

Temperature-dependent hypoxia and end-Permian mass extinction

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Rapid climate change at the end of the Permian Period (*ca.* 252 Mya) is thought to have triggered the most severe extinction in Earth's history, but a quantitative link between climate change, species' traits, and extinction is lacking. Here we present Earth system model simulations of the Permo-Triassic transition that reproduce the ocean warming and oxygen (O₂) loss indicated by the geologic record. We evaluate the effect of these environmental changes on animal survival, both regionally and globally, using the Metabolic Index (Φ), a measure of organismal scope for aerobic activity governed by species' traits sampled in modern taxa. Model aerobic habitat loss can explain most of the loss of biodiversity on a region-by-region basis. Global extinction is predicted to be more complete for organisms inhabiting higher latitudes, consistent with a spatially explicit analysis of the marine fossil record. The combined physiological stresses of ocean warming and O₂ loss thus largely account for the worst crisis in the history of marine animal life.