*Ecology: ECY21-1030*

**Maintenance of community function through compensation breaks down over time in a desert rodent community**

Renata M. Diaz and S. K. Morgan Ernest

**General Comments**

**If you are including any General Comments, they should be placed in this section. You must also provide a point-by-point response to comments below.**

**Response to EDITOR**

**COMMENT**

Your revisions should address the specific points made by each reviewer. Both provide constructive suggestions to improve the ms. I agree that an explanation of mathematical procedures will avoid confusion over the R code, as suggested by Rev #1, and that a figure of body mass of the rodents involved in this study would be very useful, as suggested by Rev #2.

**Response:**

**We have expanded the details of the statistical methods in the main text (lines) and the supplementary materials (Appendices S1, S3, S4), with specific attention to the points of confusion (temporal autocorrelation and effects of experimental treatments on *C. baileyi* proportional energy use) raised by Reviewer 1. We agree that biomass is also a relevant currency for this study, and have included a supplementary analysis (Appendix S3) and figure using biomass, rather than energy use. Results for biomass are nearly identical to those for energy use, so we were comfortable including this analysis in the supplement rather than as part of the main text.**

**Response to Reviewer 1**

**COMMENT**

1 - Make sure all acronyms used on the manuscript are defined. For example, “SG” is never defined.

**Response:**

**We have included definitions for “SG”, “KR”, and all other acronyms in the main text, in addition to in the figure legends (lines).**

**COMMENT**

2 - L39: Define “community function”.

**Response:**

**We have added a short definition of community function in this context (line).**

**COMMENT**

3 - L104-105: “...the habitat at the study site has transitioned from desert grassland to scrub...”

Why? Is it because of the rodent community or because of other environmental constraints? Please give more details. This information is important because if it is caused by the rodent species themselves, it could have important implication for the rodent community structure.

**Response:**

**This is an excellent point. The habitat transition at this site occurred primarily from the late 1980s-early 1990s, driven by a period of high winter rainfall associated with the early 1990s La Niña cycle that encouraged the growth of woody shrubs (Brown et al. XXXX). The change occurred site (and region)-wide, and not differentially on different plots as a result of ecosystem engineering by the rodents. We have summarized this in the text as “shifting environmental conditions” (line).**

**COMMENT**

4 - L111-112: Move this small paragraph to the end of the Method section.

**Response:**

**Done (lines)!**

**COMMENT**

5 - L114-120: Could the exclosure with small holes prevent other species (e.g. larger predators of rodents) to enter in the exclosure thus influencing the dynamic of the rodent community and potentially the environment (see my comments above)? Please explain.

**Response:**

**The primary predators to rodents in this system are believed to be coyotes, birds of prey, and snakes, all of which are able to access all of the plots with minimal obstructions (with the possible exception of some snakes). While we do not have direct data on predator presence or predation pressure on plots with different treatments, we can use the response of non-granivorous rodents (the insectivorous grasshopper mice *O. leucopis* and *O. torridus*, and the omnivorous *…*) to kangaroo rat removal to disentangle differences between the treatments driven by competition from treatment artefacts, such as predation pressure. Non-granivores should not be strongly affected by competitive release due to kangaroo rat removal, but should be similarly affected by any reductions in predation pressure caused by the exclosure treatments. Like past investigators at Portal (Brown and Munger XXXX), we do not observe an increase in non-granivore rodent abundance on exclosure plots (in contrast to a consistent increase in small granivore abundance on these plots). [include a figure?]**

**COMMENT**

6 - L126-130: On these lines a description of the time periods used for comparison are presented. This description should explain in details why the boundaries of each time period was selected as they were.

**Response:**

**We selected these time period boundaries following previously-published cutoffs for the corresponding transitions in the rodent community (). We explored using slightly different boundaries (using the first observation of *C. balieyi* at the site as the first boundary, and exploring an 18-month window corresponding to the 95% credible interval for the timing of the second boundary) and found that this did not have a qualitative effect on the overall results. We have expanded the details regarding the choice of time-period boundaries in the text (lines).**

**COMMENT**

7 - L131: “5.69 \* (m^0.75)”. In the context of the study, it is important to explain the meaning of this equation and of the different values in this equation.

