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GSA Proposal

Introduction:

My objective is to test how the extinction rates of non-dominant species in an ecosystem respond to different levels of dominance in the most dominant species. Dominance will be defined as low evenness. The effect dominance has on extinction rates is not fully know. It is crucial that we develop a better understanding of extinction because we are in a time with high extinction rates(Barnosky et al., 2011). In this study, I will examine ecosystems with different levels of dominance, and draw conclusions about its effect on extinction rates. I hypothesize that the marine ecosystems around named rock formations with high dominance levels will have elevated extinction rates of the non-dominant species. This is because, as Bonsall and Hassell(1997) explain, competition will increase extinction rates. This increased extinction will be felt more by non-dominant species because the dominant species are better competitors(Robertson 1996).

Justification:

As stated by Raup(1993), extinctions are clearly not a random biological event. Biologists, paleontologists, and many others have since been able to identify many factors, such as geographic range, body size, and population size, among other traits, as predictors of extinction(Cardillo et al., 2005). However, there is still much that is unknown about extinctions and what can cause them and therefore need to be researched more. This study is necessary today because we are currently facing the potential for a sixth mass extinction and some argue it has“already arrived”(Barnosky et al., 2011). For conservationists to effectively combat this

extinction event both time and money need to be invested into the study of extinction to avoid a sixth, anthropogenic extinction.(Vitousek, Mooney, and Lubchenco 1997).

This study would be an important piece of the effort to further understand extinction for many reasons. First, dominance has never been studied as a direct causation for extinction or other taxa in the same ecosystem. While these two factors have been correlated before, it was only thought to be correlated by a third variable, high grazing levels, and not one causing the other(Olff and Ritchie 1998). Secondly, it can be well justified, ecologically, that sharing an ecosystem with a dominant species would increase extinction rate. This is because it leads to direct competition with that species. As said by Slatkin(1974), competition increases extinction rate. Furthermore, Robertson(1996) demonstrates in his paper that dominance can be a product of an ability to outcompete others. I hypothesize non-dominant species in an ecosystem will see raised extinction rates due to the fact that the dominant species is able to outcompete the non-dominant taxa. This effect will not be seen in every species, due to the fact that some taxa will have no resource overlap with dominant taxa, however, the average extinction rate will be statistically significantly raised.

Research Plan:

The first step in this study is to identify ecosystems with varying levels of the most dominant species immediately prior to the Cretaceous–Paleogene extinction event. The ecosystems being studied will be limited to marine ecosystems surrounding named rock formations because availability of rock will have a positive effect on the quality of the fossil record. This is important for this study because the number of occurrences are key to the result. The simple presence of an occurrence is not helpful, but we will be needing an accurate

measurement of abundance of each species in the ecosystem. Again, high dominance will be measured as low evenness.The data for this study will come from the Paleobiology Database, using occurrences of species in each ecosystem to find abundances. This will be my source of data for several reasons: it is convenient, easily accessible, and it is a reliable source of data as well as easily reproducible. Following this step, in PBDB, I will look at the same environments and find the percentage of species in each environment that went extinct in the mass extinction event. These percentages will then be graphed on the y-axis, and the x-axis will be the original dominance, prior to the extinction event. Displaying the data graphically is appealing because it can directly reveal trends that arise from the comparison of the two variables. For my hypothesis to be proved correct, I will need to see a statistically significant trend of an increasing percent of species lost as the dominance increases. To prove these are statistically significant, a t test will be performed against the null hypothesis that these two variables are uncorrelated.

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