

Appendix 1. Birds detected in a single survey in the dairy sector; model specifications of the best-fit detection functions; and estimates of effective survey widths (ESW, m), densities (per hectare) (and coefficients of variance, CV), and correction factors. Truncation = right truncation distance (m); Key = key function fitted; Adjustment = adjustment function fitted; NAP = number of adjustment parameters; NCP = number of covariate parameters. Note the density estimates have been adjusted using the specified correction factor.

Species	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV	Correction factor
		Truncation	Key	Adjustment	NAP	NCP	Covariates					
Blackbird	120	100	Hazard rate		0	3	Observer	37	0.08	0.38	0.14	1.13
Chaffinch	130	160	Hazard rate		0	1	Cue	88	0.07	0.17	0.13	1.32
Fantail	71	150	Half-normal		0	3	Observer	70	0.10	0.12	0.16	1.25
Goldfinch	362	100	Hazard rate		0	1	Cue	45	0.04	1.68	0.09	1.16
Greenfinch	302	125	Half-normal	Cosine	1	1	Cue	59	0.04	0.71	0.09	1.21
Grey warbler	57	200	Half-normal		0	0		112	0.11	0.05	0.18	1.40
Harrier	64	246	Hazard rate		0	1	Panel	112	0.10	0.06	0.19	1.40
House sparrow	333	120	Half-normal	Cosine	2	3	Cue, habitat	43	0.05	2.89	0.12	1.15
Magpie	157	225	Half-normal		0	1	Cue	133	0.05	0.22	0.12	1.48
Myna	63	200	Half-normal		0	1	Cue	108	0.11	0.10	0.24	1.39
Redpoll	36	160	Half-normal		0	1	Observer, wind	75	0.15	0.07	0.28	1.27
Silvereye	132	120	Half-normal		0	1	Panel	61	0.06	0.38	0.14	1.22
Skylark	385	160	Half-normal	Cosine	2	1	Cue	72	0.04	0.73	0.09	1.26
Starling	112	100	Half-normal		0	1	Panel	64	0.06	1.54	0.23	1.23
Thrush	46	80	Hazard rate		0	1	Cue	34	0.13	0.16	0.24	1.12
Welcome swallow	46	60	Half-normal		0	0		31	0.12	0.26	0.28	1.11
Yellowhammer	206	175	Hazard rate		0	1	Cue	97	0.07	0.22	0.10	1.35

Appendix 2. Birds detected in surveys in the kiwifruit sector; model specifications of the best-fit detection functions; and estimates of effective survey widths (ESW, m) and densities (per hectare) (and coefficients of variance, CV) for both survey-specific and global datasets. Truncation = right truncation distance (m); Key = key function fitted; Adjustment = adjustment function fitted; NAP = number of adjustment parameters; NCP = number of covariate parameters.

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV
			Truncation	Key	Adjustment	NAP	NCP	Covariates				
Blackbird	1	3234	100	Hazard rate		0	0		40	0.02	6.63	0.04
	2	1239	100	Hazard rate	Cosine	1	1	Cue	25	0.03	4.99	0.04
	3	1020	100	Half-normal	Cosine	2	5	Observer, cue	20	0.03	7.92	0.04
	Global	5493	100	Hazard rate		0	3	Survey, cue	32	0.01	5.96	0.03
California quail	Global	93	100	Half-normal		0	1	Cue	33	0.09	0.12	0.15
Chaffinch	1	1009	100	Hazard rate	Simple polynomial	1	4	Observer, cue	46	0.03	1.72	0.05
	2	511	100	Hazard rate		0	2	Wind, cue	28	0.05	1.79	0.07
	3	123	100	Hazard rate		0	1	Cue	18	0.09	1.04	0.13
	Global	1643	100	Hazard rate	Cosine	1	14	Observer, cue	39	0.03	1.43	0.05
Eastern rosella	Global	92	100	Hazard rate		0	1	Cue	37	0.09	0.09	0.15
Fantail	1	208	100	Hazard rate	Hermite polynomial	1	0		23	0.20	0.70	0.21
	2	110	100	Hazard rate		0	1	Cue	26	0.10	0.49	0.15
	3	25	100	Half-normal		0	0		20	0.15	0.17	0.24
	Global	343	100	Half-normal	Cosine	1	1	Cue	30	0.05	0.40	0.08
Goldfinch	1	616	100	Hazard rate		0	4	Observer, cue	32	0.03	1.98	0.07
	2	478	100	Hazard rate	Hermite polynomial	2	0		16	0.09	3.76	0.11
	3	228	100	Half-normal	Cosine	2	0		15	0.07	2.93	0.11
	Global	1321	100	Hazard rate	Cosine	1	3	Survey, cue	28	0.03	2.14	0.05
Greenfinch	1	787	100	Hazard rate		0	4	Observer, cue	47	0.03	1.36	0.06
	2	417	100	Hazard rate		0	4	Observer	36	0.04	1.29	0.08
	3	83	100	Hazard rate		0	2	Wind, cue	30	0.09	0.50	0.16
	Global	1287	100	Hazard rate	Cosine	2	3	Survey, cue	40	0.03	1.18	0.05
Grey warbler	1	82	100	Half-normal		0	1	Wind	61	0.08	0.10	0.14
	Global	139	100	Half-normal		0	1	Cue	51	0.08	0.09	0.13
House sparrow	1	1628	100	Hazard rate		0	4	Observer, cue	38	0.02	4.95	0.05
	2	686	100	Half-normal	Cosine	1	1	Cue	21	0.03	5.41	0.07
	3	485	100	Half-normal	Cosine	1	5	Cue, observer	21	0.04	5.68	0.07
	Global	2799	100	Hazard rate		0	13	Observer	31	0.02	4.85	0.04

Appendix 2 (continued).

