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Exploratory data analysis for Wings Over King Island (WOKI) data from 2017 - 2021.

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## Introduction

The aim of this exploratory analysis is to provide an overview of the data that has been collected from 2017 to 2021 in the Wings Over King Island bird surveys.

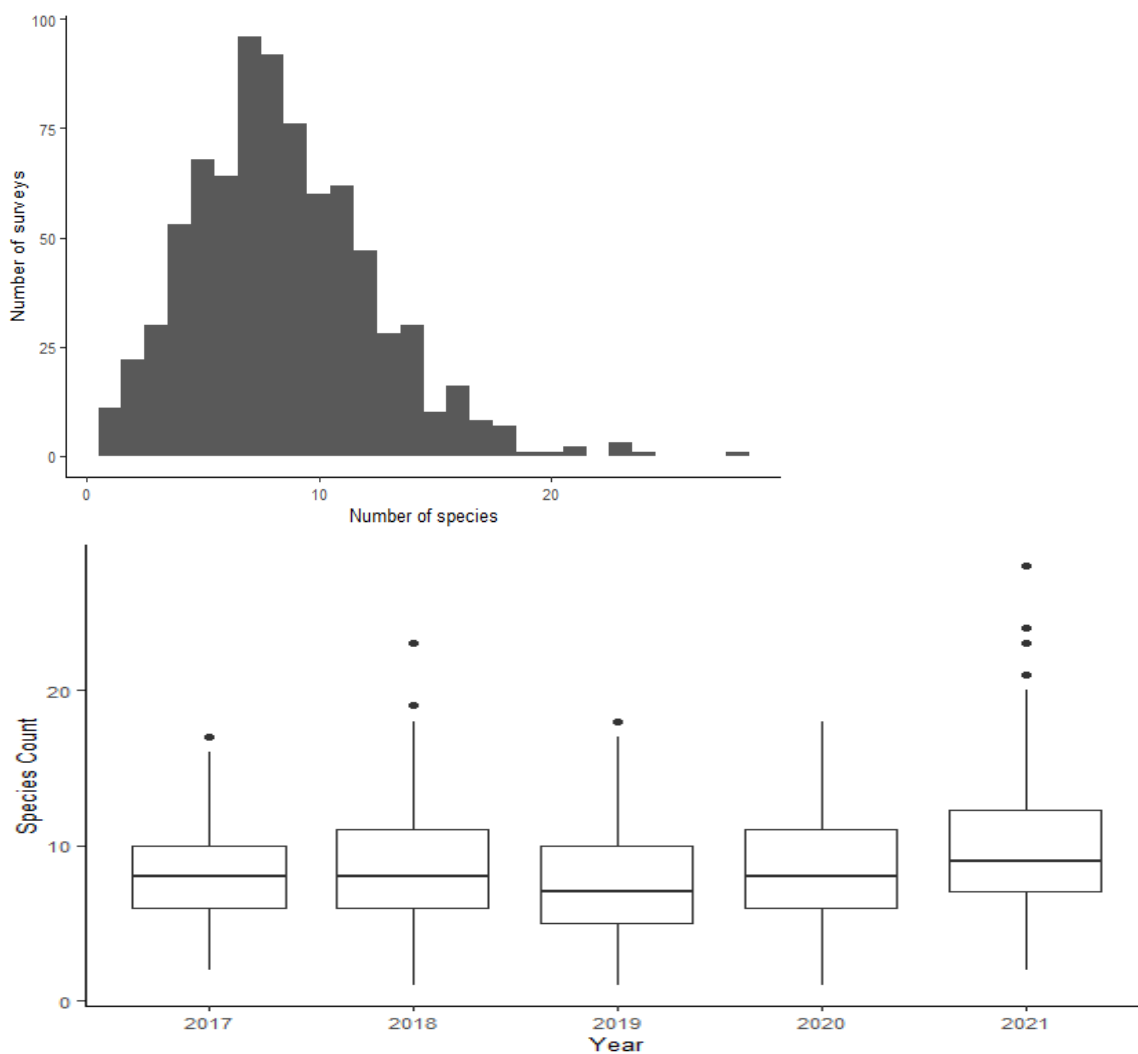


Figure 1. The frequency distribution of species counts in surveys (upper) and the count of species seen each year during WOKI surveys (lower)



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The plots in Figure 1a and 1b show that the number of species seen on each survey are not highly skewed (they are distributed pretty equally around the median of 8 species per survey) and they have not varied much from year to year. The 'Box and whisker plots' show the the interquartile range in as a box (with the median shown as a line in the box) the 'whiskers' show the range (with the outliers as dots).

## Observer differences

The WOKI data have been collected by multiple observers across multiple sites and so it is important to review any observer differences to determine whether all of the data can be pooled together to look at any patterns in reporting frequency over time or between sites.

To examine any systematic differences between observers we can look at the number of species seen by each observer as well as the relative reporting frequency of species for each observer. The relative reporting frequency is calculated for each species that an observer has reported and is the difference in the frequency of reporting for that observer (the number of surveys in which they recorded that species divided by the total number of surveys they conducted) and the frequency of reporting in all WOKI surveys.

