DISSOLVED OXYGEN IN SLOUGHS OF SAN FRANCISCO BAY

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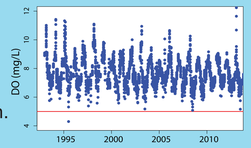
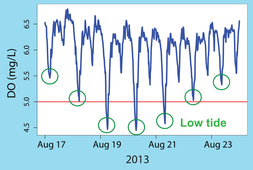
WHY MONITOR THE SLOUGHS?

Dissolved oxygen (DO) monitoring in South San Francisco Bay has historically occured 1-2x monthly and average concentrations are typically 6-8 mg/L despite high nutrient loading to this region.



Data: USGS



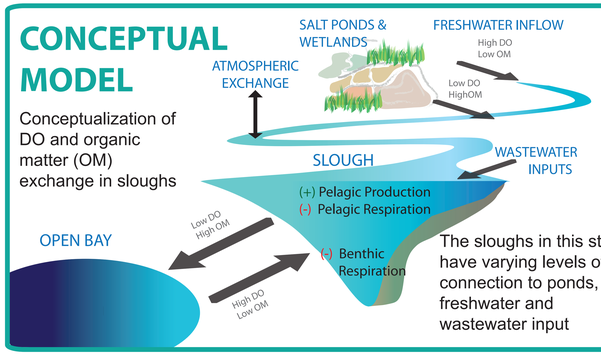
However, recent high frequency data at the Dumbarton Bridge has shown DO can dip below 5 mg/L in the deep channel on spring ebb tides.

We hypothesize that this is caused by exchange with low DO water in sloughs and wetlands, where intital observations at one moored slough site show DO frequently drops below 5 mg/L and is often 2-3 mg/L. In this project, we established a network of continuous sensors at slough and channel sites to answer the following questions:

1. **How do DO concentrations in sloughs vary in space and time?**
2. **What mechanisms control the frequency, duration and severity of low-DO events?**
3. **How does exchange with sloughs affect conditions in the open Bay?**

CONCEPTUAL MODEL

Conceptualization of DO and organic matter (OM) exchange in sloughs

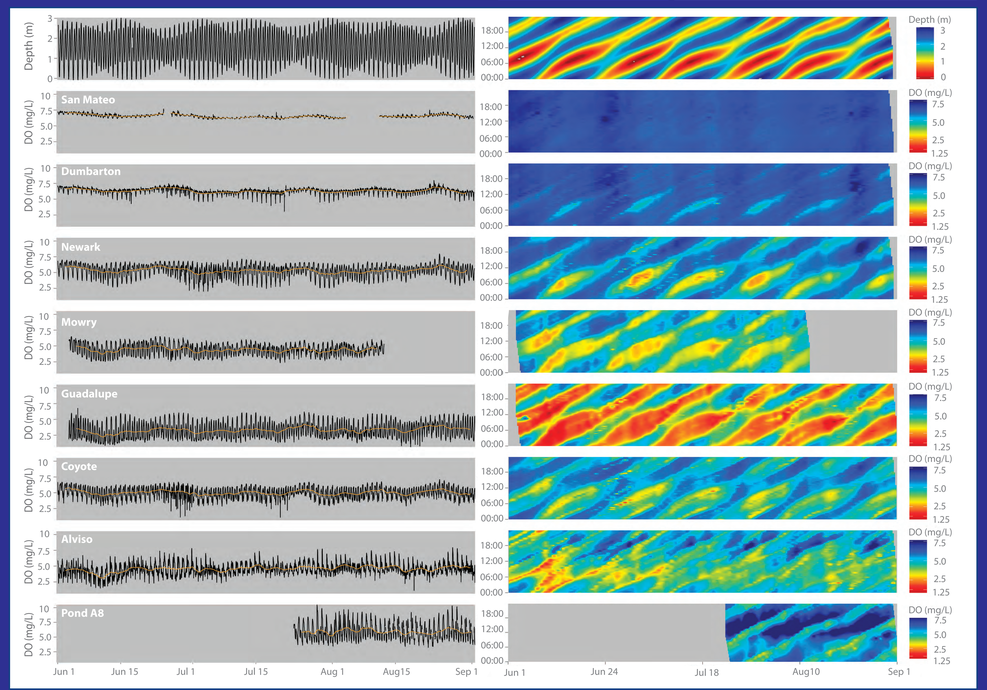


The sloughs in this study have varying levels of connection to ponds, freshwater and wastewater input

HOW DOES OXYGEN VARY IN SPACE AND TIME?

Throughout Spring 2015 we installed 5 additional sensors in sloughs and creeks of Lower South Bay, bringing our total network to 8 sites. The figures below show data from all sites for 3 months in summer 2015. The left panel shows a time series, the right panel shows contour plots of date (x-axis) and time of day (y-axis). The top panel of each shows depth (m).

	Freshwater input?	Salt Pond connections?	Wastewater inputs?
Newark Slough			
Mowry Slough			
Coyote Creek	✓		✓
Alviso Slough	✓	✓	
Guadalupe Slough		✓	✓

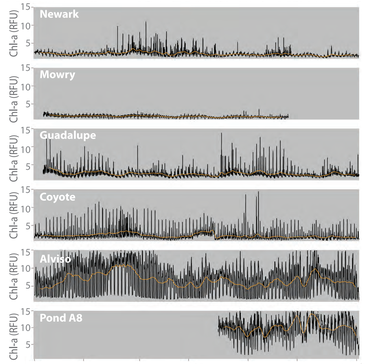


- All slough sites experienced DO concentrations < 5mg/L, and many frequently had DO < 3 mg/L
- DO concentrations were lowest in the sloughs with direct salt-pond connections: Alviso Slough and Guadalupe Slough, with Guadalupe being the lowest overall
- There is considerable tidal variability in DO concentrations at all slough sites, as much as +/- 5 mg/L at some sites
- On a qualititative basis, DO appears to be regulated not by a diurnal production cycle, but by the semidiurnal and semimonthly tides

WHAT MECHANISMS REGULATE OXYGEN CONCENTRATION?

Production/Respiration

- Chl-a concentrations in sloughs are higher than in the open Bay, as much as 5-10x higher at some sites
- Respiration of chl-a and other organic matter could draw DO down more in sloughs with low volume:area ratios

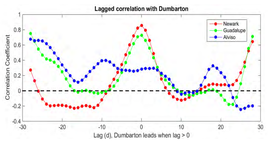


Physical Processes

- Stratification may contribute to low DO by restricting reaeration of bottom waters. Stratification has been observed previously in Alviso Slough
- DO is a minimum in Alviso and Guadalupe Sloughs on neap tides, when less flushing occurs with higher-DO waters of the open Bay

HOW MIGHT SLOUGHS AFFECT CONDITIONS IN THE OPEN BAY?

- DO at Dumbarton is lowest on ebb tides, particularly spring ebb tides, suggesting drainage of low-DO water from the sloughs. A lag correlation analysis shows that Guadalupe and Newark Sloughs are in phase with Dumbarton.



- We estimate total slough and salt pond volume to be about half of that in the open Bay. Even conservative estimates of exchange suggest the slough contribution to water conditions in the open-Bay is non-trivial.

NEXT STEPS

- Collect high-spatial resolution data (longitudinally and vertically) to complement the moored data to better characterize DO in sloughs
- Characterize the relative importance of biological and physical processes in controlling how sloughs respond to organic matter inputs
- Quantify how sloughs could affect conditions in the open Bay through a simple box-model (and ultimately complex 3D modeling)