

Supplementary material

Appendix 1

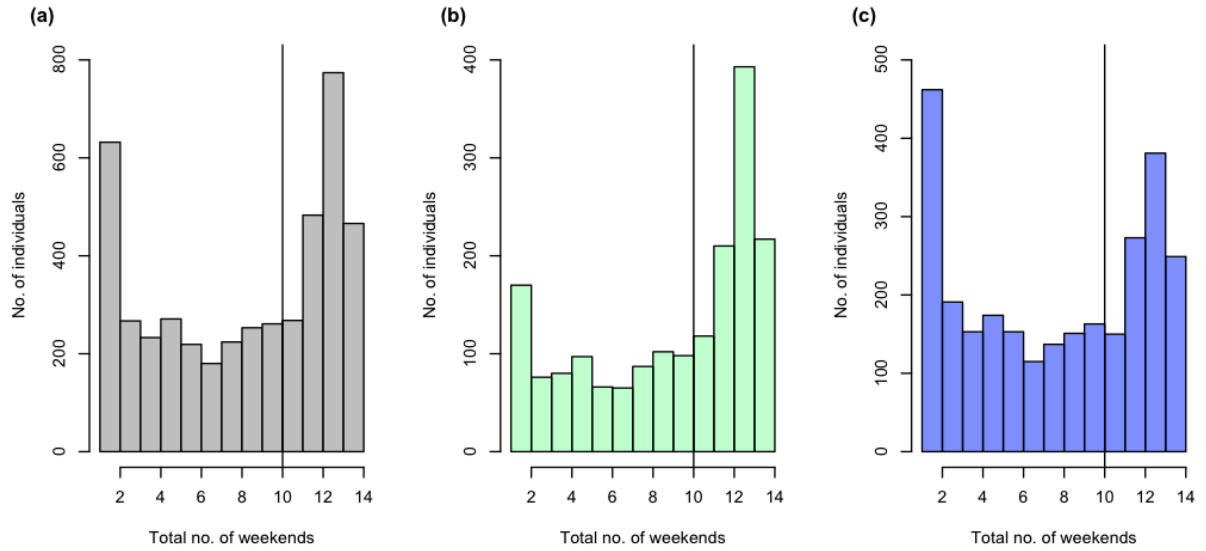


Figure A1. The distribution of the number of total weekends that each bird was recorded throughout the winter for (a) all birds (b) great tits and (c) blue tits. Vertical black line shows the cut off (10 weekends) for classification as a 'winter resident' (see Methods).

Table A1.1: Linear mixed model of factors affecting variation in estimated weekly winter supplementary seed consumption in a breeding population of great tits and blue tits (includes only breeding birds). Bold indicates the effects that are more than twice the standard error around the estimate.

	Great tit, n = 568			Blue tit, n = 549		
	Est.	se	t	Est.	se	t
(Intercept)	73.611	2.162	34.044	46.162	2.739	16.852
Age Relative to juveniles	-8.619	1.527	-5.643	-3.108	1.950	-1.593
Dispersal status Relative to immigrants	0.871	2.079	0.419	0.653	2.453	0.266
Distance from nest box to feeder	-0.003	0.002	-1.513	-0.016	0.003	-5.302
Sex Relative to female	6.193	2.073	2.987	13.747	2.393	5.744
Weekend From start of winter	1.327	0.089	14.902	1.425	0.102	13.967
Year Relative to 2013	5.016	1.098	4.569	-1.619	1.396	-1.160

Table A1.2: Follows Table S1.1 but includes all birds (rather than just winter residents)

	Great tit, n = 1240			Blue tit, n = 1672		
	Est.	se	t	Est.	se	t
(Intercept)	64.977	1.545	42.057	36.407	1.352	26.923
Age	-8.702	0.985	-8.839	-2.883	0.908	-3.176
Relative to juveniles						
Dispersal status	2.064	1.448	1.425	0.147	1.306	0.113
Relative to immigrants						
Sex	3.465	1.444	2.399	9.006	1.265	7.118
Relative to females						
Breeding status	-0.736	.0864	-0.852	0.913	0.806	1.134
Relative to non-breeders						
Winter residency status	11.827	0.999	11.843	14.65	0.848	17.271
Relative to non-residents						
Weekend	1.287	0.063	20.372	1.380	0.058	23.944
From start of winter						
Year	4.442	0.716	6.201	-2.223	0.594	-3.914
Relative to 2013						

