

# Temporal Variation in Trace Element Chemistry of Fish Otoliths: Implications for Identifying Natal Origins in River Systems

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*Abstract:* Otolith chemistry has demonstrated potential for identifying natal origins and tracing dispersal in fisheries across a variety of habitats. Our objective was to assess inter-annual and intra-annual (specifically, within the spawning season) variation of trace element signatures distinguishing different rivers. Our study site was the Upper James River and its tributary the Maury River in western Virginia. We collected smallmouth bass (*Micropterus dolomieu*) fry from various locations along the length of the Maury River and also from the James within 10 km of their confluence. In 2005 fry were collected once from each location, while in 2006 we collected fry at approximately weekly intervals where available. Water samples were taken simultaneously with each collection. We analyzed trace element concentrations in otoliths and water samples using solution-based inductively coupled plasma-mass spectrometry (ICP-MS). Results indicate significant variation in otolith strontium (Sr) and magnesium (Mg) concentrations between years (2005 vs. 2006) and between sampling periods within the 2006 spawning season. Water chemistry did not vary to the same degree as otolith chemistry, suggesting that additional factors (e.g., maternal input or age of fry) may have contributed to variation in otolith chemistry. We are currently assessing the role of these biotic factors in elemental uptake by rearing wild-caught fry in controlled laboratory conditions (aquaria) and tracking otolith chemistry through repeated sampling. These results have considerable implications for designing protocols for using otolith chemistry as natural markers of natal origins and tracking dispersal through this system. In particular, annual young-of-year sampling will be required if area-specific signatures vary annually. When analyzing core chemistry of adult otoliths to infer natal origins, material sampling will have to be carefully directed to ensure that the growth period analyzed coincides with the time period represented among fry otoliths in reference collections.

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