Appendix S1 - Full analytical methods and model results

Supplemental information for Diaz and Ernest, “Maintenance of community function through compensation breaks down over time in a desert rodent community”. In review at Ecology.

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# Compensation

We fit a generalized least squares accounting for temporal autocorrelation between monthly censuses within each time period using a continuous autoregressive structure of order 1. We compared this model to models fit without the autocorrelation structure and without the time period term using AIC. The “full” model was the best-fitting model via AIC, and we used this model to calculate estimates and contrasts.

### Table S1. AIC scores for candidate models for compensation.

|  |  |
| --- | --- |
| Model.specification | AIC |
| intercept + timeperiod + autocorrelation | 69.85023 |
| intercept + autocorrelation | 84.74902 |
| intercept + timeperiod | 157.09726 |
| intercept | 252.74534 |

### Table S1. Coefficients from GLS for compensation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Value | Std.Error | t-value | p-value |
| (Intercept) | 0.3450313 | 0.0294996 | 11.696141 | 0.0000000 |
| oera.L | 0.0647933 | 0.0524103 | 1.236269 | 0.2172146 |
| oera.Q | -0.2833553 | 0.0477359 | -5.935890 | 0.0000000 |

### Table S2. Estimates from GLS for compensation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| oera | emmean | SE | df | lower.CL | upper.CL |
| a\_pre\_pb | 0.1835362 | 0.0520378 | 44.11081 | 0.0786683 | 0.2884041 |
| b\_pre\_reorg | 0.5763899 | 0.0462641 | 47.37851 | 0.4833383 | 0.6694416 |
| c\_post\_reorg | 0.2751677 | 0.0528010 | 46.75897 | 0.1689314 | 0.3814041 |

### Table S3. Contrasts from GLS for compensation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| contrast | estimate | SE | df | t.ratio | p.value |
| a\_pre\_pb - b\_pre\_reorg | -0.3928537 | 0.0689413 | 47.89422 | -5.698378 | 0.0000 |
| a\_pre\_pb - c\_post\_reorg | -0.0916315 | 0.0741194 | 45.51740 | -1.236269 | 0.4383 |
| b\_pre\_reorg - c\_post\_reorg | 0.3012222 | 0.0694989 | 49.52957 | 4.334200 | 0.0002 |

# Total energy use

As for compensation, we fit a generalized least squares accounting for temporal autocorrelation between monthly censuses within each time period using a continuous autoregressive structure of order 1. We compared this model to models fit without each of the terms, and found the full model had the best performance via AIC. We used this model for estimates and contrasts.

### Table S5. Model comparison via AIC for total energy ratio.

|  |  |
| --- | --- |
| Model.specification | AIC |
| intercept + timeperiod + autocorrelation | -132.92138 |
| intercept + autocorrelation | -118.15000 |
| intercept + timeperiod | 13.29396 |
| intercept | 156.85988 |

### Table S4. Coefficients from GLS on total energy ratio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Value | Std.Error | t-value | p-value |
| (Intercept) | 0.5016731 | 0.0271176 | 18.499880 | 0.0000000 |
| oera.L | 0.1413504 | 0.0477646 | 2.959316 | 0.0033001 |
| oera.Q | -0.2503659 | 0.0429312 | -5.831790 | 0.0000000 |

### Table S5. Estimates from GLS on total energy ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| oera | emmean | SE | df | lower.CL | upper.CL |
| a\_pre\_pb | 0.2995118 | 0.0475806 | 36.19943 | 0.2030323 | 0.3959913 |
| b\_pre\_reorg | 0.7060960 | 0.0419773 | 38.51943 | 0.6211550 | 0.7910369 |
| c\_post\_reorg | 0.4994115 | 0.0480066 | 37.62774 | 0.4021956 | 0.5966274 |

### Table S6. Contrasts from GLS on total energy ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| contrast | estimate | SE | df | t.ratio | p.value |
| a\_pre\_pb - b\_pre\_reorg | -0.4065842 | 0.0623398 | 40.51631 | -6.522060 | 0.0000 |
| a\_pre\_pb - c\_post\_reorg | -0.1998997 | 0.0675493 | 37.12310 | -2.959316 | 0.0144 |
| b\_pre\_reorg - c\_post\_reorg | 0.2066845 | 0.0626456 | 41.44768 | 3.299267 | 0.0056 |

# Kangaroo rat proportional energy use

Proportional energy use is bounded 0-1 and cannot be fit with generalized least squares. We therefore use a binomial GLM with no temporal autocorrelation term. We compared a model fit with a timeperiod term to an intercept-only (null) model using AIC, and found the timeperiod term improved model fit. We used this model for estimates and contrasts.

