

Brook Trout Environmental DNA Detections Comparable to Two Conventional Methods in Southern Ontario Creeks

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Brook Trout require cold and clean water to survive and reproduce and are sensitive to human disturbances (overfishing, pollution, urbanization, climate change) that disrupt habitat quality and connectivity. As indicators of ecosystem health, Brook Trout are of provincial protection interest. SLR annually monitors Brook Trout biomass and spawning activities in two creeks and has been doing so for the past eight years. Conventional monitoring methods included backpack electrofishing and visual spawning surveys. Electrofishing provides abundance, biomass, and fish community information but is stressful for fish and physically laborious for staff to conduct. Visual spawning surveys observe trout age, behavior, and redd construction but rely heavily on personnel experience and timing surveys with variable spawning windows.

Starting in 2020, a third technique was introduced to the sampling program: the collection and analysis of Brook Trout environmental DNA (eDNA). Molecular surveys are non-invasive, less laborious than electrofishing, and can provide relative indications of fish presence and activity. eDNA collections were conducted in tandem to electrofishing and spawning survey activities in 2020 and 2021. Briefly, we find that Brook Trout eDNA is readily detectable throughout both stream systems and generally parallels the findings of both methods. eDNA also provided an additional line of evidence (no detections) for a location that was previously observed to no longer support Brook Trout activity. We observed less eDNA detections during the 2021 spawning surveys which occurred at the edges of the spawning window, suggesting that eDNA surveys should be closely timed with the biological activities of the target species. The inclusion of an Internal Positive Control (IPC) assay prompted the addition of a cleanup procedure to our laboratory workflow to address environmentally derived inhibitory compounds present in some samples that can adversely affect successful eDNA detection. SLR has demonstrated that eDNA surveys are a valuable addition to annual biomonitoring programs and complement conventional survey methods.

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Danielle Bourque is a Molecular Ecologist at SLR Consulting (Canada) Ltd. (SLR). Danielle graduated her M.Sc. at the University of Guelph in 2019, where she demonstrated that changes in eDNA concentration corresponded with changes in the biomass and abundance of water flea populations over a four-month time series. Danielle has been working on various eDNA projects with government and industry collaborators at the University of Guelph since 2015, and is experienced in aquatic field collections, eDNA assay design, and DNA barcoding. Danielle has applied her knowledge of eDNA at SLR on multiple projects, monitoring amphibian, mammal, and freshwater fish Species at Risk and invasive species in both Ontario and British Columbia.