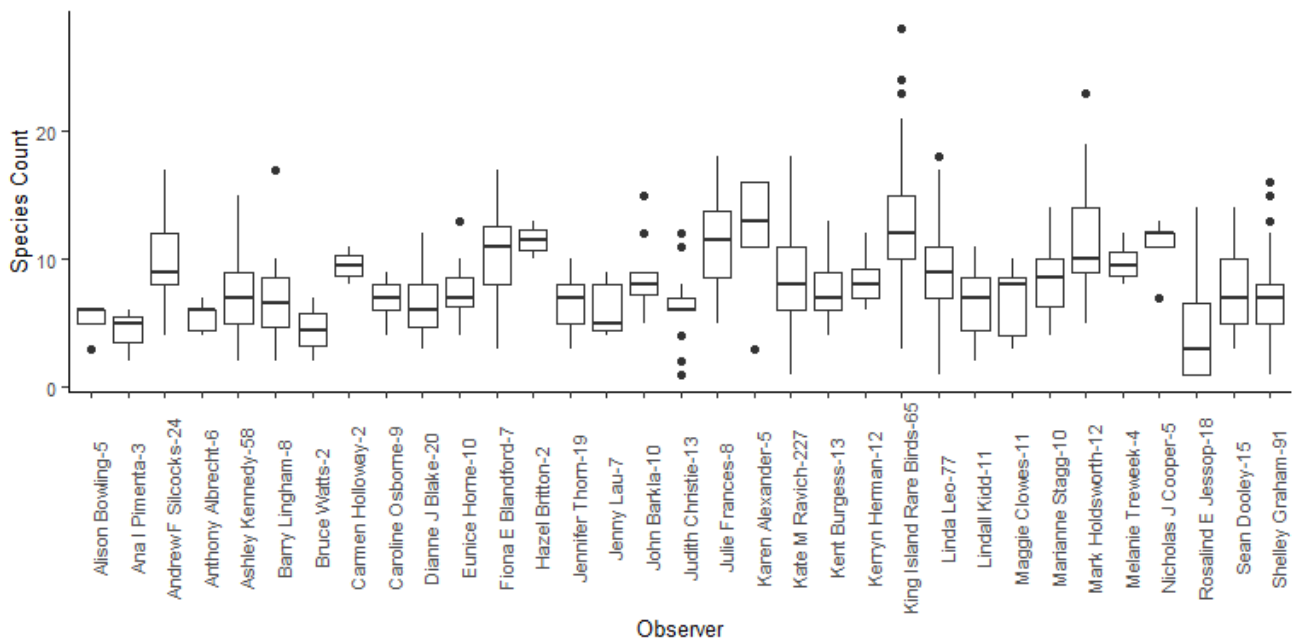


Figure 2. The number of species reported by each observer (with the number of surveys in brackets)



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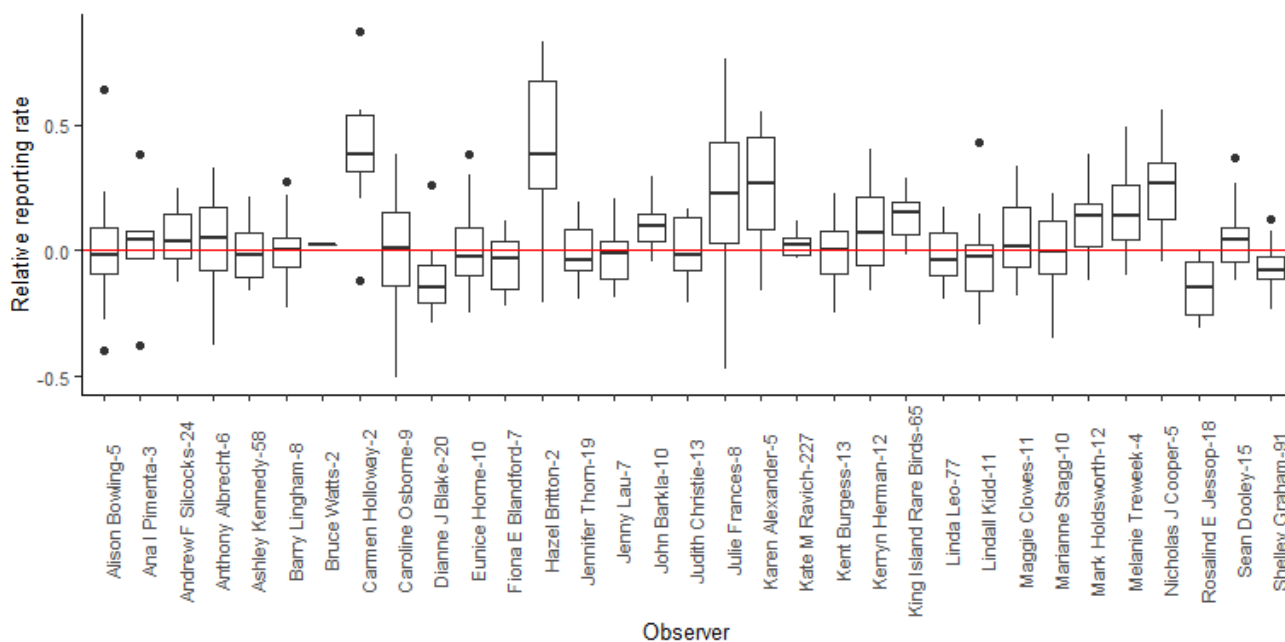


Figure 3..The relative species reporting rate for each observer (with the number of surveys in brackets)

Reporting differences between observers was considered by looking at the number of species seen in surveys by different observers (Figure 2) and the relative reporting frequency (Figure 3). The relative reporting frequency is a measure of whether observers report a particular species more or less often than the overall average for all observers. For simplicity, Figure 3 shows the observers and the number of surveys they have conducted in which they recorded the species with an overall reporting rate of > 10 (using this 10% cut off avoids the distraction of outliers caused by birds that are only seen very rarely). Those above the zero (red) line are observers that report a greater number of species more frequently than average, but of course there will be species that only occur in a few WOKI sites (e.g. Turnstones). So, while there will be differences in reporting rates between people there is little evidence for observer bias at a large scale.



## Number of surveys and species count

In order to compare the number of species recorded at different WOKI site it is important to make sure that we are making 'fair' comparison. For example, if comparing two sites, where one has been visited 5 times and the other has been surveyed 25 times then it is important to know if the species increases with the number of surveys. Figure 5 indicates that there is a strong relationship between the number of surveys and the total species list for a site. While this relationship will not increase forever, because the total number of species recorded will reach a plateau, it does mean that any comparison of the number of species at sites and other factors (such as the area of the site or the detailed vegetation categories) will need to take into account the number of surveys conducted at the sites.

