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Effect of elevated temperature on aerobic respiration of coral recruits

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Abstract:

Metabolic rates provide a valuable means to assess the condition of early life stages of scleractinians, but their small biomass creates a signal-to-noise problem in a confined respirometer. To avoid this problem, measurements of the oxygen diffusion boundary layer (DBL) and Fick's first law were used to calculate the respiration rate of coenosarc tissue on recruits (i.e., colonies 5–14 mm diameter) of *Porites lutea* (Edwards and Haime, 1860) exposed to two temperatures at a flow speed of 0.6 cm s^{-1}. All experiments were completed in Moorea, French Polynesia, between November and December 2003. At 26.8 °C, the DBL was 565±55 µm thick, the oxygen saturation adjacent to the tissue was 80±3%, and the mean respiration of the coenosarc was 1.2±0.1 µl O_2 cm^{-2} h^{-1} (all values mean ± SE, n=10). Exposure to 29.7°C for 24–48 h did not affect the DBL thickness but significantly reduced the oxygen saturation adjacent to the tissue (to 74%) and increased the mean respiration rate by 35%. As the small corals differed slightly in size, in a uniform flow speed they experienced dissimilar flow environments as characterized by the Reynolds number (Re), thereby creating the opportunity to test the flow dependency of respiration. At 26.8°C, respiration and Re were unrelated, but at 29.7°C, the relationship was positive and statistically significant. Thus, respiration of small corals may not be mass transfer limited at low temperature, but relatively small increases in temperature may result in an increased metabolic rate leading to mass transfer limitation and flow-dependent rates of respiration.