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV
			Truncation	Key	Adjustment	NAP	NCP	Covariates				
Kingfisher	1	234	100	Half-normal		0	2	Wind, cue	74	0.04	0.23	0.08
	2	58	100	Half-normal		0	1	Cue	64	0.11	0.08	0.17
	3	26	100	Half-normal		0	0		33	0.15	0.11	0.25
	Global	318	100	Half-normal		0	2	Wind, cue	66	0.04	0.15	0.08
Myna	1	97	100	Hazard rate		0	3	Observer	70	0.06	0.11	0.16
	2	36	100	Half-normal		0	0		31	0.13	0.12	0.21
	Global	155	100	Hazard rate		0	5	Survey, panel	53	0.07	0.10	0.12
Pheasant	1	189	100	Half-normal		0	1	Cue	85	0.03	0.16	0.08
	2	58	100	Hazard rate		0	0		100	0.00	0.06	0.14
	3	37	100	Half-normal		0	3	Panel, wind	46	0.18	0.11	0.24
	Global	284	100	Half-normal		0	2	Wind, cue	83	0.04	0.11	0.08
Pūkeko	1	115	100	Half-normal		0	0		85	0.11	0.10	0.18
	Global	163	100	Half-normal		0	3	Survey, cue	77	0.05	0.07	0.13
Redpoll	Global	62	100	Hazard rate		0	2	Wind, cue	23	0.12	0.10	0.19
Silvereye	1	138	100	Hazard rate	Cosine	1	1	Cue	27	0.08	0.53	0.14
	2	158	100	Half-normal	Cosine	3	3	Observer	15	0.48	1.24	0.49
	3	40	100	Half-normal		0	0		18	0.12	0.60	0.19
	Global	336	100	Half-normal		0	3	Survey, cue	23	0.05	0.63	0.09
Skylark	1	50	100	Half-normal		0	0		82	0.17	0.04	0.23
	Global	58	100	Half-normal		0	0		83	0.15	0.02	0.22
Starling	Global	76	100	Hazard rate		0	3	Survey, cue	28	0.11	0.11	0.18
Thrush	1	2632	100	Hazard rate		0	4	Observer, cue	35	0.02	6.17	0.04
	2	874	100	Hazard rate	Cosine	1	1	Cue	22	0.03	4.04	0.05
	3	445	100	Half-normal	Cosine	2	5	Cue, observer	18	0.05	3.61	0.06
	Global	3951	100	Hazard rate		0	14	Observer, cue	30	0.01	4.63	0.04
Tūī	1	213	100	Half-normal	Cosine	1	1	Observer, wind	106	0.04	0.15	0.09
	2	63	100	Half-normal		0	1	Cue	58	0.09	0.11	0.17
	3	29	100	Half-normal		0	1	Cue	36	0.18	0.12	0.30
	Global	305	100	Half-normal		0	2	Survey	75	0.03	0.13	0.08
Welcome swallow	Global	50	100	Half-normal		0	0		21	0.11	0.10	0.21
Yellowhammer	Global	60	100	Half-normal		0	2	Wind, cue	41	0.13	0.05	0.21

Appendix 3. Birds detected in surveys in the sheep & beef sector (all study sites); model specifications of the best-fit detection functions; and estimates of effective survey widths (ESW, m), densities (per hectare) (and coefficients of variance, CV) and correction factors. NAP = number of adjustment parameters; NCP = number of covariate parameters. Note the density estimates have been adjusted using the specified correction factor.

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV	Correction factor	
			Truncation	Key	Adjustment	NAP	NCP	Covariates						
Bellbird	1	83	75	Half-normal			0	5	Cue, observer	28	0.13	0.11	0.21	1.05
	2	171	82	Hazard rate	Simple polynomial		1	0		37	0.11	0.13	0.18	1.06
	3	55	60	Half-normal	Cosine		1	1	Cue	21	0.11	0.13	0.25	1.04
	Global	303	70	Half-normal	Cosine		1	3	Cue, habitat	28	0.05	0.14	0.11	1.05
Black-backed gull	1	130	150	Half-normal	Cosine		1	3	Cue, panel	73	0.07	0.09	0.19	1.12
	2	125	140	Half-normal	Cosine		1	2	Cue, wind	66	0.07	0.15	0.45	1.11
	3	81	175	Half-normal	Cosine		1	0		77	0.14	0.08	0.22	1.13
	Global	343	160	Half-normal	Simple polynomial		2	0		75	0.07	0.12	0.24	1.12
Blackbird	1	325	45	Half-normal			0	0		30	0.05	0.45	0.11	1.05
	2	405	76	Half-normal			0	6	Observer, panel	45	0.07	0.44	0.12	1.07
	3	296	75	Half-normal	Cosine		1	4	Observer	30	0.05	0.58	0.11	1.05
	Global	1087	75	Half-normal	Simple polynomial		2	16	Observer	34	0.06	0.53	0.09	1.05
Chaffinch	1	276	75	Half-normal	Cosine		1	1	Cue	32	0.05	0.36	0.11	1.05
	2	547	125	Half-normal	Cosine		1	1	Cue	53	0.03	0.47	0.09	1.08
	3	266	75	Hazard rate			0	0		31	0.09	0.64	0.14	1.05
	Global	1015	80	Hazard rate			0	3	Cue, survey	35	0.03	0.51	0.06	1.06
Dunnock	1	74	45	Hazard rate			0	0		19	0.19	0.25	0.29	1.03
	2	69	40	Hazard rate			0	3	Panel, wind	25	0.08	0.21	0.25	1.04
	Global	142	40	Hazard rate			0	0		22	0.10	0.17	0.20	1.04
Fantail	1	30	20	Half-normal			0	1	Cue	10	0.17	0.11	0.33	1.02
	2	63	30	Half-normal			0	0		15	0.11	0.13	0.30	1.02
	Global	111	35	Half-normal			0	3	Cue, habitat	15	0.08	0.10	0.23	1.02
Feral pigeon	1	33	45	Half-normal			0	0		32	0.18	0.21	0.53	1.05
	2	40	60	Half-normal			0	0		30	0.16	0.16	0.50	1.05
	Global	114	120	Half-normal			0	0		65	0.08	0.09	0.29	1.11

