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Oxygen consumption as a non-lethal proxy for determining the sensitivity of non-target fishes to TFM

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ABSTRACT:

The application of the lampricide TFM (3-trifluoromethyl-4-nitrophenol) to streams infested with larval sea lamprey constitutes the backbone of the Sea Lamprey Control Program in the Laurentian Great Lakes. While the application of lampricides has been highly successful for managing sea lamprey, other native species have greatly varying sensitivities to TFM. Earlier work by D'Souza and colleagues revealed that the whole-animal oxygen consumption of larval sea lamprey responded in a stepwise manner to increasing TFM concentrations, opening interesting testing possibilities for non-target species. We set out to determine 1) if TFM exposure leads to stepwise increases in whole-animal oxygen consumption in non-target species, and 2) if exposure to lethal TFM concentrations leads to increases in oxygen consumption comparable to the animals' MMR. Using intermittent flow respirometry, we tested three non-target fish species with varying TFM sensitivity: young-of-the-year lake sturgeon (sensitive), juvenile rainbow trout (intermediate), and juvenile smallmouth bass (resistant), and giant floaters, a mussel species. We confirmed that all three species exhibit increases in oxygen consumption during exposure to increasing concentrations of TFM, but found that the relationship between MMR and oxygen consumption during lethal TFM exposure is complex and species-dependent. Data from the mussel trials is still being processed. Our discoveries open up interesting possibilities for future in-situ and ex-situ testing of TFM sensitivity. As the warming climate shrinks the safety margins between the doses required to kill larval sea lamprey and the doses tolerated by native species, real-time monitoring will become an important tool to avoid non-target mortality events.