Evaluating the effects of biopsy procedures on fish to enable a more mechanistic approach to fish telemetry studies

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ABSTRACT:

With continuous threats facing our freshwater systems, scientists and fisheries managers require methods to evaluate the health of freshwater fishes. Previously, many health metrics were evaluated using tissue samples lethally taken from fish. However, with technological advances many of the same parameters can be evaluated with only small pieces of tissue taken from a living specimen. By obtaining small, non-lethal biopsies of various tissues (e.g., gill, white muscle, blood) from fish that are tagged and released it is possible to identify potential associations between the internal status of the fish and their behaviour (spatial patterns) and survival. Furthermore, pairing non-lethal biopsies with information gathered throughout electronic tagging and track furthers our understanding of spatial and temporal patterns and the mechanisms behind them. This pilot project evaluated the feasibility of pairing non-lethal biopsy procedures with electronic tagging to better understand physiological correlates of variation in behavior and survival of two common Great Lakes fish species; walleye and lake trout. For both species, we assessed the effects of blood sampling, gill biopsy and muscle biopsy on the short term survival and health and physiological status of these two species using metrics such as behaviour assays (Z-mazes, Flight Initiation Distance), reflex impairment and genomic expression of Major Histocompatibility Complex Class II and Glucocorticoid Receptor 1. We found that muscle and gill biopsies did not influence exploratory and reactivity behaviour in juvenile Lake trout. Furthermore, biopsies procedure regardless of type, did not hinder swimming performance 24 hours after biopsy. Similar results were also found in adult Walleye with biopsies having no significant impact on reflexes and genetic expression of Glucocorticoid Receptor 1 and Major Histocompatibility Complex Class 2 genes. Both species exhibited very low mortality rates, with between 0.5-2% of all fish sampled in each study resulting in mortalities. Collectively, this body of work suggests that biopsy can be conducted on live teleost fish common within the Great Lakes with negligible

impacts on welfare or fitness. Furthermore, researchers can incorporate non-lethal biopsies into electronic tagging and tracking studies to provide a more holistic understanding of spatial and temporal patterns and the drivers behind them without affecting survival of the individual.