

Oaklands Hill Wind Farm

Bird Utilisation Monitoring

Spring 2012 to Winter 2013

Report for Suzlon Energy Australia

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Executive Summary

Following completion of the Oaklands Hill Wind Farm, monitoring of bird utilisation of the wind farm is required for a period of two years to examine any seasonal differences in the abundance and diversity of bird species. The following report details the results of the second 12-month monitoring period undertaken from spring 2012 to winter 2013.

Point count surveys were conducted over a 20 minute period at 10 locations distributed across the wind farm. Surveys were repeated 10 times at each location at different times of the day in each season. During each point count survey, the species, number of individuals, distance from the observer and behaviour of all birds observed were recorded. Behaviour was classified as perched, foraging or flying.

Over all seasons, a total of 17,556 individuals from 56 bird species were recorded at the Oaklands Hill Wind Farm. Species diversity ranged from 30 species in summer and autumn to 43 species in spring.

Although both the number of individuals and species varied significantly between observation points, there was no apparent pattern in the spatial distribution of birds across the wind farm. The abundance of birds recorded varied significantly between different times of day. The greatest number of birds were recorded during the morning within all seasons. The greatest temporal variation in bird abundance occurred during summer when relatively low numbers were observed in the middle of the day and afternoon.

Flying was the predominant activity of most birds observed in all seasons. The proportion of birds observed foraging was greatest in spring and lowest in summer. During autumn and winter, the proportion of birds foraging was relatively similar to those perched.

The five most common bird species consisted of Corella species, Australian Magpies, Little Ravens, Sulphur Crested Cockatoos and the introduced Starling. These species accounted for 77.5% of all individuals recorded. Their relative abundance varied between seasons with the House Sparrow, Straw-necked Ibis and duck species also being relatively common in different seasons. All species are common farmland birds. Of all 56 bird species recorded, only the Black Falcon is listed as threatened (vulnerable) under the Advisory List of Threatened Vertebrate Fauna in Victoria 2013. None are listed under the Flora and Fauna Guarantee Act 1988 or Environment Protection and Biodiversity Conservation Act 1999.

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1. Introduction

The Oaklands Hill Wind Farm consists of 32 wind turbines located on approximately 2,320 ha of agricultural land near Glenthompson in south west Victoria. In accordance with the Planning Permit conditions and Bat and Avifauna Management Plan for the Oaklands Hill Wind Farm (Wood 2011), Suzlon Energy Australia engaged Australian Ecological Research Services to undertake seasonal surveys of bird utilisation of the wind farm for a period of two years following completion of the wind farm in spring 2011. Bird utilisation surveys were undertaken to document the species and abundance of avifauna at the site and to determine whether there were any seasonal differences across the site in species abundance, diversity and behaviour.

Bird utilisation monitoring during the first 12 months from spring 2011 to winter 2012 (Wood 2013) showed that a total of 69 bird species were recorded at the Oaklands Hill Wind Farm, ranging from 33 species in winter to 47 in spring. Five species accounted for over 77% of all individuals recorded and consisted of the native Corella sp. (31.9%), Australian Magpie (18.6%), Little Raven (11.5%) and two introduced species, the Starling (11.4) and Skylark (4.1%).

The following report details the results of the second year of bird utilisation monitoring undertaken in each season from spring 2012 to winter 2013.

2. Methods

2.1 Survey method

Bird utilisation surveys were undertaken using the fixed-point count survey method, based on techniques recommended by the National Renewable Energy Laboratory in the USA (Morrison 1998). Point count surveys were conducted at 10 locations distributed across the Oaklands Hill Wind Farm (Figure 1). Survey points were located to sample most areas of the wind farm and positioned in areas which provided a clear view of the surrounding landscape. These surveys involved an observer stationed at a survey point for 20 minutes and recording all birds observed or heard. Details of the species, number of individuals, distance from the observer and behaviour were documented. Behaviour was classified as 'perched', 'foraging' or 'flying'. Each observation point was surveyed 10 times at different times of day during each season to allow for temporal differences in bird movements and activity. The survey schedule for each observation point is shown in Table 1.

Figure 1. Locations of observation points at the Oaklands Hill Wind Farm

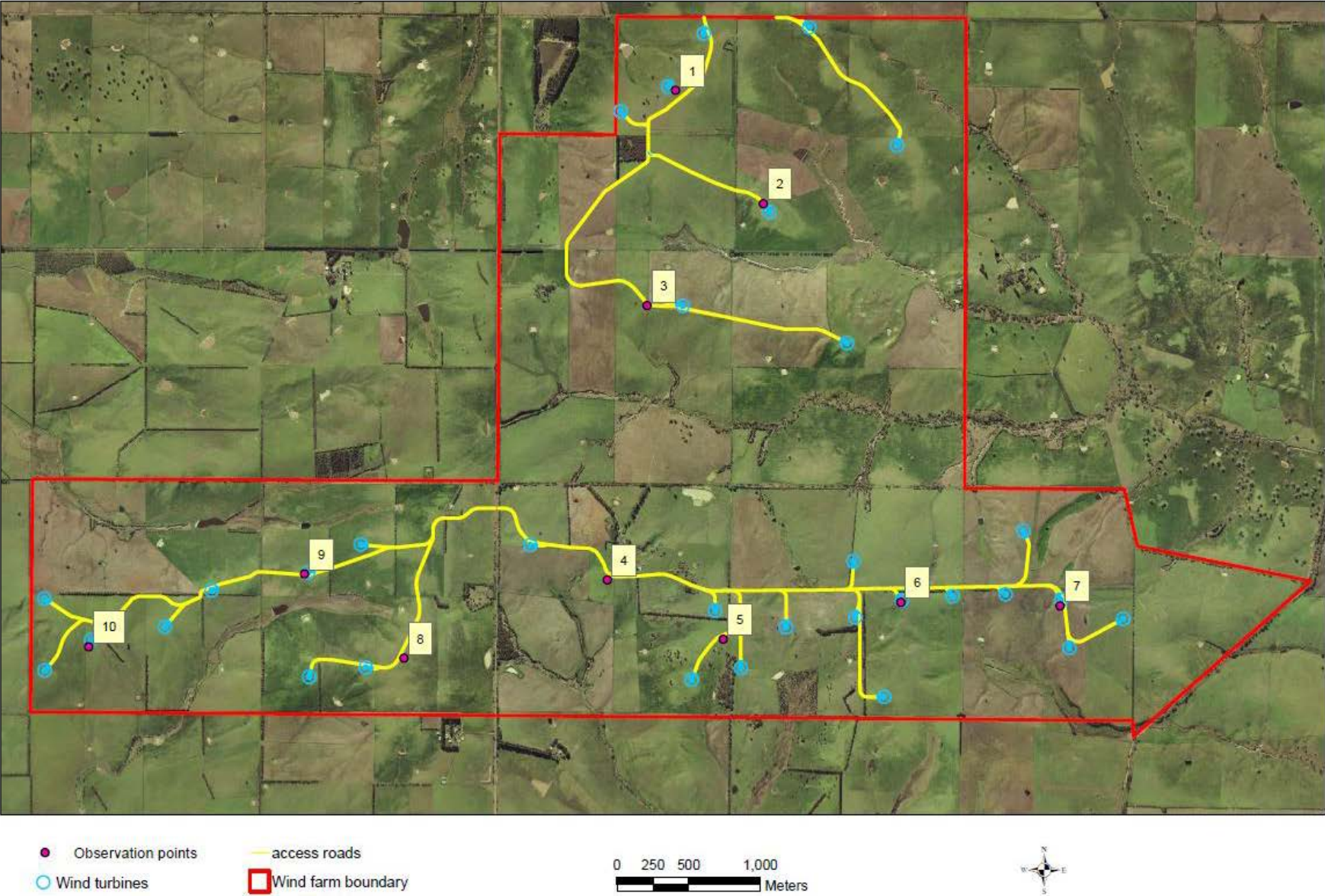


Table 1. Schedule for bird utilisation point count surveys

	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6	Survey 7	Survey 8	Survey 9	Survey 10
Observation point	1	2	3	4	5	6	7	8	9	10
	2	3	4	5	6	7	8	9	10	1
	3	4	5	6	7	8	9	10	1	2
	4	5	6	7	8	9	10	1	2	3
	5	6	7	8	9	10	1	2	3	4
	6	7	8	9	10	1	2	3	4	5
	7	8	9	10	1	2	3	4	5	6
	8	9	10	1	2	3	4	5	6	7
	9	10	1	2	3	4	5	6	7	8
	10	1	2	3	4	5	6	7	8	9

