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Supplementary material

Supporting Information

Appendix 1. Analyses of small-scale spatial autocorrelation in nest predation and failure data in Australian songbirds.

Appendix 2. Analyses of daily predation and failure rates in Australian songbirds according to information-theoretic approaches.

Table S3a. Sensitivity of our models to the inclusion of Region (south west, south east, tropical north).

Table S3b. Tests of interactions between Region (south west, south east, tropical north) and Latitude or Year to test homogeneity of latitudinal and time effects across the three geographic regions.

Figure S1. Geographical distribution of individual population estimates of nest predation (n = 138).

Figure S2. Distribution of studies across years when they were published (n = 111).

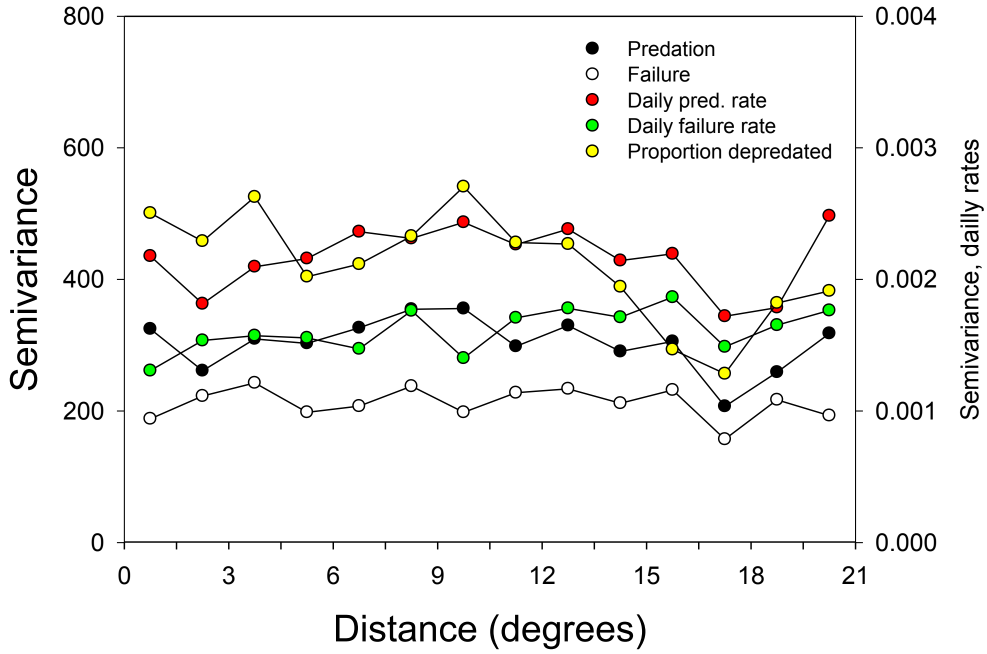
Appendix 1

<u>Analyses of spatial autocorrelation in nest predation and failure data in Australian songbirds</u>

1) Semivariograms

We calculated empirical semivariograms using function *variogram* in *gstat* package of *R* language. We used residuals from the statistical models presented in the main text. We divided the data into lag classes so that pair number in individual lag classes exceeded 100. We calculated semivariograms for 1/2 of the longest spatial extent of data, which led to lag classes measuring 1.5 degrees of geographical coordinates. This translates into ca. 166 km in latitude and from ca. 163 km (at 12°S) to ca. 128 km (at 40°S) in longitude.

