauherenikau, Pounui, Greytown Park and the Wellington City Council Reserves. Forest and Bird volunteers Alan and Glennis Sheppard, Leo and Lynne Smith and Mardi Hawkes surveyed Witako, Emerald Hill, Riverstone Park, Cloustonville, Trentham Memorial Park and Maidstone Park. Where practical, the same observers were used each year, in the same location and as few observers as possible were used. This helped increase consistency and reduce the effect of observer bias.

Five minute bird count data was analysed on spreadsheets. The average number of birds observed (seen or heard) during the five minute bird count, per station, per day was calculated. This eliminated the effect of a differing number of points in each reserve. Ninety five percent confidence intervals were calculated.

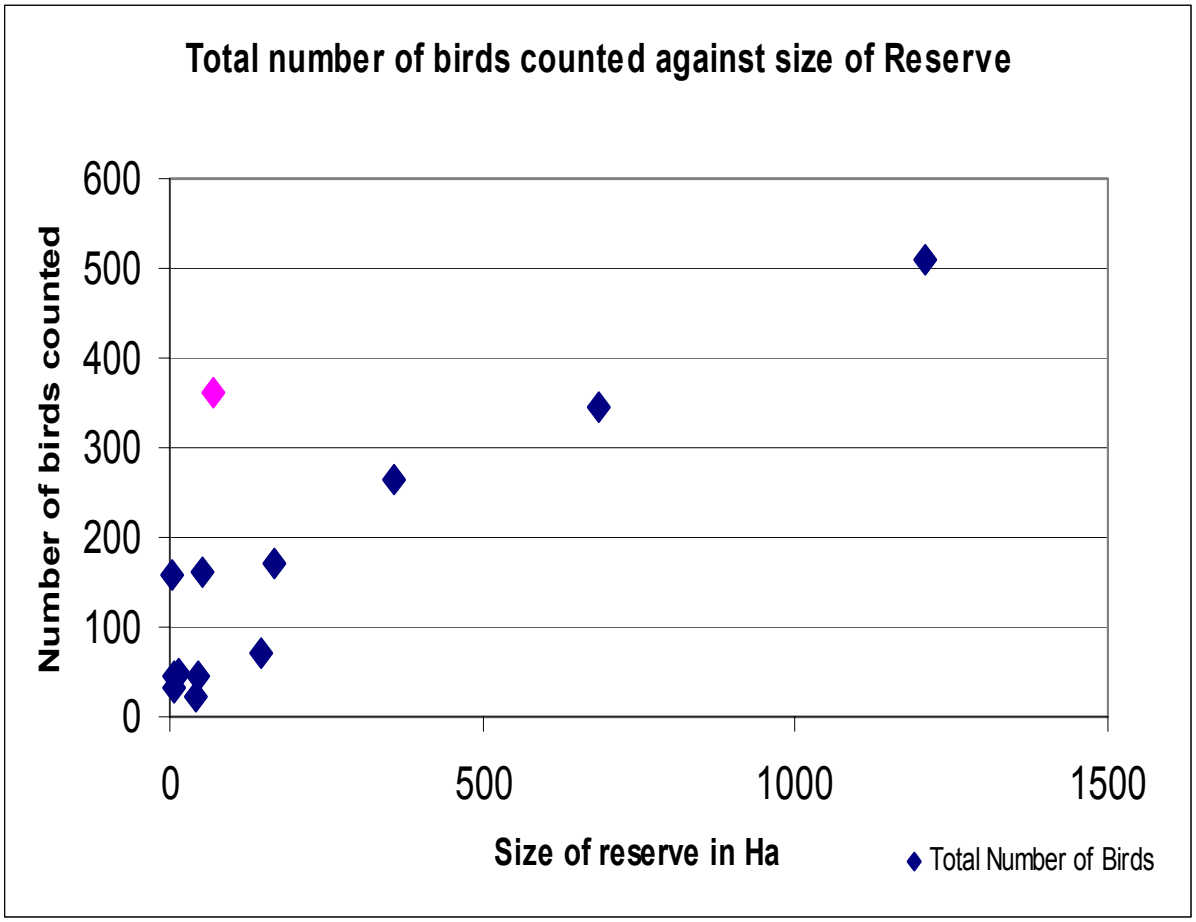
4. Monitoring Results

4.1 Bird Numbers and Reserve Size

Predictably, an analysis of the total number of birds counted in each reserve shows a positive correlation between counts and reserve size **Chart 1**. This is expected as larger habitats support larger populations of birds, and having more survey points increases the sampling effort.

One notable outcome is the result from Waikanai River reserve. Waikanae River showed far more birds than expected given the size of the reserve, 360, this was the second largest number of birds counted. Sulphur Wells had the highest count with 511 and Sulphur Wells is 17 times larger, 1206 hectares compared to 70 hectares in Waikanae. The smallest number of birds counted was 24 in Maidstone Park.

Chart 1 shows the number of birds counted in each reserve plotted against the reserve size



4.2 Bird population analysis

The number of species present in the reserves seems to differ little between reserves, **Chart 2,** suggesting no correlation between bird diversity and the forest remnant size. The percent of native birds present shows similar trends.

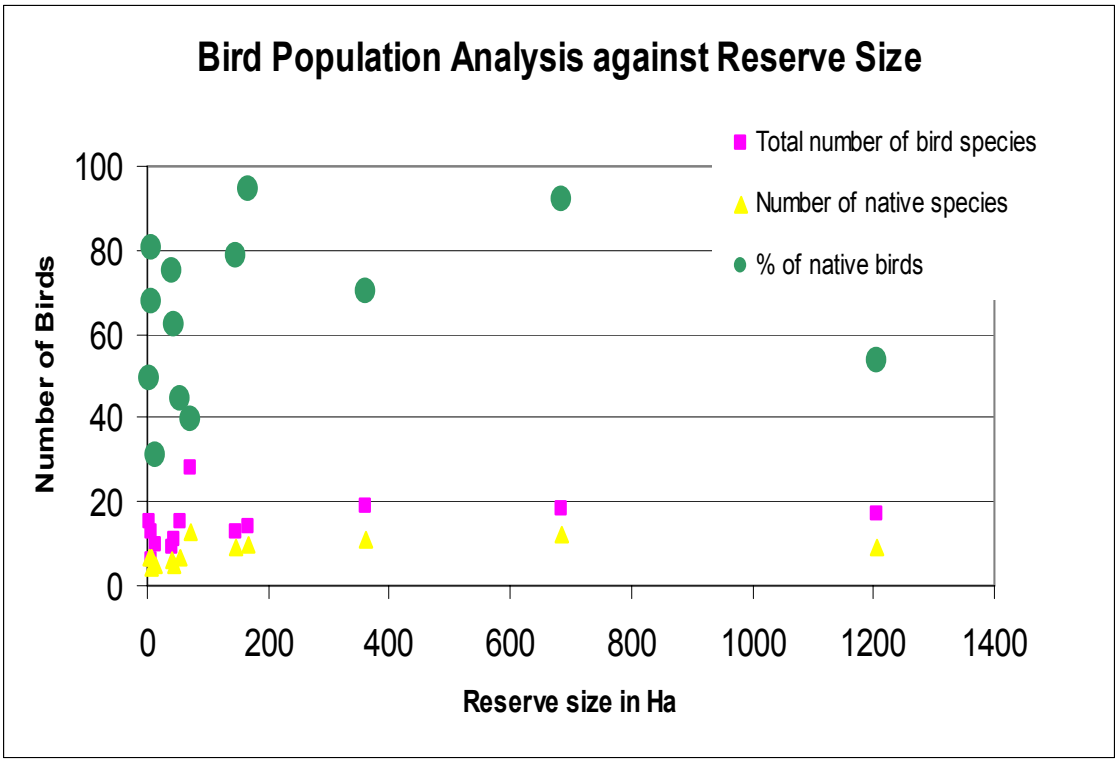
Species diversity for all sites ranged from six to 28. Thirty-four different species have been recorded in the past three years of monitoring. Of these 18 are natives and 16 are introduced.

