Lack of Metabolic Temperature Compensation in *Littorina saxatilis* and *L. obtusata*

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Two intertidal snails, *Littorina saxatilis* (Olivi, 1792) (upper eulittoral fringe/maritime zone) and *Littorina obtusata* (Linnaeus, 1758) (lower eulittoral) were collected from a boulder shore on Nobska Point, Cape Cod, Massachusetts, in July and were acclimated for 15-20 days at 4° or 21°C. Thereafter, O_2 consumption rate ($\dot{V}O_2$) was determined for subsamples of individuals (n = 11-15) at 4°, 11° and 21°C with silver/platinum oxygen electrodes. Plotting of animal dry tissue weight (DTW, X axis) against whole animal $\dot{V}O_2$ revealed a high degree of overlap of points between 4°C and 21°C acclimated individuals in both tested species at all test temperatures, indicating an apparent lack of capacity to temperature compensate metabolic rates. Multiple analysis of variance (MANOVA) of $\log_{10}$ transformed values of whole animal $\dot{V}O_2$ with $\log_{10}$ DTW values as a covariant revealed that test temperature significantly affected $\dot{V}O_2$ in both *L. saxatilis* ($P<0.00001$) and *L. obtusata* ($P<0.00001$) with increased test temperature resulting in an increased oxygen consumption rate. In contrast, MANOVA revealed that temperature acclimation did not affect $\dot{V}O_2$ in either *L. saxatilis* ($P = 0.35$) or *L. obtusata* ($P = 0.095$). Thus, neither species displayed a capacity for the typical metabolic temperature compensation (i.e., increase in $\dot{V}O_2$ at any one test temperature in individuals acclimated to a lower temperature) characteristic of most ectotherms.

Lack of capacity for typical metabolic temperature acclimation also has been reported for *Littorina littorea* (Linnaeus, 1758) and *Littoraria angulifera* (Lamark, 1822), suggesting that it may be characteristic of intertidal littorinid species in general. Lack of capacity for respiratory temperature acclimation may reflect the extraordinary semi-diurnal temperature variation that littorinid snails are exposed to in their eulittoral and upper eulittoral fringe/maritime zone habitats where any metabolic benefits derived from longer-term temperature compensation are negated by extreme daily temperature variation. Instead, littorinid species have evolved other mechanisms of immediate metabolic regulation. In all littorinid snails examined to date, including *L. saxatilis* and *L. obtusata*, such adaptations appear to center on a unique ability for near instantaneous suppression of metabolic rate and entrance into short-term metabolic diapause at temperatures above 25-35°C. As such, typical seasonal respiratory compensation mechanisms may be of little adaptive value to littorinid species.

Community ecology of littorinid snails

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The Littorinidae is a cosmopolitan family of intertidal and shallow subtidal mesogastropod snails which are extremely abundant in many ecosystems. Most members of the family