Community-based Shoreline Habitat Restoration- Save The Bay

Darcie Collins, Save The Bay, darcie@savesfbay.org

Ecological restoration by volunteers is often associated with inefficiencies, inefficacies and lack of science-based best practices. Contrary to this stereotype, for over ten years Save The Bay, San Francisco has used over 50,000 community volunteers to successfully restore transition zone salt marsh habitat throughout the San Francisco Bay Estuary. We present here ten years of tidal salt marsh enhancement data to indicate the success of Save The Bay's Community-based Restoration program. Lessons learned from analysis of this data have been used to adaptively manage our restoration efforts, increase productivity associated with utilizing volunteers, and to project a timeframe for meeting our goals. We assess our restoration efforts by measuring non-native plant reduction, native plant coverage, non-native to native plant ratio, habitat use by sensitive species, acreage, and maintenance. We depict quantitative data that indicate the financial, organizational and volunteer resources necessary for successful habitat enhancement. We conclude with recommendations for other Community-based Restoration programs.

Key Words - *restoration; Community-based; tidal marsh; transition zone; Save The Bay*

Theme: Volunteer Monitoring

Poster Board Number: 100. Submission Number: 41

Volunteer survey shows Lepidium latifolium common, increasing on East Bay shoreline

Susan Schwartz, Friends of Five Creeks, f5creeks@aol.com
Chris Dillingham, Friends of Five Creeks, cdillingham@berkeley.edu

Lepidium latifolium , perennial pepperweed, is an invasive weed of Eurasian origin common in wetland, riparian, and cultivated areas of California. It spreads by creeping roots, root fragments, and seed. From June – August 2009, volunteers with Friends of Five Creeks walked shorelines from Lone Tree Point to just north of the San Mateo Bridge, mapping and recording characteristics of *Lepidium latifolium* patches. Volunteers used a Trimble Geoexplorer III hand-held GPS unit and followed methods developed by Environmental Science Associates (ESA) for a Bay-wide survey 2004-2007. ESA provided equipment and training. A detailed map shows locations of *Lepidium latifolium* in the surveyed area. The 2009 survey found that: 1. *Lepidium latifolium* occurs in nearly all areas of the East Bay shoreline, with density increasing toward the Carquinez Strait. Infestation appears to be increasing. 2. *Lepidium latifolium* colonizes nearly all coastal substrates including the upper edges of salt marsh or mud flat, sand or gravel beach and back beach, bluff, dune, clay, loam, fill, rip-rap, road shoulder, and deteriorating pavement. Colonies thrive from about the highest tides to 2-3 m elevation, in association with nearly all native and non-native coastal and marsh vegetation types. Sizable patches occur in restored and relatively undisturbed areas. 3. Larger patches typically include a densely vegetated near-monoculture of more-mature plants with peripheral scattered or patchy less-mature plants – apparently the colony's advancing edge. Salt spray or wind appears to inhibit bolting, flowering, and setting seed. Patch spread seems to be limited by elevation and/or distance from water, by daily tidal flooding, and by erosion (which washes away root fragments that may spread the species.) The results indicate that volunteers can effectively monitor easily recognized invasive species, collecting data useful for study, control, and eradication.

Key Words - *Lepidium latifolium; perennial pepperweed; invasive species; GPS survey; volunteer monitoring*

Theme: Volunteer Monitoring

Poster Board Number: 101. Submission Number: 157

Cyanobacterial blooms in Rodeo Lagoon: phytoplankton dynamics, toxicity, and physical forcing

Mary Cousins, University of California, Berkeley, mcousins@gmail.com
Mark Stacey, University of California, Berkeley, mstacey@berkeley.edu
Jeana Drake, Romberg Tiburon Center, San Francisco State University, corngirl18@hotmail.com
Kara Nelson, University of California, Berkeley, nelson@ce.berkeley.edu

Rodeo Lagoon is a shallow, tidally choked coastal lagoon that exhibits the classic signs of eutrophication: intense algal blooms, depletions in dissolved oxygen, and fish kills that involve the federally endangered tidewater goby, *Eucyclogobius newberryi*. Our 2007 year-long field study of the lagoon, located in the Golden Gate National Recreation Area at the mouth of the San Francisco Estuary, tracked the seasonal progression of the phytoplankton bloom, the physical conditions that supported it, and its toxicity. From late March through late November, when peak chlorophyll-a concentrations occured, the brackish lagoon was well-mixed over its 2 m depth, and daytime temperatures over 20 degrees C were common. However, in winter, strong vertical salt gradients inhibited mixing and may be linked to retention of nutrients in organic matter from the previous year's growth. Large populations of the cyanobacteria *Nodularia spumigena* and *Microcystis aeruginosa* dominated the phytoplankton assemblage in spring and fall, respectively, while a bloom of the centric diatom *Chaetoceros muelleri* dominated in the early summer months and several species of flagellated protozoa dominated in late summer. Dissolved oxygen concentrations showed a strong response to these phytoplankton dynamics, increasing under bloom conditions and crashing to hypoxic levels as they declined or when protozoa were dominant. Despite the abundance of potentially toxigenic cyanobacteria, nodularin was not detectable and the microcystins RR, YR, and LR were detected only at very low levels; these hepatatoxins were unlikely to bear responsibility for fish mortality in 2007.