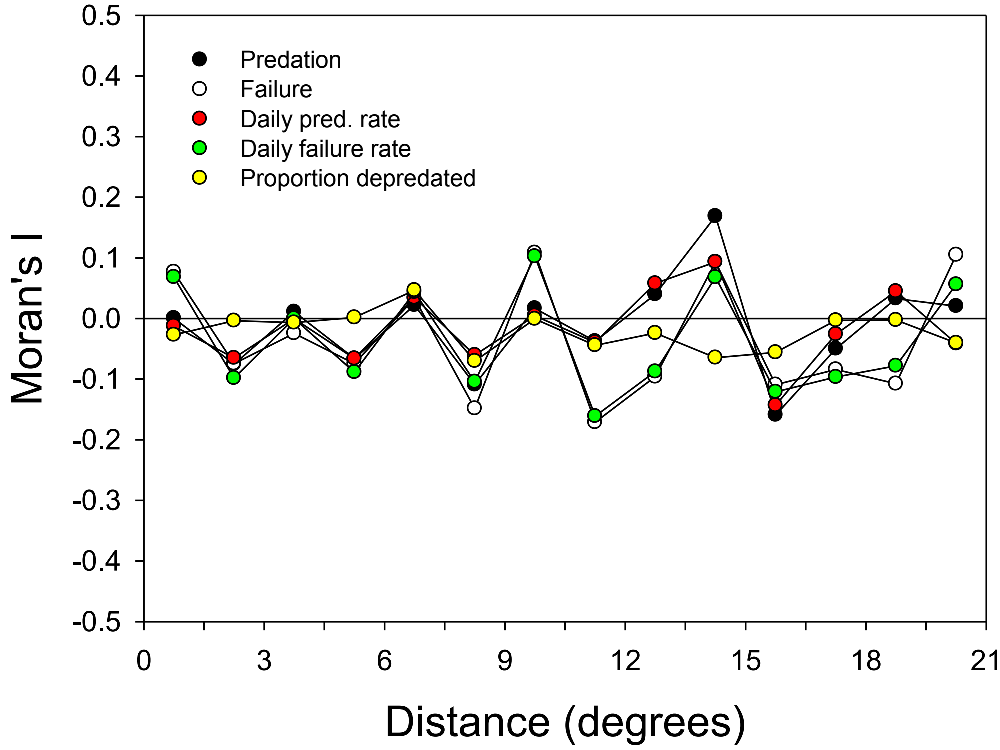
Flat shape of semivariograms indicated that there was virtually no small-scale autocorrelation in residuals (e.g. Fortin, MJ, Dale, M. 2005. Spatial analysis. A guide for ecologists. Cambridge University Press, Cambridge).



2) Spatial correlograms based on Moran's I

We calculated spatial correlograms for the same data and lag classes as above. We used function *correlog* in *ncf* package of *R* language.

Flat shape of the spatial correlograms also confirmed that small-scale autocorrelation in the residuals was absent (e.g. Fortin, MJ, Dale, M. 2005. Spatial analysis. A guide for ecologists. Cambridge University Press, Cambridge).



Appendix 2

Analyses of daily predation and failure rates according to information-theoretic approaches

We built a candidate set of models by grouping our predictors into categories to keep the number of candidate models reasonably low. The categories were as follows:

1. **GEOGRAPHY** = Latitude+Longitude
2. **ALLOMETRY** = LogBody
3. **NEST ATTRIBUTES** = LogNestHeight+NestType
4. **SOCIALITY** = SocialOrganization
5. **TIME** = Year

We chose GEOGRAPHY to be represented by Latitude and Longitude instead of categorical Region (south-west, south-east, tropical north). We did not repeat all the analyses with GEOGRAPHY represented by Region to avoid fitting an overall high number of models.

We fitted all possible models in Proc Mixed (using maximum likelihood) by combining predictors 1 to 5, which led to 31 candidate models. These models were fitted with random effects of Genus and Species, but without Family and Study site, because the latter proved to be insignificant (see Methods of the main text). We calculated AIC_c with second-order bias correction according to Anderson (2007, Model Based Inference in the Life Sciences, Springer: p. 60) as follows:

$$AIC_c = -2\log(L) + 2k\,[(n / (n-k-1)],$$

where L is the likelihood of the model, n is sample size (n = 128 for DPR, n = 122 for DFR), and k is the number of parameters (number of covariance parameters + number of fixed effects including the intercept). We ranked the models according to AICc and calculated the distances of all models from the model with the lowest AIC_c (Δ_i) and Akaike weights (w_i).

Table A1. Results of information-theoretic analyses for DSR. Models with the highest support ($w_i > 0.01$) are highlighted in bold.

Model	k	log (L)	AIC_c	Δ_i	w_i
1+2	**7**	**187.1**	**-359.17**	**0.00**	**0.778**
2	**5**	**183.4**	**-356.21**	**2.96**	**0.177**
2+5	**6**	**182.4**	**-352.01**	**7.16**	**0.022**
1	**6**	**181.8**	**-350.81**	**8.36**	**0.012**
5	5	180.0	-349.51	9.66	0.006
1+2+5	8	182.8	-348.29	10.88	0.003
1+2+3	9	181.3	-343.07	16.09	0.000
1+2+4	9	180.9	-342.27	16.89	0.000
2+4	7	178.6	-342.27	16.90	0.000
4	6	177.4	-342.01	17.16	0.000
2+3	7	178.4	-341.87	17.30	0.000