- Waikanae had the greatest number of bird species present, 28, and the largest number of native bird species present, 13. The inclusion of water birds (two duck species, pukeko, kingfishers and plovers), but also a lot of misalliance species such as pheasants, rooster, skylark and even a stitch bird have contributed to higher counts.

- The lowest number (n=6) of bird species encountered was in Riverstone Reserve. This reserve also had the smallest number (n=4) of native species present.

- Keith George Memorial park stood out as having the largest percent of native birds in the count with 94%, followed by Pounui with 92%. The lowest percent of native birds was 31% recorded in Trentham Memorial.

Chart 2 shows the total number of bird species encountered in each reserve, the number of native species present in each reserve and the percent of the total number of birds counted in each reserve that are natives



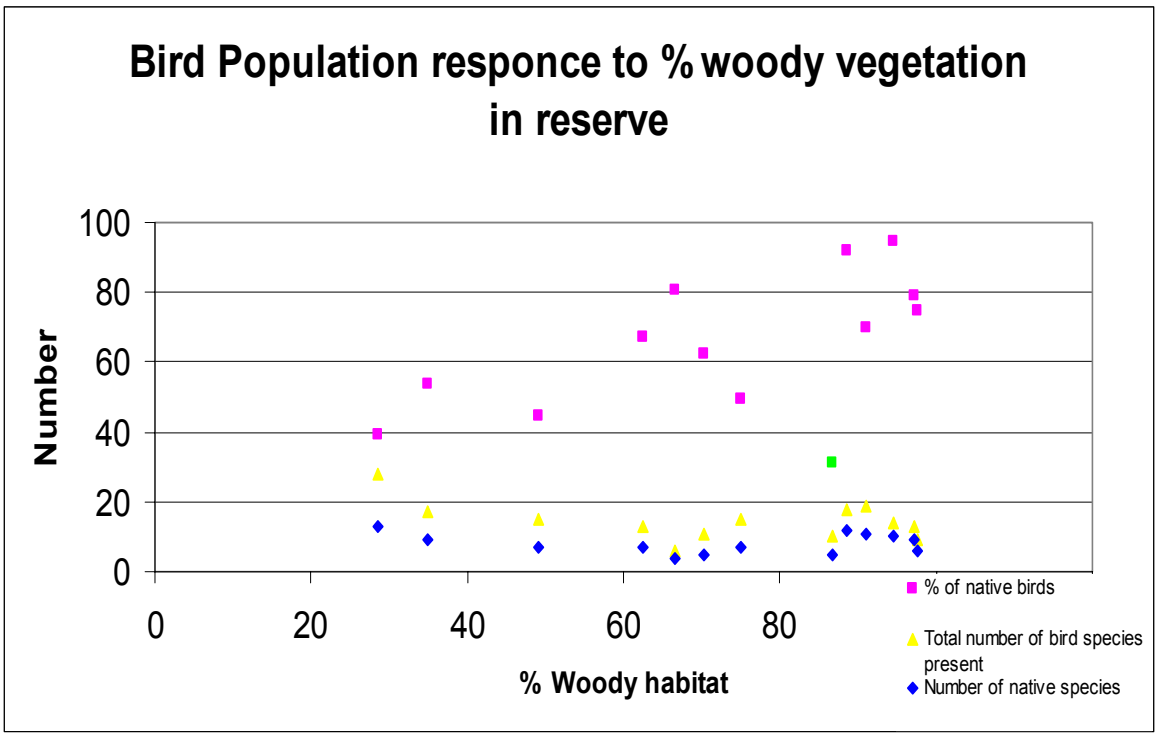
4.3 Habitat type

The number of bird species present, and the number of native species present does not appear to change as the percent of woody (bush) vegetation within a reserve increases **Chart 3**.

However, as the amount of 'woody habitat' increases the percent of native species represented in the count increases. This correlation suggests that the amount of woody habitat present has an important effecting on native bird abundance if not diversity.

The only outlier to this trend is Trentham Memorial Park and is shown as a bright green square in the chart below. This reserve had fewer than expected native bird species present. This was mainly due to the presence of a flock of eastern rosella, a large number of blackbirds and sparrows, and large areas of grass in this park. Two of the three monitoring stations in Trentham were located on the forest margin so there is a likely edge effect.

Chart 3 shows the total number of bird species, the number of native species and the percent of native birds in the total count in each reserve against the percent woody habitat in each reserve



4.4 Species Analysis

Eleven species considered abundant and widespread or which are important key indicator species were further analysed (**Appendix 1**).

Silvereyes and tui were the most abundant bird species with a total count of 423 and 267 respectively (**Appendix 1**). The average count for silvereyes ranged from 0.0 to 3.1 birds per station and 0.0 to 1.8 for tui.

Fantails and greywarblers being the only species present in all surveyed reserves are the most widely distributed species. The average count for fantails ranged from 0.1 to 1.8, and 0.1 to 2.2 for greywarblers.

Käkäriki and whiteheads have the smallest distribution, only present in one and two sites respectively. Kereru was more widely distributed than bellbirds present in ten and six reserves respectively. Tomtits also had a relatively limited distribution seen in Keith George, Pounui, and Witako.

Shinning cuckoos were recorded in four locations, Porirua, Pounui, Waikanae and Witako and long-tailed tailed cuckoos were recorded in Emerald Hill and Maidstone Park outside of the monitor

Rare species identified but not included in the analysis of key species are roosters, mallard ducks, dunnock (hedge sparrow), spur-wing plover, falcon, swan, pukeko, pheasant, skylark and a single stitchbird. The origin of the stitch bird is unclear but it is most likely to have come from Kapiti Island where the birds have been released.

