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Editor

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Dear Editor,

Please find enclosed our manuscript entitled “How predictable is extinction? Forecasting species survival at million-year timescales” by myself (Peter D. Smits) and Seth Finnegan. In this study we asked a relatively simple yet fundamental question in paleobiology: how well do models conditioned on past observations predict future extinction events. To answer this question we analyzed the well-sampled fossil record of Cenozoic planktonic microfossil taxa (foraminifera, radiolarians, diatoms, and calcareous nanoplankton.) We examined how extinction probability varies over time as a function of species age, time of observation, current geographic range, change in geographic range, climate state, and change in climate state.

Using cross-validation, we were able to estimate the expected forecast performance of our model to future observations. Our models were found to have a 70-80% probability of correctly forecasting the rank order of extinction risk for a random out-of-sample species pair, implying that determinants of extinction have varied only modestly through time. The relative quality and consistency of our models’ out-of-sample forecasting performance is encouraging given that these estimates are based on very limited biological and environmental information about the studied taxa.

These results suggest that models trained on prior extinction/survival patterns do modestly well at predicting relative extinction probability of randomly selected species pairs based on a small number of taxonomic, geographic, and historical predictors. Importantly, our results are directly comparable to conservation determinations because both are expressed in terms of a continuum of risk, from most to least. The results of this simple exercise suggest that conservation decisions would be bolstered by including fossil data.

We believe that this study will be of general interest to paleontologists, conservation biologists, ecologists, and evolutionary biologists. Thank you for considering our work. Please send all correspondence regarding this manuscript to me via my email address (psmits@berkeley.edu) or that of my co-author, Seth

Finnegan (sethf@berkeley.edu).

Sincerely,

Peter D. Smits

encl: Article, supplementary text

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