Supplementary Material

1   Supplementary Figures and Tables

1.1   Supplementary Tables

Table S1. Phenological, meteorological and social effects on the provisioning rate of male helpers as a function of their age-relatedness class. Table shows parameter estimates as posterior median and 95% CI of a mixed-effects model with zero-inflated Poisson distribution. The binomial part equates to the probability of not showing zero-inflated provisioning (based on Poisson expectation), while the Poisson part equates to the hourly provisioning rate on a given day, including zero visits where expected under a Poisson distribution. Individual class is labelled SAR, SYR and SU, with S referring to subordinates, A to adults, Y to yearlings, R to relatives (estimated 1st or 2nd order relatives of nestlings) and U to unrelated. Carer number (or carer no.) refers to the number of carers minus the breeding female. Rain refers to the days since the last meaningful rainfall on each day of data collection, temperature (or temp) is the mean daytime temperature on a given day and wind speed (or wind) is the mean daytime wind speed on a given day. Standard deviation (SD) is shown for random intercepts: indiv-nest ID refers to individual-nest identity and OLRE to the observation level random effect. Significant effects are determined when CI's fail to cross zero and are denoted *. The analyses included 712 individual-dates from 28 nests by 25 group-years.

Term	Binomial part				Poisson part			
	50%	2.5%	97.5%		50%	2.5%	97.5%	
intercept	1.06	0.90	1.24		0.54	0.28	0.84	
carer class (relative to SAR)								
SYR	0.34	0.001	0.78	*	0.15	-0.45	0.61	
SU	-0.42	-1.19	0.45		-1.31	-2.10	-0.46	*
carer number	-0.14	-0.45	0.12		0.10	-0.34	0.55	
rain	0.18	-0.28	0.70		-0.29	-0.73	0.18	
temperature	-0.25	-0.69	0.19		-0.23	-0.33	-0.13	*
wind speed	-0.37	-0.71	-0.07	*	-0.005	-0.08	0.10	
class × rain (relative to SAR)								
SYR	-0.32	-1.49	0.80		0.25	-0.61	1.22	
SU	-1.83	-3.64	0.12		0.80	-0.77	2.30	
class × temperature (relative to SAR)								
SYR	0.44	-0.67	1.83		-0.02	-0.29	0.27	
SU	-0.01	-1.34	1.32		0.02	-0.78	0.88	
class × wind speed (relative to SAR)								
SYR	0.08	-0.68	0.79		-0.02	-0.18	0.15	
SU	0.23	-1.01	1.20		-0.02	-0.59	0.60	
carer no. × rain	-0.19	-1.25	0.66		0.49	-0.28	1.15	
carer no. × temp	0.64	-0.29	1.68		-0.28	-0.48	-0.08	*
carer no. × wind	-0.11	-0.84	0.47		0.03	-0.12	0.18	
random intercept SD								
indiv.-nest ID					1.14	0.98	1.36	
OLRE					1.27	1.22	1.33	
variance level coefficient								
carer class								
SYR					0.38	0.07	0.64	*
SU					1.09	0.51	1.62	*

Table S2. Phenological, meteorological and social effects on the coefficient of variation in daily provisioning rates across days within nesting attempts of male carer class. Table shows parameter estimates as posterior median and 95% CI of a GLMM. Individual class is labelled as DM, SAR, SYR and SU, with DM referring to dominant breeding males, S referring to subordinates, A to adults, Y to yearlings, R to relatives and U to non-relatives (see Methods). Carer number (or carer no.) refers to the number of carers minus the breeding female. Days since rain refers to the mean number of days since the last meaningful rainfall during observations of a given attempt, temperature and SD temperature are the mean and standard deviation of the average daytime temperatures on each day during observations of a given nesting attempt, and SD wind speed refers to the standard deviation of average daytime wind speeds during the observations of a given nesting attempt. Standard deviation (SD) is shown for random intercepts: nest identity and OLRE, the latter referring to the observation level random effect. Significant effects are determined when CI's fail to cross zero and are denoted *. The analysis included 136 CV values from 29 nests by 26 group-years.