Key Words - *eutrophication; cyanobacteria; Rodeo Lagoon; density stratification*

Theme: Water Quality and Phytoplankton

Poster Board Number: 124. Submission Number: 217

Low CO2 Measured in the San Francisco Estuary Indicates a Healthy Algal Population

James Fuller, San Francisco State University, jfull@sfsu.edu
Frances Wilkerson, San Francisco State University, fwilkers@sfsu.edu
Richard Dugdale, San Francisco State University, rdugdale@sfsu.edu
Alex Parker, San Francisco State University, aeparker@sfsu.edu
Al Marchi, San Francisco State University, amarchi@rtc.sfsu.edu

Estuaries have been identified as potential net sources of CO_2 to the atmosphere. Bacterial respiration of organic matter entering the estuary leads to supersaturated levels of CO_2. The southern embayment of the San Francisco Estuary, the South Bay, is no exception due in part to wastewater treatment practices. Persistently high levels of pCO_2 between 600 and 1000 uatm have been reported for this embayment by the U.S. Geological Survey over the period 1976-1980 and more recently (2007-2009) in this study. However, both studies also found notable exceptions during the spring phytoplankton bloom when pCO_2 was drawn down to 375 uatm in 1980 and to 175 uatm in 2008. The latter anomalously low level corresponded directly with an algal bloom as evidenced by high concentrations of chlorophyll a and supersaturated dissolved oxygen. To our knowledge this is the lowest CO_2 level reported for the San Francisco Estuary and this indicates that portions of the estuary are a sink for atmospheric CO_2 during bloom conditions. The hydrology of the South Bay is generally dominated by the input of wastewater. In the early 1980s the wastewater treatment processes were significantly improved, often to the advanced secondary level with inorganic nitrate as the product. This may have contributed to a healthy estuarine algal population that helps maintain current CO_2 levels to those of 30 years ago despite significant urban growth around the estuary over that period. In addition this may have changed the South Bay from a net heterotrophic to a net autotrophic system. These findings have major implications both to estuarine management and to estimates of the estuarine component in global air-sea CO_2 exchange.

Key Words - *atmospheric CO2; algal blooms; advanced wastewater treatment*

Theme: Water Quality and Phytoplankton

Poster Board Number: 123. Submission Number: 116

Water, an Issue in our Community, California, and even Costa Rica

Janice Cao, Oakland High Environmental Science Academy, janice93c@yahoo.com

As part of the Environmental Science Academy program at Oakland High School, we study water quality at Lake Merritt. Studying water quality is important because it helps keep track of the health of our environment. Questions that are being investigated by my fellow students and I are: How much pollution is going into Lake Merritt? How are the species affected by changes in their environment? What can we do in order to reduce the damage that we are causing? Many people in our community don't know how our human actions affect not just the lake, but the whole ocean and all of us. Lake Merritt is part of an estuary that leads to the Bay. Consequently, what we throw on the streets will eventually come back to us in our foods.

ESA students come down into Lake Merritt once a week to collect data such as Dissolved Oxygen (D.O.), Salinity, Turbidity, temperature (water/air), and the micro/macro species in the water and on land. These types of data help us get a better understanding of how a careless act (such as throwing trash on the street) can create a domino effect that can lead to a tragedy on our environment.

On a trip to Costa Rica in May 2009, we also took water quality at different areas of the country. We found that Costa Rica is in so many ways similar and different from California. Both Costa Rica and California are diverting a great amount of water for agriculture. An example of projects done is the Arenal Dam in Costa Rica and the California Water Project which transports a great amount of water into Southern California for agriculture. These projects destroy the natural flow of water and create changes in nature that the environment may not be able to cope with. In California, our Salmon are not decreasing in numbers simply because of over-fishing. In fact, the major problem are the dams being built in practically every major river to provide irrigation for commercial farmers in California which prevents fish from freely migrating on their normal patterns to reproduce. Similarly, Arenal Lake in Costa Rica is blocked by a huge dam which prevents a majority of species from entering. Being in the Arenal lake myself, I have observed it and the Lake does not seem contain a lot of biodiversity which affects the environment. There were some spots of dried grass and the trees did not look as green and full as other parts of Costa Rica. In an open river such as Tortuguero in Costa Rica, I noticed that there were plenty of different species of large healthy plants growing in and out of the water which gives me a strong understanding of what the lack of biodiversity can do to the environment. It is important to monitor water quality, because the more we know about the conditions of the water, the more knowledge we have to develop solutions to help maintain a healthy environment. If we did not monitor the lakes, rivers, and oceans (especially the ones that are greatly affected by human action), we wouldn't have a clue in the world that the environment is being destroyed before it's too late. We cannot simply "find" new clean water to use; every drop of water from a faucet to the ground is the water that has been here for billions of years and is the only water we will have as far as science goes.