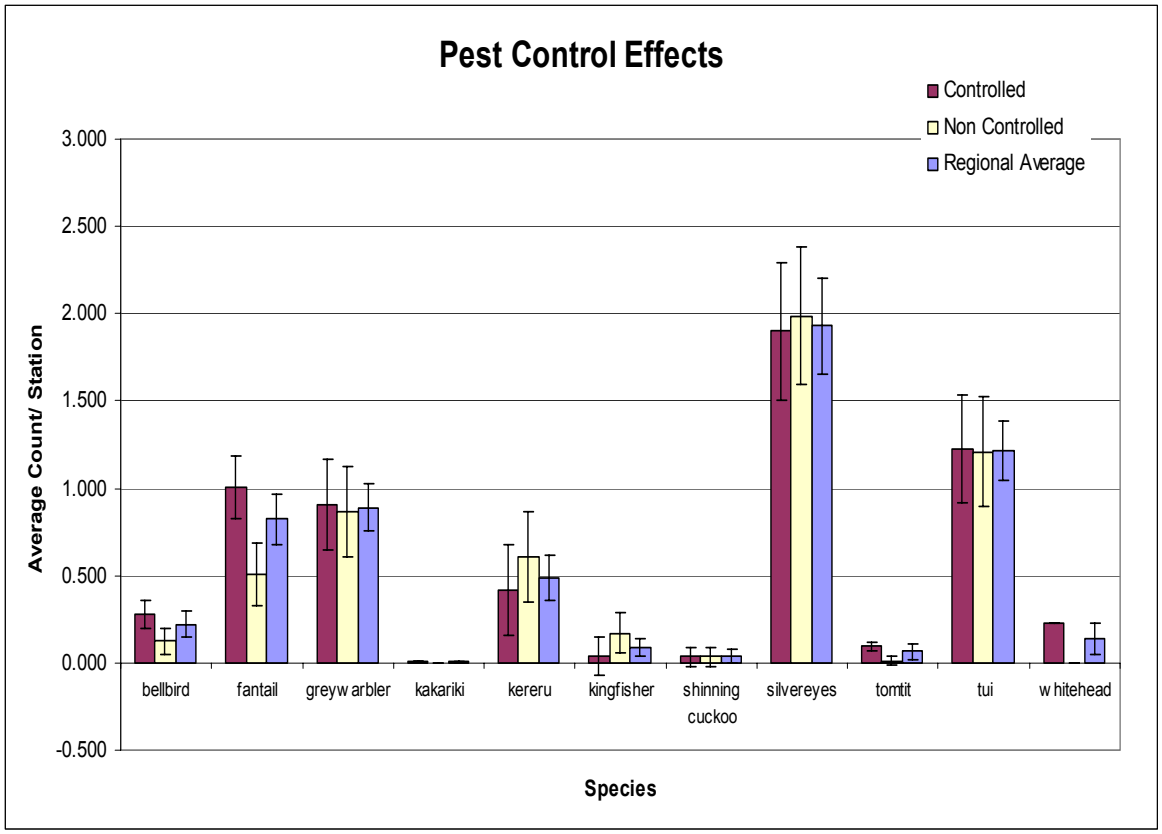
4.5 Pest Control Effect

Four of the 13 monitored sites are not currently receiving pest control:

- Cloustonville
- Pounui (limited trapping and baiting)
- Riverstone
- Waikanae River.

Chart 4 compares the changes in bird populations in sites receiving pest control with those that are not. Fantails may be benefiting from pest control. Tomtits and whitehead may also be benefiting, however, as they have a limited distribution conclusions are difficult to draw. Predator control would most likely allow an increase in abundance and viability of already present populations.

Chart 4 shows the average site count for all reserves with no pest control, those that have pest control and the average for the region.



4.6 Results for individual reserves

To remove the effect of reserve size and the varying number of survey points between reserves, bird counts were expressed as a mean number of species found per station per day (**Appendix 1**). This allowed each survey point to be treated independently. Ninety five percent error bars were added.

- Cloustonville (**Chart 5.1**) was the only site new site with bellbird and kereru. There were lower than average counts of fantails, silvereyes and tui. Bellbirds, kereru and greywarbler were the same as the regional average. No locally rare species were detected. There was a very large confidence interval for grey warbler, indicative of variability in counts. This is probably due to large transient flocks being recorded at some sample points and not others.

- In Emerald Hill (**Chart 5.1**) counts of silvereyes and tui were all significantly below the regional average. Bellbird, greywarbler, kereru, kingfisher and fantail counts were the similar to the regional average. There was a large confidence interval for fantail, again indicative of variability in the count suggesting considerable variability in site preference within this park. Long-tail cuckoos were recorded in Emerald Hill outside the count period. All other key species were absent.

- Greytown Park (**Chart 5.2**) had significantly higher fantail counts than the regional average. All other species had the similar counts to the regional average. Bellbirds and whiteheads were absent. Kereru and silvereyes had very large confidence intervals; this may be a reflection of the small sample size.

- Keith George (**Chart 5.2**) bird counts were either significantly more than, or equivalent to the regional average. Two species were not recorded at Keith George this year, käkäriki and shinning cuckoo. Tomtits, bellbird and whiteheads are well above the regional average in Keith George due to well established populations of these species in the park, and its proximity to the Akatarawa Forest Park. Eastern rosella were recorded in Keith George this survey, and may be contributing to the absence of käkäriki this season.

- Maidstone Park (**Chart 5.2**) had lower counts than the regional average for many species, and many species were missing altogether. Greywarbler and kingfisher were similar to the regional average, no species were above. Long-tail cuckoos were recorded in Maidstone Park outside the count period.

- In Porirua (**Chart 5.4**) counts of kereru were below the regional average, all other species had similar counts to the regional average. Käkäriki and whitehead were found this year but no bellbirds were recorded.

- Most species in Pounui (**Chart 5.3**) had similar counts as the regional average. Fantails were below the regional average, käkäriki and whiteheads were absent in Pounui.

- Riverstone (**Chart 5.1**) only had three of the key reported species present; greywarbler, fantail and silvereyes, and all of them were significantly below the regional average.

- Sulphur Wells (**Chart 5.3**) had above average counts for bellbird, silvereyes and fantail. All other species similar to the regional average. Käkäriki, kingfisher, cuckoo, and whiteheads were all absent from Sulphur Wells. Tomtits were recorded outside the five minute bird count. Monitoring in Sulphur Wells occurred in March and this seasonal change from previous monitors may have impacted on the results. Cohort recruits from the early nesting may be evident in the March count.

- Tauherenikau (**Chart 5.3**) had a significantly higher count of Kereru than the regional average. Counts of all other species were similar to the regional average. Silvereyes and tui had large confidence intervals and this is probably a reflection of a small sample size. Bellbirds were absent as were käkäriki, cuckoo, tomtit and whitehead.

- Trentham Memorial (**Chart 5.1**) had only three of the key species; fantail, greywarbler, and tui. Only tui counts were similar to the regional average, fantail and greywarbler were below the regional average.

- Although there were no käkäriki, tomtits or whiteheads at Waikanae River (**Chart 5.4**), Waikanae River still had the most diverse assemblage of birds of all the reserves, including pukeko, pheasants, skylark and stitchbird. Counts of greywarbler were lower than the regional average, and counts of kingfisher were above the average. All other species were similar to the regional average.

  While most of the species present there were not unique to Waikanae, it was unique to see them all appear in the same count. This result may reflect the broad habitat types represented along the river including river and estuarine habitats, combined with the proximity of Kapiti Island and the Tararua ranges. The river may be a natural corridor for these species.

- Witako (**Chart 5.2**) showed lower than average counts for silvereye, all other key species were similar to the regional average. No bellbirds were recorded but were present last year. The opposite is true for shinning cuckoo which were present this year but not in 2006.

