Reconnecting Lower Walnut Creek

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Leveed and channelized in 1963, water flowing through Lower Walnut Creek (LWC) is disconnected from the low-lying land surrounding the mouth of the Creek. Reconnecting Lower Walnut Creek (RLWC) presents a vision for 3 miles of LWC and 1300 acres of surrounding land that takes advantage of the topography, low-risk land, and fading industrial use to promote an ecologically and socially rich reserve. Constructed to increase flood water conveyance, the LWC channel has been threatened with sediment build up requiring expensive and environmentally damaging desilting efforts. A surgical approach to perforating the levees requires a small investment for a large return; meanwhile flood protection is maintained through tidal cleansing. Historically stable estuary sloughs suggest that increasing the tidal prism will increase the amount of water flowing out of LWC, carving a deeper channel that is flushed twice daily with ebb tides. This continual maintenance of the channel indicates more reliable flood conveyance during storm events while increased porosity with the floodplain increases water storage. With increased tidal connectivity, the height of 100 year flood event drops two feet as the channel widens and intertidal habitat can develop. In addition to maintained flood conveyance, RLWC establishes social connectivity for the City of Walnut Creek and nearby periurban communities by linking the last leg of Iron Horse Trail to the Bay with a multimodal trail and drawing people out to the space through an expansive trail network. Further, the project emphasizes the importance of removing and processing a landfill that exists in the former estuary zone and defines a tertiary wastewater treatment area capitalizing on secondarily treated wastewater from a nearby treatment plant. RLWC illustrates the potential of LWC, presenting a new (and old) method to manage flood conveyance with co-benefits including rich habitats, social access, and greater sea level rise resiliency.

Keywords: Flood Control, Habitat Restoration, Social Access, Horizontal Levee, Tidal Connectivity

Poster Topic: Flood Control: Habitat Restoration

Colma Creek: How Does Sediment Removal from a Flood Control Channel Affect Nearby Tidal Wetland Habitats?

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Colma Creek, a tributary to San Francisco Bay, drains urban and undeveloped areas of the northern San Francisco Peninsula including portions of San Bruno Mountain. A period of rapid urbanization in 1960s and early 1970s led to engineered flood control channels, whose sediment management challenges persist today. Horizon Water and Environment is working with the San Mateo County Flood Control District/County of San Mateo Public Works Department (County) to develop a flood control channel maintenance strategy that addresses numerous natural resource management challenges that are common throughout the San Francisco Bay. Key issues addressed through this data collection and planning effort include calculating and mapping sediment volumes and deposition patterns in the flood control channel; evaluating sediment supply to tidal marshes near the mouth of Colma Creek (downstream of the flood control channel); characterizing habitat conditions for endangered species; and assessing potential effects of sea-level rise scenarios. Colma Creek provides a useful microcosm of many of the resource management challenges facing San Francisco Bay watersheds and tributaries. This poster summarizes the data collection effort (and preliminary results) that will help guide the County to develop a sustainable flood control and maintenance strategy for Colma Creek.

Keywords: Sediment, Flood Control, Tidal Wetlands, Colma Creek, Channel Maintenance

Poster Topic: Flood Control: Habitat Restoration

Arroyo Mocho Stanley Reach Pilot Project: Floods, Fish, and Finance

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Problem Statement: The financing of restoration projects can be challenging. Even more challenging is retrofitting engineered channels to function as natural fluvial and ecological environments without giving up flood protection or water supply functions.

Like many arroyos in the Zone 7 service area, the Arroyo Mocho has been mined for aggregate, widened, and straightened throughout the last century to accommodate urbanization. Barriers to anadromous fish passage and channels choked with non-native grasses are a common occurrence—and offer little aesthetic, habitat or water quality benefits.

This Project will demonstrate the feasibility of transforming an earthen trapezoidal channel into a vegetated stream exhibiting natural fluvial and ecological function, while also maintaining its functionality for flood protection, sediment management, and groundwater recharge. It also explores the use of mitigation funds from outside agencies to facilitate construction and long-term maintenance.

Approach: The Project replaces concrete and grouted structures with naturally functioning in-stream rock and vegetative structures to allow potential fish passage and dampen stream velocities. Planting streamside vegetation will further stabilize banks, reduce velocities, and increase habitat value. Deliberately increasing “roughness” within the channel is still considered to be counter to standard flood protection practice; this Project intends to demonstrate that it can help improve habitat function within a trapezoidal channel design without increasing flood risk or adversely affecting sediment transport. Community volunteers will carry out much of the revegetation. Portions of the project are being funded through mitigation dollars from other offsite impacts.

Results: Construction is currently underway.

Conclusions: In light of the non-traditional approach to design, funding, and construction methods (e.g. use of community volunteers), the Project will encourage Zone 7 to expand beyond its conventional methods and experiment with new ways of carrying out its mission.