Appendix 3 (continued).

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV	Correction factor
			Truncation	Key	Adjustment	NAP	NCP	Covariates					
Goldfinch	1	478	70	Half-normal	Cosine	1	9	Observer, habitat	33	0.04	0.87	0.09	1.05
	2	850	65	Hazard rate	Cosine	1	2	Habitat	32	0.03	1.66	0.07	1.05
	3	335	40	Hazard rate	Simple polynomial	1	4	Observer	20	0.04	1.64	0.10	1.03
	Global	1635	60	Hazard rate		0	17	Observer, cue	28	0.02	1.37	0.05	1.05
Greenfinch	1	410	75	Hazard rate	Cosine	1	7	Observer	35	0.04	0.70	0.16	1.06
	2	814	75	Half-normal	Simple polynomial	1	0	Cue	38	0.03	1.18	0.08	1.06
	3	71	65	Half-normal		0	3	Wind, habitat	31	0.10	0.14	0.18	1.05
	Global	1298	75	Half-normal	Hermite polynomial	2	0		32	0.04	0.86	0.08	1.05
Grey warbler	1	72	75	Half-normal		0	3	Cue, panel	35	0.11	0.09	0.21	1.06
	2	156	140	Half-normal	Cosine	1	1	Cue	56	0.06	0.08	0.12	1.09
	3	50	50	Hazard rate		0	0		27	0.17	0.09	0.22	1.04
	Global	302	140	Half-normal	Hermite polynomial	2	0		51	0.08	0.07	0.11	1.08
Harrier	1	61	200	Hazard rate		0	1	Wind	178	0.05	0.01	0.15	1.30
	2	96	200	Hazard rate		0	0		176	0.11	0.02	0.15	1.28
	3	32	105	Half-normal		0	0		71	0.17	0.02	0.24	1.12
	Global	196	200	Half-normal		0	2	Survey	155	0.04	0.02	0.08	1.25
House sparrow	1	338	145	Half-normal	Simple polynomial	1	8	Cue, observer	65	0.10	0.51	0.31	1.11
	2	729	95	Half-normal		0	2	Cue, wind	52	0.03	1.48	0.09	1.08
	3	299	95	Half-normal	Cosine	1	5	Observer, cue	33	0.05	1.08	0.11	1.06
	Global	1242	80	Half-normal	Simple polynomial	2	1	Cue	37	0.06	1.23	0.10	1.06
Magpie	1	460	260	Hazard rate	Simple polynomial	1	2	Cue, wind	134	0.03	0.21	0.11	1.22
	2	452	220	Hazard rate		0	1	Cue	122	0.03	0.26	0.09	1.19
	3	189	160	Hazard rate		0	7	Observer, panel	70	0.06	0.33	0.16	1.12
	Global	1061	200	Hazard rate		0	3	Survey, cue	107	0.02	0.26	0.06	1.17
Mallard	Global	69	150	Half-normal		0	1	Cue	87	0.08	0.07	0.41	1.14
Paradise shelduck	1	58	175	Half-normal		0	1	Wind	115	0.08	0.07	0.38	1.19
	2	95	150	Hazard rate		0	0		113	0.15	0.10	0.25	1.18
	3	80	140	Half-normal		0	0		89	0.11	0.19	0.26	1.15
	Global	218	130	Half-normal		0	0		98	0.07	0.11	0.17	1.16

Appendix 3 (continued).

