Determining the Upper Thermal Tolerance of Juvenile Lake Sturgeon by Two Different Heating Regimes

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Abstract: Lake sturgeon (*Acipenser fulvescens*) historically ranged east of the Rocky Mountains from Canada to the southeastern United States. Today, their numbers have decreased and their range is much smaller due, in part, to anthropogenic effects, especially over-fishing and habitat modification. Lake sturgeon were once abundant in the Coosa River Basin in northern Georgia, but the last reported lake sturgeon were harvested during the 1960s. Shortly thereafter, they were considered extirpated. In an effort to re-establish the species, The Georgia Department of Natural Resources, Fisheries Division, has begun to release large numbers of juvenile lake sturgeon into a number of the rivers within the Coosa River Basin, namely the Oostanaula, Etowah, and Coosa. One concern associated with these stockings is that the lake sturgeon may not be able to tolerate the high temperatures that occur during July and August in these rivers. The Coosa River commonly exceeds 27 C during July and August, and it is not uncommon for the Oostanaula River to exceed 30 C during that same period. In an experiment conducted with lake sturgeon from the Great Lakes region, it was reported that 45% of the juvenile sturgeon died within five days at 25 C. This investigation was conducted in order to ascertain whether or not lake sturgeon can be safely released into Georgia's waters. In order to determine the upper lethal temperature for juvenile lake sturgeon, we subjected the fish to two different Critical Thermal Maximum (CTMax) protocols. In the first, 30 juvenile lake sturgeon (mean wt. 51 g) each were acclimated at two different temperatures (21 and 24 C) for two weeks and then half the fish from each of the two temperature groups were individually subjected to a temperature increase of 0.4 C min^{-1} until they displayed a loss of equilibrium. The remaining fish served as controls and were handled in a similar manner but were not subjected to the temperature increase. The second CTMax test involved the slow increase of temperature (0.5 C/day^{-1}) during a 35-day period. Fifteen fish (mean wt. 65 g) held together in a raceway were subjected to the temperature increase until they lost equilibrium. An additional 15 fish (mean wt. 68 g) served as controls and were housed is an identical system remaining at room temperature (21.6 C). In the first CTMax test, the upper lethal limit for the fish initially held at 21 C was 30.1 C and the fish acclimated to 24 C lost equilibrium at 34.4 C. There was a significant difference between the upper lethal limits based on initial acclimation. In the second trial, the experimental fish became incapacitated at 35 C. In addition, the experimental fish demonstrated a significantly lower growth rate than the controls held at room temperature. These CTMax tests indicate that the juvenile sturgeon currently being stocked into the Coosa River Basin should be able to withstand the thermal challenges they may encounter during the summer months.

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