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Anthropogenic intensification of climate extremes has altered vertebrate species abundance

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Assessments of the effects of climate change on terrestrial biodiversity typically rely on species distribution models [1] which neither exploit data on historical abundance changes nor consider the potentially important role of climate extremes. Here, we combine global data on the abundance of vertebrate species populations [2] with metrics of exposure to local climate conditions to demonstrate that historical warming and increased exposure to heat, heavy precipitation extremes and drought have had significant impacts on abundance, even after controlling for changing human pressures. Fixed-effects models reveal plausibly causal impacts which vary by species class and habitat system, as well as by latitude and the extent of human pressure. Results indicate that warming and intensified heat extremes have negative impacts at low latitudes for freshwater fish and terrestrial birds. By contrast, warming can bring benefits to freshwater birds and terrestrial mammals. Heavy precipitation extremes and drought appear to have had mainly negative impacts on abundance across species' and habitats. We then combine these empirical results with estimates of the changes in climate conditions and extremes which are attributable to anthropogenic influence, using an established impact-attribution framework [3]. This approach reveals that anthropogenic climate change has caused considerable alterations to the abundance of terrestrial life, for example by reducing the abundance of terrestrial birds and freshwater fish by up to 40% at low latitudes.

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