Table A2. Individual repeatability (of winter residents) in the number of seeds consumed each weekend in 2012 and 2013 separately, as well as repeatability in the number of seeds consumed annually over both years. Models assessing annual seed consumption repeatability followed the same format as those assessing repeatability in weekly seed consumption and controlled for the number of weekends each individual was recorded at the feeders for each year

Year	Great tit			Blue tit		
	n observations	n individuals	Repeatability	n observations	n individuals	Repeatability
2012	7641	628	0.345	6666	556	0.408
2013	5206	400	0.347	6132	478	0.436
Over years	1028	788	0.472	1034	814	0.5

Table A3.1: Generalised linear mixed model of the effect of estimated total winter supplementary seed consumption on subsequent recruitment to the breeding cohort in a winter resident population of great tits and blue tits, with number of weekends each bird was observed at a feeder included as a fixed effect. P values reported are calculated under the default lme4 method for GLMMs (Bates 2014).

	Great tit, n = 788				Blue tit, n = 814			
	Est.	se	z	P	Est.	se	z	P
(Intercept)	-0.635	0.742	-0.855	0.392	-1.673	0.758	-2.208	0.027
Age Relative to juveniles	0.006	0.156	0.038	0.970	-0.211	0.173	-1.219	0.223
Dispersal status Relative to immigrants	-0.211	0.139	-1.516	0.130	0.024	0.157	0.151	0.880
Sex Relative to female	-0.389	0.142	-2.736	0.006**	0.204	0.166	1.232	0.218
Annual seed consumption	-0.018	0.017	-1.102	0.270	0.027	0.016	1.730	0.084
No. weekends detected	0.129	0.074	1.751	0.080	-0.004	0.075	-0.049	0.961
Year Relative to 2013	-0.150	0.153	-0.975	0.329	0.024	0.158	0.149	0.881

Table A3.2: Follows Table A3.1 but includes all individuals, rather than just winter residents

	Great tit, n = 1240				Blue tit, n = 1672			
	Est.	se	z	P	Est.	se	z	P
(Intercept)	-1.140	0.289	-3.941	<.001	-1.347	0.208	-6.472	<.001
Age Relative to juveniles	0.150	0.123	1.221	0.222	-0.185	0.117	-1.579	0.114
Dispersal status Relative to immigrants	-0.056	0.114	-0.493	0.622	0.188	0.109	1.727	0.084
Sex Relative to females	-0.398	0.115	-3.461	0.001**	-0.135	0.111	-1.222	0.222
Seed consumption rate	-0.037	0.033	-1.146	0.252	0.009	0.027	0.342	0.732
No. weekends detected	0.138	0.017	8.014	<.001**	0.048	0.015	3.089	0.002**
Year Relative to 2013	-0.232	0.118	-1.972	0.049	-0.102	0.105	-0.969	0.333

Table A4.1: Generalised linear mixed model of the effect of estimated total winter supplementary seed consumption on ‘survival’ in a winter resident population of great tits and blue tits. Surviving birds were defined as birds that were either a) trapped or detected breeding in the spring following the focal winter or b) detected at a feeder at any point during following the focal winter. With this method, any birds that were never detected after the focal winter were assumed to have died. Although detection probability is very high if a bird remains within the woods (due to intensive monitoring) it is difficult to disentangle this measure of survival from dispersal from the woods. However, recent research demonstrates that although some birds may leave the woods each summer after breeding, the vast majority will return by the end of October (Matechou et al 2015). P values reported are calculated under the default lme4 method for GLMMs (Bates 2014).

	Great tit, n = 788				Blue tit, n = 814			
	Est.	se	z	P	Est.	se	z	P
Intercept	0.001	0.452	0.002	0.999	0.244	0.359	0.680	0.497
Age								
Relative to juveniles	0.220	0.150	1.471	0.141	-0.225	0.161	-1.400	0.162
Dispersal status								
Relative to immigrants	0.098	0.134	0.729	0.466	0.147	0.141	1.045	0.296
Sex								
Relative to females	-0.085	0.136	-0.63	0.529	0.474	0.146	3.260	0.001**
Seeds consumed	0.019	0.013	1.472	0.141	0.008	0.011	0.699	0.484
Year								
Relative to 2013	-0.214	0.144	-1.484	0.138	-0.279	0.14	-1.989	0.047**

