Dear Dr. Trexler,

## Accompanying this letter is a revision to the manuscript “From the predictable to the unexpected: kelp forest and benthic invertebrate community dynamics following decades of sea otter expansion” (OECO-D-18-00256R1). We have revised the manuscript in response to critiques from Dr. Shurin and made the requested editorial changes to the manuscript. We believe these changes improve the manuscript and that it should now be acceptable for Oecologia.

## There was only one point of contention and confusion. My response to the possibility of hysteresis and alternate states was unclear and I have edited the sentences in the discussion accordingly (see lines around 450). Dr. Shurin’s contention is an entirely reasonable mechanism that deserves mention. My main objection is that the Ling et al. paper used to support the notion of non-linearity between urchins and kelp and I am left trying to figure out what is meant by non-linearity. I think my main objection was to the casual and imprecise use of the term non-linear. In the ecological literature, there is a large variation and casual use of the term “non-linear” which is confusing rather than illuminating.

## For example, in parts of population dynamics literature, referring to dynamics as “non-linear” refers to the plotted relationship of in state-space (e.g., number of species A vs. number of species B with each point representing a time point in the time-series) and assessing if this relationship is best described by a line or a curve (e.g. Sugihara 1994, Munch et al. 2017); this is a method for describing and predicting from stochastically chaotic or cyclical dynamics and differentiating them from stochastic but simpler dynamics around an attractor. In other contexts, referring to interactions as nonlinear refers to the shape functional response between two species (e.g., rate of consumption of species A by species B as a function of the number of individuals of species B). In still other contexts, nonlinearity refers to relationships between a population state and an environmental covariate (e.g. Samhouri et al. 2017). I suspect there are other uses of the term as well that I cannot think of now. As is clear, these definitions of non-linearity do not refer to the same thing and, in most cases, are not mechanistically related. In my opinion the widespread use of this terminology doesn’t help anyone’s understanding. I really do not want to contribute to the confusion surrounding the term and so I prefer not to use it. The current manuscript has little to directly contribute to whether the dynamics are non-linear, or the relationship to an ecosystem state is non-linear, or the functional response is non-linear.

## The dynamics described in the Ling et al paper may well be derived from a non-linear function response between urchins and kelp. But importantly, the authors do not actually do a quantitative analysis to show that is the case; they make a conceptual sketch on a graph and see if observed observational and experimental changes in kelp and urchins look like their proposed sketch. Implicitly they are harkening back to the toy model proposed by Sheffer et al. (2001) which has interesting dynamics and hysteresis and other attributes. It is unclear why a deteriministic, single species model (the Sheffer model) would be a good descriptor for the Ling et al. urchin-kelp system in which should be a two-species model with stochasticity (see their discussion). There is great value in the Ling et al. paper, but strong evidence of non-linear functional responses is not part of their results. The do not even mention non-linearity in their discussion. Their analysis does reveal potential state-dependence the result of alternate states, though, even if the mechanism and stability of those states is not really investigated.

## Thank you for your consideration.

## AO Shelton for the co-authors.

## References:

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Sugihara, G. (1994) Nonlinear forecasting for the classification of nature time series. Philosophical Transactions of the Royal Society of London, Series A 348: 477-495.

Munch, S. B., Poynor, V., & Arriaza, J. L. (2017). Circumventing structural uncertainty: A Bayesian perspective on nonlinear forecasting for ecology. *Ecological Complexity.*, 32, 134–143.