

Oaklands Hill Wind Farm Bird Utilisation Monitoring

September 2011 to Winter 2012

Report for RePower 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 first 12-month monitoring period undertaken from spring 2011 to winter 2012.

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 69 bird species were recorded at the Oaklands Hill Wind Farm, ranging from 33 species in winter to 47 in spring. Although species diversity was lowest in winter, the abundance of individuals was greatest in this season.

There was no apparent spatial pattern observed in either species diversity or abundance across the wind farm. However, the lowest average number of bird species and individuals recorded for all seasons was recorded at observation point 3 whereas the highest average number of bird species recorded for all seasons, and the highest average number of individuals for summer, autumn and winter was recorded at observation point 4.

The majority of individuals comprised common native and introduced farmland birds, none of which were threatened at the national, state, regional or local level. Most individuals observed were recorded as flying, or foraging and flying. There was no significant difference between morning, mid-day and afternoon in the abundance of individuals.

The five most common bird species over all seasons accounted for 77.5% of all individuals recorded. These were common farmland birds and comprised 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%). Nine birds of prey species were observed during the surveys but were observed at relatively low frequencies (0.62% of all individuals).

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), RePower 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.

The following report details the results of the first year of bird utilisation monitoring undertaken in each season from spring 2011 to winter 2012.

2. Methods

2.1 Fixed-point bird count 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 (Tables 1 and 2). Approximately 20 point counts were conducted each day, with each survey round starting at a different observation point (Table 2).

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

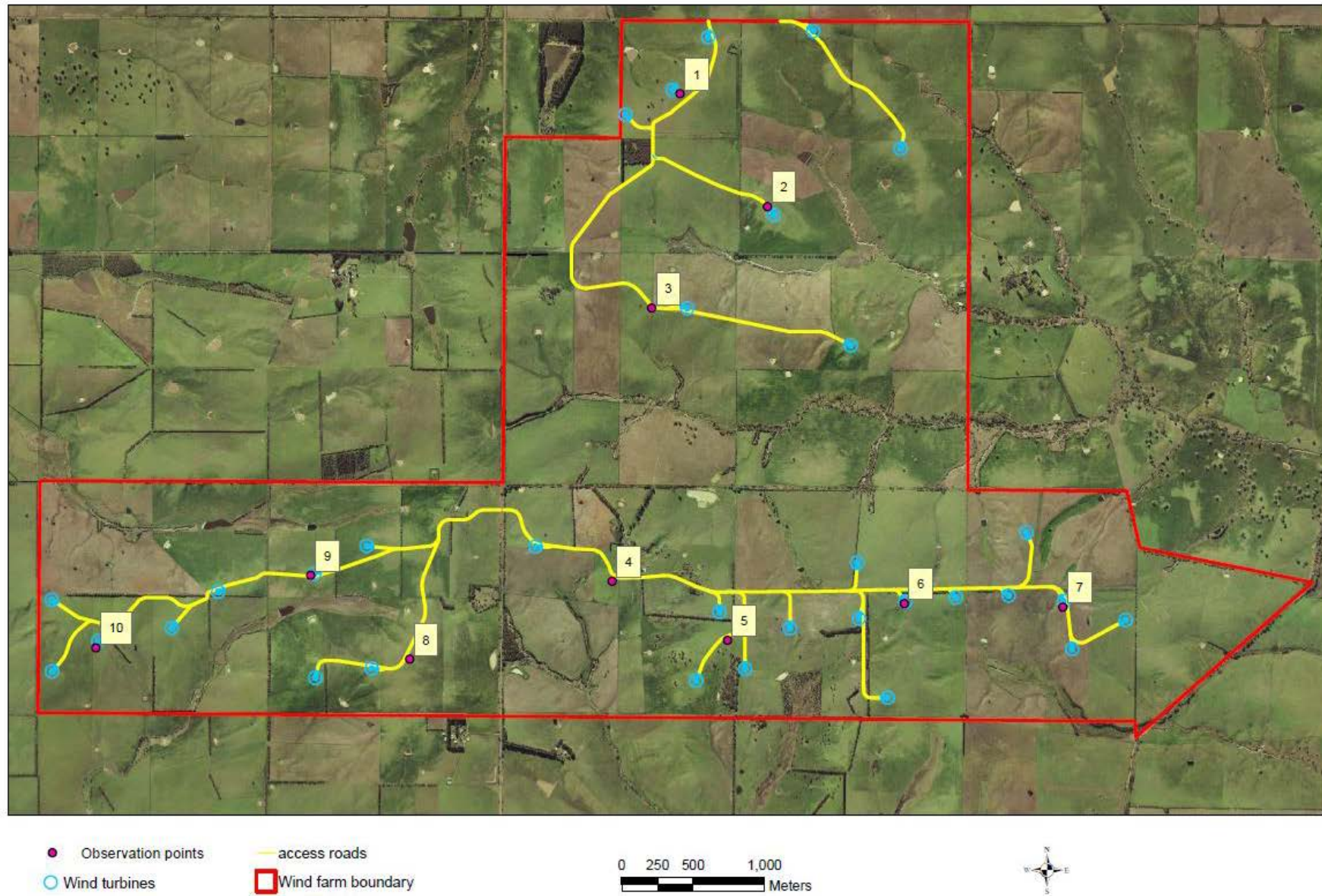


Table 1. Survey period, duration and time-spread of bird utilisation point count surveys at Oaklands Hill Wind Farm.

Survey period	Start date	Finish date	Observation days on site	Start time of earliest count	Finish time of latest count
Spring	1 November 2011	6 November 2011	6	06:57	17:45
Summer	16 December 2012	20 December 2012	5	06:20	18:00
Autumn	16 April 2012	20 April 2012	5	06:40	16:28
Winter	9 July 2012	13 July 2012	5	07:00	17:20

Table 2. 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, as well as between seasons and different types of behaviour. Statistical significance was defined as $P < 0.05$. As the behaviour of birds that were heard only could not be determined, these records were excluded from analyses of behaviour.

Point count surveys were grouped into three time-of-day periods: 06:30-10:30, 10:30-14:30 and 14:30-18:00. Although there are three behaviour types (perched, foraging and flying) seven behaviour combinations were recorded, as some birds displayed more than one behaviour type during the 20 minute survey. The seven behaviour combinations observed are:

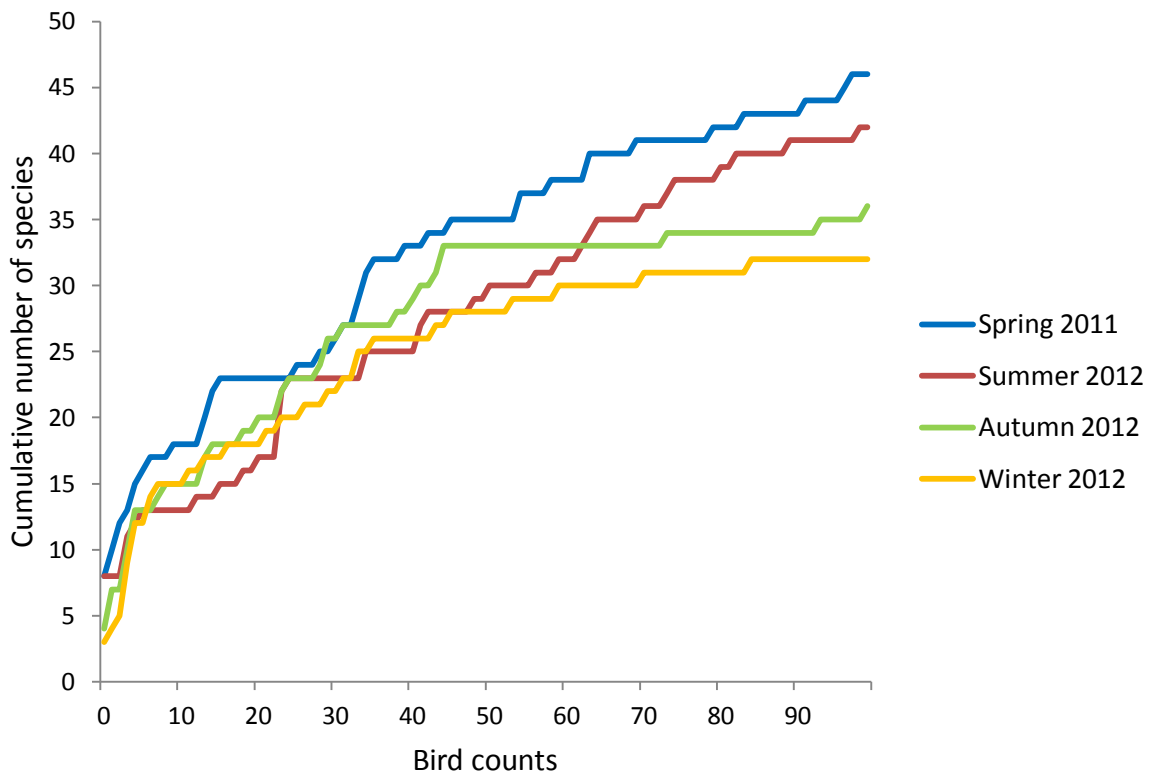
- Perched, foraging and flying
- Perched and foraging
- Perched and flying
- Perched
- Foraging and flying
- Foraging
- Flying

3. Results

3.1 Representativeness of the survey

Figure 2 shows the cumulative number of species observed across all observation points during each season. At least 70% of bird species were observed after 50% of the surveys for each season. This suggests that the surveys collectively provided a representative picture of the diversity of bird species utilising the wind farm site during the period of the survey.

Figure 2. The cumulative number of bird species recorded during consecutive counts at the Oaklands Hill Wind Farm.



3.2 Bird observations

Over all four seasons, a total of 3,301 records (14,199 individuals) of 69 birds species were observed at the Oaklands Hill Wind Farm. Some birds could not be identified to species level due to inadequate information for identification and were assigned to groups of species that share similar characteristics (see Appendix). Of the 14,199 individuals recorded, 13,258 individuals were seen and 941 individuals were heard only.

The number of bird species and the number of individuals observed varied significantly between seasons ($F=39.69$, $d.f.=3$, $p=0.000$ and $F=8.29$, $d.f.=3$, $p=0.000$ respectively). The number of bird species observed in each season ranged from 33 species in winter to 47 species in spring. The total number of individuals observed in each season ranged from 2,217 in summer to 5,355 in winter. Although the total diversity of bird species was greatest in spring, the abundance of birds was greatest in winter (Table 3).

The mean species diversity per point count was greatest in spring, with 7.31 ± 0.21 species per point count and lowest in summer (4.28 ± 0.22 species per point count). Mean species diversity was significantly greater in spring than all other seasons (Figure 3). There was no significant difference in the number of bird species recorded in autumn and winter, respectively averaging 5.26 ± 0.20 and 5.18 ± 0.18 species per point count. The mean number of individuals observed during each point count ranged from 22.39 ± 3.23 in summer to 53.55 ± 9.06 in winter (Figure 4) and averaged 35.58 ± 2.65 over all seasons. The relative abundance (% of all individuals) for each species recorded in each season is shown in Figures 10-13.

For all seasons, observation point 3 recorded the lowest mean species diversity and mean number of individuals per point count (Figure 5 and 6), with 4.30 ± 0.24 species and 19.75 ± 3.58 individuals per point count respectively. The mean species diversity per point count was greatest at observation point 4 with 6.88 ± 0.33 species per point count. The mean number of individuals per point count was greatest at observation point 9 with 62.68 ± 17.03 individuals per point count. There was no apparent pattern in the spatial distribution of bird species or their abundance across the wind farm.

The number of individuals recorded did not vary significantly between different time-of-day periods ($F=0.035$, $d.f.=2$, $p=0.965$), although in summer and autumn the most individuals were observed in the morning (Figure 7).

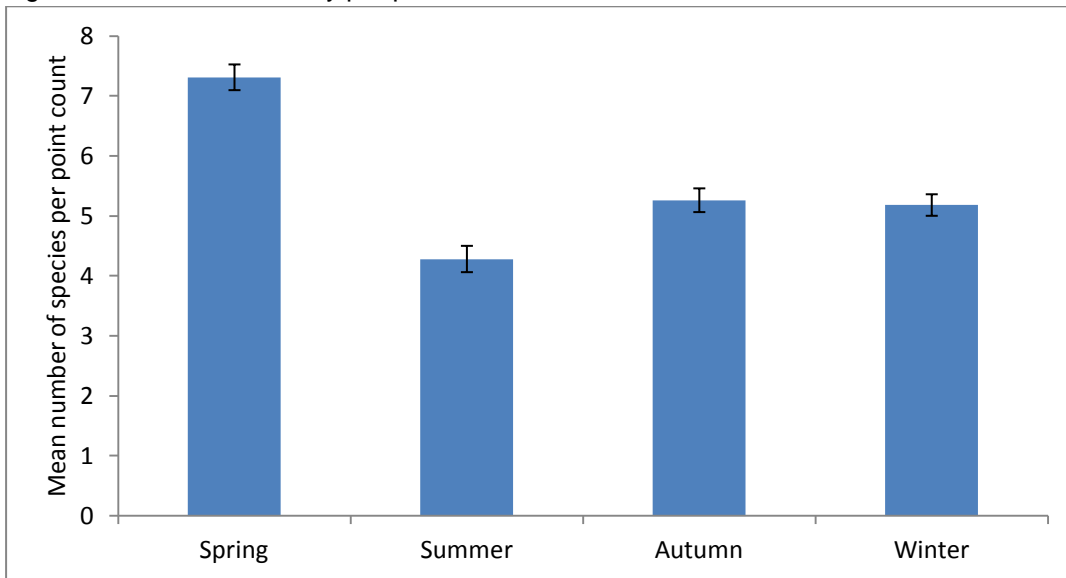
There was a significant difference in the type of behaviour observed ($F=8.618$, $d.f.=6$, $p=0.000$), with 41% of all individuals recorded as flying, and 25% of all individuals recorded as foraging and flying. The relative behaviour for individuals in each season is shown in Figure 8. The type of behaviour observed for the five most abundant species for each season and all seasons combined is shown in Figure 9.

