

1 **SUPPLEMENTARY ONLINE MATERIALS**

2 Supplementary material to manuscript: Heldbjerg et al. (2023) The lure of the big city:
 3 smaller Danish rookeries are increasingly associated with urban land cover

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5 **Table S1** Classification of all existing thematic geographic information into main land use cover in A:
 6 2019 and B: 1990, respectively. (Separate file).

7 **Table S2** Result table for generalised linear mixed models fitted to rookery data showing the relationship
 8 between the arcsine square root transformed proportions of land cover around rookeries and distance
 9 class, year and colony size. Data for other land cover types are provided in Supplementary Material Table
 10 S3.

Land cover type	Explanatory variable	Estimate ± Std.Err	t-value (df)	Pr(> t)
Forest	(Intercept)	0.269 ± 0.018	15240 (425.0)	<0.001
	Distance	0.00001 ± 0.000007	2128 (460.4)	0.03
	Year2021	-0.013 ± 0.017	-0.759 (369.6)	0.45
	Pairs	0.0001 ± 0.00007	1518 (245.2)	0.13
Grass	(Intercept)	0.098 ± 0.011	9015 (418.4)	<0.001
	Distance	0.000009 ± 0.000004	2294 (461.8)	0.02
	Year2021	0.158 ± 0.011	14959 (403.2)	<0.001
	Pairs	-0.00002 ± 0.00005	-0.556 (252.0)	0.58
Other	(Intercept)	0.134 ± 0.016	8305 (412.0)	<0.001
	Distance	0.00004 ± 0.000005	8717 (461.0)	<0.001
	Year2021	0.035 ± 0.015	2234 (523.5)	0.03
	Pairs	-0.00006 ± 0.00007	-0.886 (274.6)	0.38

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13 **Table S3** Tabulation of analysis of variance, showing details of the statistical comparisons between arc
 14 sine square root transformed mean percentage extent of each land use cover type within an area 500 m,
 15 1000 m and 2000 m out from all rook colonies compared to those within the same distance out from random
 16 points as summarized in Table 3.

Year	Distance comparison	Land use cover type	Parameter	DF	SumSq	MeanSq	F-value	Pr(>F)
1991	rookery500m v random500m	Agriculture	Distance	1	8.94	8.939	60.98	<0.001***
			Residuals	593	86.93	0.147		
1991	rookery500m v random500m	Forest	Distance	1	0.00	0.00097	0.008	0.928 ^{ns}
			Residuals	593	71.25	0.12016		
1991	rookery500m v random500m	Grass	Distance	1	0.016	0.01634	1.187	0.276 ^{ns}
			Residuals	593	8165	0.01377		
1991	rookery500m v random500m	Urban	Distance	1	8.31	8.307	109.2	<0.001***
			Residuals	593	45.12	0.076		
1991	rookery500m v random500m	Other	Distance	1	0.329	0.3286	15.27	<0.001***
			Residuals	593	12.760	0.0215		
1991	rookery1000m v random1000m	Agriculture	Distance	1	4.26	4.256	42.98	<0.001***
			Residuals	593	58.72	0.099		
1991	rookery1000m v random1000m	Forest	Distance	1	0.08	0.07540	1.031	0.31 ^{ns}
			Residuals	593	43.36	0.07312		
1991	rookery1000m v random1000m	Grass	Distance	1	0.009	0.009314	1.075	0.3 ^{ns}
			Residuals	593	5.139	0.008665		
1991	rookery1000m v random1000m	Urban	Distance	1	4.727	4.727	99.35	<0.001***
			Residuals	593	28.215	0.048		
1991	rookery1000m v random1000m	Other	Distance	1	0.584	0.5844	34.47	<0.001***
			Residuals	593	10.053	0.0170		
1991	rookery2000m v random2000m	Agriculture	Distance	1	2.00	20.023	31.6	<0.001***
			Residuals	593	37.58	0.0634		
1991	rookery2000m v random2000m	Forest	Distance	1	0.206	0.20631	4.867	0.0278*
			Residuals	593	25.138	0.04239		
1991	rookery2000m v random2000m	Grass	Distance	1	0.0069	0.006941	1.618	0.204 ^{ns}
			Residuals	593	25.440	0.004290		
1991	rookery2000m v random2000m	Urban	Distance	1	2.621	26.211	92.28	<0.001***
			Residuals	593	16.844	0.0284		
1991	rookery2000m v random2000m	Other	Distance	1	0.525	0.5250	39.27	<0.001***
			Residuals	593	7.928	0.0134		
2021	rookery500m v random500m	Agriculture	Distance	1	19.02	19.022	154	<0.001***
			Residuals	631	77.96	0.124		
2021	rookery500m v random500m	Forest	Distance	1	0.35	0.3532	4.595	0.0324*
			Residuals	631	48.51	0.0769		