2.2 Data analysis

Bird utilisation at the wind farm was quantified in terms of the total number of bird species, the total number of individuals recorded, the mean number of bird species per point count and the mean number of individuals recorded per point count. When large flocks were seen, the number of individuals in the flock was estimated.

One-way analysis of variance was used to examine differences in species diversity and abundance between seasons, as well as observation points. Two-way analysis of variance was used to examine differences in abundance between seasons and different times of day. Comparisons of bird abundance at different times of the day was examined using three time periods: 06:30-10:30, 10:30-14:30 and 14:30-18:00. Statistical significance was defined as $P < 0.05$.

The activity of birds was classified as either, perched, foraging or flying. Differences in the activity of all birds observed was examined over all seasons as well as between seasons. The activity of the five most abundant species observed in each season was also compared within and between each season. As the activity of birds that were heard only could not be determined, these records were excluded from such analyses.

3. Results

3.1 Species abundance and diversity

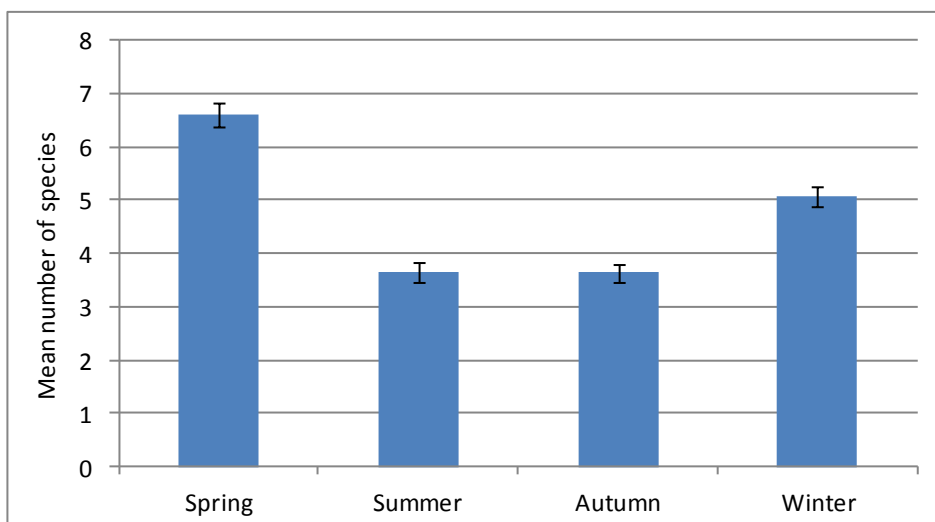
Over all four seasons, a total of 17,556 individual birds from 56 species were recorded during point count surveys. This consisted of 16,846 individuals that were observed and an additional 710 individuals that were heard only. The number of bird species and the number of individuals observed varied significantly between seasons ($F = 54.229$, $d.f. = 3$, $p < 0.001$ and $F = 4.696$, $d.f. = 3$, $p = 0.003$ respectively). The greatest diversity of bird species and greatest number of individuals was recorded in spring. The number of bird species observed in each season ranged from 28 species in summer to 43 species in spring. A total of 30 and 32 species were respectively recorded in autumn and winter. The total number of individuals observed in each season ranged from 3,375 in autumn to 6,044 in spring (Table 2).

Table 2. Total number of bird species and individuals for each survey season and all seasons combined.

	Spring	Summer	Autumn	Winter	All seasons
Total number of bird species	43	30	30	32	56
Total number of individuals	6,044	3,374	3,377	4,761	17,556

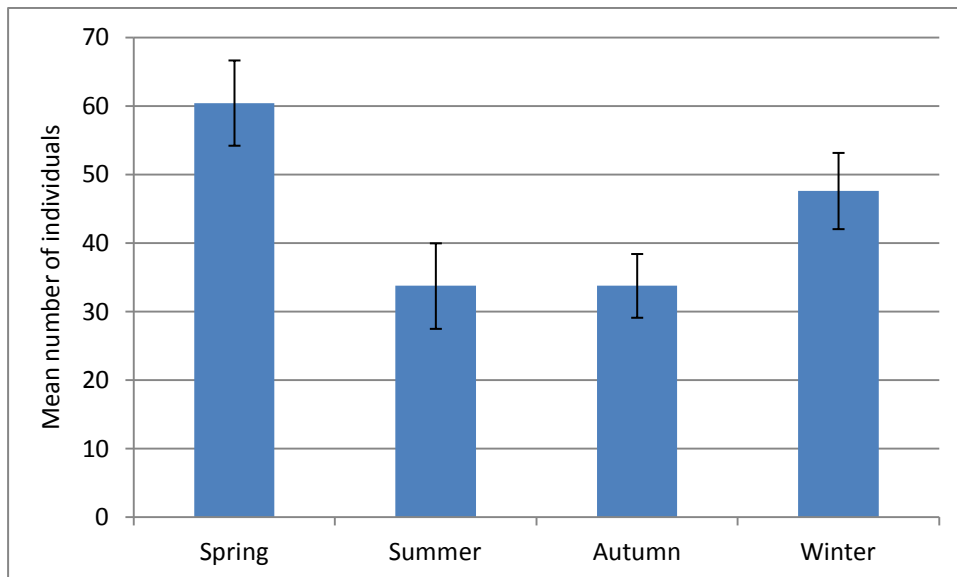
The number of species recorded during each point count was significantly higher in spring than in all other seasons. The mean number of species recorded during winter was significantly higher than in summer and autumn (Figure 2).

Figure 2. Mean number of species recorded per point count for each season



A similar pattern was observed in the mean number of birds recorded in each season. The mean number of birds recorded during each point count was also greatest during spring than in any other season. The number of birds observed in winter was significantly greater than in summer and autumn (Figure 3).

Figure 3. Mean number of birds recorded per point count for each season



3.2 Spatial distribution of birds

Over all seasons, there was a significant difference between observation points in the number of species ($F = 3.433$, d.f. = 9, $p < 0.001$) and number of individuals ($F = 3.388$, d.f. = 9, $p = 0.001$) recorded. The lowest mean number of species was recorded at observation point 6, averaging 3.83 ± 0.37 species / point count, and the highest mean number of species was recorded at observation point 9 where an average of 5.80 ± 0.32 species per point count were recorded (Figure 4). The mean number of individuals recorded at each observation point during each point count ranged from 22.47 ± 2.87 at observation point 1 to 80.35 ± 12.49 at observation point 8 (Figure 5). Whilst the number of species and number of individuals recorded varied significantly between observation points, there was no apparent pattern in the spatial distribution of bird species or their abundance across the wind farm.

Figure 4. Mean number of species per point count for each observation point.