| Term	50%	2.5%	97.5%	
intercept	-0.54	-0.80	-0.30	
carer class				
DM	-0.87	-1.23	-0.49	*
SYR	-0.23	-0.58	0.13	
SU	0.74	0.25	1.26	*
carer number	0.01	-0.36	0.45	
days since rain	1.58	0.13	2.80	*
temperature	-1.18	-2.42	0.15	
SD temperature	-0.13	-0.98	0.71	
SD wind speed	0.27	-0.29	0.70	
carer no. × rain	1.92	-0.51	4.74	
carer no. × temp	-1.22	-3.43	0.75	
carer no. × SD temp	-0.93	-2.96	0.90	
carer no. × SD wind	0.57	-0.61	1.84	
random intercept SD				
nest identity	0.23	0.01	0.53	
OLRE	0.36	0.02	0.61	

1.2 Supplementary Figures

Figure S1. Daily provisioning rates of male subordinates. Carer classes varied in: (a) their propensity for zero-inflation (i.e. visiting the nest less often on a given day than expected by a Poisson distribution); and (b) their provisioning rate based on a Poisson expectation. DM = dominant breeding males; SAR = helping adult relatives of at least one member of the breeding pair; SYR = helping yearling relatives; SU = unrelated helpers that were more distantly related or unrelated to either member of the breeding pair. The different letters inset indicate where the 95% CI of the difference between the categories did not include zero. Plots show marginalised prediction of means and 95% CI.