The five most common bird species accounted for 77.5% of all individuals recorded and at least 71% of individuals in each season (Table 4). These were common farmland birds and comprised 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%). These highly abundant species also provided the highest number of recorded flights (Table 5). The five bird species with the highest number of recorded flights accounted for at least 82.6% of all recorded flights observed for each season and all seasons combined. Nine bird of prey species (88 individuals) were recorded during the surveys. These species accounted for 0.62% of all individuals observed for all seasons (Table 6).

Table 3. Total number of bird species and individuals for each survey season and all seasons combined.

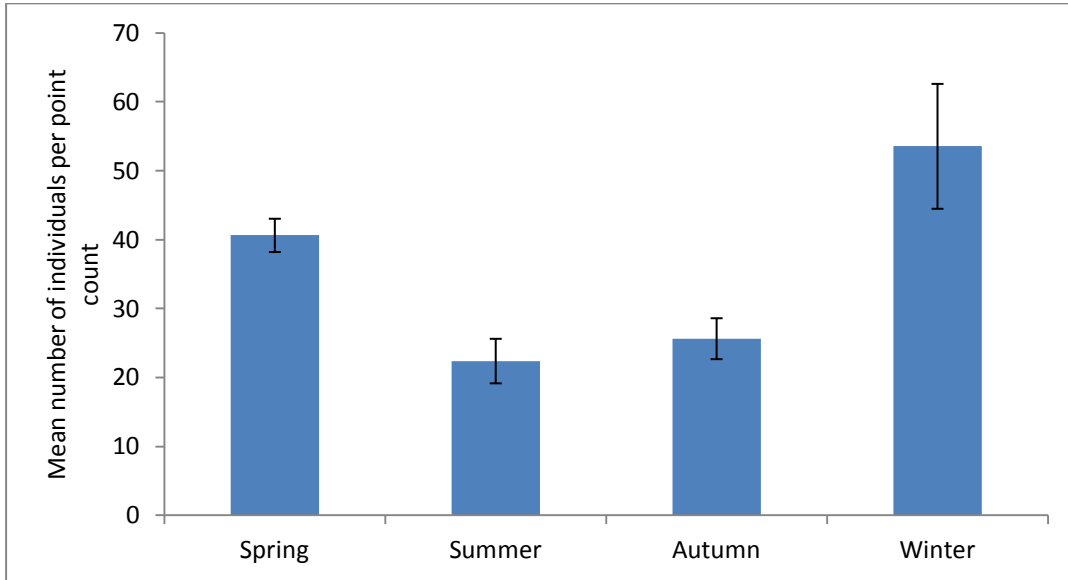
	Spring	Summer	Autumn	Winter	All seasons
Total number of bird species	47	45	38	33	69
Total number of individuals	4063	2217	2564	5355	14,199

Figure 3. Mean bird diversity per point count for each season



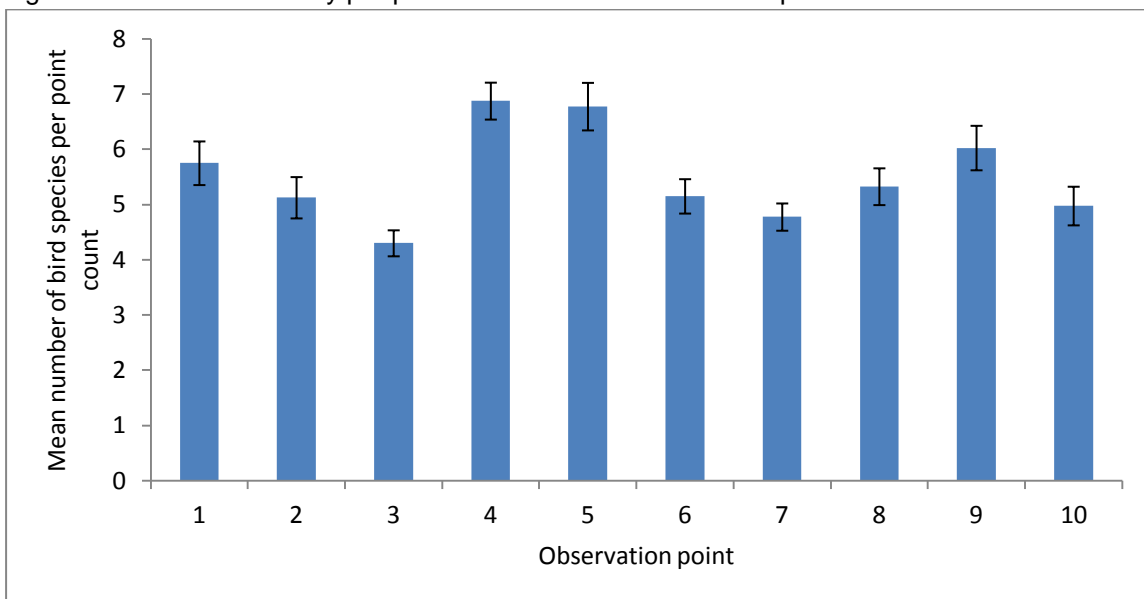
Error bars represent standard errors.

Figure 4. Mean number of individuals per point count for each survey season



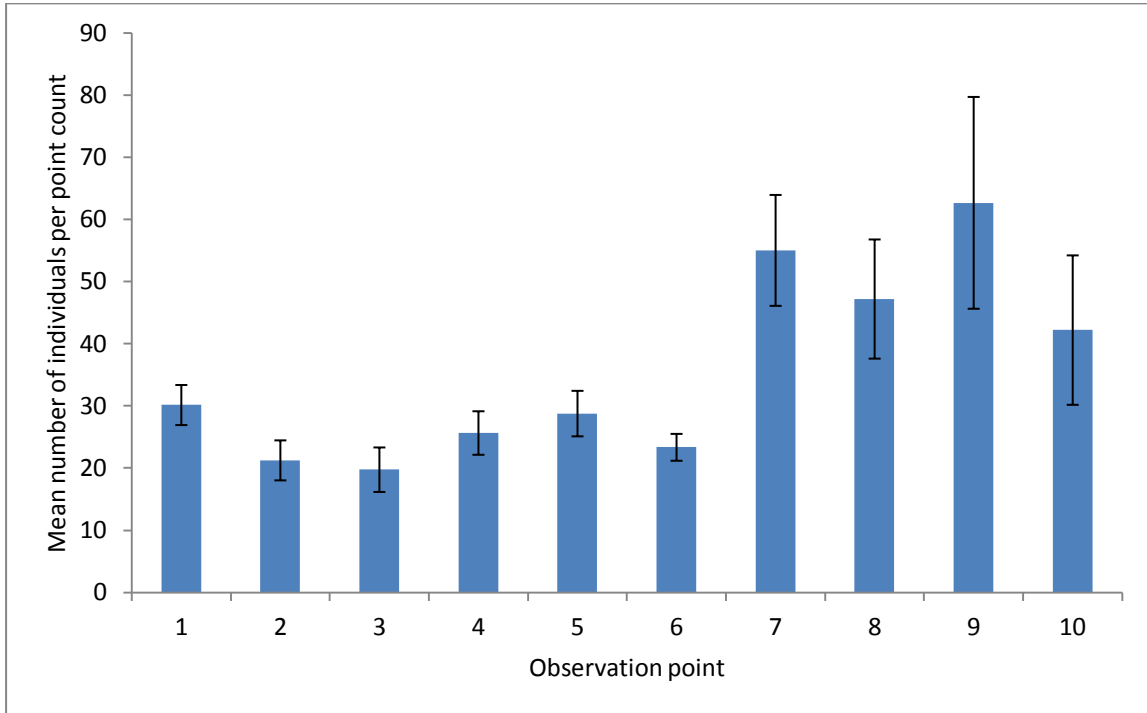
Error bars represent standard errors.

