Molly M. Morrissey
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Assessing metabolic exertion during diel vertical migration of an omnivorous macro-invertebrate

Diel vertical migration (DVM) in aquatic systems is the migration of populations between deeper daytime depths and shallower nighttime depths. At night, individuals migrate to the surface to feed when predation risk is reduced under lower light conditions. Because migration requires energy output, there must be a positive tradeoff between energy expenditure (migration) and energy gain (foraging) from DVM. An evaluation of these energetic costs and benefits is critical for understanding why some animals exhibit DVM. The opossum shrimp, *Mysis diluviana*, is an omnivorous macro-invertebrate in Lake Champlain that undergoes DVM. In this study, I tested the hypothesis that the anaerobic enzyme lactate dehydrogenase (LDH) in the opossum shrimp can serve as a proxy for migration activity, and thus its potential for developing an energy budget to better understand the energetic consequences of DVM. LDH has been shown to vary across fish populations depending on activity levels and foraging behavior. To test this hypothesis, I collected individuals from Lake Champlain before (benthic habitat) and after (pelagic habitat) their nightly migration, and quantified their LDH content. I expected to see greater LDH levels in individuals caught after their nightly migrations than before. Initial analyses suggest LDH content is positively correlated with opossum shrimp body mass, and LDH content is greater in individuals caught at night in pelagic habitat compared to during the day in benthic habitat. In-lab experiments are planned to further evaluate these initial findings, where I will conduct a series of "chasing" experiments to compare levels of LDH between chased (i.e., active) and non-chased individuals. If my expectations are supported, this work will justify future research to quantify the relationship between enzyme levels and respiration, providing a method to estimate the energetic costs of DVM *in situ*, which is a critical data need for testing hypotheses about the proximate (triggering) and ultimate (evolutionary) causes of DVM.