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV	Correction factor
			Truncation	Key	Adjustment	NAP	NCP	Covariates					
Pied oystercatcher	1	84	170	Half-normal	Cosine	1	1	Wind	77	0.09	0.09	0.28	1.13
	2	60	175	Half-normal		0	0		91	0.11	0.04	0.24	1.14
	3	43	120	Hazard rate		0	1	Cue	82	0.09	0.05	0.18	1.14
	Global	186	160	Hazard rate		0	0		82	0.13	0.05	0.19	1.13
Redpoll	1	628	70	Half-normal		0	7	Observer, cue	33	0.03	1.34	0.13	1.06
	2	502	70	Half-normal	Cosine	1	1	Cue	30	0.03	1.67	0.09	1.05
	3	152	50	Hazard rate	Cosine	1	1	Cue	21	0.07	0.90	0.16	1.03
	Global	1151	48	Half-normal	Simple polynomial	2	17	Observer, habitat	22	0.04	1.59	0.08	1.04
Silvereye	1	63	23	Half-normal		0	1	Cue	10	0.10	0.37	0.22	1.02
	2	125	95	Half-normal	Cosine	1	2	Cue, wind	40	0.08	0.30	0.20	1.06
	3	26	20	Half-normal		0	0		11	0.17	0.30	0.44	1.02
	Global	175	37.5	Half-normal		0	3	Survey, cue	16	0.07	0.32	0.15	1.03
Skylark	1	1352	110	Half-normal	Cosine	2	8	Observer, cue	54	0.02	1.13	0.05	1.09
	2	1878	110	Half-normal	Simple polynomial	1	4	Observer, cue	60	0.02	1.20	0.04	1.10
	3	559	120	Hazard rate		0	5	Observer, cue	59	0.03	0.54	0.07	1.10
	Global	3774	110	Hazard rate		0	17	Observer, cue	58	0.01	0.98	0.03	1.09
Spur-winged plover	1	183	160	Half-normal	Simple polynomial	1	0		116	0.09	0.12	0.18	1.19
	2	157	180	Hazard rate		0	2	Wind, cue	110	0.05	0.15	0.22	1.18
	3	71	125	Hazard rate		0	1	Cue	87	0.07	0.15	0.22	1.15
	Global	417	175	Hazard rate		0	2	Survey	109	0.03	0.14	0.11	1.18
Starling	1	364	130	Half-normal		0	0		79	0.05	1.07	0.18	1.13
	2	333	130	Half-normal	Cosine	2	2	Wind, cue	55	0.04	1.30	0.14	1.09
	3	143	110	Half-normal		0	0		62	0.07	0.58	0.19	1.10
	Global	832	125	Half-normal	Cosine	1	1	Cue	61	0.02	0.98	0.09	1.10
Thrush	1	225	95	Hazard rate		0	2	Habitat	42	0.05	0.22	0.14	1.07
	2	274	110	Half-normal	Cosine	1	1	Cue	43	0.05	0.29	0.14	1.07
	3	230	33	Hazard rate		0	0		17	0.11	0.79	0.17	1.03
	Global	715	70	Half-normal	Cosine	1	1	Cue	29	0.03	0.40	0.08	1.05
Tomtit	Global	38	20	Half-normal		0	0		11	0.14	0.05	0.29	1.02

Appendix 3 (continued).

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV	Correction factor
			Truncation	Key	Adjustment	NAP	NCP	Covariates					
Tūī	Global	42	120	Half-normal		0	0		69	0.13	0.01	0.25	1.11
Welcome swallow	1	109	50	Hazard rate		0	0		31	0.14	0.22	0.25	1.05
	2	59	55	Half-normal		0	2	Wind, cue	35	0.10	0.09	0.26	1.06
	Global	193	48	Half-normal		0	5	Survey, panel	29	0.05	0.13	0.13	1.05
White-faced heron	Global	52	150	Half-normal		0	1	Wind	89	0.10	0.01	0.27	1.15
Yellowhammer	1	579	125	Half-normal	Cosine	1	1	Cue	54	0.03	0.42	0.07	1.09
	2	815	125	Half-normal	Simple polynomial	1	4	Observer, cue	75	0.03	0.32	0.06	1.12
	3	258	65	Hazard rate		0	4	Observer	28	0.06	0.75	0.13	1.05
	Global	1658	120	Half-normal	Simple polynomial	4	3	Survey, cue	50	0.34	0.47	0.35	1.08

Appendix 4. Birds detected in surveys in the sheep & beef sector (26 focal study sites); model specifications of the best-fit detection functions; estimates of effective survey widths (ESW, m), densities (per hectare) (and coefficients of variance, CV) and correction factors. Truncation = right truncation distance (m); Key = key function fitted; Adjustment = adjustment function fitted; NAP = number of adjustment parameters; NCP = number of covariate parameters. Note the density estimates have been adjusted using the specified correction factor.

