WINDY HILL ROSALIE BAY CATCHMENT TRUST

TRENDS IN BIRD ABUNDANCES 2000 - 2011

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TRENDS IN BIRD ABUNDANCES AT WINDY HILL 2000 – 2011.

Introduction

This report presents the results from two sets of five-minute bird counts made by Dean Medlands at ten stations along the roads and in bush in the Little Windy Hill area from 2nd to 29th May 2000 and again at the same locations from 31st May to 21st June 2011. The data comprise 10 repeat counts at each of 10 stations.

These two data sets are additional to the three-minute bird counts made along transects lines throughout the Windy Hill-Rosalie Bay study area and reported separately each year.

Methods

On each recording day counts were made at ten locations. Count time varied from day to day and between stations, but all were made between 8.0AM and 2.15PM, with the majority between 10.0 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, 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. per 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 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 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, 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 averaged in two ways:

(1) By days: for each species on each day counts were summed by station. This gave 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).

(2) By stations: for each species at each station counts were summed by date. This gave ten values representing the sum of the days, with the variance being differences between station locations. Again the 10 values were averaged and standard errors etc. calculated.

In both cases above the different years (2000, 2011) were compared using the 't' test function in EXCEL for each species. In case (1) above, there is no exact comparison of the days between the years, so the data were 'unpaired', but in the case of (2) the same sites are being compared in different years so that 'paired' tests were possible.

Results

The overall frequency data are given in the Appendices and summarized in Fig 1. Because error bars cannot be attached to these data, they are also presented as counts with standard errors in Fig. 2. This figure shows the sum of all ten sites within dates averaged over the ten dates, and the standard error derived from that. The species means are the same if summed by dates within sites, and averaged over the ten sites, but the variance differs. As both methods of viewing the data gave statistically similar results (Table 1), only one graph is given.

Silvereyes and fantails have both declined in conspicuousness since 2000, while tui and kereru have both increased, the former dramatically. Kaka have also increased, although the difference is hardly statistically significant. Grey warblers seem to be unchanged. The results are expressed as percentage increases and decreases in Fig 3.

'Total bird' numbers (i.e. all species together) are not shown on figures to avoid distorting the other species. Totals increased from an average of 70 birds heard/seen at each station (in 10 x 5-min counts) in 2000 to an average of 77 in 2011, but this increase is not statistically significant.

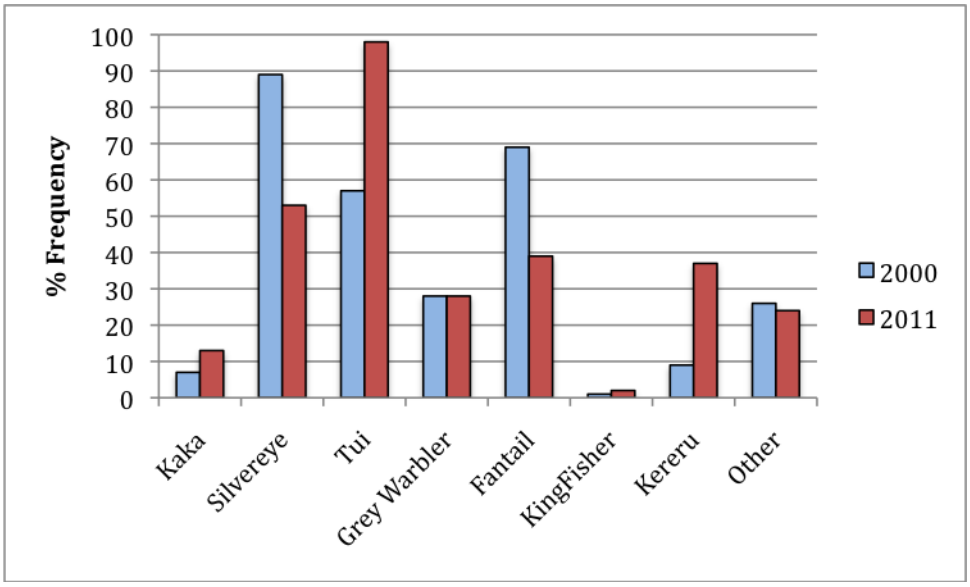

Fig 1. Frequency in 100 five-minute bird counts in winter 2000 and 2011.

