

Supplementary material

Avian monitoring – comparing structured and unstructured citizen science

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Table S1. The list of 122 bird species observed at Centennial Park, Sydney, Australia and the number of records from the eBird database and structured surveys, 2012–2016

Number of records refers to the number of times a species was recorded on a survey. Bird names follow eBird/Clements v2016 Taxonomy (<http://www.birds.cornell.edu/clementschecklist/download/>).

N = the number of surveys from the respective data sources

Species	Bird-type (W = Waterbird L = Landbird)	Number of Records	
		eBird (<i>N</i> = 178)	Structured Surveys (<i>N</i> = 242)
Black Swan (<i>Cygnus atratus</i>)	W	131	73
Magpie-lark (<i>Grallina cyanoleuca</i>)	L	127	60
Australian Magpie (<i>Gymnorhina tibicen</i>)	L	124	42
Australasian Swampphen (<i>Porphyrio melanotus</i>)	W	123	99
Australian Ibis (<i>Threskiornis moluccus</i>)	W	121	110
Australian Pelican (<i>Pelecanus conspicillatus</i>)	W	121	12
Crested Pigeon (<i>Ocyphaps lophotes</i>)	L	121	40
Dusky Moorhen (<i>Gallinula tenebrosa</i>)	W	121	118
Rainbow Lorikeet (<i>Trichoglossus haematodus</i>)	L	120	53
Pacific Black Duck (<i>Anas superciliosa</i>)	W	119	121
Eurasian Coot (<i>Fulica atra</i>)	W	116	103
Australian Raven (<i>Corvus coronoides</i>)	L	114	41
Rock Pigeon (<i>Columba livia</i>)	L	113	8
Noisy Miner (<i>Manorina melanocephala</i>)	L	111	186
Silver Gull (<i>Chroicocephalus novaehollandiae</i>)	W	110	29
Australasian Darter (<i>Anhinga novaehollandiae</i>)	W	109	49
Masked Lapwing (<i>Vanellus miles</i>)	W	108	11
Pied Cormorant (<i>Phalacrocorax varius</i>)	W	108	16
Welcome Swallow (<i>Hirundo neoxena</i>)	L	106	96
White-eyed Duck (<i>Aythya australis</i>)	W	105	60
Willie-wagtail (<i>Rhipidura leucophrys</i>)	L	105	38
Pied Currawong (<i>Strepera graculina</i>)	L	104	66
Superb Fairywren (<i>Malurus cyaneus</i>)	L	104	80
Common Myna (<i>Acridotheres tristis</i>)	L	103	43
Sulphur-crested Cockatoo (<i>Cacatua galerita</i>)	L	103	33
Little Corella (<i>Cacatua sanguinea</i>)	L	102	4
Great Cormorant (<i>Phalacrocorax carbo</i>)	W	100	38
Little Black Cormorant (<i>Phalacrocorax sulcirostris</i>)	W	99	52
Little Pied Cormorant (<i>Microcarbo melanoleucos</i>)	W	96	39
Spotted Dove (<i>Streptopelia chinensis</i>)	L	87	56
Laughing Kookaburra (<i>Dacelo novaeguineae</i>)	L	84	17
Long-billed Corella (<i>Cacatua tenuirostris</i>)	L	83	3
Australasian Grebe (<i>Tachybaptus novaehollandiae</i>)	W	80	64
Gray Butcherbird (<i>Cracticus torquatus</i>)	L	72	23
European Starling (<i>Sturnus vulgaris</i>)	L	70	4

