Using isotopes and trace elements as a tool to uncover White Sturgeon life history complexities and habitat use

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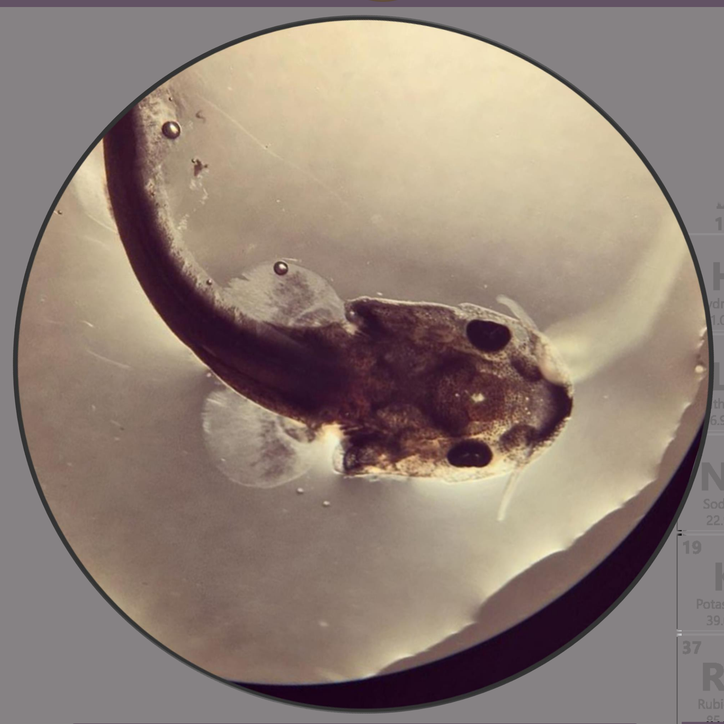
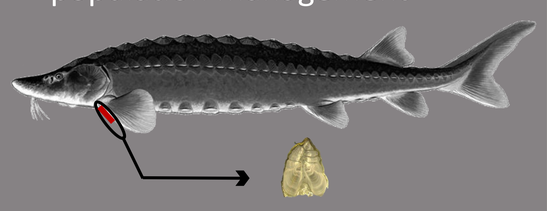


BACKGROUND

White Sturgeon are a long-lived, slow growing, and late-reproducing fish species common to estuaries and coastal habitats along the West Coast of North America.

- Vulnerable to over-exploitation
- Limited known life history information
- Better understanding of spatial distribution = improved population management



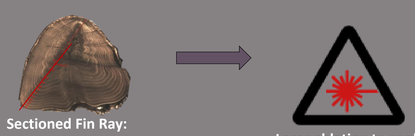
Trace element and isotopic ratios in **calcified** fin rays can be used as a non-lethal method to reconstruct migration patterns

STUDY OBJECTIVES

1) Explore life history strategies of CA adult populations using fin ray microchemistry
2) Determine how early fin rays calcify and begin recording life history information

METHODS

1) Laser ablate 116 wild adult fin rays collected in the San Francisco (SF) Estuary and San Joaquin River between 2012–2016



2) Laser ablate *and* clear/stain laboratory reared juvenile fin rays to observe when fin rays calcify and begin incorporating trace elements from their environment

ICP-MS Lab • Stable Isotope Lab
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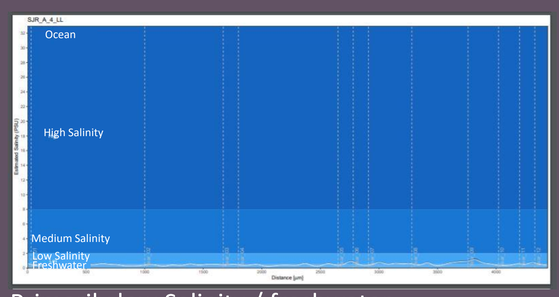
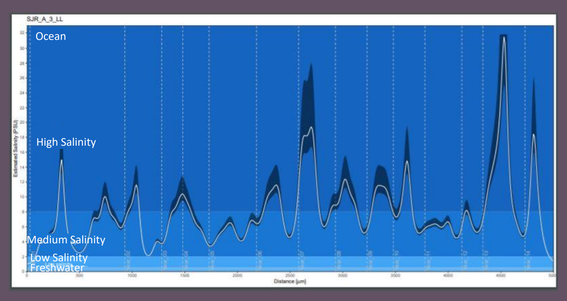
Fin ray microchemistry is a useful tool that is capable of reconstructing habitat use and migration behavior of California White Sturgeon populations