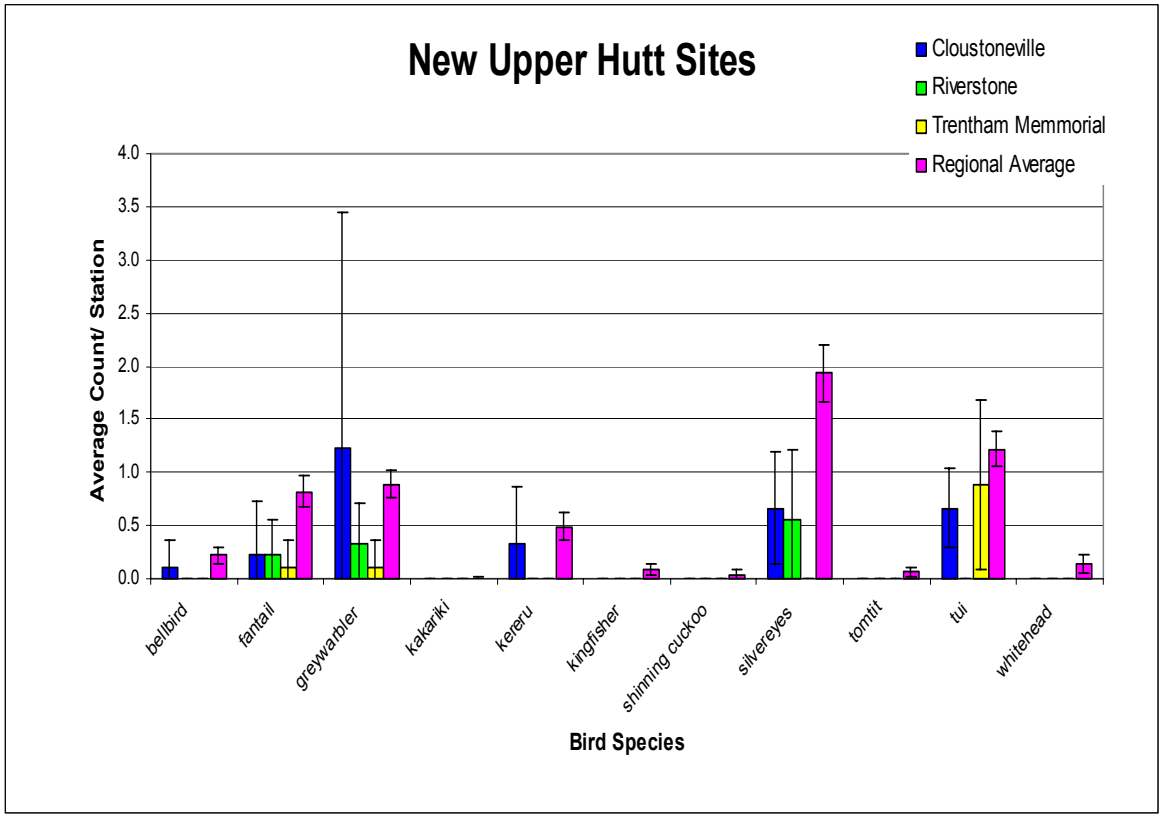


Chart 5.1 shows the average count per station for each of the new sites (sites added in 2007) in Upper Hutt and the average for the region

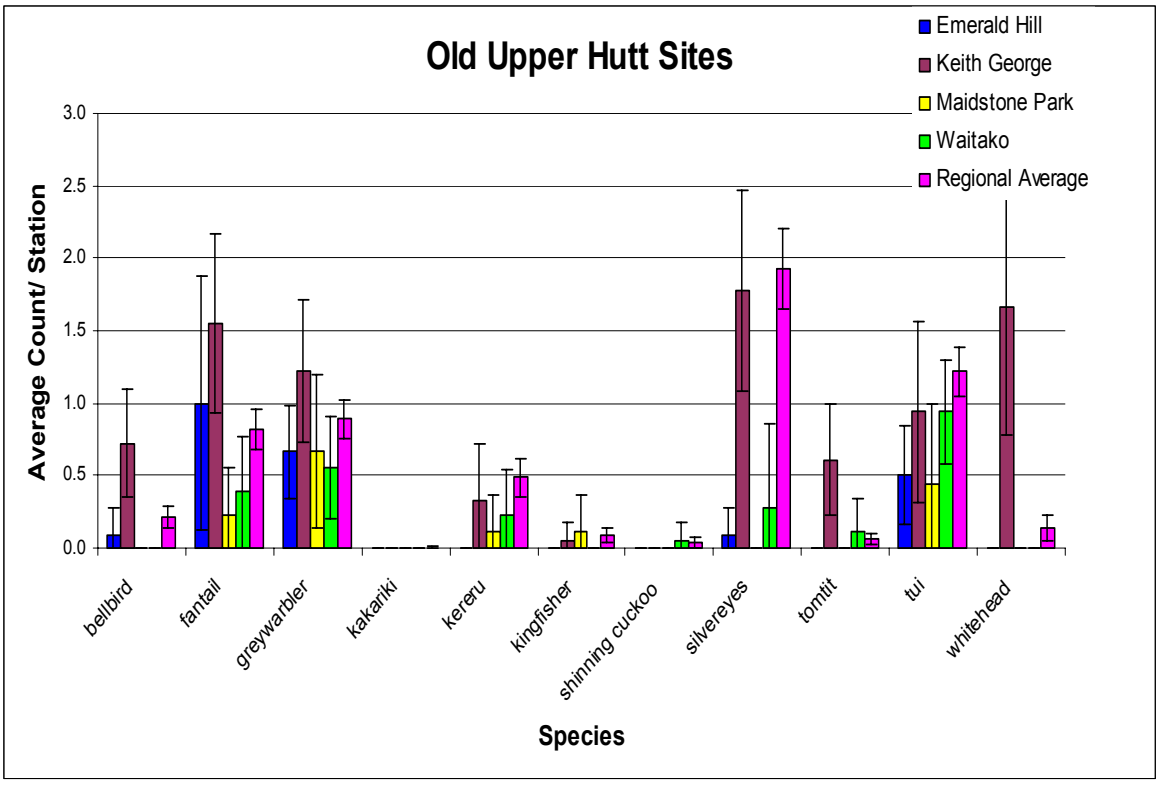


Chart 5.2 shows the average count per station for each of the old sites in Upper Hutt and the average for the region

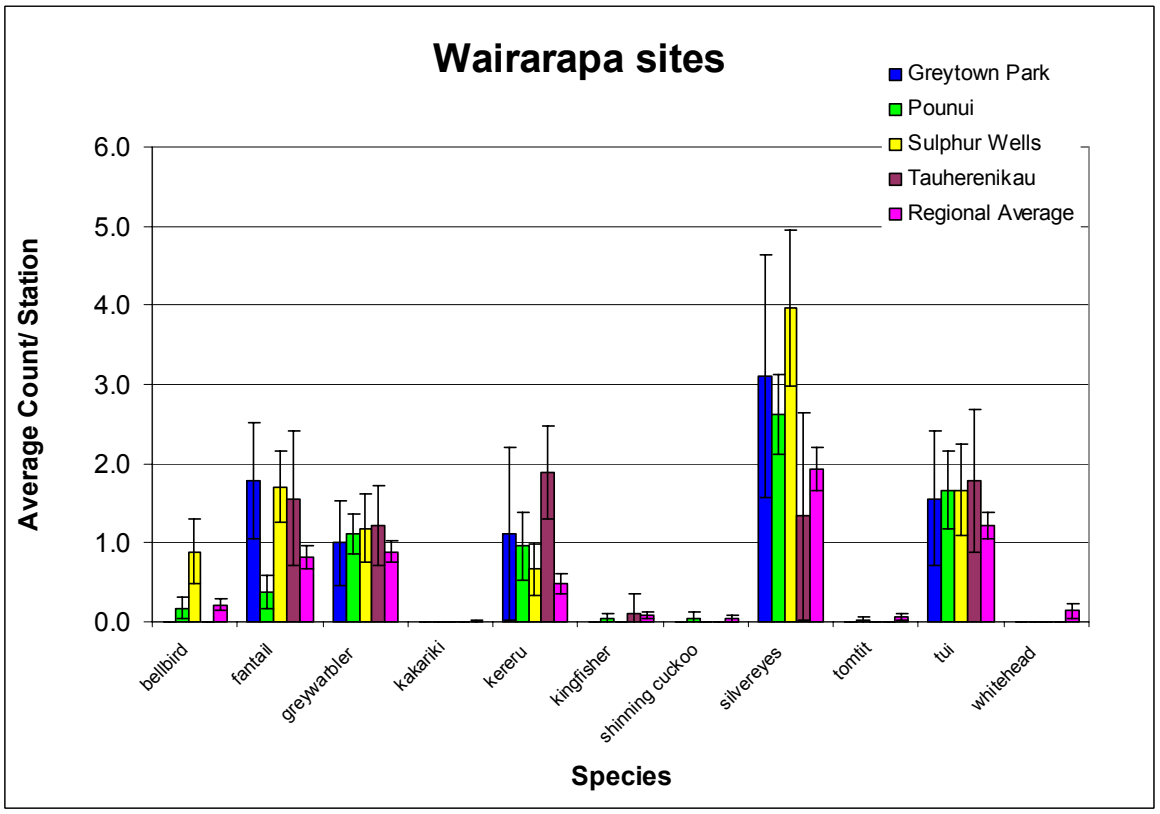


Chart 5.3 shows the average count per station in the Wairarapa sites and the average for the region

