**The effect of geographic range on extinction risk during background and mass extinction** by Jonathan L. Payne and Seth Finnegan

The authors of this article sought to describe the effect that geographic range size poses on extinction risk. They used occurrences of benthic marine invertebrates from the Paleobiology Database over the course of approximately 500 million years to evaluate this relationship. They used logistic regression because the outcome is binary, extinction or survival, and the odds ratio used in logistic regression shows the relationship between the odds of an outcome (extinction/survival) and an explanatory variable (geographic distribution). They found positive relationships between geographic distribution and survivorship in almost all time intervals except those associated with the end Permian, end Triassic, and end Cretaceous extinctions in which case there was no correlation. This result is interesting because, according to the article, it suggests that this reduced selectivity during some mass extinctions and other time intervals there may have been similar selective pressures on a global scale. The results from this study show that geographic range size may be a significant predictor of extinction risk in the marine fossil record in most cases excluding those select intervals of mass extinction where global-scale selectivity had the greatest effect.

I really liked reading about the methods used in this paper because it is very closely related to the methods I would use for my grant proposal project. In fact, odds ratios are a great descriptor for the data I would be collecting for this project. It was very interesting to see how they controlled for the effect that heterogeneous sampling could have on the tests they performed. The sample size was also great in my opinion; I think anything backed up by 227,229 data points probably has a good chance of being a significant factor in any phenomenon. The result of low selectivity for geographic range size during a mass extinction interval was a little surprising at first, but it seems to make sense because a global catastrophe has wide reaching effects that likely cover much more area than even genera with the largest geographic distributions. I also like that they included some of the formulas that they used in their analysis.

One thing I found confusing was when they described how they accounted for the significance that the number of plates defined in the PBDB and how they described three intervals that were highly sampled, but I only saw two intervals that they wrote about, the latest Triassic and latest Cretaceous. They might have been referring to two late Cretaceous intervals where sampling is unusually high, but I could not tell from reading this section. I want to know if there is a way to not separate the data into time bins, like their 10 My intervals, and use a continuous measure, but I think that may be difficult to accomplish given the nature of the fossil record and the accuracy of dating techniques.

I found most of the graphs to be very useful in supplementing the text. Figure 1A helped to show the relationship between geographic range size and selectivity, and figure 1B was useful to see the effect that the other factors had on the relationship presented in 1A. Having some background in statistics helped to make table 1 useful since the only metric with a significant effect based on the *P* value was the number of tectonic plates in the PBDB although the percent of diversity represented by range-through genera was close. It was interesting to see the cluster of mass extinctions at the bottom of the graph in figure 2 indicating less of an effect on extinction intensity based on geographic range selectivity. Figure 3 appeared to show a nice correlation between observed and expected results, but the error bars give me a little concern. Figure 3 also seems to indicate that this test gives more predictive power for Paleozoic range selectivity than Mesozoic and Cenozoic range selectivity.