Moored Sensor High-Frequency Observation Network: data analysis, interpretation, maintenance, new deployments
FY20 Estimated Cost = $355,000
Collaborators: SFEI, USGS-Sacramento (Bergamaschi, Downing, et al)

Background
San Francisco Bay is a dynamic and heterogeneous system. Data collected during USGS cruises over the past 40 years (see C.1) have played critically-important roles in shaping both our current understanding of the major factors regulating water quality in SFB, and in documenting water quality changes over that time. We also know, from other research in SFB, including along South Bay's broad shoals, that important water quality indicators - e.g., salinity, temperature, chl-a, nutrients, dissolved oxygen, suspended sediments, etc. - have strong spatial gradients (Cloern et al., 1985; Huzzey et al., 1990; Lucas et al., 2008; Thompson et al., 2008), and can change substantially over fairly short time scales (e.g., hours to days), shaped by tidal forcings, wind, day-night variations in biological cycles, and other factors.

Therefore, over the past several years, the NMS has prioritized developing a moored sensor network for high-frequency in situ measurements, focused initially in South Bay and Lower South Bay (Figure C2.1). Analysis of limited existing data for sloughs and creeks, along with early mooring network data, indicated that DO levels in sloughs frequently fell below the Bay's 5 mg/L DO standard (SFEI 2015), and further highlighted the complex spatial and temporal variations in key water quality parameters (Figure 4). Two key aims for the mooring network were to allow for more comprehensive condition assessment, and to foster data collection that will allow us to better characterize and quantify ecosystem response to SFB's high nutrient loads, including by aiding the calibration of numerical models (SFEI 2014). This project description briefly highlights major moored-sensor activities during FY19, and describes the major focus of proposed work in FY20.

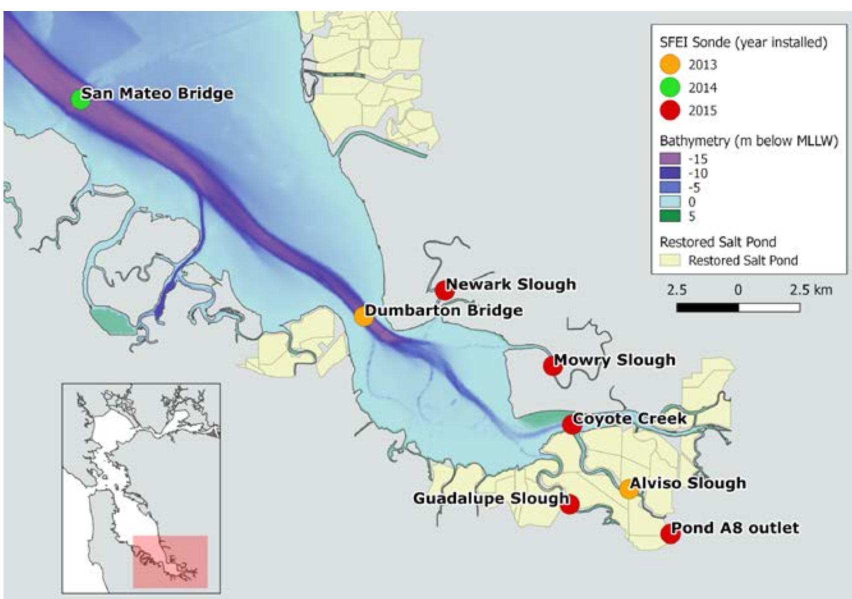

Figure C2.1. NMS-MSP site locations (as of May, 2019)

Major FY19 activities

- Sensor network maintenance (maintenance at 3 week intervals, 2 field days per interval + 1-2 days field set-up / break-down).
- Refined / cleaned dataset for additional year of data, and application of enhanced QAQC protocols to additional parameters (e.g., chl-a).
- Completed third pilot South Bay shoal deployment (10/5/2018 - 11/24/2018; same parameters as other sites, plus in situ nitrate sensor, additional chla-fluorometer, and acoustic velocity measurements). See Figure C2.2 below. Based on the three pilot shoal moorings that have been conducted, chl-a levels generally exceed those at nearby channel sites. A technical report summarizing the shoal deployments will be completed in June 2019.
- Began Deploying South Bay shoal mooring permanently on 3/19/2019 (Figure C2.3)

Proposed FY20 activities

1. Moored sensor work including shoal mooring
2. Data management

FY20 Deliverables

- Refined / cleaned dataset for additional year of data, through continued use of enhanced QAQC protocols.
- Summary of major observations in the NMS FY20 Annual Report. Work related to data interpretation and synthesis is covered under other NMS tasks.

Budget Justification

Staff support for field work and data management ($143,000); field support (including boat, fuel, and field technicians; $177,000); equipment/supplies ($30,000); analysis of discrete samples for instrument calibration ($5,000). Data interpretation included under other NMS tasks.