2021	rookery500m v random500m	Grass	Distance	1	1.70	17.003	72.31	<0.001***
			Residuals	631	14.84	0.0235		
2021	rookery500m v random500m	Urban	Distance	1	20.50	20.499	358.1	<0.001***
			Residuals	631	36.12	0.057		
2021	rookery500m v random500m	Other	Distance	1	0.004	0.004316	0.159	0.691 ^{ns}
			Residuals	631	17.171	0.027213		
2021	rookery1000m v random1000m	Agriculture	Distance	1	11.26	11.264	131.3	<0.001***
			Residuals	631	54.13	0.086		
2021	rookery1000m v random1000m	Forest	Distance	1	0.81	0.8099	16.83	<0.001***
			Residuals	631	30.36	0.0481		
2021	rookery1000m v random1000m	Grass	Distance	1	1.116	1.116	79.94	<0.001***
			Residuals	631	8.811	0.014		
2021	rookery1000m v random1000m	Urban	Distance	1	13.99	13.991	375.4	<0.001***
			Residuals	631	23.52	0.037		
2021	rookery1000m v random1000m	Other	Distance	1	0.0	0.000125	0.006	0.94 ^{ns}
			Residuals	631	13.9	0.022036		
2021	rookery2000m v random2000m	Agriculture	Distance	1	5.78	5.779	97.1	<0.001***
			Residuals	631	37.55	0.060		
2021	rookery2000m v random2000m	Forest	Distance	1	0.499	0.4987	16.65	<0.001***
			Residuals	631	18.902	0.0300		
2021	rookery2000m v random2000m	Grass	Distance	1	0.569	0.5691	82.66	<0.001***
			Residuals	631	4.344	0.0069		
2021	rookery2000m v random2000m	Urban	Distance	1	8.136	8.136	330.7	<0.001***
			Residuals	631	15.524	0.025		
2021	rookery2000m v random2000m	Other	Distance	1	0.009	0.00883	0.458	0.499 ^{ns}
			Residuals	631	12.153	0.01926		

18 **Table S4** Table showing the mean percentage areas (and 95% confidence intervals) of the five land cover types
 19 within 500 m of east Jutland rookeries in 1991 and 2021. Lower table shows results of χ^2 tests for significance
 20 differences in land use cover areas between the two years. Comparison of Grass was not possible because of
 21 different methods of classifying that land use cover between the two years. The direction of difference relative to
 22 1991 land cover areas are show with level of significance, *** indicates $P < 0.001$, * $P < 0.05$, ns $P > 0.05$ for one
 23 degree of freedom in all cases.

	Agriculture	Forest	Grass	Urban	Other
Rookery size class	1991 Means				
1-25 (n=29)	43.0 ± 11.3	8.6 ± 4.7	2.1 ± 1.7	40.2 ± 10.5	6.1 ± 3.6
26-50 (n=10)	35.7 ± 25.1	19.7 ± 19.8	2.7 ± 3.1	38.0 ± 20.8	3.9 ± 5.2
51-100 (n=20)	40.9 ± 16.8	11.5 ± 7.6	1.0 ± 0.8	42.5 ± 14.4	4.0 ± 4.0
>100 (n=36)	47.2 ± 11.8	17.3 ± 8.0	1.8 ± 1.2	27.9 ± 9.6	5.9 ± 5.8
Rookery size class	2021 Means				
1-25 (n=67)	18.8 ± 5.8	6.1 ± 1.5	9.1 ± 1.5	61.4 ± 6.2	4.7 ± 1.9
26-50 (n=21)	35.7 ± 11.0	7.3 ± 5.1	9.0 ± 3.7	41.1 ± 11.0	6.8 ± 5.0
51-100 (n=11)	28.9 ± 17.9	11.9 ± 9.8	6.2 ± 4.0	44.5 ± 18.8	8.5 ± 8.0
>100 (n=34)	37.2 ± 10.0	14.2 ± 3.8	6.7 ± 2.7	34.7 ± 9.0	7.3 ± 3.9
Rookery size class	χ^2 values				
1-25	13.63	0.72	-	11.07	0.31
26-50	0.00	7.75	-	0.25	2.12
51-100	3.57	0.02	-	0.09	4.98
>100	2.10	0.58	-	1.66	0.32
Statistical significance					
1-25	less***	ns	-	more***	ns
26-50	ns	less***	-	ns	ns
51-100	ns	ns	-	ns	more*
>100	ns	ns	-	ns	ns

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