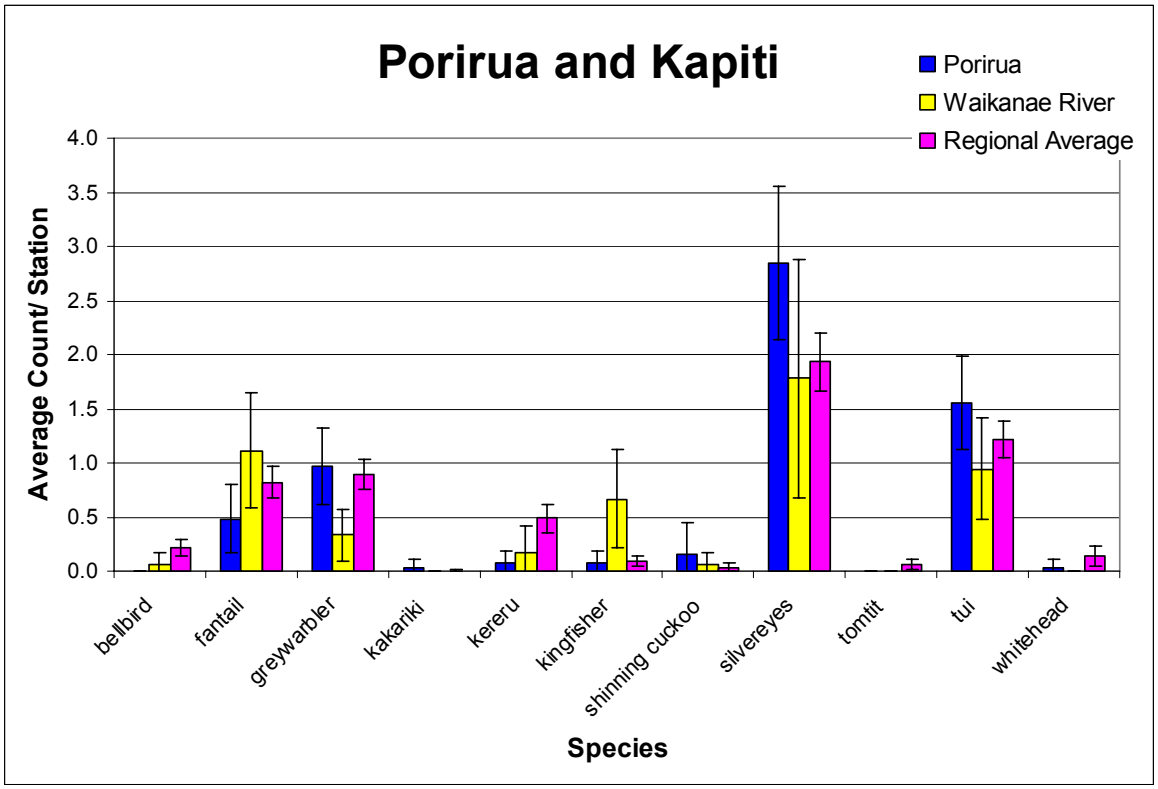


Chart 5.4 shows the average count per station for the sites in Porirua and Kapiti and the average for the region

4.7 Bird abundances and distribution trends

Monitoring of four reserves, Keith George, Pounui, Porirua and Tauherenikau has continued for three years. The data for these reserves has been combined to determine regional trends (**Chart 6**). The variability between each monitor means that we can not compare trends on a reserve by reserve basis.

There is a lot of natural variation between years, with significant differences for some species between different years. None have increased significantly between 2006 and 2007 except greywarbler, but the 2007 count was not significantly different than the 2005 count. The number of fantails has remained relatively constant over the three year period. The counts of kereru, silvereyes whitehead and tui tended to increase over the three year period. The populations of bellbird and greywarbler have tended to fluctuate over the past three years.

Eastern rosella are considered an undesirable species and may compete with indigenous parrot species for food and nesting locations, but any impacts are not well understood. More rosella than käkäriki have been observed over the past three years suggesting that rosella have successfully adapted to New Zealand environments and may be increasing in number. This year significantly more rosella were counted than last year, however, there is no statistical difference between 2007 and 2005 counts.

At this stage any differences should not be considered trends as the natural fluctuations are large and make determining trends complex. Smaller birds with large natural fluctuations in population size may need to be considered as having different populations from year to year, rather than a persisting population.

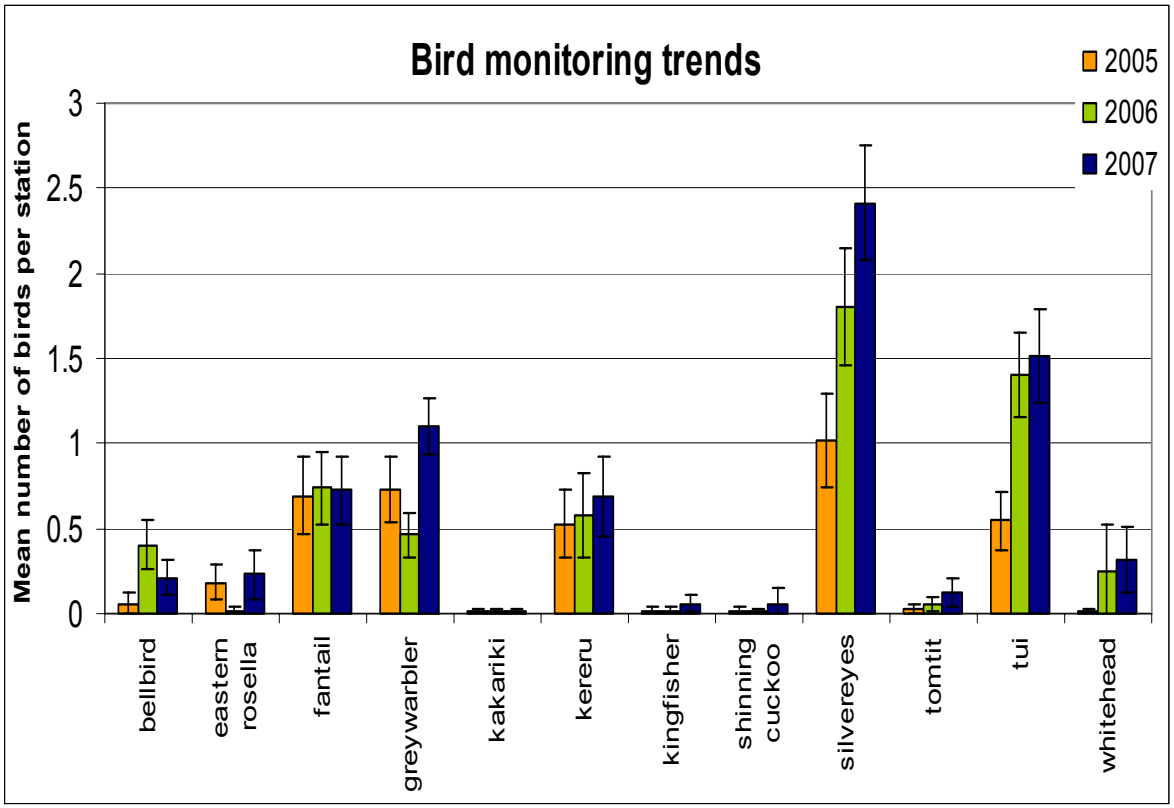


Chart 6 Regional bird monitoring trends in Pounui, Porirua, Keith George and Tauherenikau

4.8 Reserve size

The relative abundance of most bird species was found to be higher in the larger reserves (those with two or more lines) than the smaller reserves (with one line or random points). However this difference is only statistically significant for silvereyes, bellbirds and tui (**Chart 7**). Whitehead, tomtit and käkäriki appeared to be absent from small reserves. Fantail seemed to be as abundant in both large and small reserves. Kingfisher tended to be more abundant in small reserves but this was not statistically significant.

