Comparison of Phytoplankton Fate and Transport in the Cache Slough Complex during Fall Agricultural Drainage Periods Using a Particle Tracking Model

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The Yolo Bypass' large seasonal floodplain is hydrologically linked to the Cache Slough Complex (CSC) and has been identified as a significant source of phytoplankton biomass to the San Francisco Estuary during higher flow months of winter and spring. However, recent chlorophyll observations in the Lower Sacramento at Rio Vista indicate that fall agricultural drainage flow pulses through the Yolo Bypass can contribute to increased downstream phytoplankton biomass during other months of the year. In 2012 (wet year), a chlorophyll pulse was observed at Rio Vista given a net positive peak near 700 cfs at Lisbon Weir; no chlorophyll pulse was observed in 2014 (critical year) given a net positive peak flow near 230 cfs. We hypothesize that the magnitude and duration of fall agricultural drainage pulses in the Yolo Bypass are linked to the downstream fate and transport of phytoplankton biomass into the CSC and Lower Estuary. Here we use a tidal hydrodynamic model with a Lagrangian discrete parcels method (MIKE21FM - Particle Tracking Module) to describe fate and transport within the CSC of phytoplankton particles originating from the Yolo Bypass, during a fall flow pulse in 2012 and 2014. Modeling showed that depending on net positive peak Lisbon flow, tidal conditions, and diversions, particles moved laterally within the system primarily into Little Holland Tract and Liberty Island, or toward sources of loss. Tidal conditions also played a role in transporting particles lingering in Liberty Island toward Rio Vista, which may be indicative of potential for CSC-produced phytoplankton. These analyses of fall pulses in a range of recent years (collectively from 2011 – 2016) inform future monitoring programs and management scenarios in the Yolo Bypass aimed to sustain and improve Upper Estuary tidal habitats.

Keywords: phytoplankton, food web, particle tracking, modeling, hydrodynamics, tidal, habitat, management

Poster Topic Water Supplies and Instream Flows