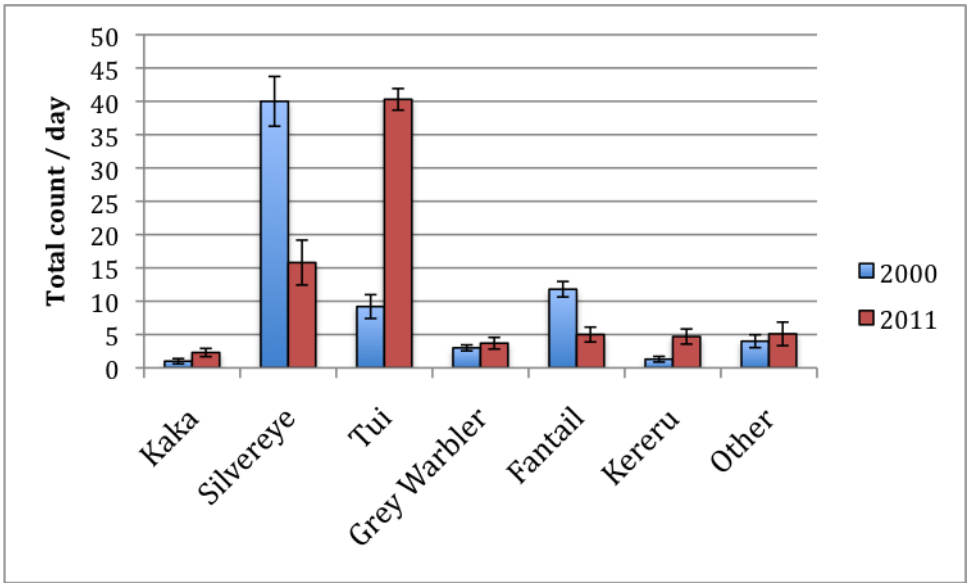

Fig 2. Total counts per day at 10 stations, means and standard errors. Kingfisher excluded due to small sample size.

Table 1. Probability (p) values for t-test differences in counts between years for each species. Asterisks indicate level of probability, with those below 0.05 regarded as statistically significant. NS means 'not significant'

	Kaka	Silver eye	Tui	Grey Warbler	Fantail	Kereru	Other	Total
By days	0.0922 NS	0.0001 ***	<0.0001 ***	0.4834 NS	0.0005 ***	0.0117 *	0.5916 NS	0.3746 NS
By stations	0.2261 NS	0.0006 ***	<0.0001 ***	0.5389 NS	0.0002 ***	0.0105 *	0.5344 NS	0.5070 NS

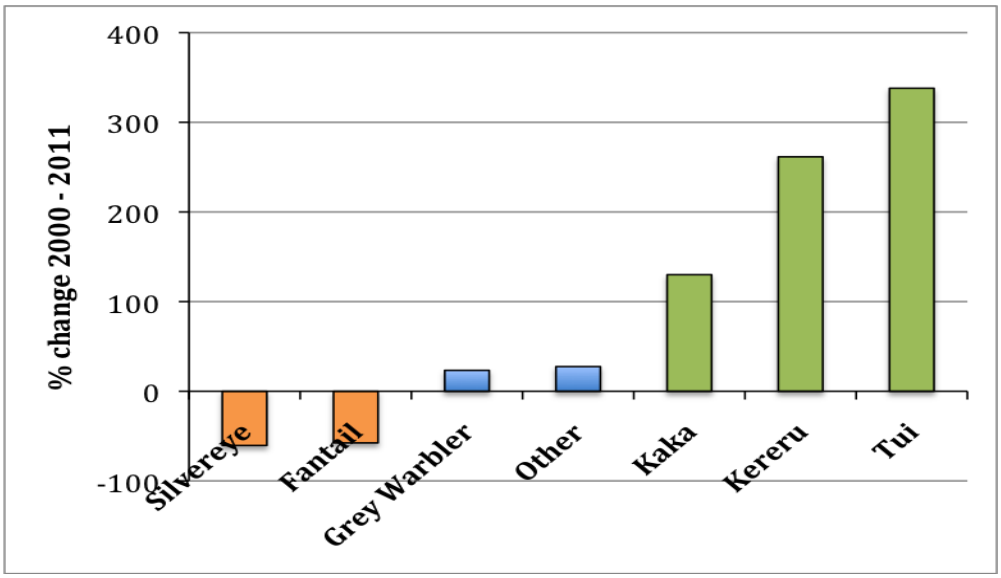

Fig 3. Percentage change in abundance in 5-minute counts 2000 – 2011. Decreases in orange, increases in green. Trends for silvereye, fantail, kereru and tui are statistically significant.

The count of introduced species grouped under 'others' has not changed much, but individual species show some trends (Fig 4). Blackbirds, yellowhammers and thrushes appear to have decreased in conspicuousness, while 'finches' have increased. Mynas have invaded the area as a flock in 2011, not having been seen on the property previously (J. Gilbert *pers. comm.).* The 'finches' were probably mainly chaffinches, but could include goldfinches or other species seen or heard at a distance.

