

# Multidimensionality of thermal niches and its implications to temperature changes responses: insights from dung beetles.

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March 30, 2022

## Abstract

Approaching the consequences of climate change demands understanding how temperature controls species' responses across key biological aspects, as well as the coordination of thermal responses across these aspects. We study the role of temperature in determining the species' diel, seasonal, and geographical occurrence, using dung beetles as a model system. We found that temperature has relatively low –but not negligible– effects in the three studied species' aspects, once accounting for alternative factors. More importantly, the estimated thermal niches were largely incongruent across aspects. This shows that species have multidimensional thermal niches, entailing that adjustments to fulfil temperature requirements for one biological aspect, such as seasonal ontogenetic cycles, may result in detrimental effects on other aspects, like diel activity. Paradoxically, the relatively weak effects of temperature we found may have serious consequences for species' responses to warming if temperature regulates essential aspects of species' biology in divergent ways.

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