Figure 5. Mean bird diversity per point count for each observation point.



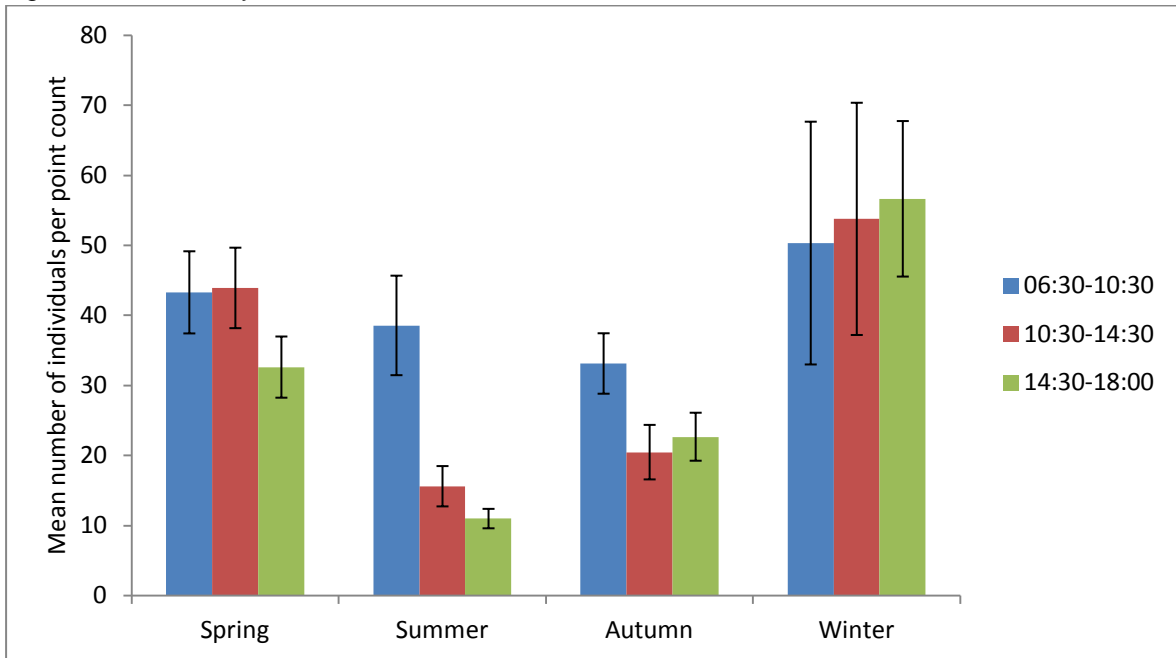
Error bars represent standard errors.

Figure 6. Mean number of individuals per point count for each observation point



Error bars represent standard errors.

Figure 7. Time of day differences in bird abundance for each season



Error bars represent standard errors.

Figure 8. Relative behaviour as a percent of number of individuals for each survey season.

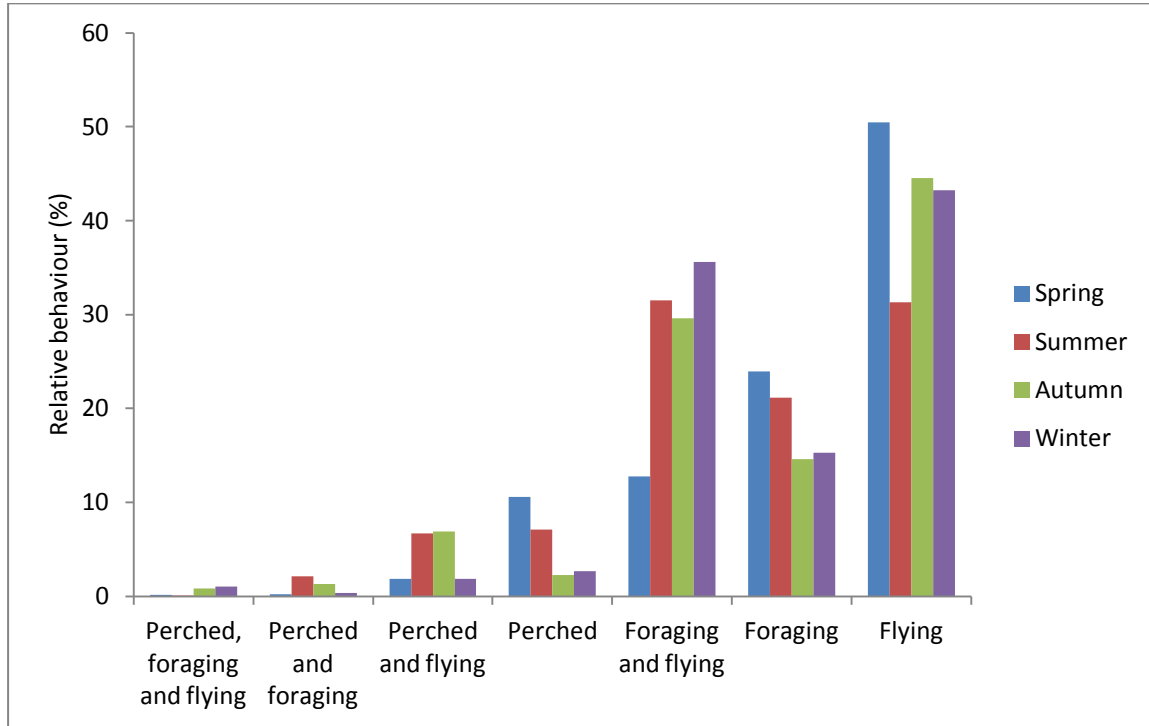
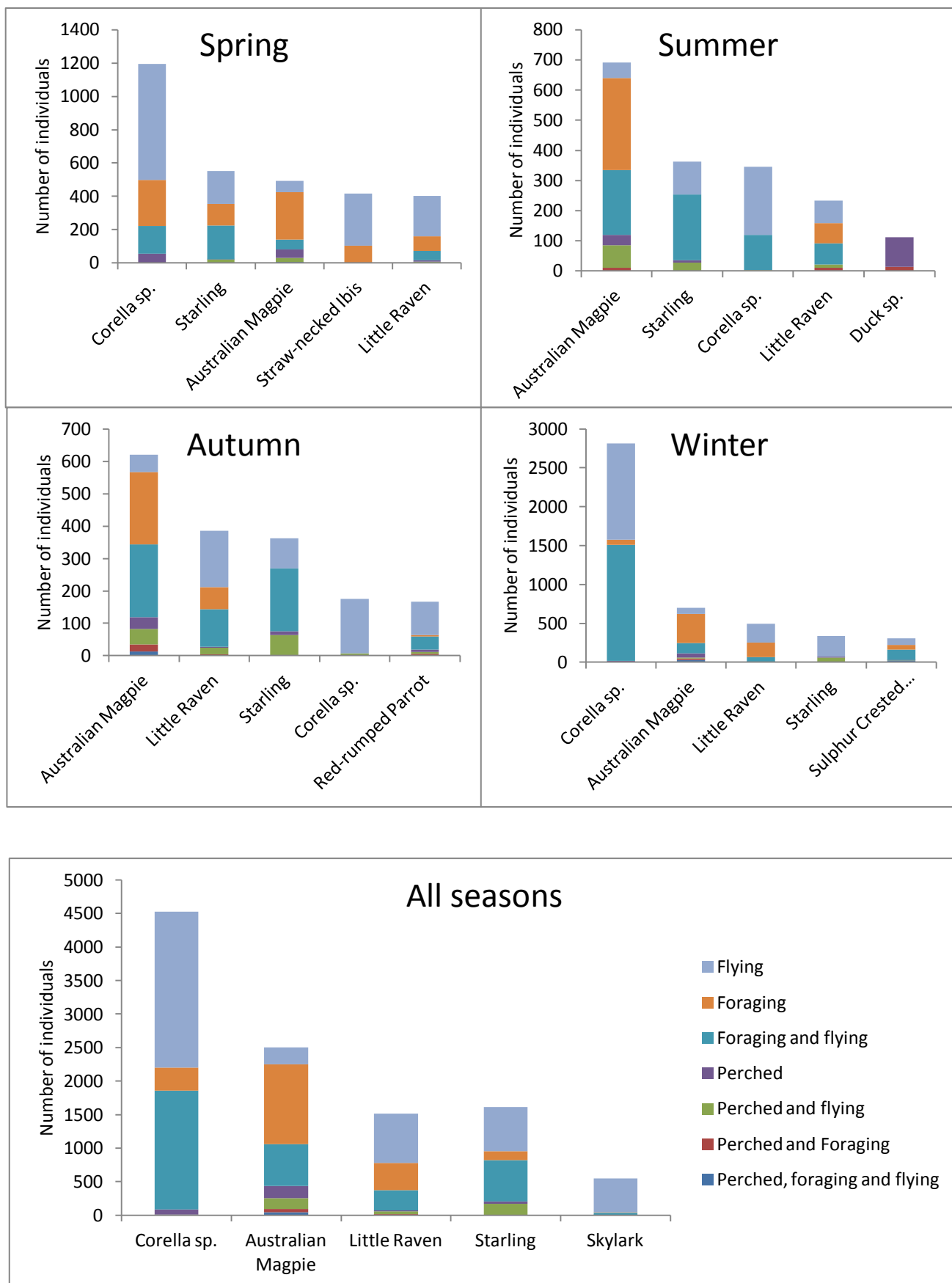