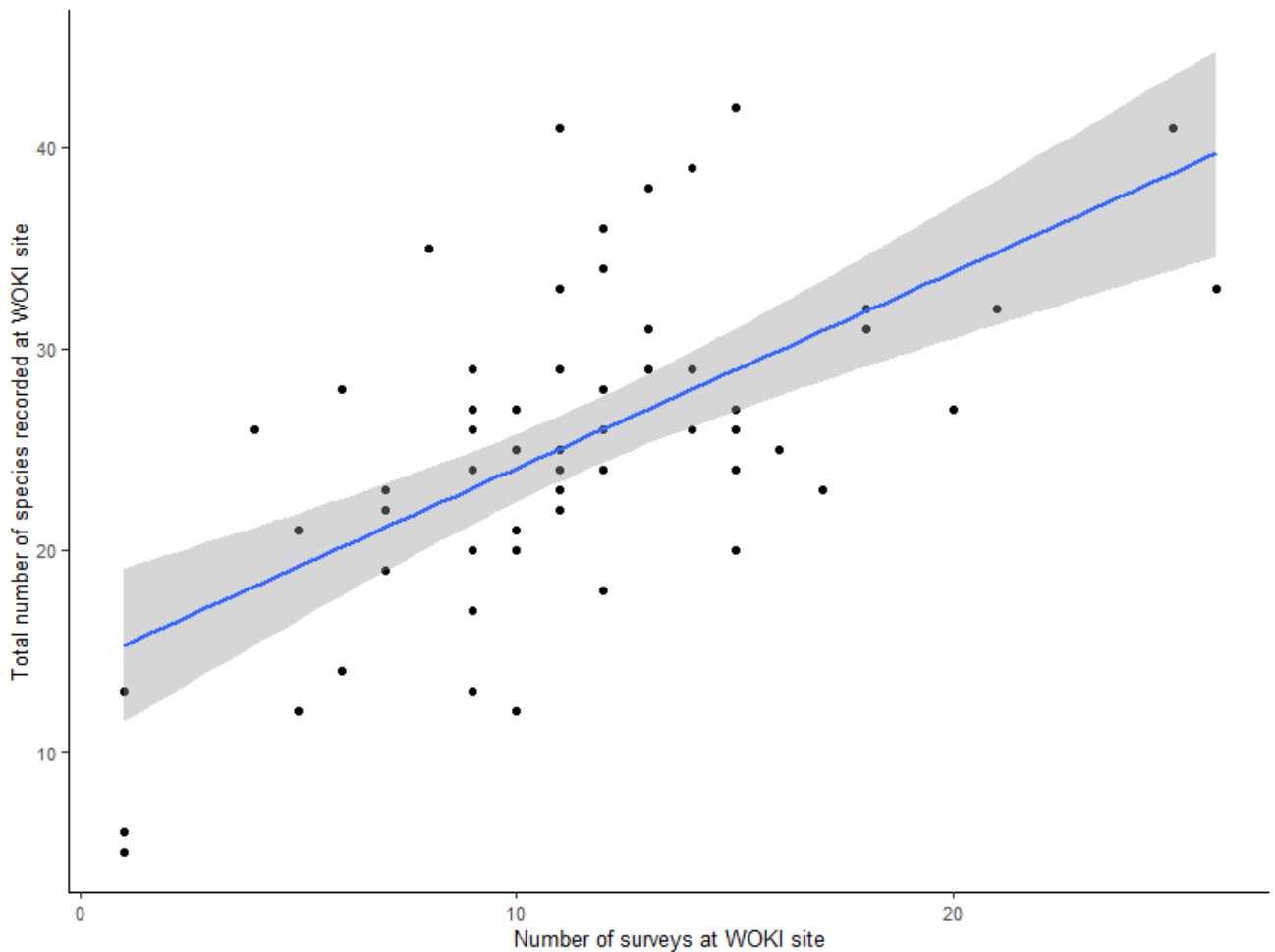


Figure 5. The number of surveys and total species list at WOKI sites



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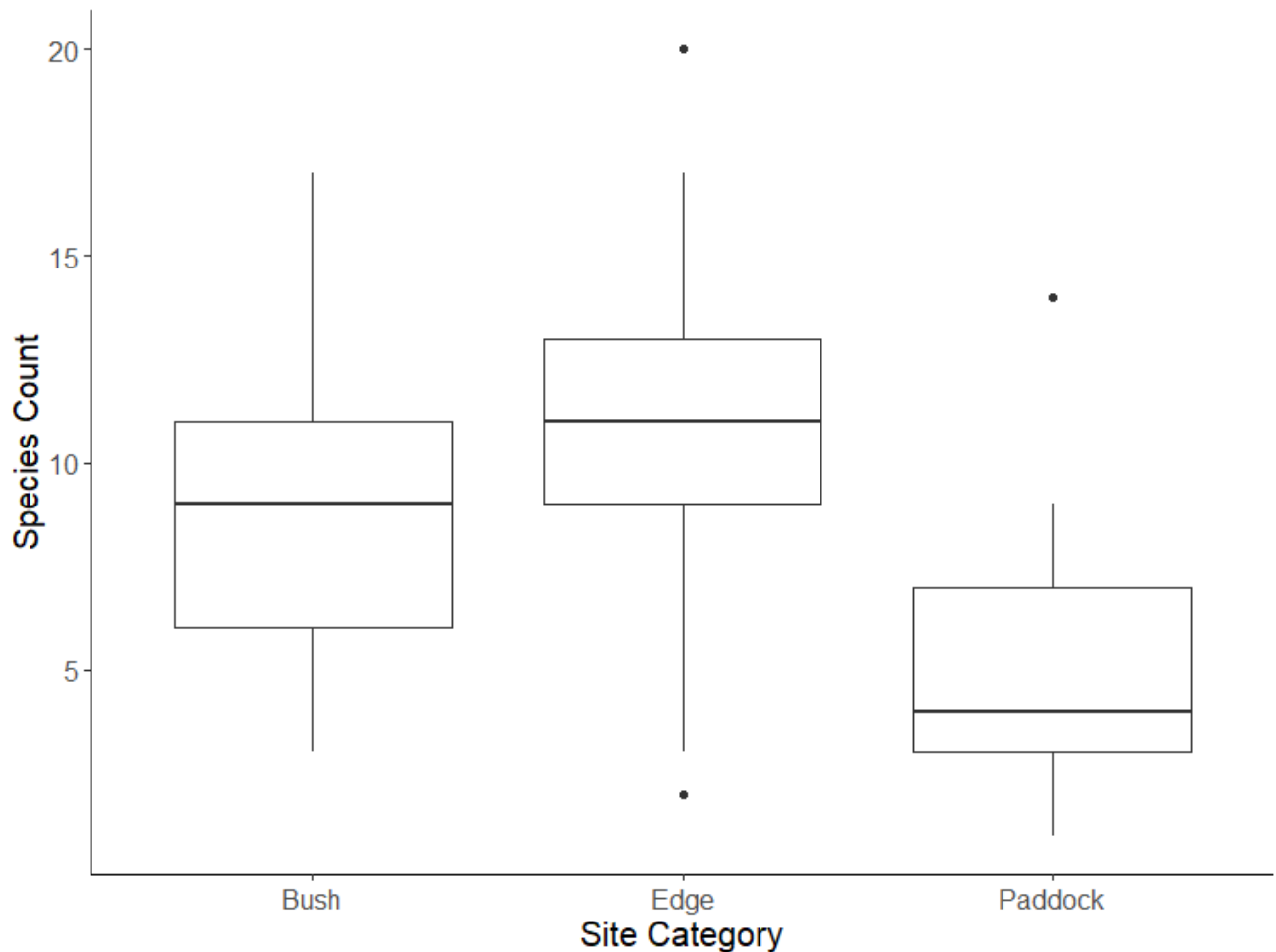


Figure 6. Comparison of species counts for surveys in WOKI sites that in either remnant bush habitat (Bush), on the edge of bush and paddocks (Edge) and grazed paddocks (Paddock).