White-faced Heron (<i>Egretta novaehollandiae</i>)	W	66	20
Powerful Owl (<i>Ninox strenua</i>)	L	64	3
Tawny Frogmouth (<i>Podargus strigoides</i>)	L	64	10
Gray Teal (<i>Anas gracilis</i>)	W	54	9
Maned Duck (<i>Chenonetta jubata</i>)	W	48	4
Buff-banded Rail (<i>Gallirallus philippensis</i>)	W	43	9
Yellow-tailed Black-Cockatoo (<i>Calyptorhynchus funereus</i>)	L	41	13
Intermediate Egret (<i>Mesophoyx intermedia</i>)	W	40	10
Royal Spoonbill (<i>Platalea regia</i>)	W	40	7
Rufous Night-Heron (<i>Nycticorax caledonicus</i>)	W	36	5
Red Wattlebird (<i>Anthochaera carunculata</i>)	L	33	25
Australasian Figbird (<i>Sphecothebes vieilloti</i>)	L	26	12
Black-faced Cuckooshrike (<i>Coracina novaehollandiae</i>)	L	25	15
Fairy Martin (<i>Petrochelidon ariel</i>)	L	25	17
Great Egret (<i>Ardea alba</i>)	W	25	5
New Holland Honeyeater (<i>Phylidonyris novaehollandiae</i>)	L	25	22
Chestnut Teal (<i>Anas castanea</i>)	W	24	2
Australian Reed-Warbler (<i>Acrocephalus australis</i>)	L	21	2
Channel-billed Cuckoo (<i>Scythrops novaehollandiae</i>)	L	20	9
Yellow Thornbill (<i>Acanthiza nana</i>)	L	19	1
Brown Goshawk (<i>Accipiter fasciatus</i>)	L	17	7
Cattle Egret (<i>Bubulcus ibis</i>)	W	16	4
Barn Owl (<i>Tyto alba</i>)	L	15	1
Tree Martin (<i>Petrochelidon nigricans</i>)	L	12	0
Pacific Koel (<i>Eudynamys orientalis</i>)	L	10	6
Collared Sparrowhawk (<i>Accipiter cirrocephalus</i>)	L	9	0
Gray Fantail (<i>Rhipidura albiscapa</i>)	L	9	6
Australian Kestrel (<i>Falco cenchroides</i>)	L	8	1
Silver-eye (<i>Zosterops lateralis</i>)	L	8	6
Galah (<i>Eolophus roseicapilla</i>)	L	7	0
Little Egret (<i>Egretta garzetta</i>)	W	7	0
Peregrine Falcon (<i>Falco peregrinus</i>)	L	7	0
Olive-backed Oriole (<i>Oriolus sagittatus</i>)	L	5	1
Pink-eared Duck (<i>Malacorhynchus membranaceus</i>)	W	5	5
Sacred Kingfisher (<i>Todiramphus sanctus</i>)	L	5	0
Spotted Pardalote (<i>Pardalotus punctatus</i>)	L	5	11
Eastern Spinebill (<i>Acanthorhynchus tenuirostris</i>)	L	4	1
White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>)	L	4	0
Dollarbird (<i>Eurystomus orientalis</i>)	L	3	0
Eastern Rosella (<i>Platycercus eximius</i>)	L	3	0
Golden Whistler (<i>Pachycephala pectoralis</i>)	L	3	1
Gray Goshawk (<i>Accipiter novaehollandiae</i>)	L	3	1
House Sparrow (<i>Passer domesticus</i>)	L	3	0
Little Wattlebird (<i>Anthochaera chrysoptera</i>)	L	3	3