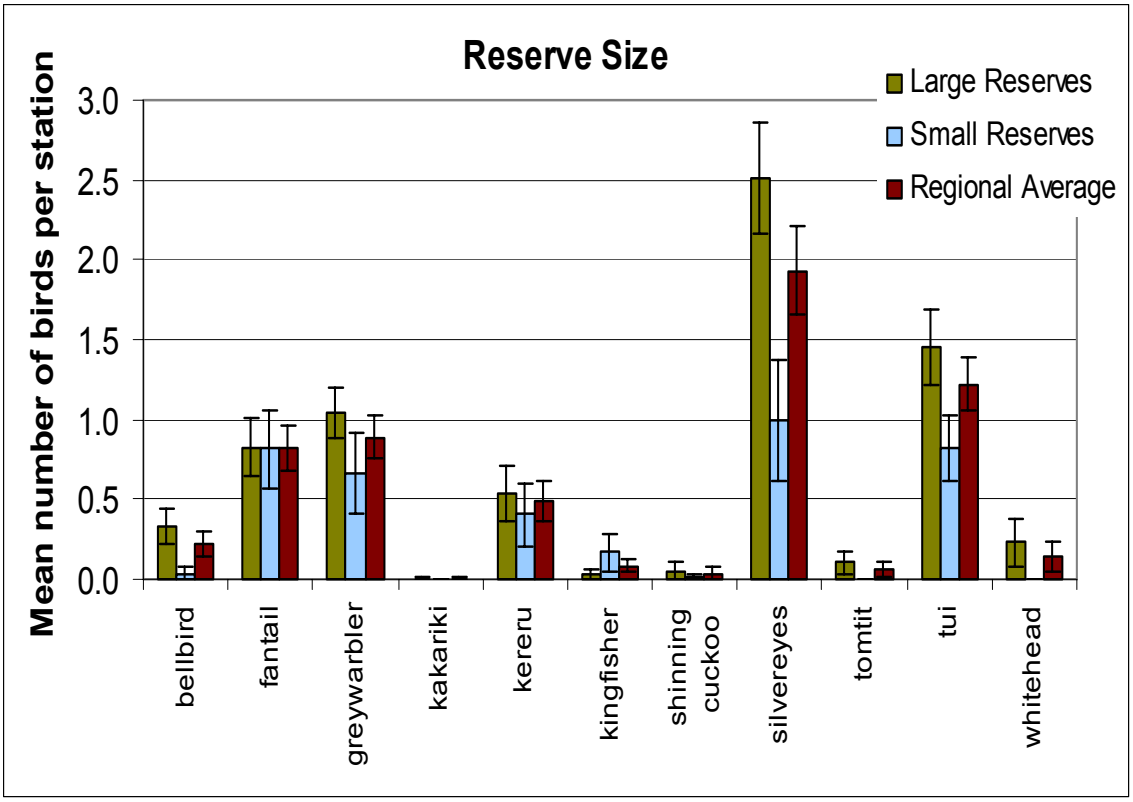


Chart 7 Reserve size and the number of individual birds and bird species recorded.

4.9 Comparison with Wellington City Bird Count

Silvereyes were the most abundant species in Wellington City (Froude, 2006) as well as regionally. Since the start of monitoring, Wellington City Council (WCC) recorded an average per site count for silvereye of 2.72 (+/- 0.36 95% CI), compared to 1.49 (+/- 0.26 95% CI) for the sites monitored by Greater Wellington (GW). This difference is statistically significantly and may be due to:

- The length of time WCC has been monitoring (since 2002)
- Two monitors a year in spring and autumn are completed by WCC as compared to one is summer by GW

WCC had similarly recorded the same increase in silvereyes over the last three years that GW recorded.

WCC also noted similar high levels of tui observations that GW detected.

4.10 Upper Hutt Bird Monitoring

Silvereyes, kereru and tui, were all significantly lower in the Upper Hutt reserves compared to the regional average (**Chart 8**), and most notably silvereyes. However, given silvereyes flocking nature, and the limited sample size in Upper Hutt reserves, considerable variation in counts is not unexpected. Zero counts occurring as a result of sampling variability may mask true population trends. For all other bird species the average counts for Upper Hutt sites were similar to those for the region.

Whitehead featured as a species with a relatively large population in Upper Hutt. The statistical significance can not be determined as most of the individuals of these species were found in Upper Hutt. All except one of the whitehead recorded in this monitor were in Keith George. This is similar for tomtits, 11 of the 15 tomtits counted in this survey were in Keith George.

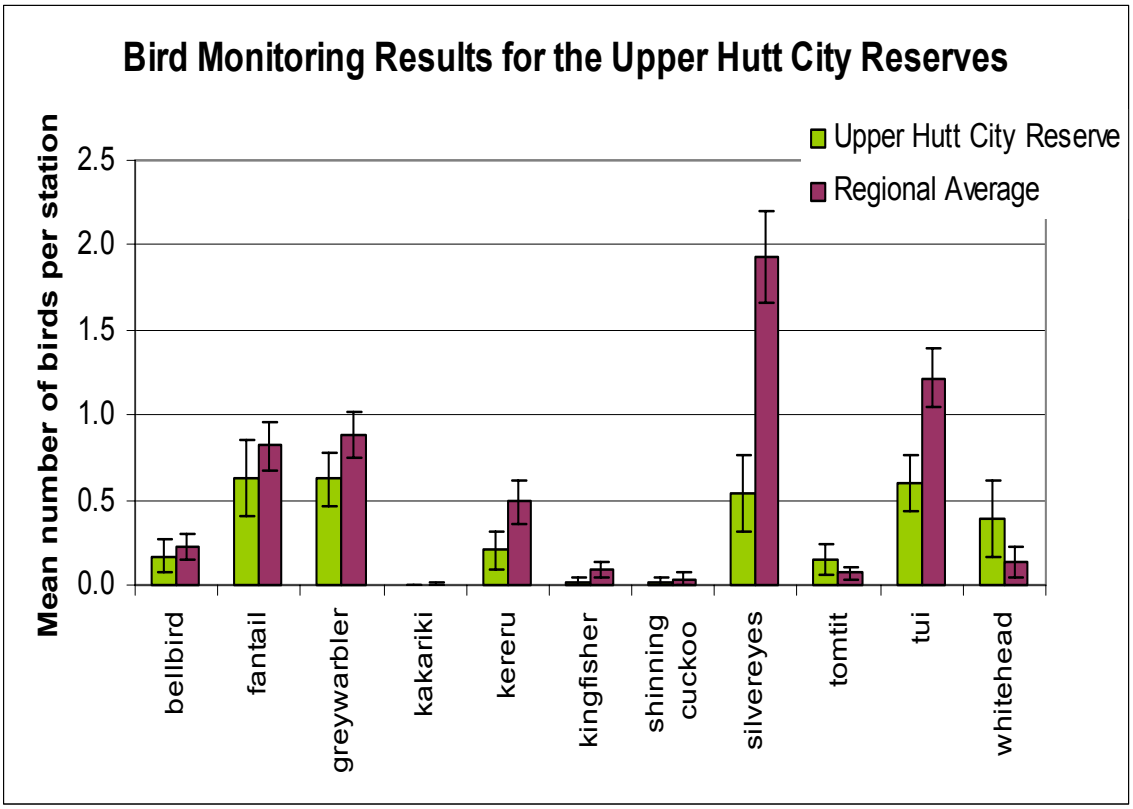


Chart 8 Bird monitoring results for the combined Upper Hutt reserves compared to the regional average for all sites recorded.