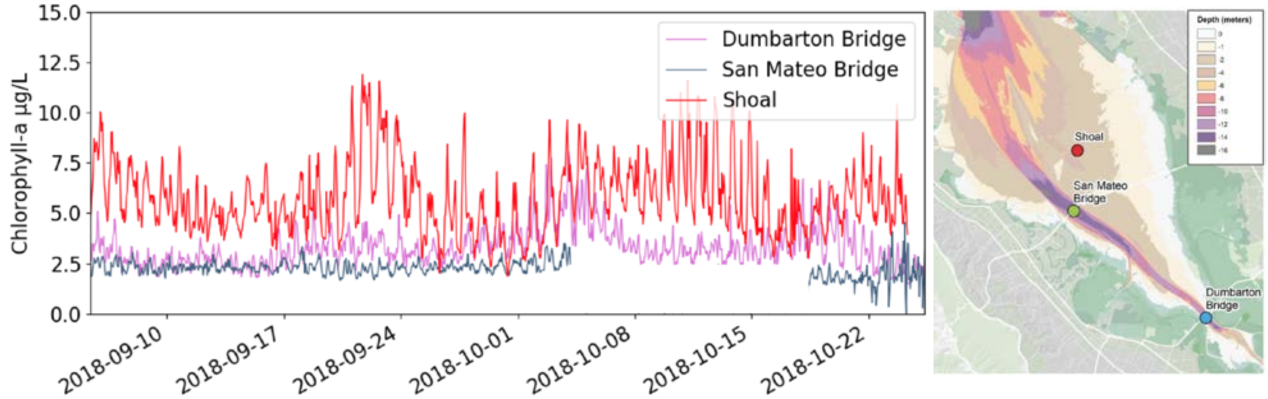

Figure C2.2 chlorophyll-a concentrations estimated from high frequency sensor readings during Fall 2018 deployments at the Shoal, Dumbarton Bridge, and San Mateo Bridge mooring sites.

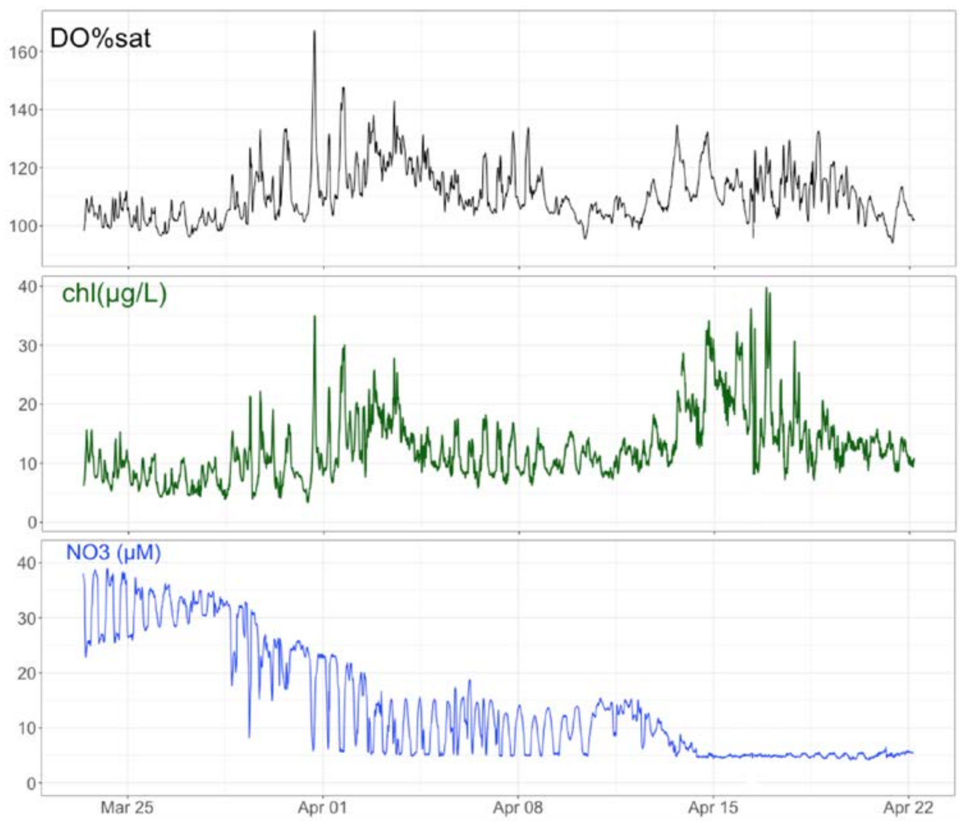

Figure C2.3 Dissolved oxygen (%saturation), chl-a, and nitrate levels estimated from in situ sensors the South Bay Shoal mooring site, Mar 23-Apr 29 2019. Supersaturated dissolved oxygen (>100%) coincided with chl-a peaks, consistent with primary production by phytoplankton. Nitrate concentration minima coincided with DO and chl-a peaks, suggesting that nitrate was being drawn down via uptake by phytoplankton. Since the detection limit for the nitrate sensor is in the range of 5-8 µM, the true concentrations during minima after April 1 and during the flat-line period between April 15-22 may have been less than 5 µM.