Figure 9. Behaviour observed of the five most abundant bird species recorded for each season and all seasons combined



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Table 4. The five most common bird species for each season and all seasons 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.	29.5	Australian Magpie	32.2	Australian Magpie	26.6	Corella sp.	52.5	Corella sp.	31.9
Starling	13.6	Starling	16.3	Little Raven	16.8	Australian Magpie	13.9	Australian Magpie	18.6
Australian Magpie	12.4	Corella sp.	15.8	Starling	14.2	Little Raven	10.1	Little Raven	11.5
Straw-necked Ibis	10.2	Little Raven	11.1	Corella sp.	6.8	Starling	6.4	Starling	11.4
Little Raven	10.1	Duck sp.	5.1	Red-rumped parrot	6.6	Sulphur Crested Cockatoo	5.8	Skylark	4.1
Total	75.8		80.5		71.0		88.6		77.5

Table 5. The five bird species with the highest number of recorded flights for each season and all seasons as a percentage of total number of recorded flights.

Five bird species with the highest number of recorded flights (% of total number of flights)									
Spring	Summer		Autumn		Winter		All seasons		
Corella sp.	34.0	Starling	24.2	Starling	19.2	Corella sp.	65.4	Corella sp.	41.1
Starling	16.4	Corella sp.	23.7	Australian Magpie	18.5	Starling	7.8	Starling	14.5
Straw-necked Ibis	12.4	Australian Magpie	23.4	Little Raven	17.0	Little Raven	7.1	Australian Magpie	10.9
Little Raven	12.1	Little Raven	10.9	Corella sp.	9.5	Australian Magpie	6.1	Little Raven	10.7
Skylark	9.2	Skylark	6.3	Red-rumped Parrot	8.2	Sulphur Crested Cockatoo	5.9	Skylark	5.4
Total	84.1		88.4		72.5		92.1		82.6

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Table 6. Bird of prey species recorded at the Oaklands Hill Wind Farm for each survey season and all seasons (number of individuals recorded and relative abundance).

Bird of prey	Spring		Summer		Autumn		Winter		All seasons	
Black-shouldered Kite	9	0.22	4	0.18	3	0.12	2	0.04	18	0.13
Brown Falcon	2	0.05	4	0.18	5	0.20	1	0.02	12	0.08
Brown Goshawk	1	0.02	2	0.09	0	0.00	0	0.00	3	0.02
Little Eagle	0	0.00	2	0.09	0	0.00	0	0.00	2	0.01
Nankeen Kestrel	5	0.12	5	0.23	17	0.66	2	0.04	29	0.20
Peregrine Falcon	0	0.00	1	0.05	0	0.00	0	0.00	1	0.01
Swamp Harrier	1	0.02	0	0.00	0	0.00	0	0.00	1	0.01
Wedge-tailed Eagle	3	0.07	5	0.23	8	0.31	0	0.00	16	0.11
Whistling Kite	1	0.02	0	0.00	4	0.16	1	0.02	6	0.04
Total	22	0.54	23	1.04	37	1.44	6	0.11	88	0.62

Figure 10. Relative abundance (%) of all species recorded in spring surveys.