Musk Lorikeet (<i>Glossopsitta concinna</i>)	L	3	0
Rufous Fantail (<i>Rhipidura rufifrons</i>)	L	3	1
Australian Shelduck (<i>Tadorna tadornoides</i>)	W	2	0
Australian Shoveler (<i>Anas rhynchotis</i>)	W	2	3
Brown Quail (<i>Synoicus ypsilophorus</i>)	L	2	1
Eurasian Blackbird (<i>Turdus merula</i>)	L	2	0
Fan-tailed Cuckoo (<i>Cacomantis flabelliformis</i>)	L	2	1
Hoary-headed Grebe (<i>Poliiocephalus poliocephalus</i>)	W	2	4
Latham's Snipe (<i>Gallinago hardwickii</i>)	W	2	0
Pied Stilt (<i>Himantopus leucocephalus</i>)	W	2	0
Red-whiskered Bulbul (<i>Pycnonotus jocosus</i>)	L	2	0
Scaly-breasted Lorikeet (<i>Trichoglossus chlorolepidotus</i>)	L	2	0
Southern Boobook (<i>Ninox novaeseelandiae</i>)	L	2	0
Spangled Drongo (<i>Dicrurus bracteatus</i>)	L	2	0
Straw-necked Ibis (<i>Threskiornis spinicollis</i>)	W	2	0
Australian King-Parrot (<i>Alisterus scapularis</i>)	L	1	0
Blue-billed Duck (<i>Oxyura australis</i>)	W	1	0
Brown Falcon (<i>Falco berigora</i>)	L	1	0
Brown Honeyeater (<i>Lichmera indistincta</i>)	L	1	0
Caspian Tern (<i>Hydroprogne caspia</i>)	W	1	0
European Greenfinch (<i>Chloris chloris</i>)	L	1	0
Lewin's Honeyeater (<i>Meliphaga lewinii</i>)	L	1	0
Mistletoebird (<i>Dicaeum hirundinaceum</i>)	L	1	0
Noisy Pitta (<i>Pitta versicolor</i>)	L	1	0
Pacific Heron (<i>Ardea pacifica</i>)	W	1	0
Red-browed Firetail (<i>Neochmia temporalis</i>)	L	1	0
Red-rumped Parrot (<i>Psephotus haematonotus</i>)	L	1	0
Rose Robin (<i>Petroica rosea</i>)	L	1	0
Rufous Whistler (<i>Pachycephala rufiventris</i>)	L	1	0
Striated Thornbill (<i>Acanthiza lineata</i>)	L	1	0
Variegated Fairywren (<i>Malurus lamberti</i>)	L	1	0
Weebill (<i>Smicrornis brevirostris</i>)	L	1	0
Whiskered Tern (<i>Chlidonias hybrida</i>)	W	1	0
Whistling Kite (<i>Haliastur sphenurus</i>)	L	1	0
Yellow-billed Spoonbill (<i>Platalea flavipes</i>)	L	1	0
Yellow-faced Honeyeater (<i>Caligavis chrysops</i>)	L	1	0
Yellow-rumped Thornbill (<i>Acanthiza chrysorrhoa</i>)	L	1	0
Australian Hobby (<i>Falco longipennis</i>)	L	0	1
Australian Kite (<i>Elanus axillaris</i>)	L	0	2
Black-fronted Dotterel (<i>Elseyornis melanops</i>)	W	0	1
Musk Duck (<i>Biziura lobata</i>)	W	0	1
Noisy Friarbird (<i>Philemon corniculatus</i>)	L	0	1
Plumed Whistling-Duck (<i>Dendrocygna eytoni</i>)	W	0	1

Table S2. The results of the SIMPER analysis, which demonstrates the species which most contributed to the difference in community composition

Species are listed in descending contribution. Bird names follow eBird/Clements v2016 Taxonomy (<http://www.birds.cornell.edu/clementschecklist/download/>)

