Title: How do biological traits affect brachiopod taxonomic survival? A hierarchical Bayesian approach.

While the effect of geographic range on extinction risk is well documented, the effects of other traits are less well known. Here, I analyze patterns of Paleozoic brachiopod genus durations and their relationship to geographic range, affinity for epicontinental seas versus open ocean environments, and body size while allowing for a nonlinear relationship between for environmental affinity and duration. Using a hierarchical Bayesian modeling approach, I model the correlations between the effects of the biological traits as well as their correlations with baseline extinction risk. I find evidence that as extinction risk increases, the expected strength of the selection gradient on biological traits (except body size) increases. This manifests as greater expected differences in extinction risk for each unit change in geographic range and environmental preference during periods of high extinction risk, as opposed to a much flatter expected selection gradient during periods of low extinction risk. I find weak evidence for a universally nonlinear relationship between environmental preference and extinction risk such that "generalists" have a lower expected extinction risk than either "specialists". While for the majority of the Paleozoic this hypothesis is strongly supported, there are many times where this hypothesized relationship is absent or even reversed. Importantly, I find that as extinction risk increases, the peakedness of this relationship is expected to increases as well. These results demonstrate the importance of directly modeling the structure inherent in the observed data as a means to better understand which processes may have been driving the observed patterns of diversification.