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV	Correction factor	
			Truncation	Key	Adjustment	NAP	NCP	Covariates						
Bellbird	1	82	70	Half-normal			0	2	Wind, cue	34	0.11	0.13	0.19	1.06
	2	171	90	Hazard rate	Simple polynomial		1	1	Wind	36	0.11	0.17	0.17	1.06
	3	55	60	Half-normal	Cosine		1	1	Cue	21	0.11	0.13	0.25	1.04
	Global	299	70	Half-normal	Cosine		1	0		29	0.07	0.16	0.12	1.05
Black-backed gull	1	106	150	Half-normal			0	5	Observer, cue	83	0.09	0.1	0.22	1.14
	2	105	160	Half-normal			0	0		94	0.09	0.13	0.49	1.15
	3	81	175	Half-normal	Cosine		1	0		77	0.14	0.08	0.22	1.13
	Global	295	160	Half-normal	Cosine		1	1	Cue	79	0.04	0.12	0.26	1.13
Blackbird	1	287	70	Half-normal	Cosine		1	2	Habitat	30	0.05	0.57	0.12	1.05
	2	332	70	Half-normal	Cosine		1	5	Observer, habitat	33	0.04	0.58	0.12	1.05
	3	296	75	Half-normal	Cosine		1	4	Observer	30	0.05	0.58	0.11	1.05
	Global	842	80	Hazard rate			0	3	Observer	36	0.03	0.5	0.07	1.06
Chaffinch	1	178	60	Half-normal	Cosine		1	1	Wind	27	0.06	0.37	0.13	1.05
	2	428	110	Hazard rate			0	0		50	0.09	0.48	0.13	1.08
	3	266	75	Hazard rate			0	0		31	0.09	0.64	0.14	1.05
	Global	842	80	Hazard rate			0	3	Survey, cue	36	0.03	0.5	0.07	1.06
Duncock	1	44	30	Hazard rate			0	0		17	0.17	0.22	0.35	1.03
	2	60	40	Hazard rate			0	0		27	0.17	0.21	0.3	1.04
	Global	106	40	Hazard rate			0	0		22	0.14	0.16	0.25	1.04
Fantail	2	65	35	Half-normal			0	0		18	0.11	0.15	0.29	1.03
Feral pigeon	1	30	100	Half-normal			0	0		69	0.18	0.11	0.62	1.12
	Global	86	120	Half-normal			0	1	Wind	71	0.07	0.08	0.33	1.12
Goldfinch	1	350	70	Half-normal			0	9	Observer, habitat	35	0.05	0.81	0.1	1.06
	2	685	65	Hazard rate			0	3	Observer	34	0.03	1.67	0.08	1.05
	3	335	40	Hazard rate	Simple polynomial		1	4	Observer	20	0.04	1.64	0.1	1.03
	Global	1410	70	Hazard rate			0	16	Observer	29	0.02	1.47	0.05	1.05

Appendix 4 (continued).

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions					ESW	CV	Density	CV	Correction factor	
			Truncation	Key	Adjustment	NAP	NCP						Covariates
Greenfinch	1	308	100	Hazard rate		0	7	Observer	42	0.05	0.74	0.22	1.07
	2	593	60	Hazard rate		0	4	Observer, cue	28	0.04	1.48	0.1	1.05
	3	71	65	Half-normal		0	3	Wind, habitat	31	0.1	0.14	0.18	1.05
	Global	981	75	Hazard rate		0	3	Survey, cue	32	0.03	0.78	0.09	1.05
Grey warbler	1	62	75	Half-normal		0	3	Panel, cue	36	0.13	0.1	0.23	1.06
	2	114	70	Half-normal		0	3	Observer	38	0.07	0.11	0.14	1.06
	3	50	50	Hazard rate		0	0		27	0.17	0.09	0.22	1.04
	Global	279	140	Half-normal		0	0		68	0.05	0.06	0.1	1.11
Harrier	1	58	250	Half-normal		0	0		215	0.16	0.01	0.21	1.36
	2	74	200	Half-normal		0	0		156	0.12	0.02	0.17	1.25
	3	32	105	Half-normal		0	0		71	0.17	0.02	0.24	1.12
	Global	165	200	Hazard rate		0	0		135	0.18	0.02	0.2	1.22
House sparrow	1	247	145	Half-normal	Simple polynomial	1	3	Habitat, cue	69	0.07	0.54	0.37	1.12
	2	548	80	Half-normal	Simple polynomial	2	2	Wind, cue	39	0.07	1.81	0.13	1.06
	3	299	95	Half-normal	Cosine	1	5	Observer, cue	33	0.05	1.08	0.11	1.06
	Global	1029	80	Half-normal	Simple polynomial	2	1	Cue	36	0.07	1.24	0.12	1.06
Magpie	1	318	250	Half-normal	Cosine	2	0		123	0.11	0.23	0.17	1.21
	2	364	200	Half-normal		0	1	Cue	116	0.04	0.29	0.1	1.18
	3	189	160	Hazard rate		0	7	Observer, panel	70	0.06	0.33	0.16	1.12
	Global	856	200	Hazard rate		0	1	Cue	106	0.02	0.27	0.07	1.17
Paradise shelduck	1	42	130	Half-normal		0	0		87	0.16	0.07	0.41	1.15
	2	78	140	Half-normal		0	1	Cue	125	0.05	0.11	0.22	1.20
	3	80	140	Half-normal		0	0		89	0.11	0.19	0.26	1.15
	Global	209	150	Half-normal		0	3	Panel	103	0.04	0.13	0.16	1.17
Pied oystercatcher	1	45	90	Hazard rate		0	0		61	0.35	0.08	0.58	1.10
	2	37	100	Half-normal		0	1	Wind	58	0.13	0.05	0.29	1.09
	3	43	120	Hazard rate		0	1	Cue	82	0.09	0.05	0.18	1.14
	Global	145	160	Hazard rate		0	2	Habitat, cue	84	0.1	0.06	0.21	1.14