Species	Average	s.d.	Ratio	Cumsum	P
Tree Martin	0.006099	0.00319	1.915	0.0236	0.04
Australian Reed-Warbler	0.00535	0.00383	1.395	0.0444	0.17
Yellow Thornbill	0.00535	0.00383	1.395	0.0651	0.17
Chestnut Teal	0.004899	0.00416	1.178	0.0841	0.13
Great Egret	0.004899	0.00416	1.178	0.1031	0.13
Sacred Kingfisher	0.004759	0.00405	1.174	0.1215	0.03
European Starling	0.0047	0.00398	1.181	0.1397	0.15
House Sparrow	0.004656	0.00393	1.185	0.1578	0.04
Peregrine Falcon	0.004656	0.00393	1.185	0.1758	0.04
Brown Goshawk	0.004649	0.00428	1.085	0.1938	0.1
Silver-eye	0.004641	0.00427	1.086	0.2118	0.11
Maned Duck	0.004432	0.00408	1.086	0.229	0.48
Long-billed Corella	0.004397	0.00404	1.087	0.246	0.48
Olive-backed Oriole	0.004373	0.00402	1.089	0.263	0.35
Galah	0.004352	0.00364	1.197	0.2798	0.11
White-bellied Sea-Eagle	0.004352	0.00364	1.197	0.2967	0.11
Barn Owl	0.004202	0.00382	1.1	0.313	0.45
Powerful Owl	0.004054	0.00403	1.006	0.3287	0.97
Gray Fantail	0.003904	0.00419	0.932	0.3438	0.93
Australasian Figbird	0.00386	0.00416	0.929	0.3588	0.96
Channel-billed Cuckoo	0.003757	0.00436	0.861	0.3733	0.19
Pacific Koel	0.003757	0.00436	0.861	0.3879	0.19
Rufous Night-Heron	0.003755	0.00434	0.865	0.4024	0.26
Little Wattlebird	0.003736	0.00401	0.933	0.4169	0.98
Little Corella	0.003638	0.00422	0.862	0.431	0.95
Cattle Egret	0.003627	0.00422	0.86	0.4451	0.91
Dollarbird	0.003609	0.00453	0.797	0.459	0.01
Royal Spoonbill	0.003609	0.00453	0.797	0.473	0.01
Tawny Frogmouth	0.003609	0.00453	0.797	0.487	0.01
Spotted Pardalote	0.003571	0.00418	0.855	0.5009	0.33
Pink-eared Duck	0.00357	0.00418	0.854	0.5147	0.26
Australian Shoveler	0.00339	0.00394	0.861	0.5278	0.86
Fan-tailed Cuckoo	0.003377	0.00396	0.854	0.5409	0.84
Eastern Spinebill	0.00332	0.00385	0.862	0.5538	0.67
Rufous Fantail	0.003318	0.00384	0.863	0.5666	0.67
Australian Shelduck	0.003316	0.00421	0.788	0.5795	0.03
Golden Whistler	0.003312	0.00384	0.863	0.5923	0.68
Australian Kestrel	0.003306	0.00383	0.865	0.6051	0.56

Collared Sparrowhawk	0.003201	0.00404	0.793	0.6175	0.04
Little Egret	0.003201	0.00404	0.793	0.6299	0.04
Rock Pigeon	0.00314	0.00397	0.791	0.6421	0.42
Latham's Snipe	0.002909	0.00364	0.799	0.6534	0.11
Pied Stilt	0.002909	0.00364	0.799	0.6646	0.11
Red-whiskered Bulbul	0.002909	0.00364	0.799	0.6759	0.11
Spangled Drongo	0.002909	0.00364	0.799	0.6872	0.11
Eastern Rosella	0.002898	0.00363	0.799	0.6984	0.11
Musk Lorikeet	0.002898	0.00363	0.799	0.7096	0.11
Black-faced Cuckooshrike	0.002769	0.00414	0.669	0.7204	0.98
Gray Butcherbird	0.002769	0.00414	0.669	0.7311	0.98
White-faced Heron	0.002769	0.00414	0.669	0.7418	0.98
Hoary-headed Grebe	0.002593	0.0039	0.665	0.7519	0.49
Gray Goshawk	0.002489	0.00374	0.665	0.7615	0.93
Brown Quail	0.002397	0.00359	0.669	0.7708	0.96
Blue-billed Duck	0.001861	0.00381	0.489	0.778	0.03
Buff-banded Rail	0.001861	0.00381	0.489	0.7852	0.03
European Greenfinch	0.001861	0.00381	0.489	0.7925	0.03
Gray Teal	0.001861	0.00381	0.489	0.7997	0.03
Red-rumped Parrot	0.001861	0.00381	0.489	0.8069	0.03
Red Wattlebird	0.001861	0.00381	0.489	0.8141	0.03
Striated Thornbill	0.001861	0.00381	0.489	0.8213	0.03
Variiegated Fairywren	0.001861	0.00381	0.489	0.8285	0.03
Weebill	0.001861	0.00381	0.489	0.8357	0.03
Eurasian Blackbird	0.001747	0.00357	0.489	0.8425	0.04
Pacific Heron	0.001747	0.00357	0.489	0.8493	0.04
Whiskered Tern	0.001747	0.00357	0.489	0.856	0.04
Pied Cormorant	0.001724	0.00355	0.486	0.8627	0.91
Fairy Martin	0.001638	0.00337	0.486	0.8691	0.93
Black-fronted Dotterel	0.001561	0.00321	0.486	0.8751	0.94
Plumed Whistling-Duck	0.001561	0.00321	0.486	0.8812	0.94
Australian Hobby	0.001536	0.00316	0.486	0.8871	0.96
Australian Kite	0.001501	0.00309	0.487	0.8929	0.96
Musk Duck	0.001501	0.00309	0.487	0.8988	0.96
Noisy Friarbird	0.001501	0.00309	0.487	0.9046	0.96
Brown Honeyeater	0.001454	0.00297	0.489	0.9102	0.11
Caspian Tern	0.001454	0.00297	0.489	0.9158	0.11
Lewin's Honeyeater	0.001454	0.00297	0.489	0.9215	0.11
Mistletoebird	0.001454	0.00297	0.489	0.9271	0.11
Rose Robin	0.001454	0.00297	0.489	0.9327	0.11
Scaly-breasted Lorikeet	0.001454	0.00297	0.489	0.9384	0.11
Whistling Kite	0.001454	0.00297	0.489	0.944	0.11
Yellow-billed Spoonbill	0.001454	0.00297	0.489	0.9497	0.11
Australian King-Parrot	0.001444	0.00295	0.489	0.9552	0.11

