Effects of dietary thiaminase on two strains of lake trout

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ABSTRACT:

The reintroduction of lake trout into Lake Ontario is a top priority for management agencies and conservation groups. However, these reintroduction efforts have not yet produced a self-sustaining population of lake trout. One major factor that has been hypothesized to be obstructing reintroduction efforts is the high abundance of exotic prey fishes—rainbow smelt and alewife—in Lake Ontario. Unlike historical prey, these introduced species contain high levels of the enzyme thiaminase, and their consumption has been associated with a thiamine deficiency in a variety of Great Lakes salmonids. Working on Atlantic salmon, my lab has previously identified negative effects of dietary thiaminase on traits that include swimming performance and body condition. Importantly, these effects differed among three Atlantic salmon strains targeted for reintroduction into Lake Ontario, suggesting that strain selection could help mitigate these negative effects. We compared effects of diet-derived thiaminase on survival and performance between two strains (Slate Island, Seneca Lake) of lake trout that differed in historical exposure to diet-derived thiaminase. Juvenile lake trout from the two strains were reared in a common garden environment and received either an experimental diet containing thiaminase or a control diet. Some effects of the diet differed between strains. Interestingly, survival and muscle thiamine concentration were lower for the strain with historical exposure to thiaminase (Seneca Lake), while the strain without historical exposure to thiaminase (Slate Island) suffered cardiac impairments. Next, we compared the strain contribution and prevalence of thiamine deficiency across wild-caught lake trout captured in Lake Ontario, North America. Lake Ontario is stocked annually with both Seneca Lake and Slate Island lake trout strains but a self-sustaining population has yet to establish in the lake. Preliminary results show that fish from the Seneca strain (historical exposure to thiaminase) make up a larger proportion of recaptured fish and have higher muscle thiamine concentrations than the Slate strain (no historical exposure to thiaminase). Taken together, our results suggest that both the Slate and Seneca strains of lake trout may possess beneficial genetic adaptations for thiaminase-tolerance that could translate to improved survival in the current and potential future environmental conditions in Lake Ontario, although the manifestation of thiamine deficiency may be different among strains.