

Appendix 1. Models fitted to four different datasets for each species to test the effect of land cover class and sampling effort (varying the count station radius and duration of the recording period) on occupancy and/or detection probabilities for six species. Ψ = probability that a sampling location is occupied; p = probability of detection given that a sampling location is occupied; Hab = the probability is different for different land-cover classes; ‘.’ = probability is the same for different land-cover classes.

Species	Sampling effort	Model	AIC	Δ AIC	AIC wgt
Bellbird	5 min, bounded	$\psi(\cdot),p(\text{Hab})$	154.05	0	0.8917
		$\psi(\cdot),p(\cdot)$	159.23	5.18	0.0669
		$\psi(\text{Hab}),p(\text{Hab})$	161.12	7.07	0.026
		$\psi(\text{Hab}),p(\cdot)$	162.16	8.11	0.0155
	5 min, unbounded	$\psi(\cdot),p(\text{Hab})$	169.14	0	0.3309
		$\psi(\text{Hab}),p(\cdot)$	169.3	0.16	0.3055
		$\psi(\text{Hab}),p(\text{Hab})$	170.06	0.92	0.2089
		$\psi(\cdot),p(\cdot)$	170.66	1.52	0.1548
	10 min, bounded	$\psi(\cdot),p(\cdot)$	175.52	0	0.6524
		$\psi(\cdot),p(\text{Hab})$	177.35	1.83	0.2613
		$\psi(\text{Hab}),p(\cdot)$	179.79	4.27	0.0771
		$\psi(\text{Hab}),p(\text{Hab})$	184.04	8.52	0.0092
	10 min, unbounded	$\psi(\cdot),p(\cdot)$	176.16	0	0.433
		$\psi(\text{Hab}),p(\cdot)$	177.12	0.96	0.2679
		$\psi(\cdot),p(\text{Hab})$	177.26	1.1	0.2498
		$\psi(\text{Hab}),p(\text{Hab})$	180.51	4.35	0.0492
Chaffinch	5 min, bounded	$\psi(\cdot),p(\cdot)$	219.41	0	0.7403
		$\psi(\text{Hab}),p(\cdot)$	222.57	3.16	0.1525
		$\psi(\cdot),p(\text{Hab})$	223.39	3.98	0.1012
		$\psi(\text{Hab}),p(\text{Hab})$	229.04	9.63	0.006
	5 min, unbounded	$\psi(\cdot),p(\cdot)$	229.89	0	0.8314
		$\psi(\text{Hab}),p(\cdot)$	234.43	4.54	0.0859
		$\psi(\cdot),p(\text{Hab})$	234.57	4.68	0.0801
		$\psi(\text{Hab}),p(\text{Hab})$	241.39	11.5	0.0026
	10 min, bounded	$\psi(\cdot),p(\cdot)$	221.99	0	0.6479
		$\psi(\cdot),p(\text{Hab})$	224.31	2.32	0.2031
		$\psi(\text{Hab}),p(\cdot)$	225.11	3.12	0.1361
		$\psi(\text{Hab}),p(\text{Hab})$	229.83	7.84	0.0129
	10 min, unbounded	$\psi(\cdot),p(\cdot)$	222.31	0	0.8127
		$\psi(\cdot),p(\text{Hab})$	226.5	4.19	0.1
		$\psi(\text{Hab}),p(\cdot)$	226.85	4.54	0.084
		$\psi(\text{Hab}),p(\text{Hab})$	233.32	11.01	0.0033

Appendix 1 (continued).

