The 2015 Emergency Drought Barrier: Huge Management Action, Huge Science Opportunity

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The Emergency Drought Barrier was installed across west False River May-November of 2015 to slow the intrusion of salt into the central Delta in the face of extreme drought conditions. The placement of the barrier provided a chance to advance fundamental understanding of hydrodynamics, water quality, and ecosystem processes throughout the central Delta. In the spring of 2015, the Delta Science Program organized discussions between agency and academic scientists regarding opportunities to augment planned compliance monitoring of the barrier with targeted scientific studies. Our approach emphasizes the relationship between the proposed research and particular scientific questions, predictions, and hypotheses.

A suite of research projects spanning hydrodynamics and bathymetry, aquatic vegetation, and benthic and pelagic productivity reveal patterns of response to this large scale manipulation. Water quality targets were met while the barrier was in, so in that way the barrier functioned as intended. However the research studies revealed some surprises. Circulation within Frank's Tract did not occur as modeled, blooms of the toxic algae *Microcystis* were less intense than projected, and hydrologic changes pushed the overbite clam Potamocorbula further up the Sacramento River channel. Here we provide an overview of the suite of studies, along with a few highlights about what was learned. More details from select studies are presented in our oral session and the rest of the poster cluster, "Evaluating an Emergency Response: False River Drought Barrier Efficacy and Effects." Synthesis efforts are still underway for these projects and we welcome feedback and discussion from the larger Bay-Delta science community.

Keywords: Emergency drought barrier, intrusion of salt, Central Delta

Poster Cluster: Evaluating an Emergency Response: False River Drought Barrier Efficacy and Effects

Setting the Stage for the Science: Planning and Implementing the 2015 West False River Emergency Drought Barrier Project

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Faced with severe drought conditions not seen since the 1970s, California took extreme actions to protect the water-reliant beneficial uses of the interior Sacramento-San Joaquin River Delta. In January 2014 dry conditions and projections that 2014 would be the driest year on record prompted Governor Edmund G. Brown Jr. to declare a State of Emergency. The Department of Water Resources (DWR) evaluated barriers to limit the quantity of reservoir releases needed to control salinity intrusion into the Delta. DWR determined from modeling an optimal barrier configuration to increase Sacramento River flow into the central Delta (Sutter/Steamboat Slough barriers) and to reduce tidal excursion into the central Delta (west False River barrier). Rapid planning, permitting, stakeholder coordination, design, and petitions for modifications to water rights were necessary. Locations and designs were modified to benefit local stakeholders and listed fishes. Spring rains alleviated the need for a 2014 barrier, but conditions remained dry and reservoir storage continued to decline, prompting greater need for barrier planning in 2015. Listed fish and local landowner concerns led to numerous project reformulations and the eventual proposal to build just one barrier across west False River. Under an emergency US Army Corps of Engineers authorization, DWR began constructing the 2015 barrier on May 4, and after placing 147,300 tons of rock and driving 35,500 square feet of sheet piles the 800-foot-wide channel was closed on May 28. The barrier performed well and slowed the intrusion of salt into the central Delta with the reduced outflows allowed under the temporary urgency change to water rights conditions, yet challenges, including effects of hydrodynamic changes, continued. After over 3 months of intensive work the barrier was fully removed on November 15, the permitted removal deadline. New monitoring stations are online, study results are in, lessons were learned, and planning continues.

Keywords: drought, salinity, barrier, emergency, fishes, levees, water rights, planning

Poster Cluster: Evaluating an Emergency Response: False River Drought Barrier Efficacy and Effects

Water Quality Effects of the 2015 False River Barrier

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In 2015, the Department of Water Resources' Bay-Delta Office installed an emergency drought barrier across False River west of Franks Tract. The purpose of the False River Barrier (barrier) was to reduce the intrusion of saltwater into the central Delta during drought conditions when water storage in upstream reservoirs was insufficient to meet Delta salinity and net outflow requirements. Left unabated, continued salinity intrusion from San Francisco Bay could (1) render Delta water undrinkable, affecting roughly 25 million Californians; (2) render Delta water unusable for agriculture; and (3) decrease freshwater habitat in the Delta for sensitive aquatic species.

DWR and USGS worked collaboratively to create and maintain a monitoring network that evaluated the water quality effects of the barrier. The monitoring network used in-situ water quality sondes to record Temperature, Specific Conductance, Turbidity, and Dissolved Oxygen measurements every 15 minutes. Discrete samples were collected for laboratory analyses of chlorophyll, TSS, Cl^-/Br^-, and for total and dissolved nutrients. The data were analyzed to address several questions: (1) Did the barrier succeed at limiting salinity intrusion? (2) How did the barrier change the spatial distribution of salinity within the Delta? (3) Did the barrier have an effect on other water quality parameters?

The analysis proved the barrier was successful at limiting salt-water intrusion into the interior Delta, while allowing the flows of the San Joaquin and Sacramento Rivers to limit upstream intrusion. Other water quality parameters were not significantly affected by the barrier. The water quality monitoring network designed to evaluate the effects of the drought has allowed DWR to refine future drought mitigation efforts that conserve limited water supplies needed to provide for human health and safety, ecosystem processes, and agricultural purposes.

Keywords: Drought Barrier Salinity Monitoring chlorophyll DWR USGS

Poster Cluster: Evaluating an Emergency Response: False River Drought Barrier Efficacy and Effects

Effects on Listed Fishes from the 2015 West False River Emergency Drought Barrier Project

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The need to limit salinity intrusion into the Sacramento-San Joaquin River Delta led California's Department of Water Resources to install the West False River (WFR) Emergency Drought Barrier (EDB) from spring to fall, 2015. Fish monitoring data indicate that migrating juvenile Winter-Run Chinook Salmon had left the Delta prior to EDB construction, whereas small proportions of Spring-Run Chinook (<20%) and Steelhead (<10%) were in the Delta (juvenile Green Sturgeon are potentially present year-round). Assessment of the proportion of Delta Smelt near the EDB is challenging because of the species' current low abundance, with the greatest density apparently in the north Delta and a small proportion likely to have been blocked from exiting the south Delta by the EDB. Vibratory pile driving for abutment sheet/king piles limited noise effects. Sediment disturbance during rock placement increased turbidity, but only near the EDB; following barrier closure, turbidity greatly increased in nearby channels in which velocity increased, whereas low flow decreased turbidity in WFR. These differences in turbidity could have affected Delta Smelt habitat suitability. SCHISM hydrodynamic modeling suggested very high flows occurred through the notch in the middle of the EDB before full closure and formed a number of eddies in WFR which could have increased short-term predation susceptibility. High-resolution measurements indicate that over 95% of tidal flow in WFR was blocked by the EDB which, although creating an impingement risk on EDB barrier rocks for larval/juvenile Delta Smelt already in the channel, would have limited additional entrainment into WFR. Leaving the abutments in place for future EDB installations could have created additional low-velocity, eddy habitat (data from SCHISM modeling), but subsequent investigations found that the abutments are no longer necessary. The assessment of EDB effects provides valuable data to aid decisions made regarding future implementations of Delta barriers, should these be necessary.

Keywords: drought; emergency; salinity; False River; barrier; Chinook; Delta Smelt; turbidity

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