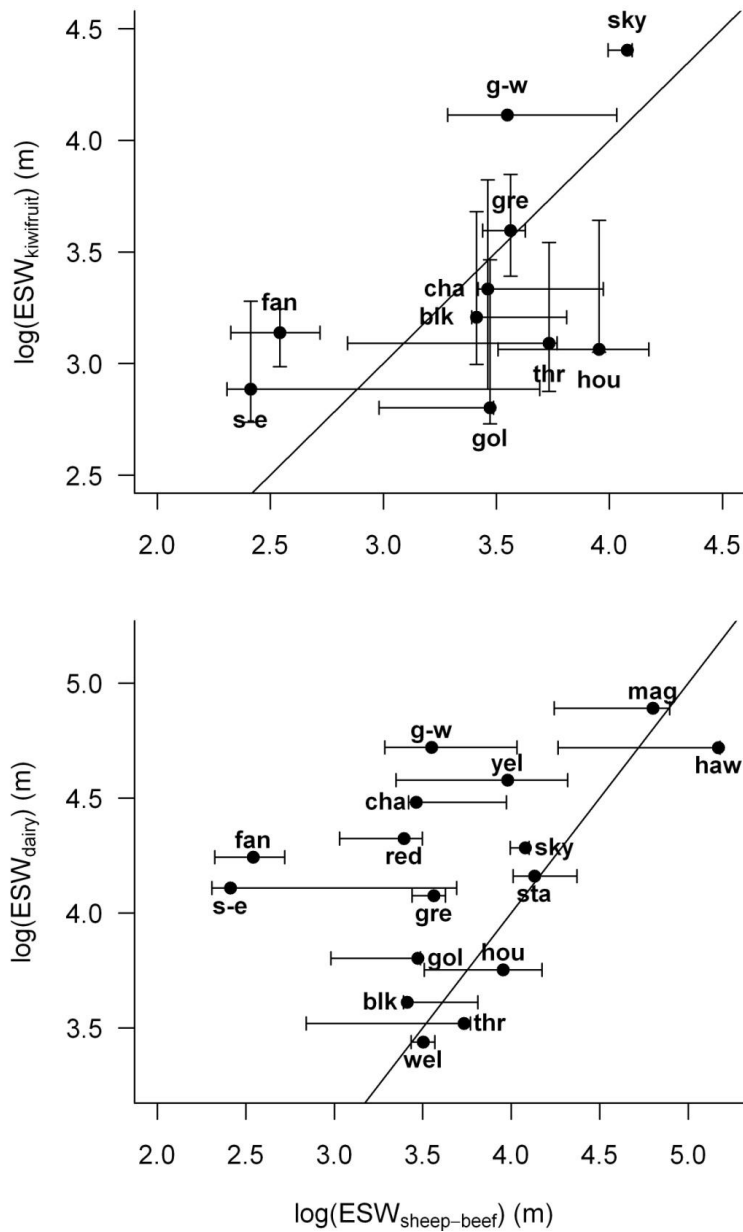
Appendix 4 (continued).

Species	Survey	Detections (<i>n</i>)	Model best-fit detection functions						ESW	CV	Density	CV	Correction factor
			Truncation	Key	Adjustment	NAP	NCP	Covariates					
Redpoll	1	510	80	Half-normal	Cosine	1	5	Panel, habitat	28	0.04	1.61	0.16	1.05
	2	480	100	Half-normal	Cosine	1	4	Observer, cue	36	0.04	1.82	0.09	1.06
	3	152	50	Hazard rate	Cosine	1	1	Cue	21	0.07	0.9	0.16	1.03
Silvereye	Global	977	48	Half-normal	Simple polynomial	2	4	Habitat, survey	22	0.05	1.8	0.09	1.04
	1	52	18	Half-normal		0	2	Habitat	8	0.12	0.51	0.24	1.01
	2	109	95	Half-normal	Cosine	1	1	Cue	38	0.08	0.35	0.21	1.06
	3	26	20	Half-normal		0	0		11	0.17	0.3	0.44	1.02
Skylark	Global	159	37.5	Half-normal		0	12	Observer, cue	14	0.09	0.42	0.17	1.02
	1	830	125	Hazard rate	Cosine	1	8	Cue	55	0.03	0.97	0.07	1.09
	2	1401	110	Half-normal	Cosine	1	2	Cue, wind	62	0.02	1.05	0.05	1.10
	3	559	120	Hazard rate		0	5	Observer, cue	59	0.03	0.54	0.07	1.10
Spur-winged plover	Global	2751	110	Hazard rate	Simple polynomial	1	17	Observer, cue	58	0.02	0.87	0.04	1.09
	1	121	125	Half-normal		0	0		102	0.09	0.12	0.21	1.17
	2	113	125	Hazard rate		0	1	Wind	101	0.05	0.14	0.22	1.16
	3	71	125	Hazard rate		0	1	Cue	87	0.07	0.15	0.22	1.15
Starling	Global	334	175	Half-normal		0	2	Survey	100	0.04	0.15	0.13	1.16
	1	224	110	Hazard rate		0	0		72	0.15	1.2	0.26	1.12
	2	247	110	Half-normal		0	3	Observer	65	0.04	1.06	0.14	1.10
	3	143	110	Half-normal		0	0		62	0.07	0.58	0.19	1.10
Thrush	Global	637	125	Half-normal	Simple polynomial	2	0		58	0.05	1.01	0.11	1.10
	1	173	75	Hazard rate		0	2	Habitat	37	0.06	0.28	0.16	1.06
	2	230	100	Half-normal	Cosine	1	1	Cue	42	0.05	0.33	0.15	1.07
	3	230	33	Hazard rate		0	0		17	0.11	0.79	0.17	1.03
Welcome swallow	Global	649	70	Half-normal	Hermite polynomial	2	0		30	0.05	0.43	0.09	1.05
	1	104	50	Half-normal		0	0		33	0.09	0.27	0.23	1.06
	2	56	50	Half-normal		0	0		37	0.14	0.09	0.3	1.06
	Global	186	50	Half-normal		0	2	Survey	30	0.05	0.16	0.15	1.05
White-faced heron	Global	42	150	Hazard rate		0	0		107	0.15	0.01	0.32	1.17
Yellowhammer	1	417	120	Half-normal	Cosine	1	1	Cue	53	0.04	0.42	0.08	1.09
	2	729	150	Half-normal		0	3	Habitat, cue	73	0.03	0.37	0.06	1.12
	3	258	65	Hazard rate		0	4	Observer	28	0.06	0.75	0.13	1.05
	Global	1356	110	Hazard rate	Simple polynomial	1	3	Habitat, cue	40	0.03	0.56	0.05	1.07