The species count per survey in three different habitat type (Figure 6) shows that the bush and edge habitats hold a lot more species than the paddocks. The high numbers in the edge reflects the combination of birds found in both the paddock and bush habitats coupled with it being easier to detect species on edges, rather than in dense bush. This is a feature known as the 'edge-effect' and although there appears to be a greater number of species in the edge, these edge habitats are not necessarily good for birds. Indeed, there is quite a bit of evidence of bush species density declining near to the edges of their preferred habitat so that they are often in higher density in the middle, but are easier to locate and record near to the edge



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## Survey Timing

The vast majority of surveys undertaken between 2015 and 2021 were carried out in Autumn (defined here as March, April and May) and Spring (Sept, October and November) (Table 1).

Table 1:1. The number of surveys conducted each month from 2015 to 2021

Year	1	2	3	4	5	6	7	9	10	11	12
2017	5	5	8	49	5	0	0	10	2	53	0
2018	1	5	5	70	1	0	15	8	44	1	1
2019	2	0	20	80	7	6	3	0	3	76	0
2020	0	10	0	39	33	5	4	0	15	50	0
2021	0	2	0	70	2	0	0	0	35	39	0



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## Annual changes in reporting rates

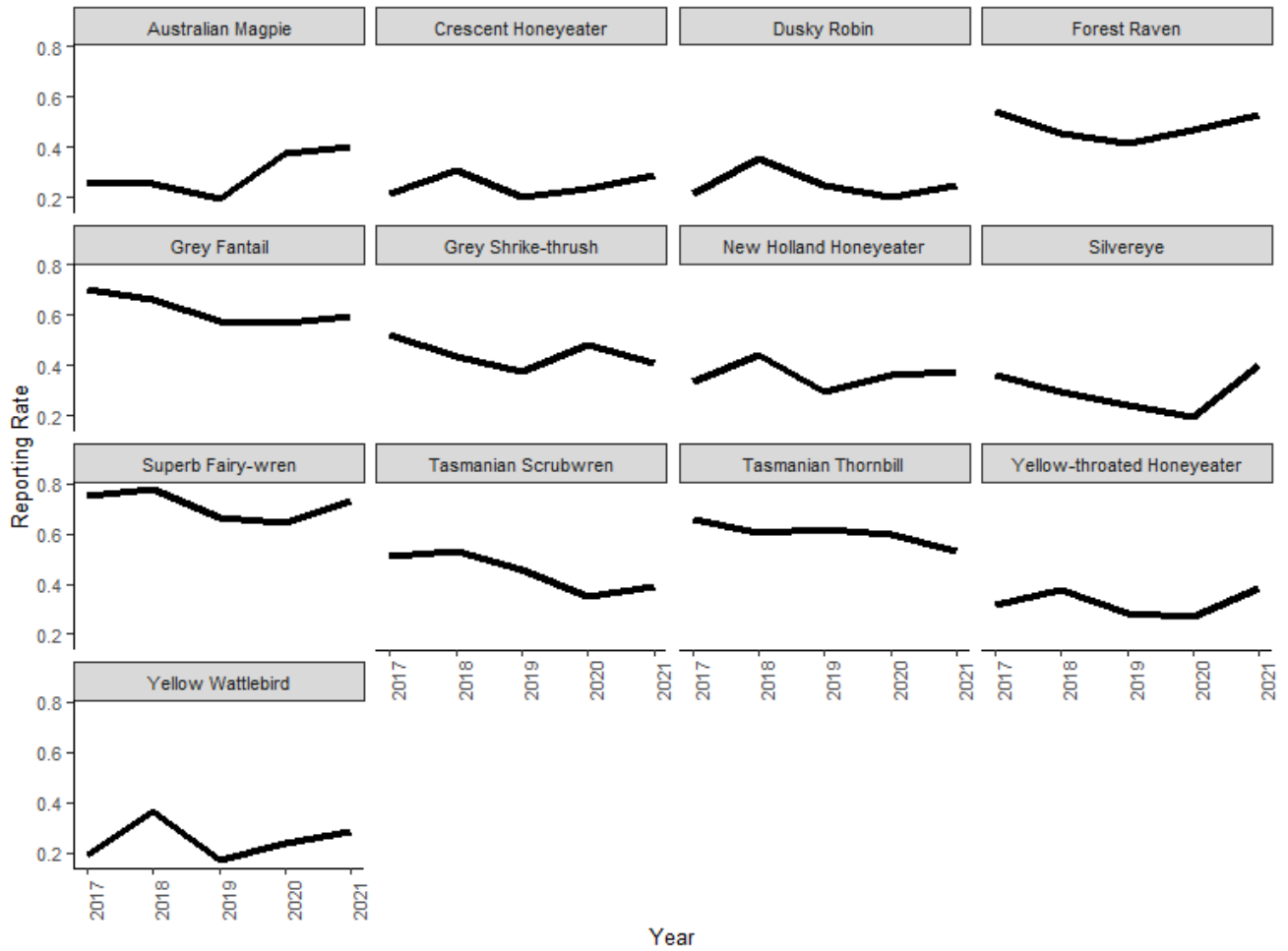


Figure 7. Reporting frequency during all surveys for species with > 20% overall reporting rates



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Figure 8. Reporting frequency during spring (September to November) and autumn (March, April, May) surveys for species with > 20% overall reporting rates

Figures 7 and 8 present the annual reporting rate for the species with > 20% overall reporting rates. As there are 5 years of data there is limited power to quantify trends but it does not appear that there are any consistent differences in the reporting rates between spring and autumn.





