

Tolerance landscapes in thermal ecology

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Summary: How thermal tolerance estimated in the laboratory can be extrapolated to natural settings remains a contentious subject. Here, we argue that the general premise that a single temperature can accurately describe upper or lower tolerance limits is incorrect. Survival probability is determined by both the intensity and the duration of a thermal stress, and the association between these variables can be adequately conveyed by a thermal tolerance landscape. Employing this framework, we demonstrate that the temperature range that an organism can tolerate is expected to narrow down with the duration of the thermal challenge. Analyses suggest that a trade-off exists between tolerances to acute and chronic exposition to thermal stress, and that changes in temperature means or extremes may result in drastically different selective pressures and subsequent evolutionary responses. After controlling for the duration of the thermal challenge, we also uncover latitudinal effects on upper let