# Resource limitation determines realized thermal performance of consumers in trophodynamic models.

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**Abstract**

1. Thermal performance curves (TPCs) are commonly used to forecast species' responses to temperature change. Recent work has demonstrated that the breadth and shape of a consumer's TPC change with resource densities, highlighting the potential for inaccurate forecasts if resource densities are not static. In particular, if resource densities decline, the optimal temperature and breadth of thermal performance also declines leading to an enhanced risk of warming, particularly among species that may incur additional costs of behavioral thermoregulation. 2. Here, we investigate the relationship between resource density and temperature (warming) on the persistence of a consumer population which exerts top-down control on its resource via trophic interaction. Trophic coupling generally reduces the potential for resource declines to exacerbate the negative effects of warming on consumers; when warming has negative effects on the consumer, resource densities tend to increase due to a reduction in top-down control. However, if resources are more sensitive to warming (e.g. due to an asymmetry amongst their thermal performance curves), the negative effects of warming on consumers can be exacerbated by declining resources. 3. Our work elucidates the importance of jointly considering temperature and resource limitation when utilizing assessing the thermal performance of species. We demonstrate how knowledge of the thermal performance of a resource population can be used to generate realized consumer thermal performance curves.

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