Appendix 5. Model comparison to identify the ‘best-fit’ models that predict variation in effective survey widths and density CV estimates among species, surveys and sectors. The model-fit candidate model included measures of model complexity (i.e. the total number of key function, adjustment terms and covariates included in the best-fit detection-function models, see Appendices 1–3) and the number of detections recorded. The conspicuousness model included the following variables (see Methods for detailed descriptions): body mass, flocking behaviour (two-level factor: solitary/pair and group/flock/colony), sector, and conservation status (two-level factor: native and introduced). Parameter estimates from the best-fit model (highlighted in bold) are presented in Fig. 5. k = degrees of freedom; CV = coefficient of variance; AICc = corrected Akaike Information Criterion.

Candidate model	k	Effective survey width			Density CV		
		AICc	Δ AICc	Weights	AICc	Δ AICc	Weights
Null	3	1136.8	45.3	0	-242.7	65.9	0
Model-fit	5	1137.9	46.4	0	-307	1.6	0.31
Conspicuousness	8	1099.4	7.9	0.019	-246.7	61.9	0
Model-fit + conspicuousness	10	1091.5	0	0.981	-308.6	0	0.69

Appendix 6. Comparison of median effective survey widths (ESW) (m) (bars = minimum-maximum range) for each species on dairy and kiwifruit farms relative to sheep & beef farms. The line indicates unity where the effective survey widths were comparable among sectors. Species three-letter codes are as follows: blk = blackbird, cha = chaffinch, fan = fantail, g-w = grey warbler, gol = goldfinch, gre = greenfinch, haw = harrier, mag = magpie, sky = skylark, s-e = silvereve, sta = starling, thr = thrush, yel = yellowhammer.



Appendix 7A. Density and effective survey widths (ESW) (means and coefficients of variance, CV) for bird species in New Zealand agricultural sectors extracted by model-averaging the estimates from the subset of best-fit models, the overall best-fit model, and the base model.

A. Bird species ($n = 6$) in the sheep & beef sector

Species	Variable	Statistic	Global			Survey 1			Survey 2			Survey 3		
			Averaged	Best-fit	Base	Averaged	Best-fit	Base	Averaged	Best-fit	Base	Averaged	Best-fit	Base
Blackbird	Density	Mean	0.53	0.53	0.42	0.47	0.47	0.47	0.46	0.46	0.44	0.65	0.65	0.46
		CV	0.08	0.08	0.06	0.11	0.11	0.11	0.12	0.12	0.11	0.13	0.13	0.11
	ESW	Mean	34	34	43	30	30	30	45	45	47	30	30	42
CV		0.06	0.06	0.03	0.04	0.05	0.05	0.07	0.07	0.04	0.05	0.05	0.05	
Magpie	Density	Mean	0.25	0.25	0.25	0.20	0.20	0.21	0.26	0.26	0.26	0.34	0.34	0.32
		CV	0.06	0.06	0.07	0.07	0.08	0.1	0.07	0.08	0.09	0.16	0.16	0.18
	ESW	Mean	107	107	111	135	134	130	122	122	129	69	70	67
CV		0.02	0.02	0.04	0.04	0.03	0.07	0.04	0.03	0.05	0.07	0.06	0.13	
Skylark	Density	Mean	0.96	0.96	0.93	1.13	1.13	0.98	1.17	1.18	1.09	0.57	0.57	0.53
		CV	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.07	0.06	0.08
	ESW	Mean	58	58	62	54	54	63	61	60	66	59	59	61
CV		0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.03	0.06
Goldfinch	Density	Mean	1.40	1.36	1.18	0.95	0.95	0.79	1.69	1.70	1.63	1.79	1.79	1.98
		CV	0.06	0.05	0.05	0.09	0.08	0.08	0.07	0.07	0.09	0.11	0.11	0.14
	ESW	Mean	29	28	34	33	33	39	32	32	34	20	20	19
CV		0.03	0.02	0.02	0.04	0.04	0.04	0.03	0.03	0.06	0.05	0.04	0.10	
Grey warbler	Density	Mean	0.08	0.08	0.06	0.10	0.10	0.09	0.08	0.08	0.06	0.09	0.09	0.09
		CV	0.11	0.11	0.09	0.22	0.22	0.21	0.12	0.12	0.13	0.21	0.23	0.23
	ESW	Mean	51	51	67	36	35	41	56	56	71	27	27	27
CV		0.08	0.08	0.05	0.11	0.11	0.10	0.06	0.06	0.06	0.14	0.17	0.17	
Fantail	Density	Mean	0.09	0.10	0.09	0.11	0.11	0.09	0.13	0.13	0.13			
		CV	0.24	0.23	0.34	0.34	0.34	0.33	0.28	0.29	0.29			
	ESW	Mean	15	15	16	10	10	12	15	15	15			
CV		0.08	0.08	0.08	0.17	0.17	0.17	0.10	0.11	0.11				

