Body size and climate change: contrasting effect of temperature anomaly along species thermal range in French birds

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Abstract

Besides distributional and phenological shifts, body size reduction was recently proposed as one of the major ecological responses to climate change. However, the mechanisms underlying body size change are still poorly understood, and the direction of size change varies between studies (with reports of body size decrease, increase, or stasis). This may be because the direction of the thermal stress may differ between climatic regions. We predicted that morphological response to temperature fluctuations should vary within species ranges, depending on the relative position of the population within species' thermal niche. We tested the effect of spring temperature anomaly on juvenile body size, and whether this effect varied along an 11∘C-thermal gradient in France (204 sites, representative of 58% ± 13 SD of species thermal niches), for 9 songbird species (n = 34,101 individuals). For all species, warmer temperatures induced body size increase in juveniles that were located towards the cold edge of their thermal niche. As expected, this effect decreased towards the hot edge, becoming negative for two species. This may be due to the differing consequences of temperature change on both organismal thermoregulation, and ecosystem production and food availability. We therefore predict that warming should induce body size increases more frequently at the cold edge of species distribution ranges, and rather body size declines at the hot edge. Hence, future studies focussing on climate-driven changes in body size should consider the possibility of non-uniform responses within species ranges.

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