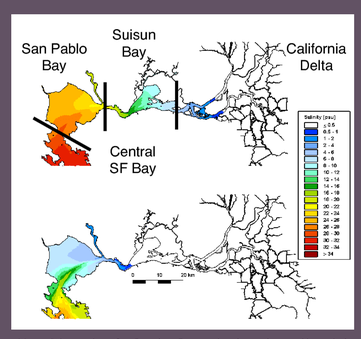
ADULT WHITE STURGEON EXHIBIT DIVERSE LIFE HISTORY STRATEGIES



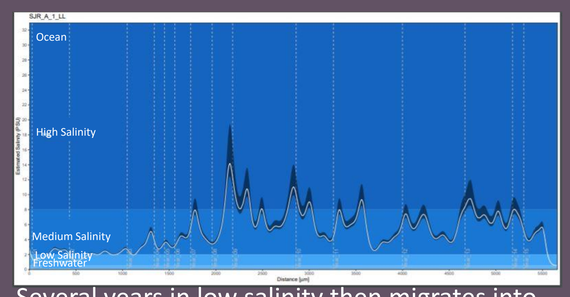
Primarily low Salinity / freshwater



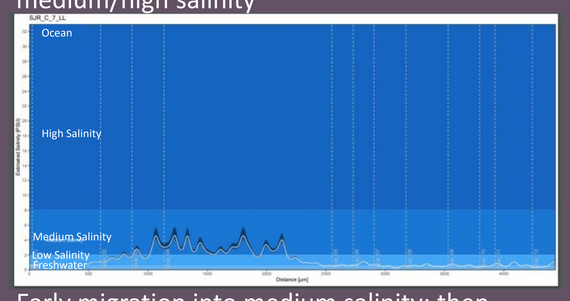
Primarily medium / high Salinity



Maps of the northern San Francisco Estuary showing regions and boundaries (black lines). Modeled depth- and daily-averaged salinity for two steady flow scenarios. Top: 140 m3 s-1. Bottom: 1,440 m3 s-1, close to the 20th and 80th percentiles, respectively, of monthly mean Delta outflow from water years 1956 through 2011. (Kimmerer et al. 2013)



