

Ecography

ECOG-03321

Severns, P. M. and Breed, G. A. 2018. Male harassment, female movements, and genetic diversity in a fragmented metapopulation. – Ecography doi: 10.1111/ecog.03321

Supplementary material

1 Appendix 1: Supporting mixed-effects model results

Model	AICc	Δ AICc	BIC	Δ BIC	df
$L_{i,j} \sim 1 + \phi_j$	4269.7	72.0	4282.5	64.1	3
$L_{i,j} \sim patch + \phi_j$	4270.1	72.4	4287.0	68.6	4
$L_{i,j} \sim harass + \phi_j$	4210.5	12.8	4227.3	8.9	4
$L_{i,j} \sim patch + harass + \phi_j$	4210.2	12.5	4230.9	12.5	5
$L_{i,j} \sim patch + harass + patch * harass + \phi_j$	4210.7	13.0	4235.0	16.6	6
$L_{i,j} \sim \ln(L_{i-1,j}) + 1 + \phi_j$	4241.6	43.9	4258.4	40.0	4
$L_{i,j} \sim \ln(L_{i-1,j}) + patch + \phi_j$	4242.9	45.2	4263.6	45.2	5
$L_{i,j} \sim \ln(L_{i-1,j}) + harass + \phi_j$	4197.7	0	4218.4	0	5
$L_{i,j} \sim \ln(L_{i-1,j}) + patch + harass + \phi_j$	4198.4	0.7	4222.8	4.4	6
$L_{i,j} \sim \ln(L_{i-1,j}) + patch + harass + patch * harass + \phi_j$	4199.4	1.7	4227.2	8.8	7

Table S1: Effect of male harassment / courting on step-lengths. $\ln(L_{i-1,j})$ is the autocorrelation term and ϕ is the individual random effect. “Patch” is a categorical variable with two levels (one for each of the two patches in which butterflies were tracked) while “harass” is continuous. The table is arranged by model complexity rather than goodness of fit; models below the double horizontal line are equivalent to those above it but incorporate an autocorrelation parameter. We selected the model highlighted using AICc (which selected the model equivocally as two other models had Δ AICc < 2), BIC (which selected the same model unequivocally; the next best model was Δ BIC 4.4 greater), and preference for simpler models – equivocal models as indicated by AIC were both more complex than the best fitting model. See main text for selection criterion.

Variable	β parameter estimate	p-value
Intercept	0.804	-
$\ln(L_{i-1,j})$	0.105	$1.08e^{-5}$
<i>harass</i>	0.800	$2.36e^{-12}$

Table S2: Effect magnitudes of the harassment model selected in Table S1. p-values calculated using likelihood ratio tests, comparing nested models as each parameter was added.

Model	AICc	Δ AICc	BIC	Δ BIC	df
$S_{i,j} \sim 1 + \phi_j$	1900.2	78.2	1910.5	71.0	2
$S_{i,j} \sim patch + \phi_j$	1898.9	76.9	1914.1	74.6	3
$S_{i,j} \sim harass + \phi_j$	1824.3	2.3	1839.5	0	3
$S_{i,j} \sim patch + harass + \phi_j$	1822.8	0.8	1842.8	3.3	4
$S_{i,j} \sim patch + harass + patch * harass + \phi_j$	1823.3	1.3	1847.9	8.4	5
$S_{i,j} \sim S_{i-1,j} + \phi_j$	1892.1	70.1	1907.3	67.8	3
$S_{i,j} \sim S_{i-1,j} + patch + \phi_j$	1890.9	68.9	1910.9	71.4	4
$S_{i,j} \sim S_{i-1,j} + harass + \phi_j$	1823.7	1.7	1843.7	4.2	4
$S_{i,j} \sim S_{i-1,j} + patch + harass + \phi_j$	1822.3	0.3	1846.5	7	5
$S_{i,j} \sim S_{i-1,j} + patch + harass + patch * harass + \phi_j$	1822.0	0	1852.0	12.5	5

Table S3: Effect of male harassment / courting on the binomial probability of making a movement at the next time step. $S_{i-1,j}$ is the autocorrelation term and ϕ is the individual random effect. “Patch” is a categorical variable with two levels (one for each of the two patches butterflies were tracked in) while “harass” is continuous. The table is arranged by model complexity and not goodness of fit; models below the double horizontal line are equivalent to those above it but incorporate an autocorrelation parameter. Given the evidence, we selected the model in row 3, which considers only the presence of courting males as the predicting factor. The slight decreases in AICc score for the more complex models that include patch and autocorrelation are not sufficient to select these models given the amount of data and increase in model complexity. Moreover, the model in row 3 has the lowest BIC score, which penalizes amount of data and parameters more harshly than AICc (see main text for selection criterion). The β parameter estimate on *harass* for the selected model is 1.49, indicating that courting increased the chance of a movement being made by a factor of 1.5 compared to when females were unharassed; this relationship is highly significant with a p -value $< 2.0e^{-16}$ (p -value calculated using a likelihood ratio test).