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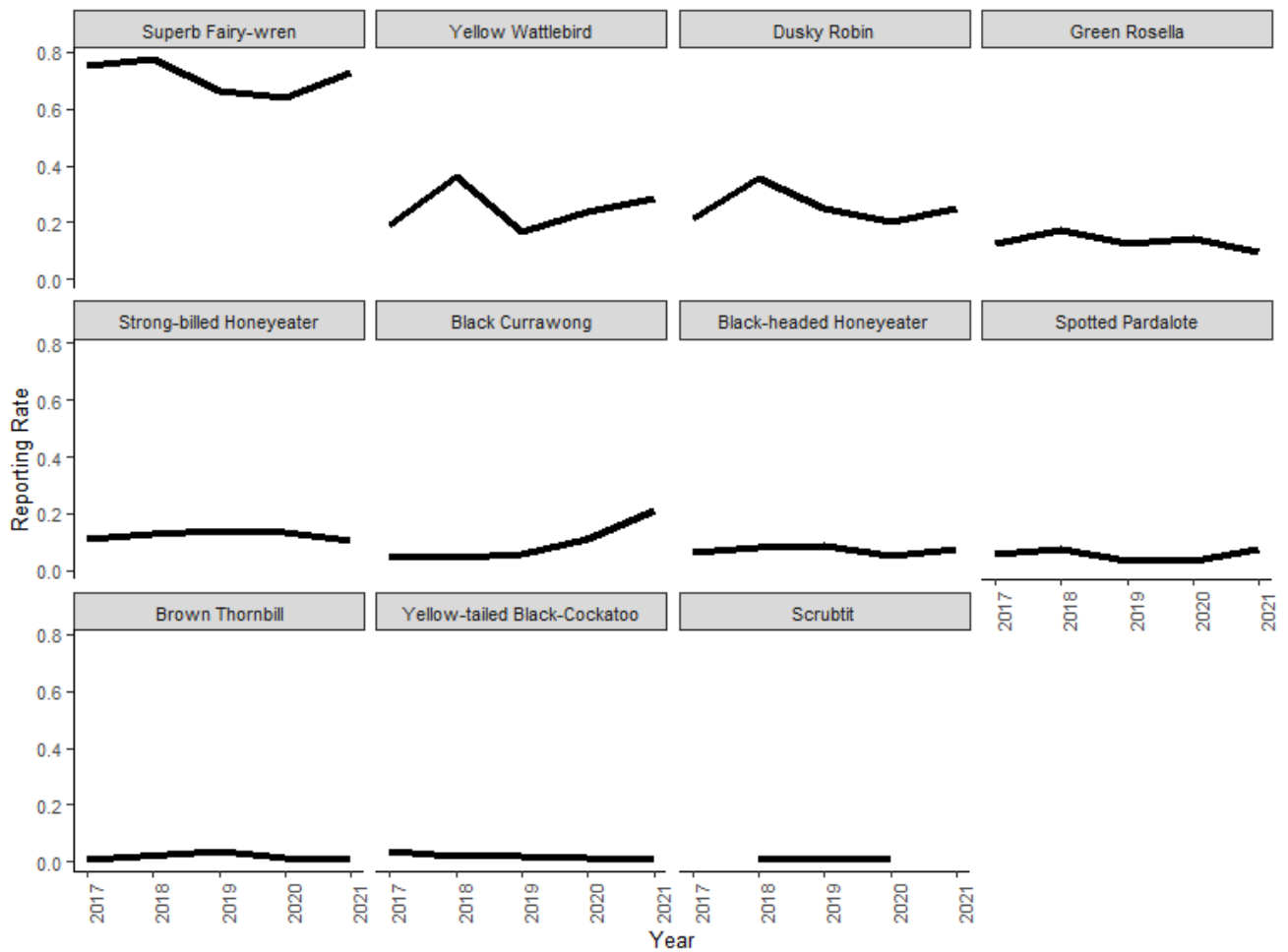


Figure 9. Reporting frequency during all surveys for the proposed 'Focal Species'

Figure 9 shows the annual reporting rates for the proposed 'Focal species' and is ordered by means reporting rate (rather than alphabetically) to show the relative differences in the reporting rates for each species.



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## Spatial distribution of key species on King Island

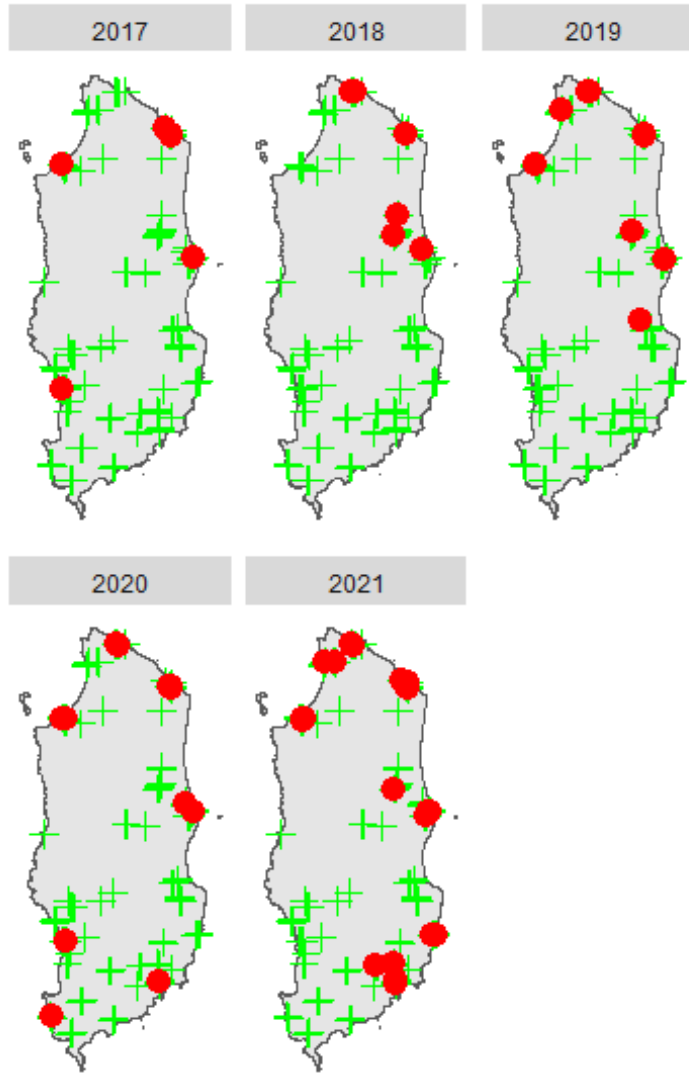


Figure 10. Map of WOKI sites (green crosses) where Black Currawong (red dots) have been recorded in each year from 2017 to 2021