Brown Falcon	0.001444	0.00295	0.489	0.9608	0.11
Noisy Pitta	0.001444	0.00295	0.489	0.9664	0.11
Red-browed Firetail	0.001444	0.00295	0.489	0.972	0.11
Rufous Whistler	0.001444	0.00295	0.489	0.9776	0.11
Southern Boobook	0.001444	0.00295	0.489	0.9832	0.11
Straw-necked Ibis	0.001444	0.00295	0.489	0.9888	0.11
Yellow-faced Honeyeater	0.001444	0.00295	0.489	0.9944	0.11
Yellow-rumped Thornbill	0.001444	0.00295	0.489	1	0.11
Australasian Darter	0	0	NaN	1	1
Australasian Grebe	0	0	NaN	1	1
Australasian Swamphen	0	0	NaN	1	1
Australian Ibis	0	0	NaN	1	1
Australian Magpie	0	0	NaN	1	1
Australian Pelican	0	0	NaN	1	1
Australian Raven	0	0	NaN	1	1
Black Swan	0	0	NaN	1	1
Common Myna	0	0	NaN	1	1
Crested Pigeon	0	0	NaN	1	1
Dusky Moorhen	0	0	NaN	1	1
Eurasian Coot	0	0	NaN	1	1
Great Cormorant	0	0	NaN	1	1
Intermediate Egret	0	0	NaN	1	1
Laughing Kookaburra	0	0	NaN	1	1
Little Black Cormorant	0	0	NaN	1	1
Little Pied Cormorant	0	0	NaN	1	1
Magpie-lark	0	0	NaN	1	1
Masked Lapwing	0	0	NaN	1	1
New Holland Honeyeater	0	0	NaN	1	1
Noisy Miner	0	0	NaN	1	1
Pacific Black Duck	0	0	NaN	1	1
Pied Currawong	0	0	NaN	1	1
Rainbow Lorikeet	0	0	NaN	1	1
Silver Gull	0	0	NaN	1	1
Spotted Dove	0	0	NaN	1	1
Sulphur-crested Cockatoo	0	0	NaN	1	1
Superb Fairywren	0	0	NaN	1	1
Welcome Swallow	0	0	NaN	1	1
White-eyed Duck	0	0	NaN	1	1
Willie-wagtail	0	0	NaN	1	1
Yellow-tailed Black-Cockatoo	0	0	NaN	1	1

