

# Spatio-temporal physical and geochemical characterization of a California bar-built estuary

C. M. RICHARDS\* AND C. PALLUD

Environmental Science, Policy, and Management, University of California, Berkeley, USA (\*cmr5064@berkeley.edu)

Pescadero Estuary is a complex, large bar-built estuary located along the Pacific coast of California. Separated from the ocean (i.e. closed) for 3-10 months per year, bar-built estuaries open with heavy rainfall. Pescadero has experienced near-annual fish mortality events since 1995, coinciding with the opening of the sandbar [1, 2]. Our previous work suggests that sulfate reduction and sulfide precipitation are dominant, spatially-dependent processes during the estuary's closed state. However, the indirect effects of the metal sulfide precipitates, which chemically deoxygenates and acidifies the water when oxidized [3], may be implicated in fish mortalities in the open state.

We seek to expand our knowledge of the geochemical conditions resulting in fish mortality events in the Pescadero Estuary. For that purpose, we investigated the spatial (thirty-two sites) and temporal (monthly: from closed to open state) variability in the sediment and overlying water physico-chemistry, including sulfate, hydrogen sulfide, and chloride concentrations as well as pH. At four of these sites, sediment pore water was also characterized on a bi-monthly temporal scale. Combined with previously-measured kinetic parameters of sulfate reduction, the pore water sulfate concentrations were used to estimate near *in situ* biogeochemical rate processes in sediment.

The pore water concentration profiles and overlying water composition indicate increases in sulfate concentration (from 0-5 to 0-25 mM) and chloride concentration (from 60-230 to 80-325 mM) as the estuary opens and flushes. Despite mixing of estuarine water with alkaline seawater, our results also show decreases in pH (from 7.5-8.5 to 6.5-7.5). This implies that the indirect, oxidative effects of sulfide precipitates may be implicated in poor water quality in the open state. Due to the elevated sulfate concentrations in pore water, near *in situ* sulfate reduction and sulfide precipitation rates are an order of magnitude larger than estimated for the water-sediment interface and correlate with the spatial heterogeneity of fish mortality events at Pescadero.

[1] Swenson (1999) *Environ. Biol. Fish.* **55**, 99-114. [2] Sloan (2006) *Master's Theses* 3032. [3] Schippers & Jørgensen (2002) *Geochim. Cosmochim. Acta.* **66**, 85-92.