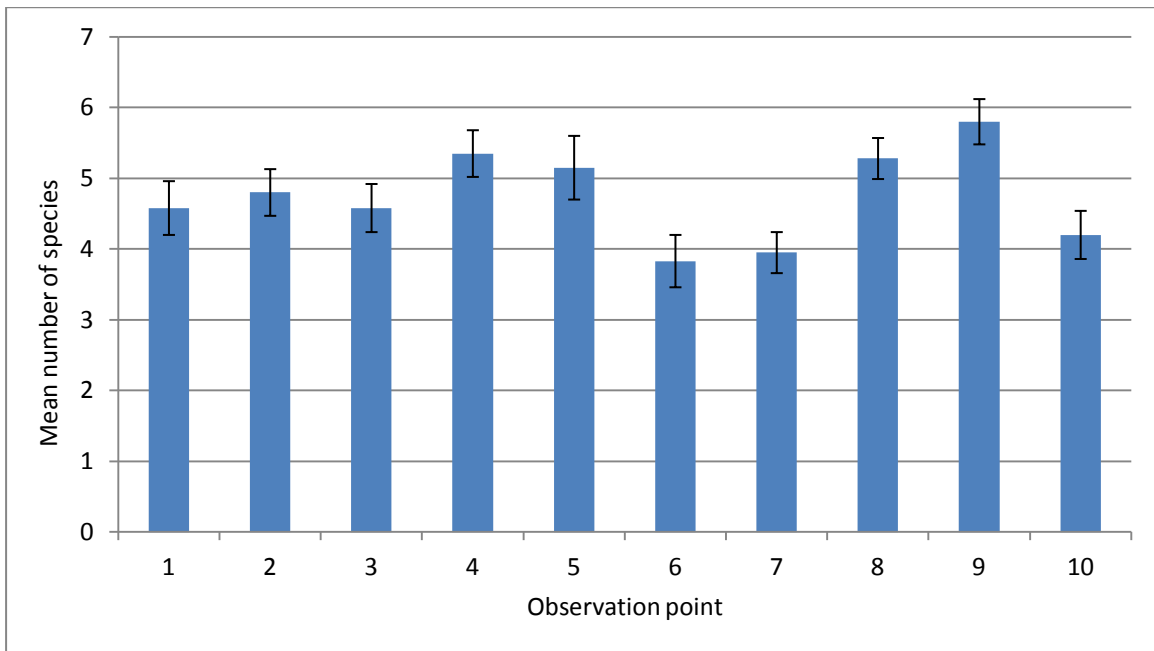
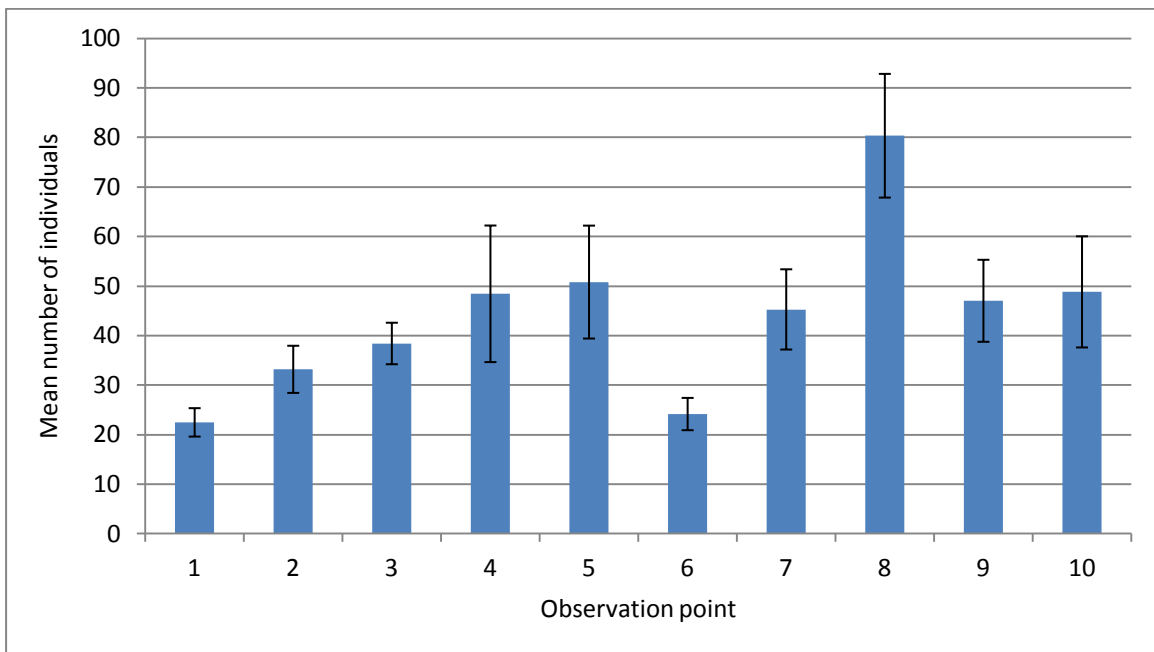


Figure 5. Mean number of individuals per point count for each observation point

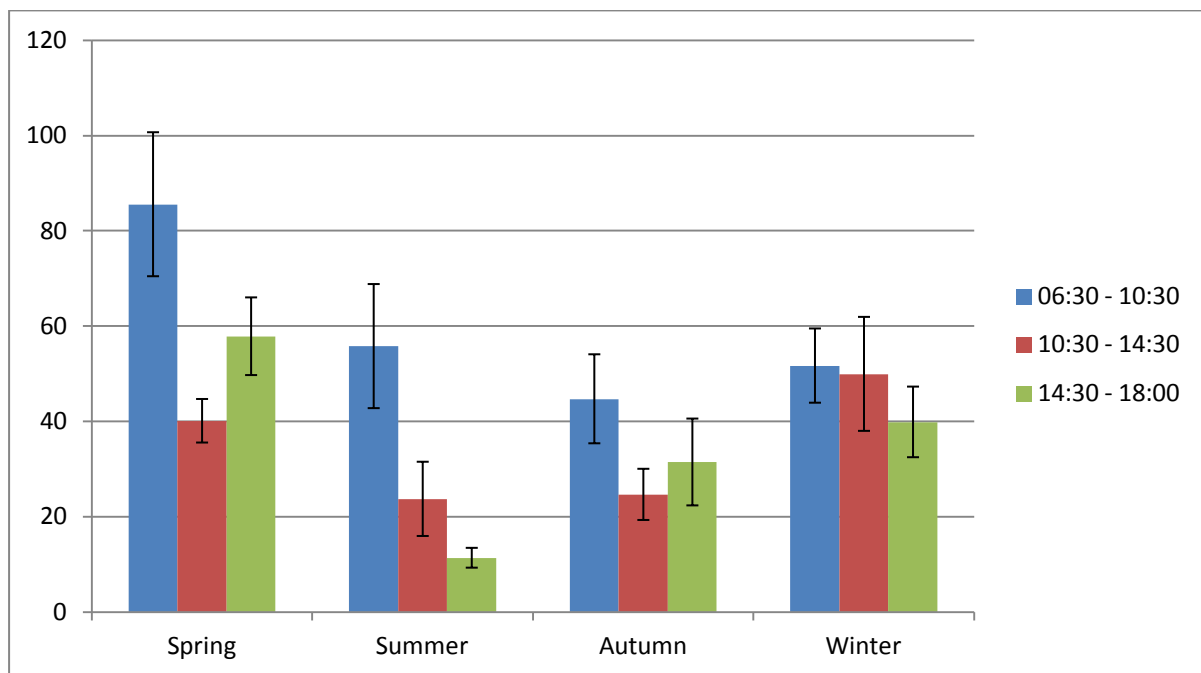


3.3 Temporal distribution of birds

Over all seasons there was a significant difference in the abundance of birds recorded at different times of the day ($F = 8.244$, $d.f. = 2$, $p < 0.001$). The number of birds recorded was greatest during the morning, averaging 59.07 ± 5.94 birds per point count, compared to during the middle of the day and afternoon when the number of birds recorded respectively averaged 34.24 ± 3.94 and 36.67 ± 4.04 per point count.

