Measuring Metabolic Rates of White Sturgeon and Striped Bass in Commercial Scale Aquaculture Systems

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ABSTRACT

Metabolic rates (oxygen consumption and carbon dioxide and ammonia production) of white sturgeon and striped bass were determined under commercial-scale conditions. Sturgeon ranged in size from 0.09 to 3.8 kg and stocking densities ranged from 13 to 202 kg m^{-2} tank surface area. Oxygen consumption rate values (RO2) ranged from 70 to 330 mg O_2 $kgFish^{-1}$ h^{-1}, carbon dioxide production rate values (RCO2) ranged from 210 to 670 mg CO_2 $kgFish^{-1}$ h^{-1}, and ammonia production rate values (RNH3) ranged from 3.5 to 27.2 mg TAN $kgFish^{-1}$ h^{-1}.

Mean daily carbon dioxide production rates were as much as 2.3 times greater than what would have been expected from measured oxygen consumption rate values and theoretical respiratory quotient values. Sources for the excessive amounts of carbon dioxide produced within the tanks is uncertain, although respiration of microbes within the fish culture tanks could have been a contributing factor.

Of the parameters measured in this study, feed ration was found to have the greatest influence on determining metabolic rate values. Feed ration was responsible for 93% of the variations in measured oxygen consumption rate values, 80% of the variations in

carbon dioxide production rate values, and 76% of the variations in ammonia production rate values for sturgeon in this study. Peak oxygen consumption rates were up to 100% greater than the mean daily values, although mean hourly values were never more than 22% greater than the mean daily values. Peak carbon dioxide production rate values were as much as 600% greater than the mean daily values.

Data on striped bass were limited to two testing sessions due to a loss of fish stock at the participating farm. Measured RO2, RCO2, and RNH3 values were 356 and 307 mg O_2 $kgFish^{-1}$ h^{-1}, 512 and 536 mg CO_2 $kgFish^{-1}$ h^{-1}, and 15.8 and 17.5 mg TAN $kgFish^{-1}$ h^{-1}, for 240 and 230 g striped bass, respectively.