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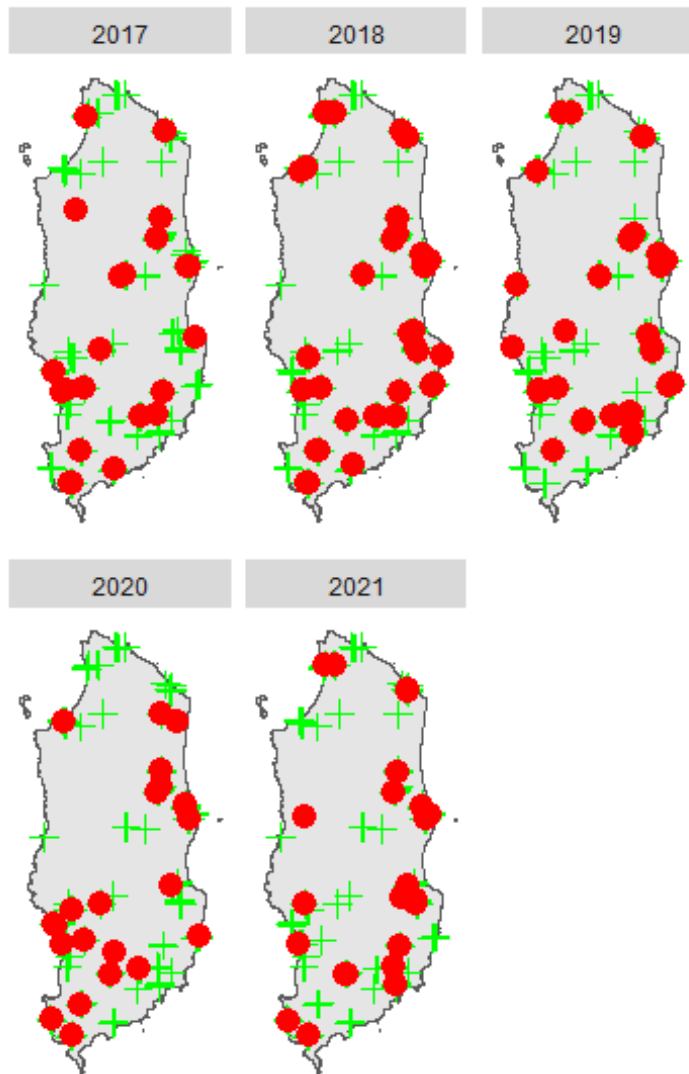


Figure 11. Map of WOKI sites (green crosses) where Dusky Robin (red dots) has been recorded in each year from 2017 to 2021



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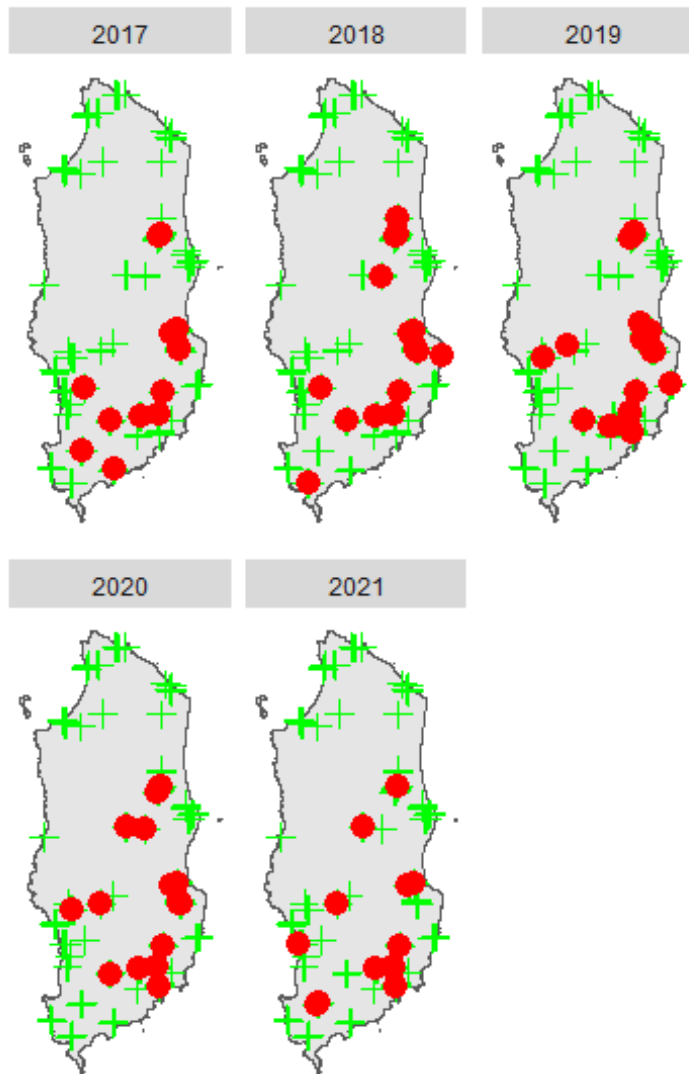


Figure 12. Map of WOKI sites (green crosses) where Green Rosella (red dots) has been recorded in each year from 2017 to 2021



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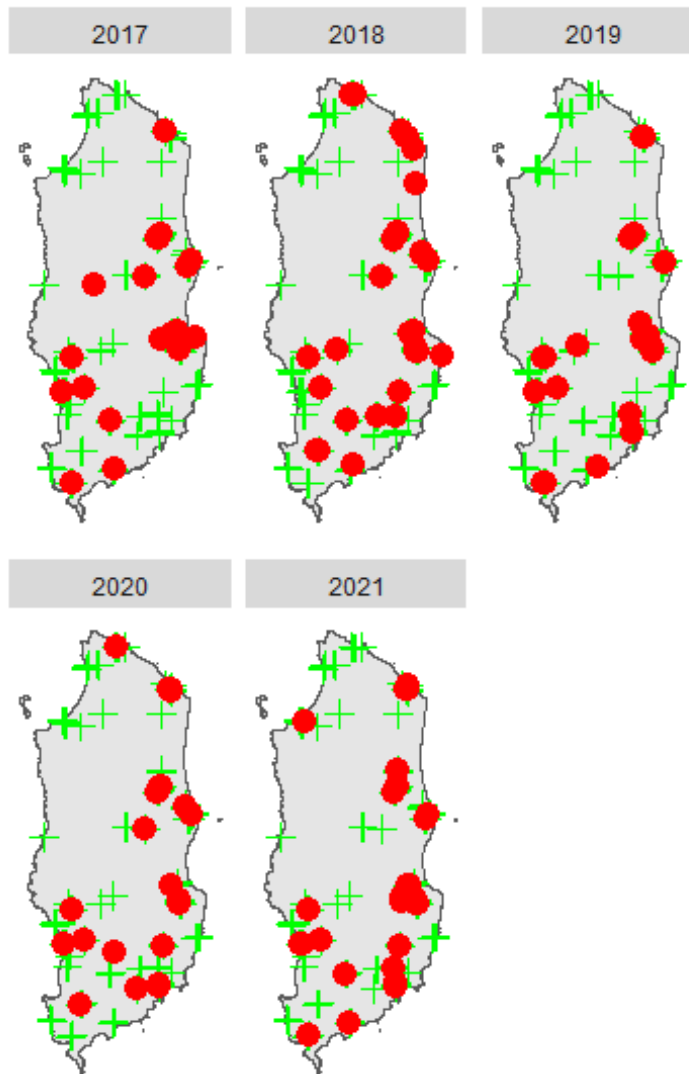