1+5	7	178.3	-341.57	17.60	0.000
4+5	7	176.8	-338.67	20.50	0.000
2+4+5	8	177.9	-338.49	20.68	0.000
2+3+5	8	177.6	-337.99	21.18	0.000
1+3+5	9	178.6	-337.67	21.49	0.000
1+4	8	177.4	-337.59	21.58	0.000
3	6	174.8	-336.91	22.26	0.000
1+3	8	176.8	-336.39	22.78	0.000
3+5	7	174.2	-333.37	25.80	0.000
1+2+3+5	10	177.0	-332.12	27.05	0.000
1+2+4+5	10	176.8	-331.62	27.55	0.000
1+4+5	9	174.0	-328.37	30.79	0.000
2+3+4	9	173.3	-327.07	32.09	0.000
1+2+3+4	11	175.2	-326.12	33.04	0.000
3+4	8	171.6	-325.99	33.18	0.000
1+3+4	10	173.1	-324.22	34.95	0.000
2+3+4+5	10	172.6	-323.32	35.85	0.000
3+4+5	9	170.9	-322.17	36.99	0.000
1+2+3+4+5	12	171.0	-315.29	43.88	0.000
1+3+4+5	11	169.3	-314.22	44.94	0.000

Table A1. Results of information-theoretic analyses for DFR. Models with the highest support ($w_i > 0.01$) are highlighted in bold.

Model	k	log (*L*)	AIC_c	Δ_i	w_i
1+2	**7**	**193.9**	**-372.82**	**0.00**	**0.913**
2	**5**	**189.3**	**-367.98**	**4.83**	**0.081**
1+2+3	9	190.0	-360.39	12.42	0.002
2+5	6	186.5	-360.27	12.55	0.002
1+2+5	8	188.1	-358.93	13.89	0.001
2+3	7	185.9	-356.82	16.00	0.000
1+2+4	9	188.0	-356.29	16.52	0.000
2+4	7	185.0	-354.92	17.90	0.000
1	6	182.8	-352.77	20.05	0.000
2+3+5	8	183.5	-349.73	23.09	0.000
5	5	179.9	-349.28	23.53	0.000
2+4+5	8	182.8	-348.23	24.59	0.000
1+2+3+5	10	184.3	-346.62	26.20	0.000
2+3+4	9	181.9	-344.09	28.72	0.000
1+2+3+4	11	184.2	-344.00	28.82	0.000
4	6	178.2	-343.67	29.15	0.000
1+2+4+5	10	182.3	-342.52	30.30	0.000
3	6	177.3	-341.87	30.95	0.000
1+5	7	177.7	-340.42	32.40	0.000
1+3	8	178.6	-339.93	32.89	0.000
1+4	8	177.8	-338.23	34.59	0.000
2+3+4+5	10	179.7	-337.42	35.40	0.000
4+5	7	175.8	-336.52	36.30	0.000
3+5	7	174.8	-334.62	38.20	0.000
1+2+3+4+5	12	178.5	-330.14	42.68	0.000
3+4	8	173.0	-328.63	44.19	0.000
1+3+5	9	173.6	-327.49	45.32	0.000
1+3+4	10	174.4	-326.82	46.00	0.000
1+4+5	9	172.8	-325.89	46.92	0.000
3+4+5	9	170.6	-321.49	51.32	0.000
1+3+4+5	11	169.2	-313.90	58.92	0.000

Supplementary Tables

Table S3a. Sensitivity of models to the inclusion of Region (south-west, south-east, and tropical north). Both analyses were controlled for adult body mass, nest height, nest type, and social organization as fixed effects and for family, genus, and species as random effects. Only results for latitude, longitude and year are given, as these were most likely to be affected by the inclusion of the region; however, results for the other variables remained also qualitatively unchanged.

RESPONSE	Daily predation rate [Sqrt]			Daily failure rate [Sqrt]		
PREDICTOR	DF	F	p	DF	F	p
Latitude	1, 101.0	6.7	**0.011**	1, 104.0	11.4	**0.001**
Longitude	1, 111.0	1.3	0.249	1, 108.0	0.4	0.506
Year	1, 92.6	5.2	**0.025**	1, 92.0	3.0	**0.088**
Region	2, 108.0	1.0	0.364	2, 106.0	2.2	0.122
n	126			120		

Table S3b. Tests of interactions between Region (south-west, south-east, and tropical north) and Latitude or Year to test homogeneity of latitudinal and time effects across the three broad regions. All interactions were tested in full models, i.e. including all other factors.

