

SCCWRP #1043

Four decades of water quality change in the upper San Francisco Estuary

Marcus W. Beck¹, Thomas W. Jabusch², Philip R. Trowbridge³, David B. Senn³

¹*Southern California Coastal Water Research Project, Costa Mesa, CA, USA*

²*Sacramento-San Joaquin Delta Conservancy, West Sacramento, CA, USA*

³*San Francisco Estuary Institute, Richmond, CA, USA*

ABSTRACT

Quantitative descriptions of chemical, physical, and biological characteristics of estuaries are critical for developing an ecological understanding of drivers of change. Historical trends and relationships between key species of dissolved inorganic nitrogen (ammonium, nitrate/nitrite, total) from the Delta region of the San Francisco Estuary were modelled with an estuarine adaptation of the Weighted Regressions on Time, Discharge, and Season (WRTDS). Analysis of flow-normalized data revealed trends that were different from those in the observed time-series. Flow-normalized data exhibited changes in magnitude and even reversal of trends relative to the observed data. Modelled trends demonstrated that nutrient concentrations were on average higher in the last twenty years relative to the earlier periods of observation, although concentrations have been slowly declining since the mid-1990s and early 2000s. We further describe mechanisms of change with two case studies that evaluated 1) downstream changes in nitrogen following upgrades at a wastewater treatment plant, and 2) interactions between biological invaders, chlorophyll, macro-nutrients (nitrogen and silica), and flow in Suisun Bay. WRTDS results for ammonium trends showed a distinct signal as a result of upstream wastewater treatment plant upgrades, with specific reductions observed in the winter months during low-flow conditions. Results for Suisun Bay showed that chlorophyll a production in early years was directly stimulated by flow, whereas the relationship with flow in later years was indirect and influenced by grazing pressure. Although these trends and potential causes of change have been described in the literature, results from WRTDS provided an approach to test alternative hypotheses of spatiotemporal drivers of nutrient dynamics in the Delta.

Due to distribution restrictions, the full-text version of this article is available by request only.

Please contact pubrequest@sccwrp.org to request a copy.