### Table S9. Model comparison via AIC for Dipodomys proportional energy use.

|  |  |
| --- | --- |
| Model.specification | AIC |
| intercept + timeperiod | 258.3581 |
| intercept | 280.8497 |

### Table S7. Coefficients from GLM on Dipodomys energy use.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Estimate | Std. Error | z value | Pr(>|z|) |
| (Intercept) | 1.4032480 | 0.1503201 | 9.335068 | 0.0000000 |
| oera.L | -1.1000833 | 0.2871738 | -3.830723 | 0.0001278 |
| oera.Q | 0.5855493 | 0.2304516 | 2.540878 | 0.0110574 |

### Table S8. Estimates from GLM on Dipodomys energy use.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| oera | prob | SE | df | asymp.LCL | asymp.UCL |
| a\_pre\_pb | 0.9183528 | 0.0256462 | Inf | 0.8680872 | 0.9686183 |
| b\_pre\_reorg | 0.7160901 | 0.0398537 | Inf | 0.6379782 | 0.7942020 |
| c\_post\_reorg | 0.7035835 | 0.0456677 | Inf | 0.6140765 | 0.7930905 |

### Table S9. Contrasts from GLM on Dipodomys energy use.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| contrast | estimate | SE | df | z.ratio | p.value |
| a\_pre\_pb - b\_pre\_reorg | 0.2022627 | 0.0473925 | Inf | 4.2678236 | 0.0001 |
| a\_pre\_pb - c\_post\_reorg | 0.2147693 | 0.0523762 | Inf | 4.1005151 | 0.0001 |
| b\_pre\_reorg - c\_post\_reorg | 0.0125066 | 0.0606124 | Inf | 0.2063368 | 0.9768 |

# C. baileyi proportional energy use

## Model specification and selection

As for kangaroo rat energy use, we used a binomial GLM to fit *C. bailyei* proportional energy use. We investigated whether the dynamics *C. baileyi*’s proportional energy use differed between treatment types. We compared models incorporating separate slopes, separate intercepts, or no terms for treatment modulating the change in *C. baileyi* proportional energy use across time periods. We also tested a null (intercept-only) model of no change across time periods. We found that the best-fitting model incorporated effects for time period and for treatment, but no interaction between them. We therefore proceeded with this model.

### Table S13; Model comparison via AIC for C. baileyi proportional energy use.

|  |  |
| --- | --- |
| Model.specification | AIC |
| intercept + timeperiod + treatment + timeperiod:treatment | 237.7643 |
| intercept + timeperiod + treatment | 231.0963 |
| intercept + timeperiod | 460.8477 |
| intercept + treatment | 348.2975 |
| intercept | 541.3799 |

### Table S10. Coefficients from GLM on C. baileyi energy use

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Estimate | Std. Error | z value | Pr(>|z|) |
| (Intercept) | -1.574028 | 0.1670168 | -9.424368 | 0 |
| oera.L | -1.409273 | 0.2010398 | -7.009921 | 0 |
| oplottype.L | 2.184896 | 0.2267112 | 9.637355 | 0 |

### Table S11. Estimates from GLM on C. baileyi energy use

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| oera | oplottype | prob | SE | df | asymp.LCL | asymp.UCL |
| b\_pre\_reorg | CC | 0.1069314 | 0.0258894 | Inf | 0.0561890 | 0.1576737 |
| c\_post\_reorg | CC | 0.0160560 | 0.0058224 | Inf | 0.0046444 | 0.0274676 |
| b\_pre\_reorg | EE | 0.7246076 | 0.0385129 | Inf | 0.6491236 | 0.8000915 |
| c\_post\_reorg | EE | 0.2639419 | 0.0428458 | Inf | 0.1799657 | 0.3479181 |

### Table S12. Contrasts from GLM on C. baileyi energy use.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| contrast | oplottype | estimate | SE | df | z.ratio | p.value |
| b\_pre\_reorg - c\_post\_reorg | CC | 0.0908754 | 0.0225901 | Inf | 4.022793 | 1e-04 |
| b\_pre\_reorg - c\_post\_reorg | EE | 0.4606657 | 0.0558852 | Inf | 8.243078 | 0e+00 |