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## **Seeing through a fish's eye: Using stable isotopes of fish eye lenses to understand life History**

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*September 2024*

### **ABSTRACT:**

Analytical techniques to re-create an individual fish's trophic ecology are limited. Recent developments in marine systems suggest stable isotope analyses of fish eye lenses may provide a tool to re-create an individual fish's feeding chronology throughout their life. These layers are comprised of crystalline proteins that maintain each layer's structure and elemental composition, and are rich in carbon, nitrogen, and other elements that can be used for stable isotope analyses. Our research tested the utility of stable isotope analyses of fish eye lenses to retroactively describe feeding chronologies of individual fish throughout the duration of their life. Individual research objectives focused on evaluating this technique across different Char populations with unique life history variations, including freshwater to marine migrations (Arctic Char in the Coppermine River), distinct ecological morphs (Lake Trout in Lake Superior), and adaptive foraging in response to prey fluctuations (Lake Trout in Lake Michigan), and evaluating formalin and ethanol preservation effects on the isotopic values of fish eye lenses. Across study systems, results uniformly highlight the utility of this technique to quantify individual life history variation; however, additional work is needed to link isotopic foraging histories to specific growth periods within a fish's life. Preservation effects were limited and suggested differences between frozen and preserved samples were primarily driven by effects of preservatives on eye lens diameter and less on shifts in isotopic composition. Early results are very promising and suggest this novel technique will be a valuable addition to the fisheries scientist and manager's toolkit.