Quantifying bioenergetic responses to temperature in walleye using modern respirometry techniques

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ABSTRACT:

Walleye (*Sander vitreus*) are a sexually dimorphic freshwater piscivore that have long been studied using bioenergetics, yet robust estimates of metabolic rates for use in those models have been lacking. Therefore, we quantified the effects of body mass, water temperature, and sex, on standard metabolic rate (SMR). We also validated the use of validated the use of swim tunnel respirometry as a method of assessing active metabolic rate in walleye. SMR was estimated across temperatures ranging 0.5-22 °C using intermittent-flow respirometry for male (n = 55) and female (n = 56) walleye raised in hatchery conditions. We found a significant interaction between sex and temperature, whereby males and females had similar SMR at 16°C and below, but the difference in SMR widened with further increases in temperature such that SMR was ~17% higher at 22°C. The temperature coefficient describing the rate of increase of SMR with temperature was slightly higher in males (Q10 = 2.64) than in females (Q10 = 2.25). The mass-scaling coefficient, b, was similar for both sexes at a value around 1, although the fish we used had a relatively narrow size range as they were all from three cohorts (5 - 7 year-old fish). These estimates of metabolic rate are the first to be generated using respirometry for adult walleye and differ slightly from those being used by previous bioenergetic models, which may have underestimated the energetic costs of SMR and did not include sex-specific estimates for metabolism.