POSTER ABSTRACTS: Volunteer Monitoring & Water Quality

Key Words - *Water Quality Monitoring, Lake Merritt. Diverting Water issues;*
Theme: Water Quality Monitoring; **Poster Board Number:** 126. Submission #: 208

Recent Time Series of Water Quality in San Pablo Estuary

Rachel Endicott, San Francisco Bay NERR, rale@sfsu.edu
Lara Martin, San Francisco Bay NERR, laram@sfsu.edu
Matt Ferner, San Francisco Bay NERR, mferner@sfsu.edu

San Francisco Bay National Estuarine Research Reserve, San Francisco State University, 3152 Paradise Drive, Tiburon, CA 94920 email: rale@sfsu.edu Established in 2003, the San Francisco Bay National Estuarine Research Reserve (SF Bay NERR) is the 26th reserve in the National Estuarine Research Reserve System. This nationwide system of reserves gathers water-quality, meteorological, and biological data as part of their System-Wide Monitoring Program (SWMP). The overarching goals of this program are to track environmental and biological variability in an effort to understand how natural and anthropogenic factors may affect the ecosystem. SF Bay NERR currently maintains four long-term monitoring stations along a salinity gradient in the San Francisco Estuary in order to collect essential baseline information and improve understanding of estuarine dynamics and watershed inputs. In particular, SWMP data collection is intended to address three primary topics: 1) Short-term variability and long-term trends in estuarine water quality in the estuary. 2) Anthropogenic disturbance caused by land use changes including human population growth, urbanization, and proximity of livestock and grazing areas. 3) Integration of these data into the broader Central and Northern California Ocean Observing System (CeNCOOS), providing much needed inland and shallow-water data to complement the extensive offshore data currently available from CeNCOOS. In our poster we will present a time series of near-continuous monitoring data to illustrate short-term variability in water quality over a four year period (2005-2009) in San Pablo Bay. Daily, tidal, seasonal and annual patterns of variability will be discussed. We highlight the need for broader analyses in conjunction with data from other water-quality monitoring programs in the estuary.

Theme: Water Quality Monitoring

Poster Board Number: 127. Submission Number: 244

Water quality in San Francisco Bay: Lessons learned from four decades of research

Sarah Foster, USGS, safoster@usgs.gov
Caitrin Phillips, USGS, cphillips@usgs.gov

On April 3, 1968 scientists from the U.S. Geological Survey ventured onto the murky waters of San Francisco Bay to make their first measurements of water quality. Forty years later, the USGS studies continue (in partnership with the Regional Monitoring Program) as one of the world's longest sustained programs of research and observation in a coastal ecosystem. Regular monitoring includes monthly measurements of salinity, temperature, dissolved oxygen, chlorophyll a, nutrients, suspended particulate matter, light penetration and phytoplankton species composition. Sampling is designed to measure spatial and temporal variability along a 145 km transect between South San Francisco Bay and the lower Sacramento River. How has California's great estuary responded to changes over the last 40 years that include: growth of the state population from 19 to 37 million people; implementation of the 1972 Federal Clean Water Act; introductions of many dozens of alien species; hydrologic extremes from the record drought of 1976-77 to the record runoff of 1982-83; and progressive increases in water export and decreases in sediment supply from the large rivers? We have mined the data set to highlight some notable events, trends, and lessons from four decades of learning by observation. As examples, we will show: historic seaward and landward extremes of X2 (location of the freshwater-seawater interface); South Bay as a hypersaline lagoon during the 1976-77 drought; remarkable and rapid shifts of salinity following major floods; occurrences of new phytoplankton blooms after the 1998-1999 El Niño-La Niña transition; and trends of decreasing nutrients and increasing dissolved oxygen during this era of improved wastewater treatment.

Key Words - *water quality; san francisco bay; phytoplankton ecology*

Theme: Water Quality Monitoring

Poster Board Number: 125. Submission Number: 82