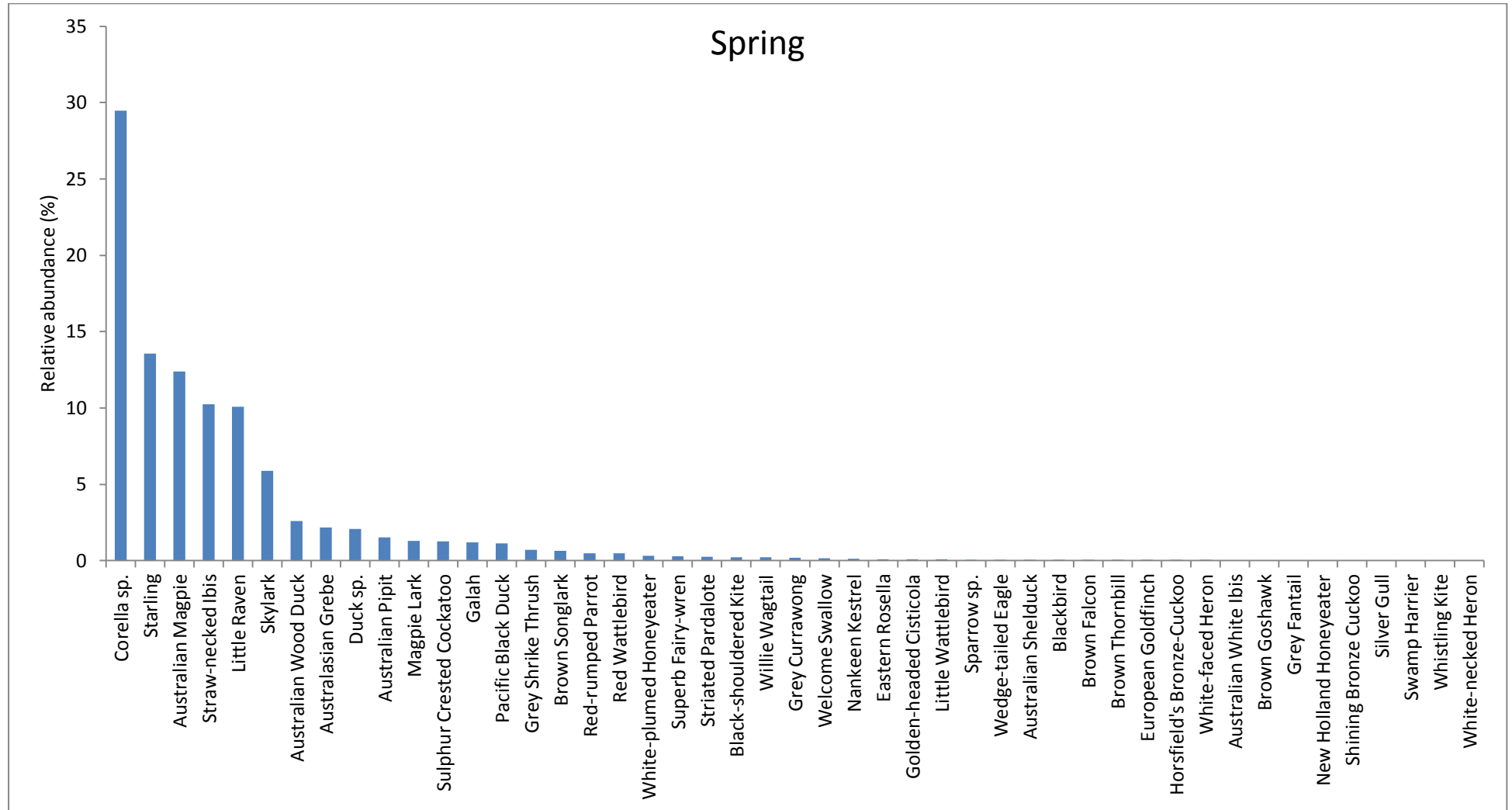


Figure 11. Relative abundance (%) of all species recorded in summer surveys.

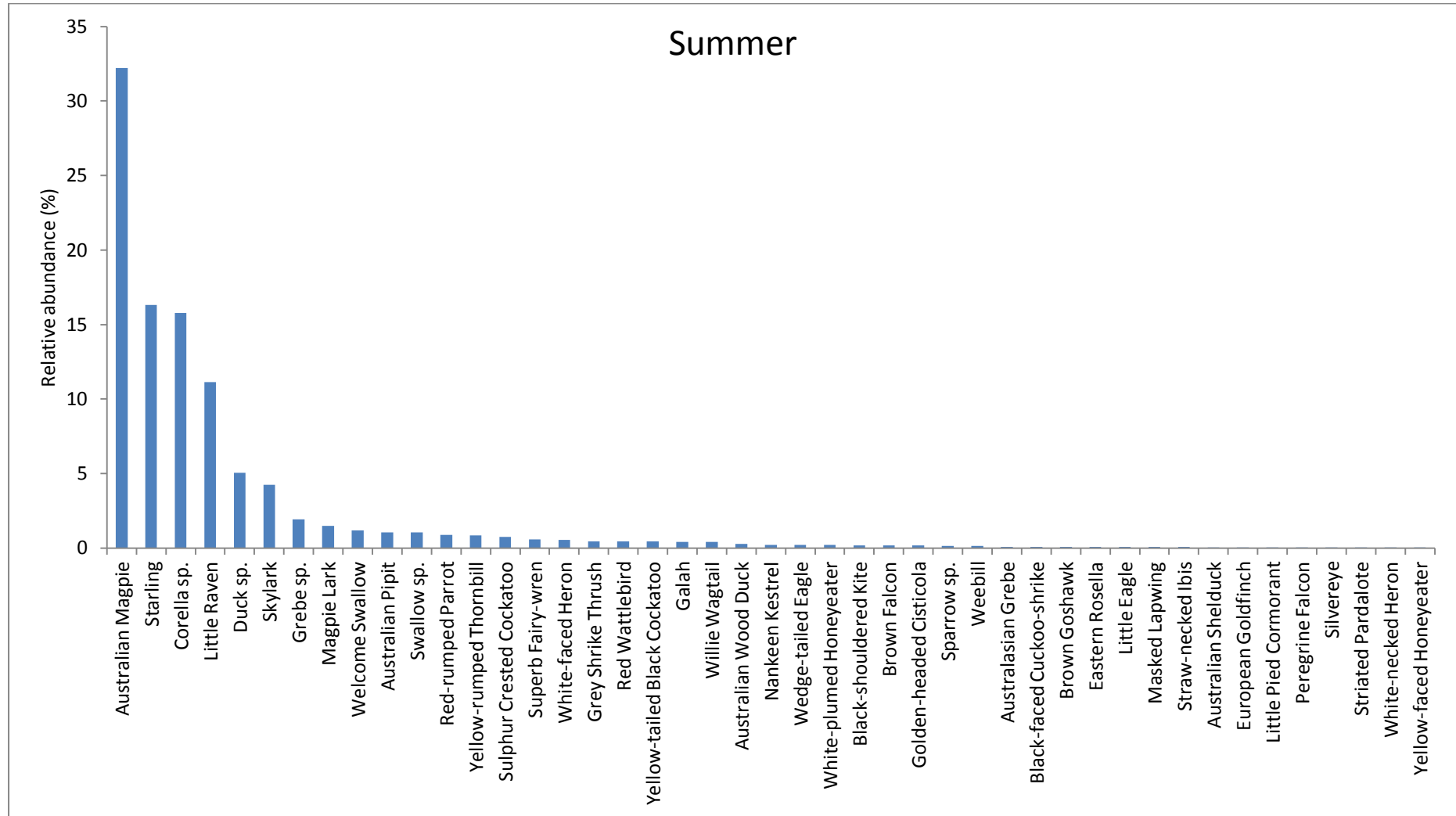


Figure 12. Relative abundance (%) of all species recorded in autumn surveys.

