

Validating Thermal Life History Reconstructions from Otolith Oxygen Isotope Analyses of California's Critically-Endangered Delta Smelt

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Delta Smelt (*Hypomesus transpacificus*) are endemic to the San Francisco Estuary and at the center of conflict over the use of California's limited freshwater resources. Despite intensive research and recovery efforts they are now nearing extinction in the wild. Delta Smelt 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 likely a driving force of their habitat use and may limit their recovery during prolonged drought periods. 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. As a first step 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 calibrated the $\delta^{18}\text{O}$ temperature-dependent fractionation using experimentally reared fish with known temperature and salinity histories. The validation of this isotopic tracer is a significant first step in understanding the temperature response of Delta Smelt and will provide new insights into the resilience and habitat utilization of this critically-endangered fish.