Whilst the number of birds observed varied significantly between season and between different times of the day, the interaction between season and time of day was not significant ($F = 1.367$, $d.f. = 6$, $p = 0.227$), indicating that the temporal abundance of birds was similar between seasons. However, examination of Figure 6 shows that during summer a far greater proportion of birds were observed in the morning compared to the afternoon, whilst in winter there was much less variation in the number of birds observed at different times of the day.

Figure 6. Mean number of birds recorded at different times of the day during each season



3.4 Relative abundance of bird species

The relative abundance (% of all individuals) for each species recorded in each season is shown in Figures 7-10.

The five most common bird species accounted for 77.5% of all individuals recorded and between 70 and 87% of individuals in each season (Table 3). These were common farmland birds and comprised the native Corella sp. (29.4%), Australian Magpie (18.8%), Little Raven (13.8%), Sulphur Crested Cockatoo (8%) and the introduced Starling (7.5%). The House Sparrow, Straw-necked Ibis and duck species were also relatively common and were among the five most abundant species in different seasons.

Table 3. The five most common bird species for each season and all seasons combined as a percentage of total number of individuals.

Five most common bird species (% of total number of individuals)									
Spring		Summer		Autumn		Winter		Total	
Corella sp.	38.6	Corella sp.	51.3	Australian Magpie	25.0	Corella sp.	20.3	Corella sp.	29.4
Australian Magpie	17.1	Australian Magpie	17.9	Sulphur Crested Cockatoo	18.3	Australian Magpie	17.3	Australian Magpie	18.8
Little Raven	16.2	Starling	7.5	Little Raven	16.2	Little Raven	13.8	Little Raven	13.8
Starling	5.4	Little Raven	6.9	Starling	12.5	Sulphur Crested Cockatoo	10.4	Sulphur Crested Cockatoo	8.0
Straw-necked Ibis	5.3	Duck sp.	3.8	Duck sp.	10.8	House sparrow	8.6	Starling	7.5
Total	82.6		87.4		82.8		70.4		77.5

Figure 7. Relative abundance of birds recorded during spring.

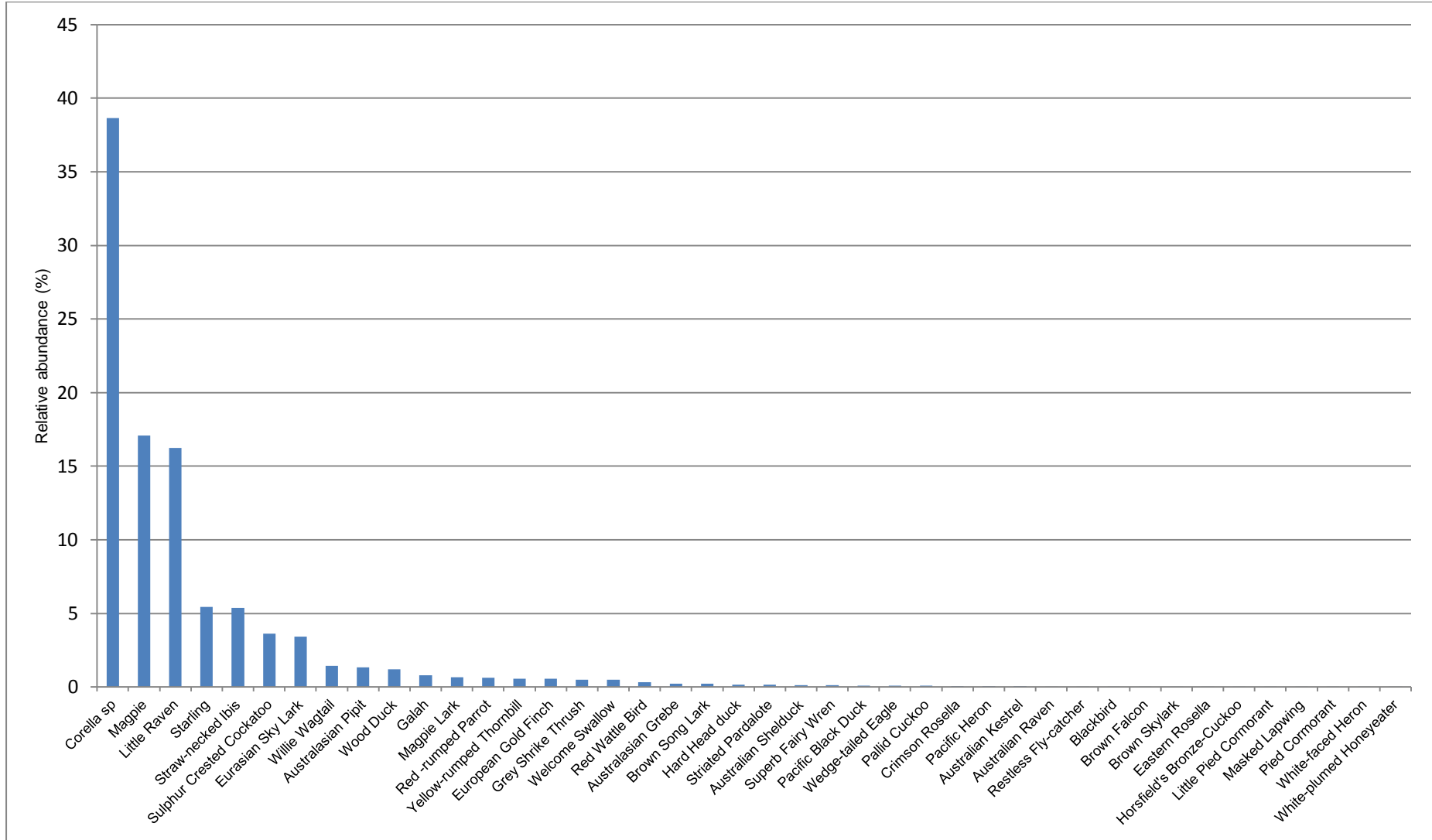


Figure 8. Relative abundance of birds recorded during summer.