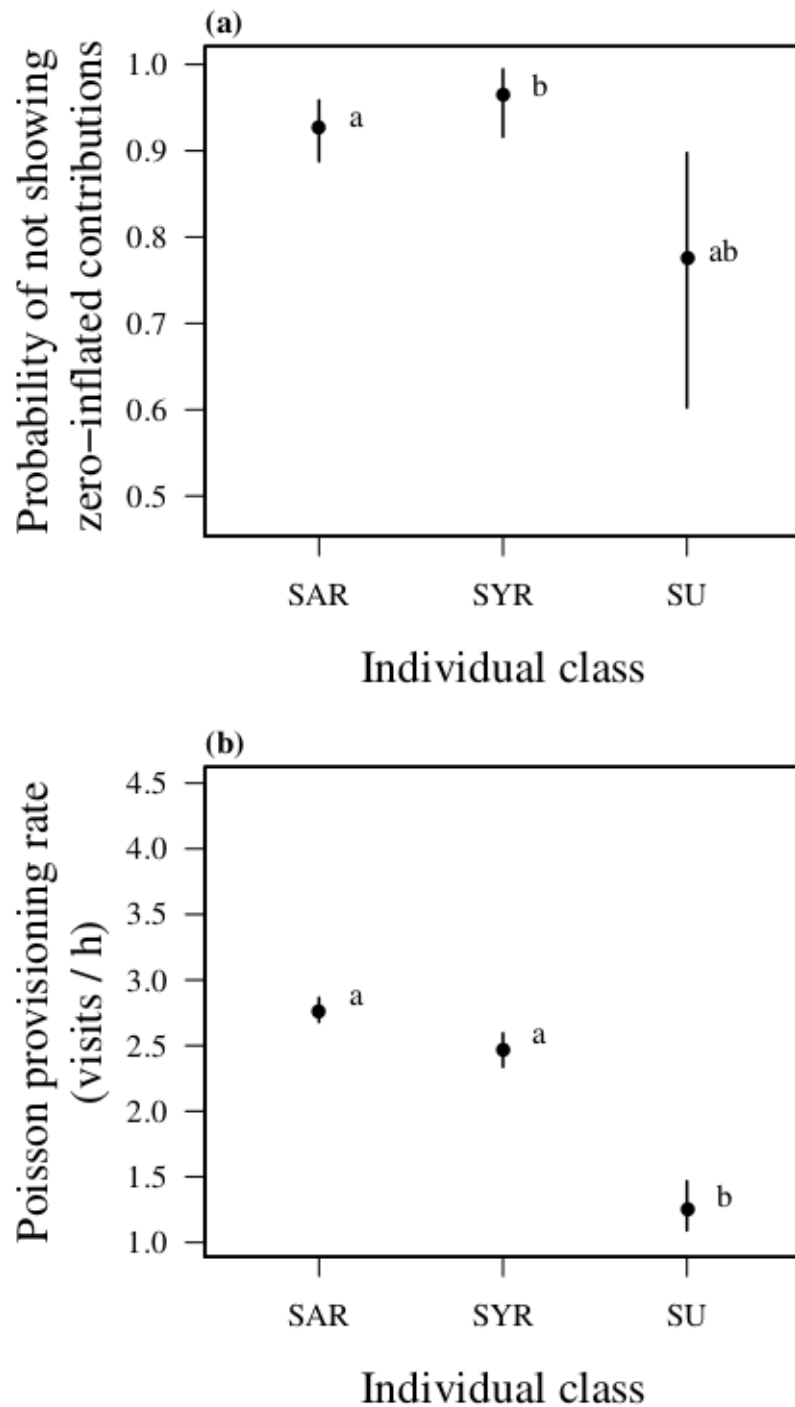
Figure S2. Environmental predictors of provisioning rates by subordinate male carers. Figures show the slope effect sizes for each carer class as a function of the three environmental variables tested and provisioning rate as a function of meteorological variables and carer number. Figures (a), (b) and (c) show effects on the probability of excess zero values for days since rain, mean daily temperature and mean daily wind speed, respectively. Figures (d), (e) and (f) show effects on the provisioning rate explained by a Poisson distribution. The slope estimates for non-reference categories were calculated by combining interaction and main effect parameters. Acronyms and meteorological measures are as for Figure S1. Bars show 95% CI, with black bars overlapping zero and red bars not doing so. Figures (g) and (h) show the effects of wind speed on individual provisioning rate, and an interaction between the number of cares and temperature, respectively. Numbers inset in (h) are the number of carers excluding the breeding female. The curves are predicted expectations of zero-inflated Poisson distribution (i.e. based on both binomial part coefficients and Poisson part coefficients).
