DELTA SCIENCE FELLOW 2016

Delta Stewardship Council
Delta Science Program

Sea Grant California

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WHY THIS RESEARCH MATTERS

Turbidity plays a key role in Delta aquatic ecosystems, where suspended sediment can limit light for phytoplankton growth, transport contaminants, provide protection from predation for many fish species, and contribute to natural sediment recovery in shallow water habitats. The impact of drought conditions on water quality and ecological health is not well studied in estuarine systems, and more information is needed to manage the impacts of California's drought and recovery in the Delta.

Large and small-scale sediment dynamics during (and after) the drought

Researchers collected high-resolution fluid and sediment data at three sites around the Delta. They used advanced particle sizing instruments shown above to measure changes in flocculation properties such as such as floc size, density and fall velocity. *Ivy Huang*

PROJECT

This project examined the effects of drought conditions on turbidity, particularly the interplay between estuarine turbulence, suspended sediment flocculation (particle aggregation and break-up), and in-water light levels. Information from this project will contribute fundamental knowledge on flocculation dynamics, help identify critical points for turbidity control during drought, and improve characterization and predictions of sediment transport within the Delta.

RESULTS

During the two-year fellowship, Huang conducted multiple field experiments along the Sacramento and San Joaquin River to observe cohesive sediment dynamics during low-flow conditions. These field experiments captured small-scale particle interactions using traditional and state-of-the-art sediment and turbulence instruments. Using the extensive network of monitoring stations across the Delta, this study also examined how drought conditions affected large-scale turbidity trends during dry, wet, and normal water years.

RESULTS (continued)

Initial results suggest that changes in particle size are most strongly influenced by flow and sediment conditions. At sites where the tidal influence was strong, particle size varied inversely with current velocity. In other words, large particles were observed when the current velocity was at its weakest and small particles were observed when the current velocity was at its strongest. At sites where the tidal influence was weaker, the suspended sediment concentration, rather than current velocity, became a better predictor of particle size.

Recovery of flow and sediment mooring after the first field experiment (09/2016) on the Sacramento River at Rio Vista. *Ivy Huang*

MANAGEMENT APPLICATIONS

The results from this study are designed to inform and improve existing approaches to measuring important sediment properties and processes. Accurate quantification of flocculation dynamics is critical to predicting how much suspended sediment is in the water column, how long sediment particles will stay in suspension, and how they may affect in-water light and sediment relationships. More specifically, in the Delta system, the processes by which the sediment eventually sinks out of the water column are important to both bottom-up and top-down effects on the aquatic food web. On one hand, light limitations in the water column will reduce the growth of primary producers such as phytoplankton. On the other hand, turbid habitats can be key to the survival of many vulnerable fish species because they provide protection from predation. Overall, the findings of this study will be of interest to local workers and anyone quantifying flow and sediment dynamics.

PUBLICATIONS AND PRESENTATIONS

Huang, Ivy B. 2017. Cohesive sediment flocculation in a partially-stratified estuary. PhD Dissertation. Stanford University, June 2017.

Huang, I.B., A.J. Manning, D.H. Schoellhamer, and S.G. Monismith, "Flocculation dynamics under various hydrodynamics conditions in the Sacramento-San Joaquin River Delta," *Ocean Sciences Conference*, Portland OR, February 2018.

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