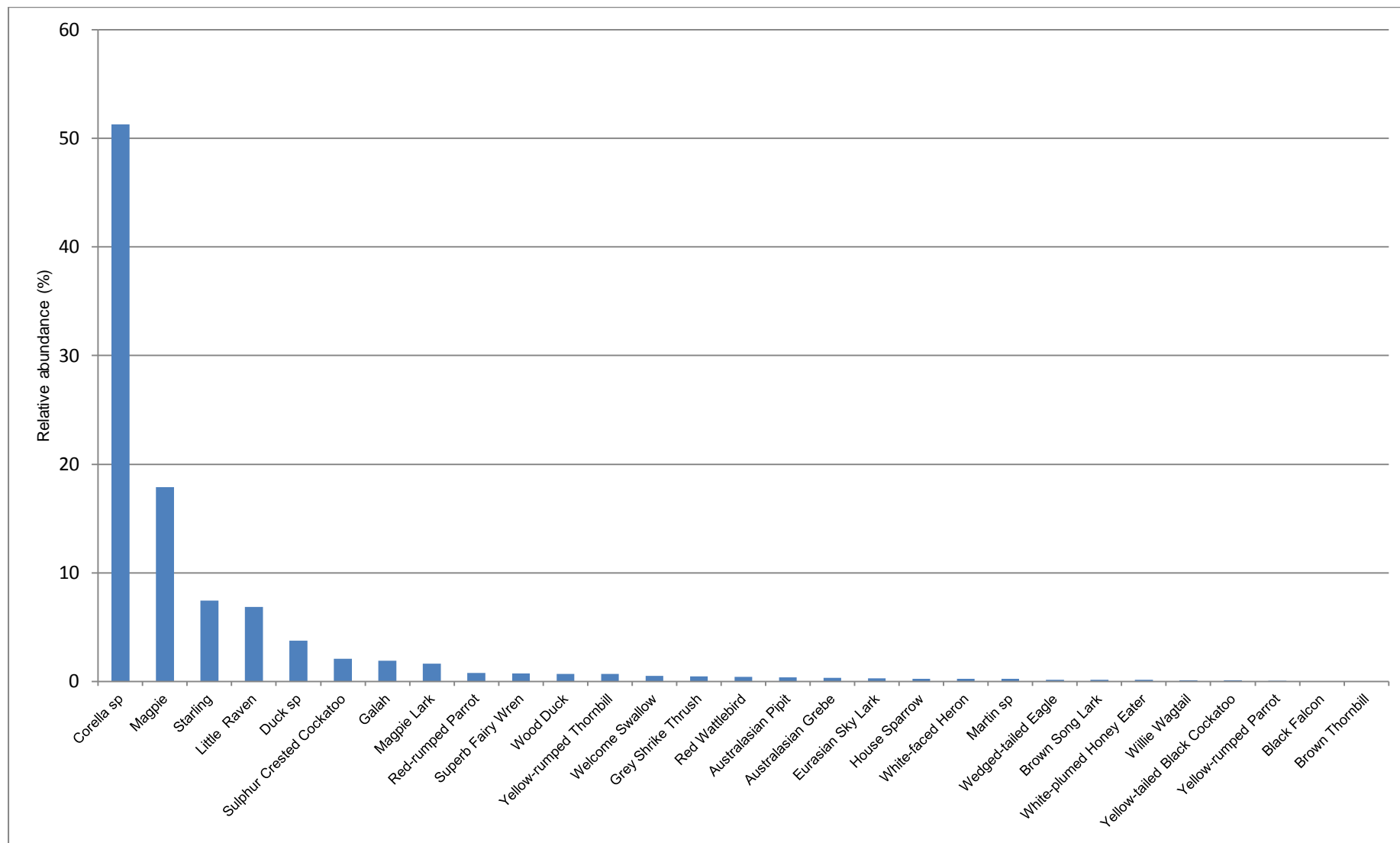


Figure 9. Relative abundance of birds recorded during autumn.

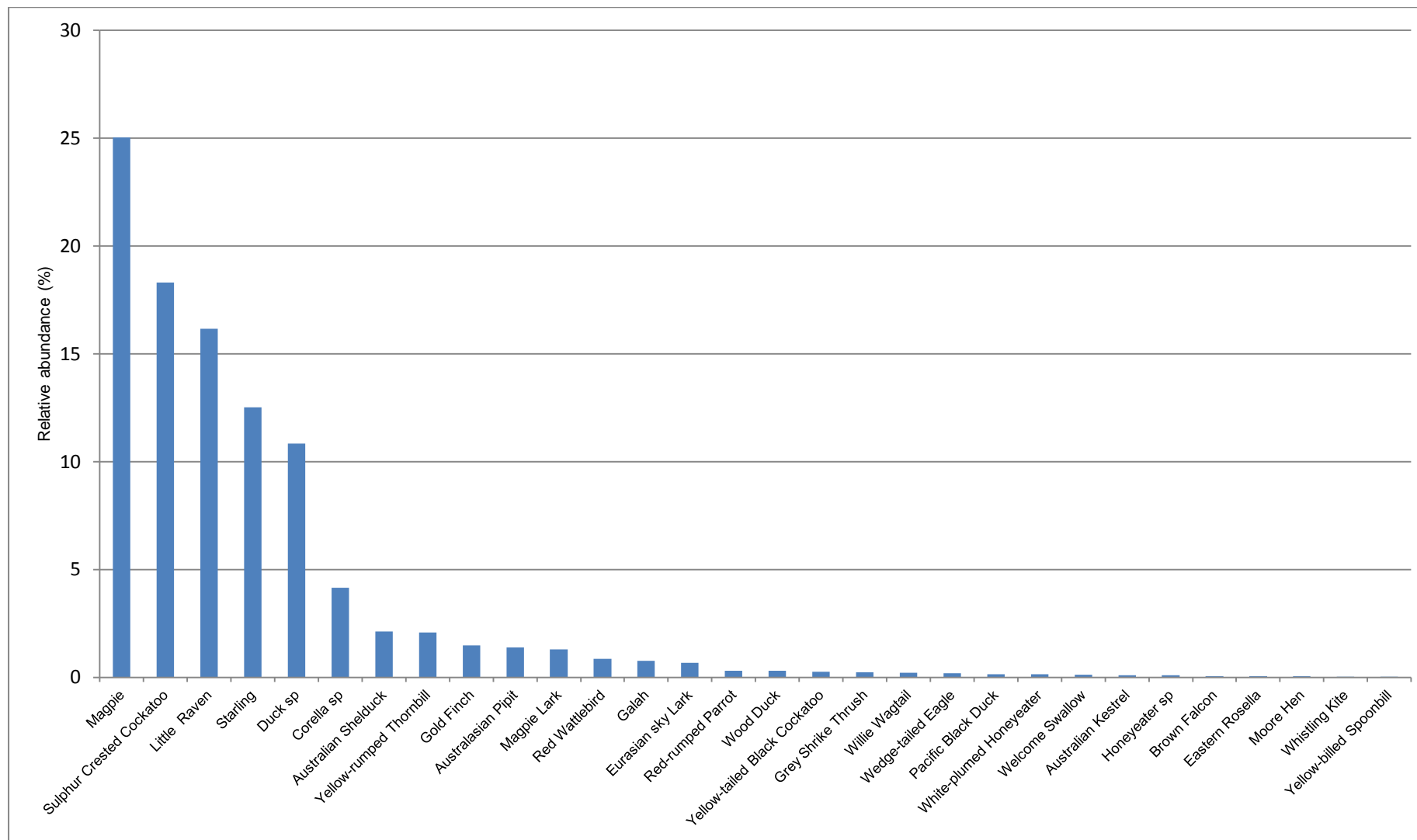
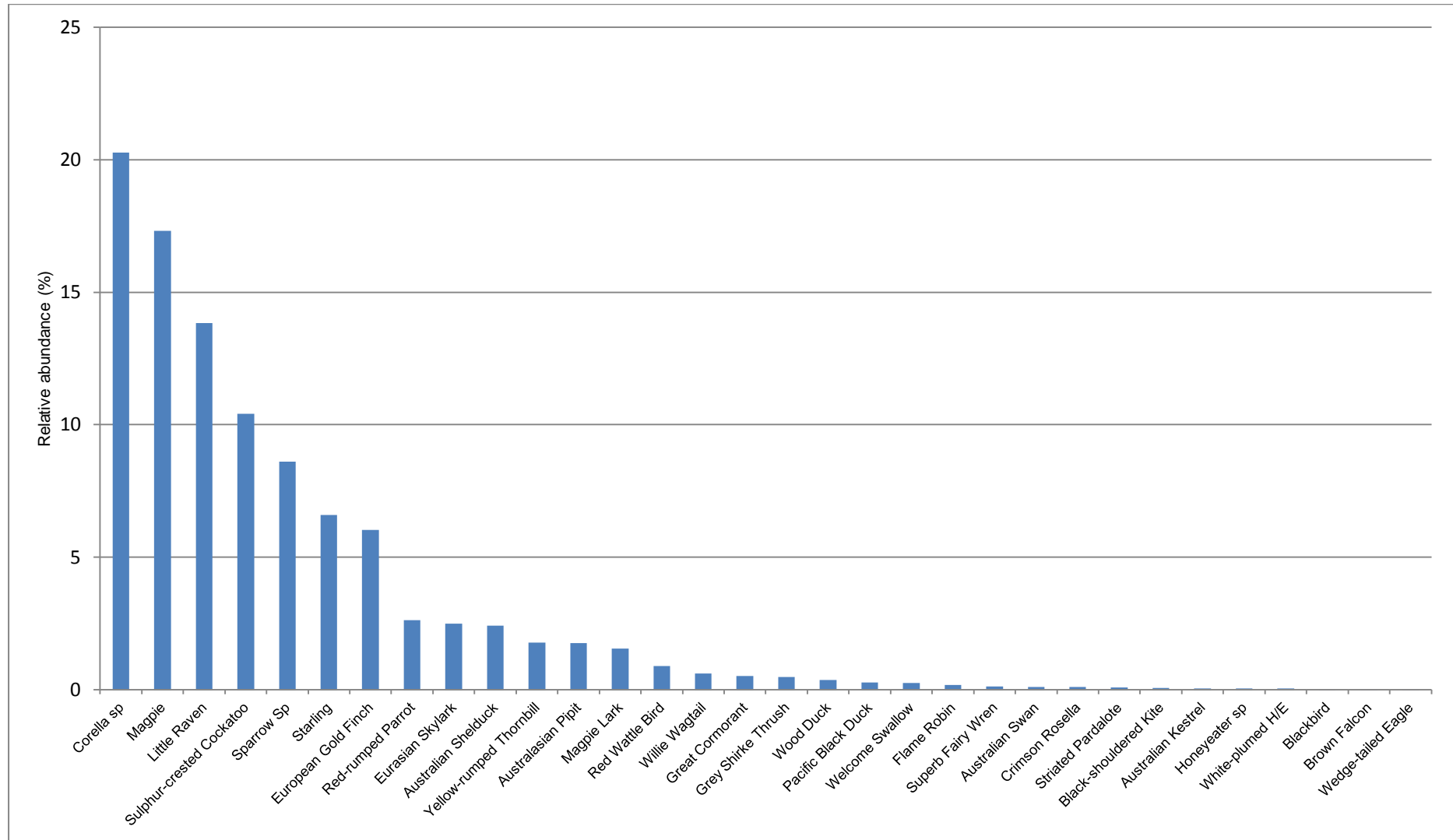