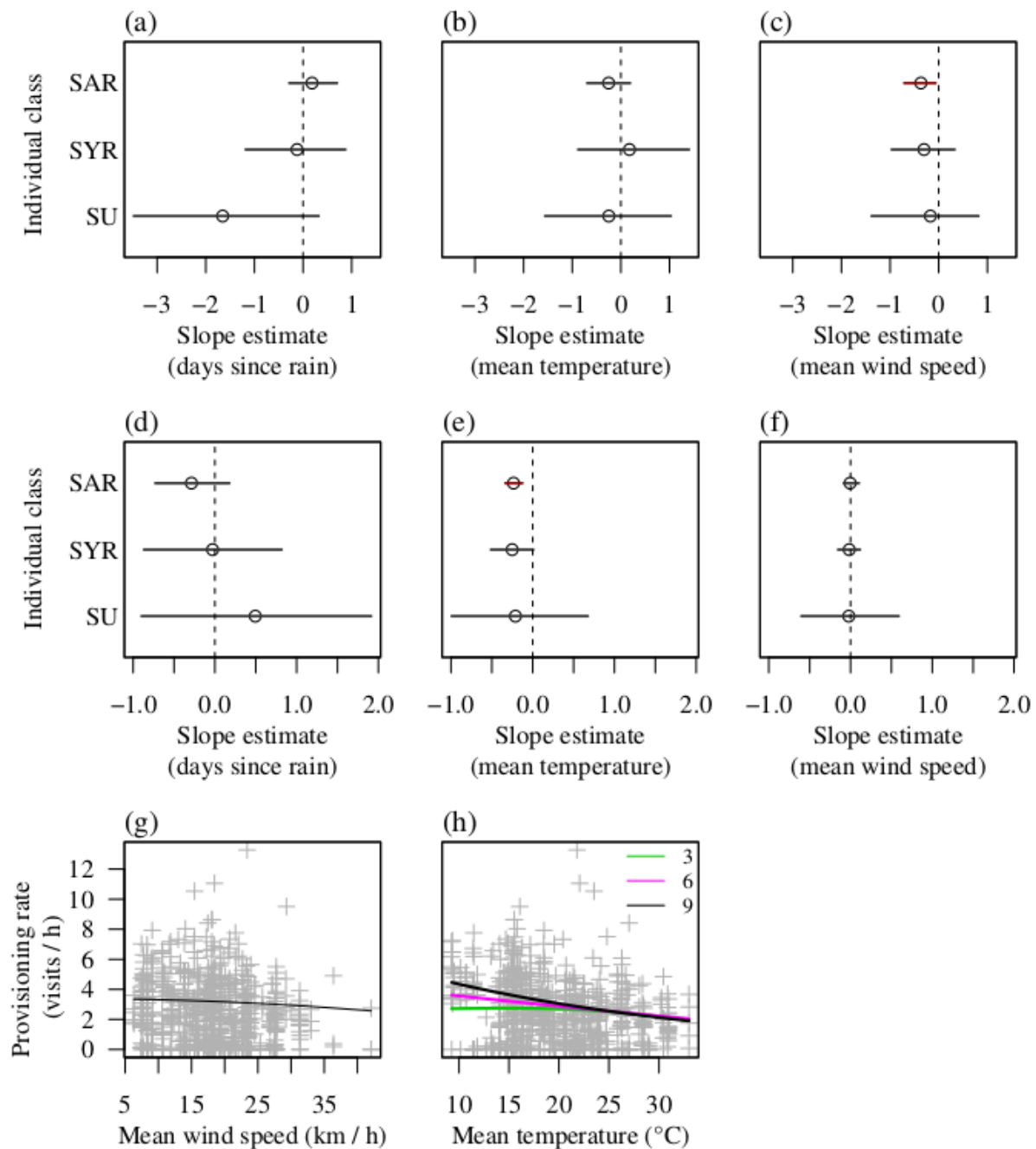
Figure S3. Proportion of variance explained by observation level random effect (OLRE) to total variance (i.e. sum of fixed effect variance, random effect variance, and distribution specific variance) in daily provisioning rate explained by a Poisson distribution (Table S1). Acronyms and meteorological measures are as for Figure 2. The different letters inset indicate where the 95% CI of the difference between the categories did not include zero. Plot shows predicted means and 95% CI.
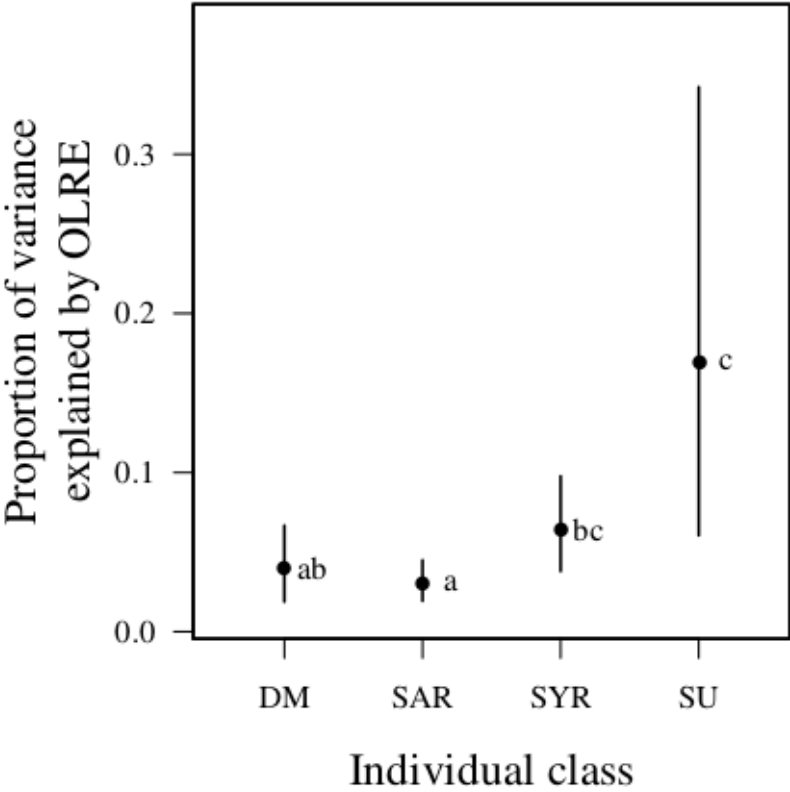
Figure S4. Coefficient of variation in carer nest visitation among days. (a) The CV of individual provisioning rate differed among different classes of individuals, and (b) increased as a function of mean days since last rain. Acronyms as for Figure S1, and letters inset indicate that 95% CI of the difference between the categories did not include zero. Figures show predicted means, and error bars show 95% CI.