Figure 13. Map of WOKI sites (green crosses) where Yellow wattlebird (red dots) has been recorded in each year from 2017 to 2021

The spatial distribution of a subset of key species (Figures 10 to 13) show the apparent increase in the number of sites at which Black currawongs have been recorded, particularly in the south east of the island, which is as well as an increase in the reporting rate for this species (Figure 9). These maps also show the broad distribution of both Dusky robin and Yellow wattlebird and the apparent absence of green rosellas from the north west of the island.



## Appendix 1 – WOKI site summary

Names, number of surveys, location, species count and habitat category for existing WOKI Sites.

Site names	Nsurv	Lat	Lon
WoK Site 3A Sea Elephant Rd	15	-39.82794	144.1088
WoK Site 3B Sea Elephant Salt Marsh	12	-39.82093	144.1184
WoK Site 3C Sea Elephant River Walking Trail	13	-39.82148	144.1137
WoK Site 3D Sea Elephant River Track	10	-39.81245	144.1021
WoK Site 3E Sea Elephant River Saltmarsh	15	-39.81177	144.1043
WoK Site 4A Lappa Road	16	-39.91605	144.0810
WoK Site 6A Barnie's Bush	13	-39.99382	144.0644
WoK Site 7A Yates Creek, Pegarah State Forest	15	-39.91182	144.0887
WoK Site 9A Hardy's Bush	11	-39.93774	143.9600
WoK Site 10 - Bloomendaal	14	-39.94641	143.9082
WoK Site 11/11A Mt Stanley Forest	15	-40.04994	144.0213
WoK Site 13A Council Hill	10	-39.76451	144.0610



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Site names	Nsurv	Lat	Lon
WoK Site 15 - Bowlings One	18	-40.07103	143.9239
WoK Site 17A Dromedary Road	20	-40.11261	143.9082
WoK Site 20 Satoris Road Reserve	12	-39.98739	143.9296
WoK Site 21A Lake Flannigan	13	-39.62498	143.9528
WoK Site 22A McFadzean Forest	14	-40.02536	144.0253
WoK Site 24A Kentford State Forest	18	-40.03122	143.9738
WoK Site 26 North Yellow Rock Road	7	-39.70571	143.9241
WoK Site 27A The Springs Dunes	11	-39.62578	143.9365
WoK Site 27B Phoques Bay Coast	11	-39.63006	143.9330
WoK Site 28A Nine Mile Track	11	-39.65929	144.0795
WoK Site 28B Penny's Lagoon Picnic	14	-39.65686	144.0782
WoK Site 28C Penny's Old Growth	9	-39.65750	144.0757
WoK Site 28D Lake Martha	4	-39.64995	144.0676
WoK Site 28F N of Lavinia Main Fire Trail	1	-39.69025	144.0613
WoK Site 28G Lavinia Coastal Scrub	1	-39.65248	144.0798
WoK Site 29 - North Road, Yambacona	7	-39.68953	143.9609
WoK Site 30 Porky Beach Road	7	-39.85158	143.8602



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Site names	Nsurv	Lat	Lon
WoK Site 31 - Pearson's Lane	10	-40.02112	143.9008
WoK Site 32 Colliers Swamp	11	-40.09533	143.9803
WoK Site 33 Grahams Road East	9	-40.02973	144.0782
WoK Site 34A Grassy Outskirts	6	-40.04655	144.0575
WoK Site 34B Grassy Township	7	-40.04778	144.0598
WoK Site 34C Grassy River lower Catchment	5	-40.04433	144.0598
WoK Site 35A The Boulders	26	-39.78926	144.0582
WoK Site 35B White Box Hill	17	-39.78710	144.0595
WoK Site 35C The Far Forest	21	-39.78435	144.0610
WoK Site 35D Bootlace Home Paddock	25	-39.79198	144.0550
WoK Site 37A Disappointment Bay	10	-39.60278	143.9875
WoK Site 37B Disappointment West Entrance	11	-39.60187	143.9836
WoK Site 37C Disappointment Far East	1	-39.60084	144.0004
WoK Site 38A Ettrick River Weir	12	-39.99156	143.8993
WoK Site 38B Ettrick River Camp	12	-39.99297	143.8935
WoK Site 40 Copperhead Walk	15	-40.09250	143.8737
WoK Site 41 Badger Box Bush	12	-39.96440	143.8800



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Site names	Nsurv	Lat	Lon
WoK Site 42 Badger Box Beach	9	-39.96744	143.8799
WoK Site 43A Grassy River Upper Catchment A	14	-40.02093	144.0550
WoK Site 43B Grassy River Upper Catchment B	11	-40.02313	144.0567
WoK Site 44A Yellow Rock	12	-39.69871	143.8930
WoK Site 44B Muddy Lagoon	11	-39.70185	143.8981
WoK Site 44C Yellow Rock Farm Paddock	10	-39.70024	143.8976
WoK Site 46A Pattersons Bush	5	-39.98297	144.1262
WoK Site 46B Grimes Creek	9	-39.98469	144.1212
WoK Site 47A Tin Mine Forest	11	-39.83863	144.0013
WoK Site 48 Punchbowl Creek	9	-39.84018	144.0341
WoK Site 49A The Garden at Wintergreen	8	-39.93502	144.0925
WoK Site 49B Valley of the Giants	9	-39.93670	144.0915
WoK Site 49C Bronzewing Creek Headwaters	6	-39.93900	144.0933
WoK Site 49D Bronzewing Creek East	9	-39.93896	144.0960



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## Appendix 2 - Reporting Rates summary

The reporting rate (the number of surveys in which a species was reported divided by the total number of surveys) was calculated for all surveys as well as for the spring and autumn.