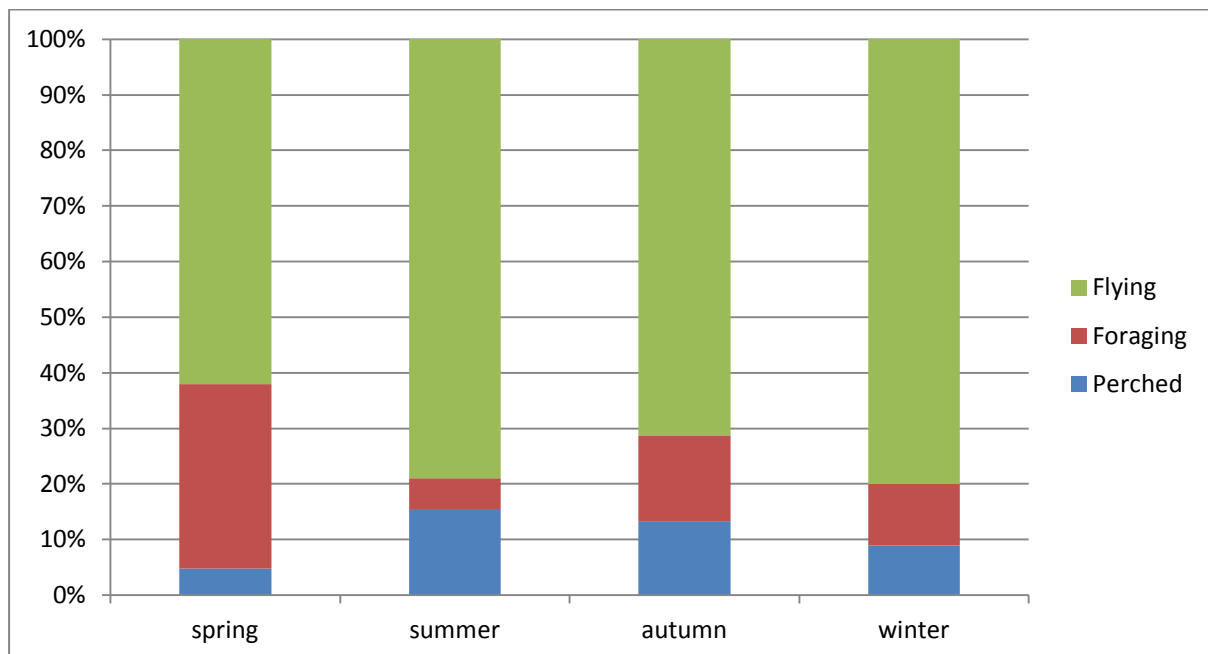
Figure 10. Relative abundance of birds recorded during winter.



3.5 Bird activity

Of the birds observed over all seasons, 73% were observed to be flying, 16.4% were observed foraging and the remaining 10.6% were perched. Figure 11 shows the frequency of each activity (flying, foraging and perched) as a proportion of all activities observed in each season. Flying was the most frequently observed activity in all seasons. The proportion of time spent foraging and perched, however, varied between seasons. In spring, birds were more frequently observed to be foraging rather than perched, whilst in summer there was a higher proportion of birds perched as opposed to foraging. In autumn and winter there was little difference in the proportion of birds observed to be foraging and those observed to be perched.

Figure 11. Relative activity of birds observed in each season.



Figures 12 to 15 illustrate the relative activity of the five most common bird species observed in each season. Flying appeared to be the predominant activity of most of these species in all seasons. However, in spring, Australian Magpies and Little Ravens spent more time foraging than flying. Although duck species were only included in the five most abundant species in summer and autumn, all were observed to be perched in summer but flying in autumn. Sulphur Crested Cockatoos were only included in the five most abundant species in autumn and winter. The majority of these birds were observed flying in autumn but perched in winter.