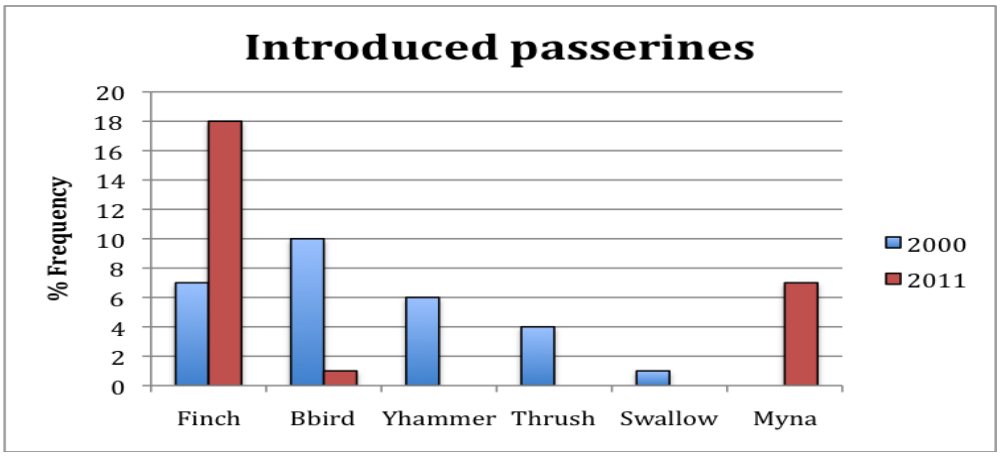

Fig 4. Changes in % frequency of introduced species grouped under "others".

Discussion

Because both counts were made close to mid-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, kaka). Overall total bird counts averaged 7.0 per 5-minute count in 2000, and 7.7 in 2011 – a 10% increase but not statistically significant.

The significant differences in species composition between 2000 and 2011 suggest that the small generalist or insectivorous species, silvereye and fantail, have decreased over the last decade, while the larger nectar and fruit feeding species, kaka, kereru and tui have increased.

These conclusions are 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[i][1]. Ogden (2011) concluded that "the abundance of small insectivores appears to have declined slightly since 2008 on the Windy Hill transects and at Benthorn." (It was then suggested that this was not a statistically significant trend and might be simply part of the natural population size fluctuations shown by these small birds). Referring to kaka, kereru and tui Ogden concluded that "the overall trend for these species is positive everywhere [in the Windy Hill Sanctuary] except in the unmanaged control". The trend of increase for tui was positive everywhere except in the unmanaged control and statistically significant in [ii]counts from ridges and the robin area.

If the results shown in Fig 3 are accepted as genuine trends over a decade, rather than just random fluctuations between two sample periods, then we can speculate on the factors driving these changes.

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[2]. Likewise, if this trend is the driver, we would expect the observed increases in frugivorous species such as kaka, kereru and tui. This 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

[1] E.g. see Ogden, J. 2011. Windy Hill Rosalie Bay Catchment Trust, Bird Counts December 2010. Report JO 4. February 2011.

[2] 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.

management at Windy Hill[3]. The negative relationship between bird and rat abundances has been clearly shown at Windy Hill by comparison between the managed and control areas[4]. However, a further factor of vegetation change, namely increased garden area and structure (with nectar producing plants and fruit trees) might be equally important.

Thus three factors may 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 (Judy Gilbert's in particular);
3. A reduction in predation pressure from rats allowing greater nesting success and more availability of food supplies.

Only the first of these seems likely to have a *negative* impact on fantail and silvereye.

Previous analyses[5] of 3-minute bird counts 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 thrive in dense native bush, so that this decline can also be associated with vegetation succession from open paddocks to manuka and kanuka, and from that to denser forest. With two exceptions, Fig 4 appears to support that trend, although the 'zeros' in 2011 do not necessarily mean the species are totally absent. Thrushes are certainly present, though apparently in lesser abundance than in 2011. The decline in blackbirds may be illusory, as these birds were recorded in dense bush at Windy Hill in the December 2010 counts. In both cases conspicuousness is very much influenced by singing. Likewise chaffinches (the main species included under 'finches') are more conspicuous along roadsides in winter. The increase in Mynas is certainly real, and seems to represent a flock penetrating the area, perhaps in search of food. Anecdotal observations indicate that this species has increased throughout Great Barrier in the last decade.

Conclusions

Some highly significant trends have been confirmed by this comparison of bird counts at Windy Hill over eleven years. In particular some of the larger frugivorous forest birds (kereru, tui and kaka) have increased, while smaller generalist and insectivorous species have remained unchanged or declined (grey warbler, silvereye and fantail). The

[3] 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.

[4] Ogden, J. 2011. Windy Hill Rosalie Bay Catchment Trust, Bird Counts December 2010. Report JO 4.

[5] Ogden, J. 2009. Windy Hill Rosalie Bay Catchment Trust, Bird Counts December 2008. Report JO 1.

diversity of introduced passerines may also have declined, although Mynas have recently invaded the study area. 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 the increase of garden supplies. 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.

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.
° Control of breeding population size in fantails and silvereyes 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 MSc topic.

APPENDIX 1. Station locations.

Number	Description	GPS location
1	Don McGreggor'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

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								
COUNT		100	7	89	57	28	69	9	26	98
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	Kaka	Silver eye	Tui	Grey Warbler	Fantail	Kereru	Other	Total
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
COUNT		100	13	53	98	28	39	37	24	100
FREQUENCY		100	13	53	98	28	39	37	24	100