

Biography: Dr. Kaelyn Fogelman is a Postdoctoral Research Fellow at Auburn University's School of Fisheries, Aquaculture, and Aquatic Sciences in Alabama, USA. Her research focuses on the ecology of aquatic molluscs and crustaceans, with an emphasis on food webs and physiology. Much of her work involves the conservation of imperiled fauna, invasive species control and how aquatic invertebrates will be impacted by our changing climate.

Title: *Using aerobic scope to evaluate the thermal tolerance of aquatic invertebrates*

Abstract: Understanding the physiological basis for thermal tolerance, and the factors that might alter tolerance, is of increasing importance in the face of ongoing climate change. Aerobic scope may be an important driver underlying thermal tolerance and geographic range of aquatic ectotherms. Aerobic scope (AS) represents the excess capacity of an organism to deliver oxygen in support of activity, growth, and reproduction. It can be calculated as the difference between resting metabolic rate (RMR: metabolism required for basic maintenance) and maximum metabolic rate (MMR: maximum metabolic rate an organism is capable of). Aerobic scope exhibits a unimodal relationship with temperature and in theory, the temperature at which AS equals zero represents the critical thermal maximum (CTM) of an organism where it is no longer physically capable of meeting its energetic needs. To assess the robustness of the predicted relationship between AS and upper thermal limits in aquatic invertebrates, we measured AS and critical thermal maxima (CTM) of unionid mussels, crayfish, and marine shrimp. We evaluated whether CTM was preceded by a decline in AS, whether CTM occurred when AS equaled zero, and the relationship of aerobic scope and CTM across species. We exposed mussels, crayfish, and shrimp to increasing temperatures (25–51°C) at a rate of 1–2°C/h. Organismal RMR was estimated via respirometry and MMR was estimated via the electron transport system (ETS) assay. Aerobic scope was calculated as MMR-RMR. CTM was estimated as the temperature at which shrimp and crayfish could be flipped over and were unable to right themselves for at least 30 seconds and mussels had an extended foot, gaping shell, retracted mantle tissue and siphons and were unresponsive to touch. Crayfish and mussels experienced CTM with high AS capacity remaining, while shrimp experience CTM as AS approaches zero. For most species, minimum aerobic scope occurs within 1°C of CTM, so while AS is not reduced to zero for all species, minimum AS appears closely related to the upper lethal temperature limits.