Figure 12. Relative activity of the five most common bird species in spring 2012

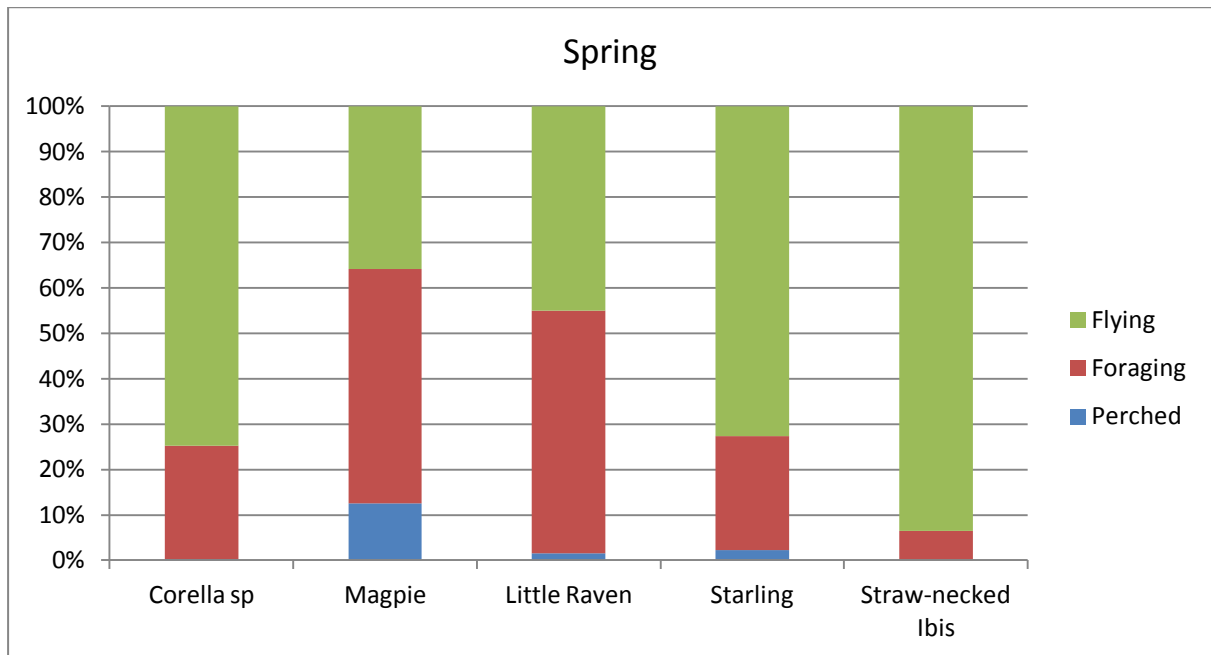


Figure 13. Relative activity of the five most common bird species in summer 2012/13

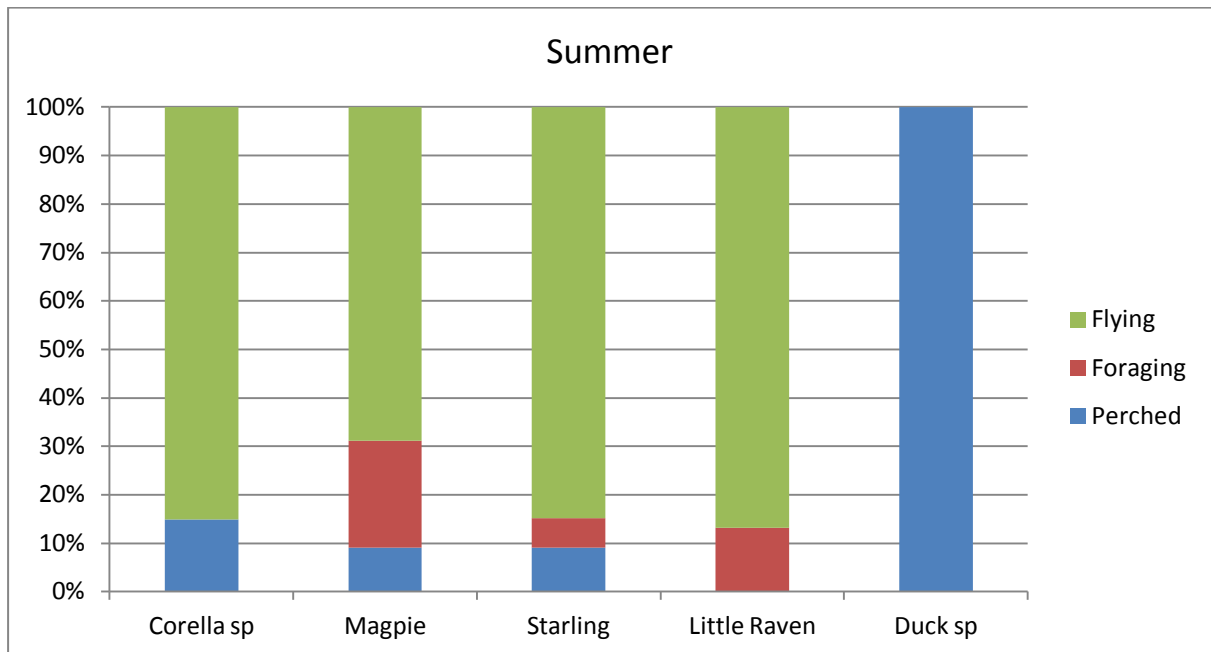


Figure 14. Relative activity of the five most common bird species in autumn 2013

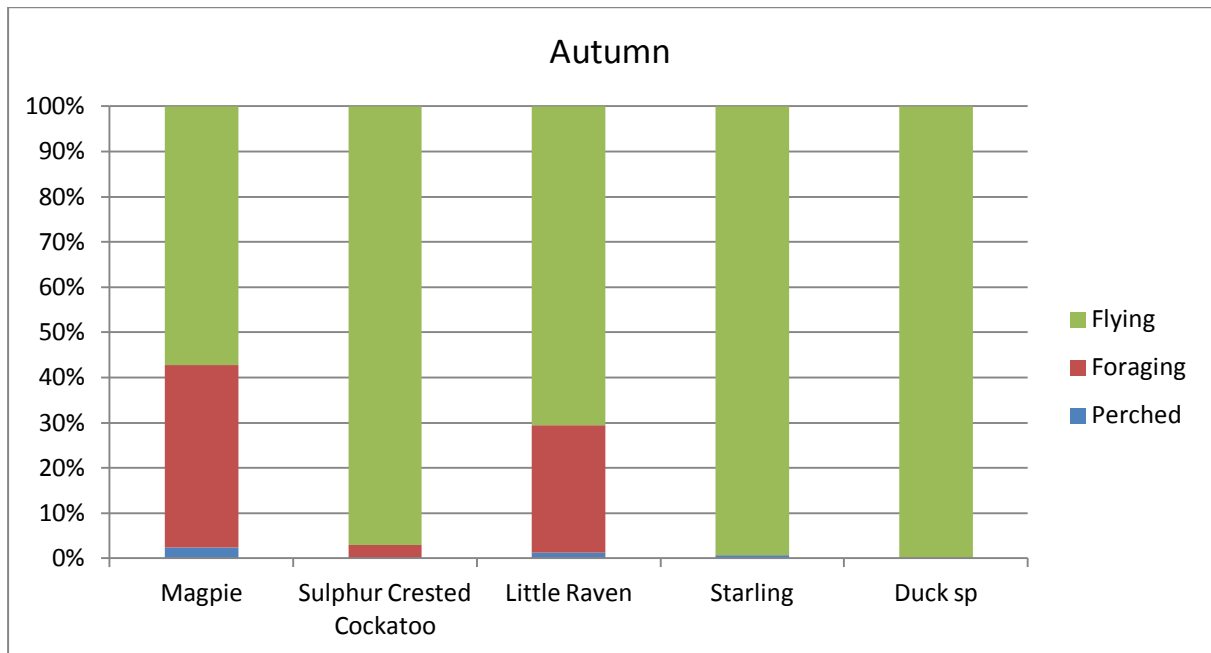
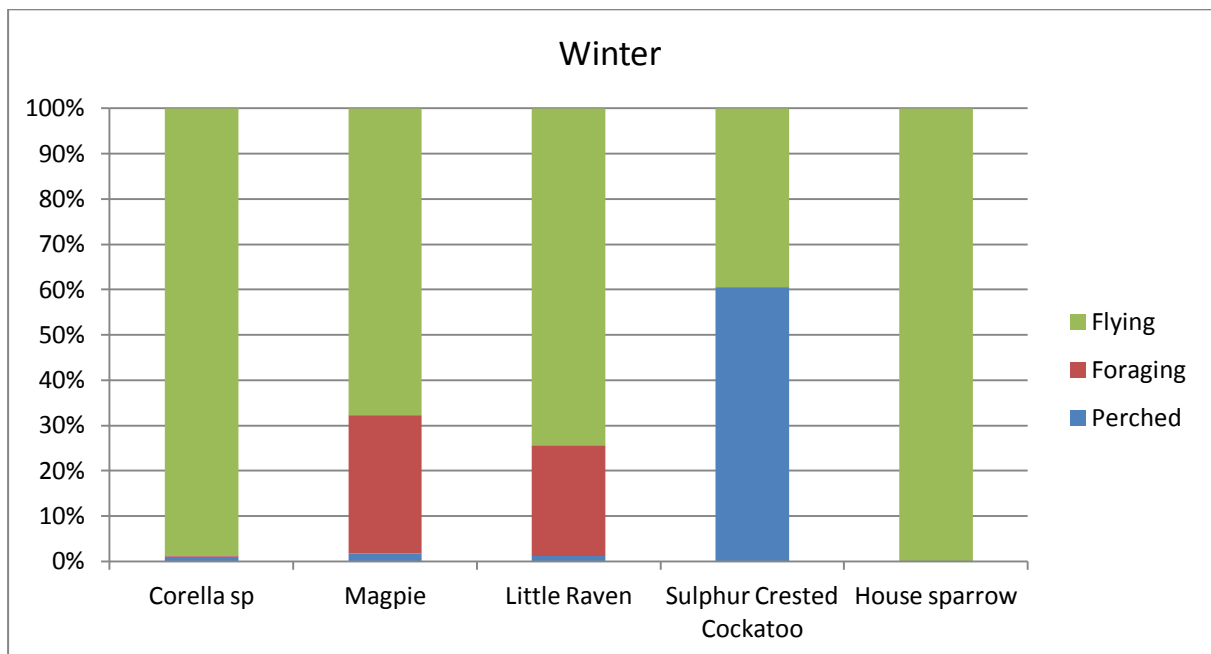