Keywords: Flood Control, Restoration, Riparian, Water Temperature

Poster Topic: Flood Control: Habitat Restoration

Seasonal Patterns of Three Key Phytoplankton Species in San Francisco Bay

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The Scientific Committee for Ocean Research (SCOR) established a working group to compile, compare and synthesize long-term observations of phytoplankton community variability in coastal estuarine waters organized around a set of first-order questions, including: Do individual phytoplankton species have characteristic seasonal patterns expressed similarly across estuarine ecosystems? As a step towards answering this question for San Francisco Bay (SFB), seasonal patterns of three key phytoplankton species were analyzed based on 900 samples collected from 1992 to 2013. The diatom *Skeletonema costatum* is a cosmopolitan, often dominant, component of coastal phytoplankton biomass, and can develop large blooms in SFB. *S. costatum* has an annual spring bloom in the salty regions of SFB and an elevated baseline biomass year-round relative to other phytoplankton species. Although infrequently, *S. costatum* can also appear in fresher regions of the system suggesting it is a generalist estuarine species. The biomass-dominant dinoflagellate in SFB, *Akashiwo sanguineum*, is detected in a minority of samples except during September-October when it blooms in regions with strong marine influence. Cryptophytes are ubiquitous estuarine flagellates, as is evident in SFB where *Teleaulax amphioxeia* occurred in 70% of all samples and across a broad salinity range (0-32). This was the highest frequency of occurrence of any of the 611 phytoplankton species in our dataset. *T. amphioxeia* demonstrated spatial and temporal variability with a regular spring bloom in the South Bay and a frequent fall bloom in the northern San Pablo Bay. These results not only provide a reference for comparing seasonal patterns of these key species in long-term records from other estuarine systems of interest to the SCOR working group, but also also begin to illustrate the complex patterns of phytoplankton community dynamics in the SFB system.

Keywords: Phytoplankton, Seasonal Patterns, Community Dynamics, Skeletonema, Akashiwo, Teleaulax

Poster Topic: Food Webs

Contrasting Pathways for Trophic Structuring in the San Francisco Estuary

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Several distinct mechanisms affect whether qualitative changes in resources at one trophic level propagate upward in pelagic food webs. Owing to changes that have occurred in the composition of the pelagic community in the upper San Francisco Estuary (SFE), there is intense scientific and management interest in understanding the extent to which resource quality at lower trophic levels (e.g., nutrients, phytoplankton) influences community composition at higher trophic levels (e.g., zooplankton, fish). Biochemical mechanisms potentially affecting food quality and trophic transfer of materials and energy include differential synthesis and transfer of essential fatty acids and other biomolecules, chemical (often inducible) forms of consumer avoidance (e.g., unpalatability and toxicity), chemical "warfare" (allelopathy), and ecological stoichiometry (imbalances between the elemental composition of consumers and elemental ratios in their resource bases). Behavioral and anatomical traits of consumers (such as foraging behavior, feeding apparatus of fish and invertebrates, vertical migration) can constrain resource use and, to a certain extent, "insulate" organisms at one trophic level from some of the qualitative changes that occur further down the food web.

In this study, several pathways and constraints for the upward propagation of effects of resource quality are illustrated with conceptual models, using key pelagic organisms from the upper SFE in examples. The conceptual models were used to evaluate the types of information that could potentially distinguish between different underlying mechanisms for observed community structure. Results include identification of data gaps and suggestions regarding study design for future research on determinants of pelagic food-web structure in the SFE.

Keywords: Pelagic Food Web, Nutrients, Plankton, Trophic Structure, Consumer, Nutritional Quality

Poster Topic: Food Webs

Assessing Phytoplankton Physiology in San Francisco Estuary with the PhytoFlash™ Active Fluorescence Probe

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The ability to monitor phytoplankton physiology in situ would greatly benefit ecologists and mangers studying food webs in San Francisco Estuary/Delta (SFE). Previous phytoplankton assessment in the SFE has been done using extracted chlorophyll a concentrations, microscope identification or by analyzing nutrient uptake rates. These laboratory measures generally rely on discrete sampling, which limits spatial and temporal habitat coverage, and can be relatively costly and time consuming. An alternative measure of phytoplankton physiology in situ utilizes natural fluorescence emission from chlorophyll, which can vary in response to environmental conditions such as light and nutrient levels. Active fluorescence probes use controlled light pulses to investigate the efficiency of electron flow through Photosystem II of the photosynthetic light pathway, a useful indicator of algal health. Active fluorescence measurements have been used to investigate photosynthetic function in plants, oceanic phytoplankton and cultured phytoplankton. Relatively little work has tested the application of bio-optical fluorescence probes in estuaries. This study involves testing the capabilities of the PhytoFlash^{TM} active fluorometer (Turner Designs) for investigating phytoplankton physiology in situ in the turbid SFE. The PhytoFlash^{TM} can be deployed from boats or moorings, and monitor field phytoplankton assemblages continuously and in real time. A series of experiments were conducted in order to validate instrument performance across an estuarine gradient, with particular interest in assessment of nutrient stress conditions on phytoplankton physiology. Preliminary results provide some practical guidance for deployment of the PhytoFlash^{TM} for monitoring and experimental work, highlighting both potential strengths and limitations for future field investigations of phytoplankton nutrient physiology in the turbid and variable SFE.

Keywords: Nitrogen, Algae

Poster Topic: Food Webs