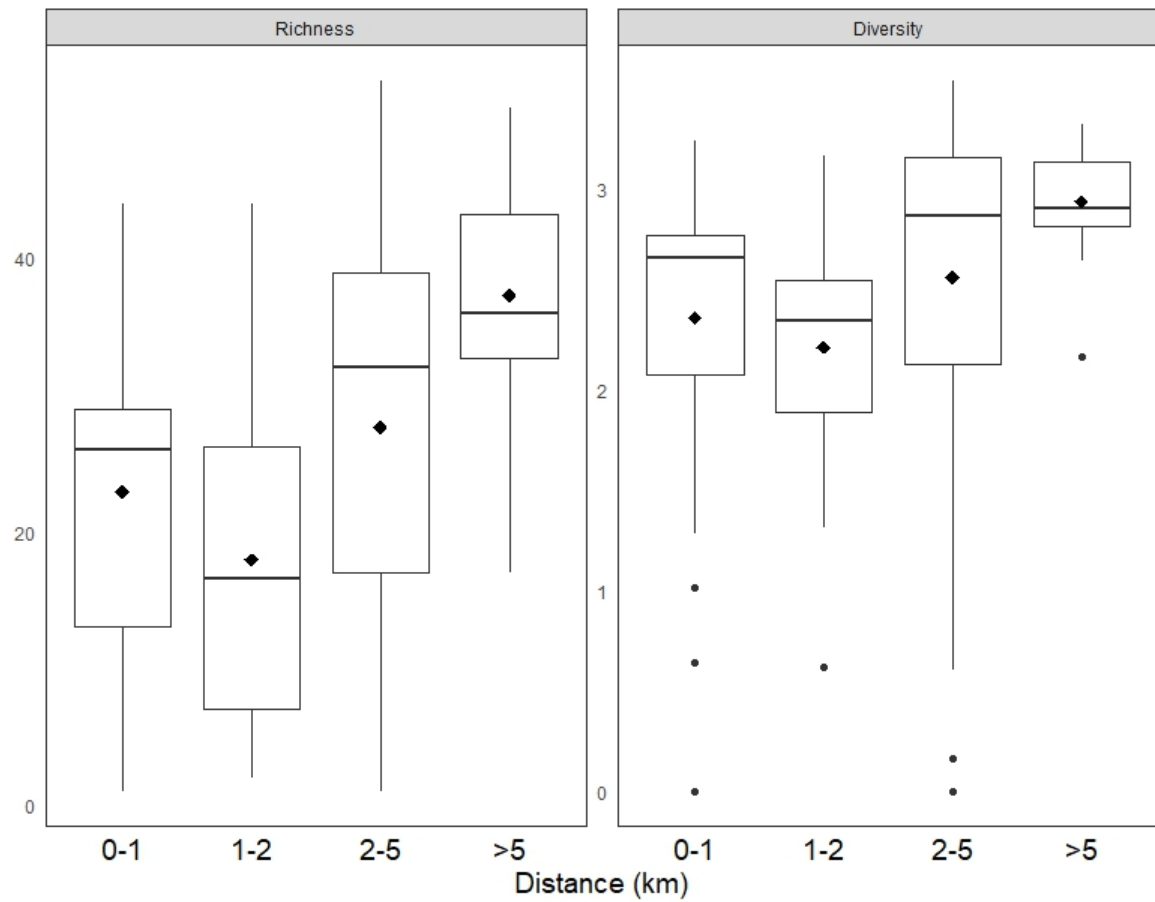


Fig. S1. The average (dark triangle) species richness and Shannon diversity calculated from an eBird checklist placed in distance bins, based on the reported distance travelled per checklist, using 178 eBird checklists between June 2012 – June 2016. As the distance travelled by an eBirder increases, there is a general increase with both richness and Shannon diversity.