RESPONSE	Daily predation rate [Sqrt]			Daily failure rate [Sqrt]		
PREDICTOR	DF	F	p	DF	F	p
Region * Latitude	2, 109.0	0.2	0.820	2, 105.0	1.8	0.168
Region * Year	2, 98.7	0.2	0.790	2, 96.3	0.2	0.863
n	126			120		

Figure S1 Geographical distribution of individual population estimates of nest predation (n = 138). Overlapping points were offset to make them visible, so the geographic position is only approximate.

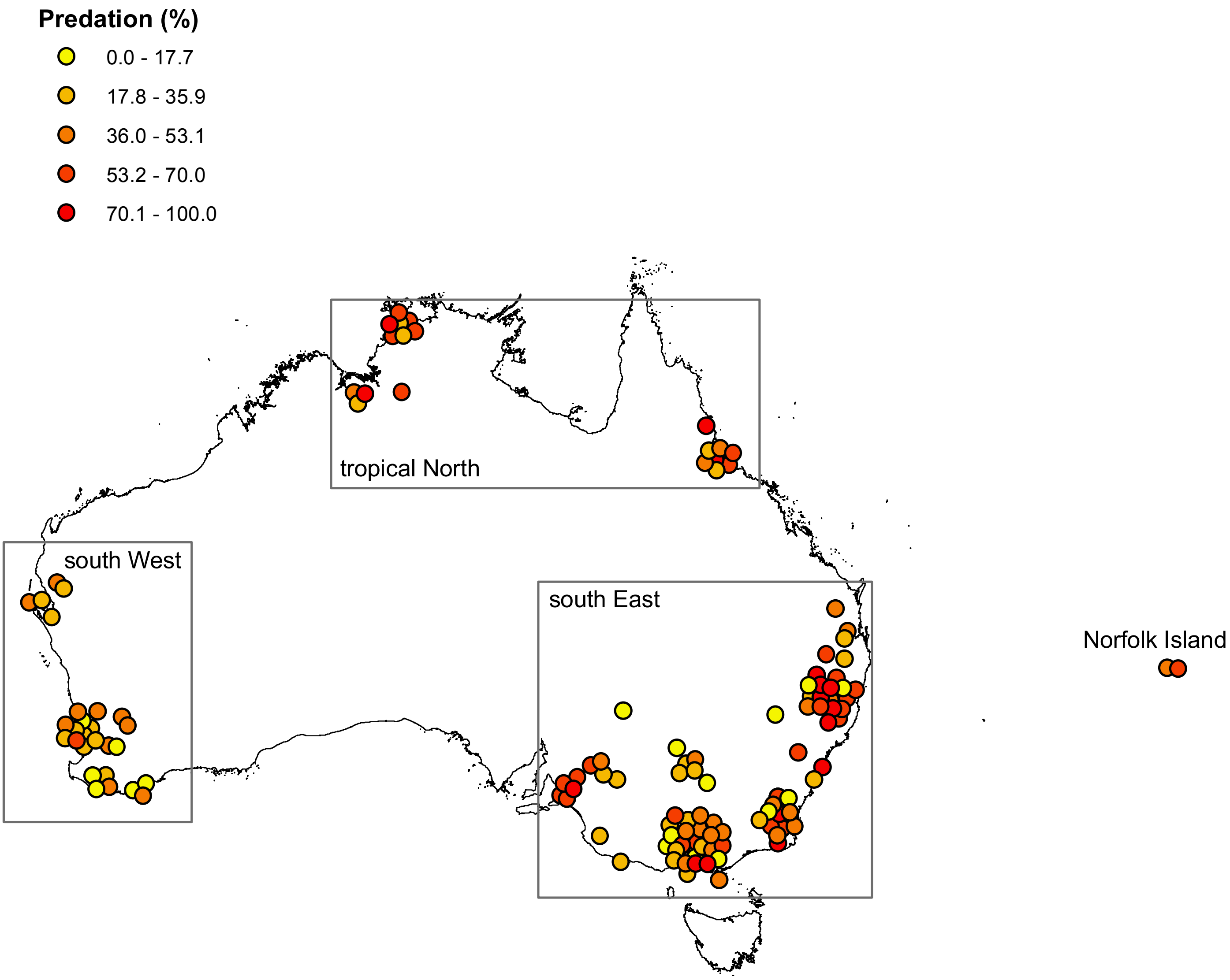


Figure S2 Distribution of studies across years when they were published (n = 111).