Species	Sampling effort	Model	AIC	Δ AIC	AIC wgt
Fantail	5 min, bounded	$\psi(\cdot),p(\text{Hab})$	91.03	0	0.6164
		$\psi(\text{Hab}),p(\cdot)$	92.97	1.94	0.2337
		$\psi(\cdot),p(\cdot)$	94.26	3.23	0.1226
		$\psi(\text{Hab}),p(\text{Hab})$	97.26	6.23	0.0274
	5 min, unbounded	$\psi(\cdot),p(\text{Hab})$	91.03	0	0.6179
		$\psi(\text{Hab}),p(\cdot)$	92.98	1.95	0.2331
		$\psi(\cdot),p(\cdot)$	94.28	3.25	0.1217
		$\psi(\text{Hab}),p(\text{Hab})$	97.26	6.23	0.0274
	10 min, bounded	$\psi(\cdot),p(\text{Hab})$	102.86	0	0.8627
		$\psi(\text{Hab}),p(\cdot)$	107.54	4.68	0.0831
		$\psi(\cdot),p(\cdot)$	109.34	6.48	0.0338
		$\psi(\text{Hab}),p(\text{Hab})$	110.35	7.49	0.0204
	10 min, unbounded	$\psi(\cdot),p(\text{Hab})$	102.86	0	0.8627
		$\psi(\text{Hab}),p(\cdot)$	107.54	4.68	0.0831
		$\psi(\cdot),p(\cdot)$	109.34	6.48	0.0338
		$\psi(\text{Hab}),p(\text{Hab})$	110.35	7.49	0.0204
Hedge sparrow	5 min, bounded	$\psi(\text{Hab}),p(\cdot)$	94.22	0	0.8623
		$\psi(\cdot),p(\text{Hab})$	99.03	4.81	0.0778
		$\psi(\cdot),p(\cdot)$	100.02	5.8	0.0474
		$\psi(\text{Hab}),p(\text{Hab})$	102.71	8.49	0.0124
	5 min, unbounded	$\psi(\cdot),p(\text{Hab})$	116.68	0	0.4804
		$\psi(\text{Hab}),p(\cdot)$	116.84	0.16	0.4435
		$\psi(\cdot),p(\cdot)$	121.58	4.9	0.0415
		$\psi(\text{Hab}),p(\text{Hab})$	121.94	5.26	0.0346
	10 min, bounded	$\psi(\text{Hab}),p(\cdot)$	95.59	0	0.8614
		$\psi(\cdot),p(\text{Hab})$	100.38	4.79	0.0785
		$\psi(\cdot),p(\cdot)$	101.4	5.81	0.0472
		$\psi(\text{Hab}),p(\text{Hab})$	103.99	8.4	0.0129
	10 min, unbounded	$\psi(\text{Hab}),p(\cdot)$	116.97	0	0.5073
		$\psi(\cdot),p(\text{Hab})$	117.37	0.4	0.4154
		$\psi(\cdot),p(\cdot)$	121.7	4.73	0.0477
		$\psi(\text{Hab}),p(\text{Hab})$	122.65	5.68	0.0296

Appendix 1 (continued).

Species	Sampling effort	Model	AIC	Δ AIC	AIC wgt
Rifleman	5 min, bounded	$\psi(\cdot),p(\text{Hab})$	83.91	0	0.9367
		$\psi(\text{Hab}),p(\cdot)$	90.43	6.52	0.036
		$\psi(\cdot),p(\cdot)$	92.36	8.45	0.0137
		$\psi(\text{Hab}),p(\text{Hab})$	92.37	8.46	0.0136
	5 min, unbounded	$\psi(\cdot),p(\text{Hab})$	83.91	0	0.9367
		$\psi(\text{Hab}),p(\cdot)$	90.43	6.52	0.036
		$\psi(\cdot),p(\cdot)$	92.36	8.45	0.0137
		$\psi(\text{Hab}),p(\text{Hab})$	92.37	8.46	0.0136
	10 min, bounded	$\psi(\cdot),p(\text{Hab})$	96.73	0	0.9684
		$\psi(\text{Hab}),p(\text{Hab})$	105.15	8.42	0.0144
		$\psi(\text{Hab}),p(\cdot)$	105.61	8.88	0.0114
		$\psi(\cdot),p(\cdot)$	106.96	10.23	0.0058
	10 min, unbounded	$\psi(\cdot),p(\text{Hab})$	96.73	0	0.9684
		$\psi(\text{Hab}),p(\text{Hab})$	105.15	8.42	0.0144
		$\psi(\text{Hab}),p(\cdot)$	105.61	8.88	0.0114
		$\psi(\cdot),p(\cdot)$	106.96	10.23	0.0058
Yellowhammer	5 min, bounded	$\psi(\cdot),p(\text{Hab})$	59.55	0	0.4647
		$\psi(\cdot),p(\cdot)$	59.68	0.13	0.4355
		$\psi(\text{Hab}),p(\cdot)$	62.78	3.23	0.0924
		$\psi(\text{Hab}),p(\text{Hab})$	67.85	8.3	0.0073
	5 min, unbounded	$\psi(\cdot),p(\text{Hab})$	84.58	0	0.9331
		$\psi(\cdot),p(\cdot)$	91.41	6.83	0.0307
		$\psi(\text{Hab}),p(\cdot)$	92.36	7.78	0.0191
		$\psi(\text{Hab}),p(\text{Hab})$	92.57	7.99	0.0172
	10 min, bounded	$\psi(\cdot),p(\text{Hab})$	86.43	0	0.9257
		$\psi(\text{Hab}),p(\text{Hab})$	91.72	5.29	0.0657
		$\psi(\text{Hab}),p(\cdot)$	96.58	10.15	0.0058
		$\psi(\cdot),p(\cdot)$	98.05	11.62	0.0028
	10 min, unbounded	$\psi(\cdot),p(\text{Hab})$	101.41	0	0.8446
		$\psi(\text{Hab}),p(\cdot)$	105.96	4.55	0.0868
		$\psi(\cdot),p(\cdot)$	107.36	5.95	0.0431
		$\psi(\text{Hab}),p(\text{Hab})$	108.41	7	0.0255

