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# Fish eye lenses allow us to see into the past, revealing geographic histories that can be compared to otolith trace-metal profiles

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**Abstract**
We previously developed a novel method to extract carbon and nitrogen stable-isotope histories from fish using eye lenses. The metabolically inert optical proteins that are deposited in fish eye lenses form in successive, concentric circles (laminae) in much the same way that annuli form in otoliths. More recently, we isolated the trophic effects recorded in the lens laminae of Red Snapper, *Lutjanus campechanus*, collected from the Gulf of Mexico (GOM) using compound-specific isotope analysis of amino acids within individual laminae from eye lenses. This allowed us to reconstruct the geographic histories of Red Snapper by comparing the isotopic records of individual fish, with trophic effects removed, to observed and modeled isoscapes. We compared these geographic histories to lifetime otolith microchemistry from the same individuals. There are countless potential applications for these new and relatively low-cost techniques. For instance, we previously documented exposure of Red Snapper in the GOM to potentially harmful levels of Ni and Zn that may have resulted in lesion formation in these fishes; however, the source and location of exposure was unknown. Comparing otolith trace-metal and eye lens isotope profiles could reveal the approximate locations of this trace-metal exposure, potentially revealing the source as well. In addition to revealing environmental signals, these new techniques could provide information on trophic growth rates, life history events, site fidelity and movement patterns, and other information needed to improve fisheries management.

**Keywords:**
Eye; otolith; Gulf of Mexico; isotope; metal; Red Snapper

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