5. Discussion of Monitoring

Most reserves recorded a broad mix of indigenous bird species with a scattering of locally rare or range restricted species such as whiteheads, käkäriki, bellbirds, tomtits and stitchbird. There are few significant differences in bird abundance and diversity between the reserves and the relative abundance of common species looks to be either static or increasing from year to year. This suggests that the forest habitats we monitor are successfully supporting a self sustaining population of birds, and are functioning effectively as refuges or corridors between larger forest habitats.

Although the overall diversity of native species present remained similar in both small and large reserves the abundance of native birds tended to increase when the size of the reserve increased. Larger reserves, or those connected to larger bush blocks, recorded significantly higher average numbers of tui, bellbird, silvereye and whitehead. Smaller or isolated blocks recorded a high proportion of exotic birds, in particular, blackbirds, starlings, finches and magpies.

The increased percentage of native birds in larger reserves appears to be an effect of the percent of woody habitat in the reserve, rather than being directly related to reserve size. The increased bush habitat will have a greater carrying capacity due to increased food availability and quality. The right quantity and type of food is available for native birds which tend to have adapted to restricted diets. Larger sites have a reduced edge effect as they have greater protection/ buffering from species incursions such as introduced bird species and domestic cats for example. Additionally, larger bush blocks typically have less historical disturbance.

Exotic birds were largely confined to forest margins and may not penetrate native forest blocks either due to exclusion or habitat incompatibility. The role that exotic species play in the decline of native birds has not been determined, but given the relatively small urban nature of many reserves, and the high number of exotic species that these reserves contain the impact should not be underestimated.

Although native bird abundance appears to be related to habitat size it appears that native bird diversity is not. The same cohort of species was present in most reserves. This suggests that large forest blocks are no more important than smaller ones for preserving native bird diversity. Other factors such as the composition of the bush, connectivity to other forest remnants or large forest blocks (source populations), historical distribution of bird species, micro-climatic effects and the presence of predators may be more critical.

Generally the diversity of native bird populations in the Wellington region is relatively low with the same assemblages in each reserve representing a handful of species. More species are identified in the monitor each year, and some of these are locally rare species.

The upward trend in counts for some species identified may be a function of the number of survey sites increasing each year, or it may be a trend showing increasing abundance. It is most likely that this outcome is due to the increased sampling effort and therefore the greater likelihood of encounter. We expect to find more species with more monitoring sites, given more time, and in an increasingly diverse range of environments. Further monitoring will show if the incidence of encounter for locally rare species is increasing and if the populations of rare species are persisting or growing.

The large number of birds recorded at Waikanae River proved the value of adding this reserve, Keith George, Porirua Scenic Reserve and Pounui also recorded higher counts. Species such as käkäriki, tomtits and bellbirds present in these reserves are accepted as indicator species of healthy native forest, because they are locally rare and are probably sensitive to environment pressures such as predation, competition and habitat fragmentation. The ongoing viability presence of these populations indicates that these reserves have a high ecological/ biodiversity value.

The importance of preserving large blocks of forest is highlighted in this study. In urban environments native birds can be encouraged by better management including the implementation of pest control programmes. Managers can do things such as ensure connectivity between reserves and that reserves are as large as feasible with as small an edge as possible (one larger bush block is better than several small ones). Smarter management of reserves will increase the biodiversity of the region and will provide a foundation that can be built on to gain the best biodiversity outcomes from available resources.

6. Monitoring Variations

- Sampling in Pounui and Sulphur Wells was conducted in March, normally completed in February.

- Monitoring was not conducted in Waihora, but was conducted in 2005 and 2006.

7. Acknowledgements

Thanks to Greater Wellington staff for their contribution to this project. Thanks to Alan and Glennis Sheppard, Leo and Lynne Smith, Mardi Hawkes, and Claudia Duncan for the collection of the monitoring data. Thanks also to Upper Hutt City Council for getting on board with bird monitoring, and to WCC for allowing access to their monitoring report and results.

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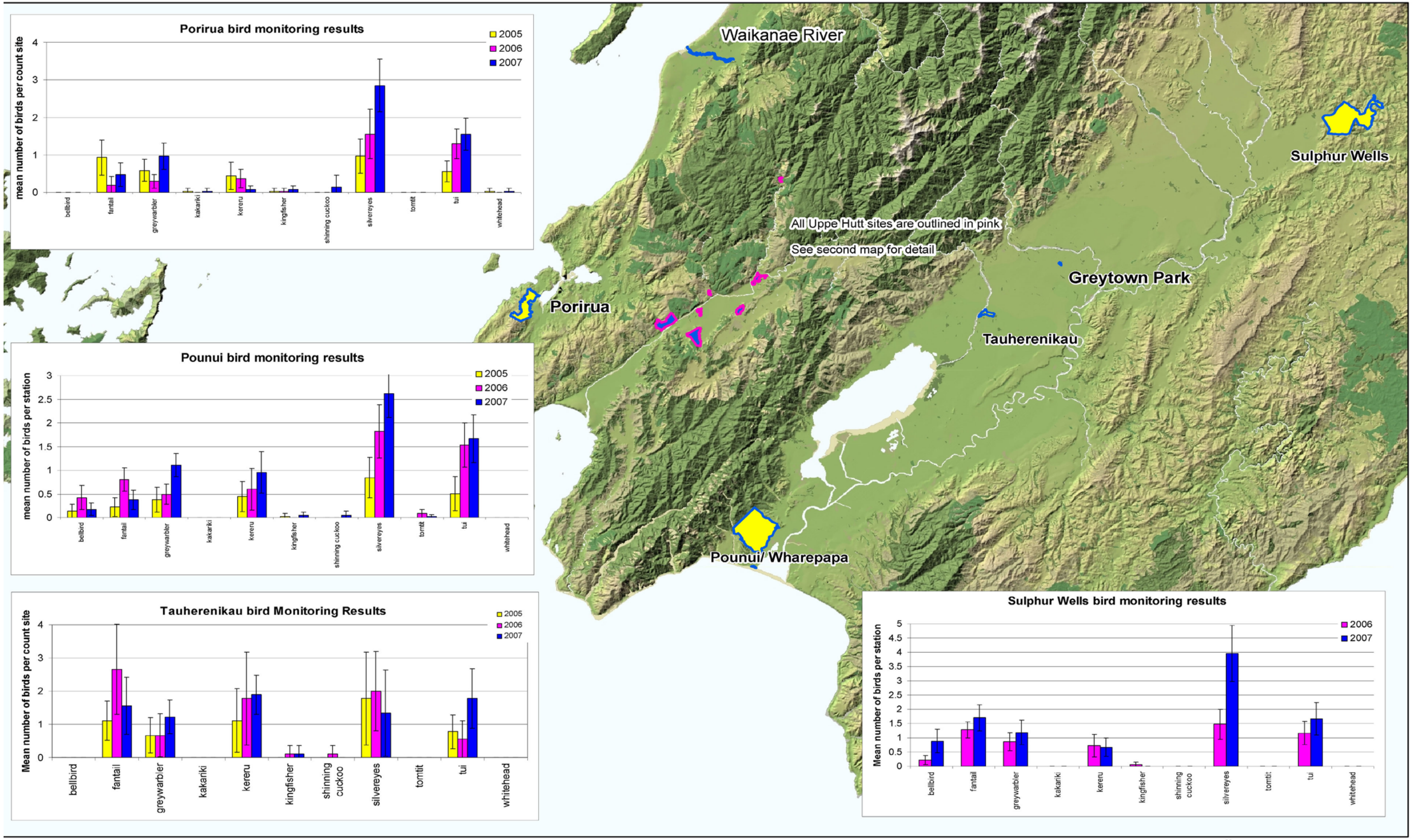
Appendix 1