Table A4.2: Follows Table A4.1 but The number of weekends each bird was observed at a feeder is included as a fixed effect

	Great tit, n = 788				Blue tit, n = 814			
	Est.	se	z	P	Est.	se	z	P
(Intercept)	-0.561	0.709	-0.792	0.428	-0.831	0.663	-1.253	0.210
Age Relative to juveniles	0.198	0.151	1.309	0.191	-0.256	0.163	-1.575	0.115
Dispersal status Relative to immigrants	0.102	0.134	0.760	0.448	0.138	0.142	0.973	0.330
Sex Relative to female	-0.090	0.136	-0.663	0.507	0.464	0.146	3.172	0.002**
Annual seed consumption	0.010	0.016	0.626	0.532	-0.007	0.014	-0.513	0.608
No. weekends detected	0.072	0.070	1.026	0.305	0.128	0.067	1.91	0.056
Year Relative to 2013	-0.252	0.149	-1.693	0.091	-0.379	0.152	-2.496	0.013*

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Table A4.3 Follows Table A4.2 but includes all individuals, rather than just winter residents.

	Great tit, n = 1240				Blue tit, n = 1672			
	Est.	se	z	P	Est.	se	z	P
(Intercept)	-0.444	0.250	-1.776	0.076	-0.333	0.168	-1.986	0.047
Age								
Relative to juveniles	0.184	0.113	1.633	0.103	-0.277	0.101	-2.741	0.006**
Dispersal status								
Relative to immigrants	0.177	0.104	1.697	0.090	0.209	0.091	2.297	0.022*
Sex								
Relative to females	-0.165	0.104	-1.592	0.111	0.198	0.091	2.164	0.030
Seed consumption rate	-0.048	0.028	-1.676	0.094	-0.017	0.022	-0.739	0.460
No. weekends detected	0.123	0.015	8.095	<.001**	0.098	0.013	7.614	<.001**
Year								
Relative to 2013	-0.137	0.115	-1.197	0.231	-0.342	0.090	-3.784	<.001**

Fixed effect	Lay date			Clutch size			Mean egg mass			Mean nestling mass			Fledging success			
	Est	se	T	Est	se	T	Est	se	T	Est	se	T	Est	se	T	
Blue tit		n = 284			n = 284			n = 265			n = 167			n = 167		
Box altitude	0.036	0.018	2.011													
Mean nestling mass													6.634	2.118	3.131	
Clutch size							-0.004	0.003	-1.283	-0.092	0.041	-2.224				
Female age	-1.520	1.006	-1.511	0.147	0.229	0.639	0.010	0.012	0.849	-0.184	0.155	-1.188	-4.651	4.188	-1.111	
Female dispersal status	1.357	0.930	1.460													
Distance from nest box to feeder	0.002	0.001	1.356													
Female seed consumption	0.002	0.002	0.816	-0.001	0.001	-1.103	0.000	0.000	-0.327	0.000	0.000	-1.100	-0.009	0.009	-0.985	
Female number of weekends	-0.206	0.201	-1.024	0.045	0.048	0.935	0.002	0.003	0.913	0.040	0.031	1.297	0.917	0.832	1.103	
Lay date				-0.104	0.014	-7.334				0.007	0.010	0.735	-0.505	0.262	-1.929	
Male age										-0.043	0.151	-0.286	1.673	4.061	0.412	
Male seed consumption										0.000	0.000	-1.357	0.001	0.009	0.079	
Male number of weekends										0.009	0.036	0.261	-0.609	0.957	-0.637	
Oak density				0.008	0.007	1.023	0.000	0.000	-0.593	-0.001	0.004	-0.338	-0.071	0.118	-0.598	
Year	17.919	0.869	20.618	0.751	0.325	2.313	0.024	0.010	2.390	0.318	0.227	1.400	15.174	6.116	2.481	
Great tit		n = 358			n = 358			n = 327			n = 208			n = 208		
Box altitude	0.047	0.016	3.023													
Mean nestling mass													3.613	0.879	4.111	
Clutch size							-0.010	0.004	-2.454	-0.239	0.081	-2.955				
Female age	-2.338	0.880	-2.657	0.015	0.187	0.080	-0.013	0.015	-0.862	-0.484	0.302	-1.603	5.498	3.799	1.447	