**Response:**

**We have expanded the explanation of this metabolic scaling relationship (line).**

**COMMENT**

8 - L153: “... using the form response ~ time period + CORCAR1(census period)...”

What does this mean exactly? Especially the CORCAR1() part. This would be clearer if mathematical equations were used to describe the model instead of R code.

**Response:**

**Thank you for raising this question; it is clear that we did not sufficiently explain our rationale for incorporating temporal autocorrelation into the models where possible. Our data consists of monthly censuses, which are then combined into decadal-scale time periods for analysis. There is temporal autocorrelation between values for census that are close to each other in time. To account for this, we included a temporal autocorrelation structure with a lag of 1 time step in our analyses of compensation and total energy use; this is implemented in R via the `CORCAR1()` constructor for generalized least squares models fit with the `nlme` package. Accounting for temporal autocorrelation improves model fit considerably (see Supplement S1, S3, S4). We have expanded our explanation of the inclusion of temporal autocorrelation in the main text (lines) and supplement (Appendix S1, S3, S4).**

**We note (also below) that we were unable to incorporate temporal autocorrelation into our models for *Dipodomys* or *C. baileyi* proportional energy use, because we prioritized using the appropriate model family over including autocorrelation, and we were not successful in finding methods implemented in R for incorporating temporal autocorrelation into binomial generalized linear models (appropriate for proportion data bounded 0-1). We proceeded with GLMs that do not account for autocorrelation, in part because the differences between time periods for these variables are so pronounced that we were not concerned about being misled over subtle effects due to autocorrelation.**

**COMMENT**

9 – Following up on comment 8, I strongly believe that presenting pseudo-code (or R code) in a manuscript as was done here may lead to confusion and result in misunderstanding of the model that was actually used and as such I recommend using mathematical equation instead. For example, in the explanation giving prior to the pseudo-code presented on L164-165 (response ~ time period \* treatment), it is not clear what the relationship between the different parts of the explanatory variable in model. In R, the code presented means that the “response” is modelled with the “time period” variable, the “treatment” variable and the interaction between “time period” and “treatment”, while in the explanation given, the text seems to imply (although this is not clear) that only “time period” and “treatment” are interacting. Obviously, this has important implication in the results and the interpretation given to the model. Note that if only the interacting terms were to be considered, “:” should be used instead of “\*” in R.

**Response:**

**We appreciate this suggestion; again, it is clear that our original description was not sufficiently specific. We have included the specific model formulae used for each analysis in the main text (lines).**

**We apologize for the lack of clarity regarding the model for *C. baileyi* proportional energy use. We initially fit the model using the full set of terms: intercept + treatment + time period + treatment:time period. We note that the interaction term (treatment:time period) is not statistically significant and has no qualitative effect on the results. We initially left this term in the model, because it is biologically relevant (i.e. *a priori* we believed that the effect of time period could vary between exclosures and controls). In this revision we have removed the interaction term, as would be traditional via stepwise model selection, resulting in the model: intercept + treatment + time period, and detail this decision making process in the supplement (S1). The results are qualitatively the same with or without the interaction term.**

**COMMENT**

10 - L159 and L164: “quasibinomial”. Explain why a quasibinomial link model was used instead of the more traditional binomial model... or any other model for that matter.

**Response:**

**We have reverted to the use of binomial GLMs, with no effect on the results (lines; S1, S3, S4).**

**Response to Reviewer 2**

**COMMENT**

This is where you will paste in the Editor/reviewer comment to which you are responding.

**Response:**

**This is where you will put your response to the comment made by the Editor/reviewer.**

**COMMENT**

This is where you will paste in the Editor/reviewer comment .to which you are responding.

**Response:**

**This is where you will put your response to the comment made by the Editor/reviewer.**