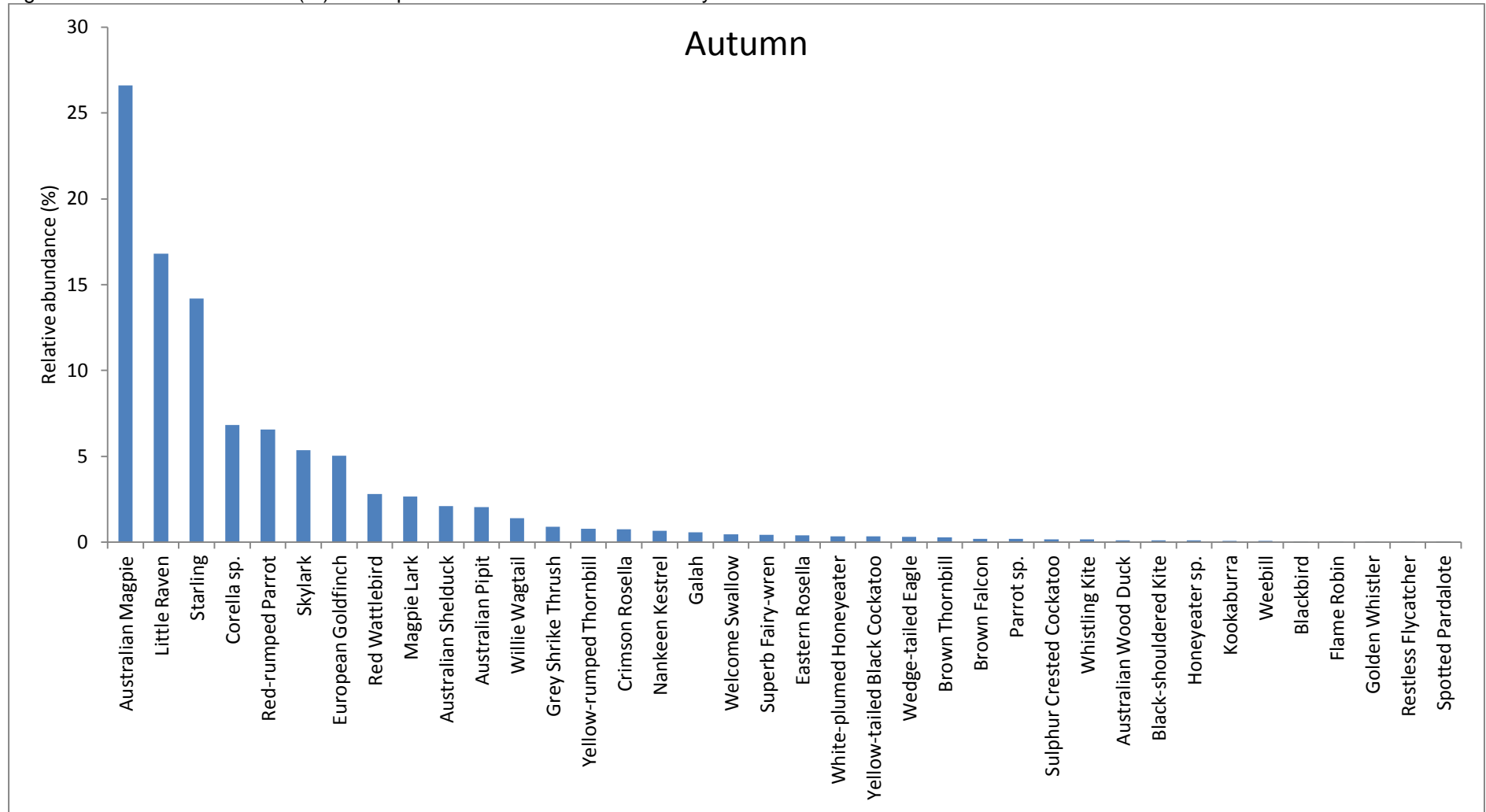
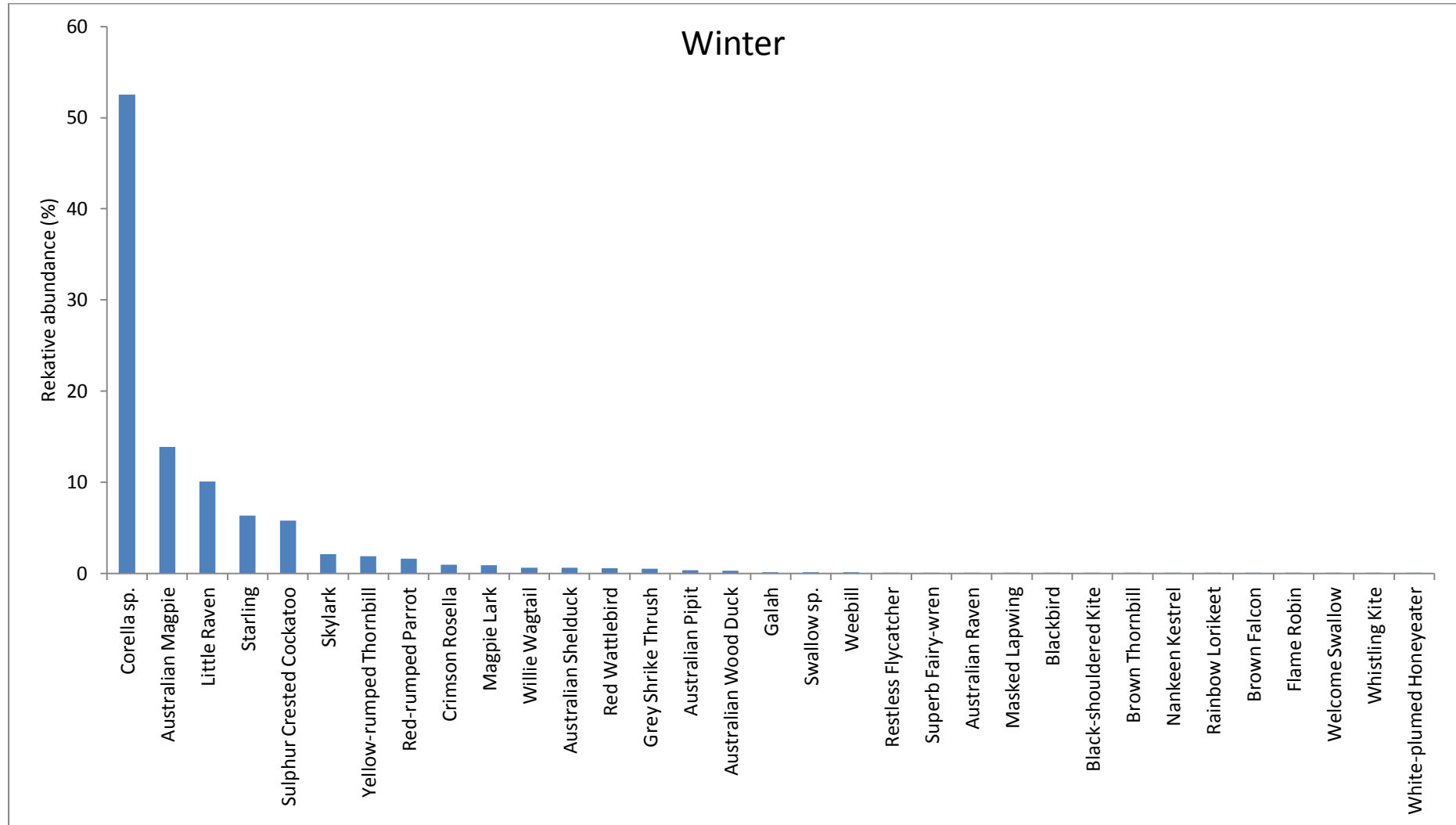


Figure 13. Relative abundance (%) of all species recorded in winter surveys.