Several years in low salinity then migrates into medium/high salinity

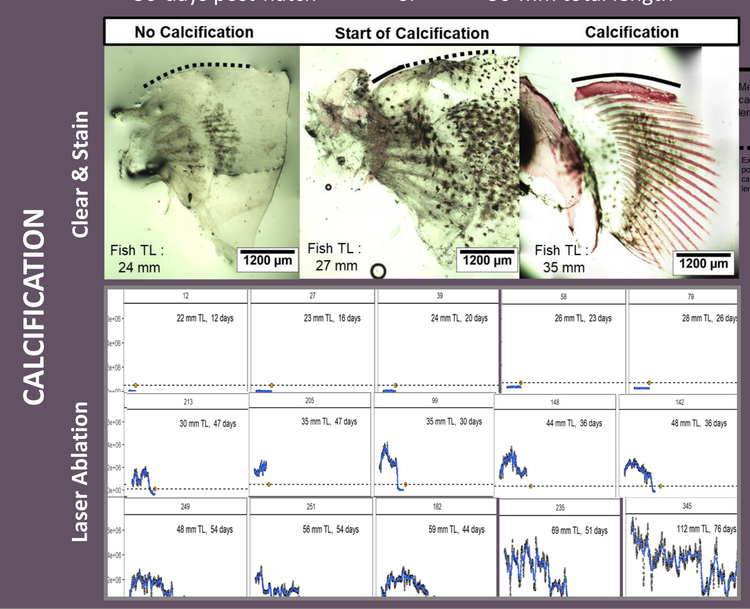


Early migration into medium salinity; then returns to freshwater / low salinity

JUVENILE WHITE STURGEON FIN RAY CALCIFICATION

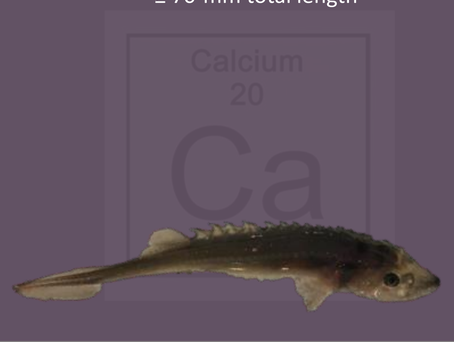
Fin Rays **begin calcifying** as early as:

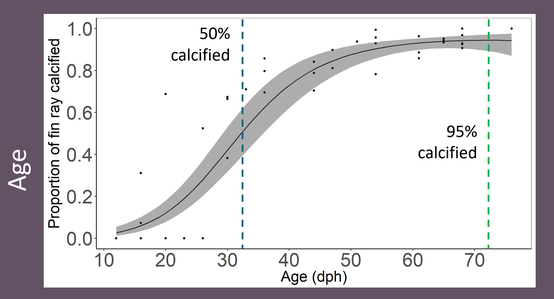
30-days post-hatch or 30-mm total length

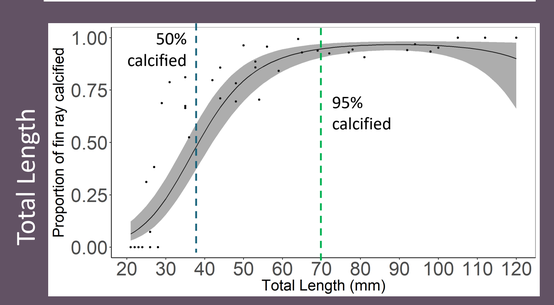


50% calcified by:
32-days post-hatch
39-mm total length

95% calcified by:
≥ 72-days post-hatch
≥ 70-mm total length



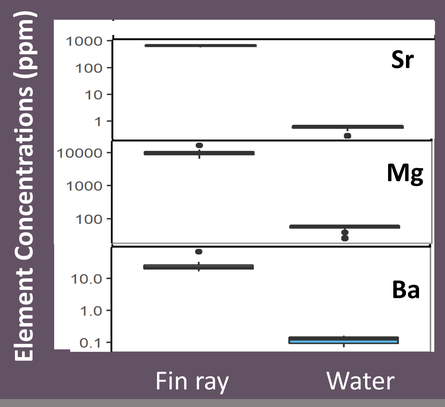


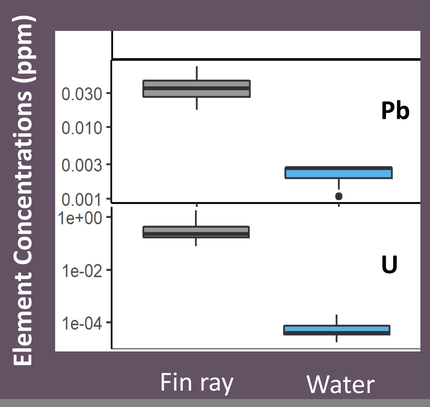


ISOTOPE AND TRACE ELEMENT INCORPORATION

Juvenile fin rays incorporated isotopes and trace elements as soon as they began to calcify

- Elements commonly used to detect migrations between different salinity zones
- Potential elements incorporated into fin rays that may provide useful markers of movement through SF Estuary or researching contaminant exposure





MANAGEMENT IMPLICATIONS

Results of these studies provide new insights into the movement patterns of White Sturgeon in the Sacramento-San Joaquin river system which can help resource managers identify potential environmental stressors, and refine flow management and habitat restoration strategies to optimize potential benefit to sturgeon.

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