Table 2:2. Reporting Rates for species in WOKI for All surveys and those in Spring (September-November) and Autumn(March-May). Empty cells indicate that the species was not recorded. Species are sorted by overall reporting frequency

Common.Name	rate.All	rate.Spring	rate.Autumn
Superb Fairy-wren	0.708	0.685	0.730
Grey Fantail	0.616	0.530	0.674
Tasmanian Thornbill	0.599	0.542	0.627
Forest Raven	0.477	0.435	0.527
Tasmanian Scrubwren	0.447	0.435	0.434
Grey Shrike-thrush	0.441	0.533	0.337
New Holland Honeyeater	0.361	0.408	0.290
Yellow-throated Honeyeater	0.323	0.241	0.362
Silvereeye	0.297	0.241	0.352
Australian Magpie	0.292	0.301	0.275
Dusky Robin	0.255	0.176	0.316
Crescent Honeyeater	0.248	0.235	0.247
Yellow Wattlebird	0.245	0.268	0.221
Olive Whistler	0.171	0.271	0.095
Welcome Swallow	0.169	0.229	0.123
Common Blackbird	0.157	0.241	0.095
Green Rosella	0.132	0.173	0.090
Golden Whistler	0.127	0.164	0.085
Strong-billed Honeyeater	0.125	0.110	0.126
Fan-tailed Cuckoo	0.115	0.259	0.005
Common Starling	0.114	0.190	0.059
European Goldfinch	0.103	0.152	0.054



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Common.Name	rate.All	rate.Spring	rate.Autumn
Black Currawong	0.091	0.146	0.049
Flame Robin	0.091	0.119	0.064
Pacific Gull	0.079	0.092	0.077
Pacific Black Duck	0.076	0.077	0.077
Black-headed Honeyeater	0.072	0.065	0.072
Australian Shelduck	0.071	0.083	0.059
Masked Lapwing	0.068	0.074	0.072
White-fronted Chat	0.068	0.080	0.062
Silver Gull	0.063	0.077	0.062
White-bellied Sea-Eagle	0.062	0.068	0.064
Spotted Pardalote	0.053	0.036	0.059
White-faced Heron	0.051	0.057	0.054
Black Swan	0.049	0.045	0.051
Eurasian Skylark	0.047	0.074	0.031
Brush Bronzewing	0.046	0.021	0.054
Chestnut Teal	0.044	0.036	0.051
House Sparrow	0.043	0.057	0.036
Shining Bronze-Cuckoo	0.043	0.098	
Australian Pied Oystercatcher	0.032	0.071	0.003
Bassian Thrush	0.029	0.024	0.026
Common Pheasant	0.029	0.042	0.023
Indian Peafowl	0.029	0.054	0.008
Pallid Cuckoo	0.029	0.065	
Australasian Pipit	0.028	0.039	0.021
Musk Duck	0.028	0.030	0.023
Crow & Raven spp	0.027	0.024	0.033
Swamp Harrier	0.027	0.054	0.008
Banded Lapwing	0.025	0.036	0.021
Black-faced Cuckoo-shrike	0.025	0.048	0.003



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Common.Name	rate.All	rate.Spring	rate.Autumn
Nankeen Kestrel	0.025	0.033	0.023
Little Pied Cormorant	0.024	0.024	0.026
Cape Barren Goose	0.023	0.027	0.018
Ruddy Turnstone	0.023	0.030	0.021
Brown Falcon	0.022	0.027	0.015
Dusky Woodswallow	0.020	0.018	0.023
Yellow-tailed Black-Cockatoo	0.019	0.006	0.026
Crested Tern	0.018	0.018	0.021
Purple Swamphen	0.016	0.015	0.021
Sooty Oystercatcher	0.016	0.018	0.018
Sulphur-crested Cockatoo	0.016	0.021	0.015
Black-faced Cormorant	0.014	0.009	0.021
Brown Thornbill	0.014	0.009	0.013
Eurasian Coot	0.014	0.018	0.013
Wild Turkey	0.014	0.009	0.021
Australian Wood Duck	0.013	0.012	0.010
Golden-headed Cisticola	0.013	0.006	0.021
Hoary-headed Grebe	0.011	0.015	0.008
Brown/Tasmanian Thornbill spp	0.010	0.024	
Striated Pardalote	0.010	0.015	0.008
Domestic Duck	0.009	0.003	0.015
Satin Flycatcher	0.009	0.009	
Domestic Goose	0.008	0.015	0.003
Great Cormorant	0.008	0.009	0.008
Great Egret	0.008	0.006	0.010
Hooded Plover	0.008	0.012	0.005
Red-capped Plover	0.008	0.018	
Swift Parrot	0.008	0.012	
Dusky Moorhen	0.006	0.012	0.003



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Common.Name	rate.All	rate.Spring	rate.Autumn
Fairy Tern	0.006	0.015	
Little Black Cormorant	0.006	0.012	0.003
Grey Teal	0.005	0.009	0.003
Horsfield's Bronze-Cuckoo	0.005	0.009	0.003
Scrubtit	0.005		0.005
Australasian Grebe	0.004	0.003	0.005
Common Greenfinch	0.004		0.008
Double-banded Plover	0.004		0.008
Hardhead	0.004	0.006	
Little Raven	0.004	0.009	
Nankeen Night-Heron	0.004		0.008
Pied Cormorant	0.004		0.008
Tree Martin	0.004		0.008
Australasian Shoveler	0.003	0.006	
Australian Hobby	0.003	0.003	0.003
Black Duck-Mallard hybrid	0.003		0.005
Blue-billed Duck	0.003	0.003	
Blue-winged Parrot	0.003	0.006	
Brown Goshawk	0.003		0.005
Latham's Snipe	0.003	0.003	0.003
Bar-tailed Godwit	0.001	0.003	
Cattle Egret	0.001		0.003
Common Bronzewing	0.001		0.003
Common Greenshank	0.001		0.003
Eastern Yellow Robin	0.001	0.003	
Fairy-wren spp	0.001		0.003
Fork-tailed Swift	0.001		0.003
Galah	0.001	0.003	



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Common.Name	rate.All	rate.Spring	rate.Autumn
Greylag Goose	0.001		0.003
Lewin's Rail	0.001		0.003
Little Grassbird	0.001	0.003	
Little Penguin	0.001		0.003
Pacific Golden Plover	0.001	0.003	
Painted Button-quail	0.001		0.003
Red-necked Stint	0.001	0.003	
Sanderling	0.001	0.003	
Short-tailed Shearwater	0.001		0.003
Tasmanian Boobook	0.001	0.003	
White-browed Woodswallow	0.001	0.003	
White-throated Needletail	0.001		
Zitting Cisticola	0.001	0.003	

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