

## Otoliths and Isoscapes: Reconstructing Thermal Life History of California's Endangered Delta Smelt

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Delta Smelt (*Hypomesus transpacificus*) are endemic to the San Francisco Estuary and despite concentrated recovery efforts are nearing extinction in the wild. They exhibit a diverse life history with both resident and migratory contingents, allowing them to utilize different salinity habitats across this highly variable estuary. However, water temperature is also a likely driving force of their habitat use and may limit their recovery even in years with high freshwater outflow. Oxygen isotope analysis of otoliths (fish ear bones) can be used to quantify the response of Delta Smelt to changes in water temperature by providing a life-long archive of environmental conditions that a fish has experienced. We validated in situ oxygen ( $\delta^{18}\text{O}$ ) isotope analysis for Delta Smelt otoliths and reconstructed thermal life history at fine temporal scales. We then developed an estuary-wide oxygen isoscape based on multiple years of water samples to apply this tracer to wild fish. This new tool will help in our understanding of the temperature response of Delta Smelt and will provide new insights into the resilience and habitat utilization of this critically-endangered fish.