Figure 15. Relative activity of the five most common bird species in winter 2013



4. Conclusion

A total of 17,556 individuals from 56 bird species were recorded at the Oaklands Hill Wind Farm. The greatest number of individuals and species were observed in spring whilst the least number of individuals and species was recorded in summer and autumn.

The number of species and individuals recorded varied significantly between observation points but there was no apparent pattern in the spatial distribution of birds across the wind farm.

Over all seasons the abundance of birds was greatest during the morning compared to during the middle of the day and afternoon when similar numbers were observed. This pattern of temporal activity was relatively similar for all seasons, although in winter there was less variation in the number of birds observed at different times of the day and greater variation in summer. This may be due to the need for many birds to seek shelter during the hottest times of the day in the summer period.

Over all seasons, 73% of birds were observed to be flying, 16.4% were foraging and the remaining 10.6% were perched. Whilst flying was the most commonly recorded activity in all seasons, the proportion of birds observed foraging was greatest in spring and lowest in summer. This is most likely due to more abundant forage resources and lower temperatures in spring compared to summer.

The five most common bird species consisted of Corella species, Australian Magpies, Little Ravens, Sulphur Crested Cockatoos and the introduced Starling. These species accounted for 77.5% of all individuals recorded. Their relative abundance varied between seasons with the House Sparrow, Straw-necked Ibis and duck species also being relatively common in different seasons. All species are common farmland birds. Of all 56 bird species recorded, only the Black Falcon is listed as threatened (vulnerable) under the Advisory List of Threatened Vertebrate Fauna in Victoria 2013. None are listed under the Flora and Fauna Guarantee Act 1988 or Environment Protection and Biodiversity Conservation Act 1999.

References

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Appendices

Appendix 1. List of birds recorded and the total number of individuals recorded for each season and all seasons combined at the Oaklands Hill Wind Farm

Species	Scientific name	Spring	Summer	Autumn	Winter	Total
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	14	11			25
Australian Magpie	<i>Gymnorhina tibicen</i>	1033	604	845	824	3306
Australian Pipit	<i>Anthus novaeseelandiae</i>	80	13	47	84	224
Australian Kestrel	<i>Falco cenchroides</i>	3		3	2	8
Australian Raven	<i>Corvus coronoides</i>	2				2
Australian Shelduck	<i>Tadorna tadornoides</i>	8		72	115	195
Australian Swan	<i>Cygnus atratus</i>				5	5
Black Falcon	<i>Falco subniger</i>		1			1
Blackbird	<i>Turdus merula</i>	1			1	2
Black-shouldered Kite	<i>Elanus axillaris</i>				3	3
Brown Falcon	<i>Falco berigora</i>	1		2	1	4
Brown Songlark	<i>Cincloramphus crualis</i>	13	5			18
Brown Thornbill	<i>Acanthiza pusilla</i>		1			1
Corella sp.	<i>Cacatua sp</i>	2335	1730	140	965	5170
Crimson Rosella	<i>Platycercus elegans</i>	4			5	9
Duck sp.			127	366		493
Eastern Rosella	<i>Platycercus eximius</i>	1		2		3
Eurasian Sky Lark	<i>Alauda arvensis</i>	207	10	23	119	359
European Goldfinch	<i>Carduelis carduelis</i>	33		50	287	370
Flame Robin	<i>Petroica phoenicea</i>				9	9
Galah	<i>Cacatua roseicapilla</i>	49	65	26		140
Great Cormorant	<i>Phalacrocorax carbo</i>				25	25
Grey Shrike Thrush	<i>Colluricincla harmonica</i>	29	16	8	23	76
Hard Head duck	<i>Aythya australis</i>	10				10
Honeyeater sp				3	2	5
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	1				1
House Sparrow	<i>Passer sp</i>		9		410	419
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	1				1
Little Raven	<i>Corvus mellori</i>	981	232	546	659	2418
Magpie Lark	<i>Grallina cyanoleuca</i>	40	56	44	74	214
Martin sp			8			8
Masked Lapwing	<i>Anas platyrhynchos</i>	1				1
Moorhen	<i>Gallinulachloropus</i>			2		2
Pacific Black Duck	<i>Anas superciliosa</i>	6		5	13	24
Pacific Heron	<i>Ardea pacifica</i>	4				4
Pallid Cuckoo	<i>Cacomantis pallidus</i>	5				5
Pied Cormorant	<i>Phalacrocorax varius</i>	1				1
Red-rumped Parrot	<i>Psephotus haematotus</i>	38	27	10	125	200

Red Wattle Bird	<i>Anthochaera carunculata</i>	19	15	29	43	106
Restless Fly-catcher	<i>Myiagra inquieta</i>	2				2
Starling	<i>Sturnus vulgaris</i>	328	252	423	314	1317
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	325				325
Striated Pardalote	<i>Pardalotus striatus</i>	9			4	13
Sulphur Crested Cockatoo	<i>Cacatua galerita</i>	220	71	618	496	1405
Superb Fairy Wren	<i>Malurus cyaneus</i>	8	25		6	39
Wedged-tailed Eagle	<i>Aquila audax</i>	6	6	6	1	19
Welcome Swallow	<i>Hirundo neoxena</i>	29	18	4	12	63
Whistling Kite	<i>Haliastur sphenurus</i>			1		1
White-faced Heron	<i>Egretta novaehollandiae</i>	1	9			10
White-plumed Honey Eater	<i>Lichenostomus penicillatus</i>	1	5	5	2	13
Willie Wagtail	<i>Rhipidura leucophrys</i>	87	4	7	29	127
Wood Duck	<i>Chenonetta jubata</i>	73	24	10	18	125
Yellow-billed Spoonbill	<i>Platalea flavipes</i>			1		1
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	34	26	70	85	215
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>		4	9		13
Total		6044	3374	3377	4761	17556