Appendix 2. List of species and total number of observations recorded in the initial five-minute count (bounded and unbounded), and the number of observations where birds were seen moving towards or away from the observer.

Species Common name	Latin name	Number of observation records		
		Bounded count	Unbounded count	Movement
Chaffinch	<i>Fringilla coelebs</i>	122	197	
Grey warbler	<i>Gerygone igata</i>	97	127	
Silvereye	<i>Zosterops lateralis</i>	87	98	
Tomtit	<i>Parus macrocephalus</i>	81	108	2
Bellbird	<i>Anthornis melanura</i>	52	137	
Redpoll	<i>Carduelis flammea</i>	48	62	1
Whitehead	<i>Mohoua albicilla</i>	32	38	
Rifleman	<i>Acanthisitta chloris</i>	28	28	
New Zealand robin	<i>Petroica australis</i>	28	46	1
Blackbird	<i>Turdus merula</i>	28	73	
Brown creeper	<i>Mohoua novoeseelandiae</i>	26	31	
Fantail	<i>Rhipidura fuliginosa</i>	25	25	2
Hedge sparrow	<i>Prunella modularis</i>	22	44	
Yellowhammer	<i>Emberiza citrinella</i>	18	25	
Song thrush	<i>Turdus philomelos</i>	13	18	
Kākāriki	<i>Cyanoramphus</i> spp.	12	13	
Skylark	<i>Alauda arvensis</i>	10	48	
Kea	<i>Nestor notabilis</i>	9	23	3
New Zealand pipit	<i>Anthus novaeseelandiae</i>	6	9	
Banded dotterel	<i>Charadrius bicinctus</i>	5	5	1
Rock wren	<i>Xenicus gilviventris</i>	4	4	
Shining cuckoo	<i>Chrysococcyx lucidus</i>	4	9	
Tūī	<i>Prosthemadera noveeseelandiae</i>	4	5	
Long-tailed cuckoo	<i>Eudynamys taitensis</i>	3	5	
Californian quail	<i>Callipepla californica</i>	2	4	
Kererū	<i>Hemiphaga novaseelandiae</i>	2	2	
Kingfisher	<i>Halcyon sancta</i>	2	2	
Australian magpie	<i>Gymnorhina tibicen</i>	1	1	
New Zealand falcon	<i>Falco novaeseelandiae</i>	1	3	
Black shag	<i>Phalacrocorax carbo</i>	1	2	
Fernbird	<i>Bowdleria punctata</i>	1	1	
Starling	<i>Sturnus vulgaris</i>	1	1	
Welcome swallow	<i>Hirundo neoxena</i>	1	1	
Black-backed gull	<i>Larus dominicanus</i>	0	1	
Black-fronted tern	<i>Sterna albobriata</i>	0	4	
Chukor	<i>Alectoris chukar</i>	0	2	
Greenfinch	<i>Carduelis chloris</i>	0	1	
Australasian harrier	<i>Circus approximans</i>	0	4	
Kākā	<i>Nestor meridionalis</i>	0	4	
Paradise shelduck	<i>Tadorna variegata</i>	0	3	
Spur-winged plover	<i>Vanellus miles</i>	0	4	
Weka	<i>Gallirallus australis</i>	0	1	