



Climate influences the impact of geographic range size on extinction risk of amphibians

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Geographic range size of many fossil and extant species is highly correlated with their extinction risk, including amphibians. Studies have shown that during mass extinction events the influence of geographic range size on extinction risk tends to become weaker for invertebrate taxa; however, little is known about whether range size/extinction risk relationship temporally varies for amphibians, i.e. due to differing climatic conditions. We herein combine the amphibian fossil record with climate proxies to test for environmental influence on geographic range size, and strength of the correlation of geographic range size with the extinction risk of species.

Using a global dataset, comprising 354 extinct amphibian species from the last 330 million years, we test for a connection between geographic and stratigraphic ranges (indicating extinction risk) with two long-term climate records; the relative mean global temperature and the global latitudinal temperature gradient, derived from oxygen isotope data.

We show that geographic range size is not correlated with the mean global temperature, but with the latitudinal temperature gradient, i.e. resulting in on average larger range sizes when the temperature gradient is relatively small. The positive correlation between geographic range size and extinction risk of species thus is temporally stable; however, there were variations in correlation strength over time. This variation is correlated both to the mean global temperature and especially to the latitudinal temperature gradient, with a stronger influence of geographic range size in time periods with a relatively high global mean temperature and a small temperature gradient.

Our results indicate that an increasing temperature gradient is associated with a weakening of the range size-extinction risk correlation. This finding suggests that the importance of range size for a species' extinction risk is highest in latitudinally homogenous environments, indicated by a small temperature gradient. By contrast, range size is less important for the survival of a species when there is a sharp latitudinal gradient in environments. Reasons might be a limited geographic range size due to climatic constraints. Under more diverse environmental conditions, other factors might become relatively more important for a species' survival, like for example the ability to cope with competitors.