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Geosci 541

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GSA Proposal – Final

Extinction of marine invertebrates in the Phanerozoic with respect to mode of life and latitude.

Statement of the Problem:

Justification:

Research Plan: 2266/2500

The selectivity patterns of molluscan fauna will be modeled across the entire Phanerozoic (including background extinction) to uncover trends in extinction with respect to mode of life and geographic range. Molluscan fossil occurrences will be downloaded using the Paleobiology Database and organisms will be separated based on their preferred mode of life, namely epifaunal or bivalves that grow at or above the sediment-water interface, and infaunal, or bivalves that grow within the sediment itself. Epifaunal bivalves will include erect epifaunal bivalves that grow vertically into the water column, as well as surficial epifaunals, which live in contact with sediment but do not extend high into the water column (Mondal et al., 2016). Infaunal bivalves will include shallow-burrowers (<6 cm) and deep-burrowers (>6cm) (Mondal et al., 2016). Semi-infaunal organisms will not be considered and the study will take place at the genera level in order to include as many organisms as possible. Data from the Paleobiology Database will be essential to this study and all fossil occurrences of bivalves will be downloaded spanning the Phanerozoic. The data will be cleaned and culled for outlier occurrences to exclude fossils with an occurrence of less than 2. Organisms will then be separated based on mode of life, age, and latitudinal region using R programming language. Log-odds, which determines the survivor to victim taxa, will be calculated separately for infaunal vs. epifaunal organisms with respect to latitude (geographic range) and time. Log-odds is calculated by taking the log of the odds ratio after survivor and victim taxa have been isolated:

Odds-ratio(Region A) = ([# of survivors/TOTAL]/[# of victims region A/TOTAL]) Equation (1)

Log-odds = log(Odds-ratio Region A/Odds Ratio Region B) Equation (2)

A positive log-odds shows an advantage for region A organisms, while a negative value shows an advantage for Region B. These calculations will also include 95% confidence intervals which determine the statistical significance of the probabilities of extinction with geographic range. Finally, for this comparison, four main latitudinal regions will be considered: tropical, sub-tropical, Antarctic, and sub-Antarctic islands.