Shows a breakdown of results from each reserve for the 2007 monitor

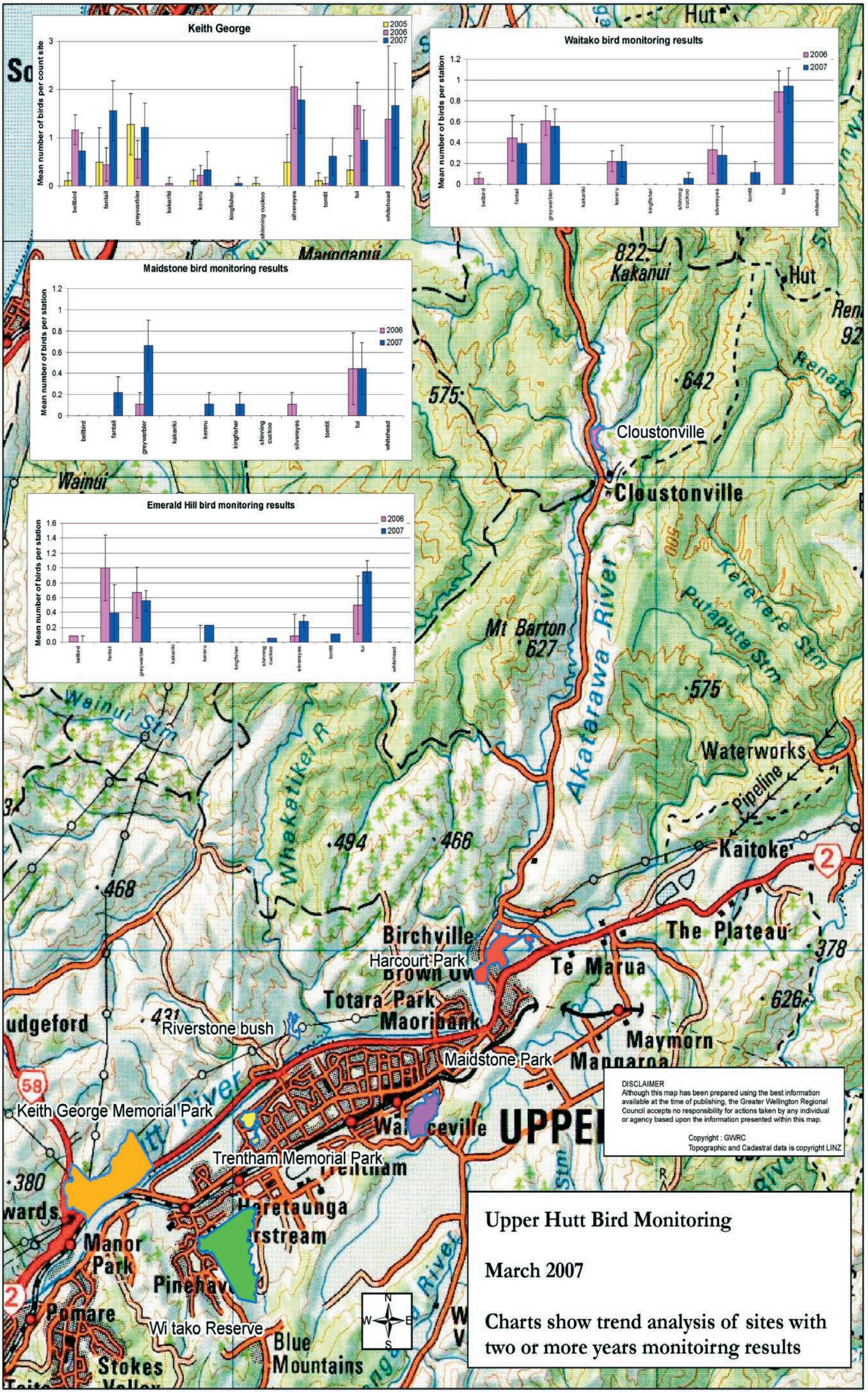
	Cloustonville	Emerald Hill	Greytown Park	Keith George	Maidstone Park	Porirua	Pounui	Riverstone Park	Sulphur Wells	Tauherenikau	Trentham Memorial	Waikanae River	Witako
Number of Stations	3	4	3	6	3	9	15	3	9	3	3	6	6
Number of visits to each station	3	3	3	3	3	3	3	3	3	3	3	3	3
Size of reserve in hectares	8	45.5	4	167	41	360	686	6	1206	53	15	70	147
% woody habitat	63	70	75	95	98	91	89	67	35	49	87	29	97
Total number of birds in each reserve	46	45	159	170	24	263	346	31	511	161	48	360	71
% of native birds	67	62	50	95	75	70	92	81	54	45	31	39	79
Total number of bird species present	13	11	15	14	9	19	18	6	17	15	10	28	13
Number of native species	7	5	7	10	6	11	12	4	9	7	5	13	9
Total Number of Birds Recorded in each Reserve													
Bellbird Bird	1	1		13			8		24			1	
Fantail	2	12	16	28	2	13	17	2	46	14	1	20	7
Greywarbler	11	8	9	22	6	26	50	3	32	11	1	6	10
Kereru	3		10	6	1	2	43		18	17		3	4
Tui	6	6	14	17	4	42	75		45	16	8	17	17
Kingfisher				1	1	2	2			1		12	
Käkäriki						1							
Whitehead				30		1							
Tomtits				11			1						2
Shinning Cuckoo						4	2					1	1
Silvereye	6	1	28	32		77	118	5	107	12		32	5



Greater Wellington Native Bird Monitoring Sites and Results 2007

Charts show trend analysis for those sites that have had two or more years monitoring

1:350,000


Keith George
2005
2006
2007
Mean number of birds per count site
bellbird
fantail
greywarbler
kakariki
kereru
kingfisher
shinning cuckoo
silvereyes
tomtit
tui
whitehead
Waitako bird monitoring results
2006
2007
Mean number of birds per station
Maidstone bird monitoring results
Emerald Hill bird monitoring results
Hut
822
Kakanui
642
575
Cloustonville
Waiwi
Mt Barton
627
Akatarawa River
Kerekere Stm
Putaputa Stm
Waterworks
Pipeline
Kaitoke
Whakatikei R
494
466
468
Birchville
Harcourt Park
The Plateau
Te Marua
Totara Park
Maoribank
Maymorn
Maidstone Park
Riverstone bush
Keith George Memorial Park
Trentham Memorial Park
Manor Park
Pomare
Wi tako Reserve
Blue Mountains
Stokes
UPPER
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Upper Hutt Bird Monitoring
March 2007
Charts show trend analysis of sites with two or more years monitoirng results

Water, air, earth and energy: elements in Greater Wellington's logo that combine to create and sustain life. Greater Wellington promotes **Quality for Life** by ensuring our environment is protected while meeting the economic, cultural and social needs of the community.

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Greater Wellington is the promotional name of the Wellington Regional Council

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