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A juvenile salmonid perspective on Delta hydrodynamics: the relative influence of river inflows, tides and South Delta exports

Abstract: The relative influence of tides, river inflows, and South Delta exports on flow patterns in California's Sacramento-San Joaquin Delta continues to be a source of confusion and uncertainty for resource managers. A particle tracking model (PTM) has been used to characterize Delta flow patterns and to evaluate entrainment risks for larval fishes and, recently for the first time to evaluate hydrodynamic effects on juvenile salmonids. While PTM results appear sensitive to net water movements over longer time periods (>days), recent findings from acoustic telemetry studies suggest migrating juvenile salmonids respond to instantaneous hydrodynamics conditions; not to daily average flows. Hydrodynamic mechanisms observed in the analysis of existing acoustic telemetry data indicate that proportion of flow entering a particular route and the proportion of time flows are positive (river discharge influenced), negative (export influenced) or a 50/50 mix of positive and negative flows (tidal influence) may be important drivers of juvenile salmonid route selection, migration time, and survival. The hydrodynamic data of interest are readily available and provided by the "Delta Simulation Model 2 HYDRO" model with considerable spatial-temporal resolution (every 15 minutes for 500+ channel locations). Our analysis indicates that commonly prescribed management actions may not yield desired and expected benefits because actual hydrodynamic conditions differ from conditions which are assumed to exist. For example, we observed little evidence that river inflows or South Delta exports, within the range typically controlled by managers, could substantially alter hydrodynamics along on the mainstem San Joaquin River between Stockton and Jersey Point. Additional acoustic telemetry studies are necessary and underway to more thoroughly test the relative importance of hypothesized hydrodynamic mechanisms. However, our analysis suggests available hydrodynamic data can be used to plan management actions with the greatest potential to enhance juvenile salmonid survival in the Delta.

Statement of Relevance: Biological Opinions, State Water Board flow criteria, and BDCP all propose changes in water management with the intent of improving hydrodynamic conditions for juvenile salmonids. A better understanding for the influence of water project operations on Delta hydrodynamics is essential for planning and implementing effective and successful management actions.