4. Conclusion

Over all seasons, a total of 14,199 individuals from 69 bird species were recorded at the Oaklands Hill Wind Farm. The number of species observed within each season ranged from 33 in winter to 47 in spring. The abundance of individuals was greatest in winter and lowest in summer. There was no apparent pattern in the spatial distribution of species or abundance of individuals nor was there any significant difference in the abundance of individuals at different times of the day apart from in summer and autumn when the abundance of individuals was greater in the morning than later in the day.

The majority of individuals recorded comprised common native and introduced farmland birds, and none of the species recorded were threatened at the national, state, regional or local level. The five most common bird species for all survey seasons accounted for 77.5% of all individuals. These were common farmland birds and comprised 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%). Nine birds of prey species were observed during the surveys and these accounted for 0.62% of all individuals.

Most individuals observed were recorded as flying or foraging and flying. The highest number of recorded flights correlated with the five most common species recorded.

References

Morcombe, M. 2003. *Field guide to Australian Birds*. Steve Parish Publishing Pty Ltd.

Morrison, M.L. 1998. *Avian Risk and Fatality Protocol*. National Renewable Energy Laboratory, USA.

Wood, M. 2011. *Oaklands Hill Wind Energy Facility Bat and Avifauna Management Plan*. Australian Ecological Research Services Pty Ltd.

Appendices

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

Common name	Scientific name	Spring	Summer	Autumn	Winter	Total
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	88	2			90
Australian Magpie	<i>Gymnorhina tibicen</i>	503	714	682	744	2643
Australian Pipit	<i>Anthus novaeseelandiae</i>	62	23	52	20	157
Australian Raven	<i>Corvus coronoides</i>				3	3
Australian Shelduck	<i>Tadorna tadornoides</i>	2	1	54	33	90
Australian White Ibis	<i>Threskiornis molucca</i>	1				1
Australian Wood Duck	<i>Chenonetta jubata</i>	106	6	3	15	130
Blackbird	<i>Turdus merula</i>	2		1	2	5
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		2			2
Black-shouldered Kite	<i>Elanus axillaris</i>	9	4	3	2	18
Brown Falcon	<i>Falco berigora</i>	2	4	5	1	12
Brown Goshawk	<i>Accipiter cirrhocephalus</i>	1	2			3
Brown Songlark	<i>Cincloramphus crualis</i>	26				26
Brown Thornbill	<i>Acanthiza pusilla</i>	2		7	2	11
Corella sp.	<i>Cacatua sp</i>	1198	350	175	2812	4535
Crimson Rosella	<i>Platycercus elegans</i>			19	50	69
Duck sp.		84	112			196
Eastern Rosella	<i>Platycercus eximius</i>	4	2	10		16
European Goldfinch	<i>Carduelis carduelis</i>	2	1	129		132
Flame Robin	<i>Petroica phoenicea</i>			1	1	2
Galah	<i>Cacatua roseicapilla</i>	49	9	15	8	81
Golden Whistler	<i>Pachycephala pectoralis</i>			1		1
Golden-headed Cisticola	<i>Cisticola exilis</i>	4	4			8
Grebe sp.			43			43
Grey Currawong	<i>Strepera versicolour</i>	8				8
Grey Fantail	<i>Rhipidura fuliginosa</i>	1				1
Grey Shrike Thrush	<i>Colluricincla harmonica</i>	29	10	23	28	90
Honeyeater sp				3		3
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	2				2
Kookaburra	<i>Dacelo novaeguineae</i>			2		2
Little Eagle	<i>Hieraaetus morphnoides</i>		2			2

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Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>		1				1
Little Raven	<i>Corvus mellori</i>	410	247	431	541		1629
Little Wattlebird	<i>Anthochaera chrysoptera</i>	4					4
Magpie-lark	<i>Grallina cyanoleuca</i>	52	33	68	49		202
Masked Lapwing	<i>Anas platyrhynchos</i>		2		3		5
Nankeen Kestrel	<i>Falco cenchroides</i>	5	5	17	2		29
New Holland Honeyeater	<i>Phyildonyris novaehollandiae</i>	1					1
Pacific Black Duck	<i>Anas superciliosa</i>	46					46
Parrot sp.				5			5
Peregrine Falcon	<i>Falco peregrinus</i>		1				1
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>				2		2
Red Wattlebird	<i>Anthochaera carunculata</i>	19	10	72	30		131
Red-rumped Parrot	<i>Psephotus haematonotus</i>	20	20	168	85		293
Restless Flycatcher	<i>Myiagra inquieta</i>			1	4		5
Shining Bronze Cuckoo	<i>Chrysococcyx lucidus</i>	1					1
Silver Gull	<i>Larus novaehollandiae</i>	1					1
Silvereye	<i>Zosterops lateralis</i>		1				1
Skylark	<i>Alauda arvensis</i>	239	94	137	114		584
Sparrow sp	<i>Passer sp</i>	3	3				6
Spotted Pardalote	<i>Pardalotus punctatus</i>			1			1
Starling	<i>Sturnus vulgaris</i>	551	362	364	341		1618
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	416	2				418
Striated Pardalote	<i>Pardalotus striatus</i>	10	1				11
Sulphur Crested Cockatoo	<i>Cacatua galerita</i>	51	17	4	309		381
Superb Fairy-wren	<i>Malurus cyaneus</i>	12	13	11	4		40
Swallow sp	<i>Hirundo sp</i>		23		7		30
Swamp Harrier	<i>Circus approximans</i>	1					1
Wedge-tailed Eagle	<i>Aquila audax</i>	3	5	8			16
Weebill	<i>Smicromnis brevirostris</i>		3	2	6		11
Welcome Swallow	<i>Hirundo neoxena</i>	7	26	12	1		46
Whistling Kite	<i>Haliastur sphenurus</i>	1		4	1		6
White-faced Heron	<i>Egretta novaehollandiae</i>	2	12				14
White-necked Heron	<i>Ardea pacifica</i>	1	1				2
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	13	5	9	1		28
Willie Wagtail	<i>Rhipidura leucophrys</i>	9	9	36	34		88
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>		1				1
			19	20	100		139

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Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>					
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>	10	9			19
	Total	4063	2217	2564	5355	14199