B. Bird species ($n = 5$) in the kiwifruit sector

Species	Variable	Statistic	Global			Survey 1			Survey 2			Survey 3		
			Averaged	Best-fit	Base	Averaged	Best-fit	Base	Averaged	Best-fit	Base	Averaged	Best-fit	Base
Blackbird	Density	Mean	5.95	5.95	5.84	6.6	6.6	6.6	4.77	4.77	4.13	8.04	8.04	6.57
		CV	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	ESW	Mean	32	32	33	40	40	40	26	26	30	20	20	25
CV		0.01	0.01	0.01	0.02	0.02	0.02	0.04	0.04	0.04	0.03	0.03	0.03	
Skylark	Density	Mean	0.02	0.02	0.02	0.04	0.04	0.04						
		CV	0.2	0.22	0.22	0.21	0.24	0.24						
	ESW	Mean	82	83	83	80	82	82						
CV		0.12	0.15	0.15	0.12	0.17	0.17							
Goldfinch	Density	Mean	2.15	2.15	2.20	2.07	2.07	1.89	4.02	4.02	3.16	3.13	3.22	2.78
		CV	0.05	0.05	0.05	0.08	0.08	0.08	0.11	0.11	0.08	0.12	0.11	0.09
	ESW	Mean	28	28	28	32	32	35	16	16	20	63	15	18
CV		0.03	0.03	0.03	0.04	0.04	0.04	0.09	0.09	0.06	0.07	0.07	0.07	
Grey warbler	Density	Mean	0.09	0.09	0.08	0.11	0.11	0.10						
		CV	0.13	0.13	0.13	0.16	0.15	0.17						
	ESW	Mean	51	51	57	62	61	62						
CV		0.09	0.08	0.08	0.09	0.08	0.11							
Fantail	Density	Mean	0.41	0.41	0.35	0.77	0.77	0.73	0.60	0.60	0.46	0.17	0.17	0.17
		CV	0.08	0.08	0.08	0.19	0.19	0.18	0.15	0.15	0.19	0.26	0.26	0.26
	ESW	Mean	30	30	36	22	22	23	22	22	32	20	20	20
		CV	0.05	0.05	0.04	0.17	0.17	0.16	0.10	0.10	0.07	0.15	0.15	0.15

Appendix 7B. Composition and weight of covariates in the subset of best-fit models used for model-averaging relative to those present in the overall best-fit model

A. Six species in the sheep & beef sector

Species	Covariates	Global		Survey 1		Survey 2		Survey 3	
		Averaged	Best-fit	Averaged	Best-fit	Averaged	Best-fit	Averaged	Best-fit
Blackbird	Observer	1	1					0.89	1
	None			0.35	1			0.11	
	Seen/heard			0.28					
	Panel			0.14		1	1	0.14	
	Wind			0.15				0.19	
	Habitat			0.08				0.12	
Fantail	Seen/heard	1		1	1	0.27			
	Habitat	0.49							
	Survey	0.25							
	Wind	0.07				0.28			
	Habitat + seen/heard		1						
	None					0.32	1		
Goldfinch	Panel					0.13			
	Observer	1		1				0.47	1
	Panel	0.1		0.1		0.29		0.28	
	Seen/heard	0.38						0.25	
	Wind	0.23							
	Observer + seen/heard		1						
	Habitat			0.63		1	1	0.06	
Grey warbler	Observer + habitat				1			0.19	
	None							0.68	1
	Panel			0.59	1				
	Seen/heard			1		1	1		
	Wind			0.12		0.23		0.32	
	Habitat					0.26			
Magpie	Survey + seen/heard	1	1						
	Seen/heard			0.57		1	1	0.08	
	Wind			0.48				0.16	
	Habitat			0.09		0.31			
	Observer			0.08				1	
	None			0.07					
	Wind + seen/heard				1				
Skylark	Panel							0.56	
	Observer + panel								1
	Observer + seen/heard	1	1	1	1		1		1
	Seen/heard					1		0.73	
	Observer					0.83		1	
	Panel							0.27	

B. Five species in the kiwifruit sector

Species	Covariates	Global		Survey 1		Survey 2		Survey 3	
		Averaged	Best-fit	Averaged	Best-fit	Averaged	Best-fit	Averaged	Best-fit
Blackbird	Survey + seen/heard	1	1						
	None			1	1				
	Seen/heard					1			
	Wind					0.56			
	Wind + seen/heard						1		
Fantail	Observer + seen/heard							1	1
	Seen/heard	1	1			1	1		
Goldfinch	None			1	1			1	1
	Survey + seen/heard	1	1						
Grey warbler	Observer + seen/heard			1	1				
	None					1	1	0.73	1
	Observer							0.27	
Skylark	Seen/heard	1	1						
	Survey	0.32							
	Wind	0.2		0.52	1				
Skylark	None			0.48					
	None	0.58	1	0.41	1				
	Survey	0.08							
	Wind	0.34		0.25					
	Observer			0.34					