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The Interface Between Physiology and Environment in the Rainbow Skink (*Trachylepis margaritifer*)

Ashadee Kay Miller

Abstract

Environmental temperature greatly affects many aspects of an ectotherm's physiology. These effects can be so significant that temperature is often the foremost constraint determining an ectotherm's distribution. However, establishing the link between these mechanistic limitations and distribution require often-intensive and costly investigations. In an attempt to improve efficiency and reduce cost, niche-based models are often implemented as a means to identify potential constraints. However, these approaches are mere hypotheses-generators, and do not directly establish causal links between geographic range and limiting factors. Furthermore, the mismatch of species-appropriate scale and resolution of input data are often not addressed in these models. This dissertation directly examined the relationship between a southern African skink, the Rainbow Skink (*Trachylepis margaritifer*) and environmental temperatures. It examined the effect of temperature on appetite, digestive efficiency, and gut transport times. It assessed the potential for this species to serve as a candidate for stress metabolite studies and evaluated how accurately a niche model predicted the environmental temperatures experienced at a fine-scale (i.e., species-appropriate, microhabitat resolution) based on broad-scale temperature inputs. Additionally, the suitability of habitat quality proxies are assessed against both model predictions and on-the-ground measures made at a fine scale. Temperature significantly affected appetite, with low temperatures (25 °C) resulting in decreased appetite. Gut transit times are also significantly affected, but not in an expected pattern. At low temperatures (25 °C), gut transit time was decreased when compared to those recorded at an intermediate temperature (27 °C). Transit times however remained predictably low at high temperatures (32 °C). However, this unusual pattern in transit times had no effect on associated digestive efficiencies. Instead, digestive efficiencies remained equally high across these three temperatures tested. Additionally, habitat quality proxy measures in general aligned poorly to modeled predictions. No meaningful differences in habitat quality were found using typical thermal assessments of environmental means, but were when using skink-relevant and biologically meaningful ones. For *T. margaritifer*, continuous exposure to 22 °C impairs digestion and promotes skin lesions and eventual death under controlled conditions, and at sites where exposure to 22 °C were greatest, skinks appeared to be in the poorest condition, and many exhibited skin lesions. These findings strongly suggest that 22 °C may represent a lower thermal constraint for the species, and highlights the importance of mechanistic studies that directly investigate factors affecting a species' physiological performance. In addition, techniques such as measuring glucocorticoids and their metabolites may better reflect habitat quality, as well as serving to validate selected habitat quality proxies. Overall, despite the ever-increasing approaches available to conservationists and ecologists alike, this work emphasizes that if we are to take full advantage of these new techniques, in-depth, trait-specific mechanistic studies must maintain their place among them.