Female dispersal status	1.870	0.822	2.274												
Distance from nest box to feeder	0.002	0.001	1.149												
Female annual seed consumption	0.004	0.002	2.251	0.000	0.000	-0.786	0.000	0.000	1.218	-0.001	0.001	-1.546	0.008	0.009	0.939
Female number of weekends	-0.421	0.191	-2.201	0.066	0.042	1.565	-0.004	0.003	-1.162	0.107	0.074	1.448	-0.542	0.934	-0.580
Lay date				-0.036	0.011	-3.150				0.097	0.019	5.077	1.024	0.254	4.025
Male age										0.711	0.303	2.347	-2.484	3.708	-0.670
Male seed consumption										0.002	0.001	3.734	-0.008	0.008	-1.012
Male number of weekends										-0.252	0.077	-3.261	1.096	0.991	1.106
Oak density				0.015	0.006	2.388	0.000	0.001	0.800	0.013	0.009	1.483	0.053	0.113	0.465
Year	19.289	0.742	25.992	-0.120	0.273	-0.439	0.012	0.013	0.897	-1.852	0.440	-4.213	-14.126	5.714	-2.472

Table A5.1 (above): Summary of linear mixed models examining the effect of estimated supplementary seed consumption during winter weekends on aspects of subsequent breeding success in a winter resident population of great tits and blue tits. Number of weekends each bird was detected at a feeder is included as a fixed effect. Bold indicates the effects that are more than twice the standard error around the estimate.

Table A5.2: Follows table A5.1 but uses seed consumption rate and includes all birds.

Fixed effect	Lay date			Clutch size			Mean egg mass			Mean nestling mass			Fledging success		
	Est.	se	T	Est.	se	T	Est.	se	T	Est.	se	T	Est.	se	T
Blue tit	N = 284			N = 284			N = 265			N = 167			N = 167		
Box altitude	0.035	0.018	2.013												
Mean nestling mass													6.677	2.093	3.190
Clutch size							-0.003	0.003	-1.204	-0.090	0.041	-2.215			
Female age	-1.508	1.005	-1.501	0.136	0.229	0.595	0.009	0.012	0.797	-0.212	0.149	-1.429	-4.047	4.008	-1.010
Female dispersal status	1.399	0.928	1.507												
Distance from nest box to feeder	0.002	0.001	1.262												
Female seed consumption rate	-0.001	0.016	-0.065	-0.004	0.004	-0.981	0.000	0.000	0.233	-0.003	0.003	-1.298	-0.060	0.068	-0.882
Lay date				-0.105	0.014	-7.431				0.007	0.010	0.723	-0.495	0.260	-1.903
Male age										-0.040	0.145	-0.277	1.044	3.890	0.268
Male seed consumption rate										-0.004	0.003	-1.530	-0.056	0.070	-0.795
Oak density				0.007	0.008	0.902	0.000	0.000	-0.648	-0.003	0.004	-0.596	-0.095	0.120	-0.792
Year	17.824	0.873	20.408	0.768	0.321	2.390	0.027	0.010	2.617	0.286	0.224	1.279	14.053	5.984	2.348

Box altitude	0.046	0.015	2.981												
Mean nestling mass													3.598	0.867	4.152
Clutch size							-0.011	0.004	-2.540	-0.237	0.081	-2.911			
Female age	-2.490	0.868	-2.870	0.064	0.186	0.343	-0.015	0.015	-0.999	-0.502	0.298	-1.682	6.065	3.718	1.631
Female dispersal status	1.878	0.821	2.287												
Distance from nest box to feeder	0.002	0.001	1.215												
Female seed consumption rate	0.035	0.016	2.196	0.000	0.003	-0.019	0.000	0.000	0.643	-0.011	0.007	-1.577	0.117	0.084	1.393
Lay date				-0.037	0.011	-3.282				0.099	0.019	5.197	1.012	0.252	4.016
Male age										0.673	0.297	2.267	-1.916	3.595	-0.533
Male seed consumption rate										0.021	0.006	3.275	-0.092	0.081	-1.131
Oak density				0.015	0.006	2.427	0.000	0.001	0.772	0.015	0.009	1.632	0.057	0.114	0.499
Year	19.419	0.737	26.355	-0.116	0.275	-0.421	0.013	0